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Proceedings of the Seventh IFC Conference,
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Indicators to support monetary and financial stability analysis: overview of the seventh IFC conference

Ummil Aminudin, Blaise Gadanecz and Bruno Tissot[1]

The seventh IFC conference on "*Indicators to support monetary and financial stability analysis: data sources and statistical methodologies*" was hosted by the BIS in Basel on 4–5 September 2014. It was opened by Muhammad Ibrahim, the IFC Chairman, who welcomed the 139 participants representing central banks and statistical agencies from 60 countries. He underlined the importance of the main theme of the Conference given the new environment that has emerged from the 2007-08 financial crisis and which will have lasting implications for central bank statisticians, among others.

In his opening remarks, Hervé Hannoun, the BIS Deputy General Manager, stressed that the increasing involvement of central banks in macroprudential policy will give rise to new data needs, in addition to those required for supporting monetary policy. Data collection, processing and analysis will all need to adapt accordingly. One example, where it is essential to make progress, is measurement issues around inflation and inflation expectations. Low or negative inflation in a number of countries is raising important issues for central banks, reflecting not only their "traditional" monetary policy mandate, but also their new financial stability focus.

The conference was a good forum for reflecting on these issues. The first two sessions covered the new indicators for monetary policy and financial stability in the aftermath of the financial crisis. Recent advances in the development and use of such indicators were presented, with a focus on accuracy, comparability and comprehensiveness. The third and fourth sets of sessions dealt with the use of sample surveys, micro and granular data, new statistical methodologies and techniques to enhance monetary and financial stability analysis at central banks, especially in the presence of data gaps. A special session was devoted to household finance statistics. Two main themes emerged from the closing panel discussion: communication around statistics and the use of micro versus macro data.

Session 1: New indicators for monetary policy

The overarching theme of the first session on *New indicators for monetary policy,* chaired by Aurel Schubert, European Central Bank, was how to condense several monetary indicators into a single one to serve as an input for policymaking. Several central banks shared their experiences of using composite indicators for (i)

[1] Central Bank of Malaysia (Statistical Services Department), Bank for International Settlements (BIS; Monetary and Economic Department) and IFC Secretariat, respectively.

assessing the impact of monetary policy and (ii) for monitoring economic developments.

Regarding the first objective, ie measuring of *the impact of monetary policy*, one example was presented by the ECB. It has built a set of indicators that reflect the cost of bank borrowing in the euro area. The indicators capture the lending rates faced by households and non-financial corporates in each member country. They are constructed as a weighted average of monetary financial institutions' lending interest rates, encompassing lending to various borrowers and providing a simple maturity breakdown. The aim is twofold: firstly to facilitate the analysis of the transmission mechanism of monetary policy and the pass-through of policy interest rates to actual lending rates; and secondly to assess the fragmentation of lending conditions across the euro area.

The National Bank of the Republic of Macedonia has also developed an indicator that measures the actual monetary policy stance once policy actions have been transmitted through the financial system. The objective is to assess the financial conditions experienced by economic agents in the real sector once commercial banks have adjusted their lending behaviour to changes in monetary policy. To obtain the indicator, a structural VAR model is estimated that incorporates both non-policy and policy variables. This approach aims at facilitating the analysis of monetary policy as a stabilisation tool.

Turning to the second objective, ie *the monitoring of economic developments*, several composite indicators have been developed to facilitate the work of monetary authorities. For instance, the Central Bank of Malaysia has designed a Holistic Inflation Surveillance Framework to gauge how various demand, cost, supply and expectation elements can both directly and indirectly impact inflation. The aim is to fine-tune the analysis of rapidly-changing inflation dynamics by better monitoring first-round effects (inflation pervasiveness) and second-round effects (inflation persistence) arising from a price shock. The framework also comprises a means of forecasting the inflation path (and the associated probability distribution), using a number of techniques. These include a nowcasting model (1 month ahead), a univariate model (3-6 months ahead), a VAR and Phillips curve model (12-24 months ahead), and a structural/DSGE model (beyond 24 months).

Bank Indonesia has also built an indicator for monitoring how the real economy is impacted by external shocks. The approach relies on the identification of various vulnerability indicators, the collection of which can be used as an early warning system. A composite index is then constructed that facilitates the monitoring of external sector fragilities.

Lastly, the Central Bank of Nigeria related its experience computing a group of macroprudential indicators in order to analyse the effects of economic factors on the financial system. Apart from its usefulness for financial stability purposes (see below), the monitoring of these indicators can be a key element for informing monetary policy decisions.

There are, however, a number of challenges related to these indicators. While they can be useful to provide input into monetary policy decision-making, there is a need to ensure that they are accurate and comprehensive. As regards *accuracy*, a drawback of composite indicators is that their apparent simplicity may mask a number of underlying issues. One example is survival bias: for instance, the measurement of the transmission of monetary policy tends to capture the financial conditions faced by those firms that continue to exist after a specific shock, not of those that may have closed their business because of their inability to access credit. Another accuracy issue is that composite indicators mix a number of heterogeneous components: for instance, financial conditions indices typically mix fixed and floating lending rates, various loan maturities, and so on. Yet another aspect is that cross-country comparisons can be complicated when using composite indicators. For instance, the monetary transmission mechanism, as measured by the ECB's borrowing cost indicators, can be distorted by the fact that competitive structures differ across various national banking sectors.

Turning to the issue of *comprehensiveness*, the conference highlighted policymakers' need to rely on more than just a single indicator to inform their decisions. That is particularly the case when gauging monetary conditions. For instance, an innovative monetary policy stance index like that of the National Bank of the Republic of Macedonia can help assess the effectiveness of both conventional and unconventional policy instruments. However, the actual reaction function of the central bank often depends on other factors such as the constraints (in Macedonia's specific case) posed by the exchange rate regime. Even an approach that encompasses a large range of indicators, like the holistic inflation analysis framework introduced by the Central Bank of Malaysia, may still be unreliable for making comparisons across sectors and over time. Changes in economic dynamics (eg the degree of persistence of an inflation shock) and structural breaks (eg changes in policy regimes) are additional factors complicating the construction of composite indicators that can pass the test of time.

Session 2: New indicators for financial stability

The second session on *New indicators for financial stability,* chaired by Gülbin Sahinbeyoglu, Central Bank of the Republic of Turkey, showed that financial stability monitoring can be enhanced by (i) constructing and using composite financial conditions indices based on macro variables and (ii) aggregating micro data reported at the granular level by individual institutions.

Regarding the construction and use of composite financial conditions indices based on macro variables, several central banks presented their work in this area. Their indicators are generally constructed by averaging various sectoral indices and applying a specific weighting methodology. The monthly Financial Conditions Composite Indicator (FCCI) constructed by the Reserve Bank of India covers the banking and monetary sectors, as well as equity, bond and foreign exchange markets. By controlling for the effects of macroeconomic fundamentals, the information value of these financial indicators is used to (i) track financial stability as an explicit policy variable, (ii) identify periods of financial stress, and (iii) provide signals of possible future tensions. In particular, a so-called Composite Leading Indicator has been constructed to detect early warning signals of financial stress in the Indian economy.

A similar approach has been followed by the Central Bank of Nigeria in developing a composite financial system stability index (FSSI) for the Nigerian financial system. This FSSI is derived by applying statistical and empirical normalisation methods to various indicators of banking system strength, equity market performance and insurance industry soundness. The index aims to capture episodes of stability and vulnerability in the financial system and can be used as a composite indicator to support financial stability analysis. This approach also complements parallel work conducted at the Central Bank of Nigeria and presented in Session 1: the computation of financial soundness indicators based on macroprudential indicators allows for the assessment of the resilience of the banking industry (in addition to informing monetary policy decisions).

The BIS has also developed a regular monitoring at the macro level of the global financial system for financial stability purposes. The aim is to assess the level of global liquidity, a concept defined as the degree of ease of financing in global financial markets. While it is hard to summarise this concept in a single indicator, the objective is to monitor the funding conditions of financial intermediaries, which, in turn, influence the build-up of vulnerabilities in the whole financial system in the form of asset price inflation, leverage, or maturity or funding mismatches. The indicators monitored and published by the BIS try, therefore, to measure these "footprints" of global liquidity. For instance, the cross-border US dollar positions of global internationally active banks are a gauge of (i) the ease by which they get international funding, (ii) their ability to channel dollar funds to the rest of the economies in which they operate, and (iii) the sources of potential contagion between major financial centres in times of stress.

Turning to the more micro level, a number of central banks presented ways to use institution-level data to support financial stability analysis, and in particular identify system-wide vulnerabilities/contagion channels. The Bank of Italy's approach assesses the interaction of individual banks' balance sheets using their granular bilateral exposures to identify the transmission channels of financial stress – going beyond the simple propagation effects due to the cascading of counterparty defaults. Such contagion/network analysis allows one to detect those financial institutions that can have a "systemic" impact and thereby provides useful information for regulatory authorities. It also echoes the analysis conducted by the Bank of Russia, which calculates a range of indicators for Russian commercial banks, based on their individual balance sheet data (such as loan-to-deposit ratios, or net stable funding ratios). Information on the funding structure of the banking industry is deemed useful for monitoring macroeconomic conditions and episodes of financial stress.

The Central Bank of Ireland also mobilises granular, security-by-security data to enhance the oversight of the Irish money market funds (MMFs) industry. A number of specific indicators have been identified to support such analysis, in particular, investor outflows/inflows and average yields, broken down by funds' characteristics (eg size, investor base). Since these funds play an important role in determining the funding and liquidity of Irish financial intermediaries, their monitoring appears useful for financial stability analyses at large.

A key takeaway of session 2 was the recognition that there is value in using more granular (institution-level) data, even when presented in aggregate. It helps to identify vulnerabilities that macro indicators collected at a sector- or country-level can less easily capture. One major point of debate, however, was whether all aspects of financial conditions can be summarised by a single indicator. For instance, a specific leading indicator can be selected because of its usefulness during an observed period of stress, but it may be less effective on other occasions. Moreover, other indicators may exhibit superior leading properties as circumstances evolve.

Sessions 3 A – 4 A: the use of sample surveys

Can central banks make use of surveys to supplement other statistical data collections in order to fill information gaps? The answer from these sessions, chaired by Eugeniusz Gatnar, National Bank of Poland, was undoubtedly positive: the use of surveys can help enhance monetary and financial stability analysis, especially by getting a better picture of areas that are not well covered by more "traditional" statistics. However, there are a number of challenges.

As regards the *use of surveys for financial stability purposes*, in the first of its presentations, the Central Bank of Nigeria reported on its recent experience assessing agents' financial positions, such as domestic financial situation and income. Moreover, a specific survey of foreign assets and liabilities is targeted to enterprises with foreign investment and helps to measure the size of foreign financial flows in the country. All this information is deemed instrumental in assessing the resiliency of the financial system and its smooth functioning.

Similarly, the first presentation by Bank Indonesia showed how a hedging survey is used as a tool to identify potential risks faced by non-bank private companies in managing their external debt, particularly currency risk and interest rate risk. The survey results help to assess the size of the private sector external debt that is hedged, with information by sector, type of risk exposure, and type of hedging instruments. The authorities can thus devote specific attention to those companies that do not hedge their external debt and are vulnerable to currency risk (eg when their revenues are primarily in domestic currency). Based on the risks identified, specific macroprudential policy tools can in turn be deployed to influence agents' level of debt, its composition, and the use of hedging.

Turning to the *use of surveys for monetary analysis,* Nigeria relies on a number of enterprise and household surveys. In particular, its business and consumer surveys help to generate reliable, accurate and timely information on economic agents' expectations, thereby facilitating the calibration of the instruments used by monetary policy and its effectiveness. A second paper by the Central Bank of Nigeria showed how consumer confidence data can support the modelling and forecasting of household consumption in the country. Similarly, the experience of the Reserve Bank of India is that qualitative business tendency surveys provide flexibility in tracking economic developments in a timely manner, compared to more conventional methods. One example is the quarterly Industrial Outlook Survey, which appears to outperform other data in capturing short-term movements and in anticipating turning points in the Indian economy. This survey information can therefore be of key interest for monetary authorities.

Several presentations underlined the usefulness of surveys when there is a lack of "real" economic data. One example, reported by Bank Indonesia, is to use surveys as "leading information". Because they provide useful insights into the real state of the economy and into the economic outlook, firms and household surveys are used for "nowcasting" exercises and short-term projections. Similarly, one issue faced by the Bank of Mauritius is that of the uncertainties surrounding output gap estimates and therefore the assessment of potential inflationary pressures. This stems from the absence of sufficient data collected in some sectors (eg tourism) when compiling GDP figures. In fact, the use of additional indicators (eg hotel occupancy rates) can significantly improve output gap estimations. A specific Business Perspective Survey is therefore being designed as a survey-based approach for capturing retail activity to enhance output gap estimates. The flagship short-term economic survey of the Bank of Japan (the Tankan survey) is a long-established source of information on the economic situation and outlook for Japanese enterprises. This survey has been recently expanded to include new items in order to get additional information on inflation expectations, both at the level of the firm and the economy in general. Evidence presented at the conference suggested that this new information is particularly valuable for the central bank: first, it captures the distribution of inflation expectations depending on a firm's size and the industrial sector in which it operates; second, it complements other sources on inflation expectations.

Yet monetary authorities can also usefully conduct surveys to obtain data that are usually not captured in the "traditional" apparatus of the national accounts. That is particularly the case when assessing the state of financial conditions and their impact on economic agents' spending. For instance, bank lending surveys can convey useful information on credit standards – especially for small and medium-sized enterprises – that is not available from other sources. The Bank of France presentation emphasised that "traditional" quantitative credit statistics are of limited use for simultaneously assessing credit supply and demand. Indeed, while opinion surveys can show how credit standards are applied by bankers and are perceived by borrowers, and how possible rationing effects can therefore arise. For instance, the Bank Lending Survey coordinated by the Eurosystem has been used to assess the dynamics of credit supply and demand for French SMEs, estimated through a dynamic disequilibrium model relating qualitative surveys' opinions and actual credit flows. The presentation by the ECB also emphasised the usefulness of the Survey on Access to Finance of Enterprises (SAFE) sponsored by the European Commission and the ECB. Another advantage of qualitative survey data is that they can be matched with other, quantitative micro data sources, for instance business registers containing firms' level financial information.

Participants confirmed that sample surveys can allow central banks to fill data gaps and improve their monetary and financial stability analysis. In fact, a number of central banks are using the same surveys for both monetary and financial stability analysis – a duality emphasised in the papers presented by the central banks of Nigeria and Indonesia, among others.

However, challenges remain. Low response rates, sampling bias, interpretation errors, discontinuities in the composition of the panel of respondents, inadequate methodologies are among the various problems that need to be overcome to ensure sufficient survey quality, as highlighted in the Indonesian case – these problems appear particularly acute for those surveys conducted by telephone, as reported by the ECB presentation. Another difficulty relates to the combination of granular datasets. For instance, matching the European SAFE survey with firm balance sheet data can provide useful information, but it also raises issues in terms of the preservation of respondents' confidentiality as well as sample representativeness. Lastly, survey data can raise important cross-country comparability issues, as reported in the ECB study on SMEs' access to credit.

Sessions 3 B – 4 B: Granular and micro data

Another avenue for supporting central banks' policies and analyses is to mobilise granular data – or so-called "disaggregated", or "micro data", ie economic information that is broken down at the individual level of households or firms. These sessions, chaired by Charles Thomas, Federal Reserve Board of Governors, highlighted the usefulness of such data, which can complement the more traditional information provided at a more aggregated level, for instance by the national accounts framework.

One area of interest is credit information. Many central banks rely on individual loan data, derived from several sources such as central credit registers, private credit bureaus, individual loan repositories as well as micro credit surveys. This information efficiently supports the banks' financial stability and monetary analysis as well as microprudential supervision tasks. For instance, the Bank of Korea has obtained micro data from private registries set up to assist creditors in evaluating individual borrowers' credit quality. Timely information is available on how credit is provided to customers (eg type of loans), their loan payment behaviour (eg credit incidents) and the situation and sustainability of their balance sheets. That is a key input supporting the central bank's monitoring of macroeconomic and credit conditions as well as financial stability risks.

Authorities may even use micro data to assess a very specific segment of the credit market. For instance, the Czech National Bank has started collecting information on renegotiated loans. Loan renegotiations have become frequent, especially in the housing area in the recent period of falling interest rates, and can have important financial stability implications, as credit institutions are competing forcefully to attract clients. The Central Bank of Ireland also uses loan-level data to assess lending conditions in the SME sector. Such a micro credit data set allows for a deeper understanding of lending to this sector, by providing information that is not available from aggregate statistics – eg lending by customer types, loan pricing trends, maturity profile, and loan characteristics by sector. The first paper presented by the ECB during the session reported on the European System of Central Banks collection of granular data from various sources, which helps to better assess borrowers' creditworthiness as well as the credit risks borne by lenders.

A second and growing area of interest is the use of micro data to support the development of macroprudential tools. The Reserve Bank of New Zealand (RBNZ) presented the data collection exercises set up to support its macroprudential policy functions. For instance, in 2013 it introduced a limit on loan-to-value ratios (LVR) so as to slow down the rapid increases in house prices and household debt (LVRs were one of the four instruments adopted under its new macroprudential policy framework). The central bank had to mobilise data that was sufficiently granular and harmonised across various credit institutions so as to support the implementation of these LVR restrictions. A second ECB presentation showed how information from supervisory reports – the "Consolidated Banking Data",[2] can serve as an input for its macroprudential analyses. These micro data can be aggregated by bank size, type

[2] These data are collected at the level of individual credit institutions for various variables and covering the whole spectrum of the banking business, from balance sheets or profits and losses to capital adequacy and asset quality.

of banks (eg foreign banks) and regions. The information is used in the context of the regular European quarterly macroprudential review exercises aimed at assessing the systemic risk faced by national and EU financial systems. They can be complemented by other similar indicators such as the Key Risk Indicators computed by the European Banking Authority (EBA) for its monitoring of the EU banking system.

A third area of interest is the use of micro data to refine macroeconomic statistics in specific areas, for instance to cover the activities of financial institutions. One example is the Bank of Japan's use of newly available, micro-level data disclosed by mutual funds in their investment reports. This fund-level data can serve to enhance the statistical estimates of household incomes and savings in Japan's financial accounts. Another example is the international banking statistics compiled by the BIS. Reporting central banks collect bank-level information on their internationally active credit institutions, and they transmit country-level aggregates to the BIS. That information can be used for various financial stability issues – eg country risk exposures, funding risks in different currencies, banks' role in the transmission of financial stress across countries. Numerous enhancements are being implemented for this dataset, which will further raise its usefulness for analytical and policy purposes.

A fourth area relates to *debt securities*. The BIS and the ECB shared their experiences with the compilation and use of large security-by-security databases. The BIS explained that, while it publishes statistics on domestic and total debt securities that are derived from countries' aggregated sources, it also compiles international debt securities (IDS) using micro level market data. This enables unique identification of each security and its issuer and provides a wealth of information. In particular, it allows issuers to be classified based on their residence ("immediate issuer"), or on the residence/nationality of their parent corporations ("ultimate issuer"). Such information allows one to better understand the risks borne by issuers and the economic groups they belong to. It can be used for various kinds of financial stability analysis, for instance when assessing the international issuance of emerging market borrowers through the foreign entities controlled by them.

Further on the topic of debt securities, the third ECB presentation noted that the European System of Central Banks (ESCB) has been compiling security-by-security data on holdings of debt securities and shares by euro area residents. The information on cross-border holdings, for different holding and issuing sectors and types of securities, can be particularly useful for monitoring the degree of financial integration in the euro area. For instance, one can measure the share of government debt in one country which is held by non-domestic residents – quite an important indicator, as highlighted during the sovereign crisis of recent years.

The sessions' discussions of country experiences highlighted the challenges posed by the collection and use of micro data, particularly with respect to data quality, confidentiality, cost-benefit issues and comparability. First, the volume and complexity of very granular data make it more difficult to maintain data quality. Indeed, micro datasets tend to be less complete than aggregated ones: the more granular the data are, the more likely there will be significant gaps. Second, a balance needs to be struck with respect to confidentiality: drilling deep down into individual (entity-level) data adds substantial information that aggregated data would not deliver; but collecting, storing, using and disseminating information based on micro-data requires overcoming confidentiality restrictions or at least offering confidentiality safeguards. In fact, granular data are often sensitive by nature. Central banks and other authorities typically have a statutory and/or legal obligation not to disclose information about individual institutions, except for specific, precisely identified purposes. These limitations need to be communicated to the potential users of the data, who can be disappointed by limited data access (especially when different levels of access exist depending on the type of users). Third, granular datasets can be very labour- and time-intensive and costly to build and manage. In particular, such statistics require extensive cleaning and quality checking, possibly leading to lengthy delays when publishing aggregates. This means that a careful cost-benefit analysis needs to be conducted before deciding on the collection of micro-data, especially when the information is not already easily available in the internal systems of the reporting entities. Lastly, there are harmonisation and comparability issues between granular databases prepared by various institutions or set up in different jurisdictions. That can pose a challenge for any cross-sector and/or cross-country analysis that relies on micro-data. A key recommendation of the panels in this respect was to ensure that granular data are collected on a very structured basis, with the use of clear definitions, identic data formats, and proper IT infrastructures and analytical tools.

Session 3 C: statistical techniques and methodologies

This session, chaired by Jacques Fournier, Bank of France, reviewed a number of new statistical techniques and methodologies that have been mobilised in the aftermath of the recent crisis for financial stability purposes, in particular to: (i) monitor the propagation of financial stress across countries and/or sectors; (ii) better assess the development of systemic risk over time; and (iii) address data limitations.

On the topic of *how systemic risk can evolve at a specific point in time*, the Bank of Italy's presentation looked at how micro-data can be mobilised to track the propagation of shocks in the financial system. The structure of the unsecured interbank money market plays an important role in this context. It acts as a network transmitting private information among banks and generating spillover effects in the prices of loans – particularly during times of acute uncertainty, ie when market participants' expectations are heterogeneous.

As regards the time dimension of systemic risk, the last financial crisis underscored the importance of taking a long-term perspective to assess the building up of financial fragilities. That puts a premium on using all the data that can be made available and for a period of time that is wide enough to cover the (long) financial cycles, and also on using various statistical techniques to extend available series. In this context, the BIS presentation discussed the methodology recently adopted to select and link various statistical series to produce long-term series on credit to the private sector, spanning several decades.

Turning to data limitations, several presentations reviewed particular techniques to meet users' needs despite incomplete data. One source of data gaps is confidentiality, which limits the use of micro-data, especially when these data are derived from different countries. The ECB presented the "distributed micro-data analysis" method to fill such gaps, by making available aggregated data with sufficient information on the distribution of the underlying (and not disclosed) micro-based dataset. The methodology was applied to construct a dataset containing the distribution of several financial indicators derived from anonymised firm-level information (eg balance sheets, profit and loss accounts). Similarly, the Central Bank of Malaysia presented a method to estimate ("best-fit") probability distributions. The analysis is based on the distributions of the original set of data, so as to use its information without accessing individual data points. This was applied in particular to assess interactions in the financial industry.

In contrast, an opposite issue with the increasing use of micro-data is *a surfeit of information*. The Dutch National Bank showed how the rise in non-bank financial entities has led to an unsustainable workload for compilers of statistics. The use of stochastic sample design (incorporating random sampling instead of a systematic data reporting scheme) helped to reduce the number of reporters. It also, somehow counterintuitively, improved the quality of both aggregated data estimates and breakdowns. That was because the freeing of more capacity to check the reports and provide support to reporting entities led to a more efficient data collection system and alleviated reporting burdens.

Discussions during the session focussed on what central banks should bear in mind when contemplating the possible use of such statistical techniques. On the one hand, these methods can help to limit data collection exercises and/or enhance their efficiency – an appealing proposition when resources are scarce, data are incomplete and the statistical burden already high. On the other hand, they rely on implicit or explicit modelling assumptions that should be carefully tested. Moreover they can also be highly demanding, for instance in terms of computation, and their complexity may be disorienting. In any case, it is key to properly communicate to users on the techniques utilised and their inherent limitations.

Session 4 C: policy indicators (public debt and macroprudential data)

The recent crisis has underscored the need for reliable policy indicators in the area of public finance and prudential supervision. Indeed, many countries have made substantial efforts since 2007/08 to cover national data gaps in these areas, not least in the context of the Data Gaps Initiative endorsed by the G20. This session, chaired by Katherine Hennings, Central Bank of Brazil, thus provided a timely platform to take stock of country experiences in this domain.

A first avenue is to collect better fiscal data. The South African Reserve Bank and the Bank of Thailand described their respective experiences with public debt statistics. In South Africa, significant progress has been achieved through the broadening of these statistics to include all levels of government and public enterprises. Data has also been added on loan guarantees extended by the government, on instrument breakdowns (eg index-linked debt securities) and on holding sector. A main objective is to provide sufficient information to enrich and put into context the analysis of fiscal positions. Nonetheless, a number of challenges remain with regard to the measurement of public debt – eg treatment of IMF Special Drawing Rights (SDRs), identification of the holders of government debt securities, difficulty of getting a comprehensive view of the government's balance sheet, move to full accrual accounting.

In Thailand, the authorities have focussed on the establishment of internationally accepted standards for fiscal transparency. The aim is to improve the comprehensiveness, quality and timeliness of fiscal data. These transparency efforts have been focussing on three dimensions: fiscal reporting, fiscal forecasting and fiscal risk analysis, with a view to strengthening sovereign credibility.

A second avenue is to mobilise various other data sources, using the full spectrum of the national accounts. In particular, the Bank of Korea has worked on the compilation of detailed Flow of Funds that show linkages between debtor and creditor sectors ("who does what with whom"). These statistics are deemed to be very useful for better analysing financial interconnectedness and in turn the specific financial position of certain sectors such as the government (eg identification of the holdings of public securities by non-residents). But the new data collected in the context of the just-introduced 2008 system of national accounts are still in their early stages of development. In addition, a number of compilation issues arise, especially regarding the consistency of creditors' and debtors' data and the relatively limited identification of the counterparts holding financial assets. The joint ECB/Netherlands Bank presentation highlighted the importance of enhancing capital stock estimates in the euro area, with sufficient breakdowns by asset types and a specific focus on non-financial assets data (eg housing), which are often incomplete.

A third avenue is to enhance the analyses based on available fiscal data. The first ECB presentation detailed in this context some new indicators on government debt securities. In particular, granular, security-by security information is being collected in the ECB Centralised Securities Database and can be used to construct useful indicators on government debt service, nominal yield, and instrument breakdowns. These shed light on governments' expected disbursements related to the servicing of their debt and the associated refinancing needs (and risks). Such an analysis is interesting from both a fiscal and a financial stability perspective. It also provides useful information on the monetary transmission mechanisms, eg from policy rates to government yields. Lastly, the data are used for cross-country comparisons.

As emphasised in the second ECB presentation, "the monitoring of government debt is not enough". It has to be complemented by the assessment of the financial positions of other economic agents (eg households, non-financial corporates), because they can have spillover effects on both the financial sector and the government. A recurring theme in the session was *the issue of consolidation*, especially in the context of the developments of financial accounts on a from-whom-to-whom basis. Non-consolidated data may suit international comparisons better, and is indeed recommended by national accounts standards. In fact, consolidating financial flows between institutional units of the same sector would prevent the capturing of lending relationships within each single sector. That could be detrimental for financial stability analyses, since intra-sector financial flows can be large and have destabilising systemic effects. On the other hand, one could also argue that the claims held by a sector unit on another unit of the same sector should be netted out. Furthermore, non-consolidated data include intra-group financing, while consolidated data at group level could be more meaningful from this perspective.

Another important issue with respect to public sector statistics is whether to measure *net versus gross debt*. Deducting assets from liabilities may be meaningful, but their value can change quickly over time and valuation practices may differ markedly across countries (especially for non-financial assets). Moreover, there are still important differences among countries as regards the way to measure public debt indicators – eg at nominal (or face) value or at market value. The current situation of very low interest rates has led to higher debt market values for several countries, which may overstate their underlying indebtedness.

Another measurement question to consider is that of the *intertemporal financial positions* of the government, which include future tax flows as well as all liabilities (especially contingent liabilities arising from pension rights). Discussions suggested that a useful way forward would be to compile various indicators of public debt based on alternative concepts in order to provide different, albeit complementary perspectives.

Session 5: household finance statistics

The recent financial crisis has highlighted the need for policymakers to specifically monitor the indebtedness and vulnerability of households when trying to identify emerging threats to financial stability. The final session of the conference, chaired by Luca Errico, International Monetary Fund, addressed progress and remaining challenges in the area of measuring household liabilities and assets, including housing, as well as the construction of vulnerability indicators.

The first ECB presentation emphasised the importance of monitoring specific ratios of household financial fragility, in particular debt service-to-income and debt-to-asset ratios. The analysis conducted with these data includes country heat maps (assessment of vulnerabilities by household groups), cluster analysis (determination of groups of countries presenting similar characteristics, using principal component analysis techniques) as well as conditional quantile regressions (to assess the joint distribution of vulnerability ratios by groups of households). This approach requires having information not only on debt, but also on income and assets. It should be sufficiently granular, because individual household characteristics (both across and within countries) are found to play a key role in explaining aggregate fragilities. The study presented relied on micro information on households' wealth and income, available in the new Eurosystem Household Finance and Consumption Survey. This survey was also referred to in a second ECB presentation. It illustrates how consumption patterns can be influenced by population heterogeneity. Another interesting application is the identification of those population segments that contribute to national savings rates most.

The Central Bank of Norway presentation concurred in stressing the importance of a granular approach, since "aggregate data hide important information". In fact, household characteristics are heterogeneous, debt is concentrated on a narrow group of borrowers, and their situation depends on the value of their housing as collateral. Moreover, the distribution of debt across households is changing over time. Administrative register data have been compiled using Norwegian tax returns and other surveys, helping to capture the dynamics of household characteristics and vulnerabilities over time (eg birth-cohort studies).

The Bank of Italy presentation also emphasised the importance of using micro data to monitor the financial vulnerability of Italian households. As in the case of the ECB, such household-level data can be obtained through household surveys. In addition, these data can be matched with macroeconomic forecasts on debt and income, allowing for the forward projection of households' indicators. This microsimulation model hence allows for the monitoring of how household's fragilities evolve under specific macroeconomic conditions, stress scenarios, and alternative policy actions – something that could not be done using the micro household data alone.

Since real estate is often households' main source of wealth, *residential property prices* are a key indicator of interest to policymakers for their assessment of household vulnerabilities and financial stability risks more generally. However, such statistics were relatively limited in the past, and this became particularly obvious during the recent financial crisis. Moreover, data sources exhibit significant heterogeneity across countries, in particular in terms of types of prices referred to, geographical coverage, quality adjustments and the representation of dwelling types. A third ECB presentation suggested that these major issues could be addressed by (i) having detailed metadata on the statistics available; (ii) harmonising concepts across countries as much as possible, in line with recent European initiatives on both residential and commercial property prices[3]; and (iii) providing clear methodological guidance (the international "Handbooks"). In any event, it was stressed that property prices, despite their statistical shortcomings, can provide useful insights on housing market dynamics and can support financial stability analysis more generally.

A similar message was spelled out in the BIS presentation. In 2009 the BIS was tasked to publish residential property prices in the context of the Data Gaps Initiative endorsed by the G20. Its monthly publication covers 57 countries (as of the beginning of 2015), and the number of series published is above 300. The BIS has in addition selected a single representative residential property price indicator per country. Moreover, long series have been constructed for about half of the reporting countries, and these have proved to be extremely helpful for the analysis of long financial cycles.

Closing panel discussion

The closing panel discussion of the conference centred on two main themes: (i) communication issues related to statistics and (ii) micro versus macro data.

As regards communication issues related to statistics, a first point is that better statistical quality could be achieved through enhanced data sharing among institutions. There are different stakeholders (eg central banks and supervisory agencies) involved in the collection of financial stability data, and there are limitations to the extent to which these data can be shared among them – not to mention the issue of publication for the general public. Difficulties include legal

[3] An harmonised dataset of house price indices has been created by the statistical institutes in the European Union, while for commercial property the European System of Central Banks has recently established an experimental price indicator.

requirements, potential conflicts of interest among independent authorities, and the fact that data access often needs to be reciprocal.

There are even communication challenges within the same institution. Good statistical communication should first be horizontal, by involving the various departments providing and using the data. In fact, engaging with staff with different professional backgrounds and experiences (statisticians, economists, supervisors, etc) can significantly enhance statistical output. Communication should also be vertical, to ensure that the different hierarchical levels of the institution are involved and to gain buy-in from senior management when conducting statistical projects.

Communication should also be enhanced vis-à-vis the public at large. A constant dialogue should be maintained between reporters, compilers and users of data, and statistical compilation methods should be transparent. One recommended form of communication is to perform more analysis with the data and to make them clearly presented to the public. Another important requirement is to ensure regular consultation with data reporters. Their reporting burden should be appropriate to ensure good quality data. And comprehensive cost-benefit analyses are essential to manage users' information needs, and to make them aware that more data will not solve all their problems and may in fact be counterproductive.

The conference also highlighted the need for good communication on statistical issues between advanced and emerging market economies. Reporting rules or guidelines are often established in the former, where there is a lot of statistical expertise. However, they must also be applied by the latter, where they may have less relevance because of idiosyncratic specificities.

As regards the second issue of *micro versus macro data,* there was general agreement that micro data can often yield superior analytical insights into aggregate or macro data. But a balance needs to be found between exploiting the full granularity of the information and protecting its confidentiality. Another challenge in the use of micro data is cross-country comparability, because of potential differences in methodologies (while there is more harmonisation for aggregated, national accounts-type data). A good compromise might be to enrich statistical analysis with indicators such as concentration measures (eg probability distribution) to complement aggregate averages.

Several participants also emphasised the importance of enriching individual data with other statistical information as well as judgement. Composite indicators are good examples. They can be particularly useful in summarising the wealth of statistical data that is being collected in response of the recent financial crisis, especially to support the growing information needs of authorities in the areas of monetary and financial stability. But a single index is often insufficient to characterise conditions or vulnerabilities in the entire economy. It can be particularly challenging to perform cross-country comparisons with composite indicators, because weights and contents differ across countries. Again, good communication and transparency – especially on the methodologies followed and the data sources used – are essential to ensure that statistics can effectively and adequately support monetary and financial stability analysis.

Seventh Irving Fisher Committee Conference on Central Bank Statistics

Hervé Hannoun, Deputy General Manager, Bank for International Settlements

Basel, 4 September 2014

Opening Remarks

Good morning ladies and gentlemen. It is my pleasure to welcome you all to the seventh biennial conference of the Irving Fisher Committee on Central Bank Statistics.

I would like to extend a special welcome to Muhammad Ibrahim, Chairman of the IFC, to all the members of the IFC Executive Committee, and to all presenters at the conference.

We at the BIS are very pleased with the continued strong support for the biennial IFC conference, which today brings together close to 150 participants who will collectively contribute around 50 papers to the forthcoming IFC Bulletin. I would also like to congratulate the nine contestants for the IFC's Best Paper by a Young Statistician Award.

Of course, we welcome the opportunity to see so many representatives of the central banking statistical community here in Basel and I trust that you have many good reasons to feel at home here, not only because your Secretariat is located in Basel, but also because the BIS is the global forum for central bank cooperation.

New indicators for financial stability analysis

The focus of today's conference is particularly apt: "Indicators to support Monetary and Financial Stability Analysis: Data Sources and Statistical Methodologies". In the wake of the global financial crisis, it is indeed the right time to revisit the data sets we need for financial and monetary stability purposes.

Indeed, the increasing involvement of central banks in macroprudential policy will certainly bring new data requirements, in addition to those required for supporting monetary policy. Data collections, processing and analysis will all need to adapt accordingly. The specific topics of the various sessions indicate the richness of new initiatives. These include new indicators for financial stability analysis; new statistical techniques and methodologies, particularly the use of surveys by central banks; and ventures into new domains such as those related to household finance. I very much look forward to the summaries of your deliberations that will be included in the next IFC Annual Report to Governors.

Financial stability is a field where the IFC has already made substantial contributions towards improving statistics of interest to central banks. I need only cite your 2008 workshop on securities statistics, which resulted in the joint BIS, ECB and IMF Handbook on Securities Statistics. Likewise, your work on housing price statistics led to the Handbook on Residential Property Price Statistics and further initiatives by the BIS on global property prices. And it was at the IFC conference in mid-2008 that the idea was first floated of identifying possible data gaps as revealed by the global financial crisis. This, in a sense, foreshadowed the launch of the Data Gaps Initiative by the G20, the Financial Stability Board and the IMF.

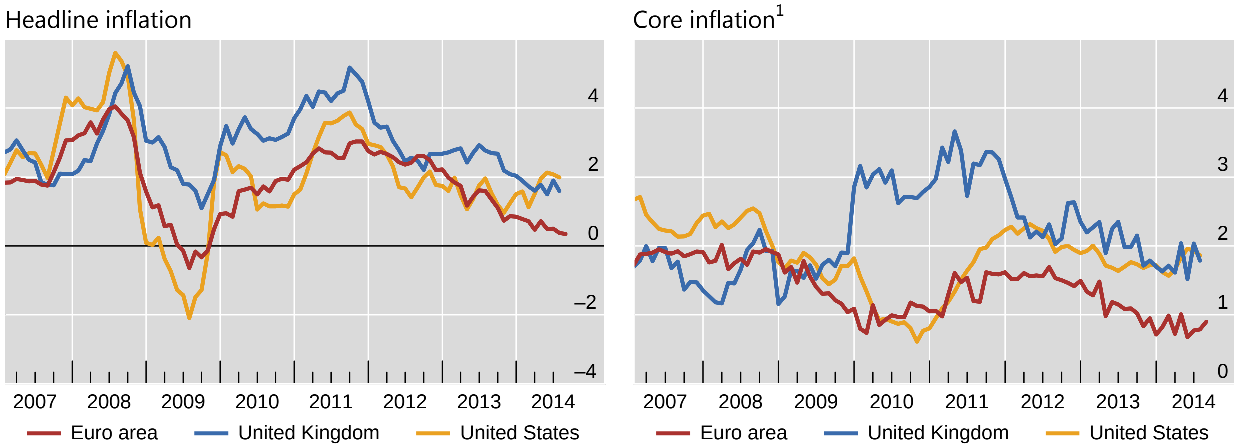
As monetary stability is no less important, I find it highly appropriate that the first session of this conference is devoted to "New monetary policy indicators". No topic could be more topical, given the vigour of the current debate about the supposed threat of deflation. But no debate can be productive, especially at the policy level, unless the supporting data are sound. In this light, measures of inflation and inflation expectations are surely an appropriate focus for an intensive review by central bank statisticians – and I would like to raise the question here if the IFC might not play a catalytic role in that process. Let me start by revisiting the intricacies of inflation measurement.

Measure of inflation (CPI)

Inflation has been on a downward trend in the major advanced economies since its 2011 peak (Graph 1), especially in the euro area, where headline inflation (CPI) is only slightly positive. But underlying inflation ("core inflation") has been more stable: the recent decline in headline inflation is mainly a reflection of falling commodity prices, which as we know are quite volatile.

Inflation in selected advanced economies

Twelve-month changes, in per cent — Graph 1



[1] Excluding food and energy.

Sources: Datastream; OECD; national data.

This shows that inflation data need to be interpreted with care and that conclusions made in haste are likely to mislead. In fact, the measurement of inflation was one of the very first topics to be discussed by the IFC. I am referring to your workshop on "CPI measurement" in 2006, which was chaired by Jan Smets of the National Bank of Belgium. Reliable CPI measures are, of course, of critical importance to monetary policymakers.

The workshop's participants reached agreement on a number of points:

- First, that CPI measures should be reliable, timely and comparable (internationally and over time).
- Second, official CPI numbers needed improvement. The publication of an official CPI Manual would contribute to this end.
- Third, the treatment of owner-occupied housing was a particular area where improvement was needed. In Europe it is still not included in the Harmonised Consumer Price Index, but I

understand that there is at least official agreement on the methodology to correct this in the future. The current weight of housing costs in the CPIs of the euro zone is as low as 6.2% (see Table 1), which is hard to justify.

Weighting of housing rent expenditure in the CPI for selected countries[1] — Table 1

Countries	Actual rents	Owner-occupied housing[2]	Total
EU 28	5.8	-	5.8
Euro area	6.2	-	6.2
France	7.1	-	7.1
Germany	10.2	-	10.2
Italy	2.7	-	2.7
Japan	3.1	15.6	18.7
Spain	2.9	-	2.9
Turkey	5.4	-	5.4
United Kingdom	7.0	-	7.0
United States	7.0	23.9	30.9

[1] CPI stands for the Harmonised Index of Consumer Prices (HICP) for the EU countries and Turkey, Consumer Price Index for All Urban Consumers (CPI-U) for the United States and Consumer Price Index for Japan. [2] Not part of the CPI basket in the EU countries and Turkey; imputed rent for Japan; owners' equivalent rent of residences for United States.

Sources: Eurostat; national data.

- Fourth, dealing with quality adjustments was seen as a major challenge for CPI compilers but particular methods such as hedonic treatments are becoming more widely accepted.
- Fifth, keeping track of new products and outlets, as well as accounting for substitution effects, were important elements for consideration.
- Sixth, research by central banks indicated a positive bias in official CPI measures at that time. But there was quite a degree of uncertainty about the size of this bias and this issue could be revisited.
- Seventh, central banks rightly looked at a range of inflation measures, including core inflation and inflation expectations.
- Finally, it was noted that a big challenge remained in terms of communicating CPI measures to the general public. More transparency would help. Ultimately, more credible CPI measures would strengthen the credibility of monetary policy.

These were very important findings. They were discussed by the BIS's Governors in 2007 and I ask myself if they might not now be of renewed relevance to the IFC, especially in this period of low inflation.

It's striking how many of the main questions raised in the 2006 workshop remain open today. For example, one might touch on the following issues:

- Has the comparability of CPI measures really improved? I note that there is a new international initiative to complement the CPI Manual with more normative methodology for CPI measurement. Indeed, the current Manual avoids being overly prescriptive, which therefore limits the comparability of current CPI measures across jurisdictions.

- When will the issue related to the weight of housing in the CPI be addressed? Improved house price statistics should go hand in hand with improvements in Europe of the way house prices and rental costs feed into the harmonised consumer price indices on which monetary policy decisions are based.
- Is there still a measurable bias in official CPI statistics?
- Has the public understanding of CPI measures improved? As you know consumer surveys reveal a large gap (6% in some cases[1]) between inflation as measured by the statisticians and inflation as perceived by the public. In other words, the general public may view price trends very differently from financial market participants who complain that "inflation is too low". And, needless to say, if the central bank itself starts to express concerns that inflation is too low, it may find it difficult to convince the public of its case.

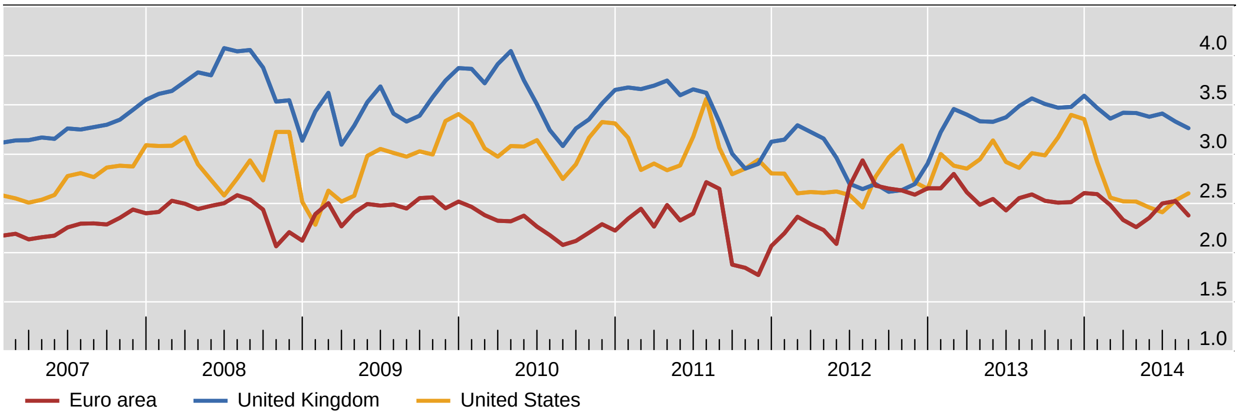
Measures of inflation expectations

Inflation expectations are another source of potential misunderstandings and, here too, central bank statisticians can play a useful part in cautioning against overhasty interpretations. And this is particularly important in the case of the two main market indicators of inflation expectations, which are the breakeven inflation rates derived from index-linked bonds, (see Graph 2) and inflation swaps (see Graph 3).

Breakeven inflation rates (index-linked bonds)[1]

In per cent

Graph 2



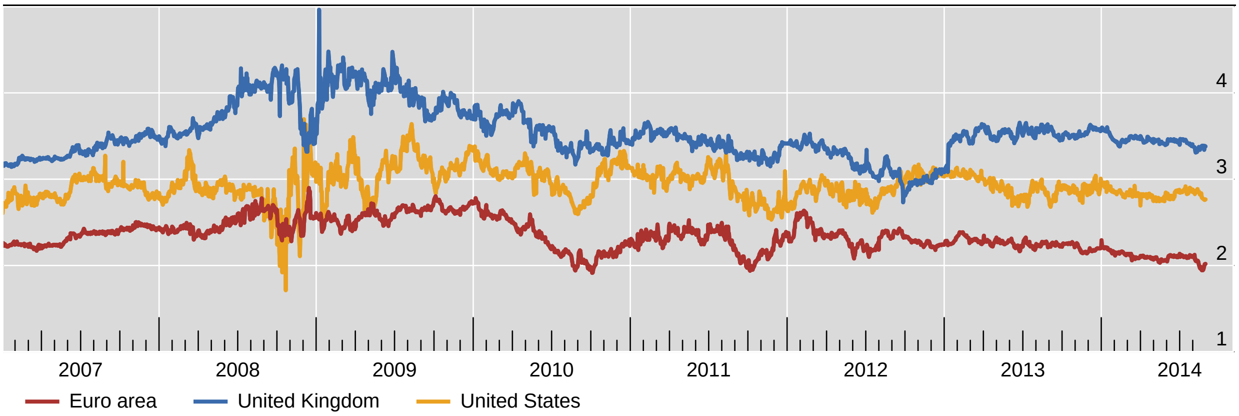
[1] Five-year, five-year forward breakeven inflation rates; monthly averages.

Sources: Bloomberg; Consensus Economics; BIS calculations.

[1] See Institut National de la Statistique et des Études Économiques (INSEE), "L'inflation telle qu'elle est perçue par les ménages", Analyses, no 5, July 2012.

Inflation swaps[1]

In per cent Graph 3



[1] Five-year, five-year forward inflation swap rates.

Source: Bloomberg; BIS calculations.

Suggestions are heard from many quarters, particularly in financial markets, that these indicators are now signalling imminent deflation in the euro zone. And the proposed response to this purported threat is that that the monetary authorities should embark on a further round of quantitative easing.

Yet these fears are almost certainly overblown from a historical perspective. As the graphs show, long-term inflation expectations appear to be relatively well anchored, having hovered at around 2–2½% in the euro zone (depending on the selected indicator) and 2½–3½% in the United States ever since the financial crisis. In the short run, though, it's true that these indicators can be quite volatile. Central bank statisticians could therefore help to explain to a wider audience how these data should be approached.

The same caution could be applied to consumer surveys on price expectations. In the euro zone, for instance, the latest indicators in August show that inflation expectations are on a moderating trend. But, looking at the long-term behaviour of this indicator (see Graph 4, covering the period 2004–14), it is hard to see any evidence for a deflationary spiral.

Consumer survey-based inflation expectations in the euro area[1]

Net balances, in per cent Graph 4

[1] Price trends over the next 12 months; European Commission (DG-ECFIN) Consumer Survey.

Sources: Datastream; European Commission.

Again, central bank statistical experts could help the public and market participants to arrive at a balanced and well supported view of the actual risks to price stability. And here might I conclude with a mention of the great economist for which your committee is named? As the originator of the debt deflation concept, Irving Fisher would surely have approved of any statistical initiatives that, one way or the other, can inform the debate around price stability.

Let me close by wishing you every success in your discussions today and tomorrow. And we look forward to seeing you here again in two years' time.

Thank you for your attention.

Opening remarks

Muhammad Ibrahim, IFC Chairman

Good morning ladies and gentlemen,

I am pleased to open the seventh IFC Biennial Conference on "Indicators to support monetary and financial stability analysis: data sources and statistical methodologies". I wish you a warm welcome, and I would also like to thank the BIS very much for hosting the conference and for the very interesting thoughts that its Deputy General Manager, Hervé Hannoun, has just shared with us.

It is now 14 years since the first conference took place in 2000. Since that time, the IFC Committee has been formally set up in Basel with a Secretariat provided by the BIS, and it reports to the BIS Governors on an annual basis.

It is a great pleasure for me to attend this biennial conference here in Basel for the second time as the IFC Chairman. I am encouraged by the great support from all of you present here today. Your participation is a testimony to your enthusiasm and to the support by your central banks of the IFC. I wish to take this opportunity to extend my deep appreciation to all the IFC Executives and members, distinguished speakers and participants, who have made time to attend this conference.

Ladies and gentlemen

Let me start by sharing with you some views on a number of key developments reviewed by the IFC Committee in its annual meeting yesterday.

Firstly, we elected two new members to the IFC Executive. They are:

- Mr João Cadete de Matos, Director of Statistics Department, Bank of Portugal; and
- Mr Robert Kirchner, Deputy Head of Statistics Department, Deutsche Bundesbank.

Let us welcome these two experienced central bankers in the statistical and central banking community and thank them for their willingness to play an active role in the IFC.

My term as the IFC Chairman, which started in 2012, will be completed by the end of this year. The process of identifying and selecting a new Chairman started several months ago. In line with IFC statutes, we are currently in the midst of finalising the selection of a candidate; a proposal will be presented to all IFC Committee members for endorsement before final approval by the BIS All Governors during their November meeting.

Another development in the IFC is the upcoming retirement, with effect from 1 October 2014, of Paul Van den Bergh, former Head of the IFC Secretariat. Paul is an experienced economist and supported the work of various committees of BIS central banks before he took up his responsibility in the statistical area in early 2000. He joined the IFC Executive soon after, and was its Chairman for two years in 2004-2005. He then helped the central banks to establish the IFC as a BIS committee of central banks and obtained support from Governors for the BIS to provide a Secretariat, which he has since headed. He has contributed personally, and with the support of his colleagues at the BIS, to the organisation of numerous IFC events. He has also guided us on content issues and in formulating excellent high-level summaries for Governors of all our deliberations, including the IFC Annual Reports.

Let me record all of these achievements by Paul and his team. I would also like to convey my personal thanks to Paul for his significant contribution during my term as the IFC Chairman. His advice and wisdom has greatly helped me to uphold the trust pledged in me by the BIS Governors.

I look forward to the continuous strong cooperation and good work from both new and existing members of the Executive as well the Secretariat, now headed by Bruno Tissot, the new Head of Statistics and Research Support at the BIS. I trust that the great teamwork I experienced and excellent support given to me by the Executive and Secretariat will continue under the leadership of the next Chairman.

On a personal note, I wish to take this opportunity to extend my greatest appreciation to all the Executive and Committee members for all their support and cooperation over the last two years, as well as to the BIS and the Central Banking Community more generally. I recognise this as a particularly rewarding experience in my career. Working with all of you here, as part of the central bank statistical community, has indeed been an enriching experience.

Yesterday, we also discussed the findings of this year's survey of IFC membership. The findings have been very useful in setting the IFC agenda, determining focus, planning initiatives and activities, and in improving the Committee's governance. In the survey responses, I am pleased to report that IFC Committee members indicated a continued strong interest in and commitment to contributing towards the successful implementation of IFC's initiatives.

The survey also confirmed that recent IFC programmes have prompted very strong interest among committee members, especially regarding supervisory data, financial accounts, and monetary and financial stability indicators. Almost all the responding institutions have expressed a strong interest in participating in today's conference, and more than 50% have already indicated that they will join us at next year's conference in Rio de Janeiro.

As regards the IFC's work programme, the survey shows that there are many statistical topics of interest to the central banking community, especially on:

- macroprudential and supervisory data;
- BIS statistics, especially on securities, banks and property prices;
- external sector statistics; and
- data management issues (eg technology, communication and dissemination).

Lastly, the survey also indicates a general satisfaction with the Committee's governance and activities as well as with the work of the IFC Secretariat.

The IFC Executive will establish a list of plans and actions to fulfil these needs and these will be implemented in the next one to two years. These activities will be in addition to the planned initiatives which the IFC has already begun. These include:

- additional regional workshops on sectoral financial accounts;
- contribution to the ISI Regional Statistics Conference on 16–19 November 2014 in Kuala Lumpur;

- organisation of the IFC Satellite Seminar with the theme "Is the household sector in Asia overleveraged: what do the data say?" to be held on 15 November 2014, in conjunction with the ISI conference in Kuala Lumpur; and
- contribution to the 60th World Statistics Congress of the ISI, and IFC Satellite Seminar in Rio de Janeiro in July 2015.

Of importance, most of the key initiatives and activities planned for the year have been delivered or achieved. These include: the establishment of a formal relationship with the ISI through an MOU; the conclusion of the study by the Task Force on Data Sharing and; the successful organisation of two regional workshops on sectoral financial accounts already held in Istanbul and Kuala Lumpur. All these planned activities and completed initiatives will be documented in our next Annual Report to the BIS All Governors.

* *

*

Ladies and gentlemen,

Let me move on to talk about our conference and specifically the agenda for the next two days.

Over the past decades, the functions and objectives of modern central banks have evolved in tandem with changing economic structures and advancements in the financial landscape. The pursuit of monetary stability has traditionally been the primary mandate of central banks. In many countries, price stability is the dominant monetary policy objective. However, as recent years have demonstrated, the role of central banks in the area of financial stability is also critical. The most recent crisis has increased the focus on financial stability and its interconnectedness with monetary stability.

With these seemingly conflicting mandates, central banks are confronted with the challenge of balancing the need to maintain monetary stability and the desire to promote financial stability. Research findings suggest that price stability objectives may not always be consistent with financial stability objectives. Occasionally, price stability itself could potentially be associated with excessive risk-taking behaviour. This in turn leads to financial imbalances, which can result in a sharp and destabilising correction in the financial system. These trade-offs have posed challenges to the function of modern central banks. This matter is a subject of debate and central banks are learning how best to deal with this trade-off.

The topic for today's conference "*Indicators to support monetary and financial stability analysis*" is timely given the increasing challenges confronting monetary policy analysis, which has been complicated by a confluence of internal and external factors. In addition, central banks' responsibility with respect to financial stability requires a comprehensive view of the patterns, elements, and relationships in the global financial system. This essentially raises demands for high quality, more granular and standardised data sets that encompass the entire financial system, as well as the interactions with the real economy.

To be useful, it is essential that indicators are compiled using appropriate tools and methodologies so that they can appropriately assist central banks in formulating the best combination of monetary and financial stability policies. A comprehensive and meaningful list of indicators on monetary conditions would guide central banks in devising a timely policy response to emerging threats in the financial system and the economy. For example, central banks should be able to identify, and respond in a timely manner, not only to short-term inflationary pressures but also to destabilising financial imbalances and other imminent risks. For instance, in response to possible build-up of excessive vulnerabilities, central banks may opt to increase the policy rate, which otherwise would remain unchanged on the basis of the short-term outlook for inflation.

We have structured this year's programme to facilitate deliberation on indicators related to the key elements of central banks' mandate. In particular, discussions in the first two sessions of this conference will provide a general review of the new types of monetary and financial stability indicators. The subsequent sessions are devoted to more specific topics, eg relevant methodologies for compiling the data needed for monetary and financial stability analyses (ie sample surveys), micro data, statistical techniques, and policy indicators. I wish to thank those who will be presenting their work on all these issues at this conference. Let me also take this opportunity to thank in advance the various members of the IFC Executive who will chair the different sessions and help us draw some general conclusions from the discussions.

On the second day, Mr Hyun Song Shin, BIS Economic Adviser and Head of Research, will share his thoughts with us on "Breaking the Triple Coincidence in International Finance". We very much look forward to his keynote address. The conference will conclude with a panel discussion to address the important question of "How to integrate and combine data from central banks and supervisory authorities, as well as across different micro and macro databases and sources, to support monetary and financial stability analysis". I will introduce the selected panellists tomorrow afternoon.

As part of our continuing efforts to encourage more involvement of young statisticians in statistical conferences and to recognise their participation in this conference, we will be presenting the Young Statistician's Award at the end of the conference. This is the third time we will confer such an award at our biennial conference. There are nine entries for this year's award. The winner will be announced at the closing ceremony tomorrow afternoon.

As IFC Chairman for almost three years now, I have noticed that the IFC has become an increasingly important forum for the exchange of views on statistical issues of interest amongst central bank economists, statisticians and policy makers. The IFC platform and its statistical initiatives were planned and implemented with the aim of generating greater interest, collaboration and benefits to all the above stakeholders.

Lastly, let me also take this opportunity to remind you again that many important IFC events will take place during the remainder of 2014. In particular, I would like to personally invite you and your institutions to participate in the IFC Satellite Seminar on household debt and in the ISI regional conference, both to be held in Kuala Lumpur this November.

With this, ladies and gentlemen, I conclude my opening remarks. Let me thank the BIS again for its hospitality and all of you for your presence and participation.

On that note, I wish you a productive and engaging conference.

Thank you.

Breaking the Triple Coincidence in International Finance*

Hyun Song Shin
Bank for International Settlements

Keynote speech at seventh conference of
Irving Fisher Committee on Central Bank Statistics
Basel, 5 September 2014

*Views expressed here are the author's, not necessarily those of the BIS.

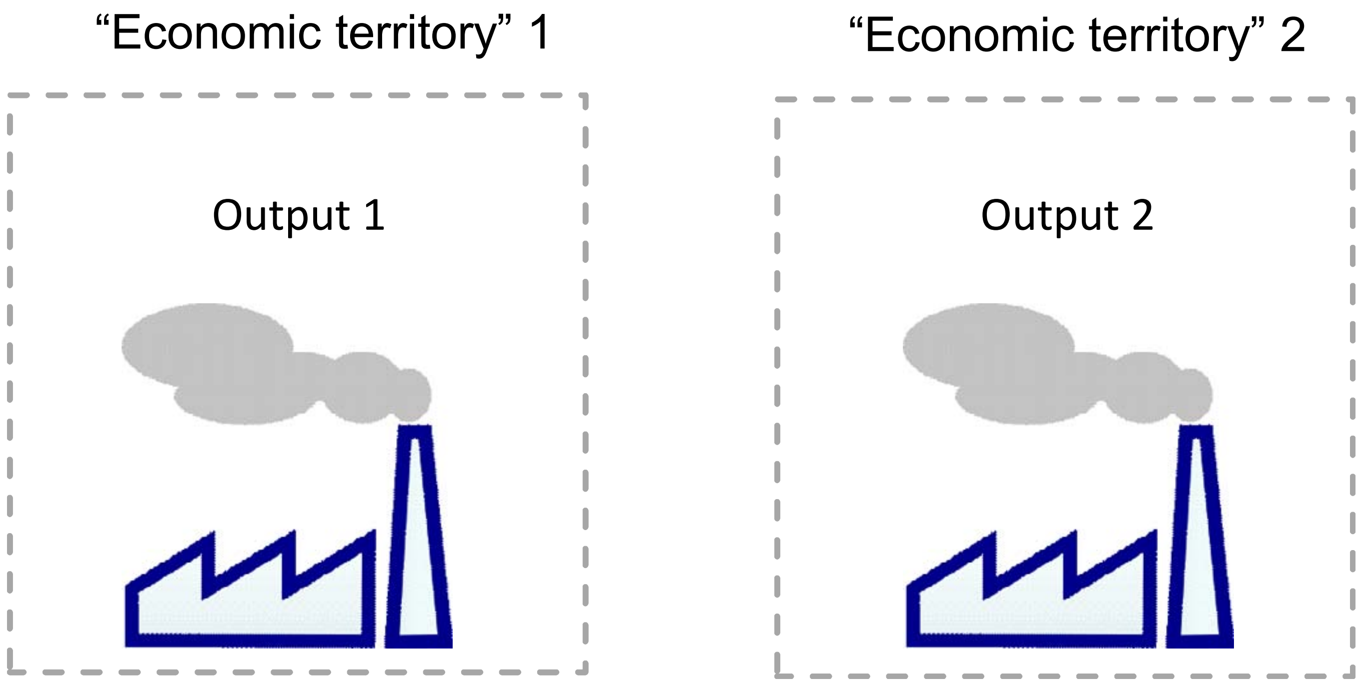


Figure 1. Boundary for national income accounting defines "economic territory"

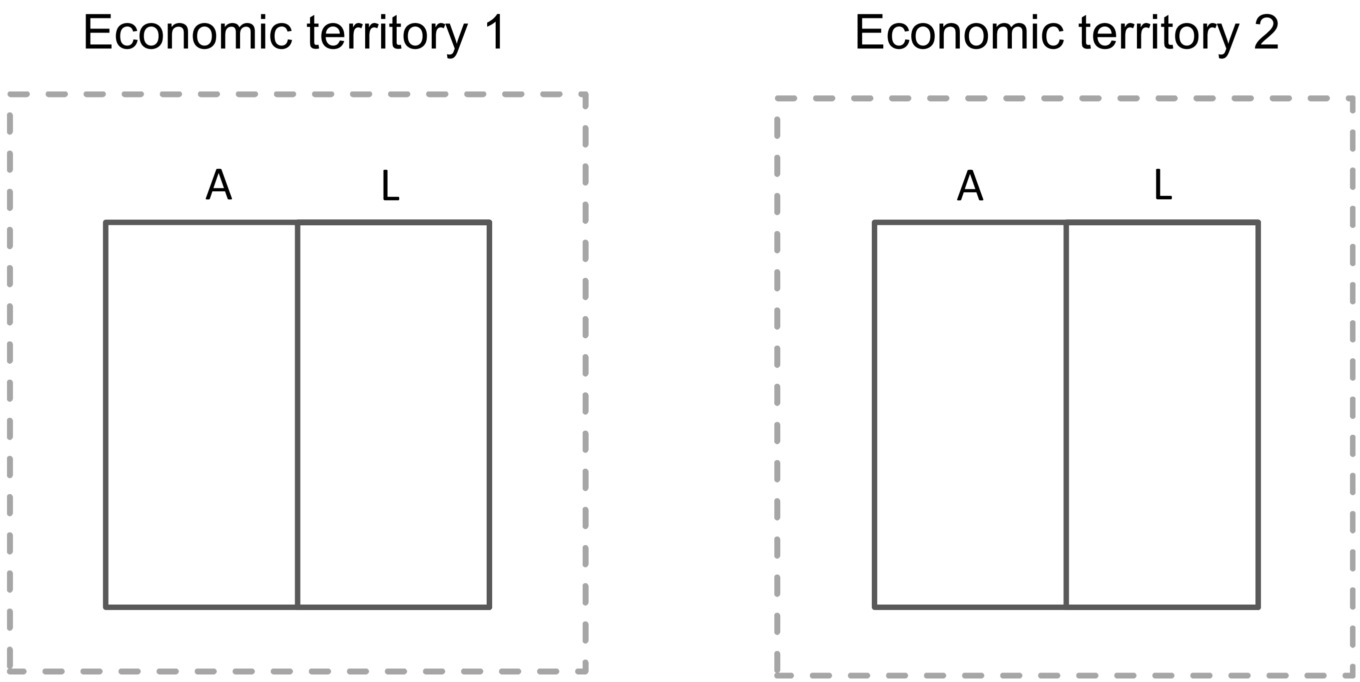


Figure 2. Boundary for national income accounting defines decision-making unit

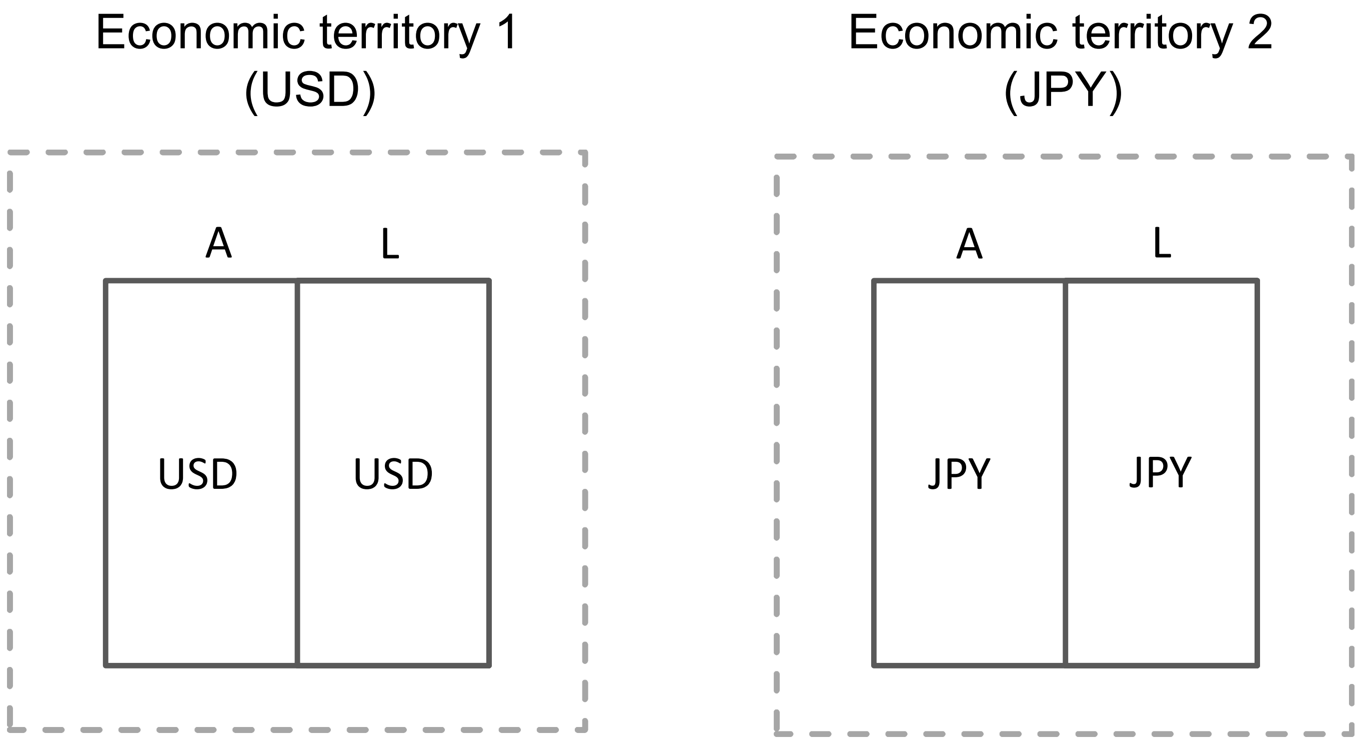


Figure 3. Boundary for national income accounting defines exchange rates as relative prices across boundary

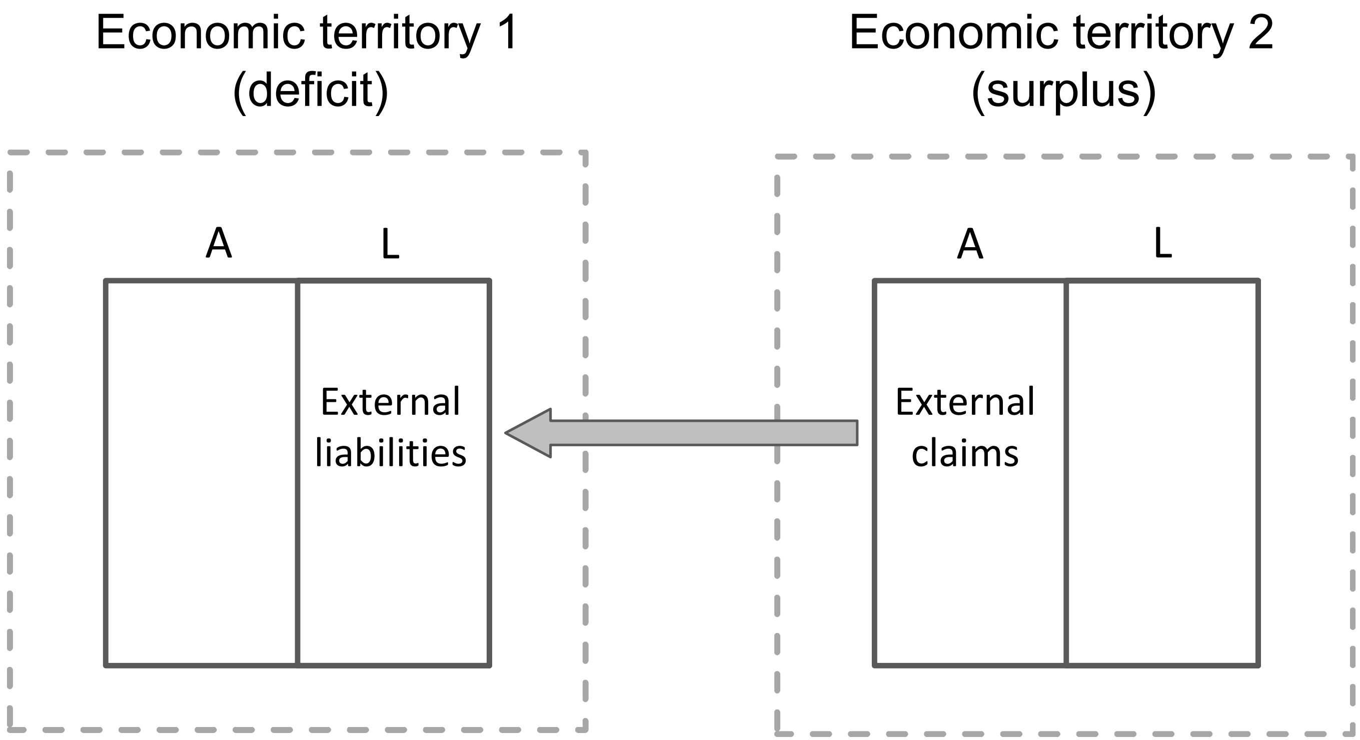


Figure 4. Boundary for national income accounting defines balance of payments and external claims/liabilities

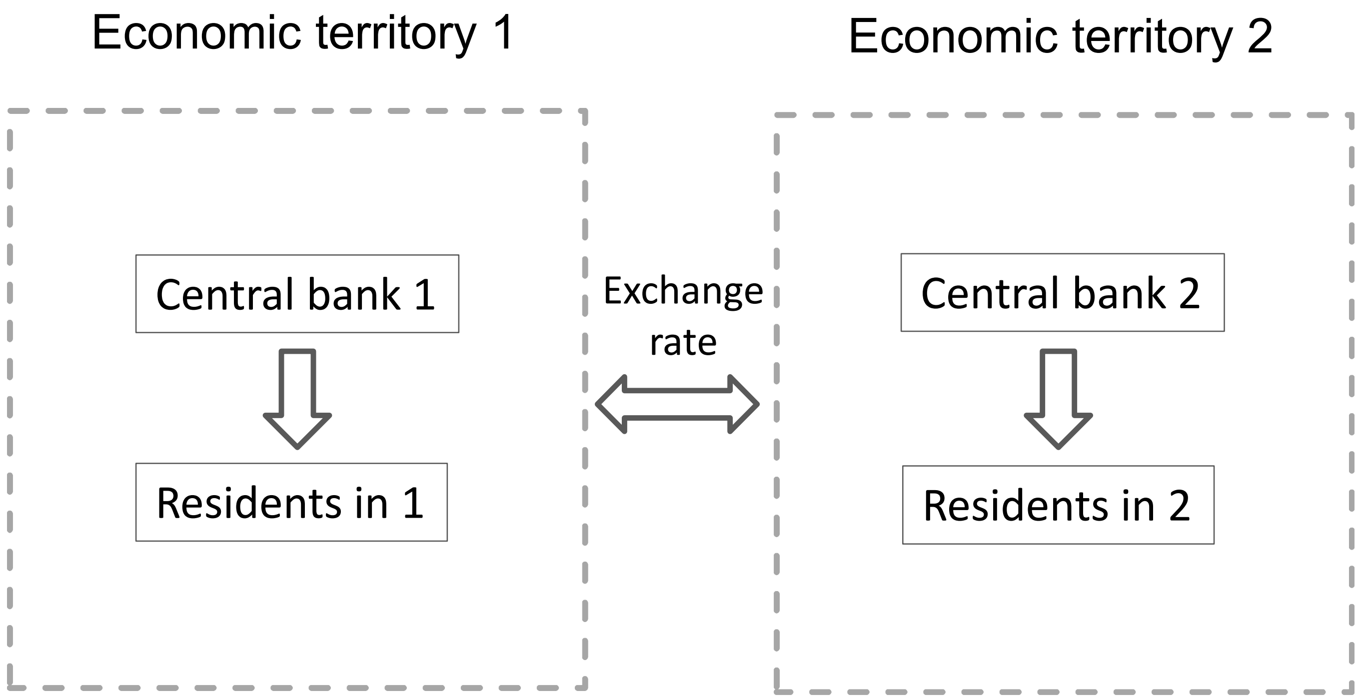


Figure 5. Boundary for national income accounting defines reach of monetary policy; floating exchange rates ensures monetary policy autonomy

"Triple Coincidence"

- Boundary of national income area
- Boundary defining decision-making unit with coherent preferences
  - Consumption and savings decisions (e.g. "global savings glut")
  - Portfolio choice decisions (e.g. preference for "safe assets")
- Boundary defining currency area
  - Exchange rate as relative price level

Three Examples

1. "Roundtrip" bank capital flows from United States to Europe and then back to the United States (2003 - 2008)

2. Offshore issuance of corporate bonds by EM borrowers (2010 -)

3. Cross-border banking and global liquidity (2003 - 2008)

Example 1

“Roundtrip” bank capital flows from Europe to the United States

(2003 - 2008)

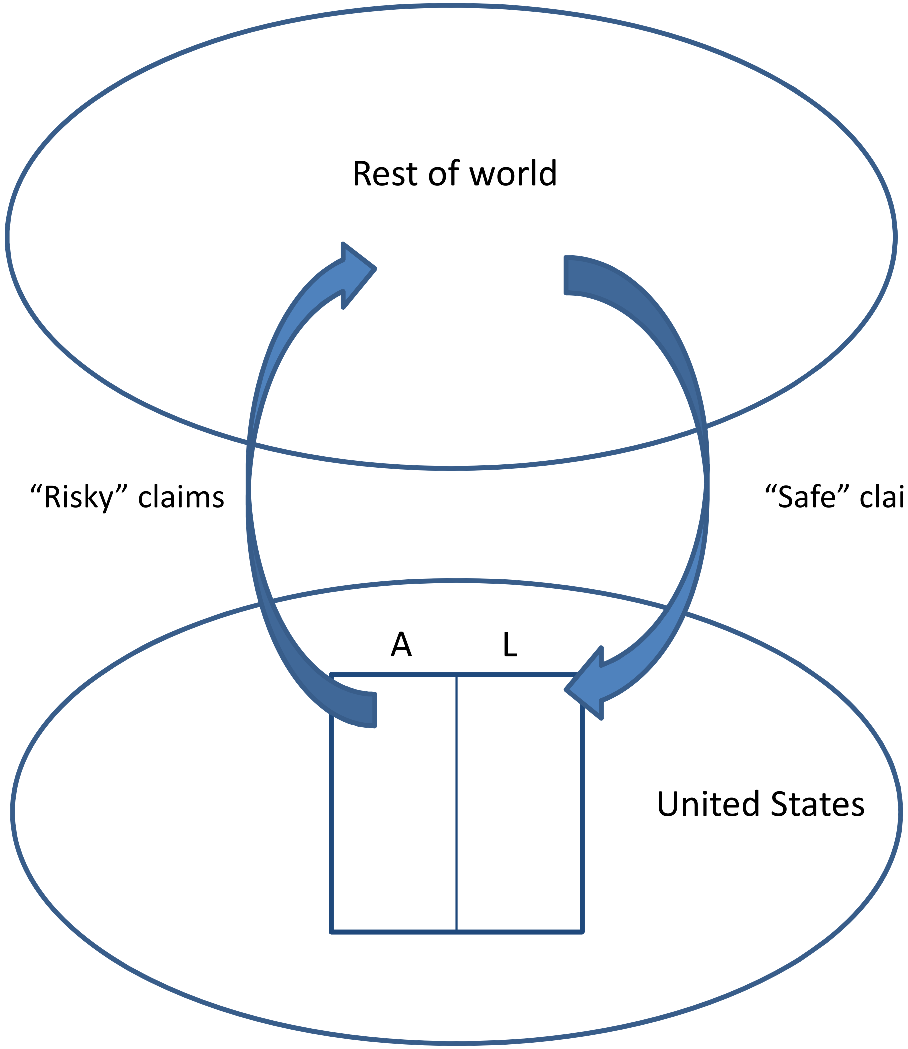


Figure 6. Schematic of "safe asset preference" view of global imbalances

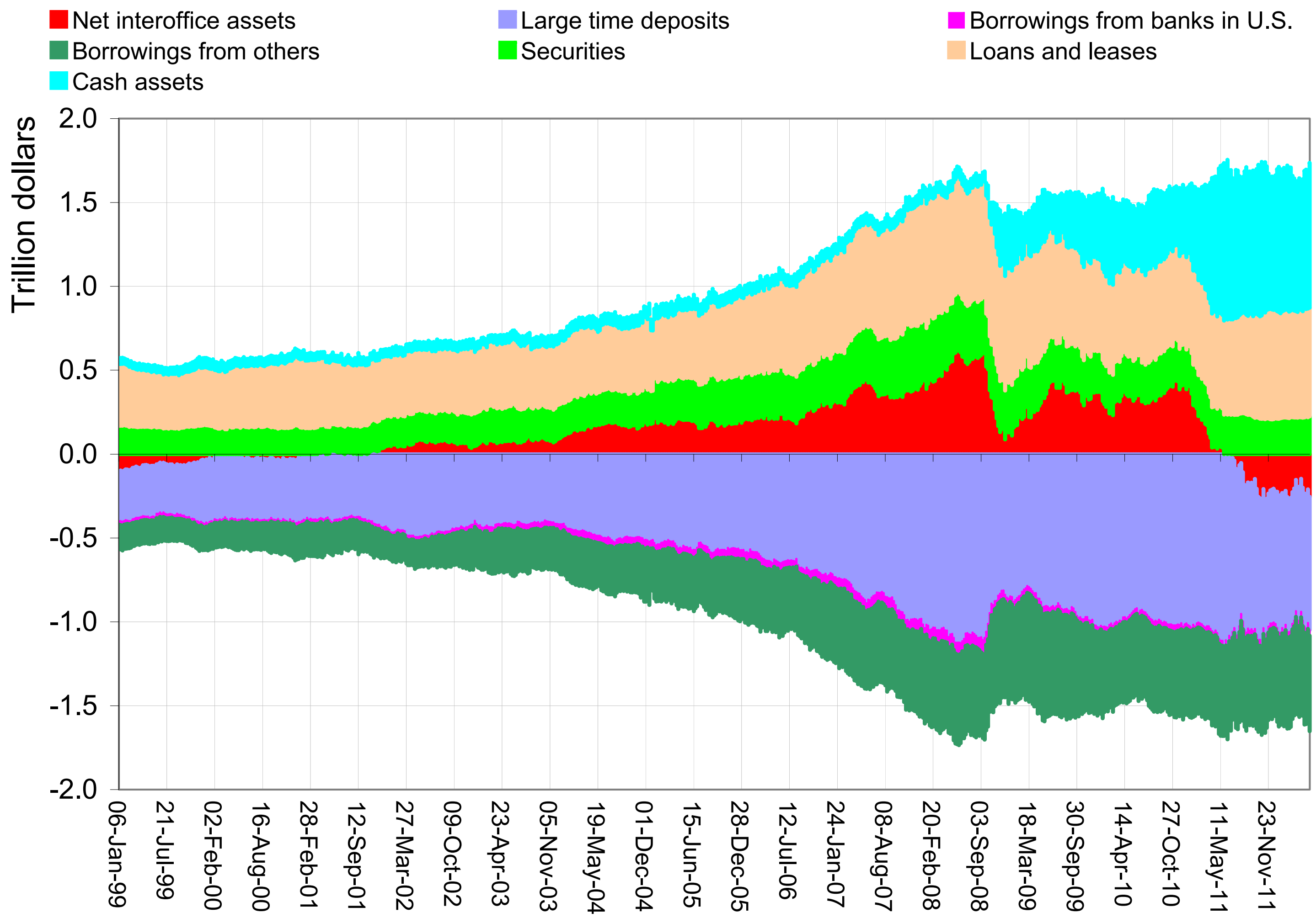


Figure 7. Assets and liabilities of foreign banks in the U.S. (Source: Federal Reserve H8 weekly series on assets and liabilities of foreign-related institutions)

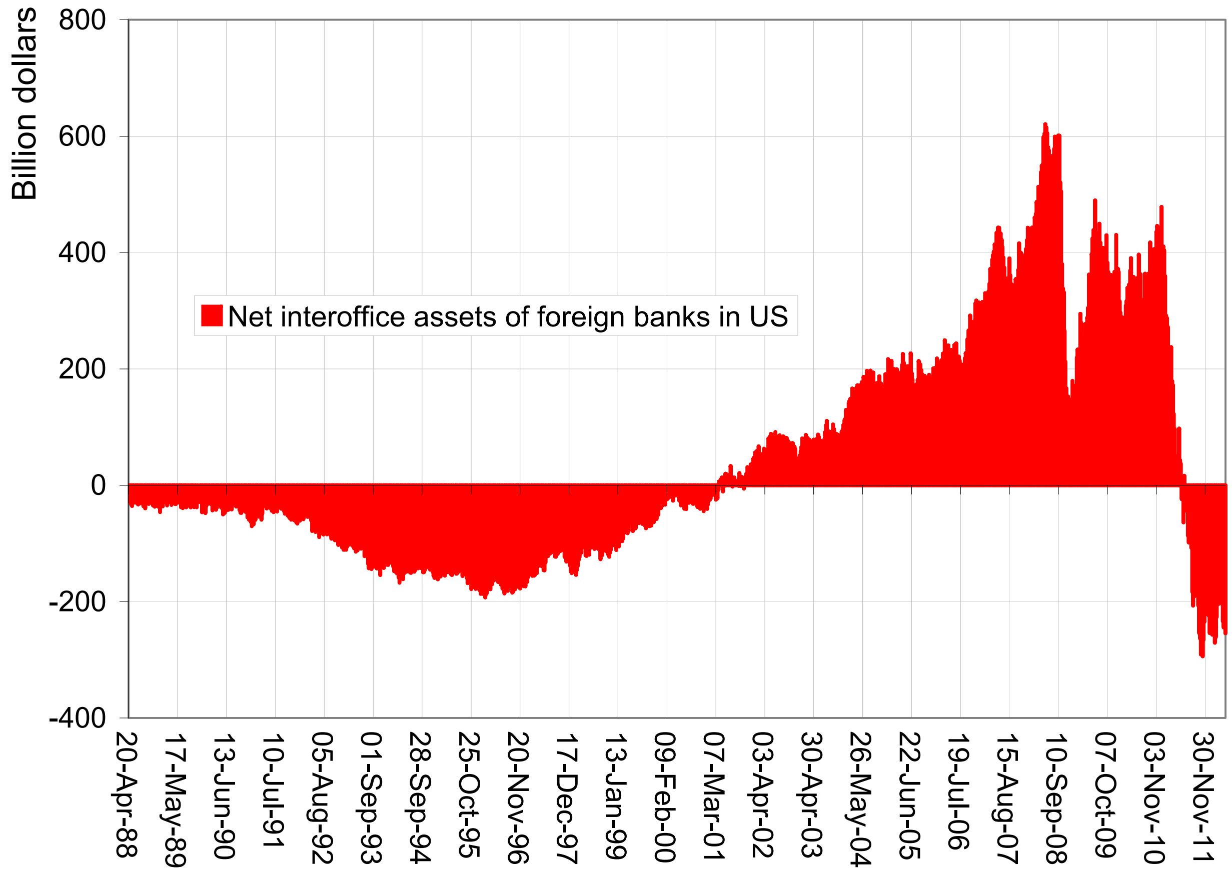


Figure 8. Net interoffice assets of foreign banks in U.S. given by negative of Federal Reserve weekly H8 series on "net due to related foreign offices of foreign-related institutions"

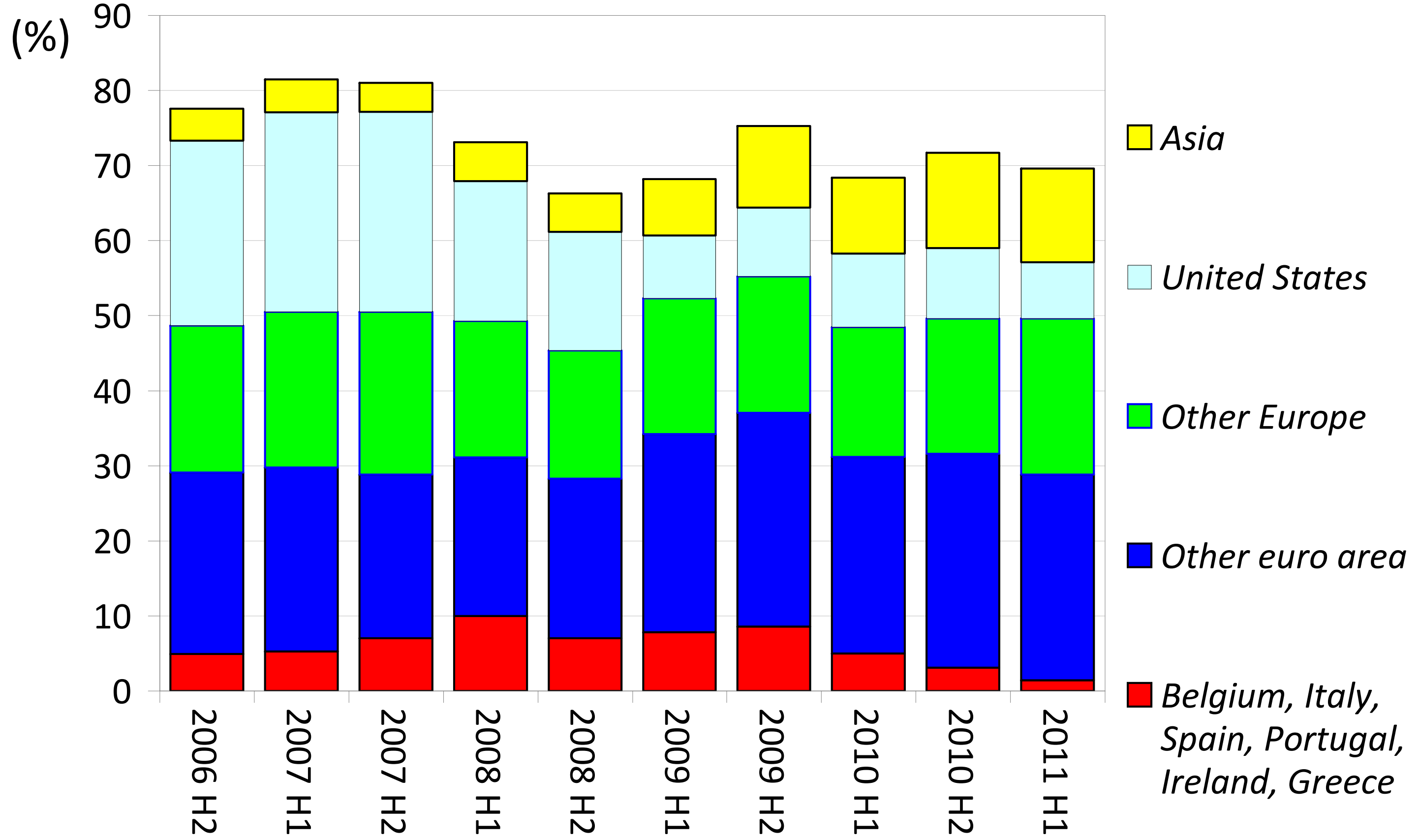


Figure 9. Amount owed by banks to US prime money market funds (% of total), based on top 10 prime MMFs, representing $755 bn of $1.66 trn total prime MMF assets (Source: IMF GFSR Sept 2011, data from Fitch).

Figure 10. Gross external assets and external liabilities of the U.S. banking system (ODC sector) by instrument (source: Errico et al. (2013))

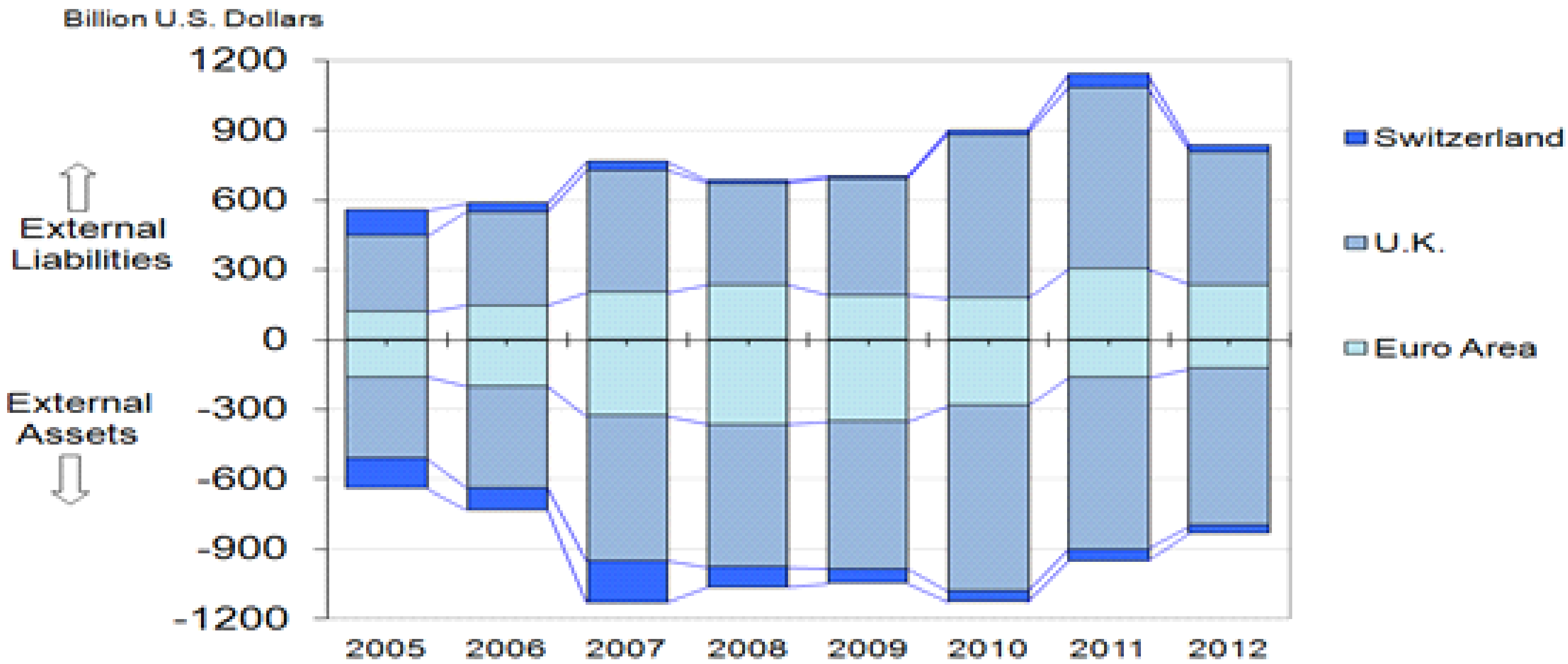


Figure 11. Counterparties by location of the "Currency and Deposits" component of the U.S. banking system (ODC sector) (Source: Errico et al. (2013))

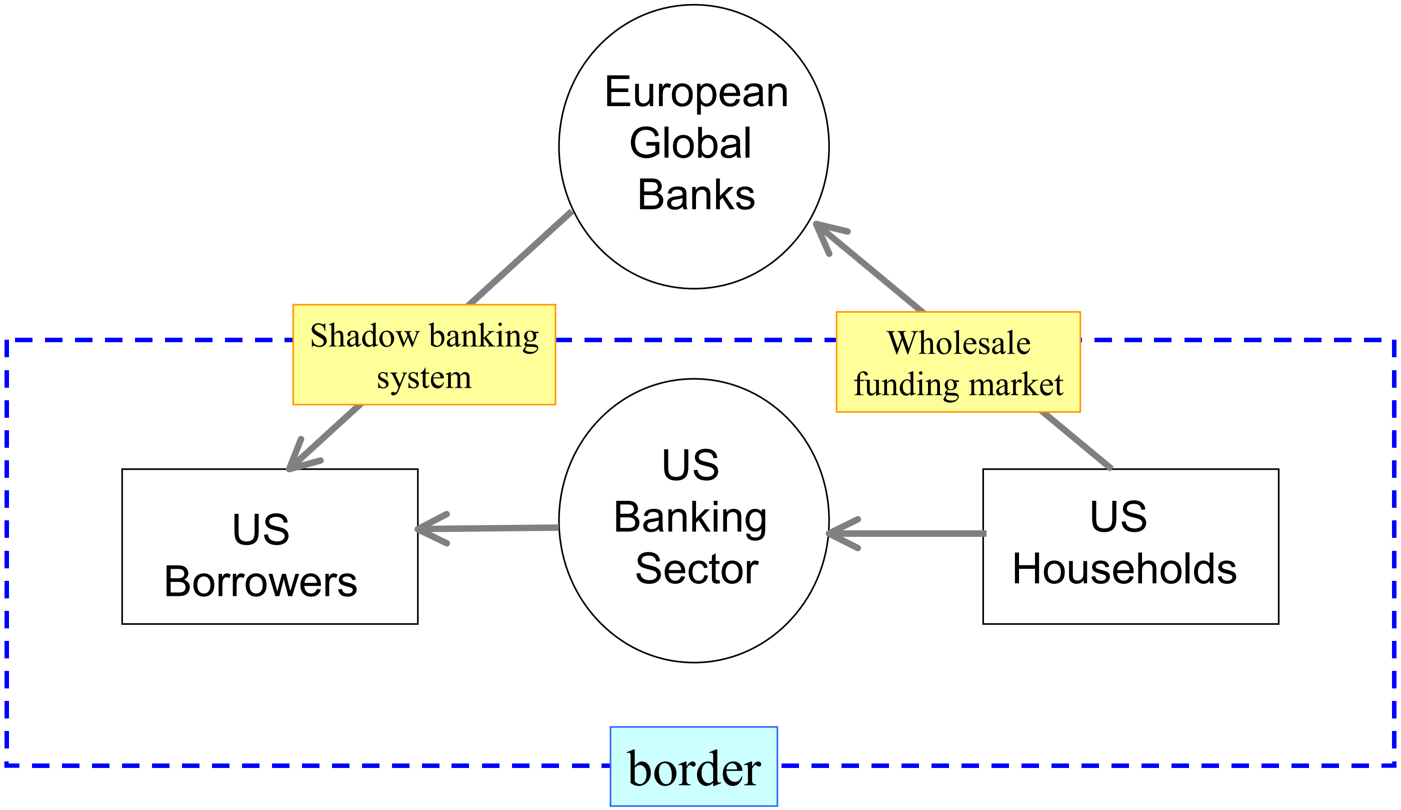


Figure 12. European global banks add intermediation capacity for connecting US savers and borrowers (Source: Shin (2012))

Example 2

Offshore issuance of corporate bonds by EM borrowers

(2010 -)

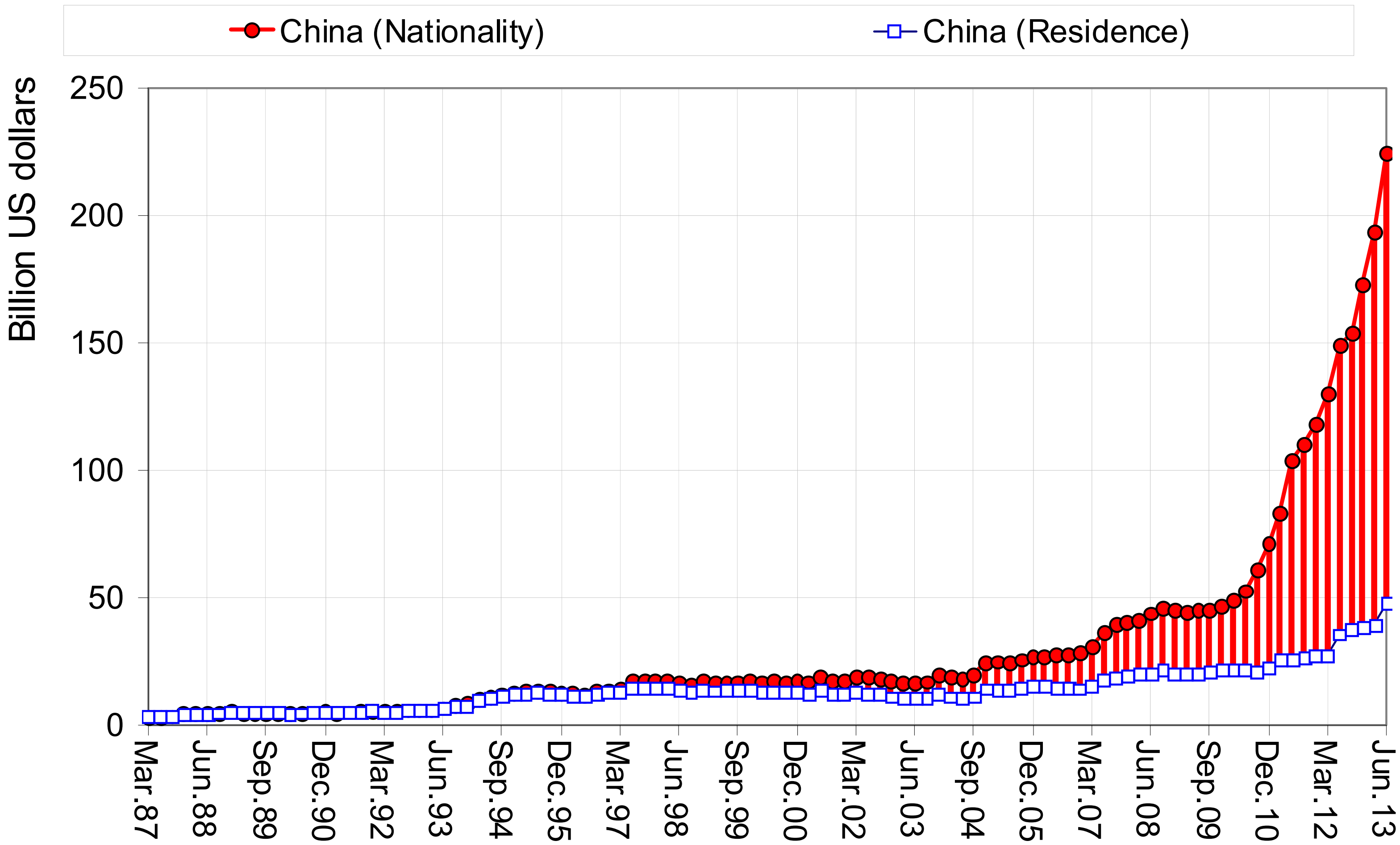


Figure 13. International debt securities outstanding (all borrowers) from China by nationality and by residence (Source: BIS Debt Securities Statistics, Table 11A and 12A)

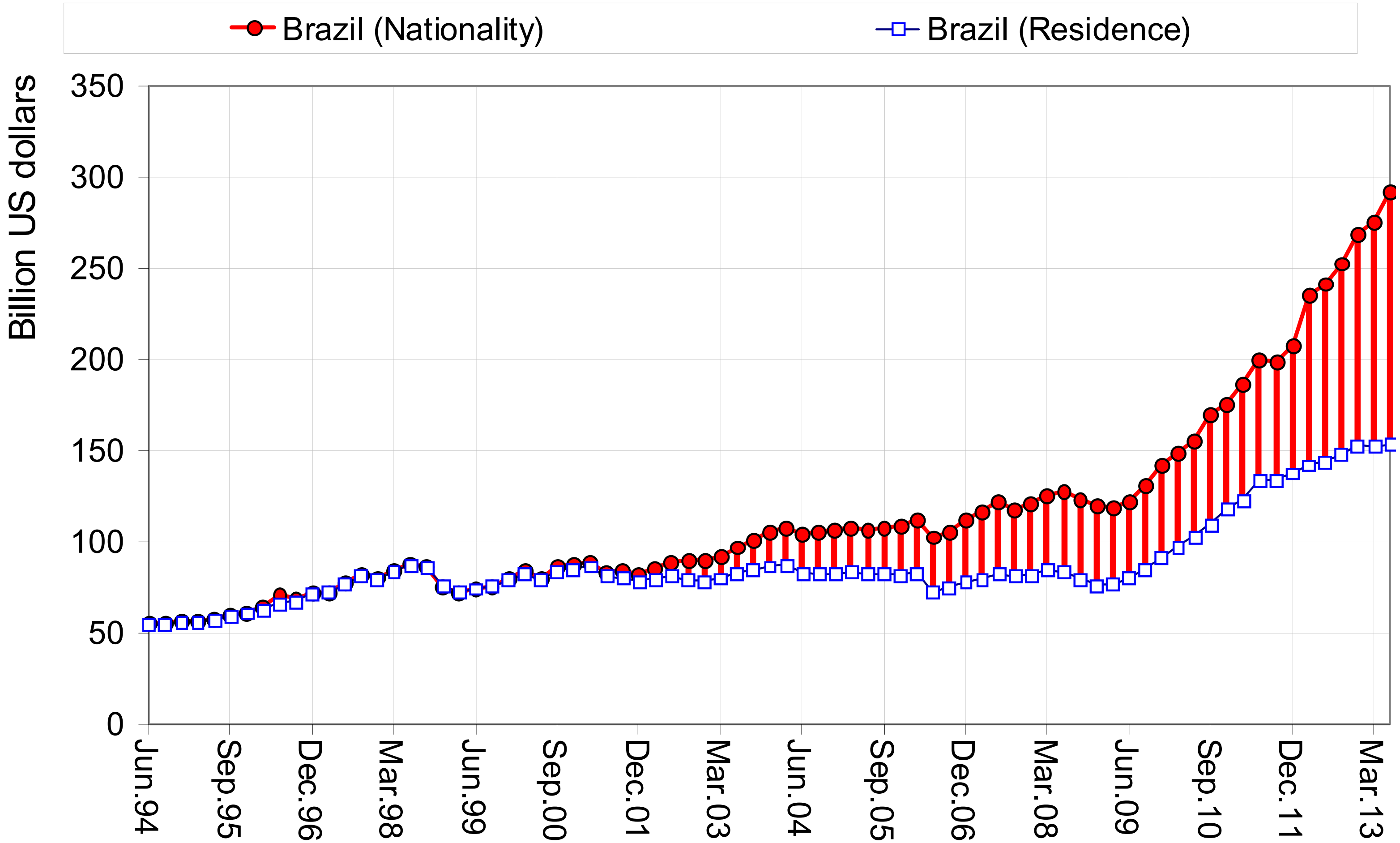


Figure 14. International debt securities outstanding (all borrowers) from Brazil by nationality and by residence (Source: BIS Debt Securities Statistics, Table 11A and 12A)

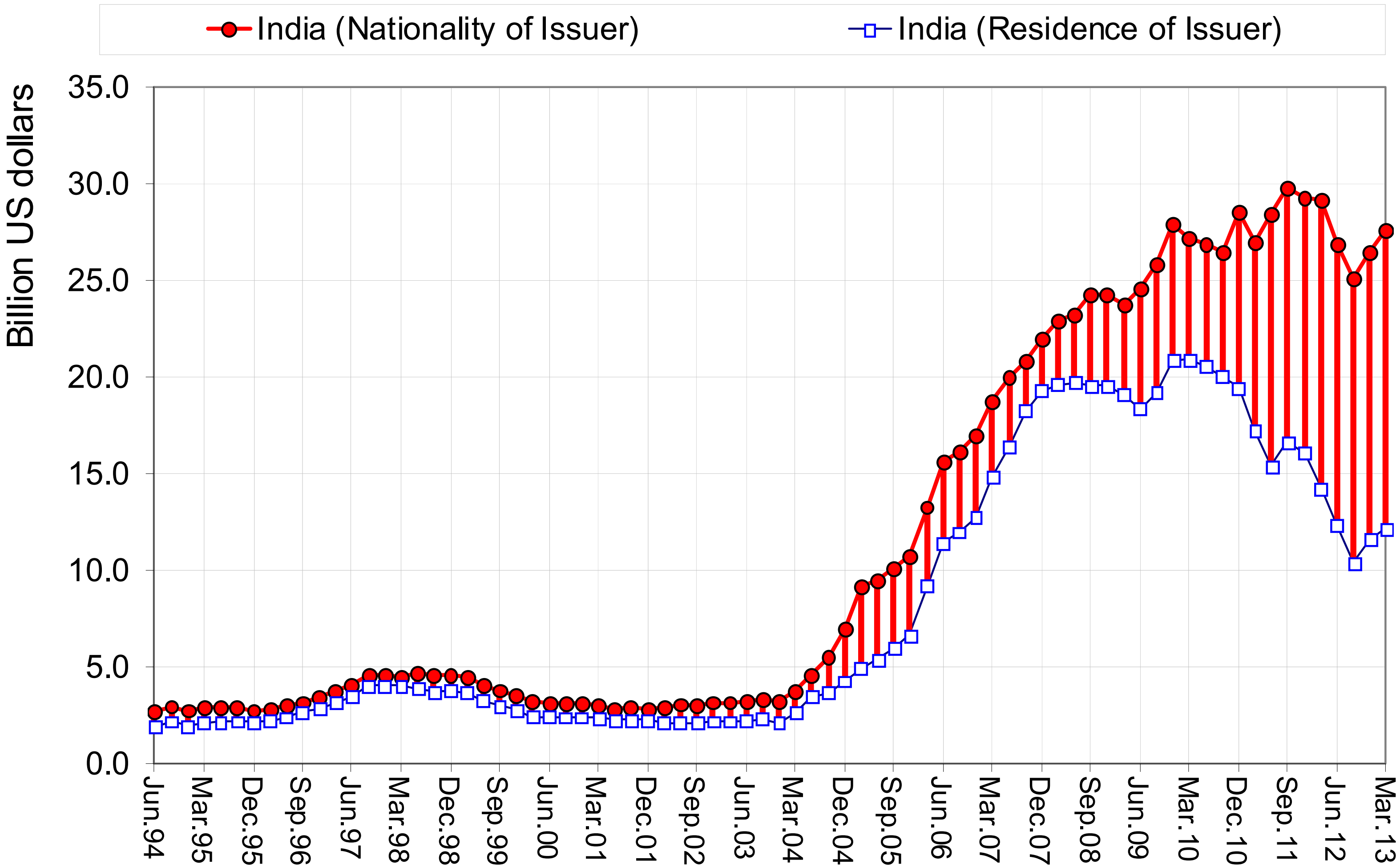


Figure 15. International debt securities outstanding for non-financial corporates from India by nationality and by residence (Source: BIS Debt Securities Statistics, Table 11D and 12D)

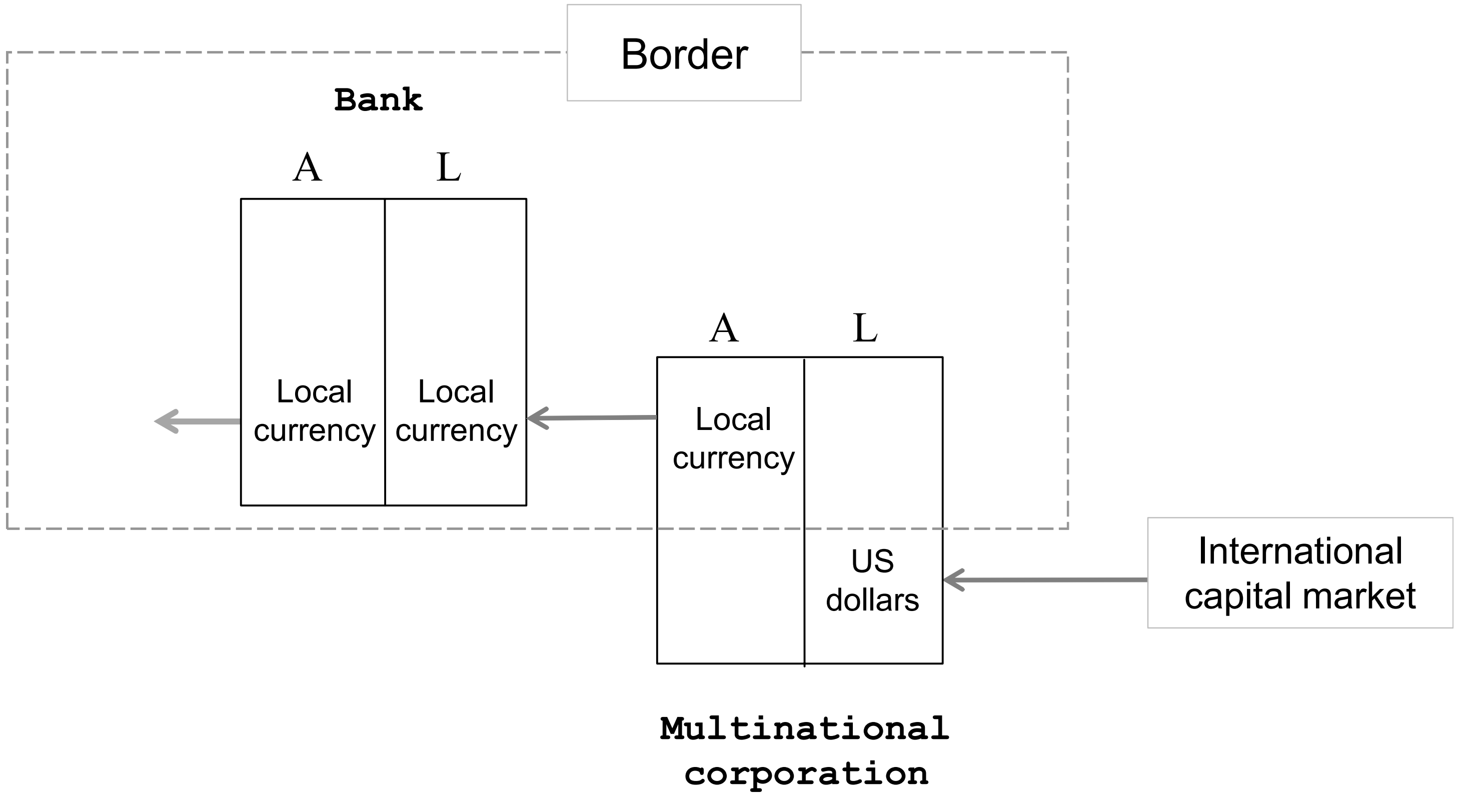


Figure 16. Offshore borrowing by multinational firm from emerging economy

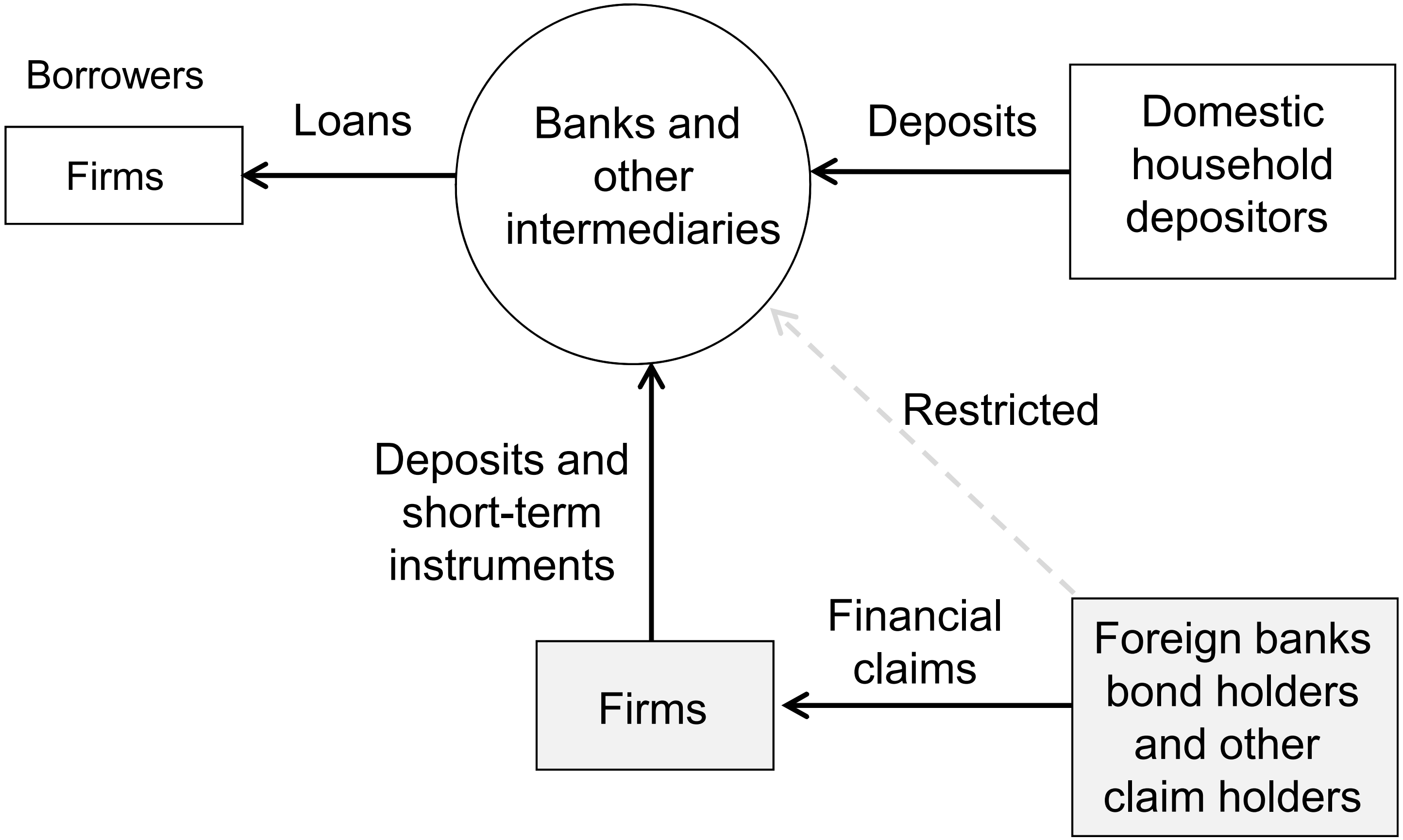
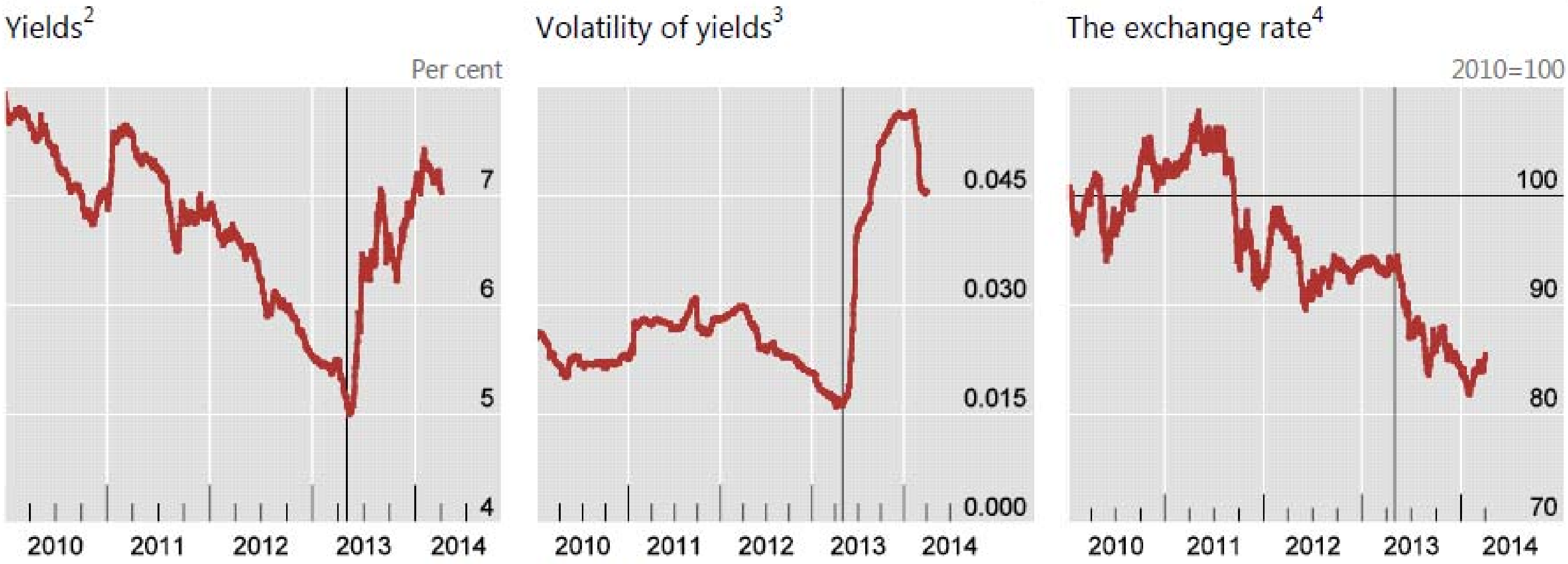


Figure 17. **Non-financial firms as intermediary.** In this diagram, firms with access to international capital markets act as an intermediary for outside funding when the banking sector has restricted access to international capital markets.

Yields of local EM government bonds and the exchange rates[1] Graph 2



The black vertical lines correspond to 1 May 2013 (FOMC statement changing the wording on asset purchases).

[1] All 3 graphs show the simple average of Brazil, India, Indonesia, Malaysia, Mexico, the Philippines, Poland, South Africa and Turkey. [2] Yields on 5-year local currency bonds. [3] 180-day moving standard deviation of daily changes in yields. [4] In dollars per unit of local currency.

Sources: Bloomberg; national data; BIS calculations.

Figure 18. Source: Philip Turner (2014) BIS working paper 441

Impact on Emerging Economies

- EME local currency bond yields
  - fell in tandem with advanced economy bond yields
  - began to move in lock-step with advanced economy bond yields
- Explosion of EME corporate bond issuance activity, especially offshore issuance
  - Implications for domestic monetary aggregates and potential for runs of wholesale deposits
  - Currency mismatch on consolidated corporate balance sheets
- Transmission channel is reinforced by exchange rate changes

Elements in Distress Loop

1. Steepening of local currency yield curve
2. Currency depreciation, corporate distress, freeze in corporate CAPEX, slowdown in growth
3. Runs of wholesale corporate deposits from domestic banking sector
4. Asset managers cut back positions in EME corporate bonds citing slower growth in EMEs
5. Back to Step 1, and repeat...

Unfamiliar Problems

- Asset managers (not banks) are at the heart of transmission mechanism in the Second Phase of Global Liquidity
- Textbooks say long-term investors are benign, not a force for destabilization
- How do we adjust to the new world?

Example 3

Cross-border banking and global liquidity (2003 - 2008)

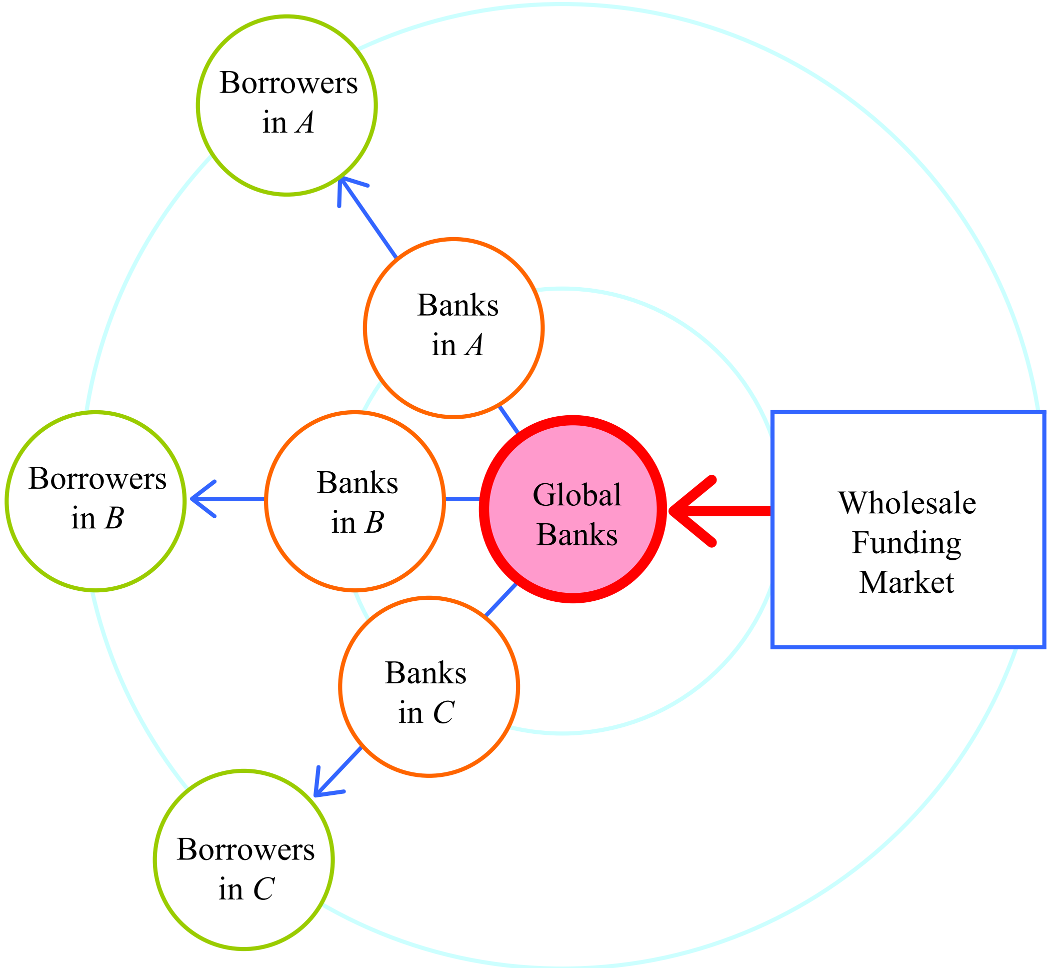


Figure 19. Topography of global liquidity

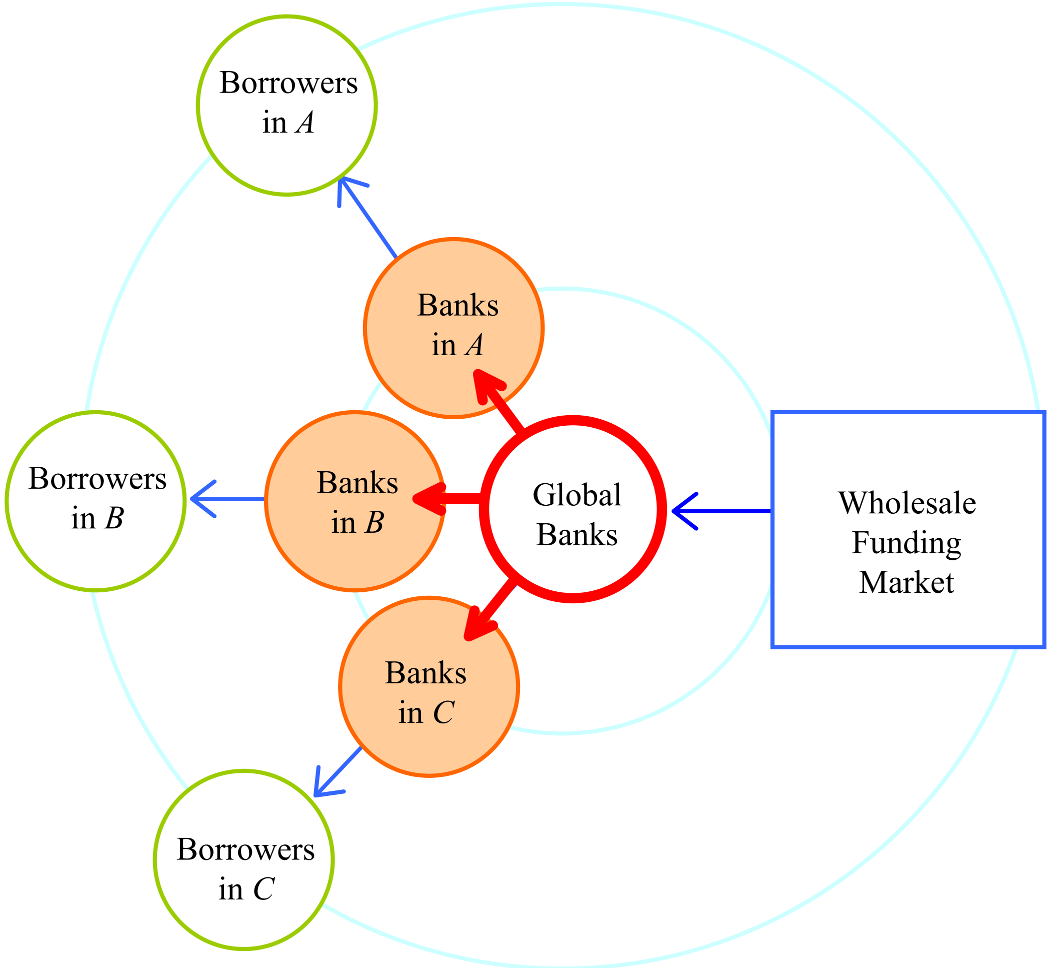


Figure 20. Topography of global liquidity

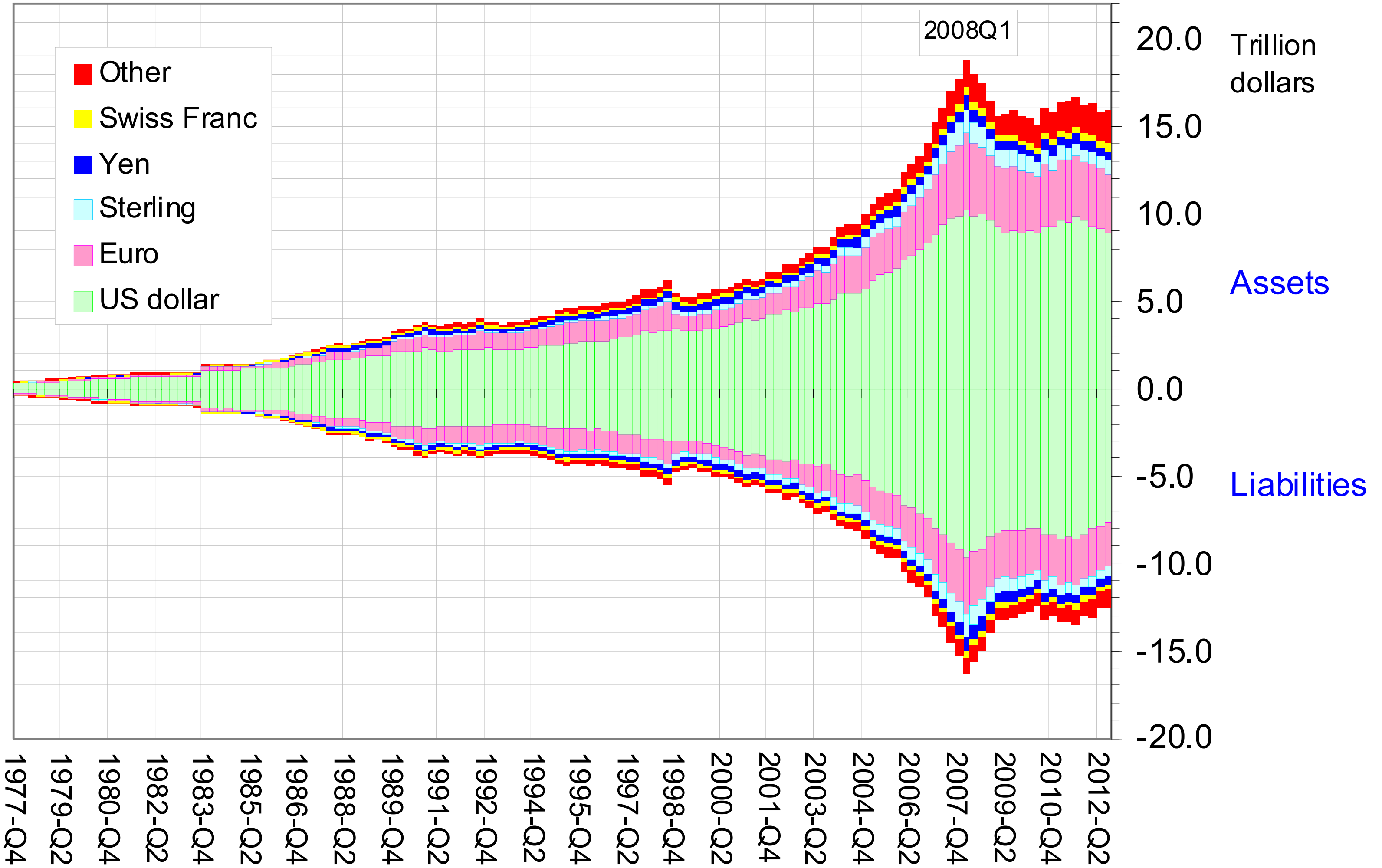


Figure 21. Foreign currency claims and liabilities of BIS reporting banks (Source: BIS Locational statistics 5A)

Three BIS working papers

- Borio, Claudio (2014) “The International Monetary and Financial System: Its Achilles Heel and What To Do About It” BIS Working Paper 456 http://www.bis.org/publ/work456.pdf

- Borio, Claudio, Harold James and Hyun Song Shin (2014) “The International Monetary and Financial System: A Capital Account Historical Perspective” BIS Working Paper 457 http://www.bis.org/publ/work457.pdf

- Bruno, Valentina and Hyun Song Shin (2014) “Cross-border Banking and Global Liquidity” BIS Working Paper 458 http://www.bis.org/publ/work458.pdf

Bruno and Shin (2014)

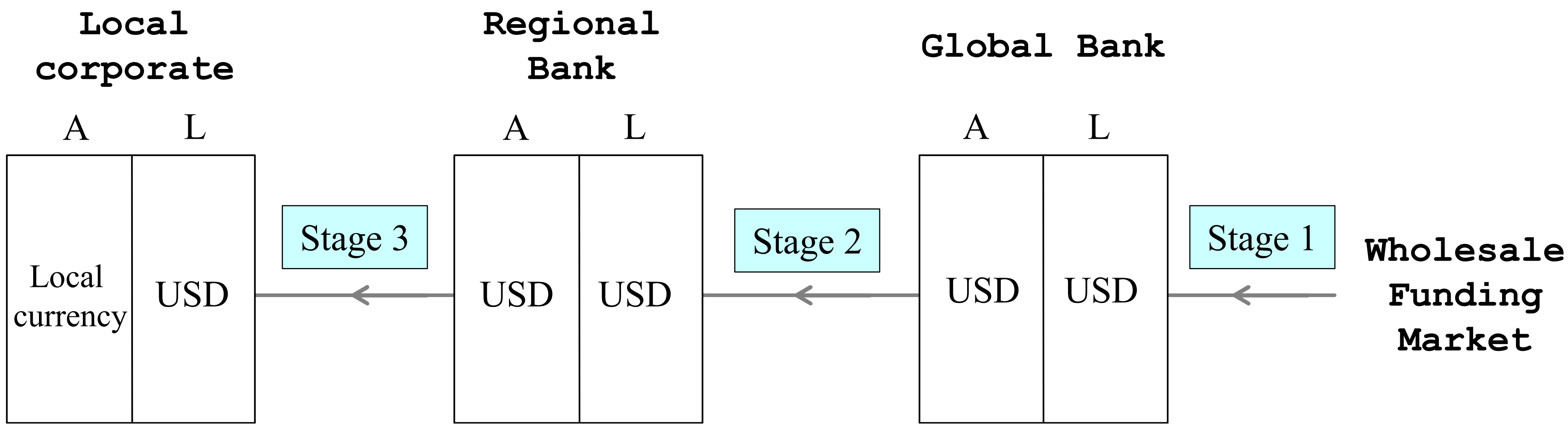


Figure 22. Cross-border bank lending in US Dollars

Where to draw the boundary?

The balance sheet chain is consistent with many variants with different placement of the border:

- The local bank can be within the border (say, branch of foreign-owned bank)
- The local bank can be in a neighbouring jurisdiction
- The asset side of the global bank could be in a regional financial centre (Hong Kong or Singapore, say)
- The liabilities side of the global bank could in the United States
- What of the European headquarters? Where does it fit in the picture?

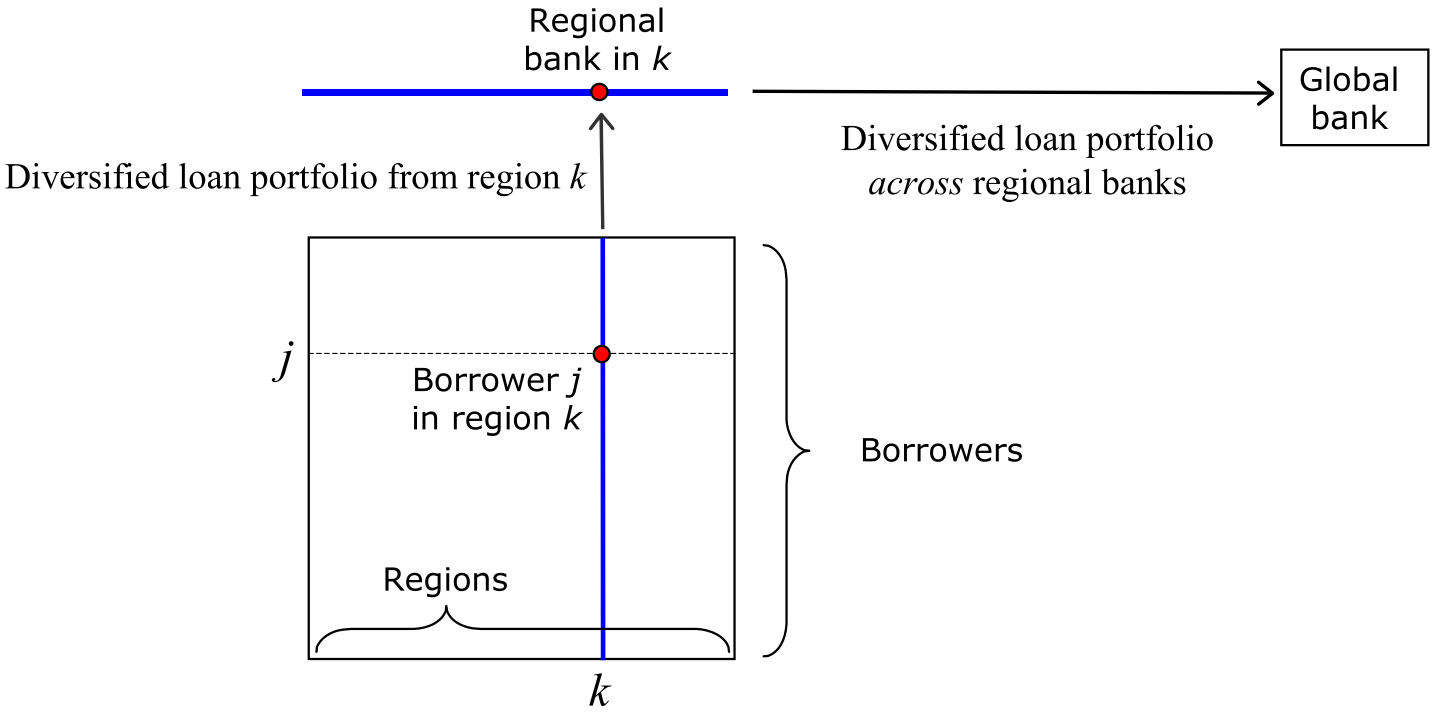


Figure 23. Global and regional banks

Bruno and Shin (2014)

- Demand for dollar credit in regions from corporate borrowers
- Credit risk follows Vasicek (2002), many-borrower extension of Merton (1974)
- Risk-neutral, price taking banks in each region; credit supply determined by regional bank leverage
- Risk-neutral, price taking global bank with access to US dollar money market funds

Closed Form Solution

$$\text{Total private credit} = \frac{\text{Aggregate bank capital (regional + global)}}{1 - \text{spread} \times \text{regional bank debt ratio} \times \text{global bank debt ratio}}$$

$$\text{Total cross-border lending} = \frac{\text{Global and weighted regional bank capital}}{1 - \text{spread} \times \text{regional bank debt ratio} \times \text{global bank debt ratio}}$$

Exchange rates and leverage

- Depreciation of US dollar constitutes a loosening of global financial conditions
  - US dollar depreciation strengthens local borrowers' balance sheets
  - Creates slack in lending capacity of local banks
  - Creates slack in global bank lending capacity
  - Expansion of lending; "excess elasticity" (Borio and Disyatat (2011))
- US monetary policy is global factor determining financial conditions worldwide

Empirical evidence in Gourinchas and Obstfeld (2012), Rey (2013), Miranda-Aggripino and Rey (2013)

Bruno, Kim and Shin (2014)

- Panel VAR exercise
  - 1995 - 2007
  - US GDP, Fed Funds rate, global bank leverage, VIX, bank capital flows, nominal exchange rate
  - US broker dealer sector leverage as proxy for global bank leverage

- Sample of 46 countries (Claessens, van Horen, Gurcanlar and Mercado (2008)): Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Malaysia, Malta, Mexico, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Kingdom and Uruguay.

Empirical Counterparts

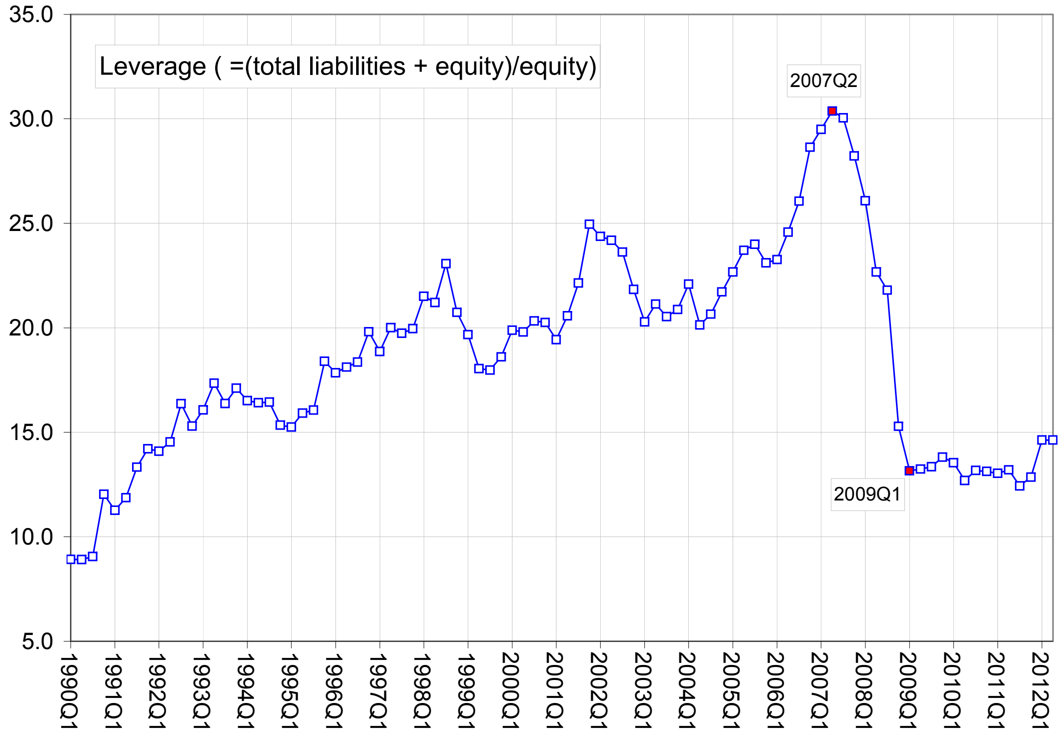


Figure 24. Leverage of US Securities broker dealer sector (Source: Federal Reserve Flow of Funds)

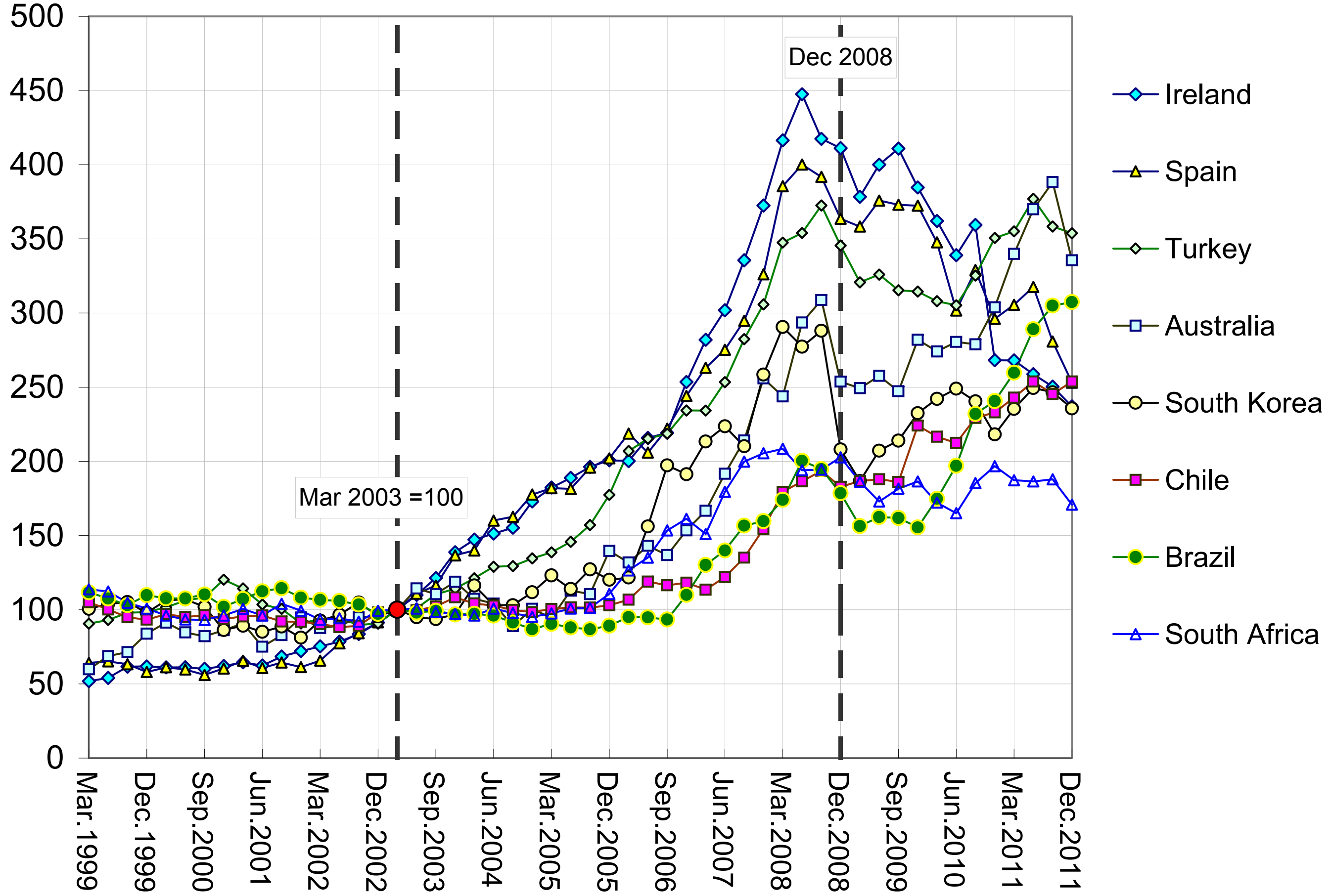


Figure 25. Cross-border claims (loans and deposits) of BIS reporting banks on counterparties listed on right (Source: BIS locational banking statistics Table 7A)

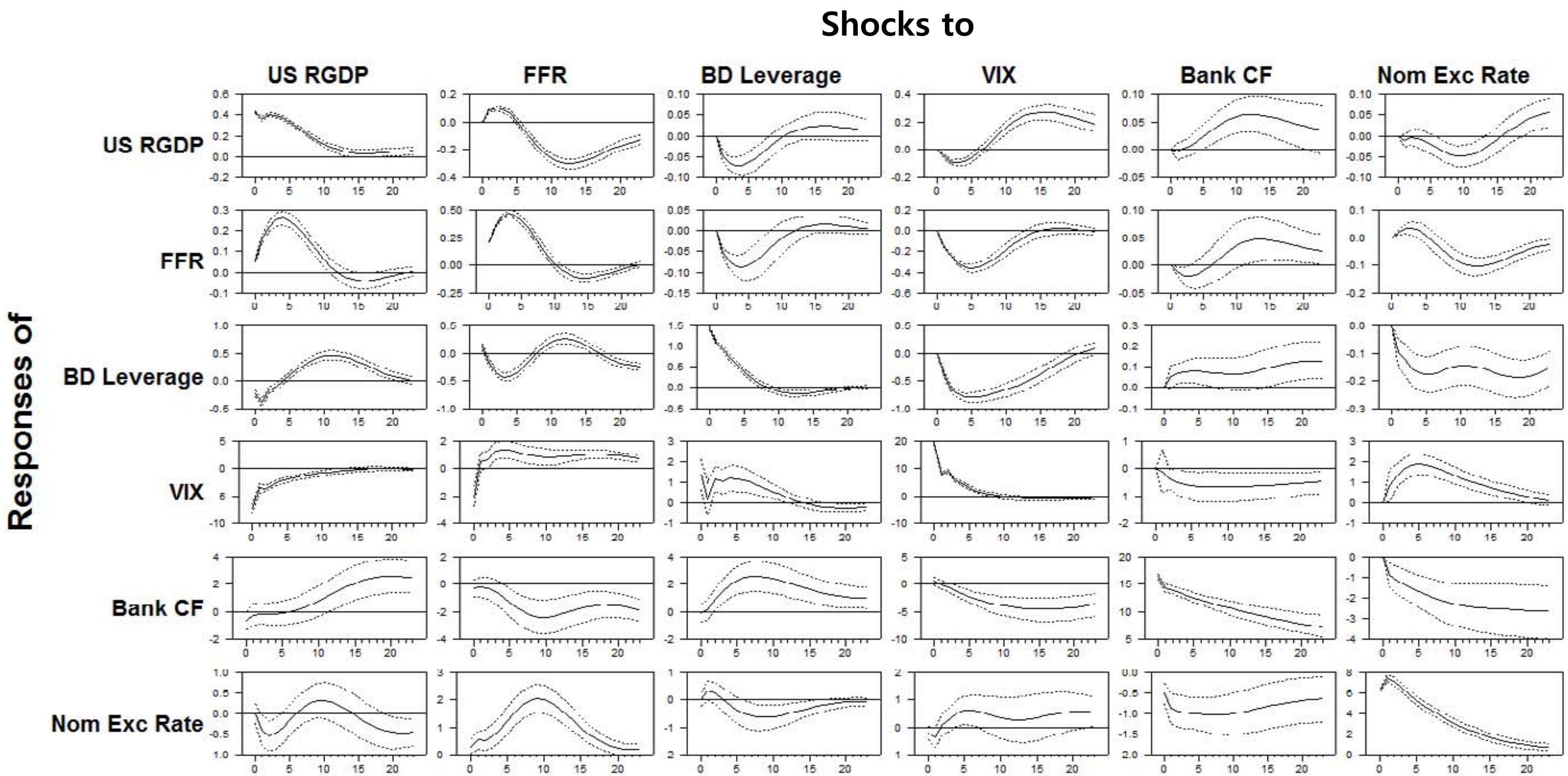
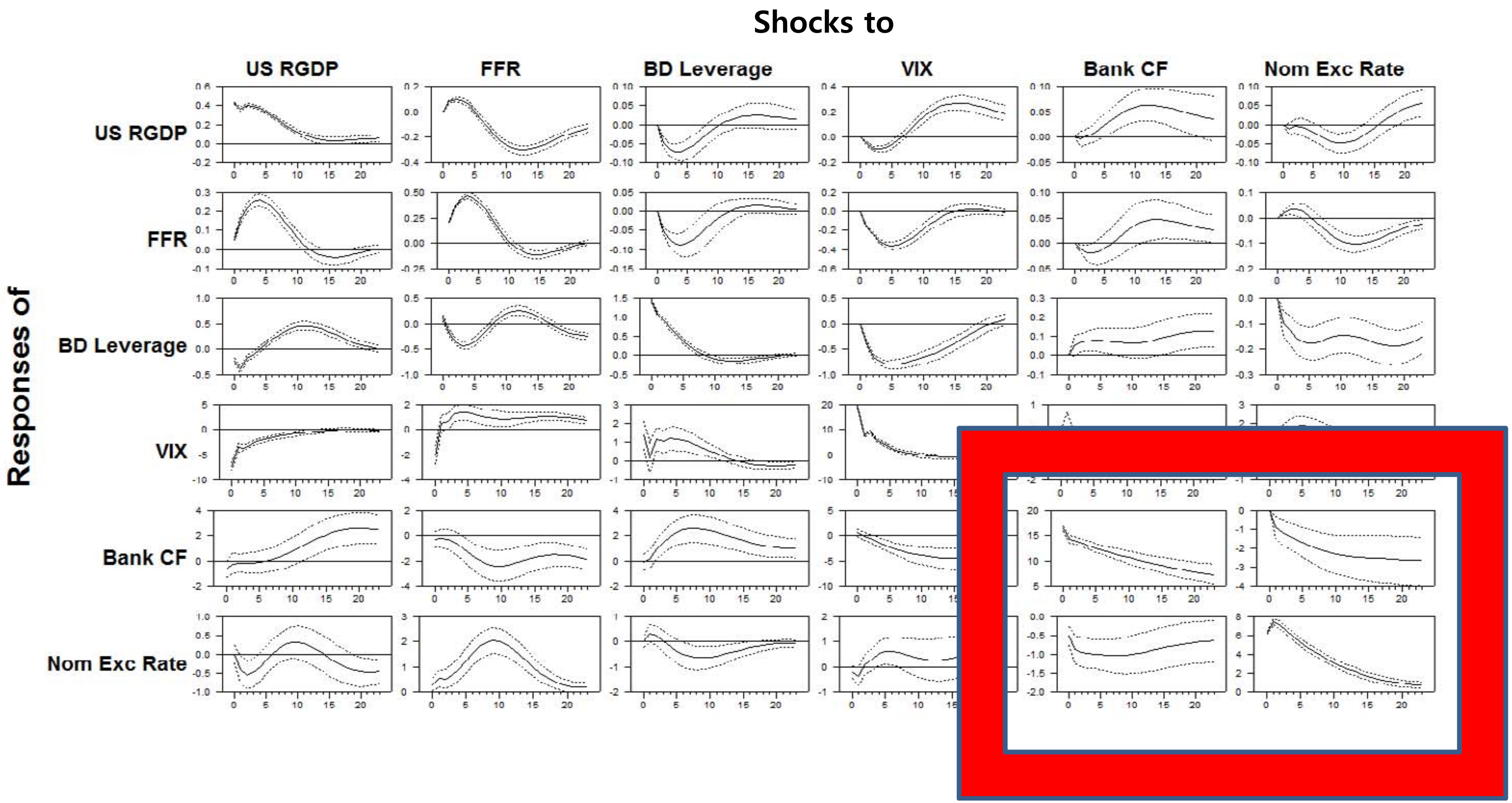

Shocks to
US RGDP
FFR
BD Leverage
VIX
Bank CF
Nom Exc Rate
Responses of
US RGDP
FFR
BD Leverage
VIX
Bank CF
Nom Exc Rate

Figure 26


Shocks to
US RGDP
FFR
BD Leverage
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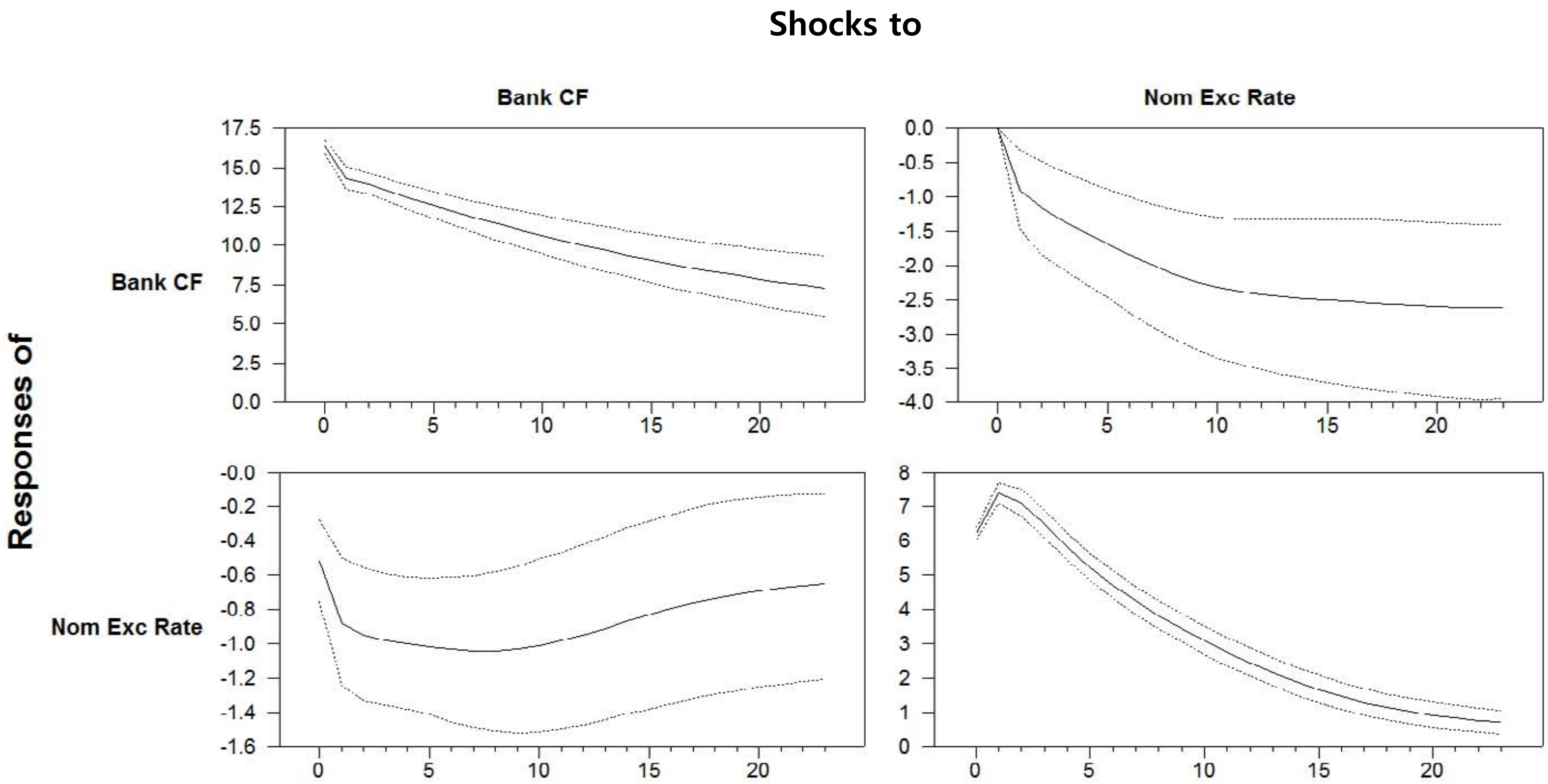
Bank CF
Nom Exc Rate
Responses of
US RGDP
FFR
BD Leverage
VIX
Bank CF
Nom Exc Rate

Figure 27


Shocks to
Bank CF
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Responses of
Bank CF
Nom Exc Rate
17.5
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12.5
10.0
7.5
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-0.6
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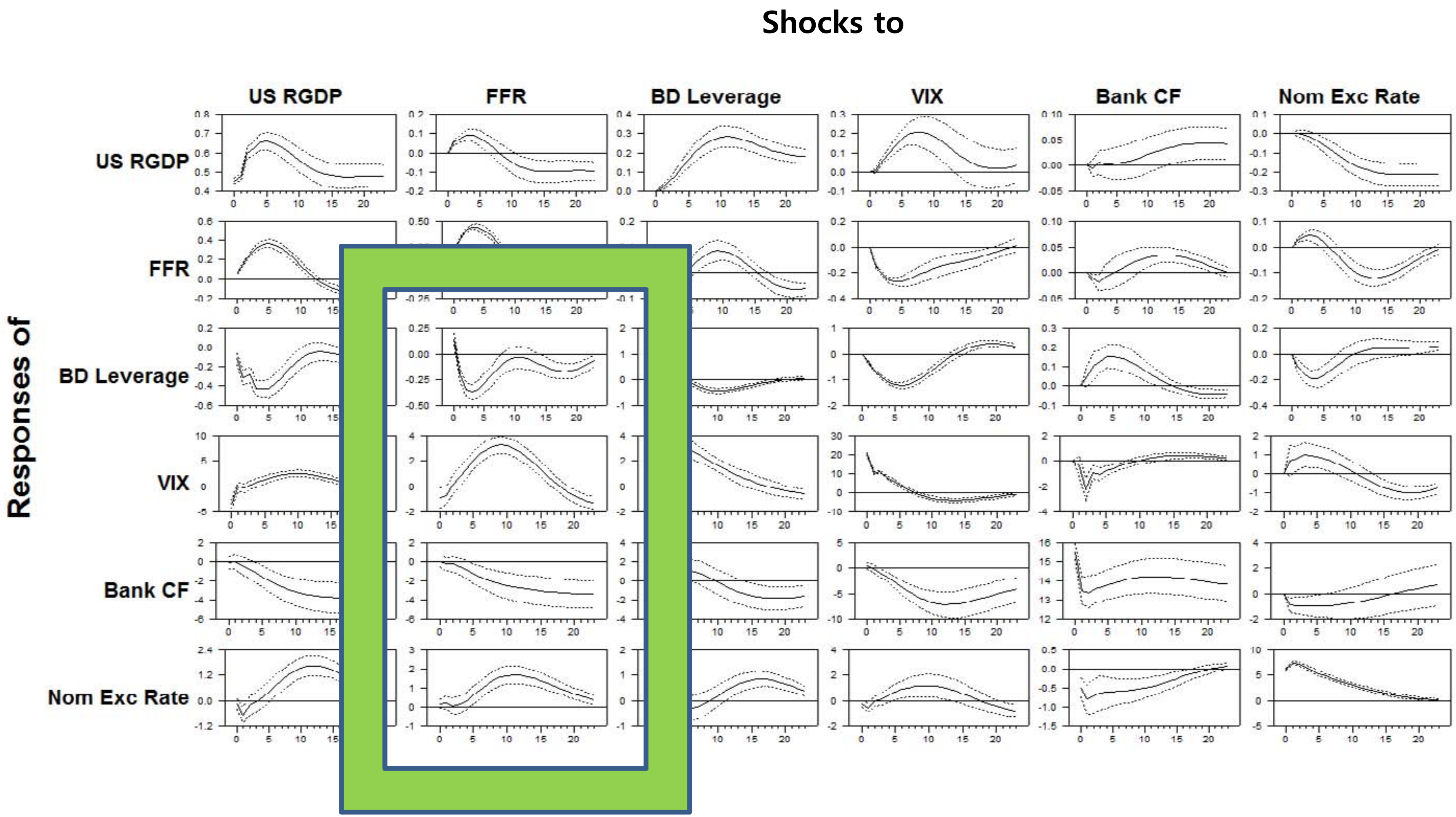
Figure 28


Shocks to
US RGDP
FFR
BD Leverage
VIX
Bank CF
Nom Exc Rate
Responses of
US RGDP
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Nom Exc Rate

Figure 29

Impulse Responses to FFR Shocks

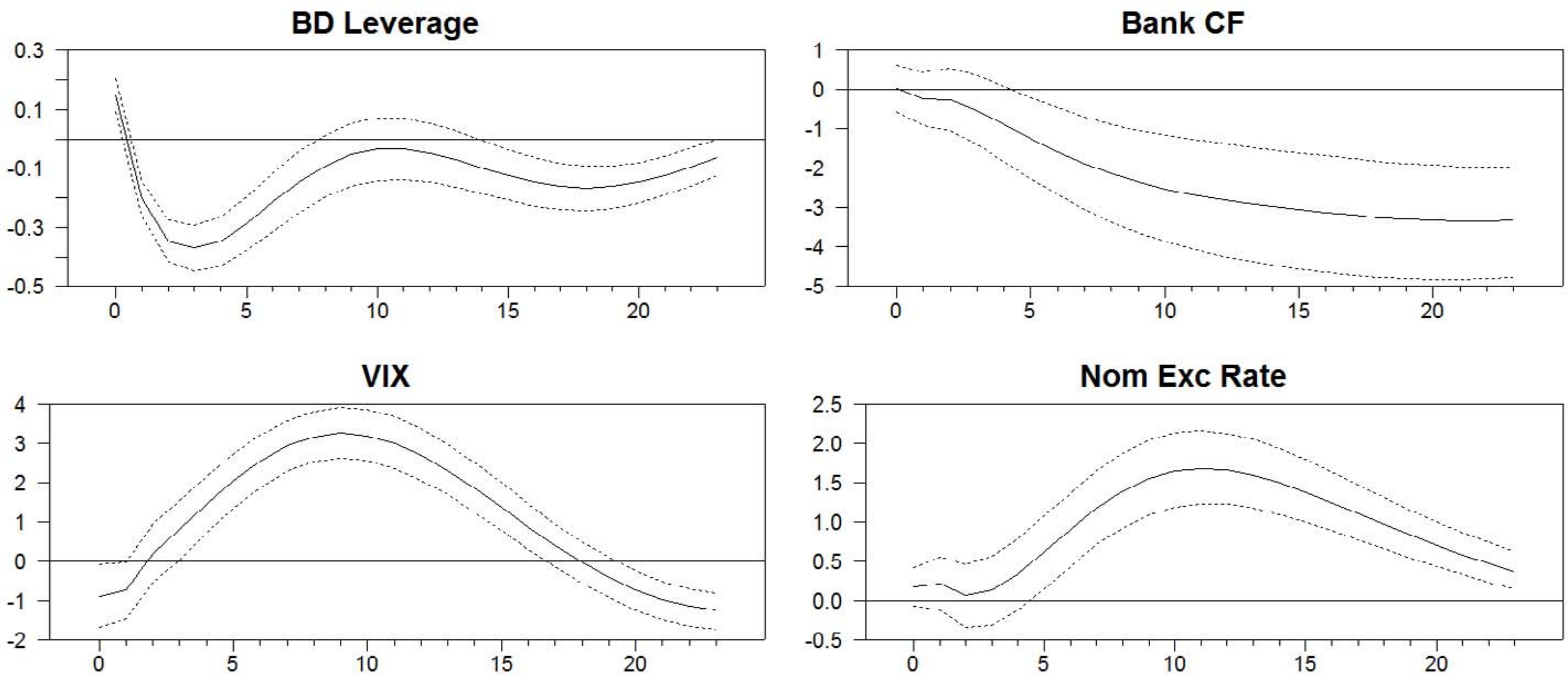

Figure 30

Breaking free from Triple Coincidence

- BIS tradition of consolidated statistics
  - Identifying the decision maker
  - Modified suitably; ownership not always same as decision making boundary (e.g. Santander)
- Balance of payments statistics under the microscope
  - When is the national income boundary the right one for analysis?
- Global financial system needs new boundaries of analysis

A new indicator for the cost of borrowing in the euro area

Karine Feraboli, Hanna Häkkinen and Josep Maria Puigvert Gutiérrez[1]

Abstract

In order to assess the effectiveness of the monetary policy pass-through across the euro area countries, it is necessary to use an accurate and comparable measure of the borrowing costs for firms and households in those countries. Cost-of-borrowing indicators can be used to accurately assess borrowing costs for non-financial corporations and households and to further enhance cross-country comparability. The construction of the new cost-of-borrowing indicators is based on Monetary Financial Institutions interest rate statistics, which are considered the most relevant source of information for bank lending rates in the euro area in particular due to their harmonised collection across countries. Four basic categories of lending rates per country are used in the calculations: short- and long-term lending rates to non-financial corporations and to households for house purchase, respectively. This paper will provide an assessment of the methodology employed in the calculation of the cost of borrowing indicators and an assessment of the results focusing on the use for policy purposes as well as the national evolution on different euro area countries.

Keywords: Monetary policy, Interest Rates, Cost of borrowing, non-financial corporations, households

JEL classification: E400, E520, C190

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Introduction

Monetary Financial Institutions interest rates (MIR) statistics cover all interest rates that credit institutions and some other MFIs resident in the euro area apply to euro-denominated deposits and loans vis-à-vis all households and non-financial corporations of any size that are resident in the participating EU Member States.[2] Euro area rates and volumes are calculated in terms of the so-called "changing composition", i.e. euro area aggregates are calculated on the basis of the countries forming part of the euro area at the time.

MIR statistics are collected, on a monthly basis, according to harmonised reporting requirements as from January 2003 for the initial 45 categories in Regulation ECB/2001/18 and as from June 2010 for additional 56 new breakdowns established in Regulation ECB/2009/7. Additionally, 16 new indicators will also be published as from January 2015 as established in Regulation ECB/2013/34. The new indicators will further expand the data set by including interest rate reset and renegotiations.

MFI interest rate (MIR) statistics enable a more complete assessment of the impact of monetary policy on the euro area economy. They facilitate the analysis of the transmission mechanism of monetary policy, in particular of the extent and the speed of the pass-through of official rates and market interest rates to lending and deposit rates faced by households and non-financial corporations.

In the aftermath of the financial crisis and as country-specific financing conditions have taken increased prominence in the analysis of euro area developments, the question of building a sound and reliable composite indicator for the cost of bank borrowing has been taking into consideration and brought to the forefront.

In this context, this note elaborates on the purpose of the cost of borrowing indicator and links it with the current aggregates using MIR, and presents some proposals for new indicators based on MIR statistics. In this respect, a new synthetic indicator reflecting the cost of borrowing has been defined by ensuring that these indicators comply with the high output quality principles of ESCB statistics in terms of: i) relevance, ii) accuracy and reliability (including stability), iii) consistency and comparability, iv) timeliness and v) clarity.

This note first describes the MFI interest rate statistics data set; section two discusses the conceptual issues in respect of the cost of borrowing indicators, section three provides the context in which cost of borrowing indicators are defined, section four and section five describe how the cost of borrowing indicators are being constructed and section six provides an example on how to interpret the evolution of the cost of borrowing indicators to non-financial corporations and households over time.

[2] The household sector also includes non-profit institutions serving households. Non-financial corporations include all enterprises excluding insurance companies, banks and other financial institutions.

Background data: MFI Interest rate statistics

In January 2003 the Eurosystem started compiling harmonised statistics on euro-denominated lending and deposits of national credit institutions vis-à-vis households and non-financial corporations. Work on the development of a steady-state approach started in summer 1999 with the aim of compiling a set of euro area interest rates on retail deposit and lending business that is harmonised, complete, detailed, and able to cope with financial innovation. To avoid invoking a potentially misleading contrast between 'retail' and 'wholesale' interest rates, expressions that can carry different meanings, the statistics developed under the steady-state approach are referred to as 'MFI interest rate statistics'.

MFI interest rate statistics 'provide an increasingly important source of information for the assessment of monetary policy transmission mechanism. The analysis derived from MFI interest rate statistics 'includes several aspects: a) studying the pass-through process from changes in official rates to lending and deposits of households (HHs) and non-financial corporations (NFCs); b) assessing the changes in the cost of capital influencing investment decisions; c) analysing cash-flow income effects resulting from changes in interest rates, with an impact on disposable income; d) structuring the cost of financing assumptions in the context of the macroeconomic projection exercise. MIR statistics are regularly used in a variety of publications and notes, inter alia the ECB Monthly Bulletin, Annual Report, and Financial Integration Report.

While the currently available breakdowns in MIR are now very detailed, and hence increasingly valuable, economic analysis may also require the construction of synthetic indicators, which aim at using the information for other analyses as well as in the context of (regular or ad hoc) forecasting exercises. In particular, cost of borrowing indicators, as part of the overall cost of capital (or corporate funding), are intended to reflect the composite interest rates that are most relevant in the investment decisions taken by non-financial corporations (NFCs), the choice between current and future consumption made by households (HHs) and the cost spread between self-financing and use of credit by both NFCs and HHs.

The prices of certain financial services in the euro area countries can also give insights into the state of financial integration. For this purpose, composite indicators of the cost of borrowing for non-financial corporations, as well as for house purchases by households, are used.

Cost of borrowing context: National Bank lending rates dispersion

In the period following the onset of the Economic and Monetary Union (EMU), at the beginning of 1999, until the start of the current financial crisis, in September 2008 with the default of Lehman Brothers, the rates charged by euro area MFIs to households, mainly for new house purchases, and to non-financial corporations for new loans recorded a low level of dispersion. Even though a certain degree of heterogeneity in MFI interest rates still persisted, as a consequence of country differences of regulatory and fiscal frameworks, different degrees of competition between banks or differences in the economic cycle, among others factors, the level of integration of the financial markets as measured by converging MIR could be qualified as highly satisfactory.

This situation suddenly changed with the eruption of the financial crisis, which fragmented the financial markets of the euro area. This complicated very much the assessment of the monetary policy transmission mechanism, since whereas in some countries, the loose monetary policy adopted by the ECB during the crisis reflected, more or less, the expected correspondence in the bank credit growth to non-financial private sectors, in other countries, this variable recorded a much lower response compared to the foreseen results in periods prior to the crisis. These different effects depending on the countries, can be explained, on the one hand, because the standard pass-through models used before the crisis are not suitable equipped to explain the levels of heterogeneity in bank lending rates during the crisis; and, on the other hand, because the relative importance of loan instruments have changed with the crisis.

Regarding the standard pass-through models (i.e. models where policy interest rates and market interest rates are considered the most important determinants of retail bank lending rates) they have failed because they do not include risk factors and sovereign debt spread among the explanatory variables. These two kinds of variables have had a strong impact on bank lending rates in some countries. On the other hand, users require less volatile instruments than the broad range of MFI interest rates instruments categories for modelling and forecasting purposes.

With respect to the relative weight of the different loan instruments, the financial crisis has, logically, increased the relative weight of short term instruments which in a situation of growing uncertainty, cover better the credit and interest rate risks than the long term instruments. Regarding bank loans to non-financial corporations, there has been a significant increase in overdrafts and other short term loans in the countries more affected by the crisis compared to other countries less affected. Therefore, it is necessary to use an accurate and more cross-country comparable measure of the borrowing costs for non-financial companies and households.

The cost-of-borrowing indicators serve both purposes: they are based on MFI interest rates statistics and they allow for easier and less volatile arguments in modelling and a better comparison on the credit conditions among euro area countries with different structures of borrowing to households and non-financial corporations.

Computing cost of borrowing indicators

In order to assess the effectiveness of the pass-through across countries it is necessary to apply an accurate and consistent measure of the borrowing costs for firms and households across the euro area countries.

Four basic cost of borrowing rates are considered per each country: short and long-term lending rates both to non-financial corporations and to households for house purchase, respectively.

Long-term lending rates to non-financial corporations and short and long-term rates on loans to households for house purchase are obtained directly from the MFI interest rate statistics. In this respect, MFI interest rate statistics on short-term loans to non-financial corporations, which capture bank lending rates on loans with a rate fixation period of up to one year, only offer a partial view of firms' financing costs in some countries. That is because those statistics do not include interest rates on overdrafts, which are a major source of finance for firms in some large euro area economies (e.g. Italy and Portugal). Consequently, when taking into account the interest rates on overdrafts (which are generally higher than other short-term bank lending rates), the estimated borrowing costs would be higher, especially in those countries where overdrafts are an important source of firm's external finance.

Cost of borrowing indicators construction

The following section describes how the different cost four types of cost of borrowing indicators are being constructed.

a) Cost of borrowing indicator for households

The cost of borrowing for households includes only loans for house purchase. Loans for consumption and other purposes have been excluded as they are too volatile and less relevant for macroeconomic projections. "Short-term" refers to loans with a floating rate or an initial period of interest rate fixation up to one year regardless of maturity. Accordingly, "long-term" refers to loans with an initial period of interest rate fixation over one year.

This indicator is calculated as a weighted average of MFI interest rates on short-term and long-term loans to households for house purchase, where the new business volumes used are smoothed with a moving average of previous 24 months' observations.

The precise formula is as follows:

At time t:

$$CB^{H} = \frac{R^{H}_{ST}(NB) * \frac{1}{24}\sum_{i=t}^{t-23} V^{H}_{ST}(NB)_i + R^{H}_{LT}(NB) * \frac{1}{24}\sum_{i=t}^{t-23} V^{H}_{LT}(NB)_i}{\frac{1}{24}\sum_{i=t}^{t-23} V^{H}_{ST}(NB)_i + \frac{1}{24}\sum_{i=t}^{t-23} V^{H}_{LT}(NB)_i}$$

where:

CB^{H} is the cost of borrowing for households.

$R^{H}_{ST}(NB)$ are the interest rates on new business on loans to households for house purchase with a floating rate or an initial rate fixation up to 1 year as defined in ECB/2013/34.

$V^{H}_{ST}(NB)$ are the new business volumes of loans to households for house purchase with a floating rate or an initial rate fixation up to 1 year as defined in ECB/2013/34.

$R_{LT}^{H}(NB)$ are the interest rates on new business on loans to households for house purchase with an initial rate fixation over 1 year as defined in ECB/2013/34.

$V_{LT}^{H}(NB)$ are the volumes of new business of loans to household for house purchase with an initial rate fixation over 1 year as defined in ECB/2013/34.

b) Cost of borrowing indicator for non-financial corporations

The aggregated cost of borrowing indicators for non-financial corporations is calculated in broadly the same way as the one for households above, i.e. as a weighted average of rates on short-term and long-term loans.

As regards short-term loans to non-financial corporations, the MFI interest rates data on new business does not include overdrafts, revolving loans, convenience and extended credit. For companies in some euro area countries, these instruments, mainly overdrafts, are however a significant source of short-term finance. Thus, since interest rates on overdrafts are, on average, higher than other short-term bank lending rates, their exclusion tends to lower average short-term rates. To improve comparability across countries, for cost of borrowing purposes, revolving loans and overdrafts and extended credit card credit are incorporated in the calculation of short-term lending rates as described below.

At time t:

$$CB^{NFC} = \frac{\widetilde{R}_{ST}^{NFC} * \widetilde{V}_{ST}^{NFC} + R_{LT}^{NFC}(NB) * \frac{1}{24} \sum_{i=t}^{t-23} V_{LT}^{NFC}(NB)_i}{\widetilde{V}_{ST}^{NFC}(NB)_i + \frac{1}{24} \sum_{i=t}^{t-23} V_{LT}^{NFC}(NB)_i}$$

where:

CB^{NFC} is the cost of borrowing for non-financial corporations.

$R_{LT}^{NFC}(NB)$ are the interest rates on new business of long-term loans (i.e. loans with interest rate fixation over one year) to non-financial corporations as defined in ECB/2013/34.

$V_{LT}^{NFC}(NB)$ are the volumes of new business of long-term loans (i.e. loans with interest rate fixation over one year) to non-financial corporations as defined in ECB/2013/34.

$\widetilde{R}_{ST}^{NFC}$ is the estimated interest rate on new business of short-term loans to non-financial corporations adjusted to take into account the overdrafts as defined in ECB/2013/34.

$\widetilde{V}_{ST}^{NFC}$ is the estimated volume of new business of short-term loans to non-financial corporations slightly inflated to take into account the overdrafts as these are an important source of short-term funding for non-financial corporations. The way to do this is to increase the volume of new business short-term loans by the share of overdraft in the total amounts outstanding of short-term loans. When calculating the total amounts outstanding of short-term loans, we consider that long-term loans with a residual maturity below one year and interest reset below one year can be considered short-term and therefore their amounts are added to the outstanding amounts of short-term loans as defined in ECB/2013/33.

The estimated volume is calculated as follows:

$$\tilde{V}_{ST}^{NFC} = \frac{1}{24} \sum_{i=t}^{t-23} V_{ST}^{NFC}(NB)_i \times \left(1 + \underbrace{\frac{V_o^{NFC}(OA)}{V_{ST}^{NFC}(OA) + \tilde{V}_{LT,IR<1year}^{NFC}(OA)}}_{=\beta} \right)$$

where:

$V_{ST}^{NFC}(NB)_i$ are the volumes of new business of short-term loans to non-financial corporations as defined in ECB/2013/34.

and β is the share of overdraft in the total amounts outstanding of short-term loans.

$V_o^{NFC}(OA)$ is the volume of overdrafts, revolving loans, convenience and extended credit (outstanding amounts).

$V_{ST}^{NFC}(OA)_i$ are the volumes of total short-term loans to non-financial corporations as defined in ECB/2013/33.

$\tilde{V}_{LT,IR<1year}^{NFC}(OA)$ is the estimated volume of long-term loans with original maturity over 1 year, residual maturity over 1 year and with interest rate reset within a year as defined in ECB/2013/34.

$$\tilde{V}_{LT,IR<1year}^{NFC}(OA) = \frac{1}{12} \sum_{i=0}^{11} \left(\frac{V_{LT,IR<1year}^{NFC}(OA)}{V_{LT}^{NFC}(OA)} \right)_{t-i} \times V_{LT}^{NFC}(OA)_t$$

with

$V_{LT}^{NFC}(OA)$ are the volumes of total long-term loans (loans with original maturity over 1 year) to non-financial corporations as defined in ECB/2013/33.

$V_{LT,IR<1year}^{NFC}(OA)$ is the real volume of long-term loans with original maturity over 1 year, residual maturity over 1 year and with interest rate reset within a year as defined in ECB/2013/33.

The estimated rate, $\widetilde{R}_{ST}^{NFC}$ is calculated as follows:

$$\widetilde{R}_{ST}^{NFC} = \beta\, R_{o}^{NFC}(OA) + (1-\beta) R_{ST}^{NFC}(NB)$$

where:

$R_{o}^{NFC}(OA)$ are the interest rates on overdrafts, revolving loans, convenience and extended credit to non-financial corporations as defined in ECB/2013/34.

$R_{ST}^{NFC}(NB)$ are the interest rates on new business of short-term loans to non-financial corporations as defined in ECB/2013/34.

c) Cost of borrowing indicator for short-term loans to households and non-financial corporations

$$CB_{ST}^{H,NFC} = R_{ST}^{H}(NB) \times \frac{\frac{1}{24}\sum_{i=t}^{t-23} V_{ST}^{H}(NB)_i}{\frac{1}{24}\sum_{i=t}^{23} V_{ST}^{H}(NB)_i + \widetilde{V}_{ST}^{NFC}} + \ldots..$$

$$\ldots\ldots + \widetilde{R}_{ST}^{NFC} \times \left(1 - \frac{\frac{1}{24}\sum_{i=t}^{t-23} V_{ST}^{H}(NB)_i}{\frac{1}{24}\sum_{i=t}^{23} V_{ST}^{H}(NB)_i + \widetilde{V}_{ST}^{NFC}} \right)$$

where all the components of the formula are already defined in the previous sections a) and b)

d) Cost of borrowing indicator for long-term loans to households and non-financial corporations

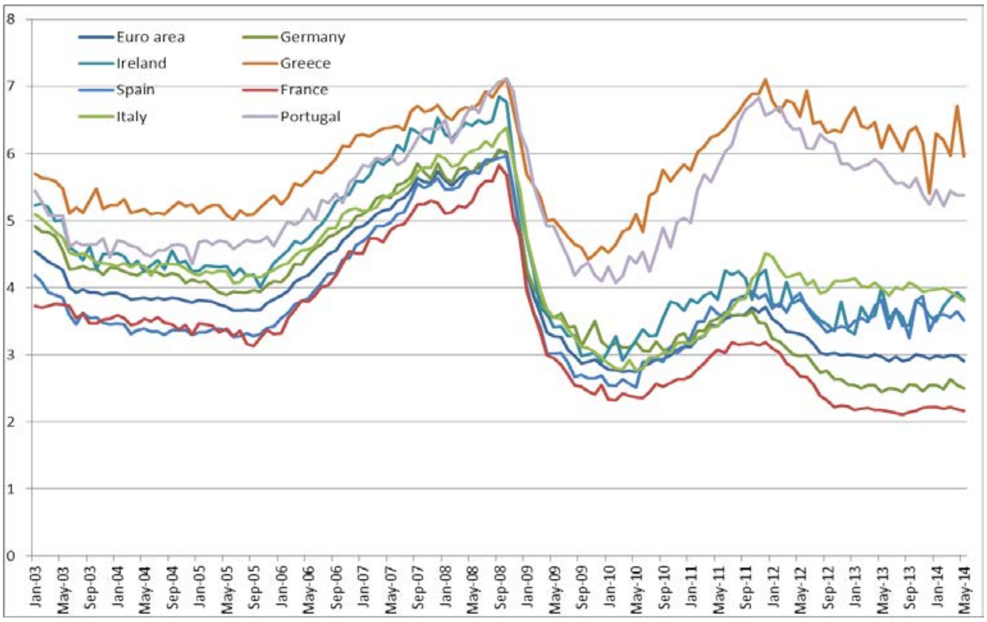
$$CB_{LT}^{H,NFC} = \frac{R_{LT}^{H}(NB) * \frac{1}{24}\sum_{i=0}^{23} V_{LT}^{H}(NB)_i + R_{LT}^{NFC}(NB) * \frac{1}{24}\sum_{i=0}^{23} V_{LT}^{NFC}(NB)_i}{\frac{1}{24}\sum_{i=0}^{23} V_{LT}^{H}(NB)_i + \frac{1}{24}\sum_{i=0}^{23} V_{LT}^{NFC}(NB)_i}$$

where all the components of the formula are already defined in the previous sections a) and b).

Example: Cost of borrowing evolution to non-financial corporations and households in distressed and non-distressed countries in the euro-area

Chart 1 and Chart 2 show a composite indicator of the cost of borrowing for non-financial corporations and households in distressed and non-distressed countries in the euro area. The two charts show that the cost of bank borrowing for non-financial corporations has exhibited different dynamics across time in response to the financial crisis and particularly since the intensification of sovereign debt concerns in the euro area.

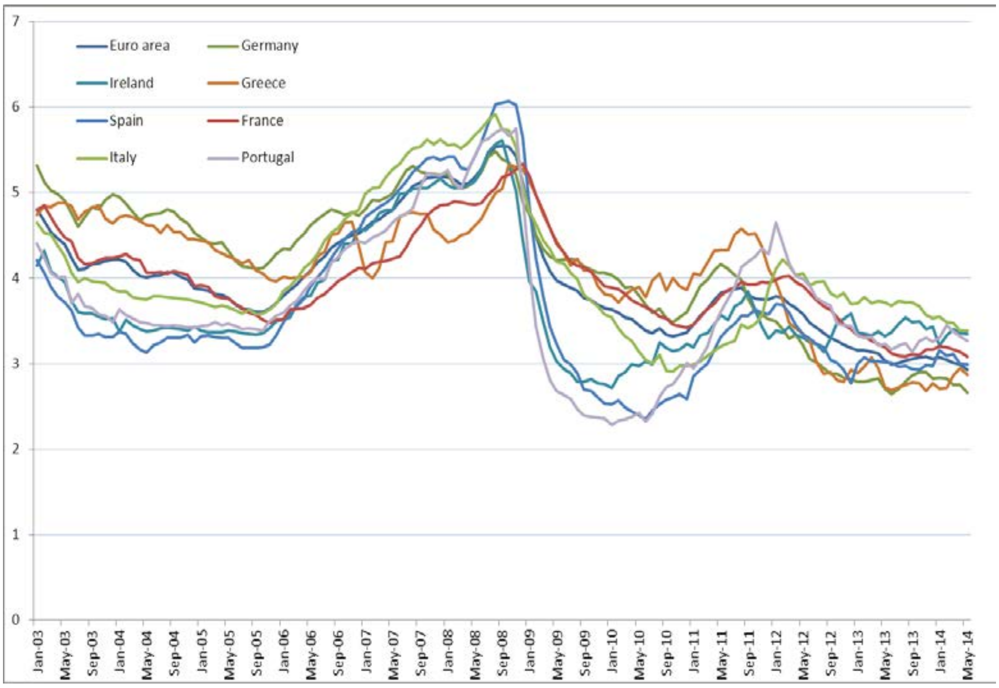
Composite cost of borrowing for non-financial corporations — Chart 1



In particular, the composite indicator for non-financial corporations shows that the borrowing costs in those countries with risk of debt distress, i.e. Greece, Ireland, Italy, Spain and Portugal and those with no risk of debt distress, i.e. France and Germany, have progressively diverged since the onset of the financial crisis. The dispersion between these two country groups increased to 160 basis points in 2012. These developments hint at some fundamental issues in the banking markets: banking markets are increasingly less integrated, as corporations do not have equal access to funding in all euro area countries because of national factors (e.g. country-specific macroeconomic risks which affect borrower risk). In the early stages of the financial crisis in late 2008 and in 2009, bank lending rates to non-financial corporations tracked broadly the ECB main refinancing rate in the distressed and non-distressed countries in the euro area. Thereafter, following the intensification of sovereign debt tensions in 2010 and in response to the increase in policy interest rates in early 2011 bank interest rates on loans to non-financial corporations started to rise sooner and more rapidly in distressed countries, especially Portugal and Greece, than in non-distressed countries. And while the cuts in policy interest rates since mid-2011 translated broadly into lower interest rates on loans to non-financial corporations in France and Germany, the pass-through has been much more sluggish in the case of Portugal and Greece, where interest rates remain at a higher level than that recorded in the other large euro area economies.

However, the same fundamental issues are not evident in the household mortgage lending market as presented in Chart 2. The composite indicator of household borrowing costs for households shows almost no divergence between distressed and non-distressed countries.

Composite cost of borrowing for households Chart 2



In the case of loans to households for house purchase, bank lending rates in Spain and in Italy reacted particularly strongly to the cut in policy interest rates recorded in late 2008 and in 2009. This strong reaction reflects the higher share of mortgage loans with a short-term interest rate fixation period in these two countries compared with other large economies in the euro area. Since the start of the sovereign debt crisis in early 2010, interest rates in these two countries increased more strongly than in Germany and France. Following the policy rate cuts since mid-2011, mortgage interest rates have contracted across countries, as expected, and in particular in Greece. Nevertheless, mortgage rates in Italy, Portugal and Spain remain above the levels observed in 2010 in spite of monetary policy rates having reached record low levels.

References

Regulation (EU) No 1071/2013 of the ECB of 24 September 2013 concerning the balance sheet of the monetary financial institutions sector (recast) (ECB/2013/33), OJ L 297, 7.11.2013, p 1.

Regulation (EU) No 1072/2013 of the ECB of 24 September 2013 concerning statistics on interest rates applied by monetary financial institutions (recast) (ECB/2013/34), OJ L 297, 7.11.2013, p 51.

ECB. "Keeping the ECB's monetary and financial statistics fit for use", Monthly Bulletin, August 2011.

ECB. "Assessing the Retail Bank Interest Rate Pass-Through in the Euro-area at times of Financial Fragmentation". Monthly Bulletin Article, August 2013.

ECB. "Manual on MFI interest rate statistics". October 2003.

ECB. "Financial Integration in Europe". April 2014.

External Vulnerability Indicators: The Case of Indonesia

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Abstract

This paper aims to find indicators that can be used to monitor Indonesia's external vulnerability as well as an early warning system of crisis. The study is conducted by evaluating a number of indicators deployed in the previous studies by using signaling method. An analysis of external vulnerability is facilitated by separating the pressure of vulnerabilities into four zones, namely normal, alert, cautious, and suspected crisis. The study obtains 12 external indicators that are then aggregated to produce a composite index of external vulnerability. The selected indicators and the composite index are well able to capture the external vulnerability.

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Introduction

1.1 Background

The economic crisis that swept over Asian countries in 1997–1998 was the worse experience for Indonesia. At the time, Indonesian economy is growing fairly high with stable inflation, but the impact of Bath depreciation spread to most countries in Asia and as a result, Indonesia fell in a very deep crisis. During the crisis, Indonesia's economy contracted the highest, reaching 13.1% in 1998. Meanwhile, economic growth in Thailand, Malaysia, South Korea, and Philippine in the same year contracted respectively by 10.5%, 7.4%, 6.9%, and 0.6% (Simorangkir, 2012).

This Asian crisis was not able to be predicted by various models developed prior to 1997–1998. The first generation model of crisis developed by Krugman (1979) explains that the crisis could occur if the government did not implement appropriate macroeconomic policies through money creation to cover the fiscal deficit. While the second generation developed by Eichengreen & Wyplosz (1993) and Obstfelt (1994) are also not suitable to explain the onset of the Asian crisis. According to this model, the crisis caused by investor behaviour who expects there will be a devaluation so that they tend to invest their funds in foreign currency. This action ultimately deplete official reserve assets and make the country was unable to maintain fixed exchange rate regimes. Krugman (1999) ultimately develop a third generation model to explain the Asian crisis in which the role of the financial system became a central point of crisis.

In three models mentioned above, basically the economic crisis in a country depends on two main things, namely the vulnerable conditions and the triggers. The difference between those crisis models lies in the indicators used as reference to describe the vulnerability of economy. If the indicators increased then the level of vulnerability rose and the probability of crisis would increased.

In 1990s, Indonesian economy is already vulnerable. Dabrowski (2001) describes that short term external debt position is swollen, current account is always deficit, and ratio of exports to external debt is very low. The condition is also accompanied by a low foreign exchange reserves so emerged a doubt about Indonesia's ability to meet its external obligations. In such conditions, when the first outbreak occurred in Thailand, the investors rushed to attract their fund from Indonesia. Even worse, the ratio of money supply to foreign reserves is rising so that causing panic in the market and encourage irrational actions such as the sale of domestic assets. As a result, the exchange rate depreciates very deep and triggering high inflation. Foreign reserves are depleted and interest rates are raised very high caused economic contraction. Indonesia then fell into deep economic crisis since that time.

Thus, the efforts to identify and to measure vulnerability indicators becomes indispensable. By using these indicators, then we can develop a mechanism to detect an early symptoms of the economic crisis, so potential crisis can be detected and anticipated. In this case, the early warning system is one method that can be used to identify and to anticipate economic crisis in the future.

This study aimed to identify which indicators can be used as an early warning system for economic vulnerability in Indonesia, especially if the vulnerability pressure comes from external sector. Thus, the evaluation of indicators limited to the indicators related to external sector only. It is based on the experience of the crisis in 1997–1998 which shows that the world economy is becoming more integrated and inter-state dependence is becoming stronger. If the shock occurs in one country then it will quickly spread to other countries. The shock transmission from one country to another is reflected from various external indicators. The problem is which external indicators are the most appropriate for use. Furthermore, from the selected external vulnerability indicators, in order to facilitate monitoring of the external sector vulnerabilities, will be constructed composite index that is able to reflect the vulnerability of the external sector as a whole.

1.2 Theoretical background

1.2.1 Definition of Crisis

One of the important things when identifying indicators that can capture the level of vulnerability is the definition of the crisis itself. Crisis is defined differently by each researcher, as well as the methods used to quantify crisis definition. Chui (2002) sums up the crisis definition used by various researchers such as Goldman Sachs, JP Morgan, Frankel & Rose, and Kumar, Moorthy & Perraudin. In general, the similarity of the researchers in defining crisis is significant depreciation of the exchange rate.

Other researchers, such as Eichengreen (1996) and Kaminsky (1998) used an index called the Exchange Market Pressure (EMP) as a basis for determining the crisis. Eichengreen used three variables to measure the EMP namely changes in exchange rates, interest rates, and official reserve assets position. While Kaminsky used only two variables, namely changes in exchange rate and reserves position.

Several researchers also used three variables when calculate the EMP, but the weights used by researchers differ from one another. Herrera-Garcia (1999) used these three variables when calculated the Index of Speculative Pressure (ISP) which is used to determine crisis periods and give equal weight to each variables. While Eichengreen (1996) gives the weights based on the standard deviation of each variable. Sachs (1996) used the weights based on the standard deviation of each variable relative to the standard deviation of all variables. Kaminsky (1998) also did a weighting based on the standard deviation of each variable but relative to the standard deviation of exchange rate depreciation.

Herrera-Garcia (1999):

$$ISP = Standardize(\Delta e) + Standardize(\Delta i) - Standardize(\Delta r)$$

Eichengreen (1996):

$$EMP_{i,t} = \frac{1}{\sigma_e}\frac{\Delta e_{i,t}}{e_{i,t}} - \frac{1}{\sigma_r}\left(\frac{\Delta rm_{i,t}}{rm_{i,t}} - \frac{\Delta rm_{US,t}}{rm_{US,t}}\right) + \frac{1}{\sigma_i}\Delta\left(i_{i,t} - i_{US,t}\right)$$

Sachs (1996):

$$EMP_{i,t} = \left(\frac{1/\sigma_e}{\left((1/\sigma_e) + (1/\sigma_r) + (1/\sigma_i)\right)}\right)\frac{\Delta e_{i,t}}{e_{i,t}} - \left(\frac{1/\sigma_r}{\left((1/\sigma_e) + (1/\sigma_r) + (1/\sigma_i)\right)}\right)\frac{\Delta r_{i,t}}{r_{i,t}} + \left(\frac{1/\sigma_i}{\left((1/\sigma_e) + (1/\sigma_r) + (1/\sigma_i)\right)}\right)\Delta i_{i,t}$$

Kaminsky (1998):

$$EMP_{i,t} = \frac{\Delta e_{i,t}}{e_{i,t}} - \frac{\sigma_e}{\sigma_r}\frac{\Delta r_{i,t}}{r_{i,t}} + \frac{\sigma_e}{\sigma_i}\Delta i_{i,t}$$

Where: ISP = Index of Speculative Pressure

EMP = Exchange Market Pressure

e = Nominal exchange rate

i = Interest rate

r = Foreign reserves position

1.2.2 Selection of Indicators

Research on indicators that are leading to the crisis have been conducted by various researchers. Among these are Eichengreen (1996) who conducted a study of 20 industrialized countries in order to capture the contagious effect of crisis. While Kaminsky (1998) did the research with the signaling approach.

Chui (2002) summarised the research into three different methods. The first method is signaling approach. Signaling method analyzed the behavior of an indicator with a certain threshold level. If the indicator passes the threshold, then the signal of crisis is given. The chosen threshold is the threshold which the most able to identify the signal of crisis.

The second method is discrete method which can analyze probability of crisis. Basically, the discrete method used probability distribution function of the crisis periods and tranquil periods. While the third method is more concerned with the relationship between certain variables with the crisis.

Other researchers, Babecký, Havránek, Matějů, Rusnak, Šmídková, and Vašíček (2011), used both discrete and continuous models. In the discrete model, the method used dynamic panel logit models, whereas the continuous model used panel VAR models.

In general, the most widely used methods are signaling and discrete models. In signaling method, threshold selection is done in non-parametric. Threshold is determined based on a certain percentille. An indicator is said to issue a signal whenever it departs from its mean beyond a given threshold level. A signal that is followed by a crisis within specific time, Kaminsky (1998) used next 24 months, is called a good signal, while a signal not followed by a crisis within that interval of time is called a false signal.

Signaling Methods

Table 1

	Crisis (within 24 months)	No Crisis (within 24 months)
Signal was Issued	A	B
No signal was issued	C	D

Where:

A = The number of periods in which the indicator issued a good signal

B = The number of periods in which the indicator issued a bad signal

C = The number of periods in which the indicator failed to issue a signal

D = The number of periods in which the indicator refrained from issuing a signal

The standard method to measure the effectiveness of the indicators in signaling method as an early warning indicator is determined by the indicators' ability to issue good signals and to avoid false signals. The common parameters which can capture this ability is Type I and Type II of statistical error and noise to signal ratio. The noise to signal ratio is obtained by dividing false signals measured as a proportion of periods in which false signals could have been issued, by good signals measured as a proportion of periods in which good signals could have been issued (Kaminsky, 1998). As a guideline, the lower the noise to signal ratio then the better the indicator.

Type I error = α = *P(reject H0|H0 is true)* = *C/(A+C)*

Type II error = β = *P(not reject H0|H0 is false)* = *B/(B+D)*

$$\textit{Noise to signal ratio} = \frac{B/(B+D)}{A/(A+C)}$$

An indicator is said to be a leading indicator of crisis if it has a noise to signal ratio not greater than 1 (Chui, 2002). Meanwhile, the threshold of crisis is determined by minimizing α and β or, in other words, has the smallest noise to signal ratio.

On the other hand, discrete method (a parametric approach) evaluates the conditional probability of a crisis. If y defined variable of crisis (*1* if the crisis occurred and *0* otherwise) and x defined as a potential indicator with β as the parameter, then the probability of crisis can be stated as follows:

$$P(y=1) = f(\beta' x)$$

where $f(\beta' x)$ is a probability distribution function. If we assume the distribution is logit, then

$$P(y=1) = \frac{exp(\beta' X)}{1+exp(\beta' X)} \quad \text{and} \quad P(y=0) = \frac{1}{1+exp(\beta' X)}.$$

Parameter β is estimated using maximum likelihood method and logit regression.

Meanwhile, in terms of the indicators, the researchers used different data sets. Eichengreen (1996) evaluated 10 indicators while Kaminsky (1998) evaluated up to 105 indicators.

1.2.3 Composite Index

Some researchers calculated a composite index of the vulnerability indicators. This is done with the consideration that each indicators has a different performance and influence. The assumption for the composite procedure is that the vulnerability indicators drift more or less in the same direction or have a common element in their behaviour prior to the crisis. Kaminsky (2000) suggest to set up a composite index for each country using a weighted average of a number of indicators that give a signal.

$$I_t = \sum_{j=1}^{n} \frac{S_t^j}{\omega^j}$$

where S_t^j is equal to *1* if the indicator *j* sent a signal at time *t*, n defined as the total number of the indicators, and ω^j stated noise to signal ratio of indicator *j*. The composite index, either simple aggregation or weighted based on the noise to signal ratio, illustrates the vulnerability of a country at a given period.

The OECD also developed a composite indexing methodologies in order to construct a composite leading indicators. Since each indicator has different scale of measurement, then the indicators should be normalized before aggregated into one composite index. Normalization is done by reducing each observation with their average and dividing by the mean absolute deviation for each indicators. Then the result added with 100 for each data. Finally, each indicators multiplied by their respective weights to obtain aggregate value and created the index.

2. Methodology

Research for Indonesia's external vulnerability indicators have already done by Majardi (2009). The vulnerability indicators selected by using panel data of 151 developing countries as the members of IMF. However, the use of panel data is less precise because not all countries have a significant economic relationship with Indonesia. Therefore, this study only used 31 countries (including Indonesia) as a sample.

Reduction of the countries in the sample is conducted by considering that contagious effect will have significant impact if the crisis comes from close ties countries, both in terms of exports and investment transactions. The reduction is also considering the countries in the region and the availability of data. Countries sample selected based on main destination countries of Indonesia's export, countries of origin of the investors for direct investment and portfolio investment, countries in the ASEAN region, emerging countries in the same peer group rating, and European countries affected by the crisis recently.

List of Countries in the Sample

Table 2

10 main destination countries of export[1]	Top 10 countries of origin of DI[2]	Top 10 countries of origin of PI[3]	ASEAN countries[4]		Sample	
1. China	1. Singapore	1. US	1. Brunei Darussalam		1. China	16. Philippines
2. Japan	2. Japan	2. Luxembourg	2. Malaysia		2. Japan	17. Kuwait
3. US	3. Luxembourg[5]	3. England	3. Philippines		3. US	18. Canada
4. India	4. England	4. Norway	4. Singapore		4. India	19. Australia[6]
5. Singapore	5. US	5. UAE	5. Thailand		5. Singapore	20. Germany[7]
6. Malaysia	6. South Korea	6. Singapore	6. Vietnam		6. Malaysia	21. Brazil[8]
7. South Korea	7. China	7. Switzerland	7. Myanmar		7. South Korea	22. South Africa[7]
8. Thailand	8. France	8. Kuwait	8. Cambodia		8. Thailand	23. Saudi Arabia[7]
9. Netherland	9. Hongkong	9. Japan	9. Laos		9. Netherland	24. Mexico[7]
10. Taiwan	10. Canada	10. China			10. England	25. Russia[7]
					11. France	26. Argentina[7]
					12. Hongkong	27. Turkey[7]
					13. Norway	28. Greece[9]
					14. UAE	29. Portugal[9]
					15. Switzerland	30. Italy[9]

[1] Position in 2012, Taiwan is not included as sample based on the degree of his exposure to Indonesia. [2] Based on the country of origin of foreign direct investment in 2012. [3] Based on the country of origin of portfolio investment (stocks) in January – June 2013. [4] Only 4 countries chosen as samples takes into account of the economic size of the country and the level of exposure to Indonesia. [5] Luxembourg was not chosen because it is the tax havens country. [6] Australia selected with consideration of the proximity of the region, diplomatic relations, and the economy (2.6% share of non-oil & gas exports). [7] Germany chosen with consideration of economic relations (2.0% share of non-oil & gas exports). [8] Countries in the peer group rating. [9] European countries affected by the crisis last few years.

Meanwhile, the external indicators which will be evaluated consists of 29 indicators. Those indicators obtained from various researchers like Majardi et al. (2009), Chui (2002), IMF (2000), Kaminsky et al. (1998), Babecký et al. (2001), Eichengreen et al. (1997).

List of Candidate External Vulnerability Indicators Table 3

No	Variables	Description
1	DSR	Debt Service Ratio
2	IRSTED	Reserves position/Short-term external debt position
3	IRMS	Reserves position/Monthly average of imports
4	IRBM	Reserves position/Broad money
5	RES	Changes in reserves position/12 months of imports (moving average)
6	NETPIIR	Short term capital flows/Reserves position
7	CAGDP	Current account/GDP
8	EDPGDP	Public sector external debt/GDP
9	EDX	External debt/Current account receipt
10	EDGDP	External debt/GDP
11	AVIN	Average interest rate of external debt
12	IRM0	Reserves position/base money
13	IRGDP	Reserves position/GDP
14	IR	Official reserve assets position
15	GIR	Growth of reserves position
16	FDIED	Foreign direct investment/Total external debt
17	KAGDP	Capital account/GDP
18	DSGDP	Debt service/GDP
19	TBGDP	Trade balance/GDP
20	XM	Export/Import
21	DX	Change in exports
22	DM	Change in imports
23	DTOT	Change in term of trade
24	DXP	Change in export price
25	FDIGDP	Foreign direct investment/GDP
26	STDTOEXTDEBT	Short term external debt/Total external debt
27	FDIINGDP	Net inflows FDI/GDP
28	FDIOUTGDP	Net outflows FDI/GDP
29	RGX	Growth of real exports

The definition of a crisis in this study used EMP indicator as described by Herrera-Garcia (1999). EMP formed by three variables, namely changes in exchange rates, interest rates, and foreign reserves position. All the variables were standardized to have mean zero and unit variance.

$$EMP_{i,t} \equiv Standardize(\%\Delta e_{i,t}) + Standardize(\Delta i_{i,t}) - Standardize(\%\Delta r_{i,t})$$

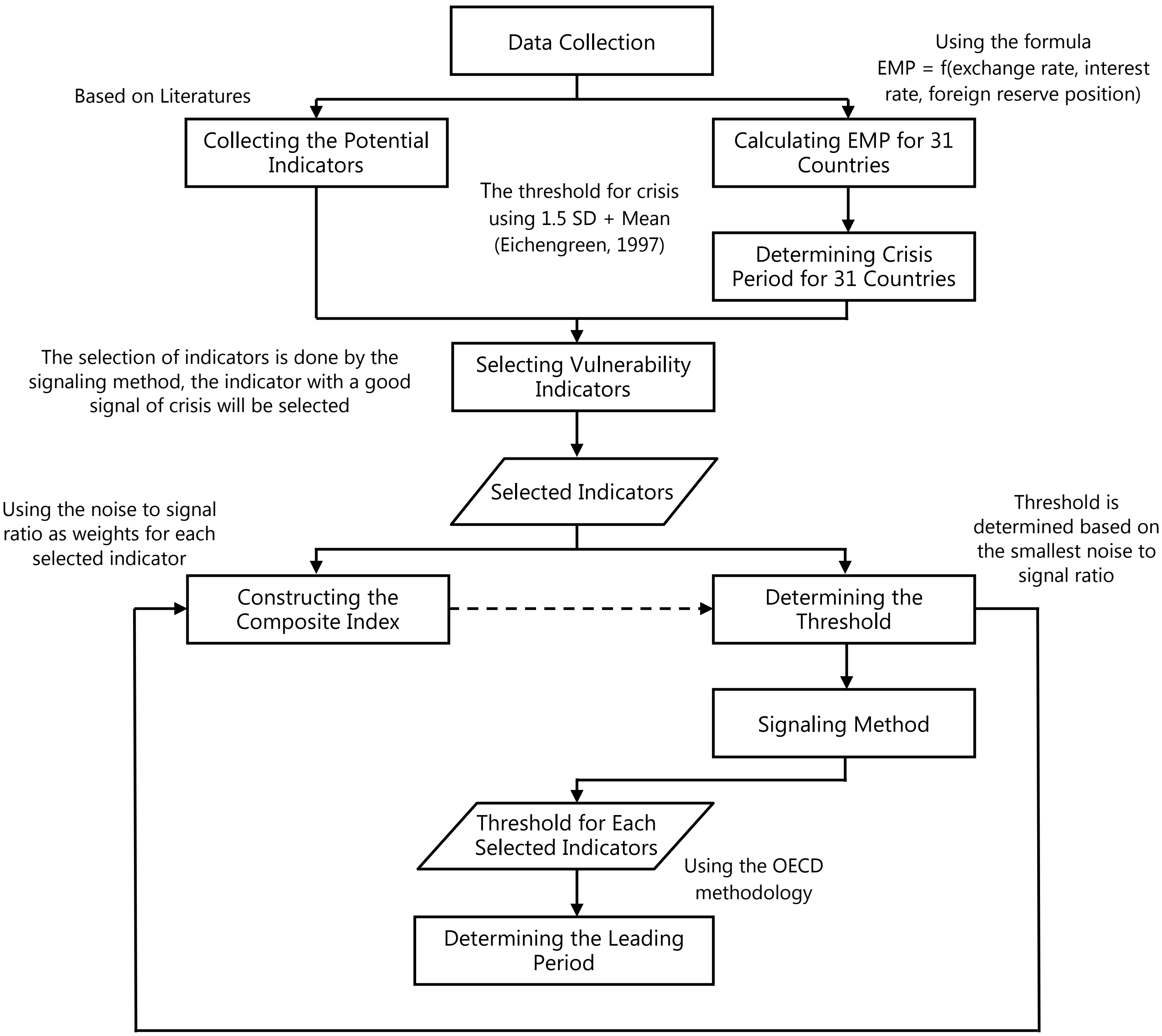
Furthermore, A crisis is defined as period in which EMP moves one-half standard deviation above the average, as done by Eichengreen (1997).

$$CRISIS = \begin{cases} 0, if\ EMP < \ \mu + 1.5\sigma \\ 1, if\ EMP > \ \mu + 1.5\sigma \end{cases}$$

Selection of vulnerability indicators and the threshold for each indicators were done by signaling method. Monitoring the signals on the signaling method performed until a two years period, as was done by Kaminsky (1998).

Lastly, the construction of the composite index will use OECD methodology with the help of CACIS software. Meanwhile, the weight for each selected indicators will be determined referring to the Kaminsky (2000) by using weights derived from the noise to signal ratio of each indicator.

Diagram 1: Construction of Indonesia's External Vulnerability Indicators



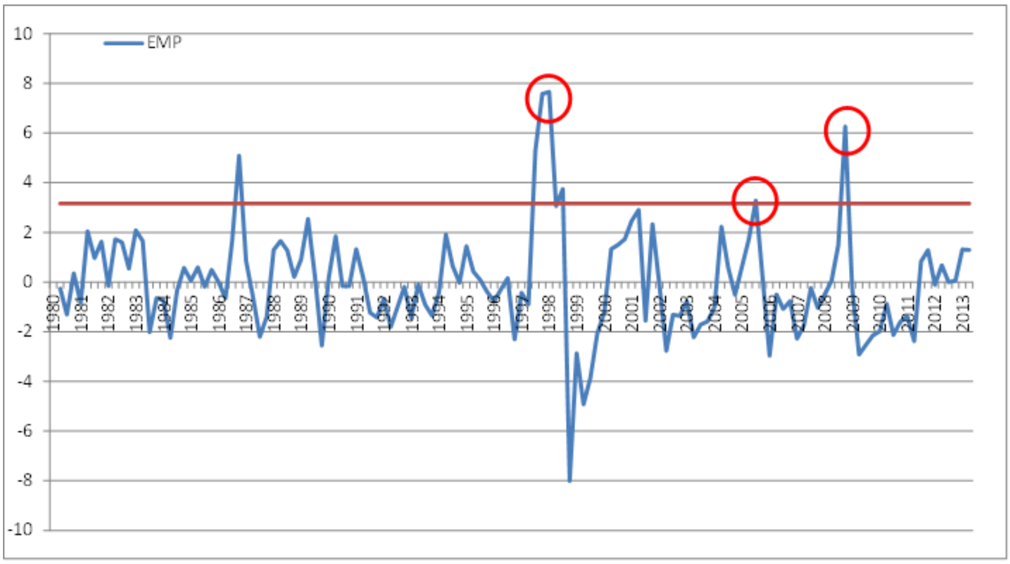
3. Empirical Results

3.1 Definition of Crisis

The data is collected from 31 countries, including Indonesia, with quarterly basis. Meanwhile the sample period is 1980Q1 to 2013.Q2. The first step of this research is determining the crisis periods by using EMP. The EMP is calculated to capture the high pressure periods on the exchange rates. In other words, the EMP is used to capture the level of vulnerability in each sample periods. Herrera-Garcia method used when calculating EMP and this method is able to capture the pressure on the exchange rate volatility. This is indicated by the movement of the EMP which is quite volatile with a few spikes in the sample periods inline with the exchange rate movements.

For Indonesia, Herrera Garcia method is able to identify the crisis that occurred in 1997–1998, 2005 and 2008. At such periods seem that EMP moves exceed the crisis threshold.

EMP of Indonesia Graph 1

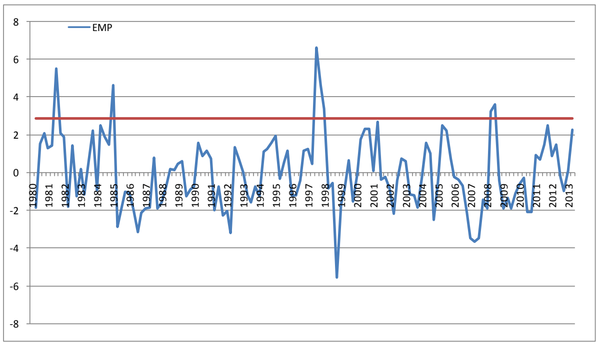


Likewise with the other sample countries, this method is able to capture most of the crisis. For example, the crisis in Thailand and South Korea can be well identified as shown with EMP movements exceed the crisis threshold at 1997–1998. So did with the crisis in Greece at 2012 and the crisis in Mexico at 1980s and 1990s can be captured by EMP.

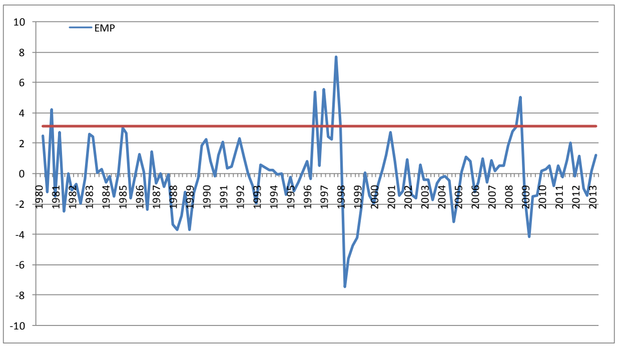
EMP of Thailand, South Korea, Greece, and Mexico

Graph 2

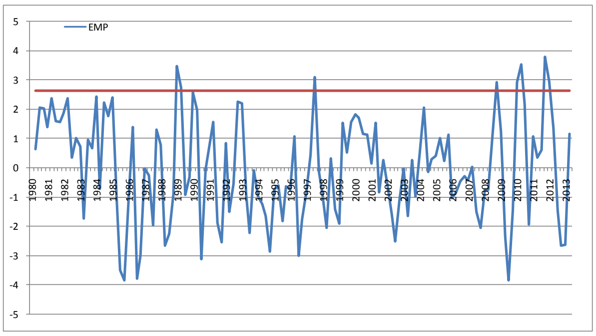
Thailand



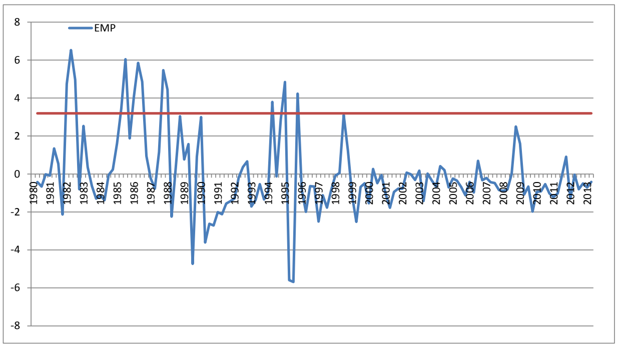
South Korea



Greece



Mexico



3.2 Selection of Indicators

The selection of indicators are done by using the signaling method. Chui (2002) requires that the chosen indicators should have a noise to signal ratio not greater than one. However, the research used more stringent criteria by chosing noise to signal ratio below 0.5 for each indicators. Using this requirement, we have 12 indicators met the criteria.

The Smallest Noise to Signal Ratio for Each Potential Indicators

Table 4

No	Indicators	The Smallest Noise to Signal Ratio	No	Indicators	The Smallest Noise to Signal Ratio
1	DSR	0.30	16	FDIED	0.70
2	IRSTED	0.46	17	KAGDP	0.60
3	IRMS	0.38	18	DSGDP	0.78
4	IRBM	0.42	19	TBGDP	0.38
5	RES	0.35	20	XM	0.61
6	NETPIIR	0.13	21	DX	0.52
7	CAGDP	0.09	22	DM	0.52
8	EDPGDP	0.98	23	DTOT	0.70
9	EDX	0.47	24	DXP	0.55
10	EDGDP	0.48	25	FDIGDP	0.19
11	AVIN	0.78	26	STDTOEXTDEBT	0.04
12	IRM0	0.61	27	FDIINGDP	1.58
13	IRGDP	0.87	28	FDIOUTGDP	2.28
14	IR	0.70	29	RGX	0.97
15	GIR	0.56			

From the result above, in order to complete the analysis of monitoring, threshold for each indicator will be determined. Each indicator will be divided into four stages of pressure, namely normal, alert, cautious, and suspected to crisis. The suspected crisis area is determined from the standard deviation which gives the smallest noise to signal ratio.

Threshold for Selected External Vulnerability Indicators

Table 5

No	Variables	Threshold		
		Alert	Cautious	Suspected Crisis
1	DSR	31.62	38.26	44.90
2	STDTOEXTDEBT	18.91	19.83	20.76
3	EDX	170.68	214.86	259.03
4	EDGDP	51.10	60.42	79.07
5	IRMS	4.39	3.82	3.25
6	IRBM	27.69	24.69	21.68
7	IRSTED	149.97	128.37	106.78
8	RES	–37.56	–50.60	–63.63
9	CAGDP	–1.42	–2.26	–3.10
10	TBGDP	–0.16	–1.17	–2.18
11	FDIGDP	–0.16	–0.37	–0.58
12	NETPIIR	–2.15	–3.41	–4.66

Furthermore, the threshold of alert and cautious determined arbitrarily by a margin of 0.25 standard deviations from the threshold of suspected to crisis. For example, if the threshold for IRMS obtained from the average plus one standard deviation, then the alert threshold is obtained from the average plus 1.25 standard deviation and the cautious threshold derived from the average plus 1.5 standard deviations. The normal area will be marked with green colour, alert area marked in yellow, cautious area marked in pink, and suspected to crisis area marked in red. Graph for each selected indicators and their threshold can be found in the Appendix. The threshold resulted by this research are not too different when compared with the results obtained by other researchers.

Threshold for Selected Indicators by Other Researchers

Table 6

	EDGDP			EDX			DSR			CAGDP		
	Alert	Cautios	Crisis	Alert	Cautios	Crisis	Alert	Cautios	Crisis	Alert	Cautios	Crisis
Present Research	51.1	60.4	79.1	170.7	214.9	259.0	31.6	38.3	44.9	–1.4	–2.3	–3.1
Majardi (2009)	50.2	55.6	86.3	150.5	189.4	215.4	27.8	36.4	43.5	–1.5	–2.4	–3.1
IMF (2000)		50.0			200.0							
Chang (2007)		66.6										
Kappagoda	30.0	40.0	50.0	100.0	150.0	200.0						
Reinhart (2010)		60.0	90.0									
Greene (2010)		50.0	80.0		120–150	200–250						
Reinhart (2003)		60.0	150.0									
Maastricht Criteria												
UN-ESCAP	48.0	48–80	80.0	132.0	132–220	220.0	18.0	18–30	30.0			
CAA		70.0			150.0			20.0				
Deutsche Bank											–3.0	

	IRSTED			IRMS			IRBM			STDTOEXTDEBT		
	Alert	Cautios	Crisis	Alert	Cautios	Crisis	Alert	Cautios	Crisis	Alert	Cautios	Crisis
Present Research	150.0	128.4	106.8	4.4	3.8	3.2	27.7	24.7	21.7	18.9	19.8	20.8
Majardi (2009)	180.7	110.0	68.0	4.3	3.8	3.5	28.1	20.0	15.7			
Calafell (2003)		100.0										
Mishev (2010)		100.0			3.0			20.0				

	RES			TBGDP			FDIGDP			NETPIIR		
	Alert	Cautios	Crisis	Alert	Cautios	Crisis	Alert	Cautios	Crisis	Alert	Cautios	Crisis
Present Research	–37.6	–50.6	–63.6	–0.2	–1.2	–2.2	–0.2	–0.4	–0.6	–2.2	–3.4	–4.7
Majardi (2009)	–43.0	–66.0	–88.0									

Next, to answer the question whether the selected external vulnerability indicators are capable to providing an early warning to the crisis, the performance of these indicators will be evaluated at some period of crisis, 1997–1998 crisis, 2005 crisis, and the global crisis of 2008.

In the 1997–1998 crisis, external vulnerability indicators have shown abnormality condition. This is reflected by four liquidity indicators, namely DSR, IRSTED, IRMS, and IRBM, lie outside the normal area, even up to several periods. Furthermore, the other liquidity indicators (RES, FDIGDP, and NETPIIR) go beyond the suspected crisis threshold at 1997Q4. This problem mainly driven by the low foreign exchange reserves and high external debt position.

In the other side, Indonesia also faced a solvency problem as reflected by four solvency indicators (CAGDP, EDX, EDGDP, and STDTOEXTDEBT) lies outside the normal area for several periods. Current account deficit and the external debt position which higher than the ability to pay was the cause of this solvency problems.

Thus, it can be concluded that Indonesia's external sector in the period, even starting from some previous period, is already vulnerable. In such circumstances, only waiting for a trigger factor for the occurrence of a crisis. The trigger then came from the depreciation of Bath which later affected the Indonesian economy.

Heat Map for external vulnerability indicators during the crisis period 1997–1998 Table 7

INDICATORS	1996Q3	1996Q4	1997Q1	1997Q2	1997Q3	1997Q4	1998Q1	1998Q2	1998Q3	1998Q4
DSR	10.81	10.56	37.39	35.02	34.93	64.18	56.20	47.22	56.86	58.75
IRSTED	48.16	55.94	57.35	61.34	61.08	51.46	50.52	58.81	66.44	77.69
IRMS	3.42	3.90	3.90	4.13	4.04	3.32	3.41	4.15	4.98	6.41
IRBM	14.87	15.62	16.20	16.57	17.68	19.33	33.92	33.95	45.80	32.53
RES	–1.98	56.11	13.70	25.09	–1.70	–72.40	–16.06	47.66	41.53	82.90
FDIGDP	2.80	2.50	3.84	2.07	2.34	–0.76	–2.18	1.69	–0.67	0.12
NETPIIR	3.81	11.04	5.05	5.18	3.05	–30.98	–21.36	9.80	0.52	–1.18
CAGDP	–3.60	–1.55	–3.59	–1.80	–2.34	–0.47	4.34	3.08	7.84	2.31
TBGDP	2.29	4.10	2.36	5.68	3.66	6.96	20.92	22.84	23.76	10.99
EDX	314.12	307.61	300.19	289.72	282.01	272.83	270.46	280.24	281.76	297.09
EDGDP	82.11	79.26	77.47	75.74	75.72	80.30	94.88	120.80	160.20	175.68
STDTOEXTDEBT	19.08	19.01	19.00	18.87	18.81	18.74	18.57	17.96	17.63	17.50

Meanwhile, in the 2005 crisis, five liquidity indicators (IRSTED, IRMS, IRBM, RES, and NETPIIR) had entered alert zone since though not to give a signal. The pressure mainly concerns from the adequacy of international reserves and foreign capital outflow. In terms of solvency, highly external debt position and current account surplus dwindling until reach the deficit in 2005Q3 was the cause of the pressure on the domestic economy.

However, the external pressure is not as strong as in the period of pressure on the eve of the crisis of 1997–1998. This is understandable because the root cause of the crisis in 2005 was the increase of fuel price which then impacted the domestic economy.

Heat Map for external vulnerability indicators during the 2005 crisis

Table 8

INDICATORS	2004Q3	2004Q4	2005Q1	2005Q2	2005Q3	2005Q4	2006Q1	2006Q2	2006Q3	2006Q4
DSR	20.35	25.11	17.07	24.30	17.29	16.30	14.91	17.28	15.07	22.91
IRSTED	140.99	147.33	144.48	143.13	124.66	145.67	167.28	175.70	184.63	206.32
IRMS	6.28	6.10	5.70	5.02	4.16	4.55	5.30	5.20	5.49	5.36
IRBM	32.27	32.04	32.73	30.10	26.37	28.85	31.21	29.09	29.91	28.15
RES	–0.88	25.48	–4.58	–32.09	–48.65	57.78	70.80	0.33	29.09	2.94
FDIGDP	0.54	1.21	1.24	5.29	2.45	2.57	1.57	1.20	1.09	1.48
NETPIIR	2.66	3.45	2.04	–2.19	7.26	8.86	10.24	–1.52	1.27	4.87
CAGDP	3.14	0.83	0.30	0.62	–1.62	1.04	3.46	2.17	3.93	2.22
TBGDP	9.18	8.52	4.61	5.72	4.87	8.85	7.85	7.73	8.91	7.60
EDX	171.65	161.94	150.42	143.37	138.18	124.25	124.97	120.26	114.92	107.21
EDGDP	56.46	55.06	53.79	52.38	51.45	46.63	45.41	42.42	39.43	35.92
STDTOEXTDEBT	17.44	17.45	17.68	16.72	17.07	17.72	17.31	16.59	16.67	15.56

In 2008Q4, deteriorating global conditions led to an outflow of foreign capital. This factor coupled with a decline in foreign exchange reserves add to pressure on vulnerability of liquidity indicators. Meanwhile, solvency indicators are relatively safer except the ratio of short-term external debt to total external debt which deteriorated along with the increase of short-term external debt position.

Heat Map for external vulnerability indicators during the 2008 crisis

Table 9

INDICATORS	2007Q3	2007Q4	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1	2009Q2	2009Q3	2009Q4
DSR	13.99	20.19	15.09	16.74	13.60	24.56	20.98	23.42	17.40	22.59
IRSTED	225.44	207.03	206.20	207.70	203.61	174.98	202.52	203.95	198.65	208.71
IRMS	5.97	6.23	5.99	5.48	4.85	4.28	4.92	5.71	6.70	7.11
IRBM	32.32	31.99	34.25	32.34	29.61	30.04	33.28	30.66	30.86	29.24
RES	22.03	44.29	20.97	4.29	–19.90	–45.28	28.71	27.15	50.66	41.05
FDIGDP	1.94	2.34	1.96	1.23	2.34	1.65	1.68	1.10	0.68	0.35
NETPIIR	3.26	–0.77	4.76	6.94	0.22	–7.75	3.31	2.66	5.30	5.79
CAGDP	1.90	3.02	2.28	–0.76	–0.67	–0.54	2.37	1.80	1.22	2.47
TBGDP	6.62	8.29	6.26	4.10	3.98	3.55	5.34	5.69	4.75	6.82
EDX	102.17	100.29	99.83	94.87	90.41	93.54	98.07	107.08	123.44	121.77
EDGDP	32.70	32.21	32.82	31.40	29.68	30.08	29.69	30.29	33.03	31.76
STDTOEXTDEBT	17.02	19.47	19.11	18.98	18.46	19.03	17.94	18.36	18.67	18.32

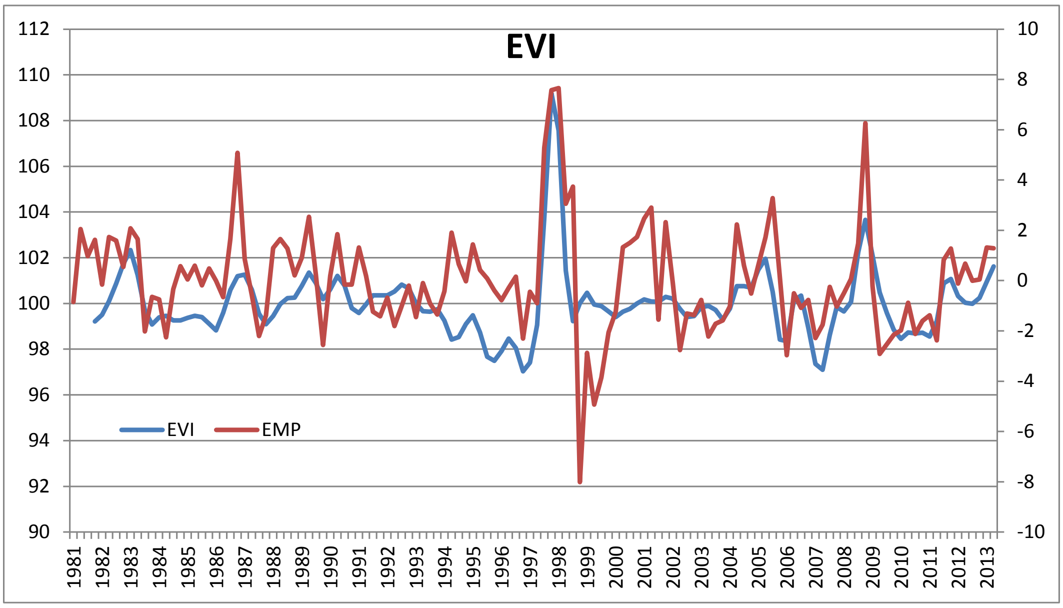
The analysis of external vulnerability indicators during crisis periods in Indonesia has shown that the resulting vulnerability indicator may give a warning or signal before the crisis occurred. Thus, the twelve selected indicators has been able to describe the level of vulnerability of external sector and can be used as a monitoring and early warning system to predict the crisis.

3.3 Composite Index

The composite index is calculated using weights based on the noise to signal ratio for each selected indicator. This research used an OECD methodology to obtain external vulnerability index (EVI). The index is aggregated from external vulnerability index, so it can be used to show the vulnerability of the external sector in general.

External Vulnerability Index vs EMP

Graph 3



The result of EVI has shown in Graph 3. In general, EVI movements cointegrated with EMP. This graph also supported by low noise to signal ratio, amounting to 0.1. Thus, EVI is able to send a good signal to detect the occurance of crisis in the next two years and can be used as leading indicator for EMP.

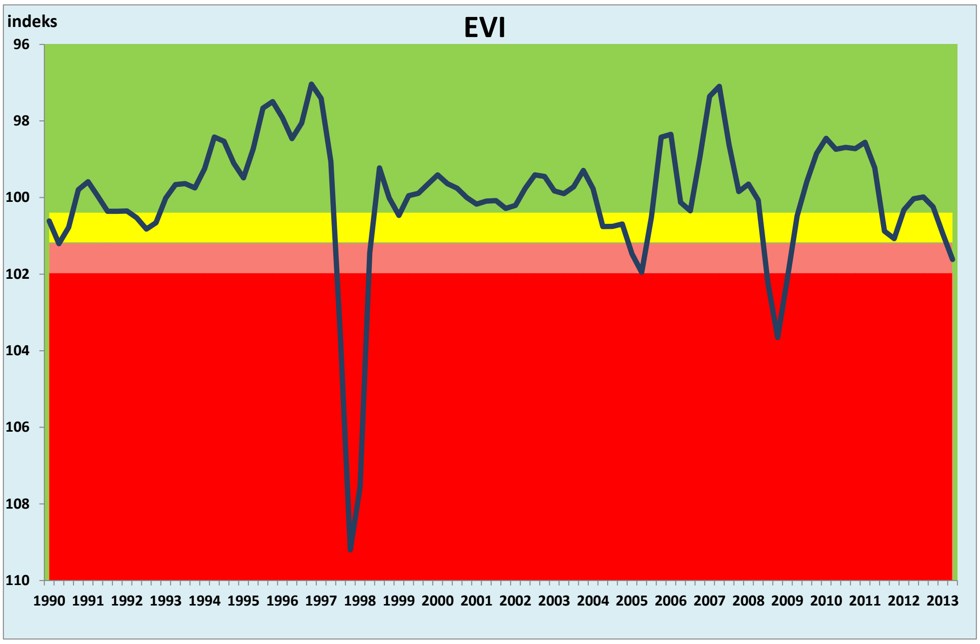
Furthermore, the noise to signal ratio also provides information about suspected crisis threshold. In this case, the smallest noise to signal ratio is obtained by using the threshold of 1.25 standard deviations above the average. The other thresholds will be determined using the difference of 0.25 standard deviations from suspected crisis threshold. Because of EVI movements and crisis are unidirectional, then the higher EVI means external vulnerability has increased. So the level of cautious and alert must be placed below the suspected crisis threshold. Thus, the cautious threshold determined by 1 standard deviation above the average and the alert threshold determined by 0.75 standard deviation above the average.

Threshold and Noise to Signal Ratio for External Vulnerability Index — Table 10

No	Variables	Threshold			Noise to signal ratio
		Alert	Cautious	Suspected Crisis	
1	EVI	100.39	101.18	101.96	0.1

From the results, it appears that EVI is able to identify the pressure in 1997–1998, 2005, and 2008. In 1997–1998, EVI send a signal before the crisis occured. It can be seen from the EVI movement through the suspected crisis area. EVI movements also indicated the pressure from external sector when the crisis occured in 2005, although not to exceed the suspected crisis threshold.

External Vulnerability Index — Graph 4



4. Conclusion

This study evaluated a number of external indicators with the aim to establish an early warning system of crisis from external side. The data used in this study was obtained from the 30 countries that have close ties with Indonesia, both from an economic standpoint or in terms of regionality and peer group ratings.

By using the signaling method, this research resulted in 12 indicators that need to be monitored on a regular basis in order to identify the pressures of the external sector. Of the twelve indicators then compiled a composite index of external vulnerability (EVI) in order to capture the level of pressure in the external sector as a whole. The threshold for composite index has been tested for its ability to provide a signal through the events previous crisis (1998, 2005, and 2008).

The twelve indicators coupled with the composite index is also feasible to use to predict the crisis. The signal issued by one of the external vulnerability indicators is a sign of increased external vulnerability for two years ahead.

References

Adiningsih, Sri, Dini N Setiawati, and Solihah (2002). "Macroeconomic Vulnerability in Indonesia". East Asian Development Network, EADN RP 2–3.

Babecký, Jan, Tomáš Havránek, Jakub Matějů, Marek Rusnák, Kateřina Šmídková, and Bořek Vašíček (2011). "Early Warning Indicators of Economic Crises: Evidence from a Panel of 40 Developed Countries". Working Paper Series, Czech National Bank.

Calafell, J G and R P Bosque (2003). "The Ratio of International Reserves to Short Term External Debt as an Indicator of External Vulnerability: Some Lessons from the Experience of Mexico and Other Emerging Economies". G4 Occasional Paper Series, No G-24.

Chang, Tsangyao and Chiang Gengnam (2007). "Threshold of Debt to GDP Ratio on GDP per Capita with Panel Threshold Regression Model – The Case of OECD Countries".

Chui, Michael (2002). "Leading Indicator of Balance of Payments Crises: a Partial Review". Working Paper no 171, Bank of England.

Dabrowski, Merek (2001) "The Episodes of Currency Crisis in Latin American and Asian Economies". Censter for Social and Economic Research, Case Reports, No 39, Warsaw, 2001.

Deutsche Bank Report (2011). "Macroeconomic Coordination". EU Monitor 78.

Eichengreen, Barry, Andrew Rose, Charles Wyplosz (1993)."The Unstable EMS". Brooking Papers on Economic Activity, Vol 1.

Eichengreen, Barry, Andrew Rose, Charles Wyplosz (1996)."Contagious Currency Crises". NBER. Working Paper, No 5681.

European Monetary Institute (1996). "Progress Towards Convergence 1996".

Greene, Joshua (2010). "Fiscal and External Sustainability: Concepts & Examples".

Herrera, Santiago and Conrado Garcia (1999). "User's Guide to an Early Warning System for Macroeconomic Vulnerability in Latin American Countries". World Bank Working Paper, November.

IMF (2000). "Debt- and Reserve- Related Indicators of External Vulnerability". Prepared by the Policy Development and Review Deaprtment in conculation with other Departments.

Kappagoda, Nihal (2007). "Debt Sustainability Framework for Low Income Countries". Paper presented at the Workshop on Debt, Finance and Emerging Issues in Financial Integration, London, March 6–7, 2007.

Kaminsky, Graciela (2000). "Currency and Banking Crises: The Early Warnings of Distress". George Washington University, Washintong, DC.

Kaminsky, Graciela, Saul Lizondo, Carmen M. Reinhart (1998). "Leading Indicators of Currency Crises". IMF Staff Papers, Vol 45, No 1 (March 1998).

Krugman, Paul (1979). "A Model of Balance of Payments Crises". Journal of Money, Credit and Banking 11, 311–25.

Krugman, Paul (1999). "Balance Sheets, the Transfer Problem, and Financial Crises". International tax and Public Finance, 6, 459–472.

Majardi, Fadjar, Ayi Supriyadi, Doddy Zulverdi, and Pujiastuti (2009). "Research and Management of External Vulnerability Indicators". Balance of Payment Bureau, Directorate of Economic and Monetary statistics, Bank Indonesia.

Mishev, Risto Hadzi (2010). "Information of the Exchange rate Stability in 2010".

Obstfelt, Maurice (1994). "The Logic of Currency Crisis". Cahiers economiques et monetaires no 43, Banque de France.

OECD (2008). "Handbook on Constructing Composite Indicators: METHODOLOGY AND USER GUIDE".

OECD (2010). "OECD Cyclical Analysis and Composite Indicators System (CACIS) User's Guide".

OECD (2012). "OECD System of Composite Leading Indicators".

Reinhart, Carmen M, Keneth S Rogoff, Miguel A Savastano (2003). "Debt Intolerance".

Sachs, Jeffrey D, Aaron Tornell, Andres Velasco (1996). "Financial Crises in Emerging Markets: The Lessons from 1995". Brookings Paper on Economic Activity, 1:1996.

Simorangkir, Iskandar (2012). "An Assessment of Early Warning Indicators of Bank Runs in Indonesia: a Markov-Switching Approach". Working Paper Bank Indonesia No WP/01/2012.

Supriyadi, Ayi (2011). "Development of External Vulnerability Indicators". Balance of Payments Bureau, Directorate of Economic and Monetary Statistics, Bank Indonesia.

The Autonomous Sinking Fund of Cameroon (CAA), "Evolution of the Public Debt Service Ration", http://www.caa.cm/EN/Debt_service_ratio.html.

United Nations-Economic and Social Comission for Asia and Pacific (UN-ESCAP) (2006). "Manual on Effective Debt Management".

Alternative indicator of monetary policy stance for Macedonia[1]

Magdalena Petrovska and Ljupka Georgievska

Abstract

This paper applies a SVAR model which combines different monetary policy instruments to construct an alternative indicator of monetary policy stance in Macedonia. It employs the approach introduced by Bernanke and Mihov (1995, 1998) of isolating monetary policy shocks from overall policy that otherwise react to real developments. The residuals from such VAR are cleaned from the central bank's reaction function and represent true monetary policy innovations. Further, we solve the interdependence among different monetary policy instruments contained in the residuals by developing a structural model. We use the model to extract unanticipated policy stance, as alternative view on the monetary policy.

Keywords: SVAR, monetary policy stance, monetary framework

JEL classification: E50, E52

[1] The opinions and views expressed in this paper are only those of the authors and do not necessarily reflect the position and views of the National Bank of the Republic of Macedonia. We would like to thank Branimir Jovanovic for his constructive comments.

1. Introduction

Measuring the monetary policy stance enables the central bank to determine whether monetary policy is contributing to macroeconomic and financial developments in the country in a way that insures achieving the aimed combination of inflation and output stabilization.

In this paper we apply the Bernanke and Mihov (1998) methodology to Macedonia thus building a multivariable indicator for the monetary policy stance. Unlike the policy rate which represents central bank's intentions thus depicting the intended or "de jure" monetary policy stance, our indicator tends to proxy the actual or "de facto" monetary policy stance vis-à-vis the real sector after transmission takes through and commercial banks adjust their behavior to monetary policy changes, in one way or another. Our indicator has additional advantage as it captures the effect of all monetary policy instruments applied by the NBRM. As such, it can be useful in detecting disruptions in monetary policy transmission mechanism due to shocks of various types. We also analyze inflation and GDP reaction with respect to monetary policy stance thus witnessing on NBRM's ability to react counter-cyclically and stabilize domestic economy given the constraints of the applied monetary strategy of targeting the exchange rate.

The paper is organized as follows. Section 2 provides a brief overview of the monetary policy setup in the Macedonian economy covering the monetary strategy and monetary policy instruments that the central bank applies. Sections 3 to 6 discuss the data and methodology. Section 7 documents the empirical results. Section 8 concludes.

2. Monetary policy in Macedonia

In order to achieve the principal monetary policy goal – price stability – the NBRM has been implementing a monetary strategy of targeting the nominal exchange rate of the Denar against the Euro (prior 2002 against the Deutsche Mark) been effective since October 1995. Thus, the NBRM pursues the nominal exchange rate as intermediate monetary policy target.

In order to pursue its intermediate and final objectives, the NBRM applies a range of monetary policy instruments. The monetary policy instruments setup of the NBRM is determined by the exchange rate targeting framework and the specifics of the banking sector in the country as monetary policy counterpart.

As to sustain the stability of the exchange rate the NBRM performs direct interventions on the foreign exchange market by purchase/sale of foreign currency. Over the 2005–2013 period, central bank's foreign interventions were predominantly net-purchases of foreign currency, thus contributing to a significant accumulation of foreign reserves as an important element for successful exchange rate targeting strategy. Exemption was the global crisis in its acute phase of late 2008-early 2009 when NBRM suffered massive loss in gross foreign reserves as to sustain the stability of the exchange rate. The shock was short-lived with losses being largely recovered as soon as the end of 2009. Since then, gross foreign reserves are generally on a growing path thus credibly supporting the exchange rate peg.

With respect to domestic liquidity management, the NBRM uses a set of various market-based monetary instruments. The main monetary policy instruments available to the NBRM are: open market operations, reserve requirements and deposit facility. Open market operations are the most important and most flexible monetary policy instrument of the NBRM with the purpose to steer interest rates, manage liquidity conditions in the banking sector and signal monetary policy stance. The underlying instruments for open market operations include CB bills auctions, repo operations and outright transactions. Due to predominant purchases of foreign exchange, open market operations conducted by the NBRM are principally used with a view to mopping up excess liquidity in the banking sector. Hence, over 2000–2013 period, CB bills hold the main role in managing liquidity with their interest rate representing the key policy rate of the central bank. As to address short-term liquidity shortage in the banking system, NBRM conducts liquidity-providing repo operations. In conditions of short-term excess liquidity, banks may place funds with the NBRM in deposit facility. Reserve requirement as standard instrument is also applied by NBRM to directly influence money and credit supply.

3. Excess reserves – an intermediate target (commitment device) of monetary policy in Macedonia

This section represents an adaptation from Lang and Krznar (2004) and aims at explaining the rationale behind using excess reserves in our monetary policy model. A number of different monetary instruments the NBRM has used during the period under consideration makes their joint assessment in the analysis of monetary policy necessary. Since most measures were tailored to support the domestic liquidity management (base money), they can be combined. As shown below, these measures have influenced both money supply and money demand. In order to use the base money as a policy variable, it needs to be adjusted for the changes in reserve requirement, which were common during the analyzed period. Otherwise the growth of the base money that results from the increase in required reserve could be interpreted as monetary easing, while the opposite is true.

Following Lang and Krznar (2004), the connection of excess liquidity and other monetary policy instruments is explained in the following accounting framework. The framework relies on the concept of demand (Rd) and supply (Rs) of commercial banks' reserves at the NBRM:

(1) $Rd = RR\,(rr,RB) + ER$

(2) $\Delta Rd = \Delta RR + \Delta ER = rr^{*}\,\Delta RB + RB^{*}\Delta rr + \Delta ER$

The demand for reserves (Rd) is equal to required reserves (RR) and excess reserves (ER). "In a developed financial system, such as in the Eurozone, with well-functioning marginal facilities, the preferred excess reserves are zero. However, if there is a shallow and inefficient money market and standing facilities are non-existent or expensive, commercial banks may prefer to hold positive excess reserves. The (preferred) excess reserve can be modelled as a function of the cost of the use of credit facility (difference between interest rate on credit facility and money market interest rate)" [Lang and Krznar, 2004].

Excess reserves as positive deviations from required bank reserves might be used by the banks as a buffer to cover unforeseen changes in the supply of central bank money. The settlement banks usually prefer to have accounts at the central bank because this gives them direct access to the ultimate source of domestic liquidity [adaptation from Ganley, BoE Lecture Notes Series].

"If required to do so for monetary policy purposes, the banks will hold a proportion of their deposit liabilities at the central bank in either remunerated or unremunerated form. Obviously, these required bank reserves are more costly to the banks if they are unremunerated. If the central bank chooses to pay a rate of return to the banks this can be at a market or sub-market rate of interest. The cost of required reserves will also depend on their coverage, namely how much of the banks' liabilities are actually included" [Ganley, BoE Lecture Notes Series]. Therefore, monetary policy can influence the demand for reserves through the change in the rate of required reserves and the change in the scope of the reserve base. During the period under review a number of changes in both rate and scope of required reserves have been implemented in Macedonia.

Following Lang and Krznar (2004), the supply of the reserves (Rs) is the difference between the base money (M0) and autonomous factors (Af – cash in circulation and government deposits):

(3) $Rs = M0 - Af$

(4) $\Delta Rs = -\Delta Af + \Delta NFAcb + \Delta NDAcb$

$= -\Delta Af + INTb + INTg + \Delta CR + \Delta OMO$

Cash in circulation is one of the autonomous factors in reserves supply. It is defined as all central bank notes held outside the central bank. Decreases (increases) in the outstanding note issue imply credits (debits) to the banking system's accounts with the central bank; in other words, decreases in the note issue add to central bank reserves. Changes in the note issue can be volatile on a daily basis, but often have some predictable seasonality, both within-week and within-month. The main long-run determinants of currency demand are transaction variables such as GDP or private consumption and opportunity cost measures like interest rates or inflation. In addition, the second potential factor in the creation of reserves is transactions to government; this accrues through the net daily cash flows in and out of the consolidated fiscal account at the central bank. In terms of the size and volatility of the flows involved, this account may have a substantial effect on the supply of reserves [adaptation from Ganley, BoE Lecture Notes Series].

According to *(4)*, the change in the supply of the reserves is the sum of the (negative) change in autonomous factors, the change in the foreign assets of the central bank and the change in the net domestic assets of the central bank. The change in the net foreign assets (NFA) is equal to the amount of foreign exchange interventions (both transactions with commercial banks INTb and government INTg).

In a fixed exchange rate country, the central bank may be forced to intervene on the foreign exchange market to maintain the parity for the domestic currency. If there is downward pressure on the parity then, with non-sterilised intervention, it acquires domestic currency in exchange for net foreign assets, resulting in a reduction in the monetary base. The central bank is generally able to neutralise this effect on the monetary base by engaging in an offsetting transaction which injects domestic currency liquidity into the market to coincide with the drain of liquidity caused by the intervention. The sterilisation transaction will usually be a purchase of domestic financial assets [adaptation from Ganley, BoE Lecture Notes Series].

The change in net domestic assets (NDA) is the sum of the change of NBRM's credits to commercial banks (CR), i.e. credit facility and open market operations (OMO). OMO includes both rarely used money creating open market operations (repo), and widely used money destructing monetary operations (CB bills in Denar), which enter with a negative sign.

Following Lang and Krznar (2004), combining the demand *(1)* and supply *(3)* of the reserves, the excess reserves are equal to the difference between base money, required reserves and autonomous factors:

(5) $Rs = Rd$

(6) $ER = M0 – RR – Af$

The change in excess reserves is therefore influenced both by changes in the supply and demand of the reserves, both of which the NBRM is influencing with its monetary policy instruments:

(7) $\Delta ER = – \Delta Af + \Delta NFAcb + \Delta NDAcb – \Delta RR$

(8) $\Delta ER = – \Delta Af + INTb + INTg + \Delta CR + \Delta OMO – rr^* \Delta RB – RB^*\Delta rr$

Excess reserves are a function of interventions, open market operations, reserve requirement and autonomous factors (signs of coefficient are given in parentheses):

(9) $ER = f (INT (+), OMO (+), CR (+), RR (–), Af(–))$

The purchase of foreign currency results in the increase of excess reserves, i.e. monetary easing. Money creation through open market operations (or the decrease of outstanding CB bills) and the NBRM's credits also leads to monetary easing, and an increase of the required reserves leads to monetary tightening. "This definition of excess reserves is consistent with reserve targeting, but is adapted to include monetary instruments influencing both money supply and money demand. Indeed, it is an interesting measure since it combines the intention of the policymaker in the sense that its increase corresponds with monetary easing and its decrease with monetary tightening" [Lang and Krznar, 2004].

4. Constructing an indicator of monetary policy stance for Macedonia

In this chapter, the monetary transmission in Macedonia is analyzed applying a Structural Vector Autoregression (SVAR) approach on monthly data. The essential part of the analysis is to identify exogenous monetary policy shocks and to consider the transmission of such shocks to the macroeconomic variables of interest. "To separate exogenous monetary policy shocks from changes in monetary policy that correspond to central bank's endogenous response to shocks originating elsewhere in the economy, the model should include a well-specified reaction function for the central bank" [Beier and Storgaard, (2006)].

In general, "identifying a reaction function for central bank policy involves confronting two basic complex issues. First, one has to take a stand on the set of information to which the central bank responds. The central bank may have a primary goal of stabilizing inflation and output, for example. But it may (and in general does) take account of a far broader set of information than simply inflation and output" [Clarida and Gertler, (1997)]. Good examples are exchange rates and current account deficits. Also, the central bank may make use of some intermediate targets as a kind of commitment device.

As stressed by Christiano et al. (1996), without a complete structural model of the economy it is the response of variables to exogenous policy actions that must be examined in order to gauge the effects of monetary policy. This is because movements of the economy following an endogenous policy action may be due to the policy action itself or to the variable that spurred that action. Each policy equation in a VAR can be interpreted as a sum of an endogenous part, a so-called implicit rule, and an exogenous part, representing deviations from the rule or monetary shocks. The central bank's behavior behind these exogenous shocks is definitely linked to its operating actions [adaptation from Cuche, (2000)].

The indicator of monetary policy stance in Macedonia is constructed by using a structural VAR model which combines different monetary policy instruments. This approach introduced by Bernanke and Mihov (1995, 1998), has become a standard approach of isolating monetary policy shocks from the overall monetary policy that otherwise reacts to real sector developments. Following Bernanke and Mihov (1995, 1998), we develop and implement a general, VAR-based methodology in which the indicator of monetary policy stance is not assumed but rather is derived from an estimated model of the central bank's operating procedure. More specifically, we employ a VAR model that leaves the relationships among macroeconomic variables in the system unrestricted but imposes contemporaneous identification restrictions on a set of monetary variables. A similar approach was applied by Clarida and Gertler (1997) in their analysis of Bundesbank's monetary policy. Cuche (2000) applied these two papers to a small open economy in his analysis of monetary policy in Switzerland [adaptation from Lang and Krznar (2004)].

"The basic idea is, by estimating a general VAR that includes both non-policy and policy variables, to eliminate elements of monetary policy reaction functions on policy variables. More specifically, the residuals from such VAR are cleaned from dynamics that originates from the central bank reaction function and represent true monetary policy innovations. However, these residuals contain interdependence between different monetary policy instruments, which needs to be solved by a structural model of monetary policy in order to extract true monetary policy stance i.e. unanticipated monetary policy" [Lang and Krznar, (2004)].

In addition, rather than building the monetary policy model around supply and demand for bank reserves as in Bernanke and Mihov (1998) they are combined into a single measure of excess liquidity. With this respect our analysis follows Lang and Krznar, (2004). This is in line with the NBRM's policy, which influenced both demand and supply of reserves. Thus, the main monetary policy variables are the nominal exchange rate and the excess liquidity (excess reserves). Excess reserves can be observed as an intermediate indicator of monetary policy, i.e. as a kind of commitment device.

5. The model

This section is an adaptation from Lang and Krznar (2004). In order to isolate monetary shocks, it is important to make a distinction between the variables that the central bank can directly influence and other variables that it cannot directly influence. Because this definition is quite loose, we use a timing assumption to sort out variables. According to Clarida and Gertler (1997) and Bernanke and Mihov (1998) we define policy variables as variables that the central bank influences within the current considered period. In addition, because of rigidities, we know that monetary policy begins to influence non-policy variables with a lag.

Following Bernanke and Mihov, the first step is to estimate the following VAR:

$$\begin{aligned} Y_t &= \sum_{i=0}^{k} B_i Y_{t-i} + \sum_{i=0}^{k} C_i P_{t-i} + A^y v_t^y \\ P_t &= \sum_{i=0}^{k} D_i Y_{t-i} + \sum_{i=0}^{k} G_i P_{t-i} + A^p v_t^p \end{aligned} \qquad (1)$$

Yt is a vector of macroeconomic (non-policy) variables and *Pt* is a vector of policy variables. System *(1)* is not econometrically identified. Without restrictions imposed on its structure, it is not possible to retrieve its coefficients after its reduced form estimation. A first step towards this identification is to break the loop of contemporaneous influences between non-policy and policy variables in this dynamic setup. In order to solve the problem we use the mentioned timing assumption again, based on the fact that central banks cannot directly influence in a timing dimension the non-policy variables. After the introduction of this assumption, system *(1)* becomes system *(2)*.

Thus, system *(1)* can be rewritten as ordinary VAR, introducing restriction that monetary policy does not immediately influence non-policy variables (C0 = 0).

$$\begin{aligned} Y_t &= \sum_{i=0}^{k} B_i Y_{t-i} + \sum_{i=1}^{k} C_i P_{t-i} + A^y v_t^y \\ P_t &= \sum_{i=0}^{k} D_i Y_{t-i} + \sum_{i=0}^{k} G_i P_{t-i} + A^p v_t^p \end{aligned} \qquad (2)$$

Non-policy and policy variables are orthogonal by construction, i.e.

$$A = \begin{bmatrix} A^Y & 0 \\ 0 & A^P \end{bmatrix} \qquad (3)$$

Matrix *A* allows the various structural shocks, also split into non-policy and policy shocks, to enter each equation with the single restriction that we do not allow the monetary world shocks to independently enter the non-policy sphere. They certainly affect the economy but only through the effects on policy variables. This assumption is not too restrictive, because we can imagine processes generating these shocks as totally independent of each other (e.g. with an independent central bank, we can assume such a disconnection). Composite residuals for each variable, or more precisely for each equation in the system, are then a mix of the different individual structural shocks.

System *(2)* constitutes the base for the second step. In order to retrieve true monetary policy shocks *vs*, it is necessary to model the relationship between different monetary instruments. In fact we directly use the VAR residuals from *(1)* and express them in terms of true structural disturbances. This is the so called *without extraction approach* [Cuche, (2000)]. Alternatively, we can extract from the residuals of the policy variables in the first SVAR new series that are the portion of VAR residuals in the policy block that is orthogonal to the VAR residuals in the non-policy block. This is the way with extraction. So, following the method without extraction we use NBRM's operating procedures to model two equations representing the central bank's behavior in innovation form. We thus proceed with the policy section.

In order to retrieve true monetary policy shocks *vs*, it is necessary to model the relationship between different monetary instruments. "Bernanke and Mihov do this by modelling the market for bank reserves by distinguishing between borrowed and non-borrowed reserves. Cuche applies their analysis for small open economy models demand and supply for reserves, as well as exchange rate" [Lang and Krznar, (2004)].

$$u_s^{mon} = u_d^{mon} \tag{4}$$

$$u_s^{mon} = \lambda v^d + \varphi v^x + v^s \tag{5}$$

$$u_d^{mon} = \rho u^i + v^d \tag{6}$$

$$u^x = \delta u^i + v^x \tag{7}$$

"Money supply (5) is a function of demand shock and exchange rate shock, as well as true money supply shock (true monetary policy shock). Money demand (6) is a function of interest rates, i.e. the opportunity cost of holding money, and demand shock. Exchange rate (7) is also a function of interest rate (interest rate parity) and exchange rate shock. This system can be solved by the GMM estimator" [Lang and Krznar, (2004)].

Still, due to short data series and relatively stable monetary policy instruments, following Lang and Krznar (2004), a simpler model was used for Macedonia, consisting of only two different monetary instruments: exchange rate and excess liquidity. This means that supply and demand shocks are combined, which is in line with the conduct of monetary policy in Macedonia:

$$\begin{aligned} u^x &= v^x \\ u^l &= \varphi u^x + v^s \end{aligned} \tag{8)–(9}$$

"Exchange rate *ux* in terms of innovations is a function of the exchange rate shock (8). Monetary policy variable *ul* (excess liquidity) in terms of innovations is a function of shock in exchange rate *ux* (monetary policy reacts to changes in exchange rate, i.e. exchange rate targeting) and unanticipated shock in monetary policy *vs* (9). This system of equations can be solved by using the GMM method. It is just-identified; there are three known variables: variances and covariance of *ux* and *ul*; and three unknown variables: variances of *vx* and *vs* (their covariance by construction equals zero) and reaction parameter φ. The true monetary policy shock *vs* is constructed from equation (9). Finally, the indicator of (unanticipated) monetary policy stance is constructed by summing up previous unanticipated monetary policy shocks *vs*:" [Lang and Krznar, (2004)]. Namely, the absolute level of *vs* is of no specific meaning, only relative movements give an indication of changes in the policy stance. An upward movement represents a tightening of the policy stance, and, a downward movement an easing. Accumulation smoothes the series so that the final series gives a clear indication of the direction of the policy shift [adaptation from Höppner].

$$MP_t = \sum_{i=0}^{t} v_{t-i}^{s} \qquad (10)$$

6. Data description

Data selection and the rationale behind the interpolations entirely follow (Lang and Krznar, 2004). Quarterly GDP data (y) is interpolated to monthly frequency using industrial production series. The GDP series is integrated of order 1.

Core inflation (p) is used as the price variable in order to control for an increase of administered prices that had major effect on the overall price dynamics in the low inflation environment. The price series is integrated of order 1.

The third non-policy variable is the external imbalance, described by the current account (ca). Current account is constructed as a ratio of current account balance and nominal GDP, and is interpolated to monthly frequency by the series of net payments abroad, which is used for the construction of the balance of payments statistics. The current account series is stationary.

The exchange rate variable (e) is the average monthly nominal exchange rate MKD/EUR. Note that increase in exchange rate describe depreciation. The variable is stationary.

In line with the discussion earlier in this paper, the excess liquidity/reserves (l) is used for modelling monetary policy of the NBRM. It is expressed as the ratio of excess reserves to required reserves (monthly averages). The variable is also stationary.

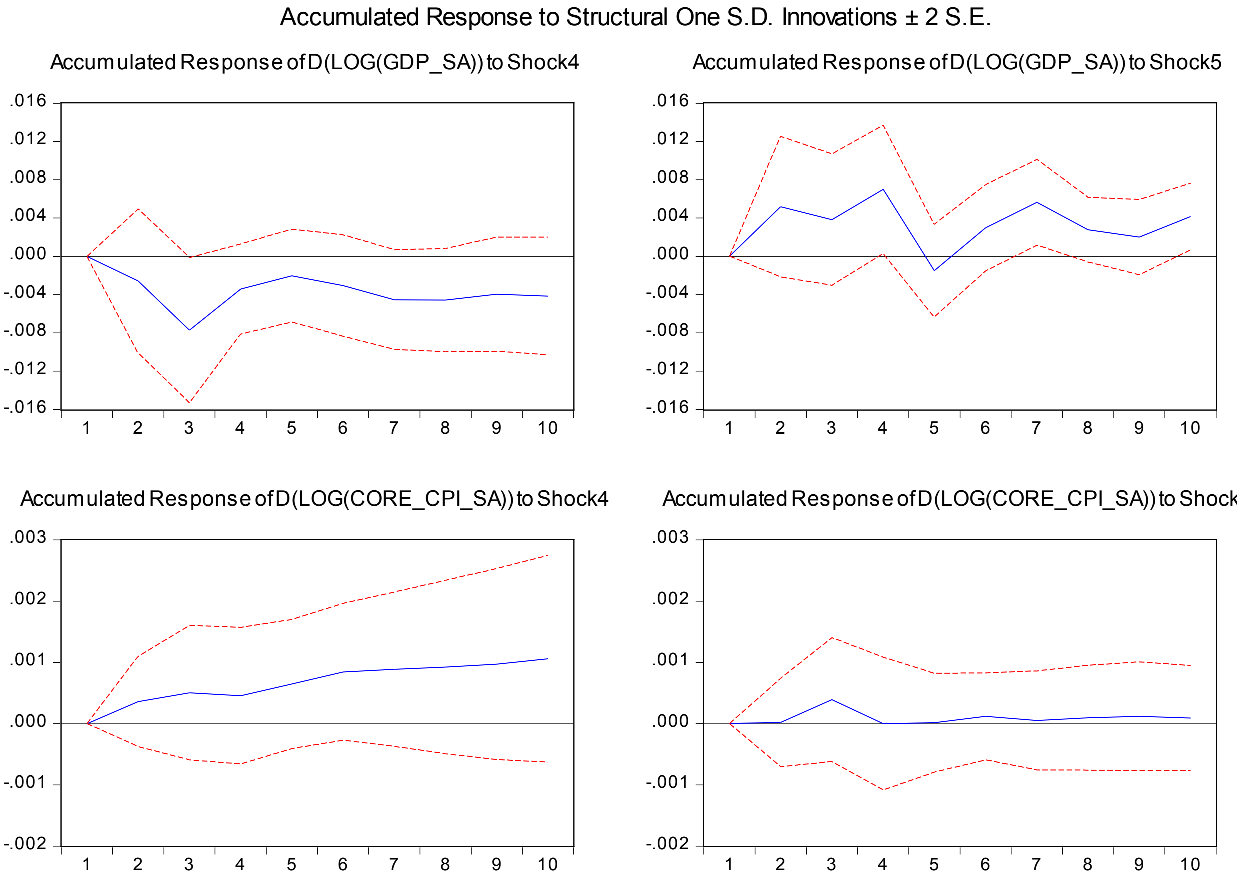
All variables are seasonally adjusted (including the exchange rate). GDP, prices, and the exchange rate are in logs, while the ratio of the current account and the excess liquidity are in percentage points. In order to have stationary series, the first differences of real activity and prices are used. Unit root tests are given in the Appendix 2. The analysis covers the period that starts in December 2005 and ends in June 2013.

7. Estimation and results

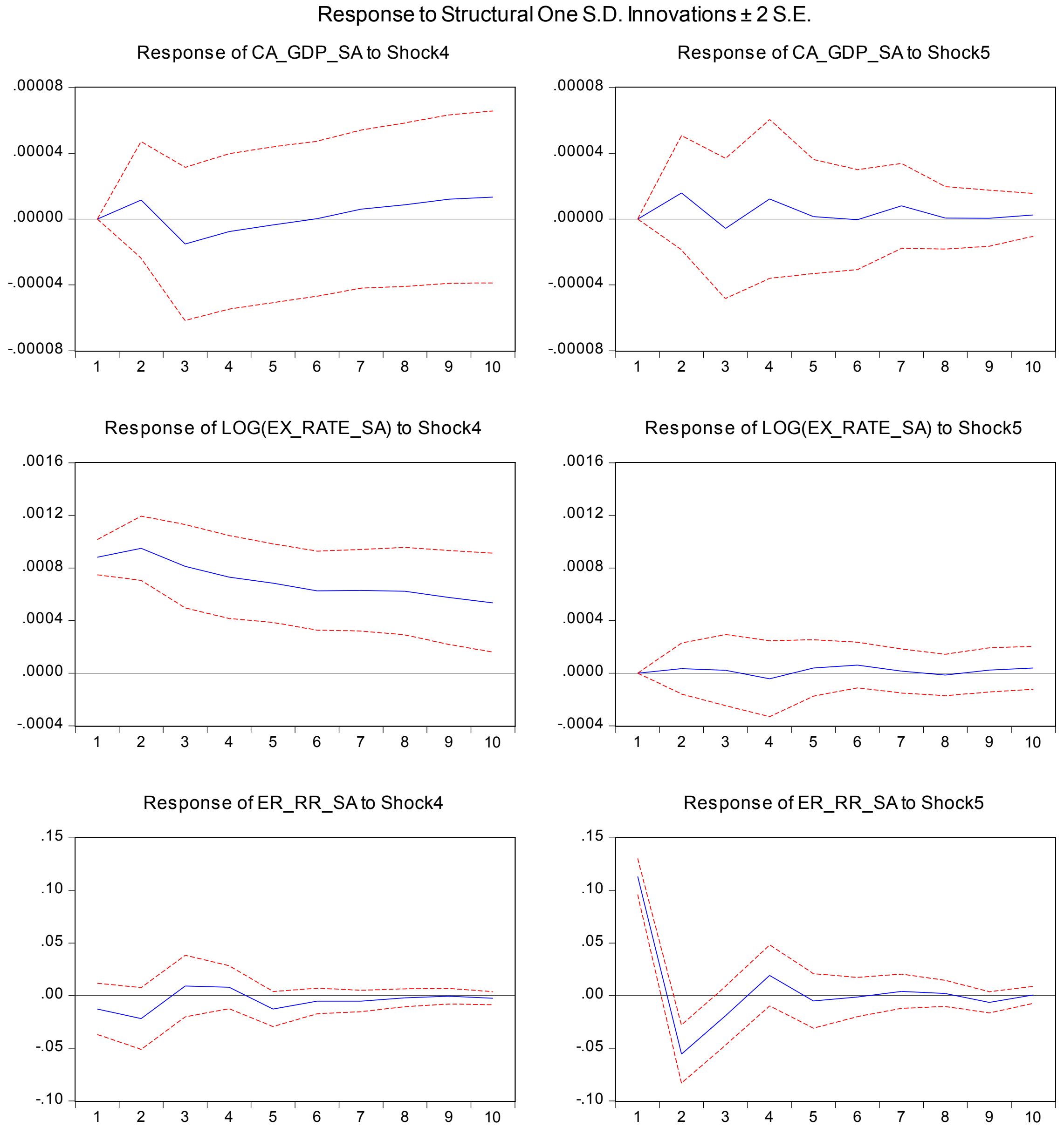
As described above, the initial step was to estimate a SVAR in form *(2)*. Non-policy variables are changes in real GDP (Δy), changes in prices (Δp), and the ratio of current account to GDP (ca). Policy variables are exchange rate (e) and excess liquidity (l). Three lags are chosen for the final SVAR specification.

Although the purpose of this benchmark SVAR is to retrieve the residuals free of monetary policy reaction, we find observing the impulse response functions informative. Therefore, just to give a brief insight of the responses of this benchmark system derived by appropriate structuralization of VAR residuals, impulse responses in the changes of GDP and prices are shown below (due to first difference of GDP and prices, effects of shocks are accumulated for those variables). With this respect, we must take one point of reservation into account, primarily because VAR analyses of the effects of monetary policy have more significant meaning when unanticipated monetary policy stance is included as an element in the VAR. Therefore, further in this section we contrast the dynamic responses of this benchmark system with those derived from a VAR which contains an alternative indicator of monetary policy.

SVAR impulse responses of shock in monetary policy (Shock 4 refers to exchange rate shock; Shock 5 refers to liquidity shock) Graph 1



SVAR impulse responses of shock in monetary policy (Shock 4 refers to exchange rate shock; Shock 5 refers to liquidity shock) *(cont)* Graph 1



Source: Authors' calculations.

Excluding large confidence bands, results, although very small in size, show that exchange rate depreciation negatively affects GDP, which using the analogy of Lang and Krznar (2004) can probably be explained by a decrease in disposable income (increased Denar value of loan repayments because of currency clauses in loan agreements) and probably by a weak response of exports to the exchange rate. Namely, a most probably smaller positive elasticity of exports to exchange rate shock could be related to the substantial share that export-processing firms account for in Macedonia's foreign trade. Processing trade relies heavily on imported intermediate inputs; therefore, a depreciation of the Denar may on the other hand increase the input costs for processing exporters. Still, for stronger conclusions on this particular issue, a conduct of comprehensive micro study which would consider almost every potential effect of currency depreciation, including both intensive (quantity and price) and extensive (entry, exit, and product scope) adjustments would be necessary.[2]

Results in addition, although not statistically significant and again very small in size, show that the increase in liquidity may positively influence GDP, which is a typical parallel with the usual finding that a reduction in interest rates stimulates aggregate demand.

The results indicate very small, positive effect on the current account in response to exchange rate depreciation. However, the positive effects are preceded by an initial worsening of the current account (the impact of devaluation may take time to have effect on the demand; in the short term, demand may be inelastic, but over time demand may become more price elastic and have a bigger effect). An improvement in the current account on the balance of payments depends upon the elasticity of demand for exports and imports. Generally, if the sum of both, the price elasticity of exports demand and the price elasticity of imports demand is higher than one, then a devaluation will improve the current account.

The reaction of prices to exchange rate depreciation, although not statistically significant, arguments in favor of the existence of pass-through. Inflation is likely to occur, first because imports are more expensive causing cost push inflation, and second, with exports becoming cheaper manufacturers may have less incentive to cut costs and become more efficient.

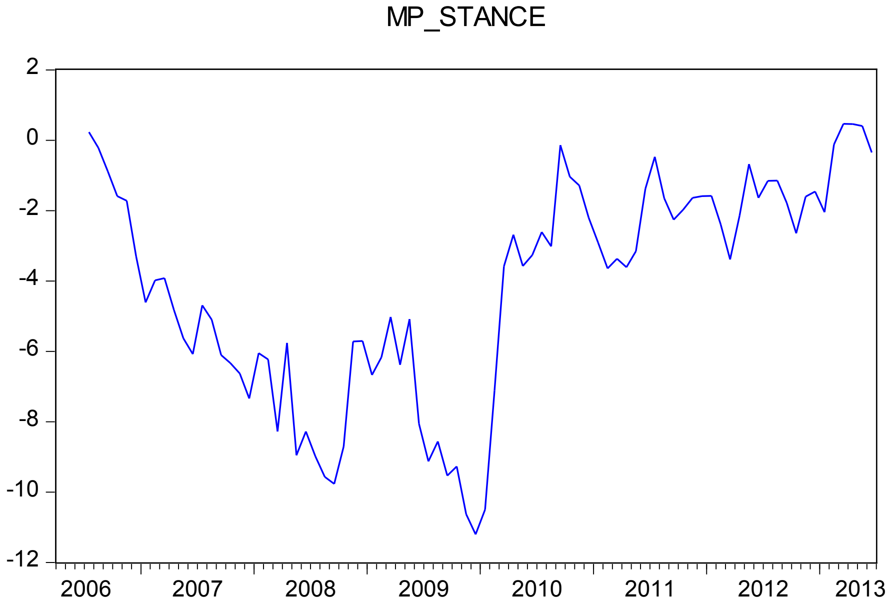
An increase in liquidity, on the other hand, although very small, has mostly positive effect on the current account. Following Lang and Krznar (2004) findings, we can point out that this result is counter-intuitive because under these circumstances one would expect a decrease in interest rates, which might in parallel boost imports backed by higher credit activity. Still, we should have in mind that a predominant part of our sample covers the period of the global financial crisis – a period in which we observed some worsening of the market sentiment, as well as a situation when banks have being hesitant about making loans.

Adapting Lang and Krznar (2004) findings, we can conclude that due to the policy response, the exchange rate does not react much to the liquidity shocks. On the other hand, liquidity decreases after depreciation, as a result of the NBRM's non-sterilised foreign exchange intervention reaction to exchange rate change. However, we need to very carefully interpret these findings as our VAR analysis produces results that are not robust enough to reliably determine the effects of potential exchange rate depreciation on various macroeconomic variables. This is due to the impulse responses that are very small in size with rather large confidence bands. Therefore, we should interpret these results more like an indication of what can be one of the possible, still not exclusive way, through which a potential exchange rate depreciation may affect domestic economy.

[2] In other words, firms' responses to exchange rate shocks are not limited to the adjustment in intensive margins (i.e., quantity and price). Recent literature has emphasized the importance of the extensive margins of trade, which accounts for a large share of the variation in imports and exports across nations (Bernard *et al.* 2009).

As stated earlier, the indicator of monetary policy stance is configured as a sum of all (autonomous) shocks of monetary policy. The indicator of monetary policy stance is shown in Graph 2.

Monetary policy stance indicator (increase in the indicator represents monetary tightening) Graph 2



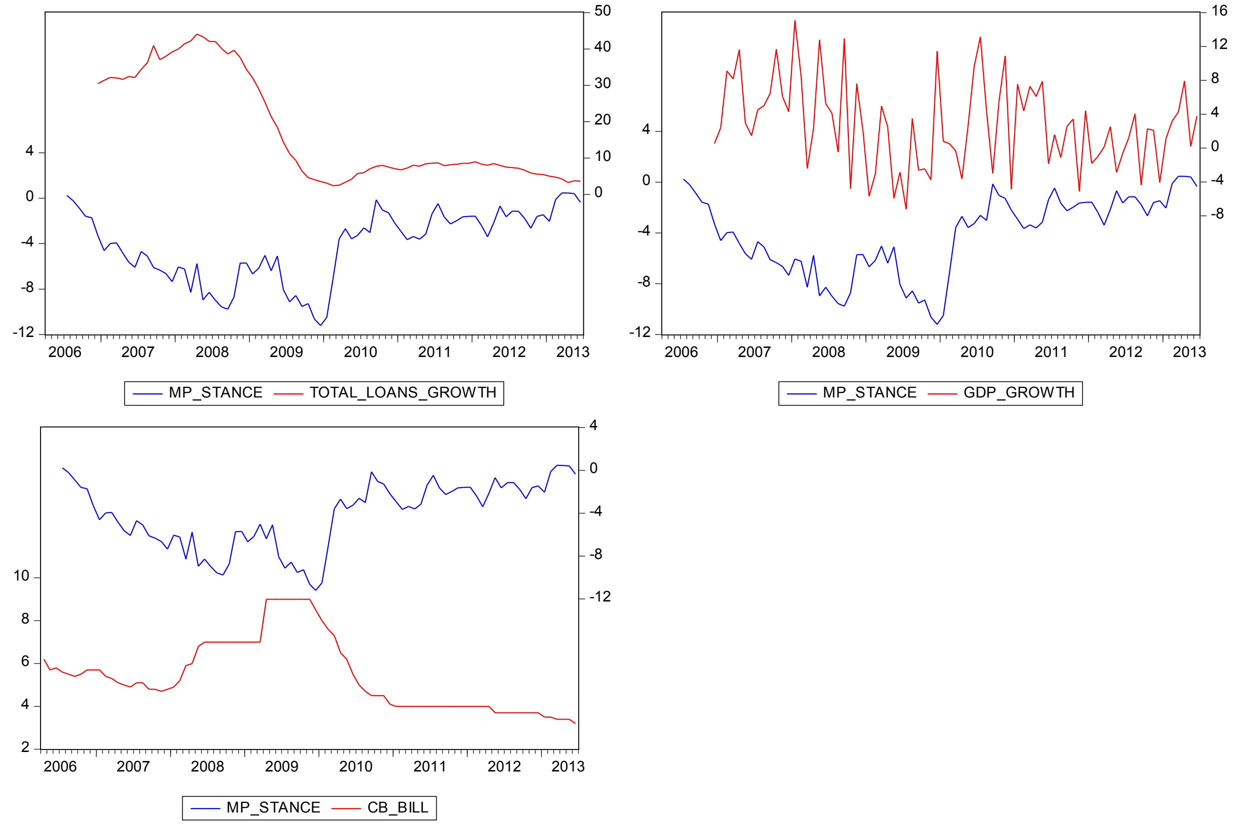
Source: Authors' calculations.

For the pre-crisis period covering 2006–2008 the constructed indicator of monetary policy stance is broadly in line with NBRM's policy rate dynamics suggesting to a well functioning monetary transmission. For the second period covering the global crisis it shows a sharp monetary tightening that started at the end of 2009 and lasted until the end of the first quarter of 2013 while this was a period when NBRM undertook bold measures as to ease the monetary policy stance. These findings suggest to a diminished monetary transmission in the recent monetary easing cycle. That is to say that low funding costs and abundant bank reserves produced by monetary policy in this period have not resulted in significant, broad-based loan growth.

The state of the banking system is central to this picture. It means some bankable loan demand is not being met in spite of ample liquidity. There are a number of reasons why credit flows via banks have been weak. They can be categorized under two headings: demand and supply. Here are some factors which most probably have restrained the demand for bank credit. Larger businesses might have been aggressively controlled costs and exploited productivity gains. In parallel, they might prefer engaging their own funds or engaging in alternative funding through inter-company loan transactions or through borrowing funds from capital markets. All this has added up to relatively weak loan demand. On the other hand, it is very likely that smaller businesses haven't yet seen much revenue growth and remain cautious about borrowing. In addition, households continue the process of deleveraging, and, as a consequence, consumer loan demand, broadly defined, has been soft [adaptation from Lockhart, (2012)].

As for the supply of bank credit, here are some factors that bankers have been living. As a result of the global financial crisis and the recession, underwriting standards across all loan categories have been tightened. In other words, due to the perceived uncertainty, banks refrain from growing their balance sheets even if there were stronger loan demand. Consequently, it can be argued that because of the interplay of demand and supply factors, the interest rate sensitivity and in general, the response of the Macedonian banking sector to monetary changes, has been dampened [adaptation from Lockhart, (2012)].

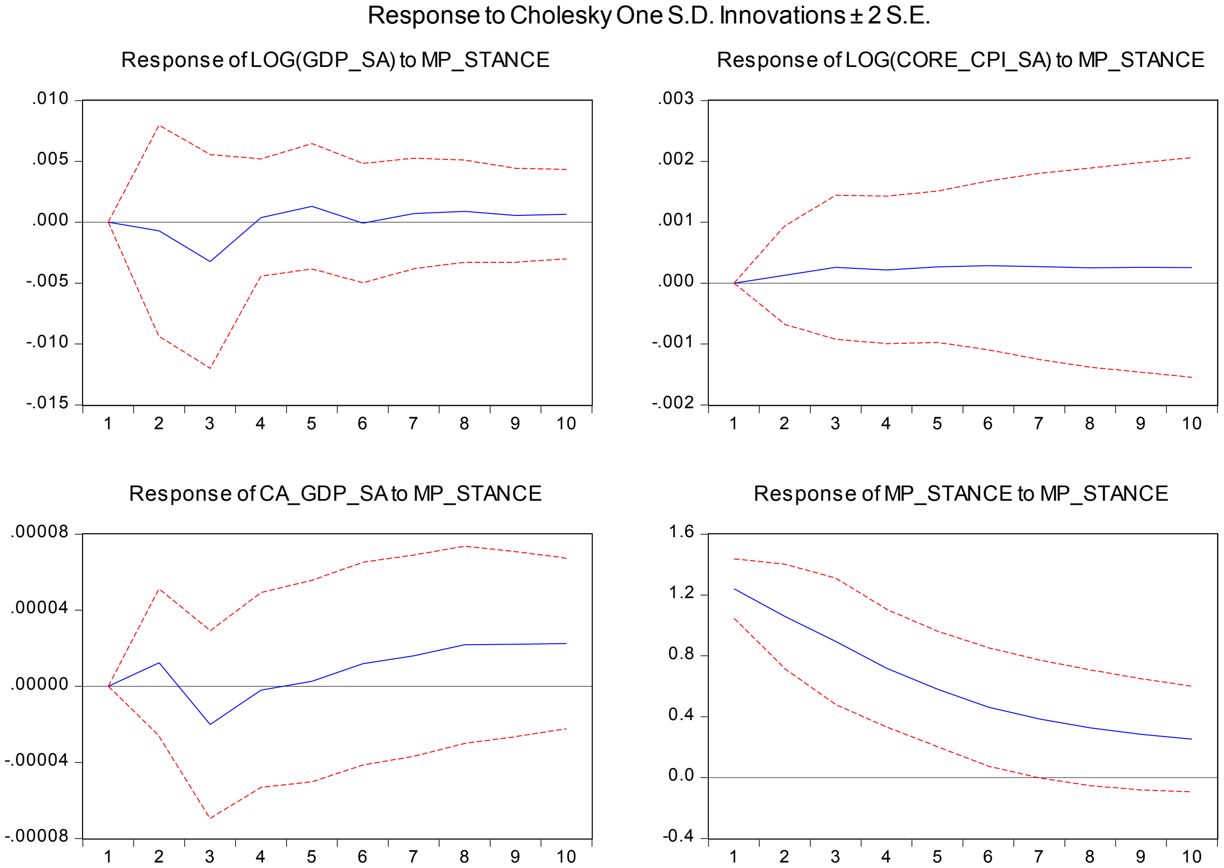
Monetary policy stance vs selected variables Graph 3



Source: NBRM, SSO and authors' calculations.

In this sub-section, the impulse response functions of the indicator of monetary policy to real sector variables are displayed.

Impulse responses of shock of indicator of monetary policy stance Graph 4



Source: Authors' calculations.

The reported responses, although statistically insignificant and small in size, imply that in the actual operating framework, the central bank's efforts to reduce external imbalance may, in addition to a decrease in the GDP, incur an additional cost, i.e. price increase. More precisely, monetary policy tightening is likely to have an initial negative effect on aggregate demand, which arguments in favor of the idea that counter-cyclical monetary policy setting in Macedonia is possible. Monetary policy tightening, however, seems to have a permanent positive effect on the price level which is an evidence on price puzzle.

"Price puzzle implies that cost channel is an important part of monetary policy transmission mechanism. As oppose to the conventional views of monetary transmission which focus on the demand side effects (monetary tightening initially reduces output and then prices), the cost channel of monetary transmission stresses that supply side or cost effects probably dominate the usual demand side effects. Therefore, monetary tightening could be followed by an increase in prices. In this view, a rise in interest rates increases the cost of funds. This cost shock pushes up prices" [adaptation from Javid and Munir, (2010)]. As already pointed out in Lang and Krznar (2004), this type of seemingly unreasonable outcome can be associated with the exchange rate targeting regime. Namely, in order to stem the depreciation pressures on the parity, the NBRM sells foreign currency which coincides with a drain of bank's Denar liquidity, i.e. monetary tightening. Accordingly, the exchange rate depreciation is found to be negatively correlated with excess liquidity and positively correlated with the monetary policy stance indicator (monetary tightening). So, the correlation between monetary tightening and an increase in prices is also positive.

However, there are some important limitations with this analysis. Reported responses are very small in size and also statistically insignificant thus undermining the reliability of the results. Given these pitfalls, we believe that our analysis fails to credibly test the price puzzle hypothesis. This suggests that further investigation is needed before drawing any conclusions on the price puzzle presence in Macedonia.

8. Conclusion

Macedonia's central bank, the National Bank of the Republic of Macedonia, has employed a range of different instruments in the implementation of its monetary policy. This complicates the identification of the NBRM's monetary policy stance as one has to bond the effects of all monetary measures to appropriately assess the monetary policy stance. We therefore follow Lang and Krznar (2004) in constructing a new measure of monetary policy stance. Our framework nests model that uses VAR residuals to identify monetary policy and produce overall stance indicator. One remarkable feature of our measure is that it tends to proxy the actual or "de facto" monetary policy stance vis-à-vis the real sector after transmission takes through and commercial banks adjust their behavior to monetary policy changes, in one way or another. It also considers the effect of all monetary policy instruments applied by the NBRM. As such, it could prove useful for both analysis and conduct of monetary policy thus enriching monetary policy analytical framework.

The indicator of monetary policy stance constructed in this paper suggests monetary easing in the pre-crisis period which is broadly in line with NBRM's policy rate dynamics as main monetary policy instrument used for signaling monetary policy stance. Results point to proper monetary policy transmission with monetary policy changes being effectively delivered to the real sector. On the other hand, for the period following the crisis our indicator strongly diverges from NBRM's actual intentions with respect to monetary policy stance. It shows sharp tightening starting the end of 2009 that lasts until the first quarter of 2013 while this was a period that witnessed a truly proactive role by the NBRM as to ease monetary policy stance. This suggests that the global crisis has been conducive for heightened risk aversion and most likely has impaired the monetary policy transmission mechanism.

This paper also sheds some light on monetary policy effectiveness as stabilizing tool. Our findings support conduct of counter-cyclical monetary policy as to correct external imbalances. However, the scope for maneuver is limited given the constraints of the exchange rate peg. Thus, every attempt of the central bank to decrease the external imbalances will in addition to a decrease in GDP growth incur an additional cost of price increase. The main drawbacks of this study are mainly related to the reliability and the statistical significance of some of the results. So, one must be aware of this pitfalls when interpreting the results and threat them with great caution, particularly when it comes to policy conclusions and recommendations.

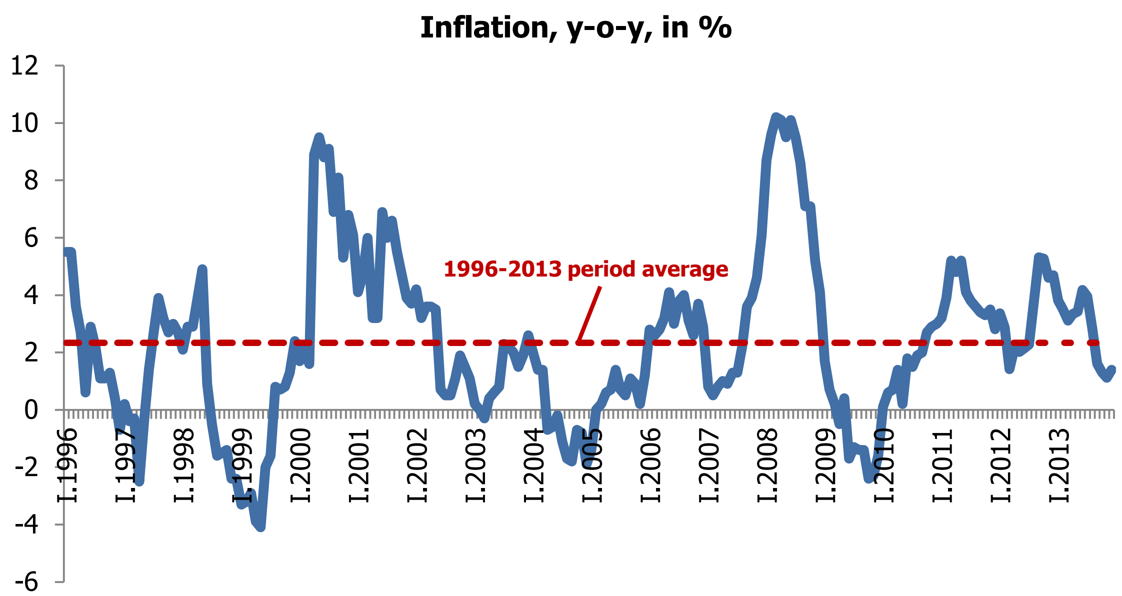
Appendix 1: Monetary policy framework

Main economic indicators

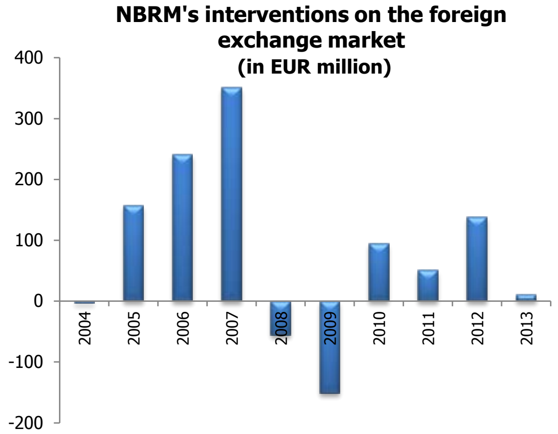
Table 1

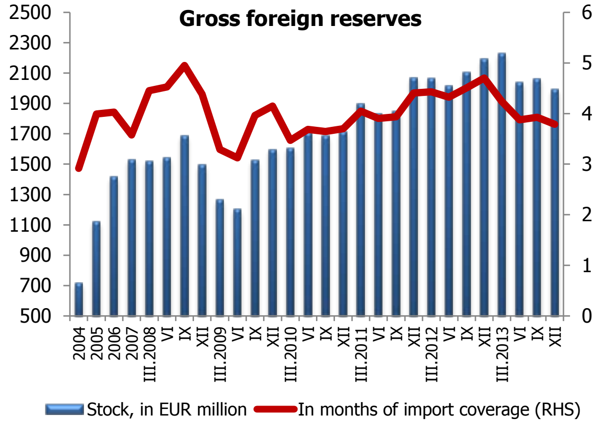
	2005	2006	2007	2008	2009	2010	2011	2012	2013
GDP (real growth rates)	4,4	5,0	6,1	5,0	-0,9	2,9	2,8	-0,4	/
Inflation (average, on cumulative basis,in %)	0,5	3,2	2,3	8,3	-0,8	1,6	3,9	3,3	2,8
Unemployment rate (in %)	37,3	36,0	34,9	33,8	32,2	32,0	31,4	31,0	/
Government budget balance (Central budget and Funds budget balance as % of GDP)	0,2	-0,5	0,6	-0,9	-2,7	-2,4	-2,5	-3,9	/
Money supply M4 (y-o-y, in %)	15,0	25,0	29,3	11,2	6,0	12,2	9,7	4,4	5,3
Bank and savings houses credits to the private sector (y-o-y, in %)	21,0	30,5	39,2	34,4	3,5	7,1	8,5	5,4	6,4
Average exchange rate MKD/EUR	61,30	61,19	61,18	61,27	61,27	61,51	61,53	61,53	61,58
Current account balance (as % of GDP)	-2,5	-0,4	-7,1	-12,8	-6,8	-2,0	-2,5	-3,0	/
Gross foreign reserves (stock, end of period in EUR million)	1.122,9	1.416,7	1.524,4	1.494,9	1.597,5	1.714,5	2.068,9	2.193,3	1.993,0
Gross external debt (as % of GDP)	52,5	47,9	47,6	49,2	56,4	58,2	64,9	69,4	/

Source: NBRM, SSO and MoF.

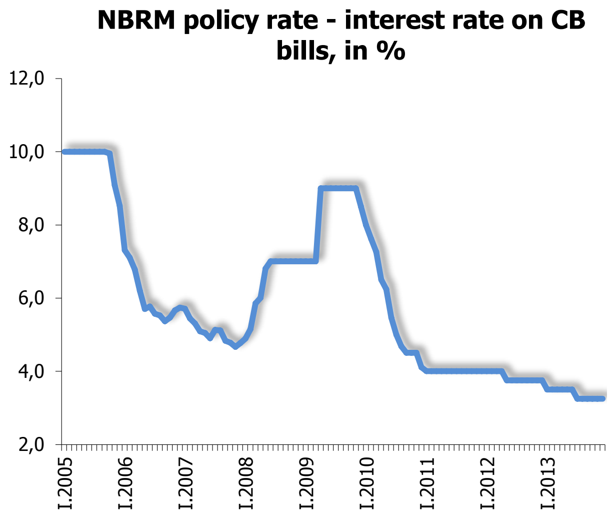


Source: State Statistical Office of the Republic of Macedonia.

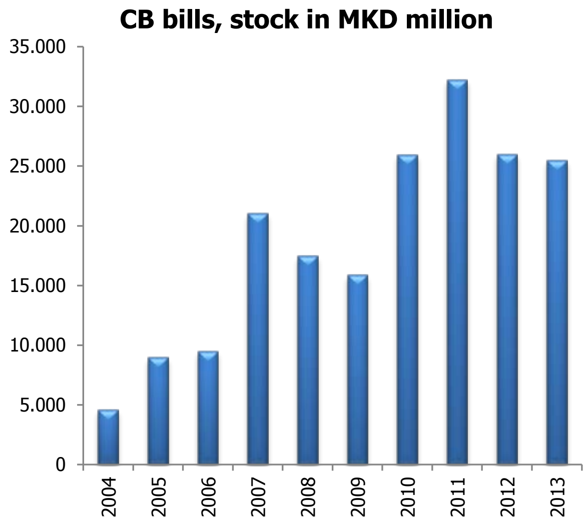




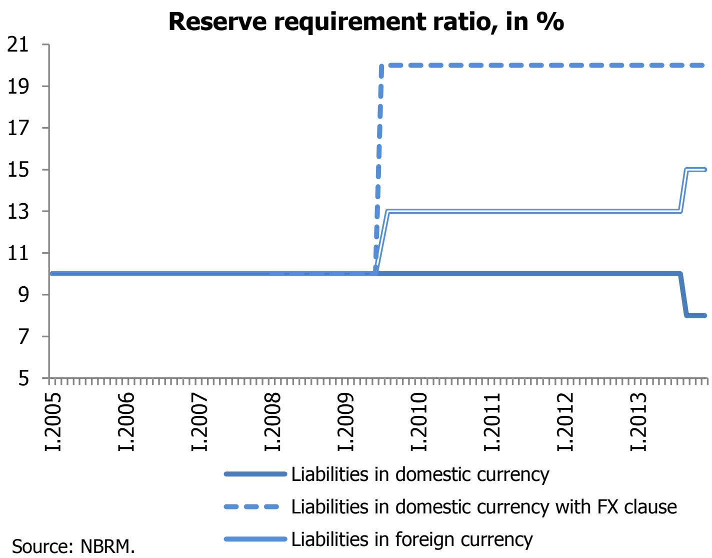
Source: National Bank of the Republic of Macedonia.



Source: NBRM.



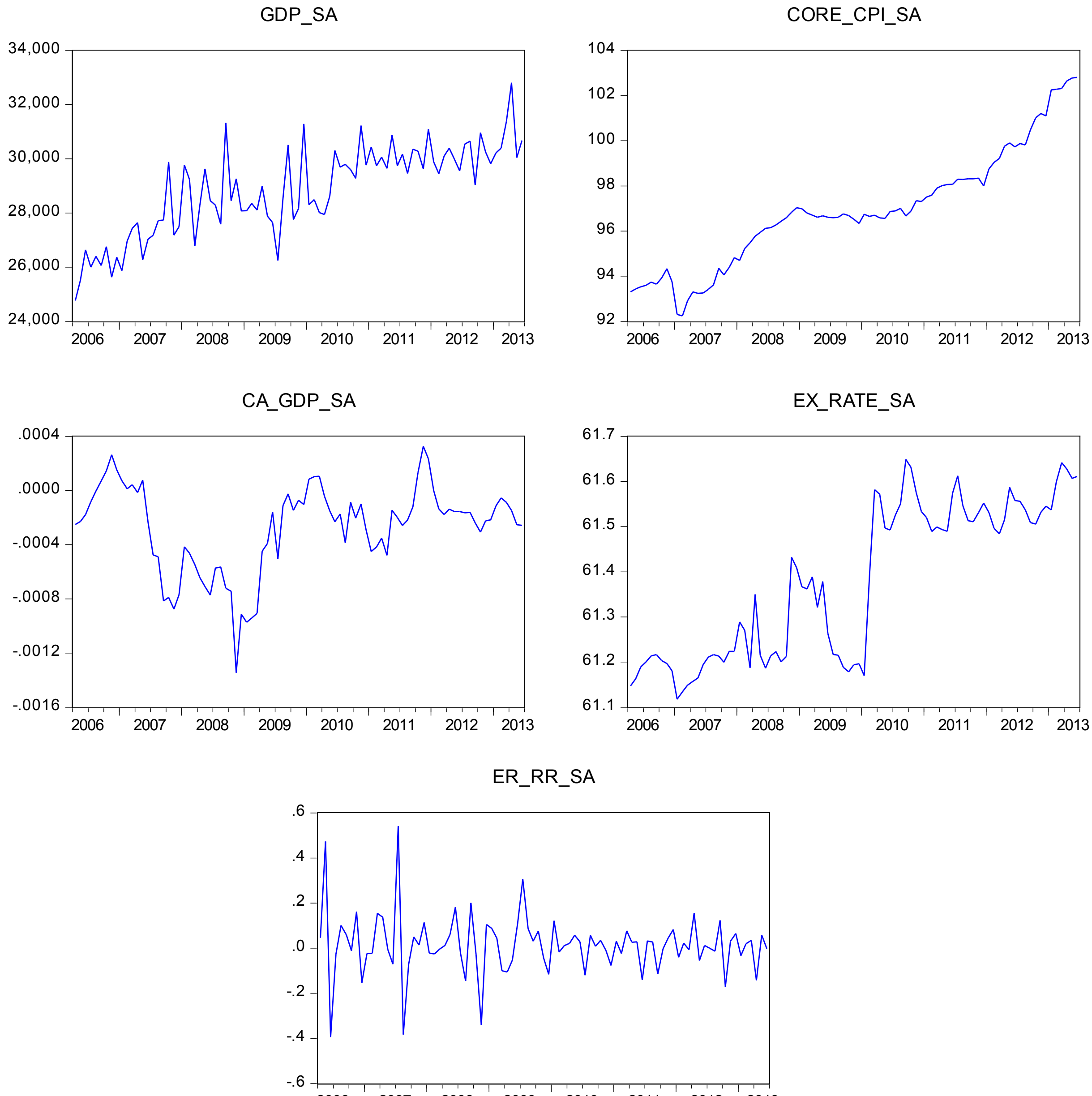
Source: NBRM.



Source: NBRM.

Appendix 2: Data

Data Graph 1



Source: NBRM, SSO and authors' calculations.

Unit root tests

Table 1

	ADF value	ADF value	KPSS value	KPSS value
	Constant included	Constant and trend included	H0 Stationary around a level	H0 Trend stationary
y	2.3096	–1.9340	0.9414	0.0411**
dy	–16.1130**	–16.4531**	0.2617**	0.2471**
p	0.9648	0.4846	1.0948	0.1418*
dp	–9.7635**	–9.7967**	0.1868**	0.0905**
ca	–2.5408***	–2.5960	0.2153**	0.1330**
e	–1.3370	–3.2638***	1.1722	0.0626*
l	–10.0714*	–10.2291**	0.3669	0.1739

Note: **, and * indicate no unit root at 1% and 5% significance. *** indicate no unit root at 10% significance.

y – real GDP

dy – change in real GDP

p – core prices

dp – core inflation

ca – current account / GDP

e – nominal exchange rate MKD/EUR

l – liquidity (excess reserves/required reserves)

9. Literature

Bagliano F. C., Favero C. A. and Franco F. (1999). "Measuring Monetary Policy in Open Economy", IGIER Working Paper No. 133.

Beier, N. C. and Storgaard, P. E., "Identifying Monetary Policy in a Small Open Economy Under Fixed Exchange Rates", Danmarks Nationalbank, Working Papers, 2006, No. 38.

Bernanake Ben S. and Blinder Alan S. (1992). "The Federal Fund Rate and the Channels of Monetary Transmission", American Economic Review 82:4, 901–921.

Bernanke, B. S. and Mihov, I., "Measuring monetary policy", The Quarterly Journal of Economics, Vol. 113, No. 3. (August, 1998), pp. 869–902.

Bernard, A., B. Jensen, S.J. Redding and P.K. Schott (2009), "The Margins of US Trade", American Economic Review P&P, 99(2): 487–493.

Boschen J. F. and Mills L. O. (1991). "The Relation Between Narrative and Money Market Indicators of Monetary Policy", Economic Inquiry 33.

Christiano L. J., Eichenbaum M. and Evans C. (1996). "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds", The Review of Economics and Statistics 78 (1).

Christiano L.J. and Eichenbaum M. (1992). "Liquidity Effects and the Monetary Transmission Mechanism", American Economic Review 82 (2).

Clarida, R. H., and Gertler, M., "How the Bundesbank conducts monetary policy", National Bureau of Economic Research, January 1997, http://www.nber.org/chapters/c8890.

Cuche, N. A., "Alternative indicator of monetary policy for a small open economy", Studienzentrum Gerzensee and University of Lausanne, October 2000.

Duguay P. (1994). "Empirical Evidence on the Strength of Monetary Transmission Mechanism in Canada", Journal of Monetary Economics 33:1.

Friedman M. and Schwartz A. (1963). "A Monetary History of United States", 1867–1960. Princeton, N.J.: Princeton University Press.

Fung Ben, S.C. and Yuan, M., "Measuring the Stance of Monetary Policy", (2001).

Ceccheti, S. G., (1995). "Distinguishing Theories of the Monetary Transmission Mechanism". http://people.brandeis.edu.

Ganley, J., "Surplus Liquidity: Implications for Central Banks", Lecture Series no. 3, Centre for Central Banking Studies, Bank of England.

Gerlach S. (2004). "Interest Rate Setting by the ECB: Words and Deeds", CEPR Discussion Paper No 4775.

Gerlach S. and Svensson L. E. O. (2002). "Money and Inflation in the Euro Area: A Case for Monetary Indicators", CERP Discussion Paper Series No 3392.

Hansson B. and Lidberg H. (1997). "Monetary Condition Index: A Monetary Policy Indicator", Quarterly Review Swedish Central Bank 3.

Hataiseree R. (2000). "The Role of Monetary Conditions and Monetary Conditions Index in the Conduct of Monetary Policy: The Case of Thailand Under the Floating Rate Regime", The Bank of Thailand.

Höppner, F., "Measuring the Monetary Policy Stance in Europe", Institute for International Economics, University of Bonn.

Javid, M. and Munir, K. (2010). "The Price Puzzle and Monetary Policy Transmission Mechanism in Pakistan: Structural Vector Autoregressive Approach", The Pakistan Development Review 49:4 Part II (Winter 2010) pp. 449–460.

Kesriyeli M. and Kocaker I. I. (1999). "Monetary Conditions Index: A Monetary Policy Indicator for Turkey", Central Bank of the Republic of Turkey Discussion Paper No. 9908.

Lang, M. and Krznar, I., "Transmission Mechanism of Monetary Policy in Croatia", The Tenth Dubrovnik Economic Conference, June 2004.

Leeper E. M. (1993). "Has the Romer's Narrative Approach Identified the Monetary Policy Shocks?", Federal Reserve Bank of Atlanta.

Leeper E. M. (1997). "Narrative and VAR Approaches to Monetary Policy Common Identification Problems", Journal of Monetary Economics 40.

Lockhart, D. P. (2012). "Monetary Policy and the Credit Channel", Federal Reserve Bank of Atlanta, Annual Banking Outlook Conference, March 1, 2012.

Norbin S. (2000). "What We Learned from Empirical Tests of the Monetary Transmission Effects?", Department of Economics Florida State University.

Qayyum A. (2002). "Monetary Conditions Index: A Composite Measure of Monetary Policy in Pakistan", MPRA Paper No. 2153.

Romer C. and Romer D. (1989). "Does Monetary Policy Matter? A New Test in the Spirit of Friedman and Schwartz". In Olivier Blanchard and Stanley Fisher (eds.). NBER Macroeconomics Annual 1989.

Rudebusch G. D. (1996). "Do Measures of Monetary Policy in VAR Make Sense?", Bank of Italy Discussion Paper No. 269.

Sims C. (1992). "Interpreting the Macroeconomic Time Series Facts: The Effects of Monetary Policy", European Economic Review, XXXVI, 972–1011.

Sims C. and Zhao T. (1995). "Does Monetary Policy Generate Recessions", Yale University and Federal Reserve Bank of Atlanta.

Taylor John B. (1993). "Discretion Versus Policy Rules in Practice", Carnegie-Rochester Conference Series on Public Policies 39 (1993) 195–214, North-Holland.

The HIS (Holistic Inflation Surveillance) Framework

An Analysis of Inflation Dynamics during Periods of High Cost-Push Inflation

Helmi Ramlee and Tan Jay Sern[1]

Abstract

As the economy evolves structurally, inflation surveillance becomes more challenging and necessitates refinement to the conventional surveillance framework. This paper highlights two main topics in the area of inflation surveillance and forecast: the common practices by other central banks; and the approach that Bank Negara Malaysia undertakes to supplement the conventional method given the country's inflation dynamic. The latter includes how Bank Negara Malaysia conducts its surveillance on knock-on effects (indirect spillover from increase in cost factors) and second-round effects to inflation, and complements the work-horse model for inflation forecast with additional statistical models.

Keywords: Monetary policy, Inflation

JEL classification: E31, E52

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The views expressed herein are solely those of the authors and do not necessarily reflect the views of Bank Negara Malaysia.

1. Introduction

Price stability has always been one of the important mandates, if not the most, for central banks to uphold. As such, many central banks choose to adopt the inflation targeting framework as the anchor for their monetary policy in ensuring that price stability is in check. While the Bank does not specifically practice inflation targeting, it adopts dual mandate of ensuring medium-term price stability and sustainable growth. Ensuring price stability is important to ensure that resources are efficiently allocated through rational decision-making. When prices are stable, firms and households are insusceptible to the risks of volatile price movements and subsequently able to allocate their resources efficiently. The environment of stable prices will enable firms to better plan their production and investment, as well as deciding on their selling prices. Similarly, household would be able to plan on their consumption and savings. The environment of low uncertainty will subsequently facilitate stronger economic growth.

However, with bouts of global commodity price shocks since 2000s and the global financial crisis in 2007/08, central banks are having difficulties in achieving their mandate of ensuring price stability. This could be partly due to the changes in inflation dynamics over the past decade, where the sources of inflationary pressures are no longer constrained to domestic factors, but also external factors. This warrants a comprehensive review of the conventional inflation surveillance and forecast framework. In light of this, Bank Negara Malaysia undertakes a different and more holistic surveillance approach, to supplement the conventional methods

2. Conventional methods of inflation surveillance

The foundation of conventional inflation surveillance framework is the concept of New Keynesian Phillips Curve (NKPC), in which inflation is determined by demand-pull factors, supply-push factors and inflation expectation. The typical inflation surveillance can be divided into three main activities, namely monitoring of various inflation indicators, forecasting of inflation path and trajectory and assessing the balance of risk of inflation going forward.

i. Monitoring various inflation indicators

Central banks typically monitor indicators to form a view on the potential sources of price pressure going forward. Identifying the source of inflation *(ex-ante)* is important as different source of price pressure warrants a different policy action. The inflation indicators can be grouped into three categories namely demand indicators, cost and supply indicators and inflation expectation indicators.

a) Demand indicators. As inflation could accelerate when demand increases beyond the productive capability of an economy, many central banks keep a tight surveillance on demand conditions. Moreover, monetary policy has been well established as a demand management tool, while having limited influence on supply-driven inflation. Hence, to gauge the demand conditions, some of the demand indicators that central banks usually monitor are household consumption, investment activities, capacity utilisation and output gap.[2] Another common demand indicator that central bank would assess is core inflation, which attempt to measure the underlying level of inflation. Due to the volatility of global commodity prices, headline inflation tends to mimic trend of commodity prices. As such, central banks will need to monitor on inflation of items that are generally not volatile (i.e. items that are included in the measurement of core inflation), to ensure that the increase in global commodity prices do not lead to a broad-based increase in prices of other goods and services. In a case where the core inflation increases significantly, appropriate policy actions could be taken to contain the increase in inflation from spiralling further.

b) ***Cost and supply indicators.*** Inflation could also increase from cost and supply factors following the decline in aggregate supply, which could be caused by natural disasters, adverse weather conditions or increased prices of inputs. A classic example of how cost and supply factors could affect domestic inflation is the movement in global commodity prices. For a country that does not have an energy subsidy in place, its domestic inflation is susceptible to the movement in global commodity prices. The common cost and supply indicators that central bank monitor are global commodity prices, movement in key import partners' exchange rates and inflation, as well as producer price inflation.

c) ***Inflation expectations.*** A price shock will have a transitory impact on inflation if inflation expectations of firms and consumers are well-anchored. In contrast, if a price shock leads to an increase and eventually unanchored inflation expectations, firms and consumers may change their investment and consumption behaviour, which could result in higher inflation. For example, workers might demand for higher wages due to rising expectations of inflation. If firms accommodate the wage demand, they will incur higher labour cost and eventually, raise prices to cope with the rising cost. In terms of indicators, central banks would monitor consumers' inflation expectation, forecast of inflation from analysts or professional forecasters and the term structure of interest rate.

ii. Forecasting of inflation path and trajectory

As most central banks' objective is to keep inflation low and stable, the key components of monetary policy is dependent on the optimum inflation forecast (Svensson, 2005). Most central banks rely on econometric models to provide an inflation forecast and simulation. In most cases, central bank has a suite of models to forecast inflation within different forecast horizons.

[2] The Bank has seven measures of potential output namely the univariate linear trend, univariate state space, Hodrick-Prescott, multivariate Kalman filter, multivariate filter, structural vector autoregression and Cobb-Douglas production function.

Inflation forecasting models

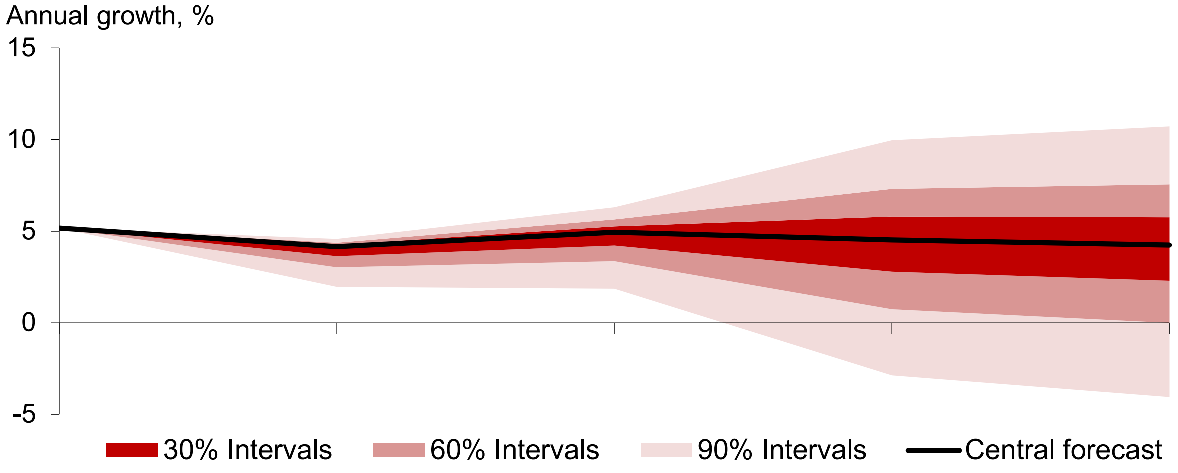
Table 1

Type of model	Forecast horizon	Explanation
Short-term model		
1. Nowcasting model	1 month ahead	The nowcasts uses high-frequency daily/weekly data to produce inflation forecast of one-month ahead.
2. Univariate model (e.g. ARIMA model)	3–6 months ahead	Time series is expressed in terms of past values of itself plus current and lagged values of a "white noise" error term (the moving average component).
Medium-term model		
3. Phillips Curve model	12–24 months ahead	A model that is based on theoretical foundation in which inflation is a function of its determinants comprising of inflation expectation, output gap and unemployment.
4. VAR model	12–24 months ahead	A theoretical model that captures the linear interdependencies among variables.
Long-term model		
5. Structural model /DSGE[1] model	>24 months	Applied flow of fund concept or general equilibrium model that accounts for dynamic interrelationships between agents based on microeconomic foundations.

[1] DSGE model stands for Dynamic Stochastic General Equilibrium model.

Example of a fan chart

Chart 1



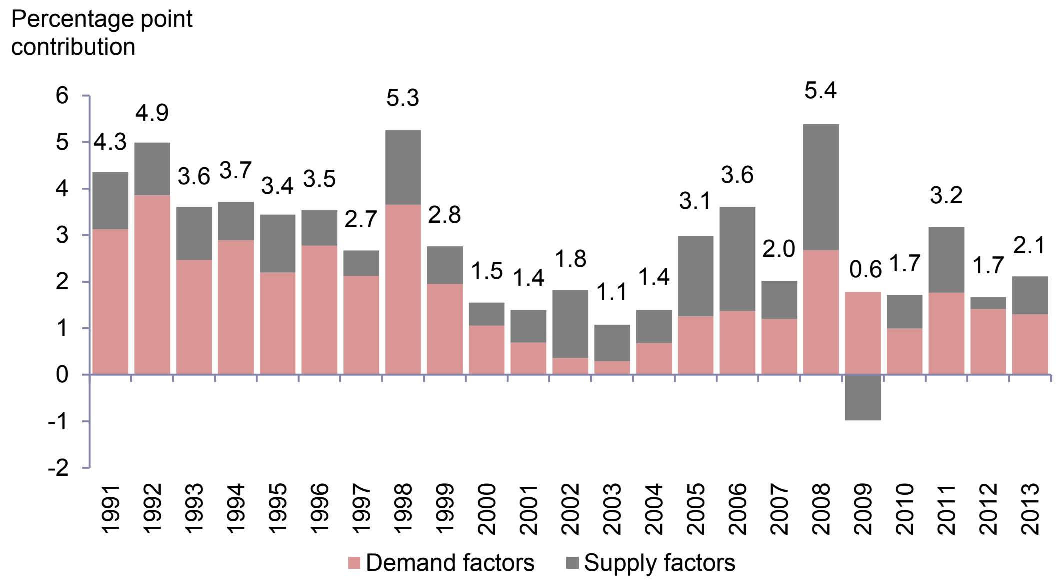
iii. Assessing the balance of risk of inflation via fan chart

In addition to the point forecast that an inflation forecast model produce, central banks would also perform an analysis on the balance of risk to inflation (e.g. upside risk and downside risk to inflation) using fan charts.[3] The fan chart depicts the probability of various outcomes for inflation in the future. The term "fan chart" was first introduced by the Bank of England in 1997 in its "Inflation Report" to describe its best prevision of future inflation to the public.

3. Inflation surveillance in Malaysia

Historically, inflation in Malaysia has been low, with average inflation of 3% from 1957–2013. The relative roles of key inflation drivers and their dynamics have shifted over time as the structure of the economy and the behaviours of economic agents in Malaysia evolved. Since the early 2000s, cost and supply factors seem to be more dominant in driving inflation.

Contribution of Demand and Cost and Supply Factors to Inflation — Chart 2



Source: Bank Negara Malaysia.

Also, an important feature to note is that prices of basic necessities in Malaysia are mostly administered. Approximately 20% of items in the Consumer Price Index (CPI) basket are price-administered items, such as petroleum products, electricity tariff, cooking oil and wheat flour. As a result, when there is an upward adjustment made to the prices of administered items, prices would increase at a faster rate. As inflation in Malaysia is mainly driven by cost and supply factors including price adjustments to administered price items, there is a pressing need to establish a more *"holistic inflation surveillance"* framework for policy analysis purposes. It is

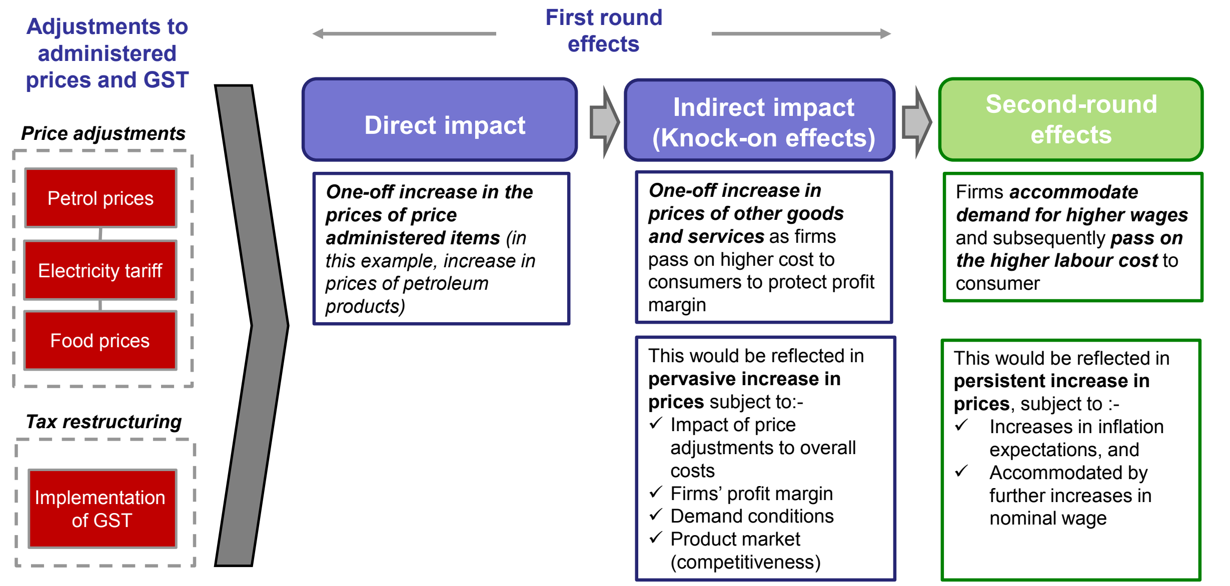
[3] A fan chart is a line chart of possible future outcomes given various assumptions. As prediction become more uncertain, these forecast ranges spread out, creating a distinctive wedge or "fan" shape.

important to have a clear understanding of key drivers of inflation process and how they have evolved to ensure that appropriate policies are undertaken.

In order to better illustrate the *"holistic inflation surveillance"* framework, an example of price adjustment to petroleum products (fuel) and the subsequent impact on other CPI items is used. The framework is a two-fold process, where the first layer of analysis is on the ***first-round effects*** and, the second layer is on the ***second-round effects*** on inflation.

Illustration of the Holistic Inflation Surveillance (HIS) practiced by Bank Negara Malaysia

Chart 3



3.1. First-round effects

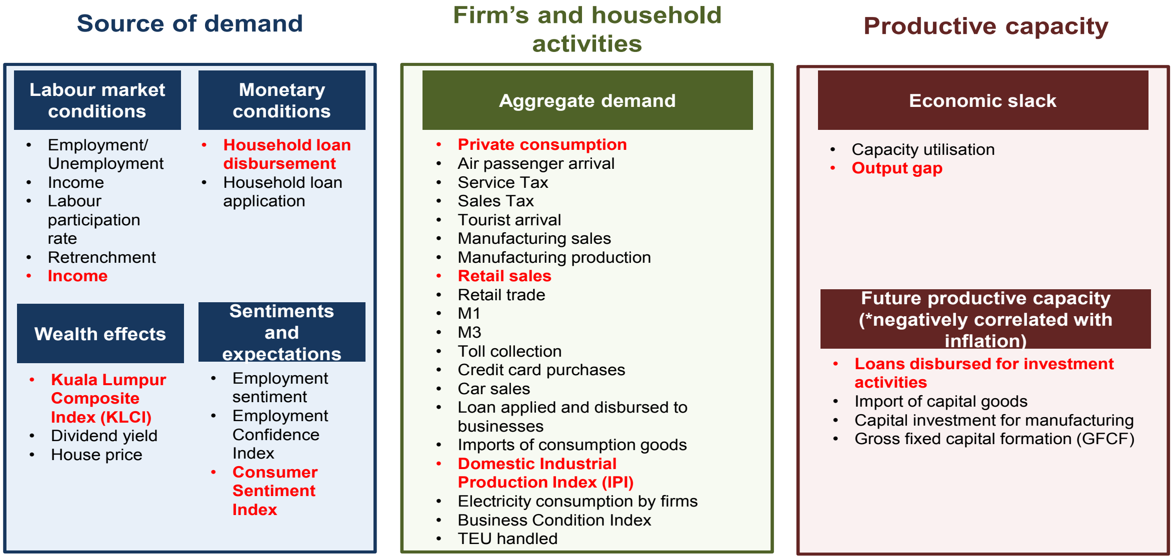
There are two types of first-round effects, namely the *direct effects* and the *indirect effects*, which are also known as the *knock-on effects*. The *direct effects* describe the price increase of the price-administered items in the CPI basket. Taking the adjustment to oil prices as an example, the price increase for CPI fuel is the direct impact. Subsequently, as a result of higher transportation cost, firms producing other goods and services will face higher operating cost and lower profit margin. Hence, firms may raise the prices of their goods to maintain the same profit margin. This is known as the *knock-on effects*. The extent of which this knock-on effects on other goods and services in CPI would then be reflected in the pervasiveness of price increases of other goods and services in the CPI basket. The ability of firms to raise prices will be subject to several criteria, such as the ***impact of price adjustments to overall costs, firms' net operating profit margin, demand conditions, product market (competitiveness) and other supply factors***.

i. Impact of price adjustments to overall costs. If transportation cost accounts for a large share in firms' total operating cost, it is more likely for firms to pass on some of the increase in transport cost to consumers. In order to develop a database on firms' cost structure, the Bank conducts annual and quarterly surveys on firms across various industries.[4] This information would facilitate in the estimation of the impact of adjustment to prices of petroleum products on firms' operating cost and subsequent impact on prices.

ii. ***Firms' net operating profit margin.*** In general, firms operate in a profit-maximising manner. Hence, if firms' net operating profit margin is declining as a result of higher cost, it is more likely for firms to raise prices of their products to protect or maintain its desirable profit margin. The Bank performs an assessment on the net operating profit margin of about 300 listed companies in Malaysia.

iii. ***Demand conditions.*** While firms may face higher operating costs due to rising transportation cost, they may not be able to raise prices if consumer demand is not strong or not sustainable. As such, the Bank institutes a framework to assess the demand conditions in the economy by monitoring a group of demand-related indicators. There are about 40 demand-related indicators based on their strength of relationship to core inflation, which are divided into three main blocks, namely the source of demand, the subsequent impact on consumers' and firms' activity, as well as firms' ability to enhance productive capacity to meet the demand (refer to chart 4).

List of demand-related indicators — Chart 4

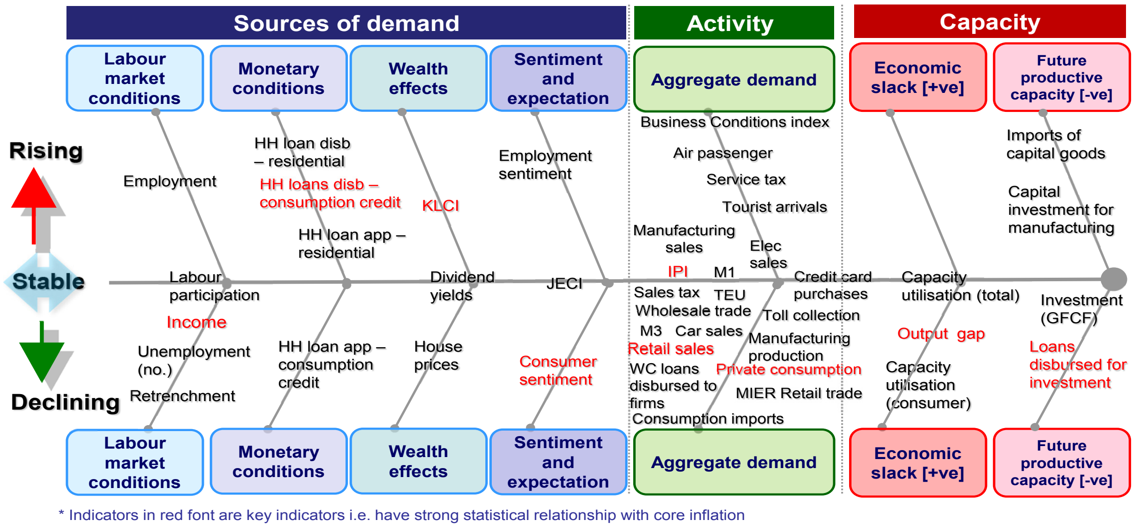


* Red font indicates key indicators which have robust relationship with core inflation

[4] The questionnaires also cover firms' intention to increase selling prices of their products and the magnitude of increase, if any, in order to protect their profit margin.

The Ishikawa Diagram

Chart 5



Demand pressure on inflation is assessed via a two-pronged approach. First, for every indicator, a comparison of its current 6-month average to its non-overlapping previous 6-month average will be made.[5] If there is any turning point in the recent observations, the prevailing trend will be assessed in terms of its persistency. Some judgement of the likely trend going forward is also incorporated. The assessment of all demand-related indicators is then summarised in an Ishikawa diagram (refer chart 5).

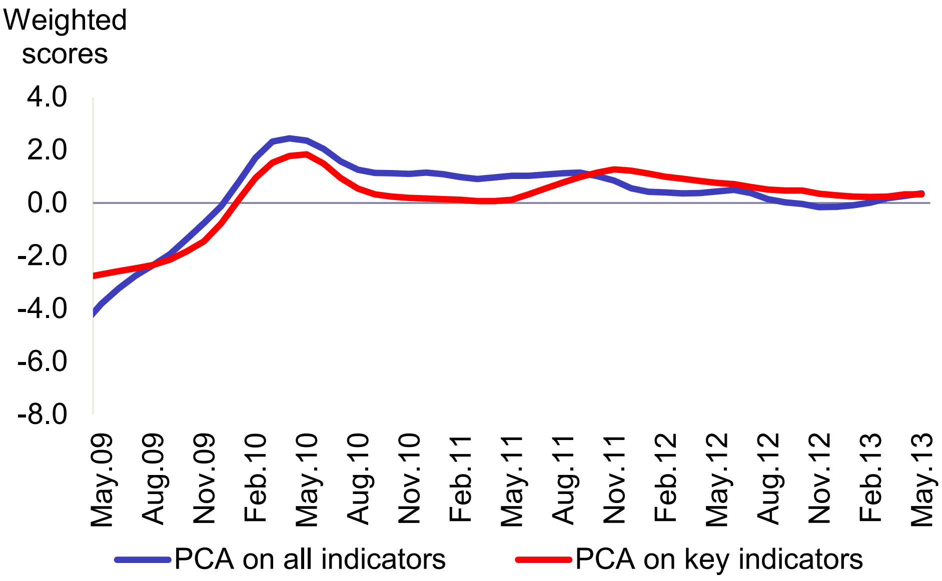
Second, the assessment is further enriched by performing a Principal Component Analysis (PCA) on all the indicators to capture the underlying movements in each group of indicators. The PCA is conditioned such that its scores must explain around 80% of the underlying common trend of these indicators (refer to chart 6).

iv. ***Product market (competitiveness and firms price setting behaviour).*** In order to have a better understanding of the market structure and price setting behaviour in the product market, the Bank also conducts industrial engagement with firms and business associations. This enables the Bank to identify any risks to inflation should there be price adjustments to price administered items or any other supply shocks.

v. ***Other supply factors.*** Although most of the basic necessities are being subsidised by the Government, the Bank still monitors other indicators that could affect the prices of domestically produced goods and services such as global energy and food prices. Of importance, with the fiscal consolidation and subsidy rationalisation going forward, closer monitoring of these factors is imperative.

[5] For example, if the current 6-month average growth in private consumption is higher than the previous 6-month average while exhibiting a rising trend after a decline (turning point), this is indicative of a rising demand pressure.

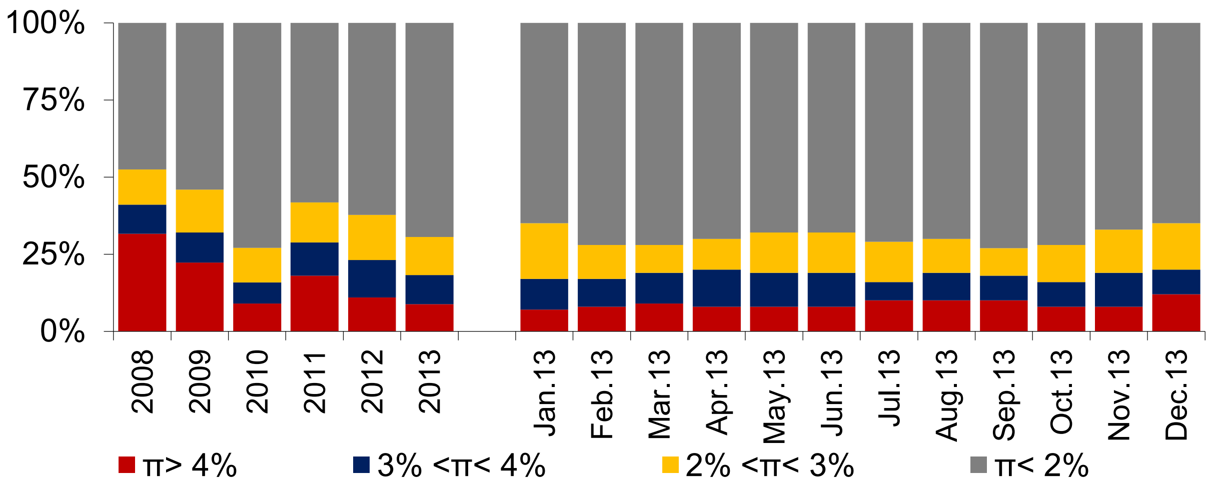
Principal Component Analysis (PCA) Chart 6



Note: PCA captures the aggregated underlying trend of indicators.

The Bank also monitors the pervasiveness of core inflation. Pervasiveness is measured by the number of core CPI items that are within specific inflation range. The CPI items are categorised into four groups namely; percentage of items registering inflation of less than 2%, between 2% and 3%, between 3% and 4%, and also inflation above 4%. Based on the Malaysia's historical average inflation rate of 3%, inflation is said to be more pervasive if there is higher number of items registering inflation above the historical average. This analysis is also complemented by making comparison with the increase in inflation pervasiveness during historical episodes of shocks.

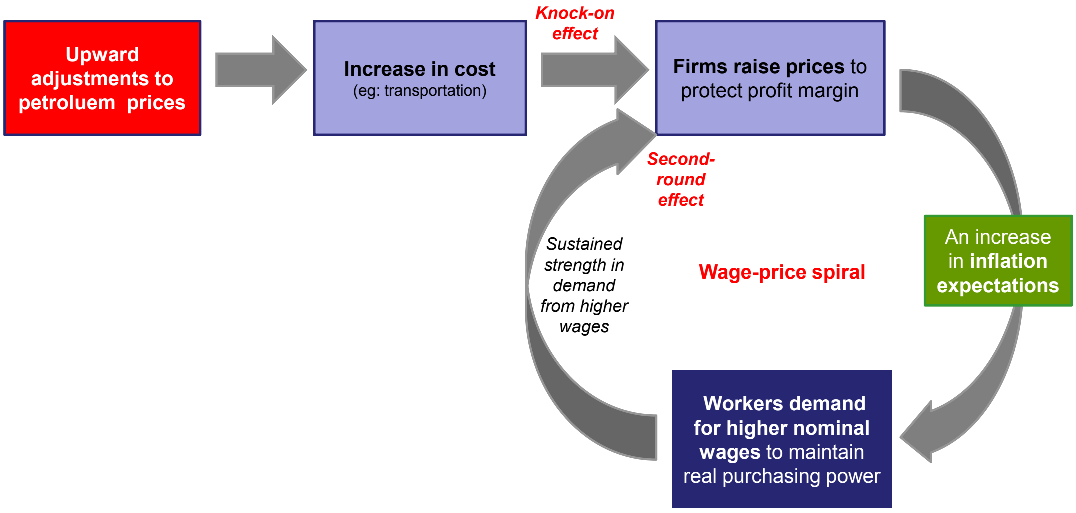
Inflation Pervasiveness Chart 7



3.2. Second-round effects

A strong inflationary pressure from first-round effects may subsequently result in a more broad-based price increases and consequently, lead to higher cost of living. This could subsequently raise inflation expectations which might result in demand for higher wages from worker. If firms accommodate the demand for higher wages, firms will face higher marginal cost due to the increase in labour cost. They will, in turn, have to resort to increasing the price of their goods and services, which could lead to *second-round effects* on inflation. In the absence of policy intervention, this process could go lead to further increase in prices of goods and services and trigger another round of wage increases, leading to even higher inflation. This process is commonly known as the wage-price spiral. At this stage, inflation will escalate and eventually lead to a decline in economic growth.

Transmission channel of first-round and second-round of inflation — Chart 8



There are two pre-conditions for the second-round effects on inflation to materialise. First, increase in *consumer inflation expectations* following the shocks from the first-round effects. As a result, *nominal wages* have to be adjusted in respond to higher inflation. Subsequently, *retail prices of goods and services* have to increase in respond to the adjustment to higher nominal wages. This will then lead to a persistent increase in inflation.

The Bank takes a two-pronged approach in the surveillance of second-round effects on inflation namely by monitoring various forward-looking indicators and assessing inflation persistence.

i. ***Monitoring various indicators.*** Indicators under the Bank's surveillance include consumer sentiments, analysts' expectation on inflation, and wage and employment outlook.

a. Consumer sentiments. The information on consumer sentiments is collected through the Bank's Consumer Sentiment Survey (CSS). The survey coverage includes consumer price expectation for the next twelve months according to type of expenditure, households' financial condition, employment prospect and income prospect.

b. *Analysts' expectation on inflation*. The Bank also monitors the analysts' inflation forecast to gauge their expectation on the future inflation path. This could be an important exercise as analysts' expectation on inflation seems to be a better gauge of the expectations that influence wage and price setting behaviour (Bernanke, 2007).

c. *Wage and employment outlook*. As range of wage data is limited in Malaysia, the Bank gauges the strength of wage pressure based on survey evidence, particularly after a price adjustment to price-administered items. Strong wage pressures arising from price adjustments could induce second-round effects on inflation. This involves assessing the structural factors of wage determinants and timing of collective agreement (CA) through an annual survey on 100 firms from various industries.

ii. Inflation persistence. It is important to ensure inflation remain low and stable with low persistence. Lower inflation persistence will provide greater flexibility for monetary policy in managing inflation. In addition, it can also lower the risk of second-round effects on inflation from manifesting. To assess the persistence in inflation, an autoregressive model is estimated.[6]

$$\pi_t = \alpha\pi_{t-1} + \beta Z_t + \varepsilon_t$$

The $\boldsymbol{\alpha}$ in the above equation represents a measure of inflation persistence. The higher the value of $\boldsymbol{\alpha}$, the higher the inflation persistence. This means that a shock will continue to have an impact on inflation for a prolonged period of time.

4. CPI components analysis

For short-term forecasting, the Bank has relied on the CPI components analysis to supplement the current workhorse model. The CPI components analysis applies a bottom-up approach by forecasting the inflation of the disaggregated components of the CPI basket. The inflation forecast for these components are based on information from industrial engagement and verified anecdotal evidence. It also takes into account seasonal factors and base-effect. CPI components with insufficient information to be incorporated in the forecast model will be modelled purely by an auto-regressive (AR) model.

5. Gaps in the HIS Framework

Nevertheless, there remain gaps in our current surveillance framework. First, there is lack of comprehensive information on the labour market conditions. High frequency and granular data on wages and productivity are not available while the short time

[6] The model would also include other factors (Z) such as wage-bargaining power and firms' price setting behaviour. This information is available through surveys and industrial engagements conducted by the Bank.

series data on employment sentiments may not be adequate to provide a conclusive finding. Second, as the survey on consumer sentiments was conducted beginning May 2013, the results were not sufficient to draw a definite conclusion on the changes in inflation expectations. Third, the current surveillance framework is not tested in a new inflation environment. The domestic price dynamics could exhibit a vast change as the Government embarked on new policies such as the minimum wage, subsidy rationalisation, and implementation of a new tax system. As an example, subsidy rationalisation could lead to prices of domestic goods and services become more susceptible to external factors such as global commodity prices.

6. Conclusion

The 1990s marked the period of "great moderation" as global inflation was relatively low and less volatile. However, the great moderation did not last long as the surge in global commodity prices in the 2000s led inflation to revert to its past behaviour of being elevated and volatile, particularly in the emerging market economies. Such rapid evolution of inflation dynamics necessitates central banks to regularly fine-tune the surveillance and forecast framework. For Malaysia in particular, the central bank focuses on a framework in which it segregates the first-round effects (which focuses on inflation pervasiveness) and the subsequent second-round effects on inflation (which focuses on inflation persistence) arising from a price shock. The framework is also supplemented by the CPI component analysis as an inflation forecast tool. Recognising the ever-evolving nature of inflation dynamics, the Bank will continue to refine this framework to ensure it remains relevant and comprehensive in monitoring the changes in the determinants of inflation.

7. Reference

Akdogan, K., Baser, S., Chadwich, M.G., Ertug, D., Hulagu, T., Kosem, S. Ogunc, F., Ozmen, M.U., and Tekatli, N. (2012) *"Short-Term Inflation Forecasting Models For Turkey and a Forecast Combination Analysis"* Central Bank of Turkey Working Paper No: 12/09.

Altissimo, F., Ehrmann, M., and Smets, F. (2006) "Inflation Persistence and Price Setting Behaviour in the Euro Area – A Summary of the IPN Evidence" ECB Occasional Paper No 46.

Atkeson, A. and Ohanian, L.E. (2001) *"Are Phillips Curves Useful for Forecasting Inflation?"* Federal Reserve Bank of Minneapolis Winter 2001 Quarterly Review.

Bank Negara Malaysia , "Annual Report", Bank Negara Malaysia, Various Issues.

Bernanke, B. (2007) *"Inflation Expectations and Inflation Forecasting"* Speech at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, Massachusetts.

Bollard, A.,(2011) *"Economic surveillance after the crisis – reflections from a small full service central bank"* , Speech to the Sim Kee Boon Institute Conference on Financial Economics, Singapore, 5 May 2011.

de Mello, L. and Moccero, D., (2007) *"Monetary policymaking and inflation expectations: The experience of Latin America",* Seminar on Monetary Policy in Emerging Markets organised by the OECD Economics Department and CCBS/Bank of England, OECD, Paris, 28 February 2007.

Faust, J. and Wright, J.H., (2011) *"Forecasting Inflation"* Department of Economics, Johns Hopkins University.

Meyler, A., Kenny, G., and Quinn, T. (1998) *"Forecasting irish inflation using ARIMA Models"* MPRA Paper No. 11359.

Mnyande, M., (2007) *"South Africa's Experiences of Monetary Policy within an Inflation Targeting Policy Framework",* Seminar on Monetary Policy in Emerging Markets organised by the OECD Economics Department and CCBS/Bank of England, OECD, Paris, 28 February 2007.

Munir, Q, Mansur, K, and Furuoka, F, (2009) *"Inflation and Economic Growth in Malaysia: A Threshold Regression Approach"*, ASEAN Economic Bulletin.

Shrestha, M. B, (2008) *"Current Macroeconomic Surveillance Framework in the SEACEN countries"* Handbook on Macroeconomic Surveillance for Monetary Policy Management in the SEACEN Countries.

Smaghi, L. B. (2011) *"The challenges of surveillance and coordination",* Speech at International symposium of the Banque de France.

Stock, J.H. and Watson, M.W., (1999*) "Forecasting Inflation"* NBER Working Paper No. 7023.

Development and compilation of macroprudential indicators for financial stability and monetary policy in Nigeria

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Abstract

This paper discusses the development and compilation of quarterly macro-prudential indicators and their relevance to financial stability and monetary policy management in Nigeria. The indicators are analyzed on time series basis to give insight to the level of soundness of the Nigerian financial system. The FSIs, complemented by stress testing of the system, serve as useful tools in evaluating the strengths and weaknesses of the financial institutions, as well as provide signals to the Monetary Policy Committee of the Bank for possible actions to ameliorate the vulnerabilities of the system. The results of recent macro-prudential analyses revealed that the Nigerian financial system was stable, robust and resilient to liquidity and funding shocks.

JEL classification: E52, E44

[1] The authors are members of staff of the Statistics Department, Central Bank of Nigeria. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Bank.

1. Introduction

Although, the performance of an economy is determined to a large extent by the level of activities in the real sector, but the critical role of the financial system in sustaining a vibrant and stable economy cannot be over-looked. The stability, soundness and resilience of the financial system have received considerable attention in the recent time due to the continuous integration of the system which leads to increased capital mobility. It brought about the gradual collapse of the financial boundaries among nations while deepening and expanding the potentials of the impact of external financial shocks, as evidenced from the various financial crisis witnessed in the past, particularly the latest global financial crisis which began from the United States as a result of crisis in the sub-prime mortgage market in August 2007.

The beginning of a crisis in any financial system can be shocking, but there may be glaring signals of financial vulnerabilities in the system that could be used in the formulation and implementation of appropriate responses to prevent financial distress or mitigate its impact on the economy. For instance, in the wake of the global financial crisis, there was a widespread acknowledgment for the need to strengthen links among key components of the financial system, examine carefully how systemic risk varies over time, as well as study the robustness of the system when hit by shocks or systemic risk.

Analysts are of the view that, excessive risk-taking coupled with lack of strict macroprudential regulation as well as loose monetary policy was the major contributor to the crisis. Although, it is generally believed that banks survived and flourished on risks, but the risks must be well managed to avoid bankruptcy. Monetary authorities and relevant regulators have a fundamental role to play in ensuring financial stability by monitoring the performance of banks and other related institutions, but their collective actions were clearly not enough to prevent the crisis.

The crisis, has undoubtedly underscored the importance of a macroprudential approach to regulation so as to assess the soundness of financial systems as well as individual financial institutions. Regulators should not only concentrate on identifying banks that do not manage their risks well but should also develop a macroprudential orientation that comprises monitoring, regulation and supervision to identify how risk systematically evolved over time and distributed across a financial system at any given point in time. To achieve this and forestall the re-occurrence of such catastrophe, the international financial community, spear-headed by the International Monetary Fund (IMF) developed a new concept of macroprudential regulation that serves as early warning signals by exposing the vulnerability of the financial system.

This paper focuses on the development and compilation of macro prudential indicators for Nigeria as well as examines how the indicators are used in assessing the stability and soundness of the Nigerian financial system and for monetary policy purposes. To achieve this, the paper is structured into six sections. Following the introduction in this section, section two provides an overview of Nigeria's financial system. The development and compilation of financial soundness indicators (FSIs) are discussed in section three. Section four reviews the dimensions of application of macro prudential indicators for financial stability analysis and monetary policy purposes. Section five discusses the complementary role of stress testing in assessing the financial strength and vulnerabilities of the banking system, while section six highlights the challenges and concludes the paper.

2. Overview of the Nigerian Financial System

The Nigerian financial system comprises both formal and informal sub-sectors. The formal sub-sector is made up of the regulatory authorities, money, capital and foreign exchange markets, insurance companies, brokerage firms, deposit money banks, development finance and other financial institutions. The informal sub-sector includes community-based organizations such as financial cooperatives, micro finance institutions, rotatory savings and credit associations, self-help groups and similar institutions. A major characteristic of the financial system is the weak relationship and integration of the informal sub-sector with the formal sub-sector.

At end-December 2013, the regulators/supervisory institutions remained the Federal Ministry of Finance (FMF), the Central Bank of Nigeria (CBN), the Nigeria Deposit Insurance Corporation (NDIC), the Securities and Exchange Commission (SEC), the National Insurance Commission (NAICOM) and the National Pension Commission (PENCOM). The operators included 24 deposit money banks (21 commercial banks, 2 merchant banks and 1 non-interest bank); 4 discount houses (DHs); 6 development finance institutions (DFIs); 82 primary mortgage institutions (PMIs); 821 microfinance banks (MFBs); 61 finance companies (FCs); 31 pension funds administrators (PFAs); 2,889 bureaux-de-change (BDCs)operators and 59 insurance companies.

The growth of the banking system in the post-consolidation period and the failure of the regulators/supervisors to develop commensurate supervisory capabilities created risks to the system in the late 2000s. Other interdependent factors such as macro-economic instability, weak corporate governance, and uneven supervision and enforcement combined to render the financial system vulnerable, and posed significant challenges to both regulators and other stakeholders. This development informed the CBN intervention in August 2009 through various initiatives aimed at enhancing the stability of the system. The high incidence of non-performing loans in the banking industry and the consequent erosion of the capital of some banks informed CBN's initiative to establish the Asset Management Corporation (AMCON) in 2010, to free such banks of the burden of toxic assets. The CBN also took steps to expose the banking system to global best practice in financial reporting and disclosure.

3. Development and Compilation of FSIs in Nigeria

3.1 The Origin and Relevance of FSIs

The idea of the FSI project was mooted shortly after the Asian financial crisis of the late 1990s. The crisis exposed an enormous data gap requirement for timely monitoring and intervention of the financial system by the monetary authorities and effective oversight of the member countries by the IMF. In order to solve this problem IMF launched some statistical initiatives including the compilation of FSIs, to improve the coverage of potential financial and external vulnerabilities. FSIs are aggregate measures of the current financial health and soundness of the financial institutions in a country as well as their corporate and household counterparties.

Table 1: Financial Soundness Indicators: Core and Encouraged Sets

Core Sets	
Capital Adequacy	Regulatory Capital to Risk-Weighted Assets Regulatory Tier 1 Capital to Risk-Weighted Assets Nonperforming Loans net of provision to capital
Asset Quality	Nonperforming Loans to Total Gross Loans Sectoral Distribution of Loans
Earning and Profitability	Return on Assets (ROA) Return on Equity (ROE) Interest Margin to Gross Income Noninterest Expense to Gross Income
Liquidity	Liquid Assets to total Assets Liquid Assets to Short Term Liabilities
Sensitivity to Market Risk	Net Open position in Foreign Exchange to Capital
Encouraged Sets	
Deposit Takers	Capital to assets Large exposure to capital Geographical distribution of loans to total loans Gross asset position in financial derivatives to capital Gross liability position in financial derivatives to capital Gross liability position in financial derivatives to capital Trading income to total income Personnel expenses to noninterest expenses Spread between refence lending and deposit rates Spread between highest and lowest interbank rate Customer deposits to total (noninterbank) loans Foreign-currency-denominated loans to toal loans Foreign-currency-denominated liabilities to toal liabilities Net open position in equities to capital
Other Financial Corporations	Assets to total financial system assets Assets to GDP
Nonfinancial Corporations Sector	Total debt to equity Return on equity Earnings to interest and principal expenses Net foreign exchange exposure to equity Number of applications for protection from creditors
Households	Household debt to GDP Household debt service and principal payments to income
Market Liquidity	Average bid-ask spread in the securities market Average turnover ratio in the securities maerket
Real Estate Market	Real Estate Prices Residential Real Estate Loans to Total Loans Commercial Real Estate Loans to Total Loans

Source: *FSIs Compilation Guide, 2006*

The process of compiling FSIs began with a meeting of a group of experts, officials of member countries of the IMF, regional and international bodies and standard setters. The meeting agreed on the urgent need for additional information and identified some set of indicators that are required to reduce the identified data gap.

In the mid-2000, the IMF conducted a survey on the compilation and dissemination of macro-prudential indicators with a remarkable response from over 100 countries. This helped the IMF to identify a core set of financial soundness indicators that all member countries are expected to compile and an encouraged set of important indicators that countries are not compelled but encouraged to compile depending on the national circumstances. These indicators are presented in Table 1.

The IMF published a compilation guide on FSIs in 2006. The Guide provides guidance on the concepts and definitions, as well as sources and techniques for the compilation and dissemination of internally consistent, cross-country comparable sets of indicators that could provide information about the current soundness of the aggregate financial system. The innovative Guide combines elements of macroeconomic frameworks, including monetary statistics, banks supervisory framework and international financial accounting standards.

3.2 Compilation of FSIs in Nigeria

The major data source for the compilation of FSIs for Nigeria is banks statutory returns to the CBN, made up of Income and Expense Statements and Financial Balance Sheet of commercial and merchant banks. The FSI compilers download the bank returns from the electronic financial analysis and surveillance system (e-FASS) of the CBN to extract relevant data for computing the FSIs. The FSI compilation is, however, limited to those indicators whose underlying series are available in the statutory returns as shown in Table 2.

To strengthen its surveillance and supervision activities, the CBN using the FSI compilation guide compiled some macro-prudential indicators of the strength and stability of the financial system. These indicators are very important in the sense that they enable the evaluation of the system based on objective measures that include both aggregate micro-prudential indicators of the solvency of the financial institutions and macroeconomic variables related to the strength of the financial system. The IMF encourages countries to compile this type of indicators in order to start systematic monitoring of financial soundness and improve the possibilities to execute macro prudential analysis. This comprehensive set of indicators has been renamed financial soundness indicators (FSIs).

Available data are sufficient for compiling 11 core (out of 12) and four encouraged (out of 28) FSIs, which is well within the range of other countries' FSIs reported in the IMF website. The granularity of the current framework for reporting Income and Expense Statements and Financial Balance Sheet of banks in the eFASS does not support the compilation of the outstanding FSIs. However, the new user specification requirements of the Bank will ameliorate this data issue when fully implemented and Nigeria would then be able to compile all core and at least nine encouraged FSIs in the near future.

4. FSIs, Financial Stability and Monetary Policy in Nigeria

The Central Bank of Nigeria computes a group of macro prudential indicators for the purpose of analyzing the effects of macroeconomic variables on the financial system in order to pursue its goals of monetary and financial stability. When the development in the key indicators are examined, it is possible to find some early warning signals that may imply the necessity to take certain economic policy action to avoid possible crisis in the financial system. However, the use of these indicators for financial system stability assessments and monetary policy decisions is quite recent.

Over the years, the CBN's monetary policies consists of a combination of actions aimed at ensuring monetary and price stability as well as promoting financial system stability. It therefore becomes pertinent to have coordination between actions taken towards each goal, as the achievement of each depends on the other. Appropriate monetary policy is desirous of financial stability and vice versa, and the maintenance of price stability requires a stable financial environment. Thus, policy actions taken for both goals must be consistent and mutually reinforcing.

The monetary policy in recent years was conducted against the background of the lingering effects of the liquidity crunch in the domestic economy, arising from the global financial and economic crises of 2007/2008 and internal problems in some deposit money banks in Nigeria.

Liquidity management was, therefore, geared towards improving the liquidity and efficiency of the financial market, without compromising the objective of monetary and price stability. Consequently, the monetary policy measures substantially improved liquidity conditions in the banking system and, to a large extent, ameliorated the capital erosion witnessed in the banking system in the late 2009.

4.1 Financial Soundness Indicators

The Central Bank of Nigeria (CBN) compiles both core and encouraged FSIs for deposit takers (DTs) in Nigeria. The compilation is limited to the indicators whose underlying series are available in the statutory returns of deposit money banks (DMBs) in Nigeria. The Bank has successfully computed quarterly series of FSIs for the period spanning 2007Q1 to 2013Q4 as reported in Table 2.

Eleven out of the twelve core FSIs are currently being compiled for the banking sector in Nigeria. These FSIs cut across four components of the indicators: capital adequacy, asset quality, earnings and profitability, and liquidity. The definition and methodology applied are explained hereunder.

4.1.1 Capital Adequacy Based Indicators

The three core indicators of capital adequacy are vital to the robustness of financial sector to withstand shocks to their balance sheets. Deterioration in the ratio signifies increased risk exposure and possible capital adequacy problems while an increase in the ratio means the reverse. *Regulatory Capital to Risk-Weighted Assets* ratio measures the capital adequacy of the banking sector in Nigeria. The numerator represents the industry position of the regulatory capital of all DMBs in the country, while the denominator is their Risk Weighted Assets (RWA) within the given period. Regulatory capital is defined in line with the provisions of the Basel Committee on

Tier 1 and Tier 2 capitals[2]. The international convention is that regulatory capital should not be less than 8.0 per cent of banks' risk weighted assets, while the required minimum ratio in Nigeria is 10 per cent for Regional and National banks and 15 per cent for International banks.

Regulatory Tier 1 Capital to Risk-Weighted Assets ratio measures the capital adequacy of the banking sector in Nigeria. The numerator represents the industry position of the Tier 1 capital of all DMBs in the country, while the denominator is their Risk Weighted Assets (RWA) within the given period. Tier1 capital comprises of paid-up capital, common stock and disclosed reserves such as retained earnings, share premiums, general reserves and legal reserves.

Nonperforming Loans net of provision to capital indicator is intended to compare the potential impact on capital of nonperforming loans net of provision. The numerator is treated in Nigeria as nonperforming when payments of principal and interest are overdue by three months or more. Specific provisions are deducted from the capital which is measured as capital and reserves reported in the sectoral balance sheet. In the alternative, however, regulatory capital can also be used.

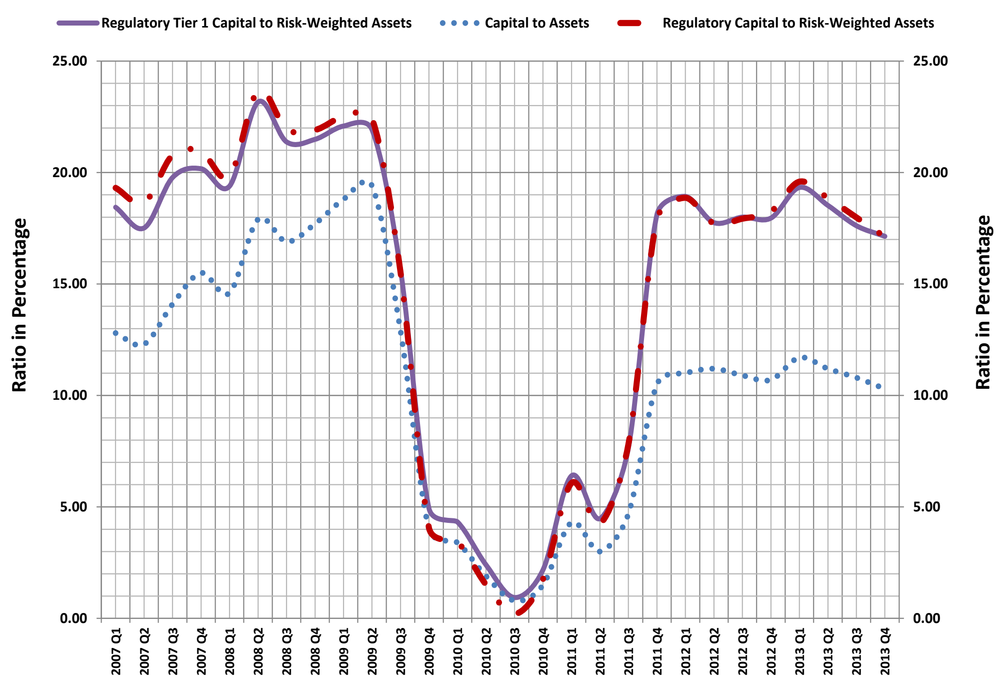

Fig 1: Trend in Capital Adequacy Based Indicators

[2] Tier1 capital is core capital, which includes equity capital and disclosed reserves.
Tier2 capital is supplementary bank capital that includes items such as revaluation reserves.

Table2: Selected Financial Soundness Indicators of the Nigerian Banking Industry*

(All figures in percentages, except otherwise indicated)

	2007 Q1	2007 Q2	2007 Q3	2007 Q4	2008 Q1	2008 Q2	2008 Q3	2008 Q4	2009 Q1	2009 Q2	2009 Q3	2009 Q4	2010 Q1	2010 Q2
1. Asset Quality and Liquidity Based Indicators														
Non-performing Loans to Total Gross Loans	8.9	7.7	7.6	8.4	7.1	4.0	4.6	6.3	6.5	8.5	20.8	27.6	34.8	28.8
Liquid Assets to Total Assets	26.6	24.7	25.7	21.2	23.6	20.7	17.7	14.7	13.8	12.9	7.6	10.5	13.0	12.3
Liquid Assets to Short Term Liabilities	31.7	29.2	32.3	26.7	29.6	27.2	23.1	19.1	18.3	17.1	10.2	13.6	15.0	13.6
2.Capital Adequacy Based Indicators														
Regulatory Capital to Risk-Weighted Assets	19.3	18.6	20.8	20.9	19.8	23.7	22.0	21.9	22.5	22.4	15.5	4.1	3.4	1.5
Regulatory Tier 1 Capital to Risk-Weighted Assets	18.4	17.5	19.8	20.2	19.4	23.2	21.4	21.5	22.1	21.9	15.6	4.9	4.3	2.4
Capital to Assets	12.8	12.3	14.1	15.5	14.6	17.9	16.9	17.7	18.8	19.4	12.9	4.0	3.4	1.9
Non-performing Loans Net of Provisions to Capital	15.0	11.9	12.4	11.1	11.4	3.5	5.5	9.1	9.5	12.5	38.9	106.8	268.0	289.8
3. Earnings and Profitability Based Indicators														
Interest Margin to Gross Income	52.6	62.3	60.7	1.4	56.6	52.4	62.7	61.2	60.2	60.0	51.1	59.1	54.0	51.9
Non-interest Expenses to Gross Income	61.6	51.1	50.7	29.1	58.4	57.1	59.8	62.6	61.7	68.0	78.2	137.4	88.3	65.7
Return on Assets	6.2	7.6	7.0	9.1	5.2	4.4	3.9	3.7	4.2	3.5	(1.5)	(8.8)	1.4	2.1
Return on Equity	48.5	55.0	44.2	57.2	32.0	23.0	22.0	20.7	22.7	17.7	(11.1)	(19.5)	39.9	110.0
Personnel Expenses to Non-interest Expenses	40.1	41.2	43.1	47.4	43.8	43.2	43.7	41.0	43.3	41.9	39.4	47.7	41.8	40.1

	2010 Q3	2010 Q4	2011 Q1	2011 Q2	2011 Q3	2011 Q4	2012 Q1	2012 Q2	2012 Q3	2012 Q4	2013 Q1	2013 Q2	2013 Q3	2013 Q4**
1. Asset Quality and Liquidity Based Indicators														
Non-performing Loans to Total Gross Loans	35.6	15.7	12.0	10.8	9.1	5.3	4.2	4.3	4.1	3.5	3.8	3.7	3.4	3.2
Liquid Assets to Total Assets (Liquid Asset Ratio)	10.3	12.0	18.1	17.4	20.8	25.4	24.6	22.5	20.9	24.6	27.9	20.9	18.1	22.0
Liquid Assets to Short Term Liabilities	11.3	13.3	20.1	19.4	24.8	30.1	29.2	26.5	24.6	28.4	32.3	24.3	21.0	25.2
2.Capital Adequacy Based Indicators														
Regulatory Capital to Risk-Weighted Assets	0.2	1.8	6.1	4.2	7.8	17.9	18.9	17.7	17.9	18.3	19.6	18.9	18.0	17.1
Regulatory Tier 1 Capital to Risk-Weighted Assets	0.9	2.2	6.4	4.5	7.7	18.1	18.9	17.8	18.0	18.0	19.3	18.5	17.6	17.1
Capital to Assets	0.8	1.5	4.3	3.0	4.7	10.5	11.0	11.2	10.9	10.7	11.7	11.2	10.8	10.3
Non-performing Loans Net of Provisions to Capital	241.3	192.7	47.0	74.3	32.2	10.1	4.5	6.8	6.7	6.1	6.0	7.2	7.1	7.4
3. Earnings and Profitability Based Indicators														
Interest Margin to Gross Income	54.7	53.6	56.4	49.4	66.4	31.0	63.8	67.7	66.6	62.0	62.6	65.2	65.8	63.9
Non-interest Expenses to Gross Income	70.3	50.2	74.0	70.6	47.5	24.4	68.4	59.2	68.5	64.8	63.4	62.7	69.7	68.1
Return on Assets	2.2	3.9	1.6	1.7	(1.3)	0.2	1.6	2.8	2.3	2.3	2.8	2.8	2.5	2.1
Return on Equity	285.6	266.0	35.5	55.1	(27.1)	2.2	14.5	25.0	20.0	21.1	23.2	24.8	22.4	20.1
Personnel Expenses to Non-interest Expenses	39.4	36.8	39.6	41.1	18.6	67.8	43.6	39.3	40.4	42.5	40.0	39.5	36.1	36.9

**FSIs are computed based on IMF guidelines, **Provisional.*

Capital to Assets (CA) tends to reveal the leverage of the deposit takers by showing the extent to which assets are funded by other funds other than those that belong to the DTs. Both capital and assets are measured as in the core FSIs.

On the capital adequacy based indicators, it can be seen that the ratio of regulatory capital to risk-weighted assets (commonly known as capital adequacy ratio) fluctuated widely and peaked at 23.7 per cent in the first half of 2008. The capital adequacy ratio showed deterioration between Q4, 2009 and Q3, 2011, but improved considerably thereafter to 17.1 per cent at end-December 2013, which was well above the CBN minimum CAR of 10.0 per cent and 8.0 per cent benchmark recommended by the Basle Committee.

The ratio of Tier 1 capital to risk-weighted assets was also strong, indicating that the Nigerian banks are resilient to shocks on their balance-sheet items. The capital based indicators remained stable in the last three years, owing largely to CBN's intervention by setting up the AMCON in 2010 to absorb the prevalent toxic assets in the banking system. Similarly, the return on equity (ROE) improved, reflecting the competitiveness of the banking system. On the whole, the above scenario reflected a strong capital base for Nigerian banks as indicated in Fig 1.

4.1.2 Assets Quality and Liquidity Based Indicators

There are two core indicators for asset quality; namely: nonperforming loans to total gross loans and sectoral distribution of loans.

Nonperforming Loans to Total Gross Loans indicator shows the quality of assets created by the banking system. The numerator is the total value of loans that are overdue while the total value of the loan portfolio is used as the denominator. Loan include those financial assets created through the direct lending of funds by a creditor to a debtor through an arrangement in which the lender either receives no security evidencing the transactions or receives a non-negotiable document or instrument.

Sectoral Distribution of Loans reveals the level of credit concentration and/or diversification in the loan portfolio which may be a source of vulnerability to the financial system. The numerators are lending to each of the listed sectors while the denominator is total gross loan.

There are two core indicators for liquidity: liquid assets to total assets and liquid assets to short-term liabilities. *Liquid Assets to Total Assets* is indicator is designed to provide an indication of the liquidity available to meet expected and unexpected demands for cash. It is calculated by imposing the core or broad measure of liquid assets on total assets. Core liquid assets comprise of currency and deposits and other financial assets that are available either on demand or within three months or less. Broad liquid asset equals the core assets plus securities that are traded in liquid markets and can be easily converted into cash with no or minimal change in value.

Liquid Assets to Short-term Liabilities determines the liquidity mismatch of assets and liabilities and provides an indication of the extent to which deposit takers could meet short-term withdrawal of funds without facing liquidity problems. The core or broad measure of liquid assets is taken as the numerator while short-term liabilities are taken as the denominator. Short-term liabilities are the short-term elements of debt liabilities plus the net short-term market value of the financial derivatives.

The asset quality and liquidity based indicators revealed an improvement in the asset quality of the Nigerian financial system over the years. The ratio of non-performing loans to total loans stood at 3.7 per cent as at end-December, 2013, reflecting a significant decline below the level of 27.6 per cent at end-December, 2009. The improved position was attributable to stricter adherence by banks to credit risk management policies and standards. Also the level of liquidity in the system improved steadily during the period, as the ratio of core liquid assets to total assets increased from 16.5 per cent at end-December 2009 to 21.2 per cent at end-December, 2013. Similarly, the ratio of liquid assets to short-term liabilities increased from 22.3 per cent to 25.0 per cent during the same period. The trends in these indicators are illustrated in Fig 2.

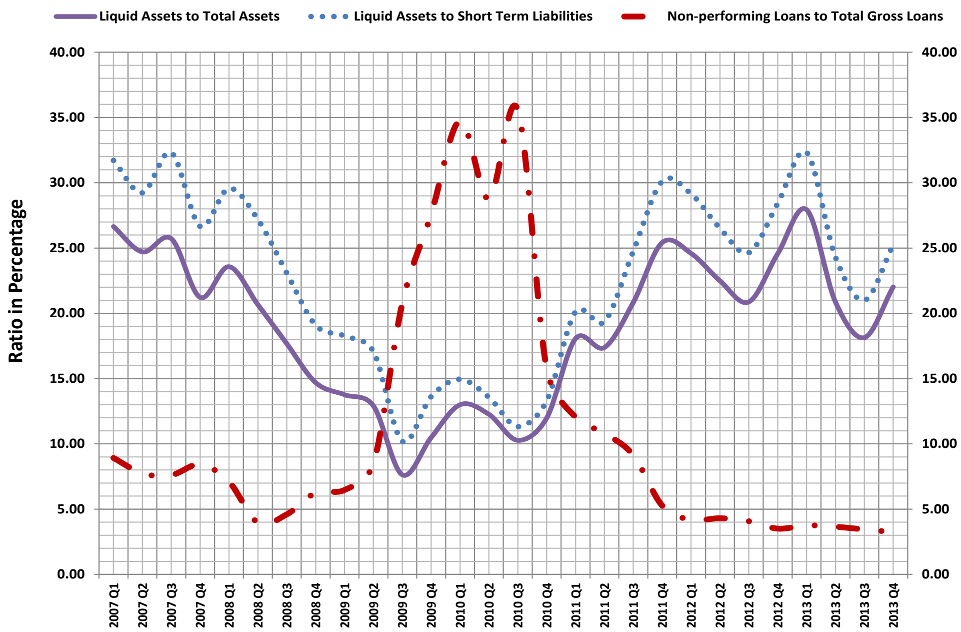

Fig 2: Trend in Assets Quality and Liquidity Based Indicators

4.1.3 Earning and Profitability Based Indicators

Return on Assets measures deposit takers' efficiency in the use of own assets. Net income according to the amended FSI Guide is defined before extra-ordinary items and taxes and includes gains and losses on financial instruments as per the provision of international financial reporting standard. *Return on Equity* measures deposit takers' efficiency in the use of capital. In this case, net income is divided by capital[3].

Interest Margin to Gross Income measures the relative share of net interest earnings – interest earned less interest expenses – within gross income. It is calculated by using interest income as the numerator and gross income as the denominator. Net interest income is interest income (gross interest income minus provisions for accrued interest on NPLs) minus interest expense. Gross income

[3] The definition of capital is given as above.

equals net interest income plus noninterest income such as fees and commissions' receivable, gains and losses on financial instruments, pro-rated earnings from other deposit takers and other income.

Non-interest Expenses to Gross Income indicates the size of administrative expenses to gross income (interest margin plus non-interest income). It is calculated by using non-interest expenses as the numerator and gross income as the denominator. Non-interest expenses cover all expenses other than interest expenses, but without provisions and extra-ordinary items.

There are three encouraged set of indicators under earnings and profitability, out of which two are currently being computed for the Nigerian banking sector. *Trading Income to Total Income* is a measure of the relative share of deposit takers' income from financial market activities in gross income. It is an indication of reliance on market-oriented activities in gross income. It also assesses the sustainability of the DMBs' profitability. The indicator is calculated by using gains or losses on financial instruments as the numerator and gross income as the denominator. Trading income comprises of gains and losses on financial instruments valued at market or fair value in the balance sheet. It excludes equity in associates, subsidiaries and any reverse equity investment. Gross income is as defined under core indicators.

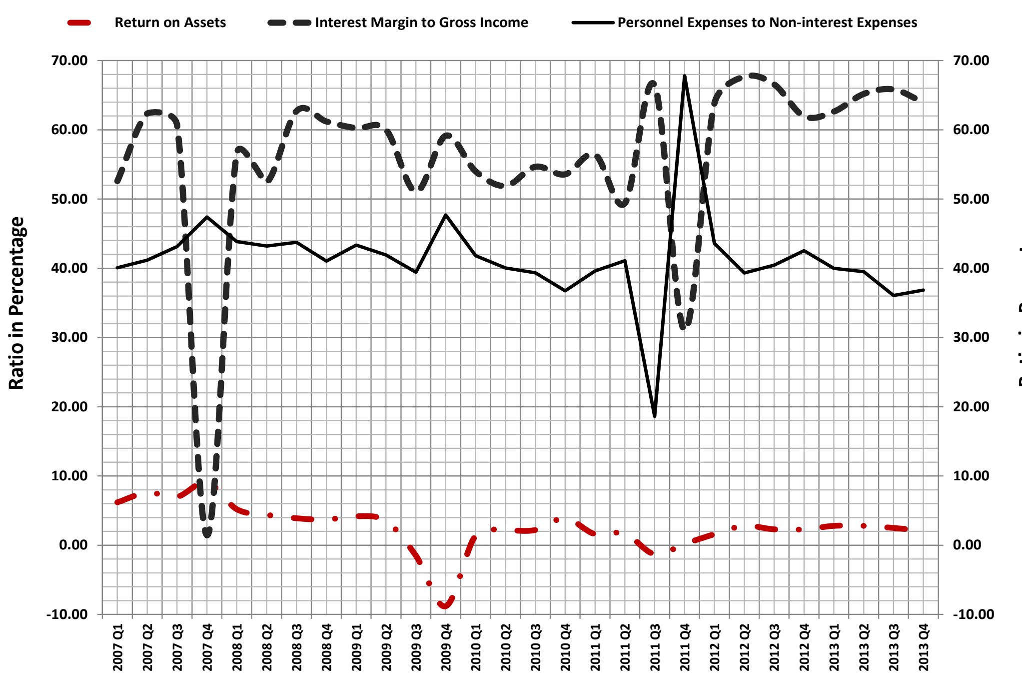

Fig 3: Trend in Earnings and Profitability Based Indicators

Personnel Expenses to Non-interest Expenses appraises the incidence of personnel costs in total administrative costs. It uses personnel costs as the numerator and non-interest expenses as the denominator. Personnel costs cover the total remuneration payable by the organization in return for services rendered by the employers. Non-interest expenses are as defined under the core FSIs.

With regard to the earnings and profitability based indicators, the ratio of interest margin (i.e. interest earned less interest expenses) to gross income remained in the range of 31.0 per cent and 67.7 per cent, except for Q4 2007 when it recorded 1.4 per cent. The ratio of non-interest expenses to gross income (a measure of the size of administrative expenses for banks) average 63.98 per cent during the period Q1, 2007 and Q4, 2013, and peaked at 137.38 per cent in Q4, 2009 with a minimum of 24.37 per cent attained in Q4, 2011. Similarly, the ratio of personnel expenses to non-interest expenses trended down to 36.9 per cent at end-December, 2013. Overall, the earnings and profitability based indicators revealed that the income and cost structure of the banking sector remained stable post crisis period, thereby confirming the sustained profitability posted by the sector in recent years.

5. Complementary Role of Stress Testing

As a complementary approach to assessing the financial strength and vulnerabilities of the banking system, stress testing is used to give information in addition to that provided by the FSIs. The relationship between FSIs and stress testing derives from the fact that FSIs are typically the output of stress tests. Specifically, an FSI provides a quantitative measure to assess a particular vulnerability, while the stress test, which is a shock to the relevant macroeconomic risk factor, yields an estimate of the FSIs associated with this vulnerability.

The CBN adopts stress testing as a means of identifying the vulnerabilities, and measuring the resilience of the Nigerian banking industry to various and varying shocks. The stress test is conducted under four scenarios: the entire banking industry; large; medium and small banks. The latest liquidity stress test was conducted by the CBN at end-December 2013, using the implied cash flow analysis (ICFA) and maturity mismatch/rollover risk approaches. The test was aimed at assessing the ability of the banking system to withstand liquidity and funding shocks. A solvency stress test was also conducted on the banking industry as at December 31, 2013 to assess the stability of the sector under various hypothetically strained macroeconomic conditions. The test results revealed that the Nigerian banking industry, in general, was resilient to liquidity and solvency stress in the second half of 2013.

The CBN has also, since 2010, consistently published its bi-annual Financial Stability Report as one of the several avenues through which the Bank seeks to contribute to the resiliency of the Nigeria financial system. The report combines the Bank's ongoing work in monitoring developments in the system, with a view to identifying potential risks to the overall soundness, as well as highlighting the efforts of the Bank and other regulatory authorities, to mitigate the risks. It is pertinent to note that macro-prudential analyses, including financial soundness indicators and stress test, are among the key features of the Financial Stability Report.

6. Challenges and Concluding Remarks

To strengthen the supervision over the financial sector, the regulatory authorities need adequate indicators of the strength and stability of the financial system. The macro prudential indicators are very important in this respect as they enable the regulators make evaluations based on objective measures. Macro prudential analysis closely complements and reinforces early warning systems and other analytical tools to monitor inherent vulnerabilities, using macroeconomic indicators as key explanatory variables.

The Central Bank of Nigeria uses a combination of macroeconomic and macro prudential indicators and the associated stress testing for financial stability assessment and monetary policy purposes. The indicators serve in measuring the soundness and vulnerabilities of the financial system in five key areas: capital adequacy, asset quality, liquidity, earnings and sensitivity to market risk. Currently, the CBN compiles eleven out of the twelve core FSIs for the banking sector and only four out of the twenty eight encouraged FSIs for deposit takers in Nigeria. The limitation in compiling the remaining indicators arises mainly from data challenges, which the Bank is trying to address through collaboration with other data generating agencies in the country.

Given the expertise required in compiling the FSIs, the CBN constituted an FSI Harmonization Committee comprising staff of Statistics, Banking Supervision, Other Financial Institutions and Monetary Policy departments. The committee is currently working on fine-tuning the metadata for the compiled FSI. Also, the Bank is exploring the feasibility of expanding the coverage of FSIs compilation to include the microfinance banks and mortgage institutions, which are major deposit takers engaged in microfinance activities and financing of real estate in Nigeria. Similarly, the Bank is reviewing and improving the data collection of the source data for the capture of sectoral distribution of loans and foreign currency exposure of the DTs. These efforts are expected to expand the number and improve the quality of computed FSIs in Nigeria.

Recent assessments using the FSIs and stress testing revealed that the Nigerian banking sector is stable, robust and resilient to liquidity and funding shocks. It was found that the quality of assets of the banking industry was good as the non-performing loans reduced drastically over time; the capital adequacy ratio of 17.2 per cent at end-December 2013 was well above the CBN minimum CAR of 10.0 per cent and 8 per cent minimum requirement of the Basle Committee; and earnings and profitability were satisfactory. These salutary developments were considered to be the fallout of the various initiatives and interventions by the CBN aimed at sanitizing the financial sector.

References

CBN (2010). Financial Stability Report, Maiden Edition, December. 2010.

CBN (2010) .Annual Report, December. 2010.

CBN (2013) .Financial Stability Report, December. 2013.

Craig, R.S. (2002). "Role of financial soundness indicators in surveillance: data sources, uses and limitations" in *IFC Bulletin* 12, October. 2002.

Elfferich, K. and M. de Jong (2002). "Macro-prudential Indicators: A pilot compilation exercise for the Netherlands" in *IFC Bulletin* 12, October 2002.

Hunter, L. (2008). "The relationship between monetary and financial stability" in *Reserve Bank of New Zealand Bulletin* vol. 71, No.2, June 2008.

IMF (2006) Financial Soundness Indicators: Compilation Guide.

Vong, Thomas L.K. (2003). "The Financial Soundness Indicators of Macao", Monetary Authority of Macau.

William C.V. (2002). "The use of macro prudential indicators: the case of Costa Rica" in *IFC Bulletin* 12, October. 2002.

Financial Conditions Composite Indicator (FCCI) for India

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Abstract

Financial stability of a country needs to be tracked as an explicit policy variable for ensuring future macroeconomic stability. This study essentially explores the relationship between financial conditions and economic activity for India. Based on the information contained in money, foreign exchange, bond, commodity and equity markets, for the period April 2004 to March 2014, as well as by controlling past influences of economic activity and inflation, we construct a monthly Financial Conditions Composite Indicator (FCCI) for India and its leading indicator. We also estimate the threshold value of FCCI for identifying stress points in the economy.

Keywords: Financial condition, principal component, leading indicator, threshold, Kernel density

JEL classification: E44, E47, E51, G10

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Views expressed in the paper are those of the authors and not of the Reserve Bank of India.

Section I

Introduction

The term Great Moderation, coined by the renowned economists James Stock and Mark Watson (2002), is popularly used to describe the phenomena of decline in volatility of major economic variables such as GDP, industrial production, monthly payroll employment and the unemployment rate, etc. This was a situation of showing overall apparent sign of prosperity. However, the prolonged period of macro-economic stability (low volatility) had caused firms to hold less capital and to be less concerned about liquidity positions. This may be a factor for encouraging the firms to increase their leverage and decrease in risk premium required. Moreover, some sort of structural imbalances or disparities like widening current account deficit in some part of the world with surplus in others, misalignment in exchange rates and booming asset prices had also developed in the world economy. These negative developments had to undo at some point of time and when the unwinding began, they marked themselves in the form of global financial crisis. Most of the regularities in the data that economist have identified are equilibrium relationships, meaning the relationship that hold true when the economy is operating more or less normally. During a serious economic dislocation, many established connections break down and new ones emerge. In the post crisis analysis a number of factors are pointed out in the literature as the likely cause of the crisis.

In the Indian context, the phased liberalisation of economy to trade and capital flows along with a broadly market driven exchange rate regime improved the role of external demand in supporting the economic growth, and at the same time exposing the economy to the forces of globalisation. In this process, India became increasingly integrated with the world economy and maintaining financial stability assumed importance to the policy makers. The multiple indicator approach implicitly established the elements of financial stability within the monetary policy framework of the Reserve Bank of India, even before the 2008 global financial crisis. Thus Indian economy had benefited from global integration and also demonstrated significant resilience to various adverse external shocks like the east-Asian crisis (1997–98), the dot.com crisis (2000–01), etc. During 2008 crisis, despite hardly any direct exposure to the distressed assets, India was impacted like most other emerging markets. The contagion had spread through all the channels – trade, finance and confidence/expectation. Though the direct impact of the crisis on India was relatively low, however, the indirect impacts on Indian economic and financial system were significantly visible. The economy had experienced a significant slowdown in 2008–09 in comparison with the robust growth performance during the preceding five years. India's financial markets had come under pressure from different directions. The substitution of overseas financing by domestic financing brought both the money market and credit market under stress. The reversal of capital flows as part of global deleveraging process brought foreign exchange market under pressure. To meet the external obligations, corporate converted the funds raised locally into foreign currency. The Reserve Bank's intervention in foreign exchange market to manage the volatility in rupee further added to liquidity tightening. As a consequence of global liquidity crunch, Indian banks and corporate found it difficult to raise funds from external sources. The pressure escalated sharply on banks for credit requirements to the corporate sector. Corporate, in their frantic search to substitute financing, withdrew their investments from domestic money market mutual funds; putting redemption pressure directly on the mutual funds and, indirectly on non-banking financial companies where the mutual funds had invested a significant portion of their funds.

Every crisis provides us powerful lessons. The global financial crisis has changed the perception of financial regulators about the issue of financial stability. The crisis has revealed that, even with macroeconomic stability, financial instability is very much possible and which in turn destabilise the macroeconomic stability. Therefore, financial stability needs to be tracked as an explicit policy variable. When policymakers decide upon the appropriate stance of monetary policy, they must consider the possible macroeconomic implications of developments in financial sector. In this context, measuring and evaluating financial stress in the economy; and incorporating a wide variety of information about financial markets and institutions into macroeconomic consequences, on continuous basis is crucial. This study essentially explores the relationship between financial conditions and economic activity for India. Based on the information contained in money, foreign exchange, bond, commodity and equity markets, for the period April 2004 to March 2014, as well as by controlling past influences of economic activity and inflation, a monthly Financial Conditions Composite Indicator (FCCI) for India is constructed and the threshold value for identifying stress points of FCCI are also estimated. Section II of this study presents the literature survey on development of financial conditions index. The methodology for identifying financial stress indicators, are described in Section III. The detailed empirical analysis for constructing FCCI, its threshold value and composite leading indicator, data sources and reference period under coverage are described in Section IV. Section V concludes.

Section II

Literature survey

This section discusses about the financial conditions, why these matter to an economy, and how an index, representing the financial conditions, has been constructed in practice.

2.1 Financial Conditions

Financial conditions can be defined as the current state of financial variables that influence economic behaviour and, thereby, the future state of economy. The financial instruments that characterize supply or demand relevant for economic activity may signify financial conditions of the economy. An FCCI summarizes the information about future state of economy contained in these current financial variables.

2.2 Importance of Financial Conditions

In the literature of monetary transmission mechanism, monetary policy influences economy by altering financial conditions that affect economic behaviour. The structure of financial system is a key determinant of various channels of transmission. In economies with sophisticated financial systems, the transmission channels are diverse and may change over time. When the policy transmission is happened solely via financial conditions, FCCI would indicate whether a change in policy will alter economic prospects. It would summarize all the information about financial conditions, arising from both policy and non-policy influences. FCCI can serve as a guide to effective stance of policy, after taking into account all other factors that affect financial variables. However, the link between financial conditions and economic activity evolves over time; the importance of factors other than monetary policy on financial conditions may vary overtime; the response of financial conditions to policy changes may change; and forces other than financial conditions may affect the performance of real economy.

2.3 Some available FCCIs in Developed Countries

A variety of methodologies for constructing FCCIs have been developed over time. In most cases, financial conditions indexes are based on current values of financial variables, but some take into account lagged financial variables as well. Two broad categories of approaches are followed to construct FCCIs, *viz.*, weighted-sum approach and principal components approach. In the weighted-sum approach, the weights on each financial variable are generally assigned based on relative impacts of changes in the variables on real output. On the other hand, the principal components approach extracts a common factor from a group of several financial variables. This common factor captures the greatest common variation in the variables.

2.3.1 Bloomberg Financial Conditions Index

The Bloomberg FCI is a convenient measure to track financial conditions and updated daily. It is an equally weighted sum of three major sub-indexes: money market indicators, bond market indicators, and equity market indicators (Rosenberg, 2009). Each major sub-index is then made up of a series of underlying indicators, which receive an equal weight in that sub-index. The index consists of 10 variables in total, with history available from 1991.

2.3.2 Citi Financial Conditions Index

This index is a weighted sum of six financial variables, *viz.*, corporate spreads, money supply, equity values, mortgage rates, the trade-weighted dollar, and energy prices; all nominal values being deflated. The weights were determined according to reduced-form forecasting equations of the Conference Board's index of coincident indicators (D'Antonio, 2008). This index uses various transformations and lags of the indicators. The index is available from 1983.

2.3.3 Deutsche Bank Financial Conditions Index

Deutsche Bank utilizes a principal components approach for constructing the index (Hooper, Mayer and Slok, 2007; Hooper, Slok and Dobridge, 2010). The first principal component is extracted from a set of seven standardized financial variables that include exchange rate, bond, stock, and housing market indicators. The index is then set to the weighted sum of this principal component and the target federal funds rate. The weights are determined in a regression of real GDP growth on the financial variables and lagged GDP growth. The index is available from 1983.

2.3.4 Goldman Sachs Financial Conditions Index

The Goldman Sachs index is a weighted sum of a short-term bond yield, a long-term corporate yield, exchange rate, and a stock market variable (Dudley and Hatzius, 2000; Dudley, Hatzius and McKelvey, 2005). The Federal Reserve Board's macroeconomic model, together with Goldman Sachs modelling, was used to determine the weights. An increase in the Goldman Sachs FCCI indicates tightening of financial conditions, and a decrease indicates easing. Unlike the other indexes, Goldman Sachs index exhibits a noticeable downward trend because it uses levels of financial variables, as opposed to using spreads or using changes in the variables as in most other indexes.

2.3.5 Federal Reserve Bank of Kansas City Financial Stress Index

This index is a principal-components measure of 11 standardized financial indicators (Hakkio and Keeton, 2009). The financial variables can be divided into two categories: yield spreads and asset price behaviour. A positive index value indicates that financial stress is higher than its longer term average, and vice versa for a negative value.

2.3.6 Macroeconomic Advisers Monetary and Financial Conditions Index (MAFCI)

Macroeconomic Advisers constructed its monetary and financial conditions index in the late 1990s to take into account the dynamic effects of financial variables on GDP over time (Macroeconomic Advisers, 1998). They used five different financial variables, *viz*., a real short rate, real long rate, dividend ratio, real exchange rate, and real stock market capitalization, and developed a "surface impulse response" methodology in aggregating these variables. Response functions are generated by estimating the partial effects of changes in the financial variable on real GDP growth over time using simulations with MA's large-scale macroeconomic model. These functions are then inverted and aggregated so that the MAFCI at any point in time shows the combined effects of current and past changes in each of the financial variables on real GDP growth in the current period.

2.3.7 OECD Financial Conditions Index

The Organization for Economic Co-operation and Development (OECD) FCI was constructed in 2008. It is a weighted sum of six financial variables (Guichard and Turner, 2008), where the variables are weighted according to their effects on GDP over the next four to six quarters. The OECD set the index weights from a regression of the output gap on a distributed lag of the financial indicators. The weights were normalized relative to the change in interest rates.

Section III

Methodology

Before moving to the methodological discussion on construction of FCCI, let us interpret the concept of financial stress indicators; their identification procedures; construction of stress index and its difference from FCCI.

Financial stress is defined as the force put forth on economic agents by uncertainty and varying expectations of loss in financial markets. Study of financial stress in the economy is vital for the policy makers to effectively gauge the current status of the economy and to make informed decision. In order to quantify the financial stress in the economy, appropriate indicators from different sectors of the economy are selected first and then are combined by using suitable methods. In general, indicators are selected from various sectors of the economy viz. Banking Sector, Foreign exchange market, Debt market and Equity market. Financial Stress Index (FSI) attempts to combine all these different indicators into a unified index and quantify the current degree of stress in financial system. It captures the contemporaneous level of stress.

3.1 Identification of Financial Stress Indicators

The identification of financial stress indicators lies on the effective measures of probable loss, risk, and uncertainty in different financial sectors such as the banking, foreign exchange, debt, and equity markets.

3.1.1 Banking Sector

In banking sector, some of the measures which reflect the happening within the sector are "banking-sector beta", computed over a 12-month rolling window; Certificate of Deposit (CD) spread; and non-linear measure of volatility of banking stock. Beta greater than unity indicates that banking stocks are moving more than proportionately with the overall stock market, implying banking sector is relatively risky. The CD spread is computed over the short-term (overnight) weighted-average call money rates.

3.1.2 Foreign Exchange Market

Foreign exchange (currency) crises are usually defined as significant devaluations, losses in reserves, and/or defensive interest rate increases. Exchange market pressure index (EMPI) is an indicator constructed based on weighted average of change in exchange rate, foreign exchange reserve and interest rate. EMPI increases as the exchange rate depreciates or as international reserves decline. Further, the non-linear measure of volatility in exchange rate is also used as indicator.

3.1.3 Debt Market

Bordo and Schwartz (2000) characterize a debt crisis as the inability of sovereign nations or the broad private sector to service foreign debts. Some of the indicators pertaining to Debt markets are (a) corporate bond yield spread (All-rated long-term corporate bond yield minus the G-Sec long-term bond yield); (b) inverted yield curve: 10 year G-sec benchmark bond yields minus the 91Days Treasury bill rate; and (c) Commercial paper spread: Commercial paper rate minus 91Days Treasury bill rate.

3.1.4 Equity Market

Most studies define equity crises as a sharp decline in the overall market index. The decline can be indicative of greater expected loss, higher dispersion of probable loss (higher risk), or increased uncertainty about the return of firms. General stock Price Index as a per cent of its maximum value over the preceding one year; and non-linear measure of volatility of the General Stock Index are commonly used indicators for equity market.

3.2 Construction of Financial Stress Index (FSI)

The choice of how to combine the variables (the weighting method) is perhaps the most difficult aspect of constructing an FSI. Various weighting techniques such as factor analysis, variance-equal weights, and transformations of the variables using their sample Cumulative Distribution Functions (CDF) are being commonly used.

The basic idea of factor analysis is to extract weighted linear combinations (factors) of a number of variables. This technique has two main purposes, *viz.*, reduction of number of variables, and detection of the structure in the relationships between variables. A variance-equal weighting method generates an index that gives equal importance to each variable. The variables are assumed to be normally distributed, which is the primary drawback of this approach. The mean is subtracted from each variable before it is divided by its standard deviation, hence the term "variance-equal" weights. In case of Cumulative Density Functions (CDFs) method, each variable is transformed into percentiles based on its sample CDF, such that the most extreme values, corresponding to the highest levels of stress, are characterized as the 99th percentile. The smallest values, corresponding to the lowest levels of stress, are characterized as the first percentile. The transformed variables are then summed equally to create the composite indicator.

3.3 Relationship between FSI and FCCI

The terms "financial conditions" and "financial stresses" are almost similar, each bearing the current state of financial variables. StijnClaessens (2010) of International Monetary Fund (IMF) mentioned FCCI as the counterpart of FSI; where, FSI and FCCI captured the stress and buoyancy of financial markets, respectively. Hatziuset. al. (2010) defined FCCI as a summarization of information about the future state of economy contained in the current financial variables. They referred FCCI as a measure of financial shocks, exogenous in nature, and thereby free from endogenous reflection of past economic activity. Illing and Liu (2003) identified stress as the product of a vulnerable structure and some exogenous shock. If financial stress is systemic, economic behaviour can be altered sufficiently to have adverse effects on the real economy. Therefore, financial stress is a continuous variable with a spectrum of values, where extreme values are called a crisis.

3.4 Construction of FCCI

In order to construct FCCI, the identification of a group of indicators, those capture the build-up of vulnerabilities and imbalances within the main segments of the domestic financial market, has of prime importance. There is a vast range of potential financial variables to be included in FCCI. However, it is observed that, in seven Financial Conditions Indexes, described in Section II, the indicators from four different markets, viz., money market (indicators are TED spread,[4]Commercial Paper/T-Bill Spread, Libor-OIS[5] Spread, etc.), debt market (indicators are yield

[4] TED spread is difference between interest rates on interbank loans and on Treasury Bills.

[5] LIBOR-OIS is the difference between LIBOR and the overnight indexed swap (OIS) rates.

spreads, corporate spreads, short-term bond yield, a long-term corporate yield, etc.), equity market (indicators are equity values, real stock market capitalization, etc.) and foreign exchange market (indicators are trade-weighted dollar, real effective exchange rate, etc.) were selected for constructing a single index. Apart from the above indicators, housing market indicators like real housing wealth to GDP, energy prices, money supply, etc. were also used. Once the indicators are selected, the next step is to combine the selected indicators using either of the two broad methods as detailed below.

Method 1: (a) Standardising the indicators (subtracting mean and then dividing by standard deviation), or alternatively, converting the indicators into percentile score (Cumulative Density Function (CDF)) and then (b) computing arithmetic average of these standardised indicators.

Method 2: This method differs from the standard applications for summarizing the information contained in the selected financial indicators, by eliminating feedback from macroeconomic conditions, and by using more than a single principal component (Hatzius et. al. (2010)). The variability in each of the indicators explained by current and past real activity and inflation, are eliminated so that the principal components reflect exogenous information associated with the financial sector, rather than feedback from macroeconomic conditions. In some sense, the residuals, obtained by eliminating feedback impact reflect financial market behaviour not fully explained by macro-fundamentals. Summarising the information collected in residuals, the top factors containing the maximum information (relating to the financial sector) are extracted through Principal Component Analysis (PCA). FCCI is then constructed as the weighted average of the factors, weights being taken as percentage variation explained by the factors.

In this paper, Method 2 was followed for constructing the indicator. Following the approach of Hatzius *et. al.* (2010), let us consider, X_{it} as i^{th} financial indicator at time "t", and Y_t as a vector of macroeconomic indicators. In this paper, the year-on-year (YoY) growth rates of Index of Industrial Production (IIP) and Wholesale Price Index (WPI) are considered. The regression equation thus constructed is as follows:

$$X_{it} = A_i(L)Y_t + \nu_{it} \tag{1}$$

where, $A(L)$ is the polynomial of lag "L", ν_{it} is uncorrelated with current and lagged values of Y_t and hence, it is assumed that, the feedback impacts of economic activity and inflation are removed. Further, we consider the decomposition of ν_{it} as follows:

$$\nu_{it} = \lambda_i^{/} F_t + u_{it} \tag{2}$$

where, F_t is a vector of unobserved financial factors, u_{it} captures "unique" variation in ν_{it} that is unrelated to F_t and Y_t. Under the assumption that u_{it}'s are uncorrelated (or "weakly" correlated) across the financial variables, the vector F_t captures the co-movement in financial indicators. Thus the goal of the econometric analysis is to estimate F_t. When the panel is balanced, the solution to least squares problem provides principal components of estimated residuals $\hat{\nu}_{it}$, which can be computed as the eigenvectors of sample covariance matrix. In the unbalanced panel, iterative methods can be used to find the least squares solution.

3.5 Derivation of Threshold Value for FCCI

Identification of threshold value for FCCI is important because, whenever the index crosses the value, it implies significant financial stress in the system. Threshold values for are derived on the basis of historical financial stress episodes, which precede the economic slowdowns or the loss of level of the real output. However, there is no unique way to identify the stress episodes.

3.5.1 Opinion Survey of Experts

In order to identify most stressful events/periods and the reasons behind those events happened economy in the past, the opinion survey of experts, including policy-makers, economists, market participants, etc., may be conducted (Illing and Liu (2003)). The study based on survey data may be used to build the relationship of those events with FCCI for validation and identification of threshold level of FCCI.

3.5.2 Kernel Density Approach

Based on the probability distribution of individual indicators, the threshold for indicators (similar to Value at Risk) may be identified, and diffusion index (i.e. proportion of indicators exceeds its own threshold) may be constructed. In this approach, $90^{th}/95^{th}$ percentile value may be considered.

3.6 Construction of Leading Indicator for FCCI

The study of financial conditions of economy should not be complete until the early warning signals of financial stress are identified. In this context, the major task is to detect the variables, from a list of selected variables that are able to provide signals in advance, i.e., detection of lead indicators.

In order to construct a composite leading indicator for FCCI, a list of potential indicators is at first prepared. The leading property of these indicators is judged by cross-correlation analysis and pair-wise Granger Causality test. Thereafter, the factor analysis technique is applied on these selected indicators for extracting the common unobserved leading forces. The weighted combination of extracted factors (weights being the percentage variations explained by the factors) is the composite leading indicator for FCCI.

Section IV

Empirical Analysis

This section describes the empirical analysis related to construction of FCCI, identification of stress period, measurement of threshold value, and finally, construction of leading indicator for FCCI.

4.1 Data Source and Frequency of Indicators

To construct the FCCI for India, ten indicators were selected from different sectors, viz., Banking sector, Equity market, Bond market, Foreign exchange market, Monetary sector, etc., of the Indian financial system. These indicators, along with definitions, are presented in Table 1.

The analysis for constructing FCCI was performed on monthly basis for the period April 2004 to March 2014. All data series required to construct the FCCI for India was collected from the Database on Indian Economy (DBIE), Reserve Bank of

India. All the selected indicators were standardised. The series which depict seasonality were adjusted prior to standardization.

Selected Indicators for constructing FCCI

Table 1

Sector	Indicators
Banking	**(1) Banking Beta:** β = cov(r,m)/var(m),calculated monthly over a rolling 1-year time horizon, where, r = per cent change (YoY) in Bank Total price Index (BANKEX); m = per cent change (YoY) in general stock index (SENSEX)
	(2) CD spread: CD rate minus 15–91Days TBills rate
Foreign Exchange	**(3) Exchange Rate Market Pressure (EMP):** Weighted average of change in exchange rate, foreign exchange reserve and interest rate.
	(4) USD_NNL_SD: ARCH(1) measure of volatility of INR-USD exchange rate.
Debt	**(5) Inverted Yield Spread:** 15–91Days TBills rate minus 10 year Government of India benchmark bond yields
	(6) CP spread: CP rate minus 15–91Days TBills rate
Equity	**(7) Calibrated YoY Stock Return (STOCK_YOY_CALB):** (Maximum of YoY return of NIFTY index)minus (current month YoY NIFTY return)
	(8) SENSEX_NNL_SD: ARCH(1) measure of volatility of BSE SENSEX.
Monetary Sector	**(9) DLM3_SA:** Seasonally adjusted Month-over-Month (MoM) change in M3.
Commodity Price	**(10) DLGOLDP:** MoM change in Gold Price.

Note: ARCH implies Autoregressive Conditional Heteroskedasticity

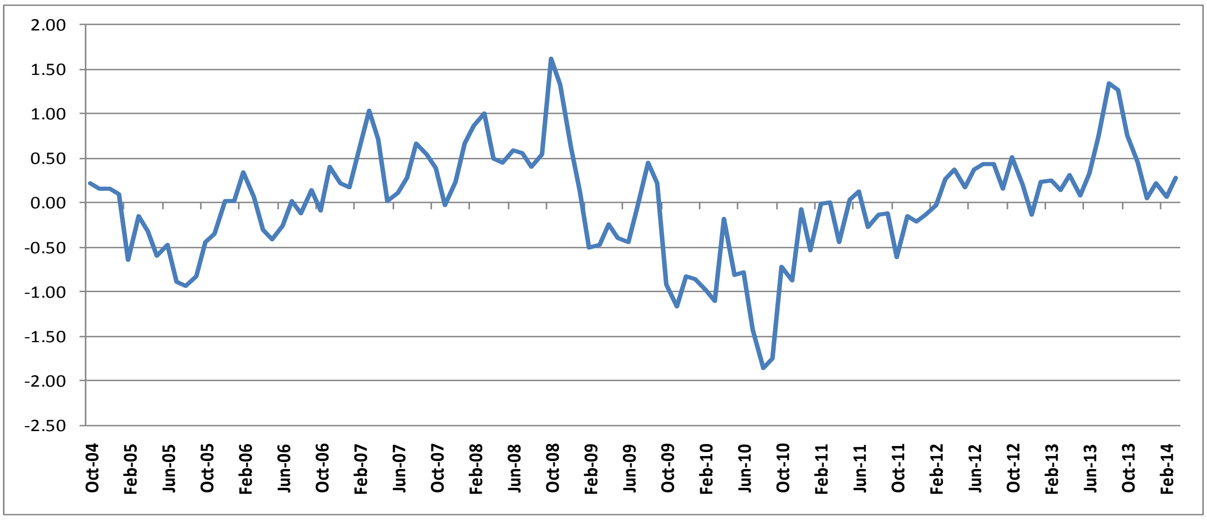
4.2 Construction of factors and FCCI

As described in the methodology mentioned in sub-section 3.5, the year-on-year growth rate of monthly Index of Industrial Production (IIP) and Wholesale Price Index (WPI) were considered as the performance of economic activity and measure of inflation, respectively. These series were also standardised before running equation (1) on each of the ten selected indicators. Six months lags of IIP growth and inflation were imposed in the equation. The residual series, hence obtained, could be treated as free from feedback impacts of economic activity and inflation. Table 2 shows the correlation between extracted residual series of indicators. Some indicators show high correlations in the residual series. In order to extract the common forces from residual series, such that, common forces are orthogonal to each other, the factor analysis based on principal component technique was applied. Accordingly, three factors were extracted. The weighted aggregation of selected factors (weights being determined according to the respective percent variation explained) was considered as FCCI for the economy (Chart 1).

Correlation Table of Residual Series of Selected Indicators Table 2

	DLM3_SA	DLGOLDP	Banking Beta	SENSEX_NNL_SD	STOCK_YOY_CALB	CD spread	CP spread	EMP	Inverted Yield Spread	USD_NNL_SD
DLM3_SA	1.00									
DLGOLDP	0.05	1.00								
Banking Beta	-0.09	-0.02	1.00							
SENSEX_NNL_SD	0.11	0.04	-0.14	1.00						
STOCK_YOY_CALB	0.03	-0.07	0.10	0.32	1.00					
CD spread	0.16	0.03	-0.38	0.35	0.42	1.00				
CP spread	0.14	0.06	-0.30	0.34	0.38	0.87	1.00			
EMP	0.11	0.13	0.01	-0.06	0.11	-0.06	-0.05	1.00		
Inverted Yield Spread	-0.01	0.01	0.38	-0.26	-0.05	-0.50	-0.35	0.11	1.00	
USD_NNL_SD	-0.01	-0.11	0.03	0.27	0.27	0.17	0.22	0.08	0.03	1.00

Financial Conditions Composite Indicator for India Chart 1

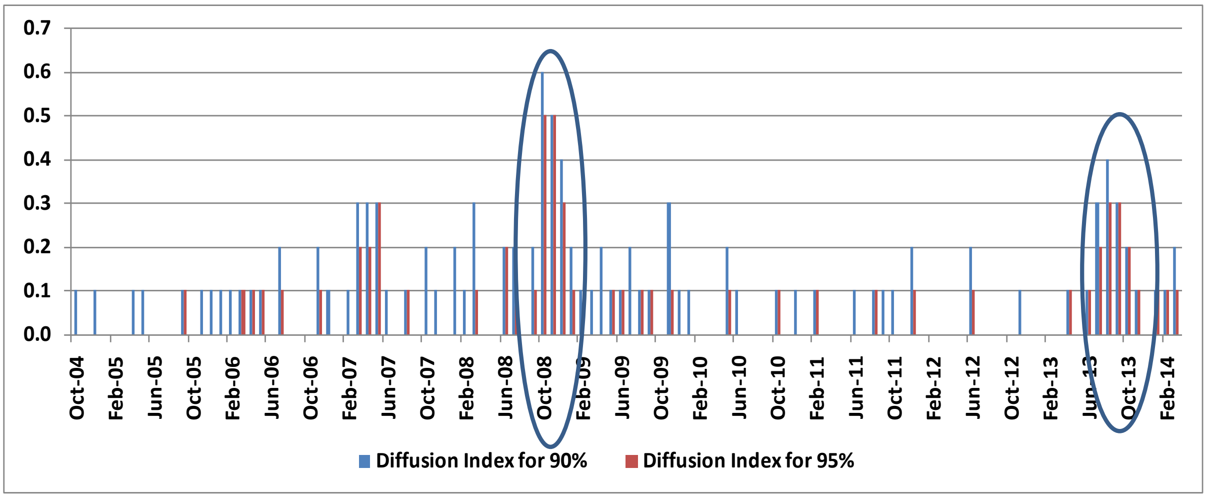


4.3 Derivation of threshold value for FCCI

To estimate the threshold value of FCCI and to identify the stress point, the kernel density approach was considered. The kernel densities of residual of ten selected indicators as well as the diffusion index are provided in Annex 1. Based on probability distribution of individual indicators and risk appetite, the threshold values for indicators were identified (similar to Value-at-Risk technique). Thereafter, the diffusion index i.e. proportion of indicators exceeding its own threshold, was constructed (Chart 2). During the stress period, the diffusion index usually shows high value. If 90th percentile of the monthly diffusion index is selected as the threshold value, then the corresponding average FCCI value is the considered as threshold for FCCI. Accordingly, at 90th and 95th percentile levels, the threshold value for FCCI stood at 1.04 and 1.51, respectively (Chart 3). During the period under study, i.e., April 2004 to March 2014, based on FCCI and threshold values, the sub-periods "*September 2008 to December 2008*" and "*August–September 2013*" are the stressful periods. Specifically, the month "*October 2008*" is identified as the most stressful period of the Indian economy. The first sub-period coincides with global financial crisis of 2008. In case of second sub-period, the stress is short-lived, and it aligns with the period of latest currency crisis. During this period, the Indian Rupee to US Dollar (INR-USD) reference rate touched the highest level at 68.3611 (date: 28-August-2013).

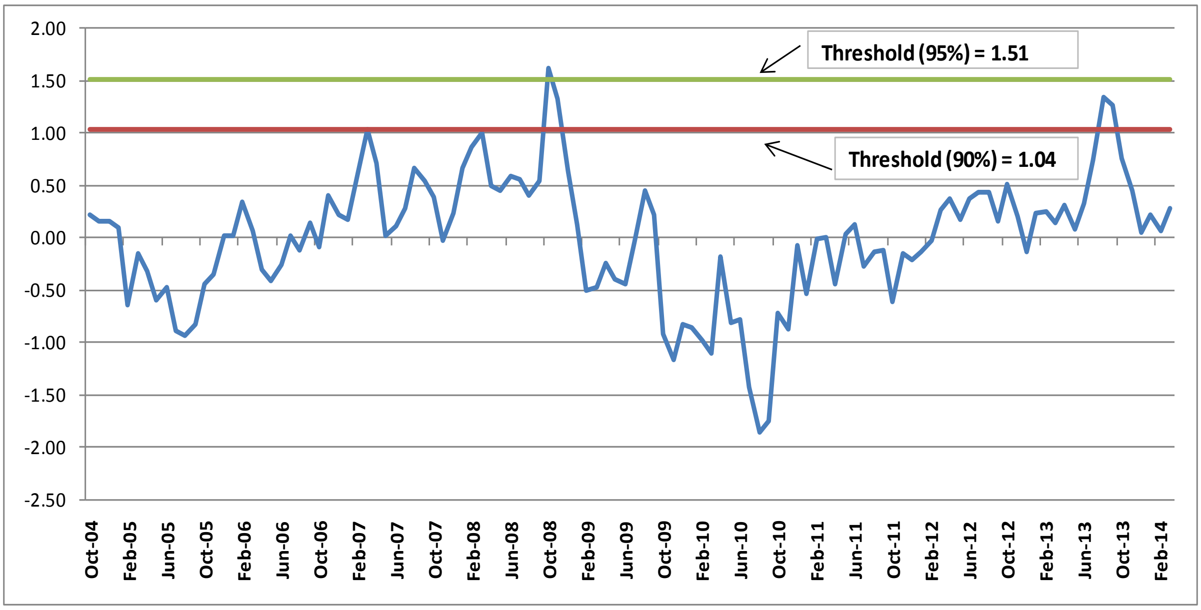
Diffusion Index of Indicators exceeding respective threshold value

Chart 2



Financial Conditions Composite Indicator for India

Chart 3



4.4 Composite Leading Indicator for FCCI

Different indicators are selected from different sectors of the economy for judging the leading properties of them (Table 3). Exports (in US$), Imports (in US$), Terms of Trade (i.e., Exports to Imports ratio), and Net inflows of Foreign Institutional Investment (FII) in debt and equity segments are taken from external sector. From the banking sector, deposits volume, credit volume, deposits rate, lending rate, assets with bank, investment in India, and net foreign exchange assets are considered. All the series, expect Terms of Trade, Net FII inflows, deposits rate, and lending rate, are taken in terms of year-on-year growth rates. The selected eleven series are also stationary, based on standard unit root tests. The leading properties of these indicators are tested by cross-correlation analysis and pair-wise Granger causality test.

Cross Correlation of Indicators with FCCI

Table 3

Indicator\No. of month (i)		0	1	2	3	4	5	6	7	8	9	10	11	12
Exports	Lag	-0.139	-0.125	-0.081	-0.066	-0.008	0.000	0.039	0.041	0.047	0.101	0.110	0.196	0.228
	Lead	-0.139	-0.170	-0.158	-0.249	-0.304	-0.352	-0.377	-0.343	-0.385	-0.389	-0.425	-0.402	-0.388
Imports	Lag	-0.153	-0.057	0.005	-0.005	-0.009	-0.054	-0.042	0.009	0.081	0.176	0.258	0.297	0.285
	Lead	-0.153	-0.189	-0.185	-0.165	-0.173	-0.155	-0.157	-0.138	-0.194	-0.262	-0.303	-0.301	-0.250
Terms of Trade	Lag	0.022	-0.046	**-0.101**	-0.097	-0.080	-0.033	0.024	0.015	-0.039	-0.052	-0.115	-0.049	0.035
	Lead	0.022	-0.020	-0.038	-0.123	-0.159	-0.194	-0.227	-0.259	-0.254	-0.175	-0.184	-0.111	-0.150
Net FII inflows - Debt and Equity	Lag	**-0.333**	**-0.305**	**-0.300**	-0.158	-0.114	-0.095	-0.047	-0.023	0.053	0.003	-0.046	-0.002	0.069
	Lead	-0.333	-0.247	-0.268	-0.236	-0.203	-0.136	0.005	-0.002	-0.096	-0.114	-0.098	-0.040	-0.061
Aggregate Deposits	Lag	0.212	0.203	**0.242**	0.230	0.200	0.182	0.146	0.129	0.105	0.067	0.021	0.010	-0.005
	Lead	0.212	0.190	0.184	0.198	0.186	0.181	0.238	0.219	0.201	0.190	0.166	0.177	0.149
Non-Food Bank Credit	Lag	0.022	0.005	0.008	0.020	0.027	0.065	0.081	0.103	0.134	0.164	0.169	0.182	0.191
	Lead	0.022	-0.021	-0.075	-0.122	-0.155	-0.166	-0.146	-0.147	-0.131	-0.139	-0.159	-0.172	-0.198
Deposits Rate	Lag	**0.528**	**0.520**	**0.499**	0.485	0.466	0.431	0.417	0.391	0.356	0.330	0.276	0.209	0.143
	Lead	0.528	0.510	0.491	0.447	0.413	0.365	0.309	0.246	0.190	0.129	0.077	0.014	-0.034
Lending Rate	Lag	0.413	0.360	0.278	0.181	0.128	0.067	0.058	0.029	0.031	0.030	-0.005	-0.030	-0.069
	Lead	0.413	0.427	0.442	0.417	0.446	0.476	0.490	0.506	0.519	0.509	0.449	0.381	0.342
Assets with banks	Lag	0.097	0.196	0.255	**0.295**	0.285	0.267	0.254	0.224	0.188	0.159	0.175	0.172	0.153
	Lead	0.097	0.037	0.012	0.038	0.050	0.059	0.048	0.009	-0.046	-0.063	-0.079	-0.146	-0.170
Scheduled Commercial Banks' Investment in India	Lag	0.107	0.060	0.015	-0.027	-0.060	-0.072	-0.103	-0.119	-0.179	-0.236	-0.308	-0.351	-0.388
	Lead	0.107	0.126	0.173	0.216	0.240	0.263	0.303	0.355	0.413	0.448	0.446	0.440	0.405
Net Foreign Exchange Assets	Lag	0.413	0.427	0.426	0.454	0.486	**0.490**	0.446	0.420	0.386	0.327	0.277	0.223	0.157
	Lead	0.413	0.371	0.334	0.310	0.272	0.238	0.206	0.184	0.132	0.125	0.105	0.085	0.050

Table 4 presents the cross-correlation between different indicators and FCCI values upto 12 months. Here, "i" indicates lead or lagged number of months. Fori = 0, the contemporaneous correlations are reported. The "lag" row for each indicator at ith month indicates the correlation of current FCCI value with i^{th} month lagged value of corresponding indicator. For "lead" rows, the correlation coefficients between lead values of indicators with current FCCI values are mentioned. Hence, for selecting leading indicators, "lag" row values are important. However, "lead" rows also tell whether FCCI is leading or not.

Out of four selected external sector indicators, exports and imports are lagging to FCCI. This is observed from the movement of correlation of "lead" rows. From the "lag" rows, if the lags upto eight months are considered, then contemporaneous correlation coefficient is highest for both cases. Thereafter, the decrease in correlation is observed. Further, the values of correlation coefficient in "lead" rows are higher than those of "lag" rows. The third indicator, "Terms of Trade" is showing leading nature (at lag 2) to FCCI, although the correlation coefficient is very low (–10.1 percent). Further, almost all the lead correlations are higher than the lag correlations. The pair-wise Granger causality test in Table 4 also does not indicate its leading nature. As this indicator includes both of the merchandise exports and imports information, hence based on cross correlation information, it is selected as a leading indicator. Moreover, it has also been observed at the time of aggregation of selected leading indicators that, the inclusion of this indicator has improved the leading capability of composite indicator. In case of Net FII Inflows in Debt and Equity segments, the contemporaneous correlation is highest. As the lag increases, the correlation value decreases. It is observed from the "lag" row that, upto lag 2, this decrease is not rapid. But in the "lead" row, the correlation is lower and its decrease is also rapid. This indicates a possibility of leading property of the indicator.

Among the banking sector indicators, Non-food Bank Credit, Scheduled Commercial Banks' (SCB) Domestic Investment, and Lending Rate are lagging to FCCI. The cross correlation pattern of Deposits Rate is similar to that of Net FII inflows. The remaining three indicators, *viz.*, Aggregate Deposits, Assets with banks, and Net Foreign Exchange Assets are leading to FCCI with 2, 3, and 5 months, respectively.

Next we describe the results obtained from pair-wise Granger causality test. Table 4 presents the probabilities of F-statistics corresponding to the test. The null hypothesis is one variable does not Granger cause the other. If 5 percent level of significance is considered, then Deposits rate, Assets with banks, and Net Foreign Exchange Assets cause FCCI at 2, 1, and 3 lags, respectively; i.e., these indicators are leading to FCCI. Further, FCCI is leading to Exports, Non-Food Bank Credit, and Lending Rate. For the other five indicators, no causality hypothesis is accepted.

Probabilities of F-statistics in Pair-wise Granger Causality Test — Table 4

Indicator\No. of month (i)		0	1	2	3	4	5	6	7	8	9	10	11	12
Exports	Lag	-0.139	-0.125	-0.081	-0.066	-0.008	0.000	0.039	0.041	0.047	0.101	0.110	0.196	0.228
	Lead	-0.139	-0.170	-0.158	-0.249	-0.304	-0.352	-0.377	-0.343	-0.385	-0.389	-0.425	-0.402	-0.388
Imports	Lag	-0.153	-0.057	0.005	-0.005	-0.009	-0.054	-0.042	0.009	0.081	0.176	0.258	0.297	0.285
	Lead	-0.153	-0.189	-0.185	-0.165	-0.173	-0.155	-0.157	-0.138	-0.194	-0.262	-0.303	-0.301	-0.250
Terms of Trade	Lag	0.022	-0.046	**-0.101**	-0.097	-0.080	-0.033	0.024	0.015	-0.039	-0.052	-0.115	-0.049	0.035
	Lead	0.022	-0.020	-0.038	-0.123	-0.159	-0.194	-0.227	-0.259	-0.254	-0.175	-0.184	-0.111	-0.150
Net FII inflows - Debt and Equity	Lag	**-0.333**	**-0.305**	**-0.300**	-0.158	-0.114	-0.095	-0.047	-0.023	0.053	0.003	-0.046	-0.002	0.069
	Lead	-0.333	-0.247	-0.268	-0.236	-0.203	-0.136	0.005	-0.002	-0.096	-0.114	-0.098	-0.040	-0.061
Aggregate Deposits	Lag	0.212	0.203	**0.242**	0.230	0.200	0.182	0.146	0.129	0.105	0.067	0.021	0.010	-0.005
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	Lead	0.022	-0.021	-0.075	-0.122	-0.155	-0.166	-0.146	-0.147	-0.131	-0.139	-0.159	-0.172	-0.198
Deposits Rate	Lag	**0.528**	**0.520**	**0.499**	0.485	0.466	0.431	0.417	0.391	0.356	0.330	0.276	0.209	0.143
	Lead	0.528	0.510	0.491	0.447	0.413	0.365	0.309	0.246	0.190	0.129	0.077	0.014	-0.034
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	Lead	0.413	0.427	0.442	0.417	0.446	0.476	0.490	0.506	0.519	0.509	0.449	0.381	0.342
Assets with banks	Lag	0.097	0.196	0.255	**0.295**	0.285	0.267	0.254	0.224	0.188	0.159	0.175	0.172	0.153
	Lead	0.097	0.037	0.012	0.038	0.050	0.059	0.048	0.009	-0.046	-0.063	-0.079	-0.146	-0.170
Scheduled Commercial Banks' Investment in India	Lag	0.107	0.060	0.015	-0.027	-0.060	-0.072	-0.103	-0.119	-0.179	-0.236	-0.308	-0.351	-0.388
	Lead	0.107	0.126	0.173	0.216	0.240	0.263	0.303	0.355	0.413	0.448	0.446	0.440	0.405
Net Foreign Exchange Assets	Lag	0.413	0.427	0.426	0.454	0.486	**0.490**	0.446	0.420	0.386	0.327	0.277	0.223	0.157
	Lead	0.413	0.371	0.334	0.310	0.272	0.238	0.206	0.184	0.132	0.125	0.105	0.085	0.050

Note: The symbol ≠> means "does not Granger cause"

Based on cross-correlation analysis and pair-wise Granger causality test, the indicators, that are finally selected, are Terms of Trade, Net FII inflows, Aggregate Deposits, Deposits Rate, Assets with banks, and Net Foreign Exchange Assets (Charts in Annex 2). Among these indicators, Deposits Rate, Assets with banks, and Net Foreign Exchange Assets satisfy both procedures.

The aggregation of six finally selected indicators is done by factor analysis technique for arriving at composite leading indicator for FCCI. The main advantage of using factor analysis technique is that, it extracts the common unobserved forces (i.e., factors) from the system, so that these factors are orthogonal to each other. It also reduces the number of variables. Further, it solves the scaling problem, because, the preliminary descriptive statistics (i.e., mean, median, minimum, maximum, standard deviation) of different indicators have different magnitudes and scales (Table 5). From six indicators, two factors are extracted. The weighted combination of these two factors is the required composite leading indicator for FCCI. Here, weights are percentage variations explained by the factors (weights: 54.6 percent and 45.4 percent).

Descriptive Statistics of selected Leading Indicators of FCCI

Table 5

Indicator	Mean	Median	Minimum	Maximum	Range	Standard Deviation
Terms of Trade	66.8	66.2	47.5	91.0	43.5	8.3
Net FII inflows	1338.0	1184.5	-7535.6	7164.4	14700.0	2374.1
Aggregate Deposits	18.1	17.6	10.2	25.9	15.7	3.8
Deposits Rate	7.8	8.3	5.3	9.6	4.4	1.1
Assets with banks	16.9	16.5	-35.5	68.2	103.7	20.3
Net Foreign Exchange Assets	10.3	9.4	-7.5	45.7	53.2	10.4

Movement of FCCI and its Composite Leading Indicator

Chart 4

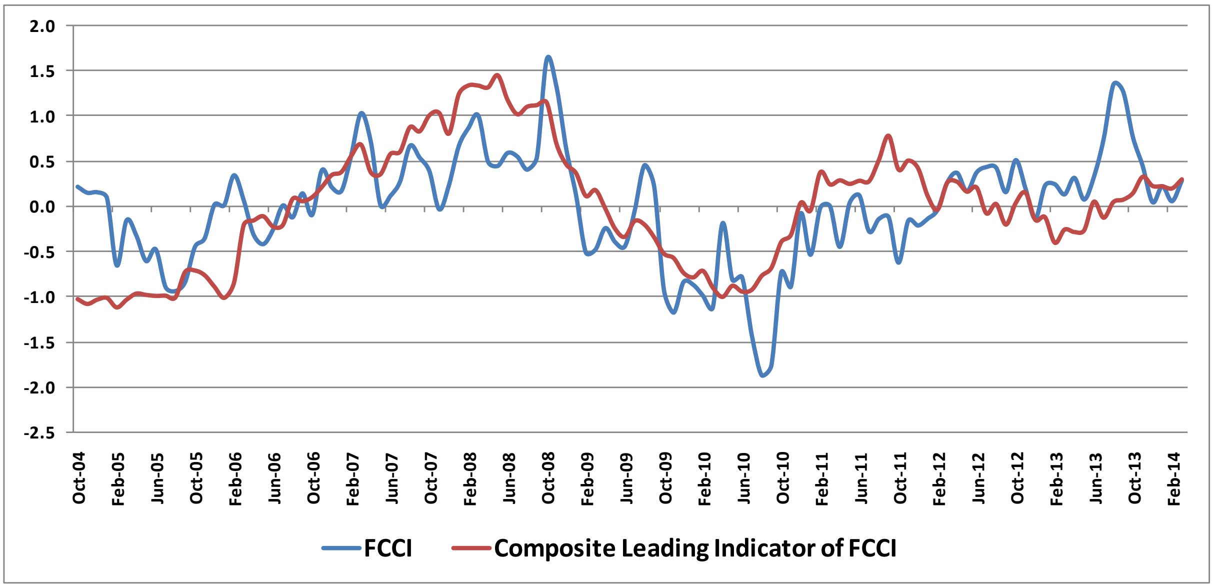


Chart 4 presents the movements of FCCI and its composite leading indicator (CLI) for the period October 2004 to March 2014. From the visual inspection, it is observed that, CLI captures the stress during the sub-period "*September 2008 to December 2008*" in Indian financial system well in advance. For the second sub-period "*August–September 2013*", the upward movement in stress is also captured by CLI well in advance. However, the movement of CLI during the period "December 2013 to March 2014" indicates persistence of stress at lower level. The pair-wise Granger causality test between FCCI and its CLI as well as turning point analysis also supports leading properties of CLI (Tables 6 and 7). Based on these two procedures, it may be concluded that, the movement of CLI is, on an average, 3–4 months leading to FCCI.

Granger Causality Test (FCCI and its CLI) – Probabilities of F-statistics Table 6

		1	2	3	4	5	6
CLI of FCCI	**≠> FCCI**	**0.008**	**0.017**	**0.032**	0.086	0.313	0.156
FCCI	**≠> CLI of FCCI**	0.478	0.700	0.787	0.868	0.889	0.905

Note: The symbol ≠> means "does not Granger cause"

Turning Point Analysis between FCCI and its CLI Table 7

Turning Point Date for		**Lead (in months)**
FCCI	**CLI of FCCI**	
Oct-08	May-08	5
Aug-10	Apr-10	4
May-13	Feb-13	3
Average Lead		**4**

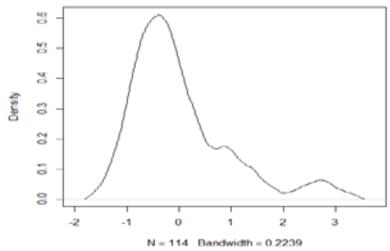
Section V

Conclusion

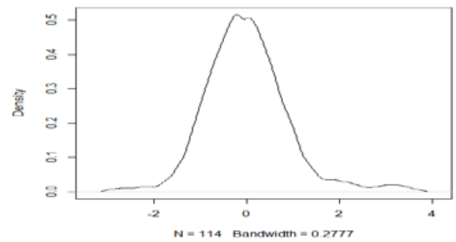
Financial stability of a country needs to be tracked as an explicit policy variable for ensuring future macroeconomic stability. This study essentially explores the relationship between financial conditions and economic activity for India. An attempt has been made to construct the Financial Conditions Composite Indicator (FCCI) for India following the principal component analysis (PCA) applied by Hatzius *et. al.* (2010). In this approach, at first, the indicators were selected from different sectors viz., Banking sector, Equity market, Bond market, Foreign exchange market, Monetary sector, etc., of Indian economy, and thereafter, the feedback impacts of economic growth and inflation on different financial indicators were removed, so that, financial market behaviour was not fully explained by macroeconomic fundamentals. Subsequently, PCA was applied on the resultant residual series, which were free from effect of economic growth and inflation. The weighted aggregation of extracted three factors was considered as FCCI. To estimate the threshold value of FCCI and to identify the stress point, kernel density approach was considered. Thereafter, the diffusion index i.e. proportion of indicators exceeding its own threshold level, was constructed. Based on risk appetite, the threshold value for FCCI was determined. During the period under study, i.e., April 2004 to March 2014, based on constructed FCCI and its 90th and 95th percentile threshold values, (i.e., 1.04 and 1.51, respectively), the sub-period "*September 2008 to December 2008*", and specifically, the month "*October 2008*" was identified as the most stressful period of the economy. Further, in order to identify the early warning signals of financial stress in the economy, a Composite Leading Indicator (CLI) for FCCI was constructed. It was found that, CLI captured upward movement in stress well in advance. However over time, the effectiveness of selected leading indicators for FCCI may be reduced and certain other indicators may exhibit the leading properties. Hence, it is imperative to update the list of selected indicators and judge the leading properties of these indicators on a continuous basis while constructing and updating CLI of FCCI.

Annex 1

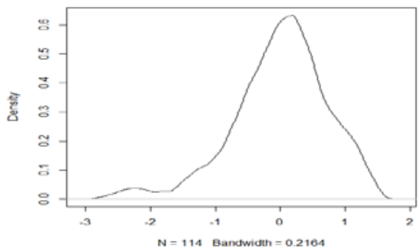
USD_NNL_SD



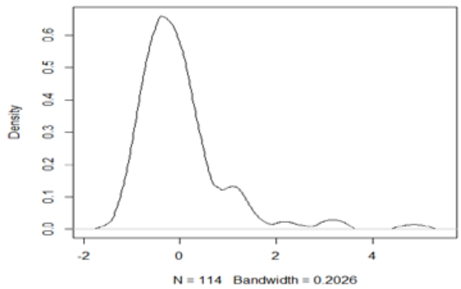
EMP



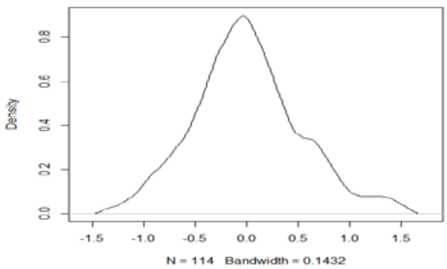
BANKING BETA



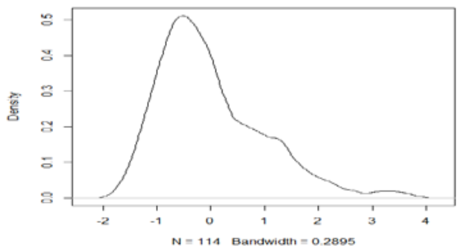
SENSEX_NNL_SD



STOCK_YOY_CALB



CD_Y91



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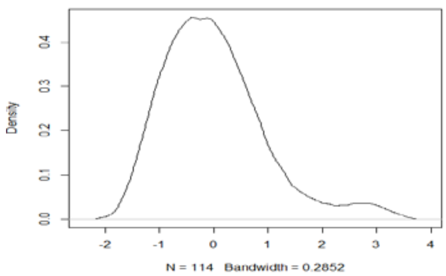

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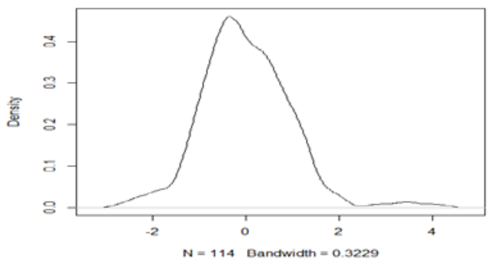

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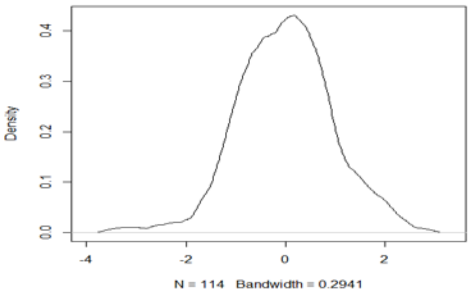
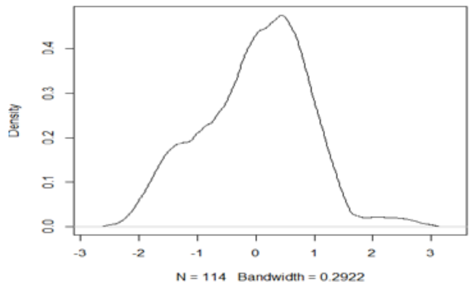
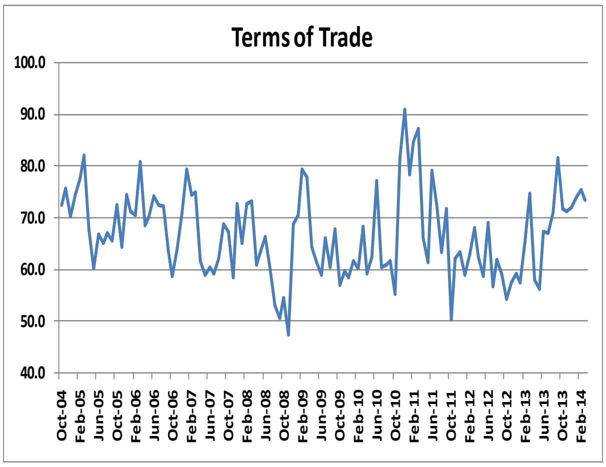
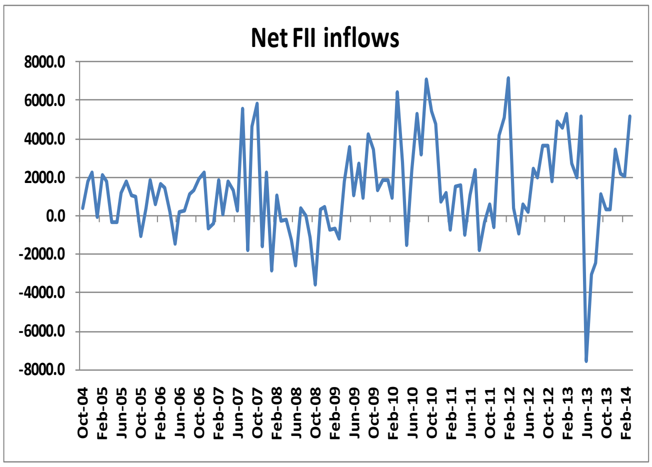


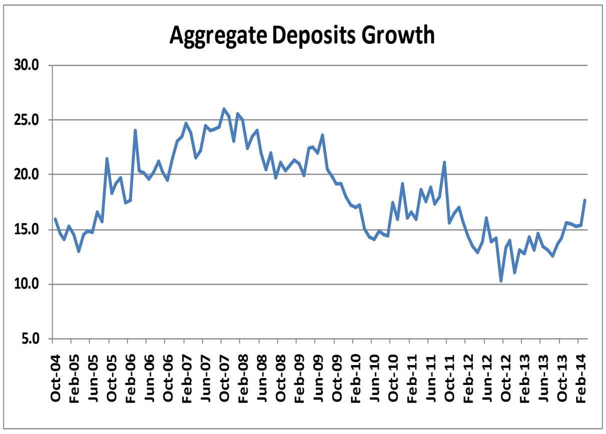
INV_YIELDNEG

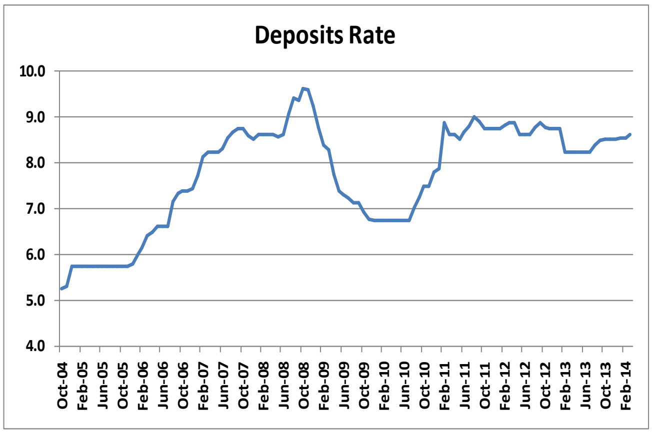


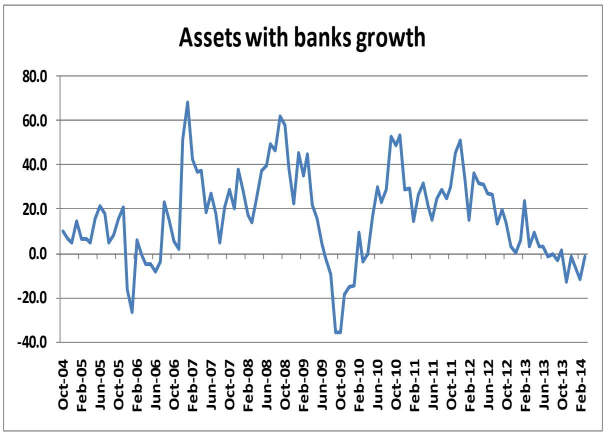
Annex 2

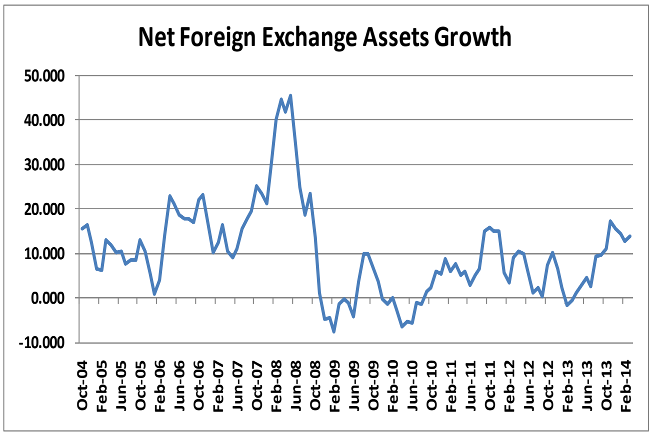

Terms of Trade
100.0 90.0 80.0 70.0 60.0 50.0 40.0
Oct-04 Feb-05 Jun-05 Oct-05 Feb-06 Jun-06 Oct-06 Feb-07 Jun-07 Oct-07 Feb-08 Jun-08 Oct-08 Feb-09 Jun-09 Oct-09 Feb-10 Jun-10 Oct-10 Feb-11 Jun-11 Oct-11 Feb-12 Jun-12 Oct-12 Feb-13 Jun-13 Oct-13 Feb-14


Net FII inflows
8000.0 6000.0 4000.0 2000.0 0.0 -2000.0 -4000.0 -6000.0 -8000.0
Oct-04 Feb-05 Jun-05 Oct-05 Feb-06 Jun-06 Oct-06 Feb-07 Jun-07 Oct-07 Feb-08 Jun-08 Oct-08 Feb-09 Jun-09 Oct-09 Feb-10 Jun-10 Oct-10 Feb-11 Jun-11 Oct-11 Feb-12 Jun-12 Oct-12 Feb-13 Jun-13 Oct-13 Feb-14


Aggregate Deposits Growth
30.0 25.0 20.0 15.0 10.0 5.0
Oct-04 Feb-05 Jun-05 Oct-05 Feb-06 Jun-06 Oct-06 Feb-07 Jun-07 Oct-07 Feb-08 Jun-08 Oct-08 Feb-09 Jun-09 Oct-09 Feb-10 Jun-10 Oct-10 Feb-11 Jun-11 Oct-11 Feb-12 Jun-12 Oct-12 Feb-13 Jun-13 Oct-13 Feb-14


Deposits Rate
10.0 9.0 8.0 7.0 6.0 5.0 4.0
Oct-04 Feb-05 Jun-05 Oct-05 Feb-06 Jun-06 Oct-06 Feb-07 Jun-07 Oct-07 Feb-08 Jun-08 Oct-08 Feb-09 Jun-09 Oct-09 Feb-10 Jun-10 Oct-10 Feb-11 Jun-11 Oct-11 Feb-12 Jun-12 Oct-12 Feb-13 Jun-13 Oct-13 Feb-14


Assets with banks growth
80.0 60.0 40.0 20.0 0.0 -20.0 -40.0
Oct-04 Feb-05 Jun-05 Oct-05 Feb-06 Jun-06 Oct-06 Feb-07 Jun-07 Oct-07 Feb-08 Jun-08 Oct-08 Feb-09 Jun-09 Oct-09 Feb-10 Jun-10 Oct-10 Feb-11 Jun-11 Oct-11 Feb-12 Jun-12 Oct-12 Feb-13 Jun-13 Oct-13 Feb-14


Net Foreign Exchange Assets Growth
50.000 40.000 30.000 20.000 10.000 0.000 -10.000
Oct-04 Feb-05 Jun-05 Oct-05 Feb-06 Jun-06 Oct-06 Feb-07 Jun-07 Oct-07 Feb-08 Jun-08 Oct-08 Feb-09 Jun-09 Oct-09 Feb-10 Jun-10 Oct-10 Feb-11 Jun-11 Oct-11 Feb-12 Jun-12 Oct-12 Feb-13 Jun-13 Oct-13 Feb-14

References

Bordo, M. and A. Schwartz, (2000), "Measuring Real Economic Effects of Bailouts: Historical Perspectives on How Countries in Financial Stress Have Fared With and Without Bailouts", NBER Working Paper No. 7701.

Cassidy John, (2009), *How Markets Fail: The Logic of Economic Calamities*.

D'Antonio, P., Appendix, pages 26–28, in DiClemente, R. and K. Schoenholtz (September 26, 2008), "A View of the U.S. Subprime Crisis", EMA Special Report, Citigroup Global Markets Inc.

Dudley, W., and J. Hatzius (June 8, 2000), The Goldman Sachs Financial Conditions Index: The Right Tool for a New Monetary Policy Regime, Global Economics Paper No. 44.

Dudley, W., J. Hatzius, and E. McKelvey, (April 8, 2005), Financial Conditions Need to Tighten Further, US Economics Analyst, Goldman Sachs Economic Research.

Guichard, S. and D. Turner, (September 2008), "Quantifying the effect of financial conditions on US activity", OECD Economics Department Working Papers.

Hakkio, C. S. and W. R. Keeton, (2Q 2009), "Financial Stress: What is it, how can it be measured, and why does it matter?", Federal Reserve Bank of Kansas City *Economic Review*.

Hatzius J. Hooper P., Mishkin F., Schoenholtz K. L., and Watson M. W., (2010), "Financial Conditions Indexes: A Fresh Look after the Financial Crisis", Draft edition.

Hooper, P., T. Mayer and T. Slok, (June 11, 2007). "Financial Conditions: Central Banks StillAhead of Markets", Deutsche Bank, *Global Economic Perspectives*.

Hooper, P., T. Slok and C. Dobridge, (January 6, 2010), "Improving Financial Conditions BodeWell for Growth", Deutsche Bank, *Global Economic Perspectives*.

Mark Illing and Ying Liu, (2003), "An Index of Financial Stress for Canada", Bank of Canada working paper, 2003/14.

Reserve Bank of India, (2010), *Report on Currency and Finance 2008–09*.

Rosenberg, M., (2009), "Financial Conditions Watch", Bloomberg.

StijnClaessens, Giovanni Dell'Ariccia, DenizIgan, and Luc Laeven, (2010), "Lessons and Policy Implications from the Global Financial Crisis", IMF Working Paper, WP/10/44.

Stock, James H., and Mark W. Watson, (2002), "Has the Business Cycle Changed and Why?", NBER Macroeconomics Annual 2002, Volume 17.

The IMF, *World Economic Outlook*, April 2009.

Capital and Contagion in Financial Networks[1]

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Abstract

We implement a novel method to detect systemically important financial institutions in a network. The method consists in a simple model of distress and losses redistribution derived from the interaction of banks' balance-sheets through bilateral exposures. The algorithm goes beyond the traditional default-cascade mechanism, according to which contagion propagates only through banks that actually default. We argue that even in the absence of other defaults, distressed-but-non-defaulting institutions transmit the contagion through channels other than solvency: weakness in their balance sheet reduces the value of their liabilities, thereby negatively affecting their interbank lenders even before a credit event occurs. In this paper, we apply the methodology to a unique dataset covering bilateral exposures among all Italian banks in the period 2008–2012. We find that the systemic impact of individual banks has decreased over time since 2008. The result can be traced back to decreasing volumes in the interbank market and to an intense recapitalization process.

Keywords: Systemic risk; interbank market; contagion; network; feedback centrality

JEL Classification: C45; D85; G21; G01

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4 Bank of Italy.

5 Bank of Italy.

1. Introduction

Over the last decades, the global financial system has become increasingly large and interconnected. In several countries, a sizable fraction of the growth in the balance sheet of the financial sector before the crisis could be attributed to mutual claims and obligations among financial firms. Interconnectedness has been a key factor in precipitating the crisis as troubles to one financial institution quickly propagated to other entities. In the last quarter of 2008 a number of markets remained dysfunctional for weeks as investors were kept away by uncertainty over the actual structure of exposures. Events showed that contagion may jeopardize the smooth functioning of the global financial system, eventually imposing large social costs to the entire economy and forcing public authorities to step in. In the economic literature, network theory has been used to study the financial sector as a complex system of interlinked agents. Theoretical and empirical works have focused mainly on (i) the assessment of the likelihood of systemic contagion episodes, (ii) different contagion propagation channels and (iii) the link between the network topology and the resilience of the system. The vast majority of contributions investigate the contagion due to direct credit exposure between two counterparties. When bank i defaults, its creditor, say bank j, faces a loss that is proportional to the amount lent to bank i and to a certain recovery rate. Whenever the loss exceeds the equity, bank j also defaults. Bank j propagates the shock to its creditors and this may trigger a cascade of defaults. A measure of the defaulting banks in the cascade represents the systemic risk posed by bank i. This approach (contagion through default) fails to predict large contagion episodes. In particular, networks appear to be resilient up to a very high threshold (tipping point), defined in terms of the severity of the initial shock. Systemic events (i.e. a large number of defaults in the cascade) may occur only in the presence of very large exogenous shocks.

This paper proposes a novel method to study contagion in financial systems. The simple idea is that distressed-but-non-defaulting institutions transmit contagion before they actually default. In the previous example, only the default of bank i affects the equity of the bank j. However, even before a credit event occurs, bank j's balance sheet might become weaker: as distance-to-default shortens, the value of bank j liabilities – including interbank obligations – declines, thereby negatively affecting the creditors of bank j. As creditor banks themselves become weaker, in turn, they also transmit some degree of contagion to their own counterparties. As a general result, even if no institution actually fails, the overall system may become much more fragile, as a non-negligible portion of the network's equity is likely to be wiped out in a marked-to-market perspective.

Our paper aims at assessing the evolution of systemic risk in the Italian interbank network over the past few years: we analyze a dataset of bilateral exposures obtained from supervisory reports to the Bank of Italy. In doing so, we modify and improve a novel method put forward by Battiston et al. (2012), DebtRank, which implements the contagion through distress idea discussed above. Our measure, DR, is able to measure losses incurred by the network following the default of each participating bank even when no other default occurs. For each bank we compute a synthetic indicator – the DR – that expresses the fraction of the total equity of the network which would be affected by an exogenous shock to the bank. The basic idea underlying the metric is that whenever a debtor institution is weakened, the market value of creditor banks equity is affected even before the debtor institution actually defaults. The DR of an institution proxies its negative externality on the network. The increase over time of the DR of many individual institutions at the same time is a footprint of increased fragility of the network. The method is particularly suited at capturing network externalities as it quantifies systemic risk on a continuous scale and is not limited to the estimation of the tipping point. Therefore, it can be used to evaluate systemically important financial institutions and may also represent a benchmark to implement new stress testing exercises targeting linkages in the financial network other than interbank lending. This is a brief summary of the main results of the paper:

Traditional indicators underestimate contagion risk. DR captures features of a bank systemic importance, such as its positioning in the network's topology, that would not be apparent under standard default cascades models. In most cases, systemically relevant institutions under DR would pose no threat to the network if losses were computed through standard default cascades models.

The DR of Italian banking groups. Systemic risk in the Italian interbank network has decreased since 2008. The decline is mainly due to decreased interconnectedness in the unsecured interbank market, as opposed to decreased leverage in the system due to banks_ recapitalization process. Decreased interconnectedness can be traced backed to the sovereign bond crisis, which dramatically reduced the amount of wholesale funds reaching the domestic interbank market from international markets. In a sense, a crisis in the interbank market has become less likely over time as another crisis took place in the sovereign bond markets. Such a result suggests the existence of a sort of "interconnectedness cycle": the financial system is intertwined and contagion risk is high in "normal/good" times (in our sample period, before the sovereign debt crisis), the latter decreases with leverage in "bad" times.

Interconnectedness and macroprudential regulation. The evolution over time of the DR of Italian banks offers supports the case for countercyclical (macroprudential) capital regulation of banks. Through simple comparative statics, we show that the effect of a bank's capital on its systemic risk is much higher when the financial network is tightly interconnected, which is most likely to happen in good times. Counter-cyclical capital buffers as agreed by the Basel III accord may therefore substantially decrease systemic risk in good times. On the other hand, the release of the buffer in bad times would have a marginal impact on financial stability in the network.

Relationship to the literature. Interconnectedness has an ambiguous effect on the stability of financial systems (Stiglitz (2010)). On the one hand, linkages across agents may improve risk sharing and help allocating risks to those that are better equipped to bear them. On the other hand, such linkages swell complexity and ease the propagation of propagation of contagion if a shock affects the system. Interconnectedness is on the top of the international reform agenda. Over the past few years, researchers across the board have been working on the identification of early warning indicators beyond the micro-prudential risk metrics. Recently the literature proposed different methodologies to measure sources of systemic risk. Shapley values (Drehmann and Tarashev (2011)), the systemic expected shortfall (Acharya et al. (2010)) and CoVaR (Adrian and Brunnermeier (2011)) are among the most relevant proposals for micro-level indicators that do not rely on network analysis. However, several critics argued that these asset prices-based indicators might perform well as thermometers (coincident measures), but not as well as barometers (forward looking indicators). To the extent that they are backward-looking, these risk metrics are typically at their lowest just before financial collapse takes place and have therefore little predictive value.

In many cases, these indicators have been proposed to circumvent the lack of data on the real topology of financial systems and the associated impossibility to identify effective contagion paths among institutions. As an alternative, network analysis based on real data, when available, has been widely employed to explore the resilience of the system to contagion of the financial system. These techniques allow to take into account the simultaneous distribution of risks across agents, beyond the evaluation of the risk-bearing capacity of each of them. Ultimately, however, the success of network techniques is intimately linked to data availability and, in turn, new initiatives on data reporting and collection at both national and international level may be affected by the success of the network approach.

Complex systems in which agents interact can have a simple network representation. In the specific case of financial networks, each financial institution represents a node and bi- lateral exposures between financial institutions are the links (or edges). Network analysis can be positive or normative. The positive, or static network, analysis allows the characterization of the network topology by means of statistical tools. This helps reaching a better understanding of linkages, hubs and clustering within a financial system. The normative, or dynamic network, analysis consists in the computation of outcomes that follows from an initial network structure that is exogenously perturbed. These exercises provide an assessment of the relationship between the financial system architecture and its stability: results carry relevant information for regulators, to the extent that they help identifying non-linearities due to the network structure.

The interest and the number of contributions on financial networks are expanding considerably. Beyond the well established theoretical literature on financial contagion (Allen and Gale (2000), Freixas et al. (2000), Acemoglu et al. (2012)), the vast majority of empirical contributions finds that the default of an individual institution is typically not able to trigger a domino effect (see, e.g., Boss et al. (2004); Elsinger et al. (2003); Furfine (2003), Mistrulli (2011)[6]). On the basis of the large sequence of contagion episodes of the recent years, the adequacy of procedures used to carry out these contagion simulation exercises is under a severe scrutiny. Recent research tries to fill the gap between the predictions of models of contagion and the evidence from financial crises. More in detail, standard contagion analyses in network economies are characterized by a common, basic idea. An initial shock that hits a region of the network (e.g. a single bank) propagates through interconnected counterparties. In general, different kinds of shocks (default of a single or a group of entities, market freeze, macro shock to common risk factors, ...), contagion channels (direct exposures, fire sales, liquidity hoarding, ...) and indicators to express the systemic importance of individual institutions have been proposed and analyzed.

Cont et al. (2011) propose to complement the idiosyncratic shock with a macro shock that reduces the equity positions of all the banks in the network at the same

6 In the specific case of Mistrulli (2011), the paper considers unconsolidated exposures. In other terms, it focuses on individual banks and not on banking group. In this respect, differently from our work, the paper neglects the possibility of internal capital markets to efficiently manage the liquidity of the banking group.

time, reflecting some sort of common risk exposures. An additional mechanism that may concur to the aggravation of the contagion is the fire sale of assets from distressed institutions (Cifuentes et al. (2005), Caballero and Simsek (2009), Shleifer and Vishny (2011)): such a response is individually rational for a distressed bank, but it imposes a negative externality on other institutions in the network, depressing asset prices and producing an inefficient aggregate outcome (Gai and Kapadia (2010)).

2. Contagion through distress: the DR

Our work proposes a novel method to assess the systemic importance of individual banks. The key idea is that a clear limitation of contagion through default models is their inability to account for the fact that, even when the default does not propagate from a bank to its counterparties, some distress do propagate nevertheless. In this sense, the contagion through default approach implies an underestimation of the intensity of contagion mechanisms. On the other hand, regulatory constraints (such as BCBS rules on Large Exposures) should make the possibility of a default following the failure of a single counterparty highly unlikely. In our work, we explicitly account for the fact that the bank j importing the contagion becomes more fragile even in the case its equity is large enough to withstand the loss. The higher fragility reduces the (market) value of its debt, making (at least) unsecured bank j's claimholders more fragile as well. The idea is fully consistent with the Merton's view on the market value of the bank's debt. As a result, even in the absence of subsequent defaults in the cascade, there can still be a significant systemic impact of an initial adverse shock.

The DR is the measure of systemic risk derived from our contagion through distress mechanism. It complements traditional methods and provide a measure of the systemic importance of a bank even when default cascades models predict no impact at all. In particular, the DR is an extension of the so-called DebtRank algorithm introduced by Battiston et al. (2012). It is inspired by feedback centrality and takes recursively into account the impact of the distress of an initial node across the whole network.7 The DR is a measure of the centrality of the bank in the network and quantifies the propagation and the final outcome in terms of the economic value of the network potentially affected by the initial shock through the cascade of contagion.

Definition 1. *The DR of the bank i expresses the fraction of the total economic value of the network – excluding the bank i – posed at risk by some exogenous shock that hits the bank i. It captures the potential negative externality imposed to the network by the bank, excluding the direct impact of the exogenous shock.*

As an illustrative example, let's compute the DR of the bank i. Consider a simplified chain of unsecured loans granted by bank k to bank j and by bank j to bank i, whose amounts are denoted as x_{kj} and x_{ji}, respectively. Let E_i, E_j and E_k be the equity of the three banks and $E = E_i + E_j + E_k$. In the paper, we use the Tier1 capital.

[7] Feedback centrality measures have found successful applications in many domains like rankings in the world- wide-web (e.g. PageRank). Feedback centrality has a physical analogy with the in-flow in a non-homogeneous diffusion process.

A shock of size s hits the bank i, the targeted bank, that suffers a loss $L_i = s$. Even when $E_i \geq s$, the bank i is still able to transmit some contagion to bank j as the loss L_i erodes its equity and increase the bank i fragility. In particular, the loss for bank j is taken to be proportional to the value x_{ji} (the loan to bank i) and to the factor $h_i = \min[1, L_i/E_i]$.[8]

In this way, the algorithm embeds a type of convexity in the distance to default: the lower the equity E_i, the lower the ability of bank i to absorb the shock, the higher the contagion it transmits to bank j. The rationale is that the value of bank i's obligations decreases as bank i becomes closer to default and the value of its obligations to j declines. Consider the case in which the initial, exogenous shock is large enough ($s > E_i$) and the targeted bank i defaults. The impact on bank j is $W_{ij} = \min[1, x_{ji}/E_j]$, with $W_{ij} = 1$ when the shock that propagates to bank j is large enough to knock the bank j down. The shock propagates along the contagion path and reaches the bank k. The impact on the latter is $W_{jk} = \min[1, W_{ij}x_{kj}/E_k]$. In this simplified case, the DR of bank i is equal to:

$$DR_i = W_{ij}\frac{E_j}{E-E_i} + W_{jk}\frac{E_k}{E-E_k} \quad (1)$$

After simple manipulations we get:

$$DR_i = \frac{1}{E-E_i}\left[x_{ji} + \frac{x_{ji}}{E_j}x_{kj}\right] \quad (2)$$

The first addendum in the brackets is the loss induced to bank j; the second is the loss to bank k, derived as the impact x_{ik}/E_j transmitted by bank j and the exposures of bank k to bank j. The overall loss to the network (the number of the expression in brackets) is divided by the total equity of the system, to have a measure of the relative disruption induced by the bank i on the network. Capital plays as a buffer that smooths the effects of the initial shock to i along the cascade. In general, in a more complex network, bank k may have several debtors that, as bank j, are exposed to the contagion from bank i. Following the initial shock to bank i, at each iteration of the algorithm, some banks down the chain are affected. The sum of the losses occurred to these banks, at each iteration, is used to calculate the DR of the bank i. One major refinement of our paper is that we explicitly account for a measure of riskiness of the bank's assets. Indeed, two banks may have the same leverage (ratio of total assets to equity) but the composition of the asset side may differ substantially. More in detail, in the previous example, the impact of bank j to bank k is

$$\hat{W}_{jk} = \min[1, c_j \hat{W}_{ij} x_{kj}/E_k]$$

where

$$c_j = \frac{\text{Average Tier1 ratio}}{\text{Tier1 ratio of bank } j}$$

[8] Note that when the $L_i > E_i$ the bank i defaults. We assume that in the short run the recovery rate is negligible and the value of its liabilities drops to zero.

where, as standard, the Tier1 ratio is defined as the ratio of Tier1 capital to Risk-Weighted Assets. The coefficient *c* captures the riskiness of the bank relative to an overall average, across banks and time; *c* acts as a buffer (it is lower than 1) for banks with a Tier1 ratio above the average, and as an amplification mechanism for the others. Finally, the method gets rid of possible infinite reverberations that can arise due to the presence of loops (i.e. $x_{jk} > 0$ and $x_{kj} > 0$). In these cases, the contagion may bounce several times between bank j and k, potentially until one or both default. To avoid this problem, walks in which one or more edges are repeated more than once are excluded. At each step t (the step is the time when the shock directly or indirectly reaches the node), to the generic bank j we associate a state variable S_j that can take three values *Inactive*, *Distressed*, *Undistressed*, so that:

$$S_j(t) = \begin{cases} Inactive & \text{if } S_j(t-1) = Distressed \\ Distressed & \text{if } h_j(t-1) > 0 \text{ and } S_j(t-1) \neq Inactive \\ Undistressed & \text{otherwise} \end{cases} \quad (3)$$

The algorithm stops when all banks are either in the Undistressed or the Inactive state.

3. Data description

Interbank linkages are the plumbing of financial markets. Exposures are surveyed within the supervisory reports submitted monthly to the Bank of Italy. The historical depth of the dataset hinges upon the continuity of data collection method: in principle, all information is available on a monthly basis at least since the early 2000. However, the subsequent adoption of different reporting templates complicates the coherent reconstruction of phenomena, for which it may be necessary an aggregation of different technical forms. Taking into account these difficulties, at this stage we have chosen to focus our preliminary analysis on unsecured interbank relationships, from 2008 on. The resulting representation of the interbank market is a weighted and directed network, namely a set of nodes (banks) that are linked to each other through different types of financial instruments (edges). The direction of the link goes from the bank i having a liability to the bank j claiming the liability, and the weight is the amount of the unsecured liabilities of i towards j. All data are available on a legal entity basis, due to the regulatory purposes of the reporting. However, given the deeply interrelated nature of financial markets and the significant concentration process which has been undergoing in the past decade, both at the Italian and international level, we assume that the economic agents underneath each transaction lie at the group level. For this reason, in the first round of analysis we choose to consolidate individual data, leaving for a later stage the analysis of the groups' internal capital market. Finally, in our exercises we use balance sheet information (e.g. total assets, core tier1 capital,...) from supervisory reports and ad hoc data gathering, that are available both on a solo basis and a banking group level. For a complete description of the Italian interbank network, see Bargigli et al. (2013).

4. The DR of Italian banking groups

4.1. The DR versus contagion through default

We compare our DR measure with the simplest, traditional indicator of systemic risk in financial networks, namely the effects of a default of a bank in terms of other defaults in the cascade. In Figure 1, these effects are measured as the ratio between the total equity of banks that default in the cascade over the equity of the network. Only in few cases the exogenous default of a bank brings about the default of other banks in the network and the overall impact in terms of equity is small (in the worst case, it is about 2% of the total equity of the system, against almost 18% for the DR measure).

Result 1. *The DR differs substantially from indicators based exclusively on contagion-through- default.*

The DR is reported on the vertical axis. The horizontal axis shows the effect to the network of a default of a bank, in terms of the fraction of the total equity of the network that is lost when we restrict to contagion-through-default. Clearly, the DR predicts sizable effects whereas the other measure typically shows no impact at all.

4.2. The DR before and after the sovereign debt crisis

Figures 2–6 report the DR of individual banks from 2008 to 2012. Graphs have a simple interpretation. Each dot represents a banking group (consolidated data have been used, netting out infra-group relationships). The horizontal axis reports the size of the bank, measured with its total assets (in millions of euros). The DR is reported on the vertical axis and, in this case, is expressed as the fraction of the total equity of the system potentially wiped out by an initial shock to a bank. In the DR computation, we exclude the direct effect of the exogenous shock that hits the equity of the targeted bank. In this particular case, we plot the DR of the bank associated to an exogenous shock that brings about the default of the bank. The size of the dot depends on the interbank lending and borrowing of the banking group with the network. Finally, the color of the dot represents the tier1 capital ratio of the banking group.

Result 2. *The DR of Italian banking groups has generally decreased since 2008.*

The decline of the DR is very clear for medium and large banks. It is due to decreasing interbank volumes exchanged in the unsecured market and to a quite intense process of banks recapitalization (Figure 7). Both phenomena reflect a global trend. However, while the sign of the impact of the two trends on the DR is the same, they have polar opposite interpretations from a financial stability perspective. Indeed, on the one hand, the proper functioning of the unsecured interbank market is essential for an efficient use of liquidity within the financial system. The unsecured interbank market dry-up during the sovereign debt crisis and the migration towards collateralized (often ECB) funding have been a widespread phenomenon in the Euro area periphery. The spike in the spreads between interbank rates and overnight index swap rates almost worldwide is a clear footprint. Acharya and Merrouche (2010) and Christensen et al. (2009) find a precautionary hoarding motive for the sudden dry-up of money markets. Conversely, in Taylor and Williams (2008) the key driver is the sizable increase in counterparty risk. Regardless the underlying cause, a decline in the volume exchanged in the interbank market is generally perceived as the symptom of a disease and represents a major concern for a smooth functioning of funding markets and for the transmission of monetary policy signals. The decreasing activity in the domestic interbank market follows a generalized dry-up of cross border flows, which has been particularly severe for some Euro Area economies over the 2010–2011 period (BIS Quarterly Review, June 2012): Italian institutions were quite dependent on this source of funding that supported a portion of the domestic interbank market and they had to resort to retail funding and to the Eurosystem to replace some of their maturing wholesale liabilities. On the other hand, the regulatory response following the global financial crisis has also pushed for a recapitalization of most institutions. One major example is the European Banking Authority EU-wide capital exercise, that led to an increase of EU banks' capital positions of more than 200 billions of euros. The average leverage levels (core capital) for Italian banks have significantly decreased (increased) over the 2007–2011 period. A decline of the DR due to stronger balance sheets is desirable; the same conclusion cannot be drawn when the systemic risk declines because the traditional flows of liquidity are impaired and the entire system is more dependent on central bank funding. We disentangle the two effects with a simple comparative statics exercise (Figure 8), running the DR algorithm on two "mixed" networks. The first one is made up with unsecured interbank exposures at Dec-2008 (when they were relatively high) and with banks' capital levels at Dec-2012 (relatively high). In the second exercise, the DR is computed using exposures at Dec-2012 (relatively low) and capital levels at Dec-2008 (relatively low). We can quantify the impact of more robust balance sheets on systemic risk when banks are more interconnected (Dec. 2008) and compare it with the effect of capital when volume exchanged in the network are lower (Dec. 2012). Comparing the two panels of the left column of Figure 8, the effect of recapitalization on systemic risk is clearly noticeable when the interbank market functions properly, private liquidity flows are significant and interconnectedness is high. On the contrary, comparing the panels of the right column, the effect of higher capital in a low-interconnected network seems much less significant.

4.3. Size, interconnectedness and DR

The regulatory approach to systemic risk is changing. Several regulatory reforms are currently underway in all major jurisdictions worldwide and at the international level. These reforms aim not only at increasing the capital and liquidity requirements for financial institutions but, in some cases, at transforming the architecture of the financial system by imposing constraints on activities and types of exposures. At the international level, the Basel III proposal envisages an additional capital buffer for global systemically important banks (G-SIBs) and, more broadly, for systemically important financial institutions (SIFIs).[9] The G-SIB surcharges will cope with the potential impact of an institution failure on the global financial system and the wider economy. Interestingly, the focus of the Basel Committee goes beyond the size of the financial institution and encompasses some measure of interconnectedness. In the proposal, the latter is captured using three indicators,

[9] Consultation material can be found at http://www.bis.org/publ/bcbs207.htm.

intra-financial system assets and liabilities,[10] intra-financial system liabilities[11] and the wholesale funding ratio. The proposal surely represents a step forward. However, for each institution, the scores for the first two indicators are calculated on the basis of the aggregate claims and obligations towards the rest of the financial network. Our analysis emphasis the limits of measures based on aggregate exposures and that neglect the topology of the network.

Result 3. *The DR captures features of the systemic importance of a bank that go beyond leverage, capital, size and interconnectedness.*

As one would expect, the DR and the size of the bank are positively related. This is mostly due to economies of scale in market making activity. In general, one important caveat in the interpretation of the relationship between size and systemic risk is that we confine the analysis to the domestic interbank market. Large institutions are more able to capture funds in the cross-border interbank market thanks to higher visibility. Therefore, the whole picture that includes foreign linkages would be different, especially in the first months of our sample period, due to the intense cross-border interbank activity. For this reason, in an extension of the exercise to the whole Euro area network, we would expect an increase of the systemic risk posed by large banking groups. However, the relationship between size and DR is absolutely non-linear and banks with similar size may show very different DR values. Interconnectedness plays a key role in determining the systemic risk of a bank. Institutional features and banks' business models may help explain the relatively high DR of some medium-size institutions. They operate as a liquidity hub of regional networks of very small, mostly co-operative banks.[12]

The systemic relevance of these banks is tied to the significant number of institutions that would be involved in the distress-cascade, despite the relatively low size of their trades. In particular, the increase of their DR is due to larger unsecured borrowing by co-operative banks from ICCREA, their liquidity pool, that had access to ECB funding through the first Long Term Refinancing Operation (LTRO).

5. Conclusions

In this work we try to put forward a new class of stress-testing techniques that (i) accounts for non-linearities in contagion propagation that are typical of network-based models and (ii) allows to identify systemically relevant institutions beyond default{cascade models. We applied the methodology to a unique dataset of bilateral exposures in the Italian interbank market. Our results show that traditional

[10] Lending to financial institutions (including undrawn committed lines), holdings of securities issued by other financial institutions, net mark to market reverse repurchase agreements with other financial institutions, net mark to market securities lending to financial institutions and net mark to market OTC derivatives with financial institutions.

[11] Deposits by financial institutions (including undrawn committed lines), all marketable securities issued by the bank, net mark to market repurchase agreements with other financial institutions, net mark to market securities borrowing from financial institutions and net mark to market OTC derivatives with financial institutions.

[12] Figure 9 reports interbank exposures and Tier1 capital for Italian banking groups, classified with respect to their size.

indicators underestimate contagion risk. Our measure, DR, captures features of a bank's systemic relevance that would not be apparent under standard default cascades models. DR estimates for the Italian banking system show that systemic risk in the interbank network has decreased significantly since 2008. However, the decline is mainly due to the fact that a crisis has indeed happened somewhere else in the financial system, namely in the sovereign bond market, as opposed to increased capitalization of the banking system. Such evidence strongly supports policy options in line with Basel III such as counter-cyclical capital buffers for banks: the effect of a bank's capital on its systemic risk is much higher when the financial network is tightly interconnected, which is most likely to happen in good times, its impact decreases with leverage in "bad" times. Extensions of the current setting to liquidity-run contagion could complement policy-makers discussion on countercyclical liquidity insurance fees.

List of Figures

DR versus contagion-through-default. Dec 2006 Figure 1

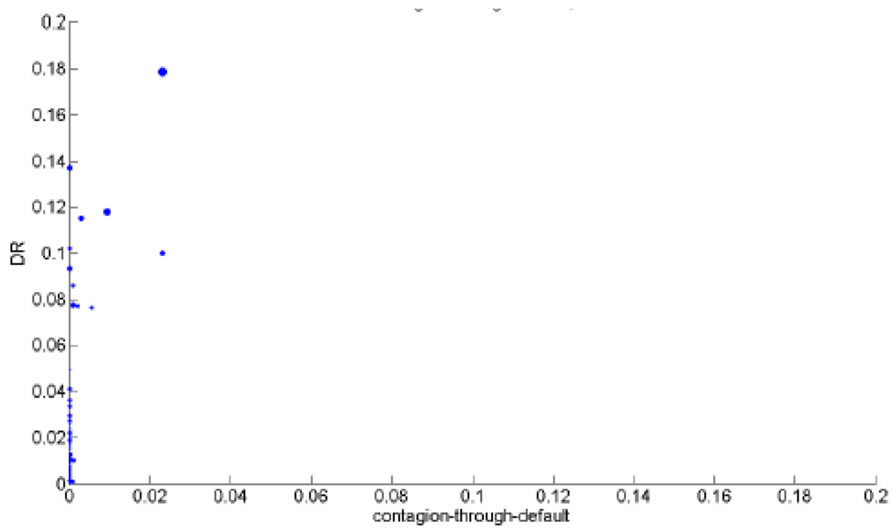


Figure 1: DR versus contagion-through-default. Each dot is an Italian banking group. Vertical axis: DR; horizontal axis: impact on the network measured with the equity loss, considering exclusively contagion-through-default. Dot size: interbank lending and borrowing relative to total assets. December 2008.

The DR of Italian Banking Groups at December 2008

Figure 2

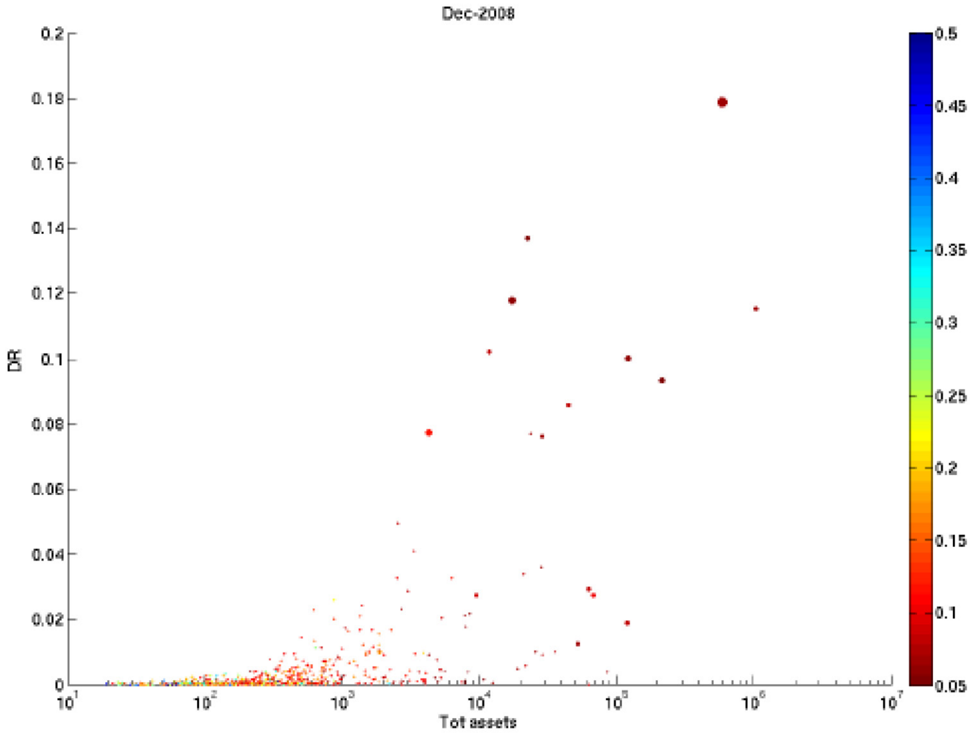


Figure 2: The DR of Italian Banking Groups at December 2008. Vertical axis: DR; horizontal axis: total assets; dot size: interbank lending and borrowing; dot color: Tier1 ratio.

The DR of Italian Banking Groups at December 2009   Figure 3

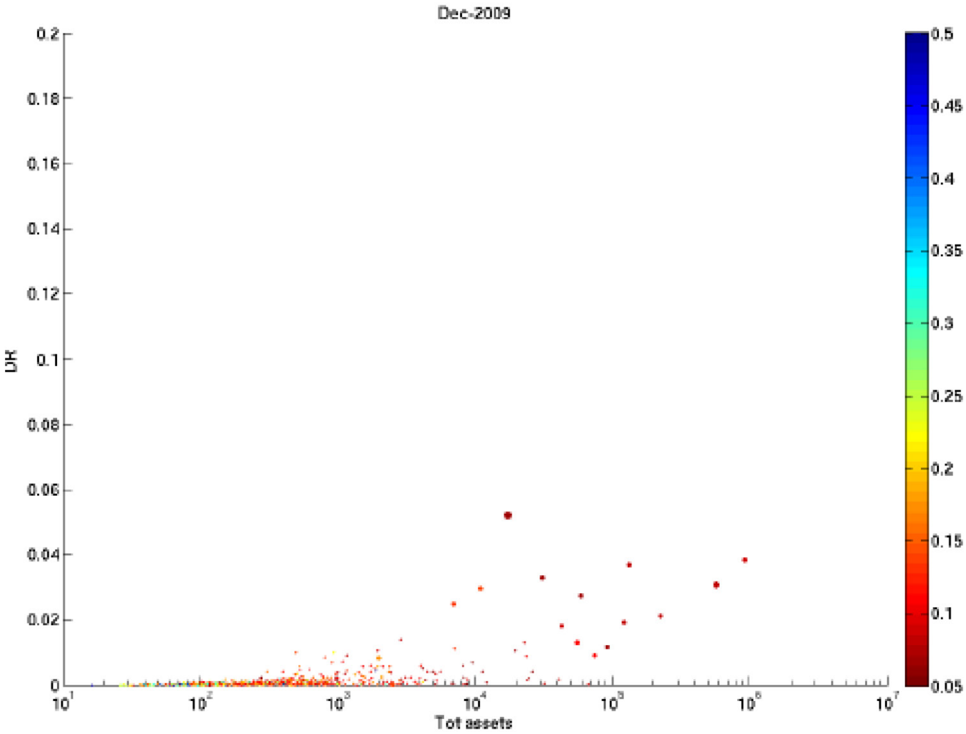


Figure 3: The DR of Italian Banking Groups at December 2009. Vertical axis: DR; horizontal axis: total assets; dot size: interbank lending and borrowing; dot color: Tier1 ratio.

The DR of Italian Banking Groups at December 2010 | Figure 4

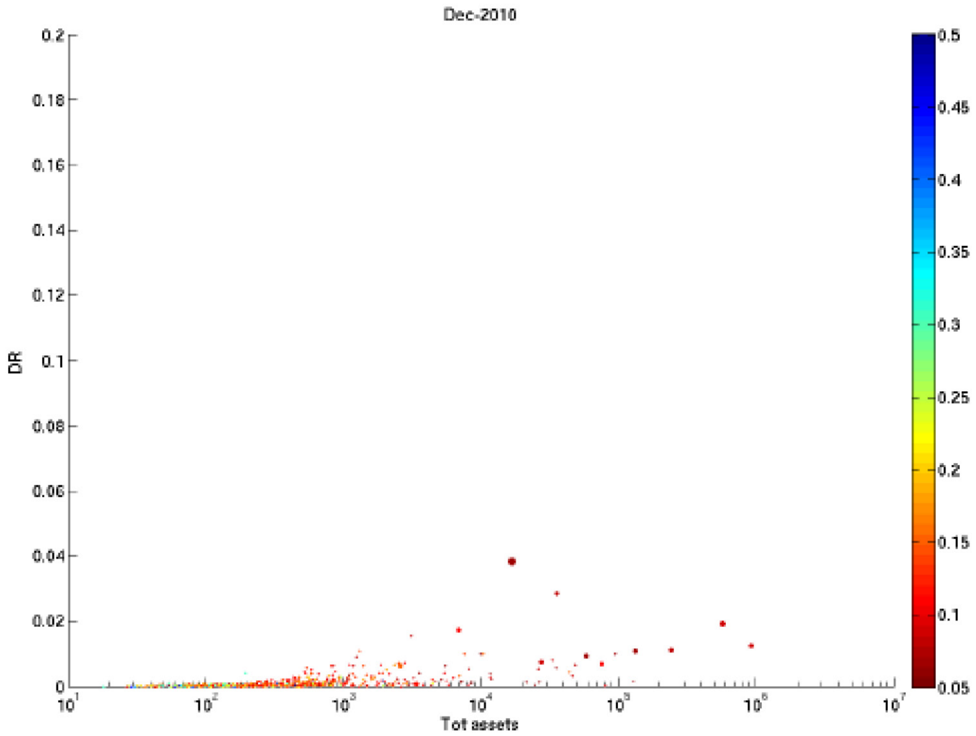


Figure 4: The DR of Italian Banking Groups at December 2010. Vertical axis: DR; horizontal axis: total assets; dot size: interbank lending and borrowing; dot color: Tier1 ratio.

The DR of Italian Banking Groups at December 2011 Figure 5

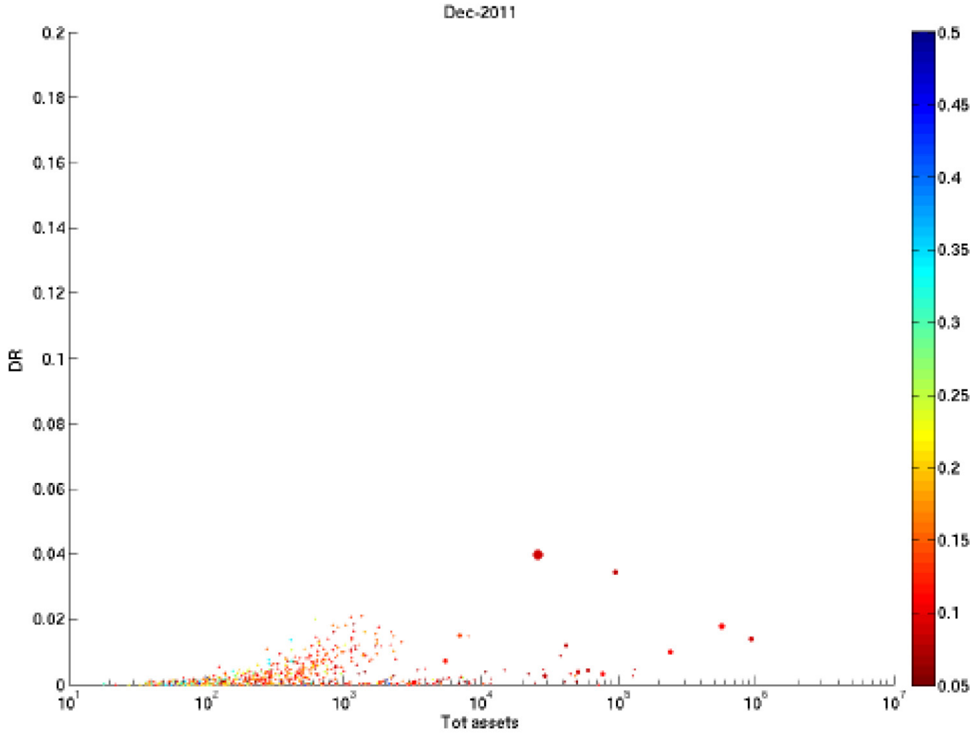


Figure 5: The DR of Italian Banking Groups at December 2011. Vertical axis: DR; horizontal axis: total assets; dot size: interbank lending and borrowing; dot color: Tier1 ratio.

The DR of Italian Banking Groups at December 2012 Figure 6

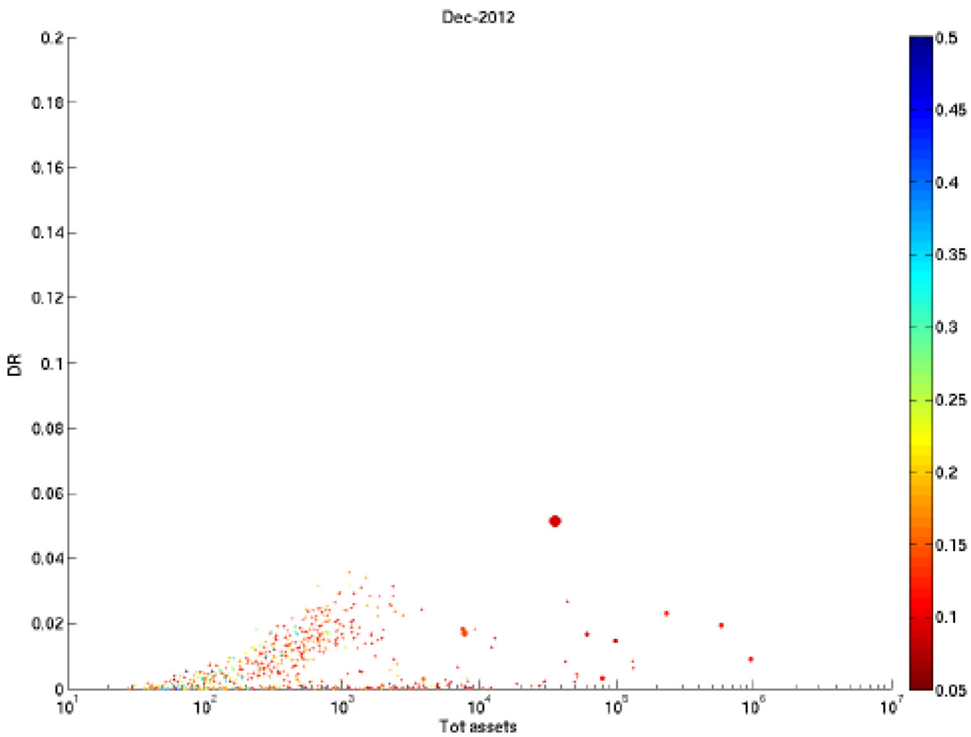
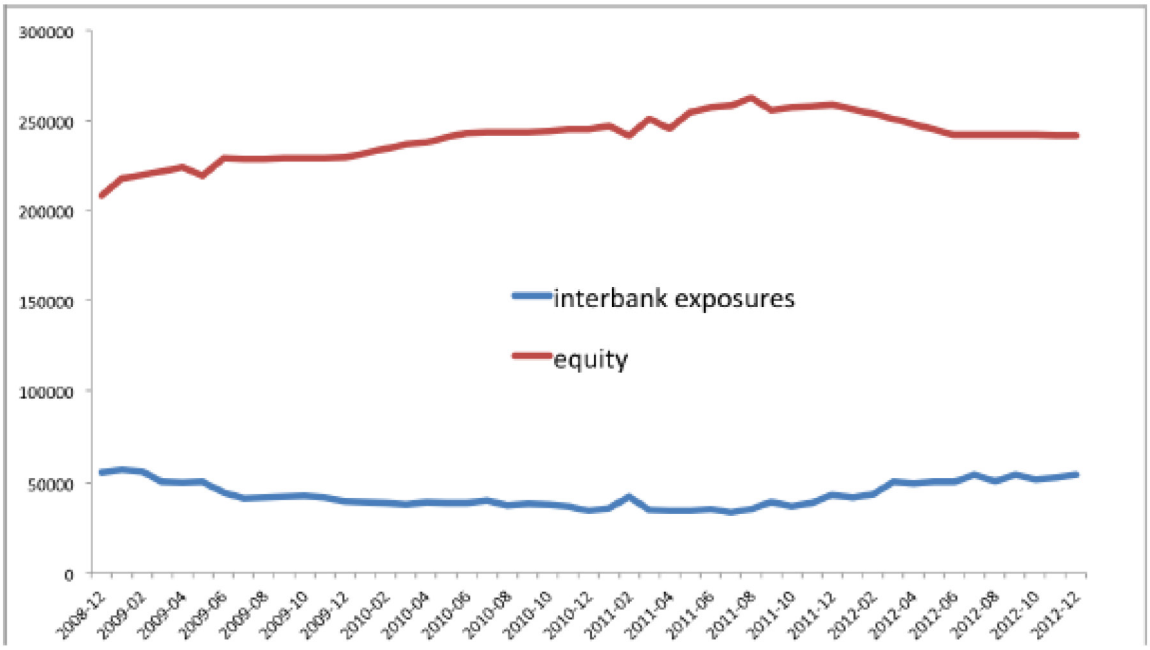


Figure 6: The DR of Italian Banking Groups at December 2012. Vertical axis: DR; horizontal axis: total assets; dot size: interbank lending and borrowing; dot color: Tier1 ratio.

Interbank exposures and Tier1 capital of Italian banking groups

(millions of euros) Figure 7



Lower volumes and higher capital

Figure 8

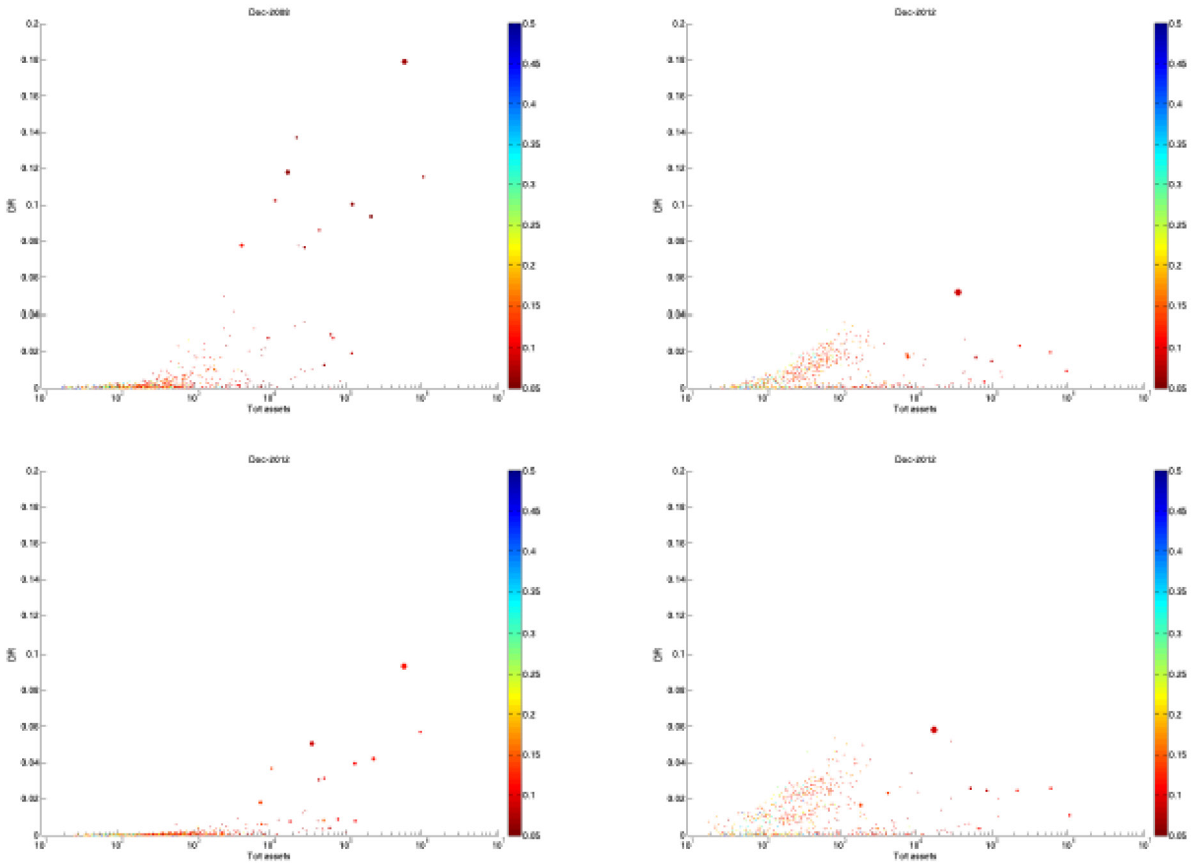
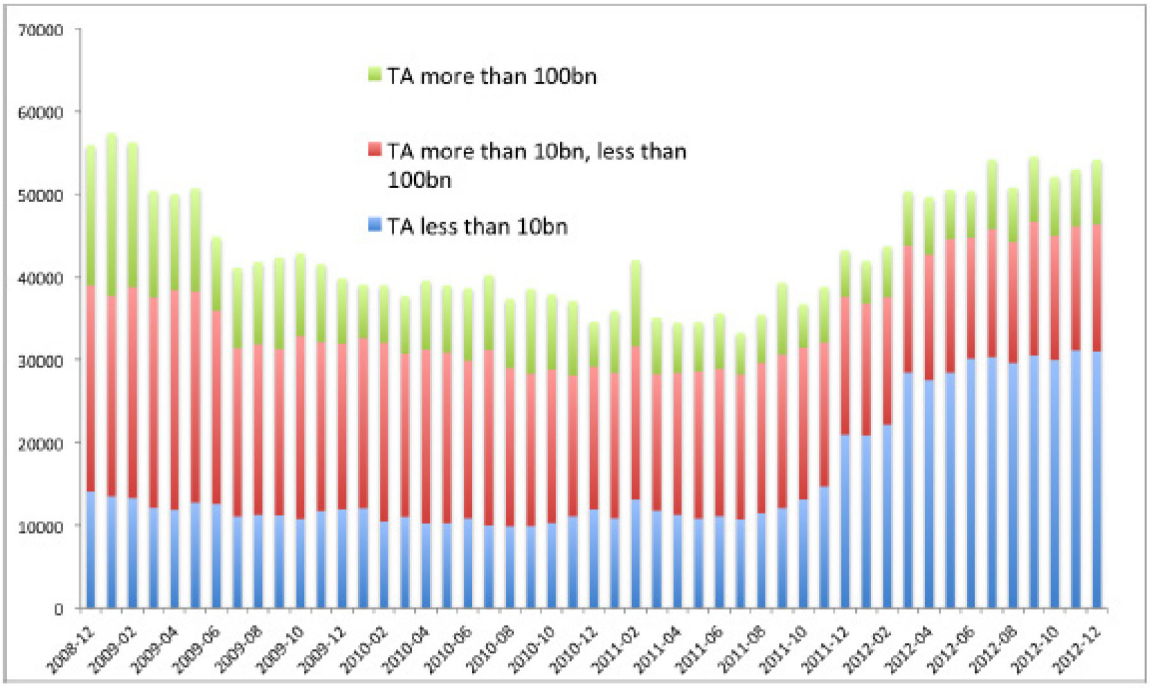
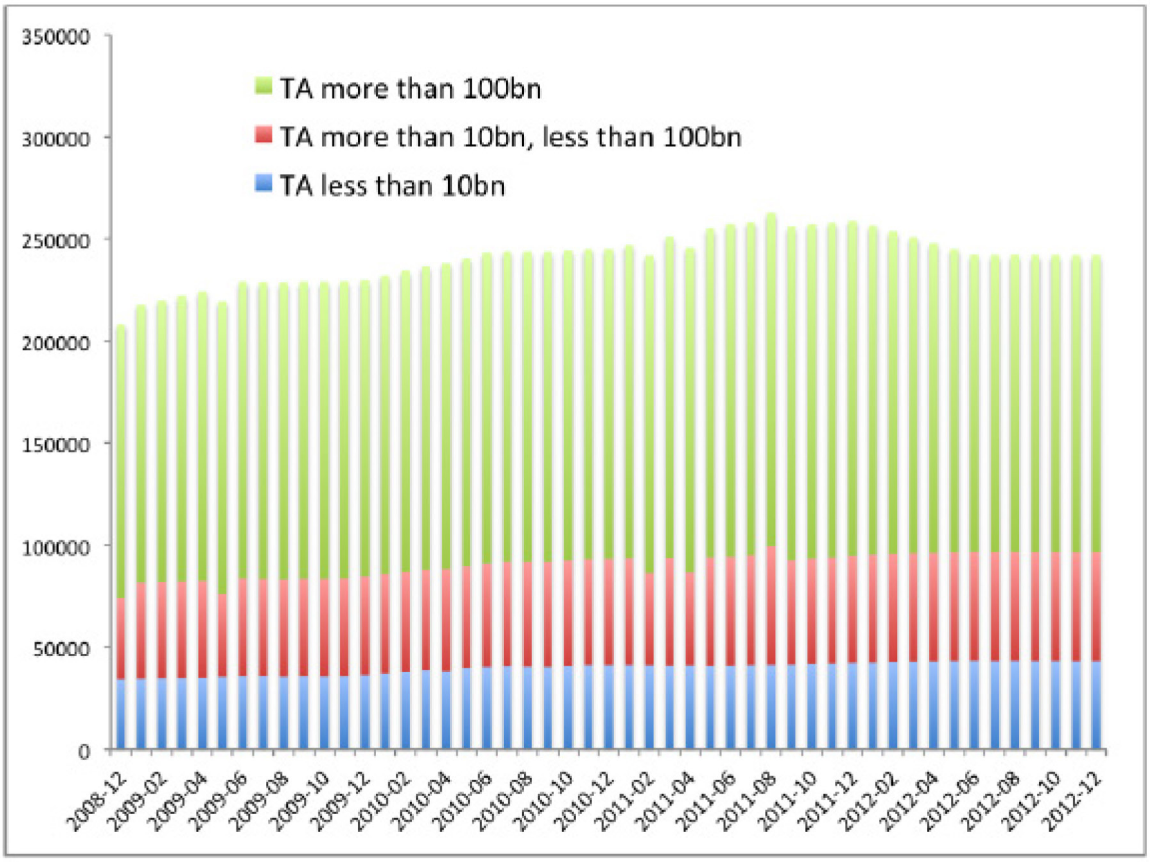


Figure 8: Lower volumes and higher capital. Top/left: DR at Dec. 2008. Top/right: DR at Dec. 2012. Bottom/left: DR with Tier1 of Dec. 2012 and exposures of Dec. 2008. Bottom/right: DR with exposures of Dec. 2012 and Tier1 of Dec. 2008. Vertical axis: DR; horizontal axis: total assets; dot size: interbank exposures; dot color: Tier1 ratio.

Interbank exposures (top panel) and Tier1 capital (bottom panel) by bank size measured with total assets

(TA, in millions of euros) Figure 9

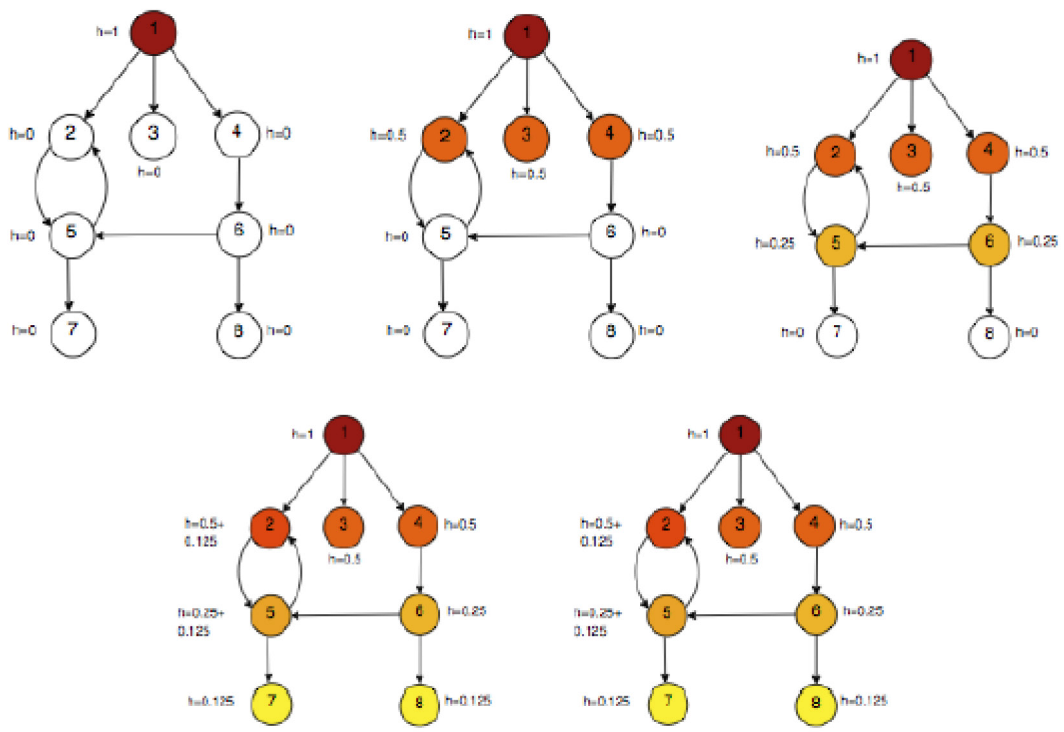




Appendix: Reverberations

In this paper we follow the DR methodology (Battiston et al. (2012)) and exclude second order reverberation in loops. To clarify the issue, consider Figure (10), with a simplified financial network, with 8 banks that interact through mutual exposures. Assume bank 1 defaults following some exogenous event. For sake of simplicity, the contagion is taken to be h = 0.5 for all exposures. What is key as regards reverberations, is the contagion between bank 2 and bank 5, for instance. These two banks form a loop, as bank 2 is exposed to bank 5 and vice versa. In the cascade, the contagion may potentially reverberate ad infinitum or, at least, until one or both banks default. In the present version of the paper, we consider only one reverberation, excluding from the computation of the DR all the paths that have been already visited.

Reverberations (read clockwise from the top-left) Figure 10



References

Acemoglu, D, A Ozdaglar, and A Tahbaz-Salehi (2012). Systemic risk and stability in financial networks. Technical report, mimeo.

Acharya, V and O Merrouche (2010). Precautionary hoarding of liquidity and inter-bank markets: Evidence from the sub-prime crisis. Technical report, National Bureau of Economic Research.

Acharya, V, L Pedersen, T Philippon, and M Richardson (2010). Measuring systemic risk. *Available at SSRN 1595075* (10-02).

Adrian, T and M Brunnermeier (2011). Covar. Technical report, National Bureau of Economic Research.

Allen, F and D Gale (2000). Financial contagion. *Journal of political economy* 108 (1), 1–33.

Bargigli, L, G Di Iasio, L Infante, F Lillo, and F Pierobon (2013). The multiplex structure of interbank networks. *arXiv preprint arXiv*:1311.4798.

Battiston, S, M Puliga, R Kaushik, P Tasca, and G Caldarelli (2012). Debtrank: Too central to fail? Financial networks, the fed and systemic risk. *Scientific Reports 2*.

Boss, M, M Summer, and S Thurner (2004). Contagion flow through banking networks. *Computational Science-ICCS 2004*, 1070–1077.

Caballero, R and A Simsek (2009). Fire sales in a model of complexity. Technical report, National Bureau of Economic Research.

Christensen, J, J Lopez, and G Rudebusch (2009). Do central bank liquidity facilities affect interbank lending rates? *Federal Reserve Bank of San Francisco Working Paper 13*.

Cifuentes, R, G Ferrucci, and H Shin (2005). Liquidity risk and contagion. *Journal of the European Economic Association* 3 (2–3), 556–566.

Cont, R, A Moussa, and E Santos (2011). Network structure and systemic risk in banking systems. *Available at SSRN 1733528*.

Drehmann, M and N Tarashev (2011). Measuring the systemic importance of interconnected banks.

Elsinger, H, A Lehar, and M Summer (2003). Risk assessment for banking systems. In *14th Annual Utah Winter Finance Conference Paper; EFA 2003 Annual Conference Paper No. 437*.

Freixas, X, B Parigi, and J Rochet (2000). Systemic risk, interbank relations, and liquidity provision by the central bank. *Journal of money, credit and banking*, 611–638.

Furfine, C. (2003). Interbank exposures: Quantifying the risk of contagion. *Journal of Money, Credit and Banking*, 111–128.

Gai, P and S Kapadia (2010). Contagion in financial networks. Proceedings of the Royal Society A: *Mathematical, Physical and Engineering Science 466* (2120), 2401–2423.

Mistrulli, P (2011). Assessing financial contagion in the interbank market: Maximum entropy versus observed interbank lending patterns. *Journal of Banking & Finance 35 (5)*, 1114–1127.

Shleifer, A and R Vishny (2011). Fire sales in finance and macroeconomics. *Journal of Economic Perspectives* 25 (1), 29–48.

Stiglitz, J (2010). Risk and global economic architecture: Why full financial integration may be undesirable. *The American Economic Review* 100 (2), 388–392.

Taylor, J and J Williams (2008). Further results on a black swan in the money market. *Federal Reserve Bank of San Francisco*, working paper.

Generating a Composite Index to Support Monetary and Financial Stability Analysis in Nigeria

Ini S Udom and Sani Ibrahim Doguwa[1]

Abstract

Sere-Ejembi et al (2014, CBN Journal of Applied Statistics) developed a banking stability index for Nigeria. This paper extends their work using indicators of stability in the banking, insurance and capital market segments, to propose a composite financial system stability index for the Nigerian Financial System. The two indices proposed capture the episodes of stability and vulnerability in the Nigerian Financial System during the study period. The paper finds signs of instability in the Nigeria's financial system from Q2, 2008 at the wake of the global financial crisis. The crises became very severe around Q3, 2009 when the indices dropped below the indicative thresholds. The indices dropped further in Q3, 2010 indicating the height of the crises. However, stability was restored thereafter.

JEL classification: E580, G01, G17, E65

[1] The authors are staff of Statistics Department of the Central Bank of Nigeria. The views expressed in the paper are those of the authors and do not necessarily represent that of the Bank.

1. Introduction

Financial System Stability is of utmost importance to policy makers in Nigeria partly because of the huge macroeconomic and financial costs of the previous episodes of instability. The effect of the 2009 banking crises on the economy was so severe that the authorities had to inject huge financial resources to recapitalize some banks. Efforts have therefore been intensified to ensure the stability of the financial system. As a result, renewed efforts have been made to complement micro-prudential analysis with macro-prudential analysis. With emphasis on the system as a whole, macro-prudential analysis and regulation seek to identify and mitigate risks to the stability of the system.

Macro-prudential analysis relies on indicators that can be used as a basis for monitoring the health, vulnerabilities and stability of the financial system. These indicators include aggregated micro-prudential indicators as well as macro-economic variables that impact on financial system stability. The Central Bank of Nigeria compiles both sets of indicators for the purpose of macro-prudential regulation. FSIs are compiled on quarterly basis and disseminated through the IMF – FSIs website and published in the Banks Financial Stability Reports. Other indicators are disseminated via other publications like the Statistical Bulletin and the Annual Report and Statement of Accounts. The current framework for the analysis of financial system stability involves the use of each of these indicators to monitor the strength or vulnerabilities of the system over time from different dimensions. Each indicator monitors a different aspect of risk arising from capital adequacy, asset quality, earnings and profitability or liquidity as the case may be. The corporate and real sector FSIs asses the risk to the system due to banking system exposure to these sectors.

Concerns have however been raised concerning the use of a wide range of indicators in macro-prudential analysis. The use of multiple indicators in financial stability analysis simultaneously could result in conflicting signals or some confusion. Efforts have therefore been made to collapse the many indicators into a single index. The Composite Index is a single indicator of the soundness of the financial system. Even though the overall stability of the financial system may be difficult to capture in a single measure, a composite Index could serve as a snap shot indicator of the strength of the system that is easily captured at a glance. Policy makers and other stakeholders could then disaggregate the composite index to identify sectors with risks and vulnerabilities for purposes of interventions aimed at financial stability. A composite indicator may give a clearer signal of direction than a wide range of indicators and make it easier to compare progress over time and space.

This paper attempts to generate a composite index for purposes of financial stability analysis in Nigeria. For this purpose the paper is structured as follows; following this introduction is Section 2 which presents an overview of the financial stability variables in Nigeria. Section 3 discusses the generation of the Financial Stability Index, while Section 4 reviews its applicability to policy. Section 5 summarizes and concludes the paper.

2. Indicators for Financial System Stability Analysis

A key issue in financial system stability analysis is the identification of the relevant variables or indicators. To identify these variables, one must take into consideration the definition of financial system stability and the structure of the financial system. The European central Bank (2007) defines financial system stability as ''a condition in which the financial system – comprising financial intermediaries, markets and market infrastructure, is capable of withstanding shocks and the unraveling of financial imbalances thereby mitigating the likelihood of disruptions in financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities.'' Central Bank of Nigeria (2013) defines financial stability as the resiliency of the financial system to unanticipated adverse shocks while enabling the continuing smooth functioning of the financial system intermediation process. These definitions and the structure of the system provide direction on what to consider when identifying the indicators of financial system stability.

2.1 The Structure of the Nigerian Financial System

The Nigeria financial system has grown rapidly over the years in terms of number of institutions and asset base. As of end-2013, gross financial system assets accounted for 61 percent of GDP. At the core of the system are banks, comprising 21 commercial banks, 2 merchant and one non-interest bank. Together they account for 80.3 per cent of total financial sector assets. The Insurance and Pension funds stand at 14.9 percent while the other non-bank financial institutions constitute the balance of 4.9 per cent of total financial market assets.

The Capital market remains relatively small with large sectors of the economy underrepresented. The only securities exchange operating in Nigeria is the Nigerian Stock Exchange (NSE). Its market capitalization dropped from ₦9,563.0 billion representing 30 percent of GDP at end-2008 to a low point of ₦7,030.8 billion, before recovering to ₦13,226.24 (12 percent of GDP) at the end of December 2013 (see Table 1).

2.2 Financial Stability Variables

The ability to conduct financial system stability analysis depends largely on the tools available for this task. With the liberalization of the financial systems and the evident systemic effects on the financial system stability, the identification and compilation of variables for monitoring this stability becomes paramount. The IMF working with other international bodies have developed a set of core and encouraged Financial Soundness Indicators. FSIs are calculated and disseminated to support macro-prudential analysis for the purpose of enhancing financial system stability. The FSIs Compilation Guide states that the FSIs are intended for use in monitoring the developments in positions (exposures) and flows that could indicate increased financial sector vulnerabilities and could help assess the potential resilience of the sector to adverse circumstances. However it is also accepted therein that FSIs are only one input into macro-prudential analysis. Also relevant are – indicators that provide a broader picture of economic and financial circumstances such as asset prices, credit growth, gross domestic product (GDP) growth, inflation and external position; the institutional and regulatory framework for the economy; and the structure of the financial system and strength of the financial infrastructure.

3. Methodology and Data

3.1 Derivation of Financial System Stability Index (FSSI)

Sere-Ejembi et al (2014) develop the banking system stability index and we extend their study by including the insurance and capital market to derive the financial system stability index for Nigeria. Although banking sector dominates the financial system in Nigeria, neglecting other sectors of the financial system in determining early warning signals of financial crisis may be misleading. The data used in this study is obtained from the Statistics Database of the Central Bank of Nigeria and it spanned the period Q1, 2008 to Q4, 2013. The sample period is small mostly because of the limited information in the insurance sector.

In this study, we derive the financial system stability index (FSSI) by applying statistical normalization and empirical normalization methodologies to indicators of banking system soundness, equity market performance and insurance industry soundness as:

$$\boldsymbol{FSSI_t} = w_2 DCAR_t + w_3 MCGDP_t + w_4 ICAR_t \qquad (1)$$

The capital adequacy ratio of the banking industry, measured as the ratio of regulatory tier 1 capital to risk weighted assets is used as a proxy for the banking system soundness indicator ($DCAR_t$). The capital market performance proxied by the ratio of equity market capitalization to gross domestic product ($MCGDP_t$), while the ratio of equity capital to total assets ($ICAR_t$) of the insurance industry measures its soundness at period t. w_j is the weighed assigned to individual indicator. The weight is obtained by using ordinary least square to estimate the responses of the change in total assets of the financial system to changes in the total assets of DMBs, Insurance sector and market capitalizations. These responses are further summed to obtain the proportion of each subsector in the financial sector with the view to ensuring that the combined weights for the subsectors sum up to one. Statistically, the weights are derived thus:

$$\Delta \boldsymbol{log}(\boldsymbol{TAF})_t = \beta_1 + \beta_2 \Delta log(TAB)_t + \beta_3 \Delta Log(MC)_t + \beta_4 Log(TAI)_t + e_t \qquad (2)$$

Where TAF represents the total assets of the Financial System, TAB is the total assets of DMBs, TAI is the total assets of the insurance companies and MC represents the equity market capitalization. Equation (2) is estimated at the level the variables were stationary. The estimated values of β_i , $i = 2, 3$ and 4 measure the responses of changes in total assets of the Financial System to changes in total assets of DMBs, Insurance sector and market capitalizations. e_t are the residuals that account for the unexplained variation in total assets of the financial system and t is the time period.

Structure of the Nigerian Financial System, 2013

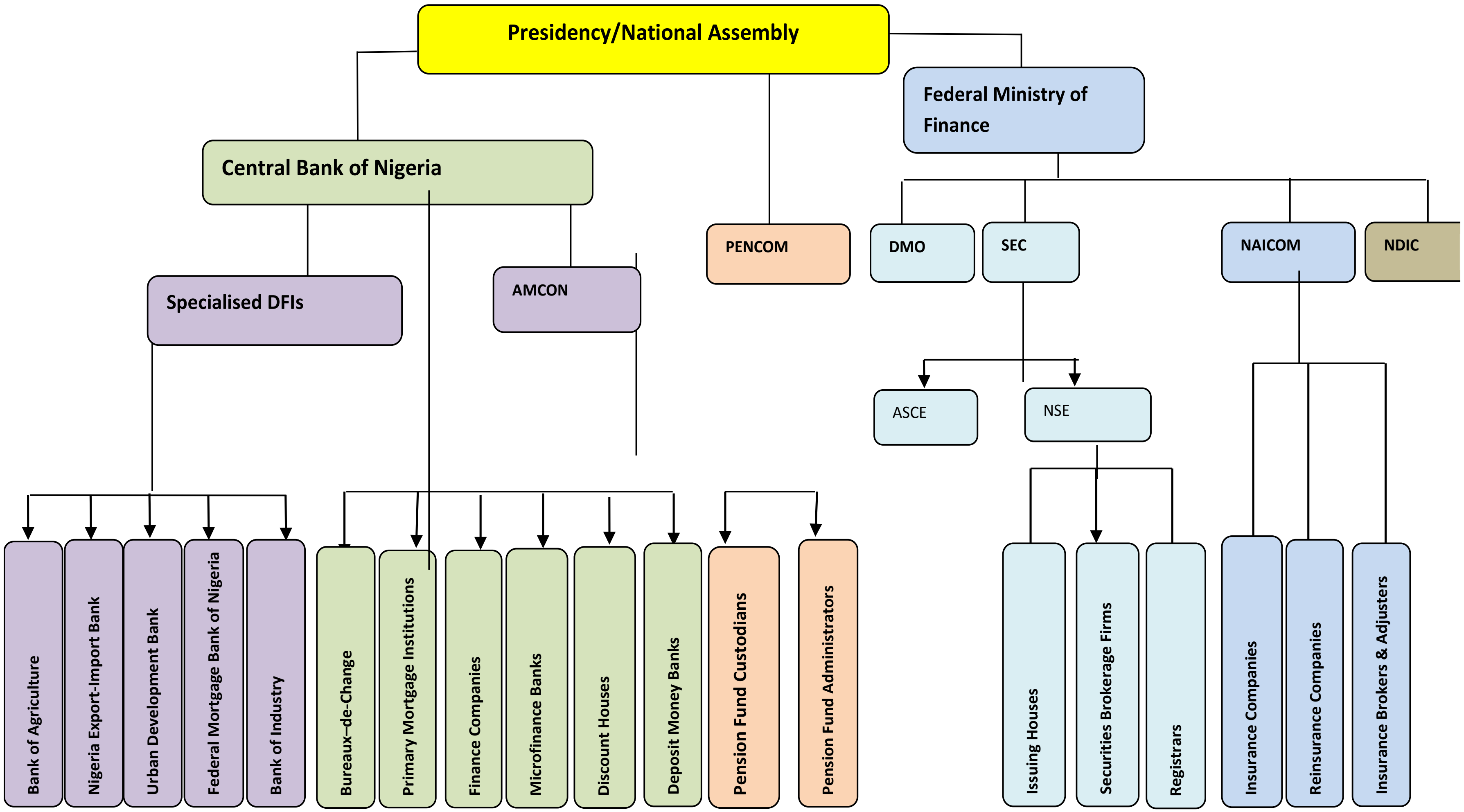
₦'billion, unless specified otherwise — Table 1

	2006			2010			2011			2012			2013		
	Number	Assets	In percent of total assets	Number	Assets	In percent of total assets	Number	Assets	percent of total assets	Number	Assets	percent of total assets	Number	Assets	In percent of total assets
Deposit Money Banks	**25**	**7,172.9**	**91.0**	**25**	**17,331.6**	**81.7**	**21**	**19,396.6**	**78.9**	**22**	**21,303.9**	**80.4**	**24**	**24,468.3**	**80.3**
Commercial	25	7,172.90	91.0	25	17,331.60	81.7	21	19,396.6	78.9	21	21,288.1	80.3	21	24,301.20	79.8
Merchant	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2	133.6	0.4
NIB	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1	15.8	0.1	1	33.5	0.1
Insurance/Pension Funds	**128**	**300**	**3.8**	**99**	**2,595.2**	**12.2**	**100**	**2,844.1**	**11.6**	**84**	**3,736.5**	**14.1**	**92**	**4,527.0**	**14.9**
Insurance Companies	107	n.a.	n.a.	61	565	2.7	61	393.7	1.6	57	586.4	2.2	59	468.9	1.5
Pension Funds	13	300	3.8	30	2,030.2	9.6	31	2,450.4	10.0	27	3,150.1	11.9	33	4,058.1	13.3
Unit Trusts	8	n.a.	n.a.	8	n.a.	n.a.	8	n.a.	n.a	n.a.	n.a	n.a.	n.a	n.a.	n.a
Other Non-banks Financial Institutions	**1,909**	**410.4**	**5.3**	**3,624**	**1299.5**	**6.1**	**3,483**	**2,340.3**	**9.5**	**3,318**	**1472**	**5.6**	**3,436**	**1,469.1**	**4.8**
Financial Companies	112	54.3	0.7	108	113.8	0.5	108	114.9	0.5	67	109.5	0.4	61	103.1	0.3
Specialized Development Institutions	6	n.a.	n.a.	5	316.2	1.5	5	359.6	1.5	5	446.9	1.7	6	586.7	1.9
Securities Firms	581	n.a.	n.a.	580	n.a.	n.a.	254	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Fund Managers	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	136	1,085	4.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mortgage Institutions	90	114.5	1.5	101	336.8	1.6	102	342.1	1.4	82	348.1	1.3	82	374.6	1.2
Microfinance Banks	757	55.1	0.7	866	170.3	0.8	821	117.9	0.5	880	222.8	0.8	820	270.9	0.9
Discount Houses	5	186.5	2.5	5	362.4	1.7	5	320.8	1.3	5	344.7	1.3	2	133.8	0.4
Bureau De Change	352	n.a.	n.a.	1,959	n.a.	n.a.	2,051	n.a.	n.a.	2,278	n.a.	n.a.	2,464	n.a.	n.a.
Assets Management Companies (AMC)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1	n.a.	n.a.	1	n.a.	n.a.	1	n.a.	n.a.
Other	6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total Financial system	**2,062**	**7,883**	**100**	**3,748**	**21,226**	**100**	**3,604**	**24,581**	**100**	**3,424**	**26,512**	**100**	**3,552**	**30,464**	**100**

Source: CBN

Structure of the Nigerian Financial System at end-December 2013

Figure 1



Therefore,

$w_j = \frac{\beta_j}{\sum_{i=2}^{4} \beta_i}$, j = 2, 3, 4

With $\sum_{j=2}^{4} w_j = 1$

The weight attached indicates the relative importance of the subsector. We empirically estimated w_2, w_3 and w_4 as 0.65, 0.34 and 0.01 for banking industry, capital market and insurance industry, respectively.

3.2 Statistical Normalization

The statistical normalization reduces the volatility of indicators ($DCAR_t, MCGDP_t$ and $ICAR_t$) and ensures that they are brought to a common scale with zero means and unit variances. This normalization process is expressed as:

$$Z_t = \left(\frac{X_t - \mu}{\sigma}\right) \qquad (3)$$

Where X_t is the value of indicators X during period t; μ is the mean and σ is the standard deviation. The zero average avoids introducing aggregation distortions arising from differences in the means of the indicators. The scaling factor is the standard deviation of the indicators. The $FSSI^{SN}$ for the statistical normalization analogous to equation (1) is then derived as:

$$FSSI_t^{SN} = \omega_2\left(\frac{DCAR_t - E(DCAR)}{\sqrt{Var(DCAR)}}\right) + \omega_3\left(\frac{MCGDP_t - E(MCGDP)}{\sqrt{Var(MCGDP)}}\right) + \omega_4\left(\frac{ICAR_t - E(ICAR)}{\sqrt{Var(ICAR)}}\right) \qquad (4)$$

3.3 Empirical Normalization

As implemented by Nicholas and Isabel (2010), empirical normalization converts all financial system stability indicators to an identical range of [0, 1] using

$$V_{tr}^n = \frac{V_{tr} - Min(V_r)}{\text{Max}(V_r) - Min(V_r)} \qquad (5)$$

V_{tr} represents the value of indicator *r* in period *t*; $Min(V_i)$ and $\text{Max}(V_i)$ represent minimum and maximum of indicator *r* across the sample period and V_{tr}^n is the indicator's normalized values using the empirical normalization method, which ranges from zero to unity, representing the most unfavorable value and most favorable value, respectively. Using this technique the $FSSI_t^{EN}$ is derived as:

$$FSSI_t^{EN} = \omega_2\left(\frac{DCAR_t - Min(DCAR)}{Max(DCAR) - Min(DCAR)}\right) + \omega_3\left(\frac{MCGDP_t - Min(MCGDP)}{Max(MCGDP) - Min(MCGDP)}\right) + \omega_4\left(\frac{ICAR_t - Min(ICAR)}{Max(ICAR) - Min(ICAR)}\right) \qquad (6)$$

The FSSI, using statistical normalization has zero as threshold. This implies that when FSSI for statistical normalization is above zero the system is stable and the reverse is the case, if the index falls below zero. Similarly, when the FSSI approaches unity, using the empirical normalization, it suggests improvement in financial stability and as it tends towards zero, it indicates worsening of the financial system, with a threshold value of 0.5.

4. Data Analysis and Interpretations of Results

Table 2 and Figures 2, and 3 show the trend in financial system stability index constructed by subjecting the indicators of banking system, insurance sector and capital market stability to two different approaches namely statistical normalization, and empirical normalization method, respectively. Figure 2 shows signs of instability in the financial system from second quarter 2008, at the wake of the global financial crisis (GFC). The impact of the GFC on the system became very severe around the third quarter of 2009 when the index dropped below the indicative benchmark of zero. The index dropped further to –1.46 in the third quarter of 2010 indicating the height of the crisis.

Although there is no exact indicative benchmark for empirical normalization method in literature, however, as the FSSI approaches zero, the financial system gets weaker; and as FSSI tends towards one, the financial system gains more momentum. Now, using 0.5 as our indicative benchmark in Figure 3, the FSSI reveals a declining strength in the financial sector until the third quarter of 2009 when it dropped below 0.5. From figures 1 and 3, the FSSI reveals similar financial system status between Q3, 2009 and Q3, 2011. During the period, between second quarters of 2008 and 2009, there were tight liquidity conditions in the financial system and financial stability indicators were trending downwards. For instance, the assets quality of the banks, measure as the ratio of non-performing loans to industry total, deteriorated by 26.5 percentage points to 32.8 per cent at end-December 2009, exceeding the 20.0 per cent international threshold and the maximum prescribed by the Contingency Plan for Systemic Distress

Industry liquidity ratio was above the 25.0 per cent minimum threshold, but three banks failed to meet the requirement (CBN, 2009). The capital market was bearish throughout 2009 as a result of capital reversal occasioned by the GFC. Total market capitalization to GDP ratio fell to 28.5% in end 2009 from 39.7% in end 2008. Secondary market segment of the NSE recorded poor performance as there was significant capital reversal owing to low investors' confidence, following the global economic and financial crisis. There was a lull in the primary market as indicated by the decline in the number of applications received and issues offered for public subscription, reflecting the liquidity crisis and investors' waning confidence in the market (CBN, 2009).

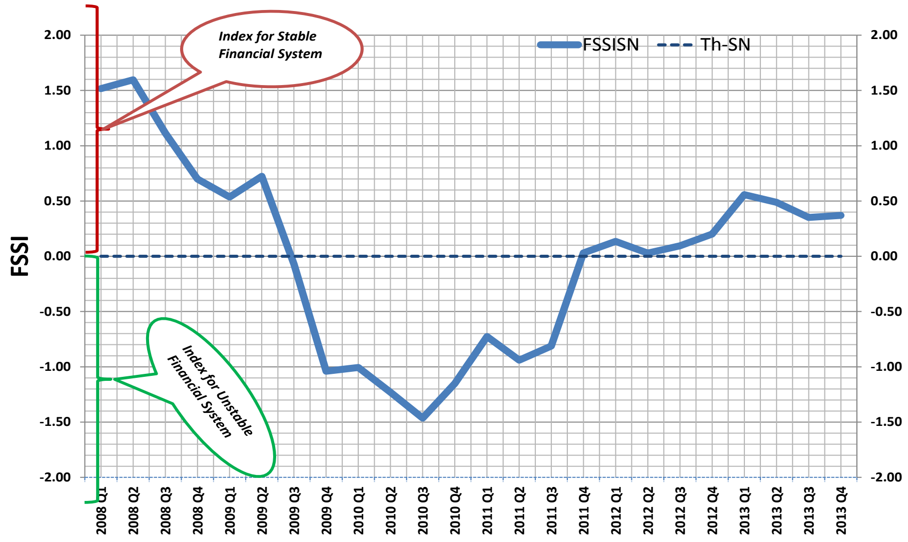


Fig 2. Financial System Stability Index for Nigeria

In 2009, having noticed the contagion effect of the GFC that kick-started in the United States, the monetary and fiscal authority rolled out stimulus packages, as well as quantitative easing of monetary policy stance to cushion the effect. Examples of these stimulus packages are disbursement of N200 billion to DMBs under the Commercial Agricultural Credit Scheme, continuation of lower tariff under the "2008 – 2012 Nigeria Customs and Tariff Book" to encourage the importation of raw materials to stimulate domestic industrial production and manufacturing activities, earmarking of N361.2 billion for investment in critical infrastructure and; injection of about N100 billion multilateral loan in critical sectors of the economy.

Table 2: Financial System Stability Index Constructed Using Statistical Normalization and Empirical Normalization Methods

	Soundeness Indicators			Statistical Normalization				Soundeness Indicators			Empirical Normalization			
Quarter	INS_CAR	MC/GDP	DMB_CAR	INS_CAR	MC/GDP	DMB_CAR	FSSI	INS_CAR	MC/GDP	DMB_CAR	INS_CAR	MC/GDP	DMB_CAR	FSSI
2008 Q1	9.813	2.190	0.198	0.56	3.10	0.70	1.52	9.813	2.190	0.198	0.37	1.00	0.84	0.89
2008 Q2	20.451	1.909	0.237	1.91	2.38	1.18	1.60	20.451	1.909	0.237	0.78	0.82	1.00	0.94
2008 Q3	18.273	1.522	0.220	1.63	1.38	0.97	1.12	18.273	1.522	0.220	0.70	0.57	0.93	0.80
2008 Q4	13.207	1.058	0.219	0.99	0.18	0.96	0.70	13.207	1.058	0.219	0.50	0.28	0.93	0.70
2009 Q1	10.06	0.82	0.23	0.59	-0.42	1.04	0.54	10.06	0.82	0.23	0.38	0.13	0.95	0.66
2009 Q2	26.14	1.02	0.22	2.63	0.09	1.03	0.72	26.14	1.02	0.22	1.00	0.25	0.95	0.71
2009 Q3	9.45	0.78	0.16	0.51	-0.54	0.17	-0.07	9.45	0.78	0.16	0.36	0.10	0.65	0.46
2009 Q4	15.31	0.73	0.04	1.25	-0.66	-1.27	-1.04	15.31	0.73	0.04	0.58	0.07	0.16	0.14
2010 Q1	0.70	0.85	0.03	-0.60	-0.36	-1.35	-1.01	0.70	0.85	0.03	0.02	0.14	0.14	0.14
2010 Q2	0.70	0.77	0.02	-0.60	-0.56	-1.59	-1.23	0.70	0.77	0.02	0.02	0.09	0.06	0.07
2010 Q3	0.65	0.62	0.00	-0.60	-0.93	-1.75	-1.46	0.65	0.62	0.00	0.02	0.00	0.00	0.00
2010 Q4	0.61	0.84	0.02	-0.61	-0.38	-1.56	-1.15	0.61	0.84	0.02	0.01	0.14	0.07	0.09
2011 Q1	0.66	0.92	0.06	-0.60	-0.17	-1.02	-0.73	0.66	0.92	0.06	0.02	0.19	0.25	0.23
2011 Q2	0.58	0.85	0.04	-0.61	-0.36	-1.25	-0.94	0.58	0.85	0.04	0.01	0.14	0.17	0.16
2011 Q3	0.56	0.66	0.08	-0.62	-0.84	-0.80	-0.81	0.56	0.66	0.08	0.01	0.02	0.32	0.22
2011 Q4	0.51	0.68	0.18	-0.62	-0.78	0.46	0.03	0.51	0.68	0.18	0.01	0.04	0.75	0.50
2012 Q1	0.30	0.72	0.19	-0.65	-0.69	0.58	0.14	0.30	0.72	0.19	0.00	0.06	0.80	0.54
2012 Q2	0.36	0.70	0.18	-0.64	-0.73	0.44	0.03	0.36	0.70	0.18	0.01	0.05	0.75	0.50
2012 Q3	0.27	0.76	0.18	-0.65	-0.59	0.47	0.09	0.27	0.76	0.18	0.00	0.08	0.76	0.52
2012 Q4	0.31	0.85	0.18	-0.65	-0.36	0.51	0.20	0.31	0.85	0.18	0.00	0.14	0.77	0.55
2013 Q1	0.31	1.13	0.20	-0.65	0.37	0.67	0.56	0.31	1.13	0.20	0.00	0.32	0.83	0.65
2013 Q2	0.32	1.12	0.19	-0.65	0.34	0.58	0.49	0.32	1.12	0.19	0.00	0.32	0.79	0.62
2013 Q3	0.26	1.04	0.18	-0.65	0.15	0.47	0.35	0.26	1.04	0.18	0.00	0.27	0.76	0.58
2013 Q4	0.22	1.15	0.17	-0.66	0.41	0.36	0.37	0.22	1.15	0.17	0.00	0.33	0.72	0.58
Mean	5.42	0.99	0.14	0.00	0.00	0.00	Min	0.22	0.62	0.00	0.00	0.00	0.00	
SD	7.89	0.39	0.08	1.00	1.00	1.00	Max	26.14	2.19	0.24	1.00	1.00	1.00	

The fiscal stimulus countered the effects of the GFC and curtailed the deceleration of Nigeria's economic growth (CBN, 2009). These efforts caused the declining financial system to moderate in second quarter of 2009, as noticed in figures 2 and 3. The effects of packages were short-lived, as the FSSI with the statistical normalization method showed unstable financial system from third quarter of 2009 to Q3, 2011. The financial system became unstable from third quarter of 2009 as revealed in the FSSI with empirical normalization and remained unstable till the end of the observation period. The stability recorded in the financial system during the second half of 2011 were attributed to concerted efforts made by the three sectors in 2011. For instance, in the insurance sector, the Market Development and Restructuring Initiative (MDRI) and the introduction of Micro insurance and Takaful insurance models were focused to address issues of low insurance uptake, financial and social inclusion, and the lack of insurance awareness, market deepening and insurance penetration in the Nigerian economy (NAICOM, 2011).

The index that has been developed is designed to incorporate the resilience in the banking, insurance and capital market into one composite measure. This composite index will capture the interconnectedness between the banking and capital market sectors. Most of the commercial banks operating in the country are listed on the stock exchange and as at end of Dec. 2013, the banking sector equities constituted 22 per cent of total market capitalization. It is instructive to note that the banking sector crises of 2008/2009 started from the capital market. The Nigerian banks were considered safe and sound after the recapitalization exercise in 2004/2005. In the course of the recapitalization exercise, many banks went to the capital market to raise funds to meet the benchmark. By the end of this exercise, the activities in the capital market had been reached unprecedented heights in terms of volume and value.

However, there was a crash in this market following the GFC which started in the US and led to the withdrawal of foreign institutional investors. This crash eroded the value of banking sector stocks resulting in virtual wiping out of the tier 1 capital of many banks. The margin loans granted by the banks with their equity shareholding as collateral became non-performing. This is the scenario that gave rise to the last banking crises in Nigeria. The Index here will give signals to developments in the entire financial system. Where a sign of bubbles or deterioration is observed, policy makers will disaggregate the index to identify sectors that require intervention.

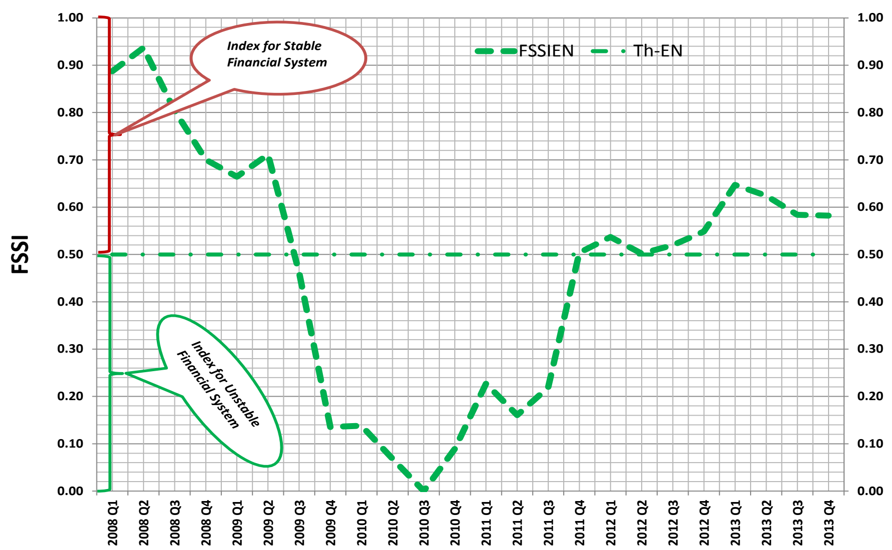


Fig 3: Financial System Stability Index for Nigeria

5. Summary and Conclusion

A composite index is a single indicator of the soundness of the financial system. Even though the overall stability of the financial system may be difficult to capture in a single measure, a composite index could serve as a swap shot indicator of the strength of the system at a glance. Using indicators of stability in the banking, insurance and capital market segments, a composite index is developed for the Nigerian Financial System. The index captures the episodes of both stability and vulnerability during the study period. This index will be a useful tool as a one stop measure in financial system stability analysis.

References

Evans, O., A.M. Leone, M. Gill, and P. Hilbers (2000) "Macro prudential indicators of Financial System Soundness" *IMF Working Paper*, 2000/193 (Washington: International Monetary Fund).

International Monetary Fund, IMF Country Report 13/14.0 Washington.

Central Bank of Nigeria (2012) Financial Stability Report, Abuja.

Sere-Ejembi, A., I.S. Udom, A. Salihu, N.V. Atoi and B.N. Yaaba (2014) "Developing Banking System Stability Index for Nigeria" *CBN Journal of Applied Statistics* Vol. 5 No. 1.

Gadanecz, B. and K. Iayaram (2010). Measures of Financial Stability. *IFC Bulletin* No. 31.

Willem, I. (2006). Indicators and boundaries of Financial Stability. *DNB Working Paper* 97/06, Amsterdam.

United Nations Economic and Social Council (2014). Indepth Review of Leading, Composite and Sentiment Indicators. Geneva.

International Monetary Fund (2006). Financial Soundness Indicators Compilation Guide: Washington D.C.

Tatantalo, S. (2010). Handbook on Constituting Composite Indicators: Methodology and User Guide. European Commission Joint Research Centre, Vienna.

Gersl, A. and J. Hermanek (2006). Financial Stability Indicators Advantages and Disadvantages of their use in the assessment of financial System Stability. *Czeck National Financial Stability Review*.

Central Bank of Nigeria: Annual Report and Statement of Accounts. Several Issues.

Central Bank of Nigeria (2011). Statistical Bulletin.

Nicholas, C. and C. Isabel (2010). "Aggregate Financial Stability Index for an Early Warning System" Research and Statistics Dept. Monetary Authority of Macao.

Can Statistical Data Contribute to Oversight of Money Markets Funds (MMFs)?[1]

Brian Godfrey and Brian Golden[2]

Abstract

Money Market Funds (MMFs) play a crucial role in the global financial system, acting as an important source of funding and liquidity to other financial intermediaries, particularly the banking sector. MMFs came into particular focus during the financial crisis, having been previously seen as very safe investment options. Many MMFs experienced significant outflows of investor funds in 2008, which further tightened credit markets and heightened fears over potential hidden exposures within the financial system. This paper explores the wider use of statistical data to contribute to the oversight of MMFs, using granular data reported to the Central Bank of Ireland by each individual fund. The paper explores how this granular data can chart varying degrees of risk in Irish MMFs since 2008, with a view to identifying potential indicators that would support financial stability analysis and regulatory monitoring going forward.

[1] This paper will be presented at the Irving Fisher Conference on "Indicators to support Monetary and Financial Stability Analysis: Data Sources and Statistical Methodologies" at the Bank for International Settlements in Basel, Switzerland, 4–5 September 2014.

[2] The authors are economists in the Statistics Division of the Central Bank of Ireland (email: brian.godfrey@centralbank.ie and brian.golden@centralbank.ie). The views in the paper are those of the authors and do not necessarily reflect the views of the Central Bank of Ireland. The authors are very grateful for the help and support provided by Joe McNeill and Rory McElligott.

1. Introduction

Money market funds (MMFs) act as a critical lending channel within the global financial system through the repo market, connecting banks and other financial intermediaries with daily liquidity. MMFs are also a key source of liquidity for short-term debt markets, investing in short term high quality debt instruments such as commercial paper and certificate of deposits issued by banks. MMFs are generally offered to investors seeking to preserve their initial investment while earning a small rate of return slightly higher than the bank deposit rate. As such, MMFs tend to be seen as substitutes for bank deposit accounts. This is particularly the case for "constant NAV" funds, which commit to maintaining a stable value per share/unit in the fund, such as $1. MMF investors usually consist of pension funds, insurance companies, other large institutional investors and high net worth individuals.

MMFs contributed to a significant intensification of the financial crisis in the second half of 2008 when the net asset value per share/unit of a number of US MMFs either fell, or threatened to fall, below their net asset value of $1 ("breaking the buck"). Following the collapse in the value of MMF holdings of Lehman Brothers' commercial paper and short term debt, concerned investors began to make large withdrawals from certain MMFs, especially those with exposure to commercial paper. This led to "bank like runs"[3] on MMFs, which were only stemmed when MMF sponsors, in many cases banks, injected considerable amounts of capital into MMFs. This heightened fears as to hidden exposures within the financial system, particularly for banks, and further credit tightening within financial markets followed, compounding already strained interbank lending and money markets.

The financial crisis revealed the need to monitor the MMF industry on a continuing basis for current and future risks that could threaten the global financial system. This paper examines possible uses of statistical data for monitoring MMFs. The Central Bank of Ireland collects quarterly granular data on MMFs on a per fund basis so as to feed into Irish and euro area aggregate national accounts and balance of payments data. This granular data has been collected on a security-by-security basis, beginning from Q4 2008. Securities data collected, can be cross-referenced against the European Central Bank's Centralised Statistical Database to gain further security attribute information. Nevertheless, this granular data was not designed to calculate risk indicators and some gaps exist with this purpose in mind.

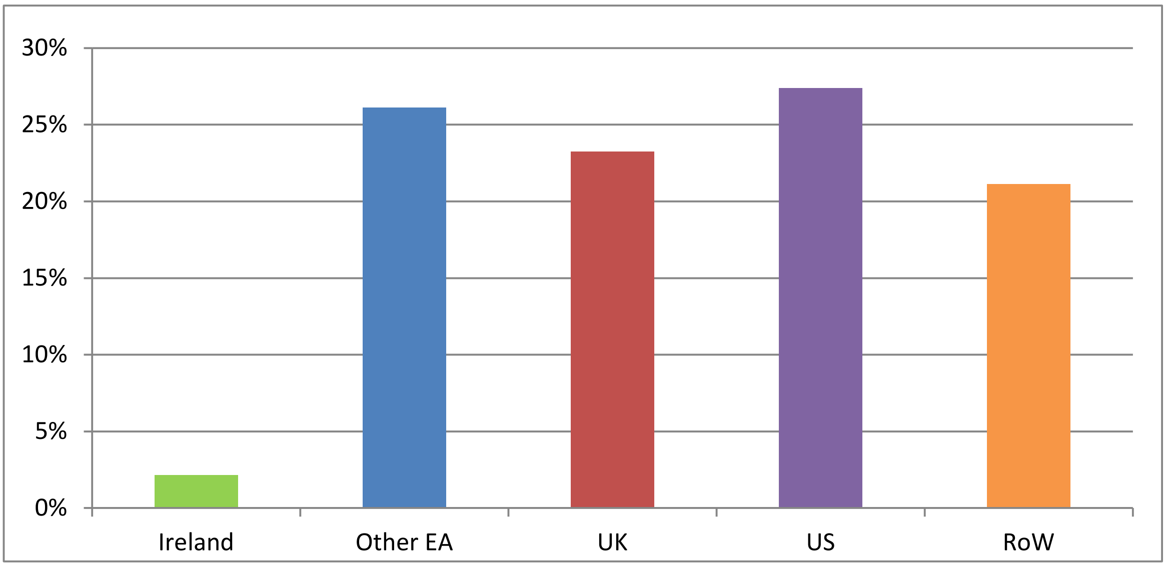
Building on some existing international research, this paper examines the potential for statistical data to chart the development of risk within Irish MMFs. The paper is structured as follows: Section 2 looks at the structure of the Irish MMF industry. Risk is explored in Section 3 using econometric techniques and analysis of outflows and yields. Section 4 focuses on MMF data that is becoming available and what new indicators will soon be possible, while Section 5 concludes the paper.

[3] As is the case with bank runs, investor withdrawals can become self-perpetuating in that an investor is enticed to make a withdrawal on foot of withdrawals by other investors that, of themselves, threaten the solvency of the fund.

2. Irish MMF Industry

The Irish MMF industry is a substantial but quite distinct portion of the euro area industry as a whole. Irish MMFs were collectively valued at €315.5 billion,[4] based on net asset value, at the end of 2013. As such, Ireland is a key host for euro area MMFs, which contribute directly to the euro area money supply. Irish MMFs invest in assets from the United States, the United Kingdom and other non-euro area countries to a much greater extent than other euro area MMFs. Irish MMFs also have less relative exposure to their domestic market (Chart 1). Similarly, investors in Irish MMFs were predominately United Kingdom based, with US investors as significant as Ireland and the euro area combined (Chart 2). While the linkages between Irish MMFs and the Irish financial system are quite weak, there is nonetheless a need to monitor Irish MMFs role and links to the international financial system.

MMF Asset Holdings of Debt Securities — Chart 1



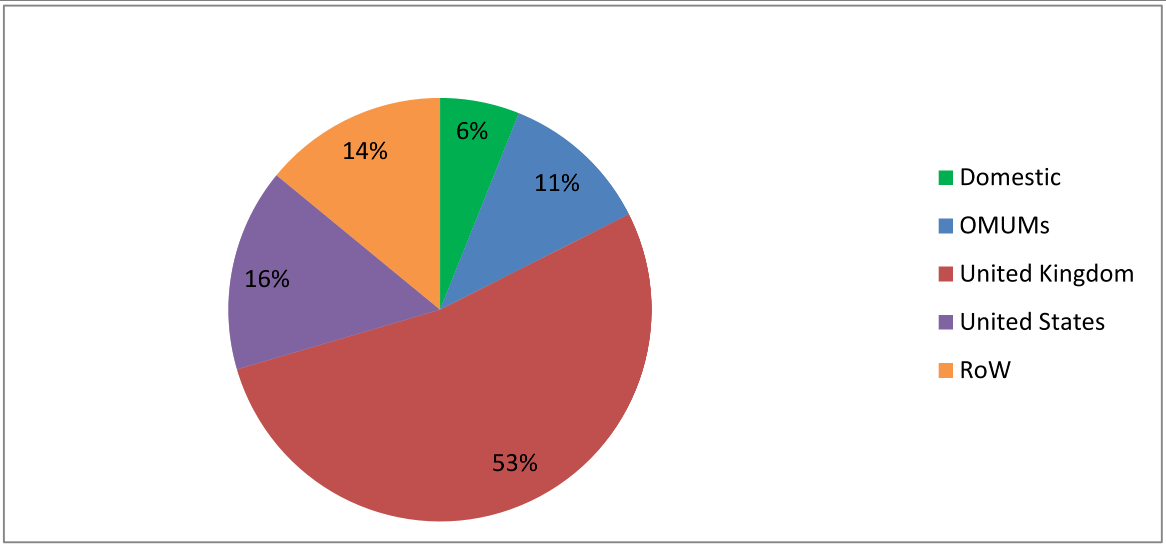
In this context, it is perhaps not surprising that the performance of Irish MMFs has diverged somewhat from those of the euro area as a whole. Irish MMFs remained relatively stable from Q2 2008 to Q2 2011, followed by a short period of growth up to the middle of 2012. Since then, however, the industry has declined, based on net asset value, though this reflects a trend that has been evident in euro area MMFs since Q1 2009 (Chart 3). The low yield environment within the money market and debt securities markets that has persisted since the middle of 2012 has taken its toll on global MMFs, as all MMFs face the challenge of providing a return in excess of deposit rates and expense ratios. In this environment, many Irish MMFs decided to waive their expense fees in order to maintain a positive return for their investors, as average MMF yields declined in 2012 and for the early part of 2013, as highlighted in our yield analysis in section 3.3. In some cases, where net yields were negative, Irish

[4] The MMF population used for this analysis includes some highly liquid funds, which were reclassified from money market funds to bond funds in the official statistics in December 2011.

MMFs chose to absorb the income losses by redeeming fund units at zero through compulsory redemptions.[5] In addition, bond price volatility saw significant investor outflows from Irish MMF in the middle of 2013, as investors reacted to the prospect of a reduction in quantitative easing by the US Federal Reserve.

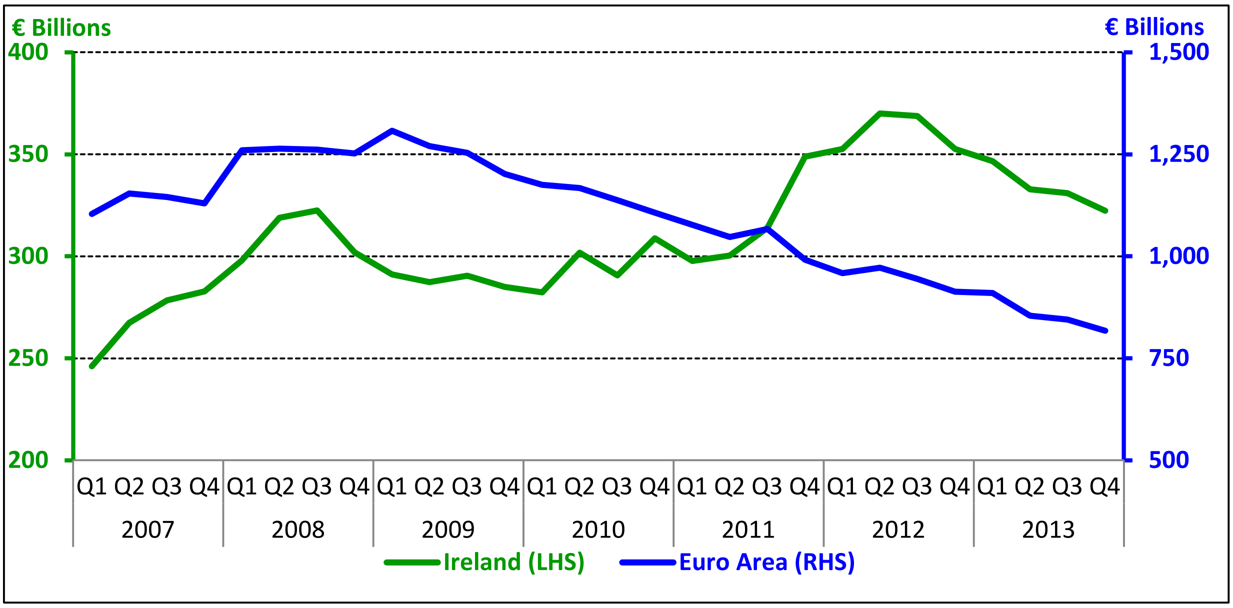
Investor Profile in Irish MMFs by Region

Chart 2



Irish[1] and Other Euro Area MMFs

Chart 3



[1] Irish MMF data has been smoothed for a reclassification that took place in Q4 2011.

The following sections look at these trends using our granular data to assess the potential for developing risk indictors for MMFs.

[5] Irish Central Bank Macro-Financial Review 2014.1, which can be found at http://www.centralbank.ie/publications/Pages/MacroFinancialReviews.aspx.

3. Risk Analysis

We conducted risk analysis under three headings: econometric analysis on investor outflows, non-econometric outflow analysis, and yield analysis using granular data for 2010–13 and more basic data for 2008 and 2009.

3.1 Econometric Analysis

Our econometric analysis draws on McCabe (2010),[6] which focused on the particularly sharp outflows from US MMFs in both 2007 and, especially, 2008. McCabe found for 2008, yield evolved as a key indicator, with higher yielding funds in the run up to September significantly more likely to experience large outflows. The size of the fund was also significant, which is also supported by findings from Kacperczyk and Schnabl (2013)[7] that larger funds with more financial strength took on more risk and suffered runs as a result. An institutional investor base was also a key driver, with institutional investors having better access to information than retail investors and reacting to negative events more rapidly. Sponsor risk was also significant, reflecting the perceived likelihood of sponsor support for the MMF in the event of stress.

We compiled and tested various indicators (Table 1) to replicate McCabe's analysis on Irish MMFs from Q1 2010 to Q4 2013, using security-by-security data from quarterly reporting forms. These data cover a period of mild stress in financial markets, in contrast to the McCabe analysis, and the below results must be interpreted with this in mind. Data were also obtained from a one-off survey of all Irish MMFs (Table 1). Both sponsor credit default swaps (CDS) and bank affiliation were used as proxies for sponsor risk, with a bank sponsor seen as generally more likely to support a stressed MMF for reputational reasons. Investor outflows and yield, using internal calculations of yield to maturity, were both tested separately as dependant variables, while the remaining indicators were used as explanatory variables. Yield as a dependant variable was not found to be statistically significant to any of the explanatory variables. This result is unsurprising as McCabe found that yield dominated as the explanatory variable, thus rendering most of the other variables insignificant.

We focused on the size of investor outflows per month[8] as our dependent variable and, using a Probit model, we found that, during a period with no episodes of extreme stress, smaller funds where investors were predominantly non-retail were the most likely to experience larger outflows (Table 2). This result, significant at the 95 per cent confidence interval, contrasts somewhat with McCabe's results which suggested large funds dominated by institutional investors were most vulnerable to large outflows during a period of financial crises. The weighted average maturity (WAM) of a fund was also significant, with funds whose assets had longer average maturities more likely to experience investor outflows. In addition, if an MMF has a triple-A credit rating, it was significantly less likely to experience outflows. Both the WAM and credit rating results were significant at the 90 per cent confidence interval.

6 McCabe 2010, "The Cross Section of Money Market Fund Risks and Financial Crises".

7 Kacperczyk and Schnabl 2013, "How Safe are Money Market Funds?".

8 Investor outflows were defined as an outflow of greater than 10 per cent of a MMFs net asset value (NAV).

Overall, our results may indicate that while large institutional funds deserve attention in terms of crisis prevention, as McCabe's and the literature suggests, smaller institutional funds may be more volatile during non-crisis periods.

Various indicators used in analysis of Irish MMFs from Q1 2010 to Q4 2013 — Table 1

Indicator		Indicator	
Asset holdings	CBI* Data	Expense ratios	Survey
Investor outflows	CBI* Data	Sponsor CDS	Survey
Fund size	CBI* Data	Yield	Calculated
Institutional or retail investors	Survey	Weighted average maturity	Calculated
Investment ratings	Survey	Investor flow volatility	Calculated
Bank affiliation	Survey		
* Central Bank of Ireland			

What caused investor outflows from Irish MMFs from 2010 – 2013? — Table 2

Dependant variable:	Probit regression 1		Probit regression 2	
1 if outflows > 10% of NAV	Co-efficient	Z-Stat	Co-efficient	Z-Stat
NAV (euro)	**-6.3**	**-4.64***	**-8.29**	**-4.44***
Yield	-4.37	-0.5	-13.7	-1.39
WAM	***0.1***	***1.79^***	0.04	0.6
Retail	**-0.84**	**-2.91***	**-0.67**	**-2.23***
Bank	-0.17	0.08	-0.02	-0.17
Rating			***-0.23***	***-1.67^***
Govt			1.38	1.46
VIX			-0.01	-0.95
** 95% confidence, ^ 90% confidence*				

3.2 Outflow Analysis

Our analysis on the more limited data we have on the 2008 period confirms literature findings that larger, institutional funds were most vulnerable. Outflows from Irish MMFs in September/October 2008 were on average 22 per cent of net asset values, though some MMFs suffered much stronger outflows, which was partly offset by inflows into other MMFs, such as those largely invested in government securities. Both the average decline in net asset values of Irish MMFs and the pattern of flows between MMFs were very similar to the experience of US MMFs at the time. Consistent with McCabe and other literature findings, larger Irish MMFs and those with the highest investor inflows in the preceding period experienced the biggest outflows during 2008 (Table 3). Irish MMFs with an average size of €4.8 billion suffered from redemptions of over 30 per cent, with a bias towards an institutional investor base. Smaller Irish MMFs experienced lesser investor outflows, while some Irish MMFs, with an average size of €1.6 billion and with less of an institutional bias, actually experienced investor inflows over the same period.

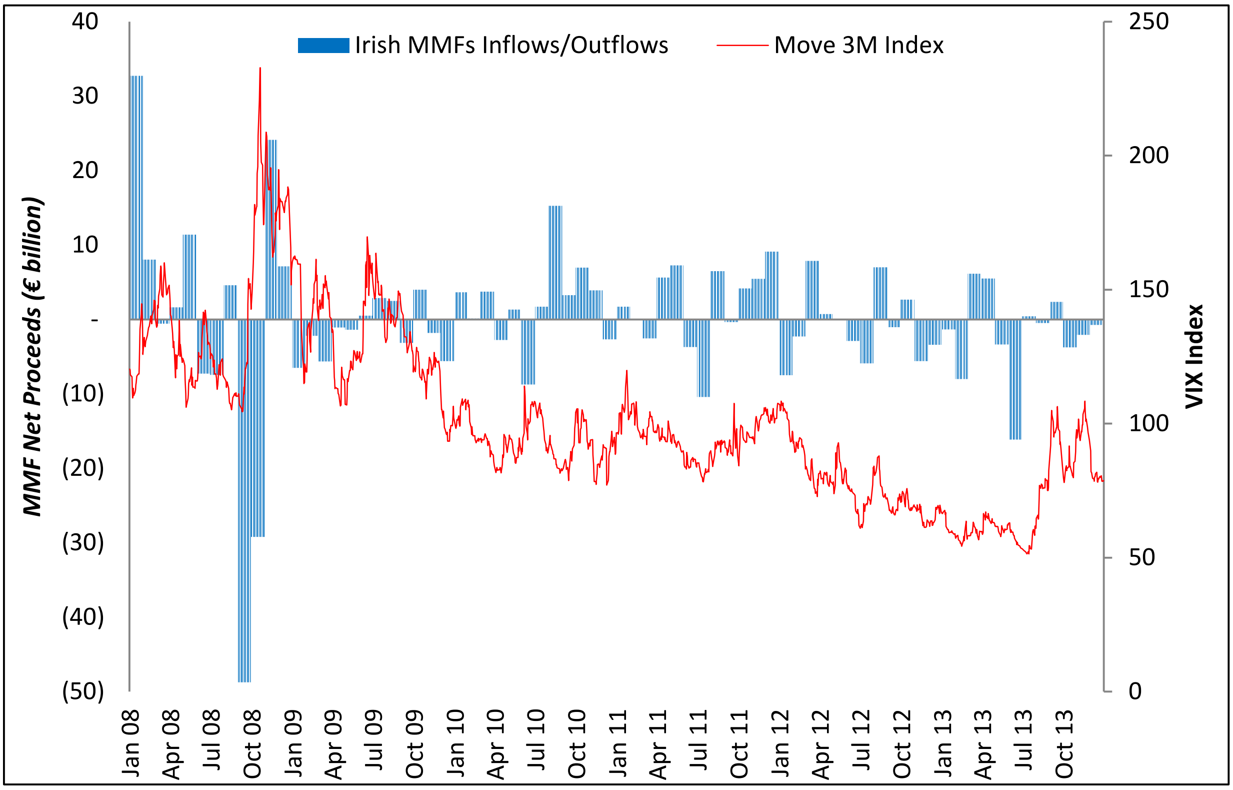
Case study of Irish MMFs flows from September/October 2008 — Table 3

Sept-Oct 2008	No. of funds (€ bn)	Average size	Institutional Weight
Over 30% outflow	25	4.75	93%
10–30% outflow	28	2.2	83%
Flows +/– 10%	32	2.06	91%
Over 10% inflow	19	1.64	78%

Looking at the period beyond 2008, Irish MMFs withstood periods of market stresses in 2010 and 2011 relatively well (Chart 4), with no further evidence of substantial investor redemptions during this period. As the MOVE volatility index[9] shows, significant market stresses occurred in 2010 and 2011 and early 2012 related to the euro area debt crisis, albeit on a much smaller scale than 2008. This suggests that the MMF industry is quite resilient even in the event of significant market stress, despite this not being true at height of the global financial crisis. This would reinforce the view held in years preceding the financial crisis when MMFs were regarded as extremely safe investments. The fact that the euro area debt crisis had a relatively limited impact on investor flows provides some reassurance.

[9] The MOVE 3M volatility index is used to measure stress in the market and is constructed from a yield curve weighted index of the normalised implied volatility on 3 month Treasury options.

Irish MMF outflows from 2008 – 2013 and the MOVE 3M volatility index Chart 4

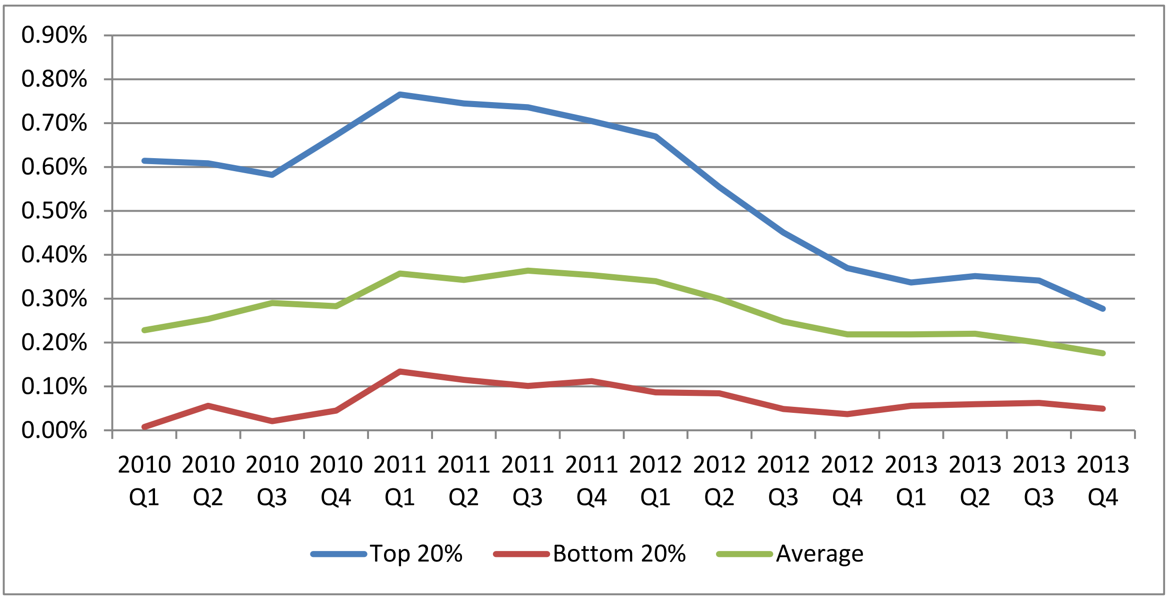


3.3 Yield analysis

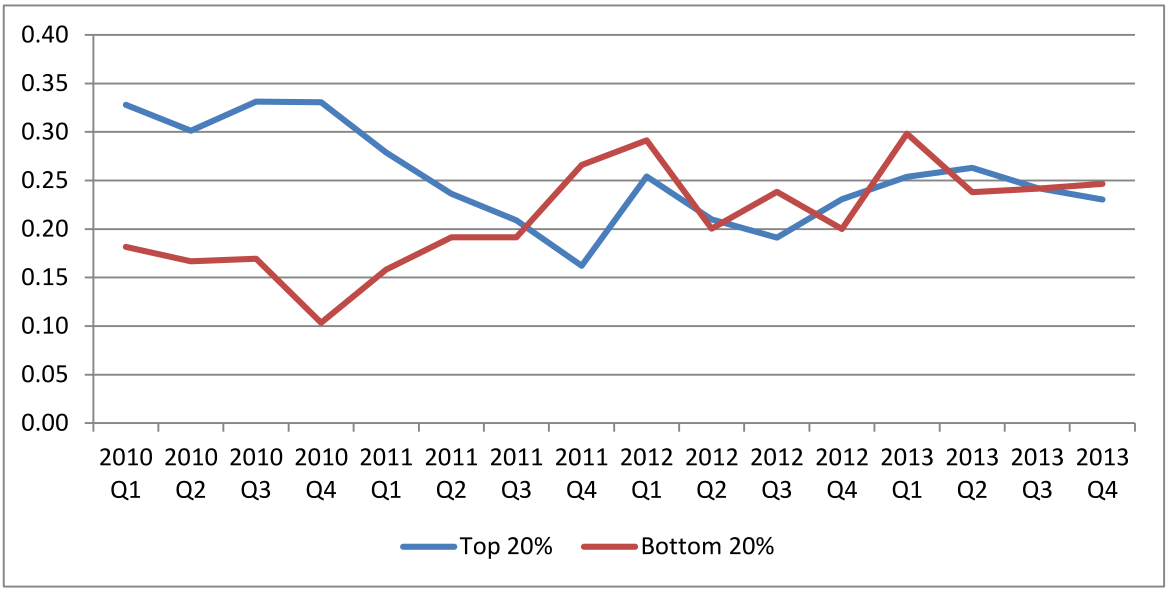
Yields tell an important story on MMF behaviour from Q1 2010 to Q4 2013, even if not significant in our econometric analysis. The following analysis looks at the yield of funds which were active at beginning of 2010 and still operating at end-2013. We found that the funds with average yields in the top 20 per cent of Irish MMFs at the start of 2010 saw their yields decline steadily since early 2011 (Chart 5), from a peak of almost 0.8 per cent to less than 0.3 per cent. The MMFs in the lowest 20 per cent in terms of average yield remained at low yields of around 0.10 per cent for the majority of this period. This pattern suggests that the higher yielding funds attempted, for a time, to maintain and even improve on their average yields until early 2011. After Q1 2011, higher yielding MMFs saw their yields decline and converge towards market averages. This either reflects a more conservative investment strategy or the lack of opportunities arising from the low interest environment.

The suggestion of a more conservative approach from the higher yielding MMFs can also be found in an analysis of weighted average maturities, although MMFs across the board appeared to have taken some limited action to maintain yields. The average WAM of higher yielding MMFs declined from between 0.30 and 0.35 years up to 2011 to around 0.16 by Q4 2011, before recovering somewhat to between 0.20 and 0.25 years (Chart 6). The lowest yielding MMFs, after initially falling to a low of 0.10 years in Q4 2010, increased in 2011 and their WAMs stayed in the range of 0.20 and 0.30 years up to end-2013. This convergence of WAMs suggests that, while the highest yielding MMFs WAM declined the most, all MMFs took some action to maintain minimum sustainable levels of yield.

The Top & Bottom 20 per cent Performing Irish MMFs by Yield Chart 5

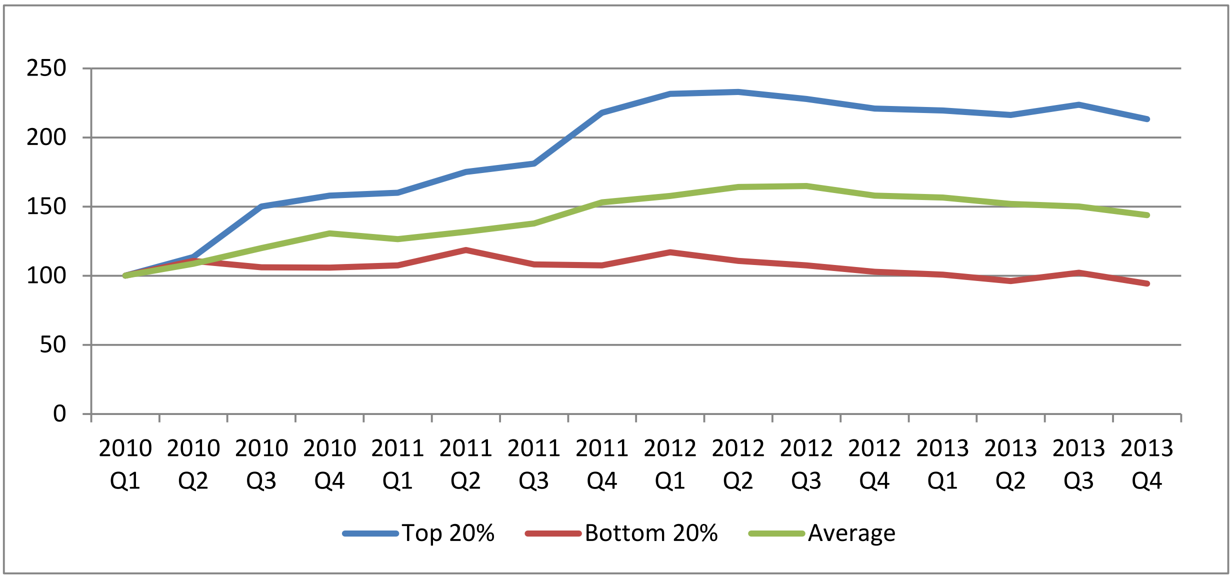


Convergence of WAM of highest and lowest yielding Irish MMFs Chart 6



The unsurprising finding that higher yielding funds attracted significantly greater investor inflows could simply reflect better performing funds though it is also consistent with higher levels of risk. McCabe and others found that the MMFs suffering the largest outflows in 2008 were both higher yielding and had attracted higher investor inflows in the preceding period. As Chart 7 shows, the top 20 per cent in terms of higher yielding MMFs in early 2010 experienced growth over the following two years, with a doubling in their NAVs. Furthermore, this growth tapered off once these MMFs saw their average yields decline. In contrast, the bottom 20 per cent performing MMFs saw very little change up to 2012, and started to decline in size from Q1 2012 to Q4 2013.

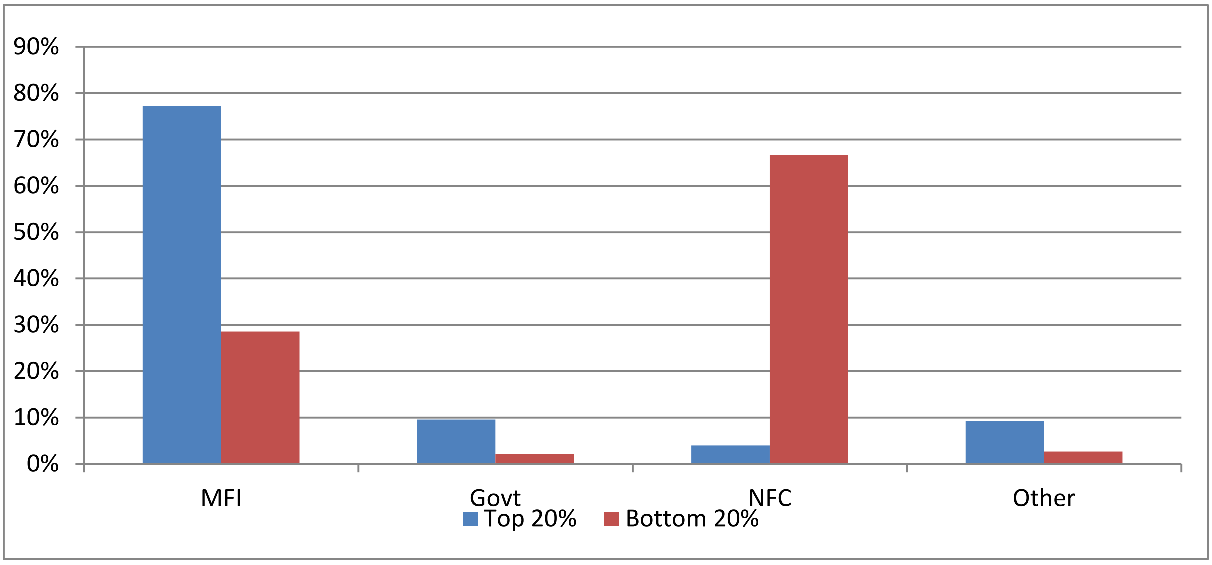
Index of NAV growth of the Top & Bottom Performing Irish MMFs by Yield — Chart 7



One way of distinguishing whether higher yielding funds simply perform better or take on more risk is to look at asset composition. In other words, do higher yielding funds invest in different sectors, geographies and maturities that might indicate a different risk profile? We found that the higher yielding MMFs invested 50 per cent more in banking debt than the lower yielding MMFs in Q4 2013 (Chart 8), while also investing slightly more in government debt. On the other hand, the lowest yielding MMFs invested over 60 per cent more in non-financial corporate debt than the higher yielding MMFs though at the very short end of the yield curve. This is not a clear-cut result but it would appear that higher yielding funds may have taken on bank debt and extended maturities on government debt. Meanwhile, lower yielding funds focused on very short maturities but within the NFC sector so as to preserve a modicum of yield.

Overall, the Irish MMF industry appears to have adopted a hunker-down attitude to the low-yielding environment, largely eschewing the option of taking on additional risk to compensate for declining yields. This is supported by the convergence in MMF yields, as seen in section 3.3.

Holdings by Sector of Top & Bottom Performing Irish MMFs in Q4 2013 Chart 8



3.4 Asset holdings

The weight of particular assets in MMF portfolios may also be an indicator of risk. For example, Chernenko and Sundaram (2013)[10] find that US MMFs with large exposures to euro area banks suffered significant outflows between June and August 2011. Unfortunately, our data was insufficient up to Q4 2013 to distinguish between prudent and forced selling of asset positions and so no concrete analysis could be undertaken. Further research would benefit from data on the times and prices at which positions were rapidly unwound. The next section looks at our new MMF dataset collected from Q1 2014, which looks to address some of the data gaps that have been identified in our analysis.

4. Development of Risk Indicators from a new MMF dataset

More detailed and granular data has been collected from Irish MMFs since Q1 2014, and from Q4 2014 this data will be collected monthly rather than quarterly. This new data will fill some data gaps, provide richer indicators and will allow for a greater analysis of risks emanating from the Irish MMF industry. The extra granularity of data includes:

- A liquidity measure of total assets.[11]
- The identification of which debt/equity securities are used in securities lending/borrowing and the amounts involved.

10 Chernenko and Sundaram (2013), "Frictions in Shadow Banking: Evidence from the Lending Behaviour of Money Market Mutual Funds".

11 This measures the amount of assets of a MMF that can be liquidated within 7 days, from 7 days up to 1 month, and over 1 month.

- More granular detail of debtor/creditor counterparties.
- Reporting of different instrument types.
- Detailed information on repo and reverse repo type transactions.
- Identification of securities used in re-hypothecation.
- Maturity dates of securities held.
- Derivatives reported by their instrument types and underlying asset/liability types.

While it will take a number of quarters for this data to bed down, possible new risk indicators can be developed from this new data set. In particular, the data will allow for measures of maturity and liquidity mismatch on both sides of the balance sheet. More detail on activities in the repo market will shed light on the liquidity provided by MMFs to other financial entities, while more granular data will assess the extent to which derivatives might mitigate or, potentially, exacerbate risk. These new indicators will allow for greater measurement of risks posed by Irish MMFs to the Irish economy as well as the wider financial system.

5. Conclusion

This paper suggests that granular financial data collected by the Central Bank can contribute to risk indicators for MMFs. Our more limited data for 2007 and 2008 is consistent with the existing literature which points to average yield per fund, larger funds during times of financial crises, asset growth and the investor base as risk indicators. More detailed data for the most recent period does not contain sharp investor outflows from MMFs. Nevertheless, our findings suggest that smaller funds with an institutional investor base may be more volatile outside periods of extreme stress. Furthermore, while we could not detect econometric relationships for yield, there are clear differences in behaviour when MMFs are split by their average yield, which supports the view that average yield per fund deserves close attention.

There is considerable scope for further work in this area and we see our work to date as a preliminary step. Our new reporting forms will provide significant scope for additional indicators, while the characteristics of those MMFs holding relatively large amounts of certain asset classes suggests that more detail on the timing and price of asset sales can provide better insights into the behaviour of funds. In summary, there is huge potential to expand the use of granular data collected for statistical purposes for monitoring of risk of money market funds and the wider financial system.

The BIS Global liquidity indicators

Patrick McGuire and Vladyslav Sushko

A. Conceptual background[1]

The term *global liquidity* is used in a variety of ways. Here, it is used to mean the *ease of financing* in global financial markets (or the ease with which perceptions of value can be turned into purchasing power). Defined this way, global liquidity depends primarily on the actions of private investors and financial institutions.

Financial institutions provide market liquidity to securities markets through their trading activities, and provide funding liquidity to borrowers through their lending activities. The conditions under which these intermediaries can fund their own balance sheets, in turn, depend on the willingness of other market participants to interact with them. Macroeconomic and prudential policies also factor in, including the terms under which central banks are willing to provide funding.

It is the interaction between these factors that determines the economy's overall ease of financing and how this contributes to the build-up of financial vulnerabilities (eg asset price inflation, excess leverage, or maturity or funding mismatches). Indicators tend to measure these "footprints" of liquidity rather than global liquidity itself. From a financial stability perspective, *global credit* is among the key indicators, since the stock of credit generally grows as financing conditions ease and history shows rapid credit growth to be closely associated with the build-up of vulnerabilities.

There are both domestic and an international components to credit flows. Of particular interest are the international components: (a) direct lending from abroad to non-bank residents, (b) indirect lending from abroad via resident banks, and (c) lending in foreign currencies. It is these international components that regularly provide the marginal source of financing in the run-up to crises. Although often small relative to the total stock of credit, swings in these international components can amplify domestic trends and are highly correlated with booms and busts in global financial conditions.

Assessment of global liquidity conditions requires putting measures of global credit into perspective and accurately separating the domestic and international components. Here, the focus is on credit supplied by *banks*, although a full assessment would naturally include credit provided via *bond markets* as well. Combined with supplementary price-based indicators (eg measures of credit tightness and incentives for position-taking, proxies of risk appetite and leverage,

[1] This material draws heavily on CGFS (2011): "Global liquidity – concept, measurement and policy implications", CGFS papers no. 45, Borio, McCauley and McGuire (2011): "Global credit and domestic credit booms", BIS Quarterly Review, September, pp 43–57; Domanski, Fender and McGuire (2011): "Assessing global liquidity", BIS Quarterly Review, December, pp 57–71; and Eickmeier, Gambacorta and Hofmann (2013): "Understanding global liquidity", BIS Working Papers no 402, February.

volatility), the resulting credit indicators can help in identifying unsustainable lending booms, potentially on a global scale.

The BIS regularly compiles and updates a wide range of indicators that are collectively referred to as the "Global Liquidity" indicators. These feed into research done at the BIS and are regularly used to facilitate policy discussions. A subset of these indicators is published on the BIS website (http://www.bis.org/statistics/gli.htm). In the remainder of this note, we highlight a few of the key indicators, in particular those that rely heavily on the use of the various BIS statistics (ie the BIS banking statistics and the international debt securities database). Sections B and C discuss how these are used in compiling global credit aggregates, and in capturing system-level funding needs in particular currencies, respectively. Sections D and E then present some of the highlights in the broader set of indicators.

B. The international element in domestic credit booms

Often during credit booms, the growth of credit to the private sector outpaces monetary growth.[2] This is true for both bank credit and broader credit aggregates. Non-bank credit channels, for example finance companies in the Nordic credit boom of the late 1980s, housing finance companies (*Jusen*) in Japan during the same period, and the so-called shadow banking system in the United States more recently, become more important during credit booms. More importantly for present purposes, *international* sources of finance become more important. This applies to both *interbank lending* and *direct cross-border lending to non-banks*.

Graph 1 documents the importance of international sources of bank credit.3 In each of the selected economies, the international components supporting credit expansion combined tended to grow faster during the boom in the run-up to the financial crisis than the credit granted by banks located in the country. The recent case of Ireland is striking: direct cross-border credit to non-banks in the country (dark shaded area) grew at roughly 40% year-on-year in the three years preceding the crisis (right-hand panel), a full ten percentage points higher than the rate of growth of domestic bank credit. Moreover, since domestic bank credit grew faster than domestic (non-bank) deposits, banks in Ireland drew heavily on cross-border sources of funds (both from banks and non-banks) to finance credit growth at home (left-hand panel, dashed brown line).[4] Combined, these two cross-border components accounted for more than half of total bank credit to non-banks in the country in 2008. In the case of Thailand around the time of the Asian financial crisis, indirect offshore financing of domestic lending by banks on the ground was even larger than direct cross-border loans to non-banks in the country.

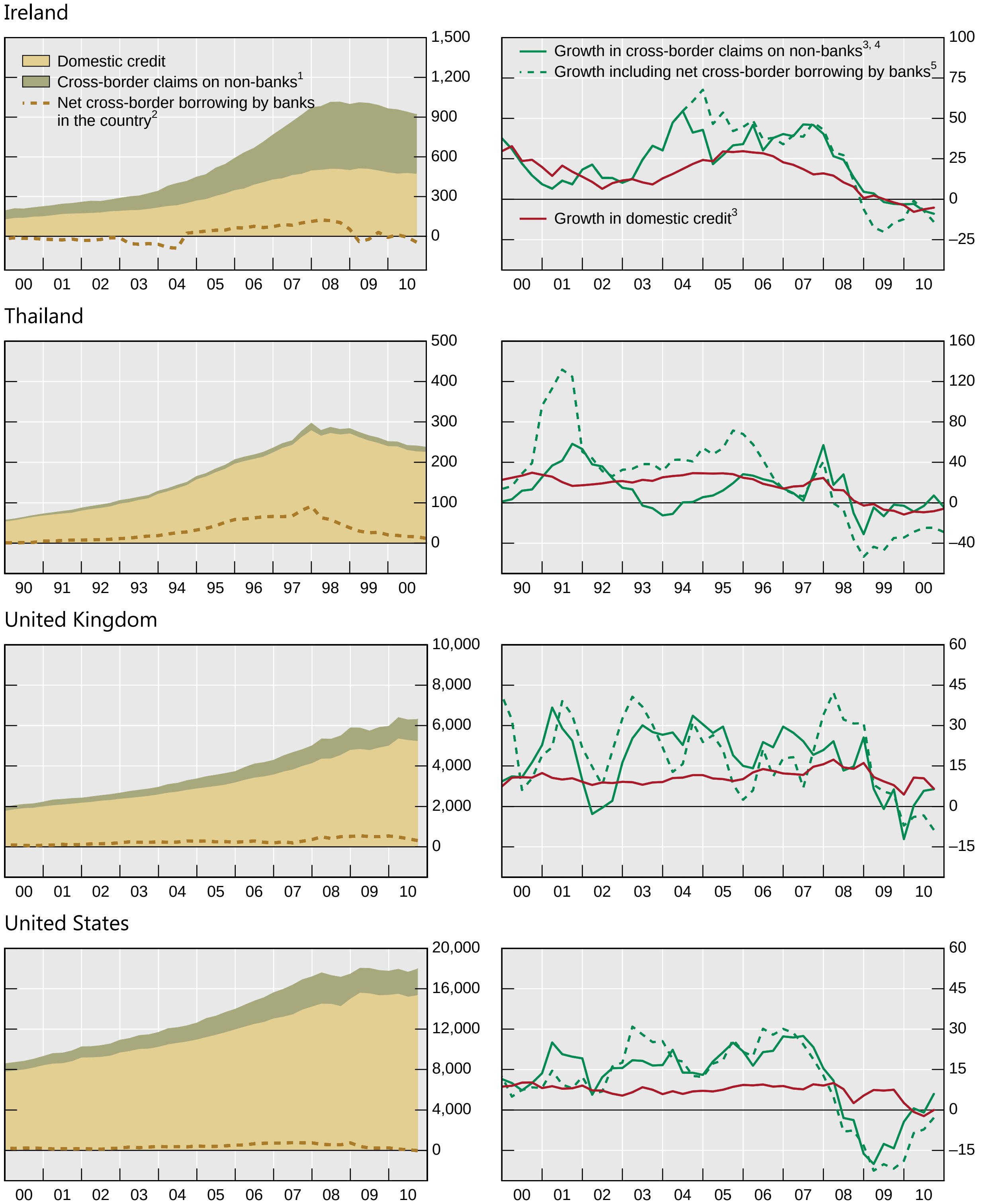
2 C Borio and P Lowe, "Securing sustainable price stability: Should credit come back from the wilderness?", *BIS Working Papers*, no 157. 2004.

3 See Avdjiev, S, R McCauley and P McGuire, "Rapid credit growth and international credit: challenges for Asia", *BIS Working Papers* no 377, for a complete analysis.

4 P Honohan, "Banks and the budget: lessons from Europe", address to SUERF Conference, Dublin, 20 September 2010.

Bank credit to non-bank residents: domestic and cross-border

In billions of US dollars (left column) and per cent (right column) Graph 1



[1] BIS reporting banks' cross-border claims on non-banks. [2] Net cross-border borrowing (liabilities minus claims) from all sectors by banks located in the country. For Thailand, BIS reporting banks' net cross-border claims on banks in the country. [3] Year-on-year growth. [4] Growth in BIS reporting banks' cross-border claim on non-banks. [5] Growth after first net cross-border borrowing (if positive) from all sectors by banks located in the country (dashed brown line in left-hand panels), under the assumption that this cross-border credit is ultimately passed on to non-banks in the country.

Sources: IMF *International Financial Statistics*; BIS *Locational Banking Statistics by Residence*.

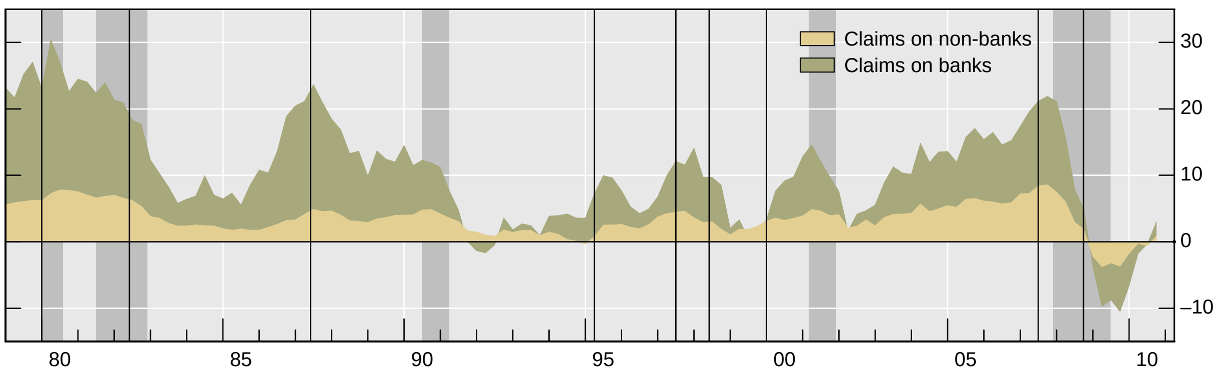
Compared with the indirect interbank component of international credit, direct cross-border lending to resident non-banks poses particular challenges to the authorities. First, it can evade or circumvent measures put in place to restrain lending, such as higher reserve requirements, (macro-) prudential tools (eg, tighter loan-to-value ratios), or quantitative credit limits. Indeed, the operation of the countercyclical capital buffer of Basel III envisages an explicit coordinating mechanism between home and host supervisors based on reciprocity agreements in order to prevent circumvention. Second, direct cross-border credit is harder for the authorities to track than domestic credit. This cross-border component of credit is often excluded from monetary statistics, the typical source of information for credit growth, while other statistics (eg balance-of-payment statistics) can be less reliable in this area.

What is true for individual countries seems to be true also in the aggregate of international bank credit (now excluding domestic currency credit extended by domestic banks). In particular, the growth in international bank credit exhibits boom-and-bust cycles that correspond closely to episodes of financial distress (Graph 2). Moreover, the interbank component tends to grow much faster than total international credit in the periods prior to financial crises.

Contributions to total international claims

Annual change; in per cent — Graph 2

By counterparty sector



The vertical lines mark: 1979 second oil shock; 1982 Mexican default; 1987 stock market correction; 1994 Mexican peso devaluation; 1997 Asian financial crisis; 1998 Russian default and LTCM; 2000 Nasdaq peak; 2007 global financial crisis; 2008 collapse of Lehman Brothers. The shaded areas mark US recessions (NBER definition).

Sources: NBER; BIS locational banking statistics by *residence*.

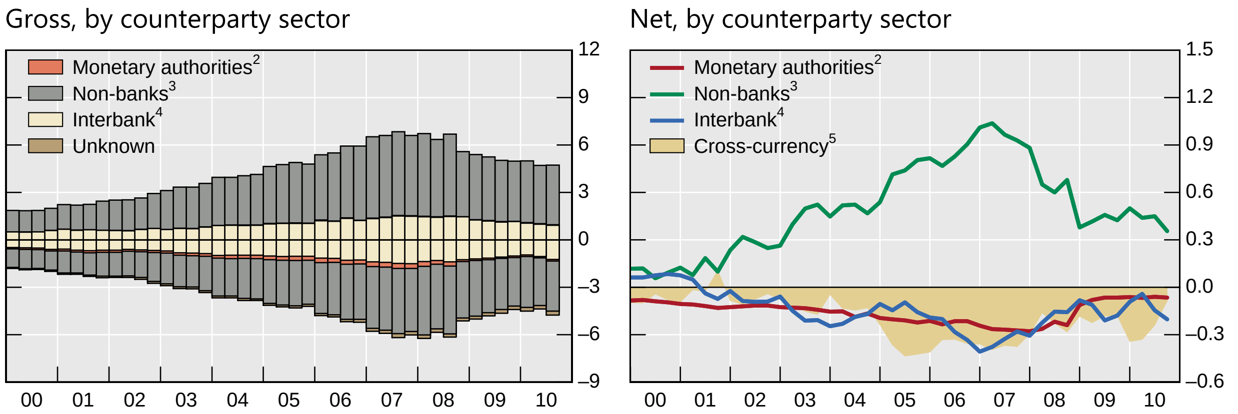
C. Global banks' foreign-currency funding needs

So far the analysis has relied on statistics drawn on the residency principle: just as with the balance-of-payment statistics, economic agents are classified based on their *residence* (location). However, the most important banks increasingly operate in several jurisdictions. These banks need to manage risks and activities across their whole balance sheet, regardless of where they happen to be located. As a result, apparent maturity or currency mismatches on the balance sheet of one office can be offset by positions booked in offices elsewhere. Thus, a relevant criterion to understand risks and vulnerabilities is to consolidate balance sheets across locations on a nationality basis (ie, based on the location of the headquarters, seen as the nerve centre of the organisation). We next illustrate how this can shed light on the evaporation of funding liquidity for banks during the crisis.

Ahead of the crisis, many large global banks, especially European ones, had built up sizeable US dollar asset positions and funded them borrowing short-term in the same currency or swapping into dollars out of their domestic currency. Either way, while hedging their foreign exchange risk, these banks ran substantial liquidity risks. As the crisis broke out, depositors' and swap counterparties' perceptions of credit risk soared, owing to the deterioration in the value of dollar assets and uncertainty about their holders. As a result, these banks found it hard to roll their foreign currency funding. In other words, as the dollar assets became harder to sell in illiquid markets, their effective maturity lengthened. And this occurred precisely as the maturity profile of the dollar liabilities shortened. This exemplifies the vicious circle between market and funding illiquidity under stress. Ultimately, the Federal Reserve arranged swap lines with other central banks to provide funding support.

Long-USD European banks' on-balance sheet USD positions[1]

In trillions of US dollars | Graph 3



[1] Estimates are constructed by aggregating the worldwide on-balance sheet cross-border and local positions reported by internationally active banks headquartered in Germany, the Netherlands, Switzerland and the United Kingdom. [2] Positions vis-à-vis official monetary authorities. Excludes liabilities to Japanese monetary authorities placed in banks located in Japan. [3] International positions vis-à-vis non-banks plus local positions vis-à-vis US residents (all sectors) booked by banks' offices in the United States. No sectoral breakdown is available for these positions. [4] Estimated net interbank lending to other (unaffiliated) banks. [5] Implied cross-currency funding (ie FX swaps), which equates US dollar assets and liabilities.

Sources: Bloomberg; JPMorgan; BIS consolidated statistics (immediate borrower basis); BIS locational statistics by nationality.

Given the limited data available, tracking such funding liquidity risks is very hard; even so, while incomplete, the BIS banking statistics provide some aggregate information on the size banks' funding needs in a given currency.[5] These data allow us to estimate cross-currency funding positions, a proxy for short-term foreign

[5] For a further discussion, see P McGuire and G von Peter "The US dollar shortage in global banking and the international policy response", *BIS Working Papers* no 291, October 2009; P McGuire and I Fender "Bank structure, funding risk and the transmission of shocks across countries: concepts and measurement", *BIS Quarterly Review*, September 2010; Committee on the Global Financial System, "The functioning and resilience of cross-border funding", *Report* no 37, March 2010.

exchange swaps on the assumption that banks hedge their foreign exchange risk. In addition, by making some additional reasonable assumptions, one can use the counterparty break-down (banks, non-banks, central bank) to approximate the maturity of other balance-sheet items. For example, it can be safely assumed that interbank positions are short-term. Together, these two pieces of information provide a rough picture of the degree of maturity transformation in a given currency (long maturity assets minus long maturity liabilities, or "funding gap").

These data indicate that, in the run-up to the financial crisis, non-US banks built up substantial liquidity risk in US dollars – a major undetected vulnerability. For example, Graph 3 shows the US dollar assets and liabilities of those European banking systems that, on the assumption of squared foreign exchange exposures, were net borrowers of dollars in the FX swap market (shaded area in the right-hand panel). In addition, these banks borrowed dollars from the cash interbank market (the blue line) and central banks (the red line). They then used the proceeds to finance their holdings of assets issued by non-banks (the green line). Graph 3 points to a significant degree of maturity transformation. The lower-bound estimate of the US dollar funding gap peaked at almost $1 trillion in mid-2007. While it has declined substantially since then, to roughly $350 billion by end-Q3 2010, the funding gap remains sizeable.

D. Highlights from the indicators

In 2014, global liquidity indicators continued to point to an unusually accommodative policy environment and funding costs near record lows, despite geopolitical risks and slowing growth outlooks across several jurisdictions. BIS data available through the first quarter of 2014) showed that growth in US dollar-denominated bank and bond market credit to non-banks remained robust, although the pace apparently slowed somewhat over the previous year (Graph I.3). Global growth in international bank credit, in contrast, was virtually zero (Graph I.1).

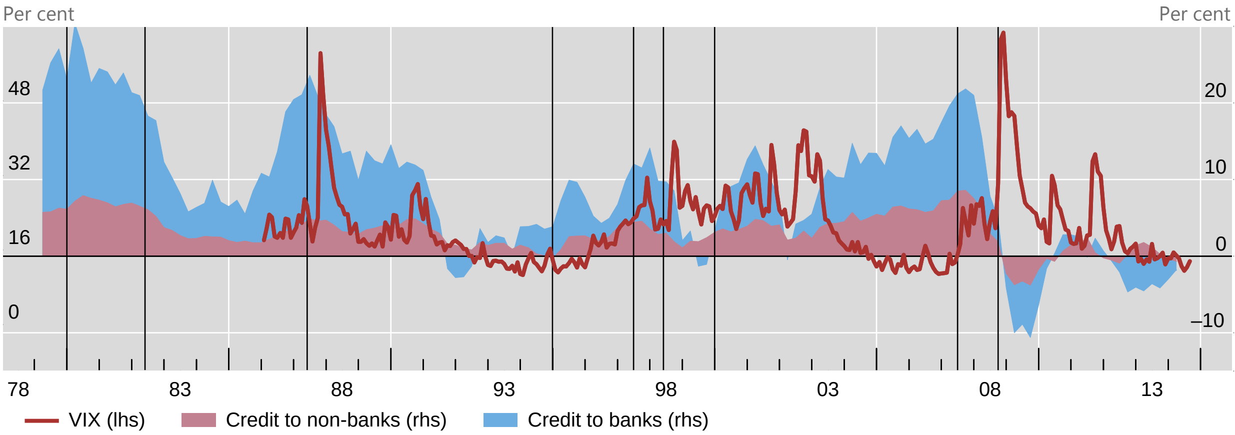
- Euro-denominated bank lending to non-residents continued to fall, while the growth in US dollar- and, especially, Japanese yen-denominated bank lending moderated (Graph I.3). At the same time, US dollar- and euro-denominated bond market credit to non-resident corporates and households grew at double-digit rates, outpacing domestic credit. The particularly robust growth of offshore euro-denominated bond market credit has been associated with sharper declines in term premia on debt in the euro area, which also appeared to lead term premia declines on US dollar denominated debt (Graph II.2).
- In contrast, cross-border bank credit growth was zero or negative in most regions, apart from Asia-Pacific, where the stock remains still low in absolute terms (Graph I.2). In addition, several emerging market economies (EMEs), such as China, exhibited particularly robust growth in locally extended foreign-currency credit, albeit from a small base (Graph I.3b).
- Short-term interest rates remained at or near record lows in advanced economies (Graph II.1). Net international debt issuance by non-financial borrowers was strong in both advanced economies and EMEs (Graph III.1). Baseline measures of risk and uncertainty continued to be compressed (Graph IV.1).

E. Select indicators

I. Credit aggregates

Year-on-year rate of growth in international bank claims[1]

Graph I.1



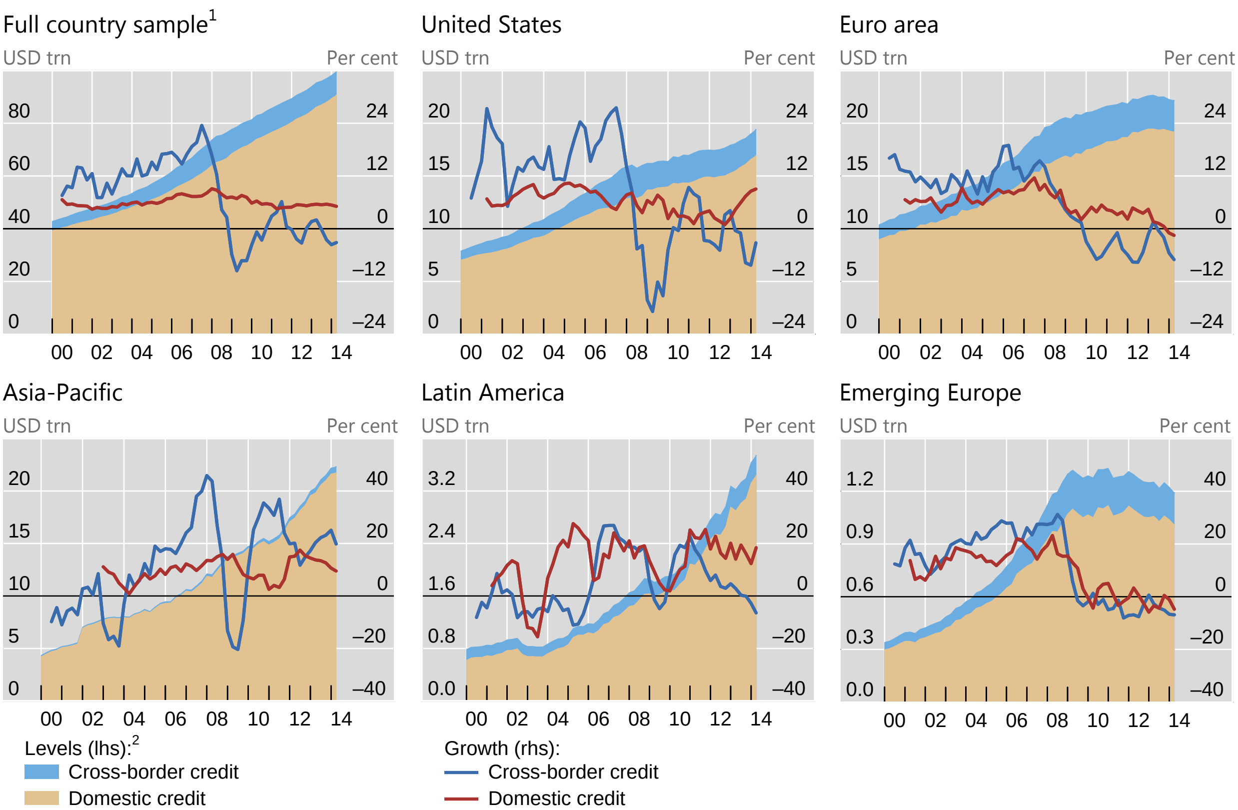
The vertical lines indicate: 1979, second oil shock; 1982, Mexican default; 1987, stock market correction; 1994, Mexican peso devaluation; 1997, Asian financial crisis; 1998, Russian default and LTCM; 2000, Nasdaq peak; 2007, beginning of global financial crisis; 2008, collapse of Lehman Brothers.

[1] Includes all BIS reporting banks' cross-border credit and local credit in foreign currency.

Sources: Bloomberg; BIS locational banking statistics by residence.

Global bank credit aggregates, by borrower region

At constant end-Q1 2014 exchange rates — Graph I.2

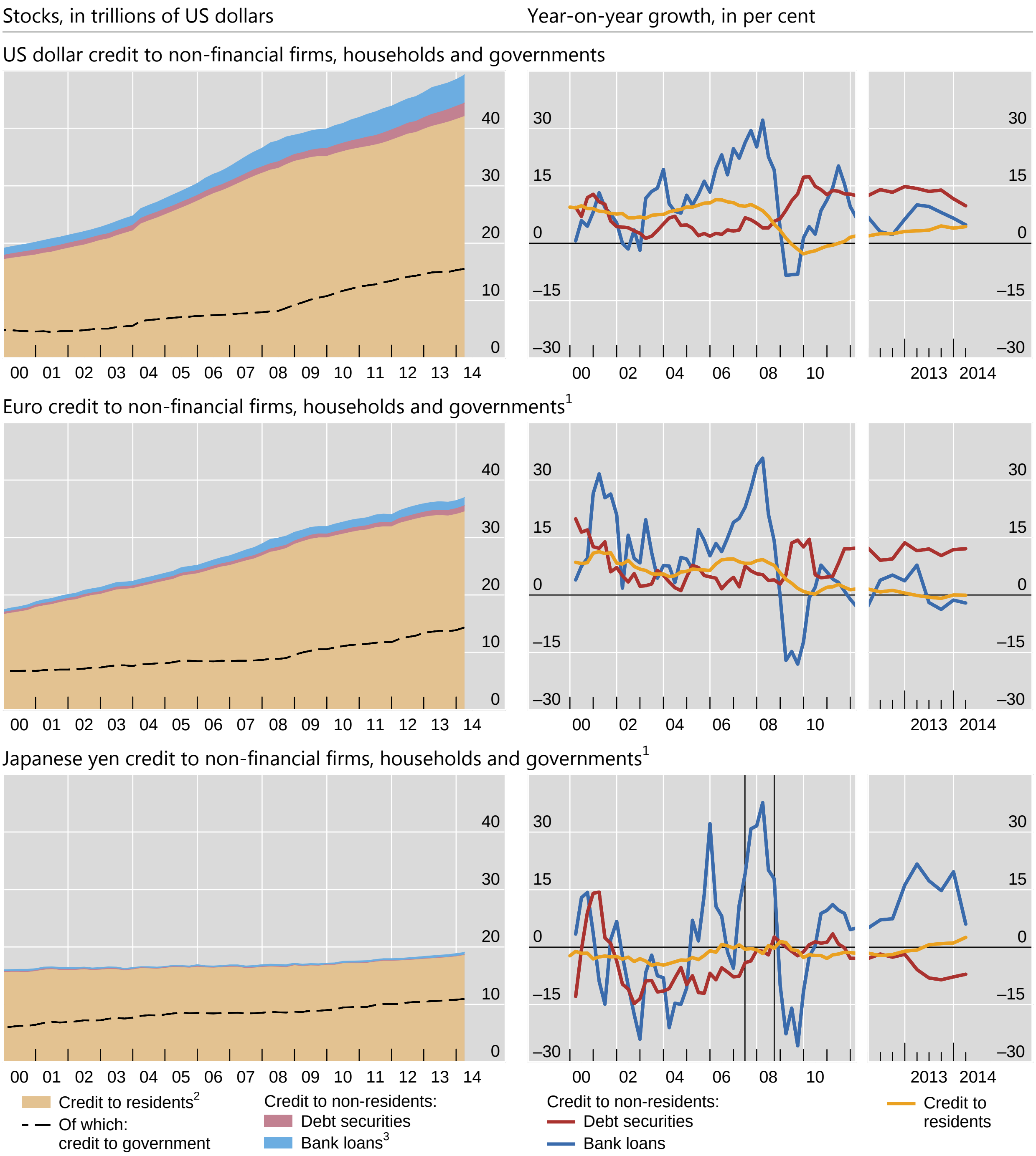


[1] Aggregate for a sample of 56 reporting countries. [2] Total bank credit to non-bank borrowers (including governments), adjusted using various components of the BIS banking statistics to produce a breakdown by currency for both cross-border credit and domestic credit.

Sources: IMF, *International Financial Statistics*; BIS international banking statistics; BIS calculations.

Global credit in US dollars, euros and Japanese yen

Graph I.3

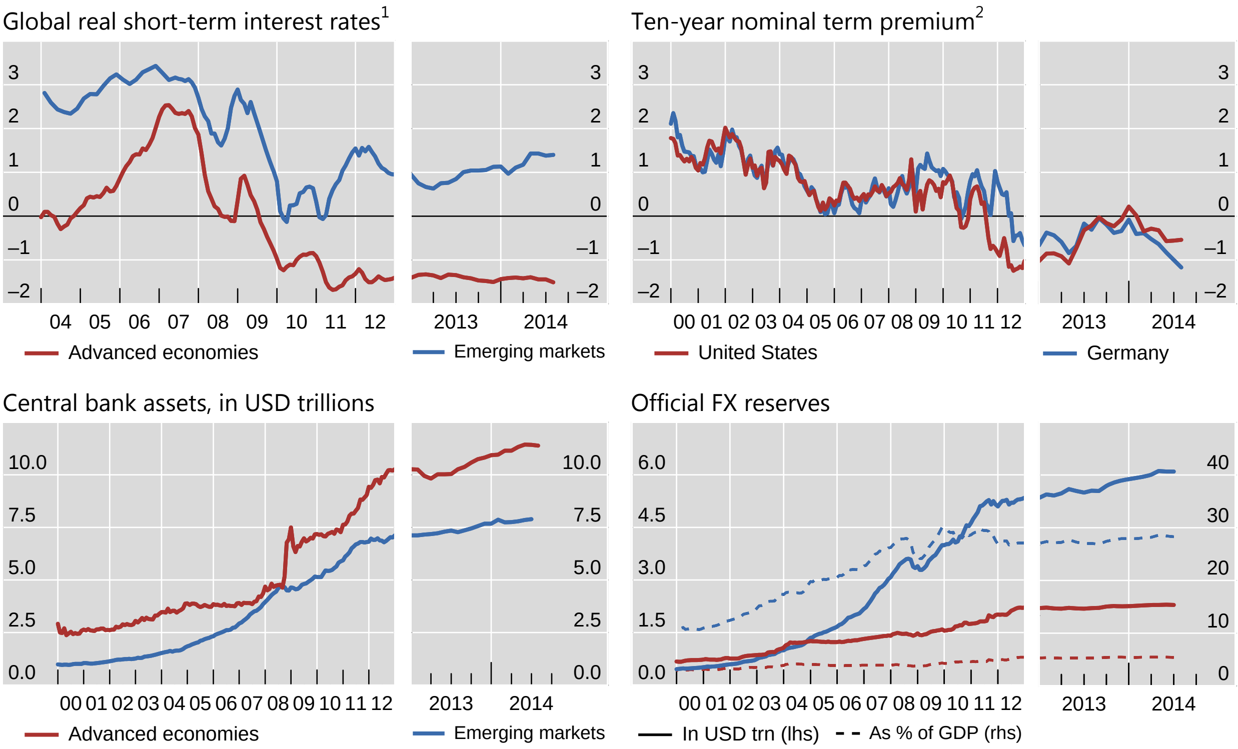


[1] At constant end-Q1 2014 exchange rates. [2] Credit to non-financial sector in the United States/euro area/Japan from national flow of funds, excluding identified credit to these borrowers in non-domestic currencies (ie cross-border and locally extended loans and outstanding international bonds in non-domestic currencies). [3] Cross-border and locally extended loans to non-banks outside the United States/euro area/Japan. For China and Hong Kong SAR, locally extended loans are derived from national data on total local lending in foreign currencies on the assumption that 80% are denominated in US dollars. For other non-BIS reporting countries, local US dollar/euro/Japanese yen loans to non-banks are proxied by all BIS reporting banks' gross cross-border US dollar/euro/Japanese yen loans to banks in the country, on the assumption that these funds are then extended to non-banks.

Sources: IMF, *International Financial Statistics*; Datastream; BIS international debt statistics and locational banking statistics by residence.

II. Monetary liquidity

Indicators of monetary liquidity | Graph II.1



[1] Based on 12-months-ahead average inflation expectations. [2] Ten-year nominal term premium (sum of the real risk premium and the inflation risk premium) as derived from econometric term structure models.

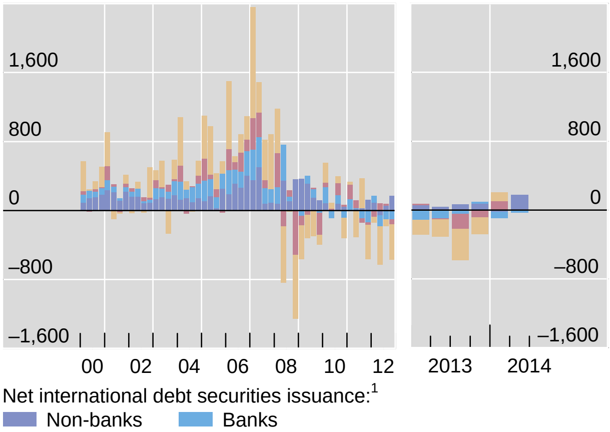
Sources: IMF, *International Financial Statistics*; OECD, *Main Economic Indicators*; Bloomberg; Consensus Economics; Datastream; BIS calculations.

III. Funding liquidity

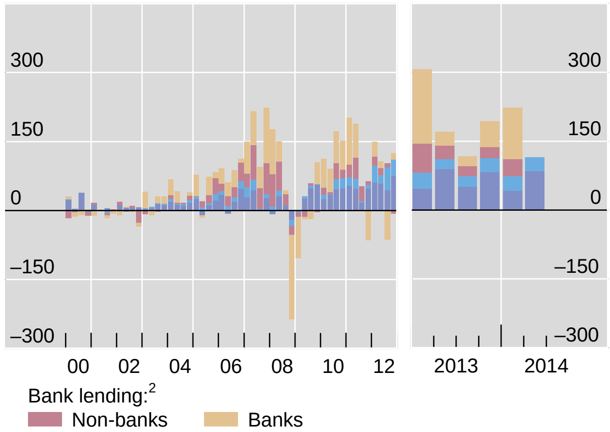
External financing flows

In billions of US dollars Graph III.1

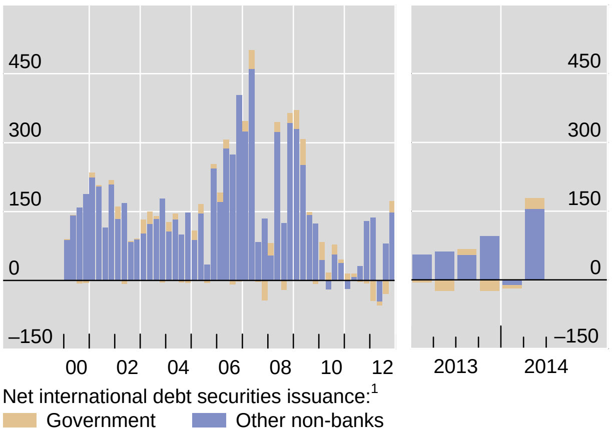
Debt and bank lending: advanced economies



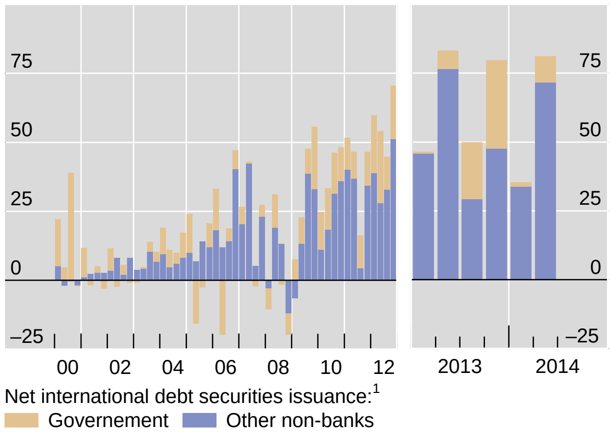
Debt and bank lending: emerging markets



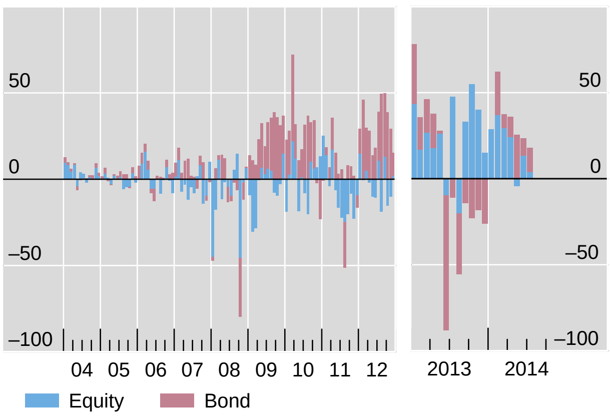
Net non-bank debt issuance: advanced economies[1]



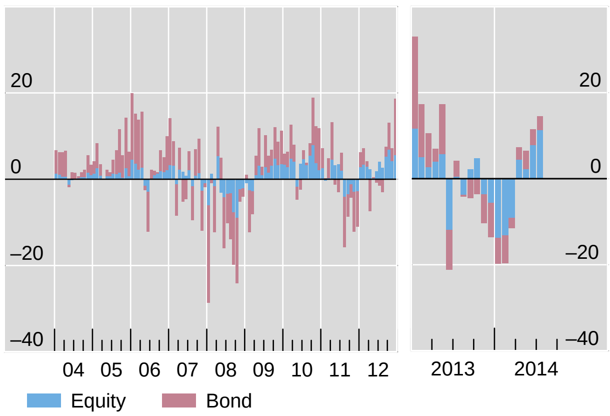
Net non-bank debt issuance: emerging markets[1]



Bond and equity flows into advanced economies[3]



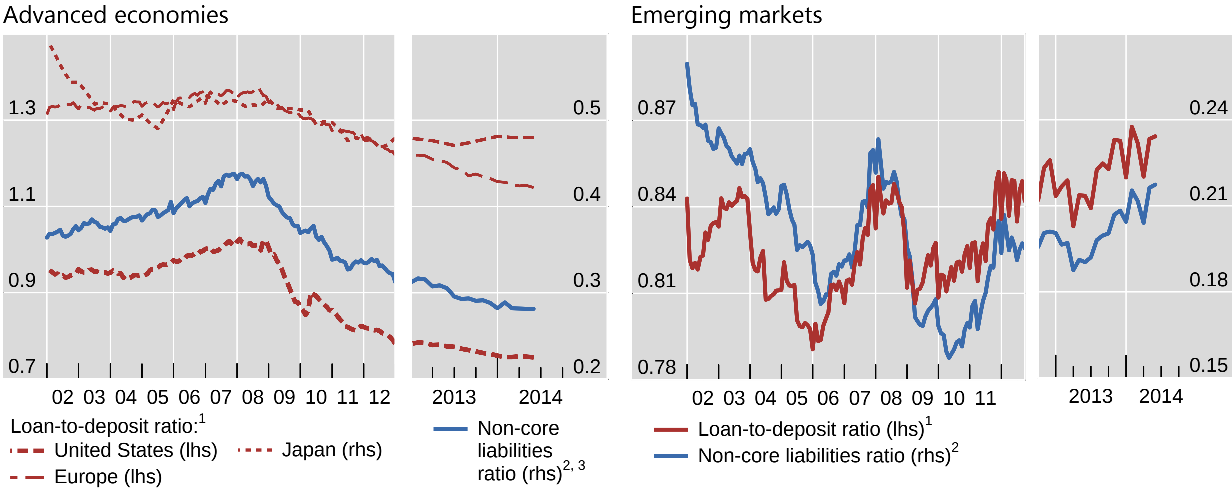
Bond and equity flows into emerging markets[3]



[1] Net international debt issuance for all issuers, in all maturities, by nationality of issuer. In December 2012, the BIS revised the compilation of its debt securities statistics to enhance their comparability across different markets. International issues were redefined as debt securities issued outside the market where the borrower resides. [2] External loans of BIS reporting banks vis-à-vis individual countries; estimated exchange rate-adjusted changes. [3] Monthly flows into equity and bond funds; for the most recent observation, sum of available weekly figures.

Sources: Dealogic; EPFR; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS locational banking statistics by residence; BIS calculations.

Banking sector loan-to-deposit and non-core liabilities ratios | Graph III.2

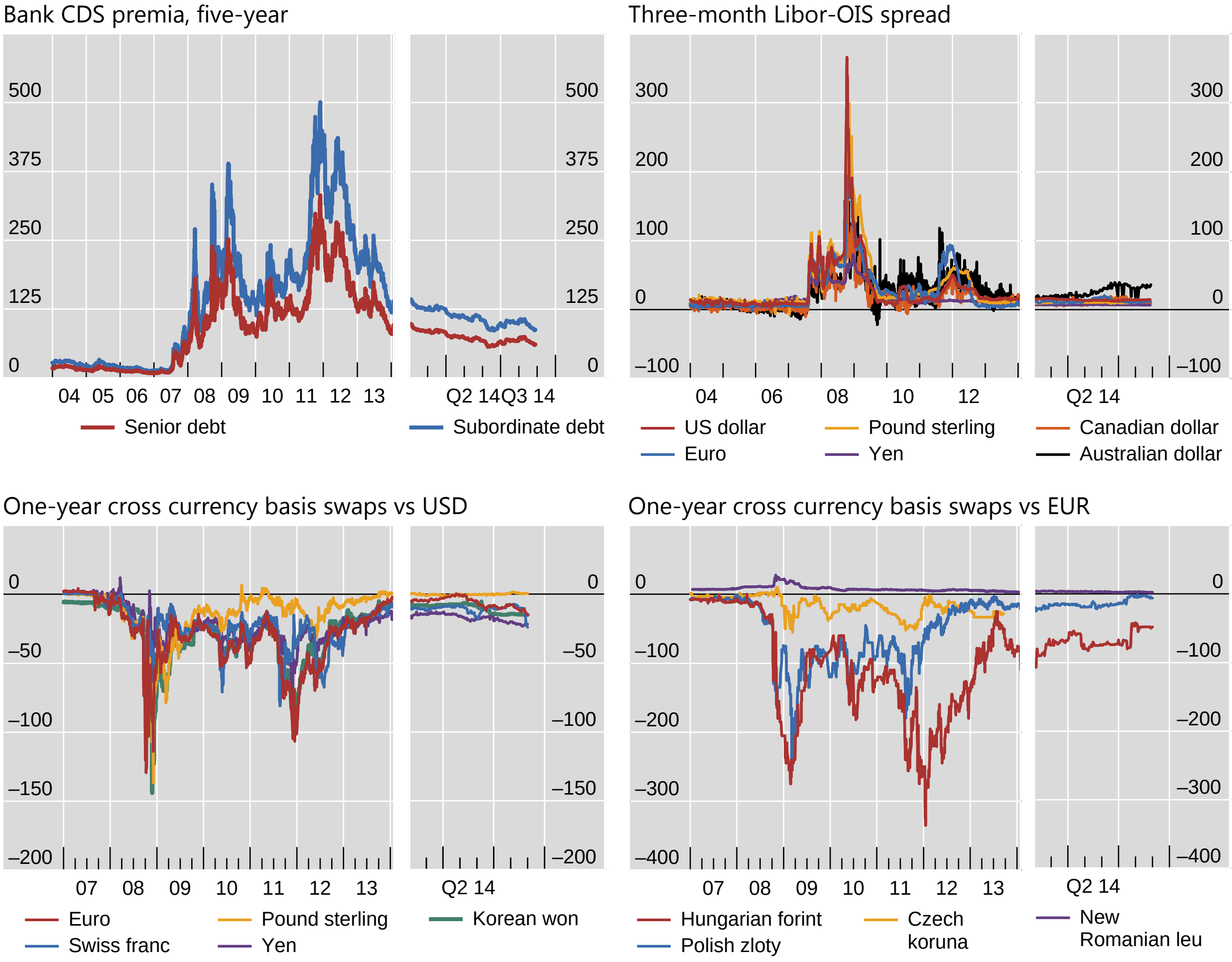


[1] Weighted average by deposits. [2] Bank liabilities (excluding equity) minus customer deposits divided by total liabilities. [3] The United States, Japan and Europe (the euro area, the United Kingdom and Switzerland). This ratio measures the degree to which banks finance their assets using non-deposit funding sources.

Sources: IMF, *International Financial Statistics*; national data; BIS calculations.

Short-term and cross-currency funding conditions

In basis points Graph III.3

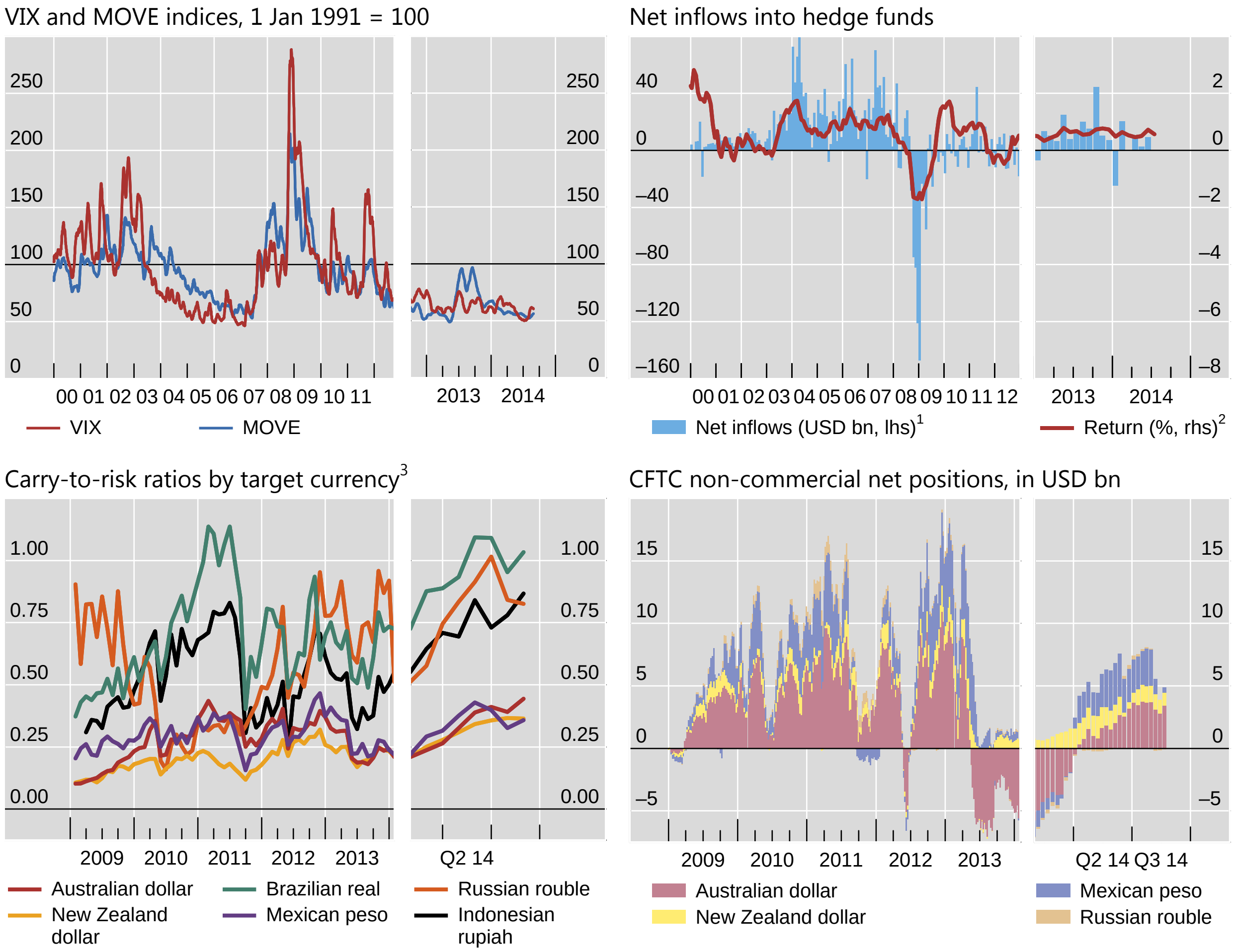


Sources: Bloomberg; Markit; BIS calculations.

IV. Risk appetite

Risk appetite and market positioning

Graph IV.1



[1] Information based on active funds reporting to HFR database. Most recent data are subject to incomplete reporting. [2] HFRI Monthly Performance Indices calculated by Hedge Fund Research; 12-month moving average. [3] Carry-to-risk ratios reflect the attractiveness of carry trades by measuring the ex ante, risk-adjusted profitability of a carry trade position such that the one-month interest rate differential is divided by the implied volatility of one-month at-the-money exchange rate options. Aggregates for possible target currencies are obtained by averaging the relevant currency pairs.

Sources: Bloomberg; HFR; BIS calculations.

Balance sheet structure indicators and the financial cycle

Anna Krupkina[1] and Alexey Ponomarenko[2]

Abstract

This paper presents the dynamics of financial cycle and the associated fluctuations in balance sheet structure indicators in Russia. Namely, we calculate a range of indicators (such as Non-core Liabilities, Loans to Deposits Ratio, Net Stable Funding Ratio, Liquidity Creation) and their transformations and examine their developments in the cross-section of emerging market economies. We conduct econometric analysis of the significance of the macroeconomic effects stemming from these developments.

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1. Introduction

The balance sheet structure indicators are extensively used for identification of financial imbalances for financial stability purposes. The literature on the macroeconomic effects of these developments is relatively scarce. Yet, as pointed out in e.g. in ECB (2011) the changes in banks funding structure (such as changes in the supply of deposits) may have substantial effect on banks behavior.

In these paper we attempt to identify such affects by following the approaches outlined in Shin and Shin (2011), Cornett et al. (2011) and Gatev and Strahan (2006).

2. Banks balance sheet developments in Russia

During the 2000s, Russian banking sector had undergone a significant transformation. Although it remained small in terms of net assets to GDP when compared to other emerging economies (Fungáčová and Solanko, 2009a), credit flows to the real sector have increased rapidly in recent years and become an important determinant of cash flows in the economy. The rapid growth of deposits (resulting in part from the cross-border cash inflows in conditions of heavily managed exchange rate regime) have provided banks with a rich resource for lending. Similar conditions have been seen in Asian economies with similar monetary policy regimes (Mohanty and Turner, 2010). Russia turned to the fiscal mechanism of the sovereign wealth fund to absorb foreign currency from central bank interventions. This approach proved insufficient to prevent rapid money stock growth in the face of an expansion in government spending and large capital inflows that triggered additional forex purchases. Moreover, the amount of foreign currency earnings diverted into sovereign wealth funds was linked by design solely to oil price fluctuations.

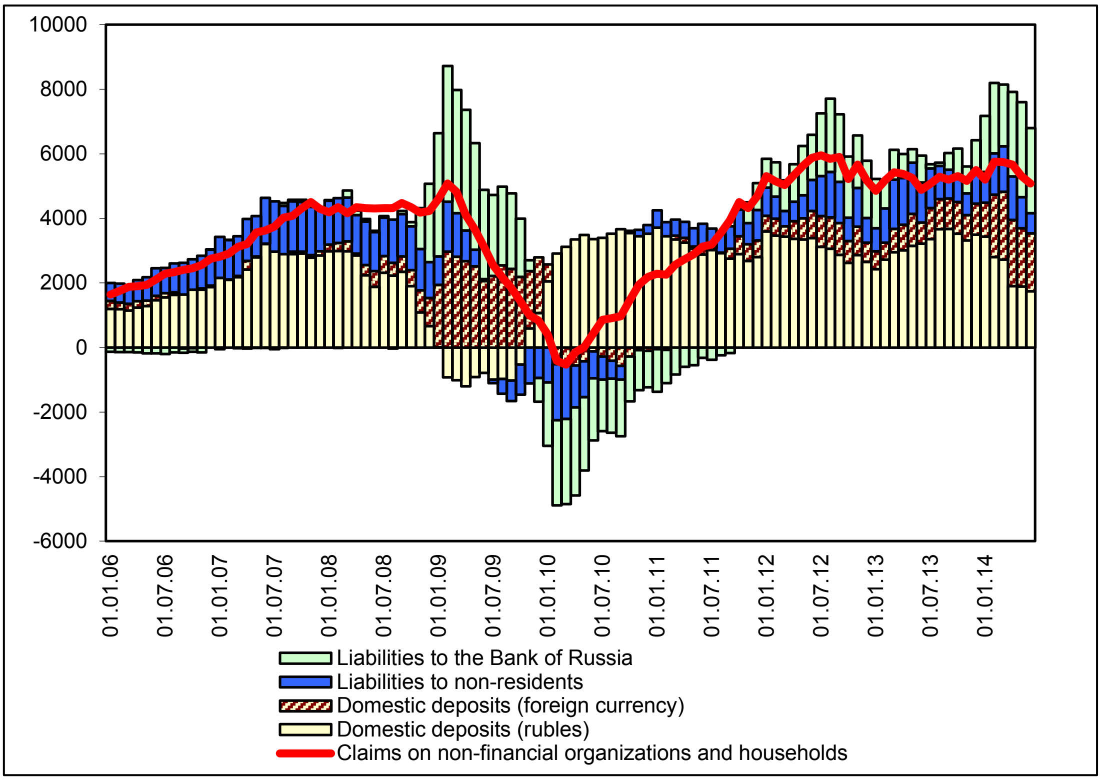
An important distinction between Russian and Asian banks was that the size of the lending booming exceeded deposit growth in 2006–2008, causing funding gaps to emerge. Russian banks relied on external borrowing to finance this gap; interbank lending in particular became dominated by transactions with foreign counterparties (Fungáčová and Solanko, 2009b).

Matters came to a head with the Lehman Brothers collapse in September 2008. Capital flows reversed and the erosion of the trade balance from falling oil prices put significant depreciation pressure on the ruble. Concerned about the possibility of the deterioration of balances in case of sharp depreciation, the Bank of Russia (CBR) implemented a "controlled devaluation" in approximately 1% increments against its dual-currency basket. That strategy involved substantial forex sales that depleted the CBR's gold and currency reserves by US$ 213 billion. The performance of the US dollar from August 2008 to April 2009 helped the private sector (and in particular, the banking sector) offset currency mismatches created by large foreign debt accumulated over previous years. As implemented, this strategy reinforced expectations of further depreciation and induced additional demand (including speculative) for foreign currency. Combined with the general loss of confidence in the banking system, ruble deposits shrank by 15% during 2008Q4–2009Q1. The CBR was forced to raise interest rates to stem capital outflow.

Tightening was only a temporary measure against depreciation pressures on the ruble. As soon as the forex market stabilized in February 2009, the CBR started to lower interest rates. The CBR and Russian government also introduced a package of measures aimed at providing additional liquidity. These measures not only sought to preserve financial stability but also implement the monetary stance. Along with the recommencement of CBR forex purchases in the latter half of 2009, these steps led to rapid accumulation of excess liquidity in the banking sector. Money market rates dropped sharply and soon were again fluctuating near CBR's overnight deposit standing facility rates as before the crisis. Remarkably, financing the government budget deficit directly from the sovereign wealth funds had a mechanical effect on the broad money stock. Deposits growth resumed in 2009 with virtually no support from the banking system. In fact, the preferences of banks for different types of assets evolved noticeably during the post-crisis period. With the reversal of the ruble's exchange rate dynamics in mid-2009, investor preference for foreign assets as risk-free (and extremely profitable during the depreciation period) investments was replaced with purchases of government securities (treasury notes and CBR bonds).

Main liabilities of Russian banking system and claims to NFOs and households

(annual growth, bn. roubles) Figure 1

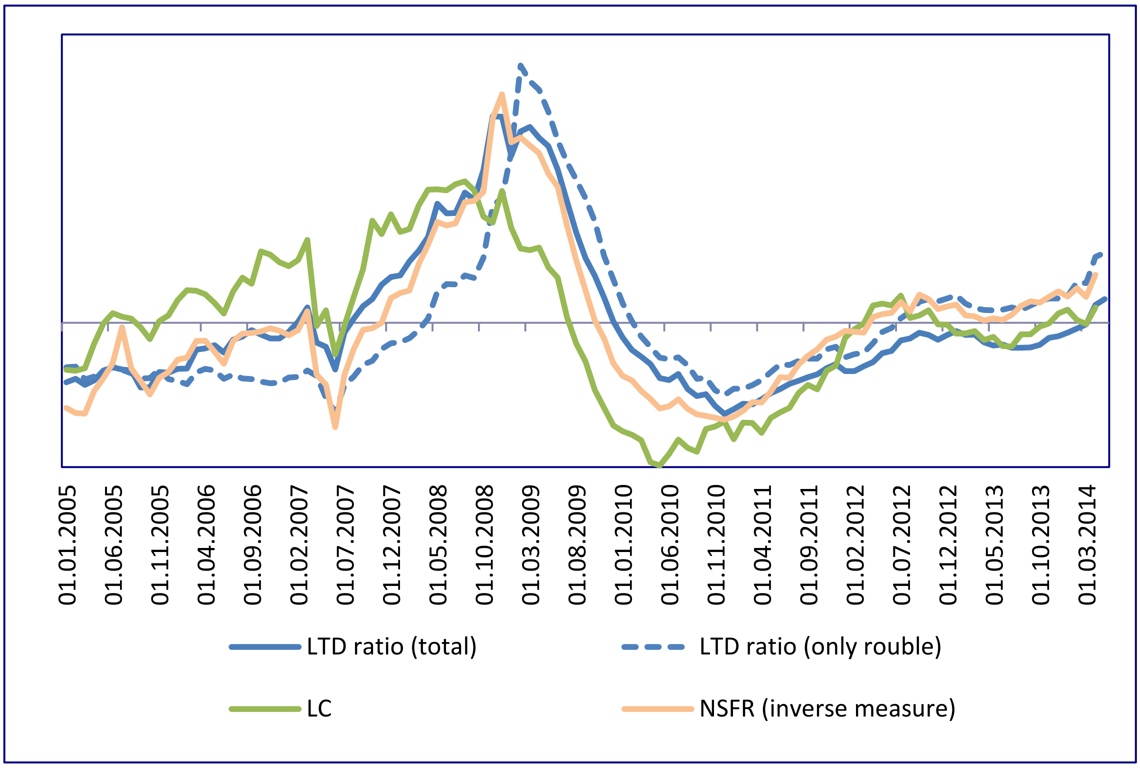


Increased bank lending was not observed until 2010Q2. But later the rapid growth reignited and over the last several years exceeded significantly the deposits growth rate. This time the banks relied extensively on market-based refinancing facilities of the Bank of Russia on routine basis (which was different from the emergency liquidity providing operations in 2009). In the beginning of 2014 macroeconomic uncertainty in Russia provoked the outflow of deposits further extending the disbalance between loans and deposits developments.

The increase in share of unstable liabilities on the banks balance together with continuing tendency of growth in illiquid banking assets may be represented by several indicators. One of the indicators which characterize this change is loans-to-deposits ratio (LTD). Recent dynamics of credit growth shows an excessive speed in comparison with deposits at the first half of 2014, which led to reduction of LTD. The imbalance in loans and deposits dynamics was due to outflow of rouble deposits in foreign currency and, partly, in in foreign currency deposits. Besides a simple LTD ratio we used other composite indicators in order to characterize banking balance sheet structure, for instance, Net Stable Funding Ratio[3] (NSFR) or Liquidity Creation[4] (LC) (see Annex 1 for the details of calculation). All of both indicators present similar representation of balance sheet structure evolution in the Russian banking sector.

Balance sheet structure indicators in Russia

(standardized, seasonally adjusted) Figure 2



[3] The computation of indicator was based on Vasquez, F., Federico, P. (2012). The indicator is taken as an inverse measure for comparability purpose.

[4] The computation of indicator was based on Fungacova, Z., Weill, L. (2012). Indicator is taken as the ratio by total assets of banking sector.

3. International comparison

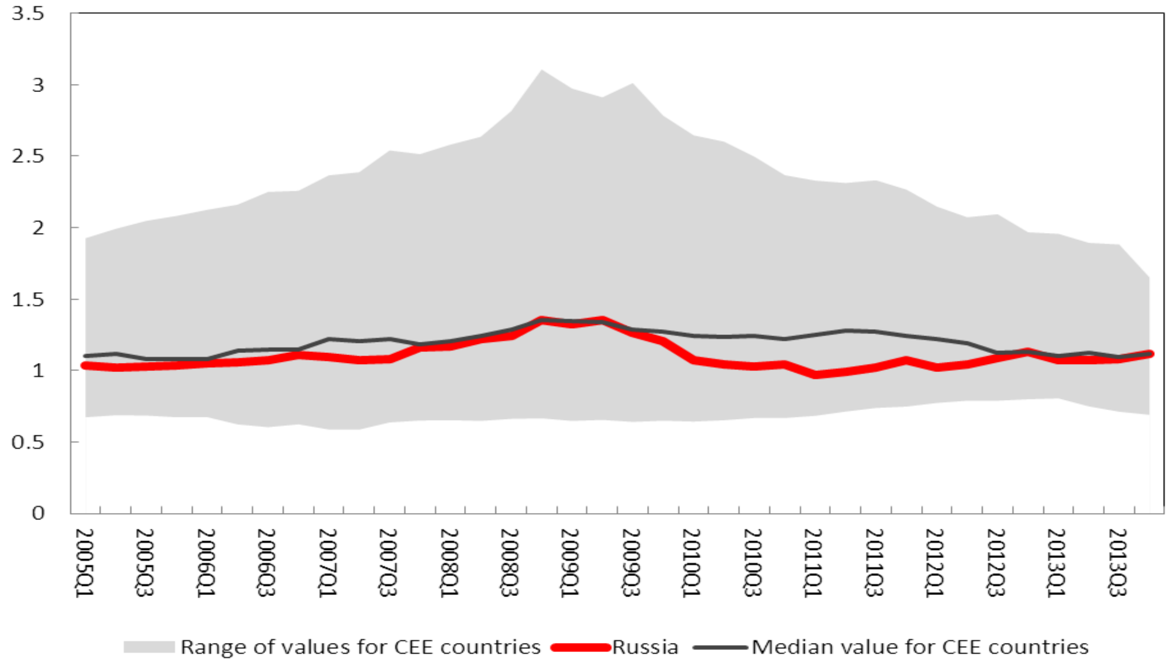
An alteration of assets and liabilities structure can potentially cause a change in behavior of certain banks and/or the whole banking sector. In order to assess the degree of illiquidity of Russian banking balance sheets, we have compared dynamics of LTD ratio in Russia with the cross-section of emerging markets.[5]

In general, the LTD ratio in Russia is a quite low and stable in comparison with broad range of values in other emerging markets (Figure 3). which can be considered as a sign of relatively low liquidity risks for the banking system and no significant constrains for loan supply and economic growth.

LTD ratio

(absolute values)

Figure 3

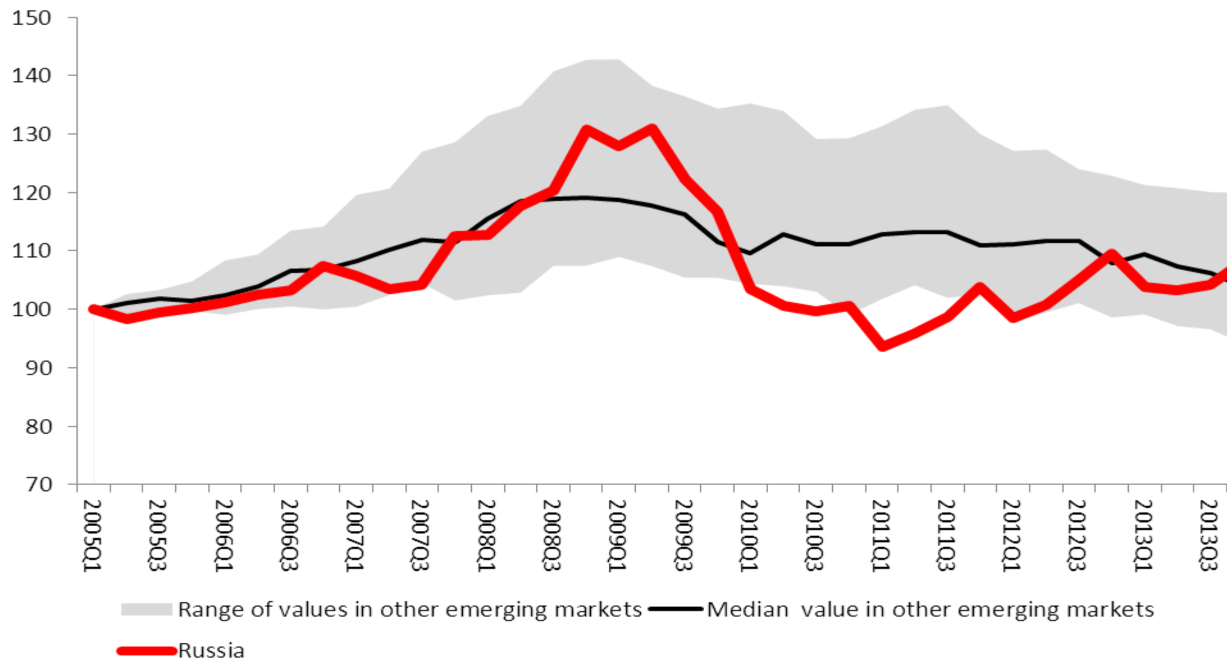


This observation may potentially be misleading if we assume that the long term equilibrium LTD ratio may differ substantially among countries. In this case it is the change of LTD ration that may serve as an indicator of a build-up of financial imbalance. The developments of LTD ratios centered around 2005Q1 (Figure 4) show that the magnitude of changes of this indicator in Russia was quite large.

5 The sample includes Argentina, Azerbaijan, Armenia, Belarus, Bolivia, Brazil, Bulgaria, Chile, Colombia, Croatia, Czech Republic, Ecuador, Estonia, Georgia, Hungary, Indonesia, Kazakhstan, Korea, Latvia, Lithuania, Macedonia, Malaysia, Mexico, Moldova, Philippines, Poland, Romania, Serbia, Slovak Republic, Slovenia, Thailand, Ukraine.

LTD ratio

(I quarter 2005=100%) Figure 4



4. Empirical model

In order to examine the relevance of balance sheet structure indicators for macroeconomic developments we conduct econometric analysis. We are mostly interested in the effect changes in balance sheet structure on loan supply. First we estimate panel[6] regression (Table 1). The results generally confirm the significance of changes in funding structure (measured as the ratio of non-core liabilities[7] to total liabilities) for loan supply (measured as the ratio of claims to domestic non-finacial sector to total assets).

We also estimate a VAR-model comprising 4 variables: non-core liabilities to broad money ratio (*nc*); the spread between loans and deposits interest rates (*spread*); log of real GDP(*y*); claims on domestic private real sector to total assets ratio (*l*). All variables are in first differences and standardized. Seasonal dummy variables are also included. The lag length of VAR is set to 4.

6 Countries in the cross-section include Bulgaria, Croatia, Czech, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Ukraine. The time sample is from 2001Q1 to 2011Q4.

7 Non-core liabilities are calculated as the sum of liabilities to non-residents, liabilities to domestic financial institutions, liabilities to the central bank.

Panel regressions estimates Table 1

Explanatory variable	OLS estimates [t-statistic]	GMM estimates [t-statistic]
Non-core liabilities to broad money ratio	–0.09 [–2.41]	–0.08 [–1.81]
GDP yoy growth	0.1 [5.9]	0.07 [2.03]
Stock index yoy growth	0.05 [1.14]	–0.01 [–0.21]
Interest spread	–0.06 [–1.63]	–0.04 [–0.64]
Lagged dependent variable	0.32 [6.95]	0.64 [4.25]
Constant	0.08 [1.74]	0.04 [0.98]
Observations	363	350
Adjusted R-squared	0.37	0.45

Dependent variable: Δ Claims on domestic private real sectort to total assets $_{t-1}$

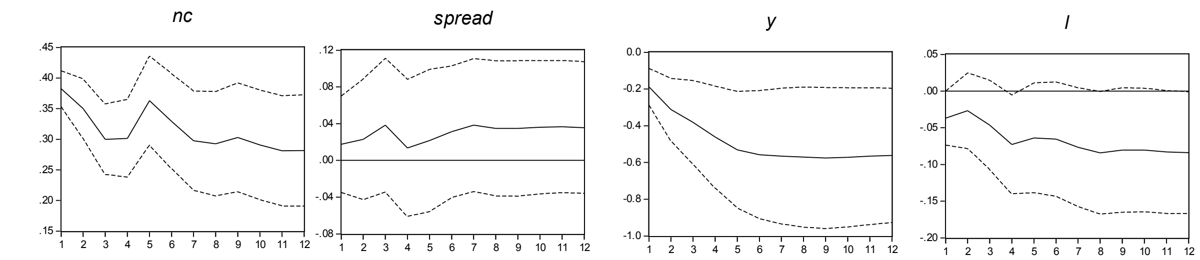
Regressions include cross-section fixed-effects. Two lags of explanatory variables are used as instruments in GMM regression.

We estimate panel and stand-alone (for Russia) versions of the model. To check we if our results are sensitive to the crisis developments we cover the period 2008Q4–2009Q1 with dummy variables in the stand-alone version. The impulse response functions[8] confirm that increase in non-core liabilities (Figure 5) may force the banks to rebalance the asset side of the balance sheet by decreasing supply of loans to non-financial sector (other impulse responses are reported in Annex 2).

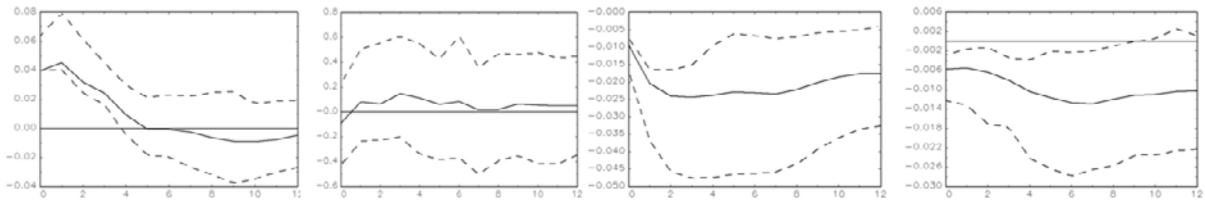
[8] We have used Cholesky identification with the following ordering: *nc, spread, y, l*.

Impulse-response functions analysis: shock to *nc* Figure 5

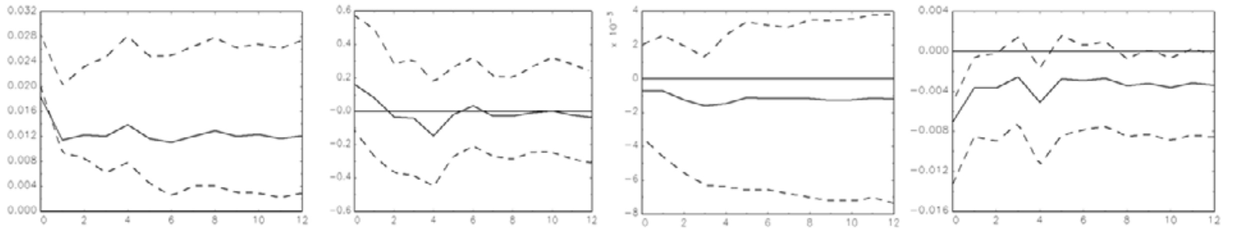
Panel VAR impulse-response functions (±2S.E)



Stand-alone VAR impulse-response functions (with 95% bootstrapped Hall percentile CI)



Stand-alone VAR with dummy-variables impulse-response functions



5. Conclusions

There had been a number of episodes when the funding structure of Russian banking system has changed significantly. These changes may have had a significant macroeconomic impact. Namely, the exogenously driven expansion of deposits stock in 2009–2010 could be one of the reasons behind recommencement of rapid credit growth and recovery of aggregate demand. Meanwhile more recent developments that led to deterioration of the balance sheet structure are likely to exert a restraining influence on loan developments.

Annex 1

Net Stable Funding Ratio (NSFR)

$NSFR = {\sum_i w_i L_i}/{\sum_j w_j A_j}$, where L_i is the total amount of liability in group i, A_j is the total amount of assets in group j, w_i is a weight of particular group i, w_j is a weight of particular group j, $i \in [1,3]$, , $j \in [1,3]$.

The group index	Assets		Liabilities	
	Description of category (A_j)	**Value of weight (w_j)**	**Description of category (L_i)**	**Value of weight (w_i)**
1	*Cash; correspondent accounts in Central Bank and other banks;*	***0***	*Deposit liabilities, debt securities ;*	***0***
2	*Interbank loans and securities;*	***0.35***	*Banking deposits;*	***0.7***
3	*Other assets*	***1***	*Other liabilities*	***1***

Liquidity creation (LC)

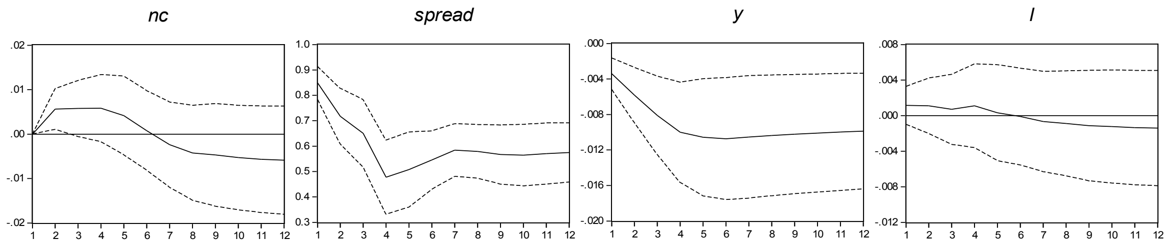
$$LC = (0.5 \times illiquid\ assets\ +\ 0 \times semi-liquid\ assets - 0.5 \times liquid\ assets) + (0.5 \times liquid\ liabilities\ +\ 0 \times semi-liquid\ liabilities - 0.5 \times illiquid\ liabilities) - 0.5 \times equity$$

Illiquid assets	**Semi-liquid assets**	**Liquid assets**
Loans to non-banking private sector	*Interbank loans*	*Correspondent accounts in Central Bank and other banks*
Other assets	*Loans to government*	*Debt securities*
Liquid liabilities	**Semi-liquid liabilities**	**Illiquid liabilities**
Notes and bank acceptance	*Debt securities*	*Other liabilities*
Deposit money of non-banking private sector	*Time deposits of non-banking private sector*	*Equity and capital*
Interbank liabilities		

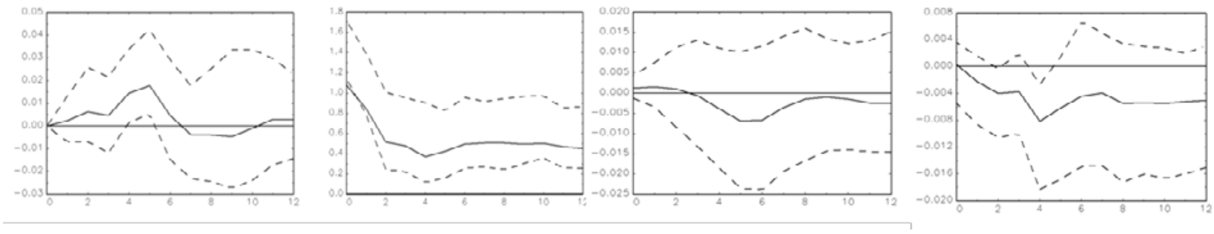
Annex 2

Impulse-response functions analysis: shock to *spread* — Figure 1

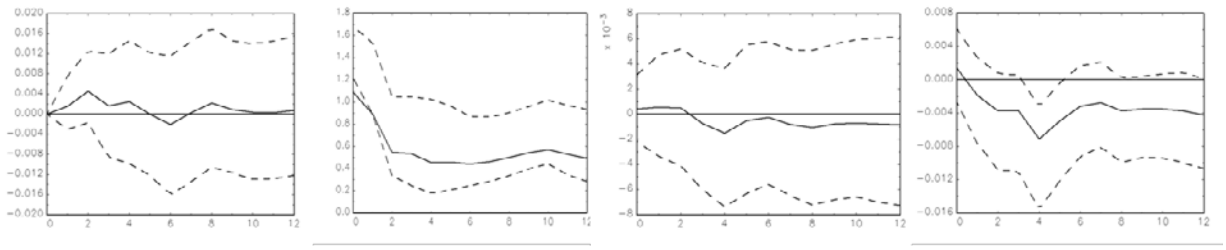
Panel VAR impulse-response functions (±2S.E)



Stand-alone VAR impulse-response functions (with 95% bootstrapped Hall percentile CI)



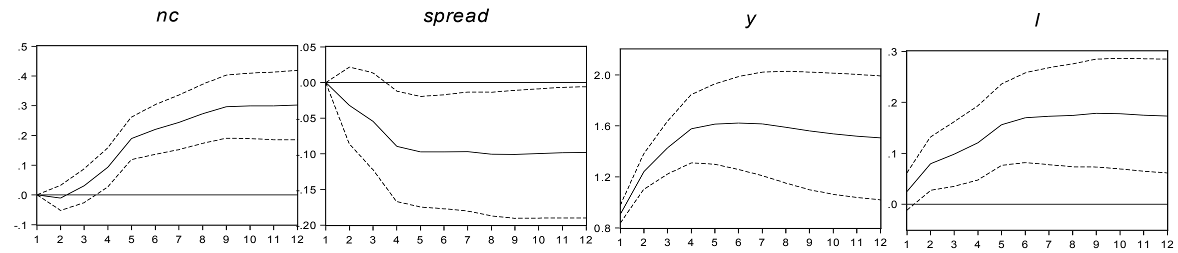
Stand-alone VAR with dummy-variables impulse-response functions



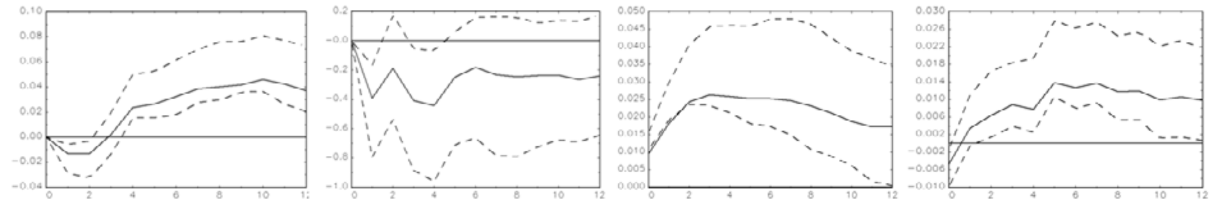
Impulse-response functions analysis: shock to *y*

Figure 2

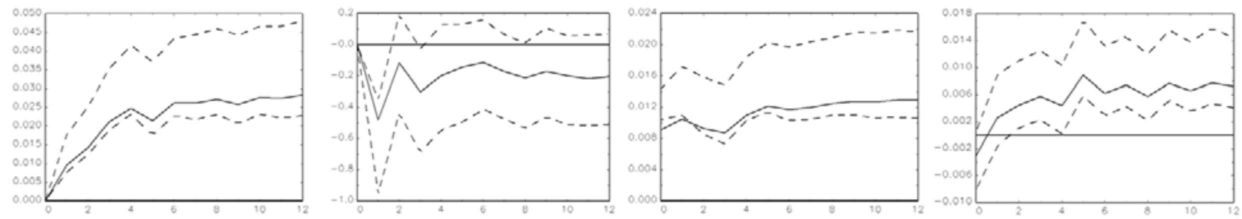
Panel VAR impulse-response functions (±2S.E)



Stand-alone VAR impulse-response functions (with 95% bootstrapped Hall percentile CI)



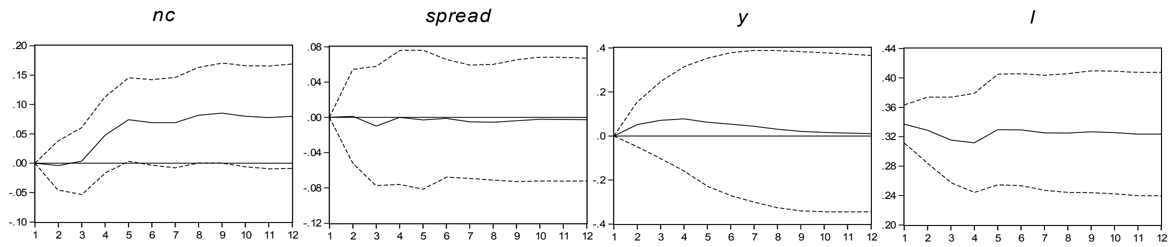
Stand-alone VAR with dummy-variables impulse-response functions



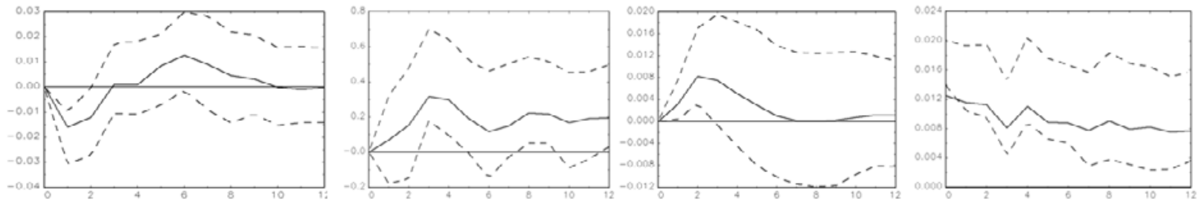
Impulse-response functions analysis: shock to *l*

Figure 3

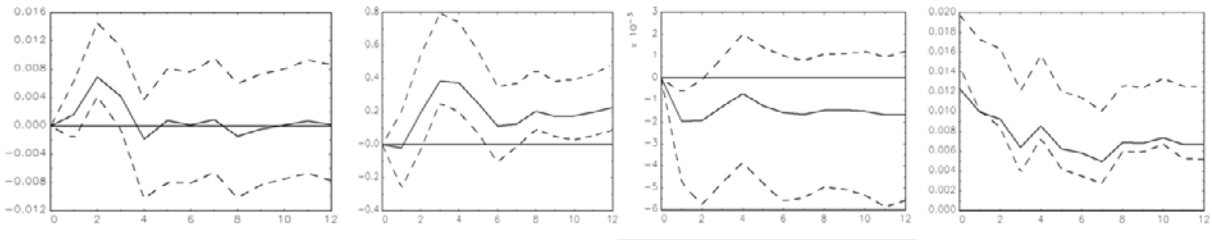
Panel VAR impulse-response functions (±2S.E)



Stand-alone VAR impulse-response functions (with 95% bootstrapped Hall percentile CI)



Stand-alone VAR with dummy-variables impulse-response functions



References

Cornett, M.M., McNutt, J.J., Strahan, P.E., Tehranian, H.(2011) "Liquidity risk management and credit supply in the financial crisis", Journal of Financial Economics 101.

ECB (2011) "The supply of money – bank behaviour and the implications for monetary analysis", ECB Monthly Bulletin, October.

Gatev, E., Strahan, P.E. (2006) "Banks' Advantage in Hedging Liquidity Risk: Theory and evidence from the Commercial Paper Market", The Journal of Finance vol LXI, No 2.

Fungáčová, Z., L. Solanko (2009a). "Has financial intermediation improved in Russia?" BOFIT Online No. 8.

Fungáčová, Z., L. Solanko (2009b). "The Russian banking industry after financial crisis – Where to next?" Bank of Finland Bulletin 2, 19–29.

Fungáčová, Z., Weill, L. (2012) "Bank Liquidity Creation in Russia", Eurasian Geography and Economics, 53, No 2.

Mohanty, M.S., P. Turner (2010). "Banks and financial intermediation in emerging Asia: Re-forms and new risks." BIS Working Papers No. 313.

Shin, H.S., Shin, K.(2011) "Procyclicality and monetary aggregates", NBER Working Paper 16836.

Vazquez, F., Federico, P.(2012) "Bank Funding Structures and Risk: Evidence from the Global Financial Crisis", IMF WP/12/29.

The Use of Sample Surveys to Support Monetary and Financial Stability Analysis: An Overview of the Central Bank of Nigeria

Kufre J Bassey[1]

Abstract

This paper presents an overview of how the Central Bank of Nigeria uses statistics from enterprise surveys to shape economic decisions as changes in the overall economic situation led to the emergence of systemic risks in the financial sector. It underscores the role of survey in generating quantitative measures of projected business conditions, consumer tendencies as well as external sector data for compilation of balance of payment and other relevant statistics by the Bank. While monetary policy is forward looking to emerging developments in the economy, the paper suggests that sample surveys should be used to obtain reliable, accurate and timely statistics for the assessment of its effectiveness on both market expectations and public confidence.

Keywords: Business expectation survey; consumer expectation survey; financial stability; survey of foreign assets and liabilities

JEL classification: C8, D1, E2, E6

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The views expressed in this paper are those of the author and do not necessarily represent those of the Central Bank of Nigeria.

1.0 Introduction:

> *"Of late, central bankers can't seem to get enough talk about financial stability and its connections to monetary policy. At the Federal Reserve, policymakers often point to financial stability concerns as relevant to their monetary policy decisions, especially in the context of the current extraordinarily accommodative stance of policy. At the Bank of England, the Monetary Policy Committee's statement included an explicit financial stability escape clause for their bank rate forward guidance. The Norges Bank explicitly incorporates financial stability in its monetary policy discussions and decisions. And the Riksbank's very public policy deliberations have centered on the tradeoffs between, and the appropriate balancing of, macroeconomic and financial stability goals (Williams, 2014)".*

> *"The elevation of financial stability concerns at central banks and other regulatory agencies is a natural reaction to the events of the global financial crisis, when the near-meltdown of the financial systems in many countries almost toppled the global economy (Williams, 2014)".*

Monetary policy can generally be seen as the institutional arrangements and the use of the monetary authority instruments in order to maximise social welfare (Gameiro *et al*., 2011). Financial stability on the other hand seems difficult to define. In this overview, it is seen as the resiliency of a financial system to unexpected adverse shocks while enabling the continuing smooth functioning of a financial system intermediation process. According to Viñals (2012), the financial and economic meltdown that hit the world economy in 2007/2008 showed that monetary policy needs to take fuller account of financial developments. Borio (2011) also opined that central banks have been rightly hailed as saviours of global financial system following their swift and internationally coordinated action through liquidity support and interest rate cuts in preventing financial system's crumbling. In Nigeria, the Central Bank monetary programme, like every other central bank, uses survey data to set benchmarks for various monetary and credit aggregates consistent with the desired overall economic activity for a given period and on a forward-looking time-frame. These benchmarks are set in consonance with the expectations of the performance of all sectors of the economy to ensure the achievement of low and stable inflation, sustainable output growth, positive balance of payments position and stable exchange rate.

In order to gain insight on how to blend monetary policy with financial stability, the Statistics Department of the Central Bank of Nigeria (CBN) introduced different enterprise and household surveys to generate timely information on market expectations and public confidence as elements of financial stability. Although the responsibility of generating such statistics is primarily domicile with the national statistical agency, the forward-looking surveillance and monitoring of some key macroeconomic indicators justified its contingencies. The objective of this paper is to present an overview of how statistics from three prominent enterprise surveys are used at different pace to support monetary and financial stability analysis in Nigeria after the global financial crisis of 2007/2008. The surveys include business expectations survey (BES) and consumer expectations survey (CES) that started in the second quarter of 2008 and 2009, respectively, as well as survey of foreign assets and liabilities (SOFAL) initiated in 2011 by IMF.

The remaining parts of the paper are structured in four sections. Section 2 presents monetary policy and financial stability overview in Nigeria, and the purpose of the enterprise surveys. The methodological framework is presented in section 3, while section 4 discusses the results. The fifth section presents the concluding remarks of the paper.

2.0 Monetary Policy and Financial Stability in Nigeria

The unprecedented global economic and financial meltdown of the world economy in 2007/2008 revealed that macroeconomic stability is vulnerable in the face of financial instability. The adverse impact of the crisis led to the collapse of many world financial institutions including Nigeria. According to Soludo (2009), the crises impacted on the Nigerian economy through commodity prices collapse (especially oil price), revenue contraction, declining capital inflows, de-accumulation of foreign reserves and pressure on exchange rate, limited foreign trade finances for banks, capital market downturn, divestment by foreign investors, among others. Thus, monetary policy was largely influenced by tight liquidity in the domestic economy, and liquidity management was therefore anchored on the need to ensure a well-functioning financial market that would foster growth without compromising the objective of monetary and price stability. The CBN made extensive use of open market operations (OMOs), being its primary tool of liquidity management. This was complemented by variation of prudential reserve ratios, the sale of treasury instruments at the primary segment of the market, and the use of CBN's standing facility window among others.

However, in the first half of 2010, the Nigerian economy was relatively stable though with a mixed outcomes in terms of developments. The CBN financial stability report of 2010 showed that the major challenge to economic and monetary policies in 2009 was the management of tight liquidity in the banking system. In particular, the growth in credit to the private sector slowed down significantly, while inflation rate (year-on-year) moderated substantially though at double digit all through 2009 to the first half of 2010. Exchange rate also depreciated during the third and fourth quarters of 2009 but later appreciated in the first quarter of 2010, while interest rates rose in the first half of 2009 as a result of the crisis which precipitated tight liquidity conditions in the banking system. It later reversed in the fourth quarter of 2009 following some improvements in liquidity conditions in the money market and the CBN guarantee of all inter-bank transactions.

2.1 Purpose of the Surveys

> *"In the narrower field of cyclical indicators, there are qualitative indices that have increasingly filled up the gap that could not be explained adequately by the more rigorous and conventional quantitative indicators, though in a less conventional way. Most of these qualitative indices are sourced from short term business tendency surveys (BTS) or business expectations surveys (BES), since they focus on the expectations and future plans of the business sector" (Cintura and Gador, 2003).*

According to Forsells and Kenny (2002), central banks have long had an interest in monitoring the behaviour of inflation expectations in the economy and in understanding the nature of the process by which expectations are formed. Kulshreshtha (2001) also reported that important short-term indicators required by the planners relate to overall economic conditions, environment for investment expenditure, capacity utilization of the existing industries and firm's financial position, among others. He also expressed that BES that are direct and up-to-date can provide necessary information for building up short-term indicators and short-term forecasting which is crucial to the planners for gauging the performance of the economy and for evaluating policy implementation. Bhattacharyay (2001) posited that results of business expectation and consumer confidence surveys are important part of the statistical information used at national and international level for monitoring economic development.

These surveys are carried out at regular intervals in several countries but they started in Europe, particularly Belgium, France and Germany, more than 30 years ago while Bank Indonesia started conducting its own business survey in 1993 (Sood, 2001; Utomo, 2001). In Nigeria, the global financial crisis added impulse to monetary policies to strengthen financial stability as changes in the overall economic situation led to the emergence of systemic risks, triggering changes in the market expectations. Thus, the introduction of the enterprise surveys was one of the critical measures to collect reliable quantitative information that cover economic phenomena and consumer tendency in order to shape economic policies and restore public confidence in the financial sector. The purpose of the BES and the CES for CBN is specifically to generate information explicitly on market expectations and consumer tendencies from households, small, medium and large enterprises, while SOFAL was initiated by IMF technical assistance missions to capture direct and portfolio investments, as well as other foreign capital flows in terms of debt securities, loans, trade and suppliers' credit, and advances.

3.0 Methodological Framework

Each of the enterprise surveys uses a well-defined structured questionnaire designed to allow for statistically valid inferences to be made over the targeted population. The questionnaire for each survey was normally drafted with the aim of stimulating useful information without imposing undue burden on the respondents. The information being sought from the surveys are as authorized by the CBN Act, 2007 which guarantees that data relating to individual entities be treated as confidential. The BES and CES are quarterly surveys that utilize opinion-testing techniques in collecting information. The methodological procedures for all the surveys are in tandem with international standard of industrial and household surveys.

3.1 The Business Expectations Survey (BES)

Specifically, the BES uses structured questionnaire designed to capture 21 responses from the respondents stratified into the six geo-political zones of the country (Table 1). The disaggregation considered includes geographical location, type of business, employment size and sector of the firm.

Distribution of Sample Size and Response Rate (%) Table 1

ZONE	SAMPLE STATE	Q1 2014 SAMPLE SIZE	Q1 2014 RESPONSES	Q1 2014 RESPONSE RATE (%)
North Central	Niger, Kwara, Kogi, Abuja, Nassarawa, Benue and Plateau	350	347	99.1
North East	Bauchi, Adamawa, Gombe, and Taraba	200	199	99.5
North West	Kaduna, Katsina, Kano, Jigawa, Zamfara, Sokoto and Kebbi	350	347	99.1
South East	Anambra, Enugu, Ebonyi, Imo and Abia	250	241	96.4
South South	Edo, Delta, Rivers, Cross River, Bayelsa and Akwa-Ibom	300	300	100.0
South West	Lagos, Oyo, Ekiti, Osun, Ogun and Ondo	400	398	99.5
TOTAL		1850	1832	99.0

Source: CBN Statistics Department Report- 1st Quarter 2014.

The analysis technique includes the use of a Net Balance Method where three global percentages for each question gross percentage changes are obtained. This is also called the proportion (in per cent) of respondents that answered in a specified manner. The balance (also known as Diffusion Index (DI)) is used to monitor the expected direction in the movement of a variable and anticipate possible turning points thereafter. The process involves adding up the number of firms with the same response in each sector; computing for the percentage distribution based on the total number of firms in the sector; and subtracting the percentage shares of the negative answers from the percentage shares of the positive answers, and disregarding the percentage shares of the "no change" or "normal" responses, to generate the diffusion index for each sector for each variable. Here, a positive index indicates a favourable view, except for the average expected inflation and borrowing rates where a positive index indicates the opposite. The overall business outlook diffusion index (DI) is computed as the percentage share of firms that have an "improving outlook" less percentage share of firms that have a "deteriorating outlook", and is also computed for the other business variables. Some of the prominent outcomes from the survey results have been business expectations index on selected economic indicators, business confidence index on own operations by sector and overall business constraints over the review period.

The mathematical summary for a survey with three reply options is given as follows:

$$balance = P - N \qquad (1)$$

where,

P = the percentage of positive replies ("up" or "above normal")

N = the percentage of negative replies ("dawn" or "below normal")

3.2 The Consumer Expectations Survey (CES)

Drawing also from Table 1, this survey also use structured questionnaire on targeted respondents who are either regular employees, casual employees, employers of labour or self-employed from age 15 years and above over the selected households. The overall consumer confidence index is thereafter computed as the average of three indices (Economic Condition Index (ECI), Family Financial Condition Index (FFCI) and Family Income Index (FII)). These indexes are all diffusion indexes computed as the percentage of respondents that answered in the affirmative less the percentage share of the respondents that answered negative in a given indicator. Thus, a negative DI indicates that the respondents with unfavourable view outstrip those with favourable view, except for unemployment, change in prices and interest rate for borrowing money where a negative index indicates the opposite. In analyzing the data, the percentage of positive replies (viz: much more better, a little bit better, increase sharply, increase slightly, very likely, fairly likely, it is right time now); Unchanged replies (viz: remain the same, neither the right time nor the wrong time); and negative replies (viz: much more worse, a little worse, a little bit worse, fall sharply, fall slightly, not likely, not at all likely, it is not the right time now) indicate the direction of change of each variable (question). The difference between the percentage of consumer responses indicating an increase and the percentage indicating a decrease constitutes the "balance" as in Equation (1). Albeit, where there are, say, five possible answers, the balance can be modified as follows:

$$Balance = (\alpha + 1/2\beta) - (1/2\gamma + \rho) \quad (2)$$

where α denote the percentage answering "much better" or total certainty, β for "better", γ for "much worse" and ρ for "worse".

Alternatively, the DI could also be computed as (100 + balance), thereby transforming the negative values to all positive values. This implies that the net balance is calculated as the difference between the percentages of positive and negative responses and 100 is added to this difference, thus forming a separate diffusion index for each question. Thereafter, the general index is calculated by taking the arithmetic means of the DIs of the questions included in the consumer confidence index frame. The index is evaluated between 0 and 200 with index above 100 indicating that the consumer confidence is optimistic, below 100 indicates pessimistic, while at 100 implies neutral opinion in the consumer confidence.

Both BES and CES are quite related in that selected survey variables are combined into a single an overall cyclical indicator in order to have composite indicator. These indicators summarize economic agents' assessments of the current economic situation and their expectations for the immediate future, and are called confidence indicators.

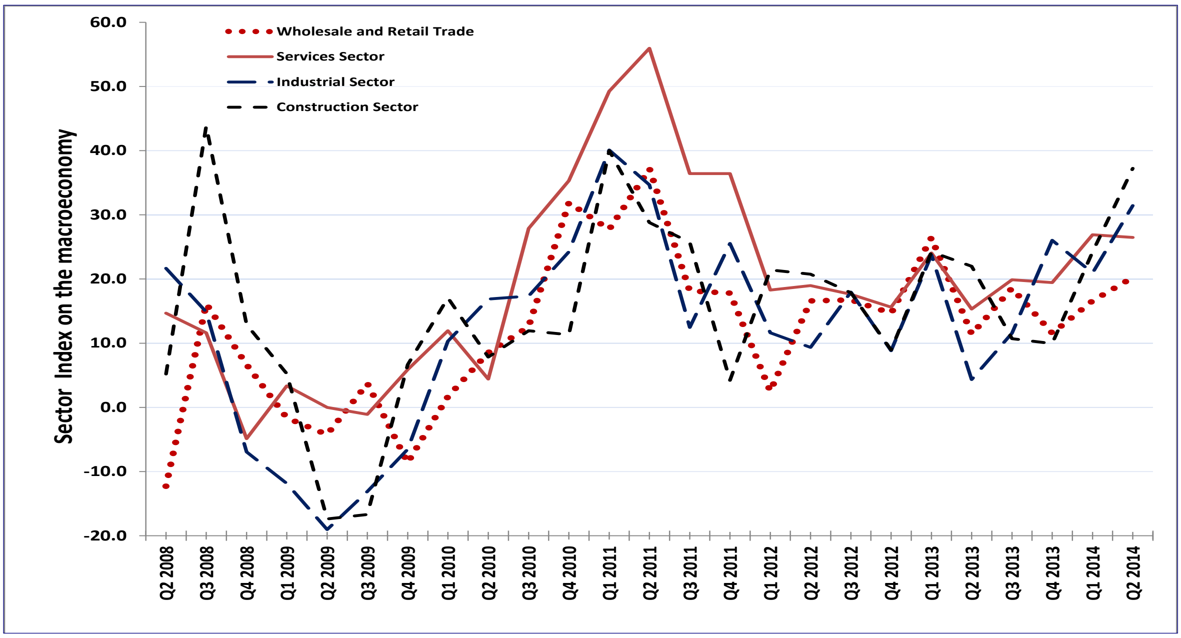
3.3 The Survey of Foreign Assets and Liabilities (SOFAL)

SOFAL uses a sample frame that includes all enterprises with 100% foreign investment in the country. Thus, the probability of being selected is always greater than or equal to zero following a purposeful sampling method (criterion sampling). The process involves a technical working group (TWG) with members drawn from all the collaborating agencies that provide an operational framework that measures the magnitude of foreign capital inflows and out-flows; as well as identifying the country's capital flow destination and inflow recipient sectors. As part of the recommendations of the TWG, the collaborating agencies are basically responsible for the conduct of the SOFAL in their respective areas of authority while CBN serves as the secretariat for the coordination of all activities. In the structured questionnaire, the survey questions are generally qualitative, and mainly take the form of asking respondents to answer precise questions on foreign investments, in and by their enterprises (equity and non-equity). The analysis of survey data are generally through consolidation.

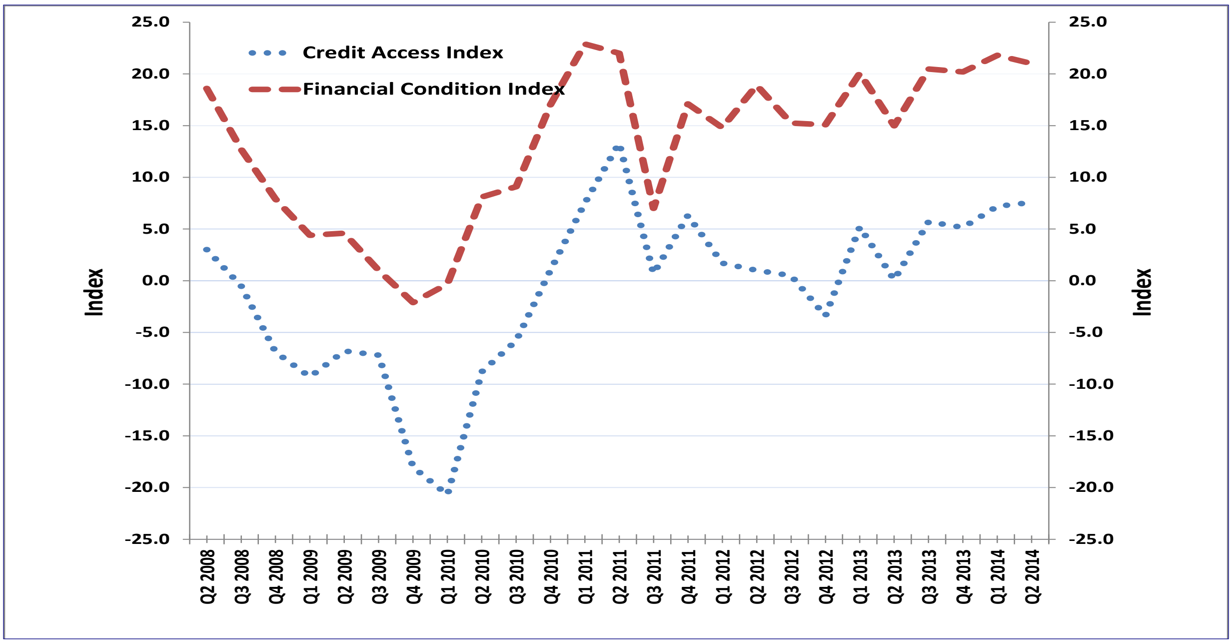
4.0 Discussion of Results

The business expectations survey generates quantitative measures of projected general business conditions and tendencies to provide policy makers with indicators on the current and prospective outlooks of the business sector (Figures 1 – 2)

Business Outlook Index on the Macroeconomy Figure 1

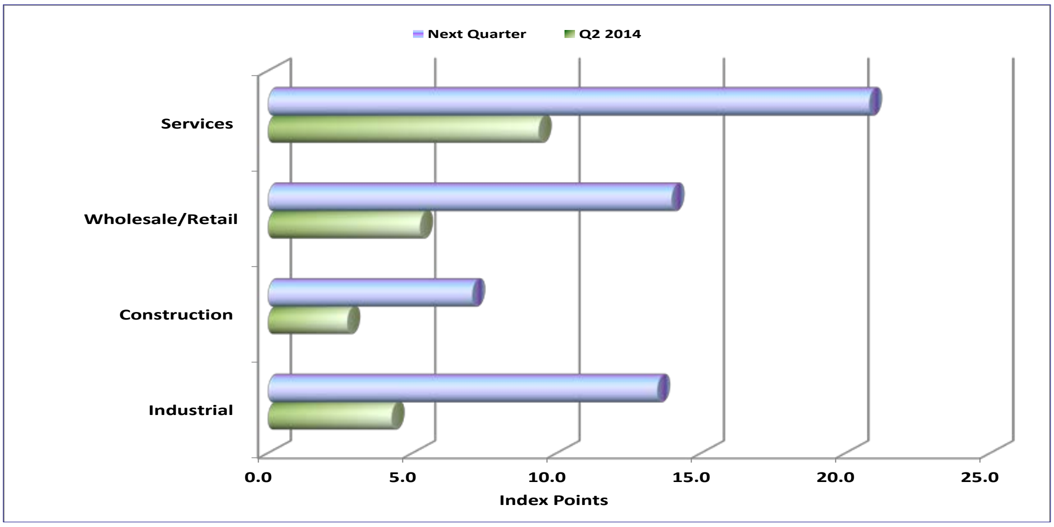


Business Outlook Index on own operations – Access to Credit and Financial Condition Figure 2



A cursor observation of Figures 1 and 2 shows how respondent firms were on average less optimistic in the overall business activities during the crisis period. For 2014q2, respondents were optimistic on the average that there would be improvement in business activities in the country.

Contribution to the Overall Business Outlook Index on the Macroeconomy by Sectors Figure 3



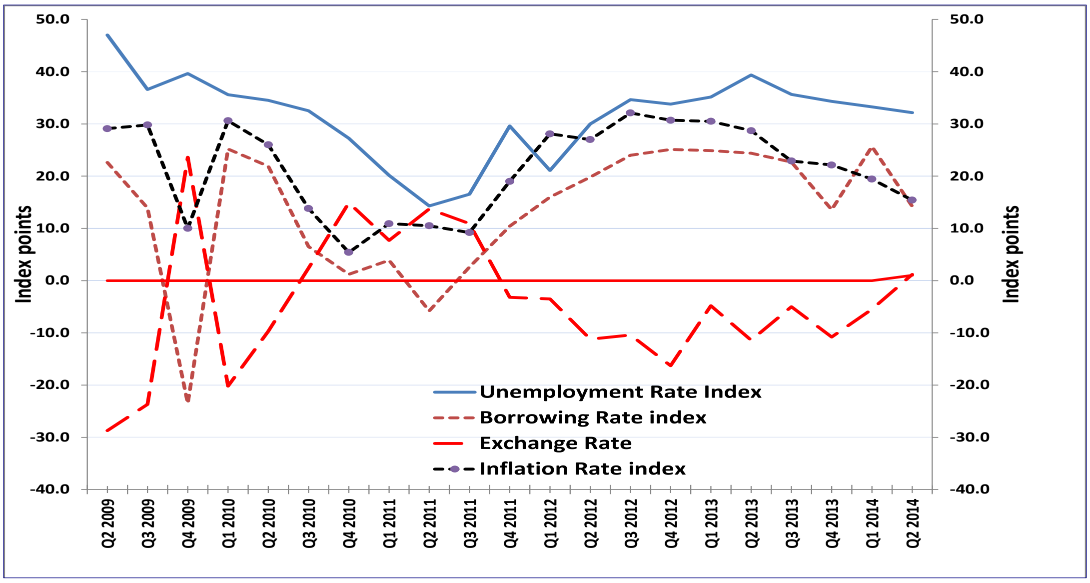
The optimism was driven mostly by the opinions from the services sector (9.4 points), while others include wholesale/retail trade recorded 5.3 points in the confidence index measure, industrial (4.3 points), and construction (2.7 points). The respondents were also optimistic on positive outlook in the volume of business activities over the next quarter (Figure 3).

Respondents also emphasized constraints in terms of insufficient power supply as a major factor that will impede business activities, together with high interest rate tendencies, financial problems, unfavourable economic climate, and competition.

On the other hand, the consumer expectations survey generates information about consumer sentiments over the overall economic condition (measured by selected economic indicators) (Figure 4), as well as family financial situation and family income (measured by the household buying intention of consumer goods and services) (Figure 5).

Indices of selected economic indicators: next 12 months

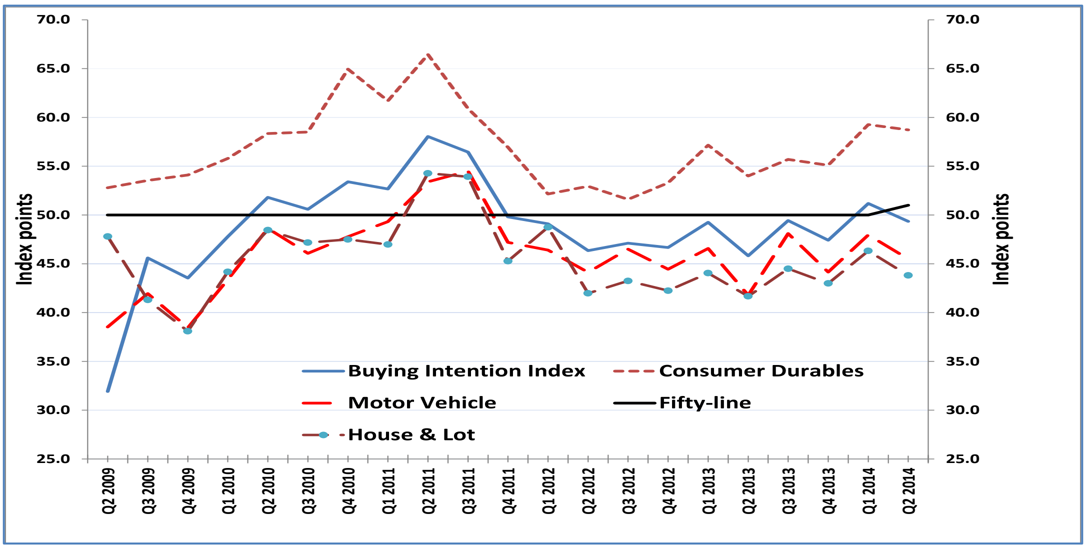
Figure 4



The improved confidence in the buying intention up to 2011q2 (Figure 5) was attributed basically to the expectation of increased rate of employment. As the expected rate of unemployment and inflation increased the confidence index declined from 2012q1. It could also be seen that in 2014q2, the overall outlook of confidence index on family financial situation and family income remained bleak. However, inflation rate was expected to decline while consumers were optimistic about naira appreciation in the exchange rate market.

Buying Intention Index: National

Figure 5



Stein (2014) showed that monetary policy, when governed by the usual dual mandate, penalizes variance in inflation and employment.

The maiden edition of SOFAL in 2011 contributed majorly to the external sector data for the compilation of balance of payment, external debt, and international investment position statistics. The survey data of respondents drawn from the Industrial, Construction, Wholesale/Retail Trade and Services sectors showed that the total inward capital to Nigeria from other countries (foreign liabilities) amounted to N12,729.69 billion as at end 2011, representing an increase of 8.97 per cent above the level of N11,681.32 billion in 2010 (Table 2).

Nigeria's Foreign Liabilities by Category (₦ 'Billion)

Table 2

	FDI	FPI	OCF	Total
2011	9,515.34	1,318.48	1,895.87	**12,729.69**
% Share	*74.75*	*10.36*	*14.89*	
2010	8,108.99	1,907.69	1,664.64	**11,681.32**
% Share	*69.42*	*16.33*	*14.25*	
Annual Change (%)	*17.34*	*-30.89*	*13.89*	***8.97***

Sources: CBN 2011 SOFAL Report.

This involves N9, 515.34 billion or 74.75 per cent FDI, N1, 318.48 billion or 10.36 per cent FPI and N1, 895.87 billion or 14.89 per cent OCF, respectively. The increase in 2011 was largely attributable to the 198.7 per cent growth in investments from Africa, while investments to Nigeria from Asia and North America grew by 10.3 and 6.4 per cent, respectively (Table 3).

Nigeria's Foreign Liabilities by Region of Origin (₦ 'Billion)

Table 3

Region	2011 (1)	2010 (2)	*% Change Btw (1) & (2)*	*% Share Column (1)*	*% Share Column (2)*
Asia	**1,778.64**	**1,612.72**	**10.29**	**13.97**	**13.81**
European Union	**6,988.08**	**7,469.34**	**-6.44**	**54.90**	**63.94**
North America	**507.73**	**477.33**	**6.37**	**3.99**	**4.09**
North Atlantic & Caribbean	**1,438.54**	**1,439.63**	**-0.08**	**11.30**	**12.32**
Others	**3.29**	**8.15**	**-59.59**	**0.02**	**0.07**
Africa	**2,013.41**	**674.14**	**198.66**	**15.82**	**5.77**
ECOWAS	*133.54*	*122.61*	*8.92*	*6.63*	*18.19*
East & Central Africa	*1,714.33*	*441.96*	*287.89*	*85.15*	*65.56*
South Africa	*157.37*	*107.71*	*46.10*	*7.82*	*15.98*
North Africa	*8.15*	*1.86*	*338.42*	*0.40*	*0.28*
Total	**12,729.69**	**11,681.32**	**8.97**		

Sources: CBN 2011 SOFAL Report.

In terms of sectoral distribution of the inward investment, extractive industry of the Nigerian economy was the preferred sector of foreign investors as it received about 49.4 per cent share, followed by the manufacturing sector with about 29.1 per cent, and transport, storage and communication with 10 per cent share. The sector on agriculture, hunting, forestry and fishing, as well as financing, insurance, real estate and business services remained unattractive among others (Table 4).

Nigeria's Foreign Liabilities by Destination Sector (₦ 'Billion)

Table 4

Sector	2011 (1)	2010 (2)	*% Change Btw (1) & (2)*	*% Share Column (1)*	*% Share Column (2)*
Agriculture, Hunting, Forestry and Fishing	**6.09**	**9.51**	**-35.91**	**0.05**	**0.08**
Financing, Insurance, Real Estate & Business Services	**726.27**	**328.73**	**120.94**	**5.71**	**2.81**
Extractive	**6,285.97**	**6,695.01**	**-6.11**	**49.38**	**57.31**
Construction	**157.57**	**127.55**	**23.53**	**1.24**	**1.09**
Manufacturing	**3,704.37**	**2,377.17**	**55.83**	**29.10**	**20.35**
Transport, Storage and Communication	**1,273.39**	**1,531.99**	**-16.88**	**10.00**	**13.11**
Wholesale and Retail Trade, Catering and Accomodation	**576.02**	**611.37**	**-5.78**	**4.52**	**5.23**
Global Total	**12,729.69**	**11,681.32**	*8.97*		

Sources: CBN 2011 SOFAL Report.

5.0 Concluding Remarks

The use of sample surveys have been a major tool of generating markets information and public opinions on the overall economy by the Central Bank of

Nigeria for over a decade. The three enterprise surveys have also supported the monetary and financial stability analysis in Nigeria by

- providing the policy makers with indicators on the current and prospective outlook of the business sector;
- generating quantitative measures of projected general business conditions and tendencies;
- generating data for measuring the size of foreign direct investment (FDI); foreign portfolio investment (FPI) and other capital flows (OCF); and
- quantifying foreign investments attribute to government investment promotion policies (such as the free trade zone policy) in Nigeria, among others.

The surveys also bring to fore some of the major challenges in Nigeria's financial system to include major weaknesses in the business environment and financial inclusion where these factors combined with other factors to weaken the financial system and constrained growth in Nigeria during the global financial meltdown of 2007–2009.

Having recognized that financial stability can be fostered by public confidence, the Bank also implemented several recommendations emanating from the surveys to enhance stability in the system. These include renewed collaboration with other regulators for data generation, establishment of power development fund (PDF) in support of small and medium enterprises (SMEs), establishment of small and medium enterprises credit guarantee scheme (SMECGS), establishment of fund for the refinancing and restructuring of the manufacturing sector loan portfolio, and establishment of commercial agriculture credit scheme (CACS) in collaboration with the Federal Ministry of Agriculture and Water Resources.

In conclusion, this paper has underscored the need for policy decisions to be informed by careful analysis of sound and transparent data on the overall economic situation for any effective and pragmatic implementation. Hence, to ensure that financial sector contributes optimally to the real sector, the availability of reliable, accurate and timely statistics is a fundamental prerequisite and sample survey can be used to achieve this.

References

Bhattacharyay B (2001). Harmonising and Strengthening Business Tendency Surveys in Selected Asian Development Bank Member Countries, in Proceedings of the Joint ADB/OECD/ESCAP Workshop on Harmonizing and Strengthening Business Tendency Surveys in Developing Countries in the Asia Pacific Region held on 21–24 November 2000 in Bangkok, Thailand; OECD, Paris, France, p 17–20.

Borio C (2011). Central Banking Post-Crisis: What Compass for Unchartered Waters? Bank for International Settlement.

CBN Survey of Foreign Assets and Liabilities in Nigeria Report, July, 2011.

Cintura A B and Gador L (2003). The BSP's Business Expectations Survey, Bangko Sentral Review, 39–50.

Forsells M and Kenny G (2002). The Rationality of Consumers' Inflation Expectations: Survey-based Evidence for the Euro Area. The European Central Bank Working Paper No 163.

Gameiro I M, Soares C and Sousa J (2011). Monetary Policy and Financial Stability: An Open Debate. Banco de Portugal Economic Bulletin: 7: 25.

Kulshreshtha A C (2001). Business Tendency Surveys – Indian Experience, in Proceedings of the Joint ADB/OECD/ESCAP Workshop on Harmonizing and Strengthening Business Tendency Surveys in Developing Countries in the Asia Pacific Region held on 21-24 November 2000 in Bangkok, Thailand; OECD, Paris, France, p 30–33.

Soludo, C C (2009). Global Financial and Economic Crisis: How Vulnerable Is Nigeria? Seminar Paper, Central Bank of Nigeria.

Sood A (2001). Business Confidence: The NCAER Survey, in Proceedings of the Joint ADB/OECD/ESCAP Workshop on Harmonizing and Strengthening Business Tendency Surveys in Developing Countries in the Asia Pacific Region held on 21–24 November 2000 in Bangkok, Thailand; OECD, Paris, France, p 34- 50.

Stein, J (2014). Incorporating Financial Stability Considerations into a Monetary Policy Framework, at the International Research Forum on Monetary Policy, Washington DC.

CBN Survey of Foreign Assets and Liabilities in Nigeria 2011 Report.

Utomo H (2001). The Harmonization Plan of Bank Indonesia Business Survey, in Proceedings of the Joint ADB/OECD/ESCAP Workshop on Harmonizing and Strengthening Business Tendency Surveys in Developing Countries in the Asia Pacific Region held on 21–24 November 2000 in Bangkok, Thailand; OECD, Paris, France, p 51–56.

Viñals J (2012). Monetary Policy and Financial Stability: Challenges in the Wake of the Crisis. International Journal of Central Banking: 297–300.

Williams J C (2014). Financial Stability and Monetary Policy: Happy Marriage or Untenable Union? Presentation to the Deutsche Bundesbank Conference on Housing Markets and the Macroeconomy: Challenges for Monetary Policy and Financial Stability, Eltville am Rhein, Germany.

Demystifying output gap pressure through surveys in a monetary analysis setting: An experimental perspective

Ashwin Madhou[1]

Abstract

The estimation of output gap is crucial in determining whether or not inflationary pressures exist in a monetary policy centred economy. Despite being riddled with statistical errors, univariate and multivariate filters are still widely used in estimating output gap, which can lead to gross misinterpretation of inflationary pressure in the domestic economy. The problematic nature of statistical filters can exacerbate the misinterpretation of output gap and inflationary pressure in small island economies, where data collection practices in many sectors are poor or practically inexistent. The inability to collect specific sector-wise data can lead to output gap inaccuracies, resulting in deficient monetary analysis. For the purpose of this paper, the case of a small island economy, namely Mauritius has been used. Typical imprecise output gap estimation is reflected in Mauritius' drivers of growth, namely the tourism and retail sector, whereby data on room occupancy and changes in sales volume, are not accounted for. The gap left by statistical filters can be filled in by a survey-based approach. This paper proposes the use of surveys to correct the statistical issues in filters for output gap estimation, thus providing additional support for monetary analysis.

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1. Introduction

Mauritius is the classical case of being a small, open and diversified economy where numerous industry groups co-exist together. Compared to other Sub-Saharan African countries, data collection practices across industry groups are generally better in Mauritius. However, Mauritius still faces the typical problem of unreliable or inexistent datasets in some industry groups. The lack of data collection practices for some industry groups can be attributed to inadequate budget, limited manpower and inexperience. The failure to capture specific data across industry groups can indeed be a cause of concern in the formulation of sound economic decision-making.

Although the main government data collection agency, namely Statistics Mauritius, has made great strides in its data collection standards and practices recently, there are still many inexistent indicators and datasets under its portfolio. Compared to data collection agencies in developed economies, there are many low-frequency and high-frequency datasets which are not captured by Statistics Mauritius.[2]

Globally, the computation of Gross Domestic Product (GDP) lies under the purview of the government's main data collection agency. Calculation of GDP is an exhaustive task by nature, whereby the higher the number of industry groups, the higher the likelihood of measurement errors. In the case of Mauritius, there exists seventeen industry groups and the probability of measurement error is significantly higher due to limited manpower and lack of appropriate data collection. On the premise of inappropriate and scarce data for computation of GDP in Mauritius, there is a strong belief that GDP figures do not provide an accurate picture on the performance of the economy. Since output gap is a function of GDP, the resulting question is whether or not measurement of output gap is technically flawed in Mauritius.

Central banks use different methodologies to measure output gap. On the quantitative side, popular techniques such as Dynamic Stochastic General Equilibrium (DSGE), Forecasting and Policy Analysis System (FPAS) and Cobb-Douglas production function are employed. On the qualitative side, survey methodology is a common practice and is considered to be an additional tool in the monetary decision-making process. The discretion to use either methodology is based on preferences, statistical validity and data availability. The Bank of Canada is a good example whereby economic models, surveys and expert judgment[3] are used to make quarterly forecast of output gap. Departing from its existing quantitative model, the possibility of employing a qualitative technique such as a survey to gauge inflationary pressures and to measure the economy's production capacity is considered.

As such, the Business Perspective Survey (BPS) has been designed with the aim to fill the qualitative gap in output gap forecasting. BPS can also be employed to gain real-world outlook from businesses about future economic activities, thus obtaining an outlook on inflationary pressures. This paper also fills the gap and contributes to the extensive output gap literature by exploring whether the use of

2 Examples include business demography, business expectations, energy, sustainability and food retailing.

3 It is to be pointed out that although quantitative and qualitative techniques are used, expert judgment tends to supersede both techniques.

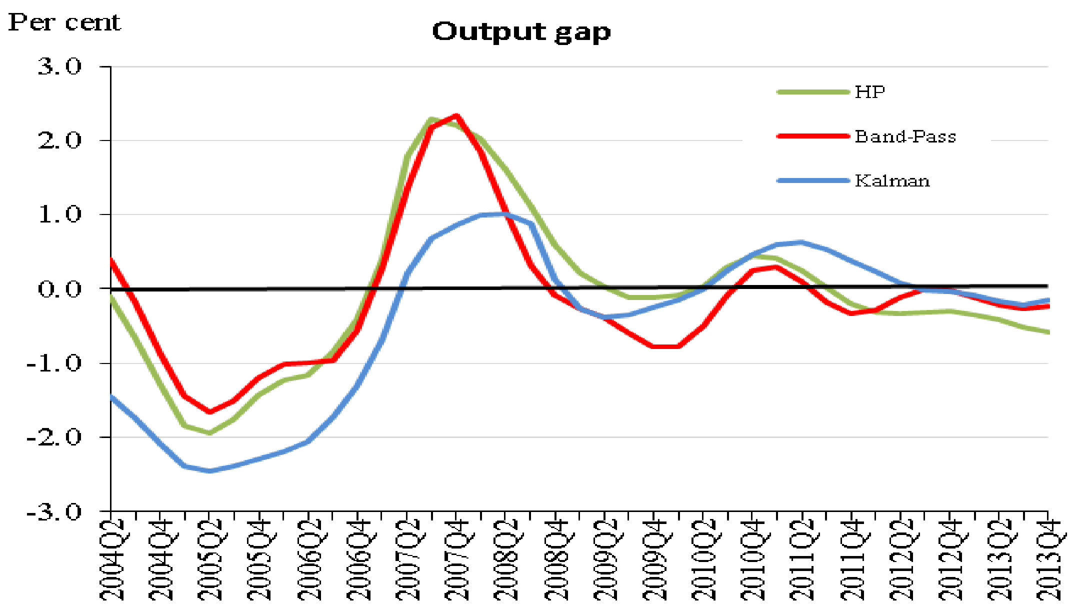
surveys can further improve output gap estimation in a small open economy. As such, this paper presents an overview of Mauritian economy[4] and subsequently introduces the BPS.

This paper advocates the setting up of the BPS, with the aim of measuring output gap of the Mauritian economy. The remainder of this paper is organised as follows: Section 2 reviews the literature on statistical filters and output gap, Section 3 focuses on the role of hotel occupancy rate and retail sales index for output gap computation, Section 4 stipulates the objectives and scope of BPS, Section 5 provides an overview of the research design, Section 6 concludes.

2. Literature review

There is no denying that univariate (Hodrick-Prescott, Band-Pass) and multivariate (Kalman) statistical filters play an important role in output gap estimation across central banks. In fact, leading central banks have already moved towards augmented statistical filters through the inclusion of enhanced variables or indicators in the computation of output gap (Borio et al. (2014)). However, this is not yet the case in Mauritius, where key variables are not computed and included in output gap estimation. The exclusion of enhanced variables or indicators in the calculation of output gap proves to be a major criticism by policymakers in Mauritius. Figure 1 presents the output gap of Mauritius using three filters namely Hodrick-Prescott, Band-Pass and Kalman for the period 2004Q2 to 2013Q4.

Measuring output gap using univariate and multivariate filters — Figure 1



4 A description of the Mauritian economy is presented in the appendix.

In addition to the exclusion of key variables in output gap estimation, the use of univariate and multivariate filters has been subject to much criticism. Literature on statistical filter is widely reported by academics and central bankers. However, there is no consensus on the appropriateness of statistical filters for measuring output gap. The next section reports on the limitations of univariate and multivariate filters.

Lawrence et al. (1999) argue that the use of an ideal band-pass filter generally requires larger datasets than typical macroeconomic time series. Benati (2001) suggests that band-pass filtered output may provide a surprisingly bad proxy for structural output gap. He further advocates that band-pass filtering can alter key business cycle and create entirely spurious stylized facts. The application of band-pass filter can prove to be ineffective in economies where large datasets are not available and where structural breaks are common. This is regrettably the case in Mauritius.

French (2001) states that the choice of smoothness parameters of Hodrick-Prescott filters have rather been ad hoc. He also stipulates that the filter does not utilise a valid method for determining the desired gain on new data points at the end of the sample, thus facing the commonly known problem of end-sample bias. Harvey and Jaeger (1993) show that Hodrick-Prescott filters can introduce can introduce spurious features into output gap trend estimation. Following the work of Harvey and Jaeger (1993), Deserres et al. (1995) explored the limitations of Hodrick-Prescott filters and concluded that the pre-conditions needed for Hodrick-Prescott filters to successfully operate as an optimal filter are rarely met in practice. Although the use of Hodrick-Prescott filters is favoured in small open economies, there are existing limitations such as lack of large datasets and the calibration of the smoothness parameter lambda that can distort output gap estimation.

The ever-growing popularity of the Kalman filter can be partly attributed to the weaknesses of the univariate filters. Nevertheless, Kalman filter still holds flaws such as being computationally complex, the use of iterative step to estimate the whole model and the time-consuming element in calibrating the variance or standard deviation of trends. Athans (1974) postulates that the use of Kalman filtering involves estimation of state variables whenever the actual measurements are influenced by white noise. Despite its inherent vices, Kalman filter remains the favoured filter for output gap estimation across central banks.

A review of the academic literature on statistical filters indicates that there is no consensus on the best filtering technique for output gap estimation. Nonetheless, the performance of filters can be enhanced through the use of new variables or indicators. In small open economies, the lack of data can pose significant problem to the proper estimation of output gap. However, the inclusion of additional indicators can augment both the reliability of statistical filters and the estimation of output gap. The next section details the introduction of new indicators, namely hotel occupancy rate and retail sales index in output gap estimation.

3. Role of hotel occupancy rate and retail sales index in output gap computation

The tourism sector has grown at a rapid pace over the last few decades and has been one of the leading contributors of GDP growth. However, it has been recently observed that the growth rate of tourist arrivals has been on a declining trend, while tourist earnings have been growing. Figure 2 depicts the seasonally-adjusted year-on-year change in tourist arrivals and earnings of Mauritius for the period 2006Q-2013Q3.

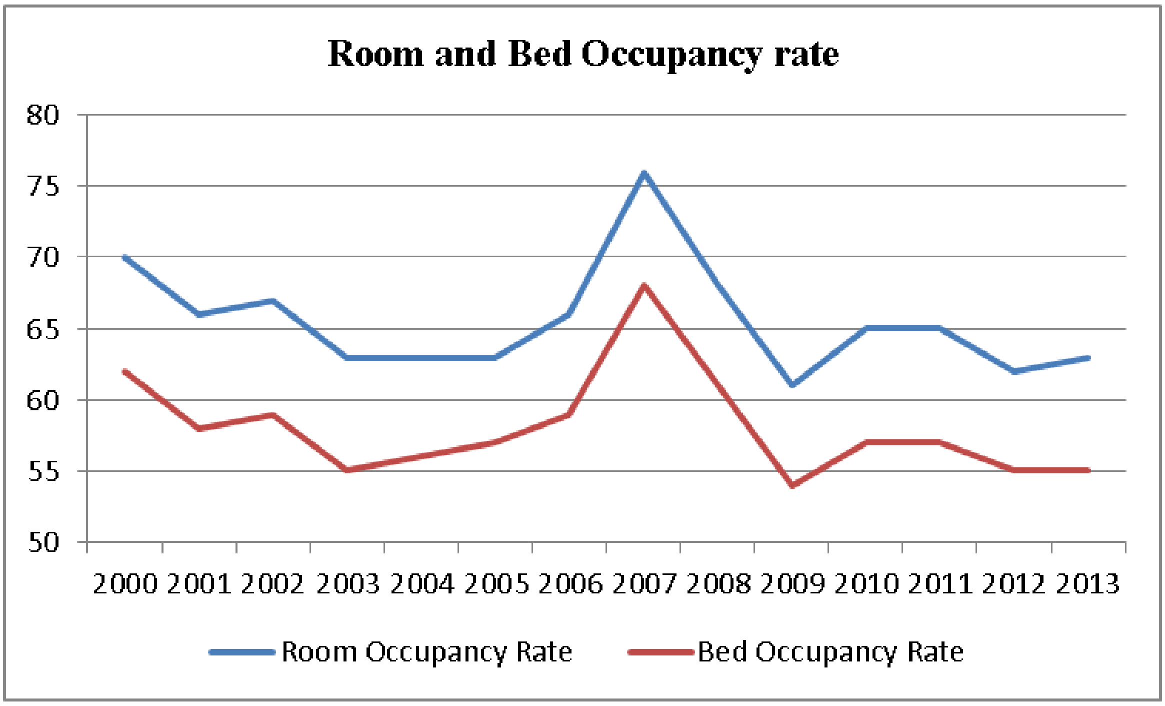
Declining tourist arrivals and earnings

Figure 2

The inverse correlation between tourist arrivals and tourist earnings has not yet been properly explained by Government authorities. The existence of divergent views has undeniable lead to political commotion in Mauritius. The possible reasons for the inverse correlation between tourist arrivals and tourist earnings have been justified through the exclusion of money changers (used by tourists to exchange foreign currency), unreliable data sources and the lag period in collecting and transferring revenue from tour-operators to hotels, which ultimately remains unaccounted for the current accounting period. As a result, the computation of output gap through the use of tourist arrivals and tourist earnings remain contentious.

One possible way to correct the issues between tourist arrivals and tourist earnings in the estimation of output gap is the use of hotel occupancy rate[5]. Hotel occupancy rates are crucial ratios for countries where the tourism industry is a major portion of their GDP[6]. Hotel occupancy rate is measured using two standards, namely, room occupancy rate and bed occupancy rate. Figure 3 shows the evolution of room and bed occupancy rate in Mauritius. Historical hotel occupancy rate data can be employed as a proxy for tourist arrivals and tourist earnings for the computation of output gap, instead of relying on inaccurate earnings data.

Evolution of room and bed occupancy rate — Figure 3



Whilst retail sales index[7] data is not yet compiled by Statistics Mauritius, several data collection agencies such as Singapore Department of Statistics[8], United

5 The existence of occupancy rate that are less than the hotel capacity means that there are lost selling opportunities, which leads to a depletion in the hotel revenue (Taha 2000, p 432).

6 Hotel occupancy rate is compiled by numerous statistical offices such as National Bureau of Statistics (Tanzania), National Bureau of Statistics (Seychelles), Statistics Mauritius and Government of Macau Special Administrative Region Statistics and Census Service.

7 The retail sales index (RSI) measure the short-term performance of retail industry based on the sales records of retail establishments. Sales figure refers to the value of retail goods sold to consumers during the month, excluding taxes on products such as Goods and Services Tax (GST), Additional Registration Fee (ARF) and Certificates of Entitlement (COE).

8 In Singapore, the retail sales index is presented at both current prices and constant prices. The index at current prices measures the changes of sales values which can result from changes in both

Kingdom Office of National Statistics and Central Statistics Office of Ireland have already broadened their data collection portfolios through regular compilation of retail sales index. The central bank literature shows that one of the variables employed by the Bank of England for the computation of output gap is retail sales data. In addition, the Central Bank of Colombia uses data from various sources such as sectorwise data and surveys to compile retail sales data, thus creating a coherent assessment of the demand situation (Rodriguez et al. 2006). Studies conducted by the Hong Kong Institute for Monetary Research indicate that there is a strong positive correlation between retail sales and GDP (Gerlach and Yiu (2004)).

The role of retail sales index as a good predictor of output gap can be established based on the above-mentioned studies. However, the interaction between hotel occupancy rate and output gap remains an area where literature is limited or practically inexistent. The next section introduces BPS.

4. Objectives and Scope of BPS

The objective behind conducting the BPS is to collect information from businesses on the following themes: demand, capacity pressures and forward-looking views on economic activity. It also aims at gathering information from selected firms in different industries on topics of interest. (E.g. Long-term views on business activities).

Firstly, the objectives of BPS are to capture data on business activity with regard to changes in sales volume over the last 12 months and future 12 months and full-time employment. Secondly, BPS aims at identifying pressures on production capacity by assessing potential difficulty in meeting an unplanned increase in demand or sales and shortages of labour restricting ability to meet demand. The BPS also helps in collecting information on variables which are difficult to quantify and forecast through macroeconomic models. As such, BPS helps in identifying pressures on production capacity and hence presents a better outlook on inflationary pressure.

BPS aims at covering firms based on industry contribution to Mauritius' Gross Domestic Product. The key advantage of running BPS is that it provides practical perspectives on the evolution of economic activity as witnessed and forecasted by businesses. The BPS also provides an opportunity to obtain a viewpoint on business developments in the Mauritian economy. The results of the BPS can also be presented to the Monetary Policy Committee (MPC) on a quarterly basis so as to aid in monetary policy decision making process.

price and quantity. By removing the price effect, the index at constant prices measures the changes in the volume of economic activity. (Department of Statistics Singapore, 2014).

5. Research Design

This section reports on the research design and methodology.

5.1 Target Population

The survey will cover firms, sampled from the latest sector-wise contribution to Gross Domestic Product statistics[9]. As a representative profile of the Mauritian economy, participants in BPS will be private sector firms.

5.2 Sample

Presently, it is not possible to consider undertaking the BPS with the whole population due to time and labour constraints. The Statistics Division of the Bank of Mauritius already conducts surveys such as Inflation Expectations and FALS and as such, has a pre-defined list of firms from different sectors that can be concurrently used to run BPS. The methodology adopted in selecting the sample is simple in nature. Firstly, sector contribution to GDP for the year 2013 is explored and sectors with the biggest contribution to GDP are ranked accordingly. Secondly, market leaders in the selected sectors are identified. Participation in the BPS is on a voluntary basis. If a firm is unavailable or unwilling to participate in BPS, another firm will be selected so that the profile of selected firms is maintained.

5.3 The Questionnaire

The BPS questionnaire is divided into 3 main parts[10]:

(i) A question about past business conditions

(ii) Questions that explore the outlook for business activity

(iii) Questions that gauge pressures on production capacity

Firms are asked to provide qualitative responses about their past and present economic activities. The newly designed BPS uses a three-part scale for measuring responses - greater/less/same. A balance of opinion[11] is then used to summarise the responses obtained. It is to be noted that the statistical reliability of the BPS results is restricted due to small sample size.

9 See Appendix 2 for sector wise distribution of GDP for 2013 and historical distribution of GDP by industry group (2006–2013).

10 See Appendix 3 for BPS questionnaire.

11 A balance of opinion is a useful way of summarizing these types of responses. The balance-of-opinion data are constructed by subtracting the proportion of negative responses from the proportion of positive responses. Values can range from –100 to +100.

6. Conclusion

This paper postulates the idea of employing hotel occupancy rate and retail sales index to improve the computation of output gap. The use of new variables can augment the performance of statistical filters, thus resulting in better output gap estimation. Since retail sales index is not compiled by the Statistical Office in Mauritius, this paper formulates a survey-based approach in order to capture it. Subsequently, BPS has been designed and the pilot-testing stage is forthcoming. The BPS remains a work-in-progress and stages such as final survey design, sensitization campaign and evaluation are projected in the near future.

Appendix 1: Description of the Mauritian economy

Mauritius has evolved from a low-income, agriculture-based economy to a middle-income diversified economy. The Mauritian economy is dependent on four pillars, namely financial services, textile, tourism and sugar. However, in an attempt to diversify the economy emerging sectors such as information and communication technology, seafood, hospitality and property development, healthcare, renewable energy and education are being encouraged to grow. Since independence in 1968, Mauritius gradually adapted to changing world conditions and as such, structured its economy to remain competitive. Research by World Economic Forum (WEF) classifies Mauritius at an efficiency-driven stage (WEF report 2013). Since 2005, the competitive analysis of the WEF is based on the Global Competitiveness Index (GCI), which is a broad measure of microeconomic and macroeconomic foundations of national competitiveness. The 2013-2014 WEF report shows that Mauritius is ranked 45th in the world, becoming the highest ranked country in sub-Saharan Africa. An overview of the GCI shows that between 2001 and 2013, ranking of Mauritius has fluctuated widely, ranging from 32 to 60. This is an indication that of the struggle that Mauritius has faced in order to remain competitive.

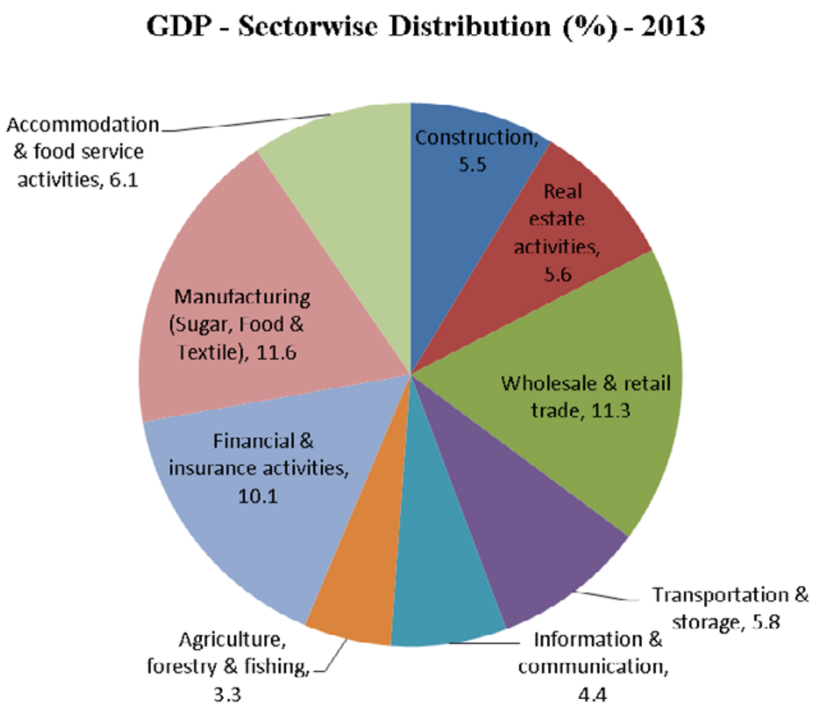
Quick Facts[12]

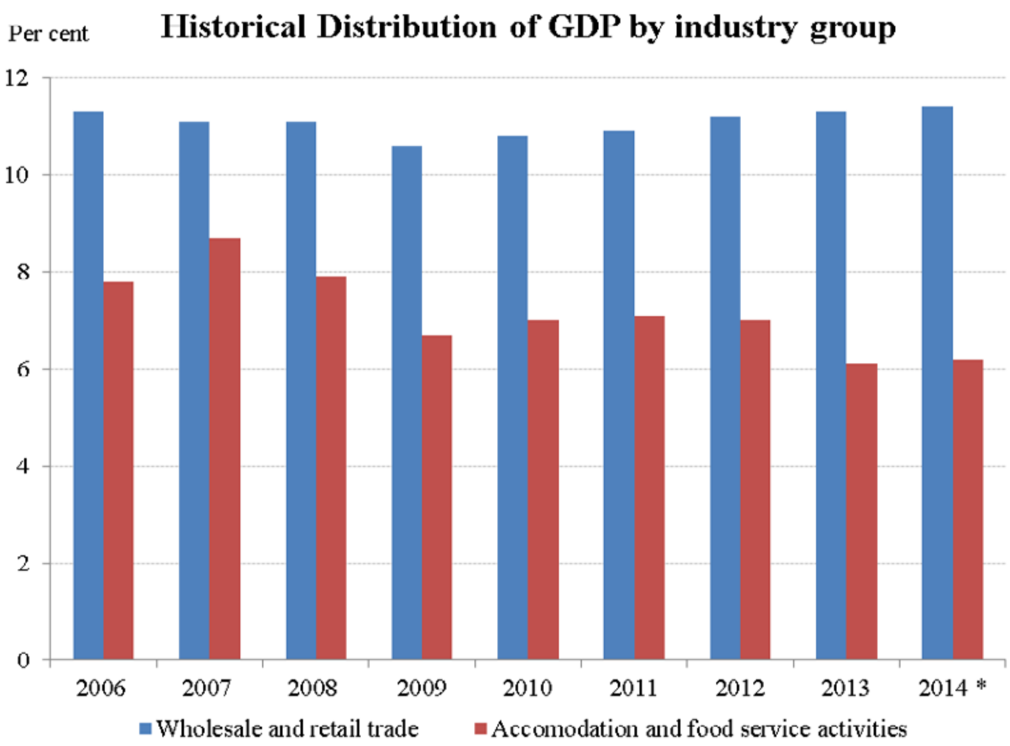
- GDP per capita: approx. USD 9,300 (2013)
- Sovereign rating by Moody’s: BAA1 (2013)
- Population: approx. 1.3 million
- Political System: Democracy with free and fair elections held every 5 years
- Official Language: English
- Legal System: dual system (Common & Civil Law)
- GDP Growth: 3.2% (2013)
- Unemployment: 8.3% (2013)
- Inflation: 3.6% (2013)
- Repo Rate: 4.65% (as at date)

[12] Quick facts were obtained from the Board of Investment website (www.investmauritius.com).

Appendix 2

GDP composition





Appendix 3: Business Perspective Survey Questionnaire

Bank Of Mauritius

BUSINESS PERSPECTIVE SURVEY

SURVEY MONTH: Month 201X

The purpose of this Survey is to collect information from businesses on demand and capacity pressures on economic activity.

Please e-mail back this survey form not later than XX Month 201X at XXX@bom.mu

Name of Institution: ………………………………………………………………………

All individual responses will be kept in strict confidentiality.

PAST BUSINESS CONDITIONS

1. PAST REVENUE GROWTH

Over the past 12 months, the rate of increase in your organisation's turnover (compared with the previous 12 months) was:

(a) Greater ☐

(b) Less ☐

(c) The Same ☐ *(Please tick as appropriate)*

OUTLOOK FOR BUSINESS ACTIVITY

2. FUTURE SALES GROWTH

Over the coming 12 months, the growth rate in your organisation's turnover (with respect to the past 12 months) is expected to be:

(a) Greater ☐

(b) Less ☐

(c) The Same ☐ *(Please tick as appropriate)*

3. FUTURE EMPLOYMENT LEVEL

Over the coming 12 months, how do you expect the level of employment in your organisation to be?

(a) Greater ☐

(b) Less ☐

(c) The Same ☐ *(Please tick as appropriate)*

PRESSURES ON PRODUCTION CAPACITY

4. ABLITY TO MEET DEMAND

To what extent do you believe your organisation will face any difficulty in meeting an unexpected increase in demand?

(a) Significant difficulty ☐

(b) Some difficulty ☐

(c) No difficulty ☐

5. LABOUR SHORTAGES

Over the past year, has your organisation faced any shortfall in labour that hindered your ability to meet demand?

(a) Yes ☐

(b) No ☐

Thank you for participating in our Survey

Contact Person:…………………………… **Contact Number:…………………………**

Designation:…………………………………… **Email:……………………………………………**

7. References

Athans, M, 1974, The importance of Kalman filtering Methods for Economic Systems, MIT Cambridge, p 49.

Borio, C, Disyatat, P and Juselius, M, 2014, A Parsimonious Approach to Incorporating Economic Information in measures of Potential Output, BIS Working Papers, No 442.

Department of Statistics Singapore, 2014, Retail Sales Index and Food & Beverage Services Index, Press Release, 14 March 2014.

Deserres, A,Guay, A and St–Amant, P, 1995, Estimating and Projecting Potential Output Using Structural VAR Methodology: The Case of the Mexican Economy, Working Paper 95–2, Bank of Canada, Ottawa.

Gerlach, S, and Yiu, M, 2004, A Dynamic Factor Model for Current Quarter Estimates of Economic Activity in Hong Kong, Hong Kong Institute for Monetary Research, p 2–3.

Harvey, A and Jaege, A, 1993, Detrending, Stylized Facts and the Business Cycle, Journal of Applied Econometrics, 8(3): 231–47.

Kalman and H-P filters versus a Markov-switching framework, p 5–6.

Lawrence, J, and Fitzgerald, T.,1999, The Band Pass Filter, Working Paper 9906, Federal Reserve Bank of Cleveland, p 39.

Luca, B,2001, Band-Pass Filtering Cointegration and Business Cycle Analysis, Bank of England, p 7–8.

Mark W French, 2001, Estimating changes in trend growth of total factor productivity.

Rodríguez, N, Torres, T., Velasco, A., 2006, Estimating an Output Gap Indicator Using Business Surveys and Real Data, p 5–21.

Tariq Taha, 2000, Hotel management-New Approach of Dar Al-M a'arefa Alexandria.

Results of a Survey on Inflation Outlook of Firms in the Bank of Japan's "Short-term Economic Survey of Enterprises in Japan"

Takashi Muto[1]

Abstract

Regarding inflation outlooks of firms, since March 2014, the Bank of Japan has introduced two new survey items – general prices and firms' output prices – in its Short-term Economic Survey of Enterprises in Japan (*Tankan*). No other surveys in Japan cover firms' mid- to long-term inflation expectations and no comparable surveys in other countries have as large a sample as the *Tankan* survey. These new survey items are expected to fill this information gap with respect to inflation expectations and to help with assessments of how monetary policy affects the inflation outlooks of economic entities. In this paper, two consecutive survey results (for March and June 2014) will be presented, and the following issues will be discussed: 1) whether the distribution of firms' inflation outlooks for general prices varies due to the firms' size and industry, 2) whether the firms' outlooks for their output prices affect the formation of their own inflation outlooks for general prices, and 3) whether the firms' inflation outlooks for general prices differ from those of households and economists.

Keywords: Business survey, inflation expectations

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The views expressed here are those of the author and do not necessarily represent the views of the Bank of Japan. The author is responsible for any errors or omissions.

1. Introduction

In March 2014, the Bank of Japan started a survey on the medium-to-long-term inflation outlooks of firms as part of *Tankan* ("Short-term Economic Survey of Enterprises in Japan"), which is one of the important information sources for the Bank of Japan in assessing the Japanese economy, and is also highly appreciated by a wide variety of entities. The new survey covers two kinds of inflation outlooks: "Outlook for Output Prices" and "Outlook for General Prices" (measured by the consumer price index). Its forecasting horizons are one year ahead, three years ahead, and five years ahead.

It is considered beneficial for the Bank of Japan to obtain additional information on inflation outlooks of economic agents. It is also highly relevant to its forecasts of economic activity and prices. Changes in real interest rates influence the spending decisions of households and firms, and changes in inflation outlooks have ramifications for actual inflation rates by affecting how firms price their products and set employees' wage levels.

The introduction of a survey on medium-to-long-term inflation outlooks of firms in the *Tankan* survey is expected to fill an information gap in surveys on inflation outlooks in Japan. There were no inflation outlook surveys in Japan that ask firms for their views on medium-to-long-term inflation before (Table 1). In addition, the *Tankan* survey is considered the best platform to collect information on the inflation outlooks of firms in terms of its accuracy. First, its sample size is very large. There are 10,427 sample firms (as of the June 2014 survey). There are no comparable surveys in other countries, to the best of my knowledge, that have as large a sample as the *Tankan* survey. Secondly, its response rate is very high compared with other business surveys in Japan and is consistently around 99%.

In section 2, the background to the new survey is explained. The questionnaires and the sample firms of the new survey are described. In section 3, the results of the new survey are presented. The following topics are mainly discussed: 1) "Does the distribution of firms' inflation outlooks for general prices vary due to firms' size and industry?," 2) "Do the firms' outlooks for their output prices affect the formation of their own inflation outlooks for general prices?," 3)"Do the firms' inflation outlooks for general prices differ from those of households and economists?" Section 4 provides concluding remarks.

2. New Survey on Inflation Outlook of Firms in Japan

Questionnaires and Responding Format

The new survey items are "Outlook for Output Prices" and "Outlook for General Prices" (Table 2). The survey on "Outlook for Output Prices" asks firms about their expectations of the rate of price changes relative to the current level with respect to their mainstay domestic products and services. The definition for output prices is the same as the one adopted in the *Tankan* item on short-term changes (over three months ahead) in output prices. The other survey item is "Outlook for General Prices," which asks firms about their expectations of the annual percentage change in general prices as measured by the consumer price index. While the consumption tax rate in Japan increased from 5 to 8% in April 2014 and an additional hike of the consumption tax rate is planned by the government for October 2015, the respondents are asked to exclude the effects of changes due to the consumption tax hike. The forecasting horizons for these survey items are one year ahead, three years ahead, and five years ahead.

The responding format is designed for the respondents to indicate the range of inflation outlook nearest to their own expectation from the nine or ten response options given (e.g., "around +6% or higher," "around +5%," …, "around −3% or lower") for both "Output Prices" and "General Prices" survey items. A numerical range is added to each response option (e.g., "+4.5 to +5.4%" or "around +5%") to clarify the range of inflation rates that each response option is intended to cover.[2] The sample firms can choose the option of "Don't know" or "Don't have a clear view" when they find it difficult to choose one of the indicated inflation figures.

Sample firms of the New Survey

Sample firms of the new survey are equivalent to the *Tankan*. They are selected from the approximately 210,000 population firms, which are private firms (excluding financial institutions) with capital of 20 million yen and more. The sample firms are selected from them by industry and size classifications under certain statistical criteria that have been set to statistical accuracy and other measuring instruments. There are 10,427 sample firms as of the June 2014 survey.

The sample firms are classified into 93 strata by size and industry (Table 3). In particular, they are categorized into large firms (capital with 1 billion yen and more), medium-sized firms (capital with 100 million yen to less than 1 billion yen), and small firms (capital with 20 million yen to less than 100 million yen) based on the size of capital. In addition, they are divided into 31 industries (17 industries in manufacturing and 14 industries in nonmanufacturing), following the "Japan Standard Industrial Classification" released by the Ministry of Internal Affairs and Communications.

3. Survey Result

Table 4 depicts the average inflation outlook for general prices of the June 2014 survey, which is the weighted average by response percentage. There are about 10,200 reporting firms. The average inflation outlook for all firms rises gradually from 1.5% (one year ahead) to 1.7% (five years ahead) as the forecasting horizon increases. The difference between the average inflation outlooks for different sizes is comparatively large. Specifically, the average inflation for small firms is higher than that for large firms by as much as about 0.6% points. In contrast, there is little difference in the average inflation outlook between basic materials (8 industries of

[2] This setting reflects comments from the public. Each option was originally expressed as a numerical range between two integers indicating annual inflation, e.g., "0% to +1%." However, a number of experts argued that the majority of firms are likely to formulate their inflation outlooks around an integer percentage (e.g., "around 0%") and these firms would pick a numerical range which has the firms' true inflation outlook as the lower end of the range (e.g., "0% to +1%,") and thus the result could be interpreted with an upward bias. To address this issue, each response option is now expressed as "around (integer) %" (e.g., "around 0%").

manufacturing), processing (9 industries of manufacturing), and nonmanufacturing. Because a similar observation applies to the results of the March 2014 survey, which are shown in the brackets, the discussion below is focused on the results of the June 2014 survey.

Does the distribution of firms' inflation outlooks for general prices vary due to firms' size and industry?

A significant difference between the distributions of inflation outlooks for "General Prices" of different sizes is also observed. First, the distributions of small firms and medium-sized firms are right-skewed to those of large firms (Chart 1). While the mode of their distributions is "around +1%" with respect to medium-sized firms and large firms, that of small firms is "around +1%" for one year ahead, and "around +2%" for three years ahead and five years ahead. In addition, the right tails of the distributions of small and medium-sized firms are much heavier than those of large firms. Secondly, the percentage share of the large firms choosing "Don't have a clear view," instead of choosing one of the indicated inflation outlooks, is much higher than that of small firms and medium-sized firms. These characteristics also hold in the inflation outlooks for "Output Prices (Chart 2)."

On the other hand, the distributions of inflation outlooks for "General Prices" of "Basic materials (8 industries)," "Processing (9 industries)," and "Nonmanufacturing (14 industries)" are very similar in slight contrast to those for "Output Prices" (Chart 3 and Chart 4). However, looking more carefully into the inflation outlooks of different industries, there are variations in the distribution of inflation outlooks for 31 industries. For example, the average inflation outlooks for "General Prices" are distributed in the range from about +1% to about +2.5% (Chart 5).

Do the forecasts of firms' output prices affect the formation of their own inflation outlooks for general prices?

Chart 6 shows the scattered plots of inflation outlooks for "Output Prices" and "General Prices" among 31 industries. As for small firms and medium-sized firms, the comparatively high correlation between the average inflation outlooks for "Output Prices" and "General Prices" is observed. This implies that the industries which have higher expectations for "Output Prices" forecast higher inflation for "General Prices." However, with respect to the large firms, there is little correlation.

Do the firms' inflation outlooks for general prices differ from those of households and economists?

Table 5 is a comparison of average inflation outlook for "General Prices" with other major surveys in Japan on inflation outlook for "General Prices" of households and economists. In comparison with a survey on economists, the average inflation outlook of firms in the new survey (*Tankan*) is higher than that of economists in "ESP Forecast," which is conducted by Japan Center for Economic Research with forecast horizons of one year ahead and five years ahead. The inflation outlooks of economists are similar to those of large firms, which are much lower than small firms and medium-sized firms. This observation is consistent with the fact that large firms often refer to economists' forecasts of economic and price developments, which can be considered one of the reasons for the disparity between inflation outlooks of small firms and large firms explained above.

On the other hand, in comparison with a survey on households, the average inflation outlook of firms in the new survey (*Tankan*) is lower than that of households in "Opinion Survey on the General Public's Views and Behavior (Opinion Survey)," which is conducted by Bank of Japan with forecast horizons of one year ahead and five years ahead.

4. Concluding Remarks

In this paper, the new survey results on inflation outlooks are discussed. The following characteristics of the new survey results are presented. First, the average inflation outlooks for "General Prices" rise gradually as the forecasting horizon increases from 1.5 to 1.7%. Secondly, the size of a firm appears to affect the inflation outlook significantly. The distributions of the inflation outlooks for both "General Prices" of small firms and medium-sized firms are right-skewed to that of large firms. Thirdly, the difference between the distributions of the inflation outlook for "General Prices" of different industries is also observed, though not to the extent of the variation between different sizes. The distributions of "Basic materials (8 industries)," "Processing (9 industries)," and "Nonmanufacturing (14 industries)" are very similar. However, there seems to be a difference between the average inflation outlooks of 31 industries. With respect to small firms and medium-sized firms, except large firms, the industries which have higher expectations of "Output Prices" tend to forecast a higher inflation for "General Prices." Finally, in comparison with major surveys in Japan on inflation outlook for "General Prices" on households and economists, the inflation outlooks of firms are in between those of households and economists. The inflation outlooks of firms are lower than those of households and higher than those of economists.

All statistics inevitably have peculiarities and certain patterns which are not related to the economic conditions of the time and which need to be taken into account when the statistics are used. Deepening the users' understanding of the characteristics and statistical peculiarities by survey item will allow the users to assess inflation outlooks of firms more accurately. However, it is too early to judge that the characteristics above, which are observed in only two surveys, are such peculiarities, mainly due to the short history of the surveys. In order to conduct the time-series analysis on correlations between inflation outlook of firms and economic variables, we should wait for the survey results to accumulate.

References

Bank of Japan (2013), "Planned Revisions of the Tankan Survey – Review of survey items, including the introduction of a survey on Inflation Outlook of Firms –," Research and Statistics Department, *BOJ Reports & Research Papers*, March

Shusaku Nishiguchi, Jouchi Nakajima, and Kei Imakubo (2014), "Disagreement in households' inflation expectations and its evolution," *Bank of Japan Review* 2014-E-1

Major Surveys on Inflation Outlooks in Japan — Table 1

	Forecast Horizons	
	Short-term (1 year or less)	Medium to long term (2 to 10 years)
Households	・Opinion Survey (1 year) <Bank of Japan> ・Monthly Consumer Confidence Survey (1year) <Cabinet Office >	・Opinion Survey (5 years)<Bank of Japan>
Business	・*Tankan* (3 months)*<Bank of Japan> ・Business Outlook Survey (3, 6 months) <Cabinet Office & Ministry of Finance> ・Annual Survey of Corporate Behavior (1 year)<Cabinet Office>	Not available
Economists	・ESP Forecast (1 year) <Japan Center for Economic Research> ・Consensus Forecast <Consensus Economics>	・ESP Forecast (2, over 5 years) <Japan Center for Economic Research> ・Consensus Forecast <Consensus Economics>

Note 1: * denotes that the question on short-term changes (over 3 months ahead) in output prices has been asked in the past.

Note 2: The entities which conduct each survey are shown in brackets.

Overviews of the New Survey on Inflation Outlooks of Firms

Table 2

Survey Items		"Outlook for Output Prices" (rate of price changes relative to the current level) "Outlook for General Prices" (annual % change)
Forecast Horizons		1 year ahead, 3 years ahead, 5 years ahead
Sample Firms		Equivalent to the sample firms of the current ***Tankan*** ("The Short-term Economic Survey of Enterprises in Japan") (10,427 firms as of June 2014)
Questionnaire	Outlook for Output Prices	[Question] Relative to the current level, what are your institution's expectations of the rate of price changes in your mainstay domestic products or services for one year ahead, three years ahead, and five years ahead, respectively? Please select the range nearest to your own expectation from the options below.
		[Options] Rate of change relative to the current level 1. around +20% or higher (+17.5% or higher) 2. around +15% (+12.5 to +17.4%) 3. around +10% (+7.5 to +12.4%) 4. around + 5% (+2.5 to + 7.4%) 5. around 0% (−2.5 to +2.4%) 6. around − 5% (−7.5 to −2.6%) 7. around −10% (−12.5 to −7.6%) 8. around −15% (−17.5 to −12.6%) 9. around −20% or lower (−17.6% or lower) 10. Don't know.
	Outlook for General Prices	[Question] What are your institution's expectations of the annual % change in general prices (as measured by the consumer price index) for one year ahead, three years ahead, and five years ahead, respectively? Please select the range nearest to your own expectation from the options below.
		[Options] In annual % rate change 1. around +6% or higher (+5.5% or higher) 2. around +5% (+4.5 to +5.4%) 3. around +4% (+3.5 to +4.4%) 4. around +3% (+2.5 to +3.4%) 5. around +2% (+1.5 to +2.4%) 6. around +1% (+0.5 to +1.4%) 7. around 0% (−0.5 to +0.4%) 8. around −1% (−1.5 to −0.6%) 9. around −2% (−2.5 to −1.6%) 10. around −3% or lower (−2.6% or lower) ※If you have no clear views on general prices, please select one of the three following reasons. 11. Uncertainty over the future outlook is high 12. Not really conscious of inflation fluctuations because they should not influence the strategy of the institution. 13. Other

Number of Sample Enterprises

(as of June 2014) Table 3

			Large Firms	Medium-sized Firms	Small Firms
Manufacturing (17 industries)			1,143	1,119	1,917
	Basic Materials (8 industries)	1) Textiles, 2) Lumber & Wood products, 3) Pulp & Paper, 4) Chemicals, 5) Petroleum & Coal products, 6) Ceramics, Stone & Clay, 7) Iron & Steel, 8) Nonferrous metals	374	373	728
	Processing (9 industries)	1) Food & Beverages, 2) Processed metals, 3) General-purpose machinery, 4) Production machinery, 5) Business oriented machinery, 6) Electrical machinery, 7) Shipbuilding, Heavy machinery, & Other transportation machinery, 8) Motor vehicles, 9) Other Manufacturing	769	746	1,189
Nonmanufacturing (14 industries)		1) Construction, 2) Real Estate, 3) Goods rental & Leasing, 4) Wholesaling, 5) Retailing, 6) Transport & Postal activities, 7) Communications, 8) Information Services, 9) Other information Communications, 10) Electric & Gas utilities, 11) Services for businesses, 12) Services for individuals, 13) Accommodations, Eating & Drinking Services, 14) Mining & Quarrying of stone and gravel	1,136	1,736	3,376

Average of Firms' Inflation Outlook

(June 2014 Survey) Table 4

(Annual Percent Rate Change. %)

	Large Firms			Small Firms		
	1 year ahead	3 years ahead	5 years ahead	1 year ahead	3 years ahead	5 years ahead
Manufacturing	1.1 (1.1)	1.2 (1.3)	1.2 (1.3)	1.7 (1.7)	1.8 (1.9)	1.9 (1.9)
Basic materials	1.1 (1.2)	1.2 (1.4)	1.1 (1.3)	1.8 (1.8)	1.9 (1.9)	2.0 (2.0)
Processing	1.1 (1.0)	1.2 (1.2)	1.3 (1.2)	1.6 (1.6)	1.8 (1.8)	1.9 (1.9)
Nonmanufacturing	1.1 (1.1)	1.2 (1.3)	1.2 (1.2)	1.7 (1.7)	1.8 (1.9)	1.9 (1.9)
All Industries	1.1 (1.1)	1.2 (1.3)	1.2 (1.3)	1.7 (1.7)	1.8 (1.9)	1.9 (1.9)

	All Firms		
	1 year ahead	3 years ahead	5 years ahead
All Industries	1.5 (1.5)	1.6 (1.7)	1.7 (1.7)

Note: () denotes a result of the March 2014 Survey.

Difference of Average Inflation Outlook between Firms, Households, and Economists

Table 5

Survey	Period	Agents	Forecasting Horizons	
			1 year ahead	5 years ahead
Tankan (Bank of Japan)	2014 June	Firms	1.5%	1.7%
Opinion Survey (Bank of Japan)	2014 June	Households	4.2%	3.5%
ESP Forecast (Japan Center for Economic Research)	2014 June	Economists	1.0%	1.4%*

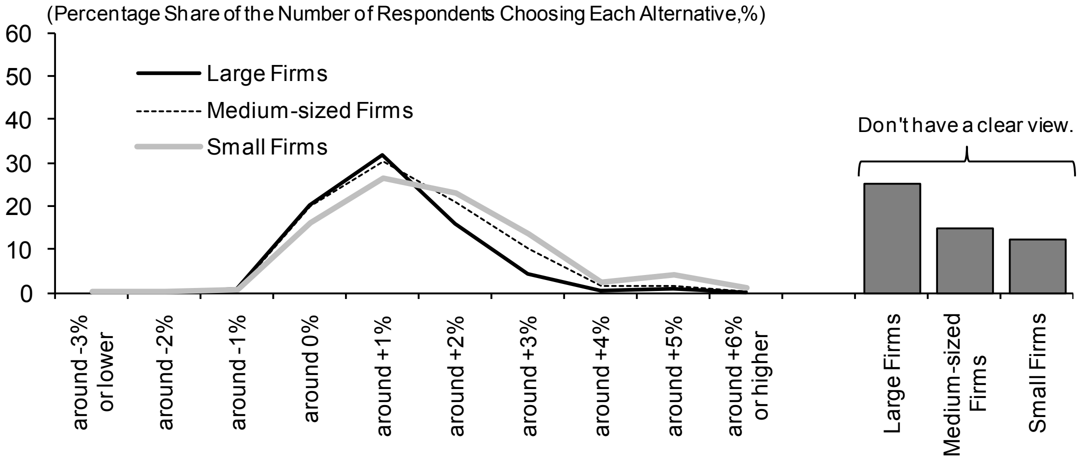
Note 1: Respondents of the surveys are asked to exclude the effects of the increase in the consumption tax rate in their reply.

Note 2: * depicts the average of the inflation outlook from Fiscal 2016 to Fiscal 2020.

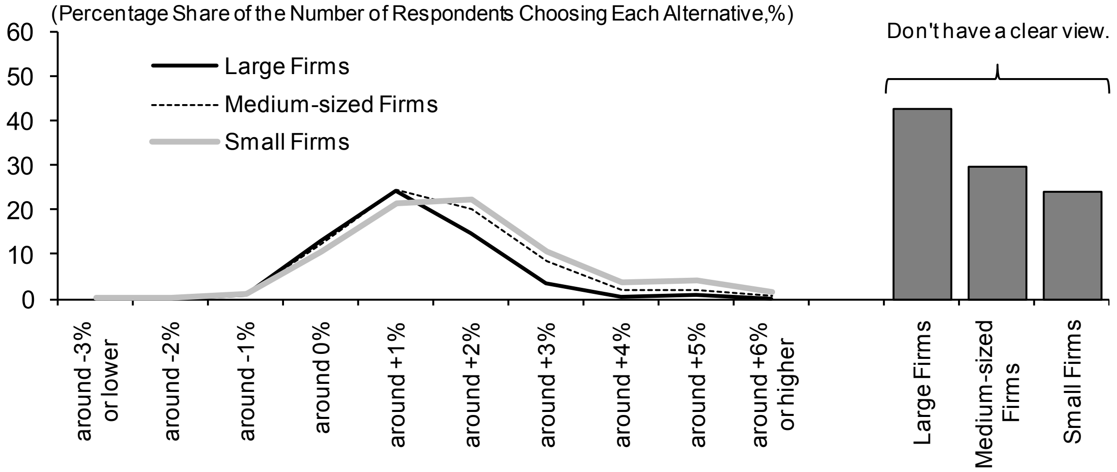
Comparison in Distribution of Inflation Outlook on "General Prices" (Size)

(June 2014 Survey) Chart 1

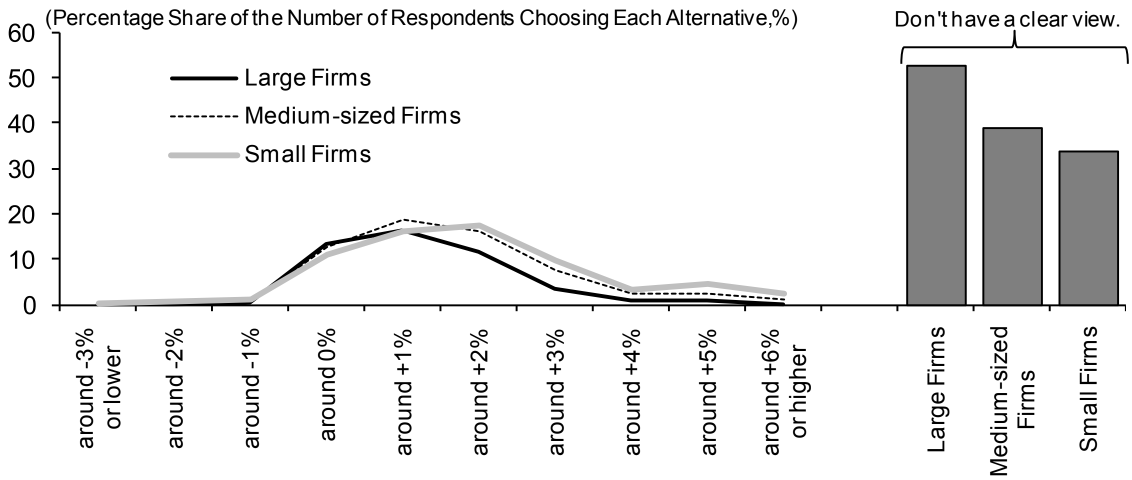
(a) Outlook for 1 Year Ahead



(b) Outlook for 3 Years Ahead

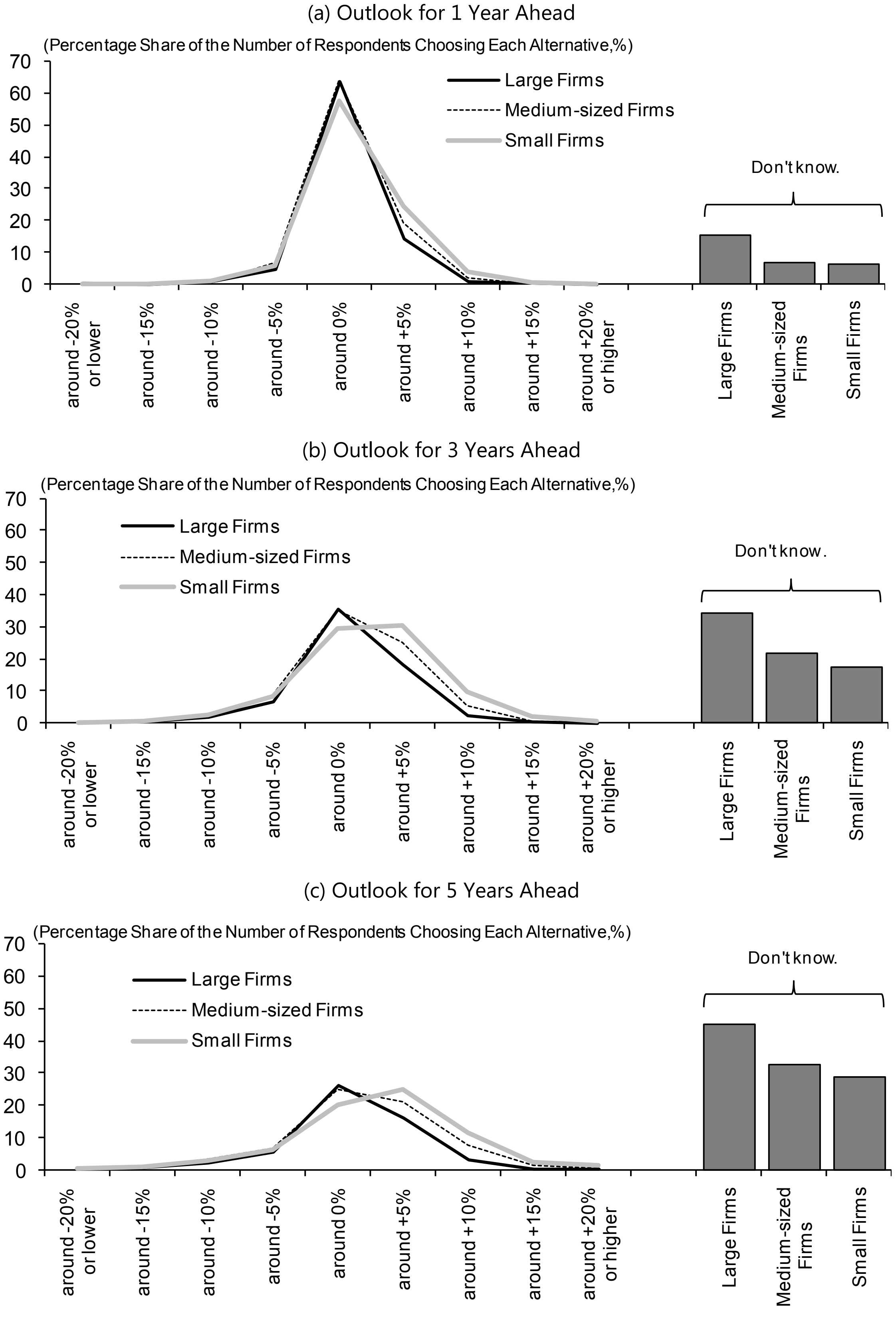


(c) Outlook for 5 Years Ahead



Comparison in Distribution of Inflation Outlook for "Output Prices" (Size)

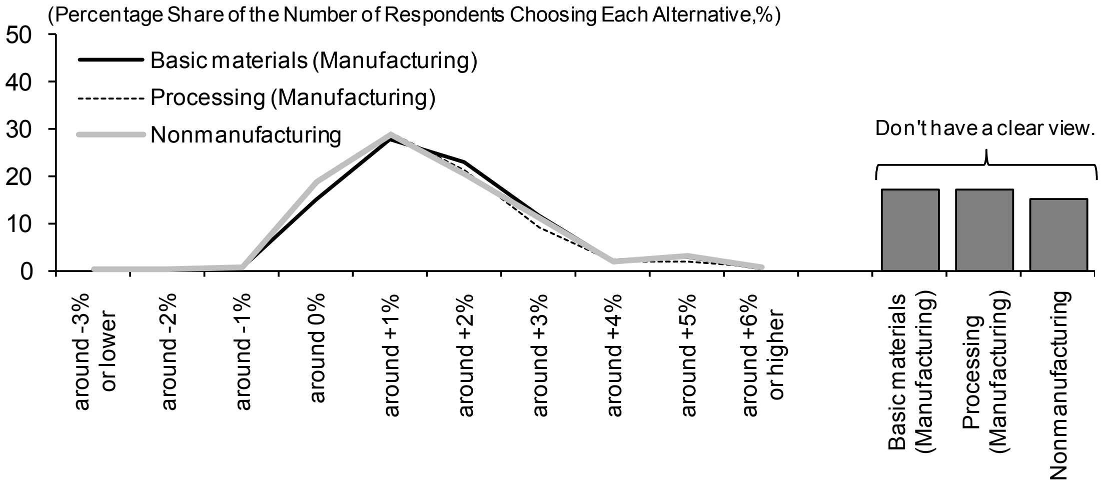
(June 2014 Survey) Chart 2



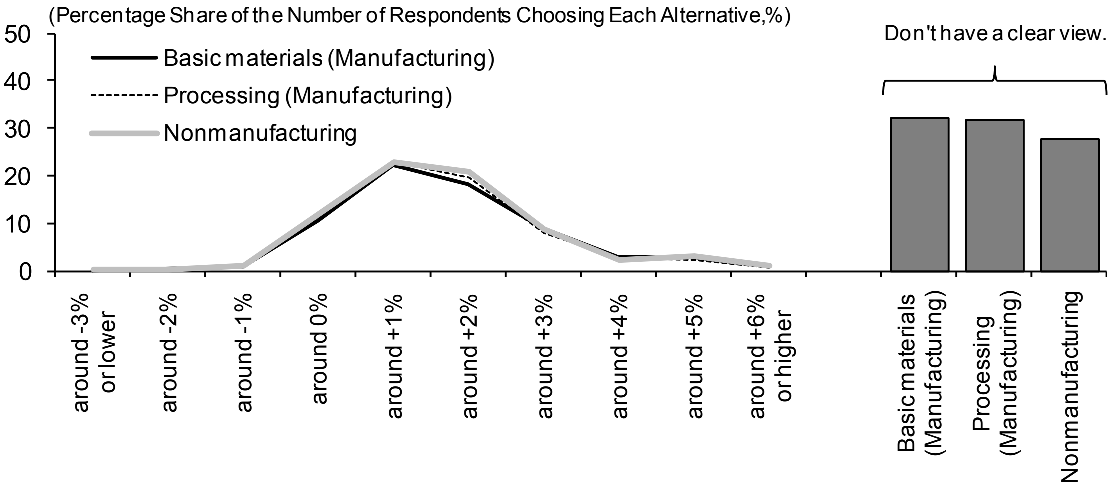
Comparison in Distribution of Inflation Outlook for "General Prices" (Industry)

(June 2014 Survey) Chart 3

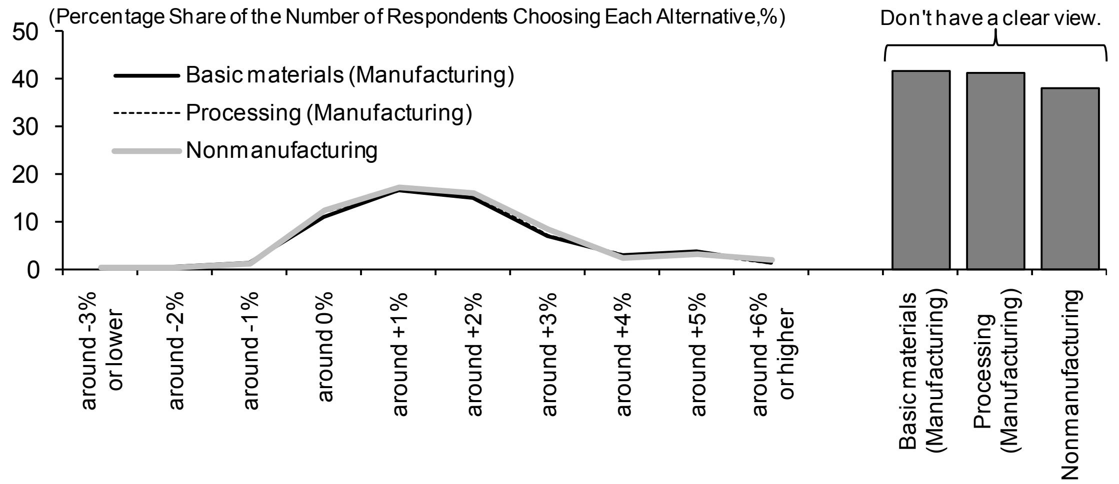
(a) Outlook for 1 Year Ahead



(b) Outlook for 3 Years Ahead



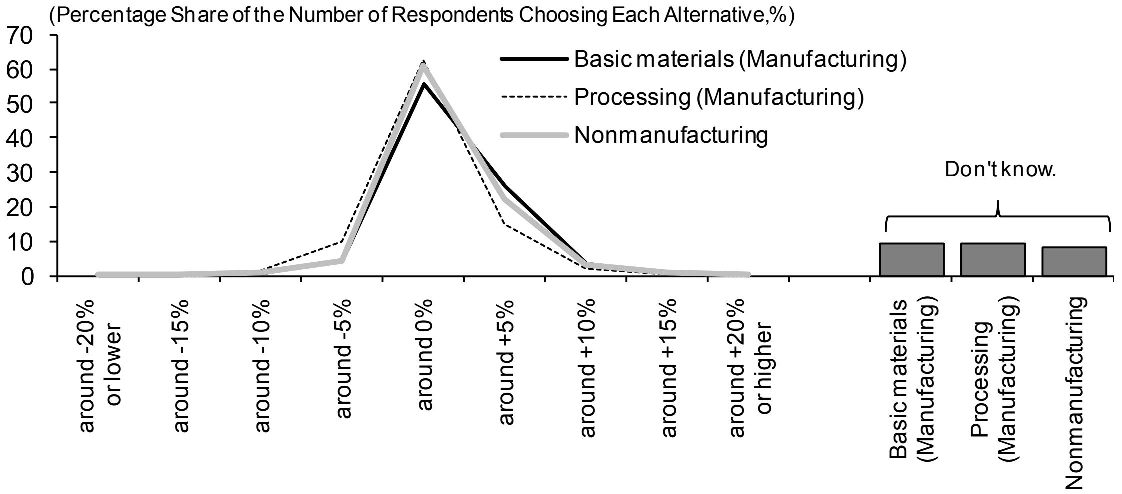
(c) Outlook for 5 Years Ahead



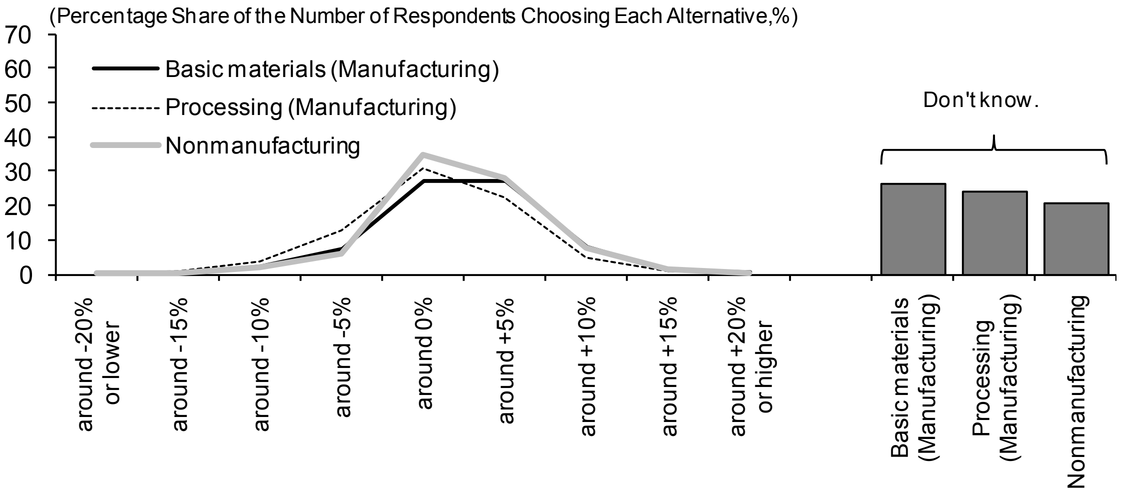
Comparison in Distribution of Inflation Outlook for "Output Prices" (Industry)

(June 2014 Survey) Chart 4

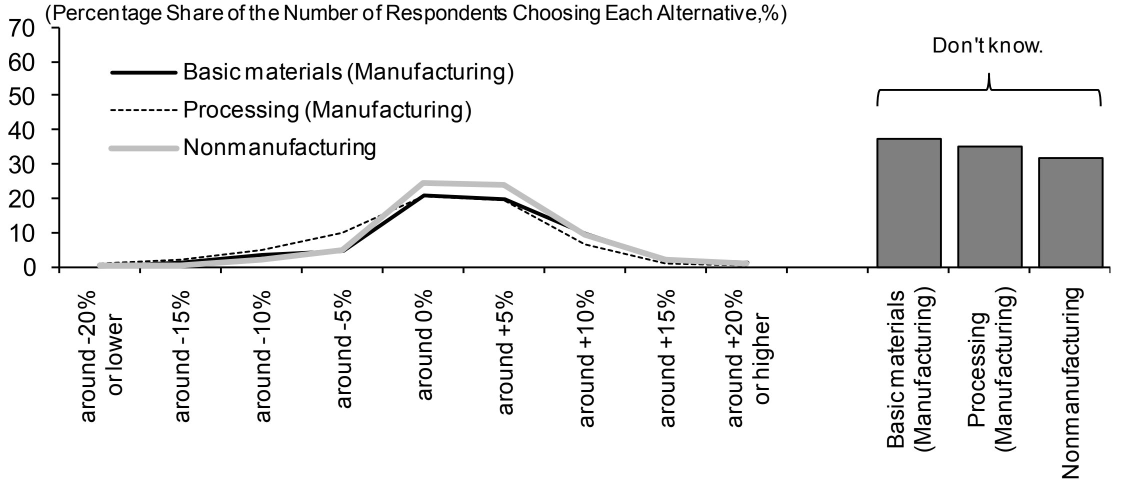
(a) Outlook for 1 Year Ahead



(b) Outlook for 3 Years Ahead

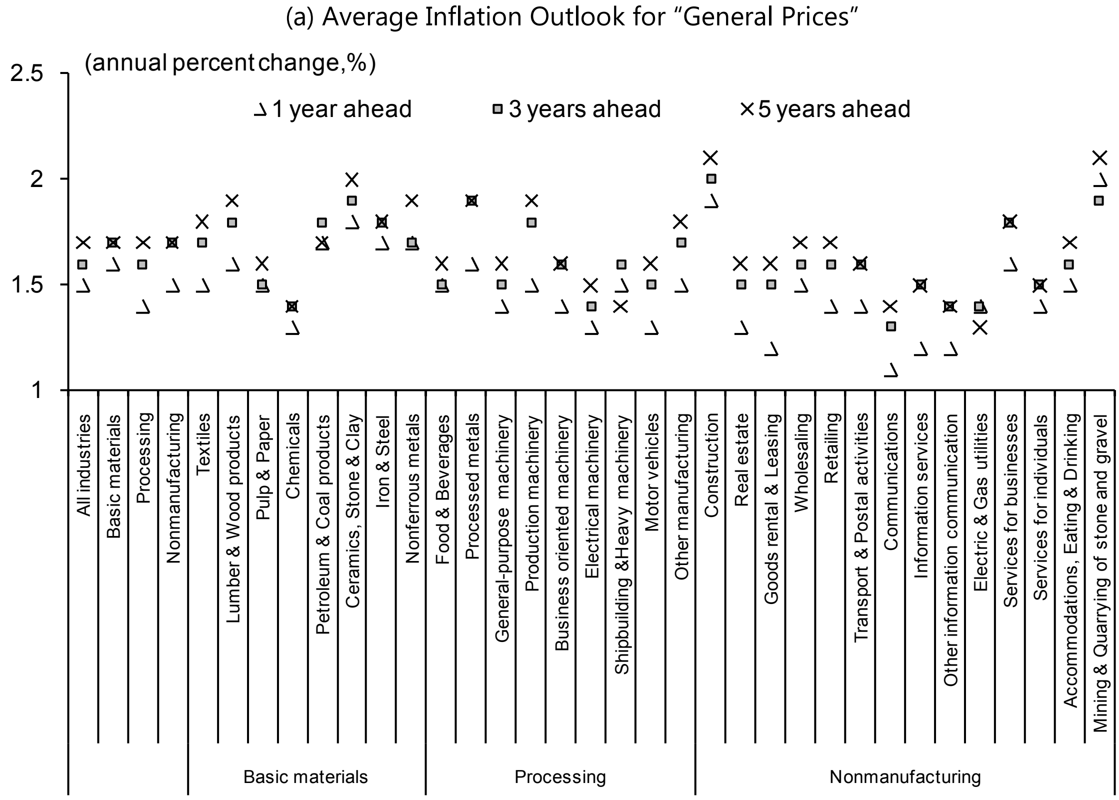


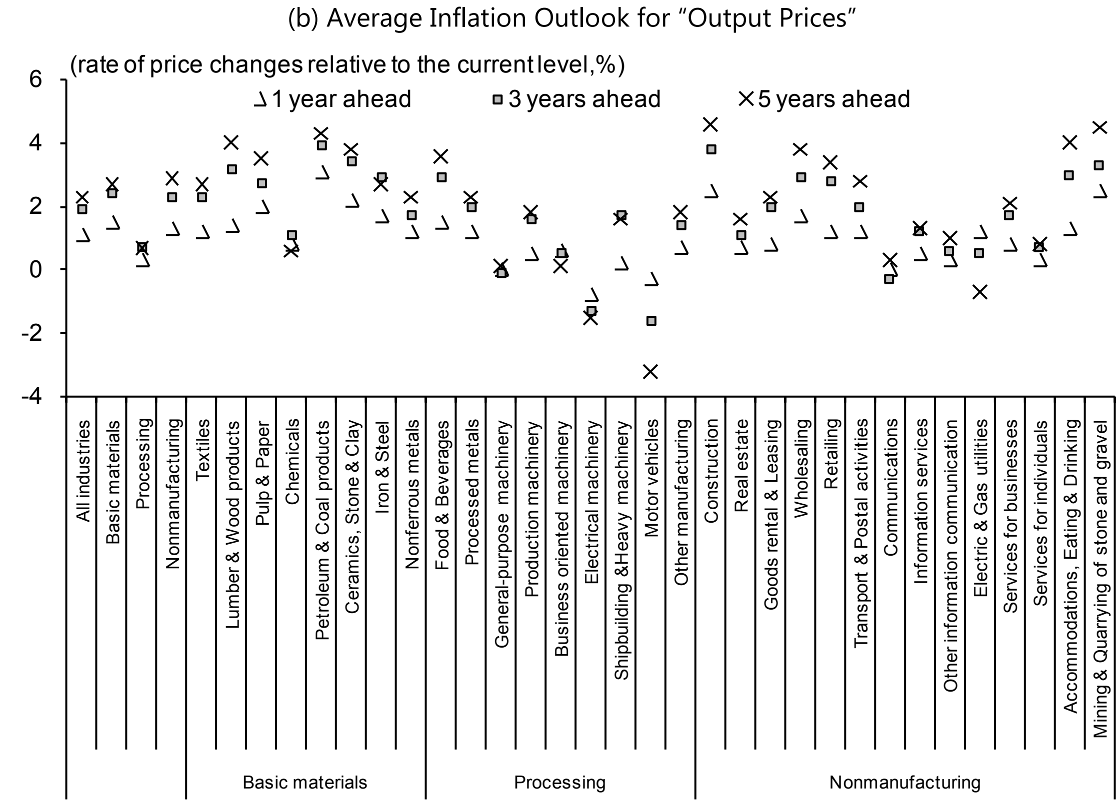
(c) Outlook for 5 Years Ahead



Comparison between Average Inflation Outlook of 31 industries

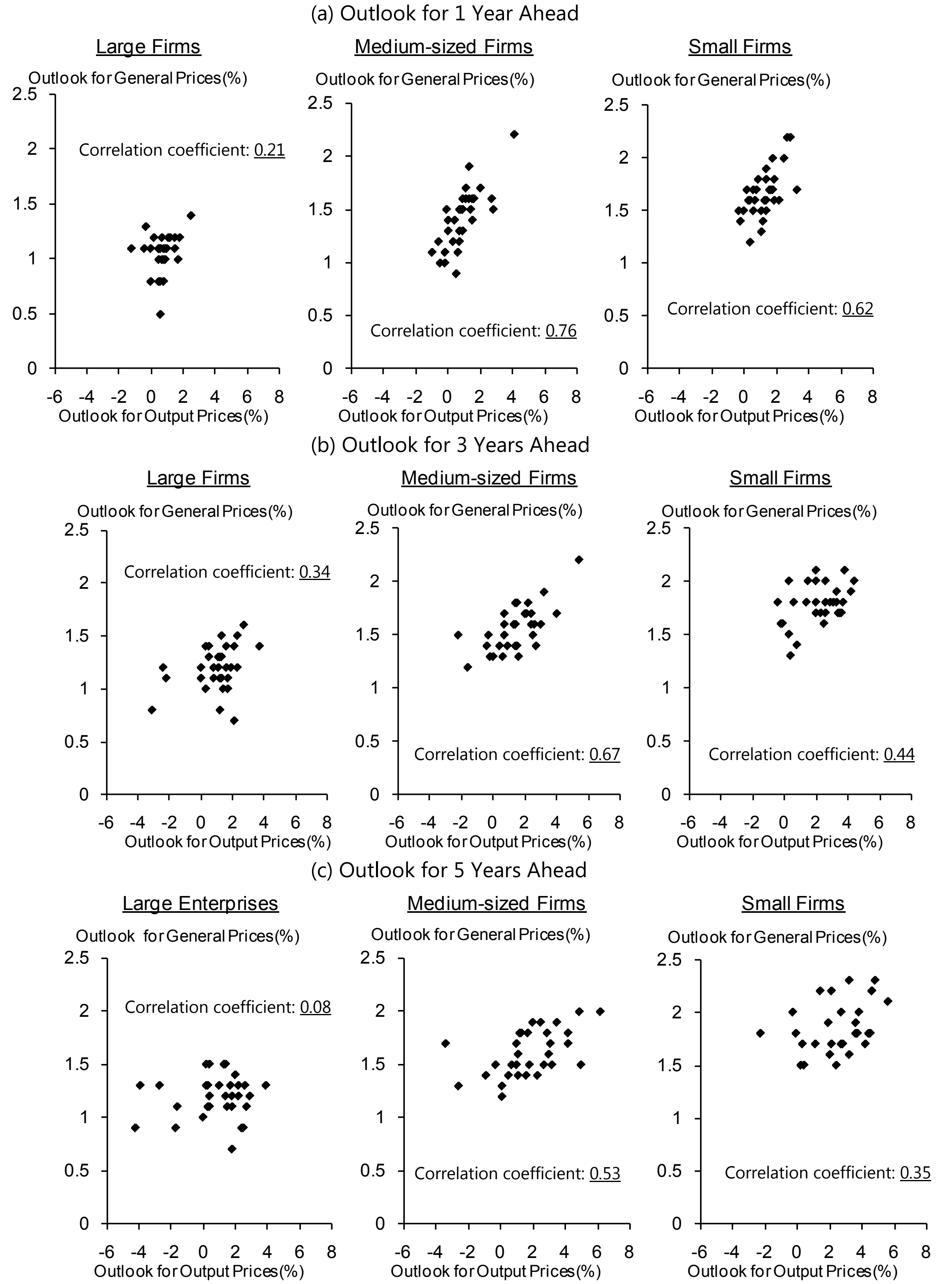
(June 2014 survey) Chart 5





Relation between Inflation Outlooks for “Output Prices” and for “General Prices”

(June 2014 survey) Chart 6



Forward Looking Surveys for Tracking Indian Economy: An Evaluation

Lekshmi Omana and Om Prakash Mall[1]

Abstract

With more economic activities coming in the ambit of organised sector, business tendency surveys have become more informative and handy in tracking and anticipating macroeconomic changes as input in monetary policy formulation. This paper discusses the efficacy of forward looking surveys in India. The lead performance of major business tendency surveys in India is also evaluated for the period Q1:2004–05 to Q4:2013–14. It is found that the Reserve Bank's quarterly Industrial Outlook Survey with focus on stratified frame with good size/sectoral representation and significant portion of regular respondents, outperforms other surveys in gauging short-term movements and turning points in the economy.

Keywords: Business tendency surveys, leading indicators, monetary policy, forecasting

JEL classification: C53, C83, E32, E37, E52

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The views expressed here are those of the authors and are not necessarily shared by the institution to which they belong.

I. Introduction

Movements in level of activities in organized business sector of an economy provide a preclude to aggregate economic activities in a market economy. As official statistics, including national accounts, provide backward-looking information on performance at sectoral / overall level, the data gap for real-time analytical needs of policy-makers is sought to be met by conducting business and consumer tendency surveys. These surveys have intrinsic utility in providing policy makers and economic agents with more timely qualitative information on business sentiment that may be driving business conditions and decisions including for the foreseeable future. Most of the central banks rely on forward-looking corporate surveys to get idea on decisions made on the future course of business which would affect major sectors / aggregate economy.

The value of business tendency surveys lies in providing reliable lead information on the macroeconomic performance, especially the direction of change. In addition to seeking assessment of the current situation and expected development relating to their own companies, respondents in these surveys are often also asked about their perception on sectoral / general business conditions. The survey questions are generally qualitative which give flexibility to seek opinion on variables that capture early stages of production, quickly respond to changes in economic activity and are often difficult to measure through conventional methods. The main summary indicators are (a) balance of opinions (or net response) and (b) confidence indicators (based on the relative size of respondent firm in the related sector and economic importance of the sector).

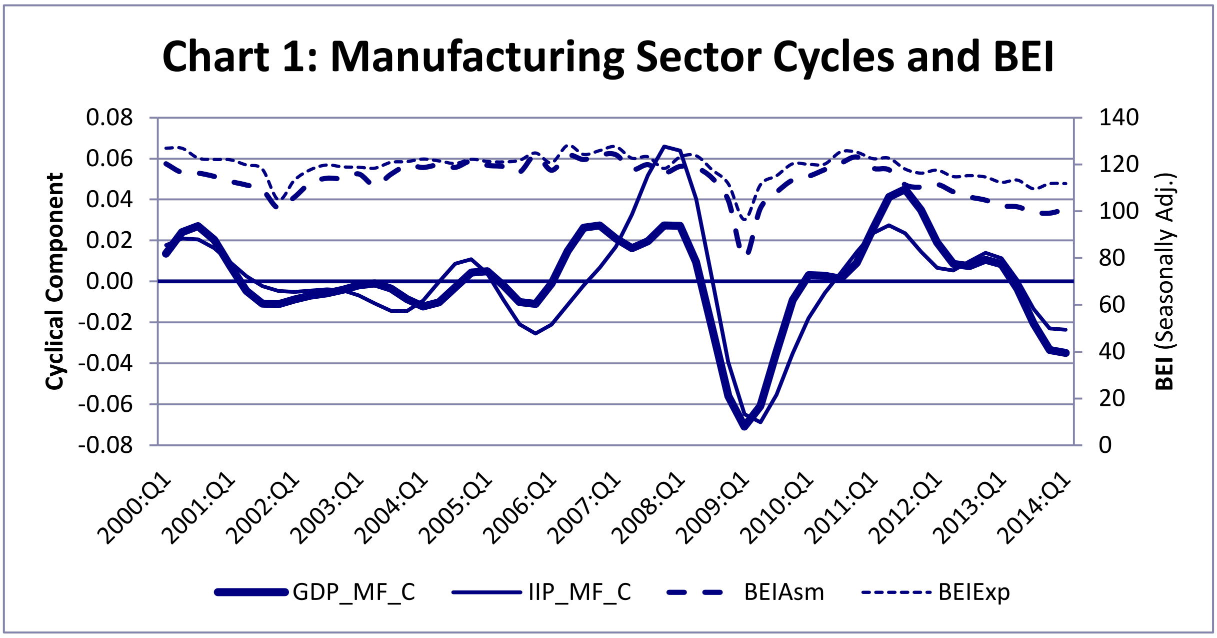
We attempt to relate the relevance of various survey indicators in assessing short-term changes in the Indian manufacturing sector, *i.e.*, to evaluate the past performance of various business tendency surveys conducted in India in tracking the movements in the sector. The remainder of this paper is organised in four main sections. Section II presents a snapshot of the business tendency surveys conducted in India. Section III evaluates the tracking performance of these business tendency surveys using alternative statistical techniques and major conclusions are presented in Section IV.

II. Business Tendency Surveys in India: A Snapshot

In India, the Reserve Bank of India (RBI) has been conducting a comprehensive quarterly Industrial Outlook Survey (IOS) for the Indian manufacturing sector since 1998. The Indian economy is continually evolving as increasingly more activities in the economy are being channelised through the organised business sector. Analysis of business cycle indicators is an obvious requirement given that macroeconomic structure has changed over the years and there are nearly a million working companies. The sector-wise no. of active companies in India in June 2014 is given in Table 1. As regular data on many conventional business cycle indicators (*e.g.*, comprehensive monthly/quarterly/annual variables related to employment, housing starts) used in developed economies are not available, IOS supplements other variables for business cycle analysis and provides useful input in the assessing macroeconomic conditions for formulation of macroeconomic policies, especially monetary policy.

IOS captures the assessment of business sentiments for current quarter and expectations for ensuing quarter, based on qualitative responses on a set of parameters pertaining to the demand, financial, employment and price situation. The survey schedule is canvassed among a panel of 2,000 private sector manufacturing companies (updated annually), mostly with paid-up capital above Rupees 5 million, representing a good mix of size and industry groups. Over the years, the response rate had lied between 65–78 per cent. Analysis is based on net response of each parameter which is calculated as the percentage difference between the optimistic response and pessimistic response (no change is ignored). Also, a Business Expectation Index (BEI) is compiled as weighted average of net responses on nine select performance parameters (for both assessment and expectations) which gives a single snapshot of the industrial outlook in each quarter.

Chart 1 presents the business cycles in India's manufacturing sector since 2000 along with seasonally-adjusted BEI for both assessment of prevailing quarter and expectation for the ensuing quarter. The cyclical components of GDP/IIP manufacturing have been estimated using the Christiano-Fitzgerald Band Pass Filter. It may be seen that the manufacturing cycle is in sync with BEI. Taking into account the data release lag for IIP and GDP, it may be broadly concluded that the survey index provides useful lead information on movements in the level of activities in India's manufacturing sector. More detailed examination of the relationship between the survey-based confidence indices and the official estimates is presented in the next section.



It may be mentioned that other agencies also conduct business expectation surveys for the Indian manufacturing sector, of which, regular results are available from (a) Business Confidence Survey of the National Council of Applied Economic Research (NCAER) and (b) Business Optimism Survey of M/s Dun and Bradstreet (D&B). In addition, Markit Economics' survey-based HSBC Purchasing Managers' Index (PMI) is available on monthly basis, which provides view on current assessment but does not give respondent's perception on future path. A summary of Business Tendency surveys conducted in India is presented in Table 2.

Corporate Sector in India: An Overview

Table 1

	Economic Activity	No. of Companies		
		Private Limited	Public Limited	Total
I	**Agriculture and Allied Activities**	**21,949**	**2,821**	**24,770**
II	**Industry**	**311,027**	**25,694**	**336,721**
	Manufacturing	191,264	17,886	209,150
	Construction	98,040	5,336	103,376
	Electricity, Gas & Water companies	10,978	1,729	12,707
	Mining & Quarrying	10,745	743	11,488
III	**Services**	**555,746**	**33,455**	**589,201**
	Business Services	221,988	9,789	231,777
	Trading	140,329	6,220	146,549
	Real Estate and Renting	67,328	3,776	71,104
	Community, personal & Social Services	57,126	3,847	60,973
	Finance	38,836	8,236	47,072
	Transport, storage & Communications	29,523	1,458	30,981
	Insurance	616	129	745
IV	**Unclassified ***	**21,912**	**2,105**	**24,017**
	Total	**910,634**	**64,075**	**974,709**

* Companies having invalid National Industrial Classification (NIC) code of economic activity have been categorized as Unclassified.

Source: Ministry of Corporate Affairs, Govt. of India

Major Business Tendency Surveys conducted in India

Table 2

Agency	Index	Frequency	Methodology of index calculation
Reserve Bank of India (RBI)	Business Expectation Index	Quarterly	Composite indicator calculated as weighted average of industry wise net response on nine select parameters, *viz.*, overall business situation, production, order books, capacity utilisation, exports, inventory of raw material, inventory of finished goods, employment and profit margin
M/s Dun and Bradstreet (D&B)	Business Optimism Index	Quarterly	Composite indicator capturing aggregate behavior of all six indices, *viz.*, volume of sales, net profit, selling price, new orders, inventory levels and employees
National Council of Applied Economic Research (NCAER)	Business Confidence Index	Quarterly	The index is based on four indicators, *viz.,* overall economic conditions, financial position of the firms, current capacity utilisation and present investment climate
HSBC-PMI (Markit Economics)	Purchasing Managers' Index	Monthly	Composite indicator based on five individual indices, *viz*, new order, output, employment, supplier delivery time and stock of item purchased

III. Tracking Performance of Business Tendency Surveys in India

In this section, an attempt has been made to examine whether business tendency surveys are useful in assessing the aggregate-level changes in the Indian manufacturing. Taking quarterly periodicity, GDP-manufacturing and IIP-Manufacturing are taken as reference series, since they reflect economic performance of the organised sector, and their statistical relationship with business confidence indices is evaluated. Since PMI and IIP data are released on monthly frequency, we take their three-month average and construct the quarterly series to match with the data frequency of GDP as well as other survey indices. Chart 2 (panel) provides a sense of how well these survey indices have served to signal changes in the manufacturing sector's growth.

We now proceed to empirically evaluate the tracking performance of business confidence indices vis-à-vis movements in official estimates relating to manufacturing sector.

III.1 Correlation of Business Confidence Indicators with Reference Series

Using survey-based confidence indicators since 2004–05, when compilation methodology for all series are consistent, correlations between business outlook indices and annual growth in the reference series (all series seasonally unadjusted) are presented in Table 3. It is found that as compared to the other business confidence indicators, BEI has higher correlation with both the reference series, both in case of assessment indices and outlook indices.

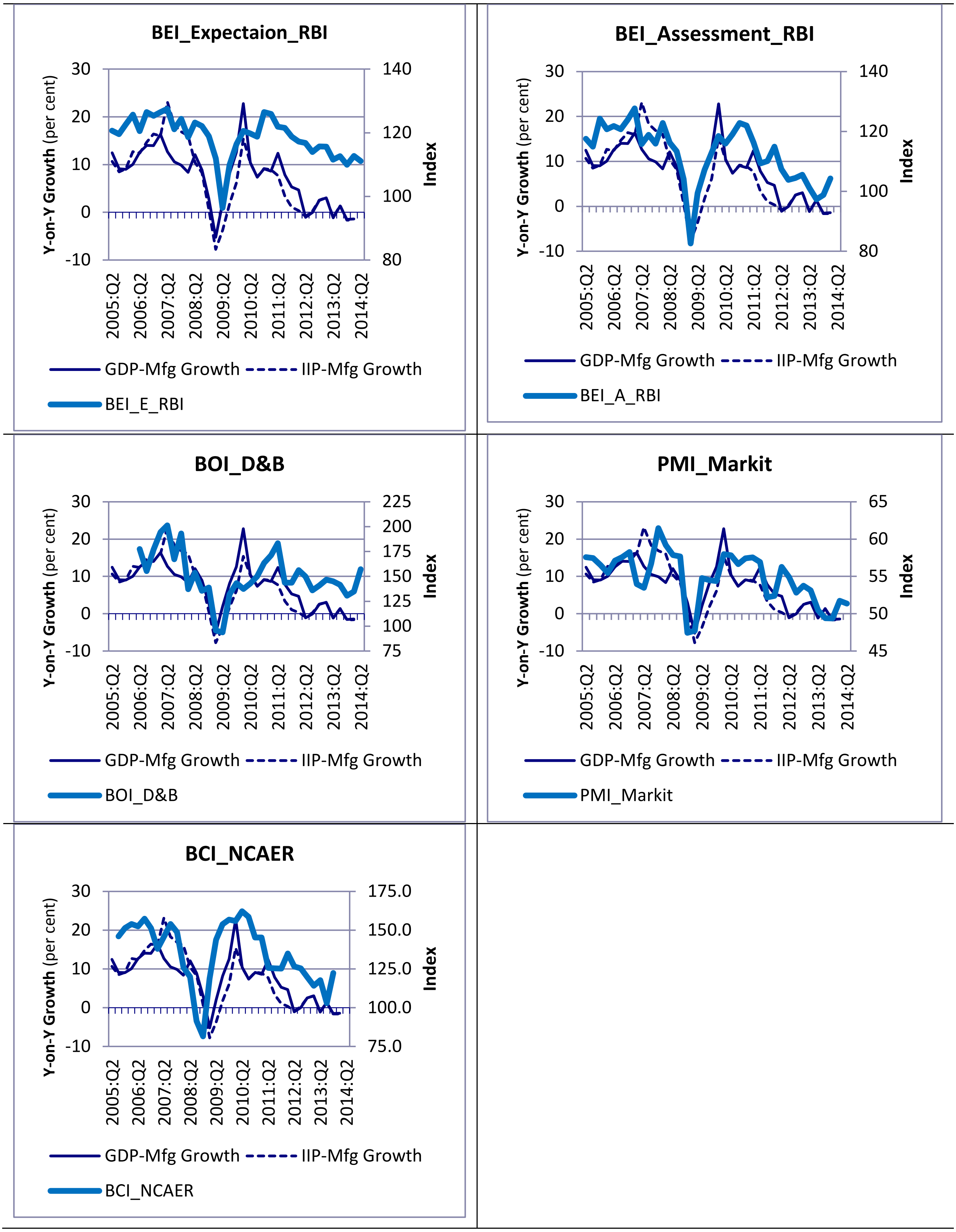
Cross-correlation of various Business Assessment / Expectation Indices with GDP / IIP – Manufacturing

Table 3

Reference Series	Outlook Indices			Assessment Indices	
	BCI (NCAER)	BOI (D&B)	BEI-Exp (RBI)	BEI-Asm (RBI)	PMI (Markit)
GDP-Manufacturing	0.55	0.57	0.67	0.81	0.67
IIP-Manufacturing	0.50	0.73	0.76	0.82	0.68

Annual Growth in Manufacturing – GDP & IIP and Movements in Business Assessment/Outlook Indices

Chart 2



III.2 Quarters for Cyclical Dominance (QCD)

QCD indicates the number of quarters at which the average amplitude of the trend-cycle component will overtake the irregular one and, therefore, measures short-term volatility in a macroeconomic time series. It indicates the minimum number of quarters before a directional change in the time series can be interpreted with reasonable confidence as a directional change in economic sentiment. It is defined as the shortest span of quarters for which the I/C ratio is less than unity, where I is the average q-on-q-change (without considering the sign) of the irregular component of the series and C is the trend-cycle component of the series. Higher QCD implies higher volatility in the time series. The convention is that the maximum value of QCD should be 2. It is estimated that all the five business confidence indices met this criteria (Table 4) during the reference period.

Business Confidence Indices and their QCDs — Table 4

Business Confidence Index	Quarters of Cyclical Dominance
BCI (NCAER)	1
BOI (D&B)	1
BEI-Exp (RBI)	1
BEI-Asm (RBI)	2
PMI (Markit)	1

III.3 Directional Analysis

Fisher's Exact (FE) test uses contingency tables to determine whether the survey indicators predict the direction of change in realization in the reference series. The null hypothesis is that the direction of change in a forecast and that in the realisation are independent. A rejection of the null hypothesis therefore implies that the survey indices are useful predictors of actual change in the reference series. To capture the direction of changes, we define

$\Delta R_t = R_t - R_{t-1}$, where R_t denotes the percentage change in the reference series in time t.

$\Delta F_t = F_t - F_{t-1}$ direction of change, where F_t denotes the level of the survey index.

The observed significance level for the usefulness of the forecast is given by:

$$\frac{\sum_x \binom{n_{10}+n_{11}}{x}\binom{n_{00}+n_{01}}{n_{01}+n_{11}-x}}{\binom{n}{n_{01}+n_{11}}}$$

for x taking values from n_{11} to $n^* = \min(n_{10}+n_{11}, n_{01}+n_{11})$, where

n_{00} = number of forecasts for which $\Delta F_t > 0$ and $\Delta R_t > 0$
n_{01} = number of forecasts for which $\Delta F_t \leq 0$ and $\Delta R_t > 0$
n_{10} = number of forecasts for which $\Delta F_t > 0$ and $\Delta R_t \leq 0$
n_{11} = number of forecasts for which $\Delta F_t \leq 0$ and $\Delta R_t \leq 0$
n = total number of forecasts

The results of the FE test for directional analysis are presented in Table 5. It indicates that the test statistic is significant for RBI's BEI (for both assessment and expectation), in predicting the direction of annual change of GDP-manufacturing whereas, in case of IIP change, RBI's BEI (expectation) turns out to well-predict the direction of change.

Significance-level probability (FE test) for Direction of Change Synchrony — Table 5

Index	Test Probability Manufacturing Sector growth (y-on-y)	
	GDP	IIP
BCI_ NCAER	0.11	0.38
BOI_D&B	0.48	0.59
BEI_Exp_RBI	0.00	0.01
BEI_Asm_RBI	0.04	0.13
PMI	0.16	0.30

The null hypothesis is that the direction of change in the Business Confidence Index is independent of the change in reference series. A rejection of null hypothesis (i.e., $p<0.05$) implies that the index is useful predictor of actual change in the reference series, which is available with a lag.

III.4 Signal-to-Noise approach

The ability of the survey indices to provide an early signal on an impending change in growth in the reference series can be evaluated through signals approach of Kaminsky-Reinhart (2000), modified by Teresita Bascos-Deveza (2010). For assessing the predictive ability of business indices, an impending change can be considered as a signal if change in an index deviates from its "normal value" beyond a "threshold". The threshold could correspond to some pre-determined value of the survey index (*e.g.,* 5 per cent, 10 per cent, etc.). For this exercise, the quarterly survey indices are transformed to a binary variable for each of the threshold value. The effectiveness of the index in signaling an impending change for the current quarter is evaluated and the performance of the variable in predicting a change is examined through

(a) Noise-to-signal ratio (*i.e.*, percentage of wrong signals to the percentage of correct signals issued by the index);

(b) conditional probability of large growth (the probability of an higher change occurring during the current quarter given that the index emitted a signal); and

(c) unconditional probability of higher growth (the probability of higher change in the current quarter).

Details of the method are given in the Annex. If the conditional probability of higher change increases as the threshold increases, then the predictive power of the survey index in projecting a possible larger change is confirmed. This approach also provides estimates of the probability of "higher change" given the value of the survey index in any given quarter.

The results of modified signals approach (Table 6) indicate that the conditional probability of higher change increases for BCI_NCAER, BEI_Asm_RBI and BEI_Exp_RBI as the threshold increases for both the reference series. This confirms the predictive power of these indices in projecting a possible larger change in the manufacturing sector. This is, however, not confirmed in case of other survey indices. The noise-to-signal ratios indicate that BOI_DNB has highest noise among the indices considered. The ratio is found lower in relation to IIP-Manufacturing when compared with GDP-Manufacturing, which is explained given that GDP also includes relatively unorganised manufacturing, whereas the business tendency surveys focus on the organised sector. The noise-to-signal ratios for IIP-Manufacturing indicate that BEI_Asm_RBI, BEI_Exp_RBI and PMI_Markit contain more signal for the first few buckets, indicating their utility in tracking the manufacturing sector's performance.

Signals Approach Probabilities of Higher Manufacturing Growth *vis-à-vis* Business Confidence Indices

Table 6

Business Confidence Index Threshold	Prob.(Higher manf. growth if Index>Threshold)		Noise-Signal Ratio	
	GDP-MF	IIP-MF	GDP-MF	IIP-MF
BCI_NCAER				
–10%	0.40	0.66	0.95	1.05
0%	0.40	0.68	0.90	0.95
10%	0.40	0.67	0.97	1.00
20%	0.40	0.68	1.12	0.94
30%	0.40	0.74	1.05	0.71
40%	0.40	0.76	0.88	0.62
50%	0.60	0.73	0.40	0.75
60%	0.00	1.00	0.00	0.00
BOI_D&B				
30%	0.41	0.68	1.02	0.95
40%	0.36	0.67	1.24	1.00
50%	0.38	0.73	1.17	0.73
60%	0.31	0.75	1.58	0.67
70%	0.22	0.63	2.45	1.20
80%	0.20	0.60	2.80	1.33
90%	0.33	0.67	1.40	1.00
100%	0.00	0.00		
BEI_Exp_RBI				
0%	0.39	0.38	1.08	0.95
5%	0.39	0.69	1.08	0.91
10%	0.39	0.70	1.11	0.86
15%	0.37	0.69	1.19	0.89
20%	0.44	0.75	0.90	0.67
25%	0.57	0.86	0.53	0.33
BEI_Ass_RBI				
0%	0.38	0.39	1.08	0.95
5%	0.38	0.82	1.12	0.69
10%	0.36	0.71	1.23	0.80
15%	0.41	0.71	1.00	0.83
20%	0.56	0.89	0.56	0.25
25%	1.00	1.00	0.00	0.00
PMI_Markit				
50	0.85	0.69	0.92	0.90
52	0.45	0.71	0.86	0.80
54	0.41	0.67	1.01	1.00
56	0.29	0.75	1.68	0.67

If conditional probability of higher growth increases as the threshold increases, then the predictive power of the survey index in projecting a possible final increase is confirmed.

IV. Conclusions

In this attempt to relate the lead properties of business tendency surveys with the actual movements in India's manufacturing sector performance, we investigate whether these indices provide a comprehensive understanding of the direction of change by predicting the direction of increase/decrease in the reference series and whether they give correct signals at various thresholds. Here, we have not judged the compilation aspects of business confidence indices which summarise various survey results, and treat the indices compiled by agencies as given.

It is found that while all surveys capture broad movements during the study period, the BEI based on the quarterly Industrial Outlook Survey (IOS) of the Reserve Bank outperforms other confidence indicators in tracking movements in the sector for both current assessment and ensuing changes. This is true for all the statistical evaluation methods employed here, *viz.*, the simple correlation, the direction analysis and the "signal" approach. IOS is a comprehensive survey with highest coverage among major business tendency surveys and its design takes into account both size and sectoral composition. While BEI is based on nine IOS parameters, IOS collects perceptions on around twenty parameters relating to demand, financial, employment and price situation, many of which are not measurable in quantitative terms but are very useful in business cycle analysis. These provide useful lead information on short-term movements in Indian manufacturing for policymakers as well as for practitioners in financial markets and business.

Annex: Predictive Ability of Business Survey Indices – Noise to Signals Approach

The ability of survey indices to provide an advance warning signal on an impending increase in growth in the reference series can be evaluated through signals approach of Kaminsky-Reinhart (2000) modified by Teresita Bascos-Deveza (2010) as follows:

When an indicator of economic growth deviates from its "normal value" and assumes an "extreme value" beyond a certain threshold, it can be considered as a warning signal of an impending increase in economic growth. The values corresponding to some pre-determined value of the survey index (e.g,: 10%, 20%, and so on) may be considered as the possible thresholds. For each threshold value, the quarterly values of the indicator were transformed to a binary variable as follows:

Let Y_t be the survey index. Let I_t be a binary variable defines as,

$I_t = \begin{cases} 1, if\ Y_t > T \\ 0, \text{if Yt} \leq \text{T} \end{cases}$, for T= 10%, 20%, 30 %, 40 % etc., or any predetermined threshold level for the survey index value.

The effectiveness of the index in signaling an impending increase in growth for the current quarter is evaluated as follows: We define

i. **A** as the number of quarters when the survey index did not issue a signal (I_t = 0) and no increase in growth occurred during the current quarter.

ii. **B** as the number of quarters in which the survey index failed to issue a signal. This means that the indicator did not signal an increase in growth (I_t = 0) and there was actual increase in growth during the current quarter.

iii. **C** as the number of quarters in which the survey index issued a bad signal or noise. A bad signal is when the indicator signal an increase in growth (I_t = 1) and no increase occurred during the current quarter.

iv. **D** as the number of quarters in which the survey index issues a good signal. A good signal is when the index signal an increase in growth (I_t = 1) and growth actually increased during the current quarter.

The performance of the survey index in predicting an increase in growth was examined in the following way:

i. Signal = D/ (B+D) measures the percentage of correct signals issued by the survey index;

ii. Noise = C/ (A+C) measures the percentage of wrong signals issued by the survey index;

iii. Noise to Signal = {C/ (A+C)}/ {D/ (B+D)} measures the ratio of the percentage of wrong signals (Noise) to the percentage of correct signals (Signal) issued by the index;

iv. Conditional probability of higher growth = D/(C+D) measures the probability of an increase in growth occurring during the current quarter given that the index emitted a signal;

v. Unconditional Probability of higher growth = (B+D)/(A+B+C+D) measures the probability of higher growth in the current quarter.

If the conditional probability of higher growth increases, as the threshold increases, then the predictive power of the survey index in projecting a possible increase in growth will be confirmed. Moreover, the significance of this approach lies in its capability of providing estimates of the probability of an "increase in growth" given the value of the survey index in any given quarter.

References

Central Statistical Organisation (CSO), Govt.of India: *Press Releases on* National Accounts Statistics and Index of Industrial Production (various issues).

Christiano, L. J. and T. J. Fitzgerald (2003): The Band Pass Filter, *International Economic Review*, Volume 44, Issue 2, pp 435–465.

Kaminsky, Graciela, Saul Lizondo and Carmen Reinhart (1998): Leading Indicators of Currency Crisis, *IMF Staff Papers*, Vol.45, No.1.

Kaminsky, G.L. and C.M. Reinhart (2000): On Crisis, Contagion and Confusion, *Journal of International Economics* Vol.51, pp 145–168.

Ministry of Corporate Affairs, Govt. of India: *Monthly Information Bulletin* (various issues).

Organization for Economic Cooperation and Development (2005): OECD Cyclical Analysis and Composite Indicators System: User Guide.

Reserve Bank of India: *Reserve Bank of India Bulletin* (various issues) and data releases on website.

Shiskin, Julius (1973): Measuring Current Economic Fluctuations, *Annals of Economic and Social Measurement*, pp 1–15.

Teresita Bascos-Deveza (2011): Quantifying Qualitative Data from Expectation Surveys: How well do Expectation Surveys Forecast Inflation?, *Fifth Conference of Irving Fisher Committee on Central Bank Statistics*, Basel.

Tsuchiya, Yoichi (2014): Purchasing and supply managers provide early clues on the direction of the US economy: An application of a new market-timing test, *International Review of Economics & Finance*, Vol.29, pp 599–618.

Hedging survey: a tool to identify potential risk on corporate sector external debt

Harisuddin

Abstract

"This paper describes Bank Indonesia survey to examine risk behavior of the corporate sector external debt. The objective of the survey is to identify proportion of companies hedging their external debt through natural hedges (export receipts or loans from affiliated companies) or market hedges (hedging in the market for currency and interest rate risk) or unhedging their external debt. The lattest group shows high risk external debt associated with currency mismatch that need close supervision. Based on this survey, Central Bank could take anticipatory measures through appropriate controls and policies".

I. Introduction

As stipulated by Law No. 23 of 1999 concerning Bank Indonesia dated 17 May 1999, as amended by Law No. 3 of 2004 and last amended by Law No. 6 of 2009 concerning Bank Indonesia, Bank Indonesia (BI) as the Central Bank has the task to formulate and implement monetary policy with the aim to achieve and maintain rupiah stability. The stability of rupiah shall include the stability of the rupiah against the goods and services (inflation) and the stability of the rupiah against other currencies (exchange rate). Stability of rupiah, in particular the rupiah exchange rate, is strongly influenced by the stability of the financial system and the condition of Indonesia's Balance of Payments (BOP).

As regards the Balance of Payments, uneven world economic recovery amid fluctuations in the global liquidity conditions could trigger a rapid capital flows in and out in the short term, which in turn can disrupt the economic equilibrium and monetary stability. In this regard, External Debt (ED) is one of the key factor that may impact positively or negatively on monetary stability, financial system stability, balance of payments and also the sustainability of economic development. On one hand, the management of ED compliance to the precautionary principle will support the national economic interest and maintain the confidence of the international financial markets, but on the other hand, external debt management that ignores those principles will potentially disrupt the national economy.

Bank Indonesia has provided a manual (guidance) in the management of the precautionary principle in the private external debt through Bank Indonesia Regulation (PBI) No. 7/1/PBI/2005 dated 10 January 2005 concerning External Debt of Banks as amended by PBI No. 13/7/PBI/2011 dated 28 January 2011. Furthermore, in the context of monitoring the Report of External Debt, BI has issued a regulation on reporting procedures of ED through PBI No.14/21/PBI/2012 dated 21 December 2012 concerning Report on Activity of Foreign Exchange Flows (LLD).

Provisions governing the private sector external debt require companies to implement risk management functions which include market risk, liquidity risk, and operational risk. In an effort to manage market risk (exchange rate and interest rate), the private sector is expected to manage the risk of external debt independently by calculating the impact of exchange rate movements and interest rate on the repayment ability and to conduct hedging. Furthermore, in terms of liquidity risk – that is the risk related to the availability of funds necessary for the external debt repayment and operational risk – the private sector is expected to match the maturity with the use of the external debt and to improve the external debt information systems. Meanwhile, LLD regulations require private sectors to report all financial assets and liabilities, and particularly on the external debt, the mandatory reports are on loan agreement, debt securities, trade credits, and other debts.

Given the importance of the risk management in the private sector external debt, a survey on mapping hedging efforts is becoming increasingly essential and crucial for a central bank. Information obtained from the survey will be a complement to primary data obtained directly from the external debt reporting company (the debtor). Therefore, the availability of information on external debt hedging is important in the process of risk monitoring and management.

II. Objectives

The objectives of the hedging survey are as follows:

1. Gaining information on the potential risks faced by the companies in managing their external debt, particularly currency risk (currency mismatch and/or exchange rate risk), and interest rate risk.
2. Giving insight on the policy direction the Central Bank has to undertake, especially to minimize risks caused by the lack of cautions in managing external debts.

III. Scope and methodology

The hedging survey has been conducted biannually since the first half of 2011. The respondents of the survey are non-bank private companies which incur external debt. This survey does not include banks as respondents because banks have certain characteristic and have been regulated by tighter prudential regulations by the Financial Service Authority (FSA). This survey maps hedging undertaken by the non-bank private companies classified in 10 (ten) economic sectors. Samples of companies were taken from the External Debt Information System's database.

Proportionate sampling method is applied to select samples, starting with grouping the largest debtors into 10 economic sectors. Then, samples for each economic sectors are determined by the proportion/percentage of each sectors to the total population of corporate external debtors.

Composition of survey respondent

Table 1

Economic Sector	**Semester II-2013**			Survey sample
	Debt Outstanding (million USD)	$\sum$ Companies	% Debt to Total Debt	
Agriculture, forestry & fishing	6,454	283	6.0%	7
Mining	25,240	135	23.3%	16
Manufacturing industry	26,660	812	24.6%	23
Electricity, gas & water	16,456	30	15.2%	7
Construction	661	32	0.6%	2
Trade, hotel & restaurant	6,787	301	6.3%	6
Transportation & communication	10,326	135	9.5%	12
Finance, leasing & financial services	12,716	319	11.7%	22
Services	563	34	0.5%	2
Other sector	2,443	115	2.3%	3
Total	**108,306**	**2,196**	**100.0%**	**100**

IV. Survey results (based on second semester 2013 survey)

Respondents' income are distinguished based on their currencies between rupiah and foreign currencies. Companies generate their foreign currencies income from exports and domestic sales, either of their own account or their subsidiaries. Those foreign currency income are then used to pay their external debts and other foreign currency liabilities so that the companies do not have to face with the risk of currency mismatch. In this case, these companies can be said to have undertaken natural hedge.

Based on the latest survey results, the proportion of companies having foreign currency and rupiah income is 68% and 32%. Of the companies with foreign currency income, around 37% generate the income from exports, 19% from domestic revenue, and the rest of 12% comes from other sources, such as capital gain from placement in subsidiary. The companies' income composition based on currencies highlight some points as follow:

a. The majority of companies incurring external debt are essentially have undertaken natural hedge and are relatively able to avoid risk from currency mismatch.

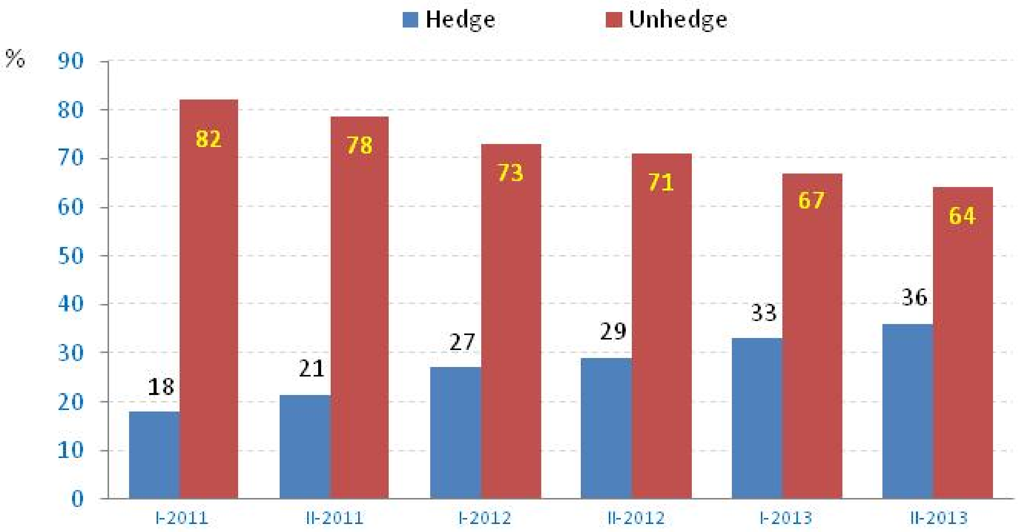
b. Number of companies incurring external debt and having foreign currency income tend to increase with average portion of above 60%. Nevertheless, it is recognized that the group of companies obtaining foreign currency income from domestic operation still face with potential market risk, which is the risk of market fluctuation, particularly domestic market.

c. Conversely, number of companies incurring external debt and having rupiah income tend to decrease with average portion approximately 30%.

Furthermore, the survey shows that 36% of total private sector external debt reporters have hedged their debt, while the rest 64% have unhedged debt. Compare to the surveys on previous periods, the percentage of companies hedging their external debt is increasing every semester. Fluctuation in rupiah as an impact from the global economic uncertainty is viewed as one factor causing increased in hedging behavior of debtors from semester to semester.

Companies hedging behavior

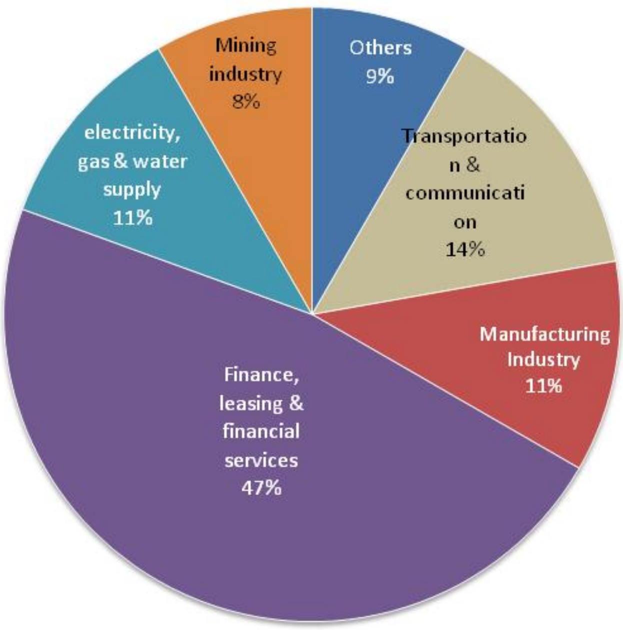
Graph 1



Based on economic sector, the majority of the private external debt reporters hedging their debt are in the financial, leasing, and financial service sector which account for 47%, followed by transportation and communication sector (14%), manufacturing industry sector (11%), and electricity, gas and water supply sector (11%). The dominance of hedging behavior in the financial sector reflects the height of the prudential aspect of this industry in response to the pressure from rupiah depreciation during reporting period.

Hedging behavior by economic sector

Graph 2



Several main findings from the second semester 2013 survey result are as follows:

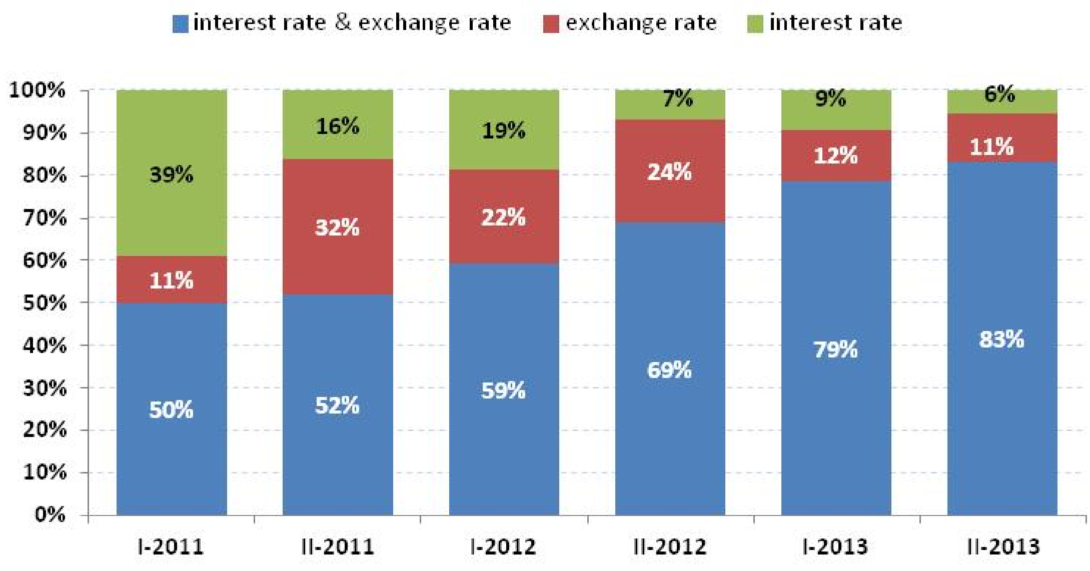
a. The main considerations of private companies hedging their external debt are:

- The benefit of hedging compared to the charge expenses
- Indonesia and global economic condition
- Executing parent company's policy and other considerations such as compliance to the policies of the company's owner / General Meeting of Shareholders.

b. Most of the companies (42%) undertake hedging to cover 26%–50% of their external debt risk, followed by approximately 36% companies that hedge as much as 76%–100% of their external debt. Meanwhile, the number of respondents hedging 1%–25% and 51%–75% of their external debt is relatively small which is only approximately 14% and 8%, respectively.

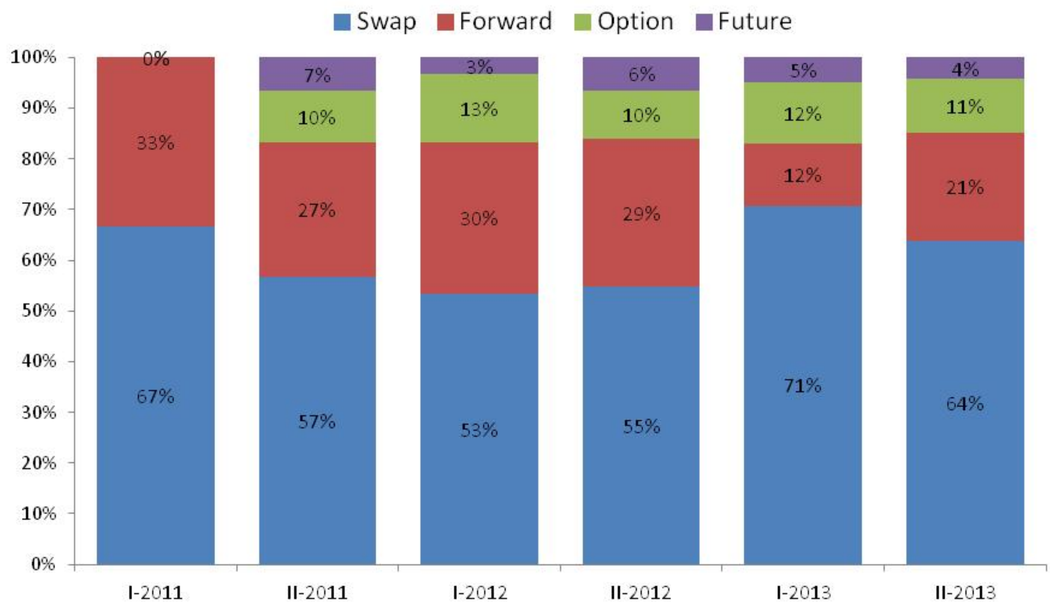
c. Examined from the type of risk exposures, in general, companies undertake hedging to cover both interest and exchange risk, followed by hedging to cover either exchange rate risk or interest risk. In the second semester of 2013, 83% of the companies undertake hedging to cover interest and exchange rate risk, followed by 11% respondents hedge for exchange rate risk, and 6% hedge for interest risk. Meanwhile, at the same time, there is a tendency of decline in percentage of companies that use exchange rate risk hedging and interest risk hedging. The tendency of the decline in interest risk hedging is in line with the decline in interest risk related to the cheaper cost of borrowing of external debt as the implication of the implementation of the interest decline policy by the central banks of developed countries and quantitative easing policy which is being carried out by the US to push its economic growth.

Type of risk exposure — Graph 3



d. Based on the type of hedging instruments, most of the companies use swap and forward instruments. The reasons for using swap instrument are matching factor between tenure and maturity of the external debt and the hedging cost affordable to companies' cash flow. Meanwhile, companies prefer to choose forward instrument because of the matching factor between tenure and the external debt maturity as well as the facilities/the ease of transactions given by the hedging counterpart. In the latest survey, companies which used swap instrument is quite dominant weighing as much as 64%. This hedging instrument is intended to cover the increasing interest risk and the fluctuation of the exchange rate. The use of forward instrument comes in the second place (21%), and followed by option and future which are relatively limited weighing as much as 11% and 4%, respectively.

Type of hedging instruments Graph 4



e. Based on the external debt instruments being hedged, most of the debt hedged by the companies are loan agreement (83%) whereas the rest are bonds.

f. From the hedging tenure perspective, most of the companies use tenure of more than 12 months (39%), and followed by the 6 months tenure (33%). The choice of such tenure is presume to be related with the swap premium which tends to be expensive for the longer tenure and rupiah that tend to weaken. Furthermore, approximately 72% of the companies will conduct rollover hedging if the hedging tenure does not match the maturity of the external debt. In business and logic perpective, rollover are generally cheaper therefore can be concluded that the players are more rational.

V. Risk analysis of the debtors of unhedged external debt

The risk management survey in semester II–2013 has identified that approximately 64% debtors do not hedge their external debt. Reasons for unhedging are, among other, companies have foreign currency income, the global and domestic economic condition are considered stable, and the hedging transactions are still relatively expensive.

In details, information acquired from the survey result are as follows:

a. ***Debtors of unhedged external debt can be classified as exporters and non-exporters.*** From 64% of companies that unhedge their debt, approximately 22% have export proceeds from their own business or from their subsidiaries. The rest (42%) do not have export proceeds but merely sale their products domestically.

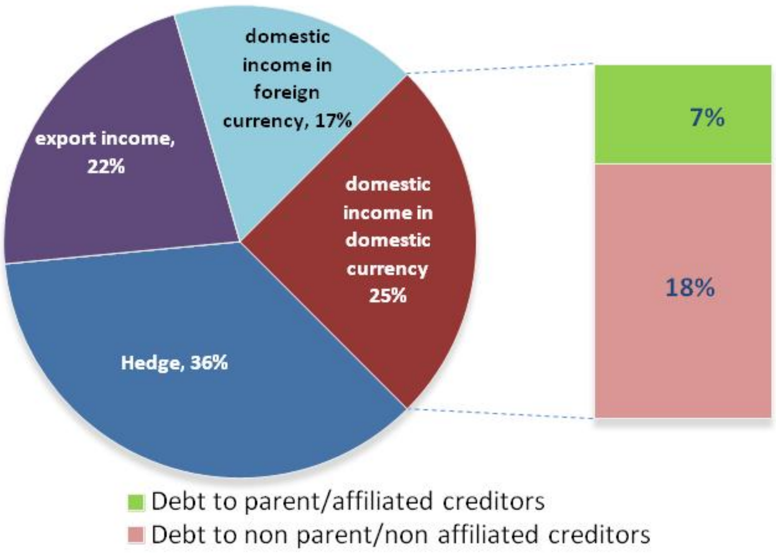
b. From the 42% of the companies which sells its product domestically, it is known that 17% of the companies received income in foreign currency, either directly from their own business of from their subsidiaries. ***From this figure, it is implied that 25% of external debt reporters are vulnerable to currency risk their revenues are in rupiah.***

c. ***However, there is still possibility that not all of the 25% reporters mentioned earlier are exposed with currency risk.*** This condition mainly holds if external debt is received from parent/affiliated creditors. Generally parent/affiliated creditors have policy to centralize risk mitigation in the head office. In this context, debtors only acts passively without any authority to mitigate risk and hence currency risk is borne by the creditors which are the parent/affiliated company.

   Within the 25% of the external debt reporters exposed to currency risk, 7% receive external debt from their parent/affiliated creditors. With the tendency of parent/affiliated creditors to grant flexible refinancing/roll-over facilities, then 7% of the total external debt reporters are exposed with currency risk but relatively free from refinancing risk. Meanwhile, the rest (18%) are exposed towards currency and refinancing risk as they have rupiah income and receive external debt from non-parent/affiliated creditors.

Income composition of debtors of unhedged debt

Graph 5



d. Survey result on the 25% sample of companies exposed to currency risk depicts interesting perspective on lack of prudent risk management (non-hedging). In general, considerations that are stated by companies are not so different with the previous survey which is:

- No clear rules/policy in doing hedging. This argument applies to State Owned Enterprises which have risk management structures but remain unhedged their debt.
- Domestic and global economic conditions is still assumed to be stable therefore there is no need of hedging. Besides, hedging charges high fee and implicates a complicated procedure.
- Creditors' policy on centralizing mitigating risk of exchange rates. Generally creditors that enforce such policy are the head/parent company of the borrower.
- External debts are in rupiah so that are not exposed to currency mismatch.

e. Companies that do not have foreign currency revenues and do not undertake hedging in the money market will make some efforts to meet their repayment obligation, with these priorities in order:

- Finding foreign currency resources in the market gradually by taking into account reasonable exchange rate
- Finding foreign currency resources in the market when their external debts are due
- Using their foreign currency deposits
- Seeking for refinancing either from the parent/affiliated or non-parent/affiliated company
- Borrowing foreign currency from domestic banks.

VI. Conclusion

a. The survey results shows that around 36% of debtors hedge their external debt and the remaining (64%) do not undertake hedging. The majority of companies undertaking hedging are in the financial, leasing and financial service sector, transport and communication sector, manufacturing sector, and electricity, gas and water supply sector.

b. The primary considerations for companies not doing hedging are: they already have foreign currency income (natural hedge), considered relatively stable global and domestic economic condition, and hedging transaction that are still considered expensive.

c. Companies not having any foreign currency income and not undertake hedging meet their external debt repayment, among other, by: buying foreign currency in the market gradually by taking account reasonable exchange rates, finding foreign currency resources in the market when their external debts are due, using their foreign currency deposits, seeking for refinancing either from the parent/affiliated or non-parent/affiliated company, and borrowing foreign currency from domestic banks.

d. From around 25% of external debt reporters that do not hedging their debt and are exposed to currency risk, 7% of them receive external debt from parent/affiliated creditors, while the remaining (18%) are exposed to currency and refinancing risk as they have rupiah income and receive external debt from non-parent/affiliated creditors.

VII. Policy implication

In order to minimize the potential risk on corporate sector external debt, central bank or monetary authorities have some alternatives debt management policies to adopt as following:

– Debt Limits. The policy should consider setting specific limits or acceptable ranges for each type of debt. Limits of debt generally are set for legal, and financial reasons.

– Debt Structuring Practices. The policy should include specific guideline regarding the debt structuring practice for each type of debt, including maximum terms, use of variable or fixed-rate debt etc.

– Use of Derivatives (hedging policy). The Debt Management Policy should clearly state whether the entity should use derivatives or not. If the policy is allowed to use derivatives, a separate and comprehensive derivatives policy should be developed.

References

Statistic Department, Bank Indonesia and Directorate General of Debt Management, Minister of Finance External (2014), "Debt Statistic of Indonesia". Bank Indonesia

Israel Glen D, (2012), "Determining Sample Size", University of Florida

Surveys as leading information to support central bank policy formulation: the case of Indonesia

Gantiah Wuryandani[1] and Indri Mardiani[2]

Abstract

This paper discusses surveys conducting by Bank Indonesia as the central bank of Republic of Indonesia. As the central bank with the objective of maintaining price stability, Bank Indonesia has core functions in monetary, payment system and financial stability. Notwithstanding Bank Indonesia has acquired primary data from reporting, it is insufficient to understand the real state of economy, the factor behind the numbers, and the behavior of economic agents. Therefore, Bank Indonesia needs to conduct surveys, particularly in corporations and households. Since 1993 Bank Indonesia has done up to seventeen types of surveys. It is acknowledged that surveys has supported economist to assess the real path of economy growth and inflation to support policy decision making process. Hitherto, there are always errors and biases in the surveys result that leave some puzzles of economic condition. In minimizing the errors, Bank Indonesia consistently reviews the surveys periodically. Nevertheless, challenges of the surveys remain exist, particularly in the quality of the survey and their optimum utilization.

Keywords: Central bank policy, Prices, Business fluctuation, Expectation

JEL classification: E58, E30, E31, D84

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1. Introduction

1.1 Background

The traditional role of a central bank in a country is as monetary authority in controlling money supply, including currency and interest rate management, and acting as lender of the last resort to prevent financial crisis. Central bank around the world in general has the main objective of maintaining price stability which is represented by inflation. Historically, the anti inflation objective of central bank had created an inflationary bias. The disinflation route, sometimes immolates economic growth and employment. Some central bank like Bank Indonesia has to maintain also the stability of exchange rate as the part of price stability objective. Epstein (2005) stated that the role of central bank as an agent of development is to create "macroeconomic stability", including financial stability. In particular, central bank has to formulate policies in monetary, payment system and financial stability in order to achieve its objective.

Inflation as the price stability objective of a central bank is resultant of all economy activities. Hence, in formulating policy decision, central bank needs to know in advance the future spectrum of economy to avoid misalignment. The full extent of central bank's policy transmissions should have been known. Central bank usually applies some quantitative tools such as econometrics to forecast the future economy pathway. Yet, despite its worth, econometrics models are sometimes considered as oversimplification of economic dynamic. Some claimed that model equations could not depict multifaceted state of the entire economy. Lucas critique even warns that some parameters might not be robust anymore.

Due to comprehensive coverage and procedures, some data and statistics usually have lags in their collection. For example, gross domestic product as a measurement of all economy activities of economics agents usually has one month lag. Therefore, additional data of which represents prompt and forward looking situation is highly required by central bank. Survey among others is a tool to acquire those data and information. In a dynamic economy, minor changes in economic agent behavior might generate a multiplier effect in other economic activities. Therefore, understanding this behavior becomes object of research. Some noises created by some economic agents may have impact on price stability effort by central bank.

1.2 Objective of the paper

The aim of this paper is to analyze the benefit of conducting surveys in order to get in advance some information to formulate policy decision. This paper will also discuss how central bank obtains information and data in advance prior to policy decision. Survey among others is a way to obtain information regarding future condition, including the behavior and the expectation of market. By knowing this information and data, central bank could track its objective achievement and establish more appropriate policy adjustment. This paper discusses and analyzes the organizing of surveys undertaken by central bank of Indonesia, the weaknesses and challenges that it faces.

The organization of the paper is as the following. The next section explains statistics collection through survey, including the definition of the survey and its role. Part three describes the measurement of surveys based on the theory and some methodologies. Section four gives details of the surveys done by central bank of Republic of Indonesia. The final part discusses conclusion of the paper.

2. Statistics collection through survey

2.1 Definition of survey and its role

Grove et al (2004) explicates a survey as a systematic method for gathering information from a sample of entities for the purposes of constructing quantitative descriptors of the attributes of the larger population of which the entities are members. Surveys are the tools to track economic trend and other indicators. Social sciences utilize survey as a method to understand the manners of societies and to test the theory of behavior. A survey could become a proxy or the best tool in completing the need of surveyor in specific data or information on certain condition, in a quick and efficient way. Furthermore, identifying population behavior would be impossible within short term period, hence a survey by means of selected sampling of group would be the best approach. Information collected from the selected group would be statistically valid information that represents the large group; despite there will be no zero error. Moreover, as the data and information needed is not readily available publicly, survey would be the feasible way to obtain the information. By survey, researcher or analyst could infer descriptive statistics quantitatively and qualitatively from the data and information. Sampling as the proxy of population condition would be valid with appropriate sampling selection and survey execution.

In gathering information, the conducts of surveys have specific characteristics such as asking some people questions by way of interviewing or filling questioner. Surveys could provide information such as behavior, needs, expectation, and opinion which represents selected group. In addition, a survey could also be used as a tool to gauge specific needs for instance attitude and preference. As a primary data, surveys usually are done by means of direct contact with the respondents. The execution of surveys is by way of written questionnaire which can be distributed by mail/fax/email, or via interviewing.

It is undeniable that there are some advantages and disadvantages of different ways in conducting the surveys. Yet, there is no such the best way that fit to every survey. Surveyors should tailor the ways of survey based on their need in terms of the objective, respondent sampling, information collected, time, and budget constraint. Sometimes there is a trade-off between the cost and the quality. For example, the written survey by mail is easier and less costly, yet it usually has low response and is difficult to communicate the missing part. The following table 1 describes the pros and cons of means in survey.

Advantages and Disadvantages of Survey Means — Table 1

Survey Means	Pros	Cons
Mail, facsimile, email	• The respondent can fill out the survey at his or her convenience. It can be filled out whenever the respondent has time • You can make it anonymous, which is much more comfortable for some respondents • All respondents will have read the same questions, eliminating any interviewer bias • The respondent will have time to check his or her records before answering, if he or she needs to verify information, he or she will have the chance to be accurate	• They are not very flexible; there is no interviewer present to probe for answers, so you can only read what the respondent has written, with no opportunity to look at facial expressions or body language • The return rate is generally low • Respondents may leave answers blank • Surveyor cannot control when respondents will send the survey back • You may not be able to tell the difference between those who simply did not return the survey and those for whom you had an incorrect address
Face to face interview	• The surveyor could achieve a 100% response rate of the questions • Surveyor could decide on follow up question • Could hear far more than just what the interviewee tell	• Requires considerable training • Time consuming and costly to conduct • Unless strictly controlled, interviews can easily meander from the main subject
Telephone	• Combines the efficiency of a mail survey with the personal contact of an interview • More efficient as many more people can be interviewed	• Less personal that face to face and all the body language data will be lost • Response rate can also be low, but could be remedied by preceding the call with a brief letter alerting the respondent that a phone call is on the way • Best used for short and very focused interviews
Focus Group Discussion	• More effective and economical instrument • A socially oriented research	• Participants may respond in ways designed to please others • People are reluctant to contradict prevailing viewpoints • Participants may choose not to reveal certain information in a group setting • Members may be influenced by opinions of others who best articulates their opinion • The moderator has less control over the focus group compared to interview • The selection of group members is likely affect the outcome

2.2 Surveys as a tool to collect data by central bank

Central bank usually collects primary data by reporting system. The obligation of reporting data to central bank has been expanded, not only by banks as the intermediary institution but also covers corporations. In Indonesia, central bank has the obligation to maintain stability in exchange rate; therefore it requires report from the corporations in foreign exchange transactions including export, import, external debt, and transactions in financial market. Nonetheless, reports by banks and corporations are not sufficient to infer some information particularly the behavior in expectation and forward looking actions.

By doing surveys, central bank could acquire some specific information needed since data movement in reporting system does not reflect the behavior driven behind the number. Moreover, flexible information needed could be tailor-made by central bank by conducting surveys to dig up deep information of preferences, reaction, reason, planning, and other forward looking actions of specific situation.

3. The measurement of surveys

3.1 Theory and methodology

The history of survey began in 1889, when Charles Booth tried to study the poor in London and the determinants of poverty by observing the life and labor of the people. He did not use specific technique in sampling and questionnaire. Nonetheless, he applied quantitative measurement to identify the fundamental social problem. Currently, in the 21st century, the execution of surveys has evolved to a more complex system, efficient and promptly, supported by rapid advanced in technology development. Most disciplines in social sciences have implemented survey as the methodology of the studies.

The methodology of the survey identifies the design; collection, processing, and analysis of survey in the framework of benefit and cost constraint. Each step has an effect on the quality of the survey and involves cost implication. By means of survey, researcher or analyst could infer phenomena and behavior from the data and information gathering based on sample. Yet, there is always a trade-off between cost and quality or level of error. Poor design and execution in each step in the survey; will generate bias and error. The fundamental challenge in the survey is how to minimize error so as to achieve the objective.

Converse (1987) described four perspectives of survey in United States that are the purpose of the survey, the development of the question, sampling method, and the data collection method. Each perspective has some challenges in building the survey becomes effective. The purpose of the survey should be clear given that it will effects the questions design.

Survey basically is intended to identify the population/group behavior or condition, not individual characteristics. Based on the statistics measured, analyst could draw inferences about the characteristics of the group or specific population. Groves et al (2004) stated that there are two requirements to achieve true inference: 1) Answers of the survey must accurately describe the characteristics of respondent; 2) The respondents must have characteristics similar to those of the targeted population/group observation. When this prerequisite is not met, then survey statistics will contain error. Error is defined as deviation of what is expected in the survey than what is gained. There are some possibilities of errors evolved such as mistake in questionnaire, poor record, and inappropriate/missing sampling. In building the survey design, surveyor has to minimize error in survey statistics by minimizing gap between successive steps. There are some errors such as coverage error, sampling error, non response error, adjustment error, measurement error, and processing error.

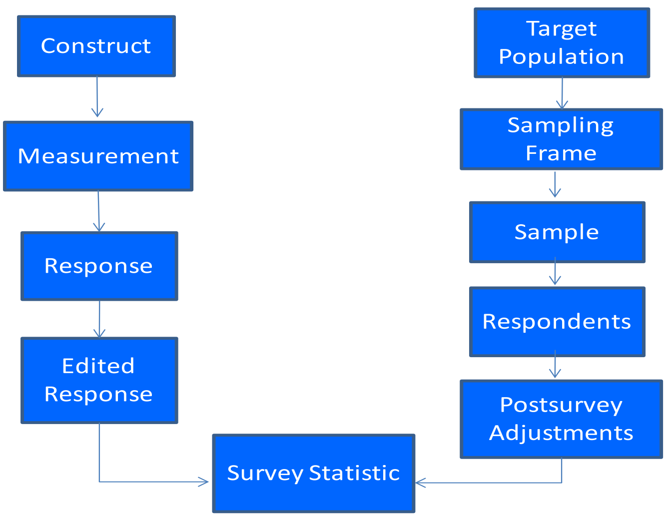
3.2 The construction of survey

Bergh (2009) in the use of surveys by central bank (IFC bulletin No 30) concluded from the workshop discussion that conducting a survey is an art as much as a science. Some central banks specifically recruit statisticians to develop and build surveys. The need of gathering information in advance has been burgeoning since macroeconomic condition becomes more dynamic and volatile. Interconnected among countries had been evolved to a borderless transaction almost in all sectors of which encouraged by advanced technology. This development has driven more complex transactions including the difficulties in data collection. One way another to obtain the data of economic activities is through survey execution.

The authority of central bank to acquire data and information from survey is based on central bank act in 1999. The legal framework of survey done by central bank has also guaranteed the confidentiality of the individual data and information as the publication always in the aggregate figure. In building surveys, central bank uses several method in sampling and statistic methodology, depends on the objective and the need. Type of questionnaires could be in the form of open ended, closed ended, or a combination questions.

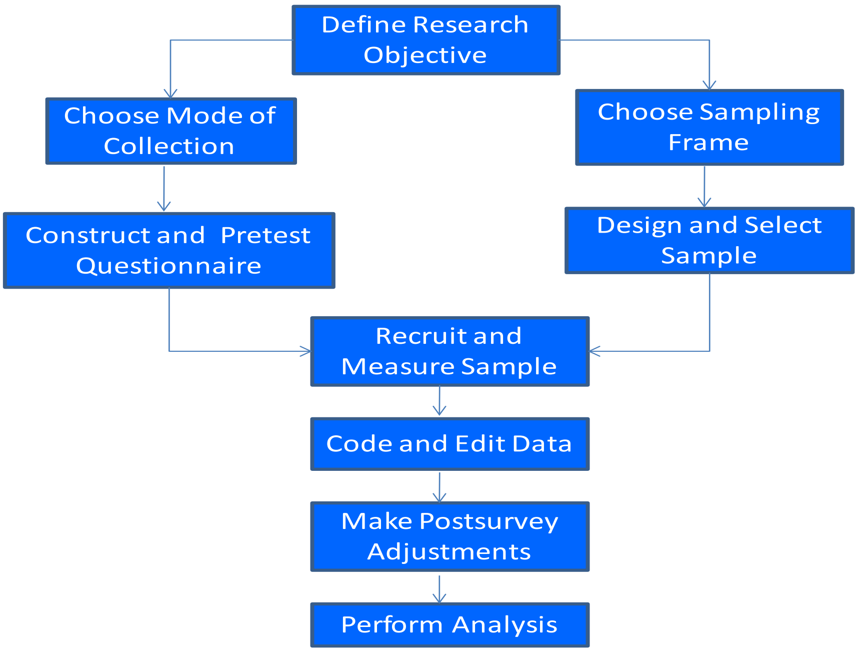
Groves (2004) stated that a survey is developed from designing to processing. Good survey design usually determines the quality of the survey. There are two parallel dimensions of a survey, the element of information needed and the population description as describes in the diagram 1. The measurement of a survey consists of several steps from construct, measurement, response, up to edited response. On the other side, representation covers stages of target population, sampling frame, sample, respondents, and post-survey adjustment. In the edited response stage, outlier responses could be identified. The missing data could be estimated in the post-survey adjustment stage by imputation. Based on the stages, analyst and researcher could infer statistics of the survey.

Survey cycle in design perspective | Diagram 1



Likewise, survey cycle based on process perspective begins with the objective which then follows into two paralell processes. One process consists of stages in choosing sampling frame, and in designing or selecting sampling. The other process encompasses of choose mode of collection, and construct or pretest questionnaire. Based on these two processes, surveyor could recruit and measure sample, followed by code and edit data, make post-survey adjustment, and finally perform analysis.

Survey cycle in process perspective — Diagram 2



3.3 Survey index construction

There are many methodologies in index construction. Some of the survey indexes conducted by Bank Indonesia are constructed by the net balance which is the difference between the percentages of respondents with the answer "increasing/better off" with the percentage of respondents with the answer "decreasing/worse off". Several surveys use balance score which is the net balance added by 100. The index above threshold of 100 indicates an optimism condition, and vice versa, the index below threshold of 100 indicates a pessimism condition. In retail survey, it implements index calculation by weighted balance score with the city weight. Furthermore, business survey applies weighted net balance by multiplying the net balance with the weight of each sector in gross domestic product.

Besides the above index calculation, primary residential property survey employs chained weighted index. In secondary residential property index utilizes cost approach and market value approach. For commercial property index, the weight is based on the spacious of leased property or unit sales. On the other hand, retail survey utilizes real retail index to measure the real retail volume by deflating the index. The retail index is also weighted based on the city weight. Consensus forecast survey uses mean point estimate in finding the average forecast from the expert. Pooling methodology is also utilized in some surveys. The following are the index calculations of some surveys.

1. Net Balance = $\sum U_i + \sum D_i$

   U_i = The number of respondents with the answer of "increasing/better off"

   D_i = The number of respondents with the answer of "decreasing/worse of"
2. Weighted Net Balance = ∑Weight *(Net Balance)
3. Balance Score = Net Balance + 100 = $(\sum U_i + \sum D_i) + 100$
4. Weighted Balance Score = ∑Weight *(Balance Score)
5. Chained index = Price Index $_{t-1}$ + (Price Index $_{t-1}$ x Price $_t$ /100)
6. Chained weighted index = ∑weight x(Chained Index)
7. Pooling = Median answer /Total Respondent
8. Mean point estimate = ∑ Answer/Total Respondent

3.4 Error and bias in survey

Why error occurs in a survey? The starting point is to understand the procedure of conducting a survey. It is necessary to identify potential sources of error in survey and minimizing its gap. Errors in the survey could be classified as sampling error and non sampling error. Survey always relates to a sample selection of population. Sampling error usually occurs to a particular group selection which does not represent the targeted respondents and sample size that creates low response rate. In addition, non sampling error such as measurement error arises as the consequence of mismeasurement. This among other includes incompetence surveyor, interviewing process, and inappropriate methodology. Yet, errors sometimes are recognized when the result creates biases and contains puzzles or contradictions. The following table lists common sources of error and some strategies to minimize them.

Survey's error and strategies to minimize error — Table 2

Source of error	Examples	Strategies to minimize error
Planning and interpretation	Inadequate definitions of concepts, terms or populations.	Ensure all concepts, terms and populations are defined precisely through consultation between data users and survey designers.
Sample selection	Inadequate list from which sample is selected; biased sample selection.	Check list for accuracy, duplicates and missing units; use appropriate selection procedures.
Survey methods	Inappropriate method (e.g., mail survey for a very complicated topic).	Choose an appropriate method and test thoroughly.
Questionnaire	Loaded, misleading or ambiguous questions, poor layout or sequencing.	Use plain English, clear questions and logical layout; test thoroughly.
Interviewers	Leading respondents, making assumptions, misunderstanding or misreporting answers.	Provide clear interviewer instructions and appropriate training, including exercises and field supervision.
Respondents	Refusals, memory problems, rounding answers, protecting personal interests or integrity.	Promote survey through public media; ensure confidentiality; if interviewer-based, use well-trained, impartial interviewers and probing techniques; if mail-based, use a well-written introductory letter.
Processing	Errors in data entry, coding or editing.	Adequately train and supervise processing staff; check a sample of each person's work.
Estimation	Incorrect weighting, errors in calculation of estimates.	Ensure that skilled statisticians undertake estimation.

4. Surveys conducting by central bank of Indonesia

4.1 Bank Indonesia surveys

Realizing the importance of surveys as the means of economic intelligence, Bank Indonesia has conducted surveys since 1993. Bank Indonesia has been developing surveys in line with the need to establish more credible and effective policies. To support the development and the quality of surveys, Bank Indonesia established a special division in the statistics department to manage surveys for requirements in all of its function in monetary, payment system, and financial stability policies. Currently, the variety of surveys undertaken by Bank Indonesia has reached up to seventeen (17) surveys as in the table 2. The majority of surveys are related to corporations as respondent to gather and comprehend the path of business condition and expectation. In addition, consumer and household is the target of the survey to measure the behavior in consumption and investment. The frequencies of surveys are varied from weekly to annual. The objective of data collection from surveys could be classified into 3 targets of factual information or economic intelligence area of measurements. These are economic development trend, expectation behavior in economic and price; and action plan of respondents. By conducting the surveys, central bank could gain early information of macroeconomic indicators and their trend movement to measure the economic condition, despite the lags in the release of macroeconomic indicators.

Bank Indonesia carries out surveys by building collaboration with all regional branches. Regional branches undertake similar surveys with the coverage of areas under their authorities. The head office collects all surveys and makes recapitulation and summarization as a national index of surveys. The surveys could also be undertaken by outsource surveyor as not all surveys could be done by Bank Indonesia itself. Sometimes there are differences of the qualitative information among regional branches which have specific factors related to the regional circumstances. This is happened as Indonesia is a country with a vast area from west to east, and has many big islands that made it has wider gap in economic development and infrastructure as well.

Survey execution is usually costly given that it needs a lot of resources in terms of human resource as interviewer, recorder and statistician. It also takes time to accomplish the whole process of survey. Therefore, the benefit and cost of survey should be measured considerably. The design and process of survey should be thoroughly prepared as it is difficult to step back when the survey has begun. Nonetheless, the refinement of the survey is usually done when there is bias in result. Some of the huge surveys need to be tested through the pilot project so that fine tuning in questionnaire and in sampling could improve the quality of the result and its effectiveness.

Bank Indonesia Surveys

Table 3

No	Type of survey	Sampling respondent	Regional coverage	Index Method	Survey method	Period	Establish-ment	Objective
1	Business tendency	Purposive sampling: 2700 corporations of all sectors in GDP	38 cities	Weighted net balance	Mail and web (on line)	Quarterly	1993	To get early information and expectation on the development of economic activities in real sector and pricing in the upcoming months (three and six months)
2	Corporation	Stratified purposive sampling : 100 non listed corporations (previously 42), sectoral	Several cities	Quantitative and qualitative descriptive analysis (pooling and simple average)	Mail	Annually	2010	To identify the sources of vulnerabilities in financial stability from the transmission of corporations activities
3	Consumer Confidence	Stratified random sampling: 4600 households	18 major cities	Balance score (net balance+100) and weighted average for qualitative data	Telephone and interview	Monthly	1999	To obtain early information on household consumption tendency and inflation expectation
4	Household	Stratified random sampling: 4700 household	10 major cities	Quantitative and qualitative descriptive analysis	CAPI (computer assisted personal interviewing)	Annually	2009	To measure the asset and liability composition of household, particularly the leverage and repayment capacity as the basis for estimation in full sectored account statistics and macro-prudential policy
5	Retail	Purposive sampling: 650 retailers	10 major cities	Weighted index – retail sales, Weighted Balance score-inflation (net balance+100)	Interview	Monthly	1999	To get early information and expectation on retail sales, consumption spending, and inflation pressures

Bank Indonesia Surveys (cont)

Table 3

No	Type of survey	Sampling respondent	Regional coverage	Index Method	Survey method	Period	Establish-ment	Objective
6	Production	Stratified purposive sampling: 250 corporations in manufacturing	Several cities	Weighted net balance	Mail, fax, email	Quarterly	1999	To get information the development of production, capacity utilization, and expected producer price.
7	Price	Stratified purposive sampling: – 48 highest weighted commodities in CPI (of 859 commodities) – 3 retailers in each market, hypermart	Markets in 18 major cities (CPI=82 cities)	Weighted commodities and cities price changes	Interview	Weekly	2006	To identify monthly inflation through the weekly price movement monitoring as nowcasting indicator.
8	Primary Residential property	Purposive sampling: 441 developers	14 Major cities	Chained weighted index	Interview	Quarterly	1999	To understand the direction of residential property price development in the primary market, as well as its supply and demand.
9	Secondary Residential property	Purposive sampling: brokerage and residential owner	Jakarta	Weighted price	Interview	Quarterly	2011	To understand the direction of residential property price in secondary market and its sales velocity as an indicator of potential bubble.
10	Commercial Property	Purposive Sampling: office, hotel, mall, apartment, industrial	3 Major cities	Weighted selling price/ rented price	Interview, telephone	Quarterly	1996	To identify the development of commercial property and its relation to the economic condition.
11	Consensus forecast	Purposive sampling: 200 of economist, academician, banker, market analyst, researcher	18 major cities	Pooling, mean point estimate	Mail, fax, email	Quarterly	2001	To discover the level of macroeconomic indicators (GDP, inflation and exchange rate) prediction by experts.

Bank Indonesia Surveys (cont)

Table 3

No	Type of survey	Sampling respondent	Regional coverage	Index Method	Survey method	Period	Establish-ment	Objective
12	Banking	Purposive sampling: 42 banks	Jakarta (head office)	Net balance	Email	Monthly	1999	To identify the movement of lending, pooling fund, liquidity and lending policy of banks in the next term. As the complement and quick information to the monthly banking reporting which has 1 month lag.
13	Liaison	Stratified purposive sampling: leading corporations in the region	41 regions	Descriptive analysis, Likert scale	In depth interview	Quarterly	2007	To get in depth qualitative information and guidance of economic condition (GDP, inflation, balance of payment, financial market) from corporations. As the complement and explanation of quantitative/statistics development.
14	Foreign direct investment	Stratified purposive sampling: corporations with foreign share of 10% and above	Major cities	Simple average and weighted average	Mail survey	Bi-annual	2000	To know the coverage of foreign capital/ownership role in corporations and the data of foreign direct investment activities. As the information of potential flows in capital account of balance of payment and international investment position.
15	Workforce (inflow-outflow)	Stratified purposive sampling: Indonesian who work abroad for a year or more, retired worker abroad and their family	9 cities classified as migrant enclave areas	Pooling data, quantitative and qualitative descriptive analysis	Interview	Biennial	2010	To understand the movement and the behavior of remittances flows as well as their impact to economy activities (in consumption and investment/saving), and welfare (education and health). As the information for proxy estimation in balance of payment.
16	Foreign Debt	Stratified purposive sampling: corporation which have external debt	Majority in Jakarta	Pooling data, quantitative and qualitative analysis	Interview	Bi-annual	2011	To identify the potential risk and risk management of corporation's external debt. As the measurement of potential demand in foreign exchange and the volatility of exchange rate.
17	Special/Ad hoc	Purposive sampling	Majority in Jakarta	Tailor made	Telephone (majority)	One time (non routine)		To get in depth qualitative information for specific current issues in economic, monetary, payment system, financial stability, balance of payment etc.

In designing the questionnaire of each survey, Bank Indonesia gathered all the needs of analyst, economist, and researcher in the central bank. All of surveys are designed to support the analysis and recommendation to the policy maker or board of governor. Central bank also publishes all of the surveys in the website, and sometimes arranges media conference. The aim of the publication is to provide information and to drive the market to a more rational expectation based on the fundamental economic condition. Liaison and ad hoc surveys have been used to collect specific economic intelligence, particularly when the economic diagnostic indicates there is a certain issue. To confirm the fundamental issues, by interviewing related corporations, liaison surveyor could gain in depth insights of economic condition and the expectation of business agents. The qualitative information from the liaison survey is valuable to gauge and judge the real state of economy in feeding the process of the appropriate policy of central bank.

It is acknowledged that primary data from the report is not sufficient to tell the story behind the numbers. Therefore, economic intelligence by survey is expected to support the factual information to identify the actual current economic condition and to forecast the future state of economy. The coverage of information in the surveys is as in table 4; among others is information of current condition and expected condition. The essential information to guesstimate the trend path of inflation is pricing and expected price movement.

The coverage of information in the surveys — Table 4

Business survey	*Consumer Survey*
• Business condition	• Current Condition
• Production volume	• Expected Consumption (6 months ahead)
• Capacity utilization	• Consumer Confidence
• Employment	• Expected price (3,6 months ahead)
• Sales, orders, inventory	• Employment
• Sales price (next quarter)	• Current income
• Expected inflation	• Expected income (6 months ahead)
• Investment realization	• Repayment capacity
Retail Survey	*Production Survey*
• Current retail sales	• Production (sector)
• Expected retail sales (3,6 months ahead)	• Capacity utilization (sector)
• Expected price (3,6 months ahead)	• Pricing (sector)
• Loan interest rate (3,6 months ahead)	• Factors affected production and price movement
Banking Survey	*Liaison survey*
• Current New Loan	• Production, inventory, sales, capacity utilization
• Loan projection	• Prospect of business, investment plan
• Deposit and projected deposit funding	• Leverage
• Sources and uses of fund	• Cost structure, pricing
• Cost of loanable fund, Cost of fund	• Employment
• Deposit and credit interest rate	• Financing
• Lending policy	• Current issues

The coverage of information in the surveys (cont)	Table 4
Corporation Survey • Production, capacity utilization, input, inventory • Cost structure • Balance sheet, profit and loss • Financing, Leverage, Liquidity • Sales, Return • Employment	*Household Survey* • Asset, Liabilities items • Share of loan in liabilities • Share of financial asset • Consumption share of income • Expenditure of household to corporate
Price survey • Price of volatile food • Price of core inflation • Price of administered commodities	*Workforce (outflow-inflow) survey* • Remittance of workforce • Salary and remittance ratio to the salary • Impact of remittance to the local welfare • Frequency and mode of transfer of fund
Foreign direct investment survey • Investment inward, outward (current and plan) • Capital investment (current and plan) • Share of ownership • Retained earning • Capital flows (outward and inward) • Liabilities to non resident	*Consensus forecast survey* • Estimated economic indicators of GDP, inflation, and exchange rate (4 quarter ahead, average of the year, and next year) • Factors behind the movement of estimated indicators
Risk management survey of foreign debt • External debt outstanding • Risk management, Hedging position • Repayment capacity • Liquidity, Solvability • Utilization of external debt	*Primary residential property survey* • Residential property price (current, next quarter) • Factors behind price movement • Residential property sales and construction • Demand and supply • Financing of residential property
Secondary residential property survey • Sales velocity • Land price • Financing mortgage • Current and expected price	*Commercial property survey* • Occupancy leased office (trend and price) • Supply of commercial property • Price of commercial property
Special/Ad hoc survey • Tailor Made based on the requirement in monetary, payment system, and macroprudential policies	

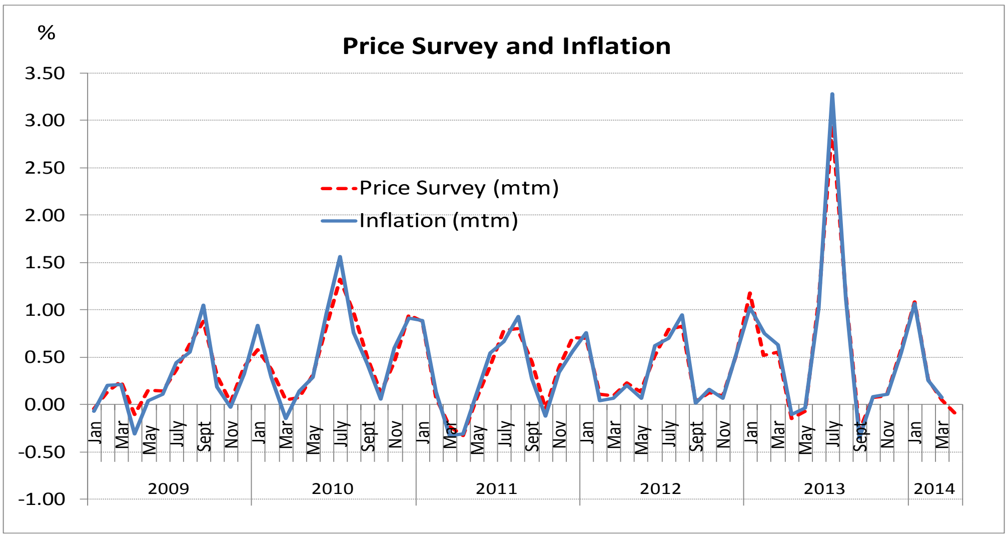
4.2 The utilization and role of surveys in Central Bank policy

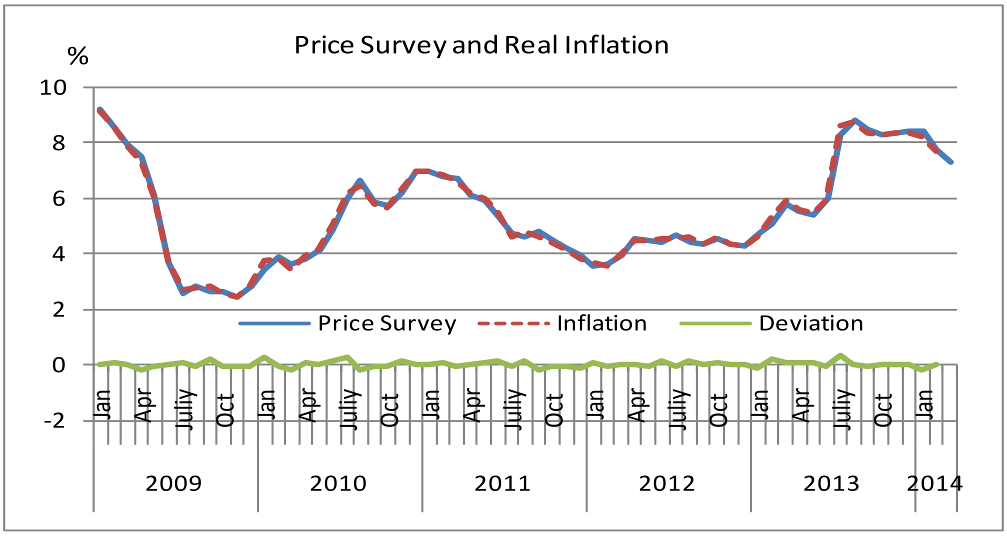
As economic intelligence, the utilization of surveys as has been described previously is to fill the data gaps and to feed the information to support economists better understand the real story behind the numbers of current and projection indicators. The result of surveys and their benefit among others are illustrated in the following graphs below. Price survey is the most significant nowcasting and accurate survey in predicting monthly inflation. The deviation of price survey to the real inflation is relatively small as indicated in the graph. In general, the deviation is close to zero for both based on month to month and year on year growths. Related to the expected inflation, consumer survey could predict the trend of inflation in most of the time, particularly in the recent years.

In addition, production index could also become signals of cycle movement trend to gross domestic product (GDP). Previously, the movements of production index tend to become a coincident indicator of GDP in manufacturing, however, in the recent years it inclined to become leading indicator. The shifting of this movement might be driven by respondent selection which moving towards manufacturers in intermediary good compare to final good production. Production index is also co-movement to the transaction in real time gross settlement (RTGS) in the payment system. This reflects that the movement of RTGS and production index are able to predict the trend of growth in GDP of manufacturing. Furthermore, retail sales index has the same tendency movement with cartal or bank notes and coin circulation, and card payment transaction. On the other side, banking survey has the capability to project the new credit growth path in the future, regardless of some inappropriate signals in the recent years.

Price Survey and Real Inflation

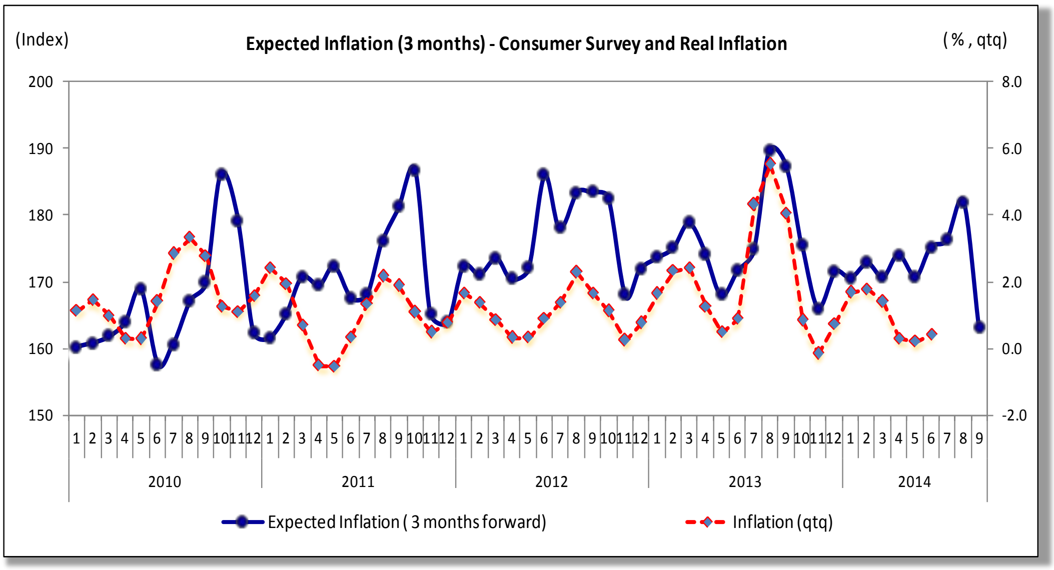
Graph 1





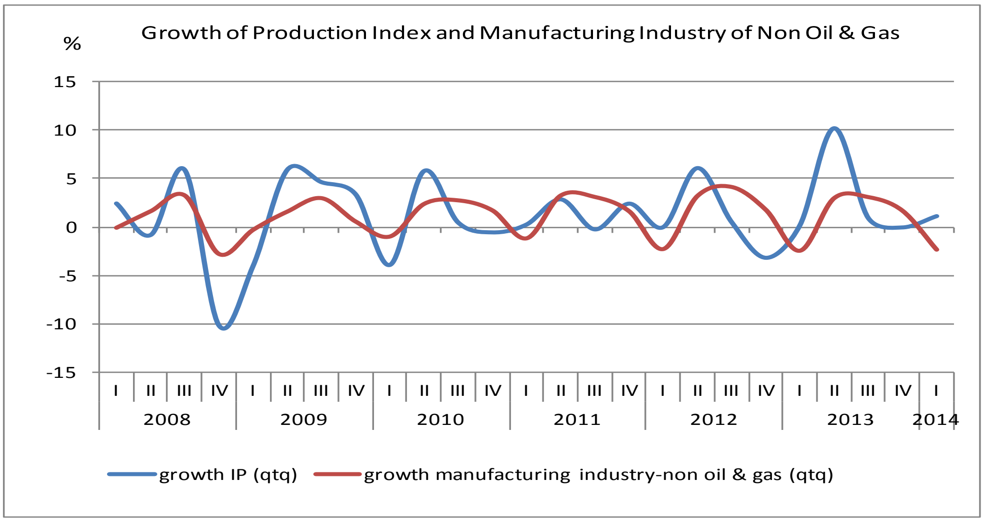
Expected Inflation (Consumer Survey) and Real Inflation

Graph 2



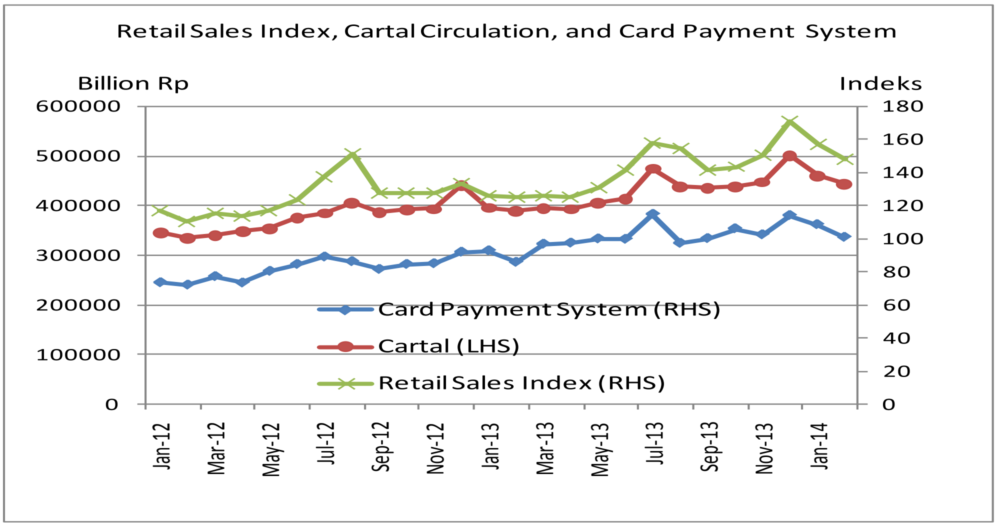
Production Index and GDP of Manufacturing Index (non oil and gas)

Graph 3



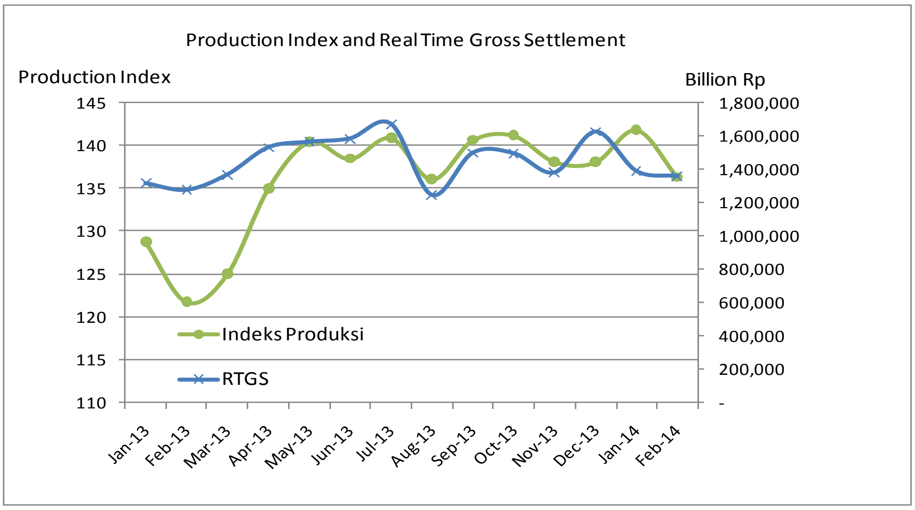
Retail Sales Index, Cartal Circulation, and Card Payment

Graph 4

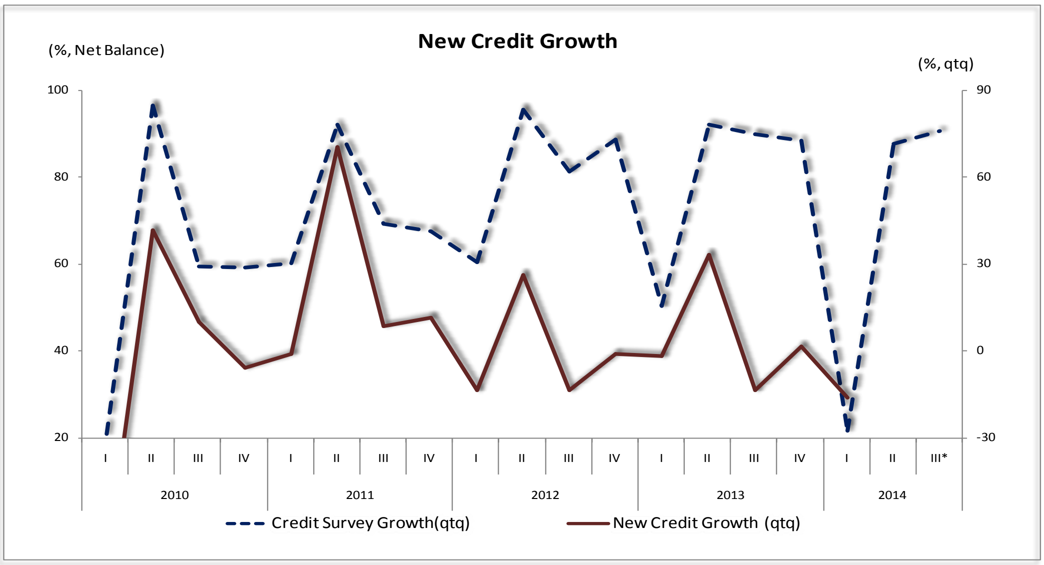


Production Index and Real Time Gross Settlement

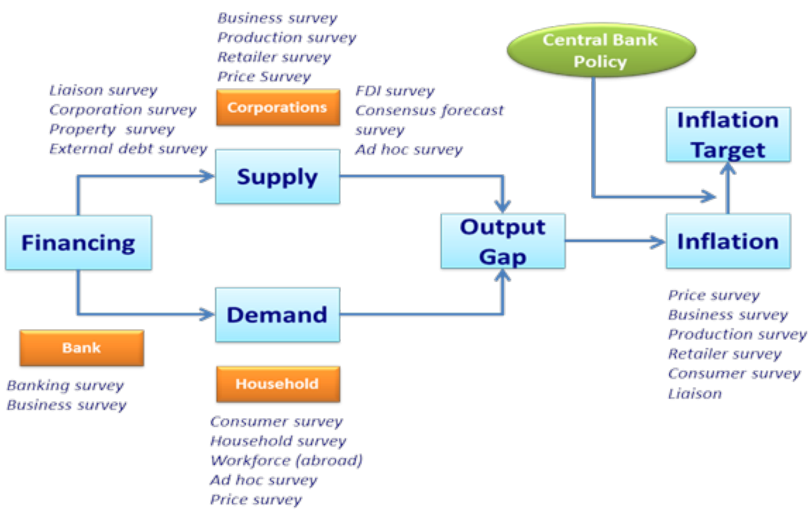
Graph 5



Credit Growth (Banking survey) and New Credit Growth — Graph 6



The role of surveys in policy formulation — Diagram 3



4.3 Bias, error, and challenge in survey

It is unavoidable that there are always errors and biases in the surveys, either sampling error or non sampling error. Nonetheless, Bank Indonesia always tries to minimize the error by evaluating the survey and its result periodically. Weaknesses and challenges among others are low response rate, bias sampling, discontinue response of panel data respondents, refusal, misinterpret questionnaire, and bias answers. Even though, there is a legal basis in the act of central bank for the surveys undertaken, hitherto there are a lot of refusal and discontinued response of respondents both in corporations and consumers. Central bank has no authorities to penalize or enforce respondents to participate in the surveys.

In dealing with obstacles in surveys, central bank always makes efforts in building engagement with the respondents. The most difficult thing is in maintaining the panel data of the survey. To fill the missing respondents of panel data, central bank always replaces respondents to persistently maintain appropriate structural sampling. Inappropriate respondents in panel data might also create biases in results. Therefore, Bank Indonesia refreshes the respondents periodically, particularly respondents with high bias result.

In building engagement with respondents, Bank Indonesia gives souvenirs as the appreciation of participation in the surveys. Periodically, Bank Indonesia arranges respondents meeting to communicate directly and gains some insights for survey improvement. Moreover Bank Indonesia always publishes the surveys in the websites so that respondents -especially corporations- could guess their position in the market compare to their competitor position in general. Nonetheless, there are always biases as the consequences of sampling error. This is attributable to the incorrect classification, false group of respondents or error in structural sampling design. Beside error in sampling, furthermore, unsatisfied result could be originated from misinterpret questionnaire by respondents.

Challenges has not just come from the current surveys, but also from the requirement of international needs such as Data Gap Initiative (DGI) recommendation in the G-20 countries commitment. This includes among others are the property price and full sequence account of sector, particularly household and corporation. To fulfill the commitment in Data Gap Initiative recommendation, Bank Indonesia develops surveys as the tools to acquire the data needed. The surveys include, inter alia, corporations, households, and property surveys. The demand of data needed by central bank and international database commitment becomes more granular. This could be understood given that the state of economy becomes more dynamic and more specific issues entrenched in it.

In addition, errors could be arisen from the inappropriate methodology. For instance, in the calculation of business index which is designed to track the gross domestic product is based on all sector productions including goods and services. As the value added calculation of services production is different to goods production, the base of index calculation of services should also be calibrated analog to gross domestic production calculation. Moreover, economy structure has been changing continuously; hence the weight of each sector has also been varying. Consequently, weights of sectors in surveys should also be reviewed from time to time.

The strategy to build strong and cohesive relationship with the respondents, either enterprise or household has been developed. It is acknowledged that the binding of Bank Indonesia with the respondents of the surveys is still in the mediocre level. Notwithstanding, Bank Indonesia keeps trying to fasten the relationship with the expert in consensus forecast survey by organizing focus group discussion occasionally. In addition, Bank Indonesia also holds workshops to educate and to appreciate corporations as respondents, and to explain the importance of surveys for the central bank policy as well as for the corporations in doing the business.

5. Conclusion

Lag in macroeconomic indicators release has made central bank in difficult position of discovering the real state of current economic condition. This has generated some limitations in accuracy of predicting future state of economic to set up appropriate policy. Furthermore, the indicator and forecasting in numbers could not fully describe the factual activities of economic agents, their expectation, and their action plan. To overcome this impediment, central bank needs to do nowcasting, among others by doing the surveys to obtain data and information of current economic circumstances and expectation of economic agents. Thereafter, central bank could track the real path of economic state and make economic state prediction in the short run.

By conducting surveys as economic intelligence, central back could get more insights in the trend and cycle of current economic condition, as well as inflation path to drive the inflation movement into the corridor of central bank target band. It is proven that surveys could become powerful sources of information to confirm the state of the economy and acquire the factual issues as well as the explanation behind the numbers.

Surveys have been admitted to be useful in providing enriched information to the economist to assess the economic condition for the policy decision process. Bank Indonesia has conducted survey since 1993, and developed its varieties up to seventeen surveys currently. Nevertheless, central bank still faces challenges in improving the quality and the accuracy of its surveys as the measurement of the real state of the economy as well as economic projection. There are many parts of the surveys that have to be improved. These among others are inappropriate sampling in group and quantity, improper methodology, and the utilization of surveys.

References

Epstein, G 2005. Central banks as agents of economic development. Political Economy Research Institute.

Blinder, A 1998. Central banking in theory and practice. The MIT Press Cambridge, Massachusetts London, England.

Groves, R M et al 2004. *Survey Methodology*. John Wiley & Sons, Inc.

Irving Fisher Committee on Central Bank Statistics. 2009. The Use of Surveys by Central Bank. IFC Bulletin No 30. Bank for International Settlement.

Converse, J 1987. Survey research in the United Stated. Berkeley: University of California Press.

Mink, M, Jacobs, J P, and de Haan, J 2008. Measuring Synchronicity and Co-movement of Business Cycles with an Application to the Euro Area.

Likert, R 1932. A technique for measurement of attitudes. *Archives of Psychology*, vol 22 June pp 55–55.

Swallow, Y C and Labbe, F 2010. Nowcasting in google trend in an emerging market country. Working paper No 588. Central Bank of Chile.

Assessing dynamics of credit supply and demand for French SMEs, an estimation based on the Bank Lending Survey[1]

Edwige Burdeau[2]

Credit supply and demand cannot be observed simultaneously as quantitative data do not enable to disentangle the two effects. Nevertheless, the Bank Lending Survey (BLS) conveys additional information on variations of credit standards for approving loans and credit demand perceived by banks.

In this study, credit supply and demand dynamics are estimated through a dynamic disequilibrium model relating balance of opinions from the BLS and flows of loans. Such a model applied on SMEs in France between 2006 and 2013 shows that credit supply fell sharply in 2008, but afterwards, flows have mainly been driven by SMEs' demand for credit.

1 This article reflects the opinions of the authors and does not necessarily express the views of the Banque de France.

2 Banque de France.

Non-technical summary

The Bank Lending Survey (BLS), a qualitative survey led across the Eurosystem since 2003, is an additional source of information on credit markets. Every quarter, euro area bankers are asked about their opinions on the evolutions of credit standards and demand for different counterparts. Their individual answers are then gathered to produce macro-economic indicators reflecting credit market conditions in the euro area. Nevertheless, the BLS balances of opinions do not enable to disentangle properly credit supply and demand as they reflect evolutions, and not levels, of credit standards and credit demand perceived by bankers. Besides, evolutions of BLS indicators and actual credit market data may be difficult to relate.

This paper expands previous studies by proposing an original estimation method, which enables to disentangle and estimate, in quantitative terms, credit supply and demand levels. A dynamic disequilibrium model linking solely net credit flows and BLS balances of opinions, a model never applied to our knowledge on these data, is considered. Disequilibrium models are defined as models, for which supply and demand cannot be observed simultaneously; only their minimum is observable. In this study, actual net credit flows are supposed to match the minimum of credit supply and demand at each observation date. Besides, the model includes dynamic components, implying the use of an innovative estimation method. This model is applied to data on SMEs' credit in France. This is particularly meaningful as French SMEs rely heavily on banks as credit intermediaries.

From this model, indicators on credit supply and demand of SMEs have been extracted. Results are consistent with studies and surveys on access to credit for French SMEs. On one hand, SMEs may have been credit rationed during the financial crisis, but only moderately and transitorily. On the other hand, if credit demand from SMEs has significantly decreased during both Lehman Brothers and the sovereign debt crisis, the demand appears still sluggish in the aftermath. Those results have been obtained using a parsimonious model due to the small sample available. As time goes by, this model may be enriched with other variables. Besides, as a growing attention is put on granular data, a dynamic model applied at a micro level relying on bank's qualitative answers to the BLS questionnaire could be explored.

I. Introduction

1. Disentangling credit supply and credit demand

Credit developments in the last years have been followed closely by decisions makers but simultaneous deterioration of banks' balance sheets and firms demand made it more difficult to design the most appropriate policies. The balances of opinions from the Bank Lending Survey, a qualitative survey conducted since 2003 at the Eurozone level, complement in a qualitative manner the usual quantitative data such as credit flows, to enlarge the range of data available to economic analysis. Nevertheless, quantitative and qualitative data on credit still do not enable to disentangle rigorously credit supply and demand.

This paper contributes to this objective, by linking qualitative and quantitative data to simulate credit supply and demand paths. Credit supply and demand to French SMEs are estimated through a dynamic disequilibrium model relating balances of opinions from the Bank Lending Survey and net credit flows. This article contributes to different strands of the literature. Firstly, even though Bank Lending Survey balances of opinions have already been used to explain the evolution of credit flows, to our knowledge, a methodology such as a dynamic disequilibrium model has never been proposed. Besides, several articles on the credit market have used a disequilibrium model but in its static form. This study relies on a dynamic form that allows the current supply and demand components to depend on their past values. Finally, few articles take advantage of the Bank Lending Survey to analyze the credit distribution to SMEs. However, the SMEs, including microenterprises, represent in France more than 99% of the enterprises, more than 50% of the jobs and around 44% of the value added.[3] Besides, SMEs are strongly dependent on the bank financing. As a consequence, the evolutions of credit to SMEs should be monitored closely.

For this purpose, several surveys on credit access of SMEs have been set up in the last years. Nowadays, for most European countries, perceptions of both bankers and enterprises on credit markets are collected and analyzed. After the implementation of the Bank Lending Survey, the European Central Bank in collaboration with the European Commission has set up in 2009 the semi-annual survey SAFE dedicated to financing conditions faced by SMEs; enterprises are asked to report their requested external financing and the financing obtained. For France, the Banque de France has decided firstly to launch a monthly edition of the Bank Lending Survey as of 2012, in addition to the quarterly one conducted under the aegis of the ECB, and secondly to conduct its own survey on small and medium-sized enterprises and mid-tier enterprises to assess their demand for financing and the credits obtained with respect to demands.

2. The Bank Lending Survey

The *Bank Lending Survey* has been set up by the Eurosystem in 2003, in the manner of those already carried out by Japanese and American central banks since 2000

[3] Source: French National Institute of Statistics and Economic Studies (INSEE).

(*Senior Loan Officer Opinion Survey on Bank Lending Practices at Large Japanese Banks*) and 1967 (*Senior Loan Officer Opinion Survey on Bank Lending Practices)* respectively. This qualitative survey, implemented in each euro area country, has been developed to enhance monetary policy-makers' knowledge on credit markets.

Each quarter, senior loans officers are asked to assess evolutions of credit supply and credit demand for different counterparts. Additional information on those evolutions is also provided, such as the underlying causes of these variations (credit factors : balance sheet constraints, external financing costs, competitive pressure, and demand factors such as the weight of other types of financing) and how credit standards are modified (variations of margins and amounts granted). Depending on the economic and regulatory environment questions may be added temporarily.

Senior loans officers give their opinion on the evolutions of credit standards by choosing among five modalities: "tightened considerably", "tightened somewhat", "remained basically unchanged", "eased somewhat", and "eased considerably". Similarly, evolutions of credit demand are assessed by bankers who choose among five modalities: "decreased considerably", "decreased somewhat", "remained basically unchanged", "increased somewhat", or "increased considerably".

In France, each quarter, major banking institutions give their opinions on various markets segments: credit to large enterprises, credit to SMEs, consumer loans and loans for house purchases. For each question, a balance of opinions is calculated from individual responses. The indicator of the evolution of credit standards (resp. the evolution of credit demand) is defined as the difference between the percentages of weighted answers relating a tightening (resp. an increase) and those relating an easing (resp. a decrease). Each individual answer is weighted by bank weight within the sample. The sample is designed to represent the French banking system: the representativeness rate of the BLS reaches 54% of the outstanding amount of credits to enterprises, 86% for loans for house purchases and 58% for consumer loans.

Since 2007, The Banque de France has been experimenting a monthly version of the ECB's Bank Lending Survey. The monthly questionnaire resumes the principal questions of the quarterly one on evolutions of credit supply and credit demand for the different counterparts; but bankers are asked to assess monthly evolutions instead of estimating quarterly ones. Since 2012, as credit markets require a close monitoring, the monthly Bank Lending Survey is published every month.

3. Previous studies

The Bank Lending Survey provides additional information on credit markets, allowing to disentangle credit supply evolutions from credit demand ones. Econometric models such as macroeconomic models linking credit cycles, business cycles and monetary policy may take advantage of this original information. Ciccarelli et al. (2010) estimate the impact of a monetary policy shock on GDP and inflation through the credit channel in the US and the euro area. For this purpose, a VAR model including BLS balances of opinions on credit demand and supply to represent the balance sheet channel and the bank lending channel respectively is estimated. According to their results, households reduce their credit demand due to constraints on their balance sheets whereas businesses credits may more probably be affected by banks' reduction of credit supply.

Besides, BLS balances of opinions have been frequently used as explanatory variables of the evolutions of credit flows, and those of GDP (De Bondt, Maddaloni, Peydro, & Scopel, 2010). From BLS responses, Hempell & Sorensen (2010) analyze the propagation of the financial crisis, and especially the impact of the worsening, during the crisis, of banks' financing capacity, on the outstanding amounts of loans to households and enterprises. Applying a cross-country panel-econometric approach, they show that even when controlling for pure demand effects, supply-side constraints can affect loan growth. For France, as shown by Lacroix & Montornès (2009), the slowdown of business loans was caused by a tightening of credit standards and then by a fall in demand. The evolutions of credit to households were primarily explained by credit demand. Additionally, from the deep structure of the questionnaire, precise analyses of which factors have influenced the changes in credit standards and demand during the crisis have also been frequently presented.

Furthermore, there is a growing interest for individual banks responses to the Bank Lending Survey. Del Giovane, Nobili and Signoretti (2013), following Del Giovane, Eramo and Nobili (2011) estimate a structural econometric model to assess the impact of demand and supply factors on the cost and the dynamics of lending at the bank level. They provide additional evidence on the effects of the sovereign debt crisis on the credit market in Italy. Blaes (2011), using a panel approach based on a dataset matching individual responses to the BLS and micro data on loan quantities and prices, finds that credit supply and demand both contributed to the fall in bank lending in Germany during the crisis years.

In this study, the BLS balances of opinions are once more used as proxies of the credit supply and demand. However, the econometric model applied in this case, a disequilibrium model, differs from those of previous studies relying on the BLS. This methodology, in its static form, has already been applied to credit markets. Pazarbasioglu (1996) assessed the possible existence of a credit rationing in Finland due to the banking crisis of 1991. Similarly, the possibility of a credit crunch following the Asian crisis has been examined by E.G. Baek (2005). Finally, Hurlin & Kierzenkowski (2003) rely on this specification to model the loans growth rate in Poland. Generally, model inputs are quantitative macroeconomic variables such as interest rate spreads, GDP and indicators of healthiness of banks' balance sheets. Nevertheless, the choice of these variables may be controversial as they include information on both credit demand and supply.

Besides, following the last financial crisis, several publications focused on the financial constraints faced by European SMEs, at a micro and macro levels relying on quantitative as well as qualitative data. Ferrando & Mulier (2013) proposed a non parametric matching procedure to match individual responses to the SAFE survey with balance sheet information. Their goal is to evaluate the probability for a firm to be financially constrained according to its financial characteristics. Disequilibrium models have also been used for models at a micro level. For France, Kremp & Sevestre (2013), relying on a static "Tobit" disequilibrium model applied at the firms' level, show that the evolutions of credit flows to SMEs during the crisis were not caused by a credit rationing but more probably by a decreasing credit demand.

This study proposes an innovative approach, relying only on BLS balances of opinions considered as indicators of pure credit demand and supply. Besides, this approach, a dynamic disequilibrium model, differs from the previous studies; this methodology is more appropriate to circumvent the fact that BLS variables reflect the variations of credit demand and supply and not their levels. The model is applied on balances of opinions on credit standards and credit demand of French SMEs. As they rely heavily on the banking system for their financing, monitoring their access to credit markets has become a major challenge.

The model will be outlined within section 2 and the results will be presented in Section 3. Section 4 concludes.

II. Model description

1. A dynamic disequilibrium model

Since the 70s and the founding works of Fair & Kelejian (1974), disequilibrium models, as a limited dependent variable models, have become a broad research topic. As one of them, the cornerstone work of Maddala & Nelson (1974) proposing an estimation method for parameters based on the maximization of a full information likelihood function (FIML), raised much interest. At first, disequilibrium models, in their static form, were defined as models for which demand and supply are not observed simultaneously, only the minimum is, and both variables are approached by exogenous variables. Other models were then derived from the original ones, adding for instance an equation on prices, which permitted to identify the limiting variable between the supply and demand components. Nevertheless, estimation methods were not yet appropriate to estimate disequilibrium models with a dynamic component, allowing to take into account serial correlation or to introduce a lagged dependent variable in the demand or supply equation.

At the end of the 80s, Laroque & Salanié (1989; 1994) proposed a new estimation method for a static disequilibrium model in which parameters are estimated by minimizing a simulated pseudo maximum likelihood function of order 2 (SPML2). This estimation method showed comparable estimation and asymptotic properties as the FIML method. Besides, this method was found more flexible; instead of estimating explicitly the likelihood function, a simplified likelihood function is considered by assuming that, the observed variables, the minimum of the supply and demand, are well described by their two first moments. The two first moments are estimated by performing simulations of the supply and demand components. Besides, as opposed to the FIML approach, this estimation method may also be used to estimate a dynamic disequilibrium model. Laroque & Salanié (1993; 1996) have tested and then applied this estimation method to a dynamic disequilibrium model with a lagged dependent variable within the demand equation.

At the end of the 90s, other approaches to estimate a dynamic disequilibrium model were developed by Lee (1997) and Manrique & Shepard (1998). Lee proposed a simulation method, a recursive algorithm to estimate a likelihood simulator. Manrique & Shepard proposed an alternative method relying on Bayesian simulations. Other methods seem to outperform Laroque & Salanié (1993) in terms of the efficiency of the estimators. Nevertheless the Laroque & Salanié method is more flexible and easier to implement.

2. Specification of the model

In the present study, the estimation method proposed by Laroque & Salanié (1993) is considered to estimate a dynamic disequilibrium model with lagged dependent variables in both equations. The credit demand d_t and credit supply s_t equations are estimated from lagged BLS balances of opinions on credit demand BLS^D_{t-i} and credit supply BLS^S_{t-j}. Both variables are supposed to be strongly exogenous. Furthermore, the observed variable y_t, i.e. the net credit flows to SMEs, is defined as the minimum between the supply and demand components:

$$(1)\ \begin{cases} \boldsymbol{d_t = \alpha_1 + \gamma_1 d_{t-1} + \beta_1\, BLS^D_{t-i} + \varepsilon_{1,t}\ where\ \varepsilon_{1,t} \sim \mathcal{N}(0, \sigma_1^2)} \\ \boldsymbol{s_t = \alpha_2 + \gamma_2 s_{t-1} + \beta_2 BLS^S_{t-j} + \varepsilon_{2,t}\ where\ \varepsilon_{2,t} \sim \mathcal{N}(0, \sigma_2^2)} \\ \boldsymbol{y_t = \min(d_t, s_t)} \end{cases}$$

The residuals $\varepsilon_{1,t}$ and $\varepsilon_{2,t}$ are assumed to be independently and normally distributed. An alternative model with a non-zero cross-correlation between the two residuals was also estimated; the correlation parameter was nevertheless not significant. The parameters $((\alpha_k)_{k\in\{1,2\}}, (\beta_k)_{k\in\{1,2\}}, (\gamma_k)_{k\in\{1,2\}}, (\sigma_k)_{k\in\{1,2\}})$ must be estimated.

From this dynamic model, a pseudo model can be derived; for which the observed variable yt is defined from its two first moments: its mean $\mathbb{E}[y_t|x_t]$ and its variance $\mathbb{V}[y_t|x_t]$):

$$(2)\quad \boldsymbol{y_t = \mathbb{E}[y_t|x_t] + \eta_t\ where\ \eta_t \sim \mathcal{N}(0, \mathbb{V}[y_t|x_t])}$$

These moments can be explicitly calculated for a static disequilibrium model but not for the present dynamic disequilibrium model. As a consequence, they must be estimated by performing simulations. For each time t in [1;T], H simulated trajectories[4] of demand and supply variables are estimated and, in this way, H simulated values of the observed variable yt. For this purpose, 2H*T values $(u^h_{i,t}, i \in \{1,2\}, h \in [\![1;H]\!], \mathrm{t} \in [\![1;\mathrm{T}]\!])$ are drawn from a standard normal distribution. These values, independently distributed according to t and h, are then used to simulate H values of the credit demand component d^h_t, the credit supply s^h_t, and the net credit flows y^h_t:

$$(3)\ \begin{cases} \boldsymbol{d^h_t = \alpha_1 + \gamma_1 d^h_{t-1} + \beta_1\, BLS^D_{t-i} + \sigma_1\, u^h_{1,t}} \\ \boldsymbol{s^h_t = \alpha_2 + \gamma_2 s^h_{t-1} + \beta_2 BLS^S_{t-j} + \sigma_2\, u^h_{2,t}} \\ \boldsymbol{y^h_t = \min(d^h_t, s^h_t)} \end{cases}$$

From these H values y^h_t, the first two simulated moments, the mean m^H_t and the variance v^H_t can be defined. In this case, as proposed by Laroque & Salanié (1993), moments chosen as inputs of the likelihood function (F^H_t, V^H_t) are moments of the

[4] The H parameter was set to 1200. Choosing fewer or more simulations has led to similar estimated values but this choice is an arbitrage between stability of results and convergence time.

instantaneous and lagged values of the simulated variable $Y_t^h = (y_t^h \;\; y_{t-1}^h)'$ to take into account the dynamic structure of the model:

$$(4)\;\; \boldsymbol{m_t^H = \frac{1}{H}\sum_{h=1}^{H} y_t^h \quad and\; F_t^H = (m_t^H\, m_{t-1}^H)'}$$

$$(5)\;\; \boldsymbol{V_t^H = \frac{1}{H-1}\sum_{h=1}^{H}(Y_t^H - F_t^H)\;(Y_t^H - F_t^H)^T}$$

The log-likelihood function l_T^H associated to the pseudo-model can be easily extracted from the previous equations. The likelihood function at time t l_t^H is defined as the probability density to observe y_t estimated from the pseudo-model. The log-likelihood function l_T^H, from which parameters are estimated by minimization, is then defined as the opposite of the sum of the logarithm of l_t^H:

$$(6)\;\; \boldsymbol{l_t^H = \frac{1}{\sqrt{\det V_t^H}} \exp\left(-\frac{1}{2}[Y_t - F_t^H]^T {V_t^H}^{-1}[Y_t - F_t^H]\right) \quad with\, Y_t = (y_t \;\; y_{t-1})'}$$

$$(7)\;\; \boldsymbol{l_T^H = -\sum_{t=1}^{T} \log(l_t^H)}$$

The parameters were estimated by minimization of the log-likelihood function using a Levenberg-Marquardt algorithm.

Besides, the asymptotic distribution of the estimated parameters $\hat{\theta}$, where θ is defined as $\theta = ((\alpha_k)_{k\,\in\{1,2\}}, (\beta_k)_{k\,\in\{1,2\}}, (\gamma_k)_{k\,\in\{1,2\}}, (\sigma_k)_{k\,\in\{1,2\}})$ may be expressed as:

$$(8)\;\; \boldsymbol{\sqrt{T}\left(\hat{\theta} - \theta\right) \underset{T\to\infty}{\longrightarrow} \mathcal{N}(0, {J_H}^{-1} I_H {J_H}^{-1})}$$

Where J_H and I_H may be approached by:

$$(9)\;\; \boldsymbol{\widehat{J_H^T} = \frac{1}{T}\sum_{t=1}^{T} \frac{\partial F_t(x^t,\hat{\theta})}{\partial\theta}\, V_t(x^t,\hat{\theta})^{-1} \frac{\partial F_t(x^t,\hat{\theta})}{\partial\theta'} + \frac{1}{2T}\sum_{t=1}^{T} Tr(V_t(x^t,\hat{\theta})^{-1} \frac{\partial V_t(x^t,\hat{\theta})}{\partial\theta}\, V_t(x^t,\hat{\theta})^{-1} \frac{\partial V_t(x^t,\hat{\theta})}{\partial\theta'})}$$

Where the abbreviation Tr represents the trace function and xt the explanatory variables, i.e. the BLS balances of opinions.

And:

$$(10)\;\; \boldsymbol{\widehat{I_H^T} = \frac{1}{T}\sum_{t=1}^{T} \frac{\partial l_t(\hat{\theta})}{\partial\theta} \frac{\partial l_t(\hat{\theta})}{\partial\theta'} + \sum_{i=1}^{m_T}\left(1 - \frac{i}{m_T+1}\right)\frac{1}{T}\sum_{t=i+1}^{T} \frac{\partial l_t(\hat{\theta})}{\partial\theta} \frac{\partial l_{t-i}(\hat{\theta})}{\partial\theta'} + \frac{\partial l_{t-i}(\hat{\theta})}{\partial\theta} \frac{\partial l_t(\hat{\theta})}{\partial\theta'}}$$

The matrices $\widehat{J_H^T}$ and $\widehat{I_H^T}$ are derived from first derivatives of the means (F_t), variances (V_t), and pseudo log-likelihood functions (l_t) obtained by first differences. The $\widehat{J_H^T}$ formula has been proposed by Gourieroux et. al. (1984), the $\widehat{I_H^T}$ by Newey & West (1987). The value m_T is determined endogenously as proposed by Andrews (1991).

3. Initialization of demand and supply trajectories

As both the demand and the supply equations contain a lagged dependent variable, a set of initial demand and supply observations $(d_0^h, s_0^h)_{h \in [\![1;H]\!]}$ is needed for the first iteration (time 1). For this purpose, some assumptions are made. The dataset considered begins at the second quarter of 2006, nevertheless, the observations of the second and third quarters of 2006 are kept to initialize the trajectories of supply and demand variables and are resumed into the notation (y_{-1}, y_0). Supply and demand are assumed to be at equilibrium and equal to the observed variable y_{-1} before the first observation date of the sample.[5] As both credit and demand equations are not strongly persistent, this hypothesis seems acceptable. Indeed, at time 0, the explained parts of supply and demand can be expressed by:

$$(11)\quad \boldsymbol{d_{exp,0} = \alpha_1 + \gamma_1 y_{-1} + \beta_1 BLS^D_{-i}}$$

$$\boldsymbol{s_{exp,0} = \alpha_2 + \gamma_2 y_{-1} + \beta_2 BLS^S_{-j}}$$

From these expressions, the probability λ that the demand is the limiting state at 0 is:

$$(12)\quad \boldsymbol{\lambda = \Phi\left(\frac{s_{exp,0} - d_{exp,0}}{\sqrt{\sigma_1^2 + \sigma_2^2}}\right)}$$

The notation ϕ accounts for the distribution function of the normal distribution.

To simulate H values (d_0^h, s_0^h), a vector of H random variables $(v_2^h)_{h \in [\![1;H]\!]}$ is drawn from a standard uniform distribution. For each h, if $v_2^h \leq \lambda$, demand is assumed to be the limiting state and equal to y_0, otherwise demand is assumed to be in excess and the demand value must be simulated. For this purpose, the unexplained part of demand is drawn from a normal distribution truncated at $\frac{y_0 - d_{exp,0}}{\sigma_1}$:

$$(13)\ \boldsymbol{For\ each\ h,}\quad \begin{cases} \boldsymbol{if\ v_2^h \leq \lambda\ then\ d_0^h = y_0} \\ \boldsymbol{else\ d_0^h = d_{exp,0} + \sigma_1 \varepsilon_{1,0}\ where\ \varepsilon_{1,0} = -\phi^{-1}\left(v_1^h \phi\left(-\frac{y_0 - d_{exp,0}}{\sigma_1}\right)\right)} \end{cases}$$

For each h, a random value v_1^h is drawn from a standard uniform distribution to simulate the truncated normal distribution.

Symmetrically, if $v_2^h > \lambda$, supply is assumed to be the limiting state and equal to y_0, otherwise supply is supposed to be in excess and must be simulated, by drawing the unexplained part of supply from a normal distribution truncated at $\frac{y_0 - s_{exp,0}}{\sigma_2}$:

$$(14)\ \boldsymbol{For\ each\ h,}\quad \begin{cases} \boldsymbol{if\ v_2^h > \lambda\ then\ s_0^h = y_0} \\ \boldsymbol{else\ s_0^h = s_{exp,0} + \sigma_2 \varepsilon_{2,0}\ where\ \varepsilon_{2,0} = -\phi^{-1}\left(v_1^h \phi\left(-\frac{y_0 - s_{exp,0}}{\sigma_2}\right)\right)} \end{cases}$$

[5] This initial choice does not seem aberrant; the balances of opinions on credit demand and credit supply prior to 2006 have been quite stable or reflecting a thriving economic environment.

From this methodology, H values of (d_0^h, s_0^h) are simulated. These simulations initialize each iteration step of the optimization algorithm, as some prior estimation of the parameters values is needed to simulate these values.

4. Choice of initial parameters

The choice of appropriate initial parameters is crucial considering that the likelihood function is not bounded, and may diverge if at least one standard deviation tends to 0 or if only one state, the supply or the demand, is the limiting state over the time period of the sample. The initial parameters have been set following the methodology proposed by Hurlin & Kierzenkowski (2003).

A first set of parameters $((\alpha_k^1)_{k\in\{1,2\}}, (\beta_k^1)_{k\in\{1,2\}}, (\gamma_k^1)_{k\in\{1,2\}}, (\sigma_k^1)_{k\in\{1,2\}})$ is estimated by considering the following equations:

$$(15)\quad \begin{array}{ll} \boldsymbol{y_t = \alpha_1^1 + \gamma_1^1 y_{t-1} + \beta_1^1 \, BLS_{t-i}^D + \varepsilon_{1,t} = d_{exp,t}^1 + \varepsilon_{1,t}} & \boldsymbol{where\ \varepsilon_{1,t} \sim \mathcal{N}(0, \sigma_1^2)} \\ \boldsymbol{y_t = \alpha_2^1 + \gamma_2 y_{t-1} + \beta_2 BLS_{t-j}^S + \varepsilon_{2,t} = s_{exp,t}^1 + \varepsilon_{2,t}} & \boldsymbol{where\ \varepsilon_{2,t} \sim \mathcal{N}(0, \sigma_2^2)} \end{array}$$

From the results of the first estimation, the sample is divided into two subsamples. The first subsample is the demand one containing observations for time periods at which the demand side is more probably the limiting side (i.e. $d_{exp,t}^1 < s_{exp,t}^1$), and the second subsample contains the other ones (i.e. $d_{exp,t}^1 \geq s_{exp,t}^1$). The second set of parameters $((\alpha_k^2)_{k\in\{1,2\}}, (\beta_k^2)_{k\in\{1,2\}}, (\gamma_k^2)_{k\in\{1,2\}}, (\sigma_k^2)_{k\in\{1,2\}})$ is then estimated by regressing the variables yt from the first subsample on demand variables and those from the second subsample on supply variables. This set of parameters is then used to initialize parameters estimation.

5. Choice of lags for Bank Lending Survey variables

It is commonly assumed that evolutions of balances of opinions in the Bank Lending Survey precede those of quantitative data such as credit flows. Therefore, the balances of opinions must be delayed in the model equations. The lags i and j of BLS variables were initially determined by selecting, according to the AIC criterion, the best model of this form:

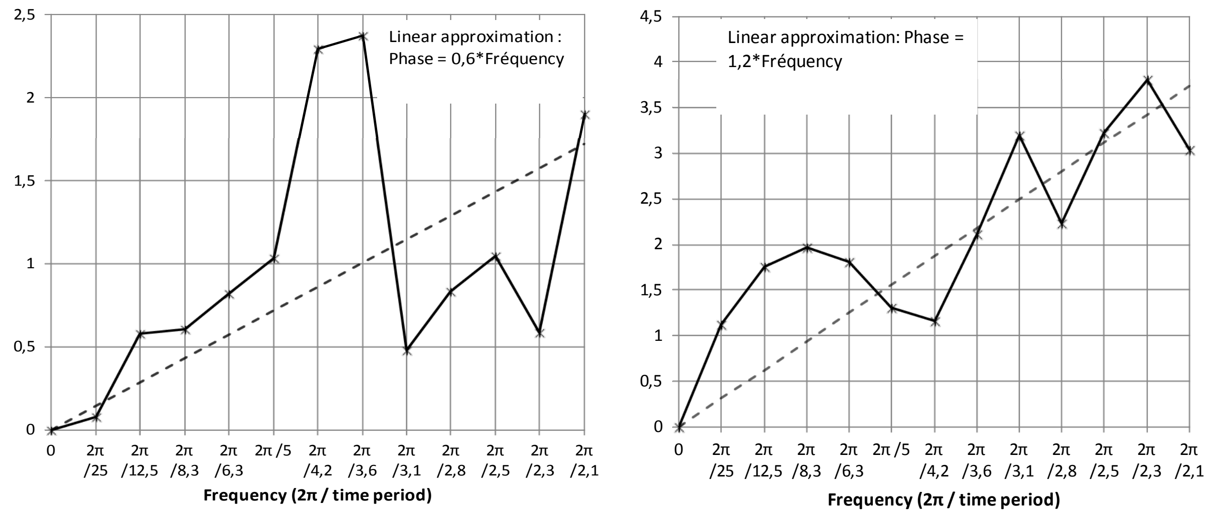
$$(16)\ \boldsymbol{y_t = \alpha\, y_{t-1} + \beta\, BLS_{t-i}^D + \gamma\, BLS_{t-j}^S + \varepsilon_t\ where\ \varepsilon_t \sim \mathcal{N}(0, \sigma^2)}$$

Where y_t represents net flows of credit and BLS_{t-i}^D and BLS_{t-j}^S account for balances of opinions on credit standards and demand respectively. The lags i and j can take any integer among {0,1,2,3}.

According to the AIC criterion, the best lags are 0 quarter for the demand component and 2 quarters for the supply component. This result is in line with the results obtained from an analysis in the frequency domain. From the Fourier transform of the cross-covariance between the net credit flows to SMEs and each BLS balance of opinions, the phase spectrum between the net credit flows to SMEs and each BLS balance of opinions can be extracted (Brocklebank & Dickey, 2003). The slope of phase spectrum corresponds to the time shift, in quarters, between the two variables. According to these results, the lag of the demand variable should be 0 or 1, and the lag of the supply variable should be 1 or 2.

Phase spectrum between BLS balances of opinions on credit demand to SMEs and net credit flows to SMEs (right figure) and phase spectrum between BLS balances of opinions on credit supply to SMEs and net credit flows to SMEs (left figure)

Figure 1



To meet both criteria, the AIC criterion and the frequency one, the selected lags are 0 for the demand component and 2 for the supply one.

III. Results

1. Dataset description

The approach favored in this study is a parsimonious model relying on few variables: the Bank Lending Survey balances of opinions and the net credit flows to SMEs. The two balances of opinions selected from the Bank Lending Survey represent banks' opinion on the quarterly variation of credit standards for SMEs and the quarterly variation of credit demand from SMEs. These balances of opinions are available from 2003 Q1 to 2014 Q1.The time series of net credit flows to SMEs is defined as the net variation of outstanding amounts of credits declared monthly by credit institutions and gathered into the Central Credit Register Database of the Banque de France. Data on outstanding drawn loans are reported by credit institutions on a monthly basis and at a firm level and then aggregated according to the category of their legal units. Only firms with a credit debt above 25 000 euros are reported.

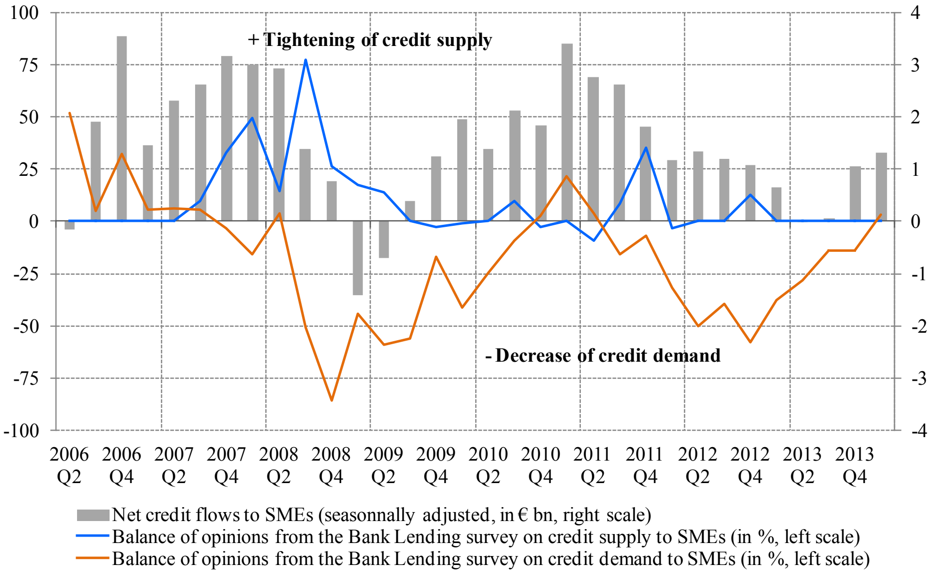
The definition of SME used in this paper is based on the usual combination of criteria: number of employees less than 250, annual turnover less than 50 million euros, and total balance sheet assets less than 43 million euros. It does not strictly stick to the new statistical definition of an enterprise published in the implementing regulation of the LME (French law for the Modernization of the Economy) and used by the Banque de France in its publications since 2013, because back data consistent with this definition are not yet available. The time series of credit flows is available on a quarterly basis from 2006 Q2 to 2014 Q1. The net credit flows have been seasonally adjusted with the procedure X12 of SAS Software; besides, responses given to the Bank Lending Survey do not present seasonality.

According to the BLS, credit standards to SMEs have remained stable from 2006 Q2 to 2007 Q3. During the financial crisis, credit standards have been strongly but transitorily tightened, due to balance sheet constraints faced by banks and the weakened economic environment. Since 2010, credit standards have been relatively stable with some punctual tightening peaks in 2011 Q4 and 2012 Q4. The evolutions of credit demand balances of opinions are close to those of macroeconomic variables such as GDP annual growth rate, or qualitative indicators such as evolution of cash flows positions of SMEs[6]. Credit demand has been quite stable or even improving until 2008 Q1, then credit demand kept falling until 2008 Q4. From 2008 Q4 to 2010 Q4, bankers continue to report a decreasing credit demand even though credit demand variations were less and less negative. The credit demand variations became punctually positive in 2011 Q1. From 2011 Q2 onwards, credit demand started to fall again, and recovered a positive level only in 2014 Q1. Over the period of estimation, the average balance of opinions on credit supply (resp. credit demand) to SMEs is positive (resp. negative), reflecting the overall deteriorated economic environment. Besides, the balances of opinions on credit demand are rather volatile compared to the credit supply ones.

The net credit flows to SMEs remain positive for almost all quarters, the outstanding amounts of credit to SMEs decreased only during the first semester of 2009. Nevertheless, net credit flows slowed down sharply from 2007 Q4 to 2009 Q1 and from 2011 Q1 to 2013 Q3.

Net flows of credit to SMEs (in € bn) and BLS balances of opinions related to SMEs credit supply and demand

Figure 2



[6] The Banque de France business survey includes questions on cash flows positions of SMEs since 2003.

Average values and standard deviations of the variables over the period 2006 Q2–2014 Q1		Table 1
	Average value over the period 2006 Q2–2014 Q1	Standard deviation over the period 2006 Q2–2014 Q1
Net credit flows to SMEs, seasonally adjusted, in € bn	1.5	1.2
Balance of opinions from the BLS on credit supply to SMEs	9.0	18.0
Balance of opinions from the BLS on credit demand from SMEs	–17.5	29.7

As mentioned by Kierzenkowski & Hurlin (2003), the use of non-stationary time series as inputs of the models may lead to counter-intuitive results; the time series must be stationary (Laroque & Salanié, 1993). The stationarity of the time series has been tested with the ERS (Elliott, Rothenberg, and Stock) test, more appropriate for small samples. For all variables, the null hypothesis of non stationarity is rejected at a 10% threshold.

2. Results

This study falls within the same category as Kremp & Sevestre (2013), the search for the identification of the origin of SMEs' credit constraints. Besides, as opposed to them, the present approach is macroeconomic, which prevents a detailed analysis of the limiting constraints of the market but may help to bring into light easily available macroeconomic indicators of the credit market conditions.

Table 2 presents the estimated values of the parameters of the dynamic disequilibrium model previously specified. All parameters are significant at a 10% threshold and have the expected sign. The BLS parameter within the demand equation (resp. supply equation) has a positive sign (resp. negative sign) reflecting the increase of credit flows following an increase in demand (resp. an easing of credit standards). The BLS supply parameter exhibits a higher absolute value than the BLS demand parameter. Parameters associated with the lagged dependent variables are significantly lower than 1, which means that a transitory shock on both equations will be attenuated after a few quarters. Besides, the supply component is more persistent; indicating that the effects of a supply shock will last longer than those of a demand one.

As far as the magnitude of the effects is concerned, a demand shock at the quarter t, materialized by a fall in the demand balance of opinions of 10% on a specific quarter, is accompanied by a decrease of credit flows of 170 €m instantaneously and a cumulated loss over 5 quarters reaching 370 €m. A supply shock at quarter t of the same magnitude has larger effects: a rise in the supply balance of opinions of 10%, is followed by a decrease of 250 €m of credit flows after 2 quarters and a cumulated loss of 800 €m over 8 quarters.

Estimated values and standard deviations of the parameters		Table 2
Estimated coefficients and standard deviations	Demand equation	Supply equation
Constant value α	1.15	0.97
	(0.31)	(0.56)
BLS parameter β	0.017	–0.025
	(0.002)	(0.01)
Parameter of the lagged dependent variable γ	0.56	0.70
	(0.13)	(0.13)
Standard deviation of the residuals σ	0.46	0.91
	(0.12)	(0.45)

These first results do not reveal detailed information on the trajectories of the credit supply and demand components. For this purpose, average trajectories are estimated from the 1200 simulated trajectories used to estimate the parameters within the SPML2 algorithm. Considering the average of the initial distributions of supply and demand ($\hat{d}_0^m, \hat{s}_0^m$), average trajectories may be estimated iteratively:

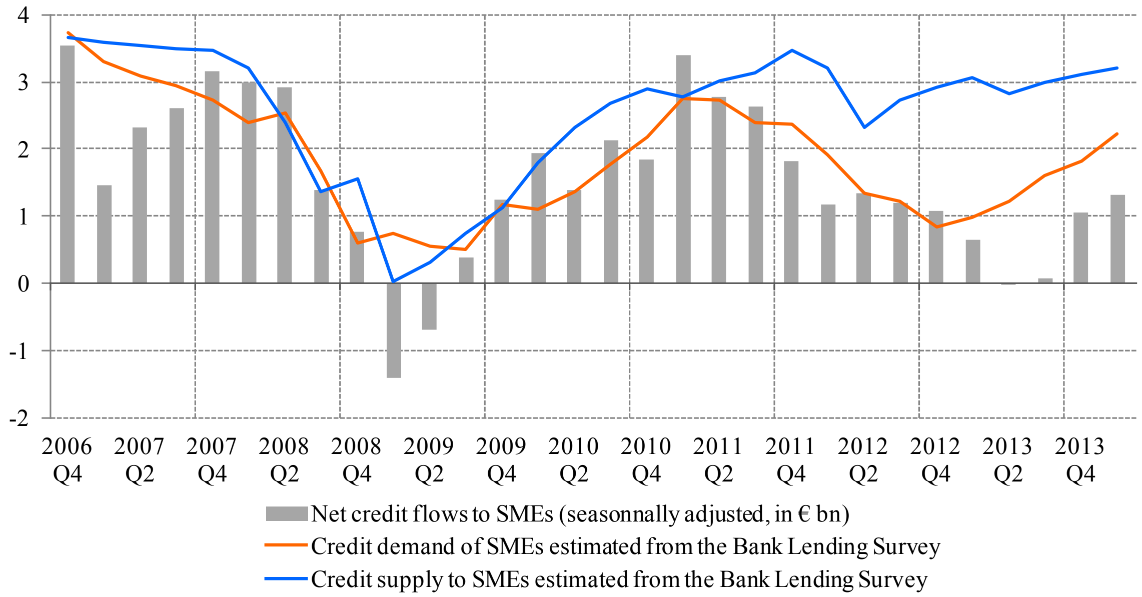
$$(17)\ \boldsymbol{\hat{d}_t^m = \hat{\alpha}_1 + \hat{\beta}_1\, BLS_t^D + \hat{\gamma}_1 \hat{d}_{t-1}^m}$$
$$\boldsymbol{\hat{s}_t^m = \hat{\alpha}_2 + \hat{\beta}_2\, BLS_t^S + \hat{\gamma}_2 \hat{s}_{t-1}^m}$$

The average trajectories of credit supply and demand from 2006 Q4 to 2014 Q1 are reported on the figure below. From these results, credit demand from SMEs has more probably limited credit flows between 2006 Q4 and 2008 Q1. Nevertheless, credit supply fell from 2008 Q1 to 2009 Q1. Following this sharp decline, supply has probably limited credit flows at least during the first semester of 2009. In 2010, both credit demand and supply have recovered their pre-crisis levels; however the demand started to fall again from the end of the first semester of 2011 to the end of 2012. Since 2013 Q1, credit demand has been increasing, but still seems to limit credit flows. These results are consistent with the findings of Kremp & Sevestre (2013) for France on micro data. All in all, supply constraints on credit to SMEs have materialized but on a very short and specific period in the aftermath of the financial crisis.

Besides, according to the model specification, the minimum between the credit demand and the credit supply estimated should be equal to the net credit flows. The trajectories of the minimum between the explained parts of credit demand and credit supply is nevertheless sometimes quite different from the net credit flows observed. This reflects the fact that residual errors (the unexplained part of both supply and demand equations) can be large for some periods. At this point, it should be noted that although our model allows for very rich dynamics, the "true" explanatory factors are reduced to a minimum. Besides, these factors (bankers' assessment on the current evolutions of credit flows) are by definition less precise than hard data. It thus appears that the ability of the model to fit the path of loans to SMEs over the period 2006–2013 is rather encouraging for further work.

Net credit flows to SMEs and average trajectories of credit supply and demand estimated

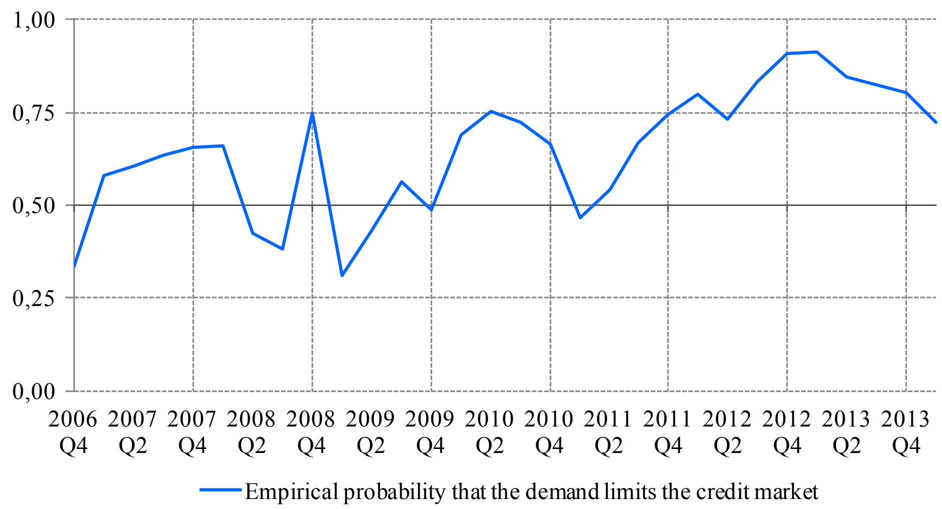
Figure 3



The probabilistic nature of the model may also be represented through the probability to be in one regime such as the credit demand regime. The empirical probability that the demand is the limiting regime is defined for each time as the ratio of credit demand simulated trajectories lower than credit supply simulated trajectories over the number of simulated trajectories. This representation also highlights periods for which the spread between credit demand and credit supply is significant. The period 2008–2009 is quite disrupted, making it hard to conclude on the existence of a credit rationing during this period.

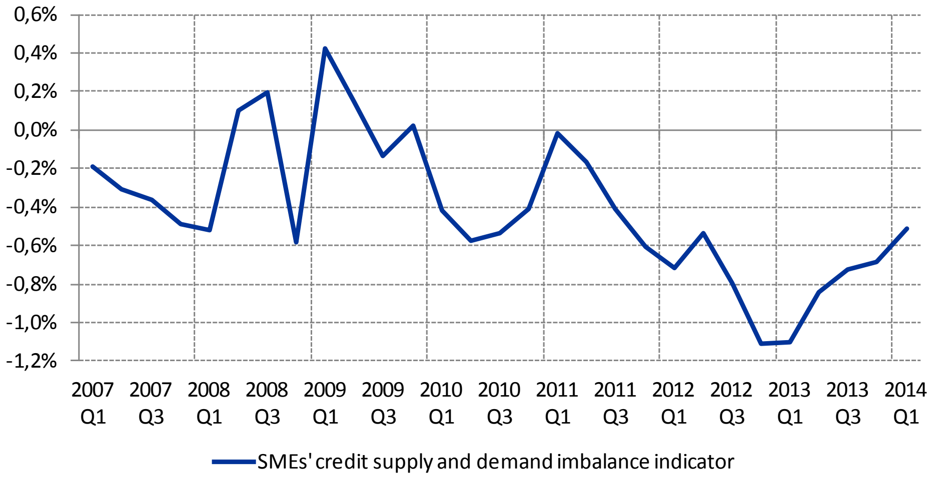
Empirical probabilities that the credit demand limits the credit market

Figure 4



Finally the spread between the credit supply and credit demand trajectories can be interpreted as a loss relatively to a “balanced” credit distribution for which credit demand and credit supply are equal. Imbalances between SME’s credit supply and demand can be measured by the distance between the average credit supply and credit demand trajectories, normalized by the outstanding amounts of credits at the previous quarter. According to this definition, the market is imbalanced by demand (resp. supply) when this rate is negative (resp. positive), and the imbalance is all the more important as the absolute rate value is higher. According to this indicator, the quarterly growth rate of credits to SMEs for 2014 Q1 could have been higher up to 0.5% if credit demand had been equal to credit supply.

SMEs credit supply and demand indicator Figure 5



3. Conclusion and future work

Credit supply and credit demand from French SMEs have been estimated using a dynamic disequilibrium model. Simulated trajectories show that French SMEs have only been moderately and transitorily credit rationed in the aftermath of the financial crisis. Indeed, credit demand from SMEs seems to have sharply decreased during the Lehman Brothers crisis and during the sovereign debt crisis. These evolutions are in accordance with surveys conducted by the Banque de France (Guinouard, Kremp, & Randriamisaina, 2013). French SMEs do not currently encounter strong difficulties to be financed, but their credit demand is still sluggish.

Besides, this model is an innovative approach to interpret information embedded within BLS balances of opinions. From these results, new indicators, such as the probability to be in a credit demand limiting state or the loss due to the imbalance on the credit market, are proposed.

Furthermore, for the sake of simplicity, the model specification is quite parsimonious given the size of the sample. Nevertheless, as time goes by, this model could be enriched with other macroeconomic variables to reduce the unexplained part of the evolutions of credit flows, especially around turning points.

References

Andrews, D. (1991). Heteroskedasticity and autocorrelation consistent covariance matrix estimation. *Econometrica* , 817–858.

Baek, E. (2005). A Disequilibrium Model of the Korean Credit Crunch. *The Journal of the Korean Economy , 6* (2), 313–336.

Blaes, B. (2011). Bank-related loan supply factors during the crisis: an analysis based on the German bank lending survey. *Deutsche Bundesbank Discussion Paper, Series 1: Economic studies, No 31/2011* .

Brocklebank, J. C., & Dickey, D. A. (2003). *SAS for Forecasting Time Series*. SAS Institute, Cary NC.

Burguete, J., Gallant, A., of North Carolina (System). Institute of Statistics, U., & University, N. C. (1980). *On unification of the asymptotic theory of nonlinear econometric models*. Citeseer.

Ciccarelli, M., Maddaloni, A., & Peydro, J. (2010). Trusting the bankers: A new look at the credit channel of monetary policy.

De Bondt, G., Maddaloni, A., Peydro, J., & Scopel, S. (2010). The euro area Bank Lending Survey matters: empirical evidence for credit and output growth.

Del Giovane, P., Nobili, A., & F.M., S. (2013). Supply tightening or lack of demand? An analysis of credit developments during the Lehman Brothers and the sovereign debt crises. *Banca d'Italia, Temi di Discussione* .

Fair, R., & Kelejian, H. (1974). Methods of estimation for markets in disequilibrium: a further study. *Econometrica* , 177–190.

Ferrando, A., & Mulier, K. (2013). Firms' Financing Constraints: Do Perceptions Match the Actual Situation? *ECB Working paper series no 1577*.

Giovane, P., Eramo, G., & Nobili, A. (2011). Disentangling demand and supply in credit developments: a survey-based analysis for Italy. *Journal of Banking & Finance*.

Gourieroux, C., Monfort, A., & Trognon, A. (1984). Pseudo maximum likelihood methods: Theory. *Econometrica* , 681–700.

Guinouard, F., Kremp, E., & Randriamisaina, M. (2013). Accès au crédit des PME et ETI: fléchissement de l'offre ou moindre demande ? Les enseignements d'une nouvelle enquête trimestrielle auprès des entreprises. *Bulletin de la Banque de France n°192*.

Hempell, H., & Sorensen, C. (2010). *The impact of supply constraints on bank lending in the euro area: crisis induced crunching?* European Central Bank.

Hurlin, C., Kierzenkowski, R., & Institute, W. D. (2003). *Credit Market Disequilibrium in Poland: Can We Find what We Expect?: Non-stationarity and the'min'Condition*. William Davidson Institute.

Kremp, E., & Sevestre, P. (2013). Did the crisis induce credit rationing for French SMEs? *Journal of Banking & Finance, vol 37(10)* , 3757–3772.

Lacroix, R., & Montornès, J. (2009). Analyse de la portée des résultats du Bank Lending Survey au regard des données de crédit. *Bulletin de la Banque de France* (178), 21–33.

Laroque, G., & Salanié, B. (1994). Estimating the canonical disequilibrium model:: Asymptotic theory and finite sample properties. *Journal of Econometrics , 62* (2), 165–210.

Laroque, G., & Salanié, B. (1989). Estimation of multi-market fix-price models: an application of pseudo maximum likelihood methods. *Econometrica* , 831–860.

Laroque, G., & Salanié, B. (1993). Simulation-based estimation of models with lagged latent variables. *Journal of Applied Econometrics , 8* (S1), S119–S133.

Laroque, G., & Salanié, B. (1996). Un modèle de déséquilibre de la courbe de Phillips en France et en Allemagne. *Annales d'Economie et de Statistique* , 1–28.

Lee, L. (1997). A smooth likelihood simulator for dynamic disequilibrium models. *Journal of econometrics , 78* (2), 257–294.

Maddala, G., & Nelson, F. (1974). Maximum likelihood methods for models of markets in disequilibrium. *Econometrica* , 1013–1030.

Manrique, A., & Shephard, N. (1998). Simulation-based Likelihood Inference for Limited Dependent Processes. *Econometrics Journal , 1* (1), 174–202.

Newey, W., & West, K. (1987). A simple, positive, semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica* , 55, 703–708.

Linking qualitative survey responses with quantitative data

Methodology, quality and data analysis from the matching of the ECB/EC Survey on Access to Finance of Enterprises and the Amadeus database

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Abstract

Timely, comparable, and good quality information on micro, small and medium-sized enterprises (SMEs) is scarce. Business surveys partially fill this gap by providing timely and harmonised data. However, there are some limitations when a survey is conducted via telephone, given the restricted length of interview and respondent's difficulties in answering questions related to the accounting concepts or statistical classifications. In this respect business registers containing financial information – even though the timeliness is less than optimal – are valuable enhancements to qualitative surveys.

This paper presents the results from the matching of the European Commission & ECB Survey on Access to Finance of Enterprises (SAFE) with Bureau van Dijk's Amadeus database. First, we describe the linking methodology, which preserves confidentiality of the respondents, and identify the most effective matching variables. Then, we examine the quality of the matching, highlighting varying success rates depending on the firm characteristics like size, sector and age. Finally, we also inspect the bias that may occur in the SAFE aggregated results when using the effectively matched sample.

Keywords: Business Registers, small and medium-sized enterprises, record linking, survey data

JEL classification: C81, C83

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1. Introduction

The information about how firms perceive their access to finance is very important for central banks, in particular, in an environment of impaired credit transmission. Small and young enterprises are by nature riskier and thus are relatively more affected by limited access to external financing (see Ferrando, Griesshaber 2011). Given that firms with less than 250 employees account for 99.8% of all firms in the euro area and that they create 69%[2] of jobs it is of high importance to analyse their financial situation in a timely manner.

The European Commission and the European Central Bank Survey on Access to Finance of Enterprises (SAFE) is a qualitative telephone survey conducted to collect timely information about the financing conditions for micro, small and medium enterprises, with a limited number of large companies also included for comparison purposes.[3]

The information collected from the survey has proven to be very useful in itself for the short-term and structural analysis of financial constraints. However, more analytical uses of the data require quantitative information about the enterprises, which would enable to measure the link between the opinion of the companies and their financial situation, in terms of turnover, indebtedness, profit developments, etc. Given the restricted length of the interview and respondents' difficulties in answering on the phone questions related to quantitative accounting elements, it is not feasible to collect this information from the company from the survey. Consequently, an alternative solution was needed: matching the results of the survey responses with individual financial information from the business register. The simplest approach would have been to use the same register as the one used for the sample that is Dun & Bradstreet (D&B). However, D&B does not have available a sufficient number of balance sheet and income account elements, whereas Bureau van Dijk's Amadeus database has the required information and covers a significant fraction of the population of enterprises. The exercise is thus a triple match, between the firms sampled from D&B, the firms participating in the survey, and the firms available in Amadeus.

Any attempt to match multiple and distinct databases will lead to some non-coverage error, arising from a variety of causes. The more different are the databases, and the more likely it is that many of the observations will either not be matched, or the quality of the match will be uncertain. An aggravating factor is the lack of a common and unique identifier shared by the different databases, which has to be circumvented by less reliable or imperfect solutions, requiring in turn an assessment of the correctness of the match.

Being able to cope with some non-matching error is in any case needed, but the statistician producing the matched data and the analyst using it first need to be convinced of the overall quality of the match and the biases or discrepancies introduced into the data by the matching process.

2 Eurostat, Structural Business Statistics, reference year 2011.

3 Firms are classified in the SAFE by the number of employees. Micro firms have 1 to 9 employees, small firms 10 to 49, medium-size firms 50 to 249 and large firms 250 or more.

An additional cause of concern is the imperfect nature of the business registers and the measurement error in the survey itself. Business registers do not necessarily contain all enterprises, and even if they do, balance sheet or profit and loss statements are missing for some of them. The information on the company size, the sector, the address might be outdated or incorrect. Survey respondents may, intentionally or not, provide the inaccurate answers to the questions in the survey, including the demographic characteristics like size and sector of the enterprise. When crossing the survey and the register data, it is not an easy task to determine which piece of information reflects the true state of the company.

Finally, in some countries, business registers are of high quality and cover all non-financial corporations. In other countries, information is partial and does not cover all types of firms; particularly smaller firms may be exempted from reporting annual accounts and thus may not be included in the registers. The matched data may therefore not be a "faithful" image of the enterprise population in the same way that the initial stratified random sample was. Analysts should therefore be aware of this issue and should have the means to at least estimate the effect of the matching on their results.

In the paper we present the analysis based on the enterprises that participated in SAFE at least ones between 3rd and 10th survey round (September 2010 to March 2014). While the 10th wave is the last available, the first two waves of the survey were conducted by another survey company and the enterprises that took part only in those early waves were not included in the matching exercise.

The objective of this paper is to present the methodology and the quality assessment of this matching. In section 2, we describe the datasets used and the methodology of the match. The outcome of the matching process is presented in section 3, while in section 4 we analyse the results of the matching, both within the matched data, with the main SAFE dataset, and with the Amadeus dataset itself. The last section concludes the paper.

2. Description of the data and matching methodology

2.1 Datasets

2.1.1 The ECB-EC SAFE

The Survey on Access to Finance of Enterprises (SAFE) is a qualitative telephone survey conducted for the European Commission and the European Central Bank to assess the developments of the financing conditions of firms. A subset of the survey is run by the ECB every six months in the euro area countries. A more comprehensive version of the survey with an extended questionnaire is run every year starting in 2013 (from 2009 to 2013, every two years), together with the European Commission. The survey is conducted by an external company with the sample drawn from D&B.

2.1.2 Amadeus

Amadeus is a proprietary database maintained by Bureau van Dijk (BvD) of comparable financial information for public and private companies in Europe. It contains balance sheet and profit and loss account information on 21 million companies, combining different information providers. Not all enterprises are covered by Amadeus, and even when companies are covered, financial information might not be present (see ECB 2013, p. 115 and onwards).

2.2 The matching methodology

For the business register to be suitable for the purpose of enriching the SAFE data it must cover with sufficient quality all euro area countries and enterprises of all sizes. While there are several databases on firm-level information, they are often specific to listed companies, the largest firms or to particular sectors. The selected provider – the Amadeus database of BvD – attempts to cover all firms, from micro to large.

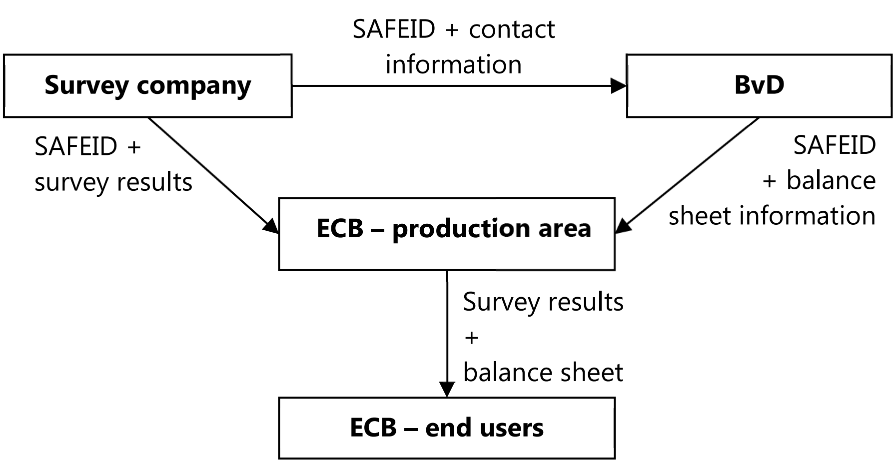
To make the matching possible, a special procedure was designed to ensure the privacy of respondents throughout the process, as this is part of the code of practice of the survey company and it has been promised to respondents during the interview. As a result, the ECB is not aware of the identity of the respondents, and cannot itself link the information from the survey to the name of the company and to external information.

Three parties are involved in the matching exercise:

- the survey company, which links the survey identification number (SAFEID) to the firm identification number (in most cases the tax ID number), name and address (and other identifiers) of each company;
- BvD, which links the firm ID, the name and address of a company with the BvD identifier (BvDEP ID), and thus to all balance sheet information available on that company in the Amadeus database, with the SAFEID provided by the survey company;
- the ECB, which links the survey responses with the balance sheet information sent by BvD through the SAFEID.

As a result, no party has the full set of information combining the confidential answers with the balance sheet information and the confidentiality of the respondents is preserved, which is graphically presented in the Figure 1.

Matching scheme preserving the confidentiality of the respondents — Figure 1



In order to link the companies from SAFE with those from Amadeus the information on tax ID number, company name, street, postcode, city and country are used. The variable 'outcome' identifies which information contributed to the successful match with the following categories:

1: unique match based on the tax ID number

2: unique match based on the company name, address, postcode, city and country

3: unique match based on the company name, postcode, city and country

4: unique match based on the company name and country

8: several matches based on one of the criteria, but no unique match

9: no match at all

The BvD uses the proprietary matching algorithm CINS (Company Identification Number Search) that is a mixture of exact matching (in case the company can be identified on the basis of the tax identification) and approximate matching, when the match is achieved on the basis of other information which may deviate to certain extent between two sources, such as combination of company name, address, postal code.

It should be noted that the concept is different from statistical matching, that aims at linking units which are similar with regard to certain characteristics and do not need to come from overlapping datasets. In case of SAFE dataset, this could be achieved by assigning the financial values from a donor company or averaging the values of companies in the same country, sector and size. Such attempts were undertaken for the SAFE dataset, where notably Amadeus database served as a population source for donor companies (see Ferrando, Mulier 2013). However, in this paper 'matching' refers to 'record linking' (following Eurostat 2013), where the aim is to connect the identical units from overlapping sources.

To link the records, the BvD matching algorithm first searches for potential candidates companies, which are later evaluated on the basis of similarity to the record in the source dataset. In the initial step, two datasets are 'normalized' by detecting and unifying references to legal forms, applying lowercase operator, replacing punctuation signs by a blank, converting synonyms to a simple form using synonyms dictionaries and skipping non-relevant words. The normalization rules are tailored to the specificities of the field (name, street, postcode, city, country, phone and fax, web and email, identification numbers) and may vary by country. Importantly, the BvD matching software supports local characters such as Hungarian, German or Polish and applies transliteration converting text into common and comparable script enabling cross-alphabet matching.

In the second step, the procedure applies so called n-grams, i.e. splitting text into a contiguous sequence of n characters. For matching of the SAFE, the BvD matching algorithm uses 3-grams, e.g. for "McDonald's Corporation" those are: MCD, CDO, DON, ONA, NAL, ALD, LDS, DSC, SCO, COR, ORP, RPO, POR, ORA, RAT, ATI, TIO, ION. Then the n-grams in both datasets are matched, but only the most relevant are selected and n-grams with many occurrences have lower weight in the comparison. On this basis, a proximity measure for each field from two sources is computed for given record. Then a weighted average is calculated for each record, where the weight is based on the probability of finding a company in the BvD database corresponding to the criterion being searched, i.e. the more occurrences are found, the less the field is significant. Finally, the accuracy is translated into the percentage matching score: A (excellent match – score at least 95%), B (good – score between 85 and 95%), C (fair – score between 75 and 85%), D (weak – score between 60 and 75%) and E (poor – score below 60%). Then the matching can result in: i) uniquely matched companies, ii) multiple matches of a SAFE respondent to two or more records from Amadeus, and iii) respondents not matched at all. A multiple match is considered as a single match, if among the multiple records there is only one with a high score of "excellent" or "good". In other cases the outcome is considered as no match.

3. Matching of the SAFE respondents

3.1 Overall outcome and quality of the matching process

Table 1 illustrates possible combinations of the outcomes, matching type and quality of the match for the SAFE respondents participating in the survey rounds from 3 to 10. There were almost 72,000 companies from all the countries participating in the survey (excluding Israel which is not available in Amadeus). The overall rate of successful matches is 83%. However, as will be discussed in the rest of the paper, this high matching rate hides variations by firm size and country that need to be understood and taken into account. Moreover, the high matching rate does not translate automatically into high availability of financial information at the firm level, a phenomenon that will also be highlighted in what follows.

Frequencies of matching outcomes

(for SAFE respondents participating in waves 3 to 10) Table 1

		Quality													
		Single match					Multi match – considered as single match		Multi match – considered as no match			No Match			
		A	B	C	D	E	A	B	C	D	E	C	D	E
Outcome	1	9818	562	330	23	1								
	2	21421	431	31	30		1770	2713						
	3	8714	377	3	4		2317	2327						
	4	4419					2497	1023						
	8								1470	1115	55			
	9											484	1203	1320

Source: SAFE-Amadeus match, authors' calculations.

3.2 Detailed analysis of the matching

In this section, we show how the successful matching rates vary across survey waves and by different characteristics of the firms.

The overall matching rate does not differ significantly across waves (Table 2). The tax ID, which is the best way to identify uniquely an enterprise, is available for the SAFE respondents only from wave 9 onwards. This is reflected in higher frequency of "single matches" counterbalanced by a drop in the category "multiple match – considered as single match" in the last two waves.

The number of pure "no matches" has stayed stable overall, with only a small drop in the last two waves. The overall single matching rate has increased from around 80% in the first waves to 87% in the last ones, as the availability of firm identifiers common to both the sample and Amadeus has increased.

Matching rates (%)

(by type of match across waves) Table 2

	Wave							
Type of match	3	4	5	6	7	8	9	10
Single match	51	52	61	69	64	64	77	75
Multi match – considered as single match	30	27	21	15	17	21	9	12
Multi match – considered as no match	7	8	11	5	4	3	5	3
No match	12	13	7	12	15	12	9	10

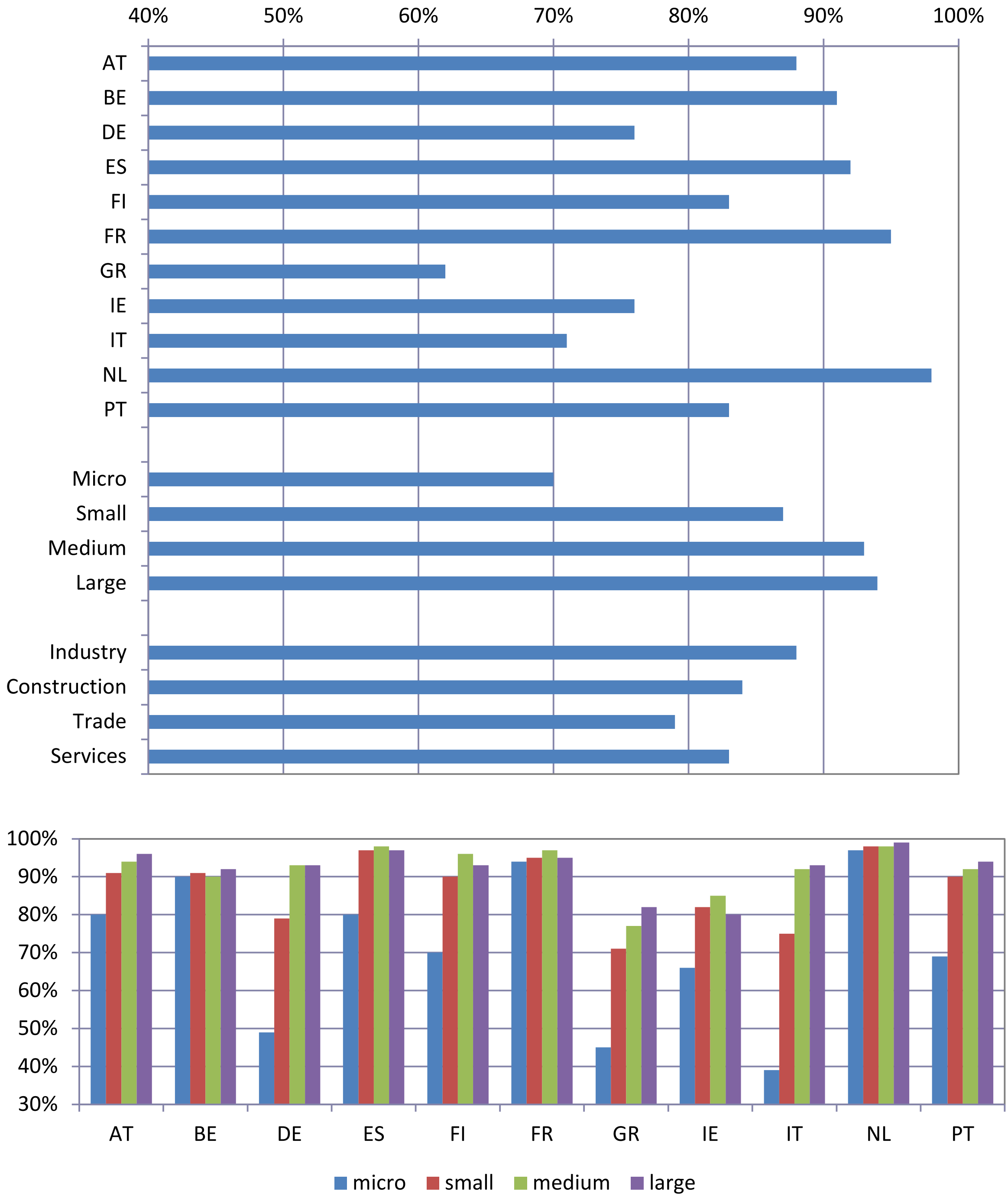
Source: SAFE-Amadeus match, authors' calculations.

Looking at the country breakdown the results are much more heterogeneous. Considering all waves jointly for the 11 largest euro area countries participating in the survey every 6 months, the success rates vary from over 90% in Belgium, Spain, France and the Netherlands to 62% in Greece. Significant differences also exist between the size classes, with large companies successfully matched in 94% cases compared to 70% for micro firms. The differences across the sectors are much less pronounced. The low matching rates for the micro companies are even more striking when analysing them at the country level. The rates below 50% were reported in Germany, Greece and Italy (Figure 2).

Matching rates by country, enterprise size and sector

Euro area, 11 largest countries, waves 3 to 10

Figure 2

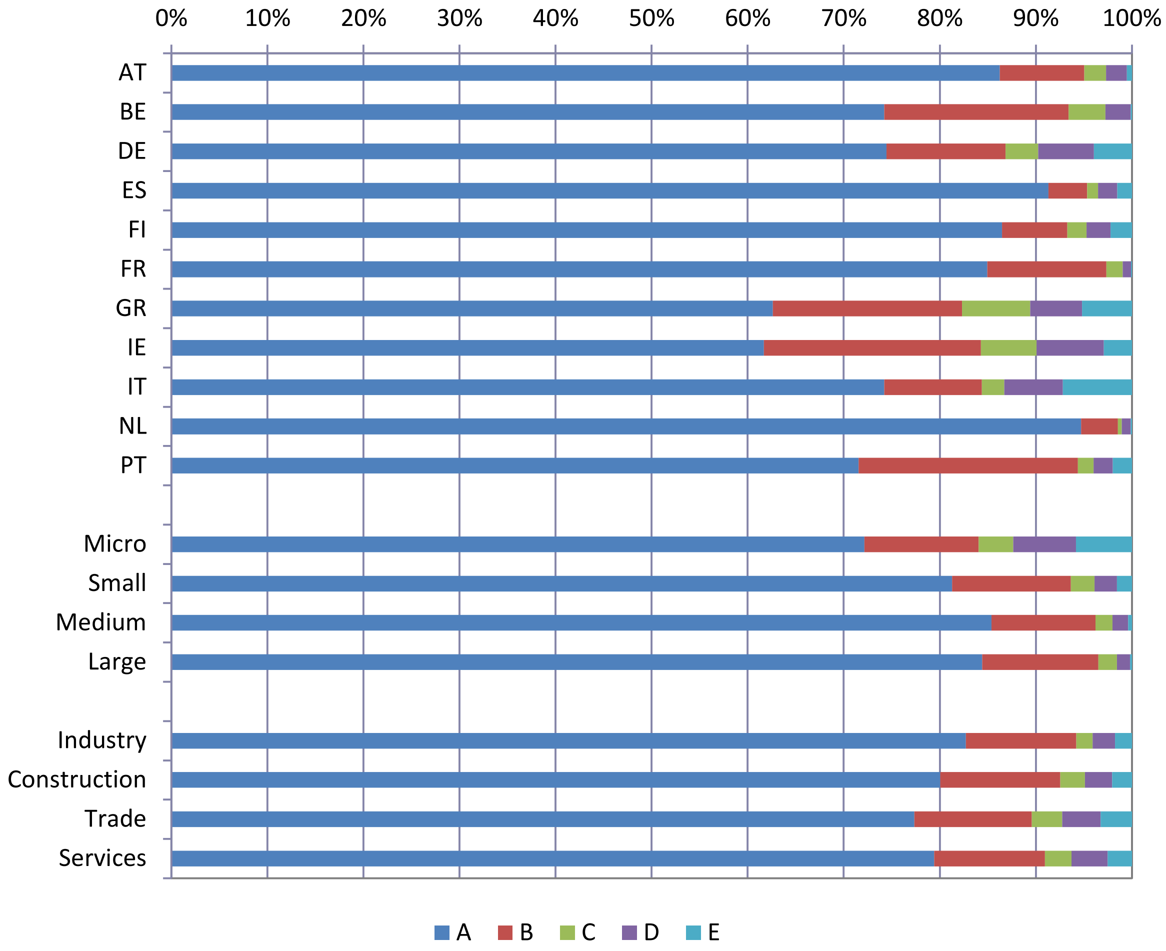


Source: SAFE-Amadeus match, authors' calculations.

Matching quality by country, enterprise size and sector

Euro area, 11 largest countries, waves 3 to 10

Figure 3



Source: SAFE-Amadeus match, authors' calculations.

4. Analysis of the matched data

4.1 Cross-validation of enterprise characteristics in SAFE and Amadeus dataset

Since the information on sector, size and age of the enterprise are available in Amadeus and they are also collected during the interview, in this section we verify the consistency of those main characteristics in both datasets. The statistics reported below are computed with reference to the period of the SAFE interview, i.e. the SAFE answers with regards to size, sector, age and turnover of the company are compared to the same variables from Amadeus reported for the year when the particular company was interviewed.[4] Consequently, the panellists are included as many times as they participated in the survey.

Sector information from Amadeus database is reported at the two digit level according to NACE Rev. 2 which was aggregated into the categories used in SAFE. The sectors are aligned in 72% of cases and there were a few instances only when it was not available in Amadeus. Concerning the size of the enterprises, measured by the number of employees and grouped into four classes, the categories overlap in 53% of cases with high percentage of companies with missing information in Amadeus. Excluding the records with the missing size, the same size classes were reported for 82% of companies.

Regarding the age, in 86% of instances the information is consistent between both sources. Most of the companies surveyed in SAFE are older than 10 years and for those the information coincides in 93% of cases. However, the younger the company and the smaller the brackets, the lower the consistency between two sources. It is also noticeable, that the respondents, who could not specify the year of incorporation during the interview belong mostly to the companies classified as older than 10 years in Amadeus. This can stem from the fact that the respondents might not be familiar with the details of setting-up the company which was created more than a decade before, especially if they have joined the company relatively recently.

As for the turnover, the variable available from Amadeus is originally continuous whereas in SAFE this information is collected in four brackets. For the non-missing observations, the categories overlap in 51% of the cases, while for as many as 38% of the companies the information is not available in Amadeus.

We also check if the lack of concordance of the categories in two dataset is related to the quality of the match. Indeed, for the single matches the share of the records with overlapping characteristics is slightly higher than for multiple matches, presumably because some companies were incorrectly linked (Table 3).

The concordance of the companies characteristics and the type of the match (%)

Euro area, 11 largest countries, waves 3 to 10 — Table 3

Match	Size			Sector			Age			Turnover			All firms
	0	1	9	0	1	9	0	1	9	0	1	9	
Multi – considered as single	24	21	27	25	22	37	27	23	44	26	22	25	23
Single	76	79	73	75	78	63	73	77	56	74	78	75	77
All firms	100	100	100	100	100	100	100	100	100	100	100	100	100

Note: 0 – characteristics belong to different categories in SAFE and Amadeus, 1- characteristics belong to same categories in both dataset, 9 – information is missing in Amadeus dataset.

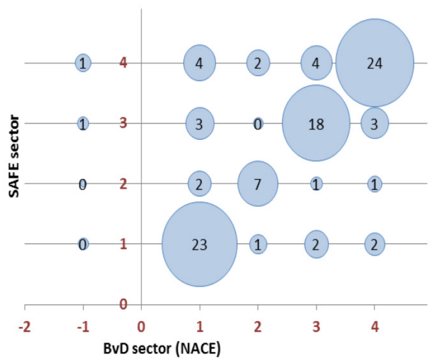
Source: SAFE-Amadeus match, authors' calculations.

[4] The reference year for wave 3 is 2010, and 2011 for waves 4 and 5. For all subsequent waves (6 to 10), the reference year is 2012, since later data are of poor coverage.

Comparison of sector, size, age and turnover from SAFE and BvD (in %)

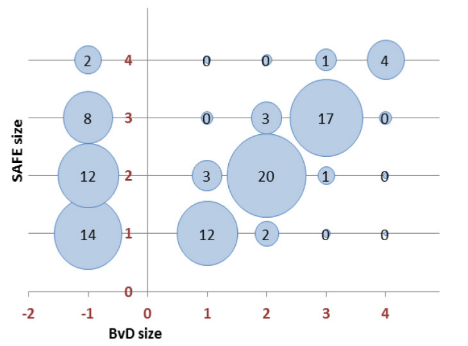
Euro area, 11 largest countries, waves 3 to 10 | Figure 4

Sector



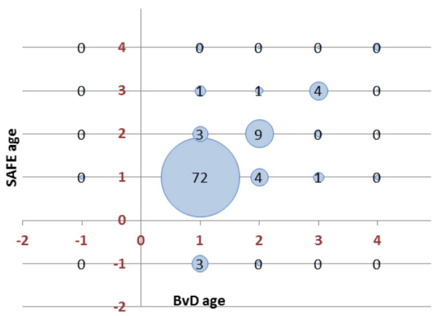
1 Industry
2 Construction
3 Trade
4 Services
-1 other or missing

Size



1 Micro
2 Small
3 Medium
4 Large
-1 missing

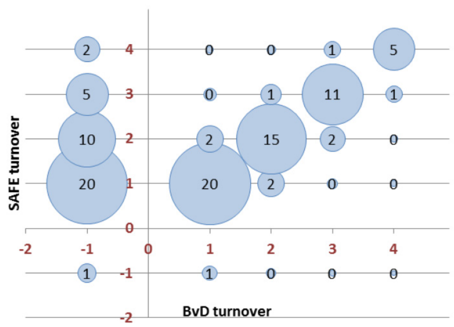
Age



1 More than 10 years
2 5 – 10 years
3 2– 5 years
4 Up to 2 years
–1 missing

Note: calculated from the year of incorporation for BvD.

Turnover



1 Up to € 2 million
2 € 2 – 10 million
3 € 10 – 50 million
4 Over€ 50 million
–1 missing

Source: SAFE-Amadeus match, authors' calculations.

4.2 Availability of financial information in Amadeus

4.2.1 Relative and effective availability within the matched enterprises

Although Amadeus includes a wide choice of financial variables, the quality of the information is not free of shortcomings. The most problematic is the large number of missing values, albeit relatively high matching rate of companies on the contact information. In this section we present the availability of various financial variables over time, by country and size class.

First, we rely on the Amadeus variable indicating the type of the reporting (the categories are presented in Table 4). In most cases (86%), the financial information are reported on unconsolidated basis, mainly because the consolidated account does not exist (see Table 4). Consolidated accounts are available only for 4% of matched records, meaning that they are part of a bigger enterprise. Observations with no financial data amount to only 3% of the matched dataset, while limited financial information is available for 7% of the companies. When looking at the breakdown by size class, it is visible that missing financial data are prevalent for the micro firms. As expected the large firms are those which report on the consolidated basis most frequently.

Type of accounts available across size classes (%)

Euro area, 11 largest countries, waves 3 to 10 — Table 4

	Micro	Small	Medium	Large	All firms
U1	78.8%	90.6%	86.3%	66.3%	84.1%
U2	0.2%	0.8%	2.2%	6.5%	1.5%
C1	0.1%	0.1%	0.9%	3.6%	0.6%
C2	0.4%	1.3%	5.3%	15.1%	3.3%
LF	13.7%	4.7%	3.6%	6.8%	7.1%
NF	6.8%	2.5%	1.7%	1.6%	3.4%
	100.0%	100.0%	100.0%	100.0%	100.0%

Code	Description
U1	Unconsolidated account of a company with no consolidated account
U2	Unconsolidated account of a company with a consolidated account
C1	Consolidated account of a company-headquarter of a group, aggregating all companies belonging to the group (affiliates, subsidiaries, etc.), where the company headquarter has no unconsolidated account
C2	Consolidated account of a company-headquarter of a group, aggregating all companies belonging to the group (affiliates, subsidiaries, etc.) where the company headquarter also presents an unconsolidated account
LF	Limited financial data
NF	No financial data

Source: SAFE-Amadeus match, authors' calculations.

In the second step, we turn to availability of the selected financial variables from balance sheet (total assets, working capital, cash and cash equivalent) and profit and loss account (net income, sales). Number of employees is also included as an example of non-financial variable. Amadeus provides the financial data for the period of last 10 years with different coverage per year. The values before the year of incorporation are not counted as missing. In addition, observations with missing information on the year of incorporation in both datasets were also excluded since it was not possible to determine whether the company existed in the reference period. When looking at the main financial variables, the period between 2006 and 2011 shows the best coverage. The last year 2013 contains hardly any information which stems from the fact that companies report the financial data with a considerable time lag varying from country to country (mostly of around 6 to

12 months). In addition, up to 3 months are necessary for the data to be incorporated in the final Amadeus database.[5]

From investigating the missingness patterns in matched data, it is apparent that the availability of the information at the record level is on both extremes. If a company reports financial statements, the quality is usually good - records with all 6 variables available appear most frequently, although in less than half of the matched sample. Observations with all analysed variables missing constitute almost 20% of the dataset, while additional for 10% of the companies missing values are justified, i.e. that the company did not exist at the reference period. From Table 5 is also visible that the balance sheet information is reported more diligently than profits and loss account. The difference in concept of sales and turnover[6] is minor, however, looking at the missingness patterns, it seems that sales are more frequently reported with other variables (the last two patterns shown in Table 5) and for that reason we exclude turnover in the subsequent analysis.

Missingness pattern

Euro area, 11 largest countries, waves 3 to 10 — Table 5

Total assets	Working capital	Cash & cash equivalents	Net income	Sales	Turnover	Nr of employees	Frequency	Percent
1	1	1	1	1	1	1	180524	37.40
0	0	0	0	0	0	0	91676	18.99
.	.	.	.	.	.	.	48852	10.12
1	1	1	1	1	1	0	46425	9.62
1	1	1	0	0	0	0	20634	4.27
1	1	1	1	0	0	1	17196	3.56
1	0	1	0	0	0	1	11640	2.41
1	1	1	0	1	1	1	9910	2.05
1	1	1	0	0	0	1	7311	1.51
0	0	0	0	0	0	1	6057	1.25
1	1	1	1	0	0	0	4545	0.94
1	0	1	0	0	0	0	4527	0.94
1	1	0	1	1	1	1	3447	0.71
0	0	0	0	0	1	1	3426	0.71
1	1	1	1	1	0	1	2873	0.60
11	9	10	6	5	5	9	459043	95.08

Note: 1 – information available, 0 – missing values (values should be reported) – justified missing values (company did not exist at the reference period)

Source: SAFE-Amadeus match, authors' calculations.

Heterogeneous coverage for the variables related to different statements is also visible in the breakdown of the availability by year of reference period (Table 6, only reference period as of the creation of a company is taken into account). Around 80% of successfully matched records have information on total assets and cash for the years with the best coverage (2006-2011), while sales are reported for around 60% of companies. All six variables are available for 47% of matched observations.

[5] Amadeus Online User Guide.

[6] Turnover (operating revenues) is the sum of net sales, other operating revenues and stock variations.

However, this figure drops to under 40% when we look at the full SAFE sample, i.e. including the companies for which the match was not found.

When analysing the matched companies in each wave (see table 7), the share of missing records is stable with the exception of the most recent wave due to low coverage of the reference year 2013. The availability is also lower for the earlier waves, possibly with some companies going out of business, which is not fully captured in Amadeus database.

Regarding the size of the company, both in terms of number of employees and annual turnover, the smallest businesses have much less information available then medium and large companies (see Table 8). It can be partially explained by the legal regulations across countries that do not oblige the smallest companies to publish their financial accounts data.

Percentage of available values by year

Euro area, 11 largest countries, waves 3 to 10 — Table 6

Variable	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	All firms
Total assets	68	76	82	83	83	84	84	82	71	9	76
Working capital	64	71	76	76	77	77	77	76	66	7	70
Cash & cash equivalent	66	73	80	80	81	81	81	80	69	8	73
Net income	59	63	66	66	67	67	67	66	58	7	61
Sales	54	57	60	63	64	65	66	65	56	7	58
Nr of employees	45	47	60	66	66	67	66	69	59	7	58
All 6 variables for matched	38	39	46	46	46	47	46	48	42	4	42
All 6 variables for SAFE	32	32	39	39	39	39	39	41	35	3	36

Source: SAFE-Amadeus match, authors' calculations.

Percentage of available values by wave

Euro area, 11 largest countries, waves 3 to 10 — Table 7

Variable	3	4	5	6	7	8	9	10	All firms
Total assets	72	71	73	80	77	79	80	73	76
Working capital	67	66	67	74	72	73	74	67	70
Cash & cash equivalent	70	69	71	77	75	76	78	71	73
Net income	61	57	57	64	63	64	65	59	61
Sales	62	55	55	60	59	60	61	56	58
Nr of employees	57	55	55	61	59	60	61	57	58
All 6 variables for matched	44	40	39	44	43	44	45	41	42
All 6 variables for SAFE	36	32	34	37	35	37	38	36	36

Source: SAFE-Amadeus match, authors' calculations.

Percentage of available values by size and turnover class

Euro area, 11 largest countries, waves 3 to 10 — Table 8

Variable	Size				Turnover					
	Micro	Small	Medium	Large	Up to € 2 million	€ 2 – 10 million	€ 10 – 50 million	Over € 50 million	DK/NA	All firms
Total assets	66	79	80	75	70	81	80	74	71	76
Working capital	61	72	75	72	64	74	75	71	64	70
Cash & cash equivalent	63	77	79	73	67	79	79	72	68	73
Net income	49	60	71	71	52	63	74	71	55	61
Sales	46	58	67	69	51	61	66	68	50	58
Nr of employees	45	58	67	66	49	62	69	66	57	58
All 6 variables for matched	29	40	53	57	33	44	55	56	38	42
All 6 variables for SAFE	20	35	50	54	25	40	51	53	29	36

Source: SAFE-Amadeus match, authors' calculations.

Percentage of available values by country

Euro area, 11 largest countries, waves 3 to 10 — Table 9

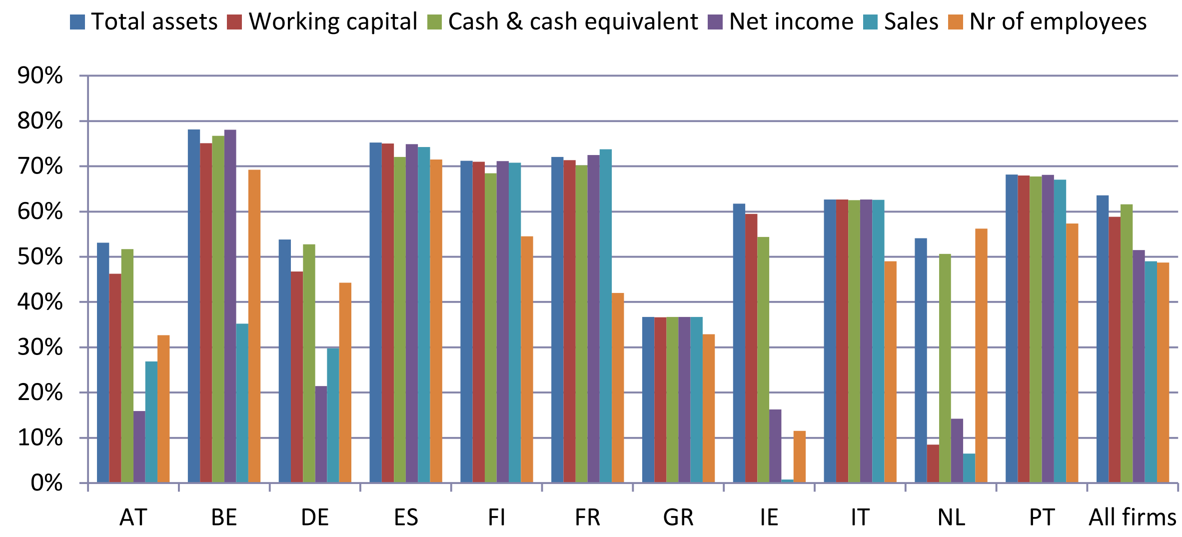
Variable	AT	BE	DE	ES	FI	FR	GR	IE	IT	NL	PT	All firms
Total assets	59	87	66	81	86	76	60	81	88	56	82	76
Working capital	51	83	58	81	86	75	60	78	88	9	82	70
Cash & cash equivalent	57	85	65	78	83	74	60	71	88	52	82	73
Net income	18	87	26	81	86	76	60	21	88	15	82	61
Sales	30	39	37	80	86	78	60	1	88	7	81	58
Nr of employees	36	77	55	77	66	44	54	15	69	58	69	58
All 6 variables for matched	10	35	15	72	63	44	53	0	69	4	68	42
All 6 variables for SAFE	9	32	12	67	52	41	33	0	49	4	57	36

Source: SAFE-Amadeus match, authors' calculations.

The availability of the financial data is diversified across countries. Good coverage of the data exists in Finland, Italy and Portugal. In those countries and also in Greece, the coverage is similar for all selected variables, while in others it varies by type of the information. Indicators such as income and sales are mostly missing in Ireland, Germany, Austria and the Netherlands. It is worth to note that in the latter, the matching rate was the highest of all the countries (over 95%). To illustrate the final outcome, Figure 5 presents the effective availability of the financial information which is a result of the matching rate and the share of missing values in the matched data. When analysing the SAFE data, the effective coverage is the most suitable indicator to reflect the quality of the matching.

Effective coverage for the selected variables (%)

Euro area, 11 largest countries, waves 3 to 10 — Figure 5



Source: SAFE-Amadeus match, authors' calculations.

4.3 Impact of matching process on SAFE estimates

In the following section we investigate to what degree the results obtained from the effectively matched Amadeus (emA) sample are in line with those based on the full SAFE sample. In order to correct for a possible bias we also apply a weighting scheme and inspect to what extent it can help to mitigate the discrepancies from the original results.

4.3.1 Variation in the effective availability leads to a biased sample

The effectively matched Amadeus (emA) sample includes the companies that have been successfully matched and for which the main Amadeus variables (i.e. 6 variables analysed in the previous section) are available in the 3-year period around the year of the survey.[7] As discussed previously, despite the overall high matching rate of 83%, the emA sample is reduced by over 50% owing to the high missing share of financial information in the Amadeus database. The emA sample includes 26,491 enterprises surveyed in waves 3 to 10 (reduced from 57,920 in the full SAFE dataset) with varying sample size across countries. In this context, the sample is particularly limited in Ireland with only a handful of companies and in the Netherlands - the country with the highest matching rate but very limited financial variables reported in Amadeus. Further analysis becomes also cumbersome for Austria and Germany, for which only less than 20% of the initially surveyed

[7] E.g. for wave 3 conducted in 2010, the emA sample would contain companies for which information is available for at least one year between 2009 and 2011. Given that 2014 data are not yet reported and 2013 data are of poor coverage, for the most recent waves (from 8 to 10) at least one year between 2010 and 2012 should be available to include the company in the emA sample.

enterprises are in emA sample. On the contrary, the highest proportion of the original sample is available for Portugal and Spain.

Across all the countries the highest loss of the initial sample is evident for micro companies, for which both the matching rates and the coverage of the Amadeus variables are the lowest. For those businesses the percentage of enterprises with sufficient amount of financial information in comparison to the original SAFE sample varies a lot, ranging from almost 0% in Austria, Ireland and the Netherlands to 63% in Portugal. Due to the lack of micro companies in emA sample Austria, Ireland and the Netherlands have been excluded from further analysis. It is also noticeable that the proportion of the original sample increases with the size classes. At the same time less variation exists across sectors, with the highest proportion for industry.

When comparing the aggregated results based on the original SAFE sample and the emA sample there are noticeable differences for the countries with a limited sample, i.e. Germany, Belgium and to a lesser extent Greece (see Figure 7). The results would point to a higher net percentage of SMEs reporting increased needs for bank loans and a much more volatile pattern in Germany and Belgium. There would be also a higher weighted percentage of the SMEs applying for a bank loan in Germany, on average by 13 percentage points (see see Figure 8). Overall, it is difficult to disentangle the effect of limited sample size from country specific aspects regarding the collection of the account data in Amadeus. However, for the countries where the emA sample did not decrease drastically and is still between 50–70% of the original sample the results are in line with the SAFE benchmark. Inspecting further the changes by the size classes, the discrepancies are mostly pronounced for the micro firms. In a case of Germany, as presented on the Figure 11, the net percentage representing the difference between the percentage of enterprises reporting increase in needs for banks loans and those reporting a decrease is highly volatile. The series matches however to a higher extent the original results in case of Spain, country with the highest proportion of the original sample (Figure 10).

Comparison of original SAFE sample and effectively matched Amadeus sample by size and sector

Table 10

	SAFE sample					Effectively matched sample (% of the SAFE sample)				
	Micro	Small	Medium	Large	All firms	Micro	Small	Medium	Large	All firms
AT	1,290	1,314	859	246	3,709	0.2%	5%	51%	54%	17%
BE	1,450	1,481	662	137	3,730	12%	35%	76%	77%	35%
DE	2,412	2,475	2,343	784	8,014	3%	12%	31%	45%	18%
ES	2,428	2,474	2,356	748	8,006	57%	85%	90%	90%	79%
FI	1,432	1,430	626	115	3,603	49%	76%	88%	86%	67%
FR	2,394	2,444	2,385	801	8,024	40%	53%	62%	59%	53%
GR	1,460	1,459	656	125	3,700	19%	51%	64%	71%	41%
IE	1,430	1,429	625	118	3,602	0.0%	0%	0%	4%	0.2%
IT	2,394	2,434	2,439	738	8,005	34%	73%	89%	90%	68%
NL	1,339	1,325	852	246	3,762	0.1%	3%	15%	35%	7%
PT	1,338	1,341	850	236	3,765	63%	86%	88%	87%	78%
Total	19,367	19,606	14,653	4,294	57,920	27%	46%	63%	67%	46%

	SAFE sample					Effectively matched sample (% of the SAFE sample)				
	Industry	Construction	Trade	Services	All sectors	Industry	Construction	Trade	Services	All sectors
AT	875	336	927	1,571	3,709	34%	13%	17%	9%	17%
BE	740	464	1,119	1,407	3,730	51%	31%	34%	29%	35%
DE	2,449	787	1,470	3,308	8,014	27%	21%	16%	12%	18%
ES	1,886	971	1,911	3,238	8,006	86%	78%	74%	77%	79%
FI	781	545	579	1,698	3,603	80%	65%	67%	63%	67%
FR	2,125	728	2,518	2,653	8,024	57%	53%	51%	51%	53%
GR	647	337	2,092	624	3,700	51%	38%	36%	52%	41%
IE	745	350	1,335	1,172	3,602	1%	0%	0%	0%	0%
IT	3,842	528	1,676	1,959	8,005	78%	59%	59%	57%	68%
NL	599	391	948	1,824	3,762	14%	4%	7%	5%	7%
PT	942	468	1,065	1,290	3,765	86%	72%	75%	79%	78%
Total	15,631	5,905	15,640	20,744	57,920	58%	45%	41%	40%	46%

Source: SAFE-Amadeus match, authors' calculations.

4.3.2 Can weights correct the bias?

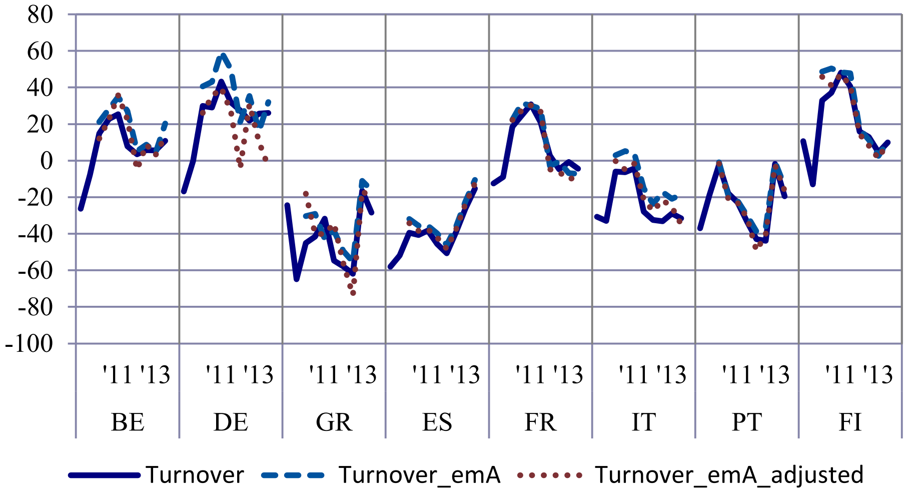
The original SAFE results are obtained by aggregating the raw data and applying the weights to restore the proportions of the population of enterprises, with regard to company size and economic activity in each country. Those weights are estimated based on the number of persons employed available from Eurostat's Structural Business Statistics (SBS) using raking method that aims to match the marginal distributions of the population (i.e. margins on size and sector classes) and minimises the distance between the initial and final weights.

In order to correct for the bias we rescaled the weights taking into account the limited emA sample. Consequently, a few enterprises from a given size and sector class may have a significant impact on the aggregates due to large weights, as in case of German sample. For almost all of the SAFE estimates presented on the Figure 6 to Figure 11, the identified discrepancies could not be corrected by the adjusted weights. Furthermore, in a few instances the deviations from the original series become even more pronounced. The overall results point to the conclusion that unbiased results cannot be obtained from the limited sample in each size class and country by applying a different set of weights. Particularly, the problem of potential bias stemming from lower coverage occurs in data for Austria, Germany, Ireland and the Netherlands, as well as for micro enterprises in all countries. However, for the sub-samples for other countries and for the larger enterprises the matched data seem to be of better quality.

In addition, limiting the analysis to fewer financial variables (in particular total assets, which have the best coverage) will improve the effective sample size. The emA sample is constructed under the condition that all six financial variables presented above are non-missing. Sales and net income have the lowest effective coverage overall and in case of Austria, Germany and Ireland these are the variables that decide about the drastic reduction of the sample size when constructing emA.

Change in the turnover situation of SMEs across euro area countries over the preceding six months

Net percentage of respondents — Figure 6

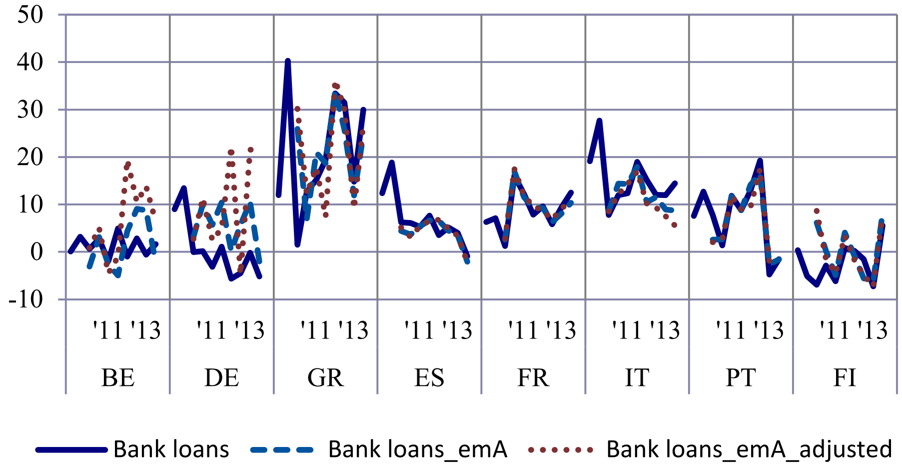


Source: SAFE-Amadeus match, authors' calculations.

Change in needs for bank loans of SMEs across euro area countries over the preceding six months

Net percentage of respondents

Figure 7

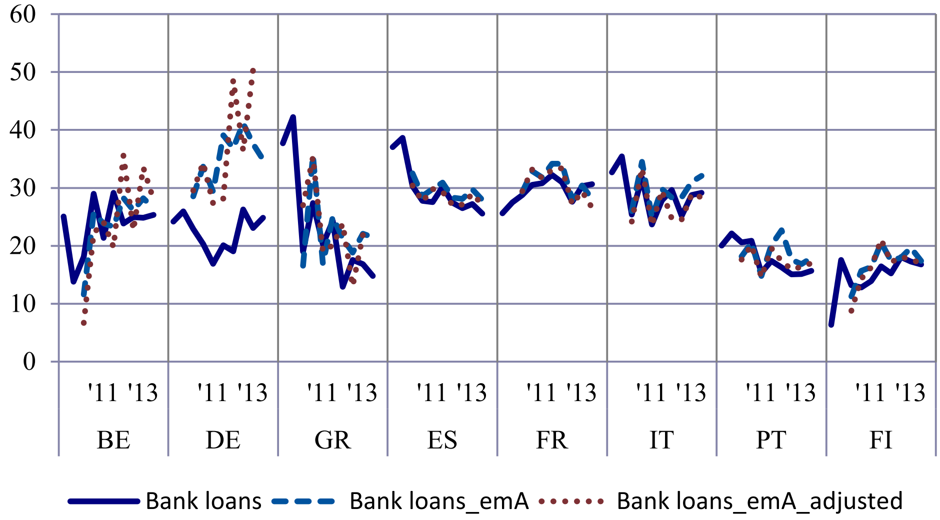


Source: SAFE-Amadeus match, authors' calculations.

Applications for bank loans by SMEs across euro area countries over the preceding six months

Weighted percentage of respondents

Figure 8

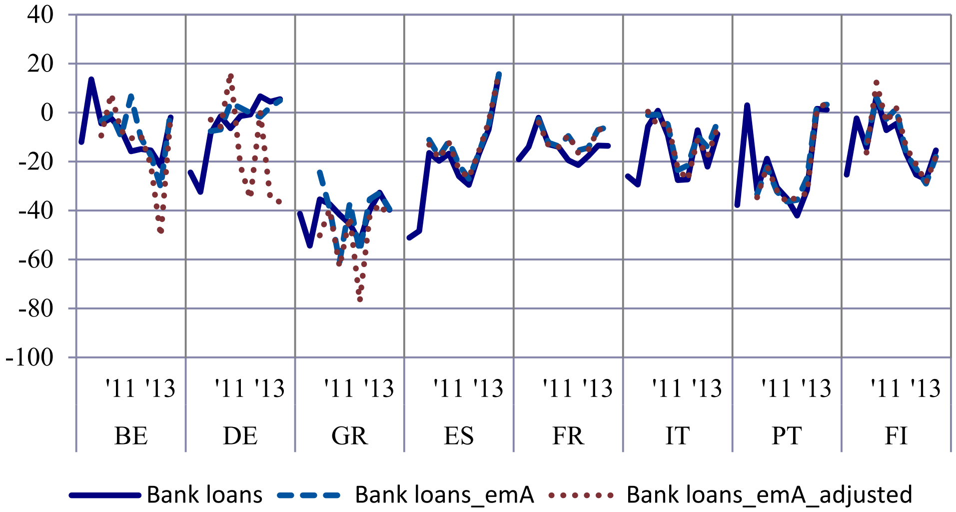


Source: SAFE-Amadeus match, authors' calculations.

Change in the availability of bank loans for SMEs across euro area countries over the preceding six months

Net percentage of respondents

Figure 9

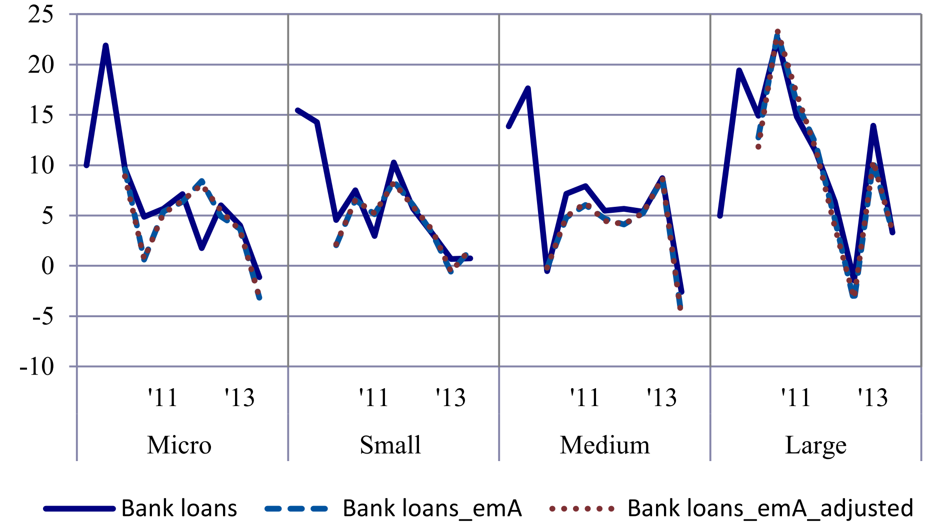


Source: SAFE-Amadeus match, authors' calculations.

Change in needs for bank loans across size classes in Spain over the preceding six months

Net percentage of respondents

Figure 10

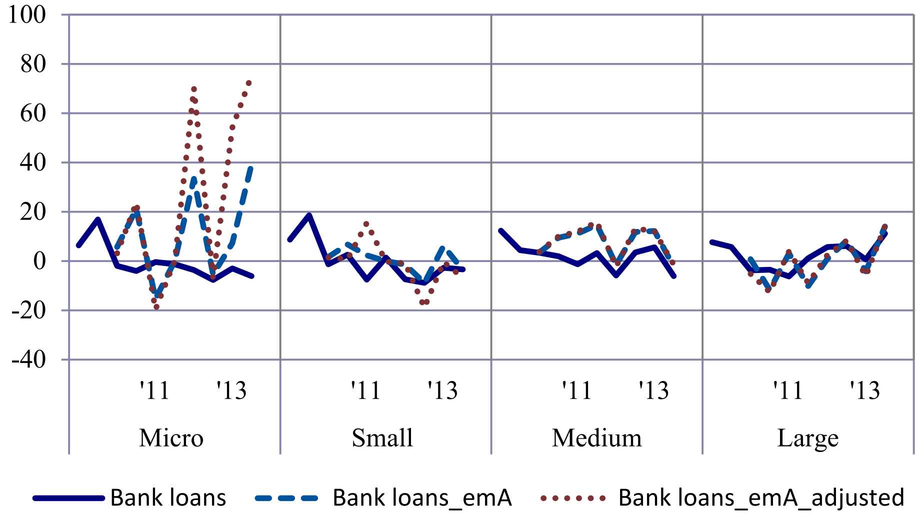


Source: SAFE-Amadeus match, authors' calculations.

Change in needs for bank loans across size classes in Germany over the preceding six months

Net percentage of respondents

Figure 11



Source: SAFE-Amadeus match, authors' calculations.

4.4 Comparison with Amadeus estimates

The matched data differ from the full Amadeus data in one main respect: the sample of the SAFE is not a simple random sample from the population of enterprises, and hence requires weighting adjustments to provide a representative, unbiased analysis of the target population. However, when using Amadeus data, it is not common practice to apply weights, and analysing the matched SAFE-Amadeus data without weighting is one of possible options.

The SAFE oversamples large firms and undersamples micro and small firms, while large firms are much better represented in Amadeus, and also have more financial information available, as the previous sections showed. In the end, it is not clear what the combination of these two effects is. Table11 shows the comparison of the structure of the matched dataset and the whole Amadeus dataset, as used in the ECB (2013) Structural Issues Report on Corporate Finance. It is clear that in all countries, in the matched sample the micro and small firms are underrepresented, with the situation of micro firms particularly dire, while the relative share of medium-sized and large firms is comparable overall but varies by country. In a few countries, large firms are underrepresented compared to medium-sized firms (Austria, Belgium, Germany, Finland and the Netherlands).

It is thus entirely predictable that the matched sample will not lead to figures that are comparable to aggregates produced from Amadeus directly.

Over-representation in the matched SAFE data vs. Amadeus (%)

Of each size class, relative to large firms — Table 10

	Micro	Small	Medium	Large
Austria	3.4	45.8	149.4	100.0
Belgium	5.4	75.2	145.7	100.0
Germany	1.4	33.7	161.1	100.0
Spain	1.9	9.9	64.5	100.0
Finland	10.1	112.0	221.4	100.0
France	1.9	17.5	89.8	100.0
Greece	14.2	41.4	97.6	100.0
Ireland	0.0	0.0	9.5	100.0
Italy	2.0	14.7	73.5	100.0
Netherlands	1.8	91.1	134.5	100.0
Portugal	2.5	19.7	67.5	100.0
Total	3.0	24.0	104.3	100.0

Source: ECB – SAFE-Amadeus match, ECB (2013) Annex 3 figures for Amadeus.

How to read this table: the share of micro firms to large firms in Austria in the matched SAFE data represent 3.4% of the same share in Amadeus.

5. Conclusion

In the paper we investigate the potential of linking the qualitative survey responses with the quantitative information from business registers to enhance the SAFE dataset. The results are mixed, with the quality of the matching varying greatly by country and the characteristics of the enterprises. In particular, the smallest businesses are underrepresented in the matched dataset and even if they are successfully matched, they exhibit the lowest coverage of the financial variables.

Overall, the balance sheet information is reported most widely with total assets available for around 76% of matched companies. If we take into account the full SAFE sample, i.e. also the companies for which successful match was not found, the coverage drops to 64%. When a study requires joint analysis of several financial variables, the share of enterprises with available information decreases drastically further – for 6 variables selected (total assets, working capital, cash and cash equivalent, net income, sales, number of employees) it amounts to 36% of the SAFE sample.

The effect of using such limited subsample on the SAFE estimates was analysed using two set of weights: i) first, with the original weights used for SAFE dataset; and ii) second, with the weights adjusted to the sample size of matched dataset. We conclude that for the breakdowns with low coverage, the weights adjustment is not able to correct for the biases stemming from distorted sample distribution. Particularly, such problem concerns data for Austria, Germany, Ireland and the Netherlands, as well as for micro enterprises in all countries. However, for the sub-samples for other countries and for the larger enterprises the matched data seem to be of better quality. In addition, a significant reduction in the sample size can be avoided by selecting smaller subset of required financial variables. A biased sample is particularly problematic, if one attempts to construct aggregates from the matched dataset. It does not, however, prevent the successful testing of certain hypotheses at the micro level – if the user is aware of the possible distortions in the sample distribution, he or she can construct the hypothesis testing so as to overcome this.

This paper presents first main findings on the quality of the matched SAFE dataset and this assessment will continue. The quality of matching might increase due to improved availability of the company tax identification number, which was not provided in the earlier waves of the SAFE. On the other hand, unfortunately a higher coverage of enterprises population in the Amadeus database cannot be expected, in particular for smaller businesses, since this group is more and more often exempted from the reporting or provided simplified and limited financial statements. However, given recent interest of policy makers in the situation of SMEs, new sources of data could become available in the future or current sources, such as business registers, can be improved with regard to quality and scope. The development in this area will be followed and investigated from the angle of enhancing the qualitative SAFE dataset with financial information, especially for micro enterprises.

At the same time, other methods of data matching can be explored. Currently, the record linking is performed by the provider of the register data. Effectiveness of other algorithms to link records can be explored, e.g. the method of probabilistic linking as described by Fellegi and Sunter. Another possible solution is the statistical matching, where the linked units do not need to be identical but only similar with regard to certain characteristics. However, given the wide scope of such methods, we leave it for future research.

6. References

European Central Bank (2013), Corporate finance and economic activity in the euro area, Structural Issues Report 2013, ECB Occasional Paper Series No. 151.

Eurostat (2013), Statistical matching: a model based approach for data integration, Methodologies and Working Papers.

Fellegi, Ivan P and Sunter Alan B, A Theory for Record Linkage. (December, 1969). Journal of the American Statistical Association, Vol. 64, No. 328.

Ferrando, Annalisa and Griesshaber, Nicolas, Financing obstacles among euro area firms: Who suffers the most? (February, 2011). ECB Working Paper No. 1293.

Ferrando, Annalisa and Mulier, Klaas, Firms' Financing Constraints: Do Perceptions Match the Actual Situation? (August 5, 2013). ECB Working Paper No. 1577.

Consumer Confidence Indices and Short-term Forecasting of Consumption for Nigeria

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Abstract

This paper examines the link between consumer sentiment and consumption expenditures in Nigeria. It assesses the predictive ability of consumer confidence indices and selected macroeconomic indicators using a simple autoregressive model which addresses the issue of how confidence indicators bring additional information beyond economic fundamentals. Given the paucity of monthly data, cubic spline interpolation algorithm was used to convert quarterly indicators from 2008Q2 – 2014Q2 into monthly series. From the analysis of the consumption model estimated, we find that the in-sample forecast performed well with little error margin and the out-of-sample values for the next six month were estimated. The results show that the confidence indicator could influence economic performance and be a good predictor of household consumption growth in Nigeria. The paper stressed that care must be exercise particularly during period of economic uncertainty and fluctuations in using the best model for decision making.

Keywords: Consumer expectations, short-term forecasting, consumption, retail trade index

JEL classification: C22, C32, E27, E37

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The views expressed in this work are those of the authors and do not necessarily represent those of the Central Bank of Nigeria.

1. Introduction

The last two decades have witnessed tremendous development on the use of surveys data to take policy decisions. For many years, indices of consumer sentiment have been used to provide stakeholders, particularly, government policy makers and business leaders with timely and important information on consumer attitudes and perceptions. A number of researchers have also conducted research studies to assess the predictive power of consumer confidence in forecasting household spending over the past few decades. For example, in the United States, Mishkin (1978) reported that Index of Consumer Sentiment (ICS) published by the University of Michigan possesses good explanatory power for changes in durable goods. Carroll *et al.* (1994) also found that the Michigan ICS has good predictive capability with regard to household expenditure but that its forecasting power decreased considerably when the Index was used along with other macroeconomic variables.

Interest in consumer perceptions and attitudes reflects general belief that the sentiments and expectations of individual consumers directly affect the direction of the economy. Empirical research has shown that measures of consumer confidence are collated with consumption and may have some short-term forecasting capability (see, for example Carrol *et al.,* 1994 and Al-eyd, *et al.,* 2009). Also, some economists have developed renewed interest in evaluating the potential link between confidence indicators derived from household based survey and some microeconomic variables. In another study, Acemoglu and Scott (1994) employed Granger causality and regression analyses to determine whether consumer confidence, as measured by the Gallup Poll in the United Kingdom, can predict future consumption and found that consumer confidence is a leading indicator of future consumption growth. In a subsequent study, Delorme, *et al.* (2001) conducted a study on consumer confidence and rational expectations in the United States compared with the United Kingdom. They reported that the predictive ability of the United Kingdom consumer confidence index is greater than that of the United States.

Using French data, Belessiotis (1996) also reported that consumer confidence index provides decent explanatory power for future consumer spending. Other studies include that of Kwan and Cotsomitis (2005) in Canada that reported that though consumer sentiment is a reliable predictor of consumer expenditures at the national level, results obtained using regional data were quite mixed. Unlike the case in the United States or the United Kingdom, Fan and Wong (1998) found that confidence indicators in Hong Kong have little or no explanatory power in forecasting household spending. Choi (2002) reported that (consumer sentiment index) CSI provides significant information about future consumption, but Kim and Goo (2005) observed that the CSI in Korea did not have reliable predictive power for future consumption.

Despite the importance of CSI, there have been a few studies on the CSI in Nigeria, apart from the work of Olowofeso and Doguwa (2012) that assesses the consumer confidence indices and the inter-linkages between consumer confidence and selected macroeconomic variables in Nigeria. Most of the studies considered focused on developed countries and studies on Africa and Nigeria in particular are sparse. This study therefore is an attempt to address issue relating to whether consumer confidence data could be used to forecast consumption in Nigeria. In particular, the paper examines whether the inclusion of confidence data and other relevant economic indicators improve the fit of consumption model. To the best of our knowledge, our study represents the first endeavour in Nigeria to assess the usefulness of consumer confidence in predicting consumption. The rest of the paper is structured in four sections. Section 2 reviews related literature. The methodology is presented in section 3, while section 4 presents the empirical results. The fifth section presents the concluding remarks of the paper.

2. Literature Review

Many researchers have explored both theoretical and empirical ways in which consumer sentiment could influence economic performance. With regard to consumers, low expectations for the future may affect different types of spending in different ways. One would expect, for example, spending on more expensive, durable items to be more sensitive to consumer sentiment, whereas outlays on essential day-to-day goods would fluctuate less in response to expectations.

So far, most studies on consumer attitudes as a leading indicator of household spending have focused primarily on the predictive power of the Michigan Index of Consumer Sentiment (ICS). The results of these studies have, however, been varied. For example, an early study by Lovell (1975) found that measures of consumer attitudes based on the Michigan Survey of Consumers are unreliable predictors of future consumption. Mishkin (1978), using a stock adjustment model, showed that the ICS provided good explanatory power for changes in consumer durables. In another development, Souleles (2001), using the microdata of the Michigan Survey, reported that consumer sentiment is useful in forecasting future consumption, even when controlling for a number of macroeconomic variables. On the other hand, Howrey (2001) found that both lagged and current-quarter monthly values of the ICS were generally insignificant when control variables were presented in the equations of total personal consumption expenditures (PCE), consumer spending on durable goods as well as on services.

Ludvigson (2004) examined the main issues surrounding the measurement and reporting of consumer confidence, as well as its relationship with the real economy. The study concluded that the most popular surveys do help predict future consumer expenditure, but the extra predictive power beyond that of other economic and financial indicators is modest.

In another related study, Lovell (2001) suggested that the Index of Consumer Expectations (ICE) developed by the University of Michigan may be a better proxy for consumer confidence than the ICS. Many other studies particularly for developed countries give emphasis on the forecasting power of sentiment indices on macroeconomic trends of the economies. With the pioneers of Acemoglu and Scott (1994) and Carroll *et al.* (1994), the studies result in having attention on consumer confidence indices since the predictive power of the indices are generally noticed via several analysis. Matsusaka and Sbordone, (1995) employed US quarterly data within the period 1953–1988 to analyze the relationship between consumer sentiment and GNP. Using Granger causality, they find that there is causality from consumer sentiment to GNP. In a related development, Utaka (2003) used vector autoregression to analyzed consumer confidence as a factor in explaining the economy using quarterly Japan data. He discovered that confidence only has an effect on short-term economic fluctuations; however, no effect is detected in the long run. Afshar and Zomorrodian (2007), using quarterly data for the U.S. from 1980 to 2005, analyze the relationship between three confidence measures and economic fluctuations. They find causality from confidence measures to GDP and that these three measures play crucial roles in economic fluctuations. Nadenichek (2007) investigates whether expectation can play a role in the creation of economic downturns using Japan's stagnation period of 1990s. Olowofeso and Doguwa (2012) developed and estimated the consumer sentiment model and conference board confidence model for Nigeria. They cited several factors that can affect the consumer confidence in an economy like Nigeria. Using simulation techniques, they discovered that consumer or business confidence indices take a part in explaining the economic fluctuations. Our approach here concentrates on monthly data instead and uses a related but somewhat different methodology.

3. Methodology

3.1 The Data

The data used in this paper are obtained from the surveys of the Consumer Expectations Survey (CES) of Central Bank of Nigeria from Q2 2008 to Q2 2014. Other data are obtained from the surveys of business expectations and Statistical Bulletin of the Central Bank of Nigeria. The confidence data were taken from consolidated quarterly expectations surveys data of both households and firms in the six-geopolitical zones of Nigeria. The sectors covered for the firms include industry, construction, wholesale and retail trade, financial intermediation, hotels and restaurants, renting and business activities and community and social services. In addition, some of the secondary data collected were obtained from various publications of the National Bureau of Statistics, the consumer price index and national accounts data. The consumer confidence index (CCI) collected reflects the short-term trend of activity and major movements in overall economic activity. Most of the data are current and expectations values for next quarter and one year ahead. In both the consumer and business expectations surveys, the results are reported as differences between positive and negative answers (net balances), which are then aggregated into a single confidence index, with each net balance receiving the same weight. The choices of the indicators are based on the relevance of the variables to this study.

3.2 Method of Data Analysis

The data collected were analyzed using the Eviews and WinSolve. Given the paucity of monthly data, cubic spline interpolation algorithm was used to convert the quarterly indicators to monthly series.

3.2.1 Computation of Confidence Indices

Overall Consumer Confidence Index is computed as the average of three indices: Economic condition index (ECI), Family financial condition index (FFCI) and Family income index (FII). The ECI, FFCI and FII are diffusion indices computed as the percentage of respondents that answered in the affirmative less the percentage share of the respondents that answered negative in a given indicator. A negative diffusion index indicates that the respondents with unfavourable view outnumber those with favourable view except for unemployment, change in prices and interest rate for borrowing money, where a negative index indicates the opposite.

The retail trade confidence index is based on the following three questions from the business expectations survey: We consider the present volume of business activity index with volume of total order book index as well as business trend over the next 3 months; the retail trade confidence index is calculated as the unweighted average of the scores for the three questions.

Table 1 below presents the summary of Consumer Confidence Indicator and the other macroeconomic indicators, the corresponding IDs and the corresponding sources from which the data are collected.

Macroeconomic factors, respective IDs and data sources — Table 1

Economic Factor	ID	Source
Real consumption	GRC_t	National Bureau of Statistics
Growth rate of consumption	ΔGRC_t	National Bureau of Statistics
Real personal disposable income	RPDI	National Bureau of Statistics
Financial deepening	FD	CBN, Statistical Bulletin
Consumer confidence	CC	CBN, Statistical Bulletin
Retail trade confidence	RTC	CBN, Statistical Bulletin

3.2.2 Pearson Correlation Analysis

Pearson correlation analysis is the statistical analysis tool used to study the relationship between the consumer confidence indicators and the other macroeconomic indicators examined in this work. The null hypothesis of the test for CCI and each macroeconomic indicator is that there is no association between CCI and other macroeconomic indicators.

3.2.3 Unit Roots

In order to evaluate the forecasting ability of the confidence, we need to get adequate information on the stationarity properties of the data being used in the forecast. Augmented Dickey-Fuller (ADF) tests proposed by Dickey and Fuller (1979), the Phillips–Perron (1988) test (PP) are used for the identification of the order of integration of the macroeconomic indicators and the Consumer confidence indicators used in this study. The null hypothesis is that the time series under study is not stationary and the alternative hypothesis is that the time series is stationary. A time series is stationary if its statistical properties do not change after being time-shifted (Brockwell and Davis, 2002). Critical values recommended by Banerjee *et al.* (1993) are used for the unit root test. In addition, we also employ several unit root tests like Dickey-Fuller Test with GLS Detrending (DFGLS), The Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test, Elliot, Rothenberg, and Stock Point Optimal (ERS) Test, Ng and Perron (NP) tests to the consumer confidence indicators and other macroeconomic variables considered (For brevity of this paper only the ADF and PP results are presented in this paper, the other unit root tests are available on request).

3.3 Econometric Model of the Consumer Sentiment and Consumer Confidence

This section clearly describes the econometric models developed for this work. The quarterly consumer sentiment and consumer confidence regressions in a structured time series framework formulated are presented below. We adopted a simple autoregressive model which was used by Carrol *et al.* (1994), to assess the predictive ability of the selected indicators. The nature of the question contained in the expectations questionnaire of the CBN makes it possible that the indicators contain information captured by other macroeconomic variables. Based on this, the standard equation adopted is specified as follows:

$$\Delta GRC_t = \alpha + \sum_{i=1}^{n} \beta_i \Delta GRC_{t-i} + \varepsilon_t \qquad (1)$$

where $\Delta \mathrm{GRC}_t$ represents the growth rate of consumption and ε is the error term that is identically and independently normally distributed with zero mean and constant variance. Consequently, by adding consumer confidence index (CCI) and retail trade index (RTI) to equation (1) separately, we have equations (2) and (3) respectively. In this paper we restrict the number of lags for the indicators to two quarters because the surveys deal mainly with current and the next quarters' views of the respondents. Thus, the two confidence-augmented equations are respectively written as:

$$\Delta GRC_t = \alpha + \sum_{i=1}^{n} \beta_i \Delta GRC_{t-i} + \sum_{i=1}^{2} \theta_i \Delta CCI_{t-i} + \varepsilon_t \qquad (2)$$

$$\Delta GRC_t = \alpha + \sum_{i=1}^{n} \beta_i \Delta GRC_{t-i} + \sum_{i=1}^{2} \theta_i \Delta RTI_{t-i} + \varepsilon_t \qquad (3)$$

We adopted the technique used by Nahuis and Jansen (2004) to investigate whether incorporating consumer confidence or retail confidence improve the model, the relative reduction in the unexplained variance of equations (3) and (4) compared to that of equation (1). This measure shows the survey indicator's relative contributions to the explanation of consumption growth besides lagged values of consumption growth itself. The F-statistic testing $(F\colon \beta_0 = \beta_1 = \beta_2 = \cdots, \beta_n = 0)$ will be used to examined if all the coefficient and jointly zero. This test shows whether the relative reduction in unexpected variance is statistically significant. In order to assess the value of other information, we add the two indicators of CCI and RTI to equation 1 to give a model stated as:

$$\Delta GRC_t = \alpha + \sum_{i=1}^{n} \beta_i \Delta GRC_{t-i} + \sum_{i=1}^{2} \theta_i \Delta CCI_{t-i} + \sum_{i=1}^{2} \phi_i \Delta RTI_{t-i} + \varepsilon_t \qquad (4)$$

Again, to be able to examine the in-sample forecast and out of sample performance of the confidence indices and the confidence indicators of household consumption, we estimated unrestricted VAR model and obtain the representations of the estimated model by obtaining the corresponding behavioural equations in WinsSolve for the forecast.

4. Empirical Results

Table 2 summarizes the results of the unit root carried out. The results show that and RCG, CCI, RPDI and FD are all I(1) and needs to be differencing to be stationary. Meanwhile, RTI is I(0) at 5 per cent level of significance. In this case, causality and predictive testing are appropriate between I(0) variable and differences of the I(1) indicators. Thus, a vector error correction mechanism (VECM) technique is inappropriate for assessing confidence since all the variable are not I(1) series that may cointegrate. Therefore we adopted the simple ARMA technique presented in equations (2) and (3).

Unit Root Tests (Augmented Dickey-Fuller and Phillip-Perron) Table 2

		Order of Integration: I(1) for all series									
		CCI		FD		RCG		RPDI		RTI	
		t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.81659	0.0611	-5.02427	0.0001	-6.04847	0.00000	-5.53244	0.00000	-3.31595	0.018
Test critica	1% level	-3.52705		-3.52289		-3.52289		-3.52289		-3.53159	
	5% level	-2.90357		-2.90178		-2.90178		-2.90178		-2.90552	
	10% level	-2.58923		-2.58828		-2.58828		-2.58828		-2.59026	
		CCI		FD		RCG		RPDI		-2.59026	
		t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*
Phillip Perron test statistic		-3.9835	0.0025	-5.05458	0.0001	-6.09752	0.00000	-5.77286	0.00000	-9.92777	0
Test critica	1% level	-3.52289		-3.52289		-3.52289		-3.52289		-3.52289	
	5% level	-2.90178		-2.90178		-2.90178		-2.90178		-2.90178	
	10% level	-2.58828		-2.58828		-2.58828		-2.58828		-2.58828	
*MacKinnon (1996) one-sided p-values.											

Source: Data Analysis.

Autoregressive roots graph reports the inverse roots of the characteristic AR polynomial. In this paper the estimated VAR is stable (stationary), we can see that all roots have modulus less than one and lie inside the unit circle as shown in Table 3 (see Lütkepohl (2006)).

Table 3: Roots of Characteristic Polynomial

Root	Modulus
0.978053	0.978053
0.877133	0.877133
0.797092	0.797092
0.695993 - 0.215611i	0.728625
0.695993 + 0.215611i	0.728625
0.489578 - 0.407243i	0.636815
0.489578 + 0.407243i	0.636815
0.190406	0.190406
-0.032709 - 0.091654i	0.097316
-0.032709 + 0.091654i	0.097316

No root lies outside the unit circle.
VAR satisfies the stability condition.

Source: Data Analysis.

4.1 Correlation Analysis

Before we report the other empirical results of the models specified couple with the other results, it would be useful to first examine the statistical relationship between consumer confidence index and some of the variables considered in the work. Table 4 shows the correlations between real consumption, real personal disposable income, Consumer confidence, retail trade confidence, growth rate of consumption and financial deepening. All of the correlations are in the expected direction: except for RTI and GRC that gave negative value of –0.0265. The confidence indices correlate well with GRC, RPDI and RTI. In addition, there are moderate and statistically significant correlations in the expected directions between the indices and the other economic variables: the RPDI and FD as well as between CCI and RPDI. As can be seen from this Table 4, these series reveal a close association for the period under consideration.

Correlations between CC Indicator and Key Macroeconomic Variables — Table 4

	FD	GRC	RPDI	CCI	RTI	DGRC
FD	1					
GRC	0.573**	1				
RPDI	–0.017	0.380**	1			
CCI	–0.526**	–0.187	0.331**	1		
RTI	–0.178	–0.265*	0.578**	0.634**	1	
DGRC	0.103	0.079	–0.158	0.088	0.275*	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Consumption model results — Table 5

Explanatory variable consumption model	Adj. R^2 without consumer confidence	Adj. R^2 with consumer confidence
RTI	0.043302	0.055939
RTI , RPDI	0.099774	0.111203
RPDI, FD	0.533908	0.451402
RTI, RPDI, FD	0.543329	0.487833

Source: Authors Calculation.

Table 5 shows the goodness of fit of each model, as measured by the adjusted R-squared. In each case the model fit improves, as we include more relevant variables and consumer confidence index as explanatory variables. It should be noted that the overall adjusted R-squared remains relatively low even under the best model and many individual coefficients (not reported) were insignificant. The best model is actually the one which includes RTI, RPDI and FD. The results at least suggest that any model of consumer behaviour, however sophisticated, may benefit from the inclusion of confidence indicators in the model.

The various growth rate of consumption model estimated

Table 6

Independent Variables	Model I	Model II	Model III	Model IV	Model V	Model VI
D(GRC(–1))	–0.610824*	–0.694157*	–0.736168*	–0.747372*	–0.615880*	–0.626549*
D(GRC(–2))	–0.286900*	–0.436602*	–0.488238*	–0.502289*	–0.423680*	–0.428309*
D(GRC(–3))	–	–0.218182**	–0.267731**	–0.280494*	–0.240881**	–0.240015**
CCI(–1)	–	0.046082	–	0.027286	–0.011480	–0.010149
CCI(–2)	–	–0.044154	–	–0.028853	–0.027290	–0.026663
RTI(–1)	–	–	0.019831	0.018187	0.019508	0.017927
RTI(–2)	–	–	–0.019259	–0.016812	–0.008395	–0.008962
FD(–2)	–	–	–	–	1.788725	1.672514
FD(–1)	–	–	–	–	–2.204969**	–2.102247
RPDI(–2)	–	–	–	–	–	0.002638
RPDI(–1)	––	–	–	–	–	–0.002162
Prob(F-statistic)	0.000009	0.000118	0.000075	0.000462	0.000161	0.000722
Akaike info criterion	0.362495	0.417008	0.401674	0.454867	0.405175	0.459575
Durbin-Watson stat	2.106615	2.051741	2.068133	2.072363	2.097431	2.097126

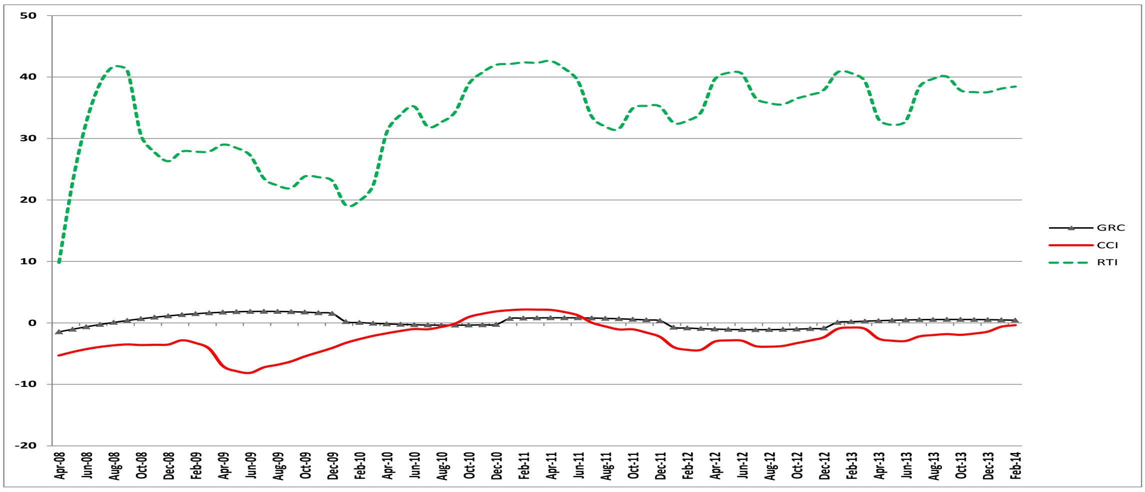
(*)Significant at 5%; (**) Correlation is significant at the 0.05 level (2-tailed).

Source: Data Analysis.

Table 6 presents the results of the model specified. Models 1 to IV clearly show that the coefficients are significant by using the F-statistic. The behavioural equation was used in Winsolve to conduct the in-sample and out-of-sample forecast. The estimated parameters that are significant are clearly highlighted in Table 6.

Trends of Consumer Confidence index, retail trade index and GRC

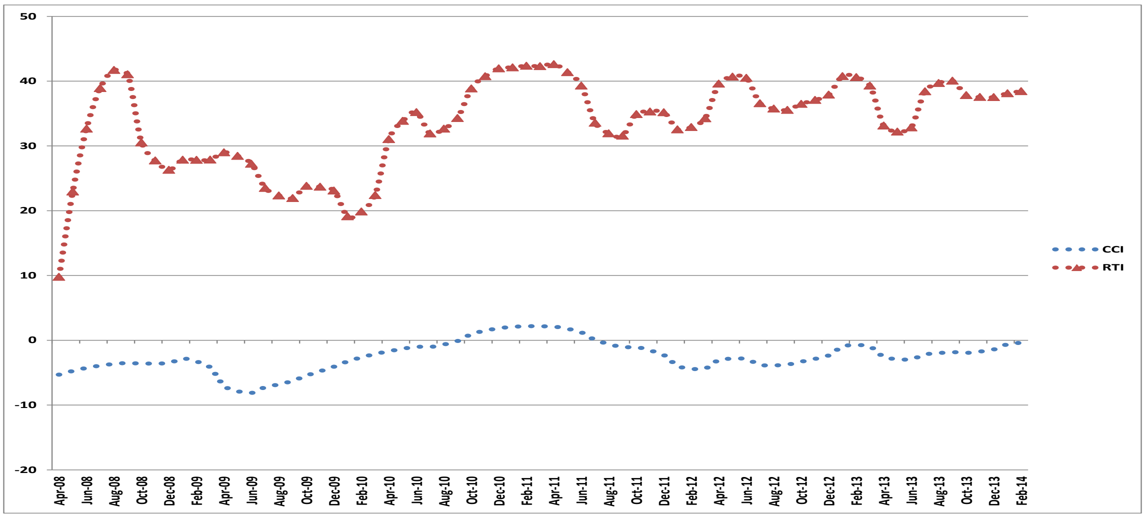
Figure 1



From the quarterly data we observed that the consumers' overall outlook in Q2, 2014 remained downbeat. At –2.4 points, it inched up by 6.0 points above the level achieved in the corresponding quarter of 2013. The bleak outlook of consumers in the quarter under review, could be attributable to the pessimistic outlook of consumers in their family financial situation which stood at –14.5 points. The indices for next quarter and the next twelve months rose by 1.5 and 4.8 points, respectively, from the level attained in the corresponding quarter 2013. The positive outlook of consumers in these quarters could be attributable largely to the optimistic outlook of consumers in their family income. The retail trade index fell slightly above CCI from August, 2011 as shown in Figures 1and 2.

Nigeria Consumer Confidence versus retail trade index

Figure 2



Consumers have more confidence in the economy when there is increase in the output of goods and services. Historically, the overall conference outlook index is a barometer of the health of the economy from the perspective of the consumer. The CCI and its related series are among the earliest sets of economic indicators available each quarter and are closely watched as indicators by the monetary policy committee members and other stakeholders for the Nigeria economy.

Short-term forecasting of consumption

Table 7

Time	Actual growth rate of consumption	In-sample Forecast	Error	Out-of-sample Forecast
201401	-0.037	-0.035	-0.002	-0.037
201402	-0.050	-0.054	0.005	-0.050
201403	-0.063	-0.074	0.011	-0.063
201404	-0.075	-0.087	0.011	-0.075
201405	-0.088	-0.091	0.003	-0.088
201406	-0.101	-0.088	-0.012	-0.101
201407				-0.103
201408				-0.070
201409				-0.061
201410				-0.060
201411				-0.061
201412				-0.061

Source: Authors Computation.

The negative values displayed by the consumption data used in the model could be as a result of consumers spending less on consumption items at the expense of other pressing needs like payment of school fees, accommodation, housing and transportation costs which are autonomous.

Trend of financial deepening verses real consumption

Figure 3

4.2 Forecast Evaluation

We present the in-sample forecast from 2014:M1 to 2014:M6 and out of sample forecast from from 2014:M7 to 2014:M12. The error margin of the in-sample forecast from –0.002 to 0.011 confirm the robustness of the model used for the forecast. This result broadly accords with Al-Eyd (2009), who finds the information content of confidence indicators for future consumption in the U.S. to be rather small. We do not reject the null hypothesis of identical forecasting performance. In other words, the models containing the confidence indicator improve the DGRC forecasts. Similarly, the confidence indicator improves the forecasts generated by the autoregressive process for GRC growth. Finally, we perform some in-sample and out-of-sample analysis to check to what extent and in which circumstances the consumption models outperform. These forecasts are obtained using models, whose parameters are estimated using data up to t-1. Root mean square errors are computed and used as comparison between models and the best model was selected for the forecast. The results of the out-of-sample forecast are displayed in column 5 of Table 7.

5. Concluding Remarks

This paper examined the predictive capacity of consumer confidence index that contained information on people's expectation of their future well-being for consumption in Nigeria. It presented the in-sample forecast from 2014:M1 to 2014:M6 and out-of-sample forecast from 2014:M7 to 2014:M12. The error margin of the in-sample forecast lies between –0.002 to 0.011 which confirm the robustness of the model used for the forecast. Broadly speaking, the results are in tandem with Al-Eyd (2009), who finds the information content of confidence indicators for future consumption in the U.S. to be rather small. However, in sharp contrast with the situation in the US or Britain, the results indicate that the confidence index have explanatory power in forecasting consumption growth in Nigeria. The empirical analyses also showed that including confidence in a model of consumption can help improve the statistical fit. Thus, the paper concludes that consumer confidence index has predictive power for consumption growth in Nigeria. This is an important implication for policy-makers and business owners, who have to plan ahead and anticipate market trends; but care must be taking particularly during period of economic uncertainty and fluctuations. For future investigation, this preliminary analysis could however be extended on various reasons. First, it is unclear how robust the results will be by including other relevant macroeconomic variables. Secondly, there is need for a comparative study of expectations data in modeling consumption in the West African zone.

References

Acemoglu, D., Scott, A., 1994. Consumer confidence and rational expectations: Are agents' beliefs consistent with the theory? *Economic Journal* 104, 1–19.

Al-Eyd A., Barrell and Davis E. P. (2009). Consumer confidence indices and short-term forecasting of consumption. *The Manchester School* Vol. 77 No. 1 January 2009.

Afshar T., G. Arabian and R. Zomorrodian (2007), "Stock return, consumer confidence, purchasing manager's index and economic fluctuations", *Journal of Business & Economics Research,* Vol. 5(8), pp. 97–106.

Banerjee A, Dolado J, Galbraith JW, Hendry DF (1993). Co-Integration, Error-Correction, and the Econometric Analysis of Non-Stationary Data. *Advanced Texts in Econometrics*. Oxford University Press, Oxford.

Belessiotis, T. 1996. "Consumer Confidence and Consumer Spending in France." Economic Papers Number 116. European Commission, September.

Carroll, Christopher D., Jeffrey C. Fuhrer, and David W. Wilcox. 1994. Does consumer sentiment forecast household spending? If so, why? *American Economic Review* 84:1397–1408.

Delorme, C., Kamerschen, D. & Voeks, L. (2001). Consumer confidence and rational expectations in the United States compared with the United Kingdom, *Applied Economics,* 33, 863–869.

Dickey, D. and W. Fuller (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root, *Journal of the American Statistical Association*, 74, 427–431.

Fan, Chengze S., Wong, Phoebe, 1998. Does consumer sentiment forecast household spending? The Hong Kong case. *Economics Letters* 58 (1), 77–84.

Howrey, Philip E. 2001. The predictive power of the index of consumer sentiment. Brookings Papers on Economic Activity 1:175–216.

Johansen S (1988). Statistical Analysis in Cointegrated Vectors. *J. Econ. Dyn. Control*, 12: 231–254.

Johansen S, Juselius K (1990). Maximum Likelihood Estimation and Inference on Cointegration – with Applications to the Demand for Money. *Oxford Bull. Econ. Stat*., 52: 169–210.

Kim, Seung-Nyeon and Young-Wan Goo, "The Predictive Power of the Index of Consumer Sentiment in Korea," *Economic Papers*, 8(2), The Bank of Korea, December.

Kwan, A. C., and J. A. Cotsomitis (2006): "The Usefulness of Consumer Confidence in Forecasting Household Spending in Canada: a National and Regional Analysis," *Economic Inquiry*, 44, 185–197.

Lovell, Michael C. 1975. Why was the consumer feeling so sad? Brookings Papers on Economic Activity 2:473–9.

Lovell, Michael C. 2001. The predictive power of the index of consumer sentiment: Comment and discussion. Brookings Papers on Economic Activity 1:208–13.

Ludvigson SC (2004): Consumer Confidence and Consumer Spending. *Journal of Economic Perspectives*, 18(2):29–50.

Lütkepohl H (2006): *New Introduction to Multiple Time Series Analysis.* Springer-Verlag, 1st ed. Matsusaka JG, Sbordone AM (1995): Consumer confidence and economic fluctuations. *Economic Inquiry*, 33:296–318.

Matsusaka, J. and Sbordone, A. (1995). 'Consumer confidence and economic fluctuations', *Economic Inquiry*, Vol. 33, pp. 296–318.

Olowofeso O.E and Sani Doguwa(2012). Consumer sentiment and confidence indices in Nigeria: a panel data analysis *IFC Bulletin* No 36, 191–216.

Phillips, P.C.B, and P. Perron (1988) “Testing for a Unit Root in Time Series Regressions” Biometrika 75, 335–346.

Utaka, A. (2003) Confidence and the real economy – the Japanese case, *Applied Economics*, 35, 337–342.

Use of Consumer Credit Data for Statistical Purposes: Korean Experience

Byong-ki Min[1]

Abstract

For some time, the Bank of Korea has sought to obtain micro data that can help us to analyze our household debt situation and to assess the financial soundness of households more accurately. This type of data, Consumer Credit Data, has been gathered by credit information registries (or credit reporting companies) primarily to assist creditors in evaluating the credit quality of current and prospective customers. Using this consumer credit data in cooperation with one of Korean Credit Bureaus, the Bank of Korea is constructing a new longitudinal databases that tracks consumers' access and use of credit at a quarterly frequency from 1Q 2009 to present. Now our pending task is to constitute a nationally representative random sample of individual consumers in any given quarter. With these processes completed successfully, the Bank of Korea will obtain more detailed and timely information on the debt status, loan payment behavior, and overall credit quality of Korea consumers. Such information will facilitate our analysis of macroeconomic conditions, improve its understanding of the way credit is provided to consumers, and enhance the bank's monitoring function of financial stability.

Keywords: Household credit, consumer debt, micro data, panel data

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1. Introduction

There has been a global trend toward strengthening the role of a central bank in monitoring financial stability. In accordance to this trend the Bank of Korea Act was revised in 2011 for the Bank of Korea, which is not a supervisory regulator of the financial market in Korea[2], to monitor the implications for financial stability when implementing monetary policy. While the rapidly snowballing household debt in Korea is likely to become a destabilizing factor to domestic financial market, the existing aggregated household debt statistics provide only limited information. Ever since the revision of the Act, the Bank of Korea has paved the way for the use of micro-data from Consumer Credit to produce statistics to replace or control the quality of the currently compiled monetary and financial statistics and to investigate domestic financial market so as to more accurately diagnose the economy. Currently, the Consumer Credit data statistics provided by CBs are in an aggregated form, not in a micro form. It is believed that constructing a new longitudinal database using raw Consumer Credit data is necessary to track individuals' and households' access to and use of credit on a periodic basis.

In this article, we first take a look at the household debt status in Korea and the relevant statistics. We then review the sharing system of Consumer Credit in Korea, explain how the Bank of Korea utilizes Consumer Credit data for statistical and analytical purposes, and describe our approach to the construction of the panel database, called Consumer Credit Panel DB (CCP DB), using a sample Consumer Credit information. The major hurdles the database development has recently faced, such as a series of Consumer Credit data leaks that has led to the increased demands for information security, is also introduced. At the end, we review the framework of CCP DB under construction and the way forward.

2. Household debts in Korea

The size of the household debt in the whole economy is obtained from the data on Household Credit and the Households' Flow of Funds account. Household credit is defined as the sum of household loans offered by financial institutions including banks and credit sales (household loans + credit sales) offered by credit card and finance companies[3]. Household debt (household credit statistics basis) stood at 1,021 trillion won as of end-2013, having risen by 6.0% compared to end-2012 (964 trillion won) as its rate of increase expanded over that (5.2%) in 2012. This was a result mainly from banks' and public financial institutions' home mortgage lending

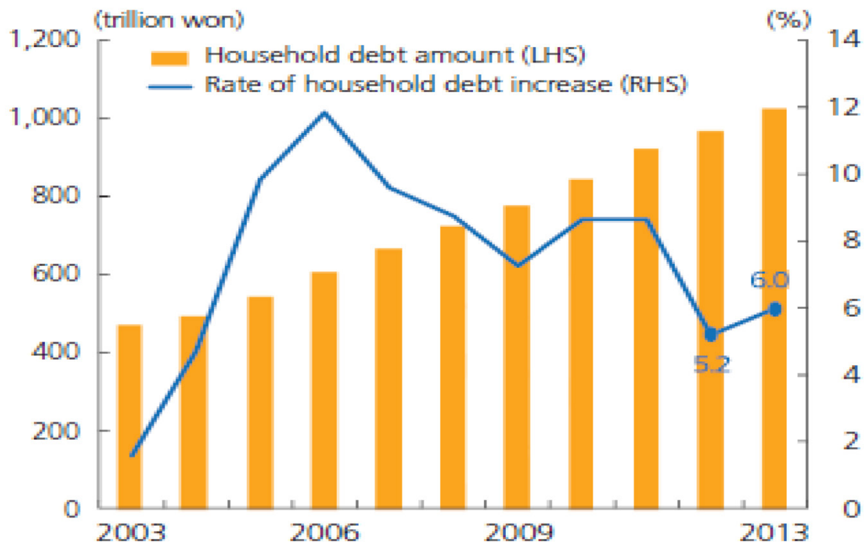
2 The Financial Supervisory Service, in Korea, is responsible for the examination and supervision of financial institutions. FSS was established on January 2, 1999, under the Act on the Establishment of Financial Supervisory Organizations by bringing together four supervisory bodies-Banking Supervisory Authority, Securities Supervisory Board, Insurance Supervisory Board, and Non-bank Supervisory Authority-into a single supervisory organization.

3 The Bank of Korea has gathered data on household credit (releasing quarterly statistics since 1996) in order to figure out the household credit supply situation since 1997.

(including leasehold deposit loans[4]) climbing, due to an expansion in housing transactions, to rises in leasehold deposit prices, etc., amid increased unsecured lending by non-bank financial institutions[5].

As household debt in Korea has rapidly snowballed in recent years, concerns have been raised about households' debt servicing capacity. It is notable that as economic conditions deteriorate such concerns can exacerbate the situation and cause the fear for a 'financial crisis' or an 'economic crisis'. One of the reasons for the raised concerns is that no objective assessment and in-depth analysis of households' debt servicing capacity have been made in spite of the growing household debt. So far the approaches of Korean household debt studies and the relevant assessments of households' debt servicing capacity have mainly been based on aggregate data, and thereby having used aggregate statistics for the overall economy and all households. For the indicators for assessing households' debt servicing capacity, the capital gearing ratio and the debt-to-income ratio have been used.

Amount and rate of increase[1] of household debt[2]



Notes: 1) Year-on-year
2) Household credit statistics basis
Source: The Bank of Korea

However, the households' debt servicing capacity assessed based on aggregates using the indicators above has a limitation in that it does not reflect the differences in households' characteristics.[6] That is, if households' debt is assessed

4 The majority of leasehold deposit loan products that banks are extending are secured by guarantees issued by the public guarantee organizations Housing Finance Credit Guarantee Fund and Korea Housing Guarantee Co., Ltd., or by the private guarantee organization Seoul Guarantee Insurance Co., Ltd.

5 Non-bank financial institutions in the text related to household financial soundness include non-bank depository institutions and other financial institutions such as insurance companies, pension funds and public financial institutions.

6 The economic, social and demographic differences among the households (ages, occupations, delinquency, payment history, income, credit score, etc).

using aggregate measures, it is impossible to figure out which type of households is in a sound financial situation and which is facing bankruptcy. In addition, this method might provide unrealistic information in accordance with households' debt distribution. For example, in case the households with sound debt servicing ability (those having high level of income or assets) own most of the household debt, this will generate little problem to the economy. However, when assessed with the aggregate data alone, their financial soundness can be said to have deteriorated simply because their debts have grown faster than their income or assets. From this perspective, it is required to conduct analysis of household debt using micro data as well as macro indicators to more accurately assess the financial soundness of households.

For some time, the BOK has sought to obtain micro data that can help us to analyze our household debt situation. This type of data, Consumer Credit Data, has been gathered by credit information registries(or credit reporting companies) primarily to assist creditors in evaluating the credit quality of current and prospective customers.[7] In next chapter, after explaining credit reporting system in Korea, we introduce our current usage of consumer credit data.[8]

3. Credit Reporting System in Korea and usage of its data

For decades in Korea, consumer credit information has been gathered by the Korea Federation of Bank (KFB)[9], established in 1928[10], and Credit Bureaus (CBs). The KFB, as a centralized credit information collection agency under the applicable Korean law, pools and manages credit information from all financial institutions and public organizations[11] and provides this information to financial institutions, public

[7] Consumer credit data has been gathered by a "Credit information registry" which refers to a database of information on borrowers in a financial system. Information in these registries is available for individual consumers and/or firms. The core of this data is a borrower's past payment history. The data available may be only negative (information on late payments, defaults and other irregularities) or may also contain positive information such as debts outstanding even if the credits and loans have always been paid on schedule. Registries may also contain other types of information, including basic personal information such as address and age, as well as information from court records or other public or government sources, which could have a bearing on creditworthiness.

[8] Credit registries operated by governments, (usually by bank supervisors), are referred to as Public Credit Registries("PCR"). Those registries operated outside government, even if they are non-profit institutions, are referred to as Private Credit Registries or Credit Bureaus (CBs).

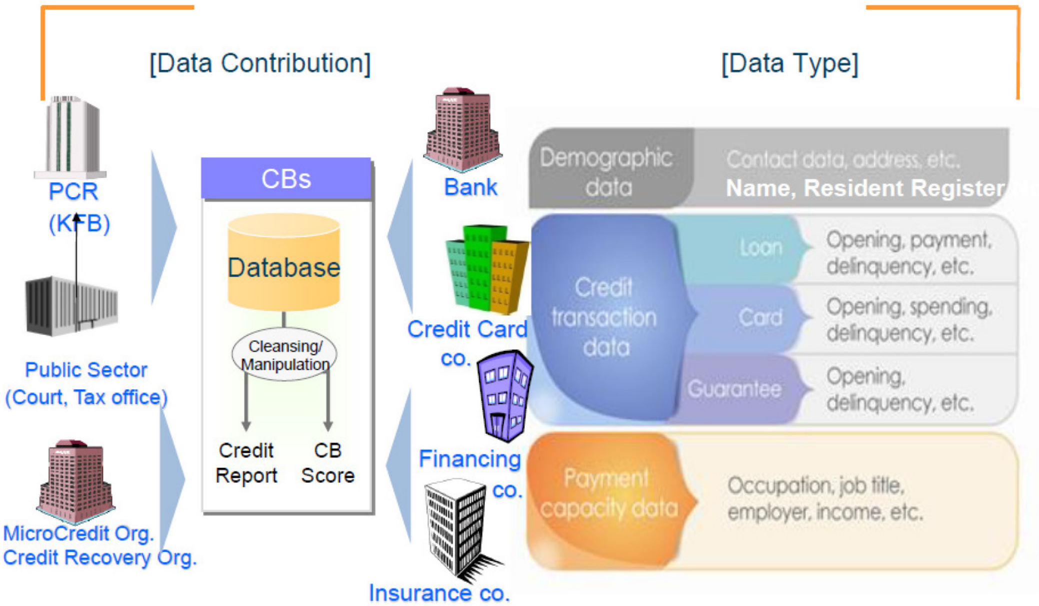
[9] The Korea Federation of Banks (KFB) is a trade association that represents and promotes the interests of the Korean banking industry as a whole.

[10] In 1986, the KFB began to offer credit information management services. In 1997, the government officially designated the KFB as Korea's centralized credit information collection agency and granted it the authority to collect and maintain credit information from all financial institutions, in accordance with the Use and Protection of Credit Information Act.

[11] As of December 2012, approximately 4,208 financial institutions and 560 other entities, including government agencies and courts, had submitted credit information to the KFB. This figure encompasses nearly every type of financial institution operating in Korea, including 18 domestic banks, two credit guarantee funds, one housing finance corporation, one policy-based finance corporation, the branches of 33 foreign banks, 45 securities companies, 37 insurance companies,

organizations and CBs for their use. The KFB covers a broad range of data that encompass every financial institution and helps these institutions to perform more effective and efficient credit assessment of their customers and to better monitor their borrowers. The KFB also collect additional information from public records and courts (for information on lawsuits, tax liens, judgments and bankruptcies). CBs have full access to the concentrated KFB as well. CBs also gather other data which is useful for credit assessment of the borrowers but not included in KFB data.

Credit Reporting System in Korea

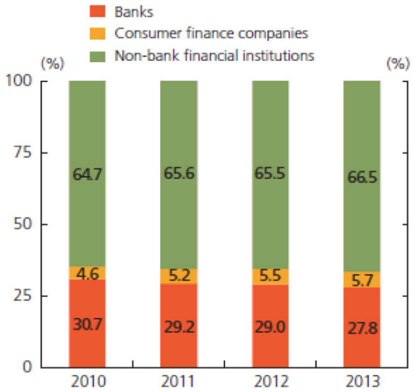


The KFB has characteristics of both a Public Credit Registry (PCR) and a CB. It is similar to a PCR in that its collection of credit information is required by law, while similar to a CB in that it pools a wide range of information and that its decision making is performed by a consultative body comprising representatives of financial institutions. KFB is not owned or administered by a central bank or a supervisory institution unlike PCRs in other countries; therefore, limitations exist to utilize the credit data concentrated by KFB for public interest.

The information gathered by CBs is vast and seeks to cover virtually all Korean consumer borrowing. To the extent that this information is complete, comprehensive, and accurate, it represents a potential new source of statistical data for the BOK on consumer credit markets and behavior. To analyze the households' debt more accurately using consumer credit data the BOK has obtained the aggregate consumer credit data from one of the CBs in Korea. These statistics are produced from the entire consumer database in Korean financial market and help the BOK to diagnose the current situation of households' debt. The figures below show some of these statistics included in "Financial Stability Report".

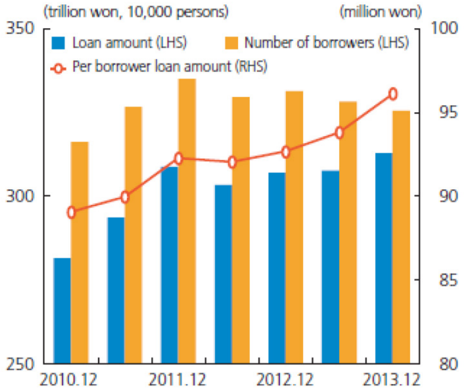
93 savings banks, 64 credit card leasing and finance companies, 1,255 agricultural and fisheries cooperatives, 949 credit unions, and 1,420 community credit cooperatives.

Proportions of low-credit borrower[1] household loans, by financial sector[2]



Notes: 1) Grades 7~10 among the ten credit ratings
2) Non-bank financial institutions excluding consumer finance companies
Source: NICE

Multiple loan amount, multiple loan borrower number, and household loan amount per multiple loan borrower



Source: NICE

The primary sources for current information on consumer debt and credit consist of the aggregate data from financial institutions and CBs using consumer credit data. These databases have several important shortcomings for analysis of loan behavior. To overcome these shortcomings, the Bank of Korea engaged one of the three CBs to supply the records of a nationally representative sample of individuals to make a panel DB. This plan, however, has been delayed due to several cases of personal information leakages. In the next chapter, we introduce our framework of Consumer Credit Panel DB and the reason why the start-up of constructing DB was delayed.

4. A Big Picture of BOK's Consumer Credit Panel DB

To address these shortcomings of existing data sources and to meet a rising need for up-to-date high quality information on household debt and credit at an ongoing basis, the Economic & Statistic Department of BOK set out to create a new and unique quarterly panel dataset, 'Consumer Credit Panel DB (preliminary title)', a new longitudinal database with detailed information on consumer debt and credit, based on information contained in individual credit reports. Our main objective is to create a longitudinal panel of individuals that tracks their access and use of credit at a quarterly frequency from 1Q 2009 to the present, with future updates added each quarter. The panel is supposed to constitute a nationally representative random sample of individual consumers in any given quarter. According to our plan, the panel DB will be comprised of a 5% sample and contain information derived from consumer credit reports to track individuals' and households' access to and use of credit on a quarterly basis. The DB will be used for statistical purposes, as the panel can compute nationally representative estimates of the levels and changes in various aspects of individual and household liabilities.

With respect to the legal environment for using Consumer Credit Information in Korea, since our planned DB would not include any personal information, such as name, national ID number, street address, and so on, our work is in compliance with the current law. However, regardless of legal compliance, public desire to reinforce the protection of personal information is growing after the recent events of consumer credit data leakages. Recently, in Jan 2014, one of the largest information theft cases occurred in Korea.[12] Regulators are preparing to announce a set of measures that will better protect personal information handled by financial firms following a recent massive data leak.[13] These moves toward the reinforcement of the protection of individual information delayed our plan of constructing CCP DB. As the importance of enhancing personal information security has increased along with personal information leaks, CBs had been reluctant to provide the individual Consumer Credit data until recently. The Economic Statistical Department of the BOK had consistently persuaded CBs that their data would be a substantial contribution to pursuing the public interest and they finally agreed to provide the individual Consumer Credit data.

Regarding the information from managed by CBs, the data to be contained in our DB can be broadly categorized into certain personal information, credit account information, including credit card information, and public records. Personal Information includes consumer identification number[14], date of birth, gender, address, income[15], employment information (occupation), and nationality (Korean/foreigner).[16] For credit account data usually occupy a major portion among other credit records, it can easily be assumed that credit account-related information would do so for the planned DB as well. In addition to loan account information provided by creditors, the consumer credit panel contains information from public records, including records of bankruptcy and tax liens.

12 An official of the Korea Credit Bureau (KCB) stole the customer information from the databases of the three of the country's major credit card firms and sold the data to an advertiser, and the information was used for marketing activities. Data of over 20 million consumer was leaked. Regulators are facing criticism that they failed to properly monitor the financial firms.

13 The measures under review include curbing financial firms from asking for "too much" personal information such as citizen registration numbers and strictly regulating information sharing among affiliates.

14 It is important to note that all individuals included in our database are anonymous: we do not know their names, street addresses or national ID numbers. Individuals in our data are distinguished and can be linked over time through a consumer identification number.

15 Not all individual's income information is included, in which case the estimated income, by CBs for the purpose of credit evaluation of borrowers, is used for proxy.

16 Inquiries Records and Credit scores would be also included. Inquiries consist of information on the consumer's credit history requested by a creditor and include date and purpose of the inquiry.

Contents of Credit Information in CCP DB	Table 1
Classification	Content
Personal information	• Consumer identification number, Date of birth, Sex, Address, etc. • Income, Employment information(occupation), Nationality • Inquiries Records, Credit score, etc.
Credit Account Information	• Outstanding loans (dates, amounts, names of lending institutions, mortgage collateral) • Outstanding card loans • Guarantees on repayment (dates, amounts, names of guarantee institutions) • Openings and closures of household checking accounts and credit card and debit card accounts • Delinquencies on debt and Defaults on credit card debt, etc.
Public Information	• Delinquencies on national taxes, local taxes, and customs duties • Failures to honor court repayment orders • Exemptions from debt repayment due to court decisions to discharge upon request from debtors • Individuals in the process of debt recovery in accordance with the Individual Debtor Recovery Act • Delinquencies on customs duties • Delinquencies on industrial insurance premiums and employment insurance premiums, etc.

5. Concluding Remarks : The Way Forward

The large culmination of consumer debt and defaults served to highlight the importance of understanding the liabilities side of households' balance sheets. To that end, the BOK has planned to establish a Consumer Credit Panel, a dataset on household liabilities based on consumer credit data. The Consumer Credit Panel would be designed to provide detailed quarterly data on a panel of Korean consumers from 2009 to present.

The most important process that is required for the DB to be representative of Korean consumer is the sampling design. The BOK is now investigating on the sampling design. If the sampling design proves to be appropriate, the dataset can be used to calculate national and regional aggregate measures of individual-level credit balances and delinquencies by product type. The panel also provides new insights into the extent and nature of heterogeneity of debt and delinquencies across individuals. The longitudinal nature of the data enables research on loan origination and repayment behavior at the individual consumer level over time, across refinances and loan modifications and across different loan types. The panel tracks consumer obligations from 2009 to present, and an analysis of a wide array of previously obscured debt behaviors is ongoing.

The next task, then, would be making household-level data. While consumer income and assets are commonly measured and analyzed at the household level, consumer debt traditionally has been measured at the individual level. For studying household economic behavior and in particular, for understanding life-cycle household finance, it would in fact be more informative to examine debt and credit aggregated at a household level rather than at an individual level.

With these processes completed successfully, the BOK could obtain more detailed and timely information on the debt status, loan payment behavior, and overall credit quality of Korea consumers. Such information could facilitate the BOK's analysis of macroeconomic conditions, improve its understanding of the way credit is provided to consumers, and enhance the bank's monitoring function of financial stability.

Renegotiated loans in the Czech Republic

Irena Zykanová

Introduction

Renegotiation of loans has become an important phenomenon in banking in recent years Renegotiation is a process whereby clients either agree to repay the lender the outstanding amount of their loans under new terms and conditions or move their loans to another lender offering better conditions. Renegotiated loans have gained importance thanks mainly to low market interest rates and the end of the period of fixed interest rates on many loans, especially those in the housing area.

The interest in monitoring the amounts of, and interest rates on, renegotiated loans is based primarily on the needs of financial stability authorities, who track information on renegotiated loans transferred from other institutions in order to monitor the "wooing of clients" between banks. Loan renegotiation is also of great interest to monetary policy makers at both national and European level.

Information on renegotiated loans has not previously been monitored at the banking sector level in the Czech Republic. Some banks have published estimates based on non-standardised methodology. The Czech National Bank is the source of information on total new loans, or new loan agreements, in a given period for the entire banking sector in the Czech Republic. However, under European Central Bank methodology, these loans include both new loan agreements, which specify the interest rate for the first time, and renegotiations of existing loans. It was therefore impossible to use these data to determine the share of renegotiated loans in total new loans.

The first part of this paper describes the reasons for introducing collection of renegotiated loans data and discusses the methodology for renegotiated loans and key items on the agenda of the working group set up to introduce collection of such data in the Czech Republic. It also defines the most difficult steps in implementing the data collection requirements. The alignment of national requirements with those based on EU legislation is then discussed.

The second part of the paper analyses the first available data reported by banks to the Czech National Bank in the first few months of 2014. The data are analysed in categories by client sector and by purpose of the loan. Outputs relating to renegotiated loans for house purchase in the Czech Republic are an important part of the paper.

Reasons for introducing collection of data on renegotiated loans

Internal requirements of the Czech National Bank

Some data on renegotiated loans were available on the websites of various organisations, and some estimates were released by banks. The former were acquired by the organisations concerned from selected banks only. However, the methodology for these data releases was not standardised and could not be applied to the entire banking sector in the Czech Republic. Integrated information on renegotiated loans was thus not available from any source. The first requirements for the collection of such data were raised by the Czech National Bank's Financial Stability Department (FSD). These requirements were formulated in the first half of 2012 as part of the standard preparations for bank reporting for 2013. Users from the Monetary Policy Department soon joined their colleagues in requiring such data. The FSD justified its requirements by the fact that renegotiated loans, particularly in the housing area, have become an important part of the credit market in recent years. The FSD expects this trend to continue in the years to come. This is mainly because the period of fixed interest rates on loans is coming to an end and interest rates are still low. Another reason is the competitive environment in the area of loans for house purchase. This is a purely positive phenomenon from the financial stability point of view, as lower interest rates reduce the burden on households. On the other hand, if clients are able to increase their borrowing again, household debt may grow further. According to the FSD, the risk may consist in households underestimating the increase in their debt burden. From the banks' perspective, "wooing of clients" and provision of low interest rates may lead to falling returns on housing loans as a whole. However, this competition may have a positive effect on banks overall, particularly where clients migrate to other banks with other banking products such as current accounts.

Requirements of the European Central Bank

The standard process of amending the relevant statistical regulations issued by the European Central Bank started at roughly the same time as bank reporting for 2013 was being prepared. These amendments are made approximately once every five years and serve as the basis for the collection of harmonised statistical data in EU Member States. The requirements raised included a strong interest in monitoring renegotiated loans. However, the ECB raised its requirements one year later than the CNB's internal users, so that data collection under the amended regulation was not scheduled to start until 2014. At that stage, the methodology had not been finalised and the new requirements regarding the collection of data on renegotiated loans were still in the preparatory phase at Member State level. A requirement for renegotiated loans to be monitored as a sub-item of new business as defined by the ECB regulation concerning statistics on interest rates was raised during this phase for both households and non-financial corporations. It was not clear, however, whether increases in loan amounts would be taken into account and whether contracts originally provided by another institution would also be regarded as renegotiations. In the interest rate statistics, new business means any new agreements between the bank and the customer. The customer's active involvement in negotiations is a necessary condition for new business. All financial contracts that specify the interest rate for the first time and all renegotiations of existing contracts are deemed to be new business.

Establishment of a working group

Based on the requirements raised internally and by the ECB, the Statistics Department prepared a document containing a methodological description of renegotiated loans and a proposal for renegotiated loan data collection starting in 2013. This document was submitted to the Czech Banking Association for approval. However, banks flatly rejected this proposal, mainly due to its high costs and the time needed to prepare their internal systems. At the same time, banks expressed an interest in establishing a working group to clarify the methodology so that the requirement could be met as part of the preparation of bank reporting in 2014. As the ECB had not entirely clarified its requirements and might change them in the future, the Czech National Bank agreed to the establishment of the working group. A document prepared for the working group described the breakdown of existing new business into other sub-items by original lender and according to whether the loan amount was increased during renegotiations (see the proposed collection method below). This breakdown was compliant with both national and European requirements.

The proposed collection method

It was proposed to divide the original collection of data on new loans in the *total* category into the following sub-categories:

Refinanced new loans – excluding increase/extension – this sub-category includes loans provided earlier by another institution and for the outstanding amount of which a new loan agreement has been signed with the reporting bank. In cases where the loan was increased when it was refinanced, it was proposed to include only the non-increased portion of the new refinanced loan in this category. This sub-category also includes consolidated loans whose original lender was another institution.

Refinanced new loans – increase/extension – this sub-category contains only the increased portion of the new refinanced loan which previously existed with another institution and for the outstanding amount of which a new loan agreement has been signed with the reporting bank.

New loan agreements – this sub-category contains loan agreements which entered the economy in the given month for the first time – so-called net new loans.

Other renegotiations of existing loans excluding increase/extension – this sub-category contains loans which were previously provided by the reporting bank and have merely been renegotiated. It also includes consolidated loans whose original lender was either another institution/other institutions in addition to the reporting bank, or only the reporting bank.

Other renegotiations of existing loans – increase/extension – it was proposed to include in this sub-category only the increased portion of the loan which previously existed with the reporting bank and for the outstanding amount of which a loan agreement has again been signed with the reporting bank. This category will also include increases in consolidated loans whose original lender was either another institution/other institutions in addition to the reporting bank, or only the reporting bank.

Issues concerning the renegotiated loans methodology

Definition of refinanced loans:

The first point on the agenda was clarification of the term *refinanced loan*. The working group members agreed that, for the purposes of collection of the new data, refinanced loans would consist solely of loans whose original lender was another institution. Loans refinanced only within the bank and loans with multiple lenders would be deemed other renegotiations of existing loans. These two categories would together make up renegotiated loans. The main purpose of separating the original lender was to meet internal users' need to monitor the wooing of clients between banks/institutions.

Relationship between refinanced loans/other renegotiations and restructured loans:

Banks also raised the question of whether restructured loans should be reported as a sub-category of refinanced loans/other renegotiations. The CNB informed them that these were two different and mutually independent terms. Restructured loans are defined as claims for which the bank has provided relief to the borrower after judging that it would probably incur a loss if it did not do so. For economic or legal reasons relating to the borrower's financial situation the bank is has thus provided the borrower with relief that it would not have granted otherwise. Such relief consists, for example, in revising the repayment schedule, lowering the interest rate or waiving late charges. A claim arising from the renewal of a short-term loan for current assets is not considered a restructured claim if the borrower has met all her payment and non-payment obligations arising from the loan agreement.

These loans are subject to collection but are not disclosed under new business. This is due to their interest rates, which do not usually correspond to the current situation in the loan market and might impair the times series of released data.

Costs of new data collection:

According to banks, obtaining information on increases in the loan amount for refinanced loans, i.e. loans originally granted by another institution, was the most expensive part of the implementation of the new requirements. This information was not available in banks' internal systems. It was very costly to implement, as a new field had to be added to enable manual entry of the information into the system. The implementation costs were assessed as follows:

a) information on refinanced loans – costs not too high

b) information on increases in the loan amount for refinanced loans – very high costs

c) information on the original lender (within or outside the bank) – significant costs

An analysis of the 2014 Q1 data

All the charts and tables below are based on the data for 2014 Q1. The data concerned are sum totals or – in the case of the rates for 1/2014, 2/2014 and 3/2014 – weighted averages. Restructured loans are excluded and all the amounts are in CZK millions for all currencies in total (CZK, EUR and USD). The data do not cover revolving loans, debit balances on current accounts and credit card debt. For these "fast-moving instruments" the stock concept is used, so data on new business is not collected. Non-negotiable debt securities are excluded.

New loans to the household sector

Chart 1 illustrates the percentage of net new loans for consumption, house purchase and other purposes overall, including increases and all renegotiated loans. These include both refinanced loans and other renegotiations. Renegotiated loans account for 36% of total loans and net new loans make up the rest.

New loans provided to households for consumption, house purchase and other purposes – share of renegotiated loans

Chart 1

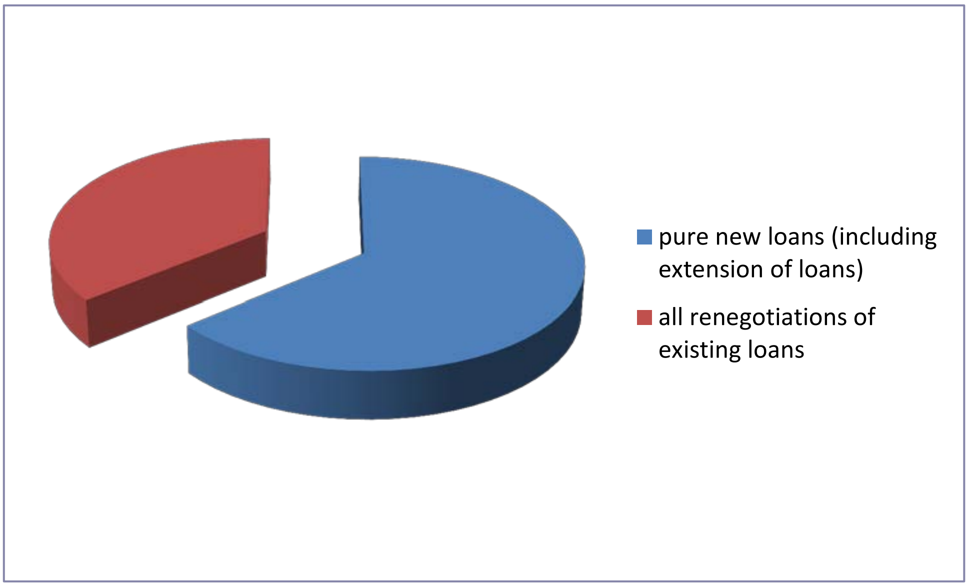
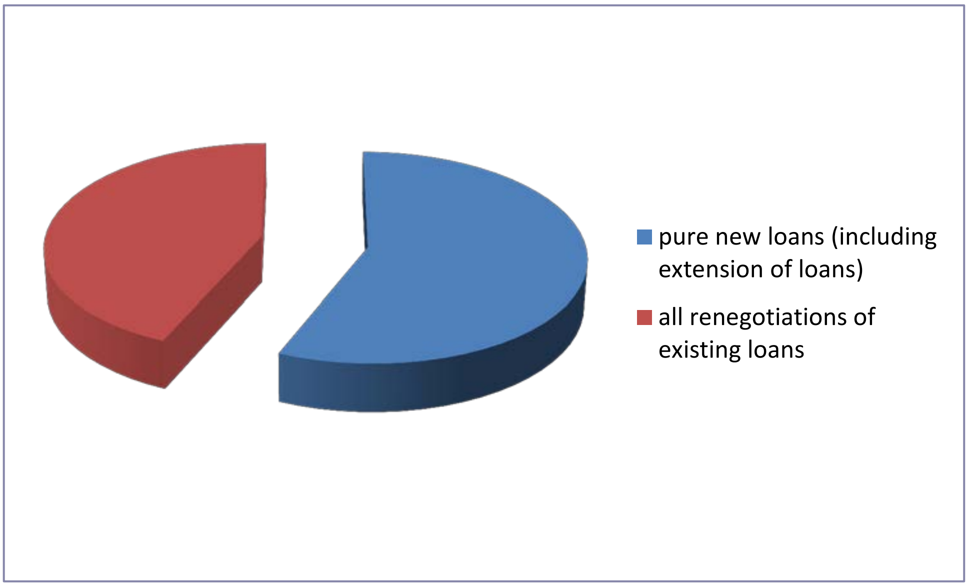


Chart 2 illustrates the percentage of net new loans for house purchase including increases and all renegotiated loans. The chart shows that in the case of housing loans, previously existing loans account for almost half (44%) of net new loans in the economy.

New loans provided to households for house purchase – share of renegotiated loans

Chart 2



It is apparent from Chart 3 that in the case of consumer credit the share of renegotiated loans is nowhere near as high as in the case of loans for house purchase. Previously existing loans account for a negligible proportion (12%) of net new loans.

New loans provided to households for consumption – share of renegotiated loans

Chart 3

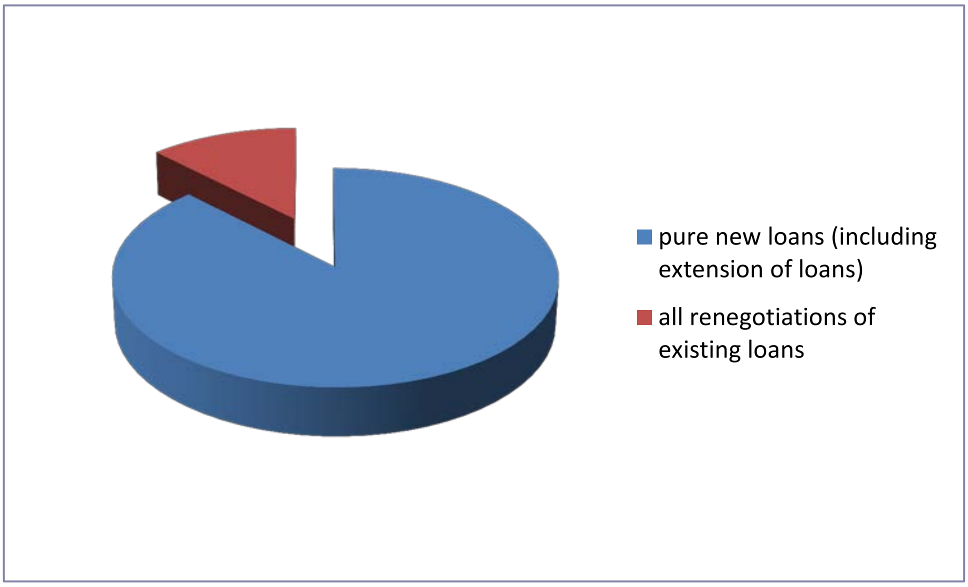


Chart 4 illustrates in more detail the share of refinanced loans and other renegotiations for both consumer credit and loans for house purchase. As regards loans for house purchase, clients tend to stay with the original bank rather than renegotiate their loans with another institution. However, these loans are not negligible either – they account for about one-quarter of previously existing loans.

Loans for house purchase and consumption by new loan category

(in CZK millions) Chart 4

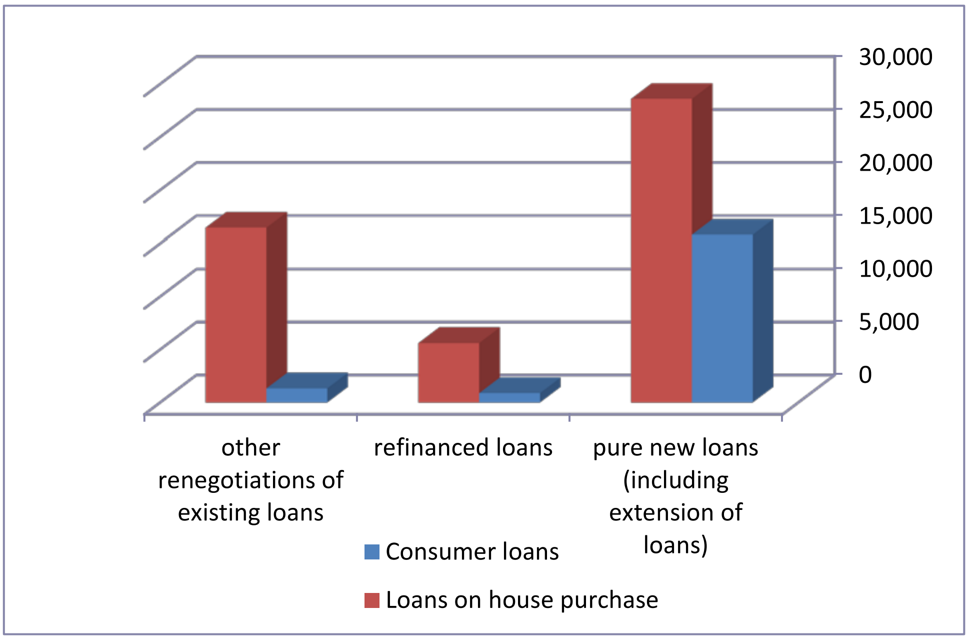
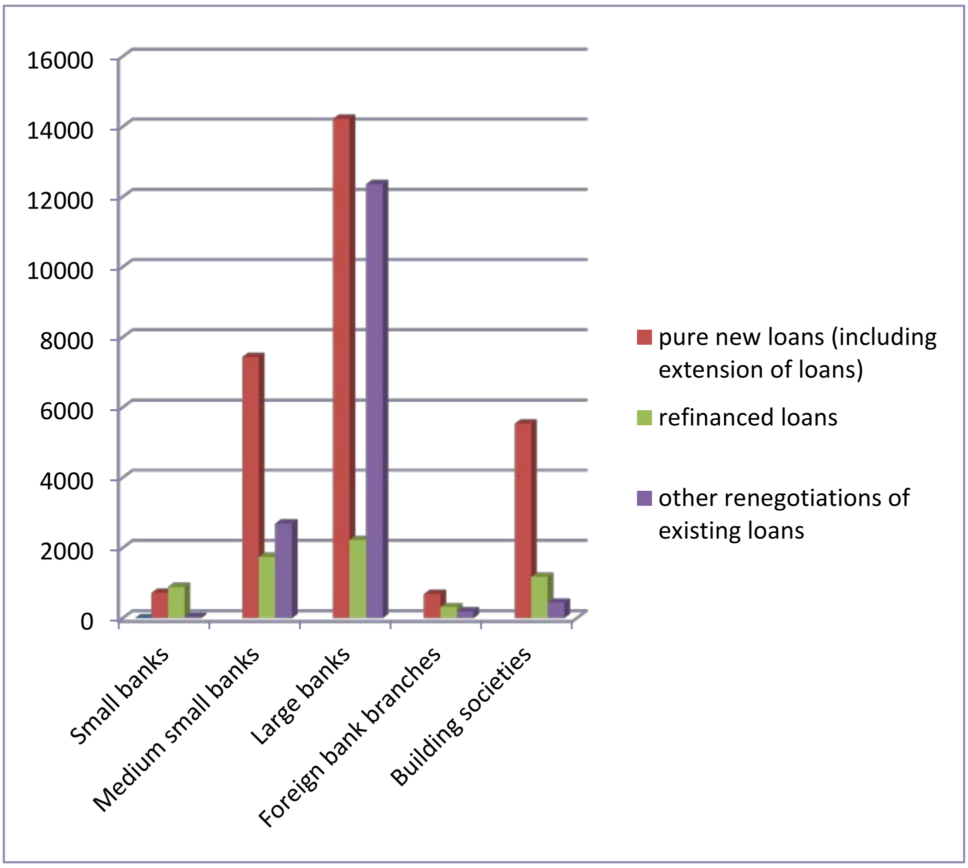


Chart 5 shows the shares of bank groups in each category of new loans for house purchase. As expected, large banks account for the largest proportion in all categories. Refinanced loans are the only category where medium-sized and small banks have comparable shares. Medium-sized banks are almost equal to large banks in this category.

New loans by bank group

(in CZK millions) Chart 5

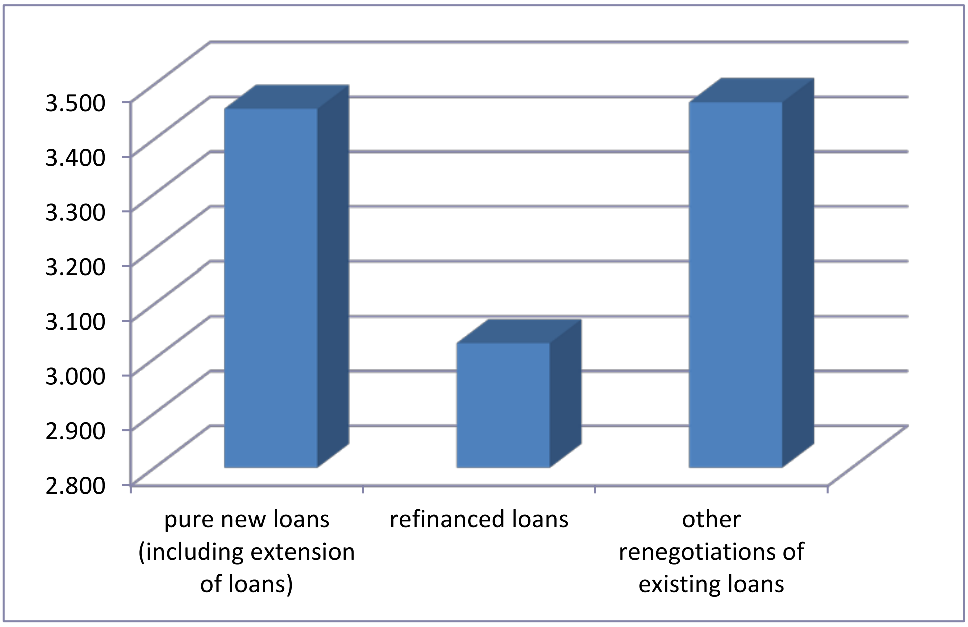


Interest rates on new loans to the household sector

Chart 6 illustrates interest rates on new loans for house purchase broken down by new loan category. The chart shows that the lowest rates are, as expected, offered for refinanced loans. In other words this means that if a client decides to renegotiate his/her mortgage with an institution other than the original lender, he/she will negotiate a rate that is about 0.4 percentage point lower. Interest rates on net new loans are almost the same as those on other renegotiated loans. This implies that if the client remains with his/her original lender when altering the terms and conditions of the contract (most frequently interest rate refixation), he/she obtains an interest rate that is comparable with that on net new loans in the economy.

Interest rates on new loans for house purchase to households

(in %) Chart 6



As regards interest rates on loans for house purchase by bank group, Chart 7 shows that they are almost identical across all bank groups. Building societies are the only group that differs. However, building societies and the services they provide differ in nature from other banks. For example, they provide bridging loans, which are provided at higher rates than the usual rates on mortgage loans for residential property.

Interest rates on new loans for house purchase by bank group

(in %) Chart 7

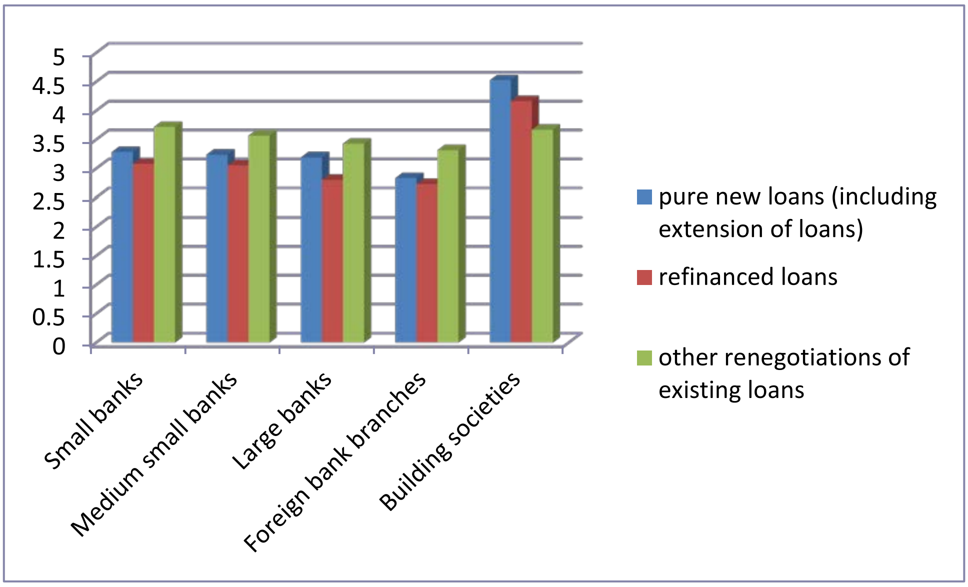
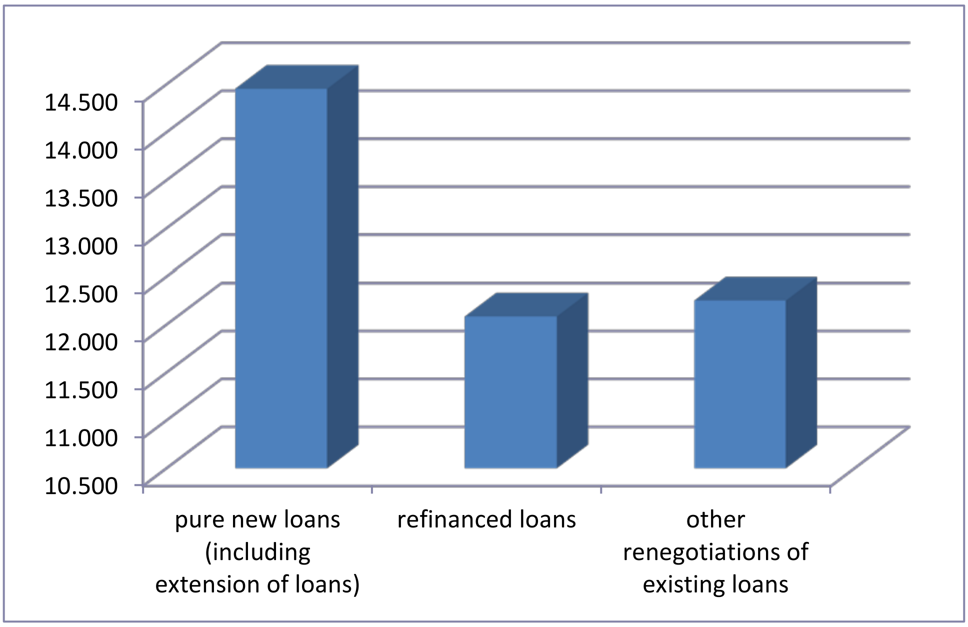


Chart 8 shows the differences in interest rates on consumer credit, again by new loan category. The highest consumer credit rates are charged on new loans. They are more than 2 percentage point higher than those on renegotiated contracts. If a client renegotiates his/her consumer credit with another institution or alters the terms and conditions of the contract with his/her original lender, he/she obtains a better rate.

Interest rates on consumer credit provided to households

(in %) Chart 8

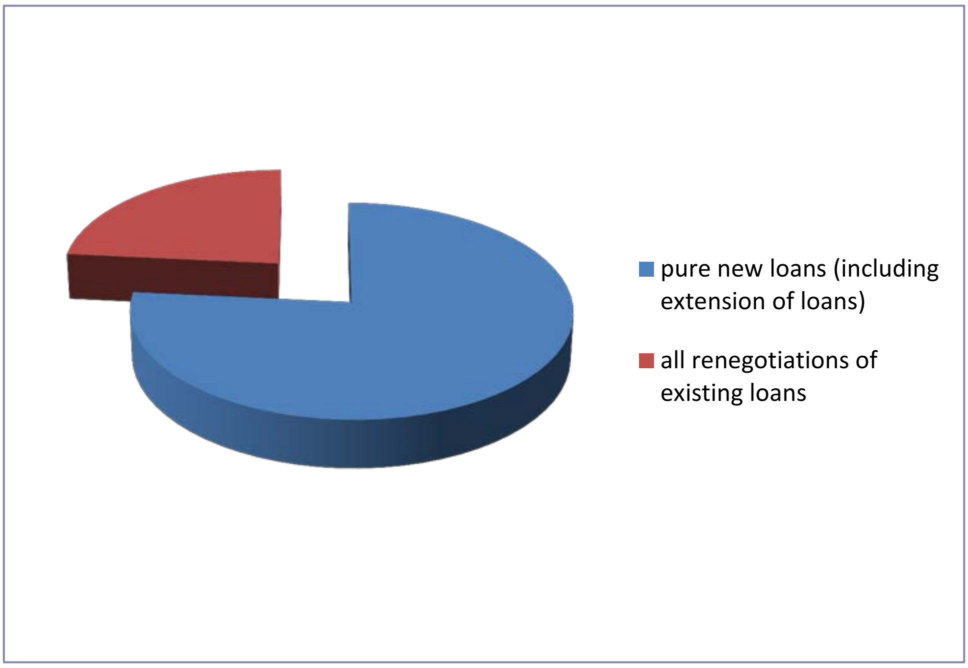


New loans to non-financial corporations

The share of previously existing loans is much lower for non-financial corporations than it is for households. Such loans account for about 23% of total loans.

Total new loans to non-financial corporations – share of renegotiated loans

Chart 9

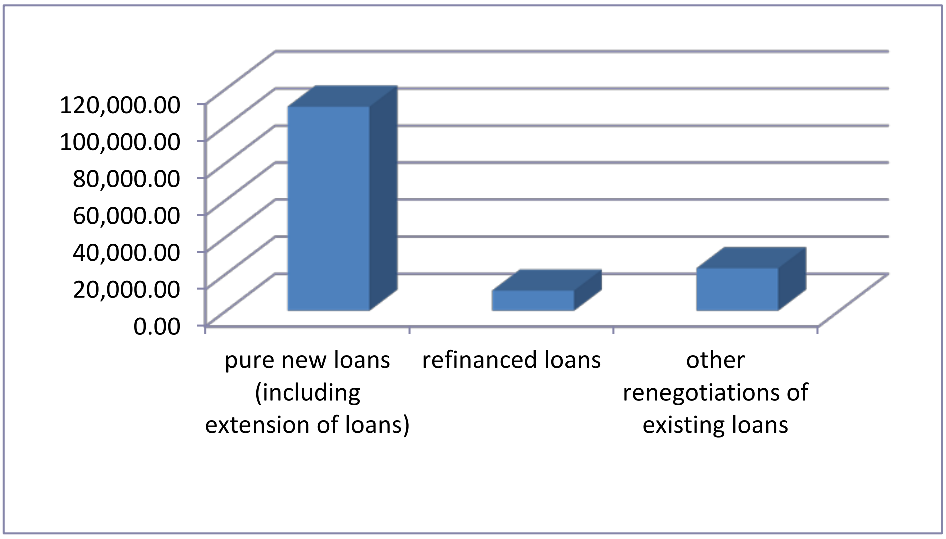


It is clear from Chart 10 that in the case of renegotiation, borrowers tend to stay with their original lender when altering the terms and conditions rather than transferring their loans to another institution. Chart 11 shows, however, that the interest rates on these new loans are about 1.5 percentage points higher than those on refinanced loans, which are provided at the lowest rates. Commercial banks explain this mainly by the fact that clients usually buy other products when taking on a completely new loan, which allows them to obtain a lower interest rate than clients who are merely renegotiating existing loans with their banks.

New loans to non-financial corporations by new loan category

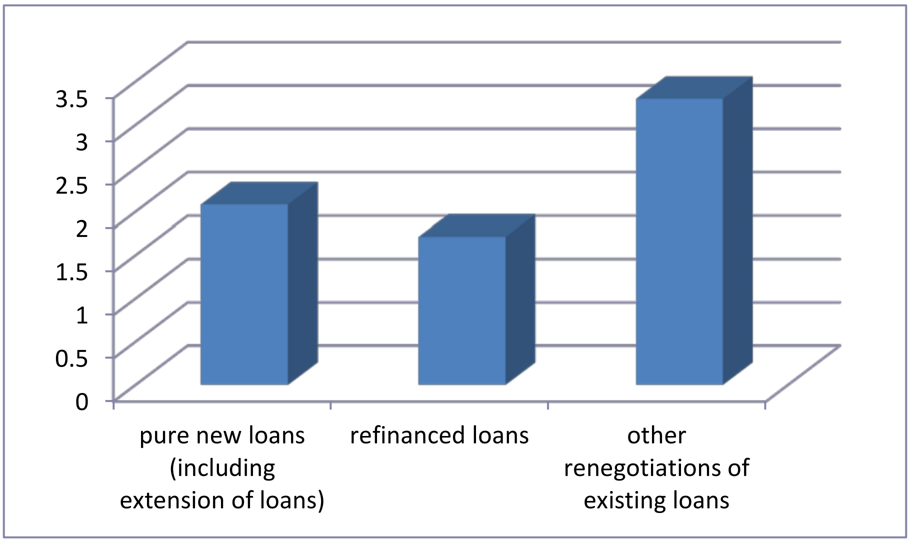
(CZK in millions)

Chart 10



Interest rates on new loans to non-financial corporations by new loan category

(in %) Chart 11



BIS debt securities statistics: a comparison of nationality data with external debt statistics

Branimir Gruić and Philip Wooldridge[1]

The BIS compiles and publishes statistics on international, domestic and total debt securities (IDS, DDS and TDS, respectively). These statistics were revised in 2012 to achieve a closer alignment with the recommendations in the *Handbook on Securities Statistics*, which sets out an internationally agreed framework for classifying securities.[2] The DDS and TDS statistics are from national sources and compiled on a residence basis. The IDS statistics are based on security-by-security information purchased from commercial sources. The granularity of the underlying information enables the BIS to compile the IDS statistics by both the residence and the nationality of issuers. This note examines the extent to which IDS on a nationality basis are incorporated within components of external debt.

Concept of nationality

Whereas residence underpins balance of payments (BOP) and system of national accounts principles, nationality is more closely associated with accounting and supervisory principles. In particular, nationality is based on concepts of corporate control and associated with the consolidation of assets and liabilities for related entities.[3]

Nationality is a proxy for the ultimate obligor, as opposed to the immediate borrower on a residence basis. Identification of the ultimate obligor is useful to analyse potential financial support that might be available from related entities and to understand links between borrowers in different countries and sectors. For example, the debts of a Cayman Islands subsidiary of a Brazilian company might be guaranteed by the parent company. The parent might thus be exposed to any liquidity or solvency difficulties experienced by the subsidiary.

Criteria for identifying the ultimate obligor are more strictly defined in the BIS consolidated banking statistics on an ultimate risk basis than in the BIS debt securities statistics. In the consolidated banking statistics, only certain credit risk mitigants are recognised as effectively transferring risks from the immediate borrower to another (ultimate) obligor. These include explicit guarantees, liquid collateral and credit derivatives (BIS (2013)). By contrast, the BIS debt securities

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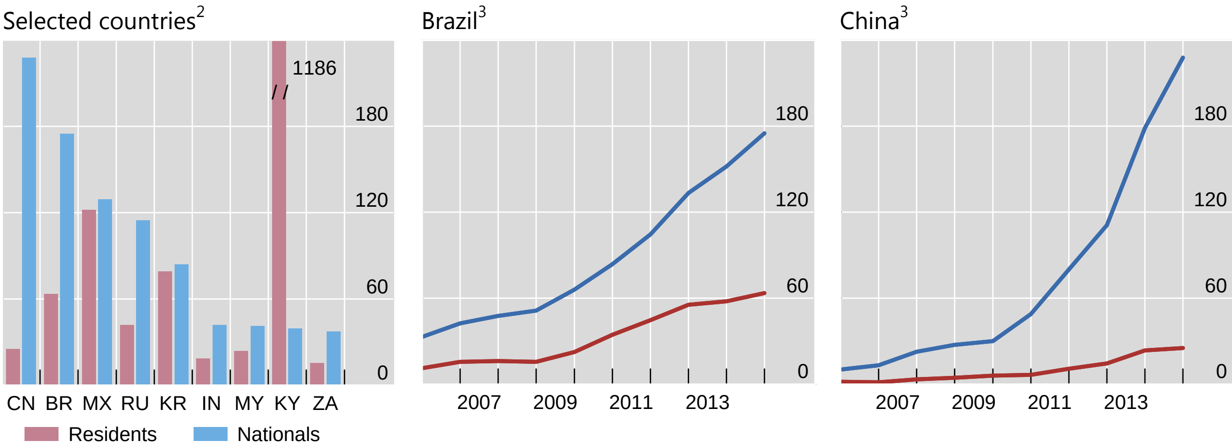
[2] For an explanation of the revisions to the BIS debt securities statistics, see Gruić and Wooldridge (2012). The *Handbook on Securities Statistics* is available at www.imf.org/external/np/sta/wgsd/hbook.htm. The BIS debt securities statistics are available at www.bis.org/statistics/secstats.htm.

[3] For a discussion of corporate control and consolidation, see Irving Fisher Committee (2012).

statistics follow a simpler approach and equate the ultimate obligor with the ultimate parent. In other words, the nationality of an issuer is based on the country where its ultimate parent resides, regardless of whether the issuer's debts are explicitly guaranteed by the parent. Continuing with the abovementioned example, debt securities issued by the Caymanian subsidiary of a Brazilian company would be allocated to the Cayman Islands on a residence basis and Brazil on a nationality basis. For issuers that are part of complex corporate groups, it can be difficult to identify the ultimate parent and thus nationality may be based on an intermediate parent.[4]

International debt securities[1]

Amounts outstanding, in billions of US dollars — Graph 1



BR=Brazil; CN=China; IN=India; KR=Korea; KY=Cayman Islands; MX=Mexico; MY=Malaysia; RU=Russia; ZA=South Africa.

[1] Issued by non-bank financial corporations and non-financial corporations. [2] At end-June 2014. [3] At end-year, except 2014 at end-June 2014.

Sources: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS debt securities statistics.

For many countries, the BIS's IDS statistics on a nationality basis are significantly larger than the statistics on a residence basis (Graph 1, left-hand panel). For example, at end-June 2014 outstanding IDS for China totalled $228 billion on a nationality basis but only $25 billion on a residence basis, and for Brazil $175 billion by nationality compared to $64 billion by residence. The main exceptions are international financial centres, such as the Cayman Islands, where issuance by residents typically exceeds issuance by nationals because foreign-owned financing vehicles are captured as resident issuers.

[4] The BIS identifies the parent based on information included with the security-by-security data purchased from commercial sources. In these data, information about group structures is often incomplete.

Intercompany lending

The difference between the residence and nationality measures mainly captures IDS issued by the offshore affiliates of financial and non-financial corporations.[5] To the extent that the parent company is able and willing to stand behind the debts of its affiliates, the difference may be considered a proxy for contingent liabilities. In selected emerging market countries, including Brazil and China, such contingent liabilities have increased significantly in recent years (Graph 1, middle and right-hand panels). This has led some analysts to caution that growing offshore issuance could raise financial stability concerns, in particular increased vulnerability to external shocks, eg BIS (2014), Caruana (2013).

In this context, a question that arises is the extent to which such contingent liabilities are captured by standard measures of international indebtedness. In countries where companies issue international bonds through their offshore affiliates, are standard measures underestimating the build up of external liabilities? The answer is that it depends on the use of the borrowed funds.

If funds raised by offshore affiliates are on-lent to the parent company, then the on-lent portion will be captured by standard measures, albeit as an intercompany transaction. In external debt statistics, "intercompany lending" is identified separately as part of gross external debt. Intercompany lending has three components: debt liabilities of parents to their affiliates, debt liabilities of affiliates to their parents, and debt liabilities between related affiliates (Task Force on Finance Statistics (2013)). IDS issued by offshore affiliates and repatriated by the parent would be included in the first component.

Intercompany lending is also recorded in BOP and international investment position (IIP) statistics, as a "debt instrument" under foreign direct investment (IMF (2009)). However, liabilities to offshore affiliates are recorded on a net basis, ie direct investments by parents in offshore affiliates (eg purchases of debt securities issued by affiliates) less direct investments by affiliates in the parent (eg funds borrowed from affiliates). In IIP and BOP statistics, debt securities issued by offshore affiliates will also be recorded within portfolio investment if (unaffiliated) residents purchase a portion of the issue.

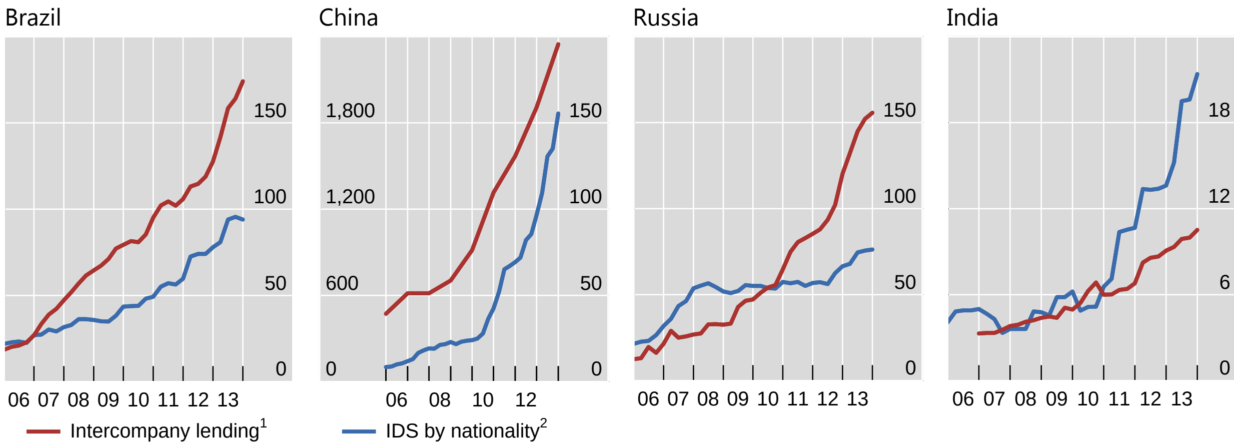
Implications

Available data suggest that a signification proportion of funds raised by the offshore affiliates of emerging market corporations has historically been on-lent to parents. Graph 2 compares outstanding debt securities issued by the offshore affiliates of Brazilian, Chinese, Indian and Russian companies to intercompany lending as reported in external debt statistics. Intercompany lending is not available for China and thus direct investment liabilities are shown instead, where liabilities comprise equity as well as debt instruments. Trends in IDS and intercompany lending are highly correlated.

5 For a discussion of why some borrowers issue through offshore affiliates, see McCauley et al (2013).

International debt securities and intercompany lending

Amounts outstanding, in billions of US dollars | Graph 2



[1] For China, intercompany lending is shown on the left-hand axis and refers to the stock of total FDI-related liabilities (debt and equity investments in China). [2] International debt securities on a nationality basis minus those on a residence basis, for non-bank financial corporations and non-financial corporations. This calculation is a proxy for bond debt owed by offshore affiliates. However, it underestimates such debt because IDS on a residence basis include IDS issued by nationals of other countries. The bias is small except in countries that are international financial centres.

Sources: Dealogic; Euroclear; national data; Thomson Reuters; Xtrakter Ltd; BIS debt securities statistics.

While simple correlations must be interpreted with caution, analyzing the relationship between issuance by offshore affiliates and intercompany lending can contribute to a richer understanding of a country's vulnerability to external shocks. To be sure, not all funds borrowed through offshore affiliates will be on-lent to parent companies. Some funds will be used to finance foreign operations and investments. This is especially true of corporations with global operations, such as the Tata Group of India. In such cases, foreign assets as well as liabilities should be considered when assessing the risks associated with offshore borrowing.

In conclusion, the BIS's international debt securities statistics on a nationality basis can provide supplementary information useful to statisticians as well as analysts. For statisticians, the difference between IDS by residence and by nationality can act as a cross-check on national estimates of intercompany lending (although it is necessarily a rudimentary and incomplete check). For analysts, the difference can signal that a deeper analysis of a country's vulnerability to external shocks may be required.

References

BIS (2013): *Guidelines for reporting the BIS international banking statistics*, Basel, March, www.bis.org/statistics/bankstatsguide.htm.

BIS (2014): *84th Annual Report*: 2013–14, Basel, 29 June, www.bis.org/publ/arpdf/ar2014e.htm.

Caruana, Jaime (2013): "Addressing risks to financial stability", speech to the 49th SEACEN Governors' Conference and High-level Seminar in Kathmandu, Nepal, 21 November, www.bis.org/speeches/sp131126.htm.

Gruić, Branimir and Philip Wooldridge (2012): "Enhancements to the BIS debt securities statistics", *BIS Quarterly Review*, December, pp 63–76, www.bis.org/publ/qtrpdf/r_qt1212h.htm.

International Monetary Fund (2009): *Balance of Payments and International Investment Position Manual: Sixth Edition (BPM6)*, Washington DC, www.imf.org/external/pubs/ft/bop/2007/bopman6.htm.

Irving Fisher Committee (2012): "Residency/Local and Nationality/Global Views of Financial Positions", *IFC Working Papers*, no 8, February 2012, www.bis.org/ifc/publ/ifcwork08.htm.

McCauley, Robert N, Christian Upper and Agustín Villar (2013): "Emerging market debt securities issuance in offshore centres", *BIS Quarterly Review*, September, pp 22–3, www.bis.org/publ/qtrpdf/r_qt1309w.htm.

Task Force on Finance Statistics (2013): *2013 External Debt Statistics: Guide for Compilers and Users (2013 EDS Guide)*, Washington DC, www.tffs.org/edsguide.htm.

Standardised granular credit and credit risk data

Violetta Damia and Jean-Marc Israël[1]

Abstract

The recent financial crisis has further highlighted that, although a wide range of data on credit are already available, more granular, frequent and flexible credit and credit risk data are considered of high relevance within the European System of Central Banks (ESCB) for monetary policy, financial stability and research analyses, as well as for the development and production of ESCB statistics. Such granular credit and credit risk data are also critical for micro-prudential supervisory purposes.

In this context, central credit registers, which are operated by several National Central Banks (NCBs) in the EU, appear as a major data channel. Such databases have proven to be very valuable sources of information by the financial industry itself for assessing creditworthiness of potential borrowers and benchmarking credit risks, and by supervisory authorities in assessing credit risk borne by credit institutions and other lenders. In many countries, (complementary) granular credit data may be available from private credit bureaus or via surveys.

Still differences in concepts, definition and coverage across countries are being revisited by the ESCB with a view to increasing their value for credit and credit risk analysis to support policy making, and for assessment of their risks by lenders.

This paper presents the current ESCB work towards harmonisation in concepts and definitions and convergence in data coverage and content so as to share a significant subset of granular credit and credit risk data to better support and serve many policy and analysis needs at European and national levels.

Keywords: European System of Central Banks (ESCB), credit and credit risk data, credit exposures, creditworthiness, indebtedness, Central Credit Registers, granular data, harmonisation, convergence

[1] European Central Bank.

1. Background

The recent financial crisis has highlighted that, although a wide range of data on credit are already available, more granular, frequent and flexible credit and credit risk data are considered of high relevance within the European System of Central Banks (ESCB) for monetary policy, financial stability and research analyses, as well as for the development and production of ESCB statistics. Such granular credit and credit risk data are also critical for micro-prudential supervisory purposes.

From the input side, central credit registers (CCRs) or similar granular (loan-by-loan or borrower-by-borrower) credit reporting systems (herein called granular-credit datasets) are considered as major data channels. CCRs are databases operated by national central banks (NCBs) containing loan-level or borrower-level information locally tailored to provide for exchange of credit information within the financial system, especially among banks, and additionally they serve to support micro-supervision analysis. Currently, there are three main uses of CCRs: (1) to enable bank supervisors to accurately assess credit risk in supervised financial institutions; (2) to support financial transactions by assisting credit institutions in the evaluation of risk; and (3) for economic analysis.

The ESCB has explored the potentials of granular-credit datasets, in particular to understand to which extent their content may be enhanced and adapted to euro area and EU statistical, supervisory and analytical needs, i.e. to meet the above mentioned user requirements while at the same time alleviating respondents' reporting burden and increasing transparency. In this context, several related ESCB initiatives have not only proven the analytical usefulness of such granular datasets but have also shown that, where applicable (since in some countries there is no CCR), the differences in terms of coverage, attributes and data content are often substantial pointing to the need for (1) harmonisation in concepts and definitions, (2) over time, convergence in data coverage and content.[2]

2. ESCB Task Force on Analytical Credit Datasets

On the basis of earlier work, an ESCB Task Force on Analytical Credit Datasets (hereinto mentioned as the TF), comprising experts from the statistical as well as from credit registers' areas, was mandated to investigate the following main issues:

[2] For more than 5 years, CCRs data (or granular data on credit in general) have been investigated by the ESCB in order to verify the possibility to (re-)use them for statistical purposes. Although there was a broad agreement on the fact that granular data may alleviate the reporting burden, at the same time it was widely acknowledged that a lot of work is still required to reach the necessary level of harmonisation. In May 2009, the Expert Group on Credit Histories set up by the European Commission, recommended for Credit Registers to converge, in particular as regards the concepts and definitions used (e.g., bad debt, arrears, default, loan types, etc.). It, however, recognised several legal and other obstacles in doing so. Based on some work organised by the ESCB in 209–2010, a task force elaborated in 2012 some recommendations for the identification and common definition of core attributes on loans. It also, ran a pilot exercise and, based on the feedback received from a representative sample of ECB internal users, concluded that harmonised granular credit and credit risk information is key for monetary and financial stability analyses. Since then, the ECB Banking Supervision (in the making) also strongly supported such an endeavour.

(1) identify a core set of information to meet main users' needs in the long term and elaborate on its scope

(2) to further analyse and consider harmonised concepts and definitions and methodological enhancements to core data, metadata and attributes;

(3) estimate the costs to be incurred by the ESCB and the reporting agents; and

(4) consider the governance, legal and confidentiality issues prevailing at national and EU levels[3] and prepare the appropriate legal instrument.

To launch its work, the TF organised in February 2014 a workshop related to ESCB users' requirements on credit and credit risk data, where ESCB users were invited to present concrete business cases of using credit data in their areas that are already implemented and related data needs. The workshop confirmed the very high importance given to granular credit and credit risk data for a number of ESCB and ESRB tasks; the availability of a granular credit dataset would:

– better address a number of ***monetary policy analysis*** relevant issues relating to the provision of credit with a variety of counterparty breakdowns (size of firms, economic activity, undrawn credit lines, etc.) and the functioning of the transmission mechanism, especially in fragmented markets;

– play an important role in supporting the direct use of credit claims in ***monetary policy operations*** and in calibrating potential credit support measures to monitor bank lending and liquidity in the euro area money market;

– adequately calibrate the different ***risk control and collateral management measures*** of the Eurosystem, including adequate pricing, credit risk assessment and haircuts, and to allow an in-depth analysis of credit claims pledged with the Eurosystem credit operations;

– support ***financial stability surveillance and macro-prudential analysis*** as well as quantitative risk assessment, notably in the context of macro-stress testing; a key expected benefit, also for micro-prudential supervision, will be the assessment of creditworthiness of borrowers (via probabilities of defaulting) by credit institutions using internal-ratings based approach;[4]

– meet ever stronger and multiform ***statistical and analytical needs*** and breakdowns which require agility through granular datasets;

– serve ***research purposes*** for supporting credit risk analysis across euro area countries and various other financial research work, also assessing their impact on the non-financial economy; and, last but not least,

– enable a multitude of usage options in the ***supervisory process*** (off- and on-site, including the use in risk assessment systems) and permit analysis options

[3] A light fact-finding exercise on the legal frameworks prevailing at national level among the participating members has shown that relevant confidentiality and data protection obligations apply, arising under both the EU and national law, and that accessibility to CCR raw data is often restricted for supervisory purposes.

[4] So far these are scarcely available as only few large credit institutions use internal-ratings based approach in each Member State. In the AnaCredit shared dataset there will be more data on probabilities of defaulting, allowing several analyses and comparisons, including possible benchmarking.

otherwise not covered by regular reporting as well as complementing other reporting systems' information.

Following users' confirmation on the analytical value of such datasets, the TF launched its work aiming at establishing ***a core set of analytical granular credit data (the so-called analytical credit dataset or AnaCredit)*** to be shared, on a need-to-know basis, across the ESCB and other relevant institutions (e.g. national supervisory authorities associated in the Single Supervisory Mechanism, SSM, the European Banking association) and the EU Commission.

To achieve the long-term objectives, the TF provided input to the preparation of ***Decision ECB/2014/6***, adopted on 24 February 2014,[5] concerning the organisation of preparatory measures for the collection of micro credit data by the ESCB (hereinto the "Decision"). The Decision, which was established to provide the necessary legal basis supporting the preparatory work, sets out a list of measures to be implemented by all euro area countries concerning

(a) the definition of data attributes and data transmission arrangements;

(b) the elimination of data gaps due to non-existent or insufficient granular databases in some Member States; and

(c) the regular monitoring of the progress achieved.

The preparatory measures also include the arrangement of annual collections of semi-annual data during the preparatory phase, for the purposes of advancing with the establishment of a harmonised granular credit data framework in line with the identified user needs.

3. Preliminary recommendations

The TF work resulted in a number of preliminary recommendations, referring to the gaps on credit and credit risk data, and including proposals to coordinate efforts to improve granular data among NCBs on lenders, borrowers and credit attributes, as well as methodological issues.

The recommendations cover the following areas:

1. Data Coverage

a. Definition of the set of granular information: as credit and credit risk data may focus on small and medium-size enterprises, as large enterprises may more easily find other funding sources, e.g. issuing securities, any threshold to minimise the reporting burden needs to be rather low. In general priority for sharing data will focus on credit to legal persons, e.g. financial and non-financial corporations, and government agencies. Loans to households, in particular housing (often mortgage) loans would also be subject to thresholds and anonymisation. All non-performing loans may need to be reported.

5 For more information please ref. http://www.ecb.europa.eu/ecb/legal/pdf/oj_jol_2014_104_r_0008_en_txt.pdf.

b. *Lenders*: The data collected should provide a clear insight into the borrowers' credit positions. This could be done with data from credit institutions and other financial intermediaries.

A Memorandum of Understanding among national CCRs[6] shows that credit institutions are reporting to all CCRs, and may remain a core reporting population, in particular for the forthcoming Banking Supervision purposes. However, as credit intermediation has increased among other financial institutions granular credit data may also be collected from these.

c. *Borrowers*: All users, in particular the Banking Supervision, have assessed that all types of borrowers would be of interest but that priority should initially be given to non-financial corporations and general government.

As regards the borrower identification, the use of a unique identification code (for individual undertakings, all the more as components of groups) would be ideal. The Legal Entity Identifier may, in the future, become the standard. In the mean time, the codification and identification used in national business registers and the ESCB "Register of Institutions and Affiliates Database" (RIAD),[7] which already includes reference data for credit institutions and other lenders, will be used to share existing codes, and map them with the LEI, where available. It is envisaged that access to lists of institutions may be granted to facilitate the use of common identifiers with respondents.

Registers also provide also key information for the identification of lenders and borrowers, for their stratification (e.g. based on turnover or other variables) and for defining whether stand-alone entities or parts of identified groups. They need timely updates for which support of the industry may be relevant.

2. Types of credit

According to the users' assessment priority should be given to loans of all types, including securitised loans derecognised from the balance sheet, in particular when they are still serviced by the originating lender. Loan provisions and credit derivatives would also be relevant. The distinction is made according to statistical manuals where tradability determines the difference between loans and securities.

From the supervisory perspective ideally all financial assets of a reporting institution, including risk-based variables, would be within the scope of a granular credit database.

As regards issuance and holdings of securities, interoperability will be sought with other relevant data sources of debt or credit exposures, e.g. the ESCB securities

[6] For more information please ref. https://www.ecb.europa.eu/pub/pdf/other/memoxinccreditregisters201004en.pdf.

[7] For more information please ref. http://www.ecb.europa.eu/stats/money/mfi/html/index.en.html.

database on issues (the Centralised Securities Database)[8] and holdings (the Securities Holdings Statistics Database).[9]

3. Level of granularity

Concerning the level of granularity, i.e. whether the reporting should be performed on a loan-by-loan (l-by-l) or borrower-by-borrower (b-by-b) basis, the level of detail can be collected using these systems may comprise (a) a collection on a l-by-l basis, (b) a multi-dimensional b-by-b system (containing e.g. "outstanding amount" of "trade receivables", "securitised", "collateralised", "derecognised" and with "maturity lower than 1 year"), or (c) less detail obtained in a simpler b-by-b model.

Mixed solutions also exist. It is recognised that the optimal reporting model for granular information, in the long term, is loan-by-loan, although the shared AnaCredit dataset will be built up to receive data on a l-by-l and a (mixed) multi-dimensional b-by-b basis to allow for a stepwise alignment over time.

4. Stepwise implementation

Last but not least, given the complexity and costs of this endeavour, the TF is of the opinion that AnaCredit should be developed in a stepwise manner, to accommodate the difficulties and different states of both the existing and non-existing granular reporting systems across Europe, taking at the same time due account of the users' priorities.

4. Challenges ahead

In view of identifying the best strategic approach towards meeting the increasing user demands for more granular data and flexible data sources in a pan-European set of credit and credit risk data, a number of work-streams are currently pursued by the ESCB:

On-going merits and costs procedure

As for all new or substantially enhanced statistics, the ESCB follows a "merits and costs procedure" so as to design a cost-effective approach to best fulfil user needs, while minimising the reporting burden. Such a procedure, rather similar to the "impact assessments" run by the European Commission is required to support the decision-making process towards establishing the long-term framework

In May 2014, the TF launched the cost assessment exercise covering (a) a number of attributes/features to be included in the reporting framework; (b) implementation issues regarding the provision of information on specific sets of

8 For more information please ref. https://www.ecb.europa.eu/pub/pdf/other/centralisedsecuritiesdatabase201002en.pdf.

9 For more information please ref. Regulation ECB/2012/24 http://www.ecb.europa.eu/ecb/legal/pdf/l_30520121101en00060024.pdf and Guideline ECB/2013/7 http://www.ecb.europa.eu/ecb/legal/pdf/l_12520130507en00170033.pdf.

exposures on a granular and aggregate basis; (c) the provision of information of group structures, and (d) the integration of information with existing datasets such as registers or securities databases.

Overall, the cost assessment showed high implementation costs (IT systems and work load) for both NCBs and reporting agents. However, the situation widely differs, e.g. between those countries where central credit registers (CCRs) are in place and those without any granular credit reporting, also translating into different cost assessments across countries. In addition, some features were reported as having a significant impact on the overall cost assessment, namely the additional reporting of credit exposures on a consolidated basis (further to solo reporting), the possible inclusion of foreign subsidiaries in the reporting, the timeliness of the reporting schemes, or the compilation of detailed multi-dimensional aggregates.

The questionnaire also included questions on the foreseen merits of AnaCredit to reporting agents. Overall, the reporting agents recognised that (1) the set-up of a harmonised granular euro area-wide (or even EU-wide) credit database may further enhance the credit institutions' assessment on the creditworthiness, in particular of cross-border borrowers, (2) such granular information may lead to reducing the reporting burden if the envisaged level of detail minimises significantly the aggregation which has to be done by them, and, if appropriately defined, (3) the reporting requirements are expected to be more stable over time (as already experienced for security-by-security reporting) which is an important factor minimising costs in highly automated systems.

Following the detailed cost assessment, the TF is about to launch a users' consultation, i.e. ESCB users, the EU Commission, the European Banking Authority and the European Systemic Risk Board, will be asked to review their business cases, in the light of costs potentially incurred, and, in particular, to clearly prioritise their needs for a stepwise implementation.

The requirements for the dataset will eventually be transposed into a legal act to be submitted (likely in 2015 Q2) to the ECB Governing Council for approval.

Credit exposures at group level

The reporting is foreseen to be established on a solo basis. However, as institutions may be part of more complex group structures, the TF investigated an appropriate approach to provide information on entities at group level, important from a financial stability and supervisory viewpoint.

Two main approaches were considered to allow for analysis of credit exposures at group level: the direct reporting on a group basis (e.g. reporting of exposures at the consolidated banking group level), or additional data on group structures. The former approach is considered more costly but provides more accurate information on exposures at group level. The latter method only uses the information reported on a solo basis and, therefore, is less costly for reporting agents. However, it requires retrieving the relevant information on group structures from other (supervisory) reports or from business registers. Although more demanding for compiling agencies, it provides flexibility to reflect changes in group structures as long as the relevant information on entities and the group is available and up-to-date.

As banking groups are not confined to the countries of parent institutions, it is important to obtain the exposures of foreign subsidiaries credit institutions. Exposures from subsidiaries resident outside the euro area would be collected through the resident parent companies –following the home approach.

Finally, the TF assumed that the RIAD system could serve as the database to store information on group structures as it already contains some criteria used to identify entities in the group. Still, should it be the case, the information in RIAD needs to be enhanced with additional data.

The TF will continue work in this area.

Identification of lenders and borrowers

The TF is working on the establishment of a procedure to (i) uniquely identify legal persons from different data sources (e.g. business registers including RIAD, AnaCredit or securities databases) and (ii) integrate the information from different sources into a unique record, under a shared responsibility within the ESCB.

The identification of lenders and borrowers is considered a key issue for the establishment of AnaCredit to ensure a consistent treatment, an accurate reporting and a correct exchange of information with other datasets. To facilitate the exchange of information without forcing a change of codes at national level (also as the Legal Entity Identifier may soon be available for lenders, but may take much longer for borrowers), RIAD is envisaged to serve as a hub where the different identifiers as aliases for a single entity or group. In RIAD, flags could indicate which identifier/alias is used in which dataset so as to allow the necessary reconciliation. For non-EU borrowers, unique identification, so far as possible via the Legal Entity Identifier, will be implemented for all lenders (the inclusion of foreign lenders in the reporting population is still under discussion, although likely at least for branches and subsidiaries headquartered in the EU) and large borrowers.

However, there are currently legal provisions in some countries hindering the connection at national level with the business register. The TF will further investigate the establishment of best practices/alternative solutions.

The RIAD system should be fed overall on a host-country principle, i.e. the country where the exposure was originated and where the (EU) borrower is resident will be the criterion for defining the NCB responsible for the data checking. However, the home-country approach would be used for foreign branches and subsidiaries outside the euro area/EU (e.g. the exposures of a Deutsche Bank in US would be reported by the German parent institution). As regards non-resident borrowers, the TF will further discuss how to ensure data quality management, e.g. some NCBs may express interest for some regions in the world, the ECB acting as a hub and ensuring coordination for borderline cases.

Overview of credit exposures and indebtedness

In order to provide users with an overall picture of the credit exposures of credit institutions or other lenders to borrowers (be it on a solo or on a consolidated basis), granular information on loans and derivatives (to be collected in AnaCredit) should be complemented by data on debt securities held by lenders. Information on issuance and holdings of debt securities is already available in the CSDB and the SHSDB, respectively.

Acknowledging the need of users (including the SSM) for an assessment of the overall exposure of lenders, i.e. beyond loans and credit derivatives, an efficient approach is to combine the AnaCredit dataset with the two securities datasets mentioned above (CSDB and SHSDB).

In both databases there are ways to uniquely identify lenders and borrowers and possibly connecting them to AnaCredit. However, on the methodological side the CSDB and SHSDB deviate from the foreseen content (e.g. level of granularity and consolidation) of AnaCredit. A light fact-finding exercise conducted by the TF has shown that either AnaCredit should comprise all types of exposures (including securities), in particular for non-financial corporations as borrowers/issuers, or the ESCB-wide shared databases on securities would need to allow for the necessary level of granularity. In the latter case, the appropriate connection between information on debt securities and AnaCredit, to be mediated via RIAD (for mapping identifiers and aggregating for group structures where appropriate), would then provide the required overview of exposures/indebtedness. This second approach may be more accurate, although costly, and require a longer implementation phase, as the level of granularity in the SHSDB would need to increase (for the sectoral data, and possibly also for the disaggregation of reporting banking groups). A borderline case relates to those instruments issued as private placements, which in principle are securities, although they are often issued without ISIN codes. As indicated by the fact-finding exercise, they may be significant in several countries and may be significant when considering credit to the non-financial economy.

The TF will investigate more in depth possible options for combining the SHSDB and CSDB with AnaCredit and ways to overcome possible methodological and practical mismatches between these datasets.

A proper IT application

The work may be further supported by the establishment of an IT solution for receiving, storing and disseminating credit and credit risk information on a euro area (or an EU-wide) scale, which would be sourced from CCRs or other similar granular datasets and would include the most important attributes on loans, lenders (likely abridged from the RIAD) and borrowers. The system may process some very granular information, e.g. on significant loans and borrowers, and more aggregated data (as combination of other, individually less significant). It needs to help protect confidentiality and handle different levels of access to the datasets (aggregated, granular anonymised, non-anonymised). The remainder of the granular information would be handled at national level, under the responsibility of NCBs who would coordinate and cooperate with any relevant national data sources.

Such a tool may substantially support credit and credit-risk analysis required for the conduct of monetary policy, micro-prudential supervision, economic analysis, financial stability, research and statistics, in particular under the on-going turmoil of financial markets. It will enable the necessary flexibility to address in a timely manner needs on granular data, e.g. credit data broken down by economic activity, size of firms, new credit granted (whether, or not, yet drawn), arrears, etc., while the reporting burden is kept to a minimum. Actually, the efforts to set up or enhance such granular credit datasets are expected to be offset, overall by (i) the additional information feedback to reporting agents (as a normal feature of CCRs or similar loan-level datasets) for them to assess the creditworthiness of their (actual or potential) customers and (ii) the substitution effect of the new granular datasets in comparison with additional breakdowns, e.g. in Monetary and Financial Statistics balance sheet statistics or in (additional breakdowns in) supervisory reports.

To meet the ESCB data needs, methods would have to be worked out in order to overcome the difficulties associated with the data scope, coverage, definitions, reporting framework, as well as the interoperability of credit registers and their links with other sources. In collaboration and with the active participation of all the entities involved, one more coherent and integrated system would have to be developed to create interconnected statistical databases to be used according to the increasing demand for data.

Accronyms

AnaCredit: Analytical Credit Datasets

CCR: Central Credit Register

CSDB: Centralised Securities Database

EBA: European Banking Authority

ECB: European Central Bank

ESCB: European System of Central Banks

ESRB: European Systemic Risk Board

NCB: National Central Bank

RIAD: Register of Institutions and Affiliates Database

SHSDB: Securities Holdings Statistics Database

SSM: Single Supervisory Mechanism

References

Memorandum of Understanding on the exchange of information among national central credit registers for the purpose of passing it on to reporting institutions, http://www.ecb.int/press/pr/date/2010/html/pr100428_2.en.html

Asset-backed securities (ABS) Loan-level Initiative: http://www.ecb.europa.eu/mopo/assets/loanlevel/html/index.en.html.

"Report of the Expert Group on Credit Histories.pdf": http://ec.europa.eu/internal_market/consultations/docs/2009/credit_histories/egch_report_en.pdf.

"General Principles for Credit Reporting.pdf": http://siteresources.worldbank.org/FINANCIALSECTOR/Resources/Credit_Reporting_text.pdf.

Legal entity identifier (LEI): http://www.financialstabilityboard.org/list/fsb_publications/tid_156/index.htm.

De Almeida, Ana M. and Damia, V. (2013), Challenges and prospects for setting-up an EU shared system on credit, Workshop on integrated management of micro-databases, Banco de Portugal: http://www.bportugal.pt/en-US/Estatisticas/Conferencias/Documents/01%20Almeida_D1_M_A.pdf.

Sola, P. and F. Strobbe (2010), Addressing data gaps revealed by the financial crisis: European Central Bank statistics on holdings of securities, Irving Fisher Committee on Central-Bank Statistics, IFC Bulletin No. 34: Proceedings of the IFC Conference on "Initiatives to address data gaps revealed by the financial crisis", Bank for International Settlements, Basel, August 2010.

Capturing loan-to-value data in New Zealand – challenges and opportunities

Rochelle Barrow and Tobias Irrcher[1]

Reserve Bank of New Zealand

1. Introduction

Like many countries, New Zealand experienced rapid increases in both house prices and household debt in the decade leading up to the Global Financial Crisis. While house prices fell modestly during the recession of 2009/10, they remained elevated relative to fundamental metrics such as rents or incomes. By 2013, house prices were rising rapidly again in some parts of the country, particularly Auckland and Canterbury, reflecting both stronger demand and housing shortages. Although the rise in house prices was accompanied by only moderate growth in total household credit, lending undertaken at high loan-to-value ratios (LVRs in excess of 80 percent) had risen to nearly a third of all new housing loan commitments.

With house prices becoming increasingly stretched, the Reserve Bank took the view that the risks of a disruptive downward correction at some point in the future were increasing, a view shared by the IMF, OECD and three major rating agencies. The Reserve Bank introduced a limit on high loan-to-value (LVR) lending with effect from 1 October 2013, to help reduce the risks to financial stability posed by these developments. LVR restrictions on residential lending were one of four instruments available for use under the Reserve Bank's macro-prudential policy framework that was agreed with the Minister of Finance in a memorandum of understanding signed in May 2013.

In March of 2013, the Reserve Bank had initiated work to develop a formal LVR data collection[2]. Data on LVRs had been collected privately from the banks for several years, but was in a non-standardised format which lacked consistency across the banks. While indicative, this data was not considered of high enough quality for aggregation or publication. In addition, the privately collected data lacked the granularity necessary to support a richer understanding of bank mortgage lending behaviour.

This paper discusses the development of two LVR data collections to shed more light on mortgage lending behaviour in New Zealand and support the successful implementation of loan-to-value ratio restrictions. It covers the development of the data collections, the challenges faced, some of the useful insights the data has provided to date, and finally some of the lessons learned.

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[1] The authors are grateful to Bernard Hodgetts and other colleagues at the Reserve Bank for helpful comments and advice.

[2] The Reserve Bank of New Zealand Act (1989) enables the Bank to collect data for monetary policy and financial stability purposes, from financial institutions in New Zealand.

2. LVR restrictions in New Zealand

The Reserve Bank's approach to implementing LVR restrictions appears to be unique among the group of countries that have used them. Instead of an outright restriction on high LVR lending (for example, no lending to be undertaken at LVRs of greater than 80 percent) banks have been required to limit new residential mortgage lending at LVRs of over 80 percent to no more than 10 percent of the dollar value of their new residential mortgage lending over a set time period. This has become known as the 'speed limit approach'. Data is needed to calculate a bank's adherence to the restrictions – i.e. whether the bank's high LVR lending is at or below the speed limit.

The Reserve Bank has exempted certain types of mortgage lending from LVR restrictions. These include refinancing of existing mortgages from another lender or shifting an existing high LVR loan from one property to another. These exemptions were made chiefly to avoid hampering competition among lenders or to avoid impeding the mobility of existing borrowers. Other exemptions are made for Welcome Home Loans (a scheme under which the government insures the loans of qualifying high LVR borrowers, subject to a quota) and bridging finance. A further exemption was finalised in early 2014 for high LVR construction loans, to avoid hindering new construction activity.

The speed limit is assessed using rolling windows. When first introduced all banks were given six months to manage their lending under the 10 percent cap. However, from this first period large banks move to a three month rolling period and smaller banks continue on a six month rolling period.

Figure 1 - Six month speed limit formula

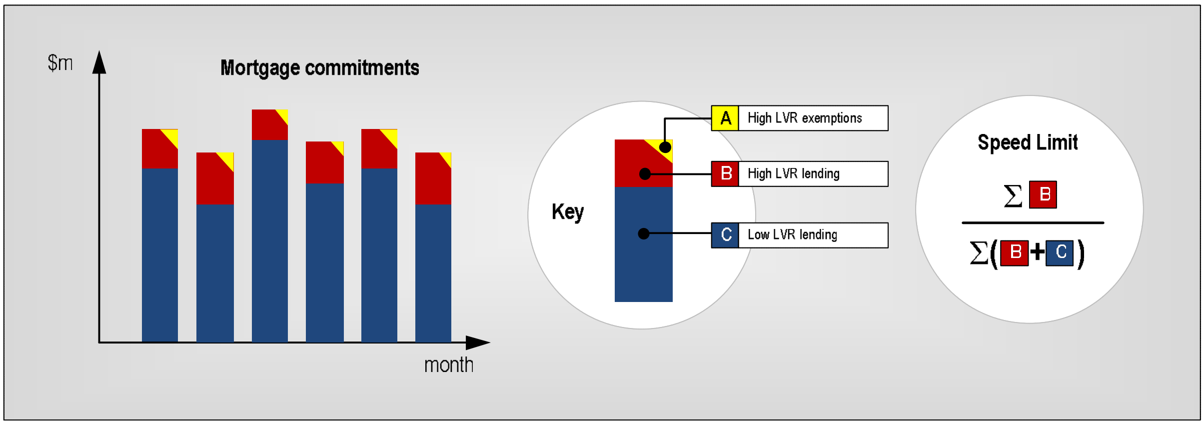
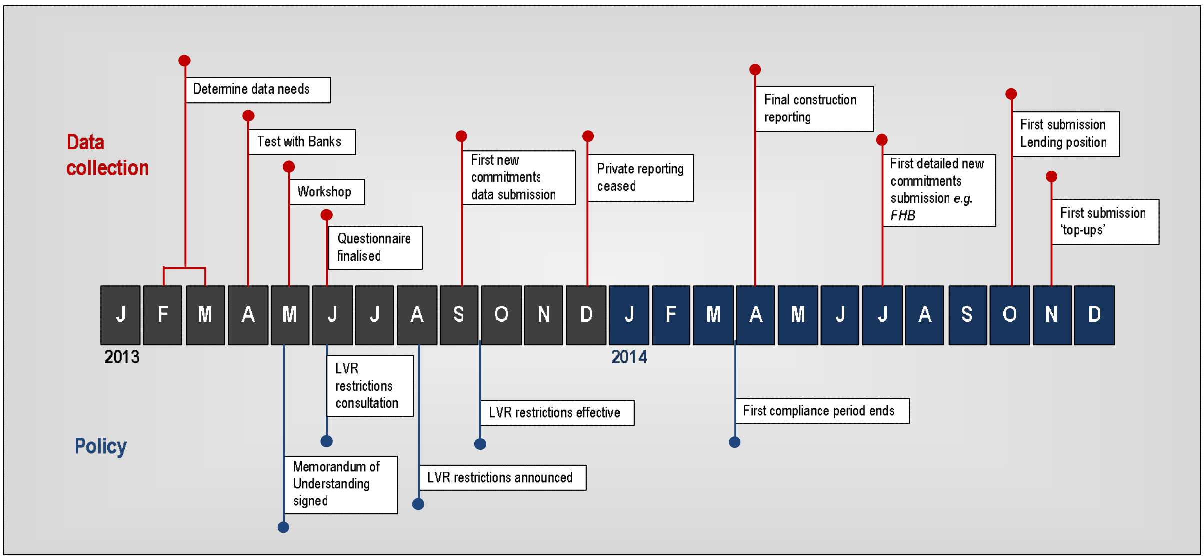


Figure 1 provides a stylised representation of the calculation. While the calculation is, in principle, a straightforward one, a key challenge of the data development process (and the policy design of LVR restrictions) was to define what exactly is meant by a high LVR new loan commitment. What is a loan commitment and how and when is it measured? And how should one define the 'loan' and the 'value' that goes into the calculation of the associated loan-to-value ratio?

3. Challenges in developing the new data collection

Figure 2 – Data development and policy timeline



Clarifying Objectives

Perhaps the most significant challenge in developing our new data collection is that the policy for which the data was intended to provide support was being refined throughout the development process. Whilst the principles were well settled, the details were still being confirmed. Many of these details were resolved in-house but some were identified by banks once they started to complete early versions of the LVR data collection templates. During the data development process it was essential that our statisticians and macro-prudential policy makers worked closely to respond to banks, revise definitions, and in some cases update existing banking prudential requirements.

This collaboration was aided by the Reserve Bank recently introducing a new Macro-Financial Department, which brought together the Bank's macro-prudential and financial system analysis teams with the Statistics Unit.

When work first began on a new collection of LVR statistics in March 2013, the main motivation was to improve our understanding of high LVR lending activity across the banks and to enable meaningful aggregation of the data for macro-financial analysis. The existing monthly collection of high LVR lending was provided by the banks on a best endeavours basis and was known to lack consistency from bank to bank. Good metadata was lacking. Some LVRs appear to have been measured at the loan approval stage, others when the loan was drawn down. There were various other technical issues. For example, when reporting the value of high LVR loans, some banks would report the full amount of any loans that were topped up over the period, while others would only report the amount of the top up. This in turn meant that the reported flow of high LVR lending was measured inconsistently from bank to bank, undermining calculations of system aggregates. Thus an over-riding aim of the new collection was to ensure more consistency in the measurement of the components of LVRs, enabling meaningful aggregations of the data to be made.

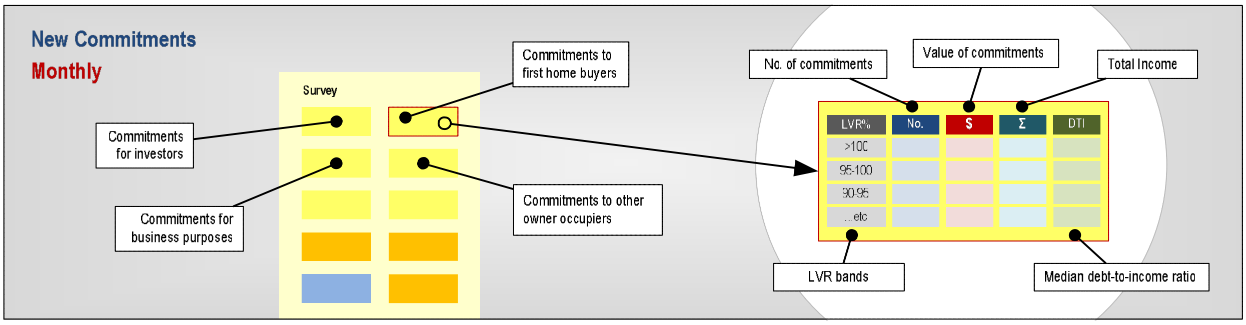
As the possibility of LVR restrictions became increasing likely, some new needs arose. In the context of LVR restrictions, the data collected would need to be used to assess the regulatory impact of the restrictions and ensure compliance with them. It quickly became clear that the specification and calculation of the loan-to-value ratios that were to be collected would form the actual metric against which the banks would be required to modify their lending behaviour in order to meet the restrictions. More detail would also be required to help monitor the effectiveness and incidence of the restrictions. For example, it would be important to know how high LVR lending was distributed across first home buyers, investors and other borrowers.

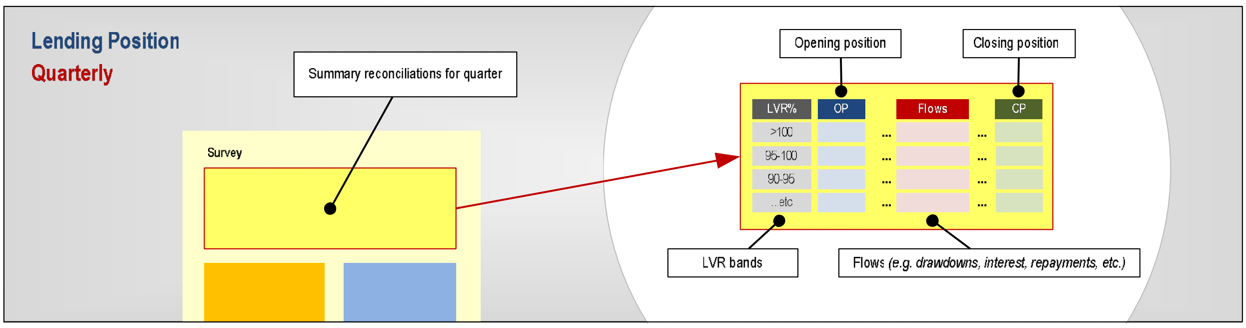
In order to minimise the reporting burden placed on banks we decided early on that LVR data for statistical and compliance purposes would be collected in one single template. However, unlike statistical data where timeliness is usually top priority, compliance data needs to be of very high quality. Since banks would be required to meet the LVR restrictions as a condition of their registration, a breach of the requirement would be a serious matter.

To better understand the marginal lending decisions of banks and monitor LVR restrictions we developed a New Commitments template to capture the flows of new lending by borrower type (e.g. owner occupier) and by purpose (e.g. to purchase/build a property). LVR restrictions are applied on a rolling three or six month basis, dependent on the size of the bank. Therefore the New Commitments collection is of monthly frequency.

To assess the current vulnerabilities of a bank we developed a Lending Position template that collects opening and closing stock of loans and the reconciling flows (e.g. drawdowns, interest charged) by LVR. The stock of outstanding mortgages moves more slowly than flows, so the Lending Position data is collected quarterly.

Figure 3 – Stylised LVR data collections





Both templates collect data by LVR buckets, which range from <= 60% to >100% in 5% increments. This enables more detailed analysis of mortgage lending and also future-proofs the collections should the High LVR threshold move (e.g. from 80% to another level). It would also potentially enable the speed limit to be stratified (e.g. a proportion of lending between 80%-90% and a smaller proportion over 90%).

Once announced, LVR restrictions were intended to be introduced with a relatively short notice period (of around six weeks). Therefore banks needed to be able to react and control lending flows quickly. In practice, the loan life cycle can run over months - from pre-approval to actual drawdown. Many loans that are approved do not actually result in loans, and it is difficult to restrict drawdowns quickly due to the length of time between when a bank agrees to lend and when the actual drawdown occurs. The Reserve Bank settled on applying LVR restrictions at the loan 'commitment' stage where the formal paperwork to support a loan is being drawn up. This is after approval, but before drawdown. At this stage, a very high percentage of commitments result in loans and it is early enough in the loan cycle for banks to restrict at short notice.

With assistance from the banks we settled on a practical definition of commitment, namely:

"A bank enters into a new commitment for a residential mortgage loan on the day that the bank sends the loan documentation to the applicant's solicitor".

Publication

As with all Reserve Bank data collections, our intention was to publish aggregate data from the LVR templates once we were assured that the data were of good quality. This was seen as particularly important given that, at the time LVR restrictions were announced the only public information on bank LVR lending was in individual bank quarterly Disclosure Statements.[3] A bank Disclosure Statement includes, amongst other things, the outstanding stock of lending by LVR. However, the LVR restrictions relate to the flow of new lending. In the absence of flow data some people had interpreted the change in stock to be equal to, or similar, to the flow of lending. This had led to confusion and added more weight to our desire to publish aggregate data from our new data collection as soon as practical.

Definitions

Conceptually the LVR restrictions were to apply to lending undertaken for the purchase of residential properties in New Zealand. Our first working definition was "all lending secured by residential property". However, in practice some non-residential loans (e.g. loans to businesses or SMEs) are sometimes partly secured by residential property. Since LVR restrictions were not motivated by concerns around business lending, it was not intended to capture such lending and doing so would add considerable complexity for the banks in calculating and reporting LVRs for such loans. For these reasons, we chose to align our definition with that of mortgage loan in bank capital definitions, which are already embedded in bank systems.

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[3] All registered banks operating in New Zealand are required by law to publish a quarterly disclosure statement. These contain a wide range of financial and other information, and are aimed at providing a broad and reasonably up-to-date view of the bank. The statements include information on the bank's conditions of registration, which are the means by which the Reserve Bank applies prudential requirements to banks.

A second issue that arose was at the time of the development banks were subject to different definitions of loan used in the calculation of LVR depending on whether they were operating as Internal Ratings Based banks or standardised banks for capital purposes. The IRB banks had a narrow mortgage loan definition in which only the loan relating to the residential property was to be included. However, the standard banks were subject to a wider definition under which any other unsecured lending to the customer (e.g. credit card limits) was to be added to the total loan amount for calculating the LVR[4]. A subsequent revision to bank capital definitions, which has seen the narrower definition adopted for all banks, has resolved this issue. However, for a period of time our LVR templates (and the operation of LVR restrictions) were based on differential reporting for these two classes of bank.

Timelines

As with any new data collection, we found that banks varied in their need to implement system changes in order to meet the reporting requirements. For very small banks new reporting is often easier as there are often few transactions and reporting can be done manually. However, large banks need to rely on system reporting and when data is sought that is not currently captured systematically, IT changes are often required.

We held workshops with banks shortly after we had circulated our draft templates. Given the feedback received, we made the decision soon afterwards to stage the implementation of the data collections. Priority was given to the totals in the New Commitments template because these are required to assess compliance against the speed limit. The detail in the New Commitments template was judged of lower priority (e.g. commitments by borrower type and debt to income figures). The Lending Position template was deemed lowest priority, because some data on loan stock positions was already publicly available, albeit in a non-standardised format.

This staged approach enabled banks to focus on providing quality data for LVR restriction compliance purposes, but they were aware of where we were intending to expand the data collection later on.

The first official collection period for the New Commitments template was August 2013. The detail followed in May 2014 and the first Lending Position template is scheduled for the September 2014 quarter. Early this year we also added a question about loan purpose (e.g. top-up, property purchase) to the New Commitments template. Data for this question is expected to become available in November 2014.

Quality assurance

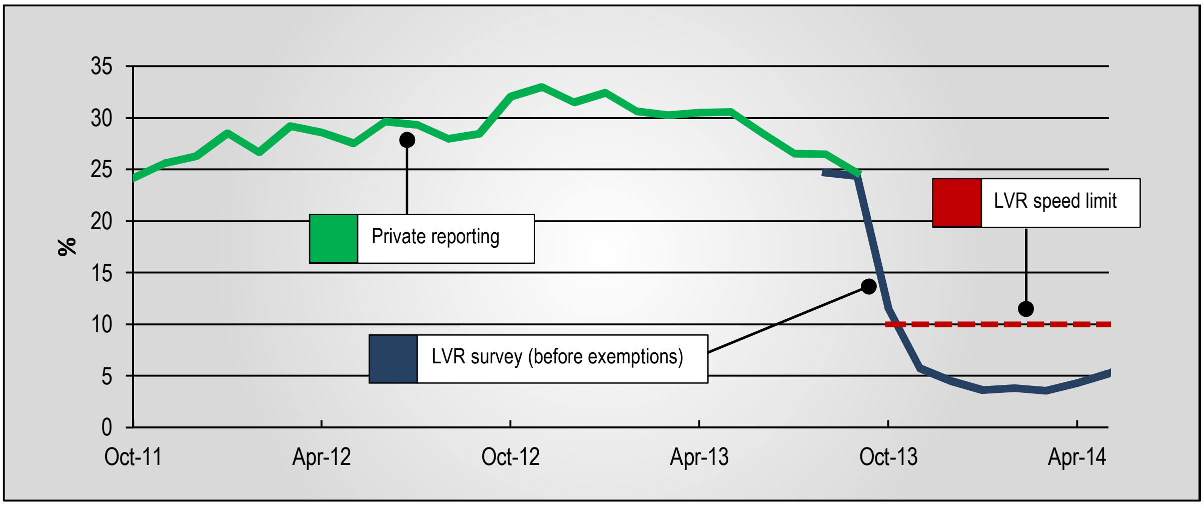
As noted earlier, in the two years leading up to the development of the LVR framework the Reserve Bank had received information from the banks on their high LVR lending flows through the receipt of internal management reports. While this privately reported data

[4] For more information, see
http://www.rbnz.govt.nz/regulation_and_supervision/banks/policy/5463896.pdf

helped the Reserve Bank to understand the volume of high LVR lending that was occurring, it was non-standardised across banks, thereby making aggregation difficult.

When the New Commitments data started to arrive we compared it closely to the previous management reporting data. In terms of levels of lending, the two sources differed significantly as the management reports variously appear to have been based on data collected at the approval or drawdown stage or some combination of the two. However, in terms of the percentage of high LVR lending, the two sources provided very similar results. This enabled us to backdate the high LVR ratio series by two years, providing scope to illustrate the trends that had been occurring.

Figure 4 – Share of high LVR lending



Series refinements

When LVR restrictions were announced in August 2013, four exemption classes were proposed. As mentioned earlier, refinancing of existing mortgages, shifting an existing high LVR loan from one property to another, Welcome Home Loans and bridging finance were exempt from LVR restrictions.

Shortly after LVR restrictions took effect in October 2013, the Reserve Bank received feedback from the banks and the construction industry that LVR restrictions were having a dampening effect on the prospects for new residential construction. While high LVR construction lending is only around 1 percent of total residential lending, Reserve Bank estimates suggest that it finances around 12 percent of residential building activity. While many construction loans do not have inherently high LVRs following the completion of the house, loan commitments sometimes allow for the borrower to draw down a higher LVR loan in order to provide capacity in the event of cost over-runs and other uncertainties associated with the building process. The industry argued that restricting LVRs of construction loans was therefore dissuading new construction activity. This was an issue that had not been highlighted during the earlier consultation phase.

After considering industry feedback, the Reserve Bank decided in December 2013 that lending for the purpose of building a new home should also be exempted from LVR restrictions, effective from 1 October 2013. The aim was to support the supply of new housing and, in doing so, reduce some of the pressure arising from excess demand in the New Zealand housing market.

In anticipation of the new exemption, we began collecting indicative data from the banks on this type of mortgage lending in December 2013. Banks were allowed up until their March month reporting to report retrospectively any construction lending. In the event, reported amounts of such lending have been quite small, not because banks are not doing this lending, but more likely because they are yet to develop systems and processes that would enable them to identify and report this data to reliable standards.

4. Future changes and Data insights

Lending by borrower type

While collecting total commitments broken down by LVR enabled compliance monitoring of LVR restrictions it did not allow us to analyse the impact of restrictions on different transactors in the residential mortgage market. The effects of the restrictions on different segments of the market such as first home buyers, investors and small businesses borrowing using the equity in their home are of considerable interest when analysing the effect of LVR restrictions.

As mentioned above, we took a staged approach to completion of the LVR templates. In mid-June we received new commitments by borrower type:

- first home buyers
- other owner occupiers
- small scale residential property investors, and
- business owners using their home to secure business funding.

In addition, a median debt-to-income for each type of borrower by LVR bucket is also available. The total value of interest only commitments and drawdowns by LVR bucket were also collected for the first time for the May reference month.

We are currently working through some quality assurance issues and hope to publish aggregate data by the end of 2014. However, initial data for a subset of banks has provided useful insights. For example, while first home buyers are a relatively small subset of all borrowers they are over represented in high LVR lending. The opposite is true for investors.

First home buyer median debt-to-income figures tend to increase as the LVR buckets increase. However, we have found that investors' median debt-to-income figures tend to fall as the LVR increases.

Lending by purpose of loan

New commitments can be made for a variety of purposes, to buy property, to renovate, to purchase cars, or to enable a customer to switch from one bank to another. By November this year all banks will report their new commitments broken down into top-ups, property purchase, change in loan provider and other commitments.

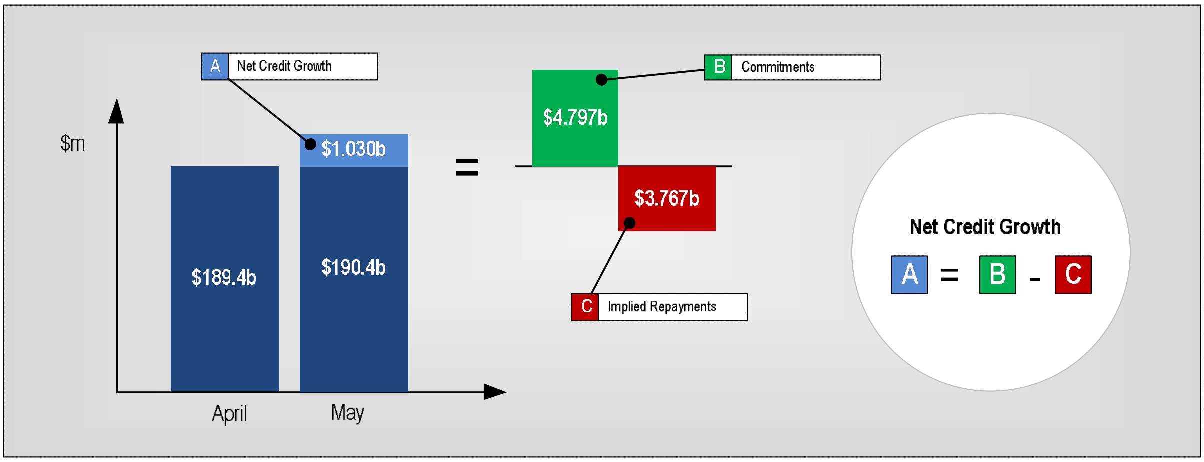
Collecting commitments for property purchase means analysts are better able to estimate the relationship between credit and housing market indicators, such as house sales. The value of top-ups helps to understand housing equity withdrawal, which is the use of housing to fund consumption or other investment. Our analysts will be closely monitoring the use of top-ups alongside other types of borrowing, such as credit card advances or term loans, to gauge the extent to which LVR restrictions may have encouraged LVR-constrained borrowers to substitute other forms of loan.

Reconciling stocks and flows

The LVR data collections will enable a far better understanding of mortgage lending flows. At present the majority of Reserve Bank surveys collect balance sheet data on mortgage lending and our headline credit series is net credit growth.

Following the GFC, net credit growth fell considerably and at present only runs at around $1b per month. However, our new mortgage commitments series indicates that new lending is approximately $4.5b per month. This implies repayment of principal flows in the order of $3.5b per month, in addition to interest payments of approximately $850m. The Lending Position template is expected to give us useful insight into these flows, which to date have largely been estimated residually.

Figure 5 – Stocks and flows for the month of May 2014



5. Lessons learned

The experience of developing the LVR templates reaffirmed some existing successful Reserve Bank data development approaches. However, it also provided us with an opportunity to trial some new approaches, and we learned valuable lessons as a result. The LVR template implementation was assisted by a policy imperative. LVR restrictions were to be introduced and compliance reporting was needed. This helped to focus timelines for all involved. Both the Reserve Bank and regulated banks wanted this reporting in place as soon as practical.

Collaboration is essential

Collaboration between policy maker, statistician and respondent was essential to the success of this project. Each party brings a unique set of skills and expertise to the project. Playing to each other's strengths and involving as many of your stakeholders in the consultation process as you reasonably can pay dividends in the end. Establishing needs and views at an early stage enables you to respond more efficiently.

Workshop your ideas

When embarking on a new area there are real benefits to be had from testing your ideas with your future respondents. Be accepting that you won't get things 100 percent right first time round. Discuss things sooner rather than later.

Signal upfront any future changes

If you expect your new template to be enhanced over time (e.g. more detail) be upfront about it. When a bank needs to introduce a system change to enable reporting it is far easier if they know of any possible enhancements that should be factored into the design.

Prioritise if you want data fast

In our case, prioritising key data elements enabled banks to respond quicker. This was essential given the impending LVR restrictions. A staged implementation of a collection is possible provided you plan ahead and keep stakeholders informed of the end game.

Future proof your design

Where possible, at low cost, enhance your design in anticipation of future change. Implementing or changing data collections can be costly and you don't want this to constrain future policy decisions.

Work out where costs exceed benefits

Be responsible with data collections. Collecting data that is nice to have rather than essential comes at a cost. It may have been possible to ask banks to report LVR data by region or by resident status of the borrower. We decided very early on that the costs in this case would likely exceed the benefits.

6. Conclusion

The development of LVR data collections at the Reserve Bank over the past year has provided a significant challenge for the Reserve Bank's statistics team. In the event, the development has been a success in part due to the collaboration between the Reserve Bank statisticians and policy analysts, our ability to be flexible and accept changes along the way, and the goodwill of banks operating in New Zealand.

The development was an exercise in prioritising, negotiation and compromise. While accepting refinements, changes in definitions, and new exemptions created rework for the Reserve Bank's statisticians, it enabled us to have the required compliance reporting in place before LVR restrictions came into force.

We believe that we have developed two high quality, future-proofed LVR data collections that provide (or will provide) analysts and supervisors with an extremely rich picture of mortgage lending, risk, and vulnerability for many years to come.

References

RBNZ (2013a) 'Memorandum of Understanding on Macroprudential policy and operating guidelines', May.

RBNZ (2103b) 'New statistics show fall in high-LVR lending', news release, 28 November.

Rogers, L (2013) 'A new approach to macro-prudential policy for New Zealand', Reserve Bank Bulletin, 76(3), September, pp. 12-22.

Rogers, L (2014) 'An A to Z of loan-to-value ratio (LVR) restrictions', Reserve Bank Bulletin, 77(1), March, pp. 3-14.

Wheeler, G (2013) 'The Introduction of Macro-prudential Policy', speech delivered at Otago University, Dunedin, 20 August.

Appendix 1 – LVR new commitments template

Loan to Valuation Ratio survey - New commitments

Note
- Complete for the reference month
- Please report figures in millions to three decimal points, i.e. to the nearest thousand New Zealand dollars. For example $1,234,567.89 is reported as 1.235
- Please report median debt to income ratios to one decimal point.

Definitions
- Only include residential mortgage loan commitments (as defined in BS19)
- Double click on the MS Word document to open the definitions

Definitions

For month ended:

1.1 Commitments made to owner occupiers that are first home buyers:

		Number of commitments	Value of commitments	Total income	Median debt to income ratio
(a)	LVR > 100				
(b)	LVR > 95 ≤ 100				
(c)	LVR > 90 ≤ 95				
(d)	LVR > 85 ≤ 90				
(e)	LVR > 80 ≤ 85				
(f)	LVR > 75 ≤ 80				
(g)	LVR > 70 ≤ 75				
(h)	LVR > 65 ≤ 70				
(i)	LVR > 60 ≤ 65				
(j)	LVR ≤ 60				
(k)	LVR unknown				
	Total	–	**0.000**	**0.000**	

1.2 Commitments made to other owner occupiers:

		Number of commitments	Value of commitments	Total income	Median debt to income ratio
(a)	LVR > 100				
(b)	LVR > 95 ≤ 100				
(c)	LVR > 90 ≤ 95				
(d)	LVR > 85 ≤ 90				
(e)	LVR > 80 ≤ 85				
(f)	LVR > 75 ≤ 80				
(g)	LVR > 70 ≤ 75				
(h)	LVR > 65 ≤ 70				
(i)	LVR > 60 ≤ 65				
(j)	LVR ≤ 60				
(k)	LVR unknown				
	Total	–	**0.000**	**0.000**	

1.3 Commitments made to owner occupiers:

		Number of commitments	Value of commitments	Total income	Median debt to income ratio
(a)	LVR > 100	0	0.000	0.000	
(b)	LVR > 95 ≤ 100	0	0.000	0.000	
(c)	LVR > 90 ≤ 95	0	0.000	0.000	
(d)	LVR > 85 ≤ 90	0	0.000	0.000	
(e)	LVR > 80 ≤ 85	0	0.000	0.000	
(f)	LVR > 75 ≤ 80	0	0.000	0.000	
(g)	LVR > 70 ≤ 75	0	0.000	0.000	
(h)	LVR > 65 ≤ 70	0	0.000	0.000	
(i)	LVR > 60 ≤ 65	0	0.000	0.000	
(j)	LVR ≤ 60	0	0.000	0.000	
(k)	LVR unknown	0	0.000	0.000	
	Total	–	**0.000**	**0.000**	

1.4 Commitments made to investors:

		Number of commitments	Value of commitments	Total income	Median debt to income ratio
(a)	LVR > 100				
(b)	LVR > 95 ≤ 100				
(c)	LVR > 90 ≤ 95				
(d)	LVR > 85 ≤ 90				
(e)	LVR > 80 ≤ 85				
(f)	LVR > 75 ≤ 80				
(g)	LVR > 70 ≤ 75				
(h)	LVR > 65 ≤ 70				
(i)	LVR > 60 ≤ 65				
(j)	LVR ≤ 60				
(k)	LVR unknown				
	Total	–	**0.000**	**0.000**	

1.5 Commitments made for business purposes:

		Number of commitments	Value of commitments
(a)	LVR > 100		
(b)	LVR > 95 ≤ 100		
(c)	LVR > 90 ≤ 95		
(d)	LVR > 85 ≤ 90		
(e)	LVR > 80 ≤ 85		
(f)	LVR > 75 ≤ 80		
(g)	LVR > 70 ≤ 75		
(h)	LVR > 65 ≤ 70		
(i)	LVR > 60 ≤ 65		
(j)	LVR ≤ 60		
(k)	LVR unknown		
	Total	–	**0.000**

1.6 Total residential mortgage loan commitments:

		Number of commitments	Value of commitments
(a)	LVR > 100	0	0.000
(b)	LVR > 95 ≤ 100	0	0.000
(c)	LVR > 90 ≤ 95	0	0.000
(d)	LVR > 85 ≤ 90	0	0.000
(e)	LVR > 80 ≤ 85	0	0.000
(f)	LVR > 75 ≤ 80	0	0.000
(g)	LVR > 70 ≤ 75	0	0.000
(h)	LVR > 65 ≤ 70	0	0.000
(i)	LVR > 60 ≤ 65	0	0.000
(j)	LVR ≤ 60	0	0.000
(k)	LVR unknown	0	0.000
	Total	–	**0.000**

2.1 Commitments that are exempt from RBNZ LVR restrictions:

		Housing New Zealand's Mortgage Insurance Scheme		Refinancing		LVR portability		Bridging finance		Construction loan		Total exemptions	
		Number of commitments	Value of commitments	Number of commitments	Value of commitments	Number of commitments	Value of commitments	Number of commitments	Value of commitments	Number of commitments	Value of commitments	Number of commitments	Value of commitments
(a)	LVR > 100											0	0.000
(b)	LVR > 95 ≤ 100											0	0.000
(c)	LVR > 90 ≤ 95											0	0.000
(d)	LVR > 85 ≤ 90											0	0.000
(e)	LVR > 80 ≤ 85											0	0.000
(f)	LVR > 75 ≤ 80											0	0.000
(g)	LVR > 70 ≤ 75											0	0.000
(h)	LVR > 65 ≤ 70											0	0.000
(i)	LVR > 60 ≤ 65											0	0.000
(j)	LVR ≤ 60											0	0.000
(k)	LVR unknown											0	0.000
	Total	–	**0.000**	–	**0.000**	–	**0.000**	–	**0.000**	–	**0.000**	–	**0.000**

2.2 Monthly speed limit calculation: This calculation is for illustrative purposes only. During an LVR restricton period the speed is measured on cumulative lending over the full restriction period (i.e. three or six months).

		Total commitments less exemptions	
		Number of commitments	Value of commitments
(a)	LVR > 100	0	0.000
(b)	LVR > 95 ≤ 100	0	0.000
(c)	LVR > 90 ≤ 95	0	0.000
(d)	LVR > 85 ≤ 90	0	0.000
(e)	LVR > 80 ≤ 85	0	0.000
(f)	LVR > 75 ≤ 80	0	0.000
(g)	LVR > 70 ≤ 75	0	0.000
(h)	LVR > 65 ≤ 70	0	0.000
(i)	LVR > 60 ≤ 65	0	0.000
(j)	LVR ≤ 60	0	0.000
(k)	LVR unknown	0	0.000
	Total	–	**0.000**

3.1 Value of interest only commitments:

		Owner occupiers	Investors	Business purposes	Total
(a)	LVR > 100				0.000
(b)	LVR > 95 ≤ 100				0.000
(c)	LVR > 90 ≤ 95				0.000
(d)	LVR > 85 ≤ 90				0.000
(e)	LVR > 80 ≤ 85				0.000
(f)	LVR > 75 ≤ 80				0.000
(g)	LVR > 70 ≤ 75				0.000
(h)	LVR > 65 ≤ 70				0.000
(i)	LVR > 60 ≤ 65				0.000
(j)	LVR ≤ 60				0.000
(k)	LVR unknown				0.000
	Total	**0.000**	**0.000**	**0.000**	**0.000**

4.1 Top-ups, refinancings and commitments for the purpose of buying a property

		Top-ups		Purchase of a property		Change in loan provider		Other commitments		Total		
		Number of commitments	Value of commitments	Number of commitments	Value of commitments	Number of commitments	Value of commitments	Number of commitments	Value of commitments	Number of commitments	Value of commitments	*Validation*
(a)	LVR > 100									–	0.000	
(b)	LVR > 95 ≤ 100									–	0.000	
(c)	LVR > 90 ≤ 95									–	0.000	
(d)	LVR > 85 ≤ 90									–	0.000	
(e)	LVR > 80 ≤ 85									–	0.000	
(f)	LVR > 75 ≤ 80									–	0.000	
(g)	LVR > 70 ≤ 75									–	0.000	
(h)	LVR > 65 ≤ 70									–	0.000	
(i)	LVR > 60 ≤ 65									–	0.000	
(j)	LVR ≤ 60									–	0.000	
(k)	LVR unknown									–	0.000	
	Total	**–**	**0.000**	**–**	**0.000**	**–**	**0.000**	**–**	**0.000**	**–**	**0.000**	

5.1 Total value of residential mortgage loan drawdowns:

		Total value of drawdowns
(a)	LVR > 100	
(b)	LVR > 95 ≤ 100	
(c)	LVR > 90 ≤ 95	
(d)	LVR > 85 ≤ 90	
(e)	LVR > 80 ≤ 85	
(f)	LVR > 75 ≤ 80	
(g)	LVR > 70 ≤ 75	
(h)	LVR > 65 ≤ 70	
(i)	LVR > 60 ≤ 65	
(j)	LVR ≤ 60	
(k)	LVR unknown	
	Total	**0.000**

Appendix 2 – LVR lending position template

Loan to Valuation Ratio survey - Lending position

Note
• Please report figures in millions to three decimal points, i.e. to the nearest thousand New Zealand dollars. For example $1,234,567.89 is reported as 1.235

Definitions
• Only include residential mortgage loans
• Double click on the MS Word document to open the definitions

Definitions.docx

For quarter ended:

1. Residential mortgage loan reconciliation

			add	add	less	less	less	add	less	add				
		Opening position	Drawdowns	Interest charged	Scheduled repayments (interest and principal)	Repayment of loan in full	Other excess repayments	Repayment deficiencies	Net write-offs	Other adjustments	Closing position	*Validation*	Off balance sheet residential mortgages	Total on and off balance sheet residential mortgages
		As at beginning of quarter	*During quarter*	*During quarter*	*During quarter*	*During quarter*	*During quarter*	*During quarter*	*During quarter*	*During quarter*	*As at end of quarter*		*As at end of quarter*	*As at end of quarter*
(a)	LVR > 100													0.000
(b)	LVR > 95 ≤ 100													0.000
(c)	LVR > 90 ≤ 95													0.000
(d)	LVR > 85 ≤ 90													0.000
(e)	LVR > 80 ≤ 85													0.000
(f)	LVR > 75 ≤ 80													0.000
(g)	LVR > 70 ≤ 75													0.000
(h)	LVR > 65 ≤ 70													0.000
(i)	LVR > 60 ≤ 65													0.000
(j)	LVR ≤ 60													0.000
(k)	LVR unknown													0.000
	Total	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**		**0.000**	**0.000**

2. Residential mortgage loan breakdown by payment type (as at end of quarter)

		Interest only	Revolving credit	Principal and interest	Closing position	*Validation*
(a)	LVR > 100				0.000	
(b)	LVR > 95 ≤ 100				0.000	
(c)	LVR > 90 ≤ 95				0.000	
(d)	LVR > 85 ≤ 90				0.000	
(e)	LVR > 80 ≤ 85				0.000	
(f)	LVR > 75 ≤ 80				0.000	
(g)	LVR > 70 ≤ 75				0.000	
(h)	LVR > 65 ≤ 70				0.000	
(i)	LVR > 60 ≤ 65				0.000	
(j)	LVR ≤ 60				0.000	
(k)	LVR unknown				0.000	
	Total	**0.000**	**0.000**	**0.000**	**0.000**	

Use of Micro-level Data on Mutual Funds to Better Determine Household Savings in Japan's Financial Accounts[1]

Naoto Osawa[2]

Abstract

The 2008 SNA recommends that retained earnings of mutual funds be recorded as income and thus savings of the investor, rather than the mutual fund, highlighting the role of mutual funds as investment vehicles or conduits. In practice, however, the data needed to estimate mutual funds' retained earnings tends to be difficult to obtain, posing a challenge to compilers of financial statistics. A recent regulatory change in Japan has made available micro-level, i.e., individual fund-level, data regarding income and dividends of mutual funds, enabling statisticians to reasonably estimate mutual funds' retained earnings. The data also reveals that a considerable portion of dividends of mutual funds in Japan comes from holding gains (principal and capital gains), which could also affect the estimation of financial surplus/deficit by the household sector in Japan's financial accounts.

Keywords: mutual funds, retained earnings, micro-level data, 2008 SNA

1 This paper draws on Bank of Japan (2014) regarding the mutual fund sector.

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1. Introduction

In the wake of the recent global financial crisis revealing the weakness of data coverage to analyse financial stability, international initiatives to develop data in particular on non-bank financial institutions (non-banks), the center stage of the crisis, have been undertaken. The G20 Data Gaps Initiative (DGI) has been created by the international statistical community and endorsed by G20 Finance Ministers and Central Bank Governors and the IMFC,[3] proposing 20 recommendations to identify and close data gaps. The SDDS plus, a new, top-tier data dissemination standard, has also been established by the IMF, supplementing the SDDS[4] with nine new data categories that would help countries in pursuit of the work on the DGI.

Following those international initiatives, the Bank of Japan (BOJ) has recently developed several new sets of data in its Flow of Funds Accounts to capture activities of non-banks, consequently improving the accuracy of estimating households' income distributed through non-banks. In view of implementing the 2008 SNA recommendations, the BOJ published its specific methods in July 2014 to estimate the stocks and flows of all employment-related defined benefit pension schemes on an accrual basis, projecting to release its revised financial accounts in 2016.[5] In June 2014, the BOJ revised the current estimation method for insurance and pension reserves in the life insurance sector to separate more accurately valuation changes due to asset prices and foreign exchange from transactions.[6]

In addition to pension funds and life insurance companies, mutual funds (MFs) have also emerged as one of the most significant sectors among non-banks to influence households' income in recent years. In fact, the 2008 SNA recommends that the retained earnings of MFs be recorded as income and thus savings of the investor (mainly households), rather than as the MFs themselves, highlighting the role of MFs as investment vehicles or conduits. In this treatment, households' income is not recognized if MFs retain earnings to improve their performance at the expense of households. This recommendation may well be motivated by the fact that, under the current treatment of investment funds in the 1993 SNA, households' income is underestimated whereas that of corporations would be overestimated by equal value.[7]

Besides the retained earnings of MFs, there is a very unique aspect of Japan's MFs that undoubtedly raises a question of whether households' income is accurately measured. A considerable portion of distributions has in recent years

3 The International Monetary and Financial Committee (IMFC) is an advisory body to the Board of Governors of IMF.

4 Special Data Dissemination Standard (SDDS) is a global benchmark set up by the IMF in 1996 for disseminating economic and financial data to the public when IMF member countries seek access to international capital markets.

5 For more details on the BOJ's revised methods for financial accounts to implement the 2008 SNA recommendations regarding the pension funds sector as well as other sectors and issues, refer to Bank of Japan (2014).

6 In the previous method of estimating transactions as stock differences, valuation changes arising from asset prices and foreign exchange were inevitably recorded as transactions in the life insurance sector.

7 Eurostat and ECB Directorate General Statistics (2005).

been paid out by MFs from the principal and capital gains,[8] but not from a regular source of income gains (that is, interest and dividends).[9] While the 2008 SNA does not explicitly consider this special case with respect to MFs, by following the principle of MFs as investment vehicles, to treat distributions from the principal and capital gains as dissaving of households, in other words, to treat such funds flowing out of the MF sector as withdrawal or repayment/refund of the investment, would significantly improve the accuracy of data on households' income in Japan.

In theory, it is appropriate to revise how to measure retained earnings in line with the 2008 SNA recommendation for MFs – and, in the case of Japan, distributions from the principal and capital gains – to improve estimates of households' income. However, in practice, data limitations pose a serious challenge to statisticians compiling those statistics. Aggregate information on MFs' retained earnings is usually not available, and individual MF's investment reports (or prospectuses) do not provide sufficiently detailed information on sources of distributions to estimate retained earnings. Even though some countries, such as Australia and the US have already implemented the 2008 SNA, data limitations have brought about serious measurement issues with estimates of retained earnings.

While data limitations are major obstacles to implement the 2008 SNA recommendation on retained earnings, a recent regulatory change in Japan has made available micro-level, i.e., individual fund-level, data regarding sources of distributions by MFs (whether from income gains, capital gains, or the principal), enabling statisticians to reasonably estimate MFs' retained earnings as well as distributions from the principal and capital gains. The purpose of this paper is to use micro-level data of MFs to measure retained earnings of mutual funds and distributions from the principal and capital gains. Measured figures reveal how much Japan's households really reinvest in and withdraw from MFs, better capturing households' income as well as the financial surplus/deficit of the MF sector.

The rest of the paper is organized as follows. Section 2 briefly explains what MFs are, highlighting their role as investment vehicles in the 2008 SNA. Section 3 describes methodological challenges for estimating MFs' retained earnings in Japan and their unique aspect of distributions from the principal and capital gains, drawing on some experiences of other countries. Section 4 depicts source data and estimation methods while Section 5 analyses estimation results. Section 6 concludes the paper.

8 Hereafter in this paper, the term "capital gains" is used to stand for "holding gains." Although the 2008 SNA prefers the latter, the two terms have essentially the same meaning (2008 SNA 3.105).

9 As for terms used in this paper, distributions from income gains refer to investment income that comprises interest (income on debt) and dividends (income on equity) while distributions from capital gains refer to payments distributed from capital gains. In the SNA, distributions from the principal and capital gains essentially refer to withdrawal of equity, defined as "large and irregular payments based on accumulated reserves or sale of assets."

2. Mutual Funds as Investment Vehicles or Conduits in the 2008 SNA

Mutual funds are collective investment schemes that raise funds by issuing shares or units to investors and invest the proceeds predominantly in financial assets and in nonfinancial assets.[10] While there are many types of MF (e.g., open-end or closed-end, active or passive, global or dedicated), the role of MFs as investment vehicles or conduits is universal across fund types in that MFs raise funds from investors, invest the proceeds mainly in securities, and distribute payments to investors.

To illustrate the role as investment vehicles, consider the case of retained earnings obtained by MFs and compare the ways in which they are recorded between the 1993 SNA and 2008 SNA – differences depend on whether retained earnings are recorded as a transaction or a reconciliation in financial accounts (Chart 1). On the one hand, the 1993 SNA recommends that retained earnings are obtained by MFs and reinvested by MFs, recording investment income obtained by MFs as a transaction on the asset side and reinvested income as a reconciliation on the liability side, leaving the MF sector with positive saving. On the other hand, according to the 2008 SNA recommendation, while investment income obtained by MFs is recorded as a transaction in the same way as in the 1993 SNA, reinvested income is imputed as if the income were distributed to and reinvested by investors and is recorded also as a transaction on the liability side of MFs (i.e., on the asset side of investors), leaving the MF sector with no saving.

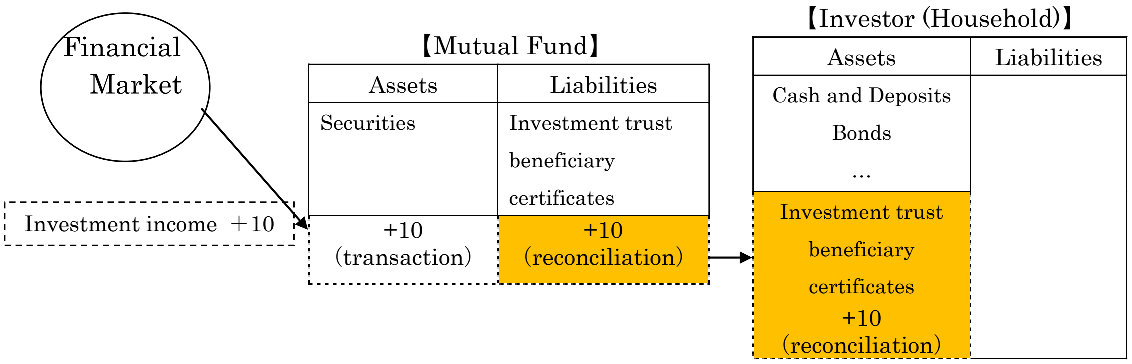
As for investors' income and savings, the 1993 SNA's treatment of retained earnings leaves investors (mainly households), with negative saving (equivalently, MFs' positive savings) while the 2008 SNA's treatment leaves investors with no saving, and consequently with a financial surplus/deficit of MFs being balanced. Given the role of MFs as investment vehicles, the 2008 SNA recommendation would be more appropriate. This change in the treatment of MFs' retained earnings is in part motivated by the fact that, under the 1993 SNA treatment of investment funds, households' income is underestimated.[11]

10 These collective investment schemes are often referred to as investment funds, managed funds, or funds. This paper uses the term mutual funds.

11 Note that estimation methods for retained earnings are different between capital accounts and financial accounts in Japan's SNA. On the one hand, in capital accounts, (property) income flows are estimated from information on the asset side of investment trusts which include MFs, automatically recording retained earnings. On the other hand, in financial accounts, (property) income flows are estimated from information on the liability side of MFs, that is, net purchases (purchases minus redemptions) by investors.

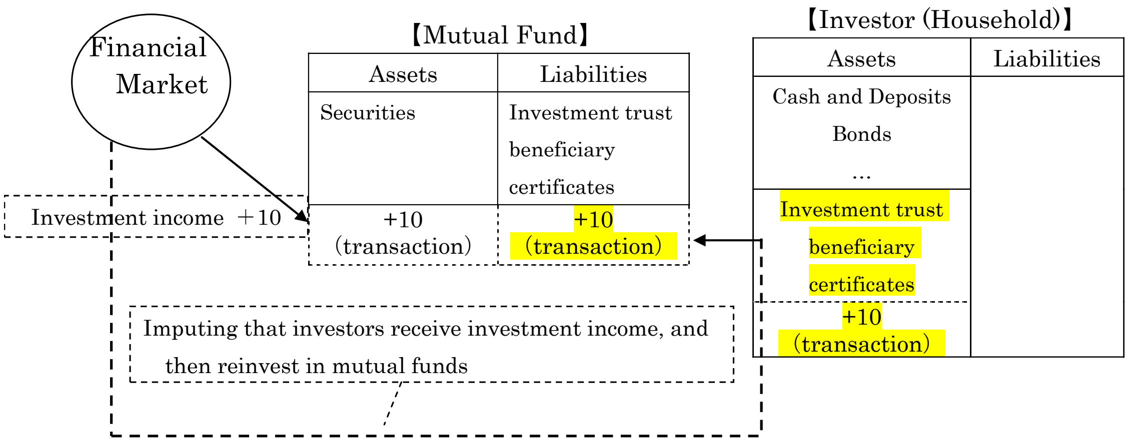
(1) 1993 SNA

-- MF sector receives ten units of investment income, and then retains them (reinvests in securities).



(2) 2008 SNA

-- MF sector receives ten units of investment income, and then retains them (reinvests in securities).

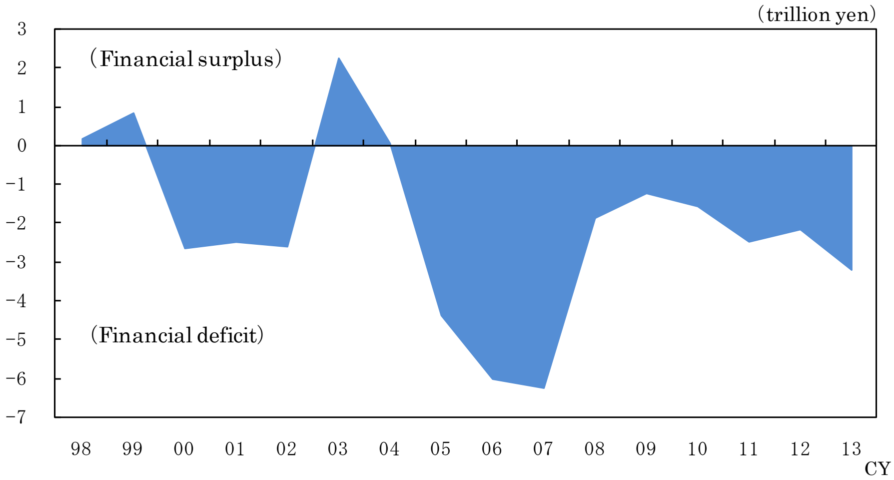


3. Methodological Challenges in Japan and Other Countries

As mentioned in Section 2, the intended motive behind the 2008 recommendation on retained earnings is in part to rectify underestimation of investors' income by imputing retained earnings as investors' income rather than MFs'. As a result, net positive savings of MFs which would prevail in the treatment of the 1993 SNA, are expected to shrink (net negative savings of investors to shrink, i.e., savings of investors to increase). However, a very unique characteristic of the MF sector in Japan is that, in recent years, MFs' net savings have structurally remained negative by a significantly large amount. The negative savings are the opposite of the outcome expected by the 2008 SNA recommendation and the problem that current

Japan's financial accounts (Flow of Funds Accounts) is facing in measuring households' income (Chart 2).

Financial Surplus/Deficit of Mutual Fund Sector in Japan Chart 2



Source: BOJ

The net negative savings of MFs mean that MFs pay out more distributions than the amount of income gains generated from their assets. This type of fund investment strategy has been commonly observed in increasingly popular MFs whose main characteristics are as follows: 1) their assets are predominantly concentrated in foreign-currency denominated bonds to aim for higher returns under the super-low interest rate environment in Japan's domestic market; and 2) distributions are paid out monthly, perceived by investors as substitutes for interest income generated from bank deposits under high-interest rate environment in the past, especially the 1980s, and thus used as supplements to living expenses and pension payouts, particularly for the elderly.[12] The problem arose when, in recent years, even after the yen sharply appreciated in the wake of the financial crisis and thus funds' performance greatly deteriorated, many MFs continued to pay out a predetermined amount of distributions denominated in yen every month, which could not be covered by income gains and thus had to be overwhelmingly financed by payouts from the principal and capital gains.

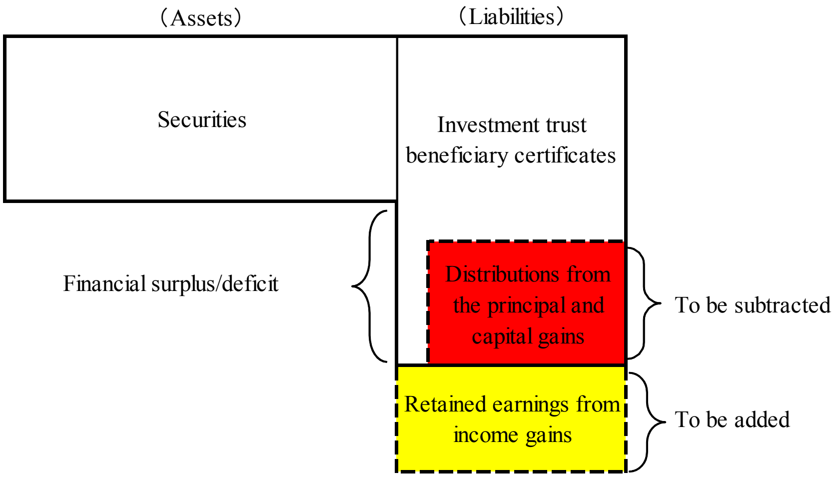
The problem of structural net negative saving in the MF sector can be understood by noting how MFs can pay out distributions from three different sources in Japan: income gains, capital gains, and part of the principal. On the one hand, distributions from income gains are standard and this does not change

[12] As general observations, the elderly who depend on pension payouts more than the younger generation. prefers monthly distribution-type MFs more than the younger generation, and the former owns more MFs in value than the latter. In tandem with the rapidly aging population in Japan, monthly distribution type MFs tend to have become increasingly popular in society as a whole. In fact, according to Nomura Research Institute, the share of monthly distribution-type MFs rapidly increased from about 10% of the net asset value of non-MMF MFs in 2000 to about 70% in 2011.

financial surplus/deficit of the MF sector; investment income flowing into the MF sector from the financial market is offset by distributions flowing out of the MF sector. On the other hand, distributions from capital gains and the principal require MFs to sell their (financial) assets to generate proceeds which can be distributed to investors. In this case, while no investment income is flowing in, the MF sector pays out distributions and as a result, records a financial deficit. As for the investor sector, even the distributions from capital gains and principal are recorded as income and thus financial surplus is recorded. Nonetheless, this treatment is not appropriate according to the 2008 SNA, which emphasizes the role of MFs as investment vehicles with net savings of MFs being zero. Similarly, for investors, as distributions are generated from sale of assets, this transaction is essentially the same as withdrawal of equity and should not be recorded as a financial surplus of the investor sector. Overestimation of investors' income should be rectified (Chart 3).

Flows in Mutual Fund Sector

Chart 3



Note: Investment trust beneficiary certificates (liabilities of MFs = assets of investors) are estimated by net purchases (purchases minus redemptions) of MFs' shares by investors.

Conceptually, as described above, treatment of retained earnings and distributions from the principal and capital gains is clear. Practically, however, data availability is a major challenge to implement the 2008 SNA recommendation, which requires information in particular on sources of retained earnings and distributions. According to the 2008 SNA, imputing retained earnings from capital gains as investors' income is not appropriate since capital gains in general are not considered as property income – at least at the time of finalizing the 2008 SNA.[13] Therefore, it is necessary to break down sources of earnings and distributions into income gains and capital gains. Such detailed data is usually difficult to obtain.

[13] Experts have not yet reached a consensus on the issue of whether capital/holding gains and losses should be included in investment income. Smith (2012) pointed out that in the case of insurance and pension funds, holding gains and losses attributable to policyholders or pension beneficiaries should be included in investment income. However, the Advisory Expert Group on National Accounts continues to discuss the topic as a future research agenda.

In fact, other countries which have implemented the 2008 recommendation on retained earnings of MFs face compilation challenges due to data limitations. For example, Australia, one of the first advanced countries to implement the 2008 SNA in 2009, reports large negative retained earnings for some time periods in part due to data limitations in that capital gains and losses cannot be perfectly separated from income gains. As another example, the US, which implemented the 2008 SNA in 2013, uses assumption of zero net savings of the MF sector in its financial accounts – financial surplus/deficit of the MF sector as balanced (i.e., zero) – due most likely to data limitations, which means that retained earnings from income gains are automatically recorded as a transaction, i.e., households' income.[14] However, a drawback of this method is that retained earnings from capital gains and losses can also be recorded as part of households' income, which is not recommended by the SNA.[15]

In the case of the US, imposing the assumption of zero net savings of the MF sector raises an issue regarding the concept of income in the SNA, that is, whether capital gains should be considered as income. Given the role of MFs as investment vehicles, investors would not distinguish between income gains and capital gains because sources of distributions would not matter as long as investors receive payments. From this point of view, it may be reasonable to record distributions from capital gains as income in the SNA. In the case of Japan, the BOJ has decided to exclude distributions from capital gains (and the principal) from income in line with the current principle of the SNA. Nonetheless, as the issue of the concept of income in the SNA has not yet been resolved, the BOJ will watch closely the direction of the future debate on this issue.

4. Estimation Methods for Retained Earnings and Distributions

While data limitations pose a serious challenge for implementing the 2008 SNA recommendation on retained earnings in other countries as explained in Section 3, Japan also faces the similar challenge: while aggregate data on distributions from (publicly offered) MFs are compiled and made publicly available by the Investment Trusts Association of Japan, no aggregate data on retained earnings of MFs are available. However, a regulatory change enacted in 2012 has made data available from June 2012 onward in order to reasonably estimate retained earnings. By this regulation, individual MF is required to disclose in its investment report (or prospectus) detailed information on income gains, capital gains, and sources of distributions. This paper shows the estimated result of retained earnings derived

14 An increase in MFs' assets by earnings retained equal to an increase in MFs' liability (by the assumption imposed), which in turn is equal to an increase in households' assets/income.

15 It is not a drawback if capital gains are *intentionally* recorded as households' income, which may well be the case in the US. Nonetheless, some practical issues remain with zero financial surplus/deficit assumption of the MF sector. First, in order for this to work practically, reasonably accurate flow data on the asset side of MFs is required. Second, time lags in settlement of purchase and redemption transactions would make income flows volatile, especially in higher frequencies, such as quarterly data.

from income gains and of distributions from principal and capital gains. Details on data and estimation methods used in this paper are described below:[16]

(Sample Data)

As there are over 7,000 MFs in Japan, this paper uses a sample of 150 MFs which represent a majority of the total MFs, ensuring the validity of the estimation as well as minimizing compilation costs. The information on a sample is as follows:

- Non-MMF MFs (MMF, REIT, or ETF is excluded)
- Publicly offered MFs (privately placed MFs, which are mostly purchased by institutional investors, are excluded due to data limitations)
- MFs paying out distributions at least four times per year
- Monthly frequency
- Sample includes about 150 MFs, which are designed to be selected without bias with respect to asset classes (equity, bonds, real estate, or mix) and regions (domestic, overseas, or mix), accounting for about 70 percent of total net asset value of publicly offered MFs[17]

(Rule for Distributions and Disclosed Information)

The rule for distributions which can be paid out by MFs and information which must be disclosed in the investment report by MFs are as follows (Chart 4):

- MFs can use the following four sources of funds from which distributions are paid out to investors: income gains generated during the current period (a), capital gains generated during the current period (b), retained earnings accumulated up to the previous period (c), and part of the principal (d); and
- The investment report discloses information on the amount of distributions (f), part of which are generated from the current period (x) – both income and capital gains – and part of which are generated from sources other than x, (y),[18] and information on (a) through (d).

16 In response to the Financial Services Agency's Year 2011 Guidelines for Supervision of Financial Instruments Business Operators, the Investment Trusts Association of Japan revised in 2012 its self-guideline for MF's financial report to make more transparent to investors MF's investment strategies and their risks involved in assets held in foreign currency denominated bonds combined with predetermined monthly distributions, especially during times of the Japanese yen's appreciation, as mentioned in Section 3.

17 A sample is selected in two steps: sample 1 is selected to account for 70% of net asset value of *total* MFs regardless of categories, while sample 2 is selected to account for 70% of net asset value in *each category* in a matrix of asset classes and regions. The final sample contains either sample 1 or sample 2 (i.e., union of two samples). As the net asset value of MFs changes over time and some MFs cease to exist, a sample is updated every year.

18 (y) consists of part of (c) and part of (d).

Disclosed Information on Sources of Distributions (an example) — Chart 4

(Calculation of Distributions)

		(yen)
Sources of Distributions	(a) Income gains from the current period	3,448,944,500
	(b) Capital gains from the current period	0
	(c) Retained earnings accumulated up to the previous periods	14,862,141,396
	(d) Part of principal that can be distributed	71,229,777,924
	(e) Total of distributable funds (a+b+c+d)	89,540,863,820
	(f) Total distributions (for about 2.5 trillion shares)	8,749,736,673
	(g) Total distributions (per 10,000 shares)	35

(Decomposition of Distributions)

		(yen, per 10,000 shares)
(g) Total distributions		35
	(x) Distributions from the current period's earnings	13
	(y) Distributions from sources other than x	22
(h) Distributable funds carried over to the next period (e - f)		323

Note: The information on sources of distributions is disclosed in MF's profit and loss report for the month of December 2013.

Source: Investment Report of Global Sovereign Open (Monthly Distribution), Kokusai Asset Management.

(Estimation Method)

The estimation method for "retained earnings derived from income gains of the current period, (p)," and "distributions from the principal and capital gains during the current period, (q)," is as follows (Chart 5):

Estimation Equations for Individual MFs

1. Distributions derived from income gains: (z) = (x')*(a/(a+b)),

where x' = x*number of every 10,000 shares in MF[19]

2. Retained earnings derived from income gains: (p) = (a) – (z)

3. Distributions from the principal and capital gains: (q) = (f) – (z)

[19] Note that as x appears as per 10,000 shares in the financial report, this figure needs to be converted to as per mutual fund for individual MF levels.

– Calculate "part of distributions which are actually paid out from income gains generated during the current period (z)" by multiplying (x′ = x*number of every 10,000 shares) – funds which are generated during the current period – with (a/(a+b)) – the share of income gains to funds generated during the current period;[20]

– Calculate "retained earnings from income gains (p)" by subtracting (z) from (a);

– Calculate "distributions from the principal and capital gains (q)" (= "distributions from capital gains during the current period" + "funds are generated from sources other than x") by subtracting (z) from (f); and then,

Estimation Equations for aggregated level retained earnings (P)

4. $p_{sample}/f_{sample} = (p_1/f_1*n_1+p_2/f_2*n_2+\ldots+p_i/f_i*n_i)/(n_1+n_2+\ldots+n_i)$, i = sample

5. $P = F*(p_{sample}/f_{sample})$

– Given estimated retained earnings at the individual MF level (p), calculate retained earnings at aggregated level (P) by weighted-averaging across sample of individual MFs with net asset value (n) as a weight, and by grossing-up with a ratio of the amount of distributions at the individual MF level (f) to that at aggregated level (F), which is compiled and made publicly available by the Investment Trusts Association of Japan.

Estimation Equations for aggregated-level distributions from the principal and capital gains (Q)

6. $a_{sample}/f_{sample} = (a_1/f_1*n_1+a_2/f_2*n_2+\ldots+a_i/f_i*n_i)/(n_1+n_2+\ldots+n_i)$, i = sample

7. $A = F*(a_{sample}/f_{sample})$, then Q = F - Z = F - (A - P)

– Similarly, for aggregated level distributions from the principal and capital gains (Q), after grossing up (a) to (A), subtract (Z = A - P) from (F).

Estimation Equation for overall adjustments of flows of MFs sector (P - Q)

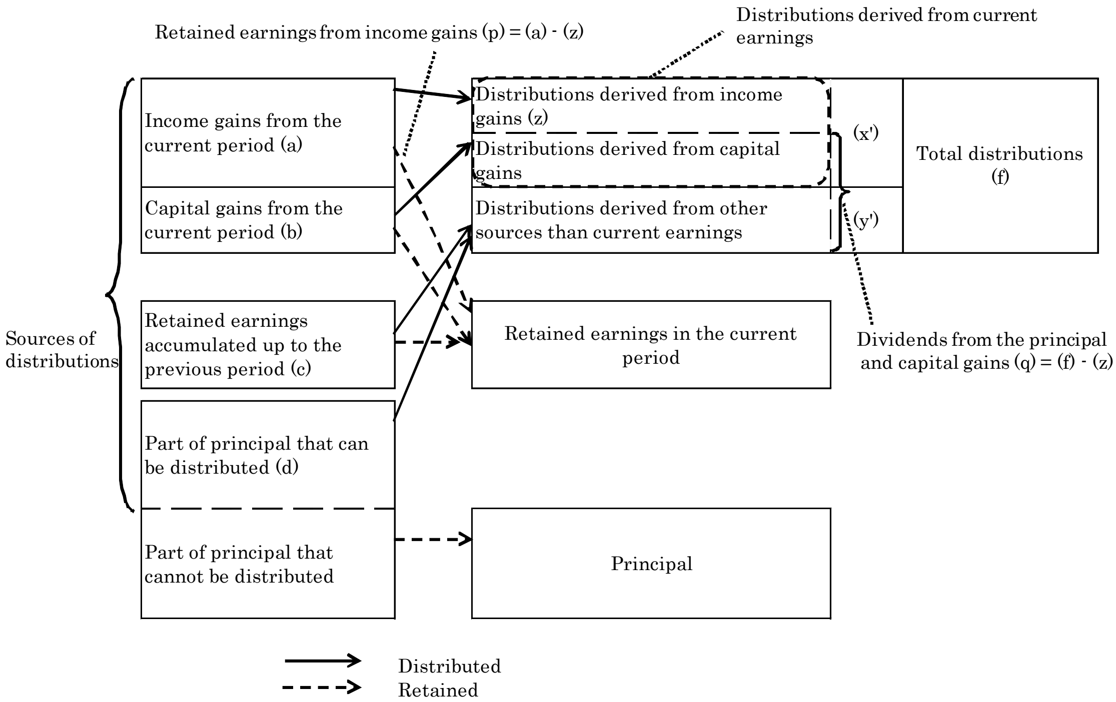
8. (P) - (Q) = (A - Z) - (F - Z) = (A) - (F)

– Overall adjustments of flows of the MF sector entail adding retained earnings, P (= A - Z), and subtracting distributions from the principal and capital gains, Q (=F - Z), simply resulting in (P - Q), that is, (A - F).

[20] An implicit assumption here is that the share of income gains *distributed* and the share of income gain *generated* are equal. Actual distribution strategies vary among individual fund managers.

Sources of Distributions, and Flows of Retained Earnings and Distributions by Mutual Funds

Chart 5



Note: x' = x times number of shares (about 2.5 trillions) in MFs (per 10,000 shares). y' = y times number of every 10,000 shares in MFs (per 10,000 shares).

5. Estimation Results

Following the estimation method described in Section 4, this section presents estimates of retained earnings and of distributions from the principal and capital gains, using sample monthly data between June 2012 and May 2013.

First, retained earnings are estimated at 0.6 trillion yen for 2012 and 1.3 trillion yen for 2013 at an annualized rate, which are about 20 percent and 37 percent of income gains generated during the current period, respectively – that is, a distribution payout ratio from income gains of 80 percent and 63 percent, respectively. Those estimates are rather small compared with total distributions of 4.8 trillion yen for 2012 and 5.0 trillion yen for 2013, in part possibly reflecting low interest rate environment.[21] This result implies that net saving of investors would increase by 0.6 trillion yen for 2012 and 1.3 trillion yen for 2013, compared with households' net savings (i.e., financial surplus of the households sector) in the

21 Those estimates are only for publicly offered MFs, which tend to pay out more distributions than privately placed MFs (about half the size of publicly offered MFs in net asset value). As privately offered MFs are mainly purchased by institutional investors with long-term investment strategies, they tend to retain rather than distribute earnings.

current statistics of 23.6 trillion yen for 2012 and 23.6 trillion yen for 2013 (Table 1).[22]

Second, distributions from the principal and capital gains are estimated at 2.2 trillion yen for 2012 and 2.6 trillion yen for 2013 at an annualized rate (excluding privately placed MFs), which accounts for about 46 percent and 52 percent of total distributions, respectively. This largely reflects the fact that many MFs paid out distributions even with their poor performance in the aftermath of the global financial crisis. This implies that net savings of households would decrease by 2.2 trillion yen for 2012 and 2.6 trillion yen for 2013 (Chart 6). Combined with estimates of retained earnings, net savings of households would decrease by 1.6 and 1.3 trillion yen on net – in turn, net savings of MFs would increase by the same magnitude to partially correct underestimation.

Decomposition of Distributions

Table 1

(trillion yen)	2012	2013
Total distributions (F)	4.8	5.0
Distributions from principal and capital gains (Q)	2.2	2.6
Retained earnings (P)	0.6	1.3
P - Q (adjustment of households' income)	-1.6	-1.3

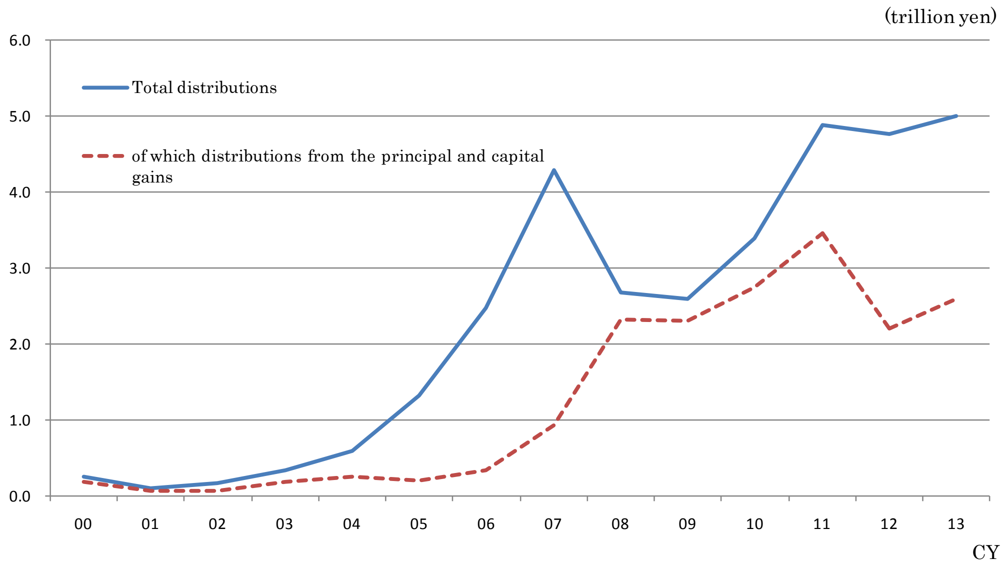
From 2008 to 2011, distributions from the principal and capital gains are estimated to account for a large portion of the total distributions, while those prior to 2007 are considerably smaller, reflecting in part the better performance of MFs and in part underestimation (as explained below). Note, however, that figures for distributions from the principal and capital gains prior to May 2012 are approximately estimated by the alternative estimation method as described in Annex, because the detailed information on sources of distributions is only available from June 2012. The alternative method makes use of the concept of the average purchase cost that is applied to individual MFs – as opposed to being applied to individual investors for filing income tax purposes. The alternative method compares the share price with the average cost in estimating distributions from the principal and capital gains: distributions from MFs are considered as those from the principal and capital gains when the share price is below the average cost.[23]

22 As a reference, Japan's nominal GDP and disposable income for 2012 are about 474 trillion yen and about 350 trillion yen, respectively.

23 This method was actually applied up to March 2000 to calculate income taxes for individual investors in Japan although the average cost of the MF as a whole and that of the individual investor diverge, generating inequality among investors.

Distributions from Principal and Capital Gains

Chart 6



Note: Distributions from the principal and capital gains are estimated by an alternative method (the average purchase cost) prior to 2012. Data are publicly offered mutual funds.

Source: BOJ

Because figures estimated by the alternative method are an approximation, some estimation biases exist in either direction. On the one hand, figures tend to be overestimated when MFs perform poorly (in the sense that the share price is below the average cost) because they would include income gains. On the other hand, figures tend to be underestimated when MFs perform well (in the sense that the share price is above the average cost) because they would exclude capital gains as may well be the case in the mid-2000s.[24]

6. Concluding Remarks

A recent regulatory change in disclosing information on sources of distributions by MFs in Japan has made it possible for statisticians to reasonably estimate retained earnings as well as distributions from the principal and capital gains in line with the 2008 SNA recommendation. This paper's analysis offers three important implications.

First, the 2008 SNA recommendation to impute retained earnings as investors' income rather than MFs' is appropriate, considering the role of MFs as investment vehicles or conduits. Nevertheless, albeit easily understood in theory, commonly prevailing data limitations make it difficult to implement it in practice, as evidenced by examples of other countries, such as Australia and the US. Only when detailed

[24] For more details, refer to the Annex.

micro-data at the individual MF level became available in Japan did it become possible to estimate income gains and capital gains separately. As in other recommendations in the 2008 SNA, implementing the 2008 SNA recommendation entails developing data, but at the same time reporting burden should be given a serious consideration. Weighing costs and benefits is (and has been) a fundamental challenge to statisticians in developing data.

Second, it is difficult to capture activities of non-banks including MFs from the existing source data although this area of data development is requested by the international community. It follows that it is also difficult to assess and analyze their effects on households' income through non-banks. Thus far, the BOJ has revised estimation methods for pension funds and insurance and pension reserves in the life insurance sector to make estimation more appropriate and accurate, and the latest attempt in this area is to take on the remaining major sector of MFs and revise estimation methods. As a result of those revisions, estimates of households' income are expected to improve significantly.

Third, as Japan's unique feature, MFs' distributions come not only from income gains, but also from the principal and capital gains. The latter part is not explicitly explained in the SNA manual, but statisticians need to decide whether to record distributions from the principal and capital gains as households' income. While other countries may not have experienced similar cases, the BOJ has decided that it is appropriate not to record them as households' income. Nevertheless, given the role of MFs as investment vehicles, recording capital gains – but not the principal – as income can be given a serious consideration, possibly stimulating future discussions about what is considered as "the concept of income" in the SNA.

References

Bank of Japan (2014), "The Implementation of 2008 SNA Recommendations in Japan's Flow of Funds Accounts," Research and Statistics Department, *BOJ Reports & Research Papers*, July.

Eurostat and ECB Directorate General Statistics (2005), "Retained earnings of mutual funds," *Issue paper for the meeting of the Advisory Expert Group*, July.

Smith, Herman (2012), "The treatment of holding gains/losses in the estimates of investment income attributable to insurance policyholders and pension beneficiaries," 7th Meeting of the Advisory Expert Group on National Accounts, April.

Annex: Alternative Estimation Method for Distributions

As discussed in the text, estimating distributions from different sources, "distributions from the principal and capital gains" and "distributions from income gains," entails a set of detailed information, such as income gains, capital gains, and sources of distributions. However, since individual mutual funds (MFs) are required to disclose detailed information on which the estimation method in the text relies only after June 2012, an alternative method to estimate "distributions from the principal and capital gains" prior to May 2012 is introduced by making use of more readily available data.

It is important to estimate "distributions from the principal and capital gains" during time periods prior to May 2012, especially in the aftermath of the global financial crisis. As explained in the text, while most monthly distribution-type MFs paid out distributions from the principal (and capital gains) following the global financial crisis, most investors did not perceive the source of distributions as the principal. Instead, they rather perceived it as the "ordinary" source of income gains – as if it were interest paid on bank deposits. Thus, those investors should be made aware of their misperception of the source of income, and the magnitude of the distributions should be made available, albeit as an approximation. Although the alternative method is not as accurate as the method in the text, given the data limitation of detailed information prior to May 2012, it is one of the best possible alternatives to quantify the magnitude of misperceived households' income. This annex explains the alternative method, its possible discrepancies from the method in the text, and its estimation results of "distributions from the principal and capital gains."

(Concept of Alternative Method)

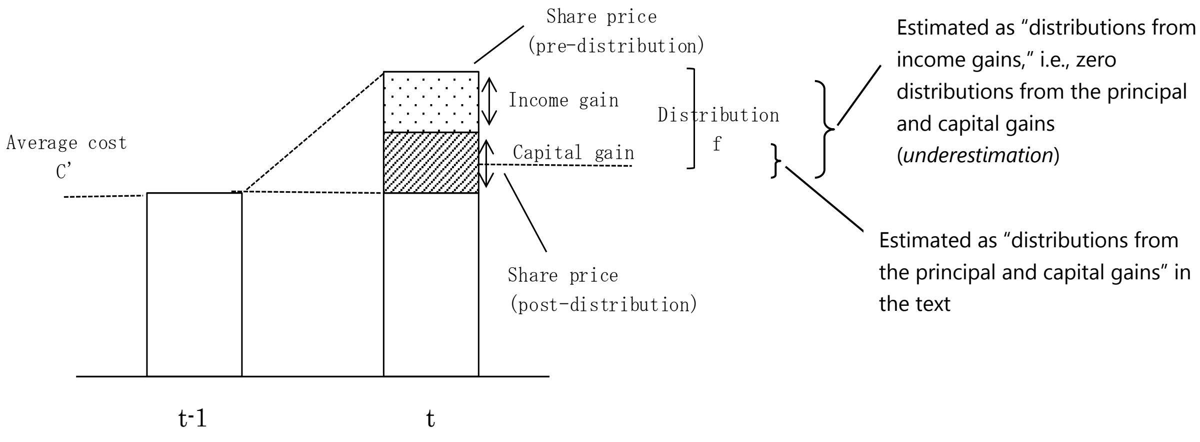
The alternative method applies the concept of the average purchase cost to individual MFs – as opposed to individual investors for more familiar taxation purposes – by using more readily available data disclosed by individual MFs, such as share prices, distributions, number of total shares, number of shares purchased, and number of shares redeemed. The alternative method compares the share price (= net asset value/number of shares) with the average purchase cost per share (= principal/number of shares; hereafter, the average cost) in estimating "distributions from the principal and capital gains." The underlying concept is to consider distributions as "normal" in the sense that the MF pays out distributions when generating "money" (e.g., income gains and capital gains) represented by the case when the share price is above the average cost while considering distributions as "peculiar" in a sense that the MF pays out distributions even when losing "money" (e.g., capital losses) represented by the case when the share price is below the average cost.[25]

[25] This alternative method makes use of the average purchase cost *at the individual mutual fund level*. In fact, this concept is rather common *at the individual investor level* where taxable income is determined by the relationship between the share price and the average purchase cost. For example, when investors redeem shares, if the share price is above the average cost, the difference between the proceeds from redemption and the principal (= average purchase cost times number of shares) will be taxed. On the contrary, if the share price is below the average cost, the proceeds from redemption are smaller than the principal, and thus no proceeds will be taxed because investors "lost their money."

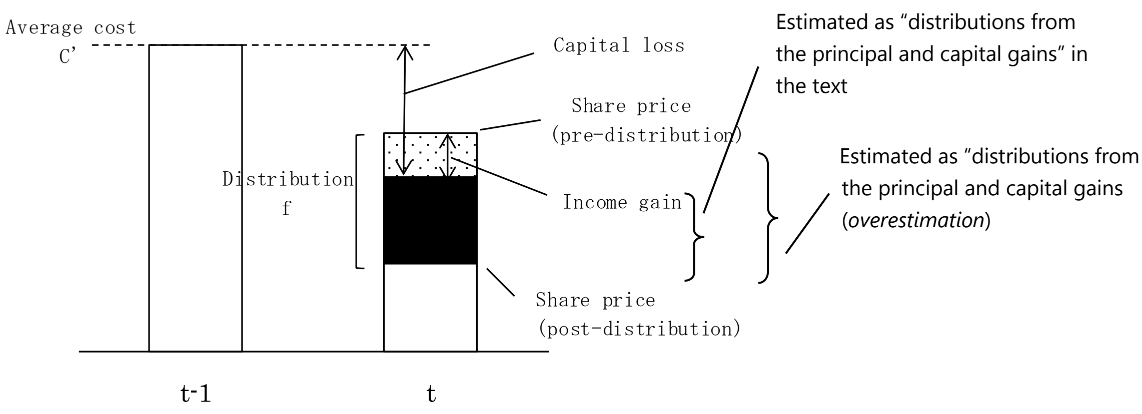
Share Price, Average Purchase Cost, and Distribution (per share unit for individual MFs)

Chart A1

[Case 1] Share Price > Average Cost



[Case 2] Share Price < Average Cost

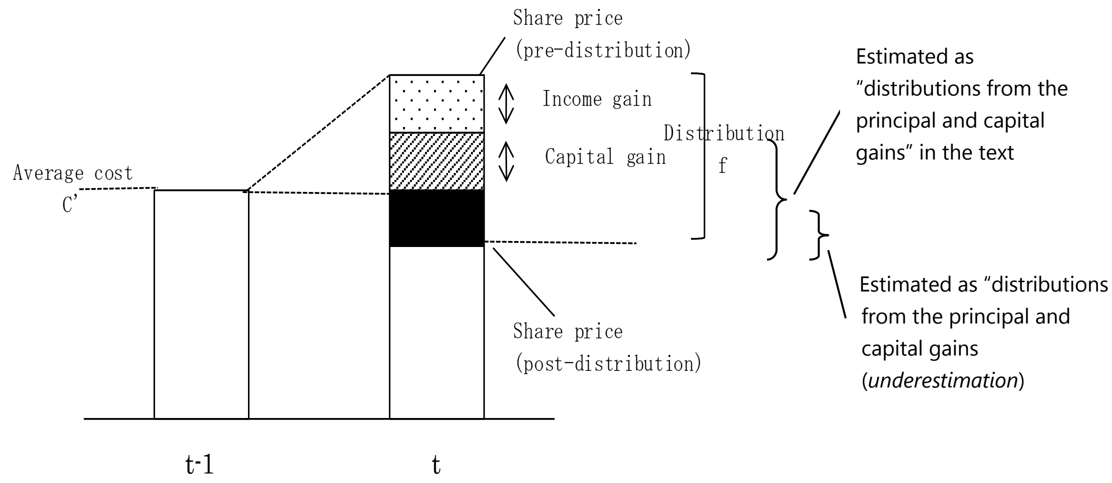


This alternative method was actually applied up to March 2000 to determine taxable income for individual investors in Japan by comparing the average cost *at the MF level* as a whole with that of the investor *at the individual investor level*. The problem is to apply the same MF level average cost to every individual investor equally although the average cost differs among individual investors, generating inequality among investors. This inequality prompted a change in the tax code which has been used to calculate individual investors' average cost since April 2000. Given this history, the alternative method of using the average cost at the MF level is relatively common in the MF industry in Japan.

Share Price, Average Purchase Cost, and Distribution (per share unit for individual MFs) (cont)

Chart A1

[Case 3] Pre-distribution Share Price > Average Cost > Post-distribution Share Price



In particular, the following three cases are worth considering (Chart A1): when distributions paid out by MFs are considered as those from income gains if the share price is above the average cost (this condition still applies even after the distribution is paid out – note that the share price, calculated as net asset value divided by number of shares, declines after the distribution is paid out), denoted as *Case 1*; when distributions are considered as those from the principal and capital gains if the share price is below the average cost, denoted as *Case 2*; and, as a case similar to Case 1, where the relationship between the share price and the average cost changes before and after the distribution is paid out, when part of distributions which lies below the average cost is considered as being from the principal and capital gains if the pre-distribution share price is above the average cost, but the post-distribution share price is below the average cost, denoted as *Case 3*.

(Discrepancies from the Method in the Text)

Not using detailed information on sources of distributions, estimates by the alternative method deviate from those by the method in the text in either direction (upward or downward), depending on the relationship between the share price and the average cost. On the one hand, figures for "distributions from the principal and capital gains" estimated by the alternative method tend to be underestimated when the share price is above the average cost because capital gains are excluded as in Cases 1 and 3. On the other hand, figures for "distributions from the principal and capital gains" tend to be overestimated when the share price is below the average cost because income gains are included as in Case 2. Nevertheless, those discrepancies tend not to remain in one direction because individual MFs are estimated separately before being aggregated using a weight of net asset value, and also because market fluctuation makes the discrepancies appear in both directions.

(Estimation Equations)

Focusing on the average cost before and after distributions are paid out, "distributions from the principal and capital gains" for individual MFs can be estimated by using a readily available data set of share prices after distribution (p_t), net asset values (I_t), shares purchased (S_t), shares redeemed (R_t), and distributions per share (f_t), at time t. Given those basic data, the number of total shares at time t (Ni_t), number of shares purchased during time t (Ns_t), and number of shares redeemed during time t (Nr_t) can be simply derived as follows:

Number of shares at time t	$Ni_t = I_t / p_t$
Number of shares purchased during time t	$Ns_t = S_t / p_{t-1}$
Number of shares redeemed during time t	$Nr_t = R_t / p_{t-1}$

Then, the average cost per share *before distributions* (C'_t) can be derived as follows:

Average cost per share before distributions $$C'_t = \frac{Ni_{t-1} \times C_{t-1} + Ns_t \times p_{t-1} - Nr_t \times C_{t-1}}{Ni_{t-1} + Ns_t - Nr_t}$$

Given distributions per share (f_t), the average cost per share *after distributions* is shown, depending on the three cases discussed above, as follows:

Average cost per share after distributions $$C_t = \begin{cases} C'_t & (C'_t < p_t) \ldots Case\ 1 \\ p_t & (p_t \le C'_t < p_t + f_t) \ldots Case\ 3 \\ C'_t - f_t & (p_t + f_t \le C'_t) \ldots Case\ 2 \end{cases}$$

Then, "distributions from the principal and capital gains" can be shown for each of the three cases (each estimate corresponds to each case discussed above, respectively) as follows:

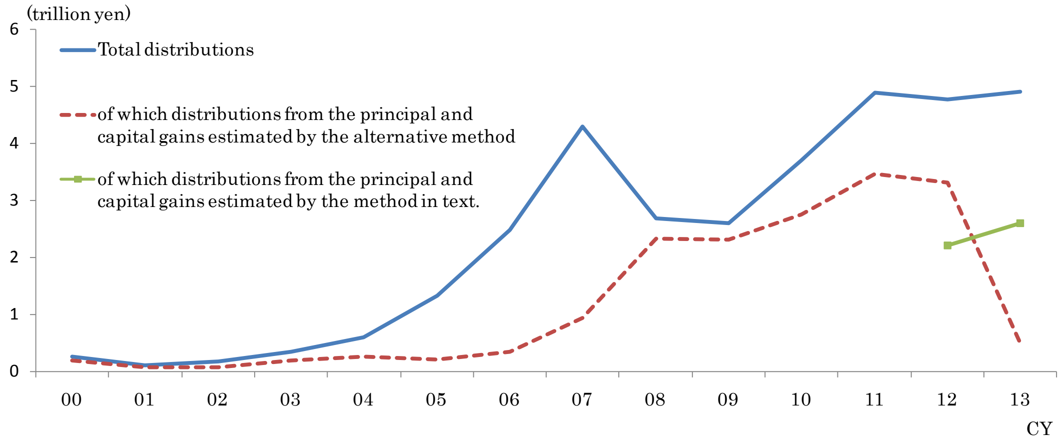
Distributions from the principal and capital gains $$g_t = \begin{cases} 0 & (C'_t < p_t) \ldots Case\ 1 \\ C'_t - p_t & (p_t \le C'_t < p_t + f_t) \ldots Case\ 3 \\ f_t & (p_t + f_t \le C'_t) \ldots Case\ 2 \end{cases}$$

Finally, to derive figures at the macro level, estimates of individual MFs are aggregated through individual MFs.

(Estimation Results and Some Implications)

The alternative method, based on monthly data for about 4,000 individual publicly offered MFs since April 2000, estimates "distributions from the principal and capital gains" whose results are shown in Chart A2:

Distributions from Principal and Capital Gains Chart A2



Note: The broken red line depicts estimates of "distributions from the principal and capital gains" by the alternative method prior to 2012 (based on about 4,000 samples of publicly offered MFs). The solid green line depicts estimates by the method in the text after 2012 (based on about 150 samples of publicly offered MFs).

Source: BOJ.

Chart A2 is similar to Chart 6 in the text with differences in figures in 2012 and 2013. Note that figures for 2012 and 2013 can be estimated by both the alternative method and the method in the text because data overlap – about 150 MF samples with detailed (more granular) data for the method in the text and about 4,000 samples with less granular data for the alternative method.

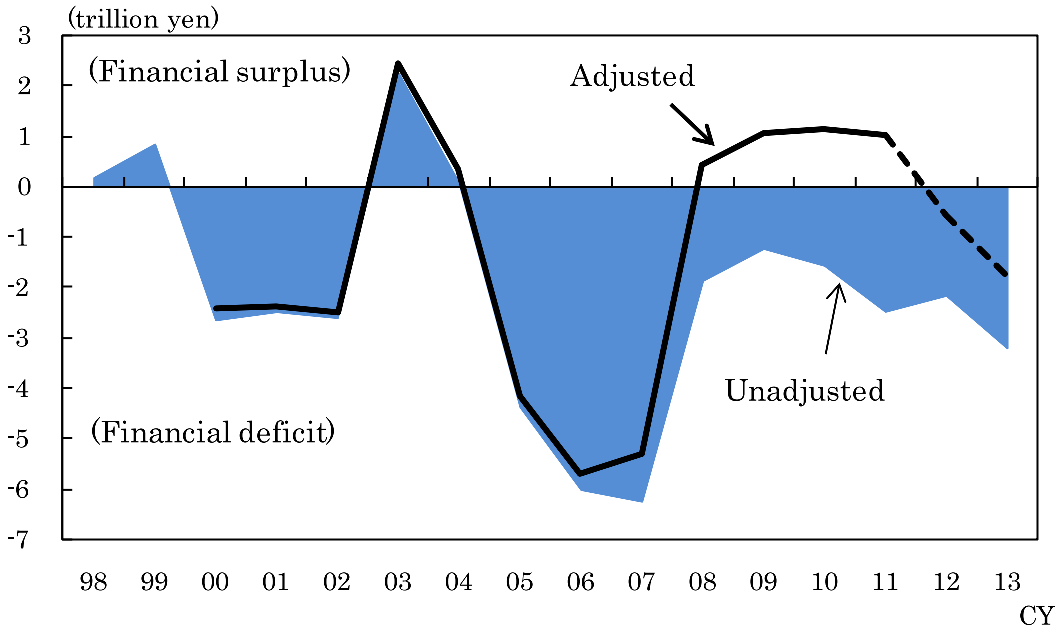
Given those estimates, the financial surplus/deficit of the MF sector as shown in Chart 2 of the text can be adjusted by adding figures of "distributions from the principal and capital gains" – as a mirror image, the same magnitude is subtracted from the household (investor) sector (Chart A3). As a result, while the excessive financial deficits of the MF sector could be mostly rectified in recent years, the deficit in the mid-2000s could hardly be rectified. The latter could be influenced by discrepancies between the alternative method and the method in the text: "distributions from the principal and capital gains" can be underestimated or overestimated, depending on the relationship between the share price and the average cost. For example, during 2005 and 2007 when the financial deficit of the MF sector was virtually not adjusted, "distributions from the principal and capital gains" estimated by the alternative method which does not capture *capital gains* can be underestimated when the share price is above the average cost as in Cases 1 and 3 – that is very likely given conditions of the financial markets (e.g., equity and

FX, both of which significantly affect the share price). If capital gains had been properly captured, the financial deficit would have been further reduced so as to be adjusted closer to what MFs' role as conduits would predict.

Separately, during 2009 and 2011, albeit a lesser magnitude, the financial deficit turned to a surplus – that is, the financial deficit is excessively adjusted. This may be explained by the fact that "distributions from the principal and capital gains" estimated by the alternative method, which does capture *income gains*, can be overestimated when the share price is below the average cost as in Case 2, which is very likely given the conditions of the financial markets in the aftermath of the financial crisis. If income gains had been properly captured and excluded accordingly from the alternative estimates of "distributions from the principal and capital gains," the financial surplus would have been further reduced so as to be adjusted closer to what MFs' role as conduits would predict.[26]

Adjusted Financial Surplus/Deficit in Mutual Fund Sector

Chart A3



Note: The area in blue indicates financial surplus/deficit of the MF sector under the current financial account. The line in black is adjusted by estimates of distributions from the principal and capital gains by the alternative method between 2000 and 2011 (solid line) and by the method in the text after 2012 (broken line). Figures for 2012 and 2013 are also adjusted by retained earnings. Refer also to descriptions of Chart 2 in the text.

Source: BOJ.

As an attempt to quantify estimation discrepancies using overlapping data during 2012 and 2013, figures for "distributions from the principal and capital gains" estimated by the alternative method can be compared with those by the method in

[26] Note that if retained earnings, which cannot be measured due to the lack of detailed data, had been measured prior to 2012, the adjustment would have been made further in the direction of widening (narrowing) the deficit (surplus).

the text, as depicted in Chart A2. Those figures suggest that discrepancies are significant, especially in 2013 (Table A1).

Estimates of Distributions from Principal and Capital Gains

Table A1

(trillion yen)

	2012	2013
Estimation method in text (A)	2.2	2.6
Alternative method (B)	3.3	0.5
Discrepancies (B - A)	1.1	-2.1

Distributions from capital gains may not be captured as in Case 3

In 2013, when the Japanese yen was on a significantly weakening trend and equity prices were sharply rising, as the MFs must have generated a significant amount of capital gains, "distributions from the principal and capital gains" by the alternative method were most likely underestimated, for example, as in Case 3. This suggests the possibility that when the share price is above the average cost, the alternative method might well fail to capture "distributions from capital gains," which could be as large as the order of a few trillion yen – corresponding to 2.1 trillion yen in Table A1. As an implication, estimates of "distributions from the principal and capital gains" during 2005 and 2007 could be underestimated by a similar magnitude, and if that is the case, the financial deficit of the MF sector would be further adjusted upwards, that is, closer to zero which is suggested by the role of the MFs as conduits.[27]

Note, however, that two years' worth of data is not sufficient to generalize factors behind the discrepancies between the alternative method and the method in the text. As more data are accumulated in the future for analyses, the factors behind the discrepancies will become better understood. At the same time, if we become confident enough to observe that the discrepancies do not systematically drift in one direction, then the justification for using the alternative method will be reinforced.

[27] Note that financial markets behaved similarly in the mid-2000s and in recent years, by observing a representative stock price index, TOPIX, and JPY/USD. TOPIX (end year period, y-o-y percentage in parenthesis): 1,149.63 (2004), 1,649.76 (2005, 43.5%), 1,681.07 (2006, 1.2%), 1,475.68 (2007, –12.2%), 728.61 (2011), 859.80 (2012, 18.0%), 1,302.29 (2013, 51.5%). USD/JPN (yen, end year period, y-o-y percentage in parenthesis): 103.78 (2004), 117.48 (2005, 13.2%), 118.92 (2006, 1.2%), 113.12 (2007, –4.9%), 77.57 (2011), 86.32 (2012, 11.3%), 105.37 (2013, 22.1%).

Analysis of the Irish SME market using micro-data

Aisling Menton and Martina Sherman[1]

Abstract

This paper focuses on the complementary nature of granular credit data for the small and medium enterprise (SME) sector. It highlights the importance of the SME sector to the Irish economy and outlines the aggregate statistics on SME credit that are available from the Central Bank of Ireland on a quarterly basis. It then examines a micro-credit data set that is available for SMEs and compares the two data sets to show how the micro-data set can complement the aggregate data and provide a deeper understanding of lending to the SME sector. The paper highlights some of the extra types of analysis that can be conducted using the highly informative micro-data; which includes analysis of the breakdown of lending by different customer types, SME loan pricing trends, maturity profiles of lending, average loan size by sector, among others characteristics.

[1] The authors are Senior Economist and Economist, respectively, in the Statistics Division of the Central Bank of Ireland. The views expressed in this article are solely those of the authors and do not necessarily represent the views of the Central Bank of Ireland or the ESCB. The authors would like to thank Anne McHugh for her work on preparing the data set and charts.

1. Introduction

SMEs are the largest providers of employment in Ireland accounting for around three quarters of private sector employment. They also make a large contribution in terms of domestic output and value added. This paper discusses the importance of the SME sector to the Irish economy, and outlines what statistics on SME credit are already available at an aggregate level. It then examines a micro-credit data set that is available on SMEs credit and compares the two data sets. The paper shows how the micro-data set can be used in conjunction with the aggregate data to provide deeper insights and understanding of lending to the SME sector that are not available from the aggregate data. The use of micro data to compile macroeconomic statistics is part of a growing international trend among statistical compilers. The availability of micro data has increased in volume in recent years in the Central Bank of Ireland and will continue to grow. These data first became available in 2010 for the purposes of conducting stress tests for domestically owned banks. Since then, data has been submitted every six months to the Central Bank of Ireland.

The paper highlights some of the extra types of analysis that can be conducted using micro-data. This includes looking at breakdowns of lending by different customer types, analysing loan pricing for SMEs, maturity profiles of lending, average loan size by sector, and many other interesting insights.

Section 2 gives an overview of the SME market in Ireland and Section 3 describes the statistics that are currently available at a national level. Section 4 discusses the matching of macro and micro data and shows how this can deepen the analysis on the SME sector. Section 5 concludes.

2. SME contribution to the macro-economy

The SME sector is a hugely important contributor to Irish employment and growth and is considered one of the most significant sectors in terms of its potential to underpin the Irish economic recovery.

The Central Statistics Office's (CSO) "Business in Ireland 2011" annual report details the substantial contribution of SMEs to the Irish economy (see Chart 1). The CSO show that SMEs in Ireland accounted for over 99 per cent of the 184,000 active enterprises operating in Ireland.[2] SMEs account for half of the total gross value added (GVA) from active enterprises and, when agriculture is included, equate to almost €45 billion or just under 30 per cent of GDP in 2011 (CSO, 2011).[3]

Despite a relatively low contribution in GVA terms, SMEs greatest contribution to the real economy is through employment. Some three-quarters of private sector employment is accounted for by SMEs, equivalent to over 900,000 jobs. This implies that there are considerable knock-on effects for employment, and therefore for

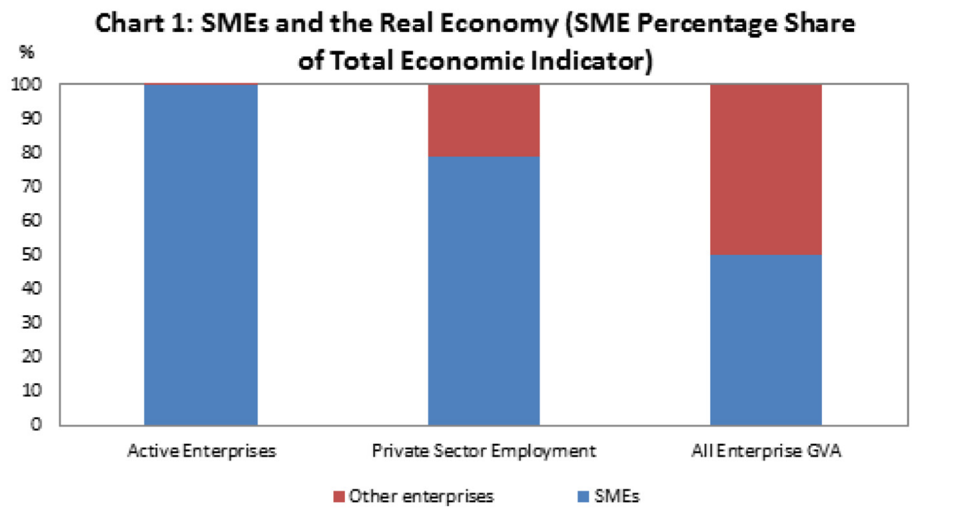
[2] The CSO's active enterprise data does not include the agriculture or public services sector. Additionally, the financial and insurance sector has been subtracted for the purposes of this paper.

[3] Gross value added figures for the agricultural sector were obtained from the CSO's Income and Expenditure release.

household distress, when SMEs face financial difficulties. Of these enterprises, over half directly relate to Irish-owned indigenous SMEs who are not engaged in export or import activities, but instead solely engage with the domestic economy.

SMEs and the real economy

SME percentage share of total economic indicator Chart 1



Source: Business in Ireland, Quarterly National Household Survey and National Income and Expenditure release, CSO and own calculations.

Note: Employment data as at end-2013 and all remaining data as at 2011. Excludes financial and insurance sectors where possible. Agriculture sector included in employment and GVA series.

3. SME credit market – aggregate data

The Central Bank of Ireland first published data on lending to SMEs in December 2010, with reference to Q1 2010. The dataset was subsequently expanded and enhanced in June 2011 with the introduction and publication of a new *"Trends in Business Credit and Deposits"* publication. The introduction of breakdowns by enterprise size and by purpose of the loan (NACE Rev.2 categorisation) provided new insight and improved visibility of the SME credit market. The enhanced data series also included a "transactions" series which provided a more meaningful and accurate measure for the underlying flow of bank credit and deposits. In addition, a gross new lending series was introduced. This is discussed in detail further on. For more information, see O'Brien and Goggin (2011).

SMEs are strictly defined in the Credit, Money and Banking statistics and subsequently in all micro data analysis that is presented later in this paper. The use of this definition may explain differences with figures or trends in previously published material on SMEs.[4]

[4] SMEs are defined according to the standard EU definition which is that an SME is an enterprise that employs fewer than 250 persons and whose annual turnover does not exceed €50 million, or whose annual balance sheet does not exceed €43 million. This is consistent with the definition applied in the Code of Conduct on SME Lending and by the Credit Review Office.

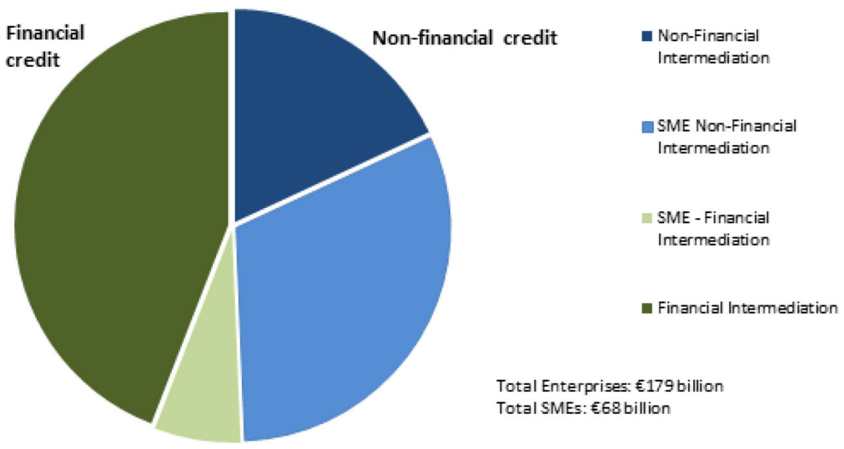
Outstanding loans to SMEs

Chart 2, below, details the breakdown of the total business credit market and illustrates the exposure of the Irish banking system to SME debt. The total SME market contains some financial intermediation enterprises; however, the remainder of this presentation mainly focuses on non-financial SMEs.[5]

SMEs account for 38 per cent of all business credit advanced to Irish companies by Irish resident credit institutions, with this share rising to 63 per cent for non-financial SMEs (Chart 2); i.e. when the mainly larger financial intermediation enterprises are excluded.

Total SME credit market relative to total business credit market

Q4 2013 | Chart 2



Source: Money and Banking Statistics, Central Bank of Ireland.

The outstanding amount of SME related credit on Irish resident credit institutions balance sheets stood at €67.6 billion at the end of 2013. Almost half of this related to property sector enterprises, at €31.4 billion, with the remainder split between €11.6 billion to financial intermediation and €24.5 billion related to non-financial, non-property[6], or "core"[7] lending (see Chart 3). Lending to core enterprises is largest in the wholesale and retail and hotels and restaurants sectors, with primary industries (which mainly consist of agriculture) also important.

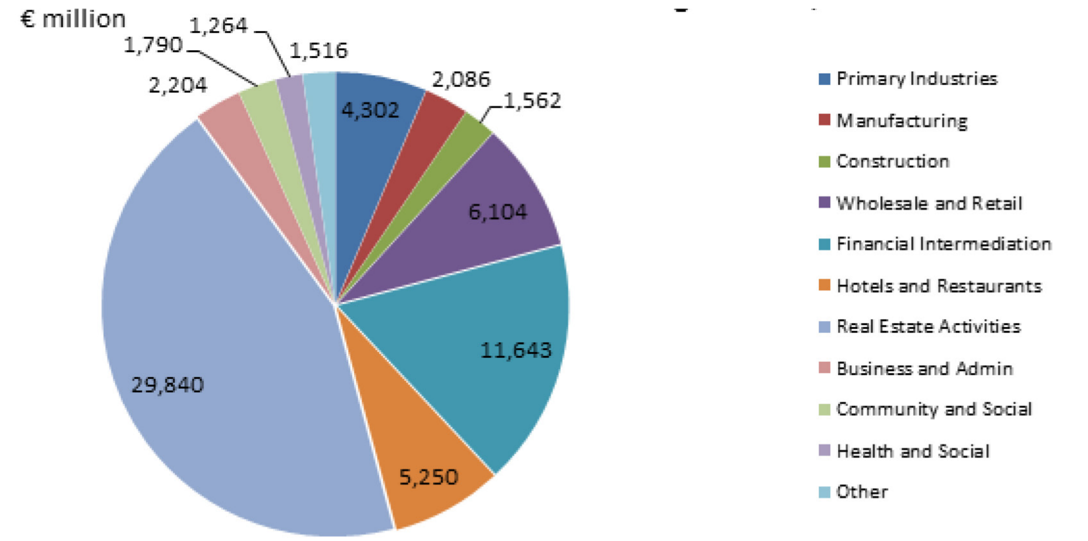
5 Some financial intermediation enterprises are included in the total SME series due to their balance sheet size. The financial intermediation sector includes non-bank financial institutions, and other financial intermediaries.

6 The property-related sector includes real estate activities and construction sectors.

7 "Core" sectors refer to all remaining sectors after financial intermediation and property related lending has been excluded.

SME sector outstanding credit

Q4 2013 Chart 3



Source: Money and Banking Statistics, Central Bank of Ireland.

It should be noted that lending is classified according to the purpose of the loan and is not necessarily related to the primary economic activity of the borrower. Therefore property related lending, for example, should capture all lending for the purposes of construction activities and for the purposes of real-estate, land[8] and development activities, regardless of the borrower's primary economic activity. The Irish Government has stressed the need to separate property and non-property lending in order to put more innovative solutions in place to address the resolution of arrears and distressed loan cases.[9] This is important where property and viable non-property loans are packaged together and property debt overhang is hindering a viable SME's access to credit.

Sectoral composition and market structure

While outstanding stocks can be informative, the transactions or flows series can tell more about the underlying flow of credit to and from SMEs. The data is also useful in tracking changes in market structure and lending patterns, which is discussed in detail below.

A substantial amount of literature exists on the build-up and misallocation of credit (see Kelly and Everett (2004); McElligott and Stuart (2007); and Kelly et al. (2011)). Traditional sectors such as agriculture and manufacturing dominated up until the early 2000's, by which time credit was being extended at an increasingly rapid pace towards the property-related sectors of construction and real estate, along with house mortgage lending. This surge in property sector credit occurred at

8 Excludes land purchased for agricultural purposes.

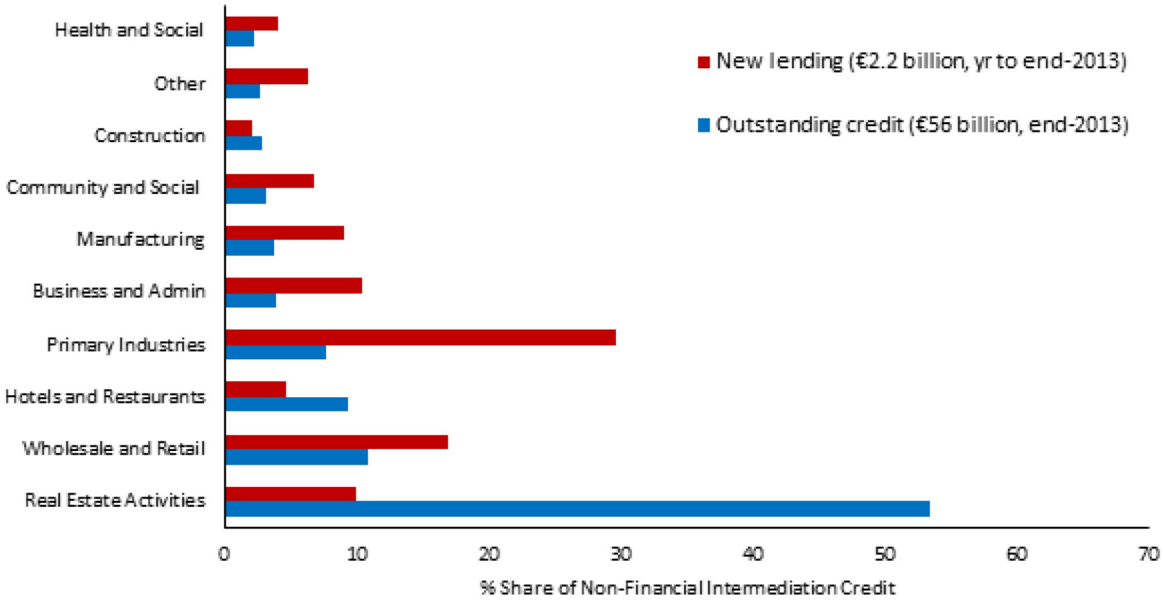
9 See http://www.kildarestreet.com/debates/?id=2014-03-12a.485.

the expense of the more traditional sectors, which experienced a significant loss in share of outstanding credit.

However, there now appears to be a rebalancing in the structure of banks' loan books, as the sectoral composition of new lending is changing (see Chart 4). New lending from the *"Trends"* series is defined as any drawdown of loans (excluding increased use of overdraft facilities or revolving credit facilities), which was not already part of closing stock of lending at the previous reference period. Capitalisation of interest is included in this figure. Renegotiations of existing loans or renewals of overdraft facilities are not included in new lending.

New drawdowns of loans by non-financial SMEs totalled €2.2 billion during 2013. The amount of new lending was equivalent to 3.7 per cent of the stock of non-financial SME credit at end-2012, rising to 7.4 per cent for core SMEs. Interestingly, most core sectors have seen a rise in their share of new lending when compared to their share of the outstanding stock of total non-financial SME credit. This may demonstrate a reallocation of credit back to the traditional core SME sectors.

Sector share of gross new lending and outstanding non-financial credit — Chart 4

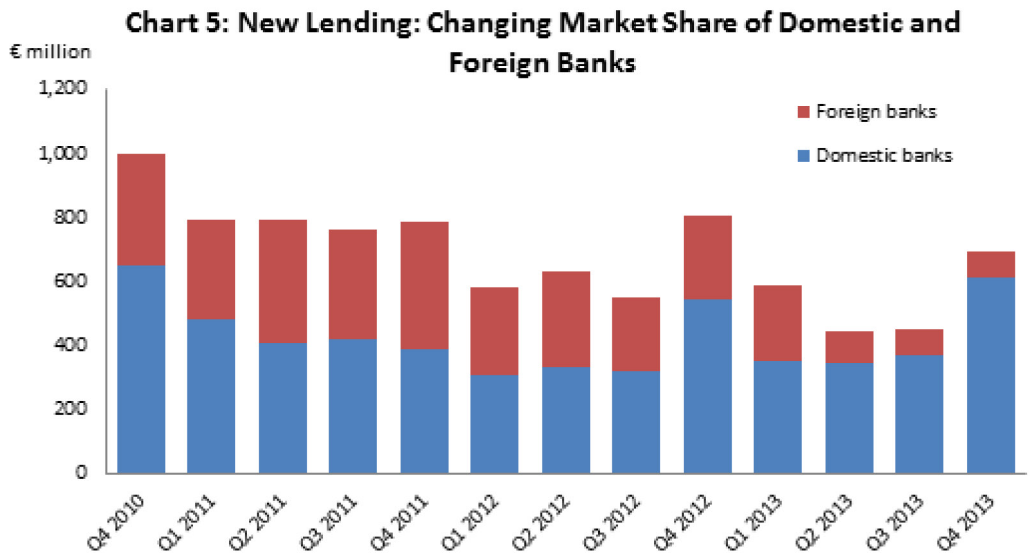


Source: Money and Banking Statistics, Central Bank of Ireland.

Primary industries, which mainly constitute agriculture, and wholesale/retail trade accounted for the largest share of total new SME lending over 2013, at 30 per cent and 17 per cent, respectively. This is despite these sectors accounting for just 8 per cent and 10 per cent of the total outstanding stock, respectively. Most notable, however, is the changing trend in real estate activities. Credit advanced for real estate activities continues to account for a substantial proportion of outstanding credit (53 per cent over 2013), yet their share of new lending is now just 10 per cent. This represents a substantial decline when compared to the sector's share of new lending of 26 per cent, as recently as early-2012.

Along with a changing sectoral composition, we can see that the market share of banks involved in SME lending is also changing. Just over one third of the outstanding stock of existing SME loans is on the books of foreign-owned resident banks; however, Chart 5 shows that foreign lenders accounted for just 11 per cent of new lending advanced to SMEs at end-2013. Irish-headquartered banks have seen their market share increase substantially in terms of gross new lending, increasing from two-thirds to almost 89 per cent. This retrenchment by foreign lenders has implications for the future structure of the banking sector. However, we must be cautious about interpreting the results, as this fall in foreign banks' share reflects both a decrease in the number of banks and a process of deleveraging by those remaining. Previous Central Bank research has also highlighted that the market is becoming more concentrated for SME lending (McCann and McIndoe-Calder (2012)).

New lending: changing market share of domestic and foreign banks — Chart 5



Source: Money and Banking Statistics, Central Bank of Ireland.

Deleveraging and new lending

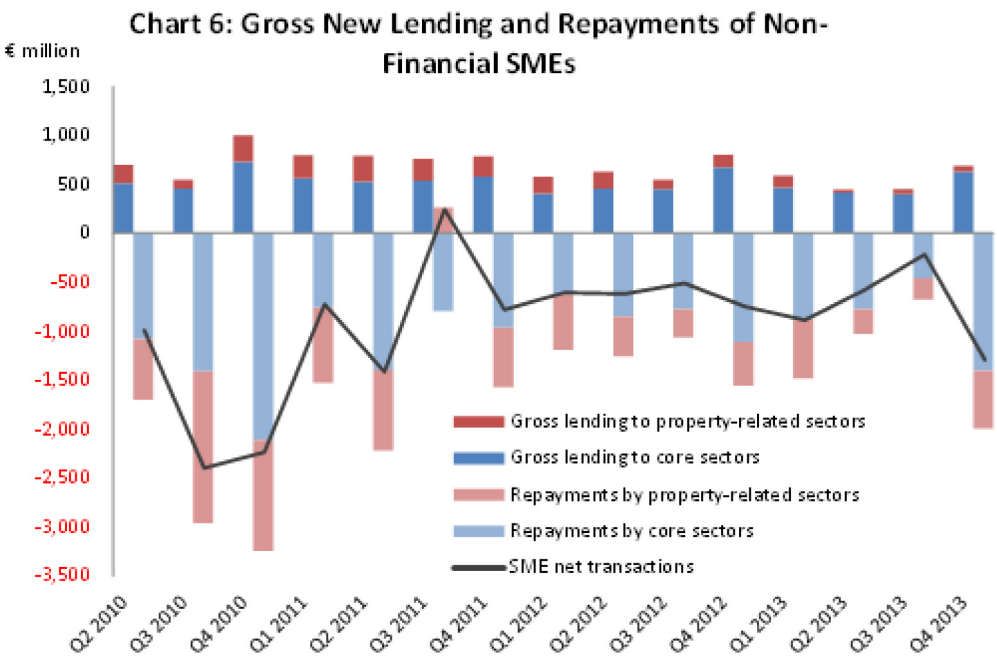
Using the transactions series of net flows, as mentioned above, it can be seen that the level of repayments on SME loans continues to outstrip the level of gross new lending. This net flows data, along with the new gross lending series, allows us to derive estimates of repayment activities and determine the amortisation trends for Irish SMEs – at a detailed sectoral level.

Chart 6 shows the lending and repayments position of SMEs by property-related and core sectors and highlights the persistent and wide-spread deleveraging. It can also be seen that repayments have outpaced new lending in almost every quarter since the series' introduction in Q1 2010. The one exception was Q3 2011, when new lending exceeded repayments by €236 million.

It is notable that new lending advanced to property-related sectors is substantially lower when compared to debt repayments. Cumulative new property-related lending in 2013 was equivalent to 0.8 per cent of end-2012 stock while repayments were equivalent to 5.1 per cent of end-2012 stock. Additionally, both gross repayments and new lending to this sector has fallen in recent quarters.

SMEs engaged in agriculture were the largest recipients of gross core new lending in 2013, drawing down €585 million, equivalent to almost 15 per cent of end-2012 stock. This sector also has very high repayment rates, equivalent to almost 20 per cent of end-2012 stock indicating that the new lending activities are likely to be very short term in nature. However, the aggregate data does not allow for greater insights or analysis of underlying characteristics. Information on average term length or average loan size can only be obtained from the highly-informative micro SME data, presented later in the paper. This confirms that loans for this sector are indeed short-term in nature and additionally consist of a large number of low average loan amounts.

Gross new lending and repayments of non-financial SMEs — Chart 6



Source: Money and Banking Statistics, Central Bank of Ireland.

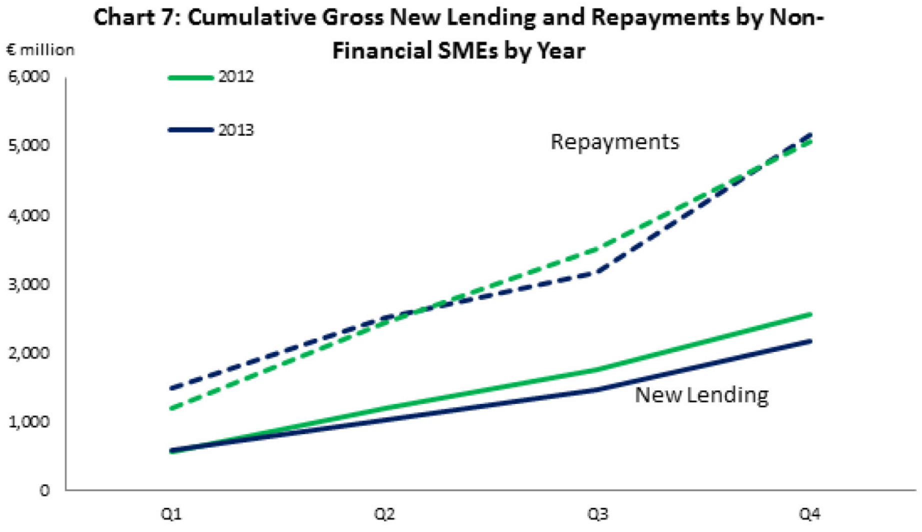
Note: Repayments is a proxy series.

The smallest amount of new core SME lending relative to the stock of loans went to the hotels and restaurants sector, with new lending drawdowns at 1.8 per cent of end-2012 stock. Repayment rates were also very low for this sector (10.2 per cent of end-2012 stock). Again, the limitations of the aggregate data mean we can only infer reasons for such figures. Examining the micro data does provide further information and clarity. This shows that loans to the sector were mainly medium term loans with high average loan balances.

Lawless et al. (2012) stated that higher new lending at end-2011 was being advanced to the sectors that dominated at the height of the pre-crisis era, but that these sectors were also associated with highest net deleveraging. This would indicate different profiles of behaviour by borrowers within these sectors. Chart 6 indicates that a more balanced sectoral distribution of credit is indeed occurring, particularly in relation to terms of credit to property related sectors.

Chart 7 below shows that, additionally, cumulative non-financial SME repayments for 2013 were higher than repayments for 2012, with new lending lower than 2012 figures. This indicates significant deleveraging in the sector which can be attributed, not just to tight credit standards imposed by banks, but also to a significant increase in SME repayment rates.

Cumulative gross new lending and repayments by non-financial SMEs by year Chart 7



Source: Money and Banking Statistics, Central Bank of Ireland.

Note: Repayments is a proxy series.

In order to further investigate trends in repayments and new lending, Chart 8 shows renegotiations[10] and new lending broken out for core SME sectors and property-related SME sectors.

In 2013, gross new lending to core sectors was equivalent to approximately 7.4 per cent of end-2012 stock, while debt renegotiations accounted for an additional 6.1 per cent of end-2012 stock (repayments were equivalent to 13.7 per cent of end-2012 stock). However, divergent trends are evident when looking at property-related lending; a higher proportion of equivalent outstanding stock was defined as renegotiated during the year than was advanced in new lending.

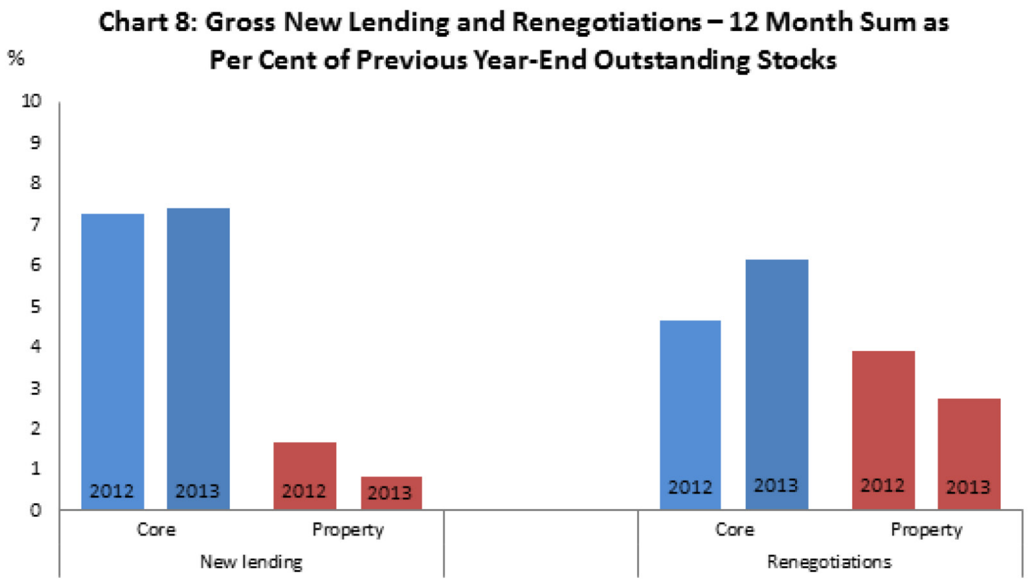
Looking at 2012 through to 2013, the diverging trends between core and property-related SMEs are interesting. While new lending and renegotiations extended to core SMEs increased, the opposite was the case with property-related

[10] Any new negotiations of loans (excluding overdraft facilities) to SME counterparties which was part of the stock of lending in the previous quarter, apart from prolongations of existing loan contracts which are carried out automatically. These include any renegotiation of the terms and conditions of the contract (including the interest rate, repayment schedule and term of the loan) which require the active involvement of the counterparty. See Notes on Compilation, Central Bank of Ireland (2012).

SMEs. While some caveats exist around the renegotiations data, the level of renegotiations is small and in the case of property related SMEs, renegotiations as a per cent of outstanding stock have been trending downwards since 2011. The largest level of renegotiations in relation to end-2012 stocks occurred for the following core sectors; human health & social (9.5 per cent end-2012 stock), primary industries (7.1 per cent) and wholesale/retail trade (7 per cent).

Gross new lending and renegociations

12 month sum as per cent of previous year-end outstanding stocks — Chart 8



Source: Money and Banking Statistics, Central Bank of Ireland.

Note: Caveats remain around the renegotiations series.

4. Micro credit data set analysis

While the publication of new high quality data on SMEs is welcomed, the aggregate picture does not give insights into all trends behind the figures. As detailed in Section 2, the official statistics tell us that repayments continue to outpace new lending (see Chart 7). It also shows that the sectoral composition of lending is changing (see Chart 4), and we know that market shares are changing. However, it is not possible to fully analyse or understand the aggregate statistics without more granular information.

For instance, the following type of analysis depends on the availability of granular loan level data:

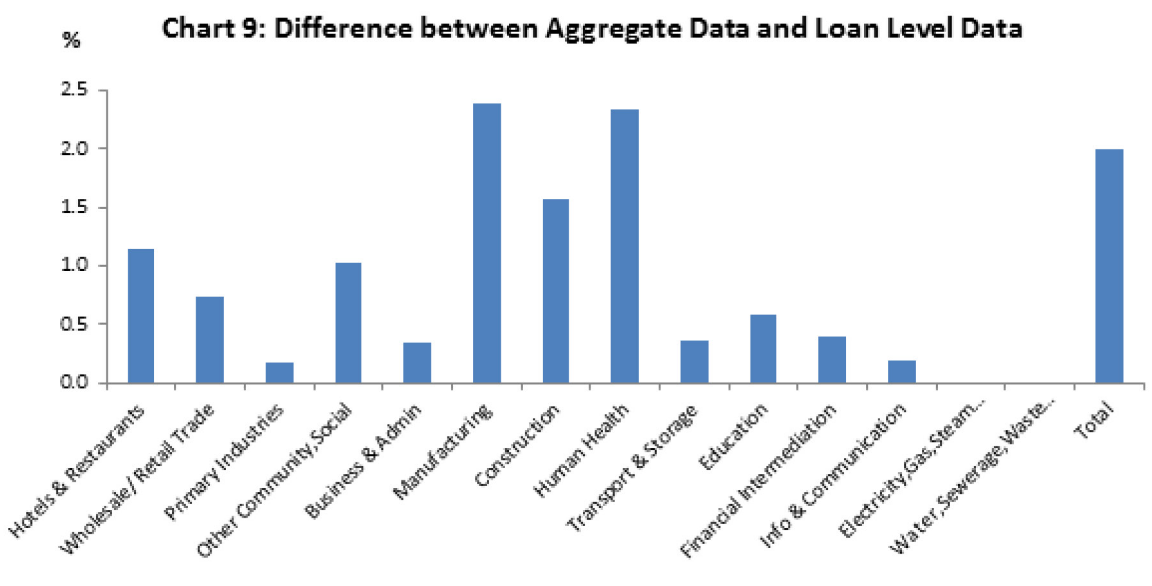
- Distribution of loan sizes
- Maturity structure – original and remaining maturity
- Loan pricing
- Collateral patterns
- Loan performance

We can also use the loan level data to track how lending conditions have changed in recent times. For example, loans issued in the six months prior to June 2013[11], can be sub-divided between existing and new customers, and compared with lending in previous periods. This allows us to monitor bank's lending policies and whether credit conditions differ across borrowers and across sectors. While it is not covered in this paper, there is also the possibility to track customers over time, using individual identifiers, to measure loan performance.

The Statistics Division undertook a pilot exercise to match the loan level data against the aggregate SME data, on a sector breakdown basis. This work involved much cleaning of the data and matching the submitted sector codes to NACE Rev 2 codes. It also involved a detailed analysis of those loans that were classified as SME, to ensure that the correct classification was given. The loan level data covers around 65 per cent of the aggregate data in June 2013, which allows for robust analysis of underlying trends detailed in the micro data.

The result of this work was that the data closely matched the aggregate data for the banks submitting loan-level data.[12] Chart 10 shows that the absolute percentage difference between loan level data in June 2013 was very small, amounting to less than 2 per cent in total. It was not possible to include lending for real estate activities (about 44% of outstanding amounts and 13% new lending over the four quarters to June 2013) in the matching exercise, but this will be addressed in later work. While many sectors match closely, the published data is larger than the loan-level data.

Difference between aggregate data and loan level data Chart 9



Source: Central Bank of Ireland.

[11] The micro data used in this paper relates to June 2013.

[12] Loan level data includes a select number of institutions.

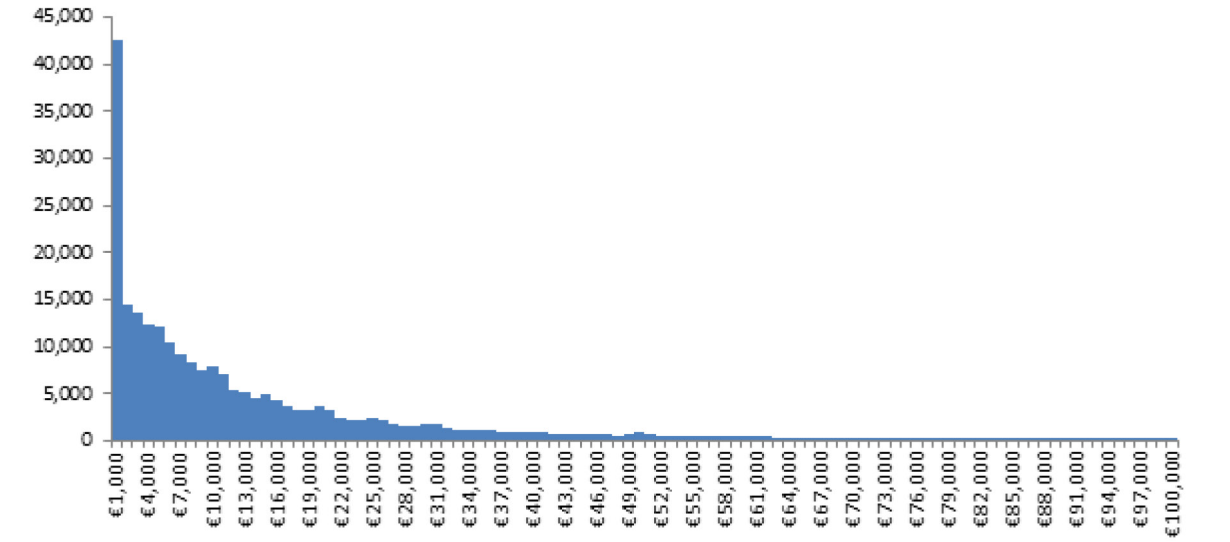
At the same time, there are a number of issues with the loan level data set. The micro data collection in the Central Bank of Ireland is an unstructured data collection, which essentially copies the reporting banks' database. As such, there may be definitional differences between institutions and, for some banks there are sizeable amounts of missing data for some variables. In addition, the micro data requires much data cleaning before becoming usable, which is time consuming and requires good software and IT systems. Micro data (in Ireland) is not as timely as aggregate data. This presentation, therefore, focuses on June 2013 data. While December 2013 data has been submitted to the Central Bank of Ireland, it has not yet been cleaned enough to allow its use in this presentation. However, despite the time lag, there is still huge value in analysing micro data, as it gives much deeper insights into data trends and complements the more timely aggregate series.

Loan distribution by size

SME loans tend to be small. In terms of outstanding amounts, only 10 per cent of the number of loans outstanding are greater than €100,000. This does not include outstanding amounts that have already been repaid. Chart 10 plots the frequency of loans against outstanding amounts. As can be seen from the chart, there is a cluster around smaller outstanding amounts.

Frequency of loans by outstanding amount

Chart 10

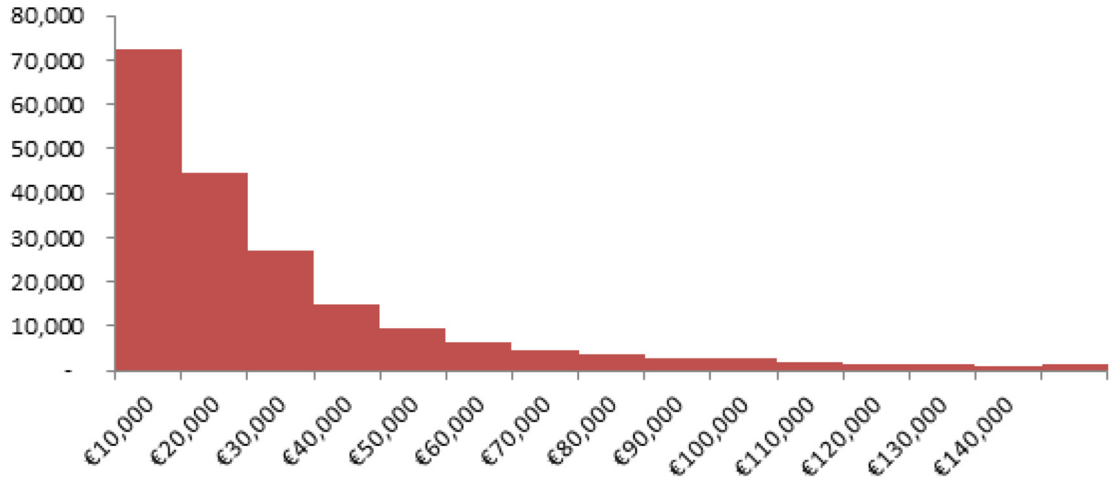


Source: Central Bank of Ireland.

We can also use the data to look at the original amount drawn down to gain further insights into the size of SME loans. As can be seen from the Chart 11, most drawdowns are for small amounts closely mirroring the profile of outstanding amounts shown in the previous chart. This result has given us a new understanding of lending to SMEs. For example, in the interest rate statistics data that is submitted to the Central Bank of Ireland for the purposes of ECB reporting, loans of up to €250,000 have in the past been taken as a proxy for lending to SMEs. This micro-credit data shows us that this proxy may not provide a reliable indicator of lending to the Irish SME sector.

Number of loans by drawdown amount

Chart 11



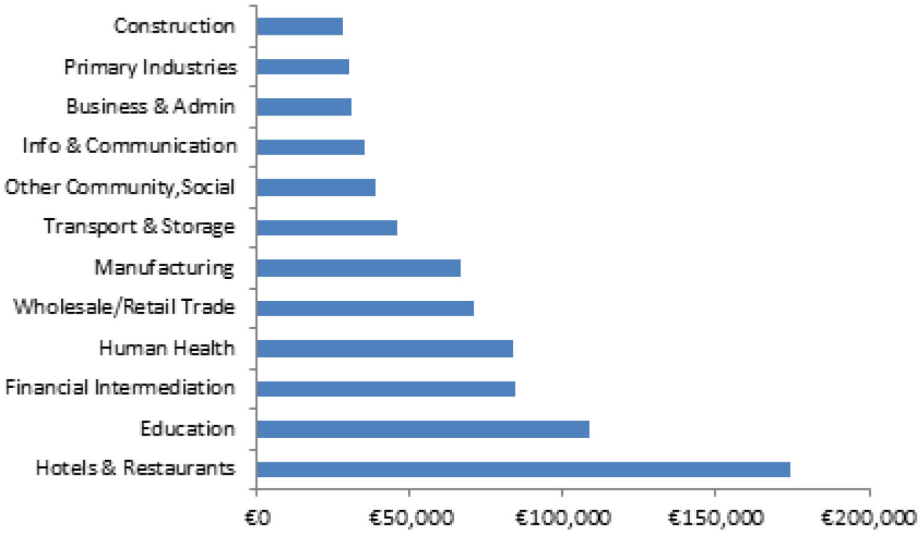
Source: Central Bank of Ireland.

Sector analysis

While the aggregate data series can show us the most indebted SME sectors, it does not provide the average outstanding loan value by sector, or the number of loans issued to the individual sectors. The aggregate data shows that the wholesale retail trade and repairs[13] sector is the most indebted sector in June 2013. However, the micro data can show that the hotel and restaurant sector has the highest average outstanding loan values (Chart 12). This is the second highest indebted sector, but is characterised by a much smaller number of loans compared to the wholesale sector. The micro data also shows us that while the education sector accounts for 1 per cent of outstanding amounts, average loan values are high. Primary industries have lower than average loan balances, but account for the highest number of loans in issue by sector. Looking at the average outstanding amount by customer type, the picture is relatively similar. Hotels and restaurants also have the highest average outstanding amount including among new customers. However, while the education sector has the second largest average outstanding amount among all customers, but this is largely due to more historic loans issued prior to 2013.

[13] This differs from published data, as the aggregate data referred to here is a based subset of institutions.

Average outstanding amount by sector | Chart 12

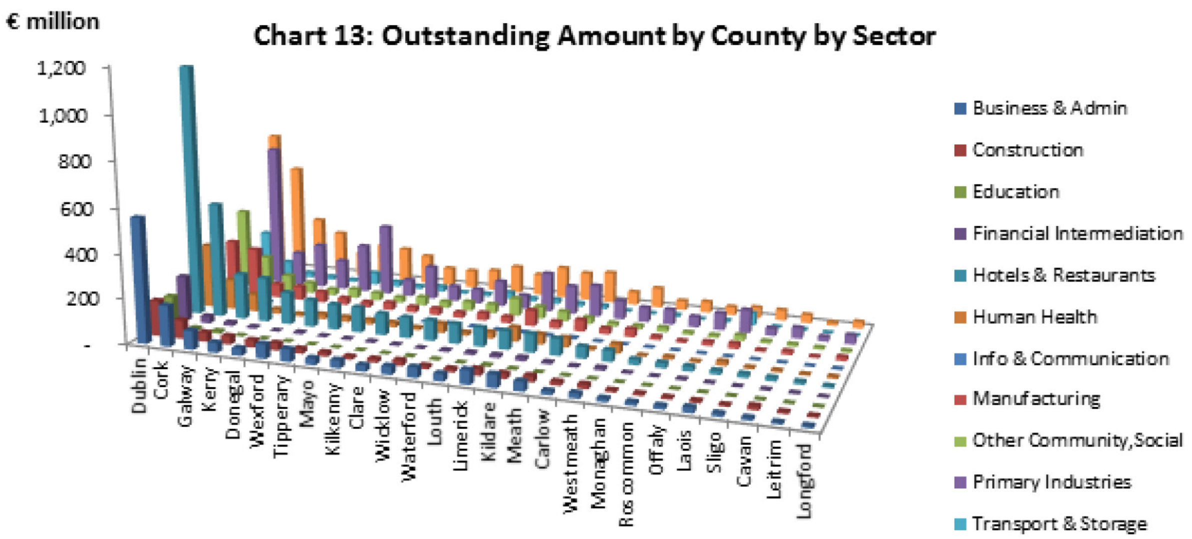


Source: Central Bank of Ireland.

Geography breakdown

A geographic breakdown of the SME loan book can also be derived from the micro data, as shown in Chart 13. As can be seen from the chart, Dublin is the most indebted county. Next in terms of indebtedness is Cork, where primary industries account for a quarter of outstanding lending. When added to hotels and restaurants and the wholesale/retail trade and repairs, these three sectors account for two thirds of outstanding credit in Cork. This is in contrast to Dublin, where primary industries accounts for just 4 per cent of outstanding credit to SMEs. Hotels and restaurants, along with the wholesale retail/trade and business administration sectors account for 56 per cent of outstanding lending in Dublin. There are a few sectors that are prominent across all counties, such as the hotels and restaurants, primary industries and the wholesale trade/repair sectors.

Outstanding amount by county by sector	Chart 13



Source: Central Bank of Ireland.

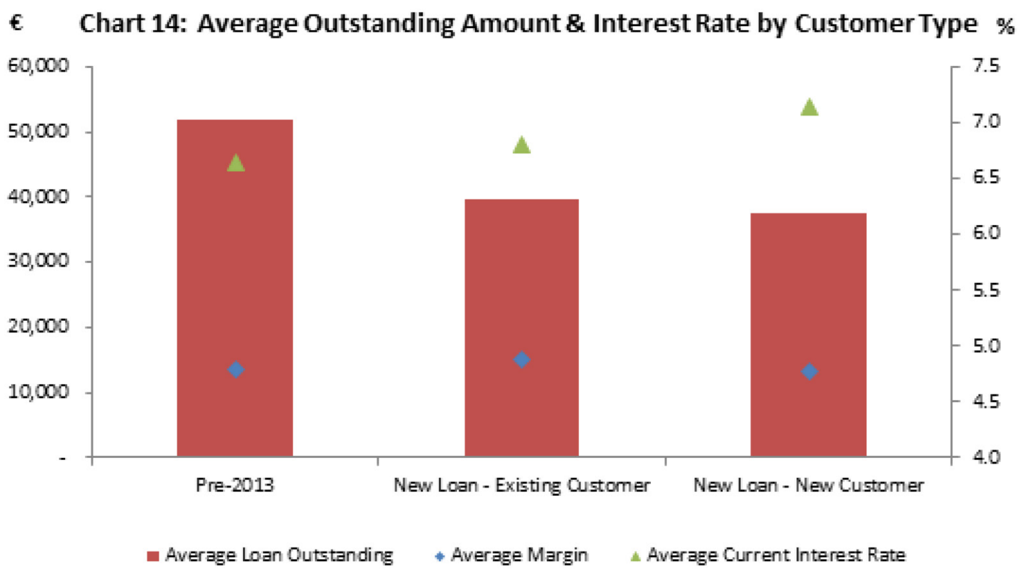
Customer analysis

Analysis by customer type is also feasible from the loan level data. The chart below shows the outstanding average loan balance by three customer categories of customer as follows:

- Pre-2013 loans: these are loans granted before 2013
- New loans – existing customers: these are loans granted in the first six months of 2013 to customers that already had a loan with the institution.
- New loans – new customers: these are loans granted to new customers that did not already have an existing SME loan with the institution

Chart 14 shows that new loans have smaller average outstanding amounts, despite net repayments on pre-2013 loans, and that they attract a higher interest rate. Loans to existing customers granted before 2013 had an average loan balance of €52,000. In contrast, for loans issued in the first six months of 2013, average outstanding balances were much lower, at €38,000. Interestingly, new customers to an institution are charged higher interest rates than existing customers.

Average outstanding amount & interest rate by customer type Chart 14



Source: Central Bank of Ireland.

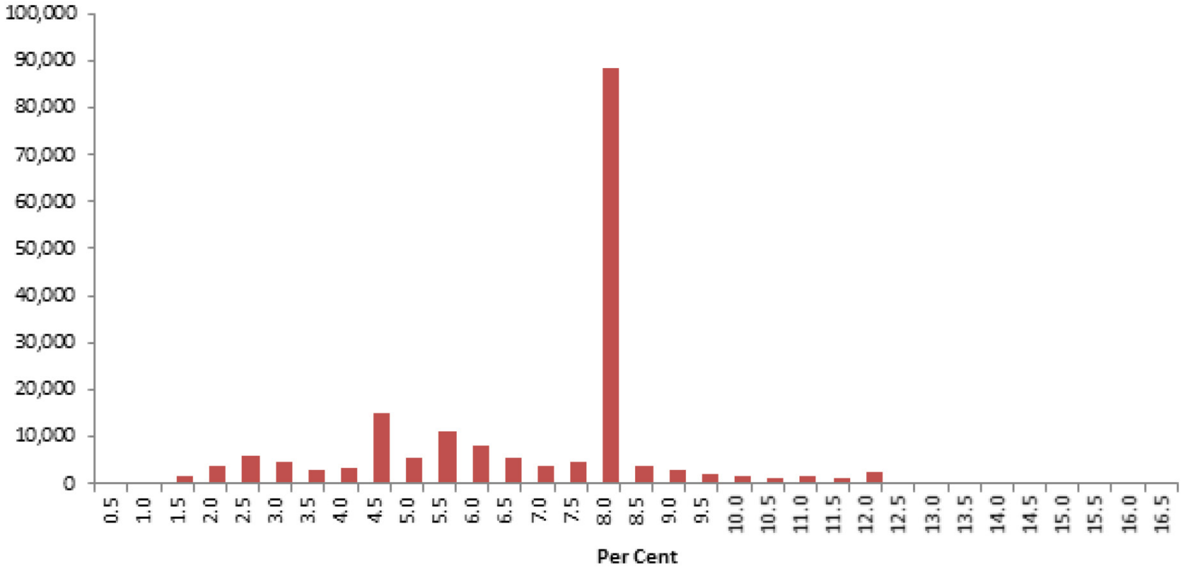
An interest rate margin is a margin over a base rate. The average interest rate margin for the three customer types is quite similar, ranging between 4.7 per cent and 4.9 per cent. However, the base rate on which margins are calculated differs by customer. This will be explored further in a later chart.

Interest rate analysis

Chart 15 shows that in terms of overall loan pricing, the vast majority of SME loans attract interest rates of between 5 per cent and 8 per cent. This could suggest that there is uniformity in pricing for SME loans. Where credit institutions offer very similar pricing for all SME loans, it is possible that riskier loans are being subsidised by less riskier loans. For loans issued prior to 2013, average interest rates are lowest of the three categories, at 6.6 per cent. New loans issued to existing customers in the first six months of the year attracted an average interest rate of 6.8 per cent, while loans issued to new customers attracted the highest average interest rate of 7.1 per cent. The results of Chart 15 are surprising however, with a significant number of loans categorised with an interest rate of 8 per cent. This suggests that a large number of small value loans attract this interest rate; however there are some questions about the quality of the data which requires further analysis.

Distribution of interest rates

Chart 15



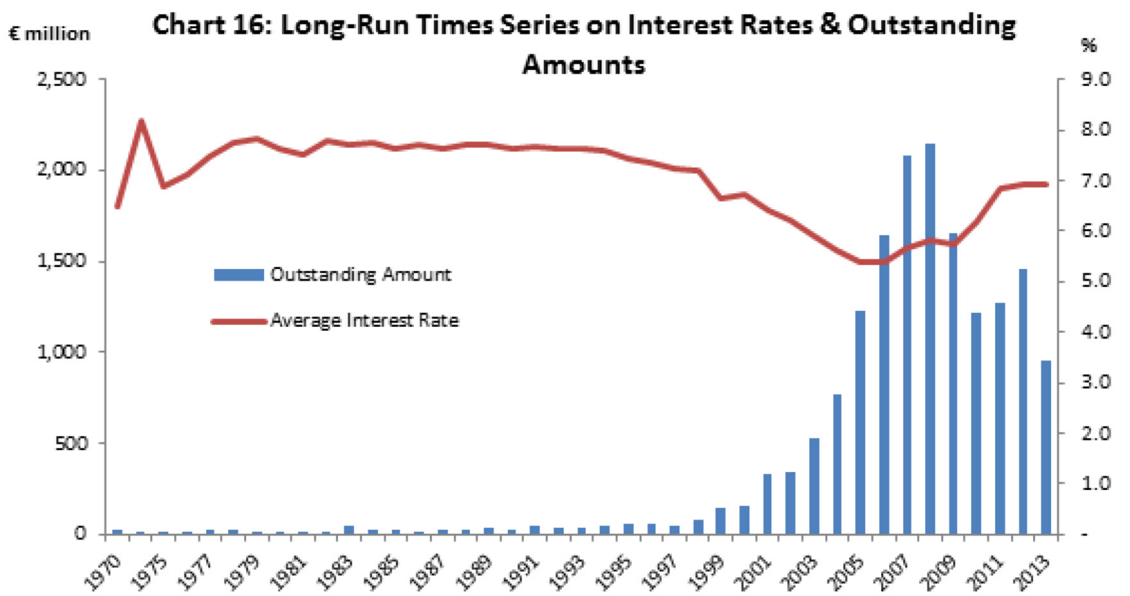
Source: Central Bank of Ireland.

The loan level data also shows differences between institutions on the prevalence of fixed and floating loans for SME lending. Changes between fixed and floating rates could suggest a possible change in the interest rate pass through channel for SMEs. The levels of fixed or floating SME loans can again be compared to structured interest rate data submitted for ECB reporting. The interest rate statistics produces data on interest rates to the NFC sector, of which the SME is a sub-sector. Taking lending up to €250,000 as a proxy for lending to SMEs (even though we know the average SME loan size is much smaller than this), the data matches well on an institution level.

Analysing longer term interest rate trends is also possible using the loan level data, as seen in Chart 16. While these data does not include loans that have been repaid prior to June 2013 and is based on current outstanding amounts, (rather than original amount drawn down), it can still provide an indication of the path of interest rates. The chart shows that the lowest average interest rates apply to loans issued between 2004 until 2007. After 2007, the average interest rates began to increase. The chart also shows that the highest outstanding amounts relate to loans issued in 2006 and 2007. This coincides with the period of rapid credit growth. Published statistics show that growth rates of loans to NFCs peaked in July 2006 at 37.1 per cent, and remained elevated during 2007, before turning negative in September 2009.

Long-run times series on interest rates & outstanding amounts

Chart 16

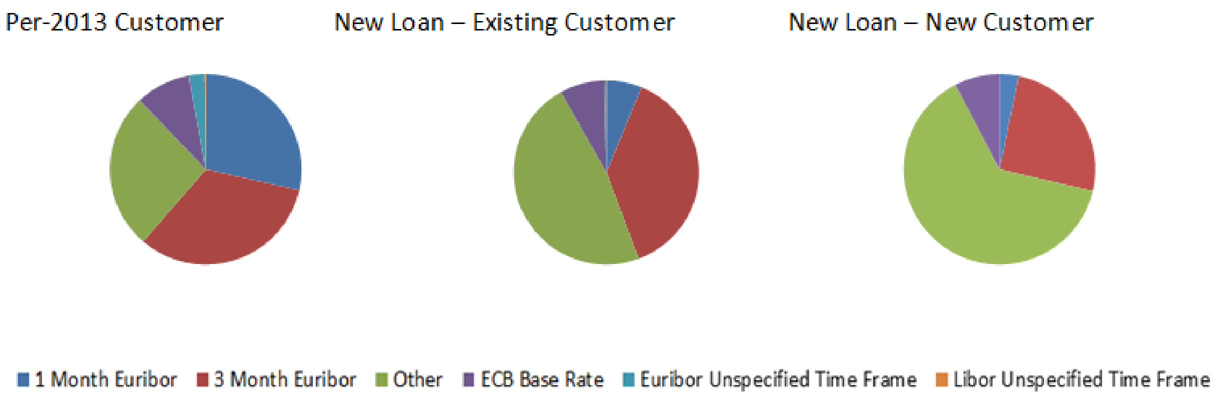


Source: Central Bank of Ireland.

As mentioned earlier, the loan level data also provides the base rates over which interest margins are applied by banks. These are outlined in Chart 17, based on outstanding amounts by the margin type. The analysis identifies the three different customer types mentioned earlier – new customer, new borrowing by existing customer and pre-2013 customers. These should be interpreted with caution however, as the data quality is less than ideal, and a sizeable proportion are classified as "other".

Interest rate margin reference rate

Chart 17



Source: Central Bank of Ireland.

New lending

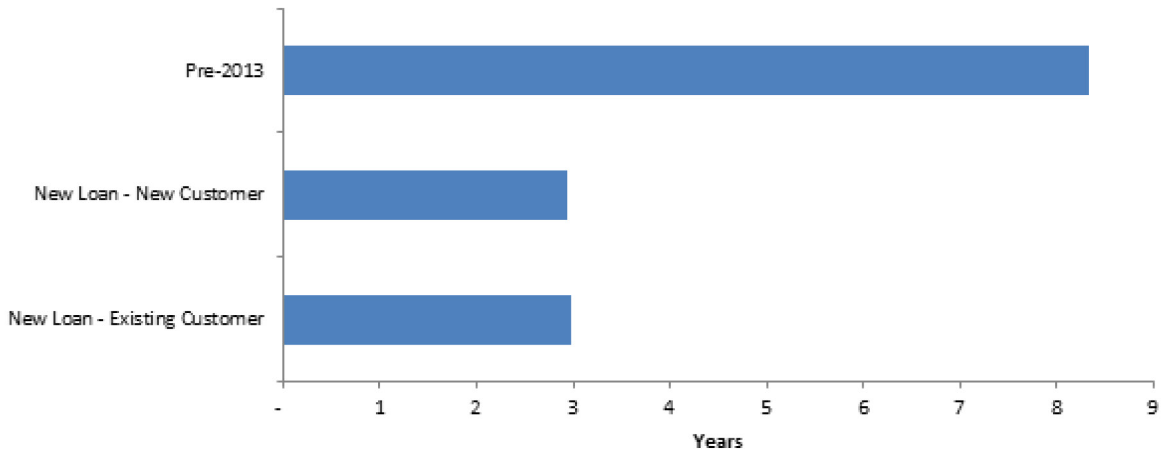
Some differences arise between the aggregated data and the loan level data when looking at the level of new lending. The change in outstanding amounts in the first six months of the year to the SME sector, according to the loan level data, was €950 million, which is higher than the aggregate data. This inconsistency may be explained by definitional differences between the two series in what is classified as new lending.[14]

Loan duration

One of the most interesting results from the loan level data is the dramatic shift in the structure of loan terms by the different customer types. As can be seen from Chart 18, loans issued prior to 2012 had an average loan term of over 8 years. In contrast, new loans have much shorter loan terms, of less than four years, for both customer types. The much longer maturity of loans issued prior to 2012 may suggest that they were closely related to real estate. Loans in this sector tend to be of longer duration. However, results earlier showed that loans to SME tend to be of a small value, which does not support real estate lending. Consequently further analysis is needed before any conclusions can be drawn.

Average loan term by customer category

Chart 18



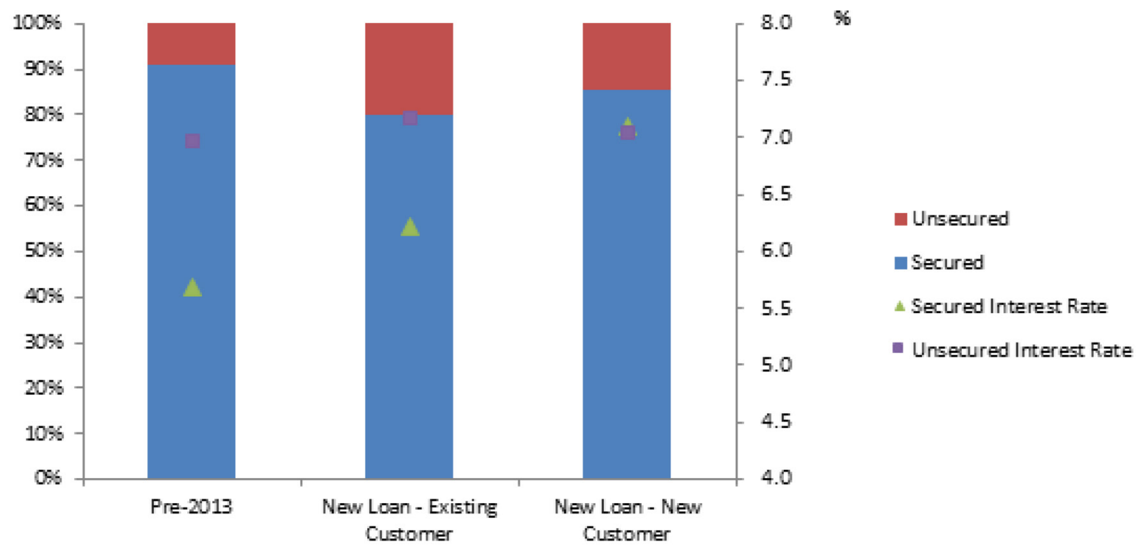
Source: Central Bank of Ireland.

[14] New lending published in the aggregate data series is defined as any drawdown of loans (excluding increased use of overdraft facilities or revolving credit facilities) to SME counterparties that took place between the current and previous reporting date, which was not already part of closing stock of lending at the previous reference period. Capitalisation of interest is included in this figure. Renegotiations of existing loans or renewals of overdraft facilities are not to be included here. However, new lending in the loan level data is any loan that was issued since 1 January 2013. This would include renegotiations or renewals of over draft facilities.

Loan collateral

Information on the types and levels of collateral associated with loans is also available in the loan level data. As can be seen from Chart 19, loans issued prior to 2013 were more highly secured than loans issued subsequently. This may indicate that real estate collateral has been used less since the start of 2013. The unsecured interest rate is higher for all customer types. Interestingly, collateral appears to make little difference to rates charged to new borrowers. Rates charged also differ by product types, with hire purchase loans attracting the highest rates.

Proportion of loan collateralisation and interest rates by customer category Chart 19

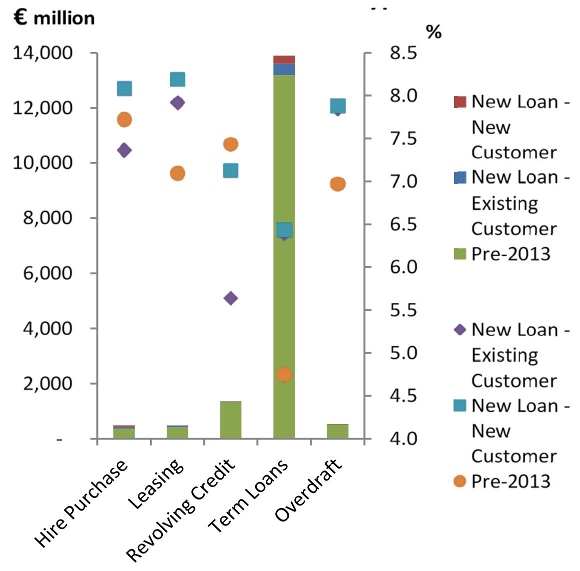


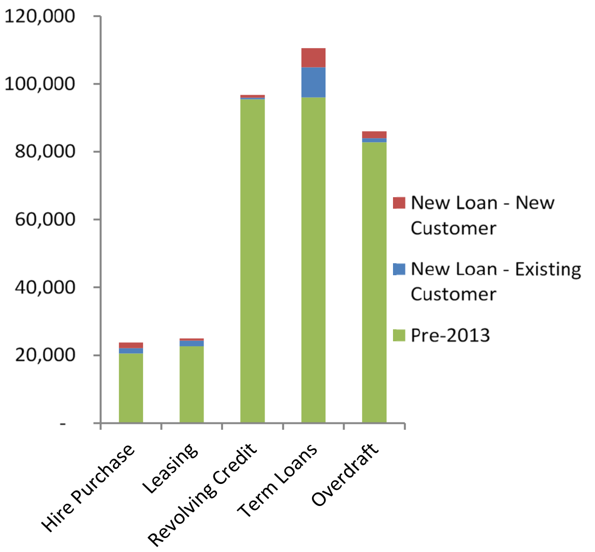
Source: Central Bank of Ireland.

Loan product type

The charts below show the loan product types offered to the SME sector in terms of outstanding amounts, and numbers of loans. For outstanding amounts, it can be seen that term loans are predominant for both new and existing lending. Term loans have the lowest average interest rate across all institutions. In contrast, revolving loans are treated differently across institutions, with some charging higher rates. The second chart, however, looks at the number of loans by product type, and a different picture emerges. While term loans are the largest loan product type by outstanding amount, revolving loans and overdrafts taken together account for the largest number of loans.

Outstanding amount by loan product type	Chart 20a	Number of loans by loan product type	Chart 20b





Source: Central Bank of Ireland.

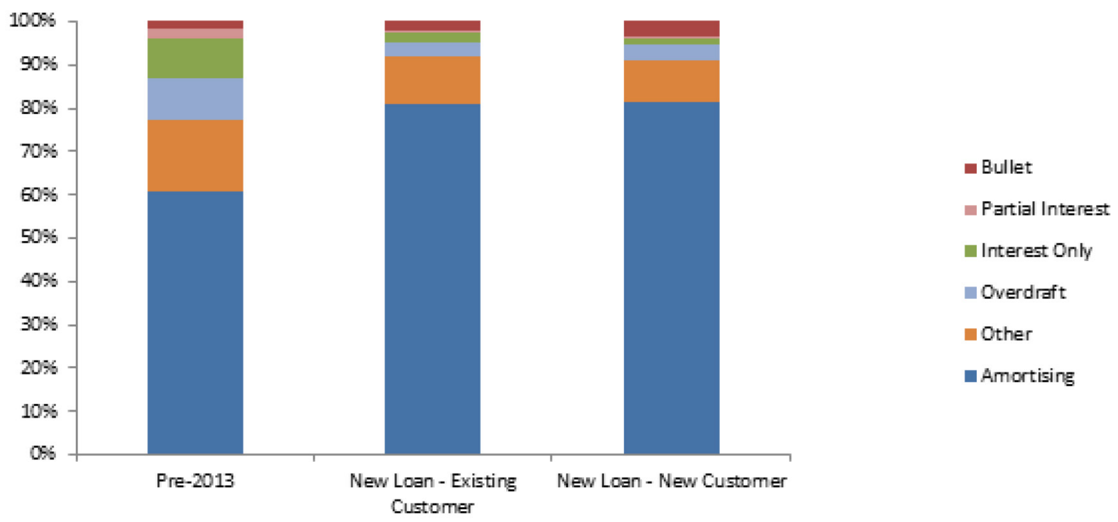
As mentioned in the previous paragraph on loan collateralisation, different types of security apply to different products. Hire purchase and leasing have the most unsecured loans. These results are surprising, given the nature of hire purchase and leasing, raising some questions about the quality of the data for this breakdown. Term loans and revolving loans have higher levels of security attaching to their loans.

Repayment types

Loan level data also allows us to look at the loan repayment types for the three categories of customers. There are many different arrangements, such as amortising loans, interest only, bullet, etc. As can be seen from Chart 21, most loans are amortising. In particular, new loans are predominantly amortising. The "other" category includes some short-term arrangements such as loans with a moratorium on repayments. Interestingly, some SME loans issued in 2013 are classified with a moratorium repayment, so may have been granted an initial holiday on repayments by the lending institution.

Repayment type by customer category

Chart 21



Source: Central Bank of Ireland.

5. Conclusion

This paper uses aggregate data in conjunction with micro data to show how the two data sets can complement each other. The results are promising, allowing us to delve into the micro data set, to enhance our understanding of credit conditions and lending to the SME sector.

This paper focused solely on the SME sector. It discusses the importance of the SME sector to the Irish economy and assesses statistics currently available at an aggregate level. It then examines the micro-data available on SMEs and shows how the level of detail available from the granular data can provide information on borrower and loan characteristics which cannot be derived from the granular data.

As discussed in the paper, the micro-data set allows us to analyse lending by different customer types. We see how loan pricing can differ depending on when the loan was drawn down, and whether the customer was an existing client of the institution, or was borrowing for the first time. The micro-data set also allowed us to look at maturity profiles of lending, average loan size by sector, and many other interesting insights.

Micro data collections, to be extremely useful, needs to be collected on a very structured basis, with all reporting institutions working off the same definitions. Many European countries are operating very effective micro credit data sets, which have taken time to develop. However the granular data available to the Central Bank of Ireland is provided in different formats by different institutions and requires extensive cleaning and quality checking before becoming usable. It is, therefore, much less timely than the aggregate data. However, the very detailed attribute information allows much deeper analysis and understanding of credit and lending conditions.

A number of initiatives are underway to enhance the quality and availability of granular data. Ideally all statistical data should be derived from detailed granular data sources. However, this requires significant investment in agreeing common definitions, developing the appropriate IT infrastructure and analytical tools and agreeing standard reporting formats. All of this will take some time. However, despite some shortcomings, the current granular data sources collected by the Central Bank, delivers hugely enhanced potential for both prudential and analytical work.

Bibliography

Central Bank of Ireland (2012), "Quarterly Analysis of Lending and Deposits (SQ1) - Notes on Compilation", Central Bank of Ireland.

Central Statistics Office (2011), "Business in Ireland 2011", *Annual Report*, CSO.

Kelly, J. and M. Everett (2004), "Financial Liberalisation and Economic Growth in Ireland", *Central Bank of Ireland Quarterly Bulletin Articles*, Autumn 2004, pp. 91–112.

Kelly, R. McQuinn, K. and R. Stuart (2011), "Exploring the Steady-State Relationship between Credit and GDP for a Small Open Economy - The Case of Ireland", *The Economic and Social Review*, Economic and Social Studies, vol. 42(4), pp. 455–477.

Lawless, M., McCann, F. and T. McIndoe-Calder (2012), "SMEs in Ireland: Stylised facts from the real economy and credit market", *Central Bank of Ireland Quarterly Bulletin Articles*, April 2012, pp. 99–123.

McCann, F. and T. McIndoe-Calder (2012), "Bank competition through the credit cycle: implications for SME financing", *Central Bank of Ireland Economic Letter series*, Vol. 2012, No. 4.

McElligott, R. and R. Stuart (2007), "Measuring the Sectoral Distribution of Lending to Irish Non-Financial Corporates", *Financial Stability Report*, Central Bank of Ireland, 2007.

O'Brien, M. and J. Goggin (2011), "Trends in Irish Credit and Deposits Markets: A New Presentation", *Central Bank of Ireland Quarterly Bulletin Articles*, October 2011, pp. 93–105.

The use of Securities Holdings Statistics (SHS) for designing new euro area financial integration indicators[1]

Linda Fache Rousová[2] and Antonio Rodríguez Caloca[3]

Abstract

Since the start of 2014, the European System of Central Banks (ESCB) has been compiling new security-by-security data on holdings of debt securities and shares by euro area residents on a quarterly basis – the Securities Holdings Statistics (SHS). This paper illustrates the value added of this new data source for measuring the degree of financial integration in the euro area. More specifically, using the first collected quarter (with the reference date of 2013 Q4), the paper presents new indicators for cross-border securities holdings for different holding and issuing sectors as well as different types of securities. Furthermore, it explains how these new indicators expand (and differ from) the set of previously available quantity-based indicators of financial integration in the euro area.

Keywords: Securities Holdings Statistics, security-by-security data, micro data, financial integration, quantity-based indicators, securities, international financial markets.

JEL classification: F36, G1, G10, G15.

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The views expressed in this paper are solely those of the authors and do not necessarily reflect the opinion of the European Central Bank.

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Introduction

The recent financial crisis has highlighted the importance of granular information about the financial system, which would help policy-makers to implement effective policies and tailor-made solutions for the specific needs of ailing market segments. As a result, several central banks all over the world are setting up or expanding several micro-databases such as securities databases with issuances and holdings information, credit register information, supervisory information as well as surveys on households and small and medium enterprises (SMEs).

This paper uses one such new data source – the Securities Holdings Statistics (SHS), which has been collected by the Eurosystem/European System of Central Banks (ESCB) since the beginning of 2014 on the basis of regulation ECB/2012/24. It includes quarterly information on holdings of *individual* debt securities and shares by institutional sectors in the euro area. The high granularity of the data, which are collected on a security-by-security basis, allows for the development of a wide range of new indicators.

This paper presents new quantity-based financial integration indicators using the new SHS data.[4] More specifically, using the first collected quarter (with the reference date of 2013 Q4), we present new indicators for cross-border securities holdings for different holding and issuing sectors as well as different types of securities. The latter is particularly important from a theoretical point of view because a pre-requisite for any measurement of financial integration is the identification of same assets in terms of risk-adjusted returns. In a perfectly integrated market, when controlling for the same (type of) asset, the location of both the issuer and the holder should not play a role (see, e.g., Adam et al., 2002).

We focus on quantity-based indicators of financial integration, since the currently available indicators for the euro area are rather limited. Notably, the set of the quantity-based indicators that are regularly used in the ECB's Financial Integration Report (ECB, 2014a) is only limited to two individual holder sectors (banks and investment funds) or aggregated for all holder sectors, as well as limited to a few types of securities. Moreover, the distinction between individual issuer countries is usually restricted to those of the euro area.

In this respect, the SHS indicators provide high value added to the previously available indicators as they cover all main holder sectors in the euro area and provide information on holdings of individual securities, so that any breakdown by issuer country, issuer sector or type of security is available. Moreover, as the new indicators are based on one harmonized data collection rather than several different data sources, the degree of integration captured by these indicators is comparable across the different holder sectors and types of securities as no conceptual, methodological or measurement differences arise within this data collection.

The development of new financial integration indicators for the euro area, which are specific to individual sectors and/or market segments, as done in this paper, is particularly important from a monetary policy perspective in recent times.

[4] Quantity-based indicators refer to indicators that are based on asset quantities (stocks or flows) as opposed to price-based indicators that focus on asset prices. Most quantity-based indicators of financial integration show the quantity of cross-border investment as a share of total investment.

This is because significant financial fragmentation remains in the euro area, which in turn hinders the smooth implementation of the single monetary policy and the balanced transmission of its effects across different countries/regions and sectors, as recently pointed out by Draghi (2014). Therefore, it is of crucial importance to identify and to monitor the most ailing market segments with the help of indicators that cover all economic sectors in a comparable way, so that policy makers can implement effective policies that would be tailor-made for the needs of these market segments.

The rest of the paper is organized as follows. Section 2 introduces the SHS data. Section 3 highlights its value added for the measurement of the degree of financial integration, analysing the available quantity-based indicators. Section 4 presents the new indicators of financial integration using the first collected quarter of 2013 Q4 SHS data, while Section 5 briefly concludes.

"Who holds what" – Securities Holdings Statistics (SHS) as a new data source

In the wake of the financial crisis of 2008, the Eurosystem/ESCB launched a project towards the development of a new type of granular and harmonised statistics on holdings of securities, the Securities Holdings Statistics (SHS). After the assessment of the merits and costs, the European Central Bank (ECB) issued a new regulation (Regulation ECB/2012/24) in 2012 (ECB, 2012), further accompanied by the corresponding ECB guideline (Guideline ECB/2013/7) in 2013 (ECB, 2013),[5] which provide a sound legal basis for this data collection (see Sola and Strobbe, 2010, for more details).

The scope and content of the SHS data collection

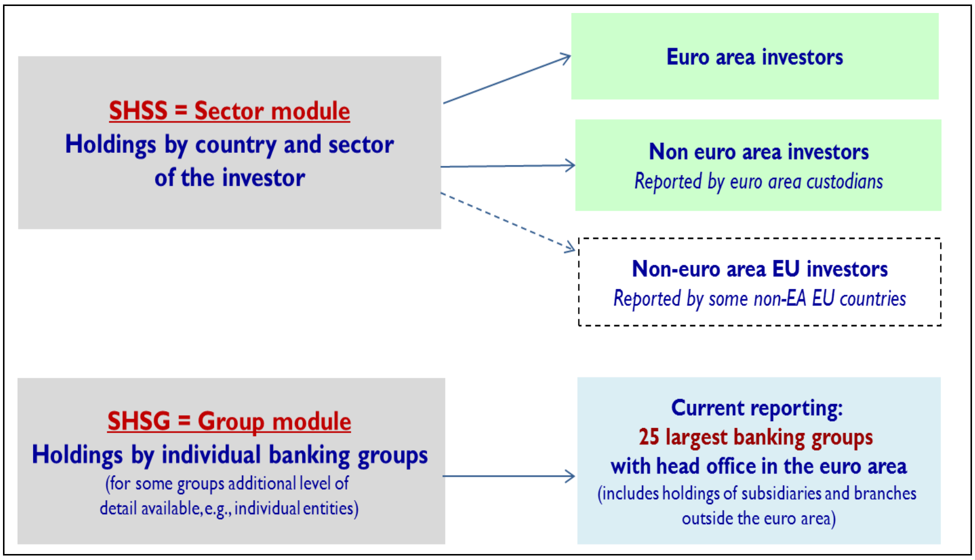
The SHS project covers three distinct sets of data on holdings of securities, which are grouped in two modules by the type of holder. The SHS Sector data module (SHSS) provides information on the holdings by each sector in each country such as households in Germany or Monetary Financial Institutions (MFIs[6]) in France. It includes two sets of data: (i) holdings of securities by investors resident in the euro area, and (ii) holdings of euro area securities by investors resident outside the euro area and deposited with a euro area custodian.[7] Furthermore, the SHS Group data module (SHSG) contains individual holdings by the 25 largest banking groups with head offices in the euro area. See **Chart 1** for a schematic overview.

5 The ECB Regulation puts forward the rules for the data reporting by the reporting agents (e.g., commercial banks), while the ECB guideline contains the rules on how the national central banks (e.g., Banque de France) shall report the data to the European Central Bank (ECB).

6 The MFIs sector comprises deposit taking corporations and money market funds, excluding national central banks, unless indicated otherwise.

7 Most non-euro area EU countries (except for UK, SE and HR) also collect the SHSS data, though only on a voluntary (best effort) basis.

Overview of the two SHS modules	Chart 1
SHS module	Type of data



The main feature of the SHS data is the security-by-security collection and compilation of the data on holdings of securities with ISIN codes[8] of four instrument types: short- and long-term debt securities, quoted shares and investment funds shares/units[9]. The collected information focusses on the information on the holder side (e.g., amount held of a particular ISIN), while the data are enriched during the compilation process with reference data from the Centralised Securities Database (ECB, 2010), which contains rich information on individual securities such as the type of security, the name and sector of the issuer, the maturity and issue dates, price, outstanding amount/market capitalisation. Additional attributes and/or dimensions can be obtained by linking the SHS data with other databases (e.g., Dealogic or European DataWarehouse)[10] using a common identifier (ISIN or the name of the issuer are one of the most common options). See **Table 1**, for an overview of the main dimensions available in the SHS data.

[8] Holdings of securities without ISIN codes are collected on a voluntary basis with limited breakdowns available and are not yet included in the SHS data compiled for the 2013 Q4 period.

[9] The investment funds shares/units are further broken down into money market and non-money market funds shares/units. ECB (2012) provides a more comprehensive overview of the different instruments and sectors included.

[10] See http://www.dealogic.com/ and https://eurodw.eu/ respectively.

Main breakdowns in the SHS dataset

(when enriched with data on ratings) Table 1

Holder data Who holds?	Security data What is held?	Issuer data Who has issued?	Holding value How much is it worth?
SHSS	ISIN	Issuer name	Positions
–Sector	Instrument type	Issuer sector	*Transactions*
–Country	Currency	Issuer country	Nominal value
–Sector in a country	Maturity date	NACE classification	Market value
SHSG	Market capitalisation	Issuer MFI code	*Accrued income*
–Individual banking groups	Outstanding amount	Issuer rating	
	Price		
	Eligibility		
	Security rating		

Note: Information not yet available in the first compiled quarter of 2013 Q4 is in italics.

The SHS data used in this paper – holdings by euro area sectors (SHSS) in 2013 Q4

The two legal acts for SHS data collection *inter-alia* set the beginning of the collection to the data referring to end-2013 (i.e., 2013 Q4). The data are reported by the national central banks (NCBs) to the ECB with a lag of 70 days after the reference period, while the compilation of the first quarter took around one more month (i.e., until end-April of 2014 for 2013 Q4 data).[11] Therefore, this paper presents cross-sectional data (rather than time-series data) as only the first quarter of SHS data was available at the time when writing this paper.[12] Furthermore, since the previously available quantity-based financial integration indicators can be replicated by information in the SHSS module (see next section), this paper uses this module with information on holdings by institutional sectors.

SHS added value: Comparison with previously available financial integration indicators

The set of previously available quantity-based indicators of financial integration is rather limited. For instance, the latest issue of the ECB's annual publication on financial integration (ECB, 2014a) presents five charts with quantity-based financial integration indicators (see **Annex 1**), in which the holder information is only limited

[11] The duration of the data compilation process is expected to improve over the first year.

[12] Prior to 2013, the E(S)CB ran an 'experimental' phase of this type of data collection for holdings by euro area sectors. The 'experimental' SHS data were provided to the ECB by the NCBs on a voluntary basis, where available, and thus suffered from several caveats in the quality of the data such as the lack of harmonization and completeness.

to two holder sectors (banks and investment funds) or it is aggregated for all sectors. In addition, only a few types of securities in terms of instrument class, issuer sector and country are distinguished.

Although the set of all quantity-based financial integration indicators for the euro area is likely to be somewhat wider (European Commission, 2014), the three underlying data sources for these charts are the most widely used in this context – at least to our knowledge. These three data sources are (i) the ECB's Monetary Financial Institutions' (MFIs') Balance Sheet Items (BSI), (ii) the ECB's Investment Funds (IVF) statistics and (iii) the IMF's Coordinated Portfolio Investment Survey (CPIS) data. For completeness, we note that information on cross-border holdings by the ICPF sector is also available – from the ECB's Insurance Corporation and Pension Funds (ICPFs) statistics, though with a shorter time span (since 2009).

In **Charts 2 to 4**, we show that the comprehensiveness of the new SHSS data allows us to replicate to a large extent all the afore-mentioned indicators using this alternative data source, although currently only for one data point (end-2013) given that the SHS data collection has just started. In particular, we point out that the new SHSS data as a *single* data source can serve all these indicators, whereas for the initial set of indicators *three different* data sources are used (BSI, IVF and CPIS). Hence, the SHSS data allow capturing the degree of financial integration in a comparable way across the different holder sectors and types of securities, as no conceptual, methodological or measurement differences arise within this data collection.

On the contrary, when comparing the actual figures obtained from the SHSS data with those from the previously available data sources, the vast range of possible differences between the statistics (data collection, compilation, coverage and derogations, measurement, valuation, sector classification, etc.) have to be carefully considered. In particular, the SHSS data presented in this paper only include holdings of securities with ISIN codes and are thus likely to have a somewhat lower coverage than other (aggregated) statistics. For instance, the comparison with national accounts data for the analysed period (ECB, 2014b) suggests that the total SHSS data cover around 80% holdings of debt securities and shares by euro area residents.[13]

Despite the various conceptual and measurement differences between the BSI and SHSS statistics, notably differences in valuation and coverage,[14] **Chart 2** shows similar profiles for the SHSS and BSI indicators of financial integration for holdings by euro area MFIs, with only small differences between the obtained figures (around two percentage points for most of the bars). The similar results are reinforced by the fact that both the BSI and SHSS statistics follow the "locational" approach and thus rely on the same definition of the reporting population, which consists of MFIs located in a given country (including foreign branches).[15, 16]

[13] For more information on the links between national accounts and the SHS data, see Lavrador et al. (2012).

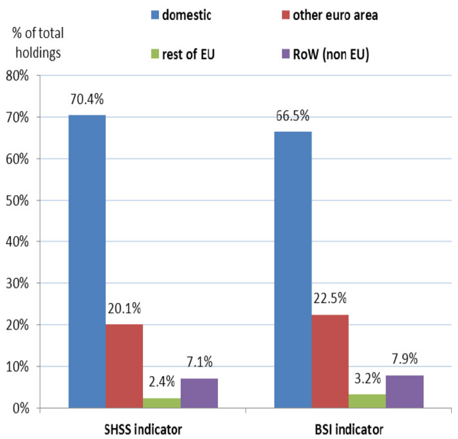
[14] Colangelo and Fache Rousová (2012) provide an analysis of the differences between BSI and SHES statistics, where SHES refer to the "Experimental SHS data" collected prior to 2014.

[15] See the 6th recital of ECB (2012).

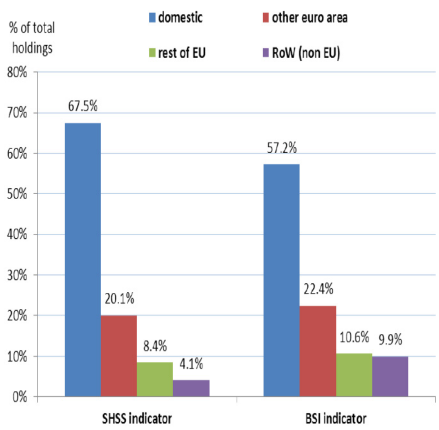
Euro area MFIs holdings of debt securities, 2013 Q4. SHSS and BSI indicators. Breakdown by residency of the issuer.

Chart 2

A. Debt securities issued by corporates and sovereigns.



B. Debt securities issued by MFIs.



Sources: ECB's MFI Balance Sheet Items (BSI) statistics and Securities Holdings Statistics Sector (SHSS) data.

One exception is the share of domestic holdings, which is significantly higher in the SHSS data than in the BSI data. The difference is particularly pronounced for the holdings of debt securities issued by MFIs (67.5% and 57.2% for SHSS and BSI data, respectively, see **Chart 2B**). A possible explanation for this difference stems from the treatment of "own" holdings (i.e. MFI holdings of their own securities) since the BSI reporting framework requires MFIs to report securities data net of their own holdings, whereas the SHS reporting framework includes all holdings.

The IVF and SHSS indicators for holdings by euro area investment funds (**Chart 3**) take on similar values for all bars (the differences stay below three percentage points). The high degree of similarity is likely to stem from the way the data are collected, since the collection of the IVF statistics relies to a large extent on a security-by-security reporting, which in turn is the building block of all SHSS data. In addition, as in case of MFIs, the definition of the reporting population in the two statistics is the same.[17]

Still, many conceptual differences remain between the two statistics including discrepancies in valuation, derogations and the treatment of information on securities without ISIN codes. For instance, although the IVF statistics is subject to derogations (up to 5% of smallest investment funds in a country), the missing tail of the distribution is estimated and thus included in the resulting aggregates. On the other hand, given the high level of detail in the SHSS data, the derogations are not corrected for in SHSS. In addition, the comparison for holdings of shares and other equity (**Chart 3B**) suffers from another caveat, which is the different coverage of

[16] Note that the fact that foreign branches (which are not separate legal entities) are included in the domestic MFI sector may lead to seemingly higher cross-border holdings in both statistics and thus to an overestimation of the degree of financial integration, though the impact is likely to be limited.

[17] See the 4th recital of ECB (2012).

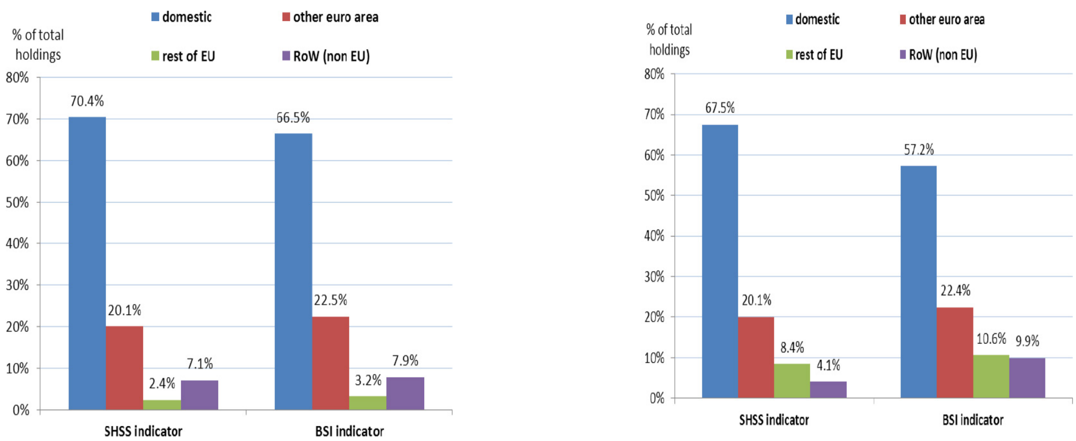
equity instruments: the chart for the IVF statistics include non-listed shares and other equity, whereas these are not captured by the SHSS data.[18]

Euro area investment fund holdings, 2013 Q4. SHSS and IVF indicators. Breakdown by residency of the issuer.

Chart 3

A. Debt securities

B. Shares and other equity[1]



Sources: ECB's Investment Funds (IVF) statistics and Securities Holdings Statistics Sector (SHSS) data.

Notes: SHSS data refer to holdings by 'investment funds' sector. Only for Ireland, holdings by 'Other financial corporations excluding financial vehicle corporations' are also included since the 'investment funds' sector is not fully identifiable.

[1] Excludes investment funds shares/units. SHSS data also exclude non-listed shares and other equity.

Note that apart from the holdings by investment funds, the SHSS also includes information on holdings by other subsectors of the 'Other financial institutions' sector such as financial vehicle corporations (FVCs). In this regard, the SHSS also includes new valuable information for the monitoring and analysis of shadow banking.

Finally, **Chart 4** shows the comparison between the CPIS and SHSS cross-border holdings of equity securities issued by the 12 euro area countries (AT, BE, DE, ES, FI, FR, GR, IE, IT, LU, NL and PT) that are covered in the CPIS indicator presented in ECB (2014a). We carry out the comparison in absolute rather than relative terms (i.e., in EUR billion rather than as shares of total investment) because the replication of the denominator used in the original CPIS indicator is not without caveats and complicates the interpretation of the relative figures. The reason is that, on the one hand, the CPIS data lack any information on domestic holdings and, therefore, the total investment in equities in the denominator of the CPIS indicator is proxied by the combination of CPIS data and market capitalisation (the latter obtained from Datastream). On the other hand, the SHSS data do not provide the complete picture of non-euro area holdings, so that the denominator for the SHSS extra-euro area indicator (i.e., total investment in equities by non-euro area entities) would also have to be constructed with the help of other data sources.

[18] This difference however stems only from the aim to replicate the financial integration indicators in ECB (2014a). For instance, both statistics provide information on the holdings of quoted shares, in which case such difference would not arise.

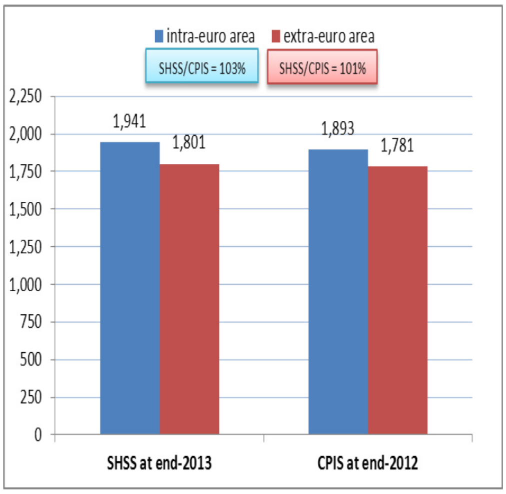
The comparison in **Chart 4A** suggests that both the SHSS intra- and extra-euro area cross-border holdings of equity securities are in line with those in the CPIS data (both statistics give values around 1.9 and 1.8 EUR trillion respectively). The somewhat higher SHSS figures could be explained by the fact that the SHSS data cover both portfolio and foreign direct investment, while the CPIS data only cover securities held as portfolio investment.

However, many other differences between the two statistics have to be taken into account in this comparison (see **Annex 2** for a detailed summary). In particular, the two indicators refer to different reference periods since the latest CPIS data are available only at end-2012 when writing this paper. Furthermore the CPIS data also include non-listed shares, whereas these are excluded from the SHSS data.

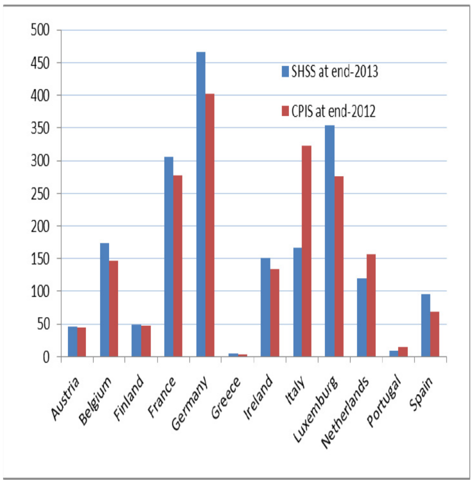
Cross-border holdings of equity issued by 12 euro area countries. SHSS and CPIS data

EUR billion | Chart 4

A. Intra- and extra-euro area cross-border holdings



B. Intra-euro area cross-border holdings. By holding country.



Sources: IMF's Coordinated Portfolio Investment Survey (CPIS) and Securities Holdings Statistics Sector (SHSS) data.

Note: SHSS data exclude holdings of non-listed shares. SHSS data include both foreign direct and portfolio investment, while CPIS data only cover portfolio investment.

In spite of these differences, the breakdown by the individual holder countries in the euro area (**Chart 4B**) suggests a very high correlation between the two statistics (around 91%). An analogous chart for extra-euro area cross-border holdings by individual holder countries could also be shown. In this paper, we however refrain from this comparison because the SHSS information on holdings of euro area securities by non-euro area investors is rather indicative as it is collected to a large extent indirectly via custodians and thus may not capture the country of the final investor (i.e., the data suffer from "custodial" bias).[19]

[19] Another caveat in such comparison would be the fact that the CPIS data do not cover all non-euro area countries as they are only collected from a restricted sample of countries (only those participating in the survey).

SHS opportunities: The new (unlimited) set of SHSS financial integration indicators

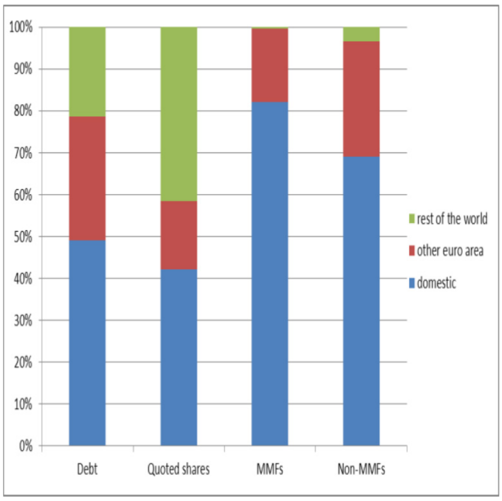
The richness of the SHSS data allow us to design euro area financial integration indicators covering a much wider set of holding sectors and instruments types than those presented in the previous section. At extreme, the security-by-security nature of the data provides us with the possibility to build quantitative indicators of financial integration for any security held in the euro area and for any combination (group) of these securities. Given that the number of securities covered in the SHS data is more than half million, the set of new SHSS quantity-based indicators that can be constructed is in practice unlimited.[20]

Rather than being comprehensive in this section, we illustrate the value added of the SHS data by only focussing on a few selected financial integration indicators. In line with previous section, all the indicators show the breakdown by the residency of the issuer in order to distinguish domestic from cross-border holdings, while the latter is further broken down into intra-euro area and extra-euro area cross-border holdings. We present the indicators using a top-down drilling approach, i.e. by going from more to less aggregated levels.

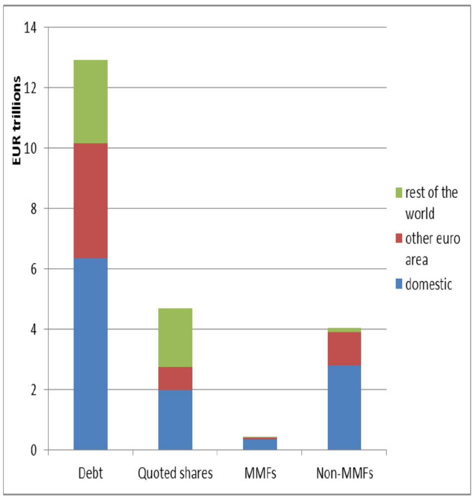
SHSS euro area securities holdings. By main instrument types and residency of the issuer.

Chart 5

A. In percentage of total holdings



B. In EUR trillion



Source: Securities Holdings Statistics Sector (SHSS) data.

Note: MMF=money market funds shares/units, non-MMF = non-money market funds shares/units.

Chart 5 with the highest aggregation level of total euro area securities holdings shows the breakdown of domestic and cross-border securities holdings by the main

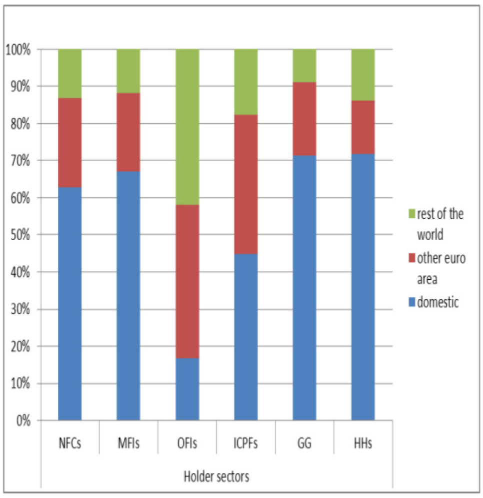
[20] The number of all (non-empty) subsets that can be created from a set of 500,000 securities is equal to (2^500,000)-1, which in turn is a number that cannot be easily calculated with current computational power – it has more than 150 000 decimal digits. See, e.g. http://www.mathsisfun.com/activity/subsets.html.

instrument types in SHS data. In particular, compared to the previously available indicators, the chart shows that investment funds shares/units can be split into money market funds (MMF) and non-money market funds (non-MMF).

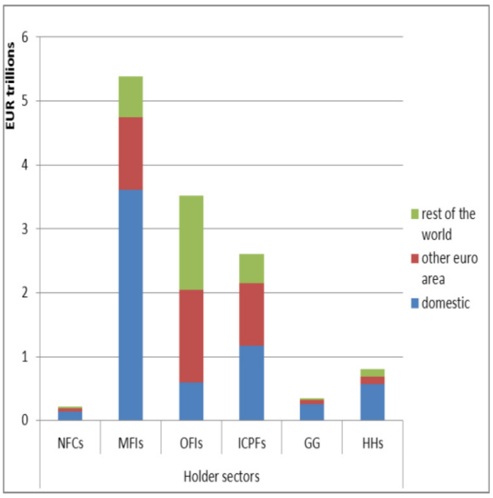
MMF shares are found to be the least integrated instrument type, as the domestic share exceeds 80% (**Chart 5A**). Moreover, nearly no euro area investors invest into the MMF shares issued in non-euro area countries. On the other hand, quoted shares, followed by debt securities are found to be the most integrated instrument types as the domestic share stays below 50% for both instruments. There is however a significant difference between the two instruments regarding the intra- vs. extra-euro area cross-border holdings. Euro area investors invests around 30% of total debt securities held in those issued by other euro area countries, whereas the corresponding share for quoted shares is only around 16%.

SHSS euro area holdings of debt securities. By holder sectors and residency of the issuer. Chart 6

A. In percentage of total holdings



B. In EUR trillion



Source: Securities Holdings Statistics Sector (SHSS) data.

Note: NFCs=non-financial corporations, MFIs=monetary financial institutions, OFIs=other financial institutions, ICPFs=Insurance corporations and pension funds, GG=general government, HHs=households.

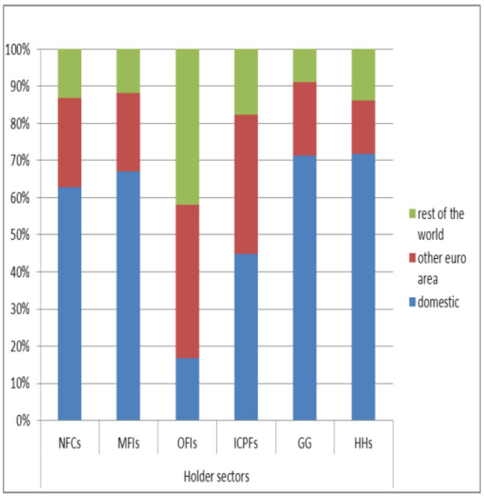
In addition, **Chart 5B** shows the absolute holdings amounts of euro area investors recorded in the SHSS data, which sum up to around 22 trillion EUR at end-2013. Debt securities with volumes of nearly 13 trillion EUR are by far the most important instrument held by euro area investors. Given its dominance, we focus on this market segment in the following and drill down into the next main breakdowns available, namely into the main holder and issuer sectors.[21, 22]

[21] We distinguish the main six holder sectors and the main five issuer sectors. However, the SHS data allow for a more detailed distinction on both sides. On the holder side, the SHS Regulation (Regulation ECB/2012/24) distinguishes further sub-sectors within all the main holder sectors up to one (the non-financial corporations sector), so that 15 different holder sectors could in principle be available for the euro area holdings data. The reporting of some of the subsectors is however not available in some countries.

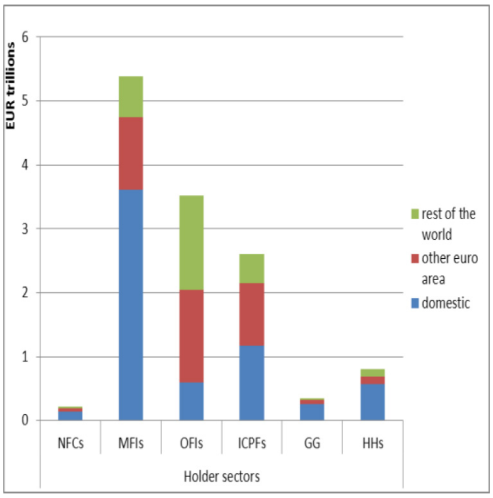
Both the holder and issuer sector breakdowns (**Charts 6 and 7**) highlight some interesting features, which could not be derived from the previously available statistics. For instance, on the holder side (**Chart 6**), two financial sectors, namely other financial intermediaries (OFIs), followed by insurance corporations and pension funds (ICPFs) are found to be the most financially integrated from the six main economic sectors in the euro area.

SHSS euro area holdings of debt securities. By issuer sectors and residency of the issuer. Chart 7

A. In percentage of total holdings



B. In EUR trillion



Source: Securities Holdings Statistics Sector (SHSS) data.

Note: Note: NFCs=non-financial corporations, MFIs=monetary financial institutions, OFIs=other financial institutions, ICPFs=Insurance corporations and pension funds, GG=general government.

In the case of the issuer sectors (**Chart 7**), these two financial sectors together with the non-financial corporations sector also show a high degree of financial integration, with less than 40% of securities held domestically. However, the holdings of debt securities issued by these three sectors are of less importance in absolute terms as the two most important issuer sectors from this point of view are general government and MFIs (**Chart 6B**). The level of integration for the latter issuer sectors is somewhat lower since more than 55% of securities issued by those sectors are held domestically.

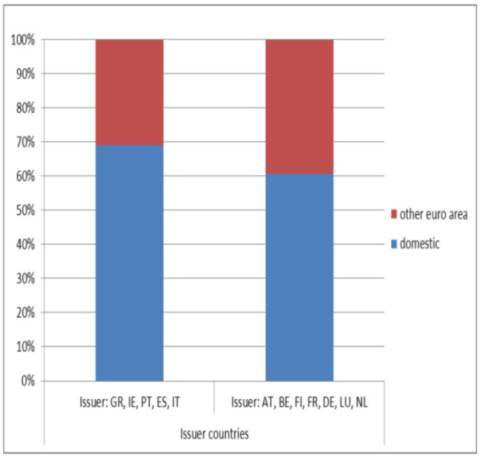
Focussing on the largest group of debt securities, namely on government debt securities, we further drill down and distinguish two groups of issuer countries: (i) countries that experienced market tensions during the euro area sovereign debt crisis or even lost market access, and (ii) countries that did not significantly suffer from these tensions (**Chart 8**). Euro area holdings of debt securities issued by the former group of countries displays a lower degree of financial integration (around 70% held domestically), as compared to those securities issued by the latter group of countries (around 60% held domestically). This finding is in line with evidence

[22] Although not shown here, we note that debt instruments could be further broken down not only by short and long term debt securities in line with most statistics, but by a more detailed original (and residual) maturity brackets, without restrictions on the level of detail regarding the issuer areas (countries) considered.

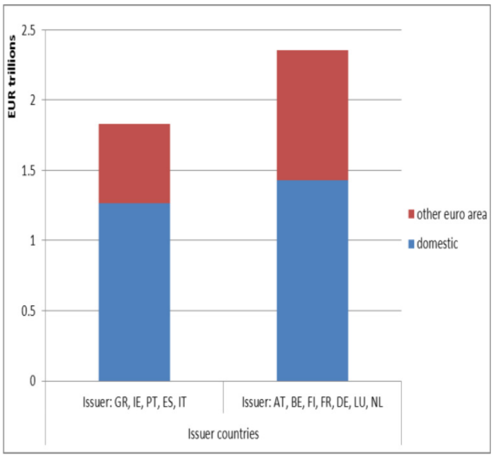
from the available price-based indicators in the last ECB's Financial Integration Report (ECB, 2014a).[23] The lower degree of integration for the former group of countries can be explained, to a large extent, by the home bias recorded by the financial sector, notably by the MFI sector (**Chart 9**).

SHSS euro area holdings of government debt securities. By groups of issuer countries and by the residency of the issuer. Chart 8

A. In percentage of total holdings



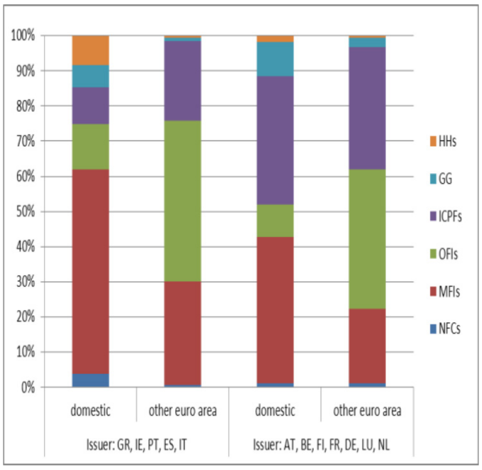
B. In EUR trillion



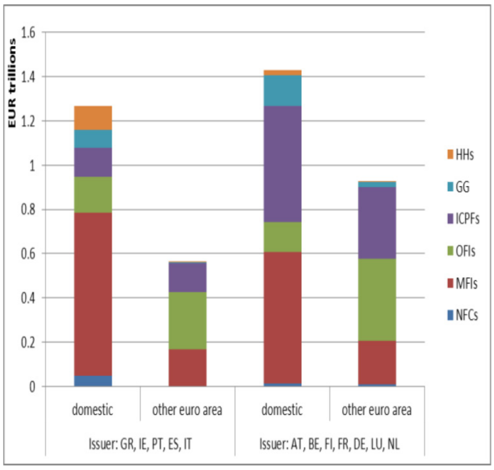
Source: Securities Holdings Statistics Sector (SHSS) data.

SHSS euro area holdings of government debt securities. By holder sector, groups of issuer countries and the residency of the issuer. Chart 9

A. In percentage of total holdings



B. In EUR trillion



Source: Securities Holdings Statistics Sector (SHSS) data.

Note: NFCs=non-financial corporations, MFIs=monetary financial institutions, OFIs=other financial institutions, ICPFs=Insurance corporations and pension funds, GG=general government, HHs: households.

23 Note that no such comparison with quantity-based indicators is possible given that, to our knowledge, no other data source allows constructing such indicators.

Conclusions

The recent financial crisis has highlighted the importance of granular information about the financial system, which would help policy-makers to implement effective policies that are tailor-made for the specific needs of ailing market segments. The SHS data, by providing security-by-security information on holding of securities, significantly help to fill this informational gap for the euro area financial system.

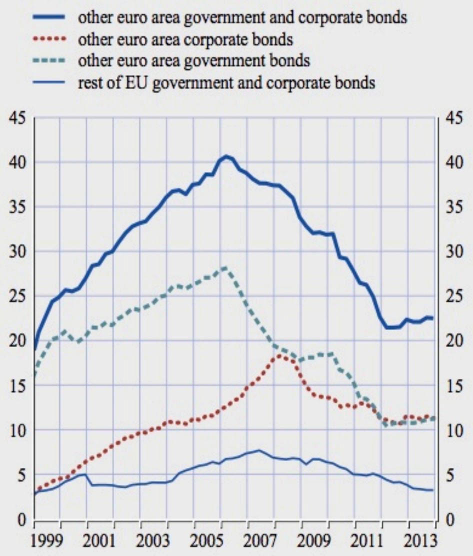
This paper shows that the SHS data can *inter-alia* be used for the design of new quantity-based financial integration indicators in the euro area, which in turn enhance the monitoring of the degree of financial integration within (and beyond) the single monetary union. The comparison with the previously available indicators confirms the validity of the SHS data as a new data source for the design of these indicators. In particular, the results show that the SHS data provide aggregated figures, which are by and large in line with the previously available statistics, but that can now be obtained from one single data collection.

Moreover, the examples provided in this paper illustrate that the granularity and the broad scope of the SHS data allow for a significant enlargement of the current toolkit of financial integration indicators. In particular, the security-by-security nature of the data allows for an unlimited drilling-down regarding the different types of securities until an individual security is reached. Regarding the holding side, the SHS Sector (SHSS) data are also of high added value as they provide information on the holdings by all main holding sectors, while previously available statistics only covered holdings by some (mainly financial) sectors or provided aggregates for all holding sectors.

Annex 1: Quantity-based indicators of financial integration *in ECB's Financial Integration Report (ECB, 2014a)*

Chart 9 Share of MFI cross-border holdings of debt securities issued by euro area and EU corporates and sovereigns

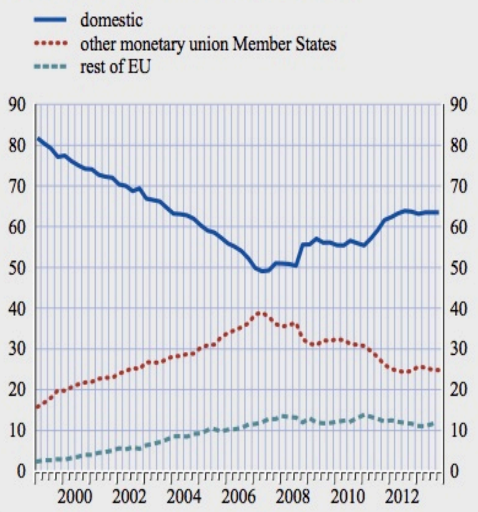
(percentage of total holdings, excluding the Eurosystem)



Source: ECB.
Note: Outstanding amounts are classified by the residency of the issuer. Eurosystem holdings are excluded.

Chart 14 Share of euro area MFI holdings of debt securities issued by MFIs by residency of the issuers

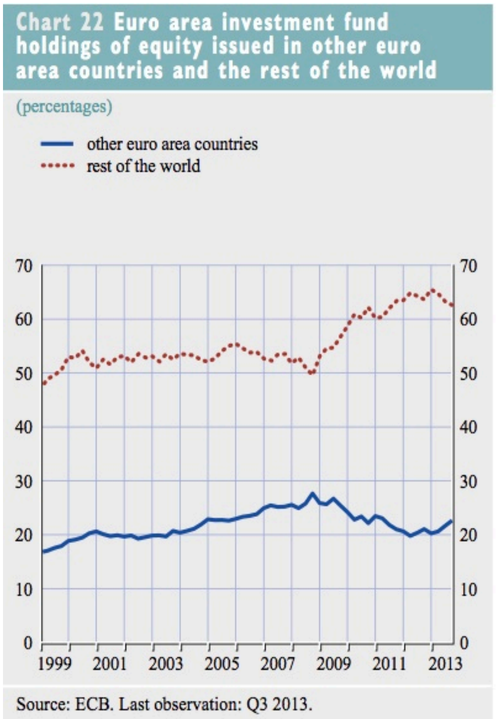
(percentage of total holdings, excl. Eurosystem)



Source: ECB.
Note: Outstanding amounts are classified by the residency of the issuer. Eurosystem holdings are excluded.

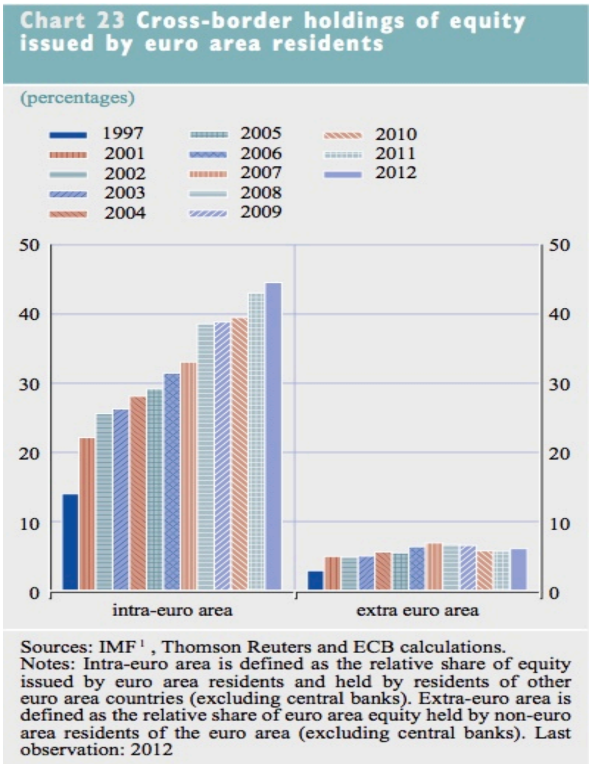
Source: ECB's MFI Balance Sheet Items (BSI) statistics. For more information, see here.

Note: The numbering of the chart in this Annex is as in ECB (2014a). The last data points of end-2013 are used in Chart 1 in the main text of this paper.



Source: ECB's Investment Funds Balance Sheet Statistics (IVF). For more information, see here.

Note: The numbering of the chart in this Annex is as in ECB (2014a). The last data points of end-2013 are used in Chart 2 in the main text of this paper.



Source: IMF's Coordinated Portfolio Investment Survey (CPIS) and Datastream. For more information on CPIS data, see here.

Note: Intra-euro area cross-border holdings are based on CPIS data for 12 euro area countries (AT, BE, DE, ES, FI, FR, GR, IE, IT, LU, NL and PT). The numbering of the chart in this Annex is as in ECB (2014a). The nominators of the last two data points at end-2012 are used in Chart 4 in the main text of this paper.

Annex 2: SHSS and CPIS statistics. Methodological summary

	Securities Holding Statistics by Sector (SHSS)	Coordinated Portfolio Investment Survey (CPIS)
Source	ECB	IMF
Brief description of the dataset	The SHSS data, collected on a security-by-security basis (based on Regulation ECB/2012/24), and subsequently linked to the Centralised Securities Database (CSDB), regards securities held by euro area institutional sectors, and securities issued by euro area residents and held by non-euro area institutional sectors. The reporting agents (MFIs, IFs, FVCs and custodians) provide positions and transactions over the covered quarter (or the statistical information needed to derive such transactions).	The CPIS provides information on economies' cross-border holdings of portfolio investment securities (based on the Coordinated Portfolio Investment Survey Guide, second edition). The coverage of the CPIS is augmented with information from two other surveys, namely Securities Held as Foreign Exchange Reserves, and Securities Held by International Organizations. The concepts and principles underlying the CPIS are aligned with the IMF's Balance of Payments (BOP) and International Investment Position Manual, sixth edition (BPM6). For more information by reporting country, see the CPIS Metadata Questionnaire.
Frequency	Quarterly	Semi-annual (since 2013), annual (since 2001)
Timeliness	Data disseminated to the users with a lag of around 112 calendar days	Data disseminated to the users with a lag of around 270 calendar days
Valuation	Both market values (including accrued income for debt securities) and nominal values are available.	Market values. The accrued income for debt securities is not included for all countries.
Instrument types covered	Short- and long-term debt, quoted and investment funds shares. Non-listed shares are excluded. Securities classified as Foreign Direct Investment (FDI) according to the balance of payments data are included.	Equity securities and long- and short-term debt securities. Non-listed shares are included. Only securities that are not part of the balance of payments data categories of direct investment, reserve assets, or financial derivatives, are included.
Reporting countries	18 euro area countries and 7 EU non-euro area countries (excl. UK, SE and HR), the latter on a voluntary (best effort) basis.	74 economies submitted end-December 2013 data.
Non-ISIN data	Not yet included for 2013-Q4	Included
Third Party Holdings (TPH) data	Collected to complement holdings by euro area non-financial sectors and to estimate holdings of euro area securities by non-euro area investors.	Not directly collected, may be estimated for selected countries

Note: TPH refer to holdings by non-resident investors reported by resident custodians.

References

Adam, K., Jappelli T., Menichini A. M., Padula M., and M. Pagano (2002), *Analyse, Compare, and Apply Alternative Indicators and Monitoring Methodologies to Measure the Evolution of Capital Market Integration in the European Union*, Report to the European Union.

Colangelo, A. and L. Fache Rousová (2012), Holdings of MFI securities: *A comparison between securities holdings experimental statistics and MFI balance sheet items statistics*, mimeo.

Draghi, M. (2014), *Financial Integration and Financial Union*, speech at the conference for the 20th anniversary of the establishment of the European Monetary Institute, Brussels 12 February 2014. http://www.ecb.europa.eu/press/key/date-/2014/html/sp140212.en.html.

European Central Bank (2010), *The Centralised Securities Database in brief*. http://www.ecb.europa.eu/pub/pdf/other/centralisedsecuritiesdatabase201002en.pdf.

European Central Bank (2012), *Regulation (EU) No 1011/2012 of the European Central Bank of October 2012 concerning statistics on holdings of securities (ECB/2012/24)*, Official Journal of the European Union. http://www.ecb.europa.eu-/ecb/legal/pdf/l_30520121101en00060024.pdf.

European Central Bank (2013), *Guideline of the European Central Bank of 22 March 2013 concerning statistics on holdings of securities (ECB/2013/7)*, Official Journal of the European Union. http://www.ecb.europa.eu/ecb/legal/pdf/l_12520130507en-00170033.pdf.

European Central Bank (2014a), *Financial Integration in Europe*. http://www.ecb.europa.eu/pub/pdf/other/financialintegrationineurope201404en.pdf?761c6bda155e07247154d37621973262.

European Central Bank (2014b), Quality assessment of from-whom-to-whom tables derived from securities holding statistics: 2013 Q4 data, mimeo.

European Commission (2014), European Financial Stability and Integration Report (EFSIR). http://ec.europa.eu/internal_market/economic_analysis/docs/efsir/140428-efsir-2013_en.pdf.

Lavrador, I., Peronaci, R. and N. Silva (2012), *Security-by-security Data on Holdings of Securities: The Importance for Euro Area and National Accounts*, Irving Fisher Committee on Central-Bank Statistics, IFC Bulletin No. 36: Proceedings of the Sixth IFC Conference on "Statistical issues and activities in a changing environment", Bank for International Settlements, Basel, August 2012.

Sola, P. and F. Strobbe (2010), *Addressing data gaps revealed by the financial crisis: European Central Bank statistics on holdings of securities*, Irving Fisher Committee on Central-Bank Statistics, IFC Bulletin No. 34: Proceedings of the IFC Conference on "Initiatives to address data gaps revealed by the financial crisis", Bank for International Settlements, Basel, August 2010.

Enhancements to the BIS international banking statistics

Stefan Avdjiev, Patrick McGuire and Philip Wooldridge[1]

The BIS international banking statistics (IBS) are a long-established data set for monitoring banks' international activities. The IBS comprise several data sets, each consisting of aggregated information for the banking system (as opposed to individual institutions) and collected with a different objective in mind. Collectively, they are a key source of information for analysing financial stability issues ranging from country risk exposures to funding risks in different currencies and banks' role in the transmission of shocks across countries. They have been used in top-level academic research (eg Aviat and Coeurdacier (2007), Buch et al (2010), Cetorelli and Goldberg (2011), Houston et al (2011), Lane and Shambaugh (2010), Ongena et al (2013)), as well as by policymakers (eg Bernanke et al (2011), Haldane (2009)) and market participants (eg Deutsche Bank (2010)).

In 2011–12 the Committee on the Global Financial System (CGFS), which oversees the collection of the IBS, approved a major set of enhancements to them (CGFS (2012)). This note explains the motivations for the enhancements and outlines the additional data being collected.

Data gaps revealed by the financial crisis

The global financial crisis of 2007–09 revealed gaps in the information available to monitor and respond to risks to financial stability. Financial institutions, and banks in particular, have become larger, more complex and more global over the past 20 years, thereby contributing to a higher degree of interconnectedness within the financial sector as well as between sectors and countries (BIS (2011)). This has made it harder to predict where vulnerabilities will emerge, and harder still to predict how vulnerabilities in one part of the financial system will affect other parts. Balance sheet data are critical to identifying any build-up of vulnerabilities, and the IBS helped to shed light on the strains that emerged in the crisis, especially the US dollar funding needs of European banks (McGuire and von Peter (2009), Borio (2013)). Nevertheless, at the time, the details available in the IBS were insufficient to support a fuller analysis of vulnerabilities.

Country risk

The BIS consolidated banking statistics (CBS) track banks' worldwide claims and other exposures to unrelated borrowers, after consolidating positions between

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affiliates of the same banking group. They thus provide internationally comparable measures of national banking systems' exposures to country risk. The statistics were expanded in the early 1980s after debt crises in emerging markets highlighted the need for information on banks' transfer risk, ie the risk associated with policy measures that have a territorial jurisdiction, such as capital controls and payment moratoriums. By the time of the Asian financial crisis, attention had shifted from transfer risk to the broader concept of country risk, or the risk associated with the economic, business, political and social elements of the environment in which the debtor operates. In the late 1990s, the CBS were expanded again to capture guarantees and other credit enhancements that result in the reallocation of banks' risk exposures from the immediate borrower to another (ultimate) obligor. These ultimate risk data have recently proved useful in tracking banks' exposures to troubled European sovereigns (Avdjiev et al (2010)).

The global financial crisis revealed some shortcomings in these data. First, the counterparty sector breakdown (bank, official sector and non-bank private sector) is too coarse to permit analysis of banks' exposures to particular parts of the non-bank private sector, in particular non-bank financials and households. Mortgage lending by foreign banks in many countries rose significantly in the 2000s. Similarly, over this period banks' exposures to special purpose vehicles, securities brokers, hedge funds and other non-bank financials built up significantly. A second shortcoming in the data is that banks do not report exposures vis-à-vis residents of their home country. These are generally large and thus should be considered in any assessment of banks' country risk exposures.

Funding risk

The IBS are also a key source of information on the currency composition of banks' balance sheets. Indeed, the BIS locational banking statistics (LBS) were established in the 1960s to track the growth in US dollar deposits outside the United States. The LBS follow balance of payments compilation practices and are collected on a residence basis, meaning that banks report business booked in the territory where they are located. Because reporting countries also provide information on the nationality (ie the home country) of the reporting banks in their territory, the statistics can also be aggregated along the lines of national banking systems, as in the CBS. These data provide a broad picture of the currency breakdown of banks' international positions. When combined with the CBS, they help to track, at the level of national banking systems, cross-currency funding and investment patterns, which proved fragile during the recent crisis.

Again, however, the global financial crisis highlighted some limitations in the data. Estimates of banks' US dollar funding needs are approximate at best since there is no reported information on the maturity of banks' assets and liabilities in specific currencies, or on banks' use of foreign exchange swaps or other currency derivatives. And the counterparty sector split that is used to proxy for residual maturity is very coarse. Moreover, the LBS only cover banks' international activities, not their domestic currency positions against residents of the reporting country. This incomplete picture of banks' balance sheets makes it difficult to monitor system-level funding risks.

Data enhancements

To close these gaps, in 2011–12 the CGFS approved a major set of enhancements to the locational and consolidated banking statistics. The basic thrust of the enhancements is to capture additional details about banks' balance sheets. In general terms, the enhancements extend the coverage of the statistics to banks' domestic positions, not just their international activities. In addition, they provide more information on banks' counterparties, specifically on their sector of activity.

The enhancements to the IBS are part of a broader international effort to close data gaps revealed by the crisis. The CGFS had earlier approved an expansion in the coverage of credit default swap statistics, which was fully implemented in 2011 (CGFS (2009), Vause (2011)). The Financial Stability Board and International Monetary Fund recommended improvements to a broad range of statistics, including the collection of detailed data on the exposures of global systemically important financial institutions (FSB and IMF (2009)).

Annex A summarises the enhancements to the IBS. They are being implemented in two stages. The first stage (blue text in Annex A) focuses on the locational banking statistics and involves the BIS gathering data already collected by many central banks from their reporting institutions. These data were first reported to the BIS for the end-June 2012 reference period, although some central banks started later. The second stage (red text) encompasses the consolidated as well as the locational statistics and involves the collection of additional data from reporting institutions. These data were first reported to the BIS for the end-December 2013 reference period, although again some central banks started later.

Dissemination of the enhanced IBS is following a phased approach. The BIS first releases data to reporting central banks and later – data quality, completeness and confidentiality permitting – to the general public. As part of the second stage of the enhancements, reporting central banks were asked to review their confidentiality classifications with a view to making data more widely available. On the basis of this review, plans are progressing to disseminate some enhanced data to the general public starting in 2015.

Challenges posed by granularity

The enhancements greatly increase the granularity of the data, and this granularity poses a number of challenges for compilers as well as users. First, the volume and complexity of the enhanced data make it more difficult for reporting central banks and the BIS to maintain data quality. For example, inconsistencies in data retrieved from different forms and systems, or across different breakdowns, are more noticeable in granular data than in more aggregated data. Also, reclassifications and other adjustments that impact the comparability of data across time are more costly to identify and implement for granular data.

Second, granular data tend to be more confidential. Central banks and other authorities typically have a statutory obligation not to disclose information about individual institutions except for specific purposes. While the IBS consist of national aggregates, the greater the granularity of those aggregates, the greater is the likelihood that individual reporting institutions' data can be inferred from them.

Consolidation in the banking industry and the withdrawal of some banks from international banking activities since the global financial crisis further increases this likelihood. The potential confidentiality issues associated with the enhanced IBS in turn hinder data sharing among reporting central banks and limit the details that can be publicly disseminated. Indeed, the enhancements are likely to introduce a sharper differentiation between data released to the general public and data released only to reporting central banks, where policies and procedures are in place to safeguard the confidentiality of unpublished data.

Third, granular data tend to be less complete. While the enhancements increase the details available in the IBS, these details are more likely to have gaps than more aggregated data. Gaps arise from differences in the details reported by each central bank as well as confidentiality restrictions. For example, in the LBS, the coverage of claims vis-à-vis the non-bank sector in a given counterparty country is typically complete, but the breakdowns by subsector introduced as part of the enhancements may have gaps. For subsectors of the non-bank sector, some central banks do not report any subsectors, others report only a broad breakdown between the non-bank financial sector and the non-financial sector, and still others report a full breakdown including non-financial corporations, general government and households. Even when a full breakdown is reported, data for some subsectors or selected observations within a subsector may be classified as confidential and thus available only to the BIS for internal use.

Such gaps complicate the analytical use of the IBS and require users to consider carefully how any gaps might bias their analysis. That said, the enhancements support a richer analysis of risks to financial stability. The BIS is planning steps to help central banks, other policymakers and private sector analysts integrate the IBS more closely into their monitoring of financial sector developments. In particular, the BIS is considering how to make the banking statistics more easily available to users, even while providing more data. Furthermore, over the next few years the BIS will step up its own research using the banking statistics. Finally, the BIS intends to organise workshops with central banks to provide guidance on how to use the banking statistics in financial stability analysis.

Simplified overview of the BIS international banking statistics

Data reported from Q2 2012 are shown in **blue (Stage 1)** and from Q4 2013 in **red (Stage 2)** Annex A

	Locational banking statistics		Consolidated banking statistics	
	By residence	**By nationality**	**Immediate counterparty**	**Ultimate risk**
Reporting countries[1]	44	43	31	25
Business reported	Financial assets and liabilities (including derivatives)		Financial assets (excluding derivatives), total assets and liabilities (including derivatives), capital, risk transfers	Financial assets (excluding derivatives), other potential exposures (including derivatives)
Breakdowns reported				
Bank type	All reporting banks, domestic banks, foreign subsidiaries, foreign branches	not available	All reporting banks, domestic banks, inside-area foreign banks,[2] outside-area foreign banks[3]	Domestic banks
Bank nationality	not available	≥ 43	≥ 31	≥ 25
Type of position	Cross-border, local		Total, international (cross-border plus local in foreign currencies), local in local currency[4]	Total, cross-border, local in all currencies[5]
Currency	Local currency, USD, EUR, JPY, GBP, CHF, other foreign currencies (optional)		*For local claims and liabilities in local currency*: >160	not available
Maturity	*For liabilities*: debt securities (of which: ≤1 year)		*For international claims*: ≤1 year, 1–2 years, >2 years[6] *For total liabilities*: debt securities (of which: ≤1 year)	not available
Instrument	Loans and deposits, debt securities, other instruments	*For liabilities*: debt securities	*For assets*: claims, total assets, risk-weighted assets *For liabilities*: deposits, debt securities, derivatives, other liabilities *For capital:* total equity, Tier 1 capital	*For other potential exposures*: derivatives, credit commitments, guarantees extended
Counterparty country	>200 (including reporting country)[7]	≥76 (including reporting country)	>200 (including reporting country)[4]	
Counterparty sector	Banks[8] (related offices, unrelated banks, central banks), non-banks[9], non-bank financial institutions, non-financial sector (general government, non-financial corporations, households)		Official sector (including central banks), banks (excluding central banks), non-bank private sector, non-bank financial institutions, non-financial private sector (non-financial corporations, households)[4,5,6]	

[1] Reporting countries and the date when they joined the BIS reporting area are listed on the BIS website: www.bis.org/statistics/rep_countries.htm. [2] For inside-area foreign banks not consolidated by their parent, encouraged to report the same breakdowns as domestic banks. [3] Report international claims only. [4] On an immediate counterparty basis, breakdown reported for claims only, ie for financial assets (excluding derivatives). Breakdowns by type of position, counterparty country and counterparty sector not reported for total assets, risk-weighted assets, total liabilities or capital. [5] Breakdowns by type of position and counterparty sector reported for claims only and reported separately, ie not crossed. Breakdown not reported for other potential exposures. [6] Breakdowns by maturity and counterparty sector reported separately, ie not crossed. [7] When crossed with bank type, only basic counterparty country breakdown reported distinguishing between residents and non-residents (and unallocated location if applicable). [8] Prior to Q4 2013, reported in LBS by nationality only. [9] Prior to Q4 2013, reported in LBS by residence only. Historically bank sector was derived as total minus the non-bank sector and thus included claims unallocated by sector.

References

Avdjiev, S, C Upper and N Vause (2010): "Highlights of international banking and financial market activity", *BIS Quarterly Review*, December, pp 13–25, www.bis.org/publ/qtrpdf/r_qt1012b.htm.

Aviat, A and N Coeurdacier, N. (2007): "The geography of trade in goods and asset holdings", *Journal of International Economics*, vol 71, no 1, pp 22–51.

Bank for International Settlements (2011): *81st Annual Report*, June, Chapter VI.

Bernanke, B, C Bertaut, L DeMarco and S Kamin (2011): "International capital flows and the returns to safe assets in the United States", *Banque de France Financial Stability Review*, vol 16, February, pp 13–26.

Borio, C (2013): "The great financial crisis: setting priorities for new statistics", *BIS Working Papers*, no 408, April, www.bis.org/publ/work408.htm.

Buch, C, K Carstensen and A Schertler (2010): "Macroeconomic shocks and banks' foreign assets", *Journal of Money, Credit and Banking*, vol 42, no 1, pp 171–88.

Cetorelli, N and L Goldberg (2011): "Global banks and international shock transmission: evidence from the crisis", *IMF Economic Review*, vol 59, no 1, pp 41–76.

Committee on the Global Financial System (2009): "Credit risk transfer statistics", *CGFS Publications*, no 35, September, www.bis.org/publ/cgfs35.htm.

——— (2012): "Improving the BIS international banking statistics", *CGFS Publications*, no 47, November, www.bis.org/publ/cgfs47.htm.

Deutsche Bank (2010): "Monitoring cross-border exposure", *Deutsche Bank Research*, November.

Financial Stability Board and International Monetary Fund (2009): "The financial crisis and information gaps", Report to the G20 Finance Ministers and Central Bank Governors, October, www.imf.org/external/np/g20/pdf/102909.pdf.

Haldane, A (2009): "Rethinking the financial network", speech delivered at the Financial Student Association, Amsterdam, 28 April.

Houston, J, C Lin and Y Ma (2011): "Regulatory arbitrage and international bank flows", *Journal of Finance*, vol 67, no 5, pp 1845–95.

Lane, P and J Shambaugh (2010): "Financial exchange rates and international currency exposures", *American Economic Review*, vol 100, no 1, pp 518–40.

McGuire, P and G von Peter (2009): "The US dollar shortage in global banking and the international policy response", *BIS Working Papers*, no 291, October.

Ongena, S, A Popov and G Udell (2013): "'When the cat's away the mice will play': Does regulation at home affect bank risk-taking abroad?", *Journal of Financial Economics*, vol 108, no 3, pp 727–50.

Vause, N (2011): "Enhanced BIS statistics on credit risk transfer", *BIS Quarterly Review*, December, pp 85–9, www.bis.org/publ/qtrpdf/r_qt1112i.htm.

The development and compilation of macro prudential data – the European perspective

Stefano Borgioli, Graziella Morandi and Joao Veiga[1]

Abstract

The availability of reliable data is a key requirement to identify and address macro-prudential stability issues and systemic risk, and to monitor their development as well as to assess the impact of mitigation measures that may be taken. The Consolidated Banking Data (CBD) have been a key component of the E(S)CB statistical toolbox for financial stability analysis for more than a decade. The dataset is an aggregation of micro supervisory returns supplied by EU banks and includes information on the whole spectrum of banking business from balance sheet or profit and loss, to capital adequacy and asset quality. Recently the CBD became a key input to the macro-prudential analysis conducted by the European Systemic Risk Board (ESRB). This paper first describes this data source and its contribution to banking and financial stability analysis. Using the CBD indicators as a starting point, the paper then puts in perspective this data source with other related statistical information, mainly the IMF Financial Soundness Indicators and the Key Risk Indicators produced by the European Banking Authority. Finally, the paper outlines how the entry into force of the Implementing Technical Standards (Financial Reporting and Common Reporting) will influence the CBD methodology and reporting.

Keywords: Macro prudential statistics, Financial stability, Financial analysis, Risk analysis, Systemic risk, Risk indicators, Consolidation, IMF, ECB, IFRS, EBA, ESRB, Financial soundness, deposit-takers, credit institutions

JEL classification: C82, G21

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Introduction

Reliable data are a basic requirement for the identification of systemic risk and the design of macro-prudential tools. The Consolidated Banking Data (CBD) are a key component of the E(S)CB statistical toolbox for financial stability analysis. This data set is an aggregation of micro supervisory returns supplied by EU banks and includes information on the whole spectrum of banking business from financial information to capital adequacy and asset quality. Recently the CBD became also a crucial input for the endeavours of the European Systemic Risk Board (ESRB).

This paper first describes this data source and its contribution to banking and financial stability analysis.[2] The paper then places the CBD in perspective with other related statistical information, namely the IMF Financial Soundness Indicators and the Key Risk Indicators produced by the European Banking Authority (EBA). Finally, the paper outlines how the entry into force of the EBA's Implementing Technical Standards (ITS) on Supervisory Reporting[3] will impact the CBD methodology and reporting.

The Consolidated Banking Data and its contribution to banking and financial stability analysis

The CBD are one of the main statistical inputs of the macro prudential analysis conducted by the European System of Central Banks (ESCB) and the ECB and are a key part of the statistical support of the ECB to the ESRB. These data include detailed information on the profitability, balance sheets, asset quality and solvency ratios of banks in the 28 Member States of the EU (the EU 28).

The current CBD collection framework is based on the aggregation of a subset of the Financial Reporting (FINREP) and the Common Reporting (COREP). Special allowances are introduced in the reporting template to accommodate data returns from banks that did not yet adopt FINREP but are still reporting according to local Generally Accepted Accounting Principles (GAAP).

Data are reported to the ECB by National Central Banks (NCBs) and National Competent Authorities (NCAs) and the same reporting framework is adopted by all the EU 28 countries. The initial CBD date back to 2002 and the current CBD reporting scheme was implemented as from 2009. The reporting scheme used to report national data was based on the FINREP/COREP templates only from 2009.

The data are consolidated on a cross-border basis (data on branches and subsidiaries located outside the domestic market are consolidated in the data

[2] Borgioli, Gouveia and Labanca (2013) deals extensively with methodological issues connected to this dataset and presents how CBD indicators can be used for topical financial stability analysis.

[3] The ITS on Supervisory Reporting cover reporting on own-funds and capital requirements (currently under the COREP Guidelines), reporting of financial information (currently under the FINREP Guidelines), reporting on large exposures (currently under the COREP Large Exposures Guidelines), reporting on leverage and reporting on liquidity and stable funding. They will be complemented by other specific reporting templates introduced by the Capital Requirements Regulation (asset encumbrance, forbearance and non-performing exposures).

reported by the parent institution) and on a cross-sector basis (affiliates of banking groups that can be classified as “other financial institutions” are included). Insurance corporations and non-financial institutions are not consolidated. The consolidation basis could, therefore, be different from the IFRS perimeter.

CBD series are currently collected on a twice-yearly basis, with a detailed template for end-of-year data and a lighter one referred to end-June. Data on EU domestic banks are divided into three groups according to bank size (small, medium-sized and large). “Large” domestic banks are those with assets totalling more than 0.5% of the total consolidated assets of EU banks of the previous reference year, while “medium-sized” banks have total assets between 0.005% and 0.5% of the total consolidated assets. Banks with total assets of less than 0.005% of the total consolidated assets are considered “small”. The concept of size is therefore in relation to the EU banking system as a whole and not in relation to the size of the banking system in each single country. Moreover, having a moving threshold has made it possible to maintain the composition of the sub-populations rather stable across the aggregate banking business cycle.

Separate information is provided on foreign-controlled institutions active in EU countries. “Foreign banks” are subsidiaries and branches that are controlled by either an EU or a non-EU parent that is “foreign” from the reporting country’s point of view. A separate reporting for these intermediaries is needed, given their prominence in several EU national banking markets.

While until recently the CBD were reported on a voluntary “best efforts” basis, these data shall now be reported by euro area NCBs in accordance with ECB “Guideline of 4 April 2014 on monetary and financial statistics (recast)”, (ECB/2014/15)[4].

Indicators based on CBD series are published at national level, euro area and EU level. It must be flagged that, when analysing CBD presented at country level, and especially when attempting a comparison across countries, it should be borne in mind that some country-level indicators differ as regards both coverage and definitions used, as well as reflecting differences in the national banking sector structures. Indicators of non-performing assets and provisioning, for instance, should be interpreted with caution owing to the differences between national definitions of impaired assets (non-performing and doubtful assets) and provisions. These differences in national level indicators will be substantially removed once the next-generation CBD framework, based on the new EBA Implementing Technical Standard (ITS) will be available (see conclusion). Lastly, country-level information may differ from that published in individual countries’ reports on account of differences in the reporting populations.

CBD are rather extensively presented and commented in the ECB “Banking structures report”[5], together with another ECB dataset, the Structural Financial Indicators[6].

4 The Guideline of the ECB of 4 April 2014 on monetary and financial statistics (recast) was released on 29 April 2014 in the ECB website (document number: ECB/2014/15). Link to the document: https://www.ecb.europa.eu/ecb/legal/pdf/en_gui_2014_15_f_sign2.pdf.

5 http://www.ecb.europa.eu/pub/pdf/other/bankingstructuresreport201311en.pdf.

6 http://www.ecb.europa.eu/stats/pdf/130708_ssi_table.pdf?6eb6a27bf4fc505cee66a57a5c20d02f.

The CBD are also one of main datasets available to the ESRB in the framework of the regular provision of aggregated information by the ECB, as specified in the Decision of the European Systemic Risk Board of 21 September 2011 (ESRB/2011/6)[7]. The CBD are extensively used in the quarterly macro prudential review that presents detailed statistical information on the different dimensions of systemic risks faced by the national and EU financial systems. This quarterly macro prudential review was complemented recently with a semi-annual summary assessment of risks faced by national EU banking systems, aimed at supporting the discussion on national differences and developments across the respective banking sectors and where the CBD also features very prominently as the main dataset. Lastly, the CBD is also used in the ESRB risk dashboard, which provides a set of quantitative and qualitative indicators to identify and measure systemic risks in the EU financial system.[8]

Other related statistical information: the IMF's Financial Soundness Indicators and the EBA's Key Risk Indicators

This section relates the CBD to other statistical datasets, namely the IMF's Financial Soundness Indicators and the EBA's Key risk indicators.

1. IMF's Financial Soundness indicators

Since January 2007, the International Monetary Fund (IMF) has been releasing on a regular basis data aiming at assessing strengths and vulnerabilities of financial systems worldwide: the so-called Financial Soundness Indicators (FSIs), covering 95 countries at end-2012. Initially made of 40 measures of national economies for the participating countries, the list of indicators was amended in November 2013 to better capture, on the one hand the main features of the global financial crisis, and, on the other hand, to adopt in the indicators' compilation methodology at national level a new regulatory framework under the Basel III Accord[9]. This last review of the FSIs is however still in the process of being implemented so that no comparison will be made in the following paragraphs with the new IMF indicators.

In the FSIs' current version, some of the measures overlap in their definition with the set of indicators published in the CBD while showing sometimes, for these "common indicators", figures that differ at country level. This makes it worthwhile comparing the two sets of data in order to better understand these discrepancies that may lead to a distinct interpretation of the same indicator.

7 OJ C 302, 13.10.2011, p.3.

8 The ESRB risk dashboard – as required by the ESRB regulation (Article 3(2)(g)) – was released for the first time after the ESRB General Board meeting on 20 September 2012. The ESRB risk dashboard is now one of the communication instruments of the ESRB, as it provides statistical information concerning risks and vulnerabilities in the financial system to the public at large. Since March 2013 the ESRB risk dashboard has also been available via the ECB's Statistics Database: http://sdw.ecb.europa.eu/reports.do?node=1000003268.

9 See the IMF cover note on *Modifications to the current list of financial Soundness indicators* available here: http://www.imf.org/external/np/pp/eng/2013/111313.pdf.

1.1 FSIs, CBD, what do these datasets include?

As the FSIs distinguish between the *deposit-takers* and *non-deposit-takers* reporting sectors, measures are split into seven categories comprising:

– Core FSIs for Deposit Takers

– Encouraged FSIs for Deposit Takers

– Other Financial Corporations

– Non-financial Corporations Sector

– Households

– Market Liquidity

– Real Estate Markets

In this section, the focus is only set on the two first categories for which the comparison with the CBD is possible, keeping in mind though that the *credit institutions* covered by the ECB statistics correspond to a narrower definition of deposit-takers. In this regard, the EBA publishes on a regular basis a list of *credit institutions* to which authorisation has been granted to operate within the European Economic Area countries (EEA) which are also listed in the ECB's Register of Institutions and Affiliates Database (RIAD). The ECB as from November 2014 or the competent national authorities are in charge of providing licences to the deposit-takers meeting the legal requirements in order to run the business of credit institutions. These can then cover, again within the European Economic Area countries, three types of banks:

– *CRD credit institutions*: undertaking whose business is to receive deposits or other repayable funds from the public and to grant credits for its own account;

– *EEA branches operating in each EEA country:* branches of credit institutions authorised in another EEA country which have the right to passport their activities;

– *Non EEA Branches*: branches of credit institutions having their Head Office in a third country.[10]

This means that there also exist in EU countries deposit-takers which are not credit institutions; these are commonly called *non-bank deposit-takers* and are not included in the CBD reporting population. This makes perfect sense when thinking of the so-to-say rule of thumb[11] applying to the reporting of the consolidated banking data: these are expected to be supervisory data, namely data collected by national supervisory authorities from the financial entities they supervise and which should be therefore institutions holding a banking license.

Table 1 in the annex gives an overview of all the indicators included in the FSIs for deposit-takers which are also available in CBD.

[10] Further information is also available on the EBA website: http://www.eba.europa.eu/risk-analysis-and-data/credit-institutions-register.

[11] The statistical treatment owed to non-bank deposit-takers operating in the EU is not specified in any CBD-related document. Similarly, no written rule specifies that the CBD should be only collected at national level for the supervised banks in the country.

1.2 Reporting and compilation

Whereas the IMF receives the FSIs directly compiled by the reporting agencies in each participating country (indicators are at national level), the 141 existing published CBD indicators are calculated by the ECB for all EU countries based on aggregated "raw data" transmitted by the NCBs. Looking at the way the data are channelled to the institution in charge of their publication is a starting point for confronting the methodologies applied to both datasets. The difference in approach is indeed crucial to assess the cross-country comparability of such statistics. From an "IMF's perspective", it is important to guarantee that the compilation methods used by countries to produce the FSIs (see FSI compilation guide[12]) are harmonised to a reasonable extent across reporters. This is not an issue in the CBD where all indicators are calculated starting from data points from the same reporting template and according to standardised formulas applied to all countries with very few exceptions in particular cases mostly related to data availability issues (missing values). On the other hand, making sure that outputs from standardised formulas are cross-country comparable requires providing clear guidance to reporters on the collection of the raw data needed for the indicators. Therefore, and in contrast to the methodological advice laid out in the IMF *Compilation guide on Financial Soundness Indicators*, the CBD reporting instructions contain a template addressed to all EU NCBs specifying, for each statistical area covered by the dataset (income statement, balance sheet, etc.), the exact positions to be reported by credit institutions, with, when it exists, a specific IFRS reference.

1.3 Coverage

One important difference between the two datasets regards their geographical coverage since the FSIs are reported to the IMF by 95 countries worldwide whereas the CBD cover the EU 28. It is also useful indicating that the FSIs are reported on a best effort basis with the support of some technical guidance provided by the compilation guide, whereas the Consolidated Banking Data, as already explained above, are now included in the *Guideline of the ECB on monetary and financial statistics,* setting up therefore a legal framework to their transmission by the NCBs to the ECB.

Going one step further in the analysis of differences in terms of coverage between the two data sources, one may also stress that while the CBD cover only credit institutions operating in the European Union, including banking groups, stand-alone credit institutions as well as foreign-controlled (EU and non-EU) subsidiaries and branches, the FSIs are compiled for a broader range of reporting entities: in addition to the non-credit institution deposit-takers as mentioned above, they cover *Other Financial Corporations* (two indicators), *Non-Financial Corporations* (five indicators) and *Households* (two indicators). Regardless of any specific reporting sector, the FSIs also contain data on market liquidity and price indices for the real estate market.

1.4 Frequency

The FSIs may be reported to the IMF on a quarterly basis but a larger set of data is usually reported annually (more countries reporting more indicators). Owing to their

12 Link to the online version: http://www.imf.org/external/pubs/ft/fsi/guide/2006/.

broader geographical and sectorial coverage the FSIs face more challenging issues in the timeliness of the data transmission by national authorities. When looking at the last available data, one may observe that the last released observation significantly differs from a country to another.

The CBD are collected semi-annually for all EU countries. However, the data reported at mid-year are only a subset of the annual collection referred to end-year. Possible revisions to the previous periods may be transmitted by all reporters at each data collection. Therefore, data gaps in the CBD only arise from data availability issues at country level: either the required series do not exist under national accounting standards for banks or the data are not (yet) statistically monitored due, for instance, to national legislation. Such issues, together with a constant attempt to lower the reporting burden towards national counterparts, also prevents the ECB from increasing the CBD reporting frequency.

1.5 Accounting standards

To even greater extent than the CBD at European level, the compilation of the FSIs requires dealing with the rather disparate accounting landscape worldwide. Although there exist internationally agreed prudential, accounting, and statistical standards, these are not necessarily implemented by all countries for various reasons. In order to deal with the lack of cross-country harmonisation in applying international standards, the IMF explicitly encourages the participating countries to *"disclose the basis of accounting that is used to compile FSI data series, along with the critical assumptions made."*

In the CBD, by default, all items are intended to be reported by EU countries under the IFRS accounting framework. For countries in which a relevant number of credit institutions do not apply IFRS, the official template allows reporting some items in specific cells for those reporters. The item *Total assets [non-IFRS and non-portfolio reporting IFRS banks]* is for instance collected together with the so-called item *Total assets [full sample]*.

Whereas the income statement and balance sheet data are expected to be consistent across IFRS compliers, the asset quality data still suffer some gaps and important short-comings in terms of the harmonisation of definitions. IAS39 *Financial Instruments: Recognition and Measurement*[13] provides accounting rules for the classification, measurement and derecognition of financial instruments aiming at assessing the amount of impaired assets. But it does not go any further into the valuation of non-performing loans for instance and for which reporting banks have to rely on some sort of commonly agreed rule of thumb: the *90-days-overdue* criterion, also recommended by Basel II.

In practice, countries may also report "loans with payments less than 90 days past due that are recognized as nonperforming under national supervisory guidance" in the FSIs as stated in the IMF compilation guide, the good news being that this also applies to the data collected in the CBD. However any strict comparison of the data released in the two datasets should be carried out only with care since the series may not cover the same underlying population (all MFIs versus

[13] The technical summary is available here on the IFRS website: http://www.ifrs.org/IFRSs/IFRS-technical-summaries/Documents/IAS39-English.pdf.

relevant supervised entities for instance) or include the same instruments (debt instruments sometimes excluded by EU countries when reporting the FSIs).

At this stage, one may look at the rule of consolidation applied to the CBD and FSIs. The scope is actually expected to be the same for both datasets; namely the required approach for compiling either the CBD raw data or the IMF financial soundness indicators is a cross-border and cross-sector consolidation. At country level, this means that all domestically controlled entities and, their subsidiaries and branches, resident or not in the country, must be included in the aggregated figures. This makes sense if one simply thinks about macro prudential analysis as the assessment of the soundness of a sector rather than individual banks. Nevertheless, whereas the FSIs are only collected for the whole reporting sector regardless of the financial institutions' ownership ("all deposit-takers operating in the reporting countries"), the CBD are at first stage consolidated on a domestic versus foreign-controlled approach and transmitted as such. The resulting indicators are therefore compiled and published for the three reporting sectors:

- Domestic banks;
- Foreign-controlled subsidiaries and branches;
- Domestic banks and EU or non-EU foreign-controlled subsidiaries and branches ("all banks").
- Table 1 gives an illustration of the impact of the methodological differences between the FSIs and the CBD on a usual profitability indicator.

The differences in the above figures can be logically investigated along two lines: compilation practises at national level and confrontation of the methodologies used by the ECB and the IMF for this specific indicator.

Regarding national compilation practises, and looking beyond the conceptual difference between deposit-takers (covered by the FSIs) and credit institutions (reported for the CBD) stated above, it is worth noting that most non-euro area countries (UK excluded) reported non-consolidated data to the IMF in 2012. This was not the case for the CBD. For other (euro area) countries, the scope of consolidation between the two datasets was also slightly different: domestically-controlled cross-border approach for the FSIs against cross-border and cross-sector consolidation under the CBD framework. Some countries simply do not use the same data sources: supervisory data versus monetary statistics for instance, which also result in discrepancies as the scope of consolidation then again differ.

On the methodologies used for compiling ROE, differences mostly arise from inconsistent approaches to compile the numerator: this is intended as *Net income before extraordinary items and taxes* for the IMF versus *Total profit after tax and discontinued operations* in the CBD approach owing to the broad concept of "return" which does not exist as such in the banks' income statement. Table 2 summarizes and compares the accounting items included in both income statement measures. On the contrary, the denominator is expected to be the same according to both guidelines; namely, "capital and reserves" required for the IMF measure should match with the "total *equity*" reported under the balance sheet part of the CBD reporting scheme. However, the IMF guidelines encourage the use of an average value of capital using the most frequent observations available. In the collection of CBD, reported accounting positions are expected to correspond to end-period positions. Although balance sheet items usually follow a flat trend, this may of course result in final values that differ for total equity, those of the IMF including in a way all variations that may have occurred in the amount of capital held by deposit-takers over the last year of activity.

Comparing two measures of ROE*

Return-on-Equity (%) … or Return-on-Equity (%)?
(data at end December 2012)

Table 1

	FSI	CBD**
Austria	5.5	4.1
Belgium	3.4	3.3
Bulgaria	6.3	4.7
Czech Republic	20.4	13.7
Denmark	1.5	2.0
Estonia	14.2	11.7
Finland	10.8	8.9
France	6.0	3.4
Hungary	-1.4	-5.1
Ireland	12.2	-14.6
Italy	-0.9	-1.0
Latvia	7.8	4.9
Lithuania	8.9	7.8
Luxembourg	10.4	7.0
Malta	24.7	4.7
Netherlands	7.4	4.1
Poland	14.0	10.8
Portugal	-5.4	-3.3
Romania	-5.9	-7.2
Slovak Republic	9.1	9.0
Slovenia	-19.6	-19.4
Spain	-21.0	-24.9
Sweden	15.3	11.4
United Kingdom	5.8	1.9

* Only EU countries for which both figures were available are displayed. ** As from 2014, foreign-controlled branches are excluded from the scope of consolidation for this specific indicator.

Income statement items included in the numerator compiled for ROE*

Table 2

FSI	CBD
Net income (before extraordinary items and taxes)[14]	Total profit (loss) after tax and discontinued operations[15]
(+) Interest income ▪ Gross interest income ▪ Less provisions for accrued interest on non-performing assets	(+) Interest income
(-) Interest expenses	(-) Interest expenses
	(-) Expenses on share capital repayable on demand
(+) Non-interest income ▪ Fees and commissions receivable (net)	 (+) Fee and commission income (-) Fee and commission expenses
▪ Gains or losses on financial instruments	(+) Realised gains (losses) on financial assets & liabilities not measured at fair value through profit or loss (+) Gains (losses) on financial assets and liabilities held for trading (+) Gains (losses) on financial assets and liabilities designated at fair value through profit or loss, net
▪ Prorated earnings	(+) Share of the profit (loss) of associates and joint ventures accounted for using the equity method
	(+) Gains (losses) from hedge accounting, net (+) Exchange differences, net (+) Gains (losses) on derecognition of assets other than held for sale, net
▪ Other income	(+) Dividend income (+) Other operating income
(-) Non-interest expenses	(-) Other operating expenses
▪ Personnel costs	▪ Staff expenses ▪ General and administrative expenses
▪ Other expenses	▪ Property, Plant and Equipment ▪ Investment Properties ▪ Intangible assets [other than goodwill]
(-) Provisions (net) ▪ Loan loss provisions ▪ Other financial asset provisions	 (-) Provisions (-) Impairment
	(+) Negative goodwill immediately recognised in profit or loss (+) Profit (loss) from non-current assets and disposal groups classified as held for sale not qualifying as discontinued operations (+) Tax (expense) income related to profit or loss from continuing operations (+) Profit (loss) after tax from discontinued operations

* Only EU countries for which both figures were available are displayed. ** As from 2014, foreign-controlled branches are excluded from the scope of consolidation for this specific indicator.

[14] See Table 4.1 in chapter 4 of the FSI compilation guide "Accounting framework and sectorial financial statements".

[15] This item is reported as such by the EU National Central Banks. It is however expected to include the sub-items listed in the table which are also reported to the ECB.

2. EBA's Key Risk Indicators

The Key Risk Indicators (KRIs) have been defined in the framework of the discussions in the High Level Group on Data of the ESRB and the European Supervisory Authorities (ESAs), with the view to aligning the EBA and ESRB's data requirements and thereby avoiding duplication of reporting obligations.

The primary objective of this set of indicators is to support the data users in terms of risk assessment and prioritisation, although some are also useful in assessing banks' business models.

The KRIs compiled by the EBA currently consist of a set of 53 indicators for a sample of 55 banks across 20 countries of the European Economic Area, which are required by the EBA for its own monitoring of the EU banking system.

The banks in the sample cover at least 50% of the total assets of each national banking sector in the EU. Data are reported by the national competent authorities to the EBA at firm-level basis. The EBA compiles the required ratios, calculates distribution measures and correlations among indicators, and transmits the aggregated information to the ECB's Directorate General Statistics, in line with the ECB's statistical support to the ESRB.[16]

The current set of KRIs is divided into five categories: solvency, credit risk and assets quality, profitability, balance sheet structures and growth rates.

Under the category *solvency indicators* are 11 indicators, like for example Tier 1 capital ratio and Total capital ratio, as well a wide-range of measures of total capital requirements for credit, market and operational risk. The group *credit risk and asset quality indicators* includes 10 indicators like, among others, coverage ratio, past due loans to total loans and advances, etc. The category *earning risk indicators* comprises 12 indicators, including *inter alia* measures of return-on-equity and return-on-assets, cost-to-income ratio and breakdowns of the total operating income. Under *balance sheet structure,* a total of 13 indicators are provided, including data for total equity and total liabilities, financial assets and liabilities held for trading among other components of the structure of banks' balance sheets. Finally, the overall package of 53 indicators is complemented by 7 indicators with growth rates for some key variables to support the risk assessment.

All raw data (numerators and denominators of the ratios) required to calculate the set of 53 micro-prudential KRIs are based on the COREP and FINREP reporting frameworks[17] and hence, standardised definitions of the data content are ensured. However, data availability varies between jurisdictions given the uneven degree of application of FINREP and COREP across the EU. Therefore the data has been requested on a best effort basis and the relevant competent authorities collect these data either: a) directly from the relevant financial institutions, or b) mapping data available in national reporting formats to the data items as defined in COREP and FINREP, or c) using other sources to proxy the missing data.

[16] Israel, Sandars, Schubert and Fischer (2013) illustrates the work that has been carried out to prepare, develop, implement and manage the initial set of statistical and supervisory information necessary to support the ESRB.

[17] FINREP rev1 published by CEBS 24 July 2007, COREP published by CEBS 6 January 2010.

Table 2 in the Annex gives an overview of all KRIs which are also available in CBD. When comparing the set of indicators from the KRIs and CBD it is important to highlight that several indicators are similar. For instance, under the group of indicators in the category *solvency indicators*, Tier 1 capital ratio and Total capital ratio derived from the KRIs dataset are also available in the CBD dataset. Considering the *earning risk indicators* there are identical indicators for example for return-on-equity, cost-to-income ratio, return-on-assets. In some cases, namely for *credit risk and asset quality* indicators and for *balance sheet structure* derived from the KRIs dataset, exact indicators are not available in the CBD; nonetheless they could be compiled from the CBD template.

Regarding the framework for the transmission of information to the ECB's Directorate General Statistics, the Decision ESRB/2011/6 specifies that based on datasets from a sample of large banking groups, the EBA should report to the ESRB the complete set of 53 indicators at aggregated level.

Aggregated information transmitted by the EBA comprises data on at least three legal entities, none of which represents 85% or more of the relevant market, regardless of whether this market consists of one or more Member States or the Union as a whole. When dispersion measures are provided, the aggregated information comprises data on at least five legal persons when referring to publicly available data and data on at least six legal persons when there is a need to protect confidential firm-level data.

Regarding frequency and timeliness, the KRIs are collected on a quarterly basis, with the EBA receiving data from national supervisory authorities by the end of the quarter after the reference date. The EBA is requested to transmit the information within five working days of collecting the data from national authorities.

Five KRIs[18] are currently released on a quarterly basis to the public in the framework of the regular publication of the ESRB Risk Dashboard. Individual institutions interquartile range and median for a sample of large EU banking groups are available also via the ECB's Statistics Database[19]. For those cases where indicators are similar to the CBD dataset, the values are comparable, for instance the return-on-equity for the CBD large domestic banks in end-2003 was close to 3%, whereas the identical ratio from the KRIs dataset was close to 4%. Since the datasets are broadly based on the same methodological reporting framework, divergences mainly arise from changes in the composition of the KRI sample over time.

Also due to low sample size, dispersion measures by country for the KRI dataset are not publicly available via the ECB's Statistics Database – this shortcoming is expected to be addressed with a new expanded sample to be used in future KRI framework, as explained below.

With the EBA's Implementing Technical Standard (ITS)[20] on Supervisory Reporting entering into force from 2014, the existing set of KRIs will be enhanced,

[18] These are Return on equity, Cost-income ratio, Net interest income to total operating income, Tier 1 capital to (total assets - intangible assets), Impaired loans and past due (>90 days) loans to total loans.

[19] Available at: http://sdw.ecb.europa.eu/browse.do?node=9545741.

[20] The Capital Requirements Regulation (CRR) sets out prudential requirements directly applicable as of 01.01.2014, and includes a number of articles with specific mandates for the EBA to develop

fulfilling data gaps in the areas that are currently not sufficiently covered, i.e. liquidity, and be complemented by a larger variety of new indicators that will help to monitor adequately all potential risks and therefore serve better the assessment and surveillance of the strengths and vulnerabilities in the banking sector.

Under the new framework for KRIs competent authorities shall submit data relating to own funds requirements, financial information, losses stemming from immovable property, large exposures, liquidity and leverage ratios as well as asset encumbrance.

The sample of banks expected to report ITS data on a quarterly basis will be expanded in a considerable way from the current 55 EU banks to around 200 EU banks. With a small sample of banks the options for building peer groups are limited and the statistical significance of any inference is also questionable. Furthermore, outliers and possible misreporting institutions can importantly affect the aggregate figures and entry/exit from the sample of – even few – reporting institutions (for instance due to Merger & Acquisitions) can have a significant impact on the computation of some indicators (for instance growth rates). In this context, a larger sample is expected to tackle one of the main shortcomings of the current set of KRIs which refers to the sample size. A larger sample should strengthen the possibilities to create different peer groups based on alternative criteria. Information would be richer and enable various sub-aggregations. More generally, larger samples provide more flexibility and possibility of benchmarking for risk analysis. This would also improve the feedback to national competent authorities, with the possibility to provide not only EU averages, but also figures for peer groups.

The remittance dates will be also further improved with the entry into force of the ITS. The EBA is expected to transmit preliminary data to the ECB's Directorate General Statistics, in line with the ECB's statistical support to the ESRB, t+42 business days after the reference quarter on a provisional basis, and a final data set at t+50 business days if there are revisions.[21]

All in all, the improvements in terms of harmonization, coverage, periodicity and timeliness that the new supervisory reporting may bring, is expected to enable a reduction in the reporting burden by using existing statistical outputs and extract the maximum possible analytical value from information already available.

Implementing Technical Standards (ITS) relating to supervisory reporting requirements. These draft ITS are part of the single rulebook ensuring regulatory harmonisation in Europe, with the specific aim of specifying uniform formats, frequencies, reporting dates, definitions and the IT solutions to be applied by credit institutions and investment firms in Europe for the submission of supervisory data required under the CRR. The reporting requirements set out in the ITS relate to own funds and own funds requirements, financial information, losses stemming from lending collateralised by immovable property, large exposures, leverage ratio and liquidity ratios. Institutions are required to comply with new CRR requirements as of 01.01.2014.

21 In the framework before the EBA's Implementing Technical Standards the KRIs were requested to be transmitted to support the ESRB in t+95 days after the reference quarter.

Conclusion and challenges ahead

The existing CBD collection framework is based on the Financial Reporting (FINREP) and the Common Reporting (COREP) guidelines, both issued by the Committee of European Banking Supervisors (CEBS), forerunner to the EBA.

With banks' supervisory reports based from 2014 onwards on the EBA's ITS, the current CBD framework needs to be adjusted. To this end, the ESCB Statistics Committee/Working Group on Monetary and Financial Statistics (WG MFS), the Financial Stability Committee/Macro prudential Analysis Group (MPAG) and the European Banking Authority (EBA) Standing Committee on Oversight and Practices (SCOP) established a Joint "Task Force on Consolidated Banking Data" to design and implement a revised CBD reporting scheme based on the ITS. At the same time, the opportunity is being taken to review the whole CBD scope and content in the light of possible new user needs over a medium term perspective, always ensuring that the reporting and compiling burden is further minimised through the re-use of supervisory returns.

The new CBD framework shall be in place in time for the data referring to end December 2014 and to be reported in spring 2015. Foremost amongst data users' expectations is that there will be an important improvement of cross-country comparability for key indicators and financial positions such as non-performing loans, provisions, risk-weighted assets ratio, and so on. The coming ITS is aiming at this and it is now up to the CBD to bridge the new reporting framework with the users 'requirements. Users are also looking forward to possibly increased granularity frequency of the CBD.

Annex – Overview of all Financial Soundness Indicators (Table 1a and 1b) and Key Risk Indicators (Table 2a and 2b) also available in CBD

Financial Soundness Indicators versus CBD measures — Table 1a

Core FSIs for Deposit Takers	Similar indicator published in/from the CBD
Regulatory Capital to Risk-Weighted Assets	Overall solvency ratio
Regulatory Tier 1 Capital to Risk-Weighted Assets	Tier 1 ratio
Non-performing Loans Net of Provisions to Capital	Net total doubtful and non-performing loans [% of total own funds for solvency purposes]
Non-performing Loans to Total Gross Loans	Gross total doubtful and non-performing loans [% of total debt instruments and total loans and advances][1]
Sectorial Distribution of Loans to Total Loans Residents Deposit-takers Central Bank Other Financial Corporations General Government Nonfinancial Corporations Other Domestic Sectors Non-residents	*No breakdown by sectorial counterpart is available in the CBD*
Return on Assets	Return on Assets [%][2]
Return on Equity	Return on Equity [%][2]
Interest Margin to Gross Income	Net interest income [% of total income]
Non-interest Expenses to Gross Income	Cost-to-income ratio [%]
Liquid Assets to Total Assets (Liquid Asset Ratio)	Banks' liquid assets ratio[3]
Liquid Assets to Short Term Liabilities	*No maturity information is available in the CBD*
Net Open Position in Foreign Exchange to Capital	*No information on foreign-currency-linked instruments in the CBD*

[1] NPLs under the CBD framework cover loans and debt securities. [2] Total profit (loss) after tax and discontinued operations is used for the CBD as numerator (can be before tax for the FSIs) . [3] The two categories of "liquid assets" used for the CBD-based indicator are (very similar to the FSI definition):
- Cash and cash balances with central banks
- Financial assets held for trading

Financial Soundness Indicators versus CBD measures

Table 1b

Encouraged FSIs for Deposit Takers	Similar indicator published in/from the CBD
Capital to Assets	Total equity [% of total assets]
Large Exposures to Capital Geographical Distribution of Loans to Total Loans Domestic Economy Advanced Economies, excluding China Other Emerging Market and Developing Countries, including China Africa Of which: Sub-Saharan Africa Central and Eastern Europe Commonwealth of Independent States and Mongolia Developing Asia, including China Middle East Western Hemisphere	*No counterpart information for the instruments issued by credit institutions is available in the CBD*
Gross Asset Position in Financial Derivatives to Capital	
Gross Liability Position in Financial Derivatives to Capital	
Trading Income to Total Income	Trading and foreign exchange results [% of total income]
Personnel Expenses to Non-interest Expenses	Staff expenses [% of total expenses]
Spread Between Reference Lending and Deposit Rates (Basis Points) Spread Between Highest and Lowest Interbank Rate (Basis Points)	*No information on interest rates in the CBD*
Customer Deposits to Total (Non-interbank) Loans	*Total deposits other than from credit institutions [% of total assets]* may be a proxy. The exact indicator could be however compiled taking the item *Total loans and advances* as the denominator.
Foreign-Currency-Denominated Loans to Total Loans Foreign-Currency-Denominated Liabilities to Total Liabilities	*No data on foreign currency in the CBD*
Net Open Position in Equities to Capital	*No information is collected directly on 1. on-balance-sheet holdings of equities and 2. notional positions in equity derivatives under the CBD framework.*

Key Risk Indicators versus CBD measures

Table 2a

Solvency Indicators	Similar indicator published in/from the CBD
Tier 1 capital ratio	Tier 1 ratio
Total capital ratio	Overall solvency ratio
Tier 1 ratio (excluding hybrid instruments) Credit risk capital requirements of total capital requirements Standardised approach capital requirements of total capital requirements Securitisation capital requirements of total capital requirements IRB approach capital requirements of total capital requirements Market risk capital requirements of total capital requirements Operational risk capital requirements of total capital requirements Settlement and delivery risk capital requirements of total capital requirements Other capital requirements of total capital requirements	*The exact indicators are not available. However, they could be compiled from the CBD templates.*

Credit Risk and Asset Quality Indicators	Similar indicator published in/from the CBD
Past due (>90 days) loans to total loans and advances	*The exact indicator is not available. However, it could be compiled from the CBD templates, using non-performing loans as a proxy.*
Impaired loans to total loans	Gross impaired loans and advances [% of carrying amount of loans and advances incl allowances]
Coverage ratio (specific allowances for loans to total gross impaired loans)	Gross impaired loans and advances [% of carrying amount of loans and advances incl allowances] – *nominator and denominator are switched in the CBD.*
Past due (>90 days) loans and debt instruments to total loans and debt instruments	*The exact indicator is not available. However, it could be compiled from the CBD templates, using non-performing loans as a proxy.*
Coverage ratio (specific allowances for loans and debt instruments to total gross impaired loans and debt instruments)	Gross impaired loans, debt instruments and loans and advances [% of carrying amount of debt instruments, loans and advances incl allowances] - *nominator and denominator are switched in the CBD.*
Coverage ratio (all allowances for loans and debt instruments to total gross impaired loans and debt instruments)	
Impaired financial assets to total assets	*The exact indicators are not available. However, they could be compiled from the CBD templates.*
Impaired debt instruments to total debt instruments	
Accumulated impairments on financial assets to total (gross) assets	
Impairments on financial assets to total operating income	

Key Risk Indicators versus CBD measures

Table 2b

Earning Risk Indicators	Similar indicator published in/from the CBD
Return on equity	Return on equity [%]
Return on regulatory capital requirements	*The exact indicator could be compiled.*
Cost-income ratio	Cost-to-income ratio [%]
Return on assets	Return on assets [%]
Net interest income to total operating income Net fee and commission income to total operating income Dividend income to total operating income Net realised gains (losses) on financial assets & liabilities not measured at fair value through profit and loss to total operating income Net gains on financial assets and liabilities held for trading to total operating income Net gains on financial assets and liabilities designated at fair value through profit or loss to total operating income Net other operating income to total operating income Net income to total operating income	*The exact indicators are not available. However, they could be compiled from the CBD templates.*

Balance Sheet Structure	Similar indicator published in/from the CBD
Loan-to-deposit ratio Customer deposits to total liabilities Tier 1 capital to (total assets - intangible assets) Debt securities to total liabilities Deposits from credit institutions to total liabilities Equity to total liabilities and equity Cash and trading assets to total assets Cash, trading, and AFS assets to total assets Financial assets held for trading to total assets Financial liabilities held for trading to total liabilities and equity Loans and advances (excl. Trading book) to total assets Debt-to-equity ratio Off-balance sheet items to total assets	*The exact indicators are not available. However, they could be compiled from the CBD templates.*

Growth rates (%) per annum	Similar indicator published in/from the CBD
Total assets Total loans Total customer deposits Total operating income Impairments on financial assets	*The exact indicators are not available. However, they could be compiled from the CBD templates.*
Past due (>90 days) loans and debt instruments; total gross impaired loans and debt instruments	*The exact indicator is not available. However, it could be compiled from the CBD templates, using non-performing loans as a proxy.*
Risk weighted assets	*The exact indicator is not available. However, it could be compiled from the CBD templates.*

References

Borgioli S., Gouveia A. and Labanca C. (2013), "Financial stability analysis: insights gained from consolidated banking data for the EU", *Occasional Paper Series, No. 140*, ECB, Frankfurt am Main, January.

Bürgi-Schmelz A. (2009), "Further statistical work in the light of the financial crisis both within the IMF and with other international agencies", *Conference paper*, IFC Bulletin No. 31, Durban, July.

Commission Implementing Regulation (EU) No 680/2014 of 16 April 2014 laying down implementing technical standards with regard to supervisory reporting of institutions according to Regulation (EU) No 575/2013 of the European Parliament and of the Council (OJ L 191, 28.6.2014, p.1).

European Central Bank (2013), *Banking Structures Report*, Frankfurt am Main, November.

Financial Soundness Indicators: Compilation Guide (March 2006), IMF, Washington.

San Jose A. and Georgiou A. (2008) *Financial soundness indicators (FSIs): framework and implementation*, Conference paper, IFC Bulletin No. 31, Basel, August.

Israel J-M., Sandars P., Schubert A., and Fischer B. (2013), "Statistics and Indicators for Financial Stability Analysis and Policy", *Occasional Paper Series*, No. 145, ECB, Frankfurt am Main, April.

Keunig S. (2009), "Statistical need emanating from the financial crisis and the ECB's initiatives for more comprehensive financial statistics", *Conference paper*, IFC Bulletin No. 31, Durban, July.

PricewaterhouseCoopers' website (2013), *IFRS pocket guide*, available at https://www.pwc.com/jm /en/assets/document/ifrs_pocket_guide_2013.pdf.

Price Transmission in the Unsecured Money Market

Edoardo Rainone[1]

Abstract

The price of money in the interbank market is a fundamental indicator of the smooth transmission of signal rates by the central bank. Public information plays an important role in this context, as central banks announce their signal rate and market rates are published daily. Nevertheless, according to the theoretical literature on OTC markets, private information may have an important role in a decentralized market. The diffusion of private information can thus generate prices that depend on the interbank network structure. In this paper we use an ad hoc (network) version of the spatial autoregressive model for assessing the presence of this mechanism in the euro unsecured money market. A wide time span including sovereign debt crises in the euro area is considered. We find that private information played a greater role during periods dominated by strong uncertainty.

Keywords: Interbank markets, money, spatial autoregressive models, trading networks, payment systems

JEL classification Codes: E52, E40, C21, G21, D40

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1. Introduction

Average rates in the unsecured money market and their volatility are key indicators for a large set of phenomena: financial tensions, market expectations and the cost of mortgages and loans to the real economy (the pass-through mechanism from market to banking rates). Some relevant market rates, like EONIA and EURIBOR in the Euro area, have a direct impact on lending and deposit rates, as shown in Gambacorta (2008) and other papers, determining the amount of households and firms' debts at variable rates. Furthermore banking rates are influenced by interest rate volatility, following the model by Ho and Saunders (1981). The mechanism investigated in this paper has relevant implications on both market rates and rates volatility, having thus indirect effects on micro and macro financial conditions of households and firms. Rates in money markets represent an important issue for central banks since uncontrolled market rates prevent a smooth rate transmission, which is one of its fundamental missions. Financial stability of the system may be threatened as well. In order to achieve this goal, central banks try to be fully conscious about all the factors impacting interbank market rates.

Prices are supposed to be mainly driven by *public information* in money markets. Central banks determine upper and lower bound for the cost of money and, collecting information from banks and publishing it, provide banks with market average rates in order to avoid information asymmetry and to smoothly transmit their signal rate.[2] Nevertheless, given the decentralized nature of this market, *private information* may play a relevant role as argued by a growing theoretical literature on OTC markets.

The process of trade can transmit some relevant information in a decentralized market characterized by asymmetric information (Wolinsky; 1990). The idea that prices contain information appears in Hayek (1945) and was deeply investigated by the literature on information transmission in rational expectation equilibrium (Grossman; 1981; Grossman and Stiglitz; 1980). Recently, Babus and Kondor (2013) propose a model characterized by information diffusion in OTC markets. In their model dealers have private information and each bilateral price partially aggregates the private information of other dealers, depending on the market network structure. They theoretically show how it is implied by decentralization and heterogeneous dealers' valuation on the exchanged asset. The authors also mention the fed funds market as an example. The econometric model proposed in this paper can be used to test for one of the empirical predictions of Babus and Kondor (2013) theoretical model, the latter can thus be taken as one of the possible microfoundations for our empirical specification.

This mechanism of diffusion implies that if a lender increases (decreases) her valuation about central bank money future value because of a random idiosyncratic shock, this will have an impact on prices of loans she agrees and, because of

[2] Here we are simplifying this process. Market rates are not always published by the central bank. They may be published by international non-profit making associations. In Europe, for instance, Euribor-EBF is in charge with this task, see http://www.euribor-ebf.eu/euribor-ebf-eu/about-us.html. A corridor is often used to place lower and upper bounds to market rates. Bounds are determined by marginal lending and overnight deposit rates, these are set by the central bank. Other instruments can be used in order to control market rates.

diffusion process, on prices of loans in which she is not involved. Observe that it generates a higher (lower) variation in the average price.[3] Coming back to the pass-through mechanism, if a shock on single price has a stronger impact on price average and variance because of transmission mechanism, it will have a stronger impact on the households and firms' debts as well. It implies that an increase in the price of an interbank loan will lead to a higher increase of the rate of loans to households and firms if a transmission mechanism is at work (ceteris paribus).

Moving to the empirical argument, the market rate and its variance, are the first and second moments of the rate distribution, which is composed by single rates. The rate of a loan has been usually modelled as a function of lender and borrower's characteristics and aggregate conditions. Nevertheless, the unsecured money market is known to be a *decentralized* one, thus formed by bilateral relationships. This set of interbank relationships generates a network.

Given the relational nature of these loans and following the theoretical literature on OTC markets, we want to test for a cross-sectional dependence among rates implied by private information diffusion. The network nature of this market makes this task easier since, if micro-data is available, the structure of this dependence can be exactly traced. The spatial econometrics literature has developed a large set of models to formalize this dependence and it recently focused on networks (Lee; 2007; Lee et al.; 2010; Liu and Lee; 2010). Conceptually, this cross-sectional dependence can be seen as a consequence of the process of private information diffusion in the interbank network, according to Babus and Kondor (2013).[4]

This paper empirically explores the informational role of prices in the Euro unsecured money market. The nature of the exchanges' network is used for exploiting the diffusion of private information. Suppose that bank i trades with bank j and bank j trades with bank k, then the prices of these two loans are connected. The diffusion of private information is measured by network-based spillover effects among connected prices. We rigorously test this hypothesis, estimate the magnitude of this effect in the Euro unsecured money market and its evolution over time. Network theory and a rearranged spatial econometric toolkit are, respectively,

[3] Here, the behavioral mechanism can be synthesized as follows: when a bank has to evaluate the expected price of a loan, it can be influenced by prices experienced in other loans (in addition to its own characteristics, counterpart's characteristics and liquidity conditions of the system). Prices experienced represent the private signals coming from other banks and reflect a mixture of their expectations. Note that here we used the term "expectation". If we think about the bank's production function in the money market, it is characterized by a "lag" (the final outcome comes out at the end of a maintenance period). It naturally implies the presence of expectations about the future value of central bank money. Note also that the process of expectations' formation about prices is typically conceived as based on time-lags (Muth; 1961; Nerlove; 1958). What we are hypothesizing here, is that it may be based on network-lags.

[4] Rates reflect the expectation of market operators, thus a cross-sectional dependence of rates, after having controlled for counterparts characteristics and aggregate conditions, may indicate a diffusion of expectations. Single rates can be observed only by the respective counterparts, so that they represent a piece of *private information* about the cost of money, contrasting the *public information* provided by market rates, i.e. the average of rates. Each bank can see its experienced prices and the market average, thus they respectively play the role of private and public information. Other definitions of private information can be conceived. Given that price is the outcome of interest here, this specification seems to be the most appropriate.

used to formalize the local diffusion in prices and to identify and estimate the spillover effects.

The dataset used consists of loans detected with the Furfine algorithm (with maturities from one day up to one year) implemented on Target2 data (Arciero et al.; 2013). Loans are then matched with lender and borrower characteristics.[5] This large set of information allows us to distinguish a price variation due to a change in bank's economic outlook from one generated by an impulse coming from *connected* prices. We consider a wide time period, as it enables us to study also time series of spillover intensity.

Summing up, the main contribution of this paper is to examine a novel banks' behavioral mechanism and to test for it. This suggests a different perspective from which money market dynamics can be studied and provides a new tool for measuring market tensions. It translates into an additional explicative variable when price is modeled. A consistent methodology for estimating this (endogenous) variable is proposed, using an *ad hoc* spatial autoregressive model.

The main empirical findings are the following: *(i)* information diffusion is relevant only when there are market tensions and high uncertainty, *(ii)* diffusion flows in multiple directions through the interbank network, lenders are influenced by the price they experience as borrowers and borrowers are influenced by the price they experience as lenders.

The rest of the paper is organized as follows. Section 2 outline the link between the conceptual framework and the econometric setup, Section 3 provides preliminary evidence and the basic ingredients of the analytical framework. Section 4 describes the econometric model and discusses the issues related to the consistent estimation of the spillover effects. Section 5 presents the results of the application of the econometric model on the Euro unsecured money market estimated by the application of Furfine algorithm on Target2 data. Section 6 discusses the transmission mechanism, Section 7 concludes.

2. Conceptual Framework and Econometric setup

Suppose that the market is composed by n banks that trade bilaterally an asset (central bank money) and they are uncertain about its market value.[6] Assume that each bank receives a private signal about the value, it implies that the information on the price of a unit of money, I, can be split in two components for each bank i, I_M and I_i, respectively *public* and *private* information. Note that this setting is the same of Babus and Kondor (2013), thus we can set bank i's valuation as $\theta_i = \theta + \eta_i$, where

[5] Furfine algorithm is used to detect loans from a set of payments. By definition a loan consists of two payments, the first equal to l and the second equal to l(1 + i), where i is the interest rate. The algorithm matches those two legs, see Furfine (1999) for more details. The procedure is described in Arciero et al. (2013). See Armantier and Copeland (2012) for an assessment of the quality of Furfine-based algorithms. Target2 is the European RTGS Payment System. Banks characteristics come from Bankscope.

[6] Note that, given that bank's production function in the money market is characterized by a "lag" (the final outcome realizes at the end of a maintenance period), it naturally implies the presence of valuations about the value of central bank money.

θ is the common component which represents *public* information while η_i is the individual one which reflects *private* information. It implicitly implies that there is heterogeneity in banks' valuation. As an example, we can have that $\theta = n(\overline{p}_{k\in K}; \psi)$, where K is a set of lags and ψ is a set of parameters, it implies that the public component is a function of market rates observed in the past. As an alternative, we can suppose that the term structure of interest rates is used for computing $\boldsymbol{\theta} = b(\overline{p}^m, m \in M; \iota)$, where M is a set of maturities and ι is a set of parameters (Alonzo et al.; 1994; Shiller and McCulloch; 1987). Observe that we can assume that both are considered in θ.[7]

Bilateral trading and heterogeneity in valuations imply price dispersion and transmission of information. According with Babus and Kondor (2013), each price thus partially incorporates private signals of market participants. It also implies that if agent j trades with agent k then p_{jk} may affect p_{ij}. Indeed, the residual inverse demand function of dealer i in a transaction with dealer j in their model is a function of other prices.[8]

Suppose now that the price of a loan which has b as a borrower and l as a lender is also a function of lender and borrower characteristics. We thus have $p_{bl} = f(c_{bl}(P), x_b, x_l, E_{bl}, \chi)$, where χ is a set of parameters, E_{bl} is a random component, P is a vector containing all the prices in the market, $c_{bl}(\bullet)$ is a loan-specific function which includes prices that are connected with p_{bl}, x_b and x_l are borrower and lender characteristics respectively. If we assume linearity we thus have that $p_{bl} = \alpha + \beta c_{bl}(P) + \gamma x_b + \mu x_l + E_{bl}$, with $\chi = (\alpha, \beta, \gamma, \mu)$.

In other words, each price starts from a "baseline" price, α, determined by market-wide expectations (which captures θ, the common component which represents *public* information), then spreads depending on counterparts' characteristic (x_b, x_l) are added (for instance a risky borrower should be priced accordingly to its probability of default) and finally a set of other prices ($c_{bl}(P)$) play a role in determining the agreed (observed) price, capturing the diffusion of private information via prices.

Observe that, according to this specification, if only public information matters, i.e. $\theta_i = \theta$, the price equation reduces to $p_{bl} = \alpha + \gamma x_b + \mu x_l + E_{bl}$, thus a formal test for the presence and diffusion of private information consists in estimating the full model and checking whether we would reject the null $\beta = 0$. If private information matters, i.e. $\eta_i \neq 0$, β will be significantly different from zero.

3. Preliminary Evidence

Price volatility in the Euro unsecured money market (hereafter UMM) estimated by Furfine algorithm shows significant time-variation. Panel (a) of Figure 1 depicts the variance of price across loans with maturities from overnight to three days agreed in

[7] Note that we are assuming separability, thus each bank elaborates in the same way the common information available. This assumption can be relaxed, but here is useful for the sake of simplicity.

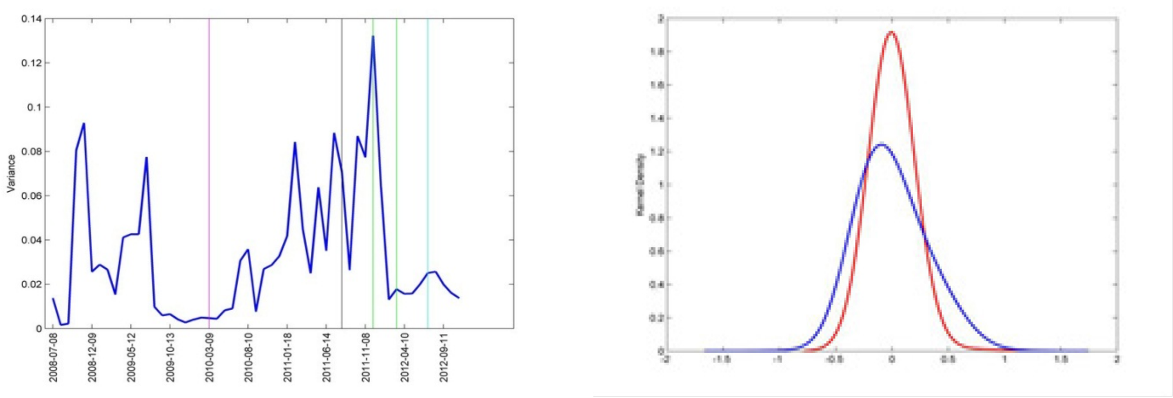
[8] They also show that p_{ij} can be represented as a function of posterior beliefs of i and j, which in turn are shaped by prices privately observed by i and j.

each maintenance period. We can see that it remarkably increased after Lehman, first and second Sovereign Crises (hereafter FC and SC), and drastically decreased after ECB intervention by 2011 LTRO.[9] During these crises the credit default swap of hit countries dramatically increased, the default risk of banks belonging those countries increased as well. It produced big uncertainty in the interbank money market. Furthermore, the expectations about the reaction of ECB dispersed until the LTRO took place, generating an additional source of uncertainty in the interbank money market. If we take two maintenance periods, the first from 2010-01-20 to 2010-02-09 (before FC) and the second from 2011-07-13 to 2011-08-09 (after SC), we can see from panel (b) of Figure 1 that the density changes dramatically. The price dispersion has notably increased in the second period.

Price Variance

Figure 1

(a) Time Evolution | (b) Density Change



Panel (a): violet vertical line traces first Sovereign crises, black vertical line traces second Sovereign crises, green lines trace LTROs and azure line traces signal rate change in July 2012. Maintenance periods are considered. Panel (b): kernel density of prices centered to zero. Bandwidth = 0.2, kernel = Normal. Red line: distribution of prices during the maintenance period from 2010-01-20 to 2010-02-09, blue line: distribution of prices during the maintenance period from 2011-07-13 to 2011-08-09.

The main reason behind this change is the generalized increase in perceived risk by treasurers. An additional source of variation might be the propagation of changes in agents' expectations. Agents show updated expectations by changing their reference prices, thus sending signals to other agents. If this mechanism is at work, we should see a higher variance for *connected* prices during *hot periods* since they are contracts characterized by agents which receive more signals.[10] Panel (a) of Figure 2 shows the variance computed for *connected* and *unconnected* prices, the variance among connected prices is usually higher than the one computed for unconnected (it happens roughly 80 percent of total observations), apparently confirming the intuition. Connectedness can also act as a valid support for searching (and even finding) lower prices, panel (b) of Figure 2 depicts the average price for the two subsamples previously defined. It highlights that connected prices are on

9 The first Sovereign crises was in April 2010 and hit Ireland, Greece and Portugal, while the second Sovereign crises was in August 2011 and hit Italy and Spain.

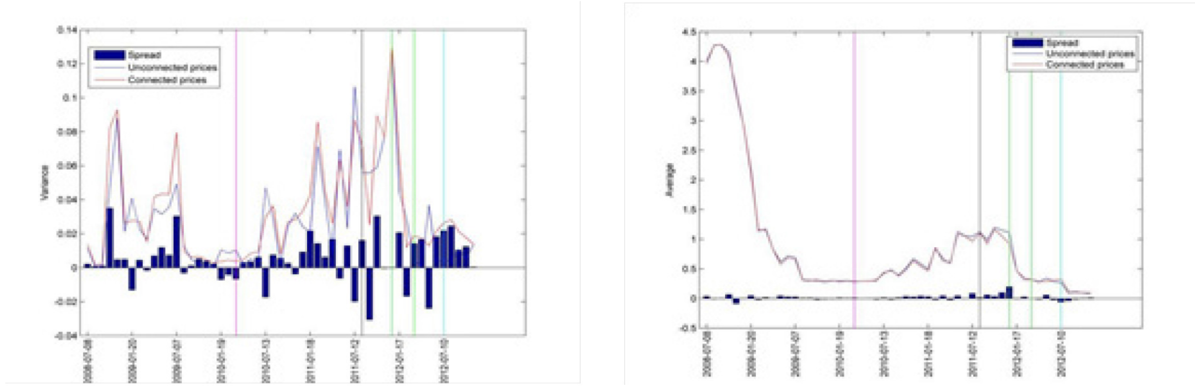
10 A price of a loan is *connected* whether it has its borrower or lender shared with other loans.

average lower than unconnected ones, the spread starts to be significant after the FC and approaches to zero after 2011 LTRO.[11] The rest of the paper is based on the subsample of connected price.

Connected vs Unconnected Spreads

Figure 2

(a) Volatility | (b) Price Density Change



Violet vertical line traces first Sovereign crises, black vertical line traces second Sovereign crises, green lines trace LTROs and azure line traces signal rate change in July 2012.

The question does the prices' volatility have a network nature? In other words: is it likely that "neighbors" prices are more similar? Or from a distributional perspective: If we draw two similar prices how likely is that they are neighbors? Here the main idea is that the prices' positions in the money market network may be relevant in explaining the aggregate dispersion, consequently the experienced prices influence the bargained price of a contract. This price is couple-specific to the banks, and represents a deviation from the average market rate that is a common piece of information available to everyone because it is published daily in the European market. Suppose that an idiosyncratic shock strikes a bank, given the network nature of these exchanges – if this mechanism is found to take place – we should observe a propagation of this shock through the network. Testing for this mechanism may be quite important for understanding the money market dynamics and correctly interpreting its evolution over time.

3.1 Payment System Data and Furfine Algorithm

The data used in this paper come from Target2 (hereafter T2), the European RTGS (Real Time Gross Settlement) Payment System.[12] T2 allows banks operating in European central bank money (hereafter ECBM) to settle large value payments on their accounts. The reserve requirement (hereafter RR) is managed on these accounts too, so participating banks have to exchange money in T2 for

[11] From Figure 2 we can also observe a sharp decrease of interbank rates after 2011 LTRO. Bech and Klee (2011) develop a model to explain this phenomenon.

[12] For more information about Target2 see http://www.ecb.europa.eu/paym/t2/html/index.en.html.

accomplishing RR.[13] The Market for ECBM is thus generated by RR and has T2 as a designed support. Several types of markets settle in T2, according to their nature. The main sources of liquidity for a bank are basically three: central bank, secured money market, and UMM.[14] The focus of this paper is on the third source. The UMM transactions can be settled basically in two ways. First, through Ancillary Systems,[15] which make easy to detect loans among banks. Second, the two legs (the loan and its pay back) can be freely sent through T2 without labeling. In the second scenario UMM is confounded with other types of payments, making more challenging to identify loans. Furfine (1999) argued that matching these two legs is a way for identifying them. Arciero et al. (2013) applied this criterion on payments settled in T2, augmenting the maturity spectrum up to one year.[16] The starting point of this paper is consequently the Money Market Database generated by Arciero et al. (2013) where information about prices of unsecured ECBM loans are provided for maturities from overnight up to one year. The time span considered here is from June 2008 to the end of 2012.[17] The very basic time unit considered here is the maintenance period (hereafter MP),[18] it has at least two big advantages compared with other choices. Firstly an economical and statistical reason, banks are constrained to have an average amount of ECBM in their T2 account taking MP as time interval, thus it makes MP as a natural candidate for money market analysis. Statistically it makes comparable different MPs. Hamilton (1996) and Prati et al. (2003) showed that days are not comparable since the position of day in MP makes the market conditions completely different depending on its distance to the end of MP. The second, more operational, reason is its practicality when considering a large time interval.

3.2 Network of Prices

Suppose that bank i trades with bank j and bank j trades with bank k, we want to address the following question: to what extent does the price of the loan of bank i to bank j *affect* the price of the loan of bank j to bank k (Figure 3)?

[13] Many types of payments are actually settled in T2, here a short list: Customer Payments, Securities Systems Payments, Open Market Operations, Treasury Bonds issues. This should give an idea of the importance of this system and its centrality in a bank's liquidity management perspective.

[14] Of course the list can be largely expanded, intra-group transfers are an example. Here I will not deepen this argument since is out of the scope of this paper.

[15] An Ancillary System is connected and send payments instructions to T2, operating upon banks' accounts. Payments coming from an Ancillary System can be labelled and isolated. e-MID is an example of ancillary system.

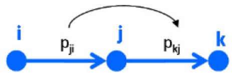
[16] Their paper contains detailed information about the algorithm and its practical implementation in T2. I will not deepen the algorithm's details since is out of paper's scope. In Arciero et al. (2013) the database is based on settler banks, since final agents information was not available at that time. The 3CB recently made this information available and then let the same authors run the algorithm with this new information and make it possible to have the database used in this analysis. 3CB are the three central banks, Banca d'Italia, Banque de France and Deutsche Bundesbank, which provide T2 as a service. I am grateful to both Arciero et al. (2013) and 3CB for providing this essential information, making this paper and a wider investigation possible.

[17] T2 starting date was 19 November 2008. The analysis is limited to the end of 2012. The database is up to date so that the analysis can be updated.

[18] See http://www.ecb.europa.eu/home/glossary/html/act4m.en.html#226 for details.

Connection between two prices

Figure 3



In order to answer it, it is useful to move from the *banks' network* to the *prices' network*, in order to verify if a spillover exists. In network analysis the units are usually the nodes and the spillover is measured considering the adjacency matrix,[19] here we have substantially inverted the role of these two sets of elements, the units being the arcs (the adjacency entries) and the spillover measured through an *arcs' adjacency* where nodes have the role of connectors among arcs. More formally let C be the set of active banks in the UMM, for the sake of simplicity suppose it is referred to a specific maturity m and time t, two banks are connected if a loan of maturity m is agreed at time t. Let P be the matrix which keeps track of these connections, where the element p_{ij} is equal to the price of the loan if bank j lending to bank i, where $i, j \in C$, zero otherwise.[20] Note that it is a directed weighted adjacency matrix among banks. Following the criterion specified above two prices, $p_o = p_{ij}$ and $p_q = p_{lk}$, are connected if $i = k$, in other words if the borrower of o coincides with the lender of q. In this way the connections among prices can be traced with a *arcs' adjacency matrix* A, where the element a_{qo} is equal to one if price o influences price q, zero otherwise. Observe that this criterion of connectivity is set by the econometrician and is a subjective choice.

3.3 Assessing Network's Role

For a preliminary response to our main questions, Moran's I, a popular index in Economic Geography, can be helpful. This statistic is commonly used to assess whether adjacent units are more likely to be similar (Moran; 1950). In spatial analysis this test is used to find a preliminary evidence of spillover among units for a certain economic outcome and to check residuals' spatial-correlation after a regression analysis. Here we consider a maximum distance of 10 in order to assess the length of the radius for a possible spillover.[21] We computed the statistic for five ranges of maturities: (i) from one to three days, (ii) from four to ten days, (iii) from eleven days to one month, (iv) from one month to three months and (v) from three month to one year. For the maturities from one to three days (Figure 4) the network transmission of prices doesn't seem to be constant over time, Moran's I is particularly high in two hot periods, the second quarter of 2010 and the third quarter of 2011. One can note that these two periods coincide with the peaks of market tensions deriving from the strong increase of Sovereigns' spreads. In 2011 the index reaches its maximum. Moran's I decreases with the distance among prices,

19 The adjacency matrix keeps track of connections among nodes, it represents a graph in a matrix form.

20 Given that MP is considered as time interval, the average price of loans from i to j is considered in this analysis.

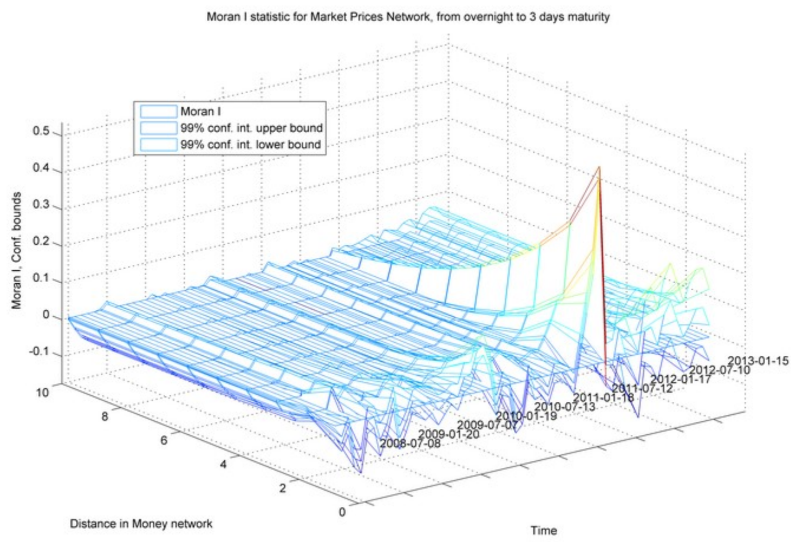
21 It operationally means that we set to 10 the maximum length of a path in the network. Increasing the maximum distance does not provide additional information.

it is typical in a process of diffusion, but for some periods it doesn't converge to zero when the distance increases.[22]

Anselin (1996) interpreted Moran's I as a regression coefficient in a regression of $A^d_{m,t}P_{m,t}$ on $P_{m,t}$, but it must be noted that Moran's I is not a consistent estimator of spillover effects, consequently it can't be stated that the transmission in prices network in the third quarter of 2011 is higher than the one in the second quarter of 2010, it simply tests the existence of spillover effects. In order to estimate the magnitude of the latter we need to employ a different approach. Note also that a price depends on lender and borrowers characteristics, if an assortative (dissortative) matching takes place in UMM the statistical significance of Moran's I may be driven by banks covariates.[23]

Moran's I Statistic for maturities from one to three days, computed for distances from 1 to 10

Figure 4



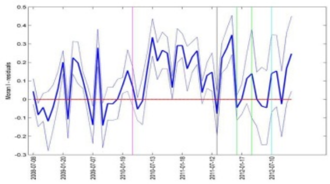
The focus has been on maturities from overnight to three days so far. Given the augmentation of maturities in Arciero et al. (2013) we can split loans in several maturities' intervals. Another interesting point is that the Moran's I is less likely to be significantly different from zero as the maturity increases (Figure 5). As we can see the index signals a high network-correlation up to one month maturities. The period between FC and SC seems to be the more interested by high price transmission for maturities from four days to one month. Maturities longer than one month seem to be less impacted by price transmission, even though maturities from one to three months seem to be impacted during the SC and maturities over three

22 This may indicate the presence of cycles in chains of loans.

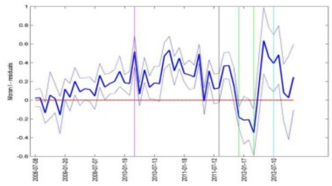
23 If assortative matching is at work, banks which are similar to each other tend to connect; dissortative means exactly the contrary. If banks connected with an assortative matching during FC and SC and the price was a function of the same characteristics that drive the link formation process, the higher Moran's I would just reflect this change in matching process.

months during the FC. From this preliminary evidence it seems that short maturities' prices are more sensitive to the network nature of the market while for long ones the bargained prices do not depend strongly on their neighbors. Standard errors are larger for maturities longer than three days, the reason why is that the relative networks are much sparser, highlighting a thin market. The low market thickness and consequently network density precludes a robust estimation of price transmission as well, paths longer than length 2 are few and, as we will see in the next section, sound instrumental variables are difficult to find. This is the reason why we will mainly focus on short maturities (up to three days) in this paper.[24]

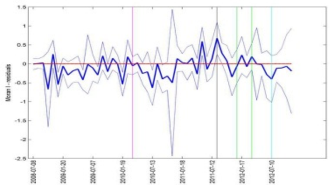
Moran's I Statistic for longer maturities, computed for distances 1 — Figure 5



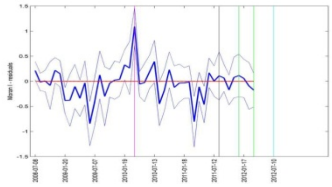
(a) from four to ten days



(b) from eleven days to one month



(c) from one month to three months



(d) from three month to one year

Violet vertical line traces first Sovereign crises, black vertical line traces second Sovereign crises, green lines trace LTROs and azure line traces signal rate change in July 2012.

4. Econometric Model

As stated before, Moran's I offers evidence of spillover effects, but this index can't account for the matching process and the omitted variables problem. Furthermore it is not a consistent estimator of spillover effects, and, for this reason, we have to deal with these issues using different tools.

In this framework the basic unit is the price of a contract, as explained in Section 3.2. Modeling outcomes of arcs instead of outcomes of nodes is not common in the network and spatial econometric literature. Here the switch is useful since we are not interested in a node specific characteristic, prices are bilateral by definition, so that they are *couple-specific*. This makes difficult to think about an outcome that is *node-specific*, the best way of measuring network transmission seems to take arcs (prices) as basic unit.

[24] The network sparseness can be mitigated by enlarging the number of banks for which covariates are available. Efforts along this way are still an object of our interest.

Martinez and Leon (2014) take the weighted average price (as a borrower) as outcome of a node and the row-normalized matrix of exchanged volumes as network which spillover passes through. This approach may be problematic because of an in-built correlation induced between the outcome and its spatial lag. Preventing this issue requires one to take prices (arcs) as the unit of analysis and consider their adjacency matrix.

4.1 Including Banks' Characteristics

If banks' characteristics should be the main driver of loan's price deviation from the public signal (EONIA), as shown in Angelini et al. (2011) and Afonso et al. (2011), then it is important to include them when explaining the price variations among different loans. Furthermore, if the matching process between lender and borrower is driven by those characteristics, the interaction of these two factors may create an *apparent* network transmission of prices driven by omitted variables. Controlling for banks' covariates is fundamental in assessing the presence and magnitude of spillover in prices. For instance we can find an high network correlation among prices, looking at Moran's I statistic, simply because similar banks are used to lend each other, cleaning up this source of variation is necessary to understand whether a price's deviation is purely influenced by adjacent prices' deviations from the average market price. Suppose we want to estimate the effect of adjacent prices on price, in matrix form we have

$$\bar{P}_{m,t} = \alpha_{m,t}\iota + \varphi_{m,t}A_{m,t}\bar{P}_{m,t} + E^*_{m,t},$$

where $\bar{P}_{m,t}$ is the vector of connected prices, $A_{m,t}$ is the row-normalized prices' adjacency matrix and $E^*_{m,t}$ is the error component, $\alpha_{m,t}$ is a constant and $\boldsymbol{\iota}$ is a $N_{m,t}$ vector of ones, all evaluated for maturity m at time t.[25] The term $\alpha_{m,t}$ captures the general market conditions for maturity m at time t. If lender and borrower's characteristics matter in price determination, suppose linearly, the OLS estimate of $\varphi_{m,t}$ may be not consistent because of omitting variables problem, given the elements included in the error term. If $[x_{b,m,t}, x_{l,m,t}]$ is correlated with $\sum_q a_{oq,m,t}$ $p_{q,m,t}$ inconsistency occurs, note that in this framework it is may be true since two prices are neighbors if the borrower of one coincides with the lender of the other. The bias is evidently different from zero if $corr(a_{oq,m,t}p_{q,m,t}, x_{b,m,t}) \neq 0$ or $corr(a_{oq,m,t}p_{q,m,t}, x_{l,m,t}) \neq 0$, it occurs if $a_{oq,m,t} = f(x_{b,m,t}, x_{l,m,t})$ and $f(\bullet)$ allows for such correlation. In other words, if the link formation process is driven by banks characteristics, then bias is non-zero, which demonstrates the necessity of including covariates in this framework. We include this information with data available from Bankscope, balance sheet variables and country dummies are considered here. The econometric model expressed in matrix form is thus the following

$$\bar{P}_{m,t} = \alpha_{m,t}\iota + \varphi_{m,t}A_{m,t}\bar{P}_{m,t} + \beta_{B,m,t}X_{B,m,t} + \beta_{L,m,t}X_{L,m,t} + E_{m,t}, \qquad (1)$$

[25] Row normalizing $A_{m,t}$ means that we are looking at the effect of the average neighbor prices. It evidently makes more sense than considering the non row-normalized adjacency matrix in this context, because the latter produces a sum (instead of an average) of neighbor prices and it is not a meaningful statistic for price setting.

where $X_{B,m,t}$ and $X_{L,m,t}$ are two $N_{m,t} \times K$ matrices collecting respectively the lenders and borrowers' characteristics for each loan observed,[26] $E_{m,t}$ is an error term i.i.d normally distributed with zero mean and variance $\sigma_{um,t}$. Observe that equation (1) is basically one of the possible empirical counterparts of the price equation outlined in Section 2.[27]

4.2 Accounting for Endogeneity

Another issue occurs when we want to estimate equation (1), the simultaneity. If each price depends on the others, simultaneity characterizes the set of individual equations. In this context we have to account for possible endogeneity of $A_{m,t}\bar{P}_{m,t}$, as usual in network models, see Lee et al. (2010), Kelejian and Prucha (2004) and Kelejian and Prucha (1998) for a detailed discussion. This step is a fundamental one, because we can be completely misled by OLS estimation if it is inconsistent. The simultaneity of equations in model (1) creates an intrinsic endogeneity likelihood if

$E[(A_{m,t}\bar{P}_{m,t})' E_{m,t}] = E[(A_{m,t}(I - \varphi_{m,t}A_{m,t})^{-1} (\alpha_{m,t}\iota + \beta_B X_{B,m,t} + \beta_L X_{L,m,t} + E_{m,t}))' E_{m,t}] \neq 0,$

from the reduced form of equation (1) we have

$\bar{P}_{m,t} = (I - \varphi_{m,t}A_{m,t})^{-1}(\alpha_{m,t}\iota + \beta_{B,m,t}X_{B,m,t} + \beta_{L,m,t}X_{L,m,t} + E_{m,t}).$

The last inequality holds if

$E[(A_{m,t}(I - \varphi_{m,t}A_{m,t})^{-1} E_{m,t})' E_{m,t}] = \sigma^2_{Em,t}\, tr(A_{m,t}(I - \varphi_{m,t}A_{m,t})^{-1}) \neq 0.$

Note that endogeneity is basically determined by the structure of the observed network, represented by $A_{m,t}$. The literature of network econometrics deeply investigated several methods to treat the endogeneity created by these simultaneous equations, Kelejian and Prucha (1999) and Liu and Lee (2010) propose a GMM approach, Lee (2004) used a Quasi-Maximum Likelihood Estimator. In this paper we use an instrumental variable approach, following Lee et al. (2010), Lee (2007) and Kelejian and Prucha (1998), the IVs are substantially "network embedded", in other words the network topology is used to create IVs which are correlated with the variables to be instrumented, being independent from the error term.[28] The expected value of the endogenous variable, $E(A_{m,t}\bar{P}_{m,t})$, meets these two conditions. Taking advantage of the reduced form, the theoretical best IV is thus derived as

$$TIV_{m,t} = E(A_{m,t}\bar{P}_{m,t}) = E[A_{m,t}(I - \varphi_{m,t}A_{m,t})^{-1} (\alpha_{m,t}\iota + \beta_B X_{B,m,t} + \beta_L X_{L,m,t})], \quad (2)$$

since $E((I - \varphi_{m,t}A_{m,t})^{-1} E_{m,t}) = 0$. Given that the parameters in equation (2) are unknown, $TIV_{m,t}$ is unfeasible. Assuming $|\varphi_{m,t}| < 1$,[29] the term $(I - \varphi_{m,t}A_{m,t})^{-1}$ is an

26 Note that in this framework a bank can be represented many times in both these two matrices, depending on its activity in the UMM.

27 Here we set $c_i(p_{t\_l,l \in L}) = A_o P$

28 2SLS estimation is faster and, consequently, more convenient when a multiple repeated cross section data is analysed.

29 This is a necessary condition for the invertibility of $(I - \varphi_{m,t}A_{m,t})$, it also determines the parameter space for spillover effects.

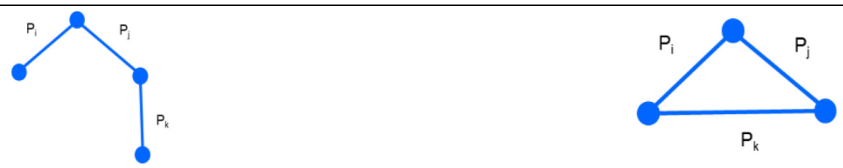
infinite sum of elements $\Sigma_{k=0}^{\infty}\varphi_{m,t}^{k}A_{m,t}^{k}$. A linear approximation of vectors appearing in equation (2) can thus be used for the empirical IV, in practice we use a second order approximation

$EIV_{m,t} = [A_{m,t}[X_{B,m,t}, X_{L,m,t}], A^2_{m,t}[X_{B,m,t}, X_{L,m,t}]]$

Identification is guaranteed if $(A_{m,t}\bar{P}_{m,t}, \iota, X_{B,m,t}, X_{L,m,t})$ has full column rank, it can be shown that if $(\iota, X_{B,m,t}, X_{L,m,t})$ has full column rank and $I_{m,t}$, $A_{m,t}$ and $A^2_{m,t}$ are linear independent this condition is met (Bramoulle' et al.; 2009). In other words, the network must not be composed by transitive triads. A transitive triad is composed by three loans, say *i*, j and *k*, which are fully connected. Each loan is connected with the other two. If a network is composed only by transitive triads (Figure 6, panel (b)), then $I_{m,t}$, $A_{m,t}$ and $A^2_{m,t}$ are linear dependent. The intuition is as follows, if we use the exogenous characteristics of loan *k* as an instrument for the price of loan *j*, when the price of loan *i* is the dependent variable, we have no exclusion restriction if loan *k* is connected with loan *i*. The interbank unsecured money market network meets this condition in almost every maintenance period considered in this analysis.

Network structure and identification

Figure 6

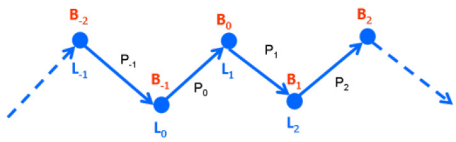


(a) Intransitive triad (b) Transitive triad

In this context, which has arcs as units and nodes as connectors, we are constrained to use only a *one side* IV because of collinearity issues. Let us make a simple example, suppose we want to evaluate the effect of p_1 on p_2 in Figure 7. We can't use $[B_0, L_0]$, where L_0 are the characteristics of lender and B_0 are the characteristics of borrower of loan with price p_0 as IV, because $B_0 = L_1$ and it implies a not full rank matrix of instruments. Consequently only L_0, L_1, ... can be used in the *IV chain*, which is thus extended only on the lender side, when the optimal IV is approximated.

Instrumental variables' chain

Figure 7



Consequently the applied IV in this context is the following

$AIV_{m,t} = [A_{m,t}X_{L,m,t}, A^2_{m,t} X_{L,m,t}]$.

Note that this approach must be used in every application in which flows or interactions between nodes are modeled including spillover effects and nodes characteristics. The estimation of parameters using this approach is consequently

$\hat{\theta}_{m,t,2SLS} = (Z' P_Q Z)^{-1}(Z' P_Q Z),$

where $Z = [\iota, A_{m,t}\bar{P}_{m,t}, X_{B,m,t}, X_{L,m,t}]$, $P_Q = Q(Q'Q)^{-1}Q'$, $Q = [\iota, AIV_{m,t}, X_{B,m,t}, X_{L,m,t}]$ and $\hat{\theta}_{m,t,2SLS} = [\hat{\alpha}_{m,t,2SLS}, \hat{\varphi}_{m,t,2SLS}, \hat{\beta}_{B\,m,t,2SLS}, \hat{\beta}_{L\,m,t,2SLS}]$.

5. Empirical Analysis

Given the wide time span and the large volume of trades, we can estimate a regression for each time (maintenance period) and evaluate all the parameters for each time observation, being able to keep track of time patterns in spillover effects. In this section we will focus on overnight to three days maturities.[30] In the empirical analysis both OLS and 2SLS are performed for each time observation (MP). The OLS estimate of $\varphi_{m,t}$ in model (1) are reported in the first row panels of Figure 8, while 2SLS estimate are plotted in the second row. The baseline model is estimated in the first column-panels, model (1) is augmented with the lender network-lag (i.e. $AX_{L,m,t}$) in the second column-panels.[31]

The characteristics included in the model are the balance sheet variables and country dummies. *Total assets* expressed in millions of Euros captures the dimension of each bank. Balance sheet items are included as percentages of total assets. On the asset side *Loans, Fixed Assets* and *Non-Earning Assets* are included.[32] On the liabilities side *Deposits and Short term funding, Other interest bearing liabilities, Other Reserves* and *Equity* are included.[33] Country dummies are included as well: Italy, France, Spain, Netherlands, Greece, Ireland, United Kingdom, Austria, Portugal, Luxembourg, Cyprus, Switzerland, Finland and Belgium have a specific dummy. Other European countries are grouped in one dummy as well as US, Japan and other non-European countries. Results of the empirical analysis are represented in Figure (8).

The first emerging evidence is that the price transmission is not constant through the time span considered, and estimates of $\varphi_{m,t}$ are not significantly different from zero for each MP considered (panel (c) and (d) of Figure 8). Price transmission becomes relevant after the big crises that characterize the time interval, i.e. the FC and SC. The higher risk perceived by treasures after these macro shocks seemed to increase attention to market signals and price transmission as well.

The second interesting point is that the estimation results using a 2SLS estimation with $AIV_{m,t}$ as instrument do not change drastically qualitative conclusions derived from the OLS estimation, in fact $\hat{\varphi}_{m,t,OLS}$ and $\hat{\varphi}_{m,t,2SLS}$ are quite

[30] As mentioned before, we can potentially analyse several maturities. The reason behind this choice is that the number of loans is very sparse for maturities higher than one week in time interval under analysis. The small sample size may lead to bad inference.

[31] In this model the set of instrument is augmented as well $AIV_{m,t} = [A_{m,t}X_{L,m,t}, A^2_{m,t}X_{L,m,t}, A^3_{m,t}X_{L,m,t}]$

[32] *Other Earning Assets* are dropped because of collinearity.

[33] *Loan Loss Reserves* and *Other (Non-Interest bearing)* are dropped.

similar as can be noticed from panel (a)–(d) of Figure 8, even if point estimates are different and OLS shows a small bias. The closeness between OLS and 2SLS is due to the particular topology of the UMM network, as stated before the endogeneity problem is generated by the observed network's topology. In particular it is generated by *circularity*, Figure 9 shows a simple example of it. More specifically, the higher is the number of cycles in the network the higher is the circularity, the more relevant is the endogeneity issue.

As we can see in the third row-panels of Figure 8, where the time series of $tr(A_{m,t}(I - \hat{\varphi}_{m,t,2SLS} A_{m,t})^{-1}$ and $\hat{\sigma}_{m,t,2SLS}\, tr(A_{m,t}(I - \hat{\varphi}_{m,t,2SLS} A_{m,t})^{-1})$ are plotted, the level of circularity is quite low in the Unsecured Money Market (see Figure 9), consequently the OLS bias is not huge in most of the cases.

Another interesting aspect is that the sparseness of UMM network after the LTROs generates a very large increase in estimated standard errors for both OLS and 2SLS, thus price transmission assessment after April 2012 is not reliable.

The last interesting fact is that including the lender's characteristics of the *influencing* loan (i.e. $AX_{L,m,t}$) is important in order to better fit the data, in fact the *generalized* R^2 (plotted in the last row of Figure 8) is strictly preferable for the augmented model.[34] In the fourth panel of Figure 8 Moran's I is computed for the residuals of 2SLS estimators, excluding $AX_{L,m,t}$ brings to a strong network-correlation in residuals, while including it brings to an extremely frequent rejection of residual network-correlation.[35] Note also that including $AX_{L,m,t}$ brings to a higher estimated price transmission.

6. Mechanism of Diffusion and Market Rate

The presence of price transmission in the unsecured money market has an impact on the market rate and its volatility, which in turn has an effect on banking rates. It seems worthy to provide an example of the implications that this mechanism has on the market rate. Suppose that there are four banks and three loans in the unsecured money market and they do not change over time (Figure 10). Let $\Delta p > 0$ be an idiosyncratic exogenous shock, and $p_{ji} = p_{kj} = p_{gk} = p^*$ = EONIA are the prices before the shock.[36] Suppose Δp hits p_{ji}, without price transmission the new EONIA will be

$p^{**} = \frac{3p* + \Delta p}{3}$,

with price transmission the new EONIA will be

$p^{***} = \frac{3p* + (1+\varphi+\varphi 2)\Delta p}{3} > p^{**}, if \varphi > 0.$

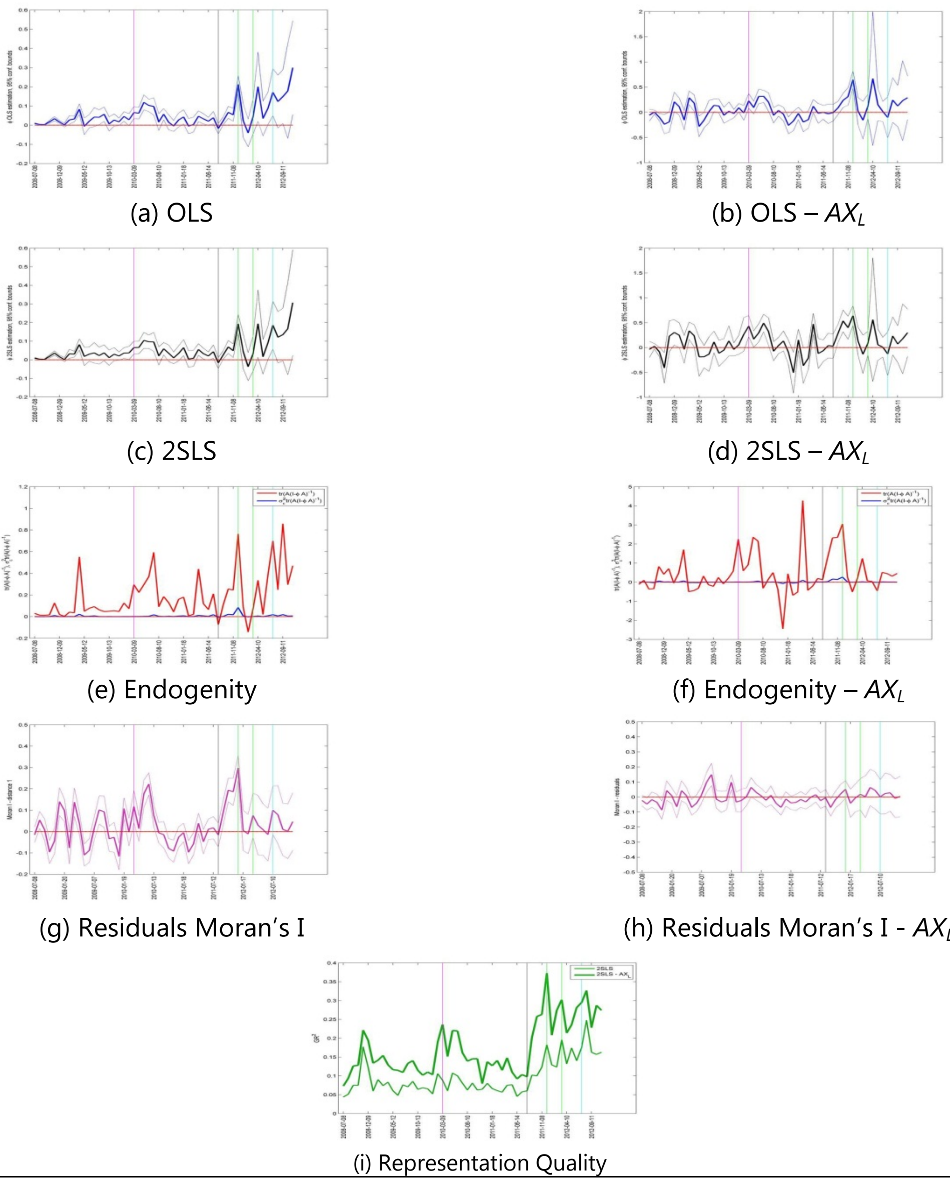
34 Since we are evaluating the fitting quality of 2SLS a *generalized* R^2 is used, see Pesaran and Smith (1994) for more details.

35 Some MPs are characterized by network-correlation of residuals, this may be caused by the omission of some unobservable bank characteristic. The small entity of the problem doesn't erode the robustness of results. Inclusion of unobservable factors is an objective of future research.

36 Let us assume that all the banks are in the EONIA panel. Observe that a change in signal rate by the central bank would not imply this mechanism of diffusion because it has an impact on all the rates, the following holds only for the propagation of a shock hitting a single loan.

The difference between p^{***} and p^{**} ($\frac{(\varphi+\varphi 2)\Delta p}{3}$) is generated by the transmission mechanism, which brings the EONIA to a higher level after a positive shock received by a single loan. The propagation of this shock (Δp) depends on the structure of the interbank network and on a *multiplier* φ. This parameter, according to our econometric model, is constrained to be less than one in absolute value. It implies that the initial shock has a decaying effect on other loans when the distance in the network increases ($\varphi > \varphi^2 > \varphi^3 > \cdots$). A similar argument can be made for the effect of the transmission mechanism on prices' volatility. Observe also that, given that the final effect of a shock depends on where it hits the interbank network, if a shock hits a *central* loan, it would have a higher impact on market rates with respect of a *peripheral* loan. This example highlights the effect that the presence of this mechanism of diffusion has on market rates and the relevant role it may play when shocks occur.

2SLS and OLS estimation of $\varphi_{m,t}$, m = overnight to three days maturities — Figure 8



(a) OLS — (b) OLS – AX_L

(c) 2SLS — (d) 2SLS – AX_L

(e) Endogenity — (f) Endogenity – AX_L

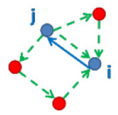
(g) Residuals Moran's I — (h) Residuals Moran's I - AX_L

(i) Representation Quality

Dashed lines represent 95 percent confidence intervals. Violet vertical line traces first Sovereign crises, black vertical line traces second Sovereign crises, green lines trace LTROs and azure line traces signal rate change in July 2012. Third-row panels represent the estimated $tr(A(I-\varphi A)^{-1})$ and $\sigma^2 tr(A(I-\varphi A)^{-1})$ which measure the endogeneity issue in observed network. Generalized R^2 is used for evaluating representation quality.

An Example of Network Circularity

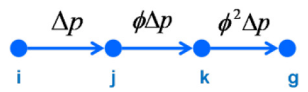
Figure 9



In this example the level of circularity between *i* and *j* is high.

Chain of loans

Figure 10



7. Concluding Remarks

The main contribution of this paper is to uncover a behavioral mechanism implemented by banks in the Euro unsecured money market. According to the relevant theoretical literature on OTC markets (Babus and Kondor; 2013), private information may have a relevant role in a decentralized market with heterogeneous valuations of the exchanged asset. A formal test for the presence and diffusion of private information is proposed using network econometrics. If it is at work, this mechanism has a direct role in defining the average market rates and their volatility, and an indirect one in determining debts at variable rates of households and firms, via the pass-through from market to banking rates. Along this way, the paper proposes also a new perspective from which studying the dynamics of money market and its turbulence.

The second contribution is empirical, we tested for private information diffusion in the Euro unsecured money market network detected by applying an augmented Furfine algorithm on Target2 payments data. Spatial econometrics techniques were adapted to a network framework in which arcs (loans) are considered as basic units instead of nodes (banks) and spillover effects in bargained prices are estimated. 2SLS estimation was proposed and computed for a wide time span from June 2008 to the end of 2012, estimates reveal that diffusion is not constantly at work during the period considered. It is relevant only during *hot periods*. This evidence indicates that market tensions and Sovereign crises let individual evaluations be dispersed and diffusion of private information take place, with banks paying a higher attention to signals coming from others. The estimated parameter, which captures private information diffusion, can be seen as a *multiplier* of price dispersion. Idiosyncratic shocks to bank's valuation (about central bank money market value) trigger propagation of deviance (from the signal rate) through the interbank network, resulting in a higher aggregate price dispersion. A robust estimator of this *multiplier* is proposed. Diffusion has been found to flow in multiple directions through the interbank network, lenders are influenced by the price they experience as borrowers and borrowers are influenced by the price they experience as lenders. Transmission cannot be evaluated robustly after ECB 2011 LTRO intervention, highlighting it as a right decision if private information diffusion is not thought worthy in this market.

EONIA and, more widely, public information provided by monetary institutions are designed for preventing asymmetric information and strong (or clustered) deviance from the signal rate. We found that during periods characterized by strong uncertainty, even on future central bank decisions, the role of private information becomes relevant. Deviance form public signal seems to take place and have a network nature driven by private signals that market participants send to each other. In a similar scenario the intervention of ECB through Open Market Operations was effective in avoiding a similar pattern evolving. The practical implication of this intervention was to provide banks with a large amount of collateralized liquidity, with the ECB acting as an intermediary.

As a minor contribution, the paper may be seen as an application of spatial econometrics which is concerned about spillover effects among arcs instead of nodes.

References

Afonso, G., Kovner, A. and Schoar, A. (2011). Stressed, not frozen: The federal funds market in the financial crisis, *The Journal of Finance 66*(4): 1109–1139.

Alonzo, S., Masi, P. and Tresoldi, C. (1994). La riserva obbligatoria ei tassi di interesse: il comportamento delle banche, *Bancaria*.

Angelini, P., Nobili, A. and Picillo, C. (2011). The interbank market after august 2007: what has changed, and why?, *Journal of Money, Credit and Banking 43*(5): 923–958.

Anselin, L. (1996). The moran scatterplot as an esda tool to assess local instability in spatial association, *Spatial analytical perspectives on GIS 4*: 111–127.

Arciero, L., Heijmans, R., Heuver, R., Massarenti, M., Picillo, C. and Vacirca, F. (2013). How to measure the unsecured money market? the eurosystem's implementation and validation using target2 data, *DNB Working Papers 369*.

Armantier, O. and Copeland, A. (2012). Assessing the quality of furfine-based algorithms, *Federal Reserve Bank of New York staff report 575*.

Babus, A. and Kondor, P. (2013). Trading and information diffusion in over-the-counter markets, *Technical report*, Working paper.

Bech, M. L. and Klee, E. (2011). The mechanics of a graceful exit: Interest on reserves and segmentation in the federal funds market, *Journal of Monetary Economics 58*(5): 415–431.

Bramoulle', Y., Djebbari, H. and Fortin, B. (2009). Identification of peer effects through social networks, *Journal of Econometrics 150*: 41–55.

Calvó-Armengol, A., Patacchini, E. and Zenou, Y. (2009). Peer effects and social networks in education, *The Review of Economic Studies 76*(4): 1239–1267.

Furfine, C. (1999). The microstructure of the federal funds market, *Financial Markets, Institutions & Instruments 8*(5): 24–44.

Gambacorta, L. (2008). How do banks set interest rates?, *European Economic Review 52*(5): 792–819.

Graham, B. S. (2008). Identifying social interactions through conditional variance restrictions, *Econometrica 76*(3): 643–660.

Grossman, S. J. (1981). An introduction to the theory of rational expectations under asymmetric information, *The Review of Economic Studies* pp. 541–559.

Grossman, S. J. and Stiglitz, J. E. (1980). On the impossibility of informationally efficient markets, *The American economic review* pp. 393–408.

Hamilton, J. D. (1996). The daily market for federal funds, *Journal of Political Economy 104*(1): 26–56.

Hayek, F. A. (1945). The use of knowledge in society, *The American economic review* pp. 519– 530.

Ho, T. S. and Saunders, A. (1981). The determinants of bank interest margins: theory and empirical evidence, *Journal of Financial and Quantitative Analysis 16*(04): 581–600.

Kelejian, H. and Prucha, I. R. (1998). A generalized spatial two-stage least squares procedure for estimating a spatial autoregressive model with autoregressive disturbances, *The Journal of Real Estate Finance and Economics 17*(1): 99–121.

Kelejian, H. and Prucha, I. R. (1999). A generalized moments estimator for the autoregressive parameter in a spatial model, *International economic review 40*(2): 509–533.

Kelejian, H. and Prucha, I. R. (2004). Estimation of simultaneous systems of spatially interrelated cross sectional equations, *Journal of Econometrics 118*(1): 27–50.

Lee, L. F. (2004). Asymptotic distributions of quasi-maximum likelihood estimators for spatial autoregressive models, *Econometrica 72*(6): 1899–1925.

Lee, L. F. (2007). Identification and estimation of econometric models with group interactions, contextual factors and fixed effects, *Journal of Econometrics 140*: 333–374.

Lee, L. F., Liu, X. and Lin, X. (2010). Specification and estimation of social interaction models with network structures, *The Econometrics Journal 13*: 145–176.

Liu, X. and Lee, L. F. (2010). Gmm estimation of social interaction models with centrality, *Journal of Econometrics 159*: 99–115.

Martinez, C. and Leon, C. (2014). The Cost of Collateralized Borrowing in the Colombian Money Market: Does Connectedness Matter?, *Borradores de Economia 803*, Banco de la Republica de Colombia.

Moran, P. A. P. (1950). Notes on continuous stochastic phenomena, *Biometrika 37*(1/2): 17–23.

Muth, J. F. (1961). Rational expectations and the theory of price movements, *Econometrica* pp. 315–335.

Nerlove, M. (1958). Adaptive expectations and cobweb phenomena, *The Quarterly Journal of Economics 72*(2): 227–240.

Pesaran, M. H. and Smith, R. J. (1994). A generalized r2 criterion for regression models estimated by the instrumental variables method, *Econometrica 62*(3): 705–10.

Prati, A., Bartolini, L. and Bertola, G. (2003). The overnight interbank market: Evidence from the g-7 and the euro zone, *Journal of banking & finance 27*(10): 2045–2083.

Shiller, R. J. and McCulloch, J. H. (1987). The term structure of interest rates, *National Bureau of Economic Research Cambridge, Mass., USA*.

Wolinsky, A. (1990). Information revelation in a market with pairwise meetings, *Econometrica 58*(1): 1–23.

Firms' financial statements and competitiveness: an analysis for European non-financial corporations using micro-based data

Nicola Benatti, Annalisa Ferrando and Pierre Lamarche

Abstract

In the empirical analysis the use of micro-data often encounters confidentiality issues, especially when data are derived from different countries. One way to tackle this type of problems is known as "distributed micro-data analysis", which proposes an aggregation of data with sufficient information on the distribution of the underlying micro-based data. In this paper we propose an inverse analysis, i.e. a methodology to mimic the anonymised firms' micro-data starting from a distributed micro-dataset and using standard equations and assumptions about the distribution of the residuals that are most likely to reproduce the original micro dataset. As a result this paper offers an easy tool to analyse the firm-level financial ratios, such as firms' leverage, profitability, and productivity performance of firms across country, sector and firm size even when firm-level data are not readily available.

Keywords: firm-level data, distributed micro-data analysis, simulation-based inference

JEL classification: D22, D24, C53

Introduction

In order to maintain data confidentiality, the information and summary statistics of institutional micro datasets are often published in aggregated form, i.e. providing totals and averages. However, given the increasing need for studying agents' heterogeneity, a number of additional statistics has been included in some publications in the few past years. In general, second and third moments of the distributions and percentiles of the studied variables could provide useful information on their underlying distributions (Bartelsman et al. 2004). The heterogeneity in firms' balance-sheet variables is addressed, for example, in the Bank for the Account of Companies Harmonized (BACH) dataset of the European Committee for Central Balance Sheet Data Offices (ECCBSO), which provides weighted averages, medians, standard deviations and the 25th and 75th percentiles for several balance-sheet items in nine euro-area countries. In a similar way, the Eurosystem Competitiveness Research Network (CompNet) develops a much more detailed dataset providing the values of each decile of the distributions of both balance-sheet items and competitiveness indicators (Lopez Garcia et al. 2014). Last but not least the DynEmp OECD dataset on employment dynamics provides distributed micro-data analysis of business and employment dynamics and firm demographics (Criscuolo et al. 2014).

In this paper, we propose then a methodology to mimic the anonymised firms' micro-data using standard equations and assumptions about the distribution of the residuals that are most likely to reproduce the original dataset. The methodology we propose derives to some extent from other methods often used when facing incomplete information. Indeed the data we are using are only some kind of summary of the complete information we would like to reproduce.

In particular, in surveys, item non-response is often treated so to replace the missing values with values drawn from the appropriate distribution conditional on the information available in the data. For instance, Little and Rubin (2002) have developed Bayesian techniques to deal with incomplete data, addressing in particular the issue of the non-response mechanism. More specifically, household surveys often provide information that can be also considered as incomplete in the sense that the households give answers about e.g. income or assets owned only in brackets. This kind of data collection is used mainly to ease the answer of the households, who are less reluctant to provide fuzzy information that ensures the de facto anonymisation of their answers. Our situation is quite similar in the sense that in the CompNet kind of data we only have information in brackets. Various techniques have been developed to address this issue, such as simulated residuals (see Gourieroux et al. (1987) or Lollivier and Verger (1987)).

We try different approaches to determine the most efficient way of mimicking the data by taking into account the correlations between variables and the bulk of information about the distributions we have at our disposal. We expect the chosen method to be easily implemented and to reproduce as best as possible the expected economic results carried out from the actual micro-data. To do so, we first implement a very simple method but very demanding in terms of hypotheses, assuming a log-normal distribution for each variable. We then try to relax the assumptions by modelling the joint distribution of two given variables in order to avoid using variance-covariance matrices. Finally, for the third model we adopt a Bayesian approach, following for example Gautier (2008). This method is quite computationally demanding, but in theory is able to reproduce any distribution. The different Bayesian techniques that we experimented are described for example by Arnold (1993) or Robert and Casella (2004).

To test the proposed methodology, we first construct an aggregated dataset starting from firm-level observations from Bureau van Dijk's AMADEUS dataset using the CompNet methodology. Our dataset contains information on the distribution of a set of indicators of interest for three euro area countries (France, Italy and Spain) in the period 2006-2011.

Overall, our methodology could be applied to different datasets provided they contained enough information on the distribution of the variables of interest.

The paper is structured as follows: the second section describes the construction of the dataset and its main characteristics while the third section introduces the empirical strategy. In the fourth section we present the results. Then we apply our data to estimate a leverage function and finally we conclude.

Construction of the dataset and data description

As the aim of our analysis is to develop a methodology to retrieve firm-level information from an aggregated database that provides sufficient information on distributions, we decided to use the approach followed by the Eurosystem Competitiveness Research Network (CompNet). The CompNet was established by the European System of Central Banks (ESCB) in 2012 to study competitiveness-related dynamics by collecting indicators and statistics from several European countries. As firm-level balance-sheet data is treated as confidential in most of European countries and cannot be exchanged across different national entities, the network decided to use a common analysis tool (i.e. a Stata script, thereafter CompNet toolkit) to aggregate firm-level data with information on the distribution of the indicators of interest. The script is then sent to National Central Banks (NCBs), where the confidentiality issue does not apply and therefore, the data is available at firm-level.

The characteristic of the database resulting from the data collection is that even though the indicators are computed as aggregates at a country-sector-year level (meso-level), other statistics beyond averages are collected in it, in particular statistics regarding standard-deviations, deciles, skewness and joint moments of the distributions of each indicator.

The main advantage of this procedure is clearly that by applying a common analysis tool to different countries allows using exactly the same treatment for outliers across countries and the same techniques to compute the indicators to produce comparable results.[1]

This type of information, collected via a remote-based analysis, allows studying firms' behaviour in terms of productivity, export, employment, and mark-ups, as well

[1] The network is aware of the many caveats associated to the sample comparability and harmonization of variables' definitions. In this respect a detailed preliminary work has been done to avoid as much as possible discrepancies in the definition (Lopez Garcia et al., 2014).

as studying the impacts on the distribution of firms for the values of each indicator computed. Most recently a "financial module" has been added to the main exercise in order to enlarge the analysis on the impact of the financial situation of firms on their real decisions. For this scope, financial ratios have been collected and indicators on financial constraints have been computed. This paper focuses in particular on this new – not yet published – part of the analysis.

Given the structure of the overall exercise, the available information related to the distributions comes from specific moments (deciles, averages, skewness and standard deviations), making it impossible to further investigate firm heterogeneity within deciles (e.g. to investigate how the distribution of firms between the 1st and 2nd deciles of labour productivity actually looks like). More simply, the limitation of the database derived through the CompNet analysis toolkit is the fact that it cannot be used for a fully micro-based economic analysis.

As the final CompNet dataset is not yet publicly available, we decided to replicate the dataset by applying the CompNet analysis toolkit on a firm-level sample derived from the Bureau van Djik Amadeus database. The aim is twofold. On one side, we apply the CompNet toolkit and we create the aggregated database with information on the distribution of the indicators we have chosen for the analysis. This allows us to apply our methodology to retrieve in a direct way anonymised firm level data. On the other side, the fact that we do have at disposal the original dataset implies that we will be able to prove the goodness of the algorithm we propose in the paper.

Our starting point is the Amadeus database, which is a commercial product from Bureau Van Dijk that collects business registers' balance-sheets information about non-financial corporations in Europe. For our exercise we selected a sub-sample of the database which includes all the available firms in France, Italy and Spain for the period 2006 to 2011. These three countries are those with the highest number of companies in the original dataset and their representativeness across firm size and sectors is relatively high compared with other countries.

We run the CompNet toolkit[2] on this initial sample. The program removes erroneous observations and runs an outlier treatment, which consists of removing observations beyond the 1st or 99th percentile. In addition it is verified that certain ratios (such as collateral) cannot exceed unity. Table 1 summarises some characteristics of the resulting sample. The number of observations is around 4 million and the number of firms 1.3 million. The observations are uniformly distributed across countries with Spanish firms covering 36% of the sample, French companies 33% and Italian firms the remaining 31%. Most of the sample consists of micro and very small firms.[3]

[2] In particular, in order to obtain a set of micro-based aggregated indicators and the statistics of their distributions, we re-adapted the CompNet analysis programme (".do file") to be able to run it on a dataset which contains also a country dimension and we focus only on a set of indicators we are interested in implementing our algorithms.

[3] Firms are divided in five categories according to the number of employees: micro firms are firms with less than 10 employees, very small firms between 10 and 19, small firms between 20 and 49, medium between 50 and 249 and large firms have more than 250 employees.

Number of observations and firms, broken down by country — Table 1

Country	Number of observations	Number of firms	%				
			Micro	Very small	Small	Medium	Large
Spain	1,474,803	446,201	70.2	15.1	9.7	4.2	0.9
France	1,380,743	454,811	74.7	11.1	8.6	4.5	1.1
Italy	1,290,529	419,171	63.7	18.7	10.5	6.0	1.1
Total	4,186,069	1,320,183	69.7	14.9	9.6	4.9	1.0

The statistics refer to the number of observations and firms when the leverage ratio is not missing.

After having cleaned the data, the CompNet toolkit creates the set of indicators and their distributions. In this paper we choose to focus on the following indicators: (a) financial leverage, which is defined as the sum of short- and long-term debt, divided by total assets; (b) cash holding defined as cash and cash equivalents divided by total assets; (c) cash flow to total assets; (d) return on assets (ROA) as net income over total assets and (e) labour productivity as real value added over number of employees. Table 2 presents some of their characteristics across the three countries. Spanish firms are more indebted than French and Italian firms, they are less profitable and their productivity is also lower. French firms are holding more cash and cash equivalents and they produce more internal funds than Italian and Spanish firms.

We focus on eight macro-sectors based on NACE rev. 2 codes. Firms whose code is not available are excluded from the dataset. Furthermore, firms operating in agriculture, fishing, mining, financial activities, public sector, education, health, entertainment, and other services (sections A, B, K, O, P, Q, R, and S) are excluded. The detailed sectorial classification used in the analysis is as follows (in parentheses we report the percentage of observations in our sample): 1) Manufacturing (20%); 2) Construction (18%); 3) Wholesale trade and retail trade (28%); 4) Transportation and storage (5%); 5) Accommodation and food (8%); 6) real estate (5%); 7) Professional, scientific and technical activities (8%) and 8) Administrative and support service activities (8%). Most of the companies in our sample are in the trade, manufacturing and construction sectors, covering altogether two-thirds of the whole sample. The details of the breakdown of the financial indicators by macro-sector are reported in Table A1 in the annex.

As explained above, the final result of the CompNet tool is a set of indicators computed as aggregates at a country-sector-year level (meso-level) with information on their averages, standard-deviations, deciles, and skewness.

Figure 1 on the left displays in detail the heterogeneity of a specific variable, labour productivity, as derived from the CompNet toolkit. We observe that the mean of labour productivity within different countries is always statistically different from the median and it always lays closer to the 70th percentile rather than the 50th.

Summary statistics of financial indicators and productivity, broken down by country

Table 2

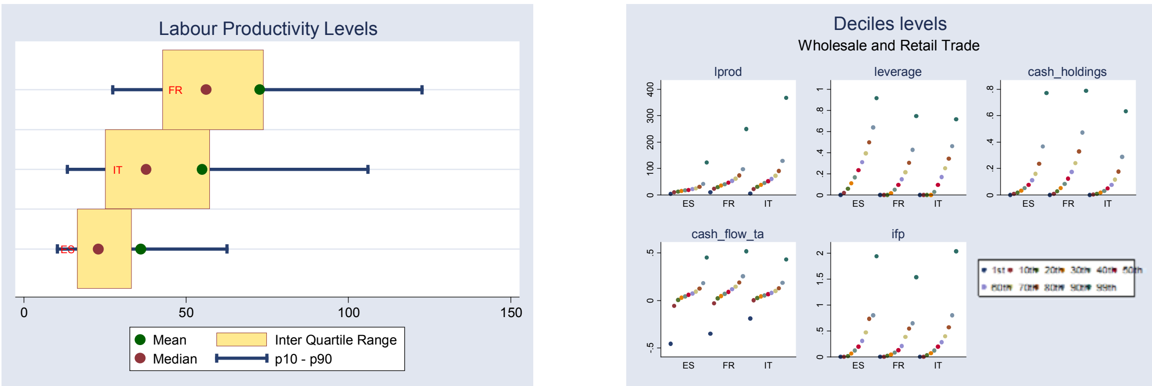
Country		Leverage	Return on Assets	Cash holdings	Cash flow	Labour productivity
Spain	Mean	0.3	0	0.14	0.07	36.02
	Median	0.25	0.03	0.07	0.06	22.88
	Std.	0.25	0.33	0.18	0.16	56.41
France	Mean	0.15	0.07	0.22	0.12	72.63
	Median	0.08	0.07	0.16	0.11	56.07
	Std.	0.19	0.22	0.21	0.17	71.58
Italy	Mean	0.17	0.05	0.1	0.09	54.95
	Median	0.09	0.04	0.04	0.08	37.66
	Std.	0.2	0.14	0.14	0.12	65.54

Notes: All indicators are unitless, except labour productivity in thousands of euro per employee.

Furthermore, by plotting the deciles for the variables of interest, we can easily observe how skewed the distributions actually are (Figure 1 on the right). This is often a characteristic of firm's balance-sheet data.

Labour productivity levels and decile levels[4]

Figure 1



[4] Given the nature of the collected data (i.e. deciles), the Inter Quartile Range of the boxplots is computed using the difference between the 7th and the 3rd deciles.

Empirical strategy

The main aim of this paper is to simulate micro-data that would in the end reflect as much as possible the results given by the CompNet database. We have then at our disposal a set of moments (some percentiles, standard deviation, totals and inter-quartile ranges and joint moments) for a few given variables (namely cash, net income, financial debt cash flow, total assets, employees, real value added, depreciation, labour cost, real turnover, interest rates and capital). We have also for a set of financial ratios derived from these variables (namely financial leverage, cash holding, cash flow over total assets, return on assets, labour productivity, unit labour cost, and labour cost per employee).

The difficulty is to generate micro-data matching all the information listed above. For instance, finding a law whose parameters could be adjusted so to respect percentiles as well as mean, standard deviation and inter-quantile range. We have to impose at least 14 constraints[4] on each variable, without any regards to the ratios that impose also indirect constraints. Finding such a law turns to be challenging. At this point, we have at our disposal two options: the first one is to determine the optimal parameters of a joint distribution thanks to some kind of Newton-Raphson algorithm,[5] the second one is to use a Bayesian approach like in Gautier (2008). We choose the second approach, given the complexity of the likelihood, as described hereafter.

As a starting point, we chose not to impose any constraint on each expected percentile. We rather simulate each variable as the realisation of a random variable following a log-normal law, whose parameters are given by the data. We are able to reproduce the correlation between variables thanks to the variance-covariance matrix, but we have no insurance so far that we will reproduce as expected the distribution of ratios. We generate the variables for each country, sector and year to take into account as much as possible the heterogeneity between firms.

Since the covariance between different variables is not entirely available through the CompNet database, we investigate other methods that would be likely to take into account the link between variables through the distribution of ratios. In a second method, we divide the population according to the percentiles for two given variables (say real value added and labour) and look for the most likely repartition of the population between these joint percentiles with respect to the expected distribution of the ratio (in our example, labour productivity). Doing so, we do not make any assumption about the shape of the joint distribution. However, we assume a uniform distribution and the independence of the variables within each cell of the joint distribution. This method can be seen as a linear interpolation between each given percentile when computing the distribution of the variables. Moreover, the number of parameters to be estimated is higher, making the computation process more demanding.

Finally we relax the assumption for the distribution for each variable per decile. More exactly, we have at our disposal the 1st, 10th, 20th, …, 90th and 99th percentiles. Within each of the 12 strata defined by these percentiles, we simulate the expected variables following a bounded law. Thanks to this method we mechanically generate data that respect at least the given percentile for each variable. However, this method does not ensure at all that the other constraints will be respected. In particular, the data generation shall also be conditioned by the distribution of the financial ratios that have been computed with the variables.

As a first assumption, we consider a Beta distribution for each variable within each stratum of the population. This distribution is conditioned on two parameters, α and β. These parameters have to be set so as to respect as much as possible the

[4] We have at our disposal the mean, the standard deviation, the inter-quantile range, the 1st, the 10th, the 20th,…, the 90th and the 99th percentiles.

[5] See for instance Atkinson (1989).

distribution of the different ratios. We therefore use Bayesian algorithms and in particular Monte Carlo Markov Chain algorithms (MCMC) so to find the proper parameters α and β giving the expected distribution not only for the variables but also for the ratios.

We derive here our algorithm from the idea proposed by Metropolis (1953) and improved by Hastings (1970), under the so-called Hastings-Metropolis algorithm. We set a prior distribution denoted $\pi(\theta)$ for $\theta = (\alpha_1, \dots, \alpha_n, \beta_1, \dots, \beta_n)$ the parameters of our Beta distributions. As a matter of fact we have $n = v * s$, where v denotes the number of variables we want to simulate, and s the number of strata for the total population (in this first approach, we take s=12). For $k \in [1:s]$, we consider the different indicators $\gamma_k^{i,j}$ that we want to reproduce in the data. These indicators can be estimations for percentiles, inter-quantile ranges, means or standard deviations. We here make the assumption that each of them follows a normal law. Thanks to this assumption, we can write the likelihood associated to a set of v random variables $(x_1^1, \dots, x_M^1, \dots, x_M^v)$ following a Beta law:

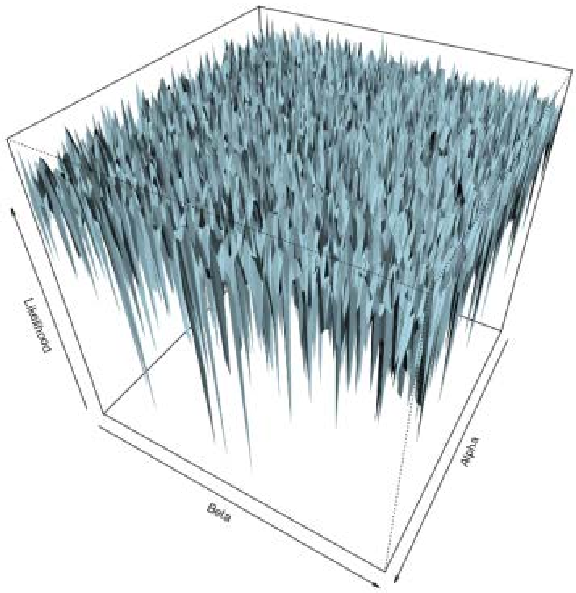
$$L_k(x|\theta) = \prod_{j=1}^{J} \varphi_{i,j}\left(\widehat{\gamma_k^{i,j}}\right)$$

where J denotes the number of constraints in the generation of the model. Then in a Bayesian perspective we use the prior distribution of θ to improve the likelihood associated to the observations $(x_1^1, \dots, x_M^1, \dots, x_M^v)$. We then obtain the posterior distribution $\pi(\theta|x)$ that enables to generate observations that will fit as much as possible the constraints defined a priori. This method, also known as importance sampling, enables to maximize a likelihood which is difficult to compute analytically. Indeed the shape of the likelihood (Figure 2) makes it very difficult to derive analytically. Hence a Bayesian approach is completely justified, given the high number of constraints applied to the model.

Following the Metropolis-Hastings algorithm, we generate θ according to a prior symmetric distribution iteratively and retain a new set of θ only if the likelihood associated to the new set of observations $(\mathrm{x}_1^1, \dots, \mathrm{x}_\mathrm{M}^1, \dots, \mathrm{x}_\mathrm{M}^\mathrm{v})$ is above the previous one. We determine the number of iterations according to an expected acceptance rate and, also, since this method is computationally demanding, taking into account the time of computation. We test different ways of simulating the data to impose the least constraints as possible, in particular in terms of correlations between the v variables. The only source of information we use so far on potential links between say, number of employees and real value added is the information on the distribution of the ratio of labour productivity. Then generating micro-data should make explicit the implicit link between these two variables through information on labour productivity.

The first way of doing it is to take into account potential correlations between the variables thanks to an expectation-maximization algorithm. Indeed, once the v variables generated according to the Beta law, we merge the different columns according to an order that has to be defined. In the initialisation phase, we randomly sort the variables so there is almost no correlation between the different variables. During each iteration, we regress each variables on the v-1 other ones and use the fitted values to sort the variables. However this method does not prove to be conclusive and we rather introduce correlations as part of the vector θ. This method shows significantly better results, in particular in terms of acceptance rate. This new component of θ is generated thanks to a truncated normal law.

Representation of the likelihood Figure 2



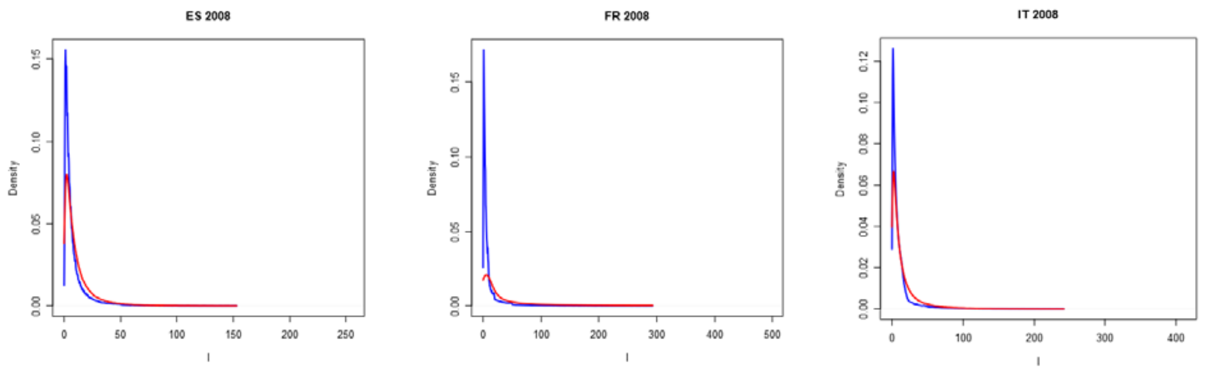
Furthermore, to improve the convergence process and to shrink the time of computation, we add an annealing part to the algorithm. The intuition behind this classical method in Bayesian inference is to reduce the area in which the optimal parameters θ are more likely to be found so to avoid a huge number of iterations. To implement statistical annealing in our algorithm, we decrease the variance associated to the prior law by for instance a half after *n* iterations for which none of the generated parameters have succeeded in improving the likelihood.

Finally, we have also to consider the law we need to use for simulating the last percentile of each variable. Indeed, for the rest of the distribution, we can use as lower and upper bounds the different percentiles that we have at our disposal. Then the maximisation process is just about finding the proper parameters that will give the expected shape for the distribution of the variable within the deciles. However, for the last percentile we do not have any upper bound at our disposal. We could set of course an upper bound related to the treatment of outliers that is made on the original data. We rather set a different law that do not use any upper bound. Given the high concentration observed for the variables we want to simulate, we choose a Pareto law, whose parameter k also follows a prior distribution.

Results

For the first method we generate data for Spain, France and Italy. Since we impose strong assumptions on the joint distributions of the variables, the obtained marginal distribution do not completely match with the expected ones (figure 3). Indeed, the link between the variables is generated thanks to the variance-covariance matrix, which imposes strong assumptions on the shape of the joint distribution and deteriorates the modelling of each variable.

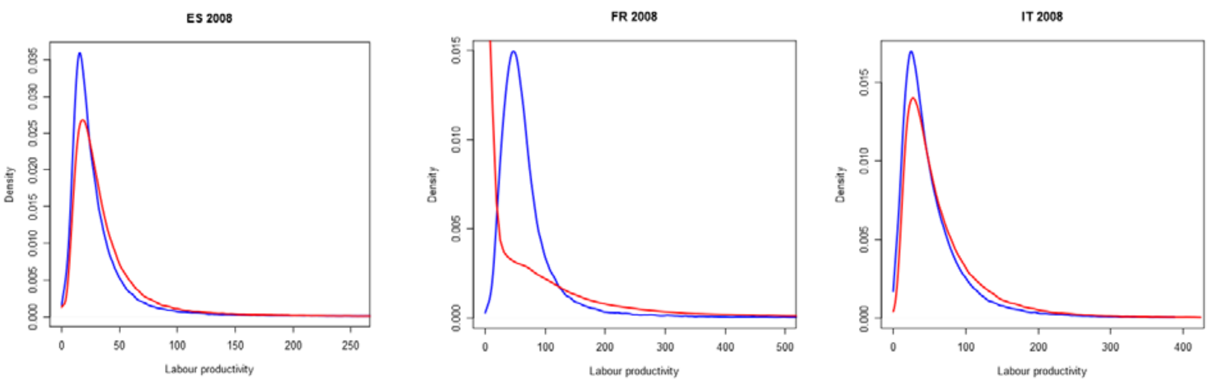
Distributions of labour for 2008, Spain, France and Italy — Figure 3



The blue line stands for the expected distribution, the red one shows the simulated distribution.

As a result, the ratios may not have the expected distribution, which weakens the simulation. We take here the example of the labour productivity which is defined as the ratio of real value added over productivity. As shown on Figure 5, the obtained distribution does not properly fit the expected one, in particular for France, where the labour is poorly reproduced.

Distributions of labour productivity for 2008, Spain, France and Italy — Figure 4

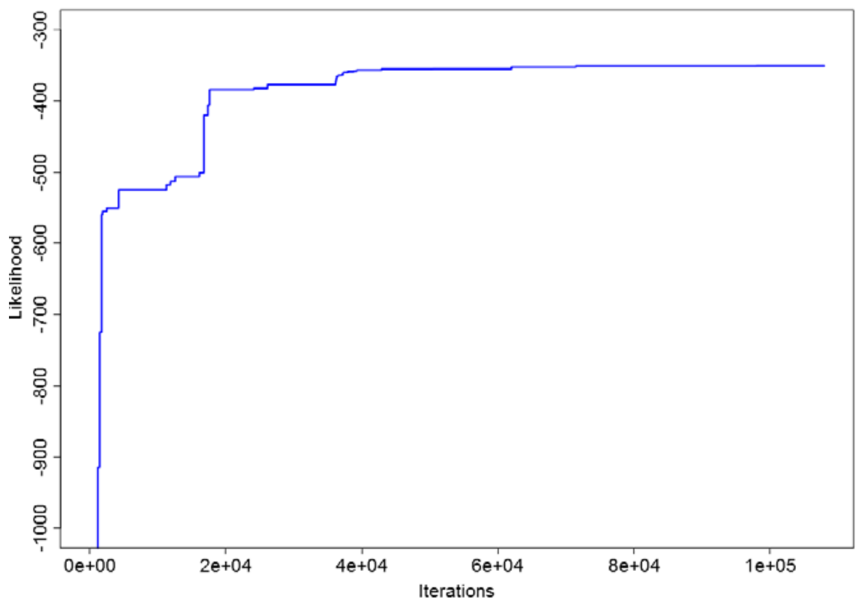


The blue line shows the expected distribution, the red one the simulated distribution.

We also implemented the second method, with no conclusive results. However, the estimation of the parameters can be done thanks to Bayesian procedures or through a Newton-Raphson algorithm. The latter one offers more guarantees in terms of convergence, but has not been yet implemented.

We run the maximisation program over 252 parameters for each country, year and sector. Such an algorithm is very demanding in terms of computations, and the computations for one given country, year and sector may take several hours. Regarding such duration for computing, the annealing part of the algorithm enables to gain both time and accuracy. We set the number of iterations here to 10,000 before starting the annealing process. This means, the algorithm starts the annealing only after 10,000 iterations without any change. As shown on figure 5, the annealing has enabled to increase the likelihood in a more efficient way.

Evolution of the log-likelihood for the third algorithm Figure 5



Evolution of the log-likelihood over iterations.

We choose for the annealing part to reduce the variance associated to the prior law of the parameters by 90%, and we iterate the decrease 4 times. The whole algorithm implies about 100,000 iterations, or more, depending on the number of constraints we apply to the model.

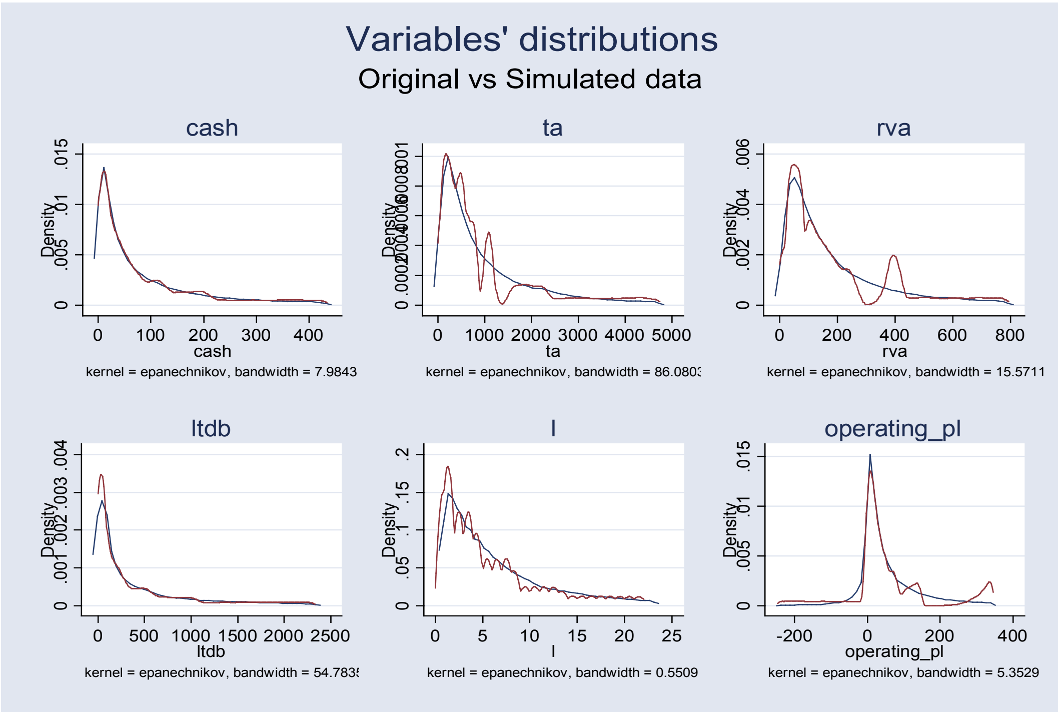
As the algorithm is highly time-consuming, we only present results for a very restricted sample of combinations of countries, years and sectors for which we performed the computation.

When looking at the results of the simulations and comparing them to the original data, we observe that the absolute percentage differences between the two vary both across variables and percentiles. In particular, results improve significantly when adding constraints related to joint moments of the distributions, as shown in Table A1 and Table A2 for the Wholesale trade sector in Spain in the year 2007.

Differences are especially strong in terms of mean. From this point of view the algorithm has difficulties to properly reproduce the high concentration of cash, total assets, long term debt, loans and operating profits and losses. The specification of the Pareto law for the very top of the distribution of each of these variables was intended to precisely reproduce the high concentration; however convergence of the simulation toward properly concentrated variables is not achieved. With this regard, another approach should perhaps be chosen for the simulation of the top the distribution. Indeed, the simulation in the case of the Pareto law is highly volatile. Then the parameter could be set thanks to another approach (e.g. maximum likelihood) and the simulated observations could be chosen with respect to given constraints. However, this method implies to get more information about the top of the distribution, which can be difficult with regards to the anonymisation rules that may be applied.

Distributions of the variables for the third algorithm compared to the expected ones

(data for Spain, NACE 46, year 2007) Figure 6



The blue line stands for the expected distribution, the red one shows the simulated distribution.

However, although the resulting simulated data seem to properly fit their original distributions (see Figure 6), this does not happen when looking at the correlations among those. The ordering of the observations, in fact, does not allow so far letting us find the expected correlations. Given the higher number of constraints we will be able to add, especially on joint moments, we expect this not to be a problem in the future replications of the exercise. Indeed information carried out by only the distribution of ratios such as labour productivity seem not to be sufficient to drive the simulation toward the expected link between labour and real value added for example. From this point of view, adding more constraints in terms of joint distribution should solve at least partially this issue.

An empirical application: leverage model

As an assessment of the goodness of the data produced by the algorithms of the previous sections, we estimate a simple static leverage function using first the firm-level data derived from Amadeus and second the simulated firm-level data as derived from the aggregated dataset. The purpose of the exercise is to compare the estimated coefficients derived from the two datasets.

Following the literature,[6] we estimate the following leverage model for each country c in our sample:

$$\text{Leverage}_{ict} = \sum_{k=1}^{K} \beta_k X_{kict-1} + \eta_i + \eta_{ts} + \nu_{ict}$$

where Leverage_{ict} is the leverage of company i in country c at time t. Among the control variables we include: Sales growth, Size, Collateral and Cash flow. We also include Cash holdings to control for other factors that may allow firms to attain a degree of financial flexibility. All variables are lagged once to avoid endogeneity. Finally, we include firms fixed effects (ηi) that account for the potential correlation between firm-specific characteristics and regressors; and time-sectoral effects (ηts) that account for macro-economic factors (such as market shocks) related also to economic sectors.

Leverage results from firm-level dataset (Amadeus) Table 3

Variables	(1)	(2)	(3)
	Italy	France	Spain
Cash flow/total assets	–0.03809***	–0.03978***	–0.06590***
	(0.003)	(0.002)	(0.002)
Collateral	0.05384***	0.15714***	0.00174
	(0.004)	(0.004)	(0.002)
Cash holdings	–0.02477***	0.01738***	–0.02054***
	(0.003)	(0.002)	(0.002)
Sales growth	0.00121*	0.00972***	0.00205***
	(0.001)	(0.001)	(0.000)
Size dum2	0.00029	0.00409***	–0.00707***
	(0.001)	(0.001)	(0.001)
Size dum3	0.00329*	0.00591***	–0.01588***
	(0.002)	(0.002)	(0.001)
Size dum4	0.00704***	0.01075***	–0.01744***
	(0.002)	(0.003)	(0.002)
Constant	0.17963***	0.09714***	0.29416***
	(0.001)	(0.001)	(0.001)
Observations	434,465	453,253	749,699
Number of firms	170,209	198,769	293,851
Firm fixed effects	yes	yes	yes
Year-sector fixed effects	yes	yes	yes

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[6] See among others, Wanzeried (2006) and Ferrando, Marchica and Mura (2014).

Results on the leverage model derived from the first dataset are reported in Table 3 where each column shows the results at country level. Results are in line with previous findings in the capital structure literature (e.g., Rajan and Zingales (1995); Flannery and Rangan (2006); Wanzenried (2006)). Firms whose sales are growing faster need more leverage and this result is robust across countries. The results show also a clear size effect as larger firms are less opaque and may raise external finance more easily, and at more favorable rates. This appears to be true for Italian and French companies while in the case of Spanish firms the coefficient is negative. Collateral is also important when it comes to enabling firms to obtain external finance, hence the positive sign. The coefficient of Cash Flow is negative. According to the pecking theory, firms should prefer internal to external finance. Hence the more profitable the firm, the lower the need for external finance. Finally, leverage is negatively affected by Cash Holdings signaling that the availability of liquid assets may reduce the need of external debt.

We then use the same analysis approach on the simulated data using the first simulation method (Table 4). Although the difficulties described above when ordering the observations in order to reproduce the proper correlations across variables, the results deriving from an economic analysis are overall convincing. The coefficients are always statistically significant but the signs might differ and we can conclude that although the simulated data properly reproduce the distributions of the raw variables, the joint distributions of those variables are not completely reliable and regressions on these data should be run carefully.

Leverage results from simulated dataset (1st Method) — Table 4

Variables	(1) Italy	(2) France	(3) Spain
Cash flow/ total assets	–0.02115***	0.06219***	0.04271***
	(0.002)	(0.003)	(0.003)
Collateral	0.06838***	0.14125***	0.10723***
	(0.001)	(0.003)	(0.002)
Cash Holdings	–0.12482***	–0.05284***	–0.11942***
	(0.001)	(0.002)	(0.002)
Sales Growth	–0.00964***	–0.01672***	–0.00495***
	(0.001)	(0.001)	(0.001)
Size dum2	–0.01221***	–0.02644***	–0.04110***
	(0.001)	(0.001)	(0.001)
Size dum3	–0.01501***	–0.03060***	–0.06114***
	(0.001)	(0.001)	(0.001)
Size dum4	–0.01988***	–0.00029	–0.06718***
	(0.001)	(0.001)	(0.002)
Constant	0.15548***	0.10155***	0.32955***
	(0.001)	(0.002)	(0.004)
Observations	635,808	181,513	418,662
Firm fixed effects	no	no	no
Year-sector fixed effects	yes	yes	yes

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Conclusions

In this paper we proposed a methodology to mimic anonymised firms' micro-data using standard equations and assumptions about the distribution of the residuals that are the most likely to reproduce the original dataset

This exercise turned to be highly demanding in terms of computations, which makes its assessment quite difficult. Indeed, simulating the entire database for Italy, Spain and France appeared to be highly time consuming. Moreover, the results obtained for all given years, countries and sectors are not completely convincing yet, since the algorithm seems not to be completely able to reproduce expected correlations between variables. The idea of sorting variables so to reproduce the correlations relies on the assumption that conditionally to the fact that distributions are properly reproduce, there is an order for each variable that should ensure to get closer to the expected correlation matrix. This order can be of course found in the original data; for the time being seems not completely convincing to achieve reproducing this order.

Annexes

Absolute percentage differences between percentiles of original and simulated data before using joint moments as constraints

Table A.1

Statistics	Cash	Tot. assets	Real value added	Long term debt	Loans	Op. profits & loss
mean	0.29	0.37	0.08	0.57	0.38	0.46
p1	–	0.00	0.00	–	0.00	0.00
p10	0.00	0.00	0.00	0.00	0.00	0.00
p20	0.10	0.00	0.00	0.00	0.50	1.00
p30	0.50	0.35	0.31	0.56	0.00	0.64
p40	0.39	0.31	0.27	0.01	0.00	0.08
p50	0.35	0.00	0.26	0.31	0.17	0.38
p60	0.04	0.30	0.25	0.43	0.29	0.37
p70	0.37	0.06	0.17	0.42	0.19	0.05
p80	0.40	0.27	0.00	0.00	0.00	0.43
p90	0.00	0.51	0.48	0.54	0.01	0.56
p99	0.05	0.87	0.00	0.00	0.00	0.89
sd	0.36	0.47	0.25	0.35	0.74	0.35

Absolute percentage differences between percentiles of original and simulated data after using one joint moment as constraint

Table A.2

Statistics	Cash	Tot. assets	Real value added	Long term debt	Loans	Op. profits & loss
mean	0.11	0.01	0.43	0.27	0.42	0.11
p1	–	0.00	0.01	–	0.00	0.00
p10	0.00	0.00	0.00	0.00	0.00	0.00
p20	0.00	0.00	0.00	0.00	0.08	0.00
p30	0.00	0.00	0.16	0.00	0.00	0.00
p40	0.00	0.00	0.00	0.00	0.00	0.00
p50	0.00	0.03	0.00	0.00	0.00	0.00
p60	0.00	0.11	0.00	0.00	0.00	0.00
p70	0.00	0.06	0.00	0.00	0.00	0.00
p80	0.00	0.00	0.00	0.00	0.00	0.00
p90	0.00	0.00	0.00	0.00	0.00	0.00
p99	0.00	0.00	0.00	0.00	0.00	0.00
sd	0.11	0.73	0.60	0.03	0.30	0.51

Summary statistics of financial indicators and productivity, broken down by country and macrosectors

Table A1

Country	Sector/Variable	Cash Holdings			Leverage			Labour Productivity			Returns on Assets		
		Mean	**Median**	**Sd**	**Mean**	**Median**	**Sd**	**Mean**	**Median**	**Sd**	**Mean**	**Median**	**Sd**
ES	**Manufacturing**	0.12	0.06	0.15	0.30	0.25	0.78	35	27	72	0.01	0.03	0.42
	Construction	0.14	0.07	0.18	0.34	0.26	0.78	47	21	299	0.00	0.03	0.71
	Wholesale and retail trade	0.14	0.08	0.17	0.31	0.24	0.53	25	18	50	0.01	0.03	0.36
	Transportation and storage	0.13	0.07	0.16	0.34	0.29	0.68	63	40	407	0.01	0.03	0.27
	Accommodation and food service activities	0.15	0.07	0.19	0.47	0.41	0.87	42	31	141	-0.02	0.02	0.55
	Real estate activities	0.10	0.03	0.16	0.36	0.26	1.62	108	35	722	0.00	0.02	0.56
	Professional, scientific and technical activities	0.20	0.12	0.22	0.34	0.25	1.26	40	19	311	0.03	0.04	0.40
	Administrative and support service activities	0.18	0.10	0.21	0.36	0.26	1.13	74	35	688	0.00	0.03	0.93
FR	**Manufacturing**	0.18	0.12	0.19	0.16	0.09	0.28	71	53	406	0.07	0.06	0.15
	Construction	0.27	0.23	0.22	0.11	0.06	0.17	82	62	304	0.10	0.08	0.19
	Wholesale and retail trade	0.19	0.12	0.19	0.16	0.09	0.47	63	46	682	0.07	0.06	0.16
	Transportation and storage	0.21	0.16	0.19	0.15	0.08	0.23	88	65	315	0.06	0.05	0.18
	Accommodation and food service activities	0.19	0.12	0.19	0.27	0.21	0.28	69	49	829	0.08	0.07	0.19
	Real estate activities	0.39	0.36	0.30	0.18	0.06	0.58	204	60	2255	0.06	0.04	0.27
	Professional, scientific and technical activities	0.28	0.22	0.24	0.11	0.02	0.22	203	71	3610	0.10	0.08	0.23
	Administrative and support service activities	0.26	0.20	0.23	0.11	0.02	0.22	193	85	1605	0.08	0.06	0.24
IT	**Manufacturing**	0.08	0.03	0.12	0.20	0.15	0.20	43	31	239	0.05	0.04	0.27
	Construction	0.09	0.03	0.13	0.18	0.10	0.21	44	28	161	0.06	0.05	0.10
	Wholesale and retail trade	0.10	0.05	0.14	0.17	0.10	0.20	268	54	47631	-2.26	0.04	427.65
	Transportation and storage	0.10	0.04	0.14	0.15	0.06	0.19	100	76	169	0.04	0.04	0.13
	Accommodation and food service activities	0.11	0.05	0.16	0.22	0.12	0.27	61	46	112	0.03	0.03	0.39
	Real estate activities	0.08	0.02	0.14	0.22	0.12	0.25	94	28	632	0.03	0.03	1.35
	Professional, scientific and technical activities	0.13	0.06	0.16	0.13	0.03	0.20	67	26	998	0.08	0.05	0.15
	Administrative and support service activities	0.13	0.07	0.17	0.13	0.03	0.19	92	59	352	0.07	0.05	0.15

	Number of Firms for which the Leverage indicator is available																	
	ES						FR						IT					
sector	2006	2007	2008	2009	2010	2011	2006	2007	2008	2009	2010	2011	2006	2007	2008	2009	2010	2011
10	5934	1533	6716	7067	7117	7046	6314	6825	6944	7792	8685	8199	3225	3581	4860	4434	3879	7077
11	1296	376	1449	1600	1618	1602	468	452	420	404	420	446	572	651	779	704	636	958
12	15	8	15	13	13	12	706	712	620	602	679	594	8	9	8	7	11	12
13	1540	258	1700	1714	1722	1694							1861	2078	2622	2232	1890	3499
14	1155	187	1310	1320	1267	1204	635	627	579	606	606	534	1820	2087	2936	2463	2078	4349
15	886	124	1009	1007	1006	1006	269	265	281	264	257	263	1379	1633	2074	1919	1606	3394
16	2653	346	2948	2961	2840	2653	1472	1455	1376	1425	1525	1421	1257	1516	2164	1827	1523	3190
17	763	265	828	852	824	823	465	471	414	399	431	373	914	1000	1261	1128	948	1657
18	3586	523	4023	4116	4028	3875	1901	1881	1768	1873	1914	1780	1415	1624	2345	1982	1600	3237
20	1627	560	1748	1810	1822	1845	856	816	732	723	760	713	1515	1707	2072	1845	1657	2558
21	202	119	216	217	234	228	170	162	157	139	140	139	287	309	342	330	313	404
22	1956	543	2179	2203	2230	2155	1378	1385	1237	1220	1307	1150	2375	2595	3304	2807	2424	4339
23	3213	873	3585	3572	3400	3159	1370	1399	1301	1357	1382	1256	2587	2953	3952	3344	2810	5245
24	973	320	1103	1111	1114	1074	356	344	296	296	342	303	1043	1122	1255	1159	1070	1575
25	9279	1534	10614	10585	10155	9479	5064	5058	4778	4688	5018	4720	8672	10179	13771	11831	9957	20030
26	584	173	692	726	757	777	846	821	773	773	830	705	1587	1823	2364	2077	1760	3261
27	899	277	963	986	1023	981	639	659	584	562	600	552	2001	2236	2875	2552	2205	3928
28	2649	572	3060	3101	3084	3051	1754	1747	1556	1525	1654	1477	5676	6467	8141	6980	6092	10855
29	776	336	860	874	869	857	586	562	535	494	572	530	680	747	891	789	746	1222
30	221	93	265	271	275	263	194	208	199	200	205	190	512	660	882	786	672	1295
31	3149	386	3443	3318	3148	2924	937	936	886	922	953	862	1774	2045	2825	2377	1934	3926
32	1124	193	1290	1367	1353	1312	1646	1698	1635	1713	1820	1630	1437	1710	2473	2062	1730	3263
33	2211	247	2695	2803	2805	2763	3342	3284	3308	3471	3757	3648	1069	1307	1935	1741	1406	3418
41	29503	4664	34292	31958	28654	25398	3282	3409	3362	3708	4012	3773	9715	12473	21136	17813	13791	31684
42	1136	332	1390	1394	1391	1280	1258	1242	1150	1065	1157	1077	1081	1201	1718	1544	1301	2592
43	22592	2606	27790	27227	25733	23391	33994	36398	37391	42248	45685	42918	6973	8880	15052	12990	10258	24707
45	10415	1947	12463	12929	12788	12522	11963	12305	11906	13215	14485	13621	4660	5572	8570	7341	6015	12296
46	33381	7179	39171	41002	41096	40381	21657	21437	20222	20908	22536	20936	19206	22719	34124	29330	23760	47527
47	26930	3207	32575	34245	34114	33270	30857	32765	32413	37005	40504	37731	10351	12789	21321	18236	14476	34437
49	9801	1534	11783	12088	11997	11737	6491	6670	6578	7068	7787	7323	3624	4079	6368	5565	4744	11403
50	410	77	476	492	504	542	151	155	167	199	207	216	186	199	237	227	197	339
51	92	28	109	107	111	107	53	46	54	48	59	52	46	52	54	53	49	75
52	2608	662	3168	3351	3435	3404	1571	1614	1520	1570	1713	1568	2748	2916	4184	3681	3197	6433

53	*297*	*48*	*391*	*434*	*450*	*451*	*78*	*80*	*77*	102	113	104	52	68	101	115	89	245
55	*4873*	*1001*	*5803*	*6363*	*6503*	*6531*	*6606*	*6865*	*6603*	7371	7803	7110	2535	3168	4861	4128	3221	7848
56	*10867*	*1249*	*14504*	*15918*	*16072*	*16119*	*15935*	*18021*	*19042*	23136	25525	24291	3779	5196	9717	8269	6381	18744
58	*934*	*249*	*1189*	*1250*	*1219*	*1166*	*1762*	*1712*	*1677*	1693	1769	1657	815	906	1275	1099	941	1661
59	*844*	*176*	*1073*	*1147*	*1157*	*1140*	*1495*	*1496*	*1466*	1694	1779	1558	450	518	767	692	539	1211
60	*296*	*65*	*338*	*384*	*398*	*388*	*121*	*112*	*113*	114	113	117	352	415	657	522	423	787
61	*570*	*162*	*693*	*737*	*752*	*777*	*262*	*262*	*274*	314	379	353	200	252	402	387	341	668
62	*2521*	*551*	*3401*	*3741*	*3909*	*3953*	*2983*	*3194*	*3272*	3492	3812	3622	2828	3468	5073	4571	3700	7687
63	*338*	*55*	*477*	*528*	*534*	*550*	*606*	*602*	*589*	634	665	618	2597	3272	5625	4746	3676	7957
68	*19141*	*2710*	*20642*	*21361*	*20448*	*20072*	*8588*	*8765*	*8335*	8713	9191	8327	5616	6967	10439	8769	6434	13506
69	*6151*	*899*	*8292*	*9499*	*9555*	*9588*	*2923*	*2967*	*2951*	3023	3362	3118	1088	1304	1992	1684	1358	2622
70	*2490*	*457*	*3269*	*3667*	*3719*	*3754*	*5360*	*5539*	*5450*	5868	6364	5871	2547	3050	4560	4148	3473	6966
71	*4539*	*738*	*6489*	*6827*	*6619*	*6370*	*7115*	*7475*	*7473*	8143	8914	8508	2017	2507	3993	3546	2850	6098
72	*264*	*56*	*409*	*469*	*513*	*554*	*323*	*332*	*340*	328	343	326	345	400	578	528	507	931
73	*2294*	*377*	*3034*	*3238*	*3188*	*3002*	*2217*	*2283*	*2232*	2333	2560	2323	1266	1538	2457	2119	1667	3615
74	*3470*	*552*	*4683*	*5075*	*5089*	*4916*	*1340*	*1355*	*1328*	1538	1675	1631	1254	1571	2520	2275	1790	4478
75	*327*	*36*	*499*	*550*	*563*	*600*	*151*	*154*	*196*	256	307	327	11	22	42	32	23	69
77	*2300*	*370*	*2757*	*2835*	*2771*	*2664*	*1430*	*1473*	*1446*	1562	1699	1590	676	852	1387	1179	955	2272
78	*282*	*91*	*359*	*387*	*392*	*365*	*631*	*686*	*690*	700	736	795	136	162	203	187	164	280
79	*1135*	*205*	*1503*	*1598*	*1582*	*1513*	*959*	*944*	*936*	975	1027	937	1067	1300	2067	1658	1290	2731
80	*427*	*101*	*554*	*619*	*629*	*640*	*602*	*649*	*656*	749	852	755	228	285	365	287	292	714
81	*2401*	*406*	*3152*	*3402*	*3329*	*3349*	*3746*	*3998*	*4202*	5070	5483	5169	1649	1663	2599	2550	2201	5790
82	*2204*	*388*	*2782*	*3086*	*3081*	*3098*	*2232*	*2291*	*2210*	2386	2637	2387	1925	2321	3829	3464	2789	6195

References

Arnold S. F. (1993), "Gibbs sampling", *Handbook of Statistics*, 9,pp. 599–625.

Bartelsman, E, Haltiwanger, J. and S. Scarpetta (2004): "Microeconomic evidence of creative destruction in industrial and developing countries." The World Bank, Policy Research Working Paper No. 3464, December.

Criscuolo, C., P. N. Gal and C. Menon (2014), "DynEmp: A Stata® Routine for Distributed Micro-data Analysis of Business Dynamics", *OECD Science, Technology and Industry Working Papers*, No. 2014/02, OECD Publishing.

Ferrando, A, M.T: Marchica and R. Mura (2014), "Financial Flexibility across the Euro Area and the UK", ECB WP n 1630.

Flannery, M. and K. Rangan, 2006, "Partial adjustment toward target capital structures," *Journal of Financial Economics* 79,469–506.

Gautier, E. (2008), "Bayesian estimation of inequalities with non-rectangular censored survey data".

Gourieroux, C., Monfort, A., Renault, E., & Trognon, A. (1987). Generalised residuals. *Journal of Econometrics*, *34*(1), 5–32.

Little, R. J., & Rubin, D. B. (2002). Statistical analysis with missing data.

Lollivier S. and Verger D., (1987), "D'une variables discrete à une variable continue: la technique des résidus simulés".

Paloma Lopez-Garcia, Filippo di Mauro, Nicola Benatti, Chiara Angeloni, Carlo Altomonte, Matteo Bugamelli, Leandro D'Aurizio, Giorgio Barba Navaretti, Emanuele Forlani, Stefania Rossetti, Davide Zurlo, Antoine Berthou, Charlotte Sandoz-Dit-Bragard, Emmanuel Dhyne, João Amador, Luca David Opromolla, Ana Cristina Soares, Bogdan Chiriacescu, Ana-Maria Cazacu, Tibor Lalinsky, Elena Biewen, Sven Blank, Philipp Meinen, Jan Hagemejer, Patry Tello, Antonio Rodríguez-Caloca, Urška Čede, Kamil Galuščák, Jaanika Merikyll and Péter Harasztosi, 2014, "Micro-based evidence of EU competitiveness: the CompNet database" ECB WP n 1634.

Rajan, R. G. and L. Zingales, 1995, "What Do We Know about Capital Structure? Some Evidence from International Data," *Journal of Finance* 50, 1421–1460.

Robert, C. P., & Casella, G. (2004). *Monte Carlo statistical methods* (Vol. 319). New York: Springer.

Wanzenried,, G., 2006, "Capital Structure Dynamics in the UK and Continental Europe," *European Journal of Finance*, 12, 693–716.

The Advantages of Random Sampling versus Cutting-of-the-Tail: the Application of a Stratified Sample Design for the Collection of Data on Special Financial Institutions in the Netherlands

Raymond Chaudron and Krit Carlier[1]

1. Introduction

The Netherlands is home to a large number of Special Financial Institutions (SFIs). SFIs are subsidiaries of foreign companies with almost exclusively financial relations with other foreign entities. The main motives behind the presence of these companies in the Netherlands are fiscal and regulatory. Interest in the sector has heightened since the 2008 financial crisis, especially from those working on macro-prudential issues relating to shadow banking. As mentioned in the *Global Shadow Banking Monitoring Report 2013* of the Financial Stability Board, the Netherlands has one of the largest non-bank financial intermediaries sectors in the world, relative to GDP[2]. SFIs make up the majority of this. It is therefore very important to have statistical data about SFIs that is accurate and reliable.

In the Netherlands SFIs were traditionally surveyed using a two-tiered collection system. The largest SFIs were surveyed on a monthly basis, while the remaining SFIs reported only limited information in a census every other year. The selection of SFIs for monthly reporting was determined on the basis of a cut-off sample of the largest companies aimed at a predetermined coverage of total assets of roughly 95%. In between the two-yearly censuses, population totals were calculated by simple grossing up. This system was quite reliable at first, since the population was extremely skewed, not too large and fairly stable. However, the growth of SFIs since the middle 2000's in both number and size (see figure 1) led to an ever increasing number of monthly reporters, as well as an upward shifting cut-off threshold.

The increasing number of monthly reporters placed an increasing workload on the organisation to check the monthly data, whereas the upward shift in the threshold increased the non-observed part of the population, both in absolute and relative terms. At first, compilers at the central bank increased the number of monthly reporters (from 600 in 2004 to 1200 in 2008) in order to maintain the required coverage of 95%. Thereafter it became necessary to lower the coverage from 95% to 89% in 2012, in order to prevent the number of reporters of growly to unsustainable levels. By 2012 a coverage of 95% would have required more than 1800 monthly reporters. The increase in the number of reporters led to a

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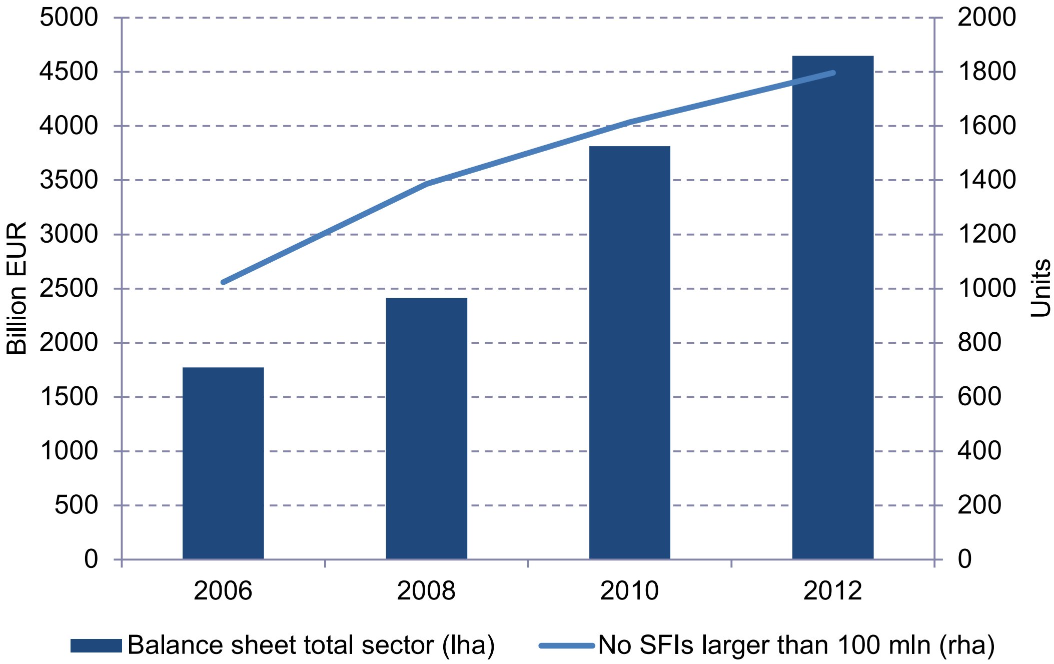
2 See FSB (2013), Exhibit 3–1, page 11.

deterioration in the quality of the reports due to insufficient capacity to check them, provide support to reporting institutions and monitor population developments. The latter being of utmost importance for this very volatile population. Ex-post revisions of the data on 2010 exceeded EUR 100 billion due to newly detected SFIs from the census. The high level of dynamism in the population of SFIs also meant that the grossing-up ratio became outdated more quickly. It was thus deemed necessary to increase the frequency of the two-yearly census to an annual census, putting additional strains on the organisation.

Size of the special financial institutions sector

Figure 1



The above-mentioned problems prompted the need for a more efficient data collection system. In 2011 an investigation was initiated to explore the possibilities to move to a more sophisticated sample design incorporating random sampling in order to reduce the number of monthly reporters and increase quality. These analyses showed that the cut-off sample was introducing an increasingly large bias into the population estimates, particularly regarding individual items of the balance sheet. It also showed that a stratified sample design incorporating an include-all top stratum and an exclude-all tail, with a random sample for the mid-sized SFIs, could significantly lower the number of monthly reporters while improving the quality of the population estimates. By 2013 a sample design was chosen and implemented for the SFI sector. This paper elaborates on the rationale to move to this new sample design and its features.

The rest of the paper is structured as follows. The following section provides a brief description of the SFIs in the Netherlands as well as an indication of their size. Section 3 explains the limitations to cut-off sampling, while section 4 presents an outline of the sample design incorporating random sampling. Section 5 illustrates the results of the Monte Carlo simulations which were used to fine-tune the sample design. Section 6 ends with conclusions.

2. A brief description of SFIs in the Netherlands

Broadly speaking, SFIs can be classified into four types: holding company SFIs, financing company SFIs, Financial Vehicle Corporations (FVCs) for the securitisation of assets and other SFIs. These types of SFIs are distinguished according to the structure of their balance sheets[3]. Holding company SFIs primarily have equity participations in or by group companies on both sides of their balance sheet. They are usually part of a multinational's group structure in order to optimise the tax payments of the whole group. Financing company SFIs are set up to concentrate a conglomerate's external (wholesale) funding into one entity. Financing company SFIs obtain funding through either the issue of debt securities or through loans which is then distributed throughout the conglomerate. Both the assets and liabilities of financing SFIs are therefore dominated by borrowings. The balance sheet of SPVs contain the assets which are securitised (usually mortgages or commercial loans) on the asset side, financed by the issue of asset backed securities on the liabilities side. The group of other SFIs is fairly heterogeneous. Some are hybrids, mixtures of the first three, while some are set up for a specific purpose, such as the management of royalties or intra-company factoring.

International investment position (IIP) of the Netherlands, 2013 (billion euro) Table 1

	Assets			Liabilities		
	SFIs	Other sectors	Total	SFIs	Other sectors	Total
Direct investments	2,814	757	3,571	2,438	498	2,936
Equity capital	2,014	524	2,565	2,000	294	2,294
Other capital	772	233	1,005	439	203	642
Portfolio investment	102	1,223	1,325	526	1,253	1,779
Equity securities	47	567	614	21	413	434
Debt securities	55	656	711	505	840	1.345
Financial derivatives	58	225	283	19	229	248
Other investment	139	726	865	128	706	834
Official reserves	0	34	34	–	–	–
Total	3,112	2,965	6,077	3,111	2,686	5,797

3 SFIs may also be classified according to the activity of the group to which they belong. For macro-prudential purposes, the Nederlandsche Bank uses a distinction between financial groups and other groups.

All SFIs have in common that they have no or only a few employees and that they have no relationship with the real economy of the Netherlands. Most small SFIs are managed by external management companies called trust offices. These companies should not be confused with the Anglo-Saxon trust company – which is a legal construct for the administration of financial assets for a group of beneficiaries. Dutch trust companies can be best described as corporate service providers, providing administrative, legal and compliance services. They are subject to supervision of the Dutch central bank under the Trust Offices Supervision Act ('Wet toezicht trustkantoren'). SFIs themselves are not supervised. SFIs which are part of financial conglomerates together with SPVs are considered to be an important part of the shadow banking sector in the Netherlands. Statistical data on SFIs was originally collected only for the Dutch balance of payments, but is used increasingly as a stand-alone dataset since the interest in shadow-banking activities has surged after the financial crisis, for instance in the annual FSB *Global Shadow Banking Monitoring Report*. Table 1 provides an overview of the size of the SFIs' financial position in relation to the international investment position of the Netherlands. As the data in the table clearly shows, SFIs make up roughly half of all cross-border assets and liabilities of the Netherlands.

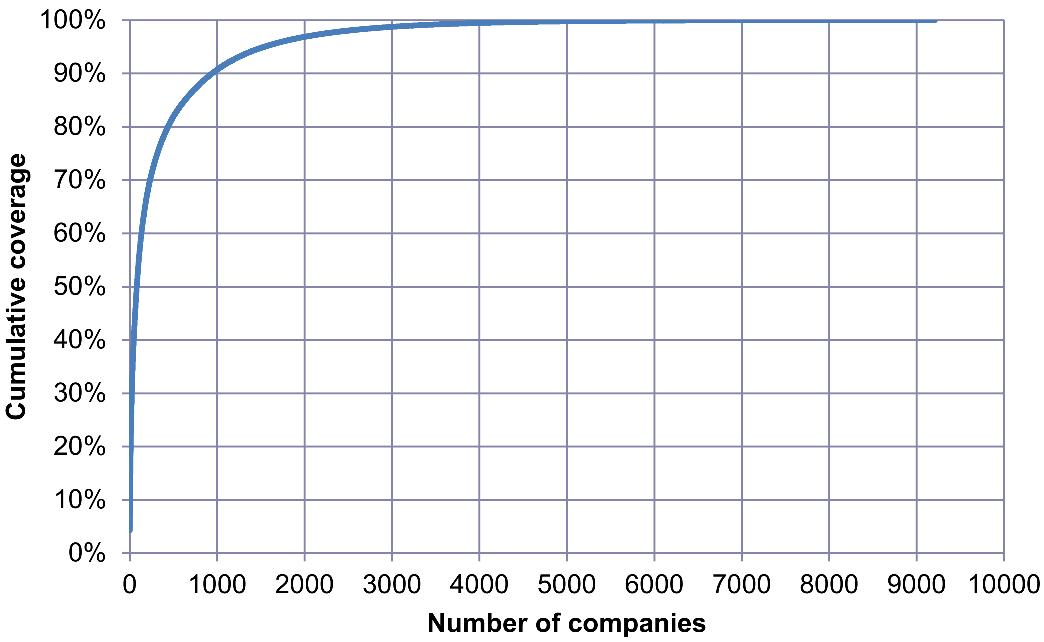
3. Limitations to cut-off sampling

A cut-off sample design works well if the population is both stable and homogenous. A stable population does not show many new institutions which appear (births) or disappear (deaths) in between the updates, nor shows many fundamental changes of entities themselves. In a stable population the risk of missing out on important developments concerning out-of-sample entities is therefore minimal. In turn, in a homogenous population institutions vary by size, but not by other characteristics. In other words, a cut-off sample design assumes the largest institutions to be representative for the small institutions in every respect. Their balance sheet structure is comparable and they grow or contract in the same way as the small institutions. Obviously, once these assumptions are less realistic the cut-off sample design will lead to biased estimates of the population as a whole. As such biases most severely affect the breakdown of the estimates, whether these matter or not depends on user demands. The more statistical demands of users concern certain breakdowns, the more important the aspect of homogeneity becomes.

Surveys of financial institutions carried out by central banks have traditionally used a cut-off sample design. In such a design, institutions are ordered by size (for instance total assets) and the largest institutions, representing a certain percentage of the population total (usually 90 or 95%) for the size measure are selected for regular (e.g. monthly or quarterly) reporting. The whole population is enumerated using a less frequent census, on the basis of which the cut-off sample and the grossing-up ratios are updated. This sample design is efficient in terms of sample size and reporting burden, as most financial sectors exhibit a strongly skewed population distribution. In financial sectors such as banks, pension funds and insurance companies, a small proportion of the largest institutions represent a disproportionally large fraction of the total assets of the whole sector. Furthermore, in most countries, the financial sectors consist of a few dozen or a few hundred institutions at the most and are fairly stable over time. Advantages of the cut-off sample design in these cases are the simplicity of selecting reporters, the concentration of reporting burden with the largest institutions and the procedure to gross-up the observed figures to population totals. The data from the monthly reporting institutions is simply multiplied with the inverse of the proportion of the size measure represented by the largest institutions in the sample.

Like other financial sectors, the population SFIs is highly skewed. Figure 2 on the next page shows that in 2008 the largest 1000 SFIs covered just over 90% of the population total assets. After the 1000 largest however, the additional coverage of each company quickly declines. However, unlike other financial sectors the number of SFIs involved is quite large: by the latest count there were 14.366 SFIs in the Netherlands (2013) and the population has also become very volatile. For instance, between 2008 and 2010 about 2,500 new entities were established of which more than 100 with total assets in excess of EUR 1 billion. During the same period 1,700 entities disappeared, of which 40 were larger than EUR 1 billion. Next to the high incidence of 'births' and 'deaths', entities can also mushroom in size or reversely shrink to limited proportions from one period to the other.

Cumulative coverage of total assets of companies ordered by size (2008) — Figure 2



In fact, SFIs do not form a homogenous population, even when the most basic characteristic is considered, the composition of the balance sheet. As explained in the introduction, there are four basic types of SFIs based on the structure of the balance sheet. This structure largely depends on the size of the SFI. As illustrated by figure 3, large SFIs are financed with securities and equity from group companies, whereas the smaller SFIs are predominantly financed through intercompany loans. Since the large SFIs are not representative for the smaller ones, accurate estimates for the whole population can not be provided through a cut-off sample but require sampling of all size groups. As statistical demands of users of SFI data, for instance for the analysis of financial stability, are increasingly interested in certain breakdowns, this lack of homogeneity clearly necessitates an unbiased sample design.

Composition of the liabilities of SFIs by size group

Figure 3

Finally, another drawback regarding the cut-off design is that it is very difficult to provide a measure of accuracy (such as a confidence interval) for the estimates of the population totals. As the selection of the reporting population is non-random (but systematic) it is impossible to estimate sampling errors. By contrast, a sample design which incorporates a random selection of specific groups of reporters does allow for the calculation of statistical confidence measures. Furthermore, as we show later, random selection enables to fine-tune the sample design using stochastic techniques such as Monte-Carlo simulations.

4. Outline of the new sample design

The aim of choosing the optimal sample design was to combine the efficiency in terms of sample size and reporting burden of a cut-off sample with the advantages of a stochastic sample design. Through this strategy one can still benefit from the skewness of the population, which is further documented in tables 2 and 3.

Combining the efficiency of a cut-off sample with the superior estimation of a random sample is possible by using a stratified sample design in which a top stratum is defined from which all reporters are selected and a second stratum from which reporters are selected through a random process. This sample design follows the basic set-up presented in Benedetti et al. (2010). Assuming a given number of reporters in a cut-off design and in a stratified design, the number of reporters in the top stratum will of course be smaller in this new sample design than in a cut-off sample to accommodate sampling in the sample stratum. In addition to a top stratum and a sample stratum, one can also define a tail stratum from which the reporters – whose contribution to population totals is very small – are completely exempt from reporting. This is also a cut-off in a sense and can be employed to relieve the very smallest of institutions from reporting, at the same time limiting the sample size. This cut-off stratum can be kept small enough to be estimated using a relatively naive estimator, such as a fixed amount or a proportion of the total, analogous to the cut-off sample design.

Size distribution of the SFI population over time, number of entities — Table 2

Size class	2006		2008		2010		2012	
(million EUR)	Number	Share (%)	Number	Share (%)	Number	Share (%)	Number	Share (%)
> 10.000	31	0.4%	39	0.3%	75	0.6%	97	0.8%
1.000 – 10.000	265	3.4%	345	3.1%	504	4.0%	560	4.4%
100 – 1.000	1,023	13.2%	1,386	12.4%	1,614	12.9%	1,796	14.0%
10 – 100	1,914	24.7%	2,407	21.6%	2,761	22.0%	2,915	22.7%
< 10	4,519	58.3%	5,070	45.4%	5,291	42.2%	5,102	39.8%
Liquidated			1,909	17.1%	2,283	18.2%	2,344	18.3%
Total	7,752	100.0%	11,156	100.0%	12,528	100.0%	12,814	100.0%

Size distribution of the SFI population over time, total aggregate assets — Table 3

Size class	2006		2008		2010		2012	
(million EUR)	Aggregate assets	Share (%)	Aggregate assets	Share (%)	Aggregate assets	Share (%)	Aggregate assets	Share (%)
> 10.000	638,035	34.5%	943,210	37.6%	1,746,970	44.5%	2,354,968	49.4%
1.000 – 10.000	800,500	43.2%	1,019,109	40.6%	1,498,698	38.2%	1,669,676	35.1%
100 – 1.000	335,269	18.1%	452,657	18.0%	569,336	14.5%	621,677	13.1%
10 – 100	68,878	3.7%	87,458	3.5%	100,181	2.6%	107,655	2.3%
< 10	9,003	0.5%	9,373	0.4%	11,016	0.3%	9,650	0.2%
Liquidated			–	0.0%	–	0.0%	–	0.0%
Total	1,851,685	100.0%	2,511,807	100.0%	3,926,200	100.0%	4,763,626	100.0%

The three strata are often denoted by the take-all or the certainly include stratum (CI), the take-some or random sample stratum (S) and the take-none or certainly exclude stratum (CE), where the sample stratum can be further subdivided into two or more substrata with different sampling proportions. Stratification can be based on a single criterion (variable), but also on combinations of two or more criteria. The main objective in stratification is to divide the population in homogenous groups. A common practice is to use the target variable(s) itself as auxiliary variable, provided that data on this variable is available for the entire population, for instance from the most recent census. In fact, it is best to choose stratification variables that are highly correlated with the target variables for the most accurate estimates. Since total assets have high serial correlation, lagged total assets (or other balance sheet items) make good stratification variables.

In the simplest sample design each entity in the sample stratum has an equal chance of being selected. Such a design can be described as follows. If Y denotes the target variable to be estimated for the whole of the population, N_a is the total number of SFIs in stratum a and n_a is the number of SFIs sampled from stratum a (where CI, S and CE indicate the certainly include, sample and certainly exclude strata), then the estimate of the population sum of Y is as follows:

$$[1] \quad \hat{Y} = \left(\sum_{i=1}^{N_{CI}} Y_i\right) + \left(\sum_{j=1}^{n_S} Y_j \frac{N_S}{n_S}\right) + f(N_{CE})$$

The first term of the right hand side of this equation is simply the sum of the observations from the companies in the certainly-include stratum. This sum is of course completely non-stochastic since all entities in this stratum are sampled. The second part of the equation is the sum of observations from the companies in the sample stratum multiplied with the inverse of the sample proportion. This is the only stochastic part of the estimate. The error of the population estimate will almost exclusively depend on the variance of this estimator. The final part, which is not further specified here, is a term to denote the estimate for the companies in the certainly-exclude stratum.

It is of course possible to employ a different sampling procedure than simple random sampling for the sample stratum, in which the chance of being selected is not identical for all entities within a stratum but for instance depends on the size of the entity (sampling with a probability proportional to size, PPS).

5. Choosing the optimal sampling parameters

A major advantage of stochastic sample designs over cut-off sampling is that the quality of the sample design can be objectively compared based on quantitative measures, notably by comparing the mean squared error of the estimates (MSE) to the actual realisation. Using Monte-Carlo simulations for different values of the sample design parameters, including the choice of stratification variables and stratum boundaries, we were able to fine-tune the parameters in order to produce the best population estimates. In order to find the optimal boundaries between the different strata (the certainly include stratum, the take-some or random sample stratum and the take-none or certainly exclude stratum) Monte Carlo simulations were performed for many combinations of these two boundaries, while keeping the total number of reporters fixed.

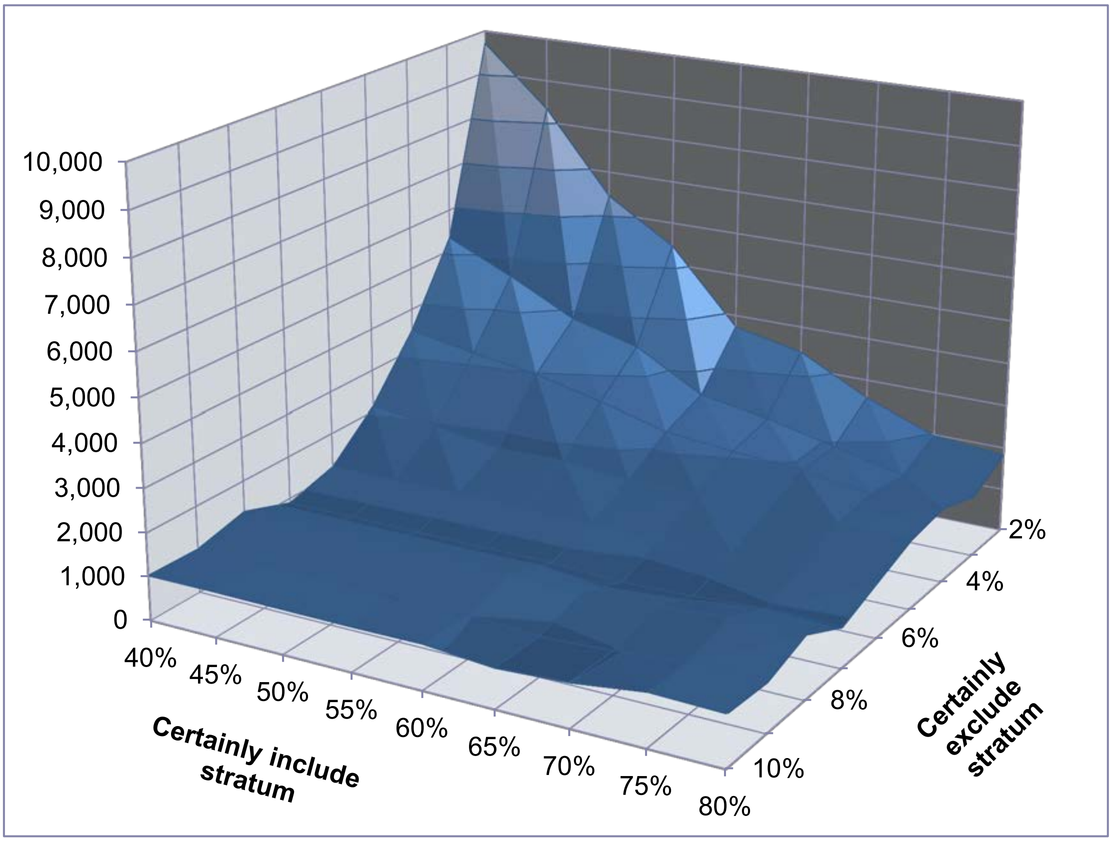
The boundary of the certainly-include stratum was varied between 40% and 80% of the population total for assets, with intervals of 5%. The certainly-exclude stratum was varied between 2% and 10% with 1% intervals. By performing 1000 simulations with sample size n divided between the certainly include and the sample strata for each of the combinations of the boundaries for the certainly-include and certainly-exclude stratum, we could obtain measures for the accuracy of each variation of the sample design.

Figure 3 presents the MSE for the population estimate of total assets. The MSE is shown to initially decline with an increase of the certainly-include boundary, but roughly from the 65% mark[4] it starts to increase with a further increase of this boundary. This pivot point results from the fact that more reporters in de CI stratum implies less reporters in the sample stratum (when keeping the total sample size constant).The figure shows a reverse pattern regarding the certainly-exclude boundary: the MSE decreases with an increase of the boundary which indicates that too low a boundary includes volatility introduced by a very limited number (low chance of selection) of small SFIs growing very fast. Similar analyses have been performed for individual balance sheet items and the geographical breakdown, showing comparable results. The shape of the figure also demonstrates that the optimal sample design includes all three strata. As the certainly-include stratum exceeds 65%, the MSE starts to increase again. This effect is caused by the fact that there are too few reporters from the sample stratum. In the end, the optimal stratification chosen was for a 65% certainly-include stratum and a 4% certainly-exclude stratum.

After the boundaries of the certainly-include and certainly-exclude had been roughly determined, the required size of the reporting population – certainly-include stratum plus sample stratum – needed to be defined. For this purpose again Monte Carlo simulations were performed, the boundaries set as defined above (at 65% and 4% respectively), but for different sizes of the reporting population. From this a downward sloping curve results (more reporters always mean higher quality estimates) but the slope becomes increasingly flat with each additional reporter (implying that each additional reporter has a lower effect on the quality than the previous one). This curve provides information of the quality of the estimate with different numbers of reporters and thus allows setting the size of the reporting population providing the quality required. In the case of the SFIs, a total sample size of around 850 was considered sufficient. Additional reporters were shown not to increase the quality substantially. Compared to the pure cut-off sample design, this entailed reducing the number of reporters with approximately one-third compared to the cut-off sample used previously.

4 At which 65% of the population's balance sheet total is covered by the CI stratum.

Mean squared error of the population sum of assets Figure 4



The new sample design thus offers two clear benefits. Firstly, the new approach has made the accuracy an explicit criterion in the sample design. This enables statisticians to engage in an informed discussion with users and management about the priorities and the resources devoted to the survey. It also allows statisticians to determine the limits for which the data can be used. Secondly, the new sample design is shown to provide better quality estimates compared to a cut-off sample (of equal size). In the case of SFIs it also allowed a reduction of the sample size significantly from around 1400 to 850. This in turn made it possible to devote more time and effort to every individual reporter and to the maintenance of the business register and the annual census, thus improving the overall quality of the statistics even more.

6. Conclusions

The main point we want to make here is that the use of stochastic sample designs – as opposed to the purely systematic selection of companies through for instance a cut-off sample of the largest units – can significantly increase the efficiency of a data collection system as well as the quality of estimates of both aggregates and breakdowns. Additionally, in contrast to systematic collection, stochastic sample designs allow quantifying the quality of the estimates with varying sample sizes, so that the sample size can be set in an informed manner. As a result, stochastic sample designs can be used to limit the sample size considerably as well as improving output quality (reporting burden, though less a concern since the financial crisis, still also plays an important role in the background), as we have illustrated for the case of Dutch SFI statistics.

We also want to mention that besides the choice of sample design, there are many other practical issues that have to be resolved in putting a new sample design into practice. One important issue is that of sample rotation. By renewing the random sample each year, companies risk having to report on and off. In order to limit this side-effect (which is difficult to understand from the perspective of the reporter), we have chosen to renew only one third of the sample each year using a system with so-called 'permanent random numbers' (see Ohlson, 1995). Monte Carlo simulations have shown that this did not significantly worsen the accuracy of the estimates. Another practical issue to be dealt with is that of maintaining the business register from which the sample is drawn and the treatment of 'births and deaths'. By limiting the number of monthly reporters, we were able to free up resources for the maintenance of the register, which is a vital prerequisite for reliable samples.

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References

Benedetti, R., M. Bee, and G. Espa (2010), A Framework for Cut-off Sampling in Business Survey Design, *Journal of Official Statistics*, 26(4), pp. 651–671.

Financial Stability Board (2013), Global Shadow Banking Monitoring Report 2013, Basel.

Ohlsson, E. (1995). Coordination of Samples Using Permanent Random Numbers. In Cox, B. et al. (eds.): Business Survey Methods. New York: Wiley, 153–169.

Financial Interaction Analysis using Best-Fitted Probability Distribution

Vincent Ang[1]

Abstract

This paper explores the statistical method to best-fit probability distributions onto data of variables and subsequently performs analysis using the derived distributions. These distributions would represent the characteristics of the variable data. By employing Monte Carlo simulation on the derived distributions to generate values and imputing them into a model or formula that defines the interaction between the variables, we obtain the outcome of their interactions. An example of performing such an analysis onto the US treasury, and subsequently a hypothetical portfolio is included.

Keywords: Probability distribution, goodness-of-fit, distribution fitting

JEL classification: C63

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1. Introduction

Probability distribution has been used in the financial industry as a way to model and quantify the outcomes of financial interactions – from the start of market activity such as option pricing, to the end of day calculation of a portfolio's Value-at-Risk (VaR). By assuming the distribution of a data, analysts can utilize the characteristics of the distribution to make predictions on outcomes. A commonly used probability distribution is the Normal distribution for its simplicity of having two easily identifiable parameters: mean and variance, and the widespread notion that most populations are distributed normally when sampled at large numbers. However, the Normal distribution assumes some criteria, such as symmetry and excess kurtosis of 0, which might not be true for all dataset. The past crisis has shown us that the Normal distribution is questionable when it comes to the performance of the financial industry. Occurrences of monumental losses causing bankruptcies and bail-outs of some of the largest financial institutions in the world has highlighted that better-fitting distributions ought to be employed in financial modelling to not underestimate any potential risk involved. It is worth highlighting that the aim of the paper is not to discourage the use of Normal distribution or to show the suitability of a distribution onto any data, but instead to encourage the practice to determine the best-fitting distribution and resist assuming data normality.

This paper explores methods to determine the best-fitting probability distribution for a given set of data, in order to use the derived distribution for further analysis. In doing so, the author hopes to also give a practical guide in using probability distribution in day-to-day analysis of financial data. Raw dataset are first matched to probability distributions of interests that reflect a good fit. Subsequently, the optimal parameters for the distribution in context are selected. Goodness of fit tests would then be conducted to determine the distribution that best fit the data. The distribution can then be used to forecast outcomes of financial interactions based on its characteristics. This paper takes sole interest in continuous random variables (as opposed to discrete random variables), as they enable forecasts at any point within the range supported by the distribution.

The introduction of the *Fundamental review of trading book* by Bank of International Settlement has also made it worthwhile to be proficient in determining the most appropriate loss distribution in embarking on the Expected Shortfall (ES) risk measurement method. As ES is suggested to better capture the tail risk, the shape of the distribution has be first be appropriately specified. Usual convention of taking the tail of a normal distribution[2] could be understating risk. ES would not provide much benefit if the users simply assume a normal distribution as the result would be a mere multiplication of the VaR of the same cut-off by a constant factor. However, after having fitted the distribution that would best match the performance of the underlying data, ES could have a more meaningful result.

2 This is a common practice in measuring Value-at-Risk, the measurement tool that ES is expected to replace.

2. Method and Materials

The best-fitted distribution for a dataset enables the user to describe the behaviour of the underlying financial data. In fitting the data with a distribution, usually more than one distribution would be of interest in the matching process. In order to identify the distributions that would be fitted onto the data, raw data is grouped into appropriate bins (frequency width) to obtain the density of the empirical data at different points. A histogram can be drawn to depict the shape of the empirical data's distribution for visual representation of the density. There are three general categories of probability distributions that can be employed to fit the distributions: Parametric, Non-parametric, and Semi-parametric. This paper would focus on the parametric and non-parametric distributions only. After determining the probability density function to be used to fit the data, goodness of fit (GoF) tests would be performed to quantitatively select the best fitting distribution.

Parametric Distributions

Parametric distributions (Pd) have pre-determined shapes and behaviours[3]. The user would have to identify Pd with similar shapes to that of the underlying dataset's density. This practice requires good judgement, understanding of the underlying data behaviour, and knowledge of the Pd's description. Non-trivial Pd would require that their parameters[4] be estimated to best fit the identified Pd to the underlying dataset. Methods to estimate parameters that have received widespread reception include Maximum likelihood estimation (MLE), and L-moment.

i) Maximum Likelihood Estimation

MLE is a process that attempts to compute the best parameters for any Pd that is hypothesized to fit the given finite number *n*, of empirical data (data points).The idea behind this is that for each different data point, there is a unique probability for that data point to exist/have occurred. Multiplying all *n* probability densities will give a joint probability, which is the likelihood probability, of all *n* data points to coexist/occur together (i.e. exactly the case when the analyst is given a set of empirical data). By selecting different parameters, the data points would result in different probabilities for each point. Hence, a different likelihood probability would be obtained for every different parameter chosen. MLE is then a process to determine the parameters that would result in the highest value of the likelihood probability i.e. highest likelihood for all the given data points to coexist. For instance, let α be a parameter of a Pd; then the likelihood probability is given by

$$(\text{Likelihood probability function} \mid \alpha) = f(x_1|\alpha).\ f(x_2|\alpha)\ldots\ f(x_n|\alpha)$$

[3] Behavior meaning the probability of the distribution at any particular point that is unique to itself, like heavy tails or skewness.

[4] Parameters here refer to the constants that would define the shape of the parametric distributions. E.g. mean and variance are two parameters of the normal distribution, while alpha and beta are the two parameters of the Beta distribution.

$$= \prod_{i=1}^{n} f(x_i|\alpha).$$

such that $f(x)$ is the probability density function of the parametric distribution, and x_i (for all i from 1 to n) are the data points. The parameters that would maximize the likelihood probability would be the maximum-likelihood estimators (MLE). Since the logarithm[5] of the likelihood probability would be maximized when the likelihood probability is maximized, the derivation of MLE is usually simplified by differentiating the logarithm of the likelihood probability to solve for the MLE. By differentiating

$$\ln \prod_{i=1}^{n} f(x_i|\alpha) = \sum_{i=1}^{n} \ln f(x_i|\alpha)$$

and equating the result to 0, the user can solve for the α that maximizes the likelihood probability. With more parameters, the logarithmic equation would have to be differentiated with respect to all parameters separately, providing each parameter with its own MLE.

ii) L-moments

In order to describe L-moments, it is useful to first explain moments and its use in estimating statistical parameters. Moments are the expected value of the powers of the probability distribution of interest. They are defined as the integration of the probability density function, $f(x)$ with the random variable, x of a certain power:

$$\begin{aligned} \text{first moment} &= \int_{-\infty}^{\infty} x f(x)dx \\ \text{second moment} &= \int_{-\infty}^{\infty} x^2 f(x)dx \\ &\dots \\ \text{nth moment} &= \int_{-\infty}^{\infty} x^n f(x)dx \end{aligned}$$

For a Pd that has j number of parameters, the user would need to determine moments up to the power of j to have j equations so that each of the parameters can be solved linearly. From the data points given, the user can derive values needed to be equated to the respective moments to solve for the parameters.

L-moments are then linear combinations of probability weighted moments (PWM), such that the PWM are defined as [Greenwood et al. (1979)]

$$\beta_r = E\{X[F(x)]^r\} = \int_{-\infty}^{\infty} xF(x)^r f(x)dx$$

where β_r is the r-th order PWM, $f(x)$ is the probability density function and $F_x(x)$ is the cumulative distribution function of the distribution of interest. The unbiased estimator of β_r is derived as [Landwehr et al. (1979), Hosking and Wallis (1997)]

$$\hat{\beta}_r = \sum_{i=1}^{n} \left[\frac{(i-1)(i-2)(i-3)\dots(i-r)}{n(n-1)(n-2)(n-3)\dots(n-r)} \right] x_i$$

[5] Logarithm function is monotonously increasing and hence the maximum point of any function would also result in the maximum of the logarithm of the function.

with the first four b_i given as:

$$\hat{\beta}_0 = \frac{1}{n}\sum_{i=1}^{n} x_i = \bar{x}\text{, i. e. the mean of the data points}$$

$$\hat{\beta}_1 = \sum_{i=1}^{n-1}\left[\frac{n-i}{n(n-1)}\right]x_i$$

$$\hat{\beta}_2 = \sum_{i=1}^{n-2}\left[\frac{(n-i)(n-i-1)}{n(n-1)(n-2)}\right]x_i$$

$$\hat{\beta}_3 = \sum_{i=1}^{n-3}\left[\frac{(n-i)(n-i-1)(n-i-2)}{n(n-1)(n-2)(n-3)}\right]x_i$$

such that x_i are the n number of ordered data points $x_1 \leq x_2 \leq x_3 \leq \ldots \leq x_n$. The first four L-moments are then defined as [Hosking (1990)].

$$\lambda_1 = \beta_0$$
$$\lambda_2 = 2\beta_1 - \beta_0$$
$$\lambda_3 = 6\beta_2 - 6\beta_1 - \beta_0$$
$$\lambda_4 = 20\beta_3 - 30\beta_2 - 12\beta_1 - \beta_0$$

By substituting the $\hat{\beta}_i$ into the β_i of the λ equations and solving the system of equations of these L-moments, the user can then obtain the parameters that best fit the Pd of interest.

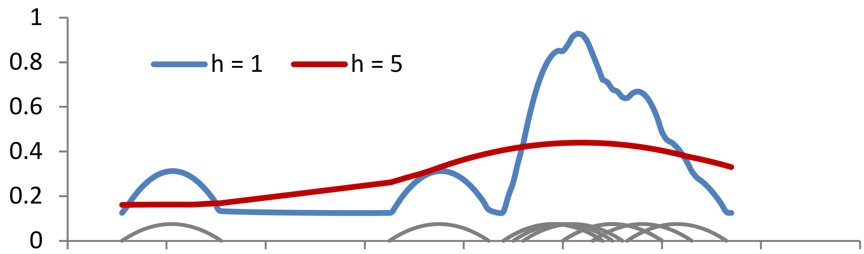
There exist extensive lists of Pd that can be chosen to fit an empirical dataset. The appendix enumerates the list of Pd, their derived MLE, and the shapes of the Pd that are used in the example that follows.

Non-parametric Distributions

Non-parametric distributions (Npd) do not have a predefined shape or behaviour, and its resultant probability distribution is highly dependent upon the data points provided to be fitted. A notable method of Npd is the Kernel Density Estimation (KDE). KDE [Rosenblatt (1956)] assigns every data point a kernel, $K(x)$, with that kernel itself being a density function with properties of symmetrical at 0, $K(x) \geq 0$ and $\int_{-\infty}^{\infty} K(x)dx = 1$. The individual kernels are then summed up to form a Kernel density estimator that would map closely to the shape of a histogram of the dataset. The KDE function is defined by

$$f_h(x) = \frac{1}{hn}\sum_{i=1}^{n} K(\frac{x - x_i}{h})$$

Example of Kernel Density Estimation | Figure 1



such that $h > 0$ is a smoothing parameter called the bandwidth. The KDE can trace the dataset more granularly by having smaller h, but at the trade-off of obtaining a less smoothed curve. In the world of finance, to observe prudency, it is advisable to structure the bandwidth such that the derived Npd has only one global maximum. This would result in $\forall n > 0, \text{if } f_h(x_t) = \text{global maximum}\text{ , then } f_h(x_t) \geq f_h(x_{t+n})$. This prudency measure makes sure that the further end (i.e. the tail) of the KDE does not have a higher probability than any point before that as it would be counter-intuitive. A list of commonly used kernels is stated in appendix.

Goodness of Fit Tests

After obtaining a satisfactory probability density function with a shape that resembles the histogram drawn (by simple observation), the user has to measure quantitatively how good the derived distribution matches the given dataset. The following section enumerates a list of GoF tests that would be major decision making tools in choosing the best-fitting distribution.

i) Pearson's Chi-Squared test

The Pearson's Chi-Squared test measures the GoF between the derived distributions against the data points. It does so by comparing the observed frequencies of occurrence (frequency of data points in their respective histogram bins) to the expected frequency using the derived distribution. This test produces a p-value statistics that can be used to compare against the Chi-Squared distribution to test the null hypothesis, h_o: difference in frequencies is equal to zero. The value of the test statistics is defined by [Pearson (1900)]:

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

such that O_i is the observed frequency of the dataset, and E_i is the expected frequency according the to the derived distribution. The test statistics would have n-p degree of freedom, with p being number of distribution's parameters plus 1. The advantage of this test is that it enables the user to test the GoF to obtain a certain degree of confidence level using the Chi-Square by itself (without the need to compare against another distribution). A low p-value would mean that the observed frequency deviated from the expected frequency with statistical significance. Functionally, a low p-value indicates that the distribution is not suitable for the dataset, and 0.05 (i.e. 5%) is usually a benchmark of confidence.

ii) Akaike Information criterion

The Akaike Information criterion (AIC) provides a relative measure of GoF among different distributions of interest. This means that using AIC on one single distribution provides no information about the GoF. AIC measures the fitness by emphasizing on GoF while deterring overfitting. The distribution that produces the smallest AIC value is the preferred choice. The AIC value is given by [Akaike (1974)]

$$AIC = 2k - 2\ln L$$

such that *k* is the number of parameters of the distribution and *L* is the likelihood function mentioned above for the derived distribution. To compare distributions that has small number of data, the corrected AIC (AICc) is used [Hurvich and Tsai (1989)].

$$AIC_c = AIC + \frac{2k(k+1)}{n-k-1}$$

The AIC and AICc however does not measure an absolute GoF and hence if none of the chosen distributions is not a good fit, this test does not show that.

iii) Cramer-von Mises test

The Cramer-von Mises test measures the distance between the cumulative density function of the derived distribution against the dataset's cumulative histogram. It is defined by [Cramer (1928)]

$$w^2 = \int_{-\infty}^{\infty} [F_n(x) - F(x)]^2 dF(x)$$

with $F_n(x)$ being the cumulative frequency of the data points and $F(x)$ being the expected cumulative probability from the derived distribution. It tests for the null hypothesis that the dataset comes from the derived distribution. The test statistics for this test is

$$T = nw^2 = \frac{1}{12n} + \sum_{i=1}^{n} \left[\frac{2i-1}{2n} - F(x_i)\right]^2$$

such that *n* is the number of data points and x_i is the data points in increasing order. If the value of the test statistics is larger than the tabulated value, then null hypothesis is rejected suggesting that the derived distribution is not a good fit [Anderson (1962)].

iv) Anderson-Darling test

Taking a step further on the Cramer-von Mises test by adding a weighing factor of $\psi\big(F(x)\big) = [F_n(x)(1-F(x))]^{-1}$, Anderson-Darling test takes the form of [Anderson-Darling (1954)]

$$W_n^2 = n \int_{-\infty}^{\infty} [F_n(x) - F(x)]^2 \psi\big(F(x)\big)\, dF(x)$$
$$= n \int_{-\infty}^{\infty} \frac{[F_n(x) - F(x)]^2}{[F_n(x)(1 - F(x))]}\, dF(x)$$

The test statistics then becomes

$$W_n^2 = -n - \frac{1}{n}\sum_{i=1}^{n}(2i-1)[\log F(x_i) + \log(1 - F(x_{n-i+1}))]$$

such that n is the number of data points, x_i is the data points in increasing order and $F(x_i)$ is the expected cumulative frequency. The Anderson-Darling's weighing factor naturally places more weight on the tail end of the data and hence would serve better purpose in trying to determine the GoF of heavy-tailed distributions. Just like the Cramer-von Mises test, if the test statistics is greater than the tabulated value, the null hypothesis is rejected and the derived distribution is not a good fit. This test however, needs a different test statistics table for each distribution of interest requiring more resources than other GoF tests. The author did not include this test in the example, but is highlighting that this test is a beneficial one in particular to test the GoF of heavy tailed events, which has been discussed as a crucial characteristic in financial analysis.

v) Mean Square Error (MSE) and Mean Absolute Deviation (MAD)

Both the MSE and MAD measure the difference in density between the derived distribution and the empirical data. MSE squares the error terms, also in a way weighing the individual errors by the size of the errors themselves, while MAD sums the absolute value of the differences. They are given by

$$MSE = \frac{1}{n}\sum_{i=1}^{n}(\hat{f}(x) - f(x))^2 \qquad MAD = \frac{1}{n}\sum_{i=1}^{n}\left|\hat{f}(x) - f(x)\right|$$

such that $\hat{f}(x)$ is the derived density and $f(x)$ is the empirical density. Naturally, MSE would put more weight on the errors that are bigger, resulting in bigger values of MSE for empirical data with outliers. The distributions with the smaller value of MSE and MAD are preferred.

Application on Financial Interaction Analysis

Having determined the best fitting distribution for the empirical data, the analysis of financial interaction that the author intends to introduce here is the application of Monte Carlo simulation onto the selected distribution to cross relates different distributions under different random scenarios. By generating random numbers bounded by (0,1),we use the inverse of the derived probability distribution's density function to generate the x-values. From the x-values, we can analyse the data according to the objective of the analysis.

For the best fitting exercise, the author has used 1000 positive daily yield hike i.e. price drop of the 1Y US treasury yield. The daily yield hikes are tabulated into bins of

50 basis points (bps) from 0 to 3500bps. These data are then fitted with different probability distribution of interests: Rayleigh, Pareto, Folded Normal, Weibull, Exponential and Gamma, all using MLE for parameter estimation. An additional Npd using the KDE is also fitted onto the data to obtain a resultant curve. These fitted distributions are then tested for GoF using the Pearson Chi-Square, Akaike Information Criteria, Cramer-von-Mises, and Mean Square Error & Mean Absolute Deviation. The best fit is then used in an example of estimating the ES of a portfolio.

In this example, the author is interested in calculating the ES of a hypothetical portfolio consisting of two assets (1Y US treasuries and 10Y US AAA corporate bonds[6]) with equal weights. The Gamma distribution is used to generate the x-values (i.e. yield hikes) of US treasuries while the Log-normal distribution is used to generate the x-values of US AAA Corporate bonds, by computing the inverses of both the distributions using randomly generated numbers within (0,1) as inputs. By simulating 1000 occurrences of yield hike using each of the derived distributions for the two assets, the portfolio's overall expected loss can be calculated by averaging the tail end after a 95% cut-off. Repeating this exercise of calculating ES for 1000 times gave a good estimate of expected shortfall of this portfolio.

3. Results and Discussion

The result from the GoF test shows different best fit depending on the test used. However, in our particular cases, Gamma distribution stands out as the best fitted line for the US 1Y treasuries. Figure 4 in the appendix shows the fitted line of the distributions onto the histogram of the empirical data.

It is observed that the KDE would give the closest estimates of the empirical data. This however does not give much meaning as the KDE is built upon each individual points given and hence would naturally be a closer match than any of the Pd. Among the Pd, Gamma is lowest in AIC and has relatively low CvM and MSE & MAD.

Goodness of Fit tests — Table 1

	Rayleigh	Pareto	Folded Normal	Weibull	Exponential	Gamma	Kernel
Chi-Square	NA	646*	NA	7891	3330	3637	33*
AIC	5559	4257	4470	3955	12747	3949^	3901^
CvM	168.2	16.8	NA	64.2	1.2	1.3	0.7*
MSE &	118.80	24.57	11.74	1.84^	2.71	2.77	1.08^
MAD	0.94	0.53	0.35	0.16	0.18	0.19	0.13

*Does not reject the distribution at 99% confidence interval.[7]

^ Top 2 relatively most suitable distributions.

[6] In this case the US AAA Corporate bond is only assumed to have a best-fitted distribution of log-normal without the process of best-fitting as done for the US treasuries.

[7] The densities of the derived distribution and the empirical data are not statistically significant different at the 1% level.

Having determined the best fitted probability with their respective optimal parameters, the distributions produced expected shortfalls via repeated iterations to provide a result in Table 2 below. The portfolio ES obtained is then a reliable estimate of a potential yield hike that can be experienced by the portfolio.

Results of ES from best fitted distribution — Table 2

Asset Type	US Treasuries		AAA Corporate Bonds	
Derived distribution	Gamma Distribution		Log Normal	
Optimized parameters	k	1.0106	mean	1.8053
	θ	2.6111	standard deviation	2.0277
Expected shortfall (yield hike %)	12.3321%		35.2846%	
Portfolio ES (yield hike %)	23.8083%			

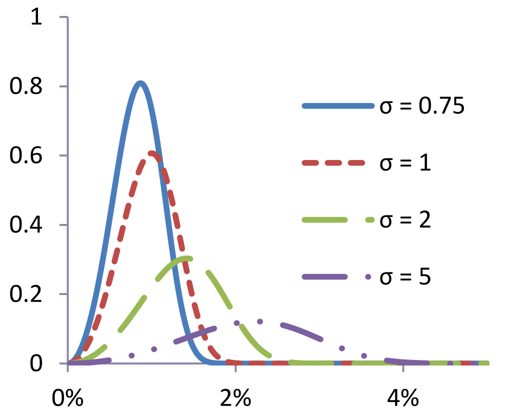
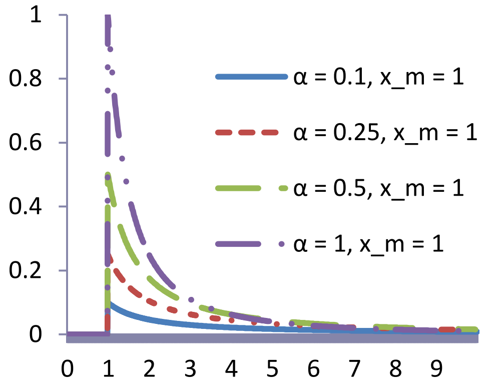
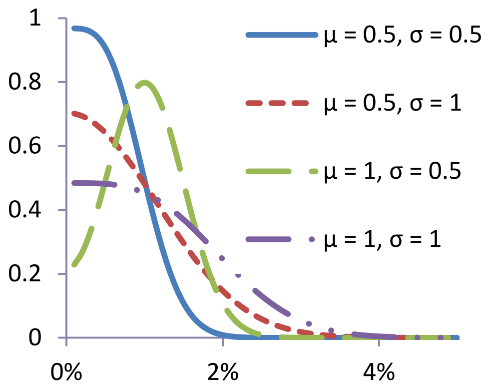
Concluding Remarks

Despite the fact that statistical tools are primarily developed for application on physical science, the financial sector would stand to benefit from more robust probability modelling and application. Using distribution fitting and subsequently Monte Carlo simulation in determining the possible outcomes of financial interactions (not limited to just ES like in this paper) is a useful method to the provide user with forecasts of the data based on its empirical behaviour. This example is in no way to show that the US treasury or AAA Corporate yield hike takes any particular shape. Instead, it serves as an example of the process flow for the user to obtain a suitable probability distribution. Such analysis can be extended further to other datasets to build its distribution.

On a separate note, the Anderson-Darling GoF method is not applied in the example as this test requires extensive resources in building a test statistics table for each individual distribution. The author wishes to note that this area of research would be beneficial for further undertaking as the AD test puts emphasis on the tail end. Recent discussions on the financial industry appearing to have fat-tail distributions, especially given large losses happening more frequently than expected, is a supporting factor for possible future research in fatter tail distributions and methods to test the goodness of fit for such dataset.

Appendix

List of probability distributions used — Table 3

Distribution Name	Probability Density Function	Shape
Supported on partial real line, [0,∞]		
Rayleigh distribution	$f(x;\sigma)=\frac{x}{\sigma^2}\exp(\frac{-x^2}{2\sigma^2})$ σ = scale parameter MLE (Siddiqui 1964) $\hat{\sigma}=\sqrt{\frac{1}{2N}\sum_{i-1}^{N}x_i^2}\,.\frac{4^N N!\,(N-1)!\,\sqrt{N}}{(2N)!\,\sqrt{\pi}}$	
Pareto distribution	$f(x;x_m,\alpha)=\frac{\alpha x_m^{\alpha}}{x^{\alpha+1}}$ x_m = scale parameter α = shape parameter MLE (Newman 2004) $\widehat{x_m}=\mathrm{Min}\{x_i\}$ $\hat{\alpha}=\frac{N}{\sum_{i=1}^{N}(lnx_i-ln\widehat{x_m})}$	
Folded normal distribution	$f(x;\mu,\sigma)=\frac{1}{\sigma\sqrt{2\pi}}\left[\exp\left(-\frac{(-x-\mu)^2}{2\sigma^2}\right)+\exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)\right]$ μ = location parameter σ = scale parameter MLE μ = mean/mod σ = standard deviation	

List of probability distributions used (cont)

Table 3

<table>
<tr><th>Distribution Name</th><th>Probability Density Function</th><th>Shape</th></tr>
<tr><td colspan="3">Supported on partial real line, [0,∞]</td></tr>
<tr><td>Weibull distribution</td><td>

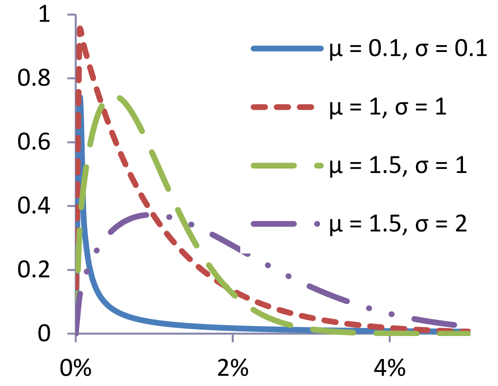
$$f(x;k,\lambda) = \frac{k}{\lambda}\left(\frac{x}{\lambda}\right)^{k-1}.\exp(-(\frac{x}{\lambda})^{k})$$

λ = scale paramter
k = shape parameter

MLE (Lei, 2008)

$$\hat{\lambda} = \left[\frac{1}{N}\sum_{i=1}^{N}(x_i^k - x_N^k)\right]^{-k}$$

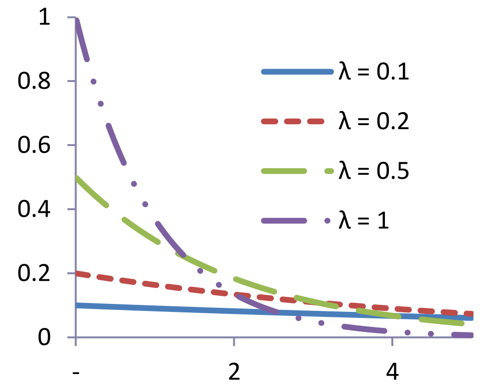
$$\widehat{k^{-1}} = \frac{\sum_{i=1}^{N}(x_i^k \ln x_i^k - x_i^k \ln x_N)}{\sum_{i=1}^{N}(x_i^k - x_N^k)} - \frac{1}{N}\sum_{i=1}^{N}\ln x_i$$

(k has to be solved using iterative procedure, as there is no closed form solution)</td><td>
</td></tr>
<tr><td>Exponential distribution</td><td>

$$f(x;\lambda) = \lambda\exp(-\lambda x)$$

λ = rate parameter

MLE:

$$\hat{\lambda} = \frac{1}{\bar{x}}$$</td><td>
</td></tr>
<tr><td>Gamma distribution</td><td>

$$f(x;k,\theta) = \frac{x^{k-1}\exp(-\frac{x}{\theta})}{\theta^k\Gamma(k)}$$

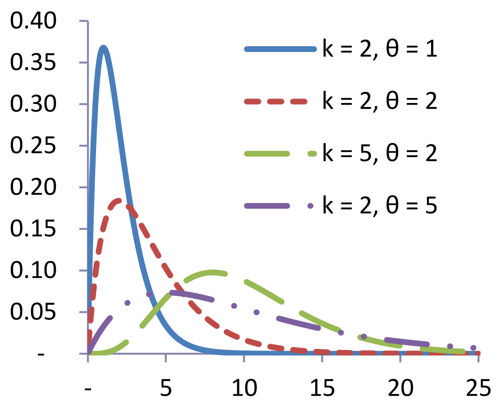
k = scale parameter > 0
θ = shape parameter > 0

MLE (Minka 2002)

$$\hat{\theta} = \frac{1}{kN}\sum_{i=1}^{N} x_i$$

$$\hat{k} = \frac{3 - s + \sqrt{(s-3)^2 + 24s}}{12s}$$

such that

$$s = \ln\left(\frac{1}{N}\sum_{i=1}^{N} x_i\right) - \frac{1}{N}\sum_{i=1}^{N}\ln(x_i)$$</td><td>
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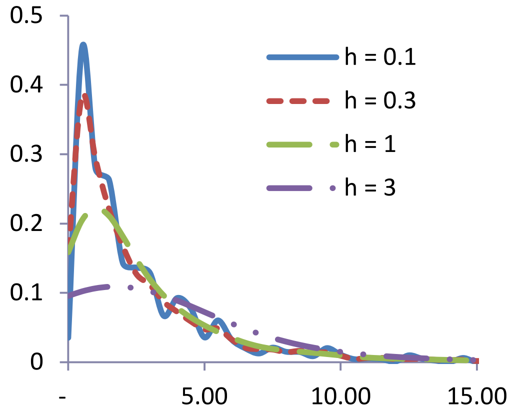
List of probability distributions used (cont) Table 3

<table>
<tr><th>Distribution Name</th><th>Probability Density Function</th><th>Shape</th></tr>
<tr><td colspan="3">Supported on partial real line, [0,∞]</td></tr>
<tr><td>Kernel Density Estimator</td><td>$$f_h(x) = \frac{1}{hN}\sum_{i=1}^{N} K(\frac{x - x_i}{h})$$
$h = \text{bandwidth}$</td><td></td></tr>
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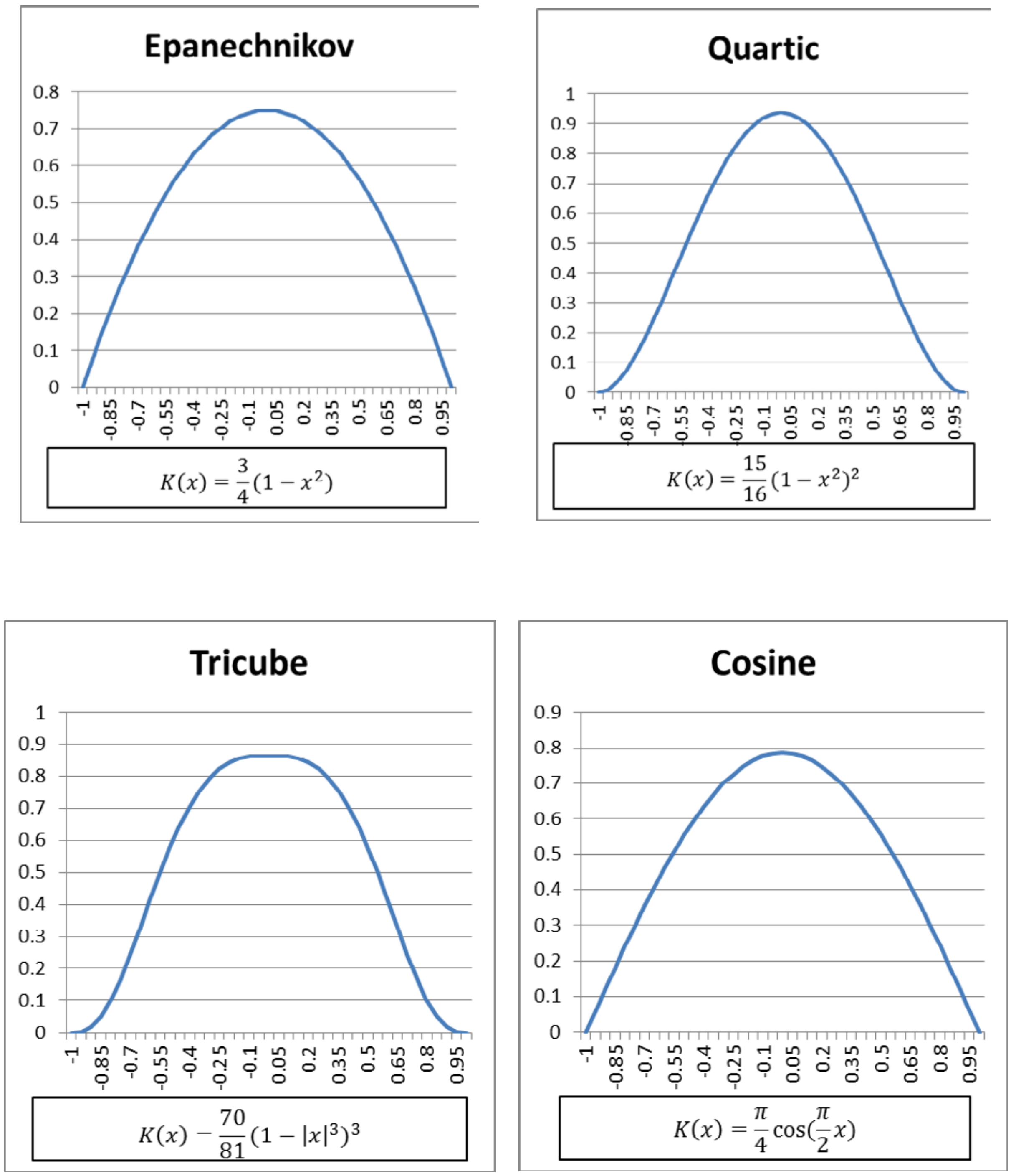
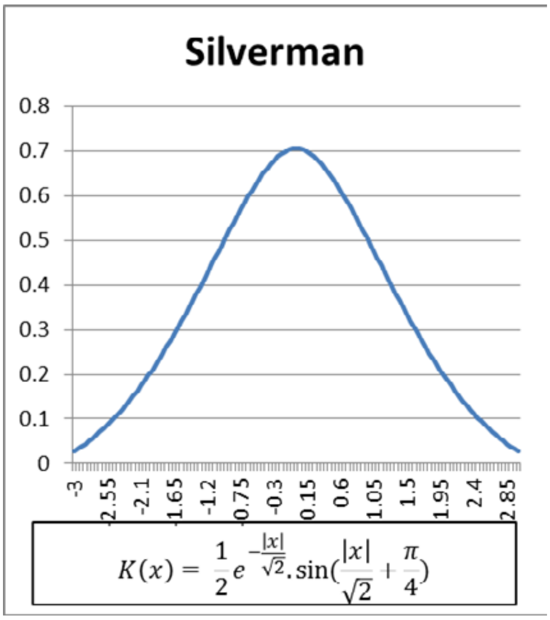
Kernels that are supported only on [0,1]

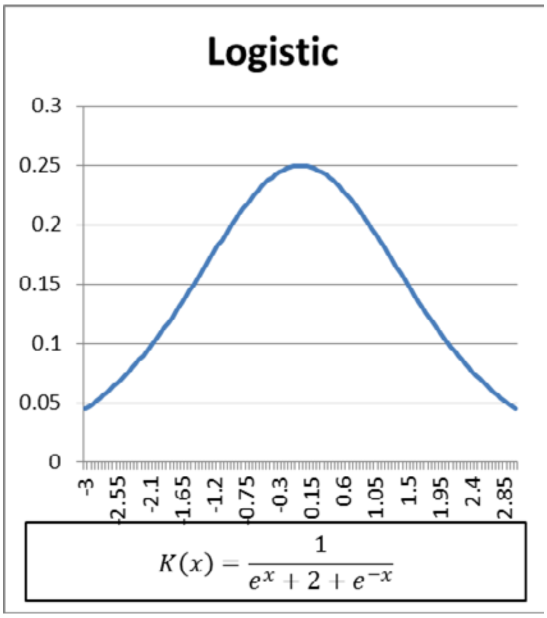
Figure 2

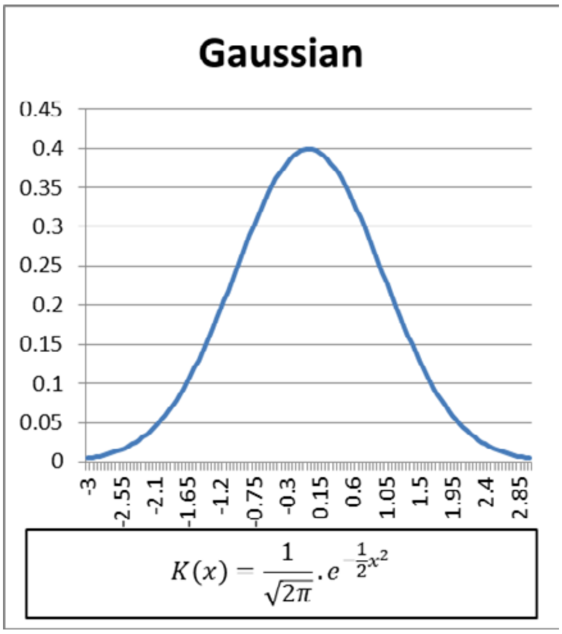


Kernels that are supported on the entire Real line

Figure 3

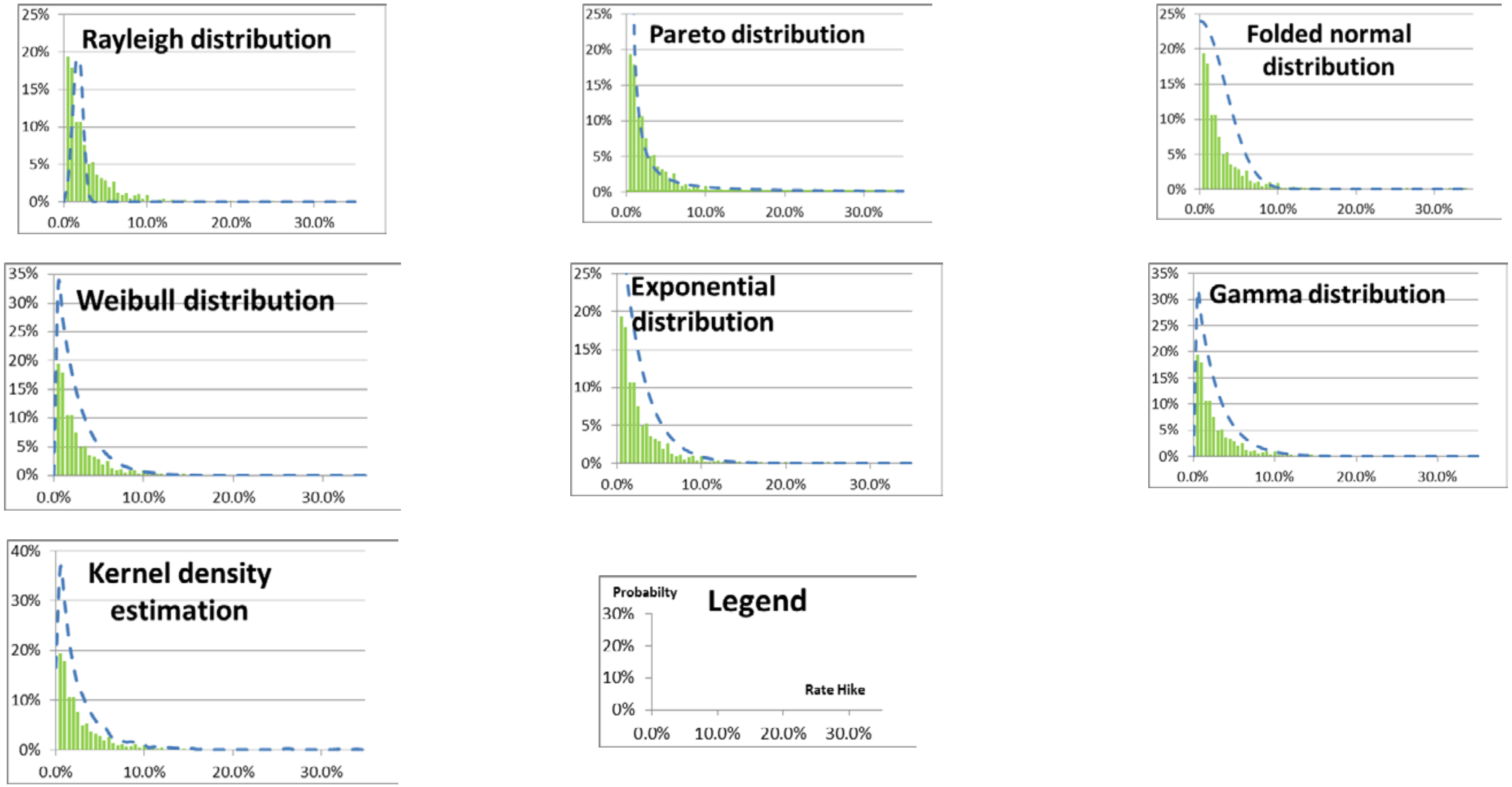






Derived distributions fitted to the data histogram

Figure 4



References

Myung, I.J. (2003). Tutorial on maximum likelihood estimation. *Journal of Mathematical Psychology* ***47***, 90–100.

Hosking, J.R.M. (1990). L-moments: Analysis and Estimation of Distribution using Linear Combinations of Order Statistics. *Journal of the Royal Statistical Society, Series B* ***52***, 105–124.

Hosking, J.R.M. (1992). Moments or L moments? An example comparing two measures of distributional shape. *The American Statistician* ***46*** (3), 186–189.

Hosking, J.R.M., and Wallis J.R. (1997). Regional Frequency Analysis – An Approach Based on L-Moments. *Cambridge University Press.*

Greenwood, J.A., et al. (1979). Probability-weighted moments: definition and relation to parameters of several distributions expressable in inverse form. *Water Resources Research* ***15*** (4), 1049–1054.

Landwehr, J.M., Matalas, N.C., and Wallis, J.R. (1979). Probability weighted moments compared with some traditional techniques in estimating Gumbel parameters and quantiles. *Water Resources* Research ***15*** (5), 1055–1064.

Rosenblatt, M. (1956). Remarks on Some Nonparametric Estimates of a Density Function. *The Annals of Mathematical Statistics* ***27*** (3), 832–837

Silverman, B.W. (1986). Density Estimation for Statistics and Data Analysis. *Monographs on Statistics and Applied Probability*.

Epanechnikov, V.A. (1969). Non-parametric estimation of a multivariate probability density. *Theory of Probability and its Application* ***14***, 153–158.

Mohammad, M., Osati, K., Sadeghi, S.A., Karimi, B., and Mobaraki, J. (2010). Determining Suitable Probability Distribution Models for Annual Precipitation Data. *Journal of Sustainable Development* **3** (1), 159–168.

Deka, S., Borah, M., and Kakaty, S.C. (2009). Distribution of Annual Maximum Rainfall Series of North-East India. *European Water (E.W.) Publications* ***27/28*** (1), 3–14.

Embrechts, P., Klüppelberg, C., Mikosch, T. *Modelling Extremal Events for Insurance and Finance*. Springer-Verlag Berlin Heidelberg 1997 Print, 152–167,283–370.

Pearson, K. (1900). On the criterion that a given system of deviations from the probable in the case of a correlated system of variables is such that it can be reasonably supposed to have arisen from random sampling. *Philosophical Magazine Series 5* ***50*** (302), 157–175.

Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control* ***19*** (6), 716–723.

Hurvich, C.M., and Tsai, C.L. (1989). Regression and time series model selection in small samples. *Biometrika* ***76***, 297–307.

Anderson, T.W., and Darling, D.A. (1954). A Test of Goodness of Fit. *American Statistical Association Journal*, 765–769.

Anderson ,T.W. (1962). On the Distribution of the Two-Sample Cramer-von Mises Criterion. *The Annals of Mathematical Statistics, 1148–1159.*

Csorgo, S., and Faraway, J.J. (1994). The Exact and Asymptotic Distributions of Cramer-von Mises Statistics. *Journal of Royal Statistical Society* ***58*** (1), 221–234

Siddiqui, M.M. (1964). Statistical inference for Rayleigh distributions. *The Journal of Research of the National Bureau of Standands* ***68D*** (9), 1007

Newman, M.E.J. (2004). Power laws, Pareto distribution and Zipf's law. *Contemporary Physics* ***46***, 323.

Johnson, N.L. (1962). The folded normal distribution: accuracy of the estimation by maximum likelihood. *Technometrics* ***4*** (2), 249.

Lei, Y. (2008). Evaluation of three methods for estimating the Weibull distribution parameters of Chinese Pine (*Pinus tabulaeformis*). *Journal of Forest Science* ***54*** (12), 566–571.

Minka, T. (2002). Estimating a Gamma distribution. *Microsoft Research*. http://research.microsoft.com/en-us/um/people/minka/papers/minka-gamma.pdf.

Data source: US Government Treasury website and Bloomberg.

The construction of long time series on credit to the private and public sector

Christian Dembiermont[1]

Data on credit aggregates have been at the centre of BIS financial stability analysis for years. But long time series on total credit over several decades are hard to find. To go beyond the well-established series on bank credit, the BIS statisticians have compiled long time series on credit. Series on credit to the private non-financial sector have already been published on the BIS website since March 2013. More series on credit to the public sector will be published in the future. This note explains the key concepts behind the compilation of these series.

Background

The BIS has a long standing interest in credit series. From a financial stability perspective, these data help policy makers to detect boom and bust episodes of financial cycles. Their medium-term fluctuations, together with property price ones, identify the financial cycles, which are much longer than traditional business cycles. Another evidence of the importance of the credit data is the role of the "Credit-to-GDP" gap, which is used within the Basel III framework as a guideline for setting capital buffers.

Credit booms are not only fuelled by credit extended by banks, but also by other domestic sectors and by the rest of the world. Therefore, the BIS monitors the evolution of the *total* credit. On the borrowing side, the focus is on the non-financial sectors, i.e. general government, non-financial corporations and households. A breakdown of credit series between these three sectors is highly desirable as their determinants might diverge and require specific policy measures. Besides total credit, series on bank credit to the non-financial sectors are useful indicators to monitor the risk borne by monetary institutions.

But the availability of statistics with a large coverage of credit sources is sometimes limited. Very often credit data are only available from domestic monetary institutions, i.e. the depository corporations. These data are compiled according to UN System of National Accounts (SNA). methodology and cover depository corporations' funding of the non-financial sectors in the (domestic) economy. Information on funding outside the banking sector is more difficult to collect. Data on debt securities held outside banks and on loans extended by the non-bank financial sector are very often not easily available.

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Characteristics of the new series for total credit

Credit series are defined by several characteristics, most importantly the borrower, the lender and the financial instrument(s).

On the borrowing side, the focus is on non-financial corporations, households, non-profit institutions serving households and the general government. The aggregate of the first three sectors is referred to as the "private non-financial sector". Separate series for the corporate, household (including non-profit institutions serving households) and government sectors are desirable.

In terms of lenders, the new total credit series aim to capture *all sources* independent of the country of origin and type of lender. This goes well beyond the provision of credit by domestic depository corporations, to include the shadow banking lending and cross-border credit.

The coverage of financial instruments includes loans and debt securities such as bonds or short-term bills. Trade credit (as well as other accounts payable and receivable) is excluded from the total credit series because the quality of the underlying data is globally poor and moreover not homogeneous across countries. If recorded at all, the historical and country coverage is very limited.

Benchmark series

To support its long-term analysis, the BIS has targeted the construction of four groups of long series:

- Benchmark 1: Credit from other depository corporations to the non-financial non-government sector
- Benchmark 2: Credit from all sectors to the non-financial non-government sector
- Benchmark 3: Credit from other depository corporations to the non-financial sector
- Benchmark 4: Credit from all sectors to the non-financial sector

The first benchmark series aims at monitoring the financing of the "private" sector by monetary financial institutions. Note that for this exercise the private sector also includes public non-financial corporations in addition to the non-financial non-government sector.

Benchmark 2 covers the total financing of the "private" sector by all resident sectors, financial and non-financial, as well as by non-residents.

Benchmark 3 aims at monitoring the financing of the non-financial sectors, both private and public, by monetary financial institutions.

Benchmark 4 covers the total financing of the non-financial sectors, both private and public by all residents, financial and non-financial, as well as by non-residents. This concept supports the analysis of the BIS credit cycles.

Table 1 illustrates these four series on the matrix of whom-to-whom sectors. From the matrix, it is easy to see that Benchmark 1 is included in Benchmark 2. Similarly Benchmark 3 is included in Benchmark 4.

Identifying credit statistics underlying the long series

The first step in the compilation of long credit series was the analysis of currently available data. Nowadays, much more information is available than before, thanks to technological advances and the fact that national compilers tend to publish more series in an attempt to meet the most recent international statistical standards. Once current statistics with the most suitable coverage had been identified, the BIS compilers had to start looking for historical series with coverage as close as possible to the latest series.

Concretely, the natural starting point for constructing total credit series are the sectoral financial accounts[2], which provide the desired borrower, lender and instrument coverage (Table 1):

- borrowing sectors: balance sheets of all required domestic sectors (non-financial corporations, households and non-profit institutions serving households and general government) are available;
- lending sectors: all domestic sectors are covered as well as cross-border credit. The sub-sector of depository corporations is available for the compilation of bank credit series;
- instrument coverage: loans and debt securities issued can easily be identified in the financial accounts.

It is important to note that the credit series are not consolidated, i.e. not netted out for credits between institutional units of the same sector. This option was selected because for most purposes, such as assessing debt sustainability, it is not relevant whether the source of credit is a bank or another institutional unit. What matters is the total amount of the credit extended.

When no financial accounts are available, two building blocks are utilised to compile credit series: the monetary statistics on the domestic side and the BIS international banking statistics on the cross-border side. The monetary statistics, and more precisely the balance sheets of depository corporations, is the main contributor to the long credit series when no financial accounts are available. The bank assets included in the monetary statistics cover claims on the non-financial sector (see Table 1). For countries which do not compile balance sheet data, the monetary survey is always available to provide the monetary aggregate counterparts, which cover the requested claims. For earlier periods, when only monetary aggregates were collected without their counterparts, domestic bank credit is approximated by using the broad monetary aggregate M3. In some countries, it is also possible to add to the domestic bank credit the credit provided by some non-bank financial institutions.

2 The financial accounts form part of the UN SNA.

The BIS international banking statistics (IBS) provide cross-border credit data and can be added to the monetary statistics for countries which do not compile financial accounts or for periods when no financial accounts are available. The IBS capture cross-border credit, particularly credit extended by banks located abroad. However, the IBS do not cover credit from non-resident non-bank lenders.[3] The volume of cross-border bank credit to the non-financial sector is derived from the both IBS data sets: the locational and the consolidated IBS.[4]

Linking credit series

After being identified, the selected credit series will have to be linked. This is not an easy task as these series come from three different statistical frameworks: financial accounts, monetary statistics or IBS. Methodologies, valuation practices are different, borrower, lender or instrument coverage can change from one series to another. All these differences lead to breaks in the long series, for instance, when coverage moves from the sum of domestic and cross-border bank credit to the total credit from financial accounts.

The BIS has adjusted the long series for these breaks in the following way: all observations prior to a break are proportionally scaled up or down. For example, to adjust for a break at time Z owing to the transition from the sum of domestic bank credit (source monetary statistics) and cross-border bank credit (source BIS IBS) (bt) to total credit (source financial accounts) (ft), break-adjusted series are derived as follows:

$$Total\ credit(break\ adjusted)_t = \begin{cases} f_t & if\ t \geq Z \\ b_t * \dfrac{f_Z}{b_Z} & if\ t < Z \end{cases}$$

It is clear that the break-adjusted series does not perfectly reflect the evolution of the unmeasured total credit prior to the break. Actually it assumes that unobserved sources of credit, typically domestic and cross-border lending by non-banks, behave in a similar way to recorded series.

To ensure transparency, the BIS publishes both the unadjusted and the break-adjusted series. The unadjusted series simply concatenated the series with different coverage and the breaks are clearly visible. With these series users can implement types of adjustment which differ from the one published on the BIS website. Users should keep in mind that these unadjusted series do not account for unobserved components at all, even though they may be quite important.

3 International investment position statistics cover cross-border credit from all non-resident sectors and are available in some countries. However, very few countries compile these series with sufficiently detailed instrument and borrowing sector breakdowns for the periods when no financial accounts are available. Consequently, using these statistics only ion some countries would hamper cross-country comparability.

4 For a detailed explanation on the way the cross-border credit component of the long credit series is estimated, see Dembiermont, Drehmann and Muksakunratana. (2013).

Publication on the BIS website

Since March 2013, the BIS publishes quarterly long series on credit for 40 economies, both advanced and emerging. The published series cover the first two of the four benchmark series the BIS has targeted, i.e. the total credit and the bank credit to the private sector. Moreover for most countries, separate series are provided for the total credit to non-financial corporations and to households. These separate series are usually shorter than the series pertaining to the private non-financial sectors, due to the lack of available data. Table 2 shows the components used for all the respective economies, and highlights the starting dates for all the credit series available in the database (bold entries).

To construct the long series, the BIS has largely used the current and historical series stored in the BIS Data Bank, the private database it shares with central banks. Historical data starting in the sixties and even the fifties are available for numerous countries. Also, the BIS has consulted its member central banks and has received methodological assistance on the series used.

Next steps

The long credit series have generated a lot of interest in the research community since their publication, and there is a strong demand for additional data.

In response to the demand for extended country coverage, the BIS is working on adding three additional countries, namely: Chile, Israel and New Zealand, and considering including Colombia, Peru and the Philippines.

Following users' suggestions, credit series will soon be expressed in percentage of GDP and in US dollars. This will ease the cross-country comparison and analysis.

Currently the credit data set is limited to the private sector. Meeting user demand for the extension of coverage to include the public sector is a big challenge. Where and when financial accounts are available, the total credit to this sector is readily available. For periods or for countries where no financial accounts are available, the compilation will be more difficult than for credit to the private sector. The monetary statistics present the credit to the General Government as net assets. The corresponding gross assets and gross liabilities are not available in all countries. Moreover in the older version of the monetary statistics, only the net claims on the central government are published and the claims on the rest of the general government are hidden within the claims on the other sectors. This will make the compilation of the claims on the General Government very challenging for the early periods. Public finance data will be an avenue to explore to solve this issue.

Creditors / Lenders **Borrowers**	Central bank	Other depository corporations (ODCs)	Other financial corporations (OFCs)	Central government	Local and state government	Public nonfinancial corporations (PNFCs)	Other nonfinancial corporations (ONFCs)	Households and Non-profit institutions serving households (NPISH)	Rest of the world
Central bank									
Other depository corporations (ODCs)									
Other financial corporations (OFCs)									
Government									
Public nonfinancial corporations (PNFCs)									
Other nonfinancial corporations (ONFCs)									
Households and Non-profit institutions serving households (NPISH)									
Rest of the world									

Benchmark 1: Credit from other depository corporations to the non-financial non-govt sector

Benchmark 2: Credit from all sectors to the non-financial non-govt sector

Benchmark 3: Credit from other depository corporations to the non-financial sector

Benchmark 4: Credit from all sectors to the non-financial sector

Starting dates for the new credit series (in bold) and sources

Table 2

Benchmark series	Domestic bank credit	Total credit					Credit to non-financial corporations and credit to households
Sources		Domestic bank credit	Bank credit (domestic + cross-border)	Bank credit (domestic + cross-border) + dom credit from other financial institutions	Total credit (annual financial accounts)	Total credit (quarterly financial accounts)	
Argentina	From **1940**	**1940**–89	From 1990[1]				
Australia	From **1953**	**1953**–77		1977–88[2]		From 1988	From **1977**
Austria	From **1949**	**1949**–95			1995–2000	From 2000	From **1995**
Belgium	From **1970**	**1970**–80				From 1980	From **1980**
Brazil	From **1993**	**1993**–94	From 1995[1]				
Canada	From **1954**	**1954**–68				From 1969	From **1969**
China	From **1985**		From **1985**[3]				From **2006**
Czech Republic	From **1993**	**1993**–95			1995–2003	From 2004	From **1995**
Denmark	From **1951**	**1951**–94				From 1994	From **1994**
Euro area	From **1997**					From **1999**	From **1999**
Finland	From **1974**				**1970**–97	From 1997	From **1970**
France	From **1969**	**1969**–77				From 1977	From **1977**
Germany	From **1948**	**1948**–70			1970–90	From 1991	From **1970**
Greece	From **1960**	**1960**–85	1985–94		1994–97	From 1998	From **1994**
Hong Kong SAR	From **1978**	**1978**–99	From 1999				From **1990**
Hungary	From **1989**					From **1989**	From **1989**
India	From **1951**	**1951**–85[4]	From 1985				From **2007**
Indonesia	From **1976**	**1976**–85	From 1985				From **2001**
Ireland	From **1971**	**1971**–99[5]	1999–2001			From 2002	From **2002**
Italy	From **1974**				**1950**–94	From 1995	From **1950**
Japan	From **1963**					From **1964**	From **1964**
Korea	From **1960**				**1962**–74	From 1975	From **1962**
Luxembourg	From **2003**					From **2003**	From **2005**
Malaysia	From **1964**	**1964**–85[6]	From 1985				
Mexico	From **1980**	**1980**–93	1993–94[1]			From 1994	From **1994**
Netherlands	From **1961**	**1961**–90			1990–2004	From 2005	From **1990**
Norway	From **1953**	**1953**–74				From 1975	From **1975**
Poland	From **1992**	**1992**–95			1995–2003	From 2003	From **1995**
Portugal	From **1947**	**1947**–85	1985–95		1995–97	From 1997	From **1979**
Russia	From **1995**		**1995**–2005	From 2005			
Saudi Arabia	From **1993**		From **1993**				
Singapore	From **1991**		From **1991**				From **1991**

[1] International banking statistics data are available before these dates but were not used due to excessive exchange rate effects in the wake of currency crises. [2] Comprises only credit extended by domestic banks and non-bank financial institutions. [3] IMF data for Q4 1985–Q4 1992. [4] For Q2 1951–Q1 1970, total credit is estimated by monetary aggregate M3. [5] For Q2 1971–Q2 1992, total credit is estimated by monetary aggregate M3. [6] IMF data for Q2 1964–Q3 1973.

Starting dates for the new credit series (in bold) and sources (cont) Table 2

Benchmark series / Sources	Domestic bank credit	Total credit: Domestic bank credit	Total credit: Bank credit (domestic + cross-border)	Total credit: Bank credit (domestic + cross-border) + dom credit from other financial institutions	Total credit: Total credit (annual financial accounts)	Total credit: Total credit (quarterly financial accounts)	Credit to non-financial corporations and credit to households
Spain	From **1970**	**1970**–80			1980–1989	From 1989	From **1980**
Sweden	From **1961**	**1961**–80			1980–1995	From 1996	From **1981**
Switzerland	From **1975**	**1975**–99			From 1999		From **1999**
Thailand	From **1957**	**1957**–85[7]	From 1985				From **1991**
Turkey	From **1986**		From **1986**				From **1986**
United Kingdom	From **1963**					From **1962**	From **1976**
United States	From **1952**					From **1952**	From **1952**

[7] IMF data for Q1 1957–Q3 1975.

Sources: National data; authors' calculations.

References

Borio, C (2013): "The financial cycle and macroeconomics: what have we learnt?", Journal of Banking & Finance, in print. Also available as BIS Working Papers, no 395, December 2012.

Cecchetti, S G, M S Mohanty and F Zampolli (2010): "The future of public debt: prospects and implications", *BIS Working Papers* no 300. March. www.bis.org/publ/work300.htm.

Dembiermont, C, M Drehmann and S Muksakunratana (2013): "How much does the private sector really borrow? A new database for total credit to the private nonfinancial sector", BIS Quarterly Review, March, pp 65–81.

Drehmann, M, C Borio and K Tsatsaronis (2011): "Anchoring countercyclical capital buffers: the role of credit aggregates", International Journal of Central Banking, vol 7, no 4, pp 189–240.

Drehmann, M, C Borio and K Tsatsaronis (2012): "Characterising the financial cycle: don't lose sight of the medium term!", BIS Working Papers, no 380.

Drehmann, M and M Juselius (2014): "Evaluating early warning indicators of banking crises: satisfying policy requirements", BIS Working Papers, no 421).

McGuire, P and P Wooldridge (2005): "The BIS consolidated banking statistics: structure, uses and recent enhancements", BIS Quarterly Review, September, pp 73–86.

Improving public sector debt statistics in South Africa

Johan van den Heever and Michael Adams[1]

Abstract

This paper proposes a number of systematic actions which can be taken to reduce the pitfalls and blind spots in the analysis and understanding of government debt, and describes a number of advances made in the compilation and analysis of public sector debt statistics in South Africa. Particular areas of focus include the broadening of such statistics to include all levels of government and public enterprises; the addition of data on loan guarantees extended by government; the addition of index-linked debt securities; and the compilation of statistics on public sector debt instruments by holder in an environment complicated by indirect holdings through structures such as nominee companies. Further improvements that are currently being worked on are also discussed.

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1. Introduction

Measurement and context matter a great deal when considering developments in government debt. The South African Reserve Bank (the Bank) naturally takes a keen interest in the finances of the public sector, not least since a sound grasp of fiscal policy is necessary to inform monetary policy and since the health of the public finances also has such a strong bearing on financial stability – both elements of the central bank's mandate. Sound statistics on and analysis of the public finances are therefore crucial to the execution of the central bank's task.

In South Africa public debt management resides with the Assets and Liabilities Unit at National Treasury, while the national statistics office, the National Treasury and the central bank join forces in the compilation, dissemination and analysis of official data on the finances of the public sector. The ongoing exchange of information between these institutions is an integral part of this process. The Bank is in particular responsible for the compilation of the public-sector borrowing requirement in South Africa, and for the government sector aggregates in the national accounts.

This paper starts by considering a toolkit or route map for those interested in detective work in the area of government debt statistics. It then outlines the scope of the public sector in South Africa and the relationship between the institutions involved in compilation and dissemination of public finance and debt statistics. This is followed by a description of key additions and enhancements made in the area of South African public sector debt statistics over the past two decades. Attention then turns to illustrating some of the types of data which are currently available, as well as showing a few examples of the provision of additional data and analysis to enrich and contextualise government debt data. The paper also highlights a number of thorny issues and challenges which remain, before concluding.

2. A toolkit for government debt detective work

The discussion in this section is not peculiar to South Africa, but applies to the analysis of government debt statistics in general. It proposes a number of systematic actions which can be taken to reduce the pitfalls and blind spots in the analysis and understanding of government debt. Fortunately many of these are already fairly standard across the world. However, it sometimes takes exceptional strain to the financial system to focus the full attention of government debt "detectives" on some of the dimensions of the toolkit.

In analysing and understanding the government debt, ***accuracy and sound measurement*** are essential points of departure, reinforced by appropriate and independent verification and auditing processes and reporting. These cornerstones must be in place – which may of course be easier said than done. If they are not, getting them in place must be a primary thrust of activity related to government debt.

The ***institutional coverage*** of the government debt is an important dimension. Exclusive or predominant focus on the central government finances and debt could lead to undue complacency in situations where the deficits and debt accumulation are shifted to lower levels of the general government, whether by design or by default. Sound practice is to build up a comprehensive picture of indebtedness at every level of government and analyse it critically on an ongoing basis. Furthermore, this should be extended to the public sector beyond general government by also including public corporations and enterprises. While the assumption is often made that the public corporations and enterprises are self-financing, charging prices for their products and services adequate to cover their costs, there is good reason to focus considerable attention on this institutional grouping too. Otherwise an unscrupulous general government institution, lacking adequate tax revenue and fearing steep escalation of its indebtedness, could hive off some of its activities to a parastatal institution and (for a while at least) let the financial deficits and indebtedness accumulate in the latter entity.

Close scrutiny of indebtedness should not only be reserved for the non-financial public sector, but should also be extended to the financial institutions in the public sector. And within the latter group of institutions, the central bank deserves special mention. Episodes of undue expansion or contraction in its unique debt instrument – the banknotes and coin officially sanctioned as legal tender in the economy – are particularly potent in triggering or accommodating macroeconomic instability. Control over the central bank's printing press is often the last resort when all the other avenues for financing public sector expenditures have been exhausted, and may easily culminate in hyperinflation. On the asset side of the central bank's balance sheet, key variables to scrutinise are the central bank's claims on the government sector, the domestic banking sector and the domestic non-bank private sector. A further checkpoint is the subsidiaries of the central bank, if any; a consolidated analysis of the central bank group accounts is helpful.

Related to the various levels of government, the measurement of debt may be usefully expanded by catering for both ***the aggregate and the consolidated levels of debt***. Monitoring the gross indebtedness positions between various institutions and institutional groupings within the public sector can be useful, given the vast differences in sources of revenue and other circumstances affecting each of these. Drilling down into these gross indebtedness positions to establish the maturity profile (current, or in arrears for various periods) of each of these can be particularly revealing. Consolidation, in which claims between public-sector institutions are netted out, can similarly be helpful in underlining the extent to which the public sector is indebted to other institutional groupings.

The measurement of public-sector debt is also enriched by allowing for both the ***nominal and market value*** of the debt. Memorandum items, notes or special tables may be utilised to state the results of the different valuation methodologies. While the nominal value of the debt is often taken as a starting point, market value is of crucial interest in assessing government's indebtedness. Marking to market is for instance important in the case of "original sin" borrowing, where government has borrowed in a "hard" foreign currency and revaluation of the debt is necessary to present the current extent of government's commitments expressed in national currency.

Detective work around public sector debt should also be prepared to focus on ***other financial instruments*** beyond loans and debt securities. For instance, borrowing that cannot be serviced may be converted into equity instruments such as shares or preference shares. Positions in derivatives can similarly be utilised to reduce or replace certain types of borrowing.

A final point on the roadmap is the need to evaluate developments in the public-sector debt in as ***broad a context as possible***. This has a time dimension: checking the history of the debt variable concerned is helpful. If it seems to be headed for an extreme value it is an additional reason for vigilance and further analysis of debt sustainability. But it also extends to evaluating the debt and debt service cost incurred in the context of all other economic variables – for instance the assets that were acquired against the debt that was incurred; the size and composition of the balance sheets of the indebted sector and its counterpart sectors in the economy; and the strength of the tax base or revenue stream that must service the debt. Of special importance for analysis of debt sustainability at the macroeconomic level are the medium to longer-term real growth rate of the economy; the rate of inflation; and the level of interest rates. Stronger growth, higher inflation, or lower interest rates contribute to greater sustainability of a given level of debt. This is of course in an "all other things equal" sense only – one should for instance be mindful of the fact that while higher inflation raises nominal gross domestic product and the nominal tax base and thereby (in the first round) debt sustainability, the higher inflation will in time also raise interest rates, thereby reducing debt sustainability.

3. Scope of the South African public sector and relationship between agencies involved in public finance statistics compilation and reporting

General government in South Africa essentially functions on three levels: National, provincial and local, with significant fiscal transfers flowing from the higher to the lower levels. The number of institutions in the South African public sector is currently fairly stable, and is summarised in the accompanying table.

Number of institutions in the South African public sector, June 2014

Institutional grouping		Number
1. National government		1
2. Provincial governments		9
3. Extra-budgetary institutions		244
4. Social security funds		4
5. Local governments		278
Metropolitan	*8*	
District	*44*	
Local	*226*	
6. Financial public corporations		7
7. Non-financial public corporations		32
8. Water boards		12
Total		**587**

National government includes 38 national votes.

Provincial governments together have 123 departments.

As far as reporting on fiscal activities including public-sector debt is concerned, there exists a long-standing relationship between the South African Reserve Bank (the Bank), National Treasury and Statistics South Africa (Stats SA) reinforced through various memoranda of understanding for sharing financial and non-financial economic data in various formats.

A Public Sector Classification Committee (PSCC), established in 2010, serves to coordinate the classification of the institutional units and subsectors in the public sector for purposes of reporting to national and international stakeholders. The classification list is available to the public. Representatives of the Bank, National Treasury, South African Revenue Service and Stats SA serve on the PSCC.

National Treasury supplies the Bank with national government debt data on a monthly basis. The Bank compiles the debt statistics for national government on a monthly basis and releases the data via the Bank's internet site. The information is also sent to the International Monetary Fund (IMF) and Bank for International Settlements (BIS). The Bank also receives information from other institutions such as the Public Investment Corporation. Information from all these sources are used to compile the debt of national government as published in the Bank's *Quarterly Bulletin*. Annually, National Treasury publishes debt statistics in its *Budget Review*. There is also a chapter in the *Budget Review* on asset and liability management where the national government debt is described in detail. More generally, the National Treasury prides itself in providing comprehensive fiscal information to the public. South Africa for instance ranks second out of 100 countries for the transparency and accountability of its budget processes, according to the *Open Budget Index 2012* report prepared by the Washington-based International Budget Partnership.

As far as local government is concerned, the Bank on a quarterly basis receives balance sheet data from Stats SA via the latter institution's *Quarterly Financial Statistics* (QFS) survey. This is used to prepare a summary balance sheet which is published in the *Quarterly Bulletin*; the outstanding debt is extracted from the balance sheet. Data may be revised later on when Stats SA publishes its *Financial Census of Municipalities*, which covers the financial year of municipalities.

The Bank receives information from the financial and non-financial public corporations via a survey which it conducts itself, and uses it to compile a balance sheet for these institutions inter alia including the value of outstanding debt. As they become available, annual reports of these institutions are later used to validate or revise the balance sheet data.

4. South Africa's experience: Additions and enhancements in the public-sector debt and finance statistics since 1990

In South Africa measures of government debt and fiscal activity have been refined and broadened over the years, keeping pace with developments in the capital market and in the political sphere.

In the early 1990s negotiations were in progress to establish a fully democratic constitution and government in South Africa. At that time the government setup was complicated. The territory known today as "South Africa" consisted of four "independent" countries – Bophuthatswana, Ciskei, Transkei and Venda – and South Africa. The four "independent" countries were not recognised by the international community, being homelands created by the pre-1994 government of South Africa, and remained largely dependent on fiscal transfers from the central government of South Africa to finance their government expenditure. Nevertheless they had their own governments, budgets and administrations. In the part of South Africa excluding these four "independent" states there were also four provinces and six non-independent homelands, again all largely dependent on fiscal transfers from the central government of South Africa, and also with own budgets and administrations. Furthermore, South Africa was also in control of Namibia – another entity with its own budget and administration.

Namibia gained independence on 21 March 1990, resulting in its extraction from the South African fiscal and other macroeconomic accounts. Furthermore, on 27 April 1994 South Africa achieved full democracy within a government framework that no longer provided for "independent" and "non-independent" homelands, but only for a national government as first level of government, nine provinces as second level of government, and local authorities as third tier of government. The homeland functions and administrations were migrated, mainly to the relevant provincial governments.

While the above description sounds relatively straightforward, fiscal administration and compilation of public finance statistics during the period of transition was complicated, as government services had to continue to be provided as restructuring took place. In many instances government revenue and expenditure flows were diverted from one entity to another, with the switching not coinciding with the start of the new fiscal year. Revenue and expenditure at each level of government as well as intergovernmental financial flows and positions therefore were jumpy in the first years of democracy. For a while at least it was probably more useful to concentrate fiscal analysis on the consolidated general government rather than its separate constituents. The challenging environment normalised as the new structures stabilised in the second half of the 1990s.

During the political transition and beyond, difficulties were also encountered in the area of local government statistics. With hundreds of municipalities spread across the country – and in part overseen by provincial governments and in part by homeland governments – local government reporting was not uniform, with consequences for the quality of statistics. The interim Constitution of 1993 and the final Constitution of 1996 laid the foundation for integrated local governments covering the entire area of the Republic of South Africa. This sphere of government now essentially consists of metropolitan, district and local municipalities. Financial management remains a concern in many of these municipalities, with a significant number of them receiving qualified audit reports to this day. However, statistical reporting has improved, not least because certain transfers of funds from higher levels of government to municipalities are conditional upon the reporting of the necessary information by the municipality concerned. This has resulted in improved building block statistics on the finances of local government.

Apart from the traditional emphasis on the national government finances and debt, a non-financial public-sector borrowing requirement for South Africa has been regularly compiled and disseminated since 1991, worked back to 1973. This exercise has continued despite the challenges related to the structural shifts in government referred to above. Furthermore, as the structures under the new Constitution have stabilised, statistical quality has improved with comprehensive coverage of government institutions. As mentioned above, in order to ensure that all public sector institutions are identified and correctly classified, a classification committee which includes staff of the Bank, Statistics South Africa, the National Treasury and the South African Revenue Services was formed in 2010 and meets regularly to perform its functions.

The team compiling public finance statistics have undertaken roadshows to respondents in the public sector, to explain the importance of the information submitted and clarify the interpretation of the key concepts used and statistics required. This outreach action has been quite successful. At the level of day-to-day operations, electronic (rather than paper) submission of information has also resulted in improved timeliness and accuracy.

The range of debt instruments issued by the South African government has broadened over the years. Conventional nominal-value bonds with six-monthly coupon payments, denominated in domestic currency, nevertheless continue to constitute the bulk of the government debt. Treasury bills also contribute significant amounts. Inflation-linked bonds were introduced for the first time in 2000, and have grown considerably in popularity over time. In May 2004 the South African government also launched RSA Retail Savings Bonds, as an alternative avenue for saving for the public and at the same time, a form of funding for government. These instruments, geared towards retail investors, have been successful and are currently available in both conventional and inflation-linked variants. From February 2009, National Treasury introduced Treasury bills with a maturity of 364 days. This added an additional maturity reference point on the yield curve, and further diversified the range of Treasury bills, being issued in 91-day, 182-day, 273-day and 364-day maturities.

From 1998/99 the South African government introduced a three-year rolling budget system, replacing the one-year budget system that had previously been used. This brought additional discipline, consistency and transparency to the fiscal processes, including the estimates and projections of government debt.

In 2000 National Treasury started to disclose national government debt not only on a gross, but also on a net basis in its annual *Budget Review*. This approach is also followed by other countries and is consistent with the disclosure recommendations of the International Monetary Fund (IMF) released in its publication *Public Debt Statistics: Guide for Compilers and Users*. This approach highlights the importance of monitoring not only one side of an institutional unit's balance sheet but both sides, in order to gauge true net exposures, net worth, and other indicators where relevant asset and liability items are combined or netted.

Foreign currency denominated debt constitutes a much smaller part of the government debt than debt denominated in domestic currency. South Africa returned to the international capital markets in 1994 after the lifting of financial sanctions with a global issue which was underwritten by a group of the world's leading financial institutions. In subsequent years the South African government continued to access the international bond market, and also made use of loans in a variety of forms, including financing agreements on favourable terms concluded at the beginning of the new millennium for a large defence procurement programme which involved the acquisition of military hardware, mainly from foreign suppliers.

5. Special focus areas

5.1 Institutional coverage of debt

Table 1.1 in the Statistical Appendix shows the level of public-sector debt as incurred by four main institutional subgroupings within the public sector. It should be noted that it is not fully comprehensive; for instance the debt of the social security funds and of the central bank have not been incorporated.

5.2 Debt by instrument

Table 1.2 in the Statistical Appendix shows the same aggregate level of public-sector debt as in Table 1.1, but in this instance disaggregated by type of instrument. Debt securities is the most important instrument, followed by loans and accounts payable.

5.3 Equity interest

Table 1.3 in the Statistical Appendix illustrates that government equity holdings in public corporations and enterprises are relatively limited; an equity interest may in some instances be preferred to debt financing.

5.4 Government-guaranteed debt

In addition to its direct indebtedness, the national government is also a guarantor of the debt of certain general government bodies. The government has issued formal contractual guarantees in respect of certain debt of wholly or partially state-owned entities, within a set of guidelines. Consistent with these guidelines, guarantees are largely restricted to concessionary loans to public enterprises, project finance for infrastructural development and facilities in support of the restructuring of public enterprises. Considerable work has been done to identify and quantify the guarantees extended by government to support the debt instruments issued by other institutions in the public sector. This has culminated in the publication of such information as part of the official dissemination of economic statistics. These guarantees are reported as a memorandum item. It will constitute debt only if the entity in question defaults on its guaranteed obligations. However, it is important to note the potential risk locked up in these contingent liabilities. Table 1.4 in the Statistical Appendix summarises the extent to which government guarantees the debt of other entities.

5.5 Provisions and contingent liabilities

Provisions and contingent liability data and projections are shown in Statistical Appendix Table 1.5. Provisions are liabilities for which the payment date or amount is uncertain. The provisions for the multilateral institutions are the unpaid portion of government's subscription to these institutions, which are payable on request. Included in provisions are the obligations of the Road Accident Fund and the Unemployment Insurance Fund. Contingent liabilities are obligations, such as government guarantees, post-retirement medical assistance and claims against government departments that only result in expenditure when a specific event occurs. The National Treasury publishes detailed information on provisions and contingent liabilities in the Annual Consolidated Financial Statements of national departments.

As at 31 March 2014, net loan debt, provisions and contingent liabilities were expected to amount to 54,8 per cent of gross domestic product, and are projected to reach 57,1 per cent of gross domestic product by 31 March 2016, before falling to 56,7 per cent in 2016/17. This remains below the Southern African Development Community's macroeconomic convergence target of 60 per cent of gross domestic product, and compares favourably with many developed countries. However, if the total public sector debt is calculated, including social security funds and provisions it amounted to 62,3 per cent of gross domestic product in fiscal 2011/12 and increased to 69,9 per cent of gross domestic product as at 31 March 2013. The National Treasury carefully monitors provisions and contingent liabilities and their potential impact on the fiscus.

5.6 The valuation of government debt

Both the nominal and the market value of government's debt are monitored, as illustrated in the accompanying table. It is helpful that the market for South African government securities is quite liquid: monthly turnover in government bonds in the secondary market is usually more than the entire stock outstanding of such debt instruments, avoiding the difficulties of price discovery in thin markets.

Outstanding balances of national government bonds listed on the JSE

End of June 2014

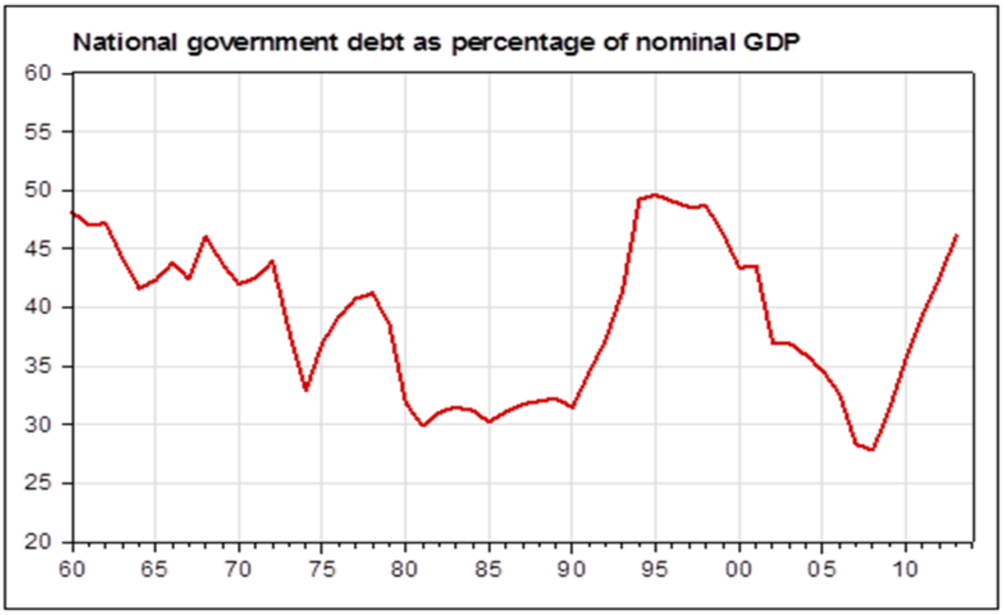
R billions

Type	Nominal value	Market value
Conventional bonds	957	944
Inflation-linked bonds	319	605
Zero-coupon bonds	1	1
Total	1 277	1 550

6. Providing additional data and analysis to enrich and contextualise government debt data

This section is merely illustrative. The appropriate context to be provided will depend on the issue being investigated. Nevertheless, it is helpful that for South Africa fairly long time series are available for most components of the government debt, so that the time dimension and identification of outliers in a historical context can be reasonably addressed. The graph below for instance spans five decades of data on the national government debt ratio.

National government debt as percentage of nominal GDP

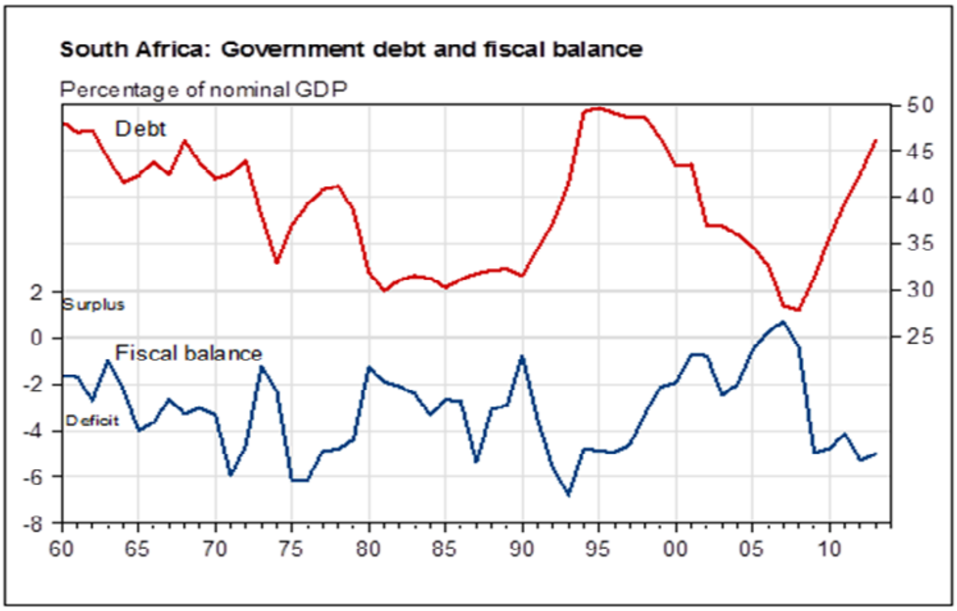


The usefulness of government debt data may be further increased by presenting it in combination with appropriate additional data. As already indicated, it is important to keep track of not only the central government debt but also that of other levels of government and public corporations, and be mindful of public corporations attracting funding by issuing shares rather than debt securities to provide a more holistic funding picture.

In terms of the analysis of debt sustainability, it is instructive to trace trends in the debt, fiscal and primary fiscal balance ratios (as percentages of gross domestic product) alongside trends in economic growth, inflation and interest rates. The graph below for instance illustrates the impact of the generally subdued economic conditions after the financial crisis of 2008 on the fiscal balance and debt ratios.

Government's debt service cost can also help inform the analysis of government debt. The line on the graph below shows how fiscal discipline and containment of government debt together with lower nominal interest rates in the wake of lower inflation reduced the debt service cost of national government relative to gross domestic product from the late 1990s; the downward trend was maintained up to the onset of the global financial crisis. In the six years subsequent to the crisis, however, countercyclical fiscal policies with an accompanying increase in government debt have resulted in a renewed increase in the debt service ratio.

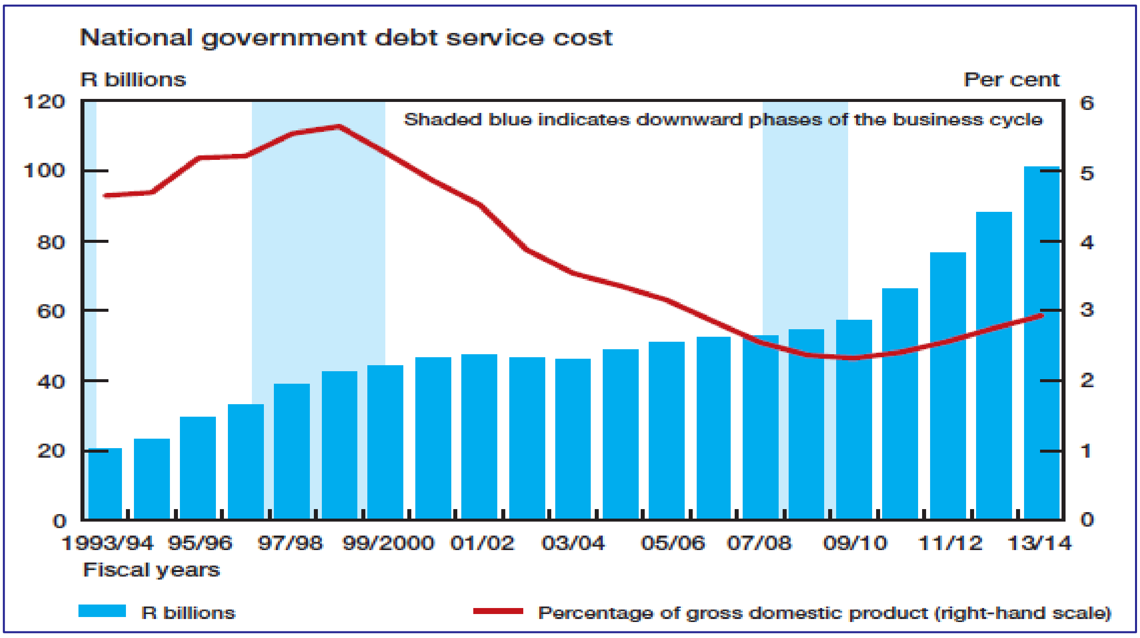
South Africa: Government debt and fiscal balance



South Africa currently disseminates the following information on interest payments in the *Quarterly Bulletin* of the Bank:

- Redemption schedule of domestic marketable bonds of national government (bond, coupon rate, redemption date and holder);
- interest payment schedule of domestic marketable bonds of national government for one year hence;

National government debt service cost



- redemption schedule of foreign debt of national government (description, coupon rate, redemption date and capital repayment); and
- interest payments schedule of foreign debt of national government for one year hence.

There are numerous further dimensions to the broader context that should be kept in mind when analysing government debt and fiscal outcomes. These are as wide-ranging as the country's stage of economic development, its level of external debt and current-account balance, the level of and trend in private-sector borrowing, and the level and productivity of the capital stock of the government sector.

7. Further improvements planned

It is planned to officially start publishing a balance sheet for social security funds in the Bank's *Quarterly Bulletin* from December 2014. There are four social security funds that autonomously manage and operate social security schemes, namely:

– the Compensation Commissioner for Occupational Diseases;

– the Compensation Commissioner for Occupational Diseases in Mines and Works;

– the Road Accident Fund (RAF); and

– the Unemployment Insurance Fund (UIF).

Publishing the debt (and other balance sheet items) of the social security funds is a step towards publishing an even more comprehensive measure of public-sector debt. An important longer-term objective is to publish the consolidated public-sector debt. This implies that intra-debt positions between the various levels of government will be eliminated.

8. Challenges and thorny issues which remain

A number of challenges and thorny issues related to the public-sector debt deserve mention.

Firstly, ***the statistical treatment of the liability of the country authorities arising from the allocation of Special Drawing Rights (SDRs)***. When the International Monetary Fund (IMF) makes an allocation of SDRs to a country, the SDRs thereby brought in possession of the country authorities are added to the stock of official foreign currency reserves, thereby boosting the country's international liquidity. The country authorities simultaneously incur a liability to the IMF.

In South Africa this liability is viewed as a unique type of financial instrument, separately identified as the SDR liability to the IMF of the South African government. This treatment stands in contrast to the IMF's guideline which proposes that the SDR liability should be included as part of the government's long-term foreign debt. This proposed treatment seems to underplay the uniqueness of SDR allocations and the corresponding liabilities. The country may decide not to make international payments with the SDRs received, but to simply keep them in stock for a rainy day; this has been the case in South Africa. Accordingly no net interest has to be paid to the IMF on the SDR liability. Furthermore, the SDR liability if utilised would ordinarily only have to be repaid to the IMF when the country withdraws from the IMF or when the IMF is dissolved. This indefinite nature of the liability and absence of net interest having to be paid while the SDRs are simply held as part of reserves underline its uniqueness, and have prompted the South African authorities to identify it separately rather than to merge it with the government's long-term foreign debt.

Secondly, the measurement of government debt by holder poses a challenge. The true beneficial holders of debt securities sometimes operate through nominee companies or other legal entities. Drilling down through these entities to identify the beneficial holders is no easy task. The reconciliation of data on transactions and outstanding balances in such a setting is equally complicated, not least because of the high volume of repurchase transactions and securities lending in the financial markets, where legal ownership and economic ownership do not necessarily coincide. Refinement of this measurement dimension continues, in collaboration with the Capital Market and Flow of Funds Division and the Balance of Payments Division of the Bank's Research Department.

Thirdly, placing the level of government debt in perspective by viewing it along with all the other items on the government's balance sheet. Construction of a comprehensive balance sheet for general government is currently work in progress in South Africa. For the public enterprises and corporations such balance sheets already exists, but the quantification of government assets in particular require much further work.

Fourthly, developing full accrual accounting for government. This is the broad strategy that is being pursued, but again much further work is required before implementation. The current system can best be described as one of modified cash accounting.

9. Conclusion

Considerable progress has been made in the measurement of government debt and fiscal activity in South Africa, with the Constitution and current institutional framework providing greater coherence than before. At the same time challenges remain, including the movement to full accrual accounting and the estimation of comprehensive balance sheets for the government sector.

Bibliography

International Budget Partnership. 2012. *Open Budget Index 2012*. www.internationalbudget.org/what-we-do/open-budget-survey accessed on 15 August 2014.

International Monetary Fund. 2011. *Public Debt Statistics: Guide for Compilers and Users*. Washington D.C. IMF.

Republic of South Africa. 2003. *Municipal Finance Management Act*. Act No. 56 of 2003. Pretoria: Government Printer.

Republic of South Africa. 1999. *Public Finance Management Act*. Act No. 1 of 1999 (as amended by Act No. 29 of 1999). Pretoria: Government Printer.

Republic of South Africa. National Treasury. Various *Budget Reviews*. Pretoria: Government Printer.

South African Reserve Bank. 2013. *Government Finance Statistics of South Africa*: *1994 to 2012*. Supplement to the March 2013 *Quarterly Bulletin* of the South African Reserve Bank. Pretoria: South African Reserve Bank. March 2013.

Van Dyk, J & Venter, L P. 1991. *South Africa's public-sector accounts*, *1973 to 1990*. South African Reserve Bank Occasional Paper no. 4. Pretoria: South African Reserve Bank. June 1991.

Statistical appendix

Debt by institutional grouping and level of government[1]

Table 1.1

End of fiscal year	National government	Local government	Non-financial public corporations	Financial public corporations	Total	Total as percentage of nominal GDP
	R billions					
2000/01	399,3	39,9	143,3	22,9	605,4	63.6
2001/02	432,2	39,7	161,5	25,4	658,8	62.8
2002/03	426,1	35,3	153,5	27,2	641,6	53.3
2003/04	455,1	39,7	174,9	23,7	693,4	53,2
2004/05	501,7	111,7	192,4	24,2	830,0	57,3
2005/06	528,6	61,3	197,3	31,3	818,5	50,7
2006/07	552,1	71,4	220,8	34,2	878,5	47,9
2007/08	571,9	71,7	277,3	42,9	963,8	46,4
2008/09	627,0	94,4	343,5	44,7	1 109,6	48,3
2009/10	805,1	117,4	423,2	41,6	1 387,3	56,5
2010/11	996,2	162,8	506,1	48,4	1 713,5	62,3
2011/12	1 187,8	127,9	541,1	61,3	1 918,1	64,3
2012/13	1 365,7	150,3	651,2	70,1	2 237,3	69,9
2013/14	1 584,7	156,0	….	….	….	….

[1] National government, extra-budgetary institutions, provincial and local governments, and the non-financial and financial public enterprises and corporations. The South African Reserve Bank and social security funds are excluded.

Sources: SARB and *Budget Reviews* of the National Treasury.

Government debt by type of instrument

Table 1.2

End of fiscal year	Debt securities	Loans	Other[1]	Total
	R billions			
2000/01	438,9	85,9	55,00	605,4
2001/02	464,2	111,1	65,60	658,8
2002/03	457,5	91,8	70,20	641,6
2003/04	512,2	86,5	94,70	693,4
2004/05	566,7	81,9	181,40	830,0
2005/06	600,0	94,7	123,80	818,5
2006/07	622,1	118,8	137,60	878,5
2007/08	657,2	117,5	189,10	963,8
2008/09	744,0	150,3	215,30	1 109,6
2009/10	951,4	185,7	250,30	1 387,3
2010/11	1,190,0	206,5	317,00	1 713,5
2011/12	1,374,9	245,9	297,30	1 918,1
2012/13	1,567,0	342,0	328,30	2 237,3
2013/14	….	….		….

[1] Includes other accounts payable.

Sources: SARB and *Budget Reviews* of the National Treasury.

Government equity holdings in public corporations/ public enterprises

Table 1.3

End of fiscal year	Non-financial public corporations	Financial public corporations	Total
	R billions		
2000/01	27,8	3,3	31,1
2001/02	26,9	2,5	29,4
2002/03	25,3	2,5	27,8
2003/04	25,3	2,5	27,8
2004/05	24,2	1,4	25,6
2005/06	21,7	1,4	23,1
2006/07	24,2	2,4	26,5
2007/08	35,5	2,4	37,9
2008/09	35,9	2,4	38,3
2009/10	35,9	2,4	38,3
2010/11	38,7	2,8	41,5
2011/12	37,1	2,8	39,9
2012/13	36,9	2,8	39,7
2013/14	....	....	....

Sources: SARB and *Budget Reviews* of the National Treasury.

Government financial guarantees

Table 1.4

End of fiscal year	Authorised	Drawn down			Balance available
	R billions				
		Domestic	Foreign	Total	
2003/04	105,8	59,6	20,0	79,6	26,2
2004/05	99,7	55,4	18,6	74,0	25,7
2005/06	91,1	49,8	18,1	67,9	23,2
2006/07	90,9	49,1	18,7	67,8	23,1
2007/08	89,5	45,7	18,8	64,5	25,0
2008/09	84,4	43,7	19,3	63,0	21,4
2009/10	292,4	111,9	17,2	129,1	163,3
2010/11	476,2	127,7	21,9	149,6	326,6
2011/12	464,4	126,9	27,1	154,0	310,4
2012/13	470,7	141,0	39,3	180,3	290,4
2013/14	469,5	160,3	48,8	209,1	260,4

Sources: SARB and *Budget Reviews* of the National Treasury.

Net debt, provisions and contingent liabilities of national government

Table 1.5

Years R million	2005/06 (actual)	2007/7 (actual)	2007/8 (actual)	2008/9 (actual)	2009/10 (actual)	2010/11 (actual)	2011/12 (actual)	2012/13 (actual)	2013/14 (projection)
Net loan debt	470,138	478,368	483,230	525,626	673,040	820,409	989,731	1,164,220	1,357,323
Provisions	46,303	49,071	55,263	61,869	81,051	73,693	98,593	115,936	117,077
Development Bank of Southern Africa	*4,800*	*4,800*	*4,800*	*4,800*	*4,800*	*4,800*	*4,800*	*4,800*	*4,800*
Special Drawing Rights	*796*	*796*	*795*	*795*	*794*	*794*	–	–	–
International Monetary Fund-Securities Account	*17,222*	*16,742*	*20,052*	*22,965*	*23,672*	*20,105*	*22,189*	*25,720*	*34,872*
International Monetary Fund – SDR Allocations					*22,638*	*19,228*	*21,223*	*24,601*	*22,653*
Leave credits	*7,480*	*7,861*	*8,503*	*8,503*	*9,762*	*10,815*	*11,266*	*12,021*	*12,646*
International Bank for Reconstruction and Development	*9,464*	*11,096*	*12,354*	*14,482*	*11,187*	*10,360*	*11,703*	*15,935*	*12,598*
Multilateral Investment Guarantee Agency	–	*106*	*118*	*138*	*107*	*99*	*112*	*134*	*120*
African Development Bank	6,541	7,670	8,641	10,186	8,091	7,492	27,300	32,725	29,388
Contingent liabilities	160,017	185,510	177,175	195,427	268,841	294,661	335,451	369,764	370,730
Guarantees	67,900	67,800	64,500	63,079	129,099	149,600	153,924	179,367	179,367
Road Accident Fund*	21,351	23,935	30,339	42,500	45,366	33,547	53,919	56,722	56,748
Claims against government departments	9,148	11,807	10,933	17,737	24,064	31,310	42,969	42,969	42,969
Post-retirement medical assistance	37,000	56,000	56,000	56,000	56,000	65,348	65,348	65,348	65,348
Export Credit Insurance Corp. S.A. Ltd	7,243	10,858	12,662	13,351	9,191	9,614	10,025	15,732	16,121
Government pension funds	12,775	12,775	–	–	–	–	–	–	–
Unemployment Insurance Fund	2,300	2,035	2,341	2,401	3,728	3,315	3,381	3,741	4,292
Other	1,300	300	400	359	1,393	1,927	5,885	5,885	5,885
SASRIA reinsurance cover	1,000	–	–	–	–	–	–	–	–
Total	676,458	712,949	715,668	782,922	1,022,932	1,188,763	1,423,775	1,649,920	1,845,130
GDP	1,613,812	1,832,763	2,075,414	2,296,571	2,452,538	2,735,274	2,973,286	3,209,142	3,520,268
% of GDP	41,92%	38,90%	34,48%	34,09%	41,71%	43,46%	47,89%	51,41%	52,41%

Source: National Treasury.

* National Treasury includes the provisions of the Social Security Funds under contingent liabilities. However, in the accounts of the Social Security Funds it is included under liabilities.

Government finance statistics for fiscal transparency and sustainability: A case study of Thailand

Somsajee Siksamat[1] and Jaruphan Wanitthananankun

Abstract

A critical element of effective fiscal policymaking and the management of fiscal risks is "Fiscal Transparency". In this regards, the development of internationally accepted standards for fiscal transparency has been established. These include an improvement in the comprehensiveness, quality, timeliness and reporting. In Thailand, a revitalized fiscal transparency effort has been enhanced to strengthen the country's fiscal credibility and performance.

This paper evaluates fiscal transparency in Thailand in the three dimensions, fiscal reporting standards, fiscal forecasting and budging standards, and fiscal risk analysis and management. Although fiscal transparency is an important predictor of a country's fiscal credibility and performance, effective monitoring and enforcing to comply with those standards are also crucial. Suggestions on enhancement of fiscal transparency are also discussed.

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1. Introduction

A critical element of effective fiscal policymaking and the management of fiscal risks is "Fiscal Transparency". Fiscal transparency is crucial as it entails the openness to the public about the government's past, present, and future fiscal activities, and about the structure and functions of government that determine fiscal policies and outcomes. This transparency fosters better-informed public debate, as well as greater government accountability and credibility. Therefore, fiscal transparency can be used as an indicator to measure or reflect the degree of fiscal performance in the government sector. Concerted effort to develop a set of internationally accepted standards for fiscal transparency has been established and widely noted. The latest improvement is suggested in the revised Fiscal Transparency Code (Consultation Draft of July 1, 2013) since the crisis in 2008 highlighted that the Code of Good Practices on Fiscal Transparency in 2007 has significant gaps in understanding fiscal position, prospects, and risks.[2]

For Thailand, the hard hit by 1997 Asian crisis resulted in economic and financial turbulence as well as fiscal risks. It left public debt to increase sharply due to the financial sector bailout during the crisis and the countercyclical role of the public sector to restore the economy. During that period, economic growth slumped sharply. Real GDP growth dropped from an average of 8% (1994–1996) to 4% (1999–2001) but shrank by –1.6 % and –11% in 1997 and 1998, respectively. Similarly, nominal GDP dropped from an average of 13% (1994–1996) to 3.6% (1999–2001). This caused the public debt to GDP ratio soared rapidly from a very low level of 12.2% at the end of FY1996 (Fiscal year is 1 October to 30 September) to the highest record of 57.8% at the end of FY2000. Efforts to reduce the public debt level to achieve fiscal consolidation then followed, and when coupled with the stronger economic recovery, led to a continuous decline in the ratio of public debt to GDP to 37.3% in FY 2008 before increased to 46.5% in 2013. Fiscal discipline together with the pickup of the economy helped increased tax revenues and allowed the country to balance its budget and repay its debts to the IMF in 2003, four years ahead of schedule.

In the past decades, Thailand's public debt path can reflect prudent fiscal management, as its ratio to GDP was kept below 60%. However, fiscal risks including weak government revenue, related to uncertain global economic outlook, and growing government expenditure including contingent liabilities could trigger public debt sustainability and fiscal credibility and performance as a whole. Therefore, Thailand has put strong effort on enhancing fiscal analysis and projection, and fiscal risk management. To accommodate these, several factors have been developed. These include development in fiscal data and statistic and disclosure. Quality of fiscal information and data and statistic has been improved in terms of accuracy, coverage, reliable, frequency and timeliness. Moreover, work coordination among public agencies, governance, and transparency are intensified. Improvement in fiscal transparency will assure better fiscal performance and sustainability. This is found in many studies the positive relationship between the degree of fiscal transparency and measures of fiscal sustainability (such as government deficits and debts), particularly those among low and middle income countries.[3] More importantly, fiscal

[2] IMF Survey (2013), "IMF Strengthens Fiscal Transparency Code," Available via the Internet: http://www.imf.org/external/pubs/ft/survey/so/2013/POL061713A.htm.

[3] Fiscal Transparency, Accountability, and Risk Prepared by the Fiscal Affairs Department in collaboration with the Statistics Department, IMF, August 2012.

sustainability and flexibility will bring in better development of the country's economic and social environment.

This paper aims to evaluate fiscal transparency in Thailand on the grounds of fiscal reporting, fiscal forecasting and budgeting, and fiscal risk analysis and management, in line with the new Fiscal Transparency Assessment (FTA) according to the revised Fiscal Transparency Code (2013). Although fiscal transparency is an important predictor of a country's fiscal credibility and performance, effective monitoring and enforcing to comply with those standards are also crucial. Suggestions on enhancement of fiscal transparency are also discussed.

2. Public Sector in Thailand

A. Coverage and developments of public sector

i. Coverage

Currently, Fiscal Policy Office (FPO), an agency under Ministry of Finance (MOF), is the key agency to compile and disseminate Thailand's public sector statistics. The public data and statistic are expected to cover data and information of all entities of nonfinancial public sector in accordance with the Government Finance Statistics Manual 2001 (Table 1) and transparency codes. However, FPO currently disseminates data and statistic only of general government. Albeit FPO does not compile Public Financial Corporation (PFC), which is part of the public sector statistics, FPO remains separately monitor quasi-fiscal policy and public service account and performance of Specialized Financial Institution (SFI) with an intention to assess and manage fiscal risk and fiscal performance. Apart from the FPO, Public Debt Management Office (PDMO), under the MOF, is a core agency who oversees and manages public debt and compiles Thailand's public debt statistics. The scope of the public debt data compiled by PDMO is broader than nonfinancial public sector, as it extend the coverage to capture public financial corporation (PFC) guaranteed by central government (CG).

Coverage of nonfinancial public sector in Thailand — Table 1

Sector	Coverage
Central government (CG)	• Central government ministries and departments • Independent public agencies (for example, The Royal Institute and the Office of the Auditor-General of Thailand) • Independent bodies under the constitution (for example, the Office of the Election Board, and the Office of the Court of Justice) • 8 Non-profit public nonfinancial corporations • 115 extra-budgetary funds
Local government (LG)	• Bangkok Metropolitan Administration • Pattaya City • 76 Provincial administrative agencies • 2,436 Municipalities • 5,339 Subdistrict administrative organizations
Public nonfinancial corporation (PNFC)	• 38 PNFCs (excluding 8 Non-Profit PNFCs)

ii. Size of public sector and its developments

Based on the data in FY 2013, size of nonfinancial public sector in Thailand accounted for 61.8% of GDP, of which the large proportion fell to PNFC at 37.8% of GDP, meanwhile 24.6% and 4.2% are attributable to CG and LG, respectively (Table 2). In terms of share to total revenues or expenditure, PNFC revenues or expenditures are largest, covering around 58% of total revenue or expenditure, meanwhile general government accounted for 42% share, of which 6–7% share belonged to local government (Figure 1).

Nonfinancial public sector balance (fiscal year 2012 – 2013) Table 2

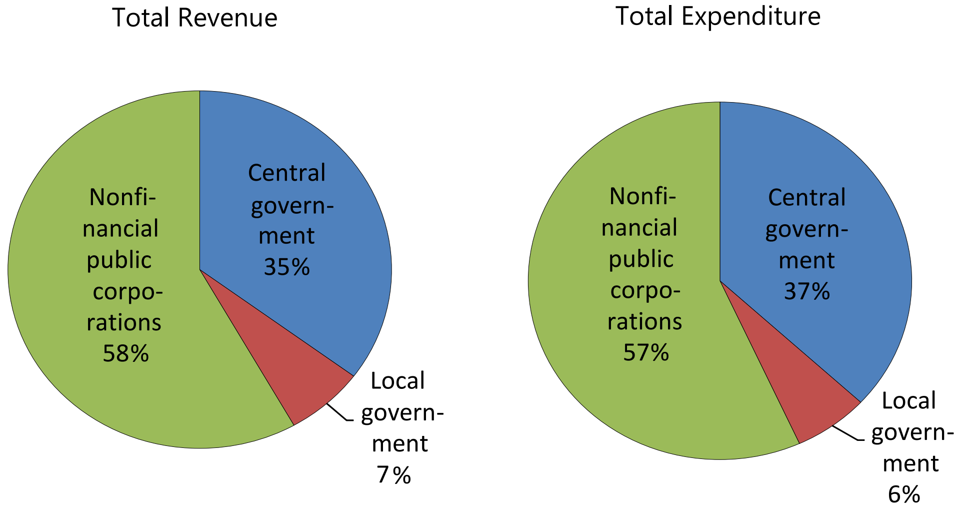
Transactions (Million Baht)	Fiscal year		diff	
	2013	2012	amount	%
1. Nonfinancial public sector				
1.1 Revenue	**7,440,775**	**6,854,000**	**586,775**	**8.6**
– Central government (include Extrabudgetary Fund)	2,814,604	2,441,144	373,460	15.3
– Local government	533,225	496,954	36,271	7.3
– Public nonfinancial corporation	4,656,686	4,447,269	209,417	4.7
– Consolidate*	–563,740	–531,367	–32,373	6.1
1.2 Expenditure	**7,324,271**	**7,139,719**	**184,552**	**2.6**
– Central government (include Extrabudgetary Fund)	2,909,555	2,711,922	197,633	7.3
– Local government	497,871	453,370	44,501	9.8
– Public nonfinancial corporation	4,480,585	4,505,794	–25,209	–0.6
– Consolidate*	–563,740	–531,367	–32,373	6.1
1.3 Nonfinancial public sector balance	**116,504**	**–285,719**	**402,223**	**–140.8**

Remark * Consolidate is inter-transaction between the central government, extra-budgetary fund, local government, and state enterprises, which is deducted from overall balance consolidation. For example, subsidy from CG to nonfinancial corporation will be deducted in CG balance, and this same amount figure in revenue of nonfinancial corporation will be also deducted in nonfinancial corporation balance.

Source: Fiscal Policy Office.

Share of subsector in total revenue and expenditure

Figure 1



Source: Fiscal Policy Office.

Detailed data on revenue, expenditure and financing are found only in central government, excluding extra-budgetary funds. For revenue side, the data are compiled by FPO on monthly basis (Table 3). Main part of the revenue is tax, covered 90% of total revenue, where 39% from income base, 46% from consumption base, and the rest of 4% from international trade base. Non-tax revenue accounted for 10% of total revenue, the main part is dividend and withdrawal from public corporations. For expenditure side, expenditures are compiled by Bank of Thailand on a monthly basis and shared by FPO (Table 4). Compilation is done for both of economic and functional classification. For disaggregation, the main item in the expense is compensation of employees, followed by subsidies and grants to local government and extra-budgetary funds, and use of goods and services. Meanwhile, acquisition of nonfinancial assets accounted for 11–12% of the budget expenditure.

CG's Revenue Collection

Table 3

Billion Baht	FY2013^{P}	FY2014^{P}				%YOY	%YOY_FY2014^{P}			
	Share	H1	Q3	May	Jun	FY2013^{P}	H1	Q3	May	Jun
1. Tax revenue	**90%**	**965.1**	**661.0**	**291.4**	**216.8**	**9.2%**	**–2.8%**	**–6.5%**	**–12.7%**	**4.4%**
1.1 Taxes on income and profits	**39%**	**317.3**	**351.9**	**188.4**	**117.4**	**11.0%**	**–0.3%**	**–9.2%**	**–18.2%**	**14.0%**
o/w Personal income tax	12%	143.7	74.8	24.5	23.7	12.3%	–5.9%	–7.4%	–2.7%	–4.6%
o/w Corporate income tax	23%	161.6	197.2	99.4	78.3	8.8%	6.2%	–8.4%	–12.9%	0.2%
1.2 Taxes on goods and services	**46%**	**588.1**	**280.3**	**93.2**	**89.8**	**9.2%**	**–3.5%**	**–3.2%**	**–0.4%**	**–5.5%**
o/w Value added Tax	27%	356.4	176.3	58.7	57.5	5.8%	0.6%	2.5%	4.7%	2.0%
o/w Excise Tax	17%	205.1	91.5	30.1	28.0	14.0%	–11.3%	–13.1%	–9.7%	–17.7%
1.3 Taxes on international trade	**4%**	**52.7**	**25.4**	**8.7**	**8.4**	**–4.9%**	**–8.4%**	**–1.9%**	**2.4%**	**–1.4%**
2. Nontax revenue	**10%**	**151.4**	**71.4**	**32.7**	**13.3**	**8.8%**	**3.0%**	**7.7%**	**12.3%**	**29.5%**
3. Total revenue	**100%**	**1,116.5**	**732.4**	**324.1**	**230.0**	**9.2%**	**–2.0%**	**–5.2%**	**–10.7%**	**5.5%**
4. Tax rebate & Allocation to LG		**139.4**	**120.9**	**41.7**	**37.3**	**8.0%**	**8.0%**	**–7.9%**	**24.6%**	**6.8%**
5. Net revenue		**941.1**	**611.5**	**282.4**	**192.8**	**9.4%**	**–3.8%**	**–4.7%**	**–14.3%**	**5.3%**

Source: Fiscal Policy Office.

CG's Expenditure

Table 4

Billion Baht	FY2013^P	FY2014^P				%YOY	%YOY_FY2014^P			
	Year	H1	Q3	May	Jun	FY2013	H1	Q3	May	Jun
1.Expense	**2,106.7**	**1,261.7**	**436.1**	**125.8**	**142.4**	**6.3**	**2.5**	**1.4**	**7.3**	**–2.1**
– Compensation of employees	845.7	443.6	206.8	66.1	66.8	5.5	0.7	3.5	–0.9	1.2
– Used of goods and Services	400.2	231.8	86.4	28.9	28.4	9.7	14.4	10.4	12.3	–1.5
– Interest	96.9	52.0	35.9	6.7	27.2	–32.2	6.8	33.1	48.0	32.5
– Subsidies + Grants	603.4	438.1	73.4	14.0	10.0	16.0	–4.4	–14.3	36.3	–36.4
– Social benefits	67.2	32.3	16.5	5.8	5.8	–8.4	–6.5	8.2	–9.7	39.5
– Other expense	93.3	63.9	17.1	4.3	4.2	17.8	39.4	–29.3	17.6	–58.9
2. Acquisition of nonfinancial assets	**268.4**	**104.6**	**61.5**	**19.8**	**22.4**	**16.9**	**–13.2**	**–1.4**	**–4.1**	**–6.5**
3. CG Expenditure (1+2)	**2,375.1**	**1,366.2**	**497.6**	**145.6**	**164.7**	**7.4**	**1.1**	**1.0**	**5.6**	**–2.7**

Source: CGD and Classified by BOT.

From the financial account position of each economic sector (most data were obtained from banks and securities custodians), financial assets of general government amounted to 6,287 Billion Baht (or 50.5% of GDP), mainly in the form of equity and investment fund shares, cash and deposits, and debt securities. It is worth mentioning that total financial assets of GG also included data of intra-sector transaction (e.g. savings of Social Securities Fund are used to invest in government securities). Meanwhile, their financial liabilities amounted to 5,577 Billion Baht (or 44.8% of GDP), mostly in the form of debt securities, followed by equity and investment fund shares and insurance, pension and standardized guarantees (Table 5). The net financial worth of the general government was then around 5.7% of GDP.

Financial Account of selected economic sectors at the end of 2013 — Table 5

Billion Baht	GG	HH	NFC	FC
Total Financial Assets	**6,287**	**25,681**	**19,352**	**39,362**
• Monetary gold and SDRs	0	0	0	245
• Currency and Deposits	1,503	10,459	3,840	2,935
• Debt securities	1,047	1,674	331	11,396
• Loans	412	26	654	21,174
• Equity and investment fund shares	3,307	9,013	7,517	2,076
• Insurance, pension and standardized guarantees	0	3,448	86	11
• Financial derivatives and employee stock options	1	0	38	491
• Other accounts receivable	180	1,061	6,885	1,034
Total Financial Liabilities	**5,577**	**11,143**	**36,823**	**40,158**
• Monetary gold and SDRs	0	0	0	49
• Currency and Deposits	0	0	0	17,419
• Debt securities	4,098	0	2,079	4,156
• Loans	770	10,268	7,850	4,849
• Equity and investment fund shares	0	0	20,150	9,118
• Insurance, pension and standardized guarantees	704	0	0	2,873
• Financial derivatives and employee stock options	2	0	77	474
• Other accounts receivable	88	875	6,667	1,220
Net Financial Assets	**710**	**14,538**	**–17,471**	**–796**

Source: Bank of Thailand.

To analyze cross financial relationships among economic sectors, BOT has also constructed consolidated financial position, excluding intra-sector transaction. As shown in the Intersectoral Asset and Liability Matrix (Table 6), GG's total financial assets was 5,656 Billion THB, most of the claims were on NFC and ODC in the form of share holdings and deposits. Regarding inter-linkages on the GG's liabilities, three main sectors, namely HH, OFC and ODC, had large claims on GG in the form of government debt security holdings. More disaggregation of intersectoral financial position statistics is also constructed by Bank of Thailand to assess balance sheet risks and mismatches as well as sectoral interconnectedness.

Intersectoral Asset and Liability Matrix in December 2013 (Billion Baht) Table 6

	Central Bank	G.Govt	ODC	OFC	NFC	HH & NPISHs	ROW	Total
Central Bank		903	3,175	387	407	1,122	163	6,158
G-Govt	245		1,270	1,339	36	1,392	665	**4,946**
ODC	242	1,591		1,495	3,903	11,636	2,889	21,756
OFC	0	530	931		890	5,494	1,654	9,499
NFC	0	2,187	6,238	2,935		6,038	7,868	25,267
HH & NPISHs	4	386	8,697	1,979	76		0	11,143
ROW	5,502	58	1,138	1,269	2,507	0		10,586
Total	**6,105**	**5,656**	**21,450**	**9,404**	**7,820**	**25,681**	**13,240**	**89,354**

Note: ** Column sector represent the claims on row sector. ** Row sector represent liabilities to the column sector. * Preliminary Data – Consolidated Sectoral Position.

G.Gov't = General Government, ODC = Other Depository Corporation, OFC = Other Finance Corporation, NFC = Nonfinancial Corporation, HH = Household, NPISHs = Non-Profit Institution Serving Households, and ROW = Rest of the World.

Source: Bank of Thailand.

B. Data source, compilation and dissemination

Compilation of Thailand's public sector statistics is mostly done by FPO, complying to the Government Finance Statistic Manual 2001 but on the cash basis. Moreover, FPO has set up GFS Working Group Committee, comprising FPO, CGD, BOT, BB, DLA, SEPO, NESDB and PDMO, to work for aligning the concept and coverage of the public sector data. Sources of data are several depending upon types of data (Table 7), and mostly are administrative data. The most comprehensive fiscal operation for consolidated general government data, compiled by FPO, are available in flow and stock of general government including extra-budgetary funds. But they are in an annual basis. Monthly data cover only those of central government's fiscal operation and excluding extra-budgetary funds. It is noted that the asset-side data are obtained from CGD who compiled and recorded such data for accounting purpose, it is not necessarily in line with the GFSM 2001. Lag time of these data is nearly 1 year.

Source of nonfinancial public sector data in Thailand (direct approach)				Table 7
Sector	Coverage	Frequency	Timeliness	Source of data
Central government (CG)	• Central government ministries and departments • Independent public agencies (for example, The Royal Institute and the Office of the Auditor-General of Thailand) • Independent bodies under the constitution (for example, the Office of the Election Board, and the Office of the Court of Justice) • 8 Non-Profit PNFCs • 115 extra-budgetary funds	M	1M	• The Revenue Department • The Excise Department • The Customs Department • The Comptroller General's Department (CGD) • Bureau of the Budget • State Enterprise Policy Office (SEPO) • Survey from 14 extrabudgetary funds, income of which is approximately 95% of total income of all 115 extrabudgetary funds.
Local government (LG)	• Bangkok Metropolitan Administration • Pattaya City • 76 Provincial administrative agencies • 2,436 Municipalities • 5,339 Tumbon administrative organizations	Q	2M	• Survey 200 – 400 large units • Department of Local Administration (DLA)
Public nonfinancial corporation (PNFC)	• 38 PNFCs (excluding 8 Non-Profit PNFCs)	Q	2M	• State Enterprise Policy Office (SEPO)
Public debt	• Central government and public corporation	M	2M	• Public Debt Management Office (PDMO)

BOT, acting as the banking facilitator to the government and the registrar for the government bonds, also collects and makes use of the treasury cash and government's debt security transaction data and information for monitoring market liquidity. Some of these data, particularly the treasury cash data and debt security transactions, are then supplied to CGD and PDMO, accordingly. In addition, BOT needs the GFS data for its owned medium-term economic projection and financial stability assessment, therefore the Bank compiles cash statement statistics of the central government operations according to functional and economic classifications and also gather government debt statistic classified by holder.[4] These data are also shared and used by FPO.

[4] In order to have the complete picture of country's financial securities, Bank of Thailand together with Securities and Exchange Commission (SEC), Public Debt Management Office (PDMO), The Stock Exchange of Thailand (SET), and The Thai Bond Market Association (Thai BMA), established The Thailand Financial Instrument Information Center (TFIIC) in 2011 to be a core centre of information and statistic of financial instruments and agree upon the use of standard reference that get along with the international communities. This helps data can be linked and exchanged between agencies easily, which will reduce overall cost of data collection.

There has been strong cooperation and coordination among agencies responsible for fiscal data and statistics. Their common goal is to improve the government finance statistics to meet the international standard and policy makers' requirement. Thailand already subscribed to the Special Data Dissemination Standard (SDDS), the first tier of the IMF's Data Standards Initiatives, on August 9, 1996, and started posting its metadata on the Dissemination Standards Bulletin Board (DSBB) on September 19, 1996. However, Thailand does not yet join in the third tier of the Data Standards Initiatives, SDDS Plus. Under SDDS plus, the fiscal sector data are needed for two additional data categories[5] involving general government operations (GGO) and general government total gross debt (GGD),[6] which are required more detailed information on revenue, expenditure and debt, with specified periodicity and timeliness.

Compiling public sector statistics and fiscal data in accordance with SDDS plus helps compiler narrower or might close data gap since the data will be sufficient for policy makers to analyze and monitor fiscal risks and formulate appropriate fiscal policy measures. However, key challenges for Thailand's fiscal data compilation and dissemination remains. These include:

1. A lack of completed local government data (including data of revenue, expenditure, financial statements and debt)

The Department of Local Administration (DLA), responsible entity for administering and allocating budget to local government (LG), has already established a system of recording and reporting, namely, Local Administrative Account System (LAAS), since 2008 to process inputs from LG in real time. These input data consist of revenues, expenditures and financial statement. As of April 2014, 7,096 local government units (or 90.4% of total local government bodies) entered data into the LAAS. Revenue data of remaining LG bodies are obtained in the form of reports which take time in collecting and compiling, hence resulting in a lag time for dissemination. In addition, main data recorded through LAAS are local government revenues meanwhile expenditures and financial statements are not intact.

DLA has long been encouraged more local government units to enter data via the LAAS system, but several LG units have less intention. To this extent, the DLA is in the process of finding measures to encourage or enforce LG units to submit complete data through this system and making them more realize the importance of data recording via this system. Furthermore, there are no specific laws and regulations to enforce government agencies to disseminate fiscal data. There are also no penalties for non-compliance. In order to improve the quality of public finance statistics, there should be a legislation which prescribes the responsibilities

[5] While GGO is a prescribed data category under the SDDS, it is also an additional required data category under the SDDS Plus with specified periodicity, timeliness, and classification requirements that differ from those under the SDDS. Under the SDDS, data on GGO are required to be disseminated on an annual basis within two quarters after the end of the reference period, while the SDDS Plus requires dissemination of quarterly GGO data within twelve months after the end of the reference period. In addition, the SDDS Plus requires that GGO data be published using the Government Finance Statistics Manual, 2001 (GFSM 2001) format. The SDDS encourages, but does not require. The adoption of successor methodology as it becomes available is encouraged. GGD is an additional data category required only under the SDDS Plus.

[6] The Special Data Dissemination Standard Plus, IMF, 2013.

of government and related agencies in compiling and disseminating timely and accurate fiscal data and statistics.

2. Incompleteness of information on extra-budgetary funds

FPO obtains data and information of extra-budgetary funds directly from the top 14 extra-budgetary funds from the total of 115 funds by monthly survey. The income size of these 14-funds covers 95% of total income of all extra-budgetary funds. Data and information of the rest extra-budgetary funds are obtained from other administrative sources, especially the Comptroller General's Department (CGD). This causes burden to data providers. Moreover, data on revenues, expenditures and financial statement received from the CGD are not recorded according to the methodology outlined in the GFS, i.e., no breakdown of items into GFS standard code.

3. Economic classification and institutional unit classification are not aligned between GFS and SNA

GFS and SNA concepts used by the Thai authorities are not yet currently aligned. Examples of the inconsistencies included: (1) inconsistent definition of expenses; (2) different data sources for compilation; (3) difference in accounting concepts, i.e., data for general government based on GFS is still recorded on cash basis, while that for SNA transaction are recorded according to accrual basis; and (4) different institutional unit coverage, which may result in incorrect data interpretation by users and may affect fiscal policy formulation.

Regarding the aforementioned challenges, if Thailand wants to move towards SDDS plus, there are needs for more complete and consistent fiscal data from all involved agencies. Furthermore, these relevant agencies must have strong cooperation and put emphasis on the enhancement of data quality through the coverage, accuracy, reliability, periodicity and timeliness as well as sharing.

3. Assessment of fiscal transparency in Thailand

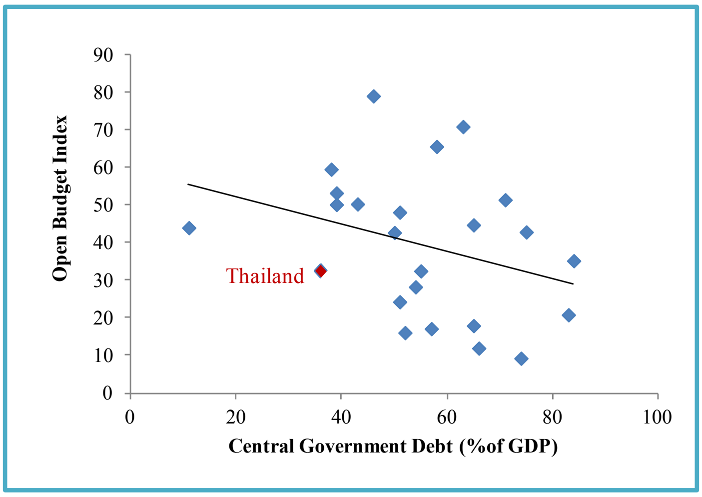
A. Fiscal transparency and its Importance

According to the IMF Fiscal Transparency Manual, fiscal transparency refers to the clarity, reliability, frequency, timeliness, and relevance of public fiscal reporting and the openness to the public of the government's fiscal policy-making process. Within this, ***clarity*** refers to the ease with which these reports can be reached and understood by users, ***reliability*** refers to the extent to which these reports reflect the government's true financial position, ***frequency*** (or periodicity) refers to the regularity with which reports are published, ***timeliness*** refers to the time lag involved in the dissemination of these reports, ***relevance*** refers to the extent to which these reports provide users with the information they need to make effective decisions, and ***openness*** refers to the ease with which the public can understand, influence, and hold governments to account for their fiscal policy decisions.[7]

[7] Ibid. 2.

There are several empirical researches highlighted the positive relationship between degree of fiscal transparency and measures of fiscal performance (government deficits and debt, credit rating, and government bond yields).[8] As seen in Figure 2, the higher degree of "Open Budget Index", which reflects fiscal transparency, the lower level of "Central Government Debt to GDP ratio", which reflects fiscal performance, is.

Open Budget Index and Central Government Debt in 2012 Figure 2



Source: Open Budget Survey 2012 and GFS year book 2012.

B. Fiscal Transparency in Thailand

As mention earlier, fiscal transparency can be measured by the degree of openness toward the public at large about government structure and functions, fiscal policy intentions, public sector accounts, and projections. It involves ready access to reliable, comprehensive, timely, understandable, and inter-nationally comparable information on government activities. In this study, fiscal transparency measure is based on the guideline of principles according to the Fiscal Transparency Principles specified in the Fiscal Transparency Code (Consultation Draft of July 1, 2013), the new Fiscal Transparency Assessment (FTA).[9] In this guideline, there are three key dimensions to be evaluated. They are: 1) Fiscal reporting; 2) Fiscal forecasting and budgeting; and 3) Fiscal risk analysis and management.[10] Each dimension has detailed questions. For the first dimension, ***fiscal reporting***, fiscal reports should

8 Ibid. 2, p.5.

9 The revised Fiscal Transparency Code will provide the basis for a new Fiscal Transparency Assessment (FTA) which replaces the Fiscal Report on the Observance of Standards and Codes (the Fiscal ROSC).

10 International Monetary Fund, 2013, "The revised Fiscal Transparency Code (Consultation Draft of July 1, 2013)."

provide a comprehensiveness, relevant, timely and reliable overview of the government's financial position and performance. The second dimension, ***fiscal forecasting and budgeting***, requires that budgets and their underlying fiscal forecasts should provide a clear statement of the central government's budgetary objectives and policy intentions and comprehensive, timely, and credible projections of the evolution of the public finances. The last dimension is ***fiscal risk analysis and management*** which requires that the governments should analyze and mange risks to the public finances and ensure effective coordination of fiscal decision-making across the public sector.

To evaluate each dimension, the authors discussed with a group of people who have involved in the fiscal data compilation, dissemination, and analysis to conclude what should be the most likely answer corresponding to each question in these three dimensions of the assessment.[11] Four choices are given, "Advance", "Good", "Basic", and "Not met". Then these qualitative choices are scored in order to construct indexes of each interested dimension, namely, fiscal reporting index, fiscal forecasting and budgeting index, and fiscal risk analysis and management index. Then these three dimension indexes are averaged to obtain the aggregate index. In scoring, the highest point, 10.0, is given to the check of best performance, i.e., "Advanced". The points, 7.5, 5.0 and 0 are given to the selected choices of "Good", "Basic", and "Not met", respectively. The dimension index (index for dimension 1, 2 and 3) is calculated by averaging the scores that are given to the questions in that particular dimension. And the aggregate index is an average of the three dimension indexes. Details of the fiscal transparency code appear in appendix I. The level of the Dimension indexes are shown in Figure 3 and key findings are summarized below.

(1) The aggregate index is at 5.6, suggesting that the overall Thailand's fiscal transparency meets the basic transparency standard.

(2) The fiscal reporting index is 6.3, which implies that the Thailand's overall fiscal reporting is slightly above the basic transparency standard, except only for the aspect of timeliness of annual financial statement.

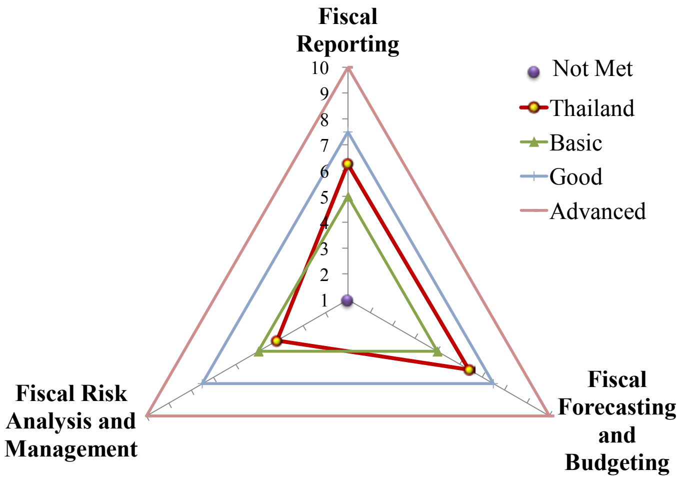
(3) The fiscal forecasting and budgeting index reaches 6.4, where fiscal forecasting and budgeting meet either good or advanced practices in many areas. This suggests that the Thailand's overall fiscal forecasting and budgeting is above the basic requirement. However, in terms of fiscal sustainability analysis and independent evaluation are not met. This is because the main fiscal aggregate is projected for medium-term with around 5-year horizon, shorter than the recommended 10-year horizon.

(4) The fiscal risk analysis and management index is relatively low at 4.2, suggesting that Thailand's overall fiscal risk analysis and management is under the basic requirement. Concerned issues include lack of disclosures of national resources, the financial derivative position, major and multi-annual contracts, the analysis of the potential fiscal exposure to environmental risks, and fiscal risks relating to the healthcare and social security funds. However, the ratio of public debt to GDP is relatively low, around 47%, leaves Thailand large room to accommodate fiscal risks.

[11] The assessment result obtained in this study is preliminary and is exclusively assessed for this study by authors. Therefore, the result is based on opinion of authors and discussion group and several principles have still been discussed.

Fiscal Transparency Assessment in case of Thailand (authors' calculation)

Figure 3



4. Improvement of Fiscal Transparency

A poor fiscal transparency may lead to incentives and more opportunities for undermining public's trust in the public policies. In Thailand, fiscal transparency has continuously developed. After the 1997 ASEAN crisis, the issues of fiscal risk, transparency, accountability and sustainability had become more pronounced. In response to this, fiscal sustainability framework has been set up since 2002 (Table 8).

Fiscal Sustainability Framework in Thailand

Table 8

Fiscal Year	2002	2003	2004	2005	2009	2014
Objective						
Public Debt/GDP (%)	≤ 60	≤ 55	≤ 50	≤ 50	≤ 60	≤ 60
Debt Service/Budget (%)	≤ 16	≤ 16	≤ 15	≤ 15	≤ 15	≤ 15
Budget Balance	Balance in 2005	Balance in 2005	Balance in 2005	Balance in 2005	Balance in 2005	Balance in 2517
Capital Expenditure/Budget (%)	–	–	≥ 25	≥ 25	–	≥ 25
Performance						
Public Debt/GDP (%)	54.0	49.4	48.1	46.1	44.3	47.1
Debt Service/Budget (%)	10.3	10.7	9.9	9.9	10.2	7.4
Budget Balance (Million Baht)	–200,000	–174,900	– 99,900	–	–347,060	–250,000
Capital Expenditure/Budget (%)	21.9	21.2	25.2	25.5	22.0	17.5

Source: Fiscal Policy Office.

The budget documentation has been improved by increasing more details of the budget allocation. Ministry of Finance attempts to disclose more information of fiscal policy formulation and the impacts of fiscal policy on the economy. Furthermore, close coordination among agencies responsible for data collection and compilation has been enhanced continuously in order to improve the quality of fiscal statistics and more useful to policy formulation and implementation as well as to public understanding. However, there are still rooms for improvement.

From the assessment result, the dimension of fiscal risk analysis and management is slightly below "Basic" requirement. To improve fiscal transparency in this dimension, the government needs to be able to identify fiscal risks and cope with them. In doing so, the quality of information about risks, powers to limit exposure to those risks that can be mitigated, and capacity to absorb the fiscal consequences of those risks that cannot be mitigated are necessary. For disclosure, the government analyzes fiscal risks and annually publishes details in the Fiscal Risk Statement since 2011. In order to improve performance specified in this dimension, key areas needed for improvement include:

- Developing of relevant tools and methodologies to help estimate fiscal risks.
- Enhancing quality of information about risks and identifying and capturing more information (narrow data gap) about public sector's exposures needed for fiscal risk assessment so that potential risks and associated burdens can be evaluated and managed properly. And, information about risks has to be disclosed. These risks include: macroeconomic analysis of risk; specific revenue risks not reflected in macroeconomic analysis; contingent liabilities; risks related to the financial sector in addition to those related to explicit guarantees; and risks related to values of assets and liabilities and associated cash flows, including debt, derivatives, financial assets, pensions, provisions, and public private partnerships as well as contracts for the exploitation of resources and natural disasters.

With respect to the dimensions of fiscal forecasting and budgeting and fiscal report, although the scores are above "Basic", rooms for enhancement remains. These include:

- Enhancing cooperation among government agencies in order to expand the institutional coverage of the fiscal statistics and encouraging the compilation and dissemination of fiscal statistics in according to international standards within a reasonable timeframe.
- Providing a more detailed reconciliation of changes to fiscal forecasts regularly publishing the long-term fiscal projections.
- Bringing the financial activities of all publicly controlled entities in to summary fiscal report.
- Encouraging LG to collect and enter data in the LAAS and improving the Public Debt Management Act to include PDMO in monitoring local government's debt.
- Establishing framework of fiscal accountability, check and balance as well as transparency, in budget procedure transparency and particularly populist policies and extra-budgetary funds.
- Overhauling fiscal rule by combining the sustainability objective with more flexibility to accommodate economic shocks and disclosure.

5. Conclusion

This paper describes briefly the public sector of Thailand regarding its coverage, performance, statistic compilation and disclosure and provides an assessment of fiscal transparency practices in Thailand according to the Fiscal Transparency Principles specified in the Fiscal Transparency Code (Consultation Draft of July 1, 2013). Fiscal Transparency measurement is decomposed into three dimensions, namely (1) Fiscal reporting; (2) Fiscal forecasting and budgeting; and (3) Fiscal risk analysis and management. The results suggest that Thailand meets the requirements of the fiscal transparency code in many respects and exceeds some in a few issues. The Fiscal forecasting and budgeting and Fiscal reporting are broadly sound. However, fiscal risk analysis and management index is below "Basic" measurement. Therefore, the fiscal impact of possible changes in macroeconomic variables; explicit government liabilities defined by law or contract; and implicit liabilities that are a possible burden for the government should be tracked and closely monitored and evaluated.

Appendix I

Fiscal Transparency Assessment of Thailand Case Study

The new Fiscal Transparency Assessment (FTA) comprises around 3 key dimension, 1) fiscal reporting, 2) fiscal forecasting and budgeting, and 3) fiscal risk analysis and management. This is researcher's view point to assess fiscal transparency in Thailand.

The fact finding of fiscal reporting practices of Thailand

	Dimension	Principle	Practices (Not Met / Basic / Good / Advanced)
1	**FISCAL REPORTING: Fiscal reports should provide a comprehensive, relevant, timely, and reliable overview of the government's financial position and performance.**		
1.1	**Coverage: Fiscal reports should provide a comprehensive overview of the fiscal activities of the public sector, according to international standards.**		
1.1.1	Structure of the public sector	The structure and function of the public sector and its relationship with the private sector are clearly defined.	Good: The government maintains and publishes a register of all public sector entities.
1.1.2	Coverage of Institutions	Fiscal reports cover all entities engaged in public activity according to international standards.	Good: Fiscal reports consolidate all general government entities and report on each subsector. But details of public nonfinancial corporation statistics are currently not meet international standards and there is no data of public financial corporation.
1.1.3	Coverage of Stocks	Fiscal reports include a balance sheet of public assets, liabilities, and net worth.	Basic: Fiscal reports cover cash and all debt. But they didn't currently cover any assets.
1.1.4	Coverage of Flows	Fiscal reports cover all public revenues, expenditures, and financing.	Basic: Fiscal reports cover cash revenues, expenditures and financing in cash basis, not yet accrual basis.
1.1.5	Tax Expenditures	The government regularly discloses all revenue loss from tax expenditure.	Basic: The estimated revenue loss from tax expenditures is published at least annually.
1.2	**Frequency and Timeliness: Fiscal reports should be published in a frequent, regular, and timely manner.**		
1.2.1	Frequency of In-Year Fiscal Reports	In-year fiscal reports and statistics are published on a frequent and regular basis.	Good: FPO reports quarterly nonfinancial public sector balance on FPO website. Even though there are less details of statistics.
1.2.2	Timeliness of Annual Financial Statements	Audited or final annual financial statements are published in a timely manner.	Not Met: There is considerable lag time in audit and publishing more than 12 months.

The fact finding of fiscal reporting practices of Thailand (cont)

	Dimension	Principle	Practices (Not Met / Basic / Good / Advanced)
1.3	**Quality: Information in fiscal reports should be relevant, internationally comparable, and internally and historically consistent.**		
1.3.1	Classification	Fiscal reports classify information in ways that make clear the use of public resources and facilitates international comparisons.	Advanced: Fiscal reports include an administrative, economic, functional, and program classification consistent with international standards, where applicable, as well as information on receipts from all major revenue sources, including resource related activities.
1.3.2	Data Consistency	Fiscal reports are internally consistent and include reconciliations between alternative measures of summary fiscal aggregates.	Good: Fiscal reports include at least two of the following reconciliations: (i) balance and financing, (ii) debt issued and debt holdings, or (iii) financing and the change in the debt stock.
1.3.3	Historical Consistency	Material revisions to historical fiscal statistics are disclosed and explained.	Basic: Material revisions to historical fiscal statistics are reported.
1.4	**Integrity: Fiscal statistics and financial statements should be reliable and subject to external scrutiny.**		
1.4.1	Statistical Integrity	Responsibility for verifying and disseminating fiscal statistics is vested in a specific body that is independent.	Basic: Verification and dissemination of fiscal statistics are the responsibility of FPO; who is an agency under Ministry of Finance and is not an autonomous agency.
1.4.2	External Audit	Annual financial statements are subject to a published audit by an independent supreme audit institution according to international standards.	Advanced: The annual financial statements is audited by Office of the Auditor General; who is a specific national audit body; and is reported to the legislature which they present a "true and fair view" of the state of public finances, even though there is considerable lag time.
1.4.3	Statistical Dissemination	Fiscal statistics meet internationally accepted systems and standards.	Good: Thailand's Fiscal statistics meet SDDS and are disseminated in BOT website.
1.4.4	Reliability of Financial Statements	The annual financial statements meet generally accepted accounting standards and their reliability is validated.	Basic: The annual financial statements meet national accounting standards and there is an audit report validating their reliability.

The fact finding of fiscal reporting practices of Thailand (cont)

	Dimension	Principle	Practices (Not Met / Basic / Good / Advanced)
2	**FISCAL FORECASTING AND BUDGETING: Budgets and their underlying fiscal forecasts should provide a clear statement of the central government's budgetary objectives and policy intentions and comprehensive, timely, and credible projections of the evolution of the public finances.**		
2.1	**Comprehensiveness: Fiscal forecasts and budgets should provide a comprehensive overview of fiscal prospects.**		
2.1.1	Unity	Revenues, expenditures, and financing of central government, both budgetary and extra-budgetary, are authorized by the legislature.	Basic: Budget documentation incorporates all revenues, expenditures, and financing by central government.
2.1.2	Gross Budgeting	Revenues and expenditures are presented on a gross basis in budget documentation.	Advanced: All domestic and external revenues and expenditure are presented on a gross basis in budget documentation.
2.1.3	Macroeconomic Forecasts	The budget projections are based on comprehensive macroeconomic forecasts which are disclosed and explained.	Good: The budget projection, including forecasts of key macroeconomic variables and the underlying assumption are annually provided in fiscal risk statement.
2.1.4	Medium-term Budget Framework	Budget documentation includes outturns and projections of revenues, expenditures, and financing over the medium-term on the same basis as the annual budget.	Basic: Although medium-term budget framework is not provided in budget documentation, it is annually presented in fiscal risk statement.
2.2	**Timeliness: The government should provide timely updates on fiscal prospects.**		
2.2.1	Fiscal Strategy Report	The government provides a mid-year report summarizing macroeconomic and fiscal developments since the last budget, and macroeconomic and fiscal forecasts for the preparation of the upcoming budget.	Basic: The government provides a mid-year report summarizing macroeconomic and fiscal developments since the last budget, and the revised macroeconomic and fiscal forecasts for the current year.
2.2.2	Budget Submission	The legislature and the public are consistently given adequate time to scrutinize and approve the annual budget before the start of the financial year.	Advanced: The budget is submitted to the legislature and made available to the public at least three months before the start of the financial year.

The fact finding of fiscal reporting practices of Thailand (cont)

	Dimension	Principle	Practices (Not Met / Basic / Good / Advanced)
2.2.3	Budget Approval	The approval and publication of the budget legislation consistently provides adequate time for its effective execution.	Good: The budget legislation is approved and published by the start of the financial year.
2.3	**Legal Framework: The fiscal powers of the executive, legislative, and judicial branches of government should be well defined in law.**		
2.3.1	Organic Budget Legislation	The use of public resources should be governed by a comprehensive legal framework.	Advanced: The legal framework defines the government's powers with respect to three of (i) fiscal policy making, (ii) budget preparation and execution, or (iii) accounting and audit.
2.3.2	Legal Basis for Revenue Collection	Laws and regulations related to the collection of tax and non-tax revenues should be comprehensive and accessible.	Advanced: Laws and regulations relating to revenue collection are comprehensive and accessible, taxpayers have access to a well-functioning appeals process, and taxpayers are provided with up-to-date guidance on how to meet their obligations.
2.4	**Policy Orientation: Fiscal forecasts and budgets should be presented in a way that facilitates policy analysis and accountability.**		
2.4.1	Fiscal Policy Objectives	The government states and reports on clear and measurable objectives for the public finances.	Advanced: The government states and regularly reports on numerical objectives for the main fiscal aggregates which are precise and time-bound for medium term about 3 years or more.
2.4.2	Performance Information	Budget documentation provides information regarding the objectives and results achieved under each major government policy area.	Basic: Budget documentation includes information of inputs acquired under each major government policy area.
2.4.3	Citizens' Guide to the Budget	The government makes available to all citizens a clear, accessible, and useful summary of fiscal performance and economic prospects as well as the distributional implications of fiscal policies.	Basic: Government provides an accessible description of recent fiscal performance and economic prospects, as well as a summary of the implications of the budget to curtained groups e.g. policy makers and parliament. In addition, details are not in full scale as there are no details of impact of major policies on different income groups.
2.4.4	Fiscal Sustainability Analysis	The government regularly publishes the projected evolution of the public finances over the long-term.	Not Met: Long-term (at least 10 years) projections of the main fiscal aggregates are not yet published.

The fact finding of fiscal reporting practices of Thailand (cont)

	Dimension	Principle	Practices (Not Met / Basic / Good / Advanced)
2.5	**Credibility: Fiscal forecasts and budgets should be credible.**		
2.5.1	Independent Evaluation	The government's fiscal forecasts are subject to independent evaluation.	Not Met: There are no any independent forecasters' macroeconomic projections in budget documentation.
2.5.2	Supplementary Budget	Any material changes to the approved budget are authorized by the legislature.	Good: A supplementary budget is undertaken prior to total expenditure exceeding budgeted amounts.
2.5.3	Forecast Reconciliation	Budget documentation and any subsequent updates explain any material changes to the government's previous fiscal forecasts, distinguishing the fiscal impact of new policy measures.	Basic: Differences between the successive vintages of the government's revenue, expenditure, and financing forecasts are shown at the aggregate level, with a qualitative discussion of the impact of new policies on the forecasts.
3	**FISCAL RISK ANALYSIS AND MANAGEMENT : Governments should analyze and manage risks to the public finances and ensure effective coordination of fiscal decision-making across the public sector.**		
3.1	**Risk Disclosure and Analysis: Governments should publish regular reports on risks to their fiscal prospects.**		
3.1.1	Macroeconomic Risks	The government reports on how fiscal outcomes might differ from baseline forecasts as a result of different macroeconomic shocks.	Good: Although budget documentation does not include alternative fiscal forecasts based on optimistic and pessimistic macroeconomic scenarios, the FPO's fiscal risk statement is included.
3.1.2	Specific Fiscal Risks	The government regularly reports on the main specific risks to its fiscal forecasts, such as contingent liabilities.	Basic: The main specific risks to the fiscal forecast are disclosed and discussed in qualitative term. However, these risks do not include the risks from the Government Pension Fund.
3.1.3	Comparability of Fiscal Data	Fiscal forecasts, budgets, and fiscal reports are presented on a comparable basis, with any deviations explained.	Good: Budget and outturn are comparable plus the outturn is reconciled with either the fiscal statistics or final accounts.
3.2	**Risk Management: Specific risks to the public finances should be regularly monitored, disclosed, and managed.**		
3.2.1	Allowances for Budgetary Contingencies	The budget has adequate and transparent provision for contingencies that arise during budget execution.	Good: The budget includes a provision for contingencies with transparent access criteria.

The fact finding of fiscal reporting practices of Thailand (cont)

	Dimension	Principle	Practices (Not Met / Basic / Good / Advanced)
3.2.2	Asset and Liability Management	Risks relating to major assets and liabilities are disclosed and managed.	Basic: All borrowing is authorized by law and the risks surrounding the government's debt holdings are analyzed and disclosed. However, the risks surrounding the government's asset are not yet disclosed.
3.2.3	Natural Resources	The value of the government's interest in exhaustible natural resource assets and their exploitation is disclosed.	Not met: Although the volume and value of the previous year's sales and fiscal revenue is published monthly, the government does not published an estimate of the volume of major natural resource assets at all.
3.2.4	Financial Derivatives	Financial derivative positions, if any, are regularly disclosed, assessed, and managed.	Not met: The government discloses its derivative positions at their market values, but not notional values.
3.2.5	Guarantees	Government guarantees and their management policy are regularly disclosed.	Good: All government guarantees, their beneficiaries, and the gross exposure created by them are published at least annually. The maximum value of new guarantees or their stock is authorized by law.
3.2.6	Financial Sector Exposure	The government's potential fiscal exposure to the financial sector is analyzed and disclosed.	Good: The government's potential exposure to the financial sector is discussed in the fiscal risk report at least annually.
3.2.7	Major and Multi-Annual Contracts	Major and multi-annual contracts, including public private partnerships and contracts for the exploitation of resources, are regularly disclosed and actively managed, with all public rights, obligations and other exposures detailed.	Not Met: The government does not publish its total rights, obligations, and other exposures under major and multi-annual contracts.
3.2.8	Environmental Risks	The potential fiscal exposure to natural disasters and other major environmental risks are analyzed, disclosed, and managed.	Not Met: The budget does not identify and discuss the main fiscal risks from natural disasters.

The fact finding of fiscal reporting practices of Thailand (cont)

	Dimension	Principle	Practices (Not Met / Basic / Good / Advanced)
3.3	**Fiscal Coordination: Fiscal relations across the public sector should be analyzed, disclosed, and coordinated.**		
3.3.1	Sub-National Governments	Comprehensive information on the fiscal condition of sub-national governments, individually and as a consolidated sector, are collected and published	Basic: The fiscal condition of sub-national governments is published quarterly. However, these data do not have details of each sub-national government.
3.3.2	Public Corporations	The government oversees and regularly publishes comprehensive information on the financial performance of public corporations.	Basic: All direct transfers between the government and public corporations are disclosed at least annually. However, indirect transfers between them are not yet disclosed.
3.3.3	Quasi-Fiscal Activity	Quasi-fiscal activity is avoided, or if undertaken, reported comprehensively.	Basic: The Fiscal Risk Statement, which is annually published by FPO, provides a qualitative discussion of quasi-fiscal activities undertaken by public corporations.
3.3.4	Health and Social Security	Fiscal risks relating to the social security and healthcare funds are disclosed and managed.	Not met: The financial and projected position of social security and health funds are not yet disclosed.

Abbreviations

BB	Bureau of the Budget
BOT	Bank of Thailand
CGD	The Comptroller General's Department
DLA	Department of Local Administration
FPO	Fiscal Policy Office
GFS	Government Finance Statistics
HH	Household
LAAS	Local Administrative Account System
NFC	Nonfinancial Corporation
NESDB	Office of the National Economic and Social Development Board
NPISHs	Non-Profit Institution Serving Households
ODC	Other Depository Corporation
OFC	Other Finance Corporation
PDMO	Public Debt Management Office
PFC	Public Financial Corporation
PNFC	Public Nonfinancial Corporation
ROW	Rest of the World
SDDS	Special Data Dissemination Standard
SEPO	State Enterprise Policy Office
TFIIC	Thailand Financial Instrument Information Center

Reference

Chui, Michael; Farrell, Diana; and Jackson, Kate, 2014, "How government can promote open data," McKinsey&Company, April 2014.

Cottarelli, Carlo, and the Fiscal Affairs Department in collaboration with the Statistics Department, 2012, "Fiscal Transparency, Accountability, and Risk," International Monetary Fund.

Fiscal Transparency, Accountability, and Risk Prepared by the Fiscal Affairs Department in collaboration with the Statistics Department, IMF, August 2012.

Hughes, Richard; Harris, Jason; Irwin, Tim; Pattanayak, Sailendra; Lucey, Mick; and Watkins, David, 2013, "Ireland: Fiscal Transparency Assessment," International Monetary Fund (IMF).

International Budget Partnership, 2012, "Open Budget Survey."

International Monetary Fund (IMF), 2012, "GFS year book."

International Monetary Fund (IMF), 2014,"Government Finance Statistics Manual 2014 Prepublication."

International Monetary Fund (IMF), 2013, "The revised Fiscal Transparency Code (Consultation Draft of July 1, 2013)".

International Monetary Fund (IMF), 2013, "The Special Data Dissemination Standard Plus."

IMF Survey, 2013, "IMF Strengthens Fiscal Transparency Code," Available via the Internet: http://www.imf.org/external/pubs/ft/survey/so/2013/POL061713A.htm.

Petrie, Murray, 2011, "Defining the Technical Content of Global Norms: Synthesis and Analytic Review," Global Initiative on Fiscal Transparency, Revised Phase 1 Report for the Advancing Global Norms Working Group.

Sangsubhan, K. and R. Wangcharoenrung (2011), 'Fiscal Issues in Thailand: Assessment on the Impact of Stimulus, Fiscal Transparency and Fiscal Risk', in Ito, T. and F. Parulian (eds.), Assessment on the Impact of Stimulus, Fiscal Transparency and Fiscal Risk. ERIA Research Project Report 2010–01, pp 241–247.

Sathit, Thalangsat; and Jitchaya, Buranahiran, 2014, "SDDS Plus: Forward to Thailand's economic and financial statistics dissemination," the Focused and Quick issue 88, June 5, 2014, Bank of Thailand.

Schaechter, Andrea; Kinda, Tidiane; Budina, Nina; and Weber, Anke, 2012, "Fiscal Rules in Response to the Crisis – Toward the "Next-Generation" Rules. A New Dataset, IMF working paper, International Monetary Fund (IMF), July, 2012.

The Fiscal Affair Department, Approved by Carlo Cottarelli and Kalpana Kochhar, 2009, "Thailand: Report on Observance of Standards and Codes (ROSC) Fiscal Transparency Module," IMF country report, May 5, 2009.

New and timely statistical indicators on government debt securities

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Abstract

New monthly statistical indicators on government debt securities for euro area countries have now been developed on the basis of the information contained in the Centralised Securities Database (CSDB). The CSDB is jointly operated by the European System of Central Banks (ESCB) and contains timely and high-quality security-by-security reference data on debt securities, equities and investment funds. The new indicators on government debt securities provide an indication of the expected disbursements made for the servicing of issued debt securities together with the associated interest rate (nominal yield), broken down by original and remaining maturity, currency and type of coupon rate.

This paper describes in detail the newly compiled statistical information and thus contributes to further describing the euro area government bond markets. The new indicators are also highly relevant for policy-making. On the one hand, they may be used to relate the nominal yields and government bond market yields, which play an important role in the monetary transmission mechanism. On the other hand, these indicators are essential for fiscal policy as a means of analysing the relationship between the sustainability, financing needs and servicing of government debt and possible feedback loops into the government deficit that, ultimately, may have an impact on the tax burden for corporations and households.

Keywords: Government debt, euro area, debt securities

JEL classification: E62, H63, H68

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We would like to thank all European System of Central Banks colleagues who contributed to the development of these indicators on government debt securities.

1. Introduction

New monthly statistical indicators on government debt securities for euro area countries have now been developed on the basis of the information contained in the Centralised Securities Database (CSDB). Live since 2009, the CSDB aims to hold complete and up-to-date reference information on all individual securities relevant for the statistical and non-statistical (e.g. monetary and fiscal analysis) purposes of the European System of Central Banks (ESCB). The security-by-security flexible approach of the CSDB, as opposed to the traditional aggregated reporting approach that offers only predetermined data breakdowns, allows the computation of new indicators on government debt securities without increasing the reporting burden on debt issuers.

This statistical paper describes in detail the newly compiled statistical information and thus contributes to further describing the euro area government debt securities markets. The indicators under review provide an indication of the expected disbursements made for the servicing of issued government debt securities (debt service) together with the associated interest rate (nominal yield), broken down by original and remaining maturity, currency and type of coupon rate. The European Central Bank (ECB) plans to start disseminating these statistics later this year.

The main findings are that these very timely statistics contain information that is highly relevant for policy-making. On the one hand, they may be used to relate nominal yields and government bond market yields to maturity, which play an important role in the monetary transmission mechanism. On the other hand, these indicators are fundamental to an analysis of the relationship between the sustainability, financing needs and servicing of government debt and the possible fiscal impact in the economy for corporations and households of alternative fiscal policy choices, such as the impact on interest rates, on the tax burden and even on prices.

This paper begins by describing the CSDB and its relevance for statistical outputs and policy-making. The next section describes in detail how statistics on euro area government debt service and average nominal yields are compiled and also presents the main statistical findings. Section 3 shows the place of debt service statistics in the analysis of government financing needs and the developments of nominal yield compared to market yield to maturity. Section 4 gives an overview of how the CSDB data are aligned with the European System of Accounts and government debt. Section 5 discusses specific issues of which a user needs to be aware when analysing debt service and average nominal yields statistics. The final section draws a conclusion.

2. The Centralised Securities Database (CSDB)

In May 2014 the outstanding amounts of debt securities issued by euro area residents amounted to approximately €16.5 trillion. This figure shows the relevance of the euro area debt securities market and the importance of having more detailed information on debt securities. The Centralised Securities Database (CSDB) was created as a multi-purpose system jointly operated by the European System of

Central Banks (ESCB) and contains detailed reference information on the issuance of securities, making it a valuable source of information for statistical compilation as well as for increasing non-statistical needs. A brief description of the CSDB and its relevance for policy-making is presented in this section.

2.1 A brief description

The CSDB is a security-by-security database that went live in 2009 with the aim of holding complete, accurate, consistent and up-to-date information on all individual securities relevant for the statistical (e.g. financial accounts, balance of payments, investment funds and securities holdings statistics) and, increasingly, non-statistical (e.g. monetary policy, fiscal analysis, market operations and risk management) purposes of the ESCB. The CSDB covers securities issued by EU residents; securities likely to be held and transacted in by EU residents; and securities denominated in euro, regardless of the residency of the issuer and holders. The CSDB currently contains information on over seven million non-matured or alive debt securities, equities and mutual fund shares/units plus approximately nine million matured or non-alive[2] securities.

The CSDB is an ESCB common data platform containing reference data on securities (e.g. outstanding amounts, issue and maturity dates, coupon and dividend information, statistical classifications, etc.), issuers and prices (market, estimated or defaulted) as well as more recently introduced information on ratings (of the security, issuer, guarantor or issuance programmes).[3]

The CSDB is a single information technology infrastructure which is operated jointly by the members of the ESCB and promotes consistent results and efficient data reporting and compilation. Developed by the ECB, the system is accessible by the ESCB and uses data from commercial data providers and other existing sources (via ESCB members); the most reliable value for each attribute is selected and gaps (in particular for prices and income) filled with reliable estimates. It makes use of expertise within the ESCB to enhance data quality in accordance with the Guideline of the European Central Bank of 26 September 2012 on the data quality management framework for the Centralised Securities Database (ECB/2012/21).

2.2 Relevance of CSDB data for government finance statistics and policy-making

The financial crisis that hit Europe in recent years increased the relevance of granular security-by-security data as a means of ensuring better microeconomic analysis of financial markets, focusing on specific instruments and markets. The changing financial environment and developing needs call for flexible statistical reporting. Additionally, interest in the risks associated with different types of instruments/issuers has added new requirements that have made the CSDB platform a relevant tool for monetary and fiscal policies. Statistics on financial stocks

2 An example of a "non-alive" security would be equity of a bankrupt company which is kept in the CSDB for reference.

3 Rating information in the CSDB has to date been used by the ECB only.

and flows broken down by institutional sector and a broad class of financial instruments are essential for the conduct of monetary and fiscal policies. Therefore, the item-by-item data included in the CSDB gives policy-makers a much broader spectrum of opportunities to analyse specific aspects of the financial markets.

In addition to the availability of granular data, the timeliness of the CSDB information enables policy-makers to react more quickly to the evolution of and trends in the financial markets. The system processes information on a daily basis and provides end-of-month data with a delay of approximately one to two weeks, which means that users have access to data far more quickly than to other aggregated statistics as well as the possibility of many more data breakdowns.

Particularly on government finance statistics (GFS), given that debt securities account for by far the largest share of government debt in the euro area (around 80% of government debt), the CSDB provides timely, granular data on government debt securities, producing information on debt service, average nominal yields and financing needs of euro area governments.

3. Government debt service and nominal yields

The issuance of government debt securities is naturally associated with its servicing (debt service) and interest rates (average nominal yield). Statistics on debt service and average nominal yields for euro area governments have shown interesting developments in recent years, which have presented a number of challenges for euro area sovereign debt. This section explains in detail how those statistics, which the ECB plans to start disseminating later this year, are compiled using the CSDB.

3.1 Debt service

The issuance of debt securities requires a set of disbursements, including principal amounts and/or interest, to be made throughout the lifetime of the debt. This set of payments is referred to as debt service. As indicated by past observations, redemptions of debt securities in debt markets can occur in one of the following situations:[4]

- The maturity date has been reached;
- Redemption took place at an early date, i.e. before the maturity date, and can be:
  - Partial – reduction of the outstanding amounts;
  - Total – the debt security is repaid in full.

This paper presents the past debt service, i.e. the set of disbursements actually made to satisfy debt obligations in a given past period, and the scheduled (future) disbursements. The focus of the paper will be the scheduled debt service of

[4] The issuance of government debt securities also covers the new debt securities issued and the increase in the outstanding amounts for any existing debt security.

government debt securities in the coming year, which, for the sake of simplicity, we will refer to as "debt service".

A security-by-security database such as the CSDB makes it possible to calculate scheduled (future) redemptions in addition to past redemptions, a concept that is central to this paper. Scheduled redemptions only take into consideration the maturity date of current debt securities. Naturally, that does not include any possible early redemption of debt securities and/or redemptions of debt securities that will be issued in the future (i.e. that do not yet exist).

The second component of debt service is the interest that is to accrue in a given future period. For coupon-bearing debt securities, this is calculated by multiplying the observed coupon rate by the current outstanding amounts. This calculation assumes that there are no future changes in the coupon rate (see Box A), independently of the type of coupon. The issuance of debt securities at discount/premium is reflected in the face value of the debt securities (see Section 0).

The scheduled debt service is then the sum of the scheduled redemptions and interest to accrue, usually broken down by future periods (e.g. the next three months, the next year). In this paper the debt service for debt securities denominated in foreign currency assumes that there is no change in the exchange rate vis-à-vis the euro (see Box A).

Box A

Variable interest rates, exchange rates and debt service for debt securities

Debt service is a forward-looking statistical concept. It gauges future disbursements, of principal and interest, in respect of the servicing of the current outstanding debt. The calculation of debt service is therefore affected by market prices that will be set in the future and are not yet know with certainty. The most important market prices for debt contracts are the exchange rates (for debt denominated in foreign currency) and the market reference variable interest rates (e.g. Euribor, for debt issued with a variable interest rate).

For any coupon-bearing security, the part relating to interest in the scheduled debt service is calculated by applying the last observed coupon rate to the current outstanding amount. This means that any future changes to the coupon rate of floating-rate debt securities, index-linked rate debt securities and changes to the coupon rate for fixed rate debt securities contractually agreed (e.g. step-up coupons) are not taken into account in the calculation of the scheduled debt. Only the last observed coupon rate is considered.

In the euro area, the debt service scheduled for the next 12 months (from June 2014 to May 2015) amounts to 16.8% of GDP, comprising €1,474 billion of principal (face value) and €211 billion of interest to accrue (see Table A). The current breakdown of government debt securities outstanding in the euro area shows that around 80% of the outstanding amounts were issued with a fixed interest rate, while only 12% were issued with a variable interest rate (floating or index-linked interest rate). Only Italy (€360 billion), Germany (€222 billion) and France (€180 billion) show some relevant issuance with variable interest rates.

Similarly, any future change in the exchange rates will not be taken into account in the calculation of the scheduled debt service, as this would involve forecasting exchange rates. Any future disbursement in foreign currency will be converted into the national currency on the basis of the representative market exchange rate prevailing on the last working day of each month. The vast majority of the government debt securities issued by the euro area governments are denominated in euro. Therefore, future changes to the exchange rates are not expected to create a significant statistical impact on the indicators.

Outstanding amounts , average nominal yields and debt service

(as scheduled at May 2014, € billion for outstanding amounts and debt service, as a percentage per annum for yields)

Table A

	Outstanding amounts (selected type of rates)			Average nominal yields (selected type of rates)			Debt service (in the coming year)	
Country	Fixed rate	Zero coupon	Variable rate	Fixed rate	Zero coupon	Variable rate	Principal	Interest
Belgium	320	12	35	3.9	0.2	1.1	69	12.0
Germany	1,337	167	83	2.6	0.2	0.4	345	33.0
Estonia	-	-	-	-	-	-	-	-
Ireland	88	25	1	4.9	-	2.9	4	4.9
Greece	68	3	15	3.7	3.1	2.1	30	2.9
Spain	738	23	79	4.3	0.8	4.3	186	31.0
France	1,289	185	216	3.4	0.2	2.1	351	43.9
Italy	1,253	137	211	4.5	1.1	1.4	349	57.3
Cyprus	5	-	3	4.6	1.9	-	2	0.2
Latvia	5	0	0	3.7	0.3	6.3	0	0.3
Luxembourg	6	-	-	2.6	-	-	0	0.2
Malta	5	0	0	4.7	0.6	1.3	1	0.3
Netherlands	315	3	42	3.1	0.2	2.3	62	9.6
Austria	193	8	7	3.8	0.6	2.0	28	6.7
Portugal	102	0	18	4.5	1.5	3.4	30	4.3
Slovenia	22	0	2	4.5	3.1	1.0	3	1.4
Slovakia	32	3	1	3.9	-	1.6	5	1.3
Finland	89	4	4	2.8	-	0.6	9	2.4
Euro area	5,867	572	718	3.6	0.7	1.5	1,474	211.6

Source: CSDB, authors' calculations.

3.2 Nominal yields

A central variable in bond markets is the market yield to maturity of a debt security. The market yield to maturity is an estimate of what an investor (creditor) will earn if the bond is held until its maturity date. The market yield to maturity is a focal variable for the creditor. However, for the debtor there is another yield that is extremely important for its financial decisions, the nominal yield.

The nominal yield (percentage per annum) is the interest rate that the debtor promises to pay debt holders per unit of time. The nominal yield comprises the coupon rate (i.e. the interest rate stated on a bond when issued) and any difference between the stated redemption price at maturity and the issue price (i.e. discount or premium). The discount or premium is linearly spread (accrued) as interest over the full lifetime of the debt security (original maturity in days).

$$nominal.yield = coupon.rate + 365 \times \frac{(redemption.price - issue.price)}{original.maturity} \quad (1)$$

For every individual debt security that is still outstanding, the nominal yield is calculated using equation (1). The average nominal yield for N securities (e.g. for a country) is calculated using the face value as the weighting factor (see equation (2)). Average nominal yields may be calculated for different types of breakdowns, such as remaining maturity.

$$average.nominal.yield = \sum_{i=1}^{N} \frac{nominal.yield_i \times face.value_i}{\sum_{r=1}^{N} face.value_r} \quad (2)$$

A security-by-security database, such as the CSDB, allows the calculation of the average nominal yields for transactions (issuances and redemptions). It is of particularly interest for gauging the current average nominal yields for the issuance of government debt securities and the average nominal yields of redeemed debt securities in the preceding 12-month period.

3.3 Main results

The statistics compiled for debt service and average nominal yields using the CSDB span the period from December 2009 to May 2014. The main results for the euro area governments are presented below.

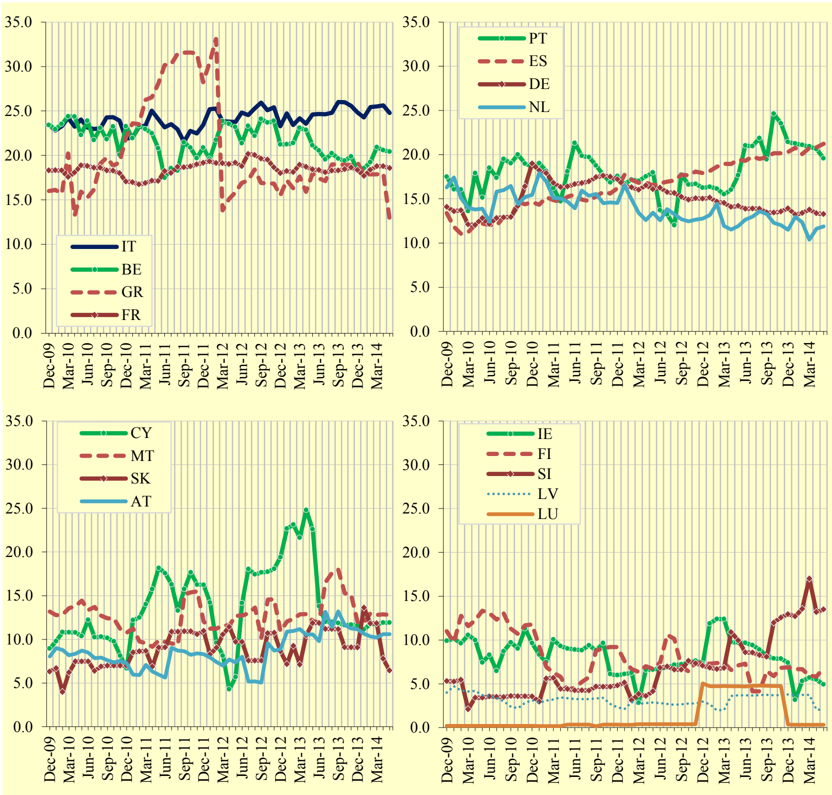
3.3.1 Debt service ratio

The scheduled debt service in the coming year records all debt securities that will mature in the next 12-month period. The values are compiled every month, taking into account the redemption and issuances of government debt securities.

Typically, euro area governments show debt service for the coming year (debt service ratio) that is lower than one-quarter of GDP (Chart 1). For Greece the debt service increased considerably between December 2010 and March 2012 and then dropped abruptly when the private sector involvement (PSI) in a Greek government debt exchange was successfully finalised. In that move, nearly 97% of private sector bondholders participated in the exchange of their Greek government bonds for short-term European Financial Stability Facility (EFSF) notes and new long-term Greek government bonds, which equated to a reduction of some 53.5% in nominal terms (around €100 billion). The longer maturities of the new Greek government bonds helped to reduce the debt service from 33% of GDP to around 14%.

Debt service in the coming year for euro area government debt securities, by country

(as a percentage of GDP) Chart 1



Source: CSDB, authors' calculations.

The debt service ratio for Italy increased slightly in the past four years and remains close to 25% of GDP. The debt service ratios for Portugal and Spain rose in the past four years to around 20% of GDP at the end of May 2014. For Spain the debt service ratio has been rising progressively. For Portugal the ratio reached 25% in October 2013 but then shrank back to 20%, partly as a result of a debt exchange in December 2013 (of some €6.64 billion) and a bond buyback in March 2014 (of some €1.37 billion).

The debt ratio for Cyprus increased by 20 percentage points of GDP between the country's request in June 2012 for financial aid from the other euro area countries in order to shore up its banks, which incurred heavy losses on Greek debt exchange, and the finalisation of the bailout agreement in March 2013. The debt service ratio then reduced quickly from 25% of GDP to around 12.0% of GDP and now remains at that level.

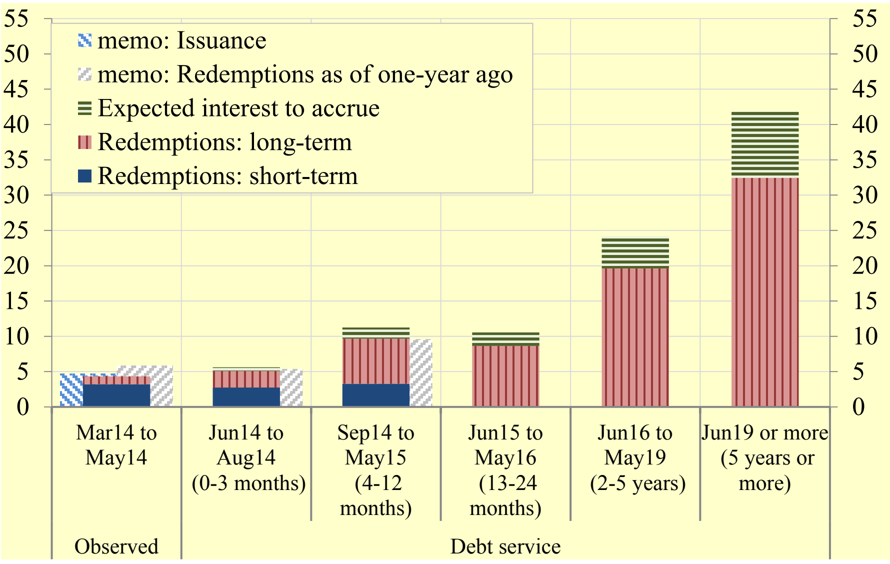
More recently, the debt service ratio for Slovenia increased rapidly (doubled in just one year). This is related to the government financial assistance for its financial sector in the form of far-reaching banking recapitalisation.

For the euro area as a whole, the debt service scheduled for the next 12 months is approximately 16.8% of GDP (€1.7 trillion), compared to 17.2% one year ago; the value comprises 14.7% of principal (face value) and 2.1% of interest to accrue (see Chart 2). The amounts of principal of both short and long-term debt securities scheduled to be redeemed in three months is 5% of GDP (down from 5.4% one year ago). On the other hand, debt securities with payment due over 3 and up to 12 months increase to 9.7% of GDP (from 9.6% one year ago).

Debt service for euro area government debt securities, by disbursement periods

(as a percentage of GDP)

Chart 2

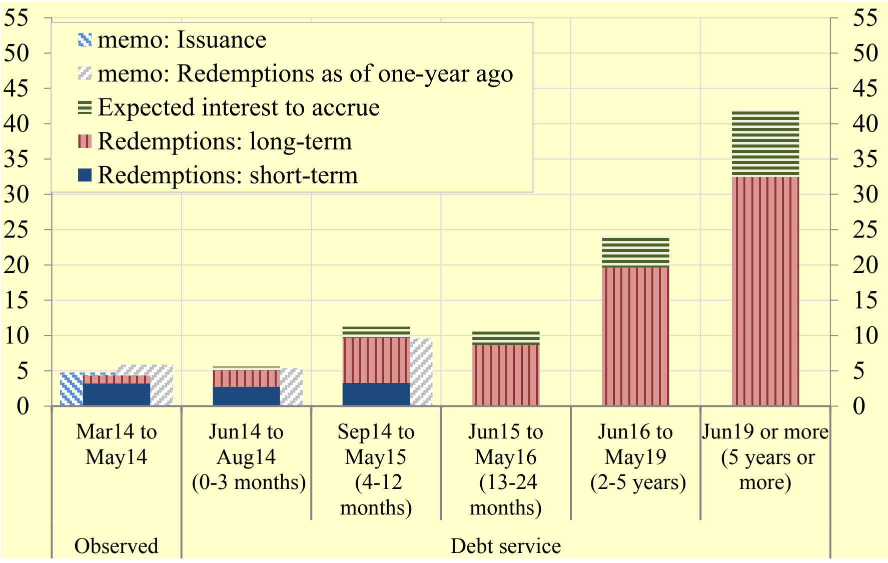


Source: CSDB, authors' calculations.

The debt service for five euro area countries (Belgium, France, Italy, Portugal and Spain) expected in the coming 12 months is more than 15% of GDP (see Chart 3), as compared to seven countries one year ago (the aforementioned countries plus Greece and Cyprus). Moreover, six euro area countries (Cyprus, France, Greece, Italy, Malta and Portugal) expect principal (face value) repayments of debt securities larger than 5% of GDP, which are due in three months or less.

Debt service of euro area government debt securities for the coming year, by country

(as a percentage of GDP and € billion, June 2014 to May 2015) Chart 3



Source: CSDB, authors' calculations.

3.3.2 Average nominal yields

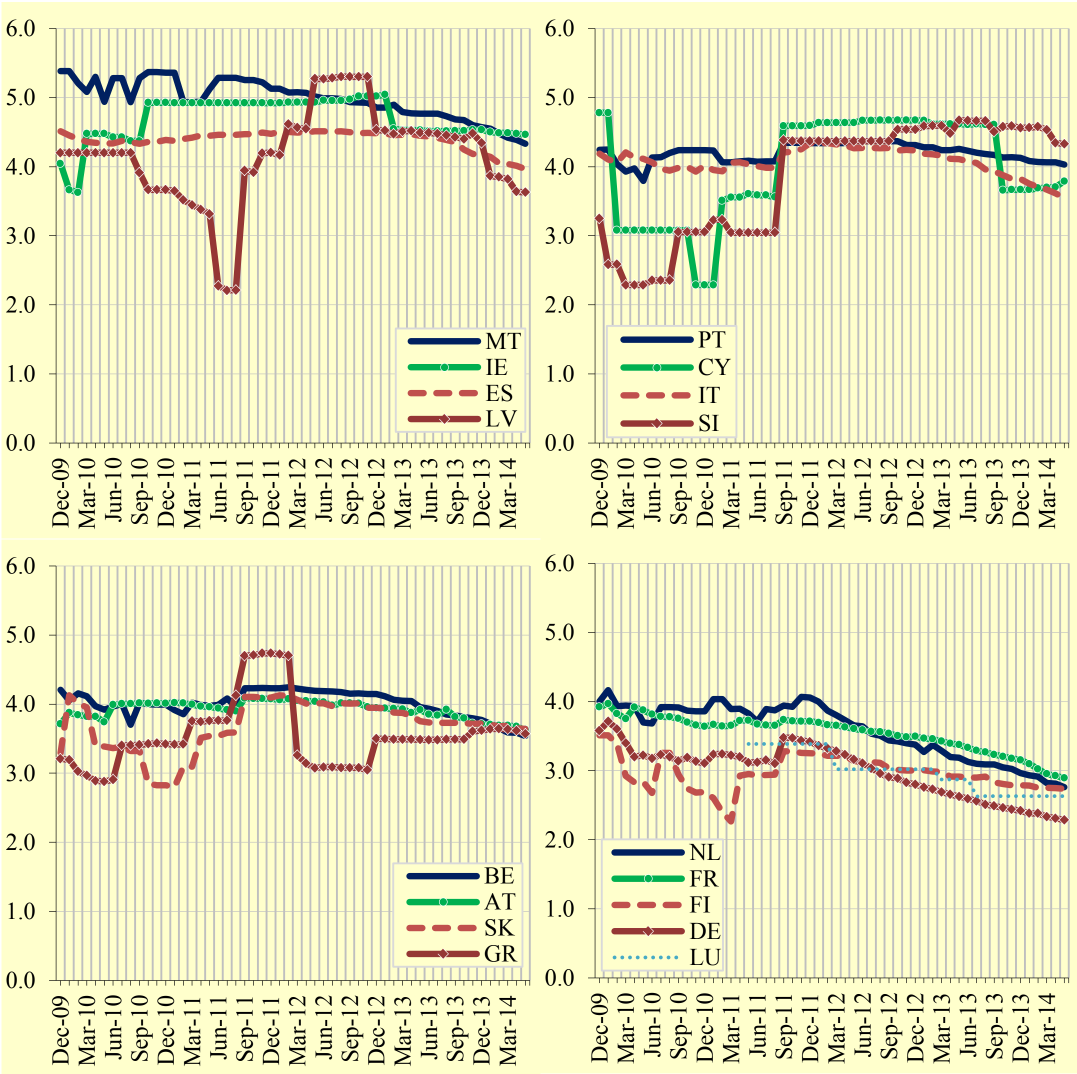
The average nominal yields of euro area government debt securities showed a fairly stable pattern after the onset of the euro area sovereign debt crisis in late 2009. With a very few country exceptions, the average nominal yields have since decreased (see Chart 4). For instance, Germany reduced its average nominal yields by almost a full 140 basis points to 2.3%, from the peak of 3.7% in January 2010.

In Ireland, the aggravation of the euro area sovereign debt crisis led to a rapid increase to around 5% in average nominal yields, which remained high until May 2014. For Greece, average nominal yields increased markedly until March 2012 when there was a sudden drop associated with the PSI. Since then the average nominal yields for Greece have increased steadily. Other countries that were distinctly affected by the crisis, such as Italy, Latvia Portugal and Spain, witnessed their government average nominal yields increasing from 2010 to 2012. It was not until 2013 that yields started to drop to levels seen prior to the sovereign debt crisis. Finally, the average nominal government yields of Slovenia and Cyprus increased considerably in 2013 in connection with the financial measures (e.g. bank nationalisation and recapitalisation) taken by their governments in order to stabilise the financial sector.

In contrast, declining developments of average nominal yields have been observed in Finland, France, Germany and the Netherlands since late 2011. A significant drop in government average nominal yields is observed for France and the Netherlands, where levels below 3% have been reached for the first time in several years.

Average nominal yields for euro area government debt securities, by country

(as a percentage per annum) Chart 4

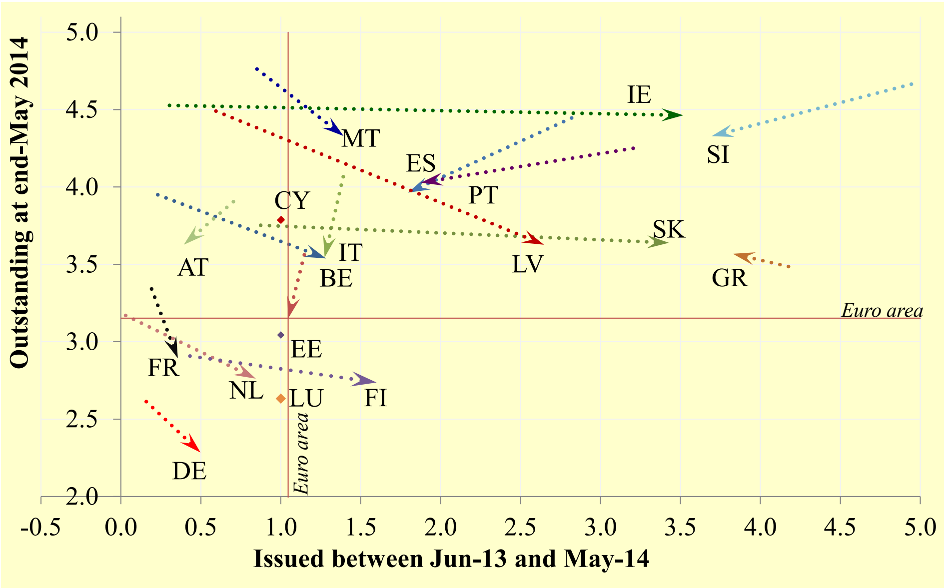


Source: CSDB, authors' calculations.

The average nominal yield on outstanding government debt securities for the euro area as a whole fell to 3.2% at the end of May 2014, from 3.6% one year ago (see Chart 5). Compared to one year ago, only Estonia and Greece recorded an increase in average nominal yield. Currently, the maximum difference in average nominal yield is between Germany (lowest, 2.3%) and Ireland (highest, 4.5%).

Average nominal yields for euro area government debt securities, euro area total and by country

(May 2014; as a percentage per annum; connecting dotted line shows situation one year-ago) Chart 5



Source: CSDB, authors' calculations.

The average nominal yield on debt securities issued by euro area governments as a whole in the past 12 months is 1.0%, some 11 bps lower than one year ago. The issuance of new debt securities in Belgium, France, Germany, Ireland, Latvia, the Netherlands, Malta and Slovakia resulted in an increase in the nominal yields, as compared to one year ago.

4. Government debt service and nominal yields: selected analysis

In this section, two selected analyses are presented using the debt service and average nominal yields statistics. First, the government financing needs for the euro area countries is explored and linked to the debt service statistics compiled from the CSDB. Second, the average nominal yields and market yield to maturity are put together to show some noteworthy developments experienced by euro area governments in recent years.

4.1 Gross government financing needs and debt service

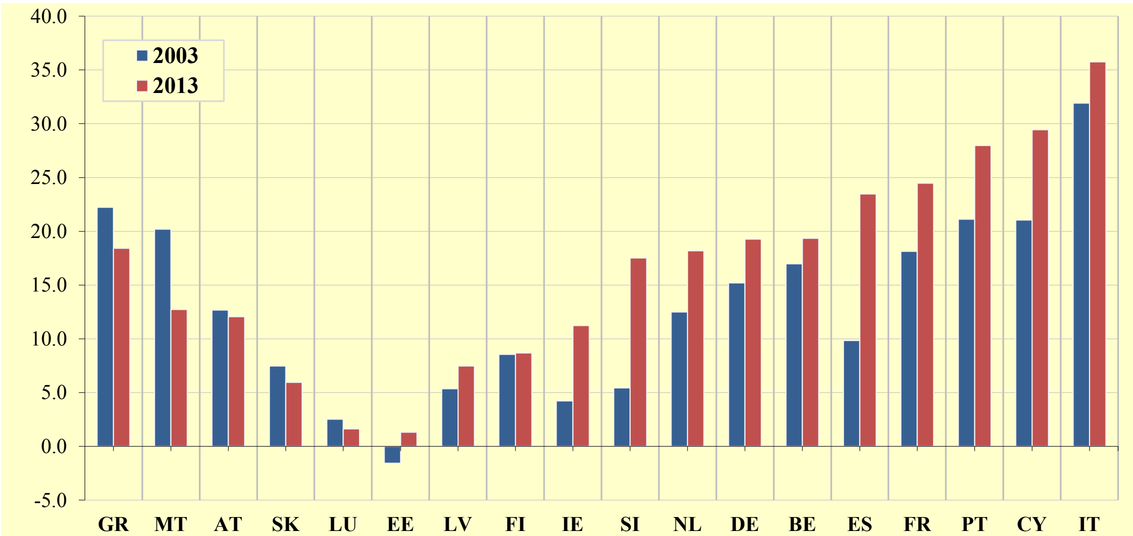
Fiscal analysis examines the financing needs for the coming months/years in relation to the government debt outstanding. The gross government financing needs provide an overall measure of government financial obligations for the coming year. In its simpler form, the gross government financing needs for the coming year are calculated by adding together the projection for government deficit/surplus (net lending/net borrowing) and government debt that matures in the course of the year (i.e. debt with a remaining maturity of one year or less). The results help to understand what a government would need to do to fulfil its financial obligations, the alternatives being a) raise more debt, b) sell financial assets, c) increase revenue (e.g. increase taxes, sell non-financial assets) and/or d) reduce expenditure (e.g. capital expenditure, compensation of employees, subsidies). These choices will have different fiscal impacts in the economy, such as on interest rates, the tax burden and even on prices. Depending on the government choice, a) and c) may have an impact on the tax burden, interest rates, costs and prices for corporations and households, while d) may reduce the net operating profits of corporations and household disposable income.

During the past decade – 2003 to 2013 – government financing needs for the euro area governments changed noticeably (see Chart 6). Only five countries managed to reduce financing needs for the next year. The increases relate mainly to higher amounts of government debt outstanding, in combination with shorter debt maturities on some sovereign crisis borrowing (see Section 6.1), which was only partly offset by reductions in government deficit/surplus (except for Belgium, Estonia, Finland, Ireland, Slovenia and Spain).

Gross government financing needs, by country

(as a percentage of GDP; 2013 includes the deficit/surplus projection for 2014, while 2003 uses the observed deficit/surplus for 2004)

Chart 6



Source: ECB, European Commission (2014 projections), authors' calculations.

The debt service calculated using data from the CSDB (see Chart 1) may serve as a unique indicator for government financing needs, given that the largest share of the government debt (about 80%) takes the form of debt securities. The debt service may be used to proxy the financing needs relating to government debt with a remaining maturity of one year or less. Thus, debt service may be used to closely monitor any strains on forthcoming government financial obligations, further detailing future periods during which the financial obligations will actually occur. In that regard, fiscal analysis requires complementary information on the interest rate cost for government debt, the current (and possible expected) market interest rates and the foregoing interest rates on maturing debt, so that the impact on government interest expenditure from refinancing debt may be calculated (see next Section).

4.2 Nominal yields and market yields

The average nominal yield provides a measure of the interest cost associated with the debt issued by an entity, in this paper by government. Typically, the average nominal yield remains fairly stable and only changes markedly when considerable amounts of debt are redeemed and/or issued. The average nominal yield can be used to assess, from the debtor perspective, the amounts of interest expenditure that will need to be serviced with the current debt outstanding. The average nominal yield is calculated for all debt securities outstanding.[5] The average nominal yield changes with the primary (issuance) market trades but does not change with trades in the secondary market, except if the issuer buys back its own debt securities in the market to proceed with an early redemption.

On the other hand, the yield to maturity quoted in sovereign bond markets reflects the interest revenue that a creditor would obtain from buying a debt security and holding it until maturity. This market rate is affected by several characteristics of the debt security, such as coupon rate, maturity, risk creditworthiness of the issuer and volume issued, but also by market supply and demand. The market yield to maturity is calculated only for a few selected government debt securities, usually called benchmark debt securities, and is calculated for several remaining maturities, such as 5 years and 10 years. The market yield to maturity may vary very quickly depending on economic events and news. It is also affected by both primary (issuance) and secondary market trades. The market yield can be used to gather information on the possible interest cost with the issuance of new debt securities.

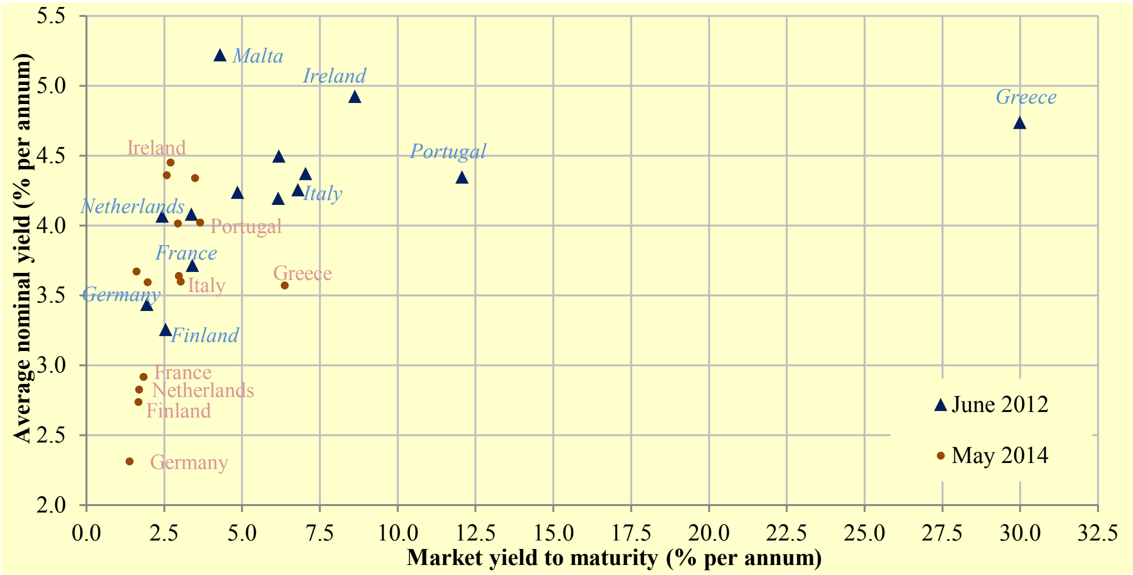
It is interesting to compare the two rates, particularly those at the peak of the euro area sovereign debt crisis (June 2012) and the latest data available (May 2014) (see Chart 7). A noteworthy development, despite the extreme market yields for some countries during the crisis, is that the average nominal yield remained below 5%. This is naturally related to the efforts that euro area countries and EU institutions took to contain the euro area sovereign debt crisis. For instance, the ECB's non-standard monetary policy measures (such as the Securities Markets Programme, covered bond purchase, the outright monetary transactions programme, emergency liquidity assistance and long-term refinancing operations)[6] have contributed to lowering the market yields considerably, to the point where, in May 2014, the dispersion between countries had been considerably reduced as compared to June 2012.

5 It is also possible to calculate a breakdown of average nominal yield by remaining maturity. Although available, this breakdown is not shown in this paper.

6 See http://www.ecb.europa.eu/mopo/html/index.en.html for further information.

Average nominal yields and 10-year market yield to maturity for euro area government debt securities, by selected countries

(May 2014 and June 2012; as a percentage per annum) Chart 7



Source: CSDB, Reuters, authors' calculations.

Another interesting observation is that while the reduction of the market yields was more visible in the countries that were financially stressed (e.g. Greece, Ireland, Italy and Portugal), the reduction of the average nominal yields is more visible for countries that had higher credit creditworthiness (e.g. Finland, France, Germany and the Netherlands).

5. The CSDB, the statistical European standards and Government debt

In this section the CSDB data are compared to the statistical concept of government debt used in Europe in terms of sector coverage, valuation and calculation method, followed by an actual comparison of the figures computed by these two sources.

On the one hand, the CSDB provides all the information needed to compile high-quality statistics on the issuance of government debt securities in accordance with the European statistical standards (European System of Accounts – ESA), in terms of sector classification and coverage, instrument breakdown (short and long-term) and valuation. On the other hand, in Europe a relevant indicator for general government statistics is government debt, also referred to as "EDP debt" or "Maastricht Debt", as defined in Protocol No 12 on the Excessive Deficit Procedure (EDP) annexed to the Maastricht Treaty and in the Council Regulation (EC) No 479/2009 (as amended) on the EDP. Total general government gross debt is defined as "total gross debt at nominal value outstanding at the end of the year and consolidated between and within the sectors of general government" and has the following characteristics:

- Sector delineation: total government debt comprises the consolidated liabilities of the general government sector (i.e. central government, state government, local government and social security funds). Publicly owned units engaged in commercial operations, such as public corporations, are excluded from the measurement of government debt.
- Breakdown by instrument: total government debt is constituted by the liabilities of general government in the form of (i) currency and deposits, (ii) debt securities, and (iii) loans, as defined in the European System of Accounts (ESA 2010).
- Valuation: total government debt is measured as the "face value" of the debt. It equals the amount contractually agreed that the government will have to refund to creditors at maturity. This means, in particular, that government debt is not affected by changes in market yields or by accrued interest.
- Consolidation: total government debt is consolidated across the general government sector, which implies that government debt instruments held as assets by general government units are not included in the calculation of the debt.

Bearing those aspects in mind, the data compiled from the CSDB on the basis of ESA may deviate in several aspects from government debt based on EDP. However, the indicators presented in this paper are complementary, relevant and useful to produce. The main differences between the CSDB data and government debt are as follows:

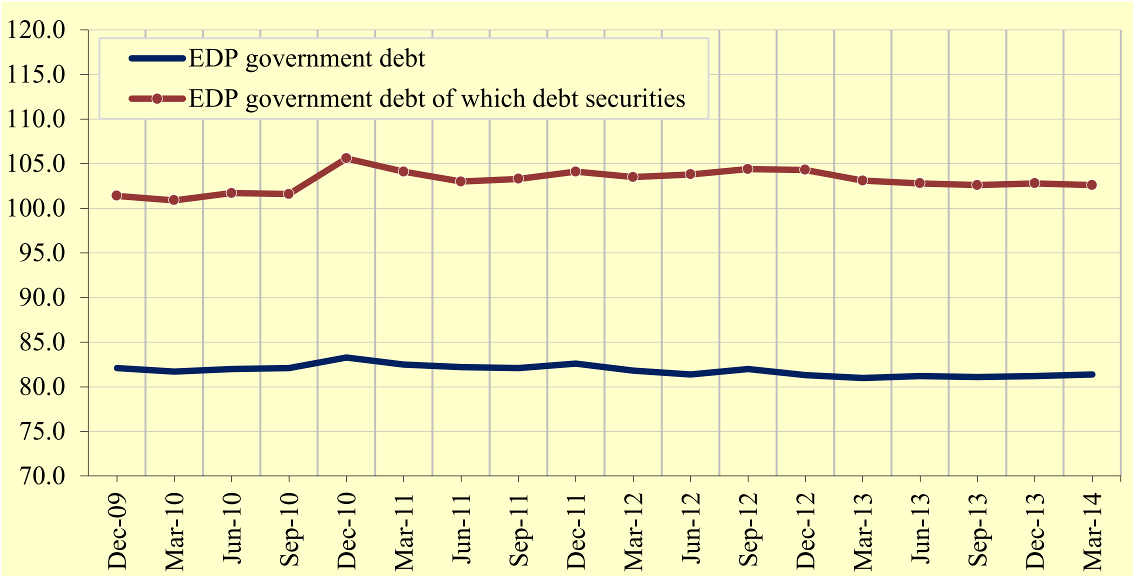
- The CSDB comprises only debt securities (which cover about 80% of euro area government debt);
- There is no information in the CSDB that allows the consolidation of government debt. Data on government debt securities held by other government units, on a security-by-security basis, are available in the ESCB Securities Holding Statistics Database, which is not yet operational;
- The CSDB can provide data on debt securities at face value (as well as at market value). Debt securities denominated in foreign currency in the CSDB are converted into the national currency on the basis of the representative market exchange rate prevailing on the last working day of each month. However, for government debt, debts that are denominated in foreign currency and are exchanged into the national currency through contractual agreements, such as swaps and forward rate agreements, are converted into the national currency at the rate agreed in those contracts and not at the prevailing market rate;
- Finally, the sector delineation in the CSDB is essentially in line with the sector delineation in the government debt. Nevertheless, there may be some cases where an entity is not classified along those lines: a) when certain operations of a specific unit are rerouted to government accounts (e.g. government special purpose units located abroad with the objective of issuing debt); b) temporary misclassification due to the CSDB data flow process. The sector classification of issuers in the CSDB is first prepared by commercial data providers, which are instructed to adhere to the description of the institutional units in the ESA. However, the statistical classification sometimes obeys very detailed rules that

data commercial data providers are not able to implement. In such situations, the national central banks perform an analysis of the sector classification and correct any incorrectly classified entity. The sector classification is then harmonised with the different statistical domains, including the statistics compiled by the national statistical institutes.

The actual comparison of the outstanding amounts of government debt securities issued by euro area countries computed from the CSDB and the EDP euro area government debt shows a very stable relation, between 80% and 83% since the end of 2009 (see Chart 8). A direct comparison of the EDP government debt in the form of debt securities and the CSDB figures reveals a ratio that has been floating at around 101% and 106% since the end of 2009. These facts inspire confidence with regard to using the timely CSDB data as an early indicator of EDP government debt.

Government debt securities computed from the CSDB compared to EDP government debt

(as of July 2014; CSDB data as a percentage of EDP government debt data) Chart 8



Source: CSDB, Eurostat, authors' calculations.

6. Selected issues using the CSDB data

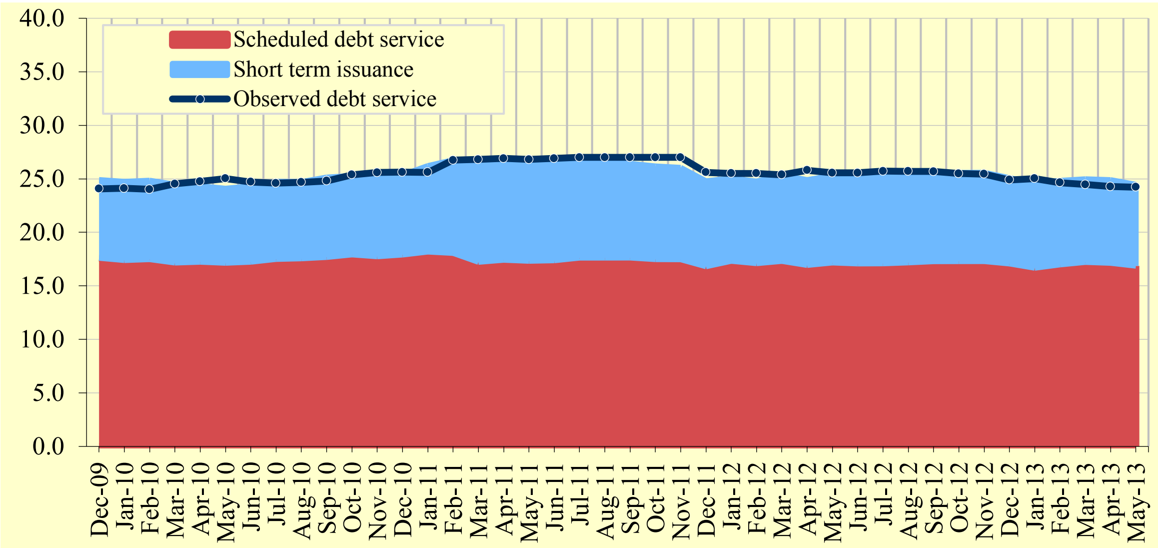
This section discusses some issues that a data user needs to consider when analysing debt service and average nominal yields. More specifically, it describes a) the impact of issuance of short-term debt and earlier debt redemptions in the calculation of debt service, and b) the effect of issuance at discount/premium in the breakdown of debt service between principal (face value) and interest. It also examines a current limitation in using the CSDB for the calculation of average nominal yields when additional debt is issued under the same debt security (tranche issuance).

6.1 Short-term issuance of debt securities and debt service

The scheduled debt service for the coming year records all debt securities outstanding that will mature in the coming 12-month period. For instance, in May 2013 the scheduled debt service in the euro area shows that government debt securities maturing in the coming year (i.e. between June 2013 and May 2014) amounted to 17.2% of GDP (see Chart 9). However, the actual debt service after that year had passed was considerably higher (25.5% of GDP). The gap between the scheduled and the observed debt service can be explained by the issuances of short-term debt securities and, to a lesser extent, by earlier redemption (partial or total) of debt securities. It should be noted that to measure the gap, not all short-term debt securities are to be considered but only those that were issued and matured between June 2013 and May 2014 (e.g. all three-month debt securities issued between June 2013 and February 2014).

Debt service in euro area governments (in the coming year) – scheduled and observed

(as of May 2014, as a percentage of GDP) Chart 9

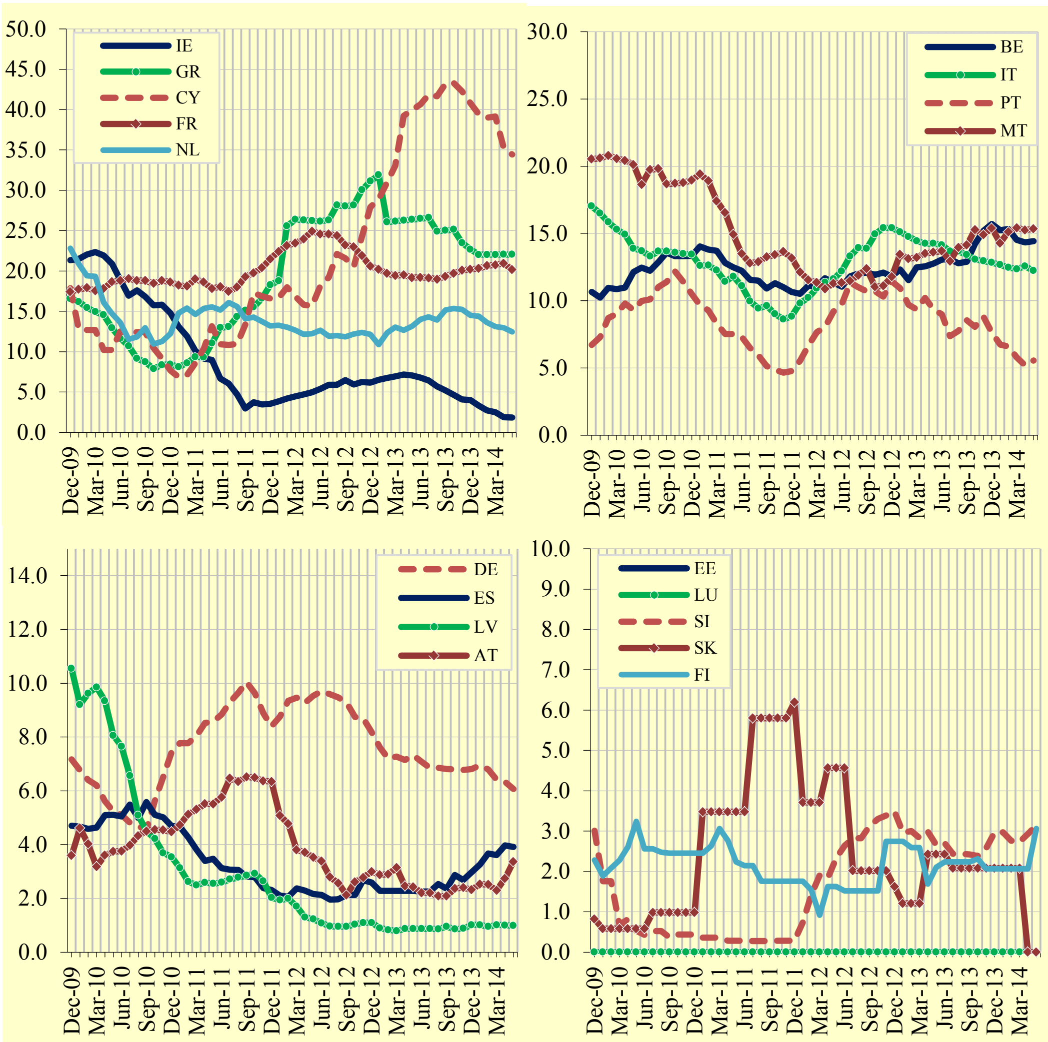


Source: CSDB, Eurostat, authors' calculations.

For most euro area governments, the issuances of short-term securities in the past 12-month period were stable and below 15% of GDP (Chart 10). At the time of the financial crisis and the euro area sovereign debt crisis, when several governments experienced difficulties when endeavouring to issue long-term government bonds, short-term issuances became noticeably important. In Cyprus, short-term issuances (in the preceding 12 months) gradually increased after December 2012 and reached a peak of 43.3% of GDP in October 2013. In Greece, short-term issuances were high, above 20% of GDP from January 2012 onwards, after reaching a maximum of 31.9% of GDP in January 2013. In the Netherlands, short-term issuances were pronounced until February 2010 but thereafter they gradually decreased to 12.4% in May 2014. An interesting development can be observed for Ireland, where short-term issuance during the crisis reached 22.4% of GDP (in February 2010) and later significantly decreased to 1.8% of GDP in May 2014. Germany also shows an increase to almost 10% of GDP (in August 2011), reducing afterwards to the levels (6% of GDP in May 2014) prior to the crisis. Since November 2011, high short-term issuances (above 20% of GDP) have also been observed in France.

Short-term issuances of debt securities

(as of May 2014, 12-month cumulated sum as a percentage of GDP) Chart 10



Source: CSDB, authors' calculations.

6.2 Issuance at discount/premium and debt service

The European statistical standards (ESA 2010) for the compilation of national accounts data recommend that for debt securities issued at discount/premium (e.g. zero coupon bonds) the difference between the issue price and the redemption price be treated as interest to be accrued over the lifetime of the security. The calculation of nominal yields (see Equation (1)) takes into account the existence of discount/premium.

As discussed in Section 5, the data on government debt securities compiled from the CSDB show the face value of the debt securities (which is closer to the concept of government debt). The face value (redemption value) for securities issued at discount/premium includes an interest component. By computing the face value of debt securities, the breakdown between principal and interest in the debt service cannot be properly separated for securities issued at discount/premium, as otherwise the interest part would be counted twice. For the debt service only the coupon part of the debt security is recorded as interest.

For example, the interest accrued on a four-year zero coupon bond issued with a discount of 20% (issue price of 80, redemption value of 100) is equal to 5% per annum. In accordance with the international statistical standards, the scheduled payments (debt service) would record 5% in the first year, 5% in the second year, 5% in the third year and finally 85% (80% related to the principal amount – issue price – and 5% related to the interest component) in the fourth year. However, the debt service for a zero coupon bond calculated using the CSDB will show only a scheduled payment in the fourth year amounting to 100% (redemption price).

6.3 Nominal yield calculation and bond taps

It is common practice among issuers of debt securities to resort to issuance of additional debt from past issues under the same instrument, referred to as "bond taps" or "tap issues". This method allows the issuer to elude certain transaction or legal costs as well as to speed up the raising of funds. In addition, many of the formalities needed to issue a bond, such as the prospectus, are bypassed by the issuer, which proceeds directly to the auction of new securities. This practice is very common for euro area government debt securities.

The special characteristics of these types of issuances have implications when considering the interest component in the CSDB. The new tranche will be issued with the same maturity date as the original issuance; however, it might have a different issue price or even coupon rate. This implies that the total nominal yield to be paid should be calculated as a weighted average of the nominal yield for each tranche and the initial issuance (i.e. the coupon rate of the tranche when issued and any difference between the stated redemption price at maturity and the issue price for each tranche).

The security-by-security information derived from the CSDB makes it possible to calculate the nominal yield for each security (see Section 3.2). However, for tap issues, the specific issue price and/or coupon are known only for the initial issuance and are not recorded for any subsequent new tranche (only the amounts outstanding are tracked) in the CSDB. The main consequence is that the nominal yield calculation has a bias towards the initial issuance as only the initial issue price and coupon rate will be considered. For the computations, the two main components affected will be: a) different coupon rate (a higher coupon of the initial issuance compared to the coupon of the tranches will result in a higher total nominal yield and vice versa); and b) different issue price (a higher issue price of the initial issuance compared to the issue of the tranches will result in a lower total nominal yield and vice versa).

An example of the bias introduced into the average nominal yield is provided in Table 1, which shows the data extracted from the CSDB supplemented with additional information for each tranche issued. In this example there are several tranches that are issued at different prices but keep the same redemption price and coupon rate. The results show that using the weighted average of the nominal yields of each tranche, the total average nominal yield is 3.97% (Method 1). If only the initial issue price of the first tranche is used for the total amounts issued, the average nominal yield is 3.86% (Method 2), i.e. equal to the average nominal yield on the first tranche. The total difference is 11 basis points lower. From a statistical perspective, this difference does not affect the general results. However, possible improvements to the CSDB are being considered in order to reduce this bias.

Example of average nominal yield calculation methods for tap issues

data as of May 2014 — Table 1

Method 1: Calculation of nominal yield considering different issue prices for each tranche

Tranches	Issue date	Maturity date	Issue price	Redemption price	Amounts issued (€ bn)	Share (% of total)	Coupon (fixed, annual) rate (% per annum)	Nominal yield per tranche (% per annum)
Initial	23/02/2005	15/04/2021	99.8	100	3,000	39.9	3.85	3.86
Second	18/04/2005	15/04/2021	99.0	100	1,108	14.8	3.85	3.91
Third	16/05/2005	15/04/2021	100.8	100	1,079	14.4	3.85	3.80
Fourth	15/08/2005	15/04/2021	100.9	100	900	12.0	3.85	3.79
Fifth	15/03/2010	15/04/2021	97.1	100	990	13.2	3.85	4.11
Last	13/09/2010	15/04/2021	83.6	100	434	5.8	3.85	5.40
							Average nominal yield (% per annum)	3.97

Method 2: Calculation of nominal yield assuming the same issue price for all tranches (currently adopted)

Tranches	Issue date	Maturity date	Issue price	Redemption price	Amounts issued (€ bn)	Share (% of total)	Coupon (fixed, annual) rate (% per annum)	Nominal yield per tranche (% per annum)
Total	23/02/2005	15/04/2021	99.8	100	7.510	100	3.85	3.86
							Average nominal yield (% per annum)	3.86
							Difference between Method 1 and Method 2 (basis points)	11

Source: CSDB, authors' calculations.

7. Conclusion

This statistical paper introduces two monthly statistical indicators related to debt securities issued by the euro area governments – the debt service, defined as the scheduled payments of principal and interest by the debtor in the coming year, and the average nominal yield, i.e. the interest rate that the debtor promises to pay creditors per unit of time. These statistics, compiled from the Centralised Securities Database (CSDB), afford interesting insights into the euro area government debt securities markets. These very timely monthly indicators, which the European Central Bank (ECB) plans to start disseminating later this year, may be used to monitor possible strains in servicing government debt, including debt sustainability, which may be useful information to be taken into account in determining monetary and fiscal policies.

The paper describes in detail the statistical compilation of the debt service and average nominal yields statistics for euro area government debt securities, forging a link to the all-encompassing government debt statistics (around 80% of government debt takes the form of debt securities). The main findings are that these statistics complement the available statistical information on government finance. Furthermore, the new statistics are available with a short time lag, providing users with data far more quickly and with many more data breakdowns than other aggregated government finance statistics.

This paper also presents the recent developments in debt service and average nominal yields statistics for the euro area governments, by country, in an extremely challenging period for the euro area sovereign debt markets.

8. References

Bank for International Settlements, European Central Bank and International Monetary Fund (2012), Handbook on Securities Statistics.

European Central Bank (2010), The "Centralised Securities Database" in brief, Frankfurt am Main, February.

European Commission (2013), European system of accounts – ESA 2010, Luxembourg.

International Monetary Fund (2013), External Debt Statistics: Guide for Compilers and Users, Washington DC.

International Monetary Fund (2013), Public Sector Debt Statistics: Guide for Compilers and Users, Washington DC.

Compilation of Detailed Flow of Funds: Korea's Experiences[1]

Hyejin Lee[2]

Abstract

Since the financial crisis of 2008, the demand for data on financial interconnectedness among economic sectors has been increasing. However, data on financial inter-linkages between sectors are still inadequate. The Detailed Flow of Funds is one such statistical series that can show sectoral linkages and as a result its compilation is recommended by the 2008 System of National Accounts. This paper discusses the Bank of Korea's endeavors to provide information on interconnectedness between sectors by compiling Detailed Flow of Funds. Its contents include an outline of the Korean Detailed Flow of Funds statistics that the Bank of Korea has developed, the method of data collection, and challenges in their compilation.

Keywords: From-whom-to-whom accounts, Inter-sectoral linkages, Detailed Flow of Funds

[1] The views expressed in this paper are those of author and do not necessarily represent those of the Bank of Korea.

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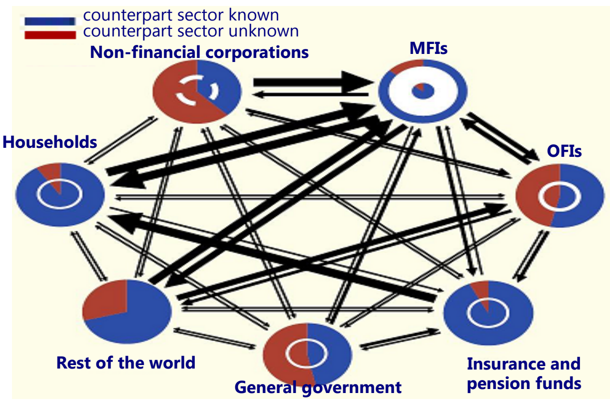
1. Introduction

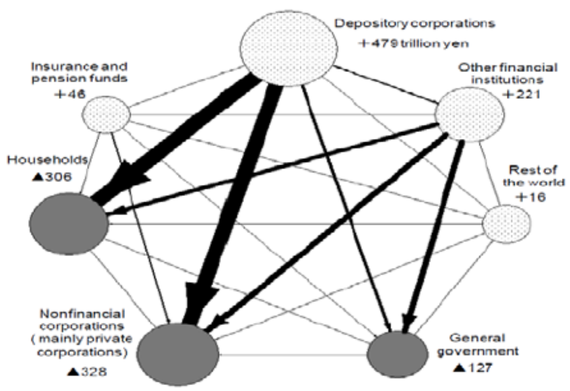
Detailed flow of funds statistics are on from-whom-to-whom basis, which can show creditors and debtors in a matrix form for every financial instrument. Their compilation has been recommended by the 2008 System of National Accounts (SNA). As the global financial crisis of 2008 clearly revealed the need to pay more attention to financial stability, the demand for these statistics, which enable data users to analyze financial interconnectedness, has also been increasing.

The G20 also recommends improving the Flow of Funds to fill in data gaps and thus international bodies such as the IMF and BIS have started to gather data for understanding financial transactions between sectors. Also, central banks are making efforts to identify linkages between institutional sectors, using economic statistics such as financial accounts or economic models such as the DSGE. Chart 1 shows euro-area and Japanese sectoral interconnectedness. Likewise, the Bank of Korea has endeavored to analyze inter-sectoral linkages. One such effort involves developing Korean Detailed Flow of Funds.

This paper is organized as follows: Section 2 presents an outline of the Korean Detailed Flow of Funds that the Bank of Korea has developed. Section 3 describes the main data sources and the compilation procedures of the Korean Detailed Flow of Funds. Section 4 provides several findings from analyses based on the Korean Detailed Flow of Funds. Section 5 concludes by setting out several challenges in compilation and future tasks.

Inter-sectoral exposures in euro area (2010) | Inter-sectoral transactions in Japan (Loans) | Chart 1





Source: ECB, Monthly Bulletin (Jan. 2012).

Source: BOJ, Bank of Japan Review (Apr. 2012).

2. Outline of Korean Detailed Flow of Funds

Korean Detailed Flow of Funds statistics consist of two tables, a transaction table and a stock table. Each table describes who does what with whom. That is, sectors in the columns and rows of the table represent creditors and debtors respectively. The basic structure of the table is shown in Table 1.

Like the Flow of Funds statistics, there are five sectors: financial corporations, general government, non-financial corporations, households and non-profit institutions serving households, and rest of the world. Particularly, financial corporations sector is classified into eight subsectors: central bank; deposit taking corporations (having two sub-subsectors, bank and non-bank); investment funds (having two sub-subsectors, money market funds and non-money market funds); insurance companies; pension funds; other financial intermediaries (having three sub-subsectors, securities companies, financing companies, and public financial institutions); financial auxiliaries; and captive financial institutions and money lenders. The reason of this is for capturing linkages among financial subsectors in detail.

In view of data reliability and availability, the Korean Detailed Flow of Funds statistics only cover five financial instruments: currency and deposits; loans; debt securities; insurance and pension reserves; and investment fund shares. These five financial instruments cover more than 60% of total financial assets. With regard to valuation, all transactions and stocks of financial instruments are evaluated at market prices. The Korean Detailed Flow of Funds statistics are compiled in a non-consolidated basis.

Basic structure of transaction and stock table

Table 1

		Creditor				
		Financial corporations	General government	Non-financial corporations	Households and NPISHs	Rest of the World
Debtor	Financial corporations					
	General government					
	Non-financial corporations					
	Households and NPISHs					
	Rest of the world					

Summary of Korean Detailed Flow of Funds — Table 2

	Details
Framework	Transaction table Stock table

Classification of Sectors	Financial corporations
	• Central bank
	• Deposit taking corporations
	  Banks
	  Non-banks
	• Investment funds
	  MMF (Money Market Funds)
	  Non-MMF
	• Insurance companies
	• Pension funds
	• Other financial intermediaries
	  Securities companies
	  Financing companies
	  Public financial institutions
	• Financial auxiliaries
	• Captive financial institutions and money lenders

	General government
	Non-financial corporations • Public non-financial corporations • Private non-financial corporations
	Households and non-profit institutions serving households
	Rest of the world
Classification of Financial instruments	Currency and deposits • Currency • Transferable deposits • Non-transferable deposits
	Loans • Short-term loans • Long-term loans • Government loans
	Debt securities • Short-term debt securities • Long-term debt securities • Derivatives-linked securities • Commercial paper
	Insurance and pension reserves
	Investment fund shares
Accounting rules	Valuation: Market price Consolidation: Non-consolidation basis

3. Data Sources and Compilation Procedures of Detailed Flow of Funds

3.1 Data sources

The main data sources are the raw data of the Flow of Funds statistics. To compile the Flow of Funds and Detailed Flow of Funds, Bank of Korea (BOK) integrates data frameworks by adding counterparty information to the original survey forms, which are collected from financial corporations, general governments, and public non-financial corporations. For instance, BOK collects data which can show who deposits where. Table 3 shows the survey form for deposits. Like this, BOK collects data on financial assets such as securities by issuers and loans by borrowers and data on financial liabilities such as debts by lenders.

Also, data collected by other institutions are used to compile Detailed Flow of Funds as supplementary data. There are financial market data such as investment fund statistics collected by Korea Financial Investment Association and debt securities statistics collected by Korea Securities Depository. Another type of supplementary data is the financial statements filed with financial supervisory authorities.

Detailed statement on deposits held

Table 3

		Institution:
Counterpart	**Breakdown of deposits**	**Amounts**
Central bank	Deposits Repurchase agreements	
Commercial banks	Transferable deposits Short-term savings deposits Long-term savings deposits Cover bills Negotiable certificates of deposits Repurchase agreements	
Specialized banks	Transferable deposits Short-term savings deposits Long-term savings deposits Cover bills Negotiable certificates of deposits Repurchase agreements	
Foreign bank branches	. . .	
Mutual savings banks	. . .	
. . .	. . .	
Total		

3.2 Compilation procedures

Basically, the compilation procedures of Detailed Flow of Funds are very similar with those of Flow of Funds. First, for every sector other than the private non-financial corporations sector and the households and non-profit institutions serving households sector, a detailed balance sheet is made out using counterpart information. Table 4 shows a detailed balance sheet for each institutional unit. Almost every financial instrument is classified by counterpart sectors. Then detailed balance sheets of institutional units are aggregated by sector.

Detailed Balance Sheet

Table 4

Financial Assets	Amounts	Counterpart sector
1. Monetary gold and SDRs		
2. Currency and Deposits		
2.1) Currency		Central bank
2.2) Transferable Deposits		
2.2.1) Bank transferable deposits		Banks
2.2.2) Non-bank transferable deposits		Non-banks
2.2.3) Deposits at the central bank		Central bank
2.2.4) Deposits by general governments		Central bank
2.3) Non-transferable Deposits		
2.3.1) Short-term savings deposits		
2.3.1.1) Banks		Banks
2.3.1.2) Non-banks		Non-banks
2.3.2) Long-term savings deposits		
2.3.2.1) Banks		Banks
2.3.2.2) Non-banks		Non-banks
2.4) Cover Bill		
2.5) Negotiable Certificates of Deposit		Banks
2.6) Repurchase Agreements		
2.6.1) Central bank		Central bank
2.6.2) Other financial corporations		
2.6.2.1) Banks		Banks
2.6.2.2) Non-Banks		Non-banks
2.6.2.3) Investment funds		Investment funds
2.6.2.4) Insurance companies		Insurance companies
2.6.2.5) Securities companies		Securities companies
2.6.2.6) Financial companies		Financial companies
2.6.2.7) Public financial companies		Public financial companies
2.7) Money in Trust		Non-banks
2.8) Other Deposits		
3. Insurance and Pension Reserves		Insurance companies Pension funds
. . .	. . .	
Total		
Total		

Detailed Balance Sheet (cont) Table 4

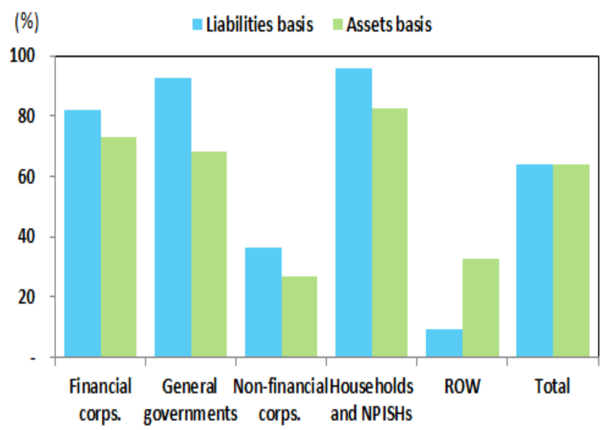
Financial Liabilities	Amounts	Counterpart sector
1. Monetary gold and SDRs		
2. Currency and Deposits		
2.1) Currency		
2.2) Transferable Deposits		
2.3) Non-transferable Deposits		
2.3.1) Short-term savings deposits		
2.3.2) Long-term savings deposits		
2.4) Cover Bill		
2.5) Negotiable Certificates of Deposit		
2.6) Repurchase Agreements		
2.7) Money in Trust		
2.8) Other Deposits		
3. Insurance and Pension Reserves		
4. Debt securities		
4.1) Short-term debt securities		
4.2) Long-term debt securities		
4.3) Derivatives-linked securities		
5. Loans		
5.1) Short-term loans		
5.1.1) BOK loans		Central bank
5.1.2) Deposit taking corporation loans		
5.1.2.1) Banks		Banks
5.1.2.2) Non-banks		Non-banks
5.1.3) Investment fund loans		Investment funds
5.1.4) Insurance co. & pension fund loans		Insurance and Pensions
5.1.5) Financial intermediary loans		
5.1.5.1) Securities companies		Securities companies
5.1.5.2) Financing companies		Financing companies
5.1.5.3) Public financial companies		Public financial companies
5.1.6) Financial auxiliary loans		Financial auxiliaries
5.1.7) Captive financial inst. and money lender loans		Captive and money lenders
5.1.8) Call money		
5.2) Long-term loans		
. . .	. . .	
Total		

Second, after aggregating detailed balance sheets by sector excluding private non-financial corporations and households and NPISHs, total financial assets or liabilities are fixed and residuals are allocated to the private non-financial corporations sector and the households and NPISHs sector using counterpart information. After balancing vertical and horizontal accounts, every cell in balance sheets is rearranged in accordance with Detailed Flow of Funds frameworks.

4. Selected Results from the Pilot study

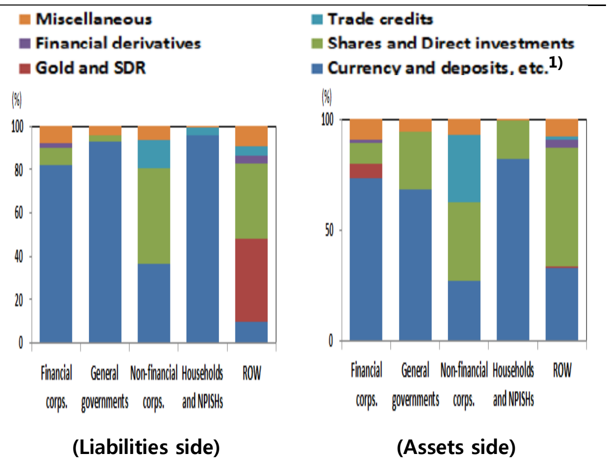
According to the pilot study, the proportion of counterparts identified in total financial assets (or total financial liabilities) is about 60%. Regarding economic sectors, the proportion of counterparts identified in total financial assets of financial corporations, general government, and households and non-profit institutions serving households is more than 70%. However, that of non-financial corporations and the rest of the world is around 30% or less. This is because the proportion of shares, direct investments, and trade credits in their total financial assets (or financial liabilities) is much larger than that of the financial instruments that Korean Detailed Flow of Funds covers. Chart 2 and Chart 3 shows respectively the proportions of counterparts identified in each sector's financial assets and liabilities and the proportion of financial instruments held by each economic sector.

Proportions of counterparts identified by sectors — Chart 2



Source: Pilot study (as of end-2012).

Proportions of financial instruments held by sector — Chart 3



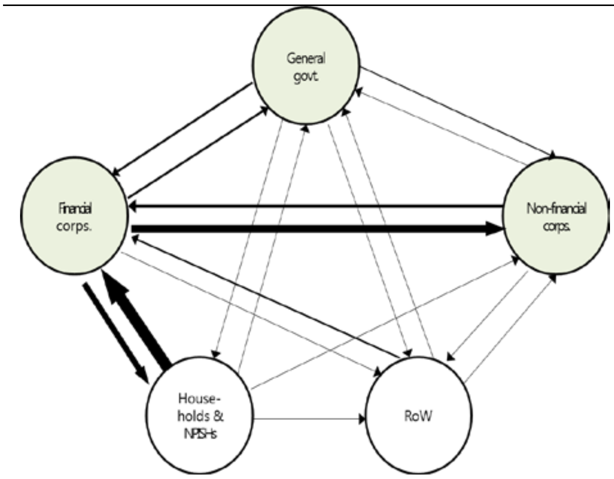
Note: 1) Currency and deposits, loans, debt securities, insurance and pension reserves, and investment fund shares.

Source: Pilot study (as of end-2012).

With regard to inter-sectoral exposures, exposures are mainly related to financial corporations, which function as financial intermediaries. For the general government sector, the proportion of exposures with financial corporations in its financial assets is about 44%, which is less than the corresponding proportions in other sectors' financial assets. This is due to the heavy weight of intra-sectoral exposures in the general government sector. For instance, there are lots of intra-sectoral transactions among general government subsectors, such as central government loans borrowed by local governments and government debt securities held by social security funds.

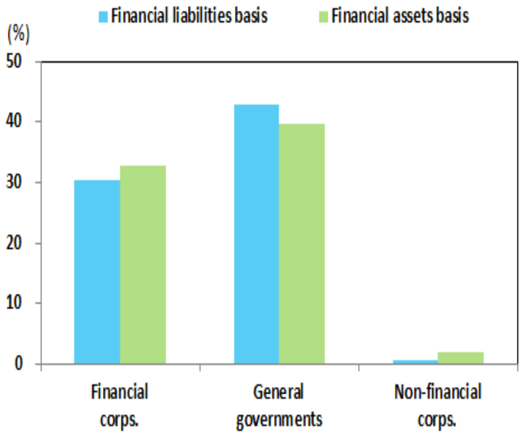
As for intra-sectoral exposures, financial corporations and general government have a large portion of intra-sectoral exposures, making up more than 30% of their financial assets (or liabilities). However, the intra-sectoral exposures of non-financial corporations account for less than 5% of their financial assets (or liabilities). Chart 4 and Chart 5 show inter-sectoral exposures and intra-sectoral exposures respectively.

Inter-sectoral exposures between economic sectors	Chart 4	Proportions of intra-sectoral exposures	Chart 5



Note: Arrows indicate direction of funds and their width indicate the size of inter-sectoral exposure.

Source: Pilot study (as of end-2012).

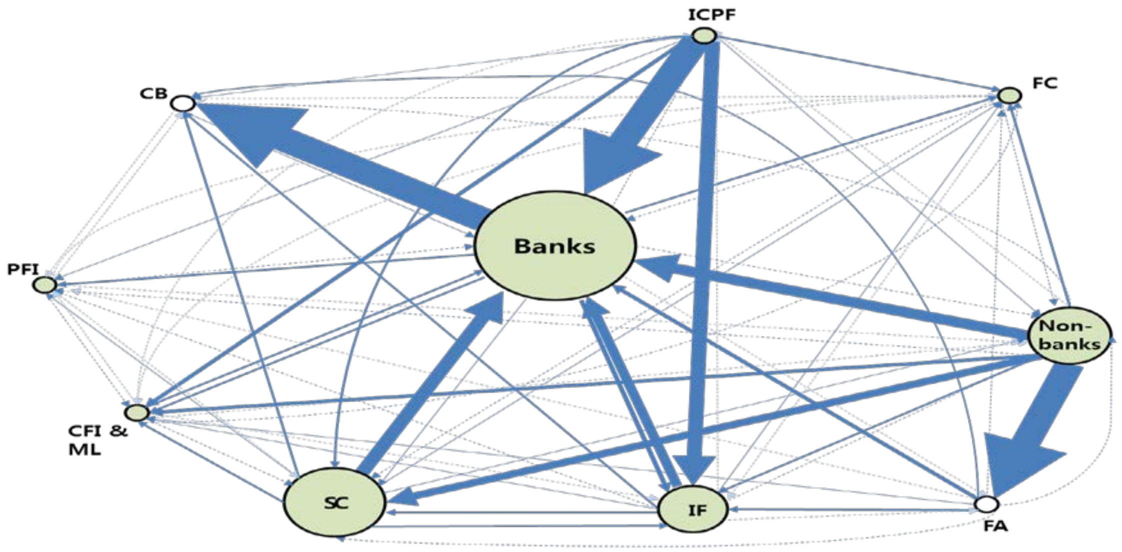


Source: Pilot study (as of end-2012).

Regarding mutual exposures in the financial corporations sector, banks play a central part in the financial system, as other financial subsectors such as central bank, non-bank deposit taking corporations, securities companies, insurance and pension funds, and investment funds have large amounts exposures to bank. Banks have a large weight of their financial assets with central bank owing to bank reserves and Monetary Stabilization Bonds holdings. However, banks raise funds from insurance and pension funds, non-bank deposit taking corporations, securities companies, and investment funds. In the case of non-bank deposit taking corporations, they operate large portion of their funds with financial auxiliaries but the scale of their financing from other financial corporations is not that large.

For intra-sectoral exposures in financial corporations sector, banks' intra-sectoral exposures are the heaviest and are followed by securities companies, non-bank deposit taking corporations, and investment funds in that order. Chart 6 displays the inter-subsectoral exposures in the financial corporations sector.

Inter-subsectoral exposures in the financial corporations sector Chart 6



Notes:

1. Size of indicates size of intra-sectoral exposures. Arrows and their width indicate the direction of funds and the size of inter-subsectoral exposures respectively.

2. CB: central bank, ICPF: insurance companies and pension funds, FC: financing companies, FA: financial auxiliaries, IF: investment funds, SC: securities companies, CFI & MF: captive financial institutions and money lenders, PFI: public financial institutions.

5. Future plans

The Korean Detailed Flow of Funds statistics briefly introduced in Section 2 and 3 promise to be very useful from a financial stability perspective, enabling data users to measure interconnectedness between economic sectors and to analyze contagion risks. However, because these statistics are in their early stage of development, there are many compilation issues needing to be improved in the future. Among them, crucial issues of mismatch problems between creditors' and debtors' data and the expansion of their coverage are described in this section.

Mismatch problems between debtors' information and creditors' information are caused by several factors. First, these problems result from the heavy dependence on balance sheet data when compiling the Detailed Flow of Funds. According to accounting standards such as Korean International Financial Reporting Standards, financial instruments are classified into four categories: held-for-trading; available-for-sale; held-to-maturity; and loans and achievable securities. Held-for-trading and available-for-sale financial instruments are measured at fair value and the other remaining financial instruments at amortized cost. Therefore, financial instruments can be evaluated differently according to their classification. Assume that banks and insurance companies hold debt securities issued by credit card companies. If banks and insurance companies classify them as available-for-sale and held-to-maturity respectively, securities values from credit card companies' balance sheets (liabilities side) are very different from the sum of their values from banks and insurance companies' balance sheets (assets side). In other words, mismatch problems necessarily arise if balance sheet data are used as the main data sources for compiling Detailed Flow of Funds statistics. Second, these problems are caused by respondents who do not fully understand the classification of counterparts. In fact, the Bank of Korea provides respondents with a detailed classification table of counterpart to help them in preparing our survey templates. However, respondents are often confused by the classification. For instance, if respondents classify debentures issued by security companies under bank debentures, the securities' aggregates using creditors' data are not the same as those using issuers' data. Therefore, it is necessary to change compilation methods from using only balance sheet data to using financial market data together with balance sheet data. For instance, securities data may be obtained from the securities depository. Also, it is important for compliers to communicate with respondents in order to let them know how to fit data correctly in survey templates.

With regard to expansion of the coverage of the Detailed Flow of Funds, there are two things to bear in mind. First, it is necessary to cover more financial instruments. For now, Detailed Flow of Funds only covers five financial instruments: namely, currency and deposits; insurance; debt securities; loans; and investment fund shares. However, shares and financial derivatives should also be included. The second issue concerns the classification of financial subsectors. In order to analyze risks incurred by financial corporations, more detailed granularity is needed.

We expect that complete statistics will be released once these issues are addressed. Consequently, the Detailed Flow of Funds statistics can then be used as background data for monetary and financial stability policy.

Consolidated and non-consolidated debt measures of non-financial corporations

Andreas Hertkorn[1]

Abstract

There is a broad consensus to use comprehensive debt measures for the analysis of non-financial corporations in terms or financial instruments. However, the choice between consolidated and non-consolidated debt measurement is not clear-cut, even from a conceptual point of view. This paper compares the approaches to NFC debt measurement both from a conceptual point of view and in terms of data quality and cross-country comparability in the light of the recent improvements in data availability for EU countries.[2] A theoretical argument that non-consolidated data are more comparable across economies of different sizes is developed and compared with evidence from euro area countries. Statistical measurement issues, including the coverage of institutional units in source data, and their impact on the cross-country comparability of consolidated and non-consolidated data are examined.

Keywords: Macroeconomic surveillance, corporate debt, financial accounts, flow of funds

JEL classification: G30

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The views expressed in this paper are those of the author and do not necessarily reflect the views of the European Central Bank. The authors would like to thank Henning Ahnert, Ilja Kavonius and Gabriel Quirós for valuable comments.

[2] This paper largely draws from the work done by the Working Group on Euro Area Accounts (WG EAA) a substructure of the European System of Central Bank's Statistics Committee.

Introduction

The indebtedness of non-financial corporations (NFCs) can influence economic activity owing to its effect on the corporations' debt servicing burden and its impact on access to external financing as it affects the credit assessments of banks and other creditors. The debt level impacts also NFCs' capacity to withstand shocks, which can have spill over effects to the other parts of the economy.[3] The recent crisis has resulted in increased interest in the monitoring of NFC and household debt in addition to government debt. The G-20 Mutual assessment process (MAP), the IMF Financial soundness indicators (FSI), the EU Macroeconomic imbalance procedure (MIP) and the European systemic risk board (ESRB) analyse NFC debt or "private" debt, the latter defined as the sum of NFC and household debt. There is a broad consensus that debt concepts should be comprehensive in terms of financial instruments and creditor sectors. In order to assess and compare debt it is advisable to consider not only bank loans, but loans in general and to include also debt securities and, if available, other financial debt instruments. With the exception of equity, all financial instruments may be considered debt. A second question is whether NFC debt should be non-consolidated, i.e. including includes debt financing within the NFC sector or not (see Annex Diagram for a stylised example).[4] In practice the inclusion of financial instruments and the choice between non-consolidated and consolidated data has to consider also data availability and quality issues, and from a European perspective, the effect on the comparability of the data. This paper discusses both conceptual as well as practical aspects concerning the inclusion of financial instruments (Section 1) and the choice between non-consolidated and consolidated data (Section 2).

1. NFC debt – what financial instruments to include

The first decision to be made when defining NFC debt is which instruments among the various components of NFCs' total financial liabilities to include in the calculation. Given the desire to measure the impact of debt on economic activity and in particular on NFCs' capacity to withstand shocks, one may strive for the most comprehensive measure of debt. While equity can absorb shocks, all other liabilities may affect a company's sustainability negatively. Thus, debt may in principle be defined as liabilities minus equity. NFC debt would thus consist of debt securities, loans, pension liabilities, financial derivatives and other accounts payable. While there is general agreement that ***loans*** and ***debt securities*** must and can be included, there are conceptual and data quality concerns regarding liabilities stemming from financial derivatives, pension entitlements and "other accounts

[3] See also Task Force of the Monetary Policy Committee of the European System of Central Banks (2013), "Corporate finance and economic activity in the euro area: Structural Issues Report 2013, Occasional Paper Series, No. 151, ECB, Frankfurt am Main, August 2013.

[4] Consolidation in national accounts data differ from the consolidated accounts in business accounting where intra-group positions are consolidated out. Comprehensive "group-consolidated" data is however not available for the NFC sector in the financial accounts or other internationally comparable data sources.

payable". These more controversial instruments are discussed in the following part in more detail.

Concerning ***trade credits and advances*** (which are a sub-instrument of "other accounts payable"), there is a considerable interest of users to include them as they are an important financing tool. Trade credit and advances arise from the direct extension of credit by the suppliers of goods and services to their customers, and from prepayments by customers for goods and services not yet provided. In the EU it was agreed to make statistical data on trade credit and advances available separately from other "other accounts payable" even on a quarterly basis.[5]

Concerning the remaining part of ***"other accounts payable"*** and *financial derivatives* data availability and compilation practices seem to vary substantially. For EU countries these financial instruments are thus not included in debt. The varying publication practices of non-EU countries confirm the view that these liabilities are at least currently not comparable across countries.

Concerning NFC liabilities arising from ***pension entitlements*** views differ regarding the cross-country comparability and doubts are also based on conceptual considerations. Under the old standards (SNA 93, ESA 95) NFC liabilities from pensions were only explicitly recognised in the case of non-autonomous pension funds. Non-autonomous pension funds i.e. where employers keep the pension reserves on their balance sheet, as they are not outsourced to an autonomous pension fund, only exist in a few countries, likely due to varying legal settings. Although such pension reserves – where they exist – are legally recognised liabilities, the fact that these non-autonomous pension funds exist only in a few countries raised doubts whether their inclusion is appropriate to obtain internationally comparable debt indicators.[6] The new statistical standards (SNA 2008, ESA 2010) explicitly foresee the recording of liabilities of NFCs in addition in the case of underfunded autonomous pension funds. If an employer has outsourced a pension scheme to a pension fund but retains the legal responsibility for a deficit in funding, the new standards require the recording of the funding deficit as liability of the employer (the "pension manager") under the new financial instrument "Claim of pension funds on pension managers". With the implementation of the new statistical standards one may argue that the legally recognised liabilities of NFCs are recorded in the financial accounts independently whether pension schemes are outsourced to pension funds or not. This supports the inclusion of NFC liabilities arising from pension entitlements in debt indicators.

[5] With the implementation of the new European System of Accounts 2010 and as a result of the new ECB Guideline in the field of quarterly financial accounts (ECB/2013/24, Official Journal L 2, 7.1.2014, p. 34) trade credit will become a mandatory separate statistical item from September 2014.

[6] In ECB publications the measurement of NFC debt takes into account loans, debt securities and pension reserves. The macroeconomic imbalance procedure (MIP) definition of private debt excludes pension reserves.

2. Consolidated versus non-consolidated measures of NFC debt

Once the set of instruments has been selected, a decision must be made as regards the consolidation method. With a few exceptions,[7] until recently the ECB, the European Systemic Risk Board (ESRB) and the European Commission in its implementation of the macroeconomic imbalance procedure (MIP) have relied on non-consolidated debt measures. The European Commission switched to the consolidated debt concept in its "Alert Mechanism Report 2014", exploiting the newly available consolidated data for all EU countries on an annual basis. Furthermore, the ECB publishes consolidated NFC debt data in addition to non-consolidated debt data on a quarterly basis for the euro area and for almost all Member States. The quarterly consolidated data is calculated as the non-consolidated debt minus intra-sector NFCs loans.

2.1 Conceptual considerations and empirical evidence

From a conceptual point of view, the choice between consolidated and non-consolidated debt measurement is not clear-cut, and can serve different analytical purposes. Consolidated debt measures the amounts of funds received by a sector from all other (both resident and non-resident) sectors. As such, this approach provides an overview of inter-sectoral flow of funds.

Non-consolidated data on NFC debt includes debt financing within the NFC sector. For assessing the debt sustainability, as well as the refinancing or credit risk of NFCs, the debt positions occurring between NFCs should also be taken into account, thus supporting the use of non-consolidated debt measures in such analyses.

Intra-sectoral debt financing consists mainly of loans and trade credit extended by companies to other companies resident in the same country, while according to financial accounts data for EU countries intra-sectoral holdings of debt securities are much less important. Intra-NFC sector loans exhibit by far the largest cross-country differences among the components of NFC debt (see Chart 1). Corporate balance sheets typically show significant amounts of loans extended between resident corporations belonging to the same enterprise group. By contrast there is little evidence for loans between corporations belonging to different groups (i.e. without a significant capital link) although they may be granted for a number of reasons, such as to support a supplier, or for pure investment purposes.

A main criticism of non-consolidated debt is that it includes, indistinguishably both intra-group financing and financing between NFCs belonging to different groups. The two are very different in nature and pose different issues as regards, for instance, debt sustainability. Intra-group lending can be very significant, with large cross-country heterogeneity. Thus, it should ideally be analysed separately from

[7] Some proxies for consolidated debt measures have been used especially in comparing the euro area economy with that of the United States. Moreover, a recent analysis by the ECB of corporate indebtedness used both non-consolidated and consolidated data (see the article entitled "Deleveraging patterns in the euro area corporate sector", *Monthly Bulletin*, ECB, February 2014).

debt owed to unrelated creditors. A split of intra-group from extra-group financing is however not foreseen in the statistical standards. Internationally comparable and comprehensive data allowing this separation is thus not available.

An argument in support of non-consolidated debt measurement is that derived indicators, such as the leverage ratio, show debt in relation to total equity or assets, which are available in the financial accounts only on a non-consolidated basis. Acknowledging the relative merits of the two concepts, the European Commission, for example, in its implementation of the MIP, continues to use non-consolidated measures of debt as an additional indicator. Similarly the ECB, in a recent analysis of corporate indebtedness, used both non-consolidated and consolidated data.[8]

Cross-country data comparability – comparing countries of different sizes

Non-consolidated data may be – ceteris paribus – more comparable across economies of different sizes. According to the statistical standards the consolidation of intra-NFC debt only refers to the consolidation of debt between NFCs resident in the same country. Therefore, the comparability of consolidated data can be affected by different shares of domestic intra-NFC financing across countries. The theoretical argument can be made that for similar countries (in particular of an integrated economic area) the share of domestic intra-NFC financing to total financing increases with the size of a country. The theoretical extreme would be a world that is economically fully integrated. Full economic integration in extreme could mean companies of different sizes are fairly randomly distributed across countries. Large countries would then tend to have higher shares of domestic intra-NFC financing than smaller countries. Non-consolidated data may therefore be preferable when comparing debt levels across countries (or states) of different sizes.[9]

However this theoretical argument is in contrast to empirical evidence from EU countries. The share of domestic intra-NFC lending (as measured by the intra-NFC debt-to-GDP ratio) is highest for some of the smaller countries. The highest intra-NFC financing ratios are recorded in Belgium, Luxemburg and Malta and are likely related to particular structural features in these countries,[10] while larger countries report relatively low values (see Chart 1). The high variability of intra-NFC financing is also reflected in the higher cross-country variance of non-consolidated debt compared with consolidated debt. Most European countries use an additive approach to compile non-consolidated debt, that is they compile consolidated debt and add intra NFC debt in order to obtain non-consolidated debt. This is because most countries lack comprehensive and timely direct information on NFCs which would allow the direct compilation of non-consolidated debt. While many countries do maintain national balance sheet data, these generally do not achieve full coverage. Compilers thus typically use counterpart sector information (e.g. for bank

8 See the article entitled "Deleveraging patterns in the euro area corporate sector", *Monthly Bulletin*, ECB, February 2014.

9 Note that in the euro area accounts aggregates the euro area is treated as a single economy and intra-NFC loans include all loans between NFC resident in any euro area Member State. Non-consolidated data is thus preferable when comparing debt indicators for the euro area against that of individual countries.

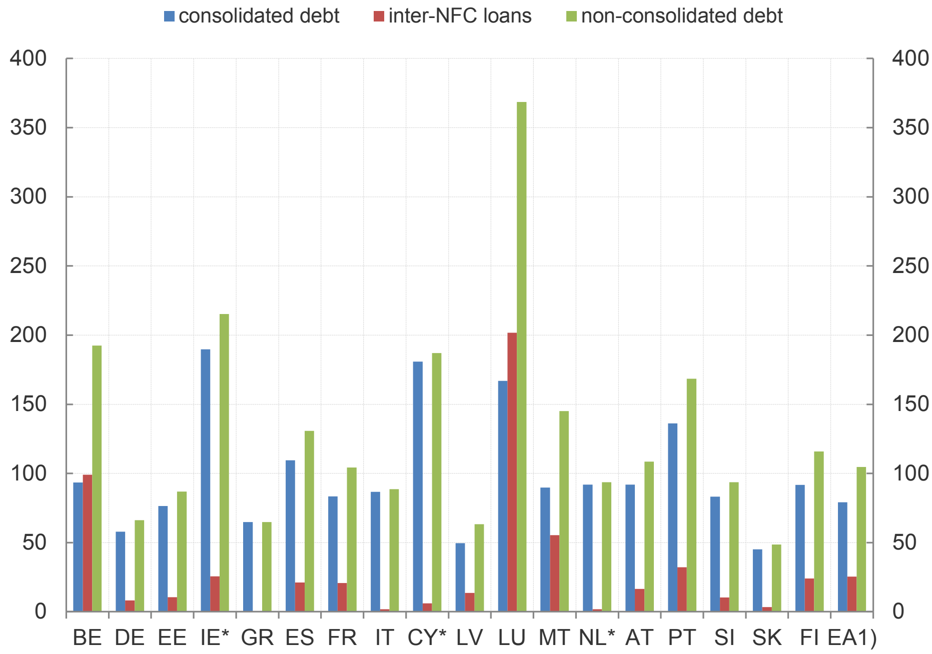
10 Structural features such as the attractiveness of these countries for multinational groups related inter alia to favourable tax treatments. See the article entitled "Deleveraging patterns in the euro area corporate sector", *Monthly Bulletin*, ECB, February 2014.

loans to NFCs) and security issuance statistics which are available with a higher frequency and timeliness, and then add intra-NFC debt.

Some of this cross-country variation of intra-NFC debt, which impacts the cross-country comparability of non-consolidated debt, is likely to reflect statistical measurement issues which are discussed in the Section 2.2.

Measures of NFC debt and intra-NFC debt

(as a percentage of four quarter nominal GDP; the data refers to 2013Q4) Chart 1



1) For the euro area, consolidated debt and intra-NFC loans are not comparable with country data.

Notes: *For Ireland, Cyprus and the Netherlands intra-NFC loans are calculated based on annual financial accounts for 2012, and consolidated debt is calculated as non-consolidated debt minus annual intra-NFC loans (as intra-NFC loans are not available on a quarterly basis).

Sources: Eurostat, ECB (quarterly, integrated euro area accounts).

2.2 Differences in data availability and compilation practices

There are two statistical factors which may have a considerable impact on intra-sector NFC debt and thus on the level and comparability of non-consolidated debt measures.

(i) Different concepts of statistical units: the level of granularity applied in the statistical definition of an NFC in relation to the enterprise group affects the debt measurement results. The more detail that goes into defining NFC, the higher the number of NFCs that are recorded separately and the higher the potential intra enterprise group financing and the non-consolidated NFC debt. Conversely, countries using higher levels of aggregations of NFCs as statistical building blocks, record significantly lower levels of inra-NFC debt. Countries using enterprise group data do not have the information to cover intra-group lending, thus significantly lowering the level of intra-NFC debt in comparison to countries that use the (solo) enterprise data foreseen by the statistical standards.

(ii) Different coverage of intra-NFC loans: most countries do not have complete coverage of NFC balance sheets in their statistical sources and the necessary estimation of missing data may affect the quality of estimates for intra-NFC debt. The estimation of missing data hinges on the methods to establish the total population – typically based on business registers and on grossing-up methods. Grossing-up requires a reference indicator, i.e. a variable that is available in both the source data and the data source used to establish the total population. The choice of the reference indicator is generally very limited because of the limited availability of variables in the total population data. Countries may use turnover, value-added, data obtained from tax-registers or number of employees depending on data availability. The correlation of any of these referenced indicators with intra-NFC loans is likely to be imperfect. Some countries try to overcome this by using detailed, stratified grossing-up method to improve the estimation of intra-NFC loans for the total population.[11]

2.3 Changes related to the new statistical standards

The relative importance of Intra-NFC loans depends to a large degree on the structure of financing within enterprise groups. Intra-group financing is likely to be somewhat centralised in all countries. Typically one unit in the group has the best access to financial markets and distributes some of the funds obtained to the other units. This central unit may be:

(a) a large NFC in the group (including holding corporations engaged in the managements of the NFCs, i.e. head offices according to SNA 2008),

(b) a holding company in the sense of SNA 2008 (i.e. not engaged in management),

(c) a captive financial institutions such as a special purpose entity (SPE) issuing debt securities.

Depending on the type and residency of the central financing unit, financial position may be recorded as intro-NFC loans or not. In case (a), e.g. a resident head office of a non-financial enterprise group, such positions are to be recorded as part of the intra-NFC loans, both according to the old (SNA 1993, ESA 1995.)

The new statistical standards specify the recording of holding companies (b) and other captive financial institutions (c) as part of the financial sector. This specification has the advantage that the debt financing raised by SPEs or holding companies will be allocated to the debt of the financial sector, and only the direct funding granted by SPEs or holding companies to non-financial corporations will be recorded as debt of the non-financial corporations sector (see Annex diagram for a stylised example). The new classification of holding companies, SPEs and similar units will lower the recorded debt of non-financial corporations and increase the

[11] E.g. the Banco de España uses a grossing-up method that is differentiated by size (number of employees), legal form and branch of activity. The results differ significantly from any one-dimensional grossing-up.

liabilities and assets of financial corporations. The impact of this change can be sizeable in some countries.

Conclusions

Overall, given the relative merits and shortcomings of the consolidated and the non-consolidated debt concepts, the monitoring of both is advisable. The quarterly euro area accounts and the quarterly financial accounts of EU countries are generally presented on a non-consolidated basis. Consolidated, quarterly debt measures can, however, be derived for NFCs by subtracting intra-NFC loans from non-consolidated debt measures.[12] These debt measures are published by the ECB at a quarterly frequency. Further improvements of the data and comparability, in particular as regards the measurement of intra-NFC trade credit and the delineation between debt of the non-financial and financial sector, are expected with implementation of the ESA 2010/SNA08 and the new ECB Guideline on financial accounts. The first publication of the euro area accounts according to ESA 2010 is scheduled for November 2014.

12 Debt securities cannot yet be consolidated as intra-NFC holdings data are not yet available; they are in any case much less important than intra-NFC loans. Based on annual financial accounts NFC debt securities holdings are estimated to account for below 0.5% of GDP in almost all euro area countries.

Annex

Diagram: NFC debt compiled according to SNA 1993 and SNA 2008, stylised example

SNA 1993 (ESA 1995):

Holding Company (HC)
= NFC 0

Loans HC to NFC 1	Debt securities
Equity	Equity

NFC 1

Loans NFC 1 to NFC 2	MFI loans
Other asset	Loans HC to NFC 1
	Equity

NFC 2

Other asset	Loans NFC 1 to NFC 2
	Equity

NFC sector (aggregate)

Equity	Debt securities	Consolidated debt	Non-consolidated debt
	MFI loans		
Loans HC to NFC 1	Loans HC to NFC 1	Intra-NFC loans	
Loans NFC1 to NFC 2	Loans NFC1 to NFC 2		
Other assets	Equity		

SNA 2008 (ESA 2010):

Holding Company (HC)
= Captive financial institution

Loans HC to NFC 1	*Debt securities*
Equity	*Equity*

NFC 1

Loans NFC 1 to NFC 2	MFI loans
Other asset	Loans HC to NFC 1
	Equity

NFC 2

Other asset	Loans NFC1 to NFC2
	Equity

NFC sector (aggregate)

Loans NFC 1 to NFC 2	MFI loans	Consolidated debt	Non-consolidated debt
Other assets	Loans HC to NFC 1		
	Loans NFC 1 to NFC 2	Intra-NFC loans	
	Equity		

Enhancing Euro Area Capital Stock Estimates

Zlatina Balabanova,[1] Ruben van der Helm[2]

Abstract

Official euro area wide statistics on capital stock and its breakdowns by asset types and sectors are not yet available, but very useful for economic and financial stability analysis. This paper proposes a constrained optimization model with the help of which a full cross-sector classification of capital stock by non-financial asset type is estimated. The model is applied for the estimation of capital stock by institutional sector, including households' housing stock and households' housing wealth both for the euro area and euro area Member States currently not estimating and/or publishing such data.

Keywords: Capital stock, household housing wealth, perpetual inventory method, constrained optimization, euro area, institutional sector

JEL classification: C33, C82, E02, E22

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The views expressed are those of the authors and do not necessarily reflect those of the European Central Bank and De Nederlandsche Bank.

1. Introduction

This paper proposes a constrained optimization model with the help of which a full cross-sector classification of capital stock can be estimated. The model is applied for the estimation of capital stock by institutional sector, including households' non-financial asset types and households' housing wealth both for the euro area and euro area Member States (Monetary Union Member States (MUMS)) currently not estimating and/or publishing such data.

As a follow-up on the recent financial crisis there have been numerous actions to strengthen data collection. More detailed and complete financial and economic data would give policy makers a broader view on the structure of the economy. Such data is needed in order to understand the relations between the different institutional sectors in the economy. More detailed sector data would give information that could identify early enough the vulnerability of the different domestic sector to external shocks.

There are many requests for more detailed data collection. For example in April 2009, G-20 requested the Financial Stability Board (FSB) and International Monetary Fund (IMF) to pin point data gaps and to suggest an improvement on data collection. The respond of the FSB and the IMF included 20 recommendations in total and one of them tackled the subject of better sector breakdown of economic data. The commission on the measurement of economic performance and social progress (Stiglitz et al., 2009) included in its report a recommendation that was directly addressing the sector compilation of balance sheets including non-financial assets. In August 2010 the Bank for International Settlements (BIS) organised a special conference on initiatives to address data gaps revealed by the financial crisis.

The compilation of the euro area balance sheets for non-financial assets by institutional sector is challenging since most of the MUMS don't provide detailed sector breakdowns for the different asset types. Since end-2009 quarterly euro area non-financial assets (gross and net) are compiled for the total economy by asset type and for the total fixed assets by institutional sectors. At present there is no compilation of the different non-financial asset into institutional sectors.

The theory underlying capital stock measurement was introduced in the 1960s by Jorgenson (1963). Later on Hall and Jorgenson (1967) worked on the estimation of cost of capital. Jorgenson and Griliches (1967) and Jorgenson and Christensen (1969) modelled a measure of capital using service prices. After the 1960s a large number of economists worked on capital theory (see Jorgenson (1969), Hulten (1990), Diewert et al. (2006)).

In addition to the academic research done in this field, central banks and statistical institutes worldwide work on estimating non-financial assets to complete national balance sheets. The most widely used manual on capital stock estimation was published by OECD in 2001 (see OECD (2001)) and a revised edition, taking into account the developments and the 1993 revision of the System of National accounts (SNA), appeared in 2009 (see OECD (2009)).

The available approaches to calculate capital stock can be separated into two groups depending on the information that they use. The first group of methods uses mainly data relevant to the level of capital stock and does not consider investment information. Whereas the second group of models uses information both on the level of capital stock and gross investment flow. Current studies that connect to the first group of methods are Bughin (1993) and Wolfson (1993) which use data from companies' book values from annual financial reports in order to proxy capital stock. Other economists use output capacity measures to obtain capital stock series among these are Lindquist (1995, 2000), Ohanian (1994), Reynolds (1986) and Lock (1985). Biorn et al. (1998) use stock exchange values as proxies of capital stock.

The major drawbacks of the first group of models are connected with the high costs related to the estimations, and limited availability and adequacy of the data. The most widely used approach in the empirical literature belongs to the second group of models and is called the Perpetual Inventory Model (PIM). This method is much cheaper than the directly observed methods since it takes into account only investment data that have to be combined with corresponding retirement and depreciation rates and some initial stock. Some examples are Hahn et al. (1984), Boehm et al. (2002), Costa et al. (1995). Little has been done to assess the effects of the *a priory* assumptions on initial stock and retirement rates in the PIM. There are only few studies among which Usher (1980), Miller et al. (1983), Barnhart et al. (1990) and Biorn et al. (1999).

In this paper we propose a new estimation method following a bottom up approach and try to model country specific non-financial assets estimates, and then compile the EA balance sheets. The paper is organized in the following way. Section two gives an overview on data availability by MUMS. Section three introduces the enhanced methodology used to estimate the institutional sector breakdown of each non-financial asset type for the EA. The results are included in section four. Section five concludes.

2. Data Availability

At this point in time there are only eight MUMS that report complete cross-classification of annual net capital stock by asset type and institutional sector (composing table 26[3]) representing 64% of Gross Fixed Capital Formation[4] (GFCF). These are Germany, France, Finland, Austria, Luxembourg, Latvia, the Netherlands, and Slovenia. In addition Italy, Estonia, Slovakia and Cyprus (17% of GFCF) publish institutional sector breakdown just for dwellings. Data for most MUMS covers the period between 1998 to 2012, however some breakdowns for Latvia are available for 2007 to 2010 only. A detailed description of data coverage, the classifications of the non-financial assets and institutional sectors can be found in the Annex A1 to A3.

Moreover 14 MUMS (all except Spain, Greece, Portugal and Malta) publish capital stock estimates for the total economy broken down by asset type and

[3] The main data source used in the presented estimations is the data collected under the European System of Accounts Transmission Programme (ESA TP). This data is collected by Eurostat and covers: Annual balance sheet for non-financial assets (table 26 of ESA TP); Cross classification of fixed assets by industry and assets-annual data (table 20 of the ESA TP); Cross classification of gross fixed capital formation by industry and assets-annual data (table 22 of the ESA TP).

[4] Reference year is 2013.

economic activity (composing table 20) [5]. This corresponds to around 87% of the euro area in terms of GFCF. Note that the timeliness of tables 20 and 26 under the ESA transmission programme is 24 month after the end of the reference year and are available on an annual basis only.

Gross fixed capital formation is reported by all 18 MUMS for the total economy broken down by asset type and economic activity (composing table 22). The valuation reported for GFCF is in constant prices and current prices, the time series are available at annual and quarterly frequency.

There is very sparse data on land (underlying dwellings) and households' housing wealth (HHW) for MUMS. National HHW data are available only for Germany, France, Italy, Spain and the Netherlands. These data are National Central Banks (NCB) estimates except for France and the Netherlands where the data comes from the respective national statistical offices.

3. Methodology

The most widely used estimation method for non-financial assets is based on the capital accumulation equations, which is also known as the Perpetual Inventory Method (PIM). The capital accumulation equation can be written as:

$$NCS_t = [1-(r_t+d_t)]NCS_{t-1} + GFCF_t \tag{1}$$

where r_t is retirement rate and d_t is depreciation for $t = 1...T$. Here NCS and $GFCF$ stands for Net Capital Stock and Gross Fixed Capital Formation respectively.

We can express (1) as a function of stock at the initial period $t = 1$ in the following way:

$$\begin{aligned} NCS_t &= (1-(r_t+d_t))NCS_{t-1} + GFCF_t \\ &= \sum_{j=2}^{T} GFCF_j \left[\prod_{s=j+1}^{T} (1-(r_s+d_s)) \right] + NCS_1 \prod_{i=2}^{T} (1-(r_i+d_i)) \end{aligned} \tag{2}$$

In order to calculate the EA capital stock series from equation (2) we have to estimate r_t, d_t and NCS_1 for the EA aggregate. The EA GFCF series are available at quarterly and annual frequency. There are two approaches that one can take in order to estimate EA capital stock – an "aggregate" approach (which was used in the past by ECB to estimate euro area capital stock) and a "bottom-up" approach (which is the enhancement in the estimation of euro area capital stock that this paper introduces). We will present the two approaches in the following sections.

[5] A detailed classification of economic activities is included in annex A4.

3.1 The "aggregate" approach for the estimation of euro area capital stock

The first approach tackles the estimation as an "aggregation" problem thus tying to estimate EA figures directly without using granularity on a MUMS level. The ECB implemented a similar approach in 2008 and used it until 2013 to estimate euro area capital stock estimates for the total economy including a breakdown by main asset type. The "aggregate" approach has several limiting assumptions. In order to estimate EA retirement and depreciation rates equation (1) is solved using the aggregated capital stock and gross fixed capital formation series from the MUMS reporting them. The estimated retirement and depreciation rates are assumed to hold for the capital stock aggregates for the EA. In order to calculate the initial net capital stock at $t=1$ it is assumed that for the block of reporting MUMS the 'GDP-to-capital stock' ratio at time $t=1$ is equal to the aggregate 'GDP-to-capital stock' ratio at time $t=1$ for the EA. In addition the sector breakdown of the EA fixed assets series is done using the shares reported by the eight reporting MUMS.

The shaded areas in Table 1 show the institutional sectors and non-financial assets for which EA estimates can be obtained based on the "aggregate" method under the assumptions listed above. As one can see there is no breakdown into institutional sectors for all fixed assets.

Estimates of euro area non-financial assets by asset type and institutional sector using the "aggregate" method. The shaded areas represent the available estimates for the euro area

Table 1

Institutional Sector / Produced Non-Financial Assets (NFA)	Total economy (S1)	Non-financial corporations (S11)	Financial corporations (S12)	General government (S13)	Households and NPISH (S1M)
Fixed assets (AN.11)					
Dwellings (AN.1111)					
Other buildings and structures (AN.1112)					
Machinery and equipment (AN.1113)					
Other produced assets (AN.111N)					

The ''aggregation" approach is not optimal since MUMS have very heterogeneous non-financial assets allocations and corresponding depreciations. The two most important enhancements of the "aggregate" method are the sectorisation of all produced assets using all available country data and the estimation of the granular capital stock data on country level which then could be used for the compilation of the EA figures.

3.2 The bottom-up approach for the estimation of euro area capital stock

In the below proposed bottom-up approach, we consider each of the 18 MUMS separately and thus work on country level. In this way the non-financial balance sheet for each individual MUMS is obtained, the euro area figures are compiled based on the country data (reported or estimated).

3.2.1 Optimization Model to Obtain Full Sector Breakdown by Asset Type

As noted previously the main goal of this paper is to obtain non-financial asset type classification by sectors and such breakdown of the annual non-financial assets is reported only by eight MUMS.

Let's call all MUMS that report capital stock by asset type and institutional sector the *available countries*. The *missing countries* do not report such cross-classifications, but only total capital stock by asset type. In addition, for all 18 MUMS we have GFCF by asset type and industry breakdown. The model presented below is a two-step procedure which compiles a full institutional sector breakdown for each asset type, for each of the MUMS. The main assumption is that countries that have very similar industry breakdowns would have also similar sector breakdowns.

In the first step of the estimation we use data from table 22 of the ESA TP to estimate a measure that indicates how close the industry breakdown of each missing country is to the industry breakdown of each of the available countries.

Let's denote the different asset types with $AN = \{AN11, AN1111, AN1112, AN1113, AN111N\}$.[6] Each asset type is decomposed into industries denoted with $V = \{VA, VB, VC, \ldots, VU\}$.[7] Let's denote the data from the available countries with X_j where $j \in J$ indicates the reporting countries and data from the missing countries with Z_i with $i \in I$ indexing missing countries. The set of all reporting countries is denoted with J and the set of all missing countries is denoted with I. Then for each missing country i the following constrained linear least-squares problem is defined:

$$\min_{\alpha_{ij}^{AN}} \frac{1}{2} \left\| \alpha_{ij}^{AN} \sum_{j}^{J} (X_j)_V^{AN} - (Z_i)_V^{AN} \right\|_2^2 \tag{3}$$

$$subject\ to \left| \begin{array}{ll} \forall i \in I & \sum_{j} \alpha_{ij}^{AN} = 1 \qquad (4) \\ \forall i \in I, \forall j \in J & 0 \le \alpha_{ij}^{AN} \le 1 \qquad (5) \end{array} \right.$$

The two constraints that are imposed are needed so that the estimated $\hat{\alpha}_{ij}^{AN}$'s serve as a weighting measure that shows the similarities of the activity classification

6 The notation that follows will be expressed in a matrix form, that is why the time dimension t will be dropped.

7 The lists with all possible asset, sector and industry breakdowns are included the annexes A.2, A.3 and A.4.

between any available country j and missing country i. Note that equation (3) holds for each missing country i and asset type AN. Once the $\hat{\alpha}_{ij}^{AN}$ are estimated we can use them as a universe measure that relates also to the similarities of the institutional sector breakdown of the different countries. Knowing the breakdown for the assets for the available countries j, we can estimate the institutional sector breakdown of the missing counties i. Note that the capital stock for the total economy by asset type is known for most of the MUMS and is obtained from table 20. The total economy capital stock by asset for the few MUMS not reporting these data is estimated and will be discussed later on.

Let's denote the set of institutional sectors with $S = \{S_1, S_{11}, S_{12}, S_{13}, S_{1M}\}$.[8] Then for each $j \in J$ and AN we know the shares $\left\{ \left(\frac{S_{11}}{S_1}\right)_j^{AN}, \left(\frac{S_{12}}{S_1}\right)_j^{AN}, \left(\frac{S_{13}}{S_1}\right)_j^{AN}, \left(\frac{S_{1M}}{S_1}\right)_j^{AN} \right\}$. This information is obtained from table 26. For each i and AN we know $(S_1)_i^{AN}$ which are retrieved from table 20 or estimated. We assume that the similarities between the industry breakdowns also hold for the institutional sector breakdowns. In this way we can estimate $\left\{ (\hat{S}_{11})_i^{AN}, (\hat{S}_{12})_i^{AN}, (\hat{S}_{13})_i^{AN}, (\hat{S}_{1M})_i^{AN} \right\}$ based on the similarities of the breakdowns by industry $\hat{\alpha}_{ij}^{AN}$. For each i and asset type AN the following shares hold

$$\left(\frac{\hat{S}_{11}}{S_1}\right)_i^{AN} = \left[\sum_j \hat{\alpha}_{ij}^{AN} \left(\frac{S_{11}}{S_1}\right)_j^{AN}\right] \tag{6}$$

$$\left(\frac{\hat{S}_{12}}{S_1}\right)_i^{AN} = \left[\sum_j \hat{\alpha}_{ij}^{AN} \left(\frac{S_{12}}{S_1}\right)_j^{AN}\right] \tag{7}$$

$$\left(\frac{\hat{S}_{13}}{S_1}\right)_i^{AN} = \left[\sum_j \hat{\alpha}_{ij}^{AN} \left(\frac{S_{13}}{S_1}\right)_j^{AN}\right] \tag{8}$$

$$\left(\frac{\hat{S}_{1M}}{S_1}\right)_i^{AN} = \left[\sum_j \hat{\alpha}_{ij}^{AN} \left(\frac{S_{1M}}{S_1}\right)_j^{AN}\right]. \tag{9}$$

In this way we obtain a weighting matrix that can breakdown asset types into different institutional sectors for all MUMS. Once the country breakdown is obtained the EA asset type by institutional sector is calculated as accumulation of all country specific breakdowns. In order to obtain the quarterly estimates for capital stock we use quarterly series on investment (available for all EA countries) to perform Chow-Lin (1971) temporal disaggregation of the annual capital stock.

[8] Note that S1 = S11 + S12 + S13 + S1M. Detailed sector classifications are included in the Annex A3.

3.2.2 Estimating Total Economy Fixed Assets for the Non-reporting MUMS

As mentioned earlier there are four MUMS (Spain, Greece, Portugal and Malta) for which there is no data on capital stock, these countries are neither present in table 20 nor in table 26. For such countries we can obtain the similarity index as described above since it is based on GFCF classification for which we have full data coverage. But at the same time we are lacking the total economy capital stock by asset in order to do the break down into institutional sectors. In order to estimate the completely missing series on capital stock for the total economy we will use the initial "aggregate" PIM methodology, with several modifications, and apply it to the four MUMS listed above.

For the calculation of initial capital stock for the missing countries we used the ratio between the accumulated consumption of fixed capital (K1) to the accumulated capital stock for the reporting countries. Knowing K1 for the missing countries and using the calculated ratio we generate initial capital stock for each of the missing countries. We chose 2005 as a starting year in our accumulation equation and we forecast and backcast capital stock to cover the period 1998 to2013. For each of the reporting countries the retirement and depreciation rates were calculated using the PIM equation. For the missing countries the rates of the most "similar" reporting countries were taken into account. The similarity in gross fixed capital formation between countries was calculated using the Brey-Curtis distance[9].

A detailed sensitivity analysis on the selection of initial year of capital stock and the use of different retirement and depreciation rates is presented in the next section.

4. Results

4.1 The Enhanced Capital Stock Estimates for the Euro Area

In this section we present the results for the aggregated EA non-financial asset estimates. All of the series are at current prices. The result presented in this section cover the period from 1998 to 2013. Figure 1 displays the estimated capital stock by asset types broken down into institutional sectors. Figure 2 shows the asset composition for each sector. The new estimation allows for calculation of the sector breakdown for all types of the assets. In addition figure 3 shows the share distribution for the sectors for each of the asset groups.

As it can be seen from figures 1 to 3 the biggest portion of the fixed assets is owned by households and NPISH (on average around 42%) followed by the non-financial corporations (NFCs) (on average around 39%). The same order of the contributions of institutional sectors shares is observed for dwellings (on average around 85% for households and 13% for NFCs). As expected the largest shares for

[9] The index is composed based on country investment data for each non-financial asset. A detailed description is included in Annex A6. The Brey-Curtis measure is usually used to compare countries based on their trade structure.

other buildings are observed for NFCs and government, followed by households and financial corporations. Machinery and equipment is mostly build up by NFCs, with very small portions attributed to the other three sectors. Similar is the allocation of sectors' shares for the other produced assets.

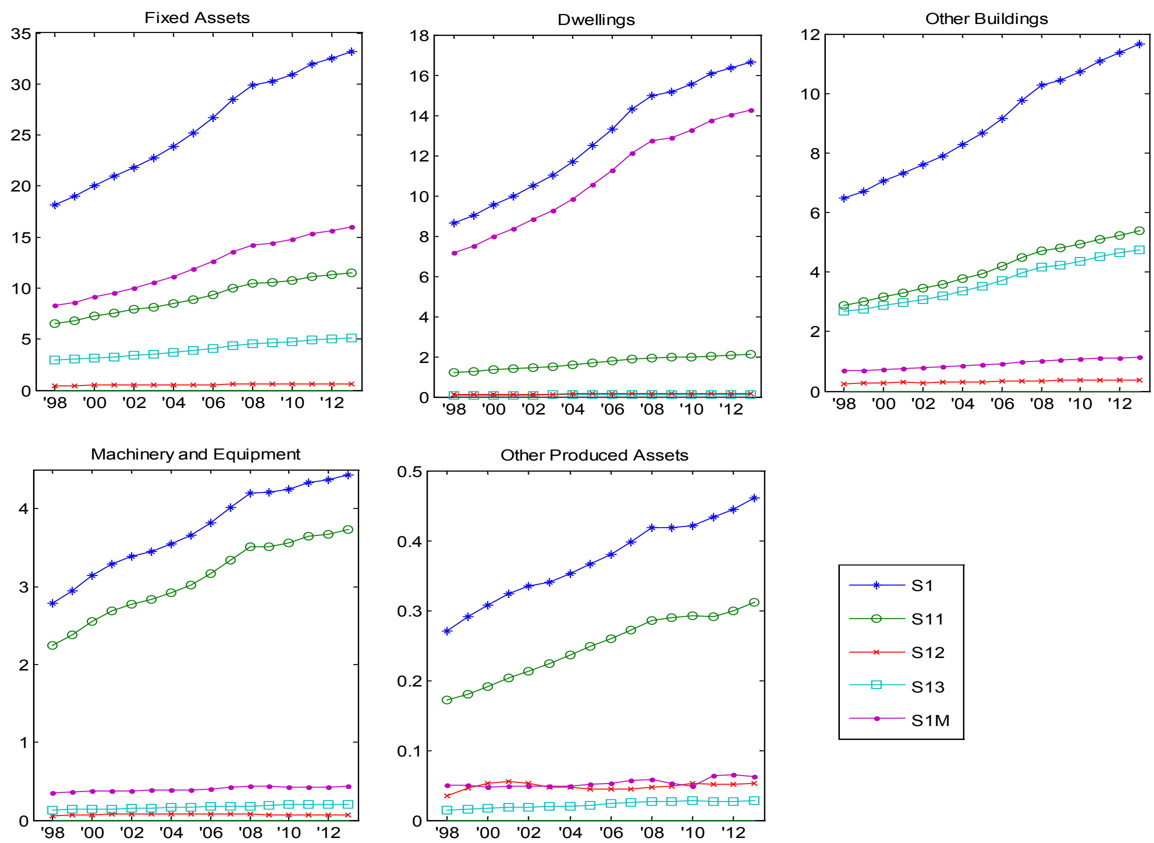
The proposed estimation method allows us to analyse the sector allocation of capital stock broken down into assets (see figure 2). The highest portion of total economy fixed assets is composed by the dwellings asset, which also applies to the households sector. On the other hand for the remaining three sectors (NFCs, general government, and financial corporations) the biggest contribution of capital stock is by other-buildings, followed by dwellings, machinery and other produced assets.

As it can be seen from figures 1 and 2 the time series are pretty stable with one exception. There is a slight fluctuation in capital stock for almost all of the series after 2008 which is due to the effect of the financial crisis. This is confirmed by figure 4, where the growth rates of the capital stock for the different sectors are displayed.

The biggest drop in growth rates in 2009 relative to 2007 occurred for the households sector. The growth rate of this sector shrank from 0.074 in 2007 to 0.012 in 2009 that is around 0.06 points in absolute terms.

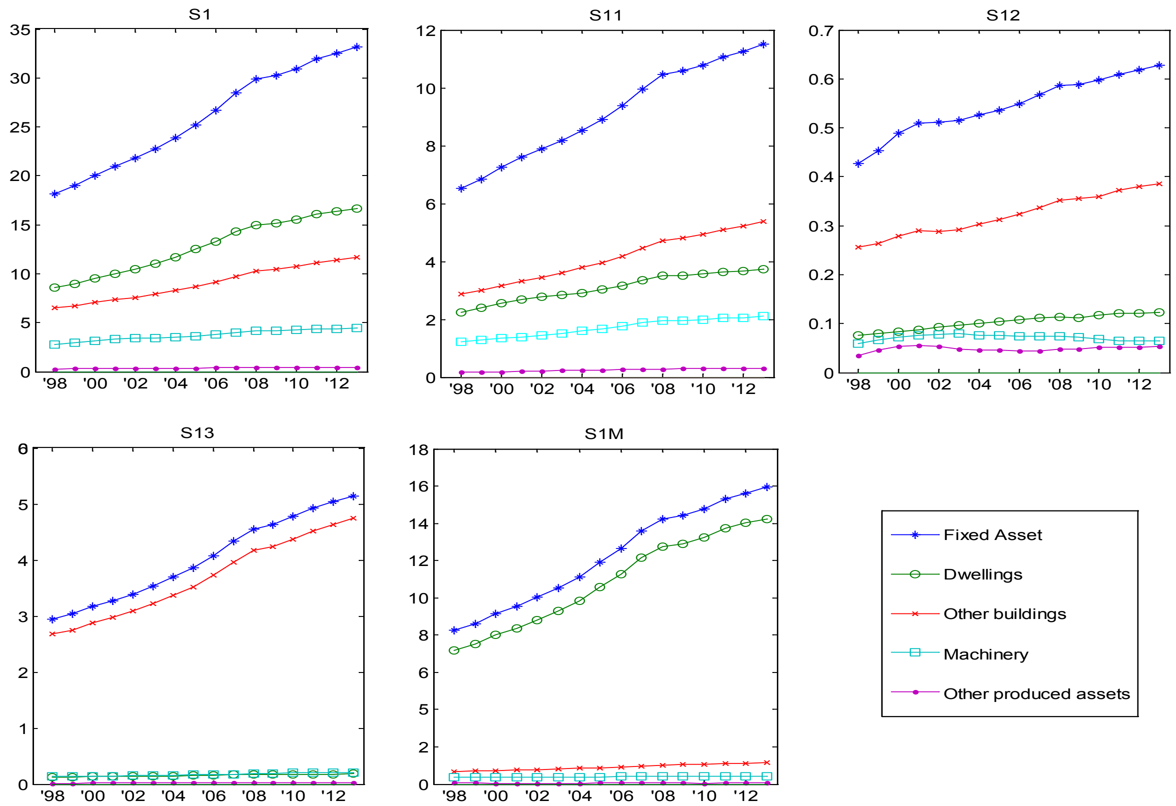
Net capital stock in current prices (levels, 1000 billions of euros) grouped by assets

Figure 1



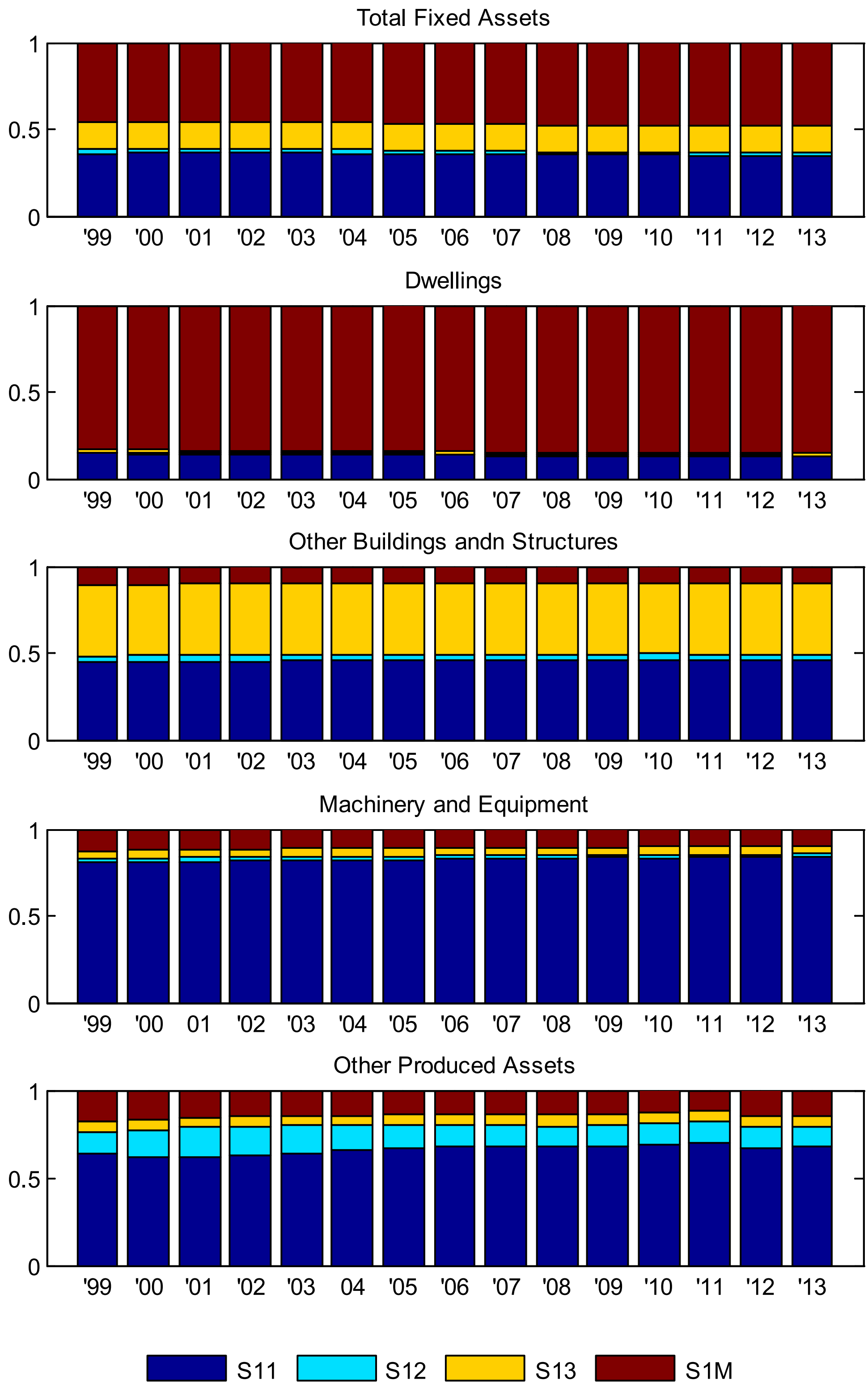
Net capital stock in current prices (levels, 1000 billions of euros) grouped by sectors

Figure 2



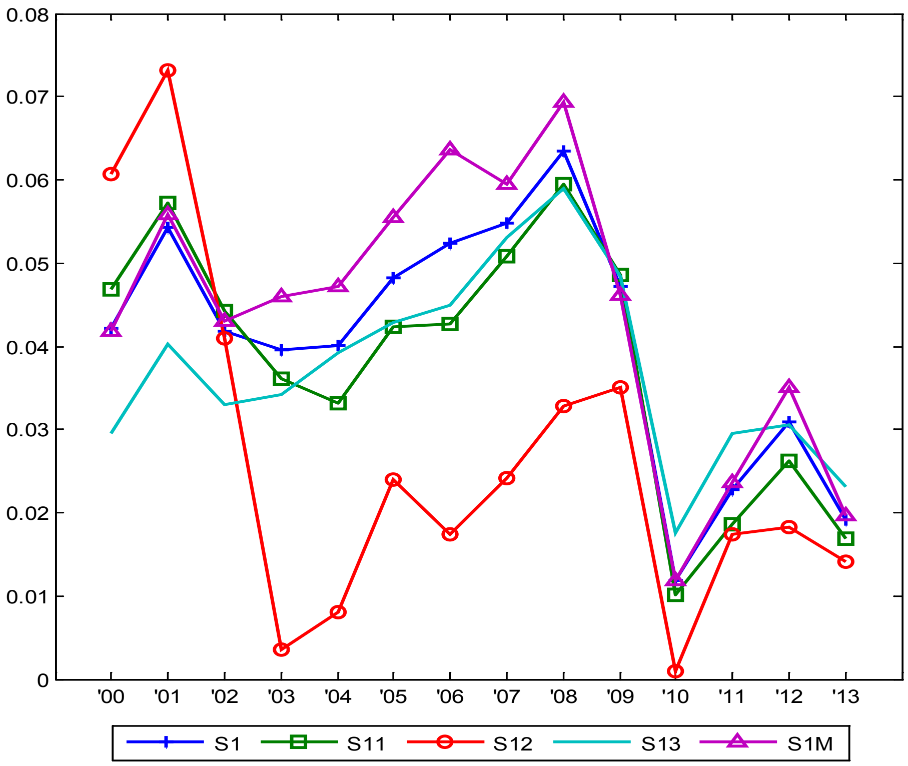
Shares of asset type capital stock into sectors

Figure 3



Fixed assets net capital stock in current prices (annual growth rates) grouped by sectors

Figure 4



In comparison the growth rate of capital stock for the financial corporation sector shrank from 0.035 in 2007 to 0.001 in 2009, which is around 0.03 points in absolute terms. The drop in the financial corporation's sector between 2000–2002 is explained by the stock market downturn in 2002, the so called dot-com bubble bursting.

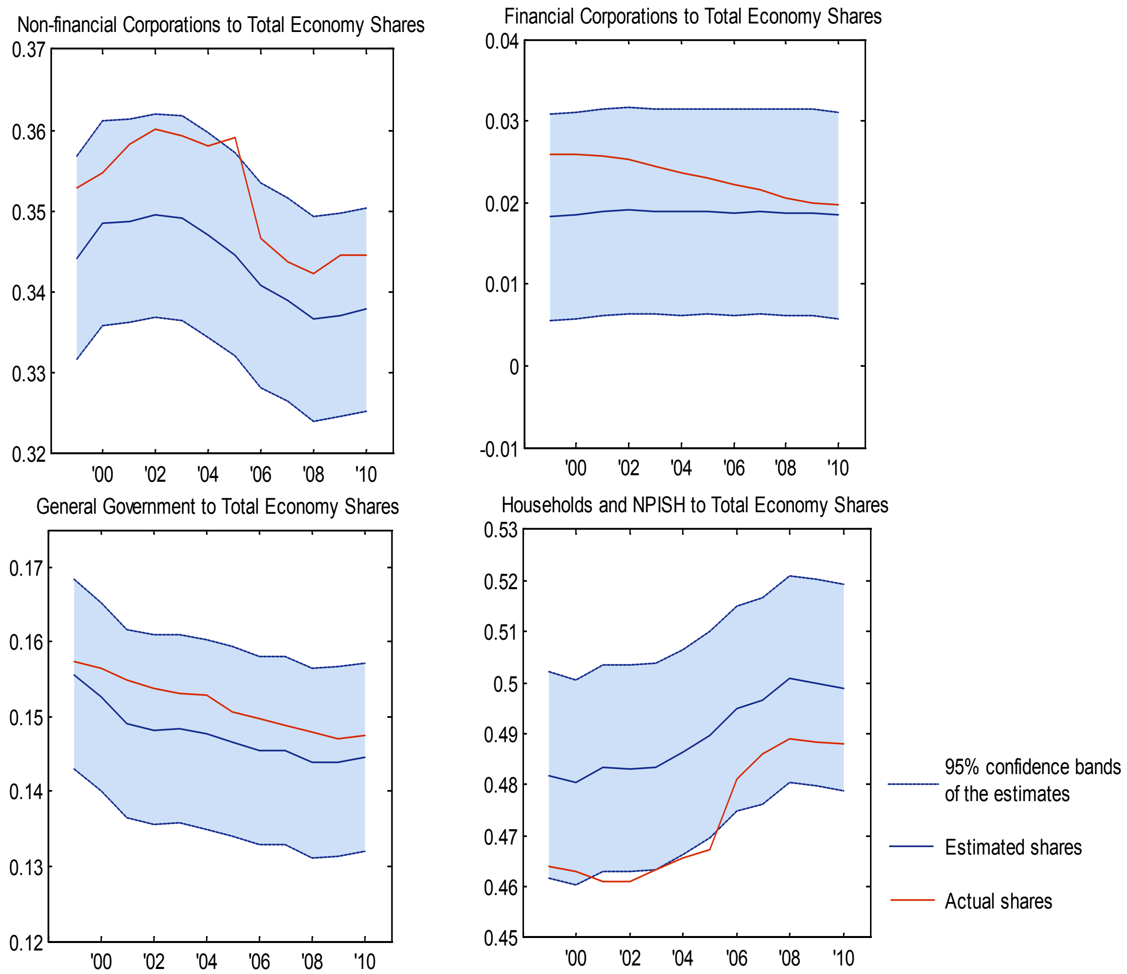
4.2 Robustness checks

In this section we will discuss some of the assumptions implied earlier. First we will test the robustness of the presented optimization model, next we will examine the PIM assumptions introduced in 3.2.2.

In order to make sure that the new model estimates correctly the shares of the different sectors with respect to the total economy stock, we performed the following experiment. For each of the MUMS for which we have an institutional sector breakdown for the fixed assets we tried to estimate this break down (countries that were considered include Germany, the Netherlands France, Finland, Austria, Latvia, Luxembourg and Slovenia). In a recursive exercise for each of the listed countries we estimated institutional sector breakdowns based on the remaining seven countries using the proposed model from 3.2.1. Figure 5 displays the results of the estimated and the actual shares along with the 0.95 percent confidence intervals of the accumulated estimates for the above countries. It can be seen that in a majority of the cases the actual shares lie within the confidence intervals of the estimates, which confirms that following the proposed method one can estimate reliable institutional sector breakdown of the EA aggregate.

The PIM assumptions that were presented in the methodology section 3.2.2 are also tested in order to obtain the most accurate capital stock estimate. As stated earlier the year 2005 was chosen as initial year of the PIM from where we forecasted and backcasted capital stock. Then the ratio consumption of fixed capital to fixed assets from reporting MUMS was used to estimate initial capital stock for missing MUMS.

Sector shares relative to the total economy for the net capital stock of fixed assets
Figure 5



In order to justify these assumptions we evaluated different methods to generate initial capital stock in different starting years. We considered the MUMS for which we have data and tried to estimate initial stock for each one of them on the basis of the rest of the available stock. We then generated the accumulated stock estimates for the available MUMS and calculated the Root Mean Square Error (RMSE) of the forecast at each initial year relative to the actual stock values. Table 2 present the results. It can be concluded that the best method to generate initial stock is to use the consumption of fixed capital to capital stock ratio for 2005. The poorly performing alternative methods considered different functions of investment or GDP to capital stock ratios.

RMSE of capital stock estimates of reporting countries. The three minimum values are indicated with stars. GDP=gross domestic product, CS=capital stock, I=GFCF, K1=consumption of fixed capital

Table 2

	Method				
Year	GDP/CS	I/CS	sum(I)/CS	sum(I-K1)/CS	K1/CS
1998	0.0380	0.0545	0.0205	0.0446	0.0572
1999	0.0389	0.0413	0.0364	0.0271	0.0367
2000	0.0034	0.0028	0.0065	0.0120	0.0029
2001	0.0029	0.0036	0.0056	0.0124	0.0025
2002	0.0027	0.0039	0.0048	0.0127	0.0023
2003	0.0025	0.0040	0.0041	0.0126	0.0022***
2004	0.0025	0.0034	0.0030	0.0136	0.0019**
2005	0.0025	0.0037	0.0026	0.0134	0.0018*
2006	0.0026	0.0037	0.0027	0.0131	0.0024
2007	0.0027	0.0041	0.0026	0.0127	0.0024
2008	0.0028	0.0043	0.0025	0.0129	0.0027
2009	0.0384	0.0270	0.0419	0.0096	0.0454
2010	0.0418	0.0371	0.0311	0.0129	0.0536
2011	0.0395	0.0285	0.0456	0.0426	0.0529
2012	0.4330	0.4810	0.1011	0.1218	0.0920

Brey-Curtis similarity distance between missing countries and reporting countries. The stared distances are the minimum distance measures indicating similarity between the missing and reporting countries

Table 3

	Missing countries			
Reporting countries	Spain	Portugal	Greece	Malta
Italy	0.157	0.152*	0.202	0.143*
Slovakia	0.329	0.284	0.340	0.307
Estonia	0.179	0.166	0.196	0.164
Belgium	0.168	0.189	0.219	0.173
Cyprus	0.110*	0.158	0.140*	0.190
Austria	0.167	0.172	0.195	0.189
The Netherlands	0.143	0.161	0.142	0.211
Slovenia	0.221	0.164	0.242	0.201
Finland	0.202	0.210	0.224	0.230
Germany	0.201	0.223	0.271	0.177
France	0.161	0.185	0.209	0.214
Ireland	0.252	0.194	0.200	0.286

Once the initial capital stock is estimated for the non-reporting MUMS we have to choose retirement and depreciation rates that enter the accumulation equations. We use the Brey-Curtis distance measure to compare the distribution of investment within industries between all countries. Table 3 present results. The lower score indicates stronger similarity which means that the retirement and depreciation rates between the countries with low scores should be similar. We followed the results from table 3 and for Spain and Greece we used the retirement and depreciation rates from Cyprus, for Portugal and Malta we used the rates from Italy.

4.3 The Enhanced Capital Stock Estimates' Relevance to Monetary Policy

In this section we discuss on the importance of capital stock figures as building element of housing wealth and its relevance to monetary policy. Maintaining price stability is the main goal of monetary policy which is achieved through the reactions of households and non-financial corporations sectors to Central Banks' monetary policy initiatives (Bull, 2013). Monitoring developments in these sectors, and across MUMS, is therefore of key interest and balance sheet information, including non-financial assets, contributes to the quality and range of sector analysis.

Also, wealth is an important variable in many respects, one of them being the possible link to household consumption (see for example Baker (2011), Kerdrain (2011), Sousa (2009), Skudelny (2009)). First, economic agents could use part of their accumulated assets to finance current consumption expenditure. Second, wealth could be used as collateral to borrow against. In particular households can offer non-financial wealth (housing) as collateral, which would ease their access to credit in case credit supply is constrained.

Households' net worth (National Accounts terms for household wealth) is calculated as the sum of financial assets (+), non-financial assets (+) and financial liabilities (–), thus measures the excess of households' assets over households' liabilities. A time series presentation of households' net worth provides balance sheet strengths (or weaknesses) of households at given points in time. In turn, it shows the impact of transactions and price changes on the stocks of households' assets and liabilities.

In general, statistics on stocks of financial assets and liabilities are more common than those on non-financial assets, more in particular statistics on housing wealth, mainly because they are reported on a voluntary basis or with a generous timeliness. To arrive at housing wealth, one should complement the estimates on dwellings with the value of land underlying the dwelling. Usually land is estimated using administrated data or surveys. Alternatively land can be estimated as residual of households' housing wealth (HHW) and households' dwelling stock. In the current estimates we use available national data on HHW to calculate the average ratio of net HHW over net dwelling stock. [10] This ratio is subsequently used to

[10] Official series up to 2012 (except Spain: 2013) are published for Germany, France, Italy, Spain, the Netherlands and Belgium. In addition, figures for Greece, up to 2001, were taken from the "Monetary Policy Report" of the Bank of Greece, November 2002, provisional estimates for 2002–2005 were provided by Bank of Greece, data after 2005 was estimated by extrapolation using residential property prices and housing investment.

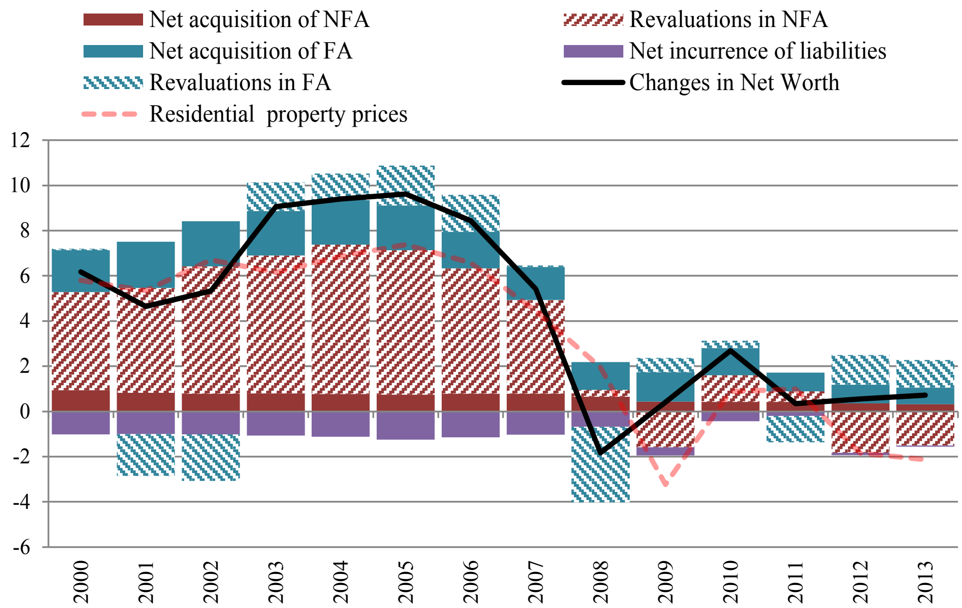
estimate HHW for non-reporting MUMS. Next, the EA HHW is estimated as aggregate of the reported MUMS HHW and the estimated ones.

Annex A.6 shows households' wealth in the euro area, broken down by type of asset. Non-financial assets are by far the largest component (60%) of gross wealth (sum of financial and non- financial assets) and accounted for most of the marked pre-crisis growth (2000–2007). The importance increased significantly since 2000, mainly due to increasing property prices.

This also becomes clear from Figure 6, which decomposes growth of euro area households' net worth into household transactions and valuation changes. Valuation changes (or holding gains and losses) account for most of the changes in households' net worth, notably those of non-financial assets. However, holding losses, reflecting negative stock price developments, contributed significantly to the marked deceleration and fall of households' net worth in 2008, leading the price fall of non-financial assets (e.g. houses) in 2009. Net acquisitions of assets and incurrence of liabilities provide a fairly stable, though modest contribution. From 2007 onward the growth of net incurrence of liabilities decelerates, reflecting the deleveraging process of euro area households.

Household wealth is unevenly distributed among MUMS and its developments are quite heterogeneous across countries (see Annex A.7 and Figure 7). This implicates that a single euro area (monetary) policy may have different impact on euro area economies. Annex A.7 shows the main wealth characteristics for Germany, France, Italy, Spain, the Netherlands and Greece. Figure 7 shows the developments of net worth, financial and non-financial assets and financial liabilities in EA and selected countries from 2000 onward. The housing boom-bust cycle is clearly observed for Spain, Greece and the Netherlands, pushing down their non-financial wealth to pre-crisis levels. Developments of financial assets are less dispersed, as their prices (valuation changes) follow general market trends that are mostly determined at euro area, and more likely, even global levels, rather than within a single country.

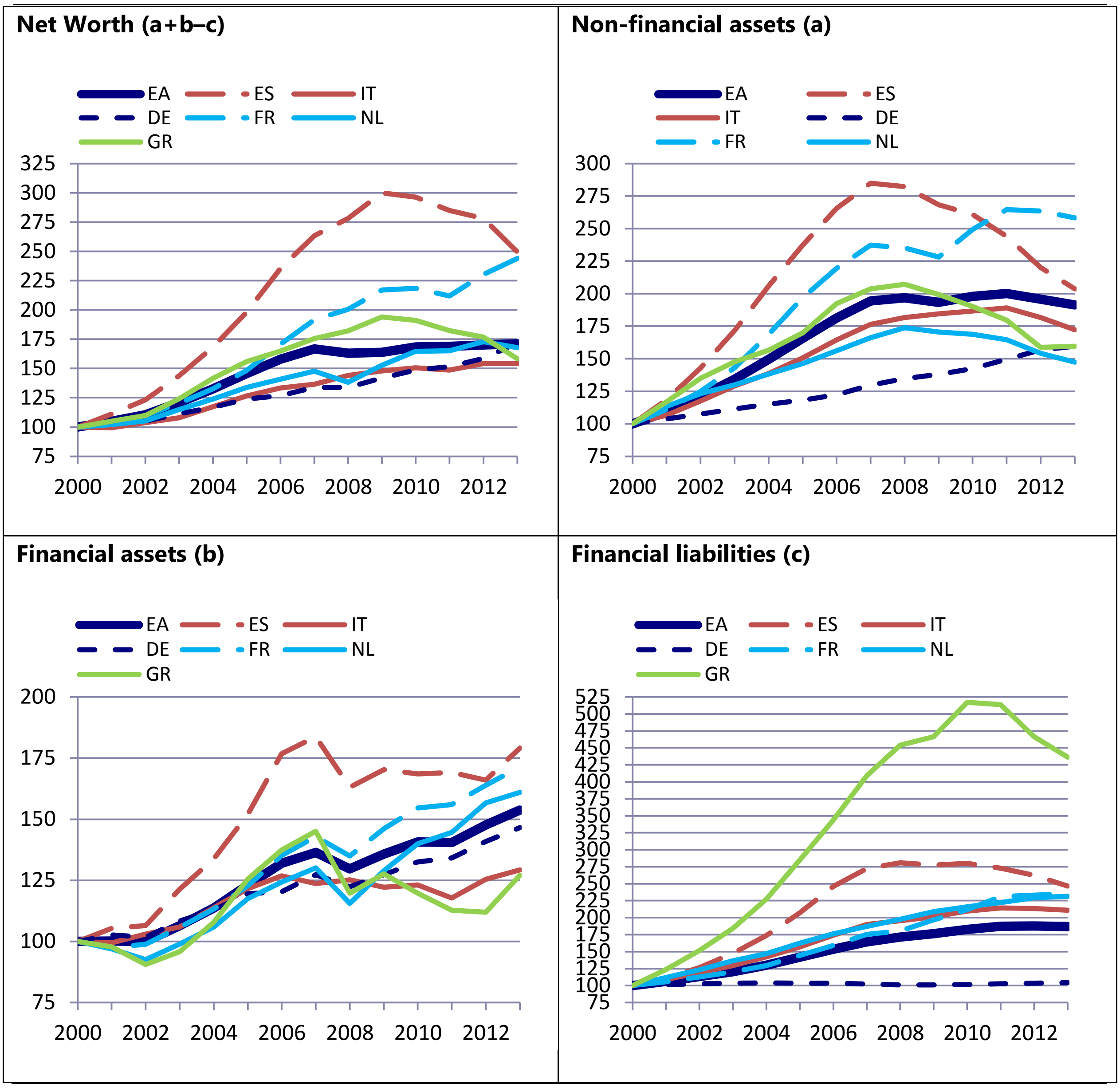
Growth of Euro Area households' net worth and contributions by asset type — Figure 6



Developments of households' net worth and its components in the euro are and selected countries

(index number: 2000=100)

Figure 7



5. Conclusion

Contrary to data on financial assets, official euro area wide statistics on non-financial assets by asset types and sectors are neither yet available nor with a feasible timeliness, but very useful for economic and financial stability analysis, since they complete sectors' balance sheets. This paper proposes a constrained optimization model with the help of which a full cross-sector classification of capital stock can be estimated. The model is applied for the estimation of capital stock by institutional sector, including households' non-financial asset type and households' housing wealth both for the euro area and euro area Member States currently not estimating and/or publishing such data.

Annex

A.1: Data availability tables 20, 22 and 26 of the ESA95 Transmission Programme

Table 20 Availability by type of non-financial assets

GEO	AN11	AN1111	AN1112	AN1113	AN111N
Belgium	2000-2012	2000-2012	2000-2012	2000-2012	2000-2012
Germany	2000-2011	2000-2011	2000-2011	2000-2011	2000-2011
Estonia*	2000-2011	2000-2011	2000-2011	2000-2011	2000-2011
Ireland	2000-2011	2000-2011	2000-2011	2000-2011	2000-2011
Greece	X	X	X	X	X
Spain	X	X	X	X	X
France	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Italy	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Cyprus*	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Latvia	2007-2010	2007-2010	2007-2010	2007-2009	2007-2010
Luxembourg	1998-2011	1998-2011	1998-2011	1998-2011	1998-2011
Malta	X	X	X	X	X
Netherlands	2000-2012	2000-2012	2000-2012	2000-2012	2000-2012
Austria	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Portugal**	2005	2005	2005	2005	2005
Slovenia	2000-2011	2000-2011	2000-2011	2000-2011	2000-2011
Slovakia	2004-2012	2004-2012	2004-2012	2004-2012	2004-2012
Finland	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012

*Some figures are missing for 2011

** Total NACE only

Table 22 Availability by type of non-financial assets

GEO	AN11	AN1111	AN1112	AN1113	AN111N
Belgium	1998-2013	1998-2012	1998-2013	1998-2013	1998-2013
Germany	1998-2013	1998-2013	1998-2013	1998-2012	1998-2013
Estonia	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Ireland	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Greece	2000-2013	2000-2013	2000-2013	2000-2013	2000-2013
Spain	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
France	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Italy	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Cyprus	1998-2013	1998-2013	1998-2013	1998-2012	1998-2012
Latvia	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Luxembourg	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Malta	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Netherlands	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Austria	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Portugal	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Slovenia	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Slovakia	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013
Finland	1998-2013	1998-2013	1998-2013	1998-2013	1998-2013

Table 26 Availability by type of non-financial assets

GEO	AN11	AN1111	AN1112	AN1113	AN111N
Germany	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Estonia	X	2000-2011	X	X	X
France	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Italy	X	1998-2012	X	X	X
Cyprus*	X	1998-2011	X	X	X
Latvia	2000-2010	2007-2010	2007-2010	2007-2010	2000-2010
Luxembourg	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Netherlands	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Austria	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012
Slovenia	2000-2011	2000-2011	2000-2011	2000-2011	2000-2011
Slovakia	X	1998-2012	X	X	X
Finland	1998-2012	1998-2012	1998-2012	1998-2012	1998-2012

*sector allocation only available for AN1111

A.2 Non-financial assets classification

AN.1	Produced Assets
AN.11	Fixed assets
AN.111	Tangible fixed assets
AN.1111	Dwellings
AN.1112	Other buildings and structures
AN.11121	Non-residential buildings
AN.11122	Other structures
AN.1113	Machinery and equipment
AN.11131	Transport equipment
AN.11132	Other machinery and equipment
AN.1114	Cultivated assets
AN.11141	Livestock for breeding, dairy, draught, etc.
AN.11142	Vineyards, orchards and other plantations of trees yielding repeat products
AN.112	Intangible fixed assets
AN.1121	Mineral exploration
AN.1122	Computer software
AN.1123	Entertainment, literary or artistic originals
AN.1129	Other intangible fixed assets
AN.111N	Cultivated assets plus intangible fixed assets (N1114 + N112)
AN.12	Inventories
AN.121	Materials and supplies
AN.122	Work in progress
AN.1221	Work in progress on cultivated assets
AN.1222	Other work in progress
AN.123	Finished goods
AN.124	Goods for resale
AN.13	Valuables
AN.131	Precious metals and stones
AN.132	Antiques and other art objects
AN.139	Other valuables

A.3 Sector classification

S1	Total economy
S11	Non-financial corporations
S12	Financial corporations
S13	General government
S1M	Households and NPISH

A.4 Economic activity classification

V	Total
VA	Agriculture, forestry and fishing
VB	Mining and quarrying
VC	Manufacturing
VD	Electricity, gas, steam and air conditioning supply
VE	Water supply, sewerage, waste management and remediation activities
VF	Construction
VG	Wholesale and retail trade; repair of motor vehicles and motorcycles
VI	Accommodation and service activities
VH	Transportation and storage
VJ	Information and communication
VK	Financial and insurance activities
VL	Real estate activities
VM	Professional, scientific and technical activities
VN	Administrative and support service activities
VO	Public administration and defence; compulsory social security
VP	Education
VQ	Human health and social work activities
VR	Arts, entertainment and recreation
VS	Other service activities
VT	Activities of households as employers; undifferentiated goods- and service-producing activities of households for own use
VU	Activities of extraterritorial organisations and bodies

A.5 Bray Curtis distance measure

Bray-Curtis distance measure used usually to measure similarity between countries' trade structures, here it is used for comparing investment structures. We will follow the same notation as in 3.2.2. The index measures the distance between two countries investment composition for certain asset using its industry shares (Data source Table 22). Mets denote with $(R_i)^{AN}_{Y}$ the investment ratio of industry V in asset AN for country i relative to the total investment in this asset. Thus the Bray-Curtis distance measure between countries i and j can be written as:

$$\beta_{ij}^{N} = \frac{\sum_{V} \left| (R_i)_V^{AN} - (R_j)_V^{AN} \right|}{\sum_{V} \left[(R_i)_V^{AN} + (R_j)_V^{AN} \right]}$$

Lower values indicate shorter distance thus greater similarity.

A.6 Households’ net worth in the euro area (2000–2013)

Wealth component	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	*2000-07 average*	*2007-1 averag*
								Amounts *(€ bln, current prices)*								
Financial assets (a)	13445	13466	13438	14312	15275	16533	17733	18330	17429	18249	18935	18879	19751	20538		
Non-financial assets (b)	15483	16860	18557	20475	22713	25080	27382	29328	29726	29254	29907	30280	29659	29152		
of w hich: housing w ealth	14336	15681	17348	19232	21423	23750	25994	27868	28203	27727	28370	28696	28055	27435		
Gross w ealth (a+b)	28928	30326	31995	34787	37987	41613	45115	47658	47155	47503	48842	49159	49410	49690		
Liabilities (c)	3683	3907	4168	4438	4784	5216	5647	6050	6311	6492	6729	6901	6921	6895		
Net w orth (a+b-c)	25245	26419	27826	30349	33203	36397	39468	41608	40844	41011	42113	42257	42489	42795		
Net worth as a % of disposable income	*589%*	*592%*	*593%*	*625%*	*662%*	*700%*	*734%*	*743%*	*699%*	*679%*	*700%*	*695%*	*684%*	*686%*		
Net worth per capita (1000 euro)	*80.5*	*83.9*	*88.0*	*95.5*	*103.8*	*113.1*	*121.9*	*127.8*	*124.7*	*124.6*	*127.5*	*127.6*	*127.9*	*128.5*		
								Wealth composition *(as a percent of total gross wealth)*								
Financial assets (a)	46.5	44.4	42.0	41.1	40.2	39.7	39.3	38.5	37.0	38.4	38.8	38.4	40.0	41.3		
Non-financial assets (b)	53.5	55.6	58.0	58.9	59.8	60.3	60.7	61.5	63.0	61.6	61.2	61.6	60.0	58.7		
of w hich: housing w ealth	49.6	51.7	54.2	55.3	56.4	57.1	57.6	58.5	59.8	58.4	58.1	58.4	56.8	55.2		
Gross w ealth (a+b)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
Liabilities to gross w ealth	12.7	12.9	13.0	12.8	12.6	12.5	12.5	12.7	13.4	13.7	13.8	14.0	14.0	13.9		
								Annual growth *(year on year percentage change)*								
Financial assets	3.5	0.2	-0.2	6.5	6.7	8.2	7.3	3.4	-4.9	4.7	3.8	-0.3	4.6	4.0	*4.5*	*2.*
Non-financial assets	8.8	8.9	10.1	10.3	10.9	10.4	9.2	7.1	1.4	-1.6	2.2	1.2	-2.1	-1.7	*9.6*	*-0.*
of w hich: housing w ealth	9.3	9.4	10.6	10.9	11.4	10.9	9.4	7.2	1.2	-1.7	2.3	1.1	-2.2	-2.2	*10.0*	*-0.*
Gross w ealth	6.3	4.8	5.5	8.7	9.2	9.5	8.4	5.6	-1.1	0.7	2.8	0.6	0.5	0.6	*7.4*	*0.*
Liabilities	6.9	6.1	6.7	6.5	7.8	9.0	8.3	7.1	4.3	2.9	3.6	2.6	0.3	-0.4	*7.3*	*2.*
Net w orth	6.2	4.6	5.3	9.1	9.4	9.6	8.4	5.4	-1.8	0.4	2.7	0.3	0.5	0.7	*7.4*	*0.*

A.7 Households key indicators by country (2000–2013)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
% Contribution to euro area net worth														
Germany	25%	25%	24%	23%	23%	22%	21%	20%	20%	20%	21%	21%	22%	23%
France	19%	19%	19%	20%	20%	21%	22%	22%	22%	22%	22%	23%	24%	24%
The Netherlands	7%	7%	7%	7%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Italy	22%	22%	21%	21%	21%	20%	20%	20%	19%	20%	20%	19%	19%	19%
Spain	11%	11%	12%	13%	14%	15%	16%	16%	17%	16%	16%	15%	14%	13%
Greece	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	2%	2%
Net worth as a % of HGDI														
Germany	446	445	446	461	473	486	488	514	503	523	528	527	542	547
France	518	513	527	575	627	691	732	745	698	693	733	738	743	741
The Netherlands	809	748	724	760	793	838	859	864	802	848	871	858	873	873
Italy	663	643	657	674	697	726	745	736	738	754	757	728	737	717
Spain	663	710	764	844	927	982	1030	1023	917	885	884	840	794	791
Greece	698	729	755	749	752	775	797	759	717	702	706	712	719	818
Net worth per capita (1000 euro)														
Germany	75.4	77.8	78.8	83.1	86.7	91.1	93.6	100.5	101.3	105.3	109.7	113.6	119.5	122.9
France	80.3	83.1	88.6	98.4	111.3	125.4	137.9	146.6	141.2	140.4	150.7	155.2	156.9	157.2
The Netherlands	112.8	114.0	112.5	117.6	124.6	134.0	141.2	148.1	138.2	143.9	149.1	148.6	150.4	151.1
Italy	96.3	98.5	104.6	109.9	116.6	124.3	131.4	133.2	135.0	133.5	134.4	131.5	130.4	126.8
Spain	69.4	78.4	88.4	102.9	118.6	133.2	147.2	153.0	144.3	139.0	134.8	127.9	117.4	116.7
Greece	64.8	71.2	77.0	82.8	88.0	95.5	106.2	111.0	106.0	104.0	97.2	91.6	83.6	85.5
Share of housing wealth in gross wealth														
Germany	48%	49%	50%	49%	49%	49%	49%	49%	51%	51%	51%	51%	51%	51%
France	50%	53%	56%	58%	60%	62%	62%	63%	64%	61%	62%	63%	62%	60%
The Netherlands	32%	37%	42%	43%	42%	41%	41%	42%	46%	46%	44%	43%	41%	38%
Italy	45%	47%	48%	50%	50%	50%	51%	54%	54%	55%	55%	56%	54%	53%
Spain	64%	67%	71%	72%	73%	74%	73%	74%	75%	74%	73%	72%	70%	66%
Greece	66%	70%	74%	75%	74%	73%	73%	73%	77%	75%	75%	75%	73%	71%
Share of debt (liabilities) in gross wealth														
Germany	20%	19%	19%	19%	18%	17%	17%	16%	16%	15%	15%	14%	14%	14%
France	11%	11%	11%	11%	10%	10%	10%	10%	11%	12%	12%	13%	12%	12%
The Netherlands	17%	18%	20%	21%	21%	21%	22%	22%	24%	24%	24%	25%	25%	25%
Italy	7%	8%	8%	8%	8%	9%	9%	9%	10%	10%	10%	10%	10%	11%
Spain	11%	11%	11%	10%	11%	11%	12%	12%	13%	13%	13%	14%	14%	14%
Greece	4%	4%	5%	6%	6%	7%	8%	9%	10%	11%	12%	13%	13%	12%
Households' savings ratio														
Germany	15%	15%	16%	16%	16%	16%	16%	17%	17%	17%	17%	16%	16%	16%
France	14%	15%	16%	15%	15%	14%	15%	15%	15%	16%	16%	16%	15%	15%
The Netherlands	12%	15%	14%	13%	13%	12%	12%	13%	12%	12%	10%	12%	11%	11%
Italy	14%	16%	17%	16%	17%	16%	16%	15%	15%	14%	12%	12%	12%	13%
Spain	11%	11%	11%	12%	11%	11%	10%	10%	14%	18%	14%	13%	10%	10%
Greece	3%	2%	0%	1%	1%	5%	5%	8%	2%	3%	-2%	-4%	-5%	0%

References

Baker, D. (2011) The End of Loser Liberalism; Making Markets Progressive, Center for Economic and Policy Research: Washington, DC.

Barnhart, S.W., and E.M. Miller (1990): Problems in the Estimation of Equations Containing Perpetual Inventory Measured Capital. *Journal of Macroeconomics*, 12, 637–651.

Biorn, E., R. Golombek, and A. Raknerud (1998): Environmental regulations and plant exit. A Logit analysis based on establishment panel data. *Environmental and Resource Economics*, 11, 35–59.

Bughin, J. (1993): Union-firm bargaining and test of oligopolistic conduct. *Review of Economics and Statistics*, 75, 563–567.

Bull, P. (2013) *Statistics for economic and monetary union; enhancements and new directions*, 2003–2012, European Central Bank, Frankfurt am Main, Frankfurt am Main.

Chow, G. and Lin, A.L. (1971): Best linear unbiased distribution and extrapolation of economic time series by related series, *Review of Economic and Statistics*, vol. 53, n. 4, p. 372–375.

Costa, P. and Marangoni, G. (1995): Productive capital in Italy: a disaggregated estimate by sectors of origin and destination:1985–1988, *The Review of Income and Wealth*, 4, 439–58.

Diewert, W. and Schreyer, P. (2006): The measurement of capital, draft entry to the New Palgrave Dictionary of Economics.

Eurostat (1996): *European system of accounts – ESA95*, Office for Official Publications of the European Communities, Luxembourg.

Eurostat (2011): Compilation on sectoral balance sheets for non-financial assets, ECB/Eurostat Task Force on Quarterly European Accounts for Institutional Sectors, TF-QSA-JUN11-8a.

Hahn, F. and Schmoranz, I. (1984): Estimates of capital stock by industries for Austria, *The Review of Income and Wealth*, 30, 289–307.

Hulten, C. R. (1990): The measurement of capital, in: Fifty years of economic measurement, E.R.

Berndt and J.E. Triplett (eds.), Chicago: Chicago University Press.

Jorgenson, D. (1963): Capital theory and investment behavior, *American Economic Review,* 3, 247–59.

Jorgenson, D. (1989): Capital as a factor of production, Technology and Capital Formation, D.W. Jorgenson and R. Landau (eds.), Cambridge: The MIT Press.

Jorgenson, D. and Christensen, L. (1969): The measurement of U.S. real capital input, *Review of Income and Wealth,* 15, 293–320.

Jorgenson, D. and Griliches, Z. (1967): The explanation of productivity change, *Review of Economic Studies,* 34, 349–83.

Kerdrain, C. (2011), "How Important is Wealth for Explaining Household Consumption Over the Recent Crisis?: An Empirical Study for the United States, Japan and the Euro Area", OECD Economics Department Working Papers, No. 869, OECD Publishing.

Lindquist, K.-G. (1995): The existence of factor substitution in the primary aluminium Industry: A multivariate error-correction approach using Norwegian panel data. *Empirical Economics*, 20, 361–383.

Lock, J. D. (1985): Measuring the value of the capital stock by direct observation, *The Review of Income and Wealth*, 31, 127–38.

Miller, E.M. (1983): Capital Aggregation in the Presence of Obsolescence-Inducing Technical Change. *Review of Income and Wealth*, 29, 283–296.

Ohanian, N.K. (1994): Vertical integration in the U.S. pulp and paper industry, 1900–1940. *Review of Economics and Statistics*, 76, 202–207.

Reynolds, S.S. (1986): Strategic capital investment in the American aluminium industry. *Journal of Industrial Economics*, 34, 225–245.

OECD (2001): OECD Manual-measuring capital: Measurement of capital stocks, consumption of fixed capital and capital services, Organization for Economic Cooperation and Development, OECD Publications, Paris.

OECD (2009): Measuring Capital: OECD Manual, Organization for Economic Cooperation and Development, OECD Publications, Paris.

Skudelny, F. (2009), Euro Area Private Consumption: Is there a role for housing wealth effect?, ECB working paper series, No. 1057, European Central Bank, Frankfurt am Main.

Sousa, R.M. (2009), Wealth effects on consumption: Evidence from the euro area, ECB working paper series, No. 1050, European Central Bank, Frankfurt am Main.

Stiglitz, J.E, A. Sen and J-P. Fitoussi (2009): Report of the commission on the measurement of economic and social progress, CMEPSP, September 14, 2009, Paris.

Usher, D. (1980): The Measurement of Capital. The University of Chicago Press, Chicago.

Wolfson, P. (1993): Compositional change, aggregation, and dynamic factor demand. Estimates on a Panel of Manufacturing Firms. *Journal of Applied Econometrics*, 8,129–148.

Measuring household debt vulnerability in the euro area

Evidence from the Eurosystem Household Finances and Consumption Survey

Katarzyna Bańkowska, Pierre Lamarche, Guillaume Osier and Sébastien Pérez-Duarte[1]

Abstract

The financial crisis has emphasised the need for monitoring the indebtedness and vulnerability of households, and in particular identifying the characteristics of the highly indebted or credit constrained households that may pose a threat to financial stability.

Many indicators of financial fragility are possible. To assess the debt vulnerability of households, we analyse the information about household debt as well as income and assets. We take advantage of the information available through the Household Finances and Consumption Survey (HFCS) to assess the debt burden and financial fragility at the household level. We track the situation of households with two twinned indicators: on one hand, the Debt Service Income ratio (DSI) gives an idea of the sustainability of the debt with regards to income. A household with a higher DSI ratio are more likely to face bankruptcy if an adverse shock to income, or to a lesser extent interest payments, occurs. On the other hand, the Debt-to-Asset ratio (DA) links the debt amount with the assets of the household. A high DA ratio highlights the households who would have difficulties paying back their debts, in particular in the case of liquidation. Households who combine both high DSI and DA ratios are thus highly sensitive to many kinds of shocks.

Combining all relevant pieces of information for 15 euro area countries, the HFCS allows us to quantify and characterise the proportion of the population that can be considered as vulnerable, but also evaluate the amounts that could not be repaid if households went bankrupt. The heterogeneity between euro area countries is also assessed and linked with different national institutional features.

Keywords: Indebtedness, Indicator, debt service, debt-to-assets, debt service-to-income

JEL classification: D140, D310

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Introduction

Assessing debt vulnerability for a given country or for a given geographical area is often a difficult task. Analysing the question of debt vulnerability among indebted households from the point of view of a representative agent hides the heterogeneity in indebtedness. Micro-data constitute a very valuable source of information, whose use may enable an accurate diagnostic of the debt vulnerability of households.

In this article we take advantage of the recent Eurosystem Household Finance and Consumption Survey (HFCS), a harmonized survey in the euro area, which provides information at the household level about wealth, indebtedness and income. As emphasised by many authors, institutions and national specificities have a strong impact on the households' indebtedness and consequently their vulnerability. It is essential to assess debt vulnerability not only for the euro area as a whole but also for at the national level, although it is not the objective of this paper to document institutional differences between countries.

Finally, as always when it comes to assessing a situation with statistical indicators, we need to define what is meant by debt vulnerability: the likelihood for a given household to be unable to finance the service of its debt and respect the reimbursement schedule agreed with the creditor. However, as this likelihood cannot be measured but only estimated, many possible indicators based on observable characteristics have been proposed. Since there is a high heterogeneity between households in terms of income, assets, demographics or even reasons to get credit, the need for taking into account all the various dimensions of indebtedness makes the indicators that are usually used to assess vulnerability incomplete. Each indicator gives only a part of the reality of indebtedness, but a parsimonious combination of indicators might enable drawing an accurate picture of debt vulnerability. HFCS data combining at the same time information on income, debt and assets, are very useful.

The rest of this article is structured as follows; we first give a list of the indicators that have commonly been used to assess debt vulnerability, and refer to some articles focusing on those indicators. We then provide a short description of the two main indicators we will use in this article and the reasons why we have chosen them. We then develop a first approach, consisting of a principal component analysis combining different indicators, to assess how far our main indicators are able to sum up the information about debt vulnerability, before trying to analyse their joint distribution and assessing the proportion of households and debt that can be considered 'at risk'. In a second approach, we offer a graphical representation of the joint distribution of these indicators according to households' characteristics, income, assets and demographics, before concluding.

Brief overview of indicators of household vulnerability

High household debt has attracted a lot of attention in policy debates as it has been regarded as one of the major economic imbalances, playing a role in the origination of the recent financial crisis. Given its importance for financial stability, analysing differences in debt across-countries and the main determinants of household debt is worthwhile.

Different definitions of overindebtedness are available in the literature e.g. Haas (2006), Oxera (2004), D'Alessio and Iezzi (2012). The European Commission (2008) also reviewed and compared those applied in the EU countries. It is not the objective of this paper to review them, and we will focus in the rest of the paper on the indicators that have been applied in the context of the HFCS.

The HFCS dataset, as described in ECB (2013), points to the significant differences across countries in the prevalence and the value of household debt. The differences were further documented by Bover et al. (2014) and Christelis et al. (2014).[2] The information collected from the HFCS allows for detecting households that are potentially vulnerable. ECB (2013) presents the most commonly used financial burden indicators with a view to assessing the financial conditions of households. The ones analysed further in this study are the debt to asset ratio (DA) and debt service to income ratio (DSI, see definitions below). Of course, these two indicators are only an imperfect measure of the potential vulnerability of a household. Additional indicators measuring debt burden and financial fragility calculated from the HFCS dataset have been used in the literature (see Table 1).

Having identified the vulnerable households, several papers also estimate the potential losses for the banking sector. The standard measures are exposure at default and loss given default, as described in Albacete and Lindner (2013). Ampudia et al. (2014) and Ziegelmeyer (2014) inspect the measures of risk under alternative scenarios, in the event of negative shocks to interest rates, house prices and income.

2 It is not the purpose of this article to detail the impact of regulatory framework and credit conditions, as well as cultural and historical factors, prevailing in each country, which might have an effect on debt and savings. Bover et al. (2014) emphasised the crucial importance of housing finance on household debt behaviour by analysing the influence of factors such as legal procedures for enforcing loan contracts, taxation of mortgage payments, capped loan-to-value ratios, amount of information available to borrowers, amount borrowed and mortgage interest rate paid. The existence of capital redemption schemes in the country, or interest-only payments, as well as the significant increases in housing prices in the years up to the survey can also explain the high debt-to-assets ratios.

Indicators

Used to identify vulnerable household and measure the debt burden — Table 1

	ECB (2013)	Albacete & Lindner (2013)	Ampudia et al. (2013)	Bartiloro et al. (2014)	Costa & Farinha (2012)	Ziegelmeyer (2014)
Debt to assets ratio	✓	✓	✓		✓	✓
Debt to income ratio	✓		✓	✓	✓	
Debt service to income ratio	✓	✓	✓	✓	✓	✓
Mortgage debt service-income ratio	✓					
Loan-value ratio of main residence	✓	✓				
Income – debt payments< food expenses				✓		
Liquid assets < 2 months of income				✓		
Negative net wealth		✓		✓		
Negative financial margin* > liquid assets			✓			
Late or missed debt payments over the past 12 months			✓			
Regular expenses exceeded household's income or were paid with debt		✓	✓			✓

* Negative financial margined is defined as income – taxes – debt payments – basic leaving costs.

Definition of the main indicators used

This paper concentrates on the two most consensual indicators for measuring household vulnerability to indebtedness, namely the Debt-to-assets (DA) and the Debt service-to-income (DSI) ratios.

The DSI ratio links the amount paid annually by an indebted household to repay the loans and the annual income earned at the same time by the household. The household's total payments include interest and repayment but exclude any required payments for taxes, insurance and other fees. They include the payments for mortgages and the payments for other loans, such as car loans, consumer and instalment loans and loans from relatives, friends, employers etc. From the income side, many components of income are included, such as labour income, self-employment income and capital income. Income here is not completely similar to disposable income; for instance, it does not take into account taxes, but it reflects pretty well the ability of the household to pay monthly the debt service. A high DSI ratio indicates a risk of bankruptcy for the household, in particular if its income would come to decrease substantially. In several countries and studies households with a DSI ratio higher than 30% or 40% are considered as at risk.

The DA ratio compares the total outstanding balance for household's liabilities with the total amount of assets possessed by the household. The household's liabilities include mortgages (household's main residence mortgages as well as other mortgages) and other non-mortgage debts. In particular, this includes all type of unsecured or non-collateralised debts: outstanding balances on credit lines or overdrafts, outstanding balance of credit cards for which the owner of the card is charged interest, and outstanding balances on all other loans (car loans, consumer loans, instalment loans, private loans from relatives, friends, employers). Household's assets include real-estate assets (household main residence as well as other properties), financial assets, business wealth and even valuables. A DA ratio close to 100% indicates that in case of bankruptcy, the household would not be able to reimburse the outstanding amount of debts, even when selling all his assets.

Cluster analysis of indicators of indebtedness by country

In this section, hierarchical cluster analysis is applied to a framework of debt-related indicators with a view to determine 'homogeneous' groups of countries with respect to household debt characteristics. A set of 24 household indicators are calculated in each country. They form a set of coherent indicators on household indebtedness and appear in the existing literature dealing with household debt vulnerability.

Debt participation (%)

(d1) Total debt

(d2) Total mortgage debt

(d3) Mortgage on household main residence

(d4) Other property mortgage

(d5) Non-mortgage debt

Debt ratios (median) – (%)

(r1) Debt to assets ratio of all indebted households

(r2) Debt to income ratio of all indebted households

(r3) Debt service to income ratio of all indebted households

(r4) Debt service to income ratio of households with debt other than credit lines, overdrafts or credit card debt

(r5) Mortgage debt service to income ratio of households with mortgage debt

(r6) Loan to value ratio of main residence

(r7) Net liquid assets as a fraction of annual gross income

Debt ratios (90th percentile) – (%)

(p1) Debt to assets ratio of all indebted households

(p2) Debt to income ratio of all indebted households

(p3) Debt service to income ratio of all indebted households (p4) Debt service to income ratio, households with debt payments

(p5) Mortgage debt service to income ratio of households with mortgage debt

(p6) Loan to value ratio of main residence

Debt vulnerability indicators – (%)

(v1) Debt to assets ratio of indebted households >= 75%

(v2) Debt to income ratio >= 300%

(v3) Debt service to income ratio >= 40%

(v4) Debt service to income ratio, households with debt other than credit lines, overdrafts or credit card debt >= 40%

(v5) Mortgage debt service to income ratio >= 40%

(v6) Loan to value ratio of main residence >= 75%

Indicators of household debt participation measure the prevalence of household debt in each country, while debt ratios focus on the burden of debt repayment on household finances, both on a short-term perspective (DSI) and a longer perspective (DA).

These indicators were calculated using the data from the first wave of the HFCS,[3] and reproduced in Table A in the annex.[4] Methodological information related to the survey can also be found on the ECB website.

In order to help interpret the clusters to be formed, a principal component analysis (PCA) is performed to identify the main patterns.[5] PCA is relevant to deal with multivariate settings, where for each country a high number of indicators are recorded. Cross-country analysis of each indicator taken separately does not reflect the correlations between indicators, which are often key determinants.

PCA summarises a set of numerical variables into a reduced set of synthetic variables, known as 'principal components', which are linear combinations of the initial variables and are uncorrelated with each other. The principal components are supposed to reflect as much of the data variability as possible; the first two or three components often capture most of it. Thus, a complex multivariate analysis is reduced to a simpler univariate or bivariate analysis. The factor loadings for the first five components, shown in Table 2, measure the correlation between the principal components and the initial indicators.

[3] https://www.ecb.europa.eu/home/html/researcher_hfcn.en.html.

[4] In the interpretation of results it should be kept in mind that the reference years of the country surveys vary between 2008/2009 and 2010/2011, as indicated in the table of reference periods available on the following pages. The differences in reference years can be particularly relevant for the values of financial and real assets, many of which have declined during the financial and economic crisis.

[5] Because of some missing indicators, Finland was excluded from the analysis.

Principal component analysis

Factor loadings Table 2

Variable	Component 1	Component 2	Component 3	Component 4	Component 5
d1	0.23	0.11	0.37	–0.10	0.09
d2	0.24	0.15	0.26	0.09	–0.04
d3	0.23	0.19	0.20	0.04	–0.19
d4	0.18	–0.04	0.32	0.21	0.52
d5	0.19	–0.03	0.42	–0.22	0.29
r1 (DA)	0.13	0.34	–0.04	–0.07	–0.02
r2	0.24	0.15	0.02	0.11	–0.35
r3 (DSI)	0.25	–0.09	0.05	0.25	–0.05
r4	0.26	–0.15	0.02	0.16	0.02
r5	0.20	–0.13	–0.21	0.35	0.27
r6	0.12	0.27	–0.36	0.19	0.13
r7	–0.16	0.06	0.32	0.37	–0.30
p1 (DA 90th)	–0.03	0.31	0.00	–0.34	0.19
p2	0.27	0.07	–0.05	0.07	–0.22
p3 (DSI 90th)	0.26	–0.16	–0.06	–0.09	–0.06
p4	0.18	–0.23	0.02	–0.36	–0.14
p5	0.24	–0.15	–0.19	0.00	0.14
p6	0.11	0.33	–0.20	0.12	0.19
v1 (DA >=75%)	0.04	0.36	–0.06	–0.26	0.06
v2	0.26	0.13	–0.03	0.09	–0.28
v3 (DSI>=40%)	0.24	–0.18	–0.06	–0.22	–0.12
v4	0.22	–0.20	–0.09	–0.29	–0.10
v5	0.23	–0.15	–0.28	0.01	0.12
v6	0.13	0.34	–0.13	–0.08	0.00

Source: ECB HFCS – author computations

If we examine these components, graphically displayed in Figure 1 and which account for more than 95% of the total variance of the country-level information, we find that:

- The first component, which accounts for 49% of the total variance, distinguishes Cyprus, the Netherlands, Spain and Portugal from Austria and Malta. This component is positively correlated with nearly all the debt measures. Basically, it measures the overall level of household debt in the country. In Cyprus, the Netherlands, Spain and Portugal, both debt prevalence and debt burden are high. On the other hand, the burden of household debt on Austrian households is relatively lower, particularly with respect to the DSI ratio.
- The second component (27% of the total variance) distinguishes the Netherlands from Cyprus. Although households in both countries are, on average, highly indebted, debt servicing puts much a heavier burden on households in Cyprus than in the Netherlands (the median DSI ratio of all the indebted households is 22.5% in Cyprus against 12.6% in the Netherlands). On

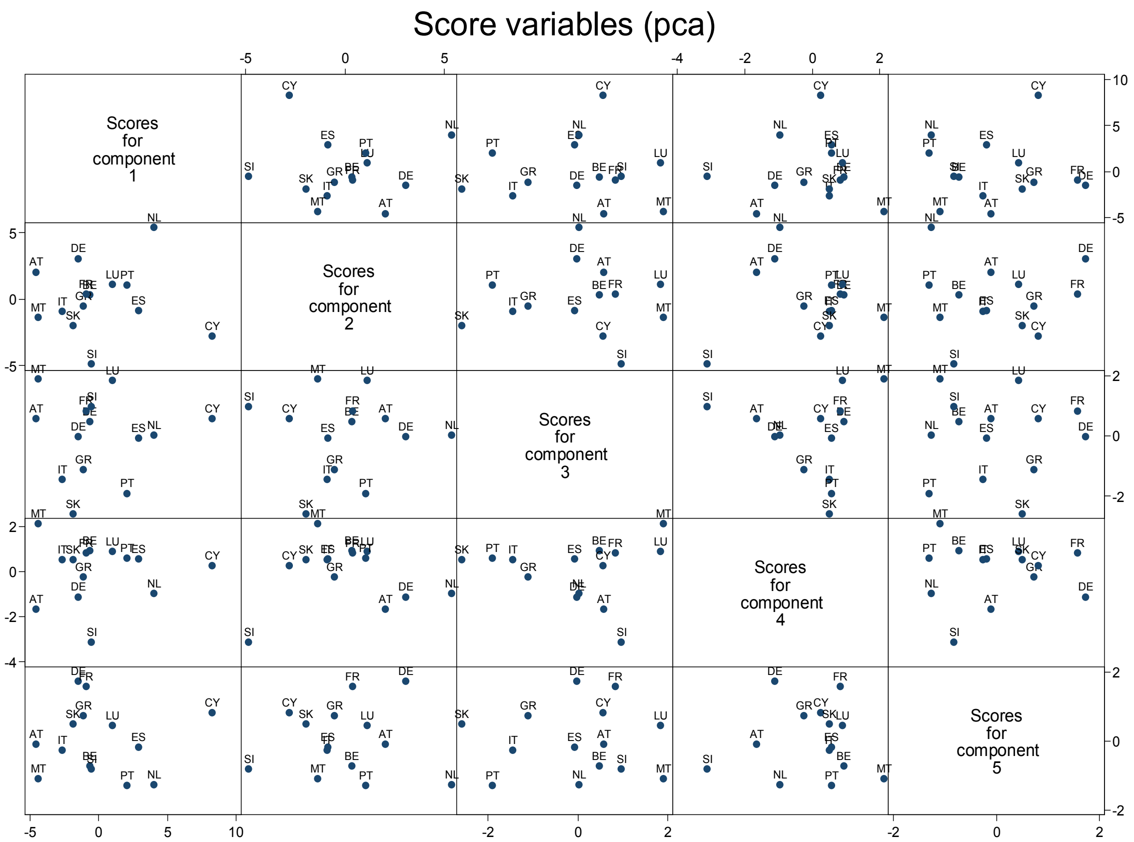
the other hand, the median DA ratio is far higher in the Netherlands than in Cyprus (41.3% vs. 17%).

Though they account for a smaller fraction of the variance, the next principal components still bring interesting information:

- The low loan-to-value (LTV) ratio of household main residence for Luxembourg and Malta (27.5% in Luxembourg and, 19.9% in Malta) and, at the opposite, the high values for Portugal and Slovakia, with 41.4% and 37.3%, respectively.
- The comparatively high share (10%) of households with other property mortgages in France.

Principal component analysis

Score plots | Figure 1

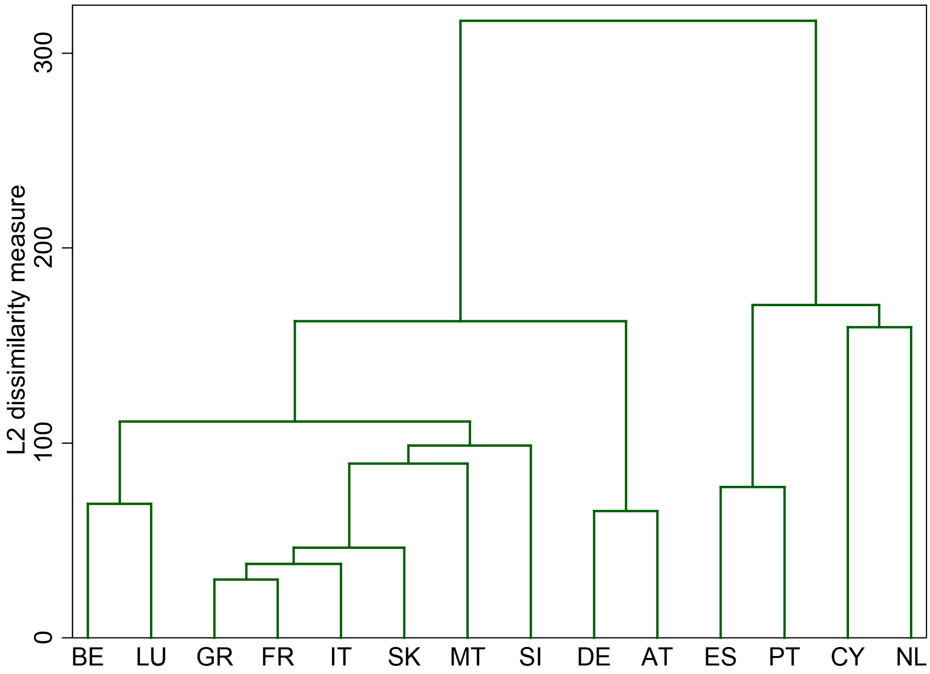


Source: ECB HFCS – author computations.

Cluster analysis of the euro area countries

Dendrogram

Figure 2



Source: ECB HFCS – author computations

The PCA then allows classifying the clusters into groups, based on their similarity (here, the L2 dissimilarity measure). The resulting dendrogram is shown in Figure 2.

A first group of countries (ES, PT, CY and NL) comprises countries where the overall level household indebtedness, as measured by the first component, is important. Among them, the Netherlands has a specific profile as the burden of household debt servicing is there much lower than in the three other countries.

A second group of countries includes Germany and Austria, where the overall importance of household indebtedness is relatively lower than in the previous group and, in particular, where the burden of household debt servicing is low.

Belgium and Luxembourg form a third group of countries, where indebtedness and debt servicing are important. On the other hand, as shown by the third component the loan to value ratio of main residence is low in Luxembourg, probably caused by the increase in housing prices in the country in the last years.

The last group of countries (Greece, France, Italy, Slovakia, Malta and Slovenia) form a 'central' group, which does not mean they may not have distinguishing features (e.g. the importance of non-property mortgages in France or the low loan to value ratio of main residence in Malta).

As a conclusion to the PCA, its first two axes explain 76% of the country variance. The first axis is positively correlated to the DA and DSI ratios, while the second axis highlights the specificity of the DSI ratio. The remaining sections will therefore focus on these two indicators.

Investigating the joint distribution of DA and DSI ratios

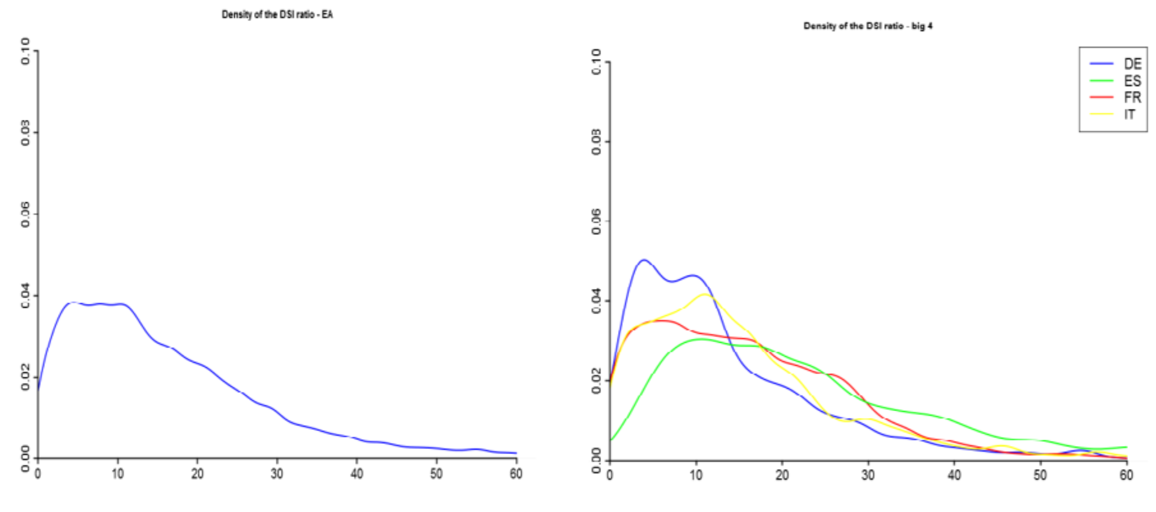
Distribution of the DSI ratio in the euro area

In the euro area, half the indebted households have a DSI ratio over 14%. This means that these households have to use more than 14% of their annual income to pay off their debts. 9% of the households living in the euro area have a DSI ratio over 40%, and even 6% of them have a DSI over 50%.

This result hides large country differences. Cypriot households have very high DSI ratios: half of them pay more than one quarter of their annual income for their debt; 10% of them have a DSI ratio higher than 81%. Spanish indebted households also have high DSI ratios, but lower than the Cypriot ones. The median for the ratio reaches 19% in Spain, and 10% of the households spend more than half of their income for the debt service.

Distribution of the DSI ratio

Left chart: euro area: right chart: Germany, Spain, France and Italy — Figure 3



Source: ECB HFCS – author computations. Kernel density estimates; optimal Gaussian kernel.

On the opposite side, German households that declare having debts dedicate a smaller part of their income for the reimbursement of their debts (see Figure 3): the median ratio for Germany is 11%. Similarly to France and Italy, 90% of the indebted households spend less than a third of their annual income for their debts.

When explaining the distribution of the DSI ratio at the euro area level, two main variables appear to be relevant for the analysis: countries and income, while the age of the reference person and the wealth of the household explain part of the variation observed in the DSI ratios. These variables are particularly significant for the top of the distribution, for which DSI ratio is mechanically the most volatile. When controlling for demographic variables in a conditional quantile regression, differences between countries remain significant: the median DSI ratio for Spain is *ceteris paribus* 8 points above the one for the reference country, Germany. The difference between the two countries is true for the entire distribution, but is higher on the top of it: the 90th percentile is 18 points higher in Spain than in Germany.

There is almost no significant effect of income on the very bottom of the DSI ratio. However, the effect is increasing along the distribution of the ratio: the higher the income, the lower the ratio and this effect is increasing with the level of the ratio. Households earning more than the 90th percentile of income have median ratio 12 points below those between the 50th and the 60th percentiles; the 90th percentile for the former is 22 points lower than the one for the latter.

The curve for wealth is completely different from the one for income. Households belonging to the bottom of the wealth distribution have lower DSI ratio, and here again, this effect increases along the ratio distribution. The households who possess more than the 90th percentile of gross wealth have a median DSI ratio 6 points higher than the households between the 50th and the 60th percentiles. For the 90th percentile of the ratio, this effect is about 4 times stronger.

Finally, demographics have, as expected, an impact on the distribution of the ratio; in particular, age (of the reference person). The 30–40 year households have slightly higher ratios than the 40–50 (less than 3 points). Labour status of the reference person also has an impact on the ratio, especially on the top of the distribution: the 90th percentile of the ratio is 14 points higher for the self-employed than for the employees. This result could be the consequence of the crisis that has affected heterogeneously the self-employed and especially those who traditionally perceived high income and were able to convince banks to grant them access to credits with higher debt service.

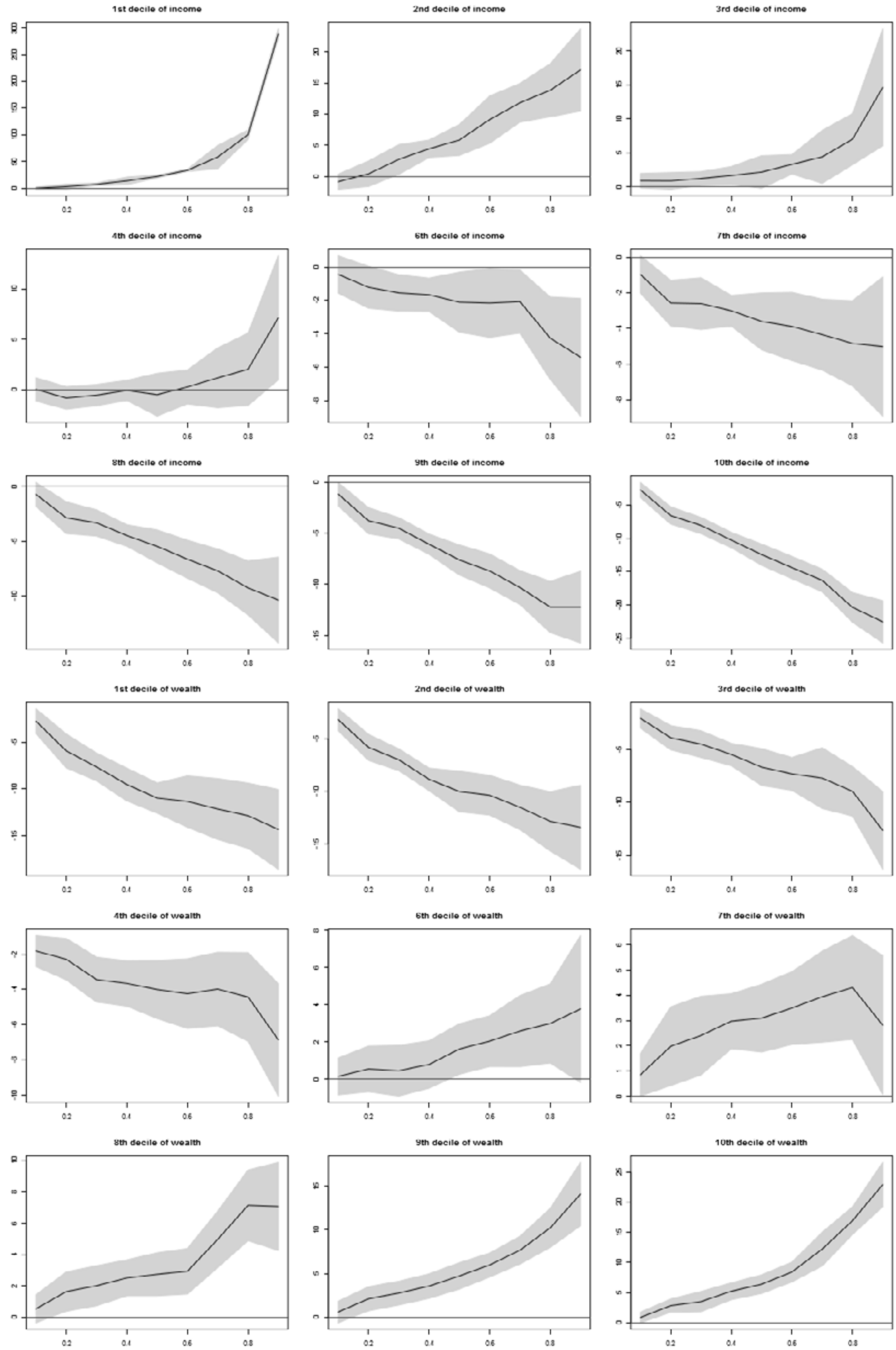
Once households' vulnerability is assessed, it is also essential to have a precise idea of the share of debt at stake. To do so, we weight the households by the outstanding amount of their debt, compare shares in terms of population and debt, and assess the risk of vulnerable households.

As shown in figure 5, there is a shift along the level of the ratio between the share of households and the share of debt. Whereas 17% of indebted households have a DSI ratio below 5%, their outstanding amount of debt is only 5% of the total amount of debt in the euro area. Conversely, 6% of households have a DSI ratio below 50%, but their total debt if almost 15% of the total household debt in the euro area. When applying the usual DSI threshold of 40%, this figure reaches 21%.

Here again, we find strong difference between countries: Cyprus appears as more vulnerable than the other countries, since about a third of the total debt is held by households with a DSI above 50%. Respectively 25% and 20% of the Spanish and Dutch total debt has been contracted by households that pay more than half of their income to reimburse their debts.

Effect of income and gross wealth

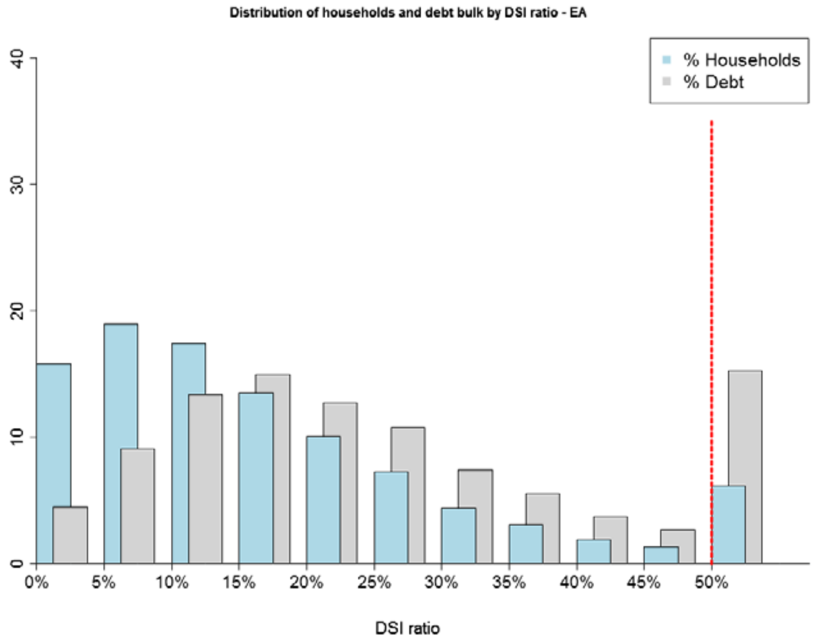
on the distribution of the DSI ratio Figure 4



Source: ECB HFCS – author computations. Coefficients of quantile regression of income and wealth deciles.

Shares in terms of population and debt in the euro area

(with respect to the DSI ratio) Figure 5



Distribution of the DA ratio in the euro area

Focusing on the DSI ratio is not sufficient to properly assess the vulnerability of households. Indeed, households possess often assets they can sell, or savings they can spend out to keep on reimbursing their debt without any interruption. This is the reason why we are also interested in the DA ratio.

In the euro area, the outstanding amount of debt for half of the households stands for more than 22% of the total amount of assets they possess. For 10% of the households, the DA ratio is higher than 99%.

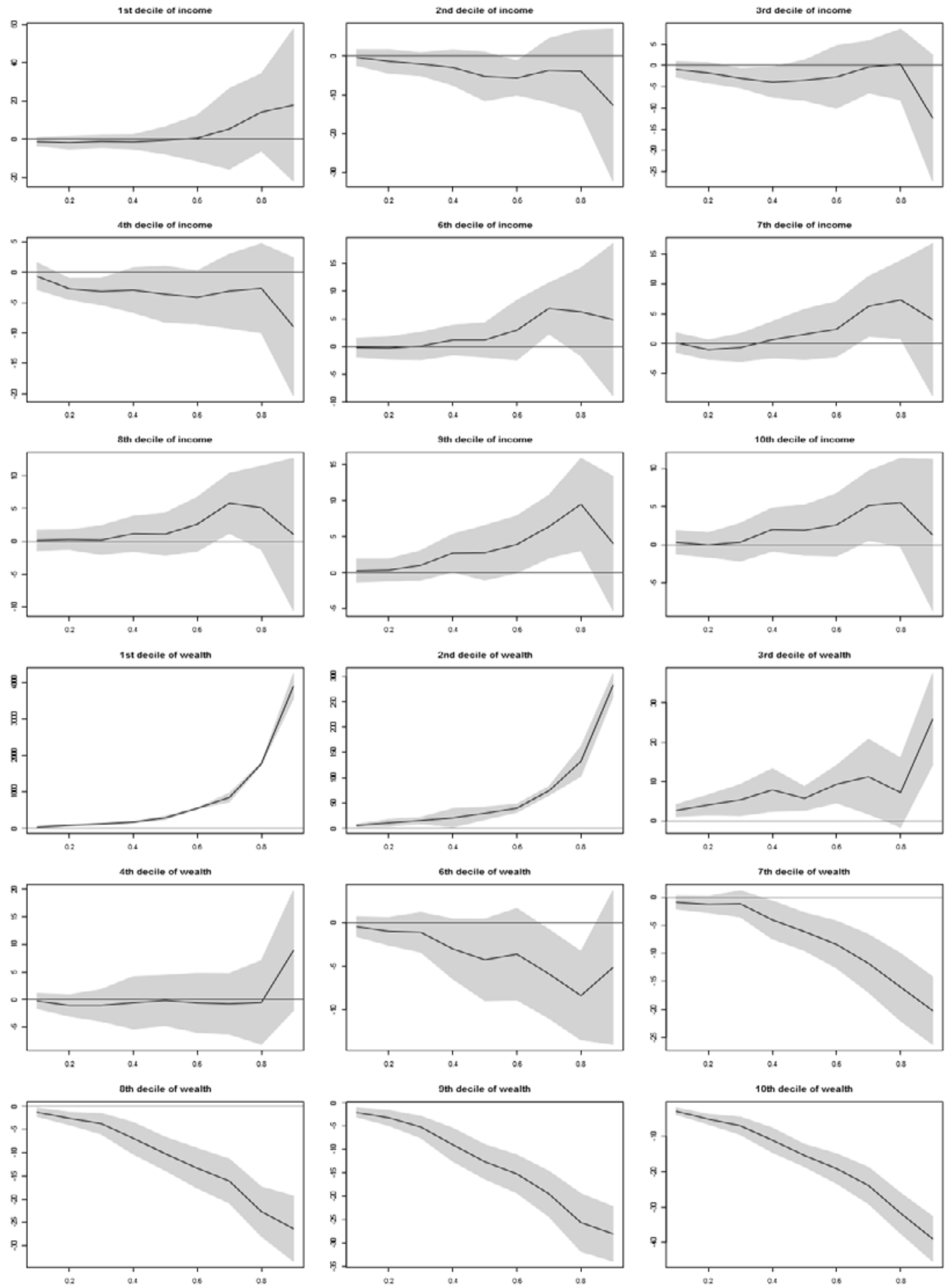
As for the DSI ratio, there are strong differences between countries. Half of the Dutch households have a DA ratio over 41%, and for 16% it is over 100%. In Portugal, the median for the DA ratio is 26%, but only 6% of households have loans that exceed the total value of their assets. Half of the indebted German households have a DA ratio higher than 28%, and 14% of them have a DA ratio higher than 100%. On the contrary, the countries for which high DSI ratios were observed have lower DA ratios: the median for the DA ratio in Cyprus is 17%, and 18% for Spain. About respectively 4% and 6% of Cypriot and Spanish indebted households have a DA ratio higher than 100%.

When explaining the distribution of the DA ratio, quantile regressions show that here again, country fixed effects remain highly significant. Germany and Netherlands have for a given income, wealth and other demographics, higher DA ratios, especially on the top of the distribution. One key finding is that income plays almost no role at all in explaining the distribution of the DA ratio. Whereas Bover et al. (2013) find that income had an impact *ceteris paribus* on the outstanding levels of debt, our regressions fail at proving a significant effect of income on the ratio. Thus debt is often used to finance acquisition of assets, and from that point of view, higher amounts of debt could be invested to buy more assets. If income affects obviously wealth and debt levels, it has no impact on the ratio between them. This phenomenon is often interpreted in the literature as an absence of credit constraints (at least from the point of view of income).

Effect of income and gross wealth

on the distribution of the DA ratio

Figure 6



Source: ECB HFCS – author computations. Coefficients of quantile regression of income and wealth deciles.

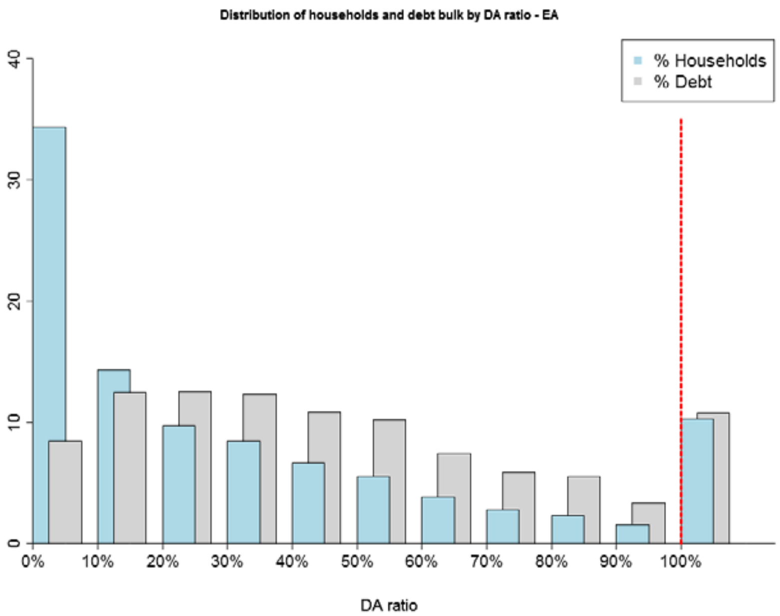
Wealth has a huge impact on the distribution of the DA ratio (figure 6): households with gross wealth above the 90th percentile have a median DA ratio 15 points below those with a total amount of assets between the 50th and the 60th percentiles. This effect is increasing along the distribution: it reaches 39 points for the 90th percentile.

Finally, age of the reference person has an effect on the distribution of the DA ratio. Households with a reference person below 40 have higher DA ratios because they are at the beginning of the wealth accumulation process, whereas older households are less indebted and have had time to save a part of their income.

Here again, we want to assess the proportion of the total outstanding amount of debt that has to be reimbursed by households that have high DA ratios (figure 7). A high proportion of households have low DA ratios: more than one third of indebted households have a DA ratio less than 10%. However, these households also have low outstanding amounts of debt, and the share of the outstanding amounts for these households is about 9%. There is a shift along the distribution of the DA ratio, affecting mainly the middle of the distribution. At the top of the distribution, the proportion of households with DA ratios higher than 100% is less than 10%, which is also the share of their debt over the total.

Shares in terms of population and debt in the euro area

with respect to the DA ratio — Figure 7

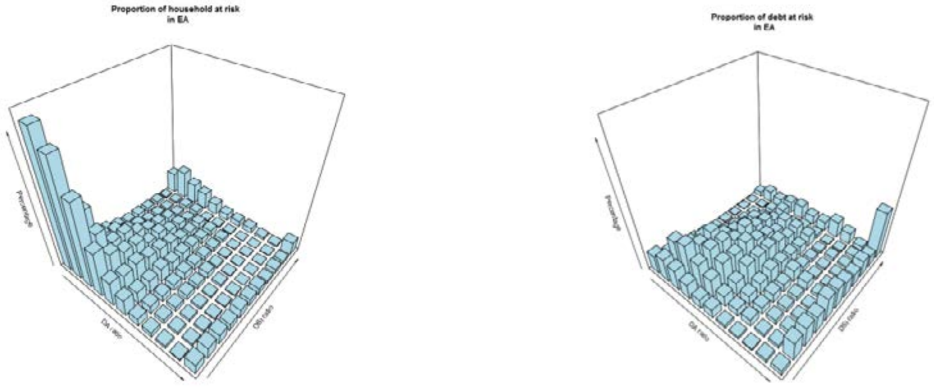


Interplay of the two ratios

It is important to study the joint distribution of the two ratios, to understand how many households have both high DA and DSI ratios and which part of the total outstanding amount of debts this represents. Households that have high DA and DSI ratios are more likely to have troubles reimbursing their loans, and can be considered as 'at risk'. A negative shock on their income could affect their ability in paying their debt service, and they will not be able to reimburse the outstanding amount in case of bankruptcy.

Joint distribution of the DA and the DSI ratios

in the euro area Figure 8



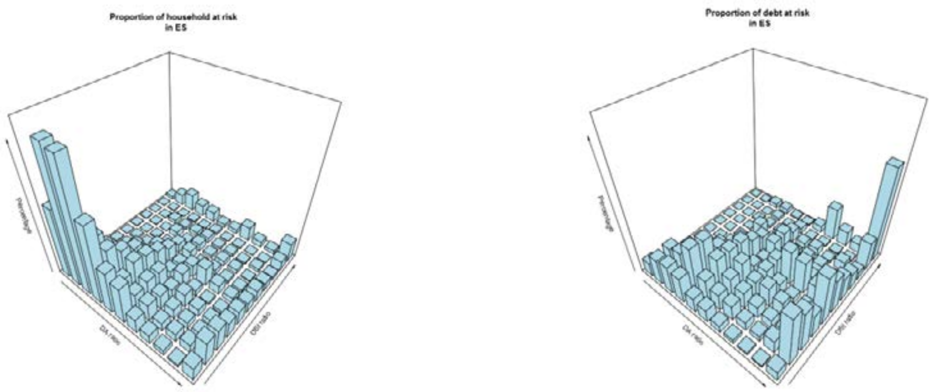
Notes: The figures above show the repartition of respectively the indebted households on the left and their debt on the right according to both DSI and DA ratios. Each ratio have divided in 11 classes. The first class stands for a DA ratio between 0 and 10%, or a DSI ratio between 0 and 5%. The last class corresponds to a DA ratio above 100% or a DSI ratio above 50%. For the graphic on the right, the height of the bar represents the share of households with corresponding DA and DSI ratios; on the left, it corresponds to the share of theses households on the total debt.

An important proportion of households living in euro area have both low DSI and DA ratios (figure 8). About 10% of households have a DA ratio below 10% and a DSI ratio below 5%. At the same time, a significant part of the households have high DSI ratios (over 50%) but often have lower DA ratios. Finally, those households who are twice at risk with DA ratios above 100% and DSI ratios above 50% (the bar on the right corner) represent less than 1% of the population.

However, once weighted with the outstanding amount of debts, the proportions tend to level because of the low amount of debt for the households in the bottom of the distribution. Conversely, households with high DSI and DA ratios appear to detain about 3% of the total amount of debt in the euro area. This strong shift is particularly obvious for a country like Spain (figure 9).

Joint distribution of the DA and the DSI ratios

in Spain Figure 9



See the Notes for Figure 8.

Visualising the composition of the joint distribution of DA and DSI ratios

Concentrating still only on the joint distribution of the two indicators of indebtedness used in the previous section, we investigate an alternative to the previous histogram representation.

An added difficulty in the analysis of the ratios is their range and skewness. When including the non-indebted households, the two distributions have a probability mass at 0. Since assets or income can be close to zero (or even negative for the latter), the ratios are theoretically unbounded. One possibility is to transform the indicators. Three transformations that are useful in general to display skewed data were tested: logarithm, inverse hyperbolic sine, and logistic transformation. Of these, only the logarithm produced approximately normal data, and even then, the resulting transformed variables' distributions have fatter tails and are slightly asymmetric, in particular the DSI ratio. Therefore these transformations were not further considered, and an alternative was sought.

Even with the proper transformation, graphical representation of joint distributions is not straightforward. The kernel density in the univariate case loses a lot of its apparent simplicity and usefulness in the bivariate case, and the representation of a surface in a graph is less revealing.

Moreover, it is sometimes more useful to have the deviations from a reference value, or population average, rather than the absolute value. We therefore propose a representation based on the quintiles of the DA and DSI ratios, and for several categories of interest, a measure of under- or over-representation.

Construction of joint quintiles

The values of the DA and the DSI ratios are assigned to the euro area quintiles 1 to 5, computed only for the indebted households but across all countries in the sample (excluding Finland due to missing information on debt service). Households with either no debt or no debt service are assigned to the extra category "0". It is possible for a household to be indebted but have no debt service. Indebted households where income is negative or assets are zero are dropped from the data; this only concerns about 134 households out of 20,892 in the sample of indebted households. By interacting the two variables in quintiles, each with 6 modalities, 32 classes are possible; households with no debt but with positive debt service are excluded (8 households are dropped in this manner). The proportion of households in each class is given in Table 3 below.

Population frequencies (%)

Joint distribution of debt to assets and debt service to income ratios — Table 3

		Debt service to income ratio quintiles						
		0	1	2	3	4	5	Total
Debt to assets ratio quintiles	0	56.6						56.6
	1	3.1	2.2	1.5	0.9	0.5	0.3	8.6
	2	1.4	1.9	1.8	1.5	1.2	0.8	8.6
	3	0.8	1.1	1.7	1.8	1.8	1.6	8.6
	4	0.6	0.9	1.1	1.7	2.2	2.2	8.6
	5	1.5	1.1	1.0	1.3	1.5	2.2	8.6
	Total	64.2	7.2	7.2	7.2	7.2	7.2	100

Source: HFCS, author calculations.

More than half of the households have no debt, and 2.2% of the households are both in the highest quintiles of both the DA and the DSI ratio.

Construction of Heat maps

For each category in the variables of interest (e.g. reference person aged between 40 and 49, or households in a particular country), the proportion of this category in each of the 32 classes of DA&DSI quintiles is compared to the average proportion in the population as a whole, and the under- and over-representation is deducted from this comparison, and calculated as the ratio of the share of the category in the class divided by the overall share of this category. This is graphically represented in a heat map, as in Figure 10, with blue parts showing the over-representation of this category and green the under-representation.

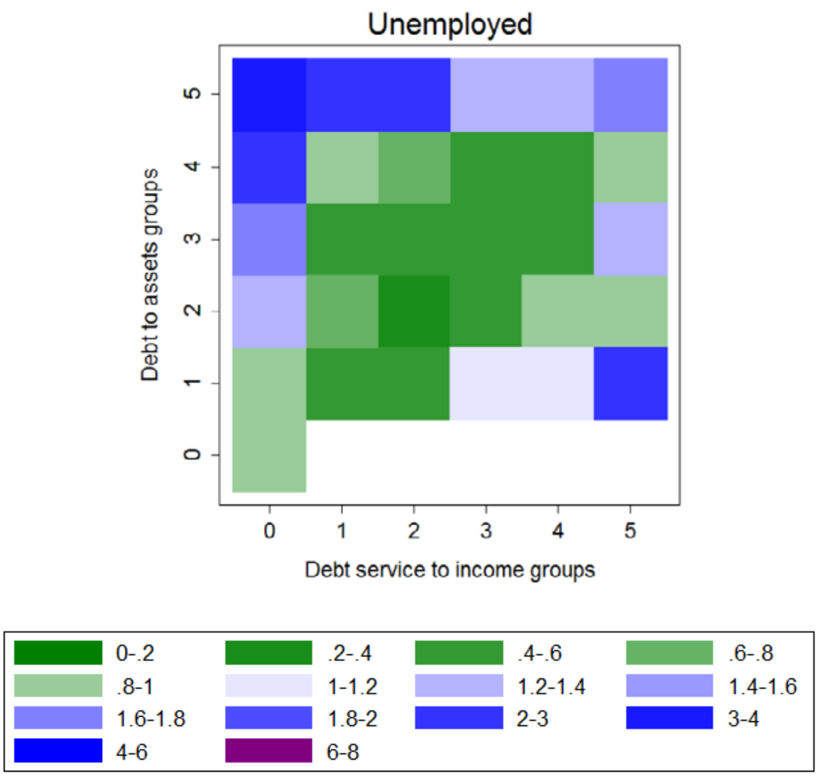
From this particular figure, it appears that the unemployed are overrepresented in either the high DA or in the low DA but high DSI – this last one may coincide with the temporary loss of a job and lower income, leading to higher DSI.

Figure 11 shows the country heat maps. The heat maps of Cyprus, Spain, Luxembourg, and to a lesser extent Belgium and France, show an over-representation of the lower right-hand corner, namely of the high DSI but low DA ratios. Austria and Germany have the opposite. The Netherlands, and to a lesser extent Portugal, have an over-representation of the high DA and high DSI corner. These results match the conclusions of the previous sections, and provide a simple graphical representation of the potential imbalances and risk areas.

Heat map of the unemployed

Out of the total population

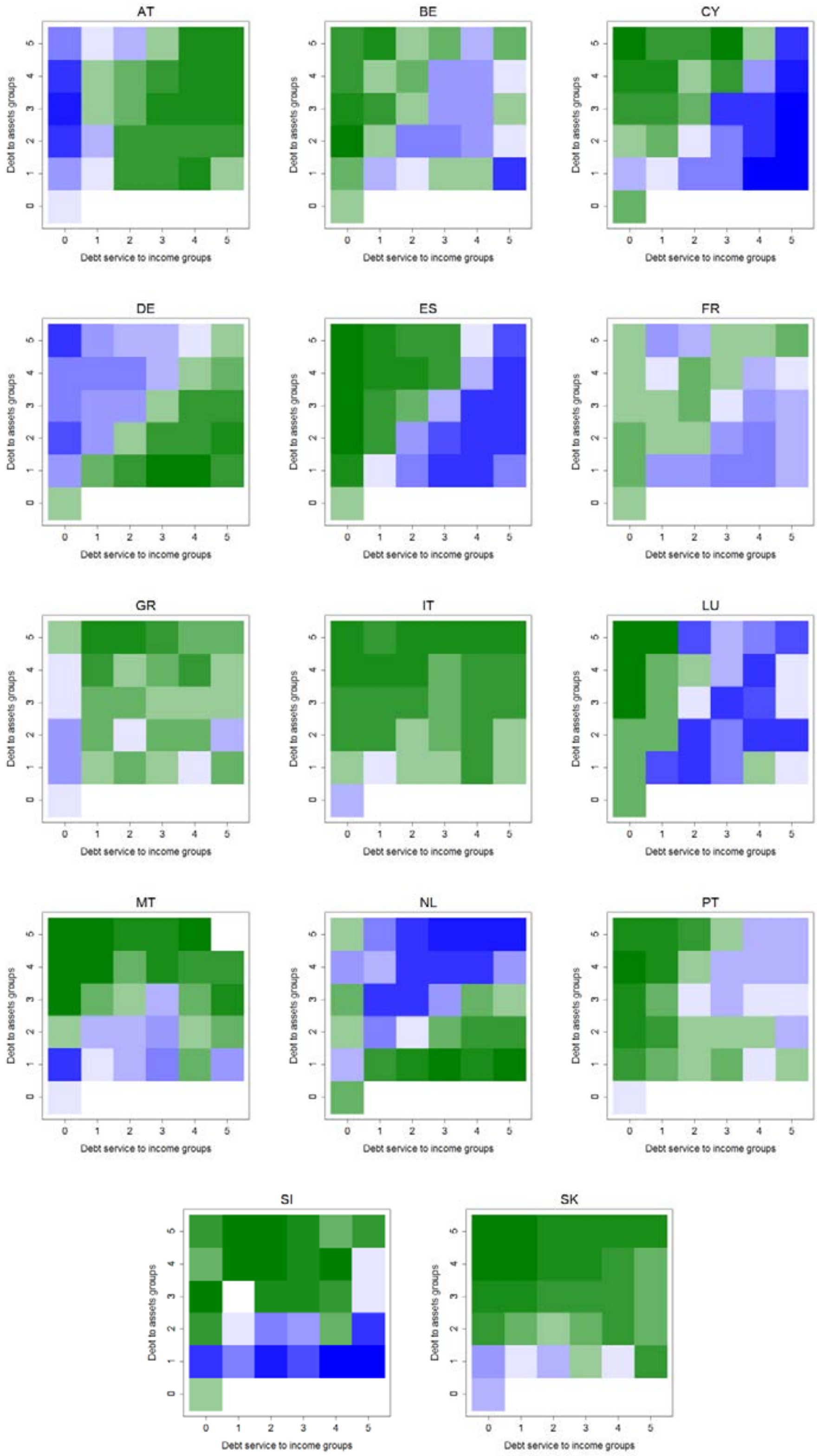
Figure 10



Source: HFCS, author calculations. Blue means that the "unemployed" category is over-represented in the corresponding DA and DSI cells.

Country heat maps

Out of the total population | Figure 11



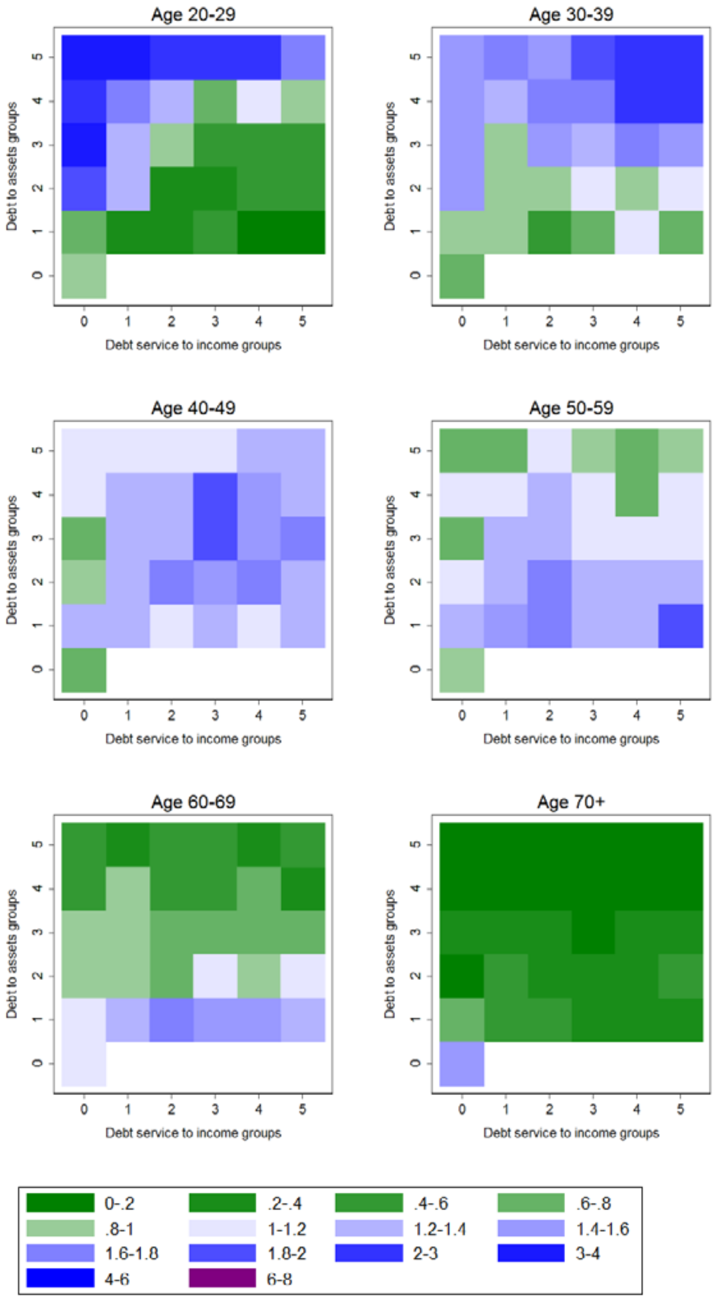
Source: HFCS, author calculations.

In Figure 12 the heat maps by the age of the reference person are computed. As the reference person ages, the over-represented parts travel from the top left corner, to the top right one, then down the right side to the bottom left corner, and finally to the debt-free corner in the bottom left. Debt to assets is high when households are young, and decreases with age, but debt service to income is low when the household is young, reaches a peak in middle age and stays high until retirement age.

Heat maps by age of the reference person

Out of the total population

Figure 12



Conclusion

Different types of analysis give consistent results about indebtedness in the euro area. Thus households in countries like Cyprus, Netherlands, Spain and Portugal are characterised by a heavy debt burden, in particular with respect to the Debt Service-to-Income ratio. Individual characteristics help in explaining the likelihood of being considered as vulnerable from the point of view of the different indicators that have been used in this article. Age of the reference person, income and wealth play an important role of course. Young indebted households with low income and no assets have higher DSI ratios; such situations happen often, conditionally to the fact that such households have been granted access to credit. Life cycle theory offers thus an explanation for such situations. Mid-life households, in the beginning of wealth accumulation and often indebted to acquire for instance their main residence are also more likely to have higher DA ratios. On top of that, the impact of macro-level factors such as the regulatory framework, credit conditions, cultural and history factors must also be considered.

When looking at the data, vulnerable households do not stand for a significant part of the population; only 3% of the indebted households combine both very high DSI and DA ratios. The outstanding amount of debt these households does not represent an important share of the total amount of debt in the euro area. Furthermore, when simulating a negative shock on asset prices and income (not reported in this article), no significant increase appears in the proportion of vulnerable households. However, these results are valid only from a descriptive point of view; indeed such negative shocks should have effect on other components of the economy and could affect more deeply indebted households. To assess such effects, a micro-simulation model is necessary – but is left for future research.

References

Albacete N., Lindner P. (2013), Household Vulnerability in Austria – A Microeconomic Analysis Based on the Household Finance and Consumption Survey, Financial Stability Report 25, Oesterreichische Nationalbank.

Ampudia M., van Vlokhoven H., Żochowski D. (2014), Financial Fragility of Euro Area Households, ECB working papers – forthcoming.

Bartiloro L., Michelangeli V., Rampazzi C. (2014), Households' vulnerability in the euro area, forthcoming.

Bover O., Casado J. M., Costa S., Du Caju P., McCarthy Y, Sierminska E., Tzamourani P, Villanueva E., Zavadil T. (2014), The distribution of debt across euro area countries: the role of individual characteristics, institutions and credit conditions, ECB Working Paper Series No. 1639.

Christelis D., Ehrmann M., Georgarakos D. (2014), Exploring Differences in Household Debt across Euro Area Countries and the US, forthcoming.

Costa S., Farinha L., Households' Indebtedness: A Microeconomics Analysis Based on the Results of the Household's Financial and Consumption Survey (2012), Financial Stability Report, Banco de Portugal.

D'Alessio G., Iezzi S. (2012), Household Over-Indebtedness. Definition and Measurement with Italian Data, IFC Bulletins No. 36, Bank for International Settlements.

European Central Bank (2009), Housing Finance in the Euro Area, Report of the Task Force of the Monetary Policy Committee of the European System of Central Banks, ECB Occasional Paper Series N° 101, March 2009.

European Central Bank (2013), The Eurosystem Household Finance and Consumption Survey: Results of the first Wave, ECB Statistical Paper Series No. 2.

European Commission (2008), Towards a common operational European definition of overindebtedness.

Haas O. J. (2006), Over-indebtedness in Germany, Employment Section, Social Finance Program Working Paper No. 44, International Labour Office: Geneva.

OXERA (2004), Are UK households over-indebted?, Commissioned by the Association for Payment Clearing Services, British Bankers Association, Consumer Credit Association and the Finance and Leasing Association.

Ziegelmeyer M. (2014), Households' investment in other than main residence real estate and its financing in selected euro area countries, forthcoming.

Table A: Household debt participation and burden indicators (%) in the euro area countries, 2008–2011

		Belgium	Germany	Greece	Spain	France	Italy	Cyprus	Luxembourg	Malta	Netherlands	Austria	Portugal	Slovenia	Slovakia	Finland
Debt participation (%)	(d1) Households with debt	44.8	47.4	36.6	50.0	46.9	25.2	65.4	58.3	34.1	65.7	35.6	37.7	44.5	26.8	59.8
	(d2) Has mortgage debt	30.5	21.5	17.5	32.5	24.4	10.8	44.8	38.8	15.6	44.7	18.4	26.7	14.1	9.6	M
	(d3) Has HMR mortgage	28.5	18.0	13.9	26.8	16.9	9.6	35.0	32.8	12.1	43.9	16.6	24.5	12.5	9.3	32.8
	(d4) Has other property mortgage	3.2	6.0	3.9	7.3	10.1	1.6	15.4	8.4	4.5	2.5	2.4	3.3	1.6	0.6	M
	(d5) Has non-mortgage debt	24.2	34.6	26.1	30.7	32.8	17.8	47.9	36.9	25.2	37.3	21.4	18.3	38.9	19.9	M
Debt ratios (median) – (%)	(r1) Debt to assets ratio of indebted households	18.2	28.4	14.8	17.9	18.9	11.7	17.0	18.2	6.2	41.3	16.7	25.7	3.9	6.6	34.6
	(r2) Debt to income ratio of indebted households	79.8	37.3	47.2	113.5	50.4	50.3	157.0	86.9	52.0	194.1	35.6	134.0	26.6	22.7	64.3
	(r3) Debt service to income ratio, all indebted households	13.8	6.7	9.4	19.2	13.1	10.6	22.5	15.7	8.4	12.6	2.9	16.0	11.0	9.0	M
	(r4) Debt service to income ratio, households with debt other than credit lines, overdrafts or credit card debt	15.1	10.9	14.7	19.9	14.7	13.2	25.0	16.6	11.5	14.5	5.6	17.3	15.8	12.5	M
	(r5) Mortgage debt service to income ratio of households with mortgage debt	14.8	12.8	16.4	20.5	17.4	15.5	25.3	16.3	12.8	14.2	4.6	16.7	11.7	20.4	M
	(r6) Loan to value ratio of main residence	28.8	41.9	31.6	31.0	32.4	30.0	31.9	27.5	19.9	52.5	18.7	41.4	5.4	37.3	48.6
	(r7) Net liquid assets as a fraction of annual gross income	33.5	22.3	4.9	12.3	18.5	21.9	5.1	20.5	75.7	16.4	32.9	15.9	2.2	12.1	9.4

		Belgium	Germany	Greece	Spain	France	Italy	Cyprus	Luxembourg	Malta	Netherlands	Austria	Portugal	Slovenia	Slovakia	Finland
Debt ratios (90th percentile) – (%)	(p1) Debt to assets ratio of indebted households	74.9	200.2	83.3	80.4	88.3	72.2	65.6	84.2	39.0	174.4	211.6	89.7	N	61.3	170.5
	(p2) Debt to income ratio of indebted households	376.0	330.0	345.5	522.5	332.4	323.0	716.9	438.0	306.7	650.9	281.3	590.3	N	332.4	290.2
	(p3) Debt service to income ratio, all indebted households	35.0	28.2	35.4	50.5	32.3	33.5	77.0	34.6	24.5	43.8	22.2	47.4	N	37.4	M
	(p4) Debt service to income ratio, households with debt payments	37.2	33.1	42.5	51.1	33.8	37.4	84.4	35.2	N	49.3	25.3	48.6	N	41.4	M
	(p5) Mortgage debt service to income ratio of households with mortgage debt	35.6	35.3	41.5	45.9	33.8	35.6	79.0	34.3	N	40.3	24.9	47.6	N	47.5	M
	(p6) Loan to value ratio of main residence	79.9	92.8	80.3	79.9	79.7	74.7	80.1	87.5	N	104.6	80.8	93.2	N	72.2	112.5
Household debt vulnerability (%)	(v1) Debt to assets ratio of indebted households >= 75%	9.9	22.0	11.6	11.3	13.2	9.7	6.5	12.8	2.6	27.3	18.8	15.3	5.3	6.3	26.8
	(v2) Debt to income ratio >= 300%	15.0	11.3	12.2	24.2	12.4	11.0	31.5	20.6	10.5	35.2	9.2	28.2	9.6	11.4	9.0
	(v3) Debt service to income ratio >= 40%	7.8	4.9	8.4	16.7	5.4	7.2	24.3	7.0	1.9	11.0	4.0	13.2	19.0	8.6	M
	(v4) Debt service to income ratio, households with debt other than credit lines, overdrafts or credit card debt >= 40%	8.5	6.7	11.4	17.2	6.0	8.8	26.8	7.5	2.4	12.3	5.0	14.2	23.6	11.1	M
	(v5) Mortgage debt service to income ratio >= 40%	8.8	7.0	10.8	14.9	5.8	8.3	28.2	6.8	2.5	9.9	4.3	13.6	10.0	17.3	M
	(v6) Loan to value ratio of main residence >= 75%	12.5	21.6	13.2	11.8	12.4	10.0	12.4	15.9	3.5	32.1	10.9	19.5	3.4	8.9	31.9

Source: Eurosystem Household Finance and Consumption Survey; Note: “M” = information not collected; “N” = information not released for based on less than 25 observations.

Can your stomach predict your total consumption?

Results from HFCS data

Pierre Lamarche

Abstract

As consumption is one of the main reasons why households accumulate income and build up wealth, micro-data containing information about households' wealth, income, and consumption together would be an important asset. Such micro-data would enable analysis on many economic questions in general and for monetary policy in particular. For example, it would be possible to address the question of wealth effects at a micro-level taking into account the heterogeneous behaviours among the population, and, with information about indebtedness, to investigate the sensitivity of consumption to credit constraints.

Convinced by the relevance of such data, one would intend to implement questions on consumption in existing surveys on wealth and income. We follow the framework described by Browning, Crossley and Weber (2003) and use the questions on expenditures for food included in the Eurosystem Household Finance and Consumption to predict total consumption. An experiment has been carried out on the French part of the survey: food expenditure at home and outside is a good predictor for total consumption, explaining two thirds of the variation of consumption. The predicted consumption in the HFCS is then compared with both micro and macro data. Thanks to these different comparisons the validity of the method can be assessed, resulting in a valuable micro-data that combine information about income, wealth, and consumption.

Keywords: Consumption, survey, household

JEL classification: D120, D140, D310

Introduction

From an economic perspective, studying wealth accumulation, indebtedness or labour offer among households is strongly related to their consumption behaviours. Indeed, according to the consumer's theory, consumption is the final aim for households and as such helps in explaining saving behaviours, portfolio choices or indebtedness. To that respect, a micro-based analysis would in an ideal world use data containing information about wealth, income and consumption at the same time. More specifically, analyses for monetary purposes such as estimations of the size of wealth effect or the reaction of consumption to credit constraint would greatly benefit from micro-data combining such pieces of information.

The Eurosystem Household Finance and Consumption Survey (HFCS), conducted in the euro area by National Central Banks, aims at gathering information on these three aspects among households. This survey is very similar to the Survey of Consumer Finances (SCF) conducted by the Federal Reserve in the U.S. The questionnaire which is already quite long collects very precise pieces of information about assets held by households. It also describes accurately indebtedness, distinguishing mortgage and non-mortgage loans. Understanding the role of income in the process of wealth accumulation or for the access to finance is a key issue. This is the reason why the questionnaire includes a part dedicated to the income of the households, describing the different sources of income that the household benefit from and similar to the framework used in the EU-SILC for instance. Finally the questionnaire includes a few questions about consumption and in particular food consumption. These questions aimed at addressing the issue of consumption for households whose income and wealth are known.

To study accurately the link between consumption, income and wealth, one would be interested in having a very precise description of the consumption expenditures for each household included in the survey. However, in this context, the direct collection of consumption data is challenged by the length of the questionnaire. Indeed, as already emphasised by Browning, Crossley and Weber, there are different ways to collect data on consumption. The most exhaustive one (but also of course the most demanding one) is based on diaries in which households' expenditures are reported, say on a weekly basis. Regarding the duration of the questionnaire, costs of data collection and response burden for the households, such a solution appears hardly feasible in the context of the HFCS.

This is the reason why a second best solution was implemented in the HFCS questionnaire. Following the recommendations by Browning, Crossley and Weber (2003) for the estimation of consumption expenditures in general-purpose surveys, a limited number of questions on aggregate components of consumption have been included in the HFCS questionnaire. Of course these questions do not describe the entire consumption; however, the framework described by Browning et al. should enable to estimate the expenditures for total consumption. Indeed, the methodology they implement uses the information in surveys such as the Household Budget Survey (HBS) so to reproduce the link between, say food consumption and total consumption as measured in consumption-oriented surveys.

Literature

Collecting information about consumption is a question that has already been investigated in the literature. As a start, Hamermesh (1984) compares the measure of consumption obtained thanks to the Retirement History Survey (RHS) with those given by the Consumer Expenditure Survey (CEX). The Retirement History Survey aims at following retired people; the CEX is the official survey for measuring consumption expenditures. Investigating for a possible decrease of the consumption due to retirement, the author takes advantage of the longitudinal data and the few questions about consumption provided by the RHS to assess this potential decrease. Indeed, one of the main drawbacks of the standard consumption surveys consists of their lack of longitudinal information. For instance households followed by the CEX are included in the survey for only one year at most, which is insufficient to assess a change through time due, say to retirement. To ensure the validity of information about consumption in the RHS, Hamermesh compares the ratio between consumption and income measured in both surveys. Taking advantage of this result, Skinner (1987) uses information about the link between food consumption, rents and value of the house estimated on the CEX to compute total consumption in the Panel Study of Income Dynamics (PSID). The method implemented in this article succeeds in explaining up to 78% of the variance of the consumption in the CEX, providing a simple method to estimate total consumption in such surveys.

This framework has been then used in different surveys, using various methodologies and investigating multiple questions. For instance, Blundell, Pistaferri and Preston (2004) implemented a more sophisticated method on the CEX, always to impute consumption in the PSID. They estimate a standard demand function for food, which can be seen as an inversion of the equation estimated by Skinner. They address the issue of potential non-linearity in such demand functions and take for potential endogeneity through time of total consumption component. Browning, Crossley and Weber (2003) provide a general overview of the different experiments that have been conducted since. They recall the importance of the measurement of consumption in general purpose surveys and provide a list of topics that could significantly benefit from such improvements. Moreover they describe and compare the many different ways of collecting information about consumption in surveys that would greatly benefit from such an improvement but that are not initially intended to gather such pieces of information. They first recall the results of experiments consisting of the inclusion of a question on broad consumption (such as "How much do you spend on everything in a typical month?") that have occurred in surveys such as the Canadian Out of Employment (COEP) or the Italian Survey on Household Income and Wealth (SHIW). They find that total consumption tends to be strongly underreported by households with only one question. This underreporting phenomenon has been confirmed by other experiments (see for example Cifaldi and Neri, 2013). However, since bias due to underreporting remains consistent over countries and experiments, they suggest the existence of methods to correct for underreporting in the estimation process.

An alternative way of collecting information about consumption consists of asking questions on very precise and limited sub-items. One typical candidate is food consumption; indeed this kind of consumption appears to be easily identified by households and seems to suffer from a less important underreporting bias. Experiments that have been conducted on the CEX or the SHIW are quite conclusive, according to Browning et al. The only major concern about the inclusion of this sole question in the survey is that it brings sometimes not enough information to properly estimate total consumption. The best way to collect information is to submit an exhaustive list of sub-items to the household. However this kind of solution is quite demanding for the respondent and does not differ so much compared to a diary survey in terms of response burden. The best trade-off between response burden and data accuracy is then a non-exhaustive list of sub-items. Thus, not only questions on food at home consumption can be included in the questionnaire, but also questions on utilities or food at restaurant. Then applying the method given by Skinner with data from a standard consumption survey should enable to estimate total consumption in general purpose surveys.

Data and methodology

The first wave of the Eurosystem Household Finance and Consumption Survey has been conducted between 2010 and 2011 in most countries. This survey is conducted in a decentralised way. Each institution participating to the Network (National Central banks or National Statistical Institute) is responsible for conducting the survey within its country, and the European Central Bank is coordinating the Network toward a common methodology. Finally, about 63,000 households living in the euro area have participated in this survey (see table 1). Information about demographics, financial and real assets, financing for the purchase of this assets, liabilities, credit constraints, employment, pensions, income, intergenerational transfers, and consumption are gathered through this survey among these households.

Sample size in the HFCS Table 1

Country	Net sample size
Belgium	2,364
Germany	3,565
Greece	2,971
Spain	6,197
France	15,006
Italy	7,951
Cyprus	1,237
Luxembourg	950
Malta	843
Netherlands	1,301
Austria	2,380
Portugal	4,404
Slovenia	343
Slovakia	2,057
Finland	10,989

Source: HFCN (2013)

One of the main features of the survey is that the countries participating in the project follow an ex-ante harmonised methodology. In particular, the variables that are included in the survey have been elaborated according to a common set of definitions and concepts. However, even if a common blueprint questionnaire has been elaborated and is the starting point, national questionnaires may differ substantially for two main reasons. First, for some countries such as France, Italy or Spain, the survey pre-existed to the HFCS. Indeed, the Enquête Patrimoine in France exists since 1986 and the Spanish Encuesta Financiera de las Familias since 2002 and even the Italian Survey on Household Income and Wealth (SHIW) since the 1960s. For these countries, there was a need for questionnaire convergence and a few variables have been adapted from the original survey variables. Second, national specificities may imply some adaptations of the questionnaire, in particular in the wording of the questions and the use of national concepts, so to ease the comprehension of the questionnaire by the respondents.

Following the framework by Skinner (1987), we use the data from the Household Budget Survey (HBS) conducted by Eurostat, which provide a precise description of the yearly consumption for the households. This survey has been conducted within the member states of the European Union in 1988, 1995, 1999, 2005 and for its last wave, in 2010. The coincidence of the HBS last wave with the first wave of the HFCS is of course highly valuable in the perspective of reproducing Skinner's methodology on those data. As emphasised by Eurostat, the main purpose of the HBS is to collect information that will allow updating the weights of the bucket of goods and services used in the computation of the Harmonised Index of Consumer Prices. However, the data can be used or other purposes related to consumption. The data collects information about household consumption using the Classification Of Individual Consumption by Purpose (COICOP). This classification enables to identify in the HBS data for instance what can be considered as food consumption (see table 2).

Classification of Individual Consumption by Purpose Table 2

CP01	Food and non-alcoholic beverages
CP02	Alcoholic beverages, tobacco and narcotics
CP03	Clothing and footwear
CP04	Housing, water, electricity, gas and other fuels
CP05	Furnishings, household equipment and routine maintenance of the house
CP06	Heath
CP07	Transport
CP08	Communications
CP09	Recreation and culture
CP10	Education
CP11	Restaurant and hotels
CP12	Miscellaneous goods and services

Source: Eurostat

One of the main features of these two surveys is the fact that they both result from gentlemen agreements and are not enforced by any European regulation. The demanding harmonisation work is then conducted by the different European networks in charge of the two surveys. This could also lead, in our perspective of applying a general methodology on these data, to the choice of adapting the method to the specificities of the national data we are facing.

Basically, Skinner's method can be justified by the idea of matching based on observations shared by both surveys. Moreover, Browning, Crossley and Weber offer a theoretical framework to justify the method. Conversely to Skinner, they focus only on non-durable consumption that seems to be more correlated to food consumption than total consumption. We follow this framework and offer a solution for estimating durable consumption. We then have a list of sub-items $(c_1 \dots c_n)$ and for each of them, one question has been asked in the HFCS. We focus on three particular components: food at home, food outside home, and utilities (water expenditures, electricity, fuel and communications), and link these components with total expenditures for non-durables using a linear Engel curve specification:

$$x_i = \alpha_i + \beta_i x + u_i$$

where x and x_i are respectively the total expenditure for non-durables and the expenditures for item i. Then, taking into account for instance the weights ω_i of each item i in non-durables consumption, Browning, Crossley and Weber obtain the estimating equation:

$$x = \left(-\sum_{j=1}^{J} \alpha_j \frac{\omega_j}{\beta_j}\right) + \frac{\omega_1}{\beta_1} x_1 + \dots + \frac{\omega_J}{\beta_J} x_J - \sum_{j=1}^{J} \frac{\omega_j}{\beta_j} u_j$$

This equation can be estimated thanks to the HBS. The estimated coefficients are then applied on the target survey (e.g. the HFCS). In order to improve the model, Browning, Crossley and Weber also add some demographic covariates to their equation. Following the work by Blundell, Pistaferri and Preston, we use a log specification and we take into account potential non-linearity: for each sub-item, we use a polynomial specification.

Once the equation estimated, we can compute for each household belonging to the HFCS an estimation of their yearly expenditures for consumption of non-durables. To do so, we take the estimated parameters and apply them to the set of covariates used in the equation. For the unexplained part (the residuals), we face different options:

– The first one consists simply of taking the expectancy conditionally to the observables. As we have modelled the log of consumption, we make the assumption that the residuals follow a normal law $N(0,\sigma^2)$ and then:

$$E(C|X) = \log(\beta X)\, e^{\frac{\sigma^2}{2}}$$

– For the second one, we draw residuals from a truncated normal law, with the lower bound defined as the sum of the known components of the consumption (food consumption, utilities, rents). We also can take into account the total consumption of non-durables as declared by the household, when the question has been asked.

– For the last one, we use a method of stratified hot-deck over the residuals obtained through the HBS data, so to address potential heteroskedasticity of the residuals. This method has for example been applied by Cifaldi and Neri (2013). We can as well reproduce this hot-deck procedure say 1,000 times and compute an estimation of the expectancy for each household. Such a procedure could be viewed as a generalised residual method.

Once the consumption for non-durables estimated, we are naturally interested in having the total consumption. Thus we impute the consumption for non-durables, using the global consumption provided by National Accounts. This flow of expenditures denoted as F has to be allocated between the households. This is achieved by using additional information provided by the HFCS data about the stock of durables possessed by the households. Let s_i stand for the share of the household i over the global amount of durables. This share can easily be estimated with the HFCS data and we obtain the consumption for durables F_i of the household i:

$$F_i = F.s_i$$

Implicitly we assume that the depreciation rate δ is the same for every household. This is very unlikely to be true; however this assumption allows us to take into account the quantity of durables possessed by the household, which in a way reflects its consumption of durables.

Results

Response pattern

As previously underlined, the surveys used here are conducted on a voluntary basis. At the time being, the HBS data are not yet available for the whole euro area. We then conducted a first estimation on a few set of countries for which micro-data are already disseminated, namely Spain, Italy and France. For these countries, surveys on wealth and income pre-existed to the HFCS, and some effort to make the different questionnaire had to be made. In particular, this can explain the fact that all variables have not been collected in every country. This could affect the process of estimation and models have to be carefully adapted country by country. In particular, for Italy and Spain, food consumption at home and outside are combined in one single variable. Both countries did not collected expenditures for utilities, which was not classified as a core variable for the survey at the first wave. For France, things are slightly different: questions about expenditures for food consumption at home, outside and utilities were included in the questionnaire alongside with qualitative questions on the habits of consumption.[1] However these questions were located in a specific module which was applied to only one third of the sample. In that case weights used to compute the estimators have to be multiplied by 3, taking into account that selection for this module is random.

Response behaviours to the questions about specific sub-items of consumption do not reveal any difficulty or reluctance for households to answer. Indeed, about 98% of the Spanish and 100% of the Italian households answered to the question on food consumption. In France, the module on consumption was located at the end of the questionnaire, and despite a quite long interview, the response rate was quite good, although lower than Spain and Italy: indeed 89% of the households

[1] These questions were focusing on the existence of regular expenditures for clothing, public transport, health, and so on.

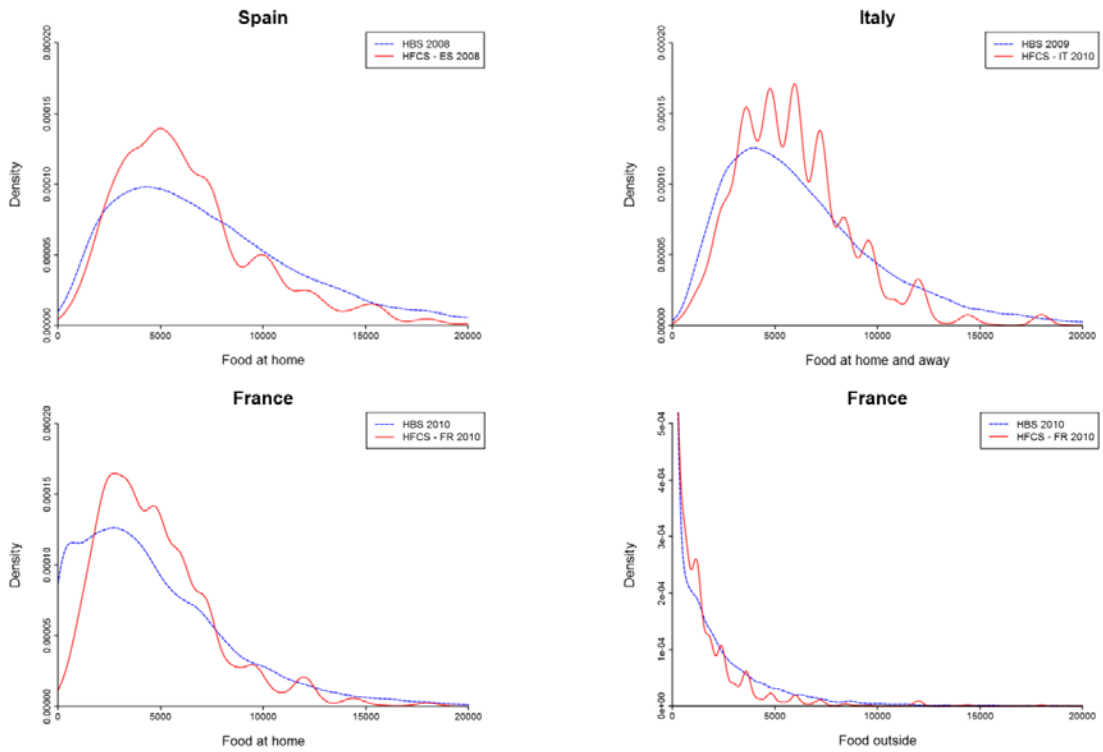
selected for this module accepted to answer to these questions. Finally, we have information about consumption for 6,064 Spanish, 7,951 Italian and 4,519 French households.

Comparison of covariates

A close look is then brought to the distribution of the covariates. Indeed, having a chance of getting a consistent estimation of consumption in the HFCS implies that covariates are distributed in the same way in both HFCS and HBS. In particular, Blundell, Pistaferri and Preston insist on the crucial need for similar data.

Comparison of the distributions of food consumption measured in the HFCS and in the HBS

Figure 1



Source: HFCS and HBS – author computations. Kernel density estimates; optimal Gaussian kernel.

For food consumption, despite completely different modes of data collection (in HBS information is collected through diaries when it is gathered thanks to one question in HFCS), the comparison between the two sources of distributions of food consumption shows quite consistent results. Indeed the global shape of the distribution is preserved in the HFCS, and the accumulation points observed in the HFCS data are due to rounding by households. In Spain and Italy, the results are comparable especially in the bottom of the distribution. Thus the Italian 10th percentile in HFCS is 5% above the one observed in HBS (for more detailed results see annex 2) and the Spanish one is 8% above. However, for these two countries, analysis on the top of distribution gives worse results: the 90th percentile is respectively 24% and 19% below expected in Spain and Italy. For France, things are quite different, since the problem is located at the bottom of the distribution.

Indeed, the 90th percentile in HFCS data is 3% below the one measured in HBS data, but the 10th percentile is highly overestimated (+38%). However, this could be explained by the fact that fieldwork has been shortened in France between the 2005 wave and the 2010 wave. In 2005, households were asked to fill diaries for two weeks, whereas they had to do so for only one week in 2010. This change in data collection could have an unexpected effect on the shape of the distribution, in particular for households in the bottom of the distribution that are more likely to go to the supermarket only once or twice a month. For those households, the shape of the distribution could be poorly estimated. Indeed experiments on HBS 2005 data show far better results for France.

To include income or not

Despite these results, we chose to use the 2010 wave for France for different reasons. First, we want to use comparable data for the consumption estimation in the different countries, in particular in terms of vintage. Second, we include in the equation not only food consumption but also a wide range of demographic variables that help in improving the quality of the model. In particular, the inclusion of income variables in the model should improve its quality. However there are pros and cons for including such variables in the equation. Browning, Crossley and Weber insist on the fact that they exclude income from the equation in spite of its predictive quality. They point out the fact that income could be poorly measured in surveys such as HBS. However, which appears important in such a work is that income is measured in the same way in both surveys. They also emphasise the potential spurious relationships that income could introduce in the equation. In order to take into account these limitations, we chose to use not income per se, but rather the deciles of income. Thus we introduce decile fixed effects and interactions so to allow coefficients to vary according to the decile of income.

Following results presented by Browning et al. and Blundell et al., we introduce in the equation demographic covariates: age and gender of the reference person , size of the household, number of children living in the household, tenure status and diploma of the reference person. These demographic variables should enable to take into account consumption behaviours that affect less food consumption. In particular, the age of the reference person carry away information about the position of the household in the life cycle. From the point of view of total consumption, the life cycle theory may not apply to the food consumption, whereas it applies to total consumption. Diploma of the reference person is commonly used as a proxy for permanent income. Here again, taking into account such pieces of information may have a value-added on the estimation of the equation. Indeed the estimation of the equation shows that such covariates have a significant effect on the total consumption even when controlling from food consumption. It also increases the explanatory power of the model.

Indeed, as shown in table 3, food consumption explains already between the two-third and the half of the variation of total consumption in the HBS data. Adding demographics in the model has a positive impact on the explanatory power of the model, increasing the explanatory power up to 10 points. We test different specifications for the inclusion of such covariates in the model. First, following specifications shown by Browning et al., we include age of the reference person and household size with polynomial terms, which turns to be a demanding specification in terms of assumptions. The second approach consists of the inclusion of only dummy variables for demographics, without any change on the explanatory power of the model.

Explanatory power of the models

Table 3

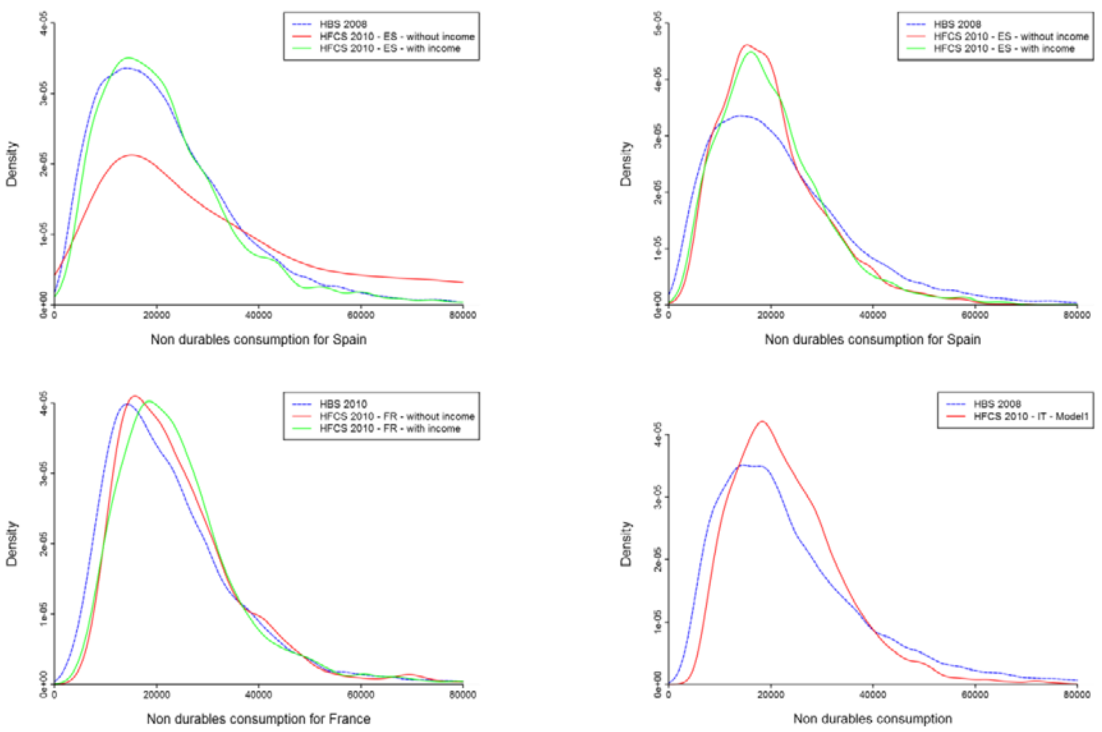
Models – Adjusted R^2	Spain	France	Italy
Only food consumption	0.66	0.61	0.51
Food consumption, demographics	0.73	0.71	0.60
Food consumption, demographics, income dummies	0.75	0.77	–
Food consumption, demographics, income dummies and interaction	0.76	0.78	–

Adjusted R^2 obtained for models estimated on the HBS data

Including income has a quite limited effect on the improvement of the model in terms of predictive quality. However, analysis of the obtained distributions in the HFCS data shows that the distribution of consumption for non-durables obtained with the inclusion of income fits better the expected distribution (see figure 2), in particular for Spain. Furthermore, as shown for Spain, the first specification with polynomial terms for age and household size (first row of figure 2, left) gives far better results than the specification with dummy variables (first row of figure 2, right) in terms of fit with the expected distribution.

Comparison of the distributions of consumption for non-durables measured in in the HBS and estimated in the HFCS

Figure 2



Source: HFCS and HBS – author computations. Kernel density estimates; optimal Gaussian kernel.

Moreover, we can compare the different choices for collecting information about consumption and determine the optimal way for such an exercise. In particular, some countries have collected food consumption at home and outside as a unique variable, while others have distinguished the two concepts. A first assessment on French data shows that even if the distinction of food consumption at home and away has not a huge impact on some indicators such as R^2, it still improves the explanatory power of the model: a Chow test proves without ambiguity that the two models are not equivalent in terms of explained variation.

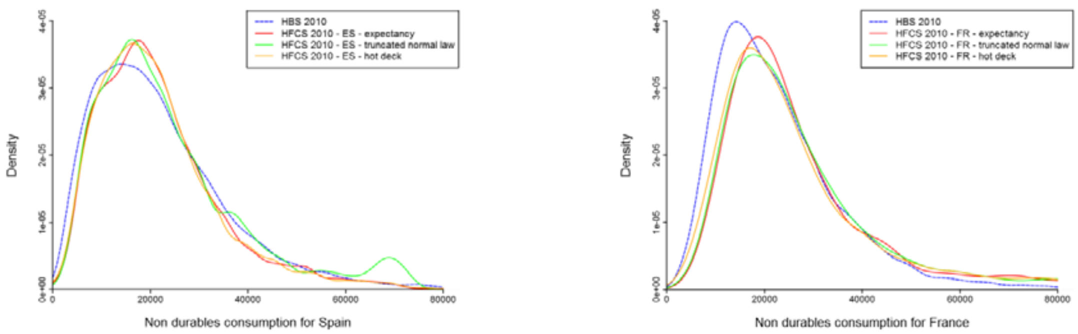
Assessment of the effect of the residuals

We assess the differences between the different ways of generating residuals when estimating consumption on the HFCS data. The first way of taking into account the unexplained part of the equation is to compute the expectancy for each household given its food consumption and other covariates that take place in the equation. The main drawback of such a solution is that it would potentially create points of accumulation in the distribution of consumption, since those households who share the same amount of food consumption and other characteristics will be imputed the same consumption. Moreover it does not enable to take into account some obvious bounds to the estimation such as the sum of sub-items of consumption that we have at our disposal in the data (food consumption, rents, utilities).

To take into account these bounds, we generate a truncated normal law with the lower bound corresponding to the maximum between total consumption as declared by the household (if the question has been asked) and the sum of the sub-items we have in the data. To address the issue of potential heteroskedasticity of the residuals, we finally use a stratified hot-deck procedure to allocate residuals estimated on the HBS data to the HFCS data, following a stratification with the percentiles of food consumption.

Distribution of consumption for non-durables with the different methods for the residuals

Figure 3



Source: HFCS and HBS – author computations. Kernel density estimates; optimal Gaussian kernel.

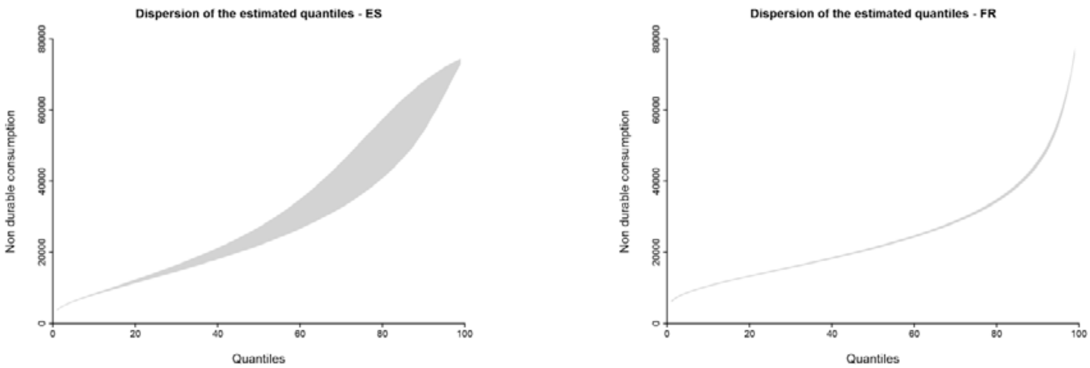
As shown on figure 3, one method does not appear clearly preferable to the other ones from the point of view of distribution. There are very slight differences between the results. In particular, taking into account the bounds in the estimation does not change completely the result, which is also encouraging for the quality of the equation. However, the upper bound appears to have an impact on the top of the distribution for Spain. This is due to the polynomial specification, which leads to the introduction of outliers in the estimation. Indeed such a specification is very demanding in terms of assumptions.

Assessment of the accuracy

We then need to assess the uncertainty related to the estimation. As consumption for non-durables is not directly observed but estimated, we want to have an idea of the accuracy of this estimation. This can been done by simulating a high number of estimations taking into account the uncertainty due to the unexplained part of the equation, but also the uncertainty related to the estimation of the coefficients. To do so, we use the fact that the estimation of the parameters follows a normal law whose parameters can also be estimated. We generate 1,000 sets of coefficients and residuals according to their respective distribution and we obtain 1,000 estimations of total consumption.

The results of the simulations show with no ambiguity that there is a trade-off between a good fit with the expected distribution and the parsimony in the modelling. For instance, equations involving interactions between income and other covariates and polynomial terms for age and size result in high standard errors associated to the estimation of the coefficients. Then the simulation of these coefficients following those standard errors becomes pretty unstable and produces highly volatile estimations, with huge coefficients of variation. The use of a lower number of parameters (see annex 4 for a complete description of the models) has a positive effect on the variance of the estimation, but as a result the fit with the expected distribution is deteriorated, in particular for Spain. As shown in figure 4, the variation of the estimated quantiles of consumption for non-durables remains pretty high for Spain. The dummy specification for France and Italy leads to a very more precise estimation. Thus, the median for France is estimated with a coefficient of variation of 0.4%; it reaches 5.4% in Spain. Results for Italy are very close to that obtained on French data. This uncertainty is represented in the figure with the grey area, which corresponds to the area where 95% of the estimations are located. From that point of view, comparison of the outcomes for the different specifications is pretty conclusive.

Confidence intervals for consumption percentiles — Figure 4



Source: HFCS – author computations.

Conclusion

The difficulties for estimating consumption in a survey like the HFCS can appear as high as the benefit from having such a variable at one's disposal in this survey. More precisely, defining a common approach for every country belonging to the euro area proves to be quite difficult: more detailed information about consumption collected by some countries has to be used in the model so to improve the outcome of the estimation. Close attention has to be put on the modelling process for which the specification may have huge effects both on the expectancy and the accuracy of the estimation. To that respect, assessment of the results has to take into account not only the comparison with the distribution in the consumption survey, but also the precision of the estimation. Moreover, results on Spain, France and Italy suggest that there is not one unique model that would predict with high accuracy total consumption. On the contrary, models have to be adjusted to match national specificities and reproduce as much as possible the expected distribution of consumption for each country.

Moreover, a similar experience run on the French data but using the 2006 HBS wave proved to give better results, in particular in terms of fit with the expected distribution. The reason for such a result is that the distribution of food consumption as measured in 2006 was far better closer to that observed in the HFCS data. As a result, the outcome of such an exercise remains pretty dependant on the good match in terms of distribution of food consumption between the two sources.

References

BLUNDELL, Richard; PISTAFERRI, Luigi; PRESTON, Ian. Imputing consumption in the PSID using food demand estimates from the CEX. 2004.

BROWNING, Martin; CROSSLEY, Thomas F.; WEBER, Guglielmo. Asking consumption questions in general purpose surveys*. The Economic Journal, 2003, 113. Jg., Nr. 491, S. F540–F567.

CIFALDI, Giulia; NERI, Andrea. Asking income and consumption questions in the same survey: what are the risks?. Bank of Italy Temi di Discussione (Working Paper) No, 2013, 908. Jg.

HAMERMESH, Daniel S. Consumption during retirement: The missing link in the life cycle. 1984.

HFCN: The Eurosystem Finance and Consumption Survey. Results from the First Wave. Statistics Paper Series, No. 1, 2013.

HFCN: The Eurosystem Finance and Consumption Survey. Methodological Report for the First Wave. Statistics Paper Series, No. 1, 2013.

SKINNER, Jonathan. A superior measure of consumption from the panel study of income dynamics. Economics Letters, 1987, 23. Jg., Nr. 2, S. 213–216.

Annexes

Annex 1: Questions on food consumption in the HFCS blueprint questionnaire

Let's now talk about household consumption:

9.01 HI0100

During last 12 months, about how much did (you/your household) spend in a typical month on food and beverages at home?

Numerical value in EUR, 6 digits. *–1 – Don't know*
–2 – No answer

9.02 HI0200

During the last 12 months, about how much did (you/your household) spend in a typical month on food and beverages outside the home? I mean expenses at restaurants, lunches, canteens, coffee shops and the like. Please, include only the amounts (you/your household) paid out i.e. net of any employer subsidy/discount/promotion etc.

Numerical value in EUR, 6 digits. *–1 – Don't know*
–2 – No answer

Annex 2: Comparison of the distribution of the covariates used in the model

Comparison of covariates

Spain Table 4a

Covariates		HBS 2008	HFCS 2010	Gap
Food consumption	mean	7626.58	6416.04	–15.8%
	p5	1577.55	2064.00	30.8%
	p10	2213.09	2400.00	8.4%
	p25	3837.89	3600.00	–6.1%
	p50	6477.04	6000.00	–7.3%
	p75	10018.36	7740.00	–22.7%
	p90	14223.05	10800.00	–24.0%
	p95	17558.96	14400.00	–17.9%

Comparison of distribution of covariates in HBS and HFCS Spanish data

Comparison of covariates (ctd.)

Spain — Table 4a

Covariates		HBS 2008	HFCS 2010	Gap
Rents	mean	4687.17	4957.44	5.7%
	p5	342.24	360.00	5.1%
	p10	700.00	756.00	7.9%
	p25	2207.28	2520.00	14.1%
	p50	4386.84	4800.00	9.4%
	p75	6600.00	6876.00	4.1%
	p90	8760.00	9360.00	6.8%
	p95	10091.23	10800.00	7.0%
Age of RP	20–	0.1%	0.1%	–0.0%
	21–30	7.2%	6.0%	–1.2%
	31–40	21.3%	22.2%	0.9%
	41–50	21.3%	22.1%	0.7%
	51–60	17.1%	17.2%	0.1%
	61–70	14.0%	14.1%	0.0%
	70+	18.7%	18.1%	–0.6%
Size of household	1	22.2%	18.3%	–3.8%
	2	28.4%	29.5%	1.0%
	3	21.4%	25.3%	3.8%
	4	19.3%	21.3%	2.0%
	5	6.1%	4.0%	–2.0%
	6	1.5%	0.9%	–0.6%
	7	0.4%	0.1%	–0.2%
	8	0.1%	0.0%	–0.1%
	9	0.1%	0.2%	0.0%
Number of children	0	50.7%	45.7%	–4.9%
	1	23.5%	27.3%	3.7%
	2	20.3%	22.3%	1.9%
	3+	5.3%	4.6%	–0.7%
Schooling (ISCED code)	1	30.5%	34.3%	3.7%
	2	38.0%	19.7%	–18.3%
	3	12.5%	19.7%	7.1%
	5	18.8%	26.2%	7.4%
Tenure status	Free use	5.2%	5.5%	0.2%
	Home owner	80.2%	82.6%	2.4%
	Tenant	14.4%	11.6%	–2.7%

Comparison of distribution of covariates in HBS and HFCS Spanish data

Comparison of covariates

France | Table 4b

Covariates		HBS 2010	HFCS 2010	Gap
Food consumption At home	mean	4730.83	5858.02	23.8%
	p5	162.00	1200.00	40.7%
	p10	532.00	1800.00	38.3%
	p25	1853.00	2400.00	29.5%
	p50	3857.00	4320.00	12.0%
	p75	6650.00	6000.00	–9.7%
	p90	9848.00	9600.00	–2.5%
	p95	12193.00	12000.00	–1.5%
Food consumption outside	mean	1607.52	1232.99	–23.2%
	p5	0.00	0.00	.
	p10	0.00	0.00	.
	p25	0.00	0.00	.
	p50	674.00	480.00	–28.7%
	p75	2172.00	1200.00	–44.7%
	p90	4459.00	3000.00	–32.7%
	p95	6295.00	4392.00	–30.2%
Rents	mean	4520.29	6551.93	44.9%
	p5	108.00	2592.00	300.0%
	p10	810.00	3360.00	314.8%
	p25	2532.00	4380.00	72.9%
	p50	4200.00	5772.00	37.4%
	p75	6000.00	7200.00	20.0%
	p90	8088.00	9360.00	15.7%
	p95	9600.00	10752.00	12.0%
Age of RP	20–	1.2%	1.2%	–0.0%
	21–30	12.4%	11.8%	–0.5%
	31–40	16.5%	17.6%	1.1%
	41–50	19.3%	17.8%	–1.5%
	51–60	17.9%	17.6%	–0.2%
	61–70	14.4%	14.7%	0.2%
	70+	17.9%	18.9%	0.9%

Comparison of distribution of covariates in HBS and HFCS French data

Comparison of covariates (ctd.)

France | Table 4b

Covariates		HBS 2010	HFCS 2010	Gap
Size of household	1	34.6%	35.2%	0.5%
	2	33.1%	32.5%	–0.5%
	3	13.7%	13.7%	0.0%
	4	12.7%	12.0%	–0.7%
	5	4.3%	4.7%	0.4%
	6	0.9%	1.2%	0.2%
	7	0.2%	0.2%	0.0%
	8	0.0%	0.0%	–0.0%
	9	0.0%	0.0%	0.0%
Number of children	0	64.7%	64.6%	–0.0%
	1	16.1%	15.8%	–0.2%
	2	13.6%	13.1%	–0.5%
	3+	5.4%	6.3%	0.8%
Schooling (ISCED code)	1	28.3%	31.6%	3.2%
	2	28.6%	6.1%	–22.4%
	3	15.5%	38.5%	23.0%
	5	27.3%	23.5%	–3.8%
Tenure status	Home owner	59.8%	61.4%	1.5%
	Tenant	40.1%	38.5%	–1.5%

Comparison of distribution of covariates in HBS and HFCS French data

Comparison of covariates

Italy | Table 4c

Covariates		HBS 2009	HFCS 2010	Gap
Food consumption	mean	6506.92	5981.01	–8.0%
	p5	1696.44	2400.00	41.4%
	p10	2291.40	2400.00	4.7%
	p25	3568.20	3600.00	0.8%
	p50	5611.56	6000.00	6.9%
	p75	8405.52	7200.00	–14.3%
	p90	11865.24	9600.00	–19.0%
	p95	14305.32	12000.00	–16.1%

Comparison of distribution of covariates in HBS and HFCS Italian data

Comparison of covariates (ctd.)

Italy Table 4c

Covariates		HBS 2009	HFCS 2010	Gap
Rents	mean	4469.02	4392.90	–1.7%
	p5	912.00	792.00	–13.1%
	p10	1536.00	1200.00	–21.8%
	p25	2844.00	2520.00	–11.3%
	p50	4200.00	4200.00	0.0%
	p75	5640.00	6000.00	6.3%
	p90	7200.00	7320.00	1.6%
	p95	8400.00	8400.00	0.0%
Age of RP	20–	0.3%	0.1%	–0.1%
	21–30	4.1%	3.9%	–0.2%
	31–40	15.4%	14.3%	–1.0%
	41–50	21.6%	23.7%	2.1%
	51–60	19.4%	18.2%	–1.2%
	61–70	16.2%	16.5%	0.3%
	70+	22.7%	22.9%	0.2%
Size of household	1	30.0%	24.9%	–5.0%
	2	27.0%	30.4%	3.3%
	3	20.0%	19.4%	–0.5%
	4	17.7%	18.7%	0.9%
	5	4.1%	4.8%	0.7%
	6	0.7%	1.4%	0.7%
	7	0.1%	0.0%	–0.0%
	8	0.0%	0.0%	0.0%
	9	0.0%	.	.
Number of children	0	53.6%	52.6%	–0.9%
	1	23.3%	22.2%	–1.1%
	2	18.7%	19.5%	0.8%
	3+	4.2%	5.4%	1.2%
Schooling (ISCED code)	1	26.8%	24.8%	–2.0%
	2	36.0%	28.4%	–7.5%
	3	25.8%	34.9%	9.0%
	5	11.2%	11.7%	0.5%
Tenure status	Free use	8.5%	10.2%	1.6%
	Home owner	74.2%	68.7%	–5.5%
	Tenant	17.1%	21.0%	3.9%

Comparison of distribution of covariates in HBS and HFCS Italian data

Annex 3: Estimation of the models on HBS data

Model for non-durable consumption

Spain — Table 5a

	Covariates	Coefficients
	Constant	7.10***
Food consumption	Log of the food consumption	0.25***
	Log2 of the food consumption	–0.04***
	Log3 of the food consumption	0.01***
Income deciles	2nd	1.63***
	3rd	11.44***
	4th	–0.39
	5th	2.40***
Rents	Log of rent	0.10***
	Log2 of rent	–0.03***
	Log3 of rent	0.00***
Age of the RP	RP less than 30	0.02*
	RP between 30 and 40	0.00
	RP between 40 and 50	Ref.
	RP between 50 and 60	0.01
	RP between 60 and 70	–0.01
	RP more than 70	–0.09***
Gender of the RP	RP male?	–0.04***
Household size	1 person in the HH	–0.08***
	2 person in the HH	Ref.
	1 person in the HH	0.01
Number of children	One child	0.04***
	2 children	0.08***
	3+ children	0.12***
Tenure status	Home Owner	0.06*
	Free use	0.02
	Tenant	Ref.
Diploma of the RP	ISCED 0+1	–0.12***
	ISCED 2	–0.04***
	ISCED 3+4	Ref.
	ISCED 5+6	0.08***
+Interactions between income deciles and food consumption		

Coefficients estimated thanks to OLS on HBS data

Model for non-durable consumption

France | Table 5b

	Covariates	Coefficients
	Constant	8.56***
Food consumption at home	Log of the food consumption	0.24***
	Log2 of the food consumption	–0.08***
	Log3 of the food consumption	0.01***
Income deciles	2nd	0.09**
	3rd	0.25***
	4th	0.42***
	5th	0.59***
Food consumption outside	Log of the food consumption outside	0.12***
	Log2 of the food consumption outside	–0.04***
	Log3 of the food consumption outside	0.00***
Utilities	Log of the utilities	0.19***
	Log2 of the utilities	–0.05***
	Log3 of the utilities	0.00***
Rents	Log of rent	0.11***
	Log2 of rent	–0.03***
	Log3 of rent	0.00***
Age of the RP	RP less than 30	0.03***
	RP between 30 and 40	0.01
	RP between 40 and 50	Ref.
	RP between 50 and 60	0.01
	RP between 60 and 70	0.03***
	RP more than 70	–0.01
Gender of the RP	RP male?	–0.01*
Household size	1 person in the HH	–0.06***
	2 person in the HH	Ref.
	1 person in the HH	0.02
Number of children	One child	0.02
	2 children	0.01
	3+ children	0.00
Tenure status	Home Owner	–0.12***
	Tenant	Ref.
Diploma of the RP	ISCED 0+1	–0.10***
	ISCED 2	–0.04***
	ISCED 3+4	Ref.
	ISCED 5+6	0.04***
+Interactions between income deciles and food consumption		

Coefficients estimated thanks to OLS on HBS data

Model for non-durable consumption

Italy | Table 5c

	Covariates	Coefficients
	Constant	3.74
Food consumption	Log of the food consumption	1.29***
	Log2 of the food consumption	–0.59***
	Log3 of the food consumption	0.08***
	Log4 of the food consumption	0.00***
Rents	Log of rent	2.46
	Log2 of rent	–0.32
	Log3 of rent	0.01
	Log4 of rent	0.00
Age of the RP	RP less than 30	–0.04*
	RP between 30 and 40	0.01
	RP between 40 and 50	Ref.
	RP between 50 and 60	0
	RP between 60 and 70	–0.05***
	RP more than 70	–0.16***
Gender of the RP	RP male?	0.00
Household size	1 person in the HH	–0.11***
	2 person in the HH	Ref.
	1 person in the HH	0.01
Number of children	One child	0.04***
	2 children	0.01
	3+ children	0.01
Tenure status	Home Owner	6.44
	Free use	6.33
	Tenant	Ref.
Diploma of the RP	ISCED 0+1	–0.24***
	ISCED 2	–0.10***
	ISCED 3+4	Ref.
	ISCED 5+6	0.13***
+Interactions between income deciles and food consumption		

Coefficients estimated thanks to OLS on HBS data

Assessing the financial vulnerability of Italian households: a microsimulation approach

Valentina Michelangeli and Mario Pietrunti[1]

Abstract

A microsimulation model to monitor Italian households' financial vulnerability is developed using household-level data from the Survey on Household Income and Wealth. Microeconomic information is then matched with macroeconomic data on debt and income in order to generate nowcasts and forecasts of the path of households' indebtedness and debt-service ratio. Within this framework, where households' debt and income are updated more frequently than by employing survey data alone, we find that the dynamics of income growth are the main driver of households' vulnerability. The share of vulnerable households (defined as those with a debt-service ratio above 30 per cent and income below the median) over the total population is projected to be about stable between 2012 and 2014, with a slight decrease in 2015 due to positive income growth. Their debt is also projected to decrease in those years.

Keywords: households' vulnerability; debt; stress test

JEL classification: D14, G10

[1] Financial Stability Directorate, Bank of Italy. We thank Paolo Angelini, Antonio Di Cesare, Giorgio Gobbi, Silvia Magri, Matteo Piazza and Luigi Federico Signorini for their useful comments.

The analysis and conclusions expressed herein are those of the authors and should not be attributed to the Bank of Italy.

Introduction

The indebtedness of the household sector and its financial vulnerability are acquiring a growing importance from a financial stability viewpoint, mainly following the boom recorded in several OECD countries in the period 2000–2008 (OECD 2010) and the subsequent financial crisis.

With the aim of closely monitor households' vulnerability, we build a microsimulation model using Italian households' data available from the Survey on Household Income and Wealth (SHIW). The survey offers a comprehensive picture of the household sector, providing information on households' idiosyncratic characteristics, such as income, balance sheet, age, education and occupation.

The main issue with survey data is their low frequency and, hence, the delay with which new information becomes available (in the case of the SHIW, the data is biennial and new data become available with about a year's delay). In this paper we provide a methodology that integrates microeconomic household data with higher frequency and more timely macroeconomic data on income, interest rates and total debt. Such a toolkit enables us to assess the financial conditions of the household sector in a timely manner and it can be used to evaluate the impact of scenarios of stress or other possible policy interventions.

In line with other studies (IMF, 2011, 2012, 2013; ECB, 2013), we take as a reference indicator of the health of the household sector the debt-service ratio (DSR), defined as the share of debt payments to income, and we identify as vulnerable those households with a DSR above a given threshold. Moreover, as households with low income are more severely affected by negative shocks, in this paper we focus on households with income below the population median. Following a previous study on Italian households (Magri and Pico, 2012), we identify as vulnerable households with DSR greater than 30 per cent and income below the median.

Our main results are as follows.[2] In a baseline scenario, with almost flat interest rates and positive income growth (up to 2.9 per cent in 2015), the share of vulnerable households with income below the median is projected to be about stable over the next few years and equal to 2.7 per cent in 2015. A small decrease in 2015 in the number of vulnerable households would be mainly due to the expected income growth. A slow deleveraging process for vulnerable households is expected to take place, partially supported by an inward shift in credit supply and banks' selectiveness in granting loans, with the their share of total debt reverting to 2010 levels.

We also perform two stress test simulations: a projected zero income growth in 2015 and a 100 basis points increase in interest rate. We find that the share of vulnerable households increases more under the former, although even such a case does not represent a major change from baseline projections. We are then led to conclude that Italian households with debt do not represent a major threat for the financial stability of the economic system.

2 See Michelangeli and Pietrunti (2014) for details on a backtesting exercise.

The paper is organized as follows: Section 2 presents the data, Section 3 gives a description of the model, Section 4 sets out the results and Section 5 concludes.

1. Data

In our exercise we make use of both microeconomic variables (taken from the 2002–12 waves of the SHIW) and of a set of macroeconomic variables.

Microeconomic variables

The SHIW contains detailed information both on households' individual characteristics such as age, education, employment status of the head of household, and on income and debt.[3] Debt is classified in three different categories: mortgage debt on the primary residence, mortgage debt on other real estate, and consumer credit.

For each debt category, we observe the outstanding amount, the initial amount borrowed, the year when the loan was granted, the total length of the contract, the amount of the annual instalment, the interest rate, and – in case of mortgage debt – whether it is adjustable rate or fixed rate.

Our starting point is the 2012 SHIW wave, the most recent available. Some descriptive statistics of the sample are provided. The fraction of households with a mortgage debt on a primary or secondary residence was about 12.4 per cent of the population. The starting value of the debt on the primary residence was about €115,000, while households had average outstanding debt of about €78,000. With respect to the type of mortgage contracts, the sample is roughly equally split in fixed and variable rate mortgages. If we extend the analysis to all kinds of real estate debt, that proportion remains about the same. About 10 per cent of households had consumer credit debt.

The SHIW is an unbalanced panel where only half of each wave's sample is retained in the next wave of the survey. To overcome the difficulty arising from tracking households from one wave to the next, we make use of a simulation strategy similar to the one described in Djoudad (2010): to simulate the income process we group observations according to their income class, while to simulate new mortgage originations we gather observations in groups according to other socioeconomic characteristics (age, education, occupation).

Macroeconomic data

As shown in the next section, the model is built in such a way to match the aggregate data on total income and amount of total debt. Table 1 presents the macro variables used in the model.

First, we extract the time series on income growth from the national accounts (*Contabilità Nazionale*, CN). According to the CN definition, income includes imputed rents and captures the standard of living of households. Nominal income

[3] For a general description of the survey, see http://www.bancaditalia.it/statistiche/indcamp/bilfait;internal&action=_setlanguage.action?LANGUAGE=en.

growth was negative in 2013, while it is projected to be positive and equal to 2.4 per cent and 2.9 per cent respectively in 2014 and 2015.

We also use projections on lending volumes to households for house purchase as input of our model. These projections are based on a macro-econometric model developed at the Bank of Italy for internal purposes. The dynamics of variable of interest, which represents the volume of loans in banks' balance sheets plus an estimate of securitized loans, imply a negative growth in total debt in 20013 and 2014 and a slightly positive growth (below 2 per cent) in 2015.

As a last macro input, we make use of the projections of data on the three-month Euribor. Historical data and projections obtained from futures contracts imply an almost flat value for the Euribor rate with one-period changes close to zero across the whole simulation. Such a variable affects the value of the instalments of variable interest rate mortgage and the ones of new originations. We choose the three-month Euribor rate as mortgage rates in Italy are typically computed by applying a spread to such rate.[4]

Macroeconomic aggregates

percentages

Table 1

	2013	2014	2015
Income growth rate at current prices	0.1	2.4	2.9
Total debt growth	-1.0	-0.3	1.8
3m Euribor	0.21	0.27	0.32

2. The Model

This section describes the evolution of households' income and debt over time.

2.1 Income growth dynamics

In this paper we make use of two slightly different definitions of income for two different goals. The variable entering in the denominator of the DSR is the "disposable income gross of financial charges and net of imputed rents". Such a variable is the one that more closely resembles the actual monetary income available to the household for current expenses.

4 The bank spread is assumed to remain fixed across simulation periods. This is generally true for existing contracts, apart from the case of mortgage refinancing.

The second definition of income is "disposable income" and we employ it to match the model statistics with the macro data.

To compute the income growth dynamics we group households' disposable income into four classes of equal frequency (Djoudad, 2010).[5]

The process for the income growth for each class *j* is given by:

$$\log\left(\frac{y_{j,t}^{k}}{y_{j,t-1}^{k}}\right) \sim \mathrm{N}(\mu_j^i, \sigma_j^i) \qquad \text{for } j=1,2,3,4 \text{ and } k=d,g \tag{1}$$

where *k* alternatively stands for disposable income (*d)* or disposable income gross of financial charges and net of imputed rents (*g*).

We estimate mean and variance of each class with the SHIW data from 2002 to 2008.

The estimated parameters are reported for each of the four income classes in Table 2.

Macroeconomic aggregates Estimated mean and standard deviation for the income processes

Table 2

	y^d *growth*		y^g *growth*	
	μ^d	σ^d	μ^g	σ^g
1st-25th percentile	0.035	0.034	0.039	0.025
25th-50th percentile	0.029	0.023	0.029	0.025
50th -75th percentile	0.026	0.026	0.025	0.023
75th -100th percentile	0.025	0.024	0.023	0.024

The dynamics of the two processes are rather similar: in both cases means are positive and slightly larger for low income households, which are the ones who benefit the most from a gradual economic recovery. The standard deviation, in line with other studies (see, for instance, Djoudad, 2010), is highest for lower groups and lowest for the upper groups.

We assign a random income shock to each household in each period, while ensuring that the mean and the variance for each class remain fixed at the values reported in Table 2. In this way we generate heterogeneity among households while keeping aggregate dynamics under control. As a last step, in order to match the dynamics predicted by our macroeconomic data, we correct income growth in each period by an adjustment factor.

[5] To get household equalized income we divide household disposable income by a factor that captures its number of components. In each period, the thresholds for each class of equalized income is calculated and each household is assigned to a specific class.

2.2 Debt growth dynamics

Households can hold both mortgage and consumer credit debt. By evaluating existing debts and accounting for loan originations and terminations, we can compute the evolution of total debt for each household over time.

For existing loans, the instalment payment is computed according to a French amortization schedule, which is the standard schedule for mortgages in Italy. Such amortization schedule allows the per-period payment to change following any modification in the interest rate.

For each household *i*=1,..., *N*, with *N* equals to the total number of indebted households, and for each type of debt *y,* the outstanding debt evolves as follows:

$$MDebt_{y,i,t+1} = MDebt_{y,i,t} - RP_{y,i,t} \tag{2}$$

where $RP_{y,i,t}$ is the annual payment of the principal. Let $R_{y,i,t}$ be the scheduled total annual repayment, which incorporates the payment of the principal and of the interest, and is computed according to the formula:

$$R_{y,i,t} = MDebt_{y,i,t}(1 + r_{y,i,t})^A \frac{r_{y,i,t}}{(1 + r_{y,i,t})^A - 1} \tag{3}$$

where $r_{y,i,t}$ is the interest rate, *A* is the residual duration of the contract. The annual payment for interest $RI_{y,i,t}$ is given by:

$$RI_{y,i,t} = r_{y,i,t} MDebt_{y,i,t} \tag{4}$$

Thus, the principal repayment could be calculated as follows:

$$RP_{y,i,t} = R_{y,i,t} - RI_{y,i,t} \tag{5}$$

While mortgage loans $MDebt_{y,i,t}$ can be either variable or fixed rate, we assume that for consumer debt $CDebt_{y,i,t}$ the annual payment $R_{y,i,t}$ remains constant in the periods of the simulation. This assumption is reasonable given the span of the simulation period.

New originations induce a composition effect by modifying the number and average characteristics of indebted households. In order to capture the increased bank selectiveness after the 2008 financial crisis, to estimate the projected number of originations we start from the last three waves (2008, 2010, 2012) of the panel component of the SHIW. A mortgage origination occurs if a household has a mortgage debt equal to zero at time *t*-1 and a positive mortgage debt at time *t* ($MDebt_{y,i,t-1} = 0,\quad MDebt_{y,i,t} > 0$). Using the household groups constructed previously, we count the number of originations at time *t-1* for each group *k*, $\theta_{k,t-1}$, and we maintain it constant for the next period *t* ($\theta_{k,t} = \theta_{k,t-1}$). According to the SHIW historical data, about half of mortgages are variable rate ones. Hence, we maintain the same proportion for new originations: about 50 per cent of new originations are variable-rate mortgage and about 50 of them are fixed ones. Each household with a new mortgage is assigned an amount of debt equal to the average debt of the group to which it belongs. Total debt associated with loans originations has been adjusted to match the macroeconomic data on total debt growth.

Mortgage terminations, *ceteris paribus*, bring a reduction in the total debt and, like mortgage originations, may induce a change in the characteristics of the pool of indebted households. Benefiting from the microeconomic households data available in the SHIW, we have information on the loan length for each household. Hence, given our model structure, we can project the evolution for each type of debt by taking into account its loan termination.

The total outstanding debt is given by the sum of mortgage loans and consumer credit loans:

$$Debt_{y,i,t} = \sum_{y} (MDebt_{y,i,t} + CDebt_{y,i,t}) \tag{6}$$

Therefore, the annual payment is given by the total annual payments on mortgage debt and consumer credit:

$$R_{i,t} = \sum_{y} R_{y,i,t} \tag{7}$$

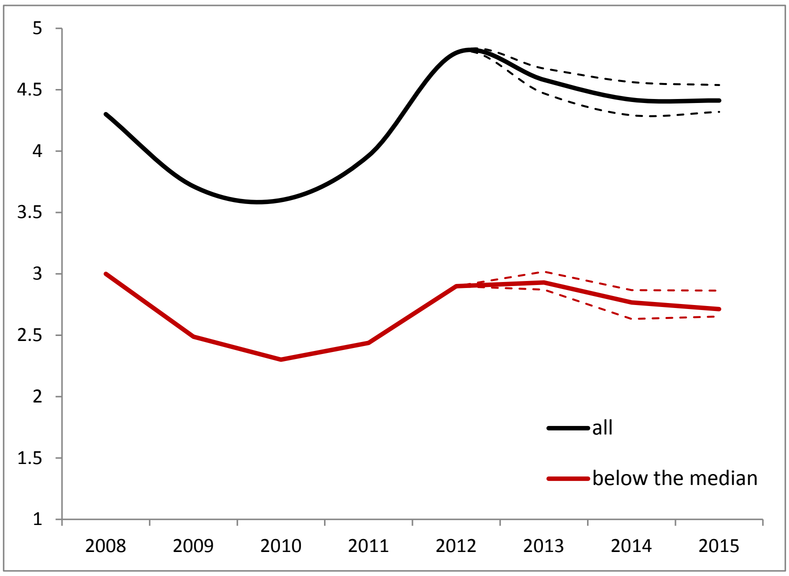
3. Results

In the baseline scenario, the share of vulnerable households in the total population is expected to slightly decrease from 4.8 per cent in 2012 to 4.4 per cent in 2015 (Figure 1). Likewise, the share of the most vulnerable households, namely those with income below the median, moves from 2.9 per cent to 2.7 per cent in the same period. In 2013, the reduction in the share of vulnerable households follows from the cut in the interest rate, which implies lower mortgage instalments both for households holding a variable-rate mortgage and for new borrowers. The reduction in the share of vulnerable households can be partially attributed to negative credit growth. Instead, in the years 2014–2015, the positive income growth is the main factor leading to the decrease in the fraction of vulnerable households. Although we expect a moderate growth in credit, banks are likely to be selective in granting loans to households; consequently, these two divergent effects may not affect in a significant way the share of vulnerable households in the economy.

We then construct two stress test scenarios to evaluate how the share of vulnerable households changes (see Figure 2 and Tables in the Appendix for detailed results). First, the effects of an increase of 100 basis points in the Euribor rate in 2015 (from 0.3% to 1.3%) have been evaluated. It induces an increase in the payment of the mortgage instalments for households with a variable-rate mortgage as well as for new borrowers: the share of all vulnerable households and of those with income below the median reaches respectively 4.6 per cent and 2.9 per cent in 2015. Second, income growth is set equal to zero in 2015, affecting the income of all households. In this scenario, the all vulnerable households and of those with income below the median moves respectively to 4.7 per cent and 3.0 per cent in 2015.

Percentage of vulnerable households in the population

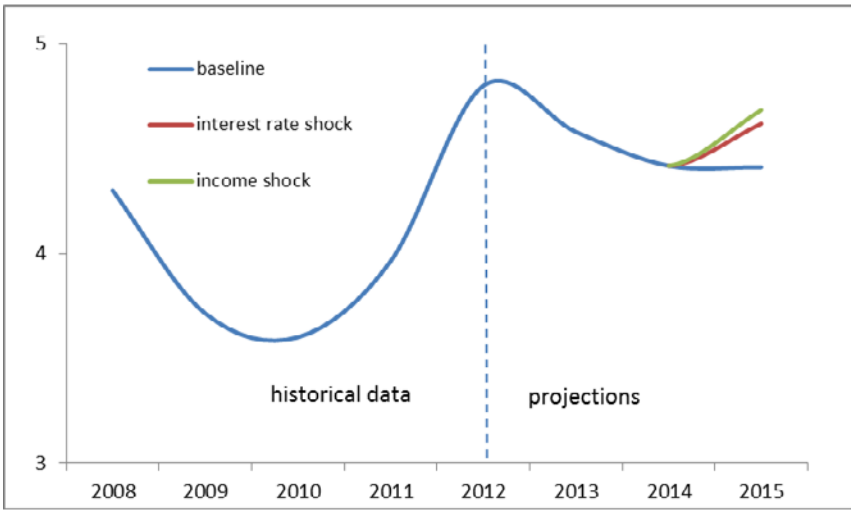
Figure 1



Note: results are based on 50 simulations of the model. The solid line represents median results; the dashed lines are results at both the 10th and the 90th percentiles. Data for 2009 and 2011 are interpolated via cubic splines.

Percentage of vulnerable households under alternative scenarios

Figure 2



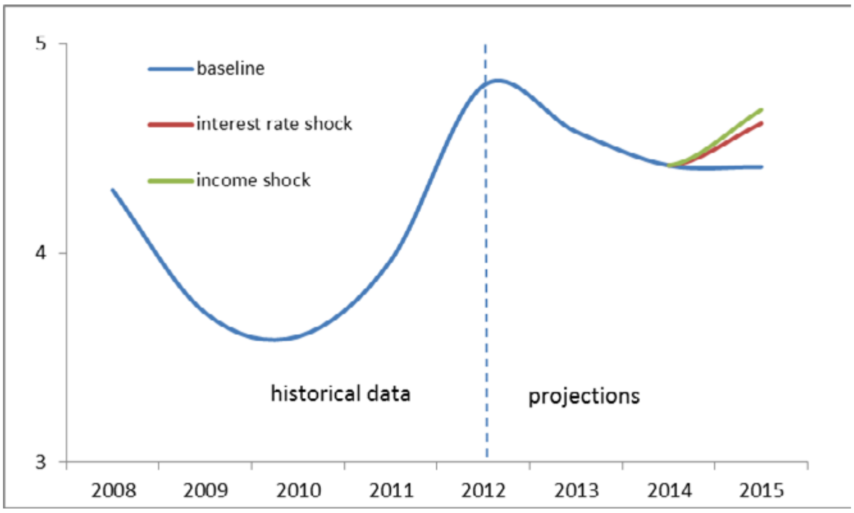
However, in order to evaluate the threat posed by the household sector to the financial stability of the system it is relevant to project the debt at risk, namely the debt held by vulnerable households. Given that households with income below the median represent the most vulnerable ones, we will focus on their debt (Figure 3).

In the baseline scenario, the share of total debt held by households with income below the median decreases from 20 per cent to about 16 per cent in 2015, in line with the 2010 data. Instead, under the first and second stress scenarios, the debt at risk is projected to be respectively 17.1 per cent and 17.3 per cent in 2015.

Those results suggest that there is no major threat for the financial stability coming from the Italian household sector: both the number of vulnerable households and their debt are relatively low.

Percentage of total debt held by vulnerable households with income below the median

Figure 3



Conclusions

In this paper, we presented a microsimulation model to evaluate and monitor the financial vulnerability of the household sector. Starting from the microeconomic data on Italian households as reported in the SHIW and augmenting them with macroeconomic projections on income, debt and interest rate, we were able to estimate households' indebtedness and debt-service ratio over time.

In the baseline scenario, the most vulnerable households, namely those with DSR greater than 30 per cent and income below the median, are projected to equal 2.7 per cent of the population in 2015, holding about 16 per cent of the total debt of the household sector.

All in all and under alternative and reasonable scenarios of stress, the model results suggest that the household sector does not pose major threat to the financial stability of the system: the number of vulnerable households and their debt are relatively small and almost stable in the next few years.

Appendix:
A1. Detailed results

1. Baseline scenario

	2012	2013	2014	2015
Percentage of vulnerable households over total households				
1st-25th percentile	1.5	1.6	1.6	1.6
25th-50th percentile	1.4	1.4	1.2	1.1
below the median	*2.9*	*2.9*	*2.8*	*2.7*
50th -75th percentile	1.2	1.0	0.9	0.8
75th -100th percentile	0.7	0.7	0.7	0.8
Total	4.8	4.6	4.4	4.4
Percentage of debt held by vulnerable households				
1st-25th percentile	9.5	10.4	9.7	9.2
25th-50th percentile	10.2	9.1	7.9	7.0
below the median	*19.7*	*19.3*	*17.4*	*16.0*
50th -75th percentile	7.9	6.4	5.9	5.2
75th -100th percentile	9.8	9.1	8.7	8.2
Total	37.5	34.7	31.8	29.5

Note: households are divided into classes according to their equalized income gross of imputed rents. The reported values have been approximated to the first decimal.

2. Stress test scenarios

a) Interest rate shock

	2012	2013	2014	2015
Percentage of vulnerable households over total households				
1st-25th percentile	1.5	1.6	1.6	1.7
25th-50th percentile	1.4	1.4	1.2	1.2
below the median	*2.9*	*2.9*	*2.8*	*2.9*
50th -75th percentile	1.2	1.0	0.9	0.9
75th -100th percentile	0.7	0.7	0.7	0.8
Total	4.8	4.6	4.4	4.6
Percentage of debt held by vulnerable households				
1st-25th percentile	9.5	10.4	9.7	9.7
25th-50th percentile	10.2	9.1	7.9	7.6
below the median	*19.7*	*19.3*	*17.4*	*17.1*
50th -75th percentile	7.9	6.4	5.9	5.7
75th -100th percentile	9.8	9.1	8.7	8.7
Total	37.5	34.7	31.8	31.4

b) Income shock

	2012	2013	2014	2015
Percentage of vulnerable households over total households				
1st-25th percentile	1.5	1.6	1.6	1.7
25th-50th percentile	1.4	1.4	1.2	1.3
below the median	*2.9*	*2.9*	*2.8*	*3.0*
50th -75th percentile	1.2	1.0	0.9	0.9
75th -100th percentile	0.7	0.7	0.7	0.7
Total	4.8	4.6	4.4	4.7
Percentage of debt held by vulnerable households				
1st-25th percentile	9.5	10.4	9.7	9.5
25th-50th percentile	10.2	9.1	7.9	8.0
below the median	*19.7*	*19.3*	*17.4*	*17.3*
50th -75th percentile	7.9	6.4	5.9	5.5
75th -100th percentile	9.8	9.1	8.7	8.2
Total	37.5	34.7	31.8	31.2

References

Djoudad, Ramdane (2010), "The Bank of Canada's analytic framework for assessing the vulnerability of the household sector." *Financial System Review,* 57–62.

European Central Bank (2013), "The Eurosystem Household, Finance and Consumption Survey, Results from the first wave", *Statistics Paper Series*, No.2.

IMF (2011), *United Kingdom – Vulnerabilities of Household and Corporate Balance Sheets and Risks for the Financial Sector Technical Note*, July 2011.

IMF (2012), "Spain – Vulnerabilities of Private Sector Balance Sheets and Risks to the Financial Sector", *Technical Note for the Financial Sector Assessment Program Update*, May 2012.

IMF (2013), "Italy – The financial situation of Italian households and non-financial corporations and risks to the banking system", *Technical Note for the Financial Sector Assessment Program Update*, August 2013.

Magri, Silvia, and Raffaella Pico (2012), "L'Indebitamento delle Famiglie Italiane Dopo la Crisi del 2008," Banca d'Italia, *Questioni di economia e finanza (Occasional Papers)*, No.134.

Michelangeli, Valentina, and Mario Pietrunti (2014), "A microsimulation model to evaluate Italian households' financial vulnerability," Banca d'Italia, *Questioni di economia e finanza (Occasional Papers)*, forthcoming.

OECD (2010), *OECD Factbook 2010: Economic, Environmental and Social Statistics*, OECD Publishing.

Debt in Norwegian households within a life-cycle perspective. An analysis using household-level data

Kjersti-Gro Lindquist, Magdalena Riser, Haakon Solheim and Bjørn Helge Vatne[1]

1. Introduction

Like many countries, Norway experienced an economic boom prior to the international financial crisis. High income growth was combined with low interest rates. As a result, house prices and household debt increased faster than their income, causing increasing concern about financial stability, see figure 1. In Norway, household default rate and bank losses have remained limited after 2008, see Solheim and Vatne (2012). However, the high and increasing debt-to-income ratio has increased households' interest rate sensitivity. An increase in the loan interest rate at today's debt-to-income level will cause a significantly higher rise in the interest payment to income ratio compared to previous periods.

The home-ownership share in Norway is high, and households typically take up large debt when they are relatively young and enter the housing market. Household debt shows a concave life-cycle pattern. The effect of a change in interest rates, or house prices, will therefore very much depend on where in the life-cycle a household is and also on its housing market affiliation. In this article we use household-level administrative register data to describe and discuss the debt behaviour of Norwegian households.

2. The Data

Our primary data source is Households' Income and Wealth Statistics from Statistics Norway, see Statistics Norway (2014) for details. For a more elaborate analysis of the data see Lindquist et al. (2014). The data are annual end-of-the year observations. Our sample covers 1987–2012 and includes both the Norwegian banking crisis 1988–1993 and the international financial crisis as from 2007. For the period 1987-2003 the data are based on the Income Distribution Survey, which is a representative sample survey based on tax return data. The number of households in the sample varies from 3000 at the beginning of the period to 20 000 at the end of the period.

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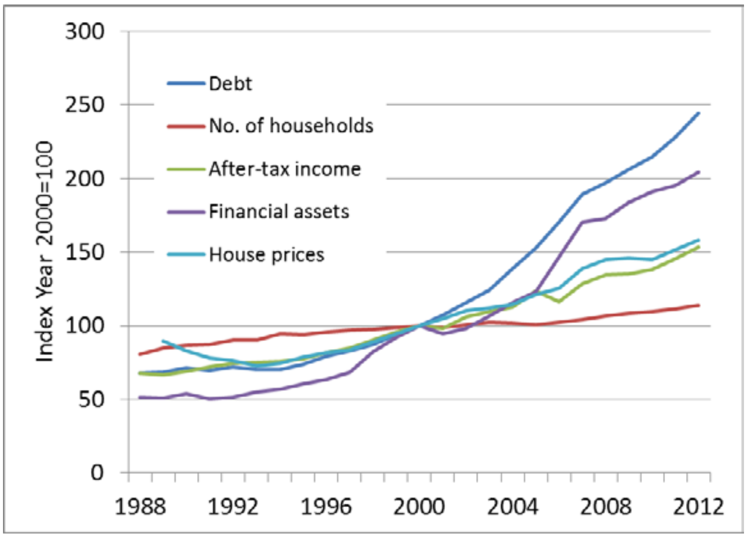
As from 2004, the statistics are based on administrative register data, as tax returns, and cover all Norwegian residents as of 31 December of the fiscal year. In addition to information on each household's composition and the household members' age etc., the data include registered income, transfers, debt, wealth and tax payments.

We restrict our sample to wage earners and benefit recipients, i.e. to households in which wages and benefits are the main income. For self-employed persons we are not able to separate out debt for business purposes from consumer and mortgage debt. Since our primary focus is on the two latter types of debt, households with main income from self-employment are excluded. In 2012, our reduced dataset consists of 4 767 503 (94 per cent of the full sample) living in 2 277 420 households.

Aggregate household data and house prices. 2000-prices. 1987–2012 — Figure 1



Source: Statistics Norway and Norges Bank.

Tax return asset values may deviate from market values. Since housing wealth is the dominant asset of Norwegian households, the valuation of dwellings is therefore particularly important. From 2010, Statistics Norway has estimated the market value of primary and secondary dwellings of all Norwegian households, see Holiøkk and Solheim (2011) and Epland and Kirkeberg (2012) for a more thorough discussion. Prior to 2010, however, we expect tax return data to undervalue dwellings. For holiday homes, cars and unregistered securities, tax values typically underestimate the market values[2]. With respect to financial assets, unlisted papers are less liquid and therefore in general difficult to value.

[2] In Norway, the tax treatment of dwellings varies across three categories; primary dwellings, secondary dwellings and holiday homes. A primary or secondary dwelling can be used as a permanent residence, while a holiday home cannot. If a household owns more than one dwelling, only one can be taxed at the favorable lowest rate.

In addition to Households' Income and Wealth Statistics, we use the Standard Budget compiled by National Institute for Consumer Research to estimate the standard cost of consumption, see SIFO (2014).

3. The balance sheet

3.1 The 2012 tax-return balance sheet

In 2012, the mean value of households' total taxable assets was NOK 2.9 million, see Figure 2 and the third column of Table 1.[3]

The estimated market value of dwellings amounted to nearly 70 per cent of households' total assets, see last column of Table 1. Primary dwellings, i.e. owner-occupied dwellings, were the far most valuable assets, and approximately two-thirds of all households reported living in a self-owned dwelling, see the second column of Table 1 and Figure 2. The rest of real assets, such as holiday homes, cars and boats etc., are reported tax values that we expect to be below market values.

Financial assets amounted to 26 per cent of total assets. Around a half of this were bank deposits, see the fifth column of Table 1. Bank deposits are reported at actual value. The next largest class, one-third of financial assets, is unlisted securities, which includes ownership shares in own companies. Unlisted papers are generally not liquid and difficult to value. By subtracting debt from total assets, we obtain the wealth, or equity, of the households. On average, households' equity ratio (equity-to-total assets) was 64 per cent, see the last column.

[3] Note that taxable assets do not include insurance claims or pension rights. This underestimates the size of the household balance sheet compared to what is reported in some other countries.

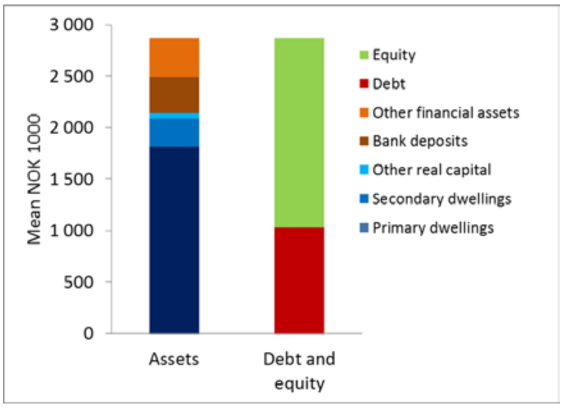
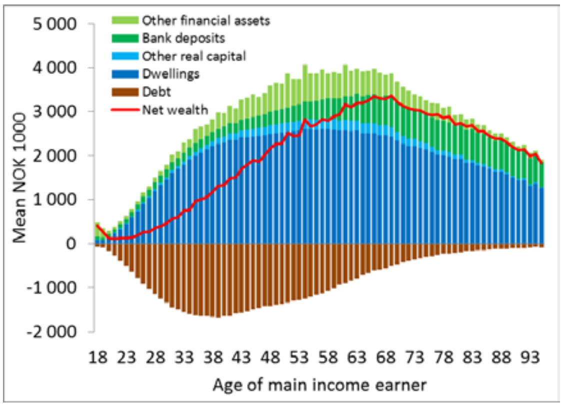
Households' taxable balance sheet. 2012						Table 1
	Sum	Share[1] with positive value	Mean All	Positive value[2]	Share Asset class	Total
	NOK billions	Per cent	NOK 1000	NOK 1000	Per cent	Per cent
Primary dwellings	4 076	64	1 790	2 777	84	62
Secondary dwellings	469	10	206	2 074	10	7
Holiday homes	75	15	33	220	2	1
Other real property	89	13	39	304	2	1
Real property	4 708	71	2 067	2 896	97	72
Production capital	18	3	8	239	0	0
Consumption capital	138	52	60	116	3	2
Real capital	4 864	78	2 136	14 293	100	74
Bank deposits	815	99	358	362	49	12
Norwegian shares and equity certificates	67	14	29	210	4	1
Units in unit trusts	70	28	31	108	4	1
Securities not registered in a securities register	539	8	237	2 810	32	8
Bond funds and money market funds	18	6	8	131	1	0
Debt receivables	78	5	34	636	5	1
Other domestic financial assets	56	30	25	83	3	1
Financial assets abroad	28	5	12	273	2	0
Financial assets	1 671	99	734	742	100	26
Total assets	6 535	99	2 870	2 904		100
Debt	2 336	84	1 026	1 224		36
Equity	4 200	79	1 844	2 345		64
Debt & Equity	6 535	99	2 870	2 904		100

1) Share of households that report a positive value in the tax return.

2) Mean value across households that report a positive value in the tax return.

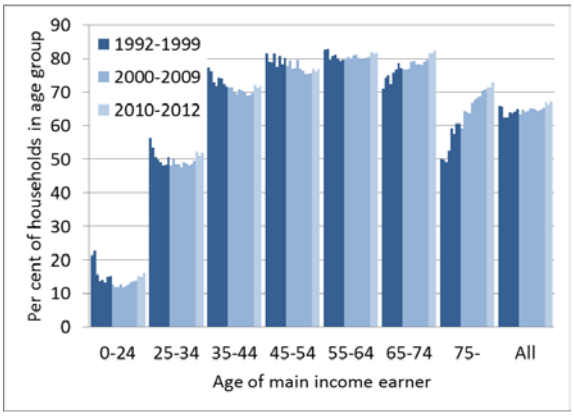
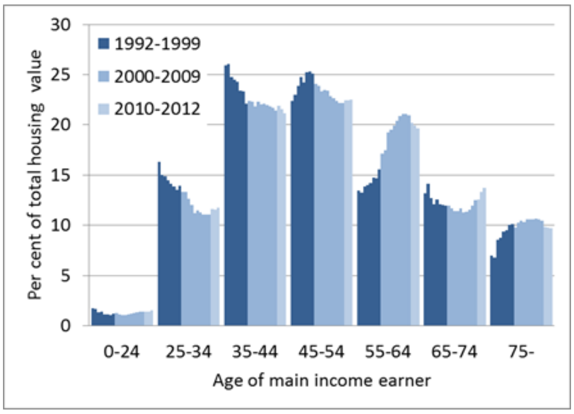
Source: Statistics Norway and Norges Bank.

Looking across age of the main income earner, we see that debt, assets and net wealth vary by age, see Figure 3. Net wealth is highest among households in their late sixties. Both debt and housing wealth increase rapidly by age among younger households. Debt peaks among households in their late thirties and decreases thereafter slowly towards zero by age. Housing wealth peaks among households in their late fifties and is relatively high also among households in older age groups. Total financial assets are largest among households in their sixties. While other financial assets start declining as from households in their fifties, deposits continue to grow and stay high among even older households. Hence, older households hold more liquid financial assets.

Households' balance sheet. 2012 — Figure 2	Households' balance sheet by age. 2012 — Figure 3
	
Sources: Statistics Norway and Norges Bank.	Sources: Statistics Norway and Norges Bank.

Net wealth of older households is on average high. In 2012, mean financial assets and total wealth among households at the age of 90 years were NOK 750 000 and NOK 2 million, respectively. A high degree of home ownership and high growth in house prices, coupled with low mortgage debt and high growth in pensions in later years are important explanations for high wealth among old households.

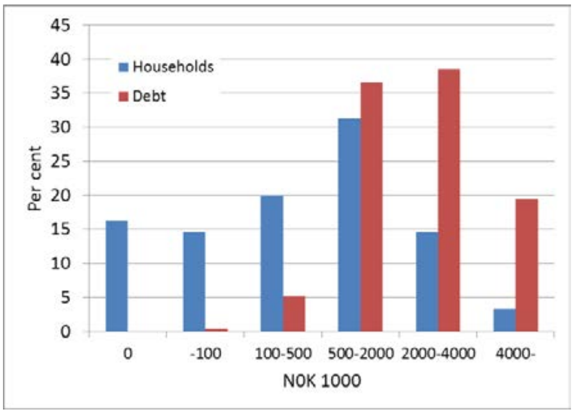
The home-ownership share of households has grown modestly from 63 per cent in 1994 to 67 per cent in 2012, see Figure 4. Among the oldest households, the home-ownership share has increased significantly. The distribution of housing wealth across age groups has changed over time, and more of the housing wealth is owned by older households and less by younger households, see Figure 5.

Home-ownership share by age of main income earner. Per cent. 1992–2012 — Figure 4	Distribution of housing wealth by age of main income earner. Per cent. 1992–2012 — Figure 5
	
Sources: Statistics Norway and Norges Bank.	Sources: Statistics Norway and Norges Bank.

3.2 Household debt

In 2012, approximately 16 per cent of the households had no registered debt, see Figure 6, blue column to the left. Approximately 50 per cent of the households had debt that was less than NOK 500 000. The mean after-tax income of households with debt this year was a little more than NOK half million. The other half of households held 95 per cent of debt. Hence, a large share of Norwegian households has little debt, and the bulk of household debt is held by households with a relatively high level of debt.

Distribution of households and debt by size of debt. 2012 — Figure 6



Sources: Statistics Norway and Norges Bank.

Distribution of debt by age of main income earner. 1987–2012 — Figure 7

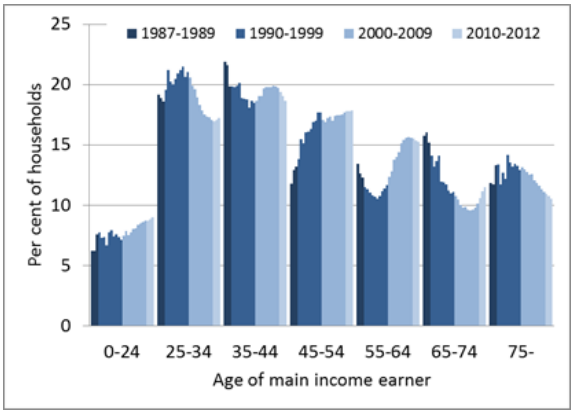
Sources: Statistics Norway and Norges Bank.

The distribution of household debt shows a clear life-cycle pattern across age groups, see Figure 7. Considerable debt is held by the primary first-time home buyer and second stepper households, i.e. age groups 25–34 and 35–44. Over time, the distribution of debt across age groups has changed. Debt has shifted from younger to older households, and particularly age group 55–64 years stands out with an increasing share of total debt. The shift in debt is a result of a combination of demographic changes, i.e. a shift in the distribution of households across age groups, a shift in the share of households holding debt within each age group, and a change in mean debt within each age group.

Both the increase in the share of households in age group 55–64 and the decrease in the share of households in age group 25–34 are consistent with the corresponding increase and decrease in share of household debt for these groups, see Figure 8.

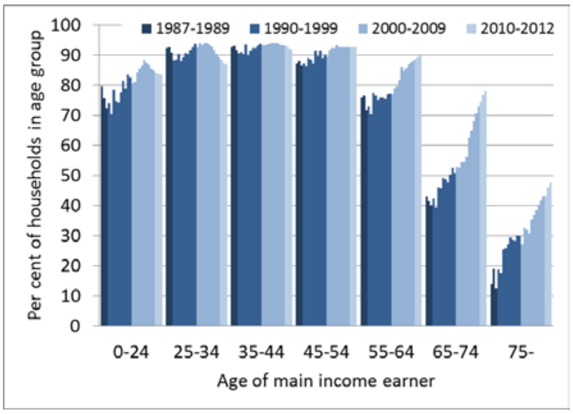
The overall share of households with debt increased from 72 to 84 per cent from 1987 to 2012, see Figure 9. The increase was particularly large among older households, see Figure.

Distribution of households by age of main income earner. 1987–2012 — Figure 8



Sources: Statistics Norway and Norges Bank.

Fraction of households with debt by age of main income earner. 1987–2012 — Figure 9

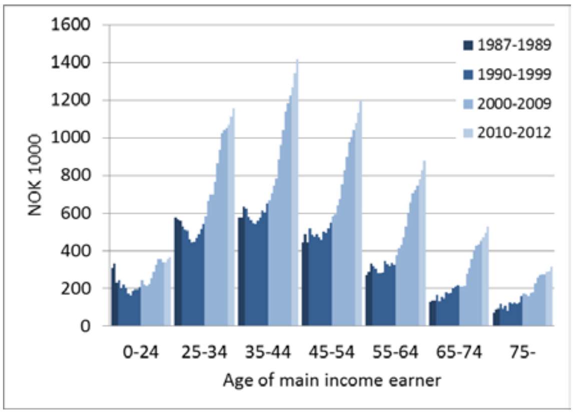


Sources: Statistics Norway and Norges Bank.

From the mid-nineties, i.e. beyond the aftermath of the Norwegian banking crisis, mean debt increased for all age groups, see Figure 10. Measured in NOK, the increase was largest for the age groups with the highest level of debt initially. Measured as a change in per cent, the increase was highest for older households with relatively little debt initially.

In Figure 11 we look at the distribution of debt across both after-tax income and age. For the age groups 35–64, about two-thirds of the debt is held by households within the highest income deciles. About one-third of the debt is held by households within the medium income deciles. The debt held by households in the age groups 25–34 and 65–74 is approximately equally distributed across income deciles 8–10 and 4–7 respectively.

Mean real debt in 2000-prices by age of main income earner. 1987–2012 — Figure 10



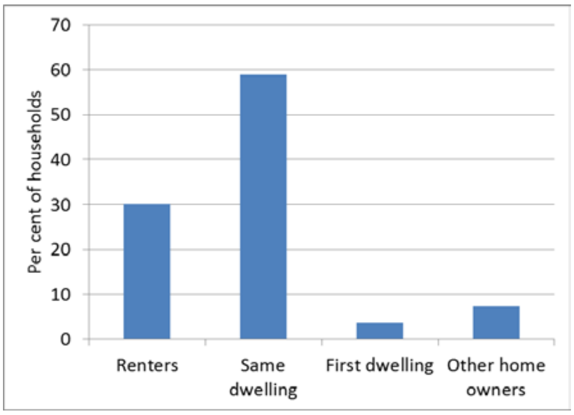
Sources: Statistics Norway and Norges Bank.

Distribution of debt by after-tax income and age. 2012 — Figure 11

Sources: Statistics Norway and Norges Bank.

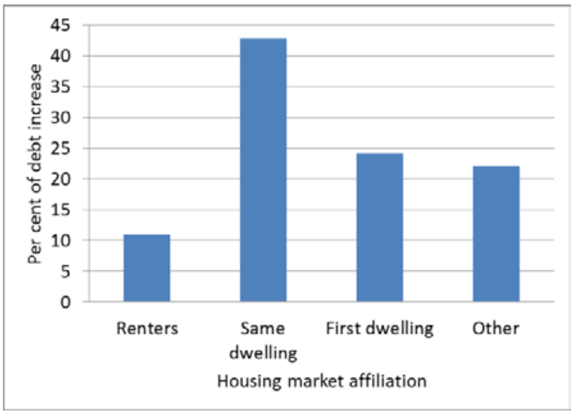
Household debt is closely related to the housing market and self-ownership. To evaluate households' housing market affiliation, we compare the housing value in households' tax return in two successive years. If a household has no taxable housing wealth in both years, it is classified as a renter. If the housing tax-value changes from zero to a positive number from one year to the next, it is classified as a first-time home buyer. If the tax value changes in accordance with the rule defined by the tax authorities, the household is classified as living in the same dwelling. The rest, including homeowners that change dwelling, are sorted in "Other homeowners". Around 30 per cent of the households are renters, see Figure 12. A little less than 60 per cent stay in the same dwelling, and approximately 11 per cent of the households are either first-time buyers or are moving to a different dwelling.

Distribution of households by housing market affiliation. 2012 — Figure 12



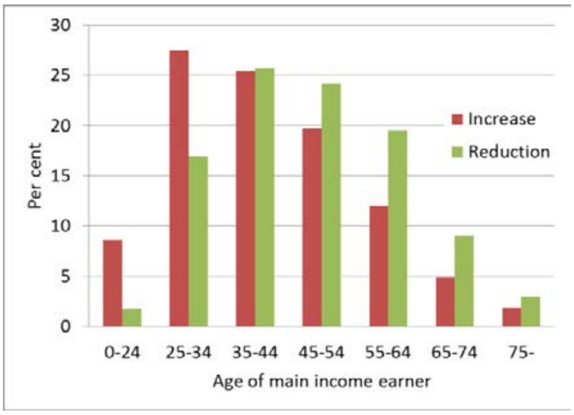
Sources: Statistics Norway and Norges Bank.

Distribution of increase in debt by housing market affiliation. 2011–2012 — Figure 13



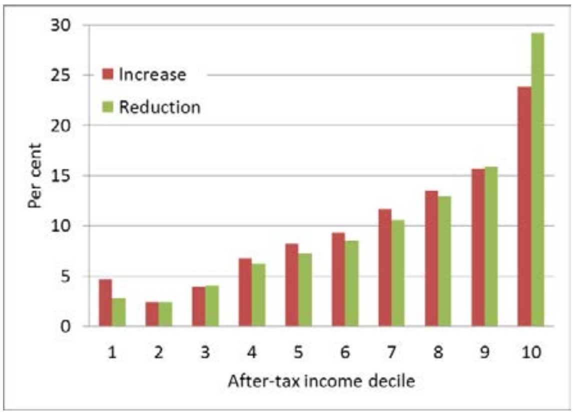
Sources: Statistics Norway and Norges Bank.

Distribution of change in debt by age of main income earner. 2011–2012 — Figure 14



Sources: Statistics Norway and Norges Bank.

Change in debt by income decile. 2011–2012 — Figure 15



Sources: Statistics Norway and Norges Bank.

In 2012, around 11 per cent of the increase in debt is by households that do not own a dwelling, see Figure 13. Compared with 2005, this fraction was more than halved. Nearly one-fourth of the increase in debt in 2012 is by first-time home buyers and around 20 per cent by households that change dwelling. More than 40 per cent of the increase in debt is by households that remain in the same dwelling.

As expected, the change in debt follows a clear age profile, see Figure 14. Age groups 24–34 and 35–44 account for most of the increase in the level of household debt. The latter age group also has the largest share of down payments. The large down payments of age group 35–44 are probably related to the high level of debt of this group, cease of interest-only period and a pyramid-shaped income profile across age groups. There is a strong connection between change in debt and income, see Figure 15. Around 40 per cent of both debt increase and down payments can be found in the two highest income deciles.

4. Birth-cohort analysis

In previous chapters we evaluated the distribution and development of household debt across different household groups, such as age groups. Our household-level data enable us to apply a birth-cohort approach and to consistently evaluate the evolution of household assets and debt over the life-cycle[4]. A birth-cohort consists of households with main income earner of the same birth year. The oldest cohort in our birth-cohort sample is 95 in 1987, i.e. the main income earner is born in 1892, and the youngest cohort in our sample is 25 in 2012, i.e. the main income earner is born in 1987. All cohorts in between 1892 and 1987 are included in the birth-cohort sample.

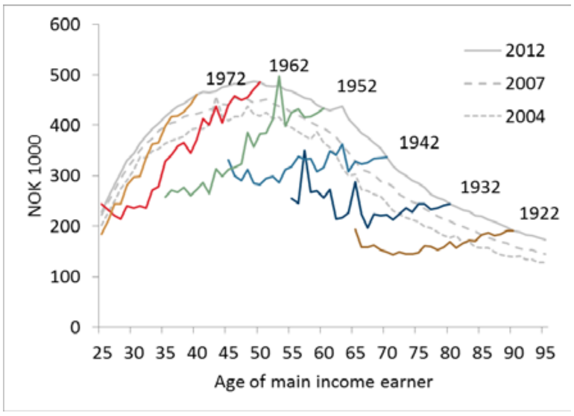
To support our discussion, we present graphs that enable us to highlight the development over the life-cycle of a limited number of cohorts in addition to show the profile each year across all cohorts. We truncate our data at age 25 and 95, i.e. we do not display the results when the main income earner is below 25 or above 95. The oldest cohort we highlight is born in 1922 and is 65 in 1987 and 90 in 2012. The youngest cohort we highlight is born in 1972, it is 25 in 1997 and 40 in 2012.

We start by showing the mean, i.e. per household, real after-tax income, see Figure 16. The solid and dotted grey lines in each graph show the cross-sectional distribution in three calendar years. For example the 2012-solid line shows the real after-tax income across all cohorts this year, and the age of the main income earner depends on the year of birth. The coloured lines trace the development of six specific cohorts over time, i.e. the part of these cohorts' life-span that is covered by our data.

4 Analyses of household saving and debt often take the life-cycle hypothesis (LCH) as a starting point. This theory, which was first presented in Modigliani and Brumberg (1954), provides a framework for analysing household spending and saving behaviour over the life-cycle.

After-tax income by age and birth year of main income earner. Mean. 2000-prices

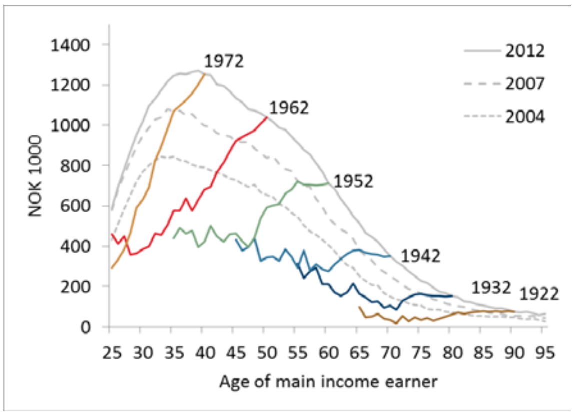
Figure 16



Sources: Statistics Norway and Norges Bank.

Debt by age and birth year of main income earner. Mean. 2000-prices

Figure 17

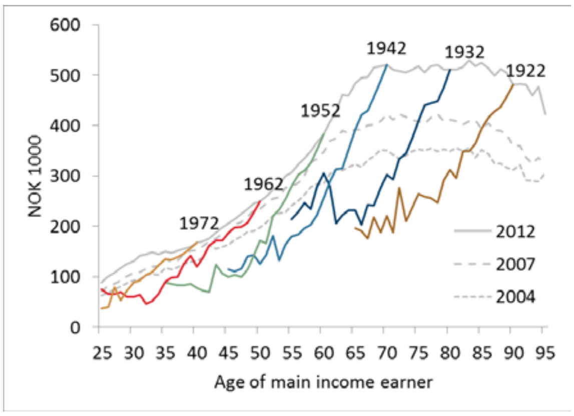


Sources: Statistics Norway and Norges Bank.

Looking across the same life-cycle period, i.e. age, of our six selected cohorts, it is clear that mean real income in general has grown over time. Later cohorts have higher real income than earlier cohorts. Concentrating on the cohort profiles, we see that real income tends to increase most in the earlier life-phases of a cohort and declines or flattens out as the households enter their sixties, which is also the normal retirement age. The cohorts experienced low, or even negative, income growth in the late 1980s and early 1990s. This is related to the severe Norwegian economic downturn at that time. Real income growth has been high in the 2000s. This is true also for pensions, which to a large degree have been linked to wage growth for manufacturing workers. Real income among cohorts in their pensioner phase shows renewed growth in the 2000s.

Deposits by age and birth year of main income earner. Mean. 2000-prices

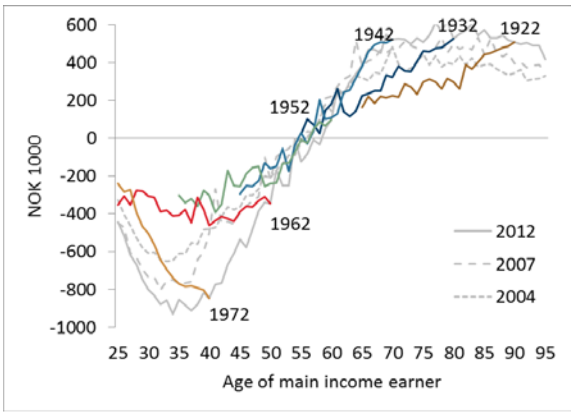
Figure 18



Sources: Statistics Norway and Norges Bank.

Net financial assets by age and birth year of main income earner. Mean. 2000-prices

Figure 19



Sources: Statistics Norway and Norges Bank.

Figure 17 shows the development in mean real debt. Looking across the cohorts, we see that real debt at the same life-cycle period, i.e. age, increases from earlier to later cohorts. This is particularly true in the 2000s, and there is a sharp shift upwards in the grey curves. However, the growth in debt is broadly levelling off when the financial crisis erupts.

To discuss the borrowing and pay-off behaviour of households within the birth-cohort framework, we must look at the development in the level of mean debt over the life-cycle of each cohort. The earliest cohorts pay down their debt up until the 2000s. The strong increase in real debt in the 2000s of the majority of the cohorts may signal a change in the attitude of holding debt coupled with an increase in the availability of credit.

We now turn to household savings in real deposits and real net financial wealth. In Figure 18 we see that our earliest cohorts continue to build up real deposits towards the end of their life-cycle. There is a tendency among households in these early cohorts to reduce their deposits in their sixties, but this is more than offset in their seventies. This increase in deposits among the earliest cohorts is in line with the shift in the composition of financial assets that we found in Figure 3. There we saw a shift from other financial assets to the most liquid and safe financial asset, i.e. deposits, among older households.

Figure 19 shows household real net financial wealth[5]. The broad picture is that households born prior to the mid-fifties go from having negative to positive real net financial wealth around their mid-fifties. We now concentrate on the life-cycle period with negative net financial wealth. By comparing the grey curves, we see that there is a clear negative shift in households' wealth position between earlier cohorts and those born after the mid-sixties. However, later cohorts have a longer life expectancy and, due to pension reforms[6], a higher expected retirement age. This may affect the down-payment profile. Moving to the life-cycle period with positive real net financial wealth, we see that later cohorts have more net wealth than earlier cohorts when we compare across the same age. Hence, the cross-cohort distribution of net wealth has become deeper on the negative side and higher on the positive side. The shift on the negative side is larger than on the positive side, however.

Debt-to-income ratio is a frequently used indicator of credit risk in the household sector. Depending on what one wants to highlight, different measures can be used.

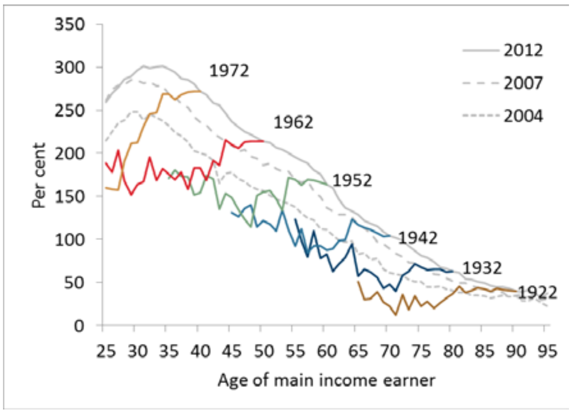
One measure is the debt-*to-after tax income*. After-tax income is the income available for consumption, savings and debt service. This ratio is a rough measure of the share of household income needed to service the debt per percentage point loan-interest rate. Due to high debt growth, this share increased from 1.3 in 2000 to 2.1 in 2012. Hence, in the 2000s, Norwegian households have become more vulnerable to interest rate increases.

[5] We should remind the reader that the value of other financial assets is volatile. Due to data limitations prior to 2010, we do not include housing wealth.

[6] The implementation of the reform started in 2011, but important elements were known at an earlier stage.

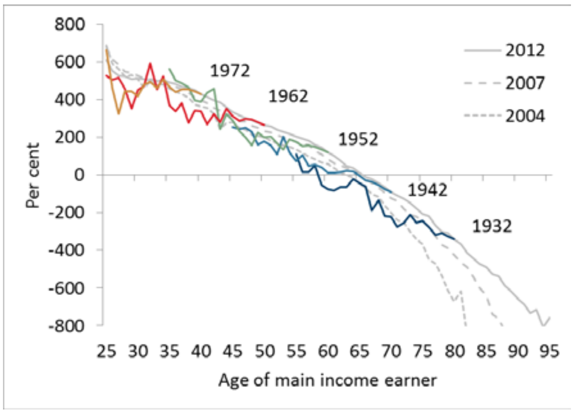
A second alternative is the *net debt-to-debt servicing income* ratio. Debt servicing income is after-tax income less standard cost of consumption. This income measure can be interpreted as the maximum income available to households to service debt. In the 2000s, debt servicing income has grown faster than after-tax income. This is because prices of important items in the standard budget basket have fallen due to an increasing share of cheap imports from emerging economies such as China. This has left more of households' income available to debt service. Since households may easily use their liquid deposits to increase the down payment of their debt, in this more concentrated debt servicing capacity measure, we choose to use net debt, i.e. debt minus deposits, as the nominator.

Debt-to-after tax income ratio. Cohort analysis. 1987–2012. Mean. 2000-prices — Figure 20



Sources: Statistics Norway and Norges Bank.

Net debt-to-debt servicing income ratio. Cohort analysis. 1987–2012. Mean. 2000-prices — Figure 21



Sources: Statistics Norway and Norges Bank.

Figure 20 shows the evolution in debt-to-after tax income across cohorts. Before the 2000s, the households seem to largely "follow the steps" of older households. After the 2000s, there is a general and significant shift upwards in this measure of the debt-to-income ratio. Younger households (for example the 1972 cohort) reach a debt-to-after tax income ratio of 300 per cent at the end of our sample. At this level of debt-to-after income, roughly speaking, if the loan interest rate increases by one per cent, the corresponding increase in interest payments equal three per cent of after-tax income. The effect of an increase in the interest rate measured as the increase in interest payments as a share of income after-tax is much higher in younger compared to older cohorts.

If we instead look at net debt-to-debt servicing income, the development is rather different, see Figure 21. This debt-ratio measure declines over time in all elderly, and also many of the middle-age, households. Even among younger households this measure shows a more modest development. While the debt-to-after-tax income measure indicates that younger generations have increased their debt ratio compared with earlier generations, this is less clear when we look at the alternative net debt-to-debt servicing income ratio. One may say that younger cohorts merely have used low interest rates and favourable prices on reference consumption to increase their debt.

5. Conclusions

In this paper we use household-level data to evaluate the distribution of debt across households and their debt servicing capacity in a life-cycle perspective.

The home-ownership-share in Norway is high, about two-third of households own the dwelling they live in. Households borrow largely in their thirties and forties to buy a dwelling, and household debt-to-income ratio peaks among these age groups. Balance sheet data show that housing wealth is important and accounts for about 60 per cent of total household wealth. Households' net wealth, i.e. their equity-to-total assets ratio, was 64 per cent in 2012.

Debt has shifted from younger to older households. This shift is very much due to a stronger growth in debt among older than younger households, but also demographic changes, i.e. a shift in the distribution of households across age groups and a shift in the share of households holding debt within each age group, have contributed. The distribution of housing wealth has also shifted from younger to older households.

A large share of households adjusts their level of debt up and down within a year. Middle-aged household both take up most debt and pay most down. Around 40 per cent of the gross increase in household debt can be related to home-equity withdrawal, while over 45 per cent is related to first-time home-buying or households buying a new house.

The debt-to-income ratio increased significantly across all cohorts in the 2000s. Comparing households born in the 1960s and 1970s, we find that, in their thirties, the households born in the 1970s have a debt-to-income ratio that is two times higher. The higher the debt-to-income ratio, the higher the share of income necessary to service each unit increase in the loan interest rate. Hence, households' interest rate sensitivity has increased over time.

References

Epland, Jon and Mads Ivar Kirkeberg (2012): Wealth Distribution in Norway. Evidence from a New Register-Based Data Source, Reports 35/2012, Statistics Norway. http://www.ssb.no/a/english/publikasjoner/pdf/rapp_201235_en/rapp_201235_en.pdf.

Holiøkk, Stig Erik and Leiv Solheim(2011): Modell for beregning av boligformue oppdatert med tall for 2010, Notater 9/2011, Statistics Norway. (In Norwegian) http://www.ssb.no/a/publikasjoner/pdf/notat_201109/notat_201109.pdf.

Lindquist, K-G, M D Riiser, H Solheim and B H Vatne (2014): Ten years of micro data. What have we leared? Staff Memo 8/2014. Norges Bank. http://www.norges-bank.no/pages/100604/Staff_memo_2014_08_2.pdf.

Modigliani, F and R H Brumberg (1954): Utility analysis and the consumption function: an interpretation of cross-section data, Post-Keynesian Economics, p 388–436, ed K K Kurihara, New Brunswick, N J, Rutgers University Press.

SIFO – National Institute for Consumer Research (2014): Standard budget. http://www.sifo.no/page/Lenker/Meny_lenker_forsiden/10242/10278 Online; accessed 30-April-2014.

Haakon Solheim and Bjørn Helge Vatne (2013): Measures of household credit risk, Economic commentaries 8/2013 ,Norges Bank. http://www.norges-bank.no/en/Published/Papers/Economic-commentaries/2013/Economic-commentaries-82013/.

Statistics Norway (2014): Households' income and wealth, http://www.ssb.no/en/inntekt-og-forbruk/statistikker/ifformue. Online: accessed 14-April-2014.

The measurement of euro area property prices pitfalls and progress

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Mortgage lending forms a significant part of EU banks' activity. The value of these loans is underpinned by the value of the real estate used as collateral. The real estate market is known to experience deep economic cycles. Real estate price developments are important for macro prudential analysis. The statistical measurement of real estate price developments is a challenging subject that recently has gained more prominence in Europe. This paper reports on the ESCBs development work in this field for both Commercial and Residential property price measurement.

The measurement of real estate property price developments poses distinct challenges for statisticians. Real estate property is by nature very heterogeneous and is traded infrequently. In normal times this already poses challenges in the observation of transaction prices for comparable (like for like) real estate. This is especially true for commercial real estate. Compiling real estate prices during times of stress, e.g. when the volume of transactions decreases sharply from the normal level, is even more challenging.

On residential property, the paper reports about statistics on changes in house prices which have been collected by European central banks since the year 2000. Underlying data sources have exhibited heterogeneous statistical properties, in particular in terms of types of prices referred to, geographical coverage and representation of dwelling types. Nevertheless, residential property price indicators, derived from this source information, have provided useful insights, into cyclical behaviour as well as into the variation of housing market dynamics across EU countries. A harmonised data set of house price indices has been created by the statistical institutes in the European Union. While this achievement poses a great improvement for recent analyses and assessments of house price developments, the central banks' residential property price data can still be considered useful, e.g. for addressing developments time periods in the 1990s and early 2000s and for benchmarking purposes.

As regards commercial property the ESCB has recently established an experimental indicator of commercial property prices. The paper presents this work in detail and highlights both the advantages and the deficiencies of the approach taken. Finally the paper also presents the research agenda for continued development of the data.

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3 The views expressed in this paper are those of the authors and do not necessarily reflect the views of the European Central Bank. The authors would like to thank Gabriel Quirós and Tjeerd Jellema for their helpful comments and suggestions.

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JEL classifications: C43 – Index Numbers and Aggregation, R30 – Real Estate Markets, Spatial Production Analysis, and Firm Location – General, R31 – Housing Supply and Markets

1. Introduction

1.1 Background

The recent financial and economic crisis has highlighted that developments in real estate markets (commonly separated into a commercial and a residential segment) can have a major impact on macroeconomic developments and financial stability. Therefore, it is of utmost importance, in particular for policy makers, to report adequately and timely information about the key factors underlying these real estate movements.

In November 2010 a clear impetus for developing statistics on indicators of commercial property prices came from the IMF and the Financial Stability Board, which included real estate price statistics as a principal global indicator (PGI) as recommendation 19 in their report to the G20 entitled "The Financial Crisis and Information Gaps[4]".

Residential property price indices aim to measure changes over time in transaction prices of houses and flats, including the underlying land, independent of which sector of the economy the buyer or seller come from and who occupies the dwelling after the purchase. Residential property price indicators have been collected by the European Central Bank (ECB) since the year 2000; official statistics, if available, were very incomplete at that time. The ECB's data collection was set up in collaboration with the EU central banks. Price indicators were mainly obtained from the Bank for International Settlements (BIS) which started in the late 1980s to create a data base on house price indicators from data provided by its member central banks. The European System of Central Banks' (ESCB) Working Group on General Economic Statistics (WG GES) has been developing and contributing to the enlargement and improvement of the ECB data collection. This paper heavily draws and largely presents done by the WG GES. While in most cases existing data sources have been applied, some National Central Banks (NCBs) have become actively involved in the data collection. Several central banks contributed to the compilation of the indicators. Statistical activities have ranged from providing data, e.g. for weighting, to the complete development of residential property price indicators. However, the fact that most NCBs are not directly involved in the collection or compilation of residential property price information has been limiting further improvements of the ESCB dataset, in particular in terms of harmonisation. The degree of heterogeneity in terms of data sources, collection methods and compilation procedures has remained substantial. Overall, the statistical quality of the ESCB data has remained below the standards of other economic statistics and price indicators for the euro area. Nevertheless, most indicators allowed identifying major upswings and downturns of housing market prices, while there were several cases in which it turned out to be difficult to capture short-term movements.

[4] See IMF Staff and FSB Secretariat, "The financial crisis and information gaps", available on the IMF's website at http://www.imf.org/external/np/g20/pdf/102909.pdf.

In the mid-2000s, the European Statistical System[5] started creating a set of comparable house price indices for EU Member States, compiled according to harmonised statistical concepts and methods. The official publication of these house price indices started in February 2013. While the ESS achievements on house price indices mark a milestone towards a harmonised statistical compilation and reporting, the non-harmonised statistics collected by central banks, in particular those by the BIS, and other institutes may be considered to be still useful, in particular in terms of back data and long time series, but also for enriching the picture in terms of recent developments.

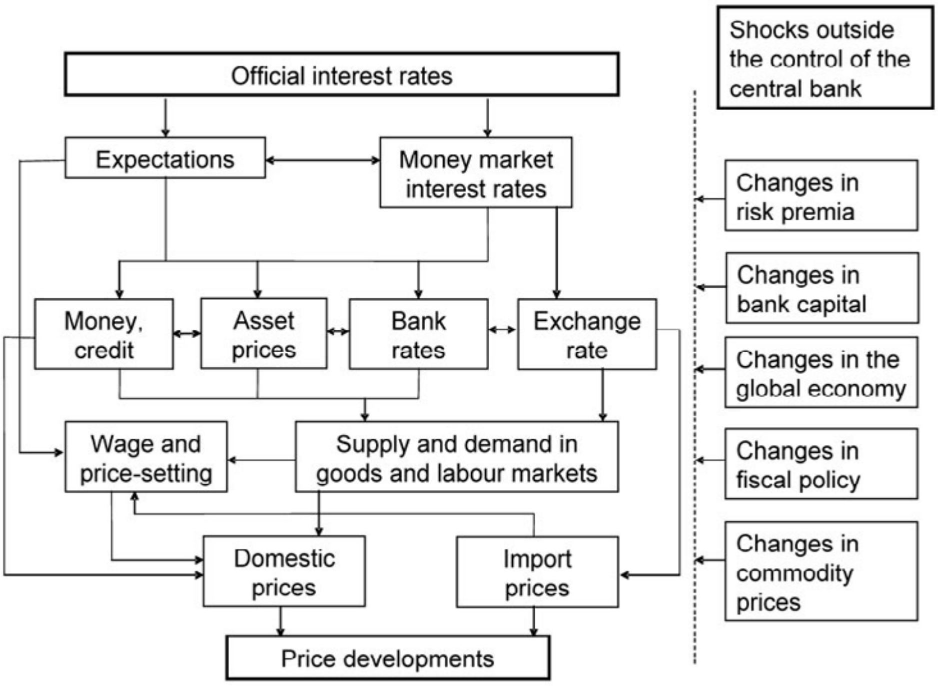
1.2 The use of commercial and residential property price analysis in the European Central Bank

Measures of changes in real estate prices can provide valuable input to both monetary policy and financial stability analyses. This reflects the role that these prices can play in the monetary transmission mechanism and the assessment of the asset quality of bank balance sheets.

The role of commercial property prices in the monetary transmission mechanism is similar to that of other asset prices. On the one hand, commercial property prices may move in response to changes in financing conditions and expectations triggered by monetary policy actions (see Figure 1). On the other hand, commercial property prices can propagate monetary policy actions to economic growth and HICP inflation. While residential property prices may also have a more direct influence on consumer price inflation, the influence of commercial property prices might normally be more indirect through effects on investment decisions. For instance, higher commercial property prices could be reflected in the valuation of fixed assets which might lead to improved financing conditions and better enable firms to raise funds for investment projects.

[5] The European Statistical System consists of Eurostat, the statistical office of the European Union, and all national statistical institutes of EU Member States.

Stylised representation of the monetary transmission mechanism Figure 1



Source: ECB.

Residential property price indicators play a role for monitoring and forecasting macro-economic developments, in particular those related to private households' economic decision making. The buying or selling of a dwelling is typically the largest transaction a private household enters into. Changes in residential property prices are therefore likely to influence substantially budget plans and saving decisions of the potential buyers and sellers. Such price changes also impact on the wealth of dwellings owners of given that it is the largest asset in their portfolio. Houses and flats are purchased as an investment, which creates rental income in the case the dwelling is being let. This is, for the time being, the main channel through which house price inflation may impact on the rates of change of Harmonised Indices of Consumer Prices (HICPs) – the European Central Bank's measure to define price stability in the euro area. The impact materialises via rents and not directly via house prices, since the Harmonised Index of Consumer Prices covers rental payments by households whose weight in the Harmonised Index of Consumer Prices for the euro area in 2014 is 6.2%), but excludes – for the time being – expenditures by owner-occupiers for purchasing or using their own house or flat. Housing investments may also create significant capital gains. Housing price developments can also have an effect on residential construction investment. Finally, housing prices can provide important insights for financial stability analysis, since sharp changes in house prices can have a detrimental impact on financial sector health and soundness, by affecting credit quality and the value of collateral.

From a financial stability perspective, it is also important to observe that institutional investors, such as insurance companies, pension funds, hedge funds, private equity firms and sometimes banks, have large investments in commercial and residential property markets. Banks and other financial intermediaries also tend to have real estate exposures via collateralised loans extended for investment in real estate. A fall in property prices and rents weakens the property companies' financial soundness and thus their ability to service debt, as well as lowering the value of collateral for mortgages. Lending for real estate activities is the biggest category of total MFI loans to non-financial corporations in the euro area, accounting for 35% of the total, a share that has been increasing over the past ten years. In addition, loans for construction account for an additional 9% of total loans to non-financial corporations. However, the importance of lending for real estate and construction activities combined differs greatly across countries.

2. Types of data sources

The nature of real estate markets is such that data collection can be undertaken at different stages of the process of acquiring real estate, can be collected from different actors and, as a result, are available with different timeliness and accuracy. For instance, for a house purchase one might collect data at the time of first marketing (an offer price), when an offer is made for purchase (a bid price), or when the sale takes place (a transaction price) and might be collected from the house owner, a real estate broker, a lawyer or a registration authority, etc. These differences can obviously affect the quality and comparability of the data used. Different types of data sources are explained below.

2.1 Types of commercial property data

Commercial property is usually defined as income-generating property, such as office buildings and retail establishments (restaurants, shopping centres, hotels, etc.); industrial buildings (e.g. warehouses, factories, etc.); and residential property that is being leased or developed for commercial purposes. It is helpful to view income generation predominantly in terms of rental income obtained from the letting of commercial property, which is part of the real estate activity. Indicators of commercial property prices are high on the list of central banks' data needs. Commercial property markets play an important role in the real economy and are also important for financial stability, primarily due to banks' large loan exposures to commercial property.

The ESCB conducted a stocktaking exercise aimed at determining what indicators exist in the EU to measure commercial property prices. It found that data sources and methodological approaches varied significantly between countries and over time. The stocktaking showed that data are collected at different stages in the purchase process, or at values or appraisal regimes that are not comparable, or that they are extracted from other, related, information rather than from prices. In broad terms, four types of data sources were identified, including transactions data, property valuations (either official or from the private sector), other expert judgement, and financial markets data.

a) ***Transactions based data:*** The ideal source for accurate measurement of commercial property prices is to collect data on transactions as and when they occur given that actual purchases reflect best current market situations and conditions. The data collection needs to have a big enough sample to be representative both of the market as a whole and to allow robust estimates for any breakdowns that are required. Furthermore, both a good coverage of property types (reflecting the market) is equally important as a sufficient coverage of geographical areas. While transaction prices remain the preferred option for price stability analysis, this may, in reality, be difficult to achieve for commercial property, which tends to be highly heterogeneous and infrequently traded, in particular in small countries and in the case of the latter during times of financial or economic market stress, when property markets often register reductions in liquidity.

In reality, the commercial property market is often highly illiquid (especially in times of market stress) which restricts the possibility of compiling a purely transactions based statistic significantly.

b) ***Valuation-based data sources:*** The majority of the price data identified for commercial property are valuation-based indices, and the data sources are predominantly private organisations such as estate agencies, portfolio benchmarkers and other financial market or real estate companies. These indices are often designed for performance measurement purposes rather than for measuring price changes over time. Such valuation-based indices, while allowing a price estimate to be collected when it would not otherwise be available, can thus often have the following drawbacks:

- valuation errors: the sample used for the calculation of the index may be non-representative of the commercial property transactions (i.e. sample bias);
- smoothing issues: the index value may be based on subjective valuations and thus incorporate a bias, because there is a tendency for valuers to use comparable historical or past transaction prices when forming an opinion of the value of a property. Hence, a particular value might therefore be too "tied" to its previous valuation in a rapidly moving market;
- the underlying sample can have non-continuous coverage;
- only relatively short histories of index data are available for many countries.

c) ***Other expert judgement:*** An alternative approach that can be used is to ask property market professionals (for example valuers, architects and property portfolio managers) to make a professional judgement on the price for a specified but fictitious property. This method is used in some of the better known commercial indices – for instance those produced by Jones Lang Lassalle – but suffers from the valuation-based concerns mentioned above. Furthermore, unless a full range of quality and types of property are judged in this way, they tend to concentrate only on the highest quality property in the most prestigious areas. The approach does, however, have the advantage that it can be compiled in a very timely fashion.

d) ***Financial market data:*** In several countries, there are unit trusts or other financial vehicles (e.g. real estate investment trusts) that solely contain commercial properties as the underlying asset. Movements in these might then be used to infer commercial property prices. However, the underlying assets are unlikely to be representative of the market as a whole. Similarly, movements in the value of the financial asset will not only be due to the change in underlying commercial property prices, but also due to other factors, such as the gearing of the fund in question or money market rate movements. The data are, however, available in real time.

2.2 Types of residential property data

Price data underlying the residential property price indicators stem from various sources. Residential property prices collected for registration or taxation purposes usually provide a comprehensive data source. However, data collected for taxation purposes may be prone to underreporting of the prices actually agreed between the buyer and the seller. Administrative data sources are, e.g. used for the compilation of residential property price indicators in countries in Denmark, Lithuania, the Netherlands, Finland, Slovenia, Sweden and the UK. In Germany, the statistical institute collects prices from the local expert committees for property valuation.

Data recorded by notaries also provide a comprehensive source for index compilation, used, e.g., by statistical institutes in Spain and France. Real estate agencies' price data may not be fully representative of all housing transactions depending on the market segments covered by the agencies' business activities. A broader market coverage may be reached by simultaneously referring to transaction and offer prices as well as assessments by market experts. Such price data are typically used by real estate consultancies, as one of several sources of price information. Examples of the use of real estate agencies' price data for the compilation of residential property price indicators are Belgium, Germany ("Bulwiengesa"), Greece, France, Italy ("Nomisma"), Portugal and Slovakia.

Data collections of offer or asking prices usually suffer from not taking into account that actual transaction prices may significantly deviate from offer prices. Asking prices are used in the indicator compiled by the Central Bank of Malta.

House price data collected in the process of financing purchases by mortgage loans may also represent only some segments of the market. Cash-paid transaction may present a significant part of all transactions. In Ireland and the UK residential property price data are provided by mortgage lenders. The indicator compiled by the UK's Office for Communities and Local Government is based on a mortgage survey conducted by the Council of Mortgage Lenders.

Price data derived from appraisals may have the advantage of covering a broad sample of houses and flats. If conducted for administrative purposes, for example in Denmark and the Netherlands, appraisal values might even be available for the entire population of residential properties. However, appraisal values might be biased vis-à-vis actual transaction prices, which is more likely if the appraised value is used when a mortgage loan is refinanced than in cases it is used for taxation purposes. Appraisers might react with a delay to recent market developments. Changes in appraised values might only be reported after actual price have increased by a certain amount.

3. Data requirements

Given these important uses of changes in real estate prices, price indicators of good statistical quality are required. The primary objective, whether measuring commercial or residential property, is to measure changes in transaction prices, given that actual purchases reflect best current market situations and conditions. A good representation of property types is equally important as a sufficient coverage of geographical areas. In order to identify market dynamics driven by price changes over time, property price statistics have to control for quality changes in the properties sampled over time.

Due to the divergent developments of real estate property prices across euro area countries, results for individual euro area countries are essential. In addition, it is desirable to obtain at national and at the euro area level a distinction in the price development between urban and non-urban areas. Separate price indices for different property types would also provide useful information for macro-economic and macro-prudential analyses.

The ECB restated its minimum requirements for residential property price data in December 2004[6] – a euro area (and underlying Member States) quarterly index, covering houses and flats (new and existing), with at least coverage of the large cities and with a 60-90 days timeliness. Similarly, for Commercial Property the requirement is a quarterly index with 60-90 days timeliness. The country coverage requirement is for the EU (reflecting that commercial property bank lending is more likely to cross borders than for residential property).

One aspect, that is as yet unsolved, is that there may be some overlap in the boundaries between residential and commercial indices. This is because in order for a property to be commercial it must, by definition, give rise to an income stream. As a result residential property which is not owner-occupied but is instead rented out fulfils the criteria for commercial property.

Real estate is by nature very heterogeneous, is traded infrequently and the property market can be, particularly in times of market stress, illiquid. The application of the fundamental principle of price statistics, i.e. to calculate price changes of items whose price-determining characteristics are constant over time, requires specific efforts for the measurement of changes in real estate prices, in particular in terms of sampling. Sample-selection biases and insufficient control for shifts in the composition of real estate properties whose prices are used for index compilation may significantly hamper the interpretability of real estate price indicators. Since these issues may not be entirely overcome under all relevant circumstances, their impact to the design and use of real estate price indicators has to be considered in the context of user requirements. For example, the reporting frequency has to be chosen in the light of sufficiently large sample sizes, also in terms of stratification by regions and types of properties. Many practical applications have shown that the compilation of monthly indices is only feasible in real estate markets with high turnover, e.g. in the area of greater London. A quarterly reporting frequency has been reached for many house price indices, while commercial property markets may in some cases only currently allow the calculation of annual indicators.

3.1 Commercial property data requirements

Transaction-based data sources provide a priori the best theoretical approach, at least for price stability analysis, but cannot be the sole data source, as market liquidity tends to be too low in times of stress. Valuation data, perhaps

[6] See "Review of the requirements in the field of general economic statistics", ECB 2014, https://www.ecb.europa.eu/pub/pdf/other/reviewrequirementsgeneconomstat200412en.pdf.

supplemented by additional indicators, are therefore likely to be key inputs. Given the difficulties encountered in collecting representative information on commercial property transactions directly and hence deriving meaningful price data, it is necessary to examine alternative or complementary sources of information as described in the previous section.

Bearing this in mind, the ESCB has developed experimental[7] mixed source or hybrid indicators, based on nationally available data and that supplied by a major commercial data provider. The data are available at a quarterly frequency around 70 days after the quarter in question and their method of calculation is described in Section 4 of this paper.

3.2 Residential property data requirements

In the area of residential property prices, the main interest of the European Central Bank and the national central banks of the European Union in changes is related to developments of transaction prices. Besides that, statistics on the value of the housing stock can also contribute an important piece of information, e.g. for analysing wealth effects. In this context it should be mentioned that different uses of residential property price indices may require different concepts.[8] Whereas an indicator which is designed for tracking price changes over time has to be adjusted for changes in quality over time, appreciation or depreciation of the housing stock as a whole due to quality changes should show up in indicators of housing wealth.[9] Other conceptual differences are related to the type of price and weight information to be used for compiling indices.

4. Data used by the European Central Bank

Prices of commercial and residential properties are in most cases derived from secondary data sources. Often, this implies that the structure, the representativity and the timeliness may vary considerably across different sources.

4.1 Commercial Property price sources and definitions

A hybrid source approach has been taken to construct headline experimental euro area and EU aggregate indicators of commercial property prices. Transaction-based indicators are the preferred data source, at least for price stability purposes, but the availability of these data is rather sparse. Several EU countries have data that are to some extent based on transactions. These are Denmark (produced by the national

[7] Experimental ECB statistics were defined and discussed in detail in the paper entitled "Experimental data as part of the ECB's statistical production and dissemination policy" by Aurel Schubert (available at http://q2012.gr/articlefiles/sessions/26.2-Experimental-statisticsECB-Aurel-Schubert.pdf).

[8] See Fenwick, 2006, "Statistics on real estate prices: the need for a strategic approach", p. 6.

[9] Keeping the sample representative for the housing stock may require adjusting the composition of the sample for shifts in the dwelling characteristics.

statistical institute), Germany (sourced from BulwienGesa AG) and Italy (produced by the Banca d'Italia[10]).

An overview of the source data used is shown in Table 1. The choice made uses the following convention: where transaction-based data are not available from national official statistical sources, data are obtained from a commercial data provider. The ESCB's preference is to use valuation-based data that have been enhanced by available transaction information to construct national indicators. In the absence of transaction data, only valuation-based data are used. Quarterly data are preferred to interpolated annual data.

The Investment Property Databank (IPD) is a commercial information business providing market data and performance analysis for the owners, investors, managers and occupants of real estate. In 2011 the IPD entered into an agreement with the ECB to enhance its dataset in order to supply quarterly commercial property price indices for all directly held commercial real estate assets (all property) and for the four main market sectors – retail, office, industrial and residential (i.e. those residential properties that are let to tenants by professional landlords).

The IPD dataset contains asset-level data from a wide variety of professional investors in real estate. It excludes any data from properties that are indirectly held through investment vehicles, bonds, cash, derivative and real estate funds/investment trust share holdings. This source of data is a key input in the production of the ESCB dataset.

The IPD uses two different methodologies to estimate commercial property prices at a national level: a valuation-based method and, where the required data are available, a transaction-linked method. The valuation-based method uses data on professional valuations of existing buildings. Ideally, the market valuation of a property corresponds to the price that would be agreed between a willing buyer and a willing seller within a reasonable negotiating period, net of purchasers' costs (e.g. legal fees and tax payments). Nonetheless, in practice, the valuations may diverge from the prices that would be settled if a transaction were to take place on account of the cyclical conditions of demand in the market. The calculation of valuation indices starts from very detailed asset-level prices, which are then aggregated up to sector (retail property, industrial, etc.) and national aggregates.

10 It is expected that data for Greece and Poland will be added to this list in the course of 2014.

Source data used in the compilation of euro area and EU indicators of commercial property prices

Table 1

Country	Source	Original series frequency	Extrapolation method
Belgium	IPD (valuation based)	Annual	Linear extrapolation
Germany	BulwienGesa AG	Annual	Linear extrapolation
Estonia	.	.	.
Ireland	IPD (transaction linked)	Quarterly	None
Greece[a]			
Spain	IPD (valuation based)	Annual	Linear extrapolation
France	IPD (transaction linked)	Biannual	Linear extrapolation
Italy	Banca d'Italia	Quarterly	None
Cyprus	.	.	.
Latvia	.	.	.
Luxembourg	.	.	.
Malta	.	.	.
Netherlands	IPD (transaction linked)	Quarterly	None
Austria	IPD (valuation based)	Annual	Linear extrapolation
Portugal	IPD (valuation based)		
Slovenia	.	.	.
Slovakia	.	.	.
Finland	.	.	.
Bulgaria	.	.	.
Czech Republic	IPD (valuation based)	Annual	Linear extrapolation
Denmark	Danmarks Statistik	Quarterly	None
Croatia	.	.	.
Lithuania	.	.	.
Hungary	IPD (valuation based)	Annual	Linear extrapolation
Poland[a]	IPD (valuation based)	Annual	Linear extrapolation
Romania	.	.	.
Sweden	IPD (transaction linked)	Annual	Linear extrapolation
United Kingdom	IPD (transaction linked)	Monthly	None

[a] Data from the national central bank are expected to become available by end 2014.

The transaction-linked dataset uses the valuation data, but supplements and enhances it with available data on transactions in the market in the quarter in question. These are determined by estimating the sale prices of the properties sold as a function of their prior valuations by means of linear regression. The regression coefficients associated with valuations are then used to predict the "hypothetical" sale price of the "unsold" properties in the quarter.

Several caveats to the IPD datasets should be highlighted.

- In times of financial stress, market liquidity tends to be very low and, consequently, a reduced number of transactions may affect significantly the statistical quality and the reliability of the transaction-linked indicator estimations. The basic estimation model includes checks to see if there are a sufficient number of transactions to produce the associated coefficients with country dummy variables.

- Portfolio investment/disinvestment can cause problems in interpreting the data, as volume changes could have an effect on the prices recorded. To prevent structural breaks emanating from volume changes in the portfolio, the sample is held constant for five consecutive quarters to allow the compilation of year-to-year percentage change series.
- A true quarterly index is preferable in order to facilitate a frequent analysis of commercial property market developments. The IPD provides quarterly data on indicators of commercial property prices that are calculated from the highest possible frequency data available. However, since quarterly valuations are not available for all countries, lower frequency data are interpolated to construct quarterly series[11].
- Professional investors are likely to predominantly cover the prime segment of the market – usually defined as modern buildings in sought-after locations. In addition, the source data used at present do not include building or construction projects which are still under development. This can be a drawback, in particular when the data are used for financial stability analysis, as they cannot be used to gauge the credit risk confronting banks that have lending exposures to commercial property developments.

Taking into account these caveats, a multi-source analytical approach using a hybrid headline indicator, supplemented by both valuation and hybrid valuation/transaction-based series, is arguably necessary for users to assess and monitor the development of commercial property prices.

The IPD datasets currently used to construct the headline dataset at the ECB contain national quarterly price series for Belgium, Ireland, Spain, France, the Netherlands, Austria, Poland, Portugal, Sweden and the United Kingdom, although some of these series are interpolated. This means that the quality of the annual data compiled is higher than that shown at a quarterly frequency.

As mentioned above, for the ESCB dataset on indicators of commercial property prices, the preferred data are those supplied by national official statistical sources or endorsed by the relevant national central bank. When these are not available, IPD data are used by the ECB to compile euro area and EU aggregates. In the case of indicators of commercial property prices, the commercial property prices of a country should ideally be weighted by the total size of the commercial property market in that country or the value of the annual turnover. As such data are not generally available, a suitable proxy has to be found. At present, the euro area and EU indices are compiled using nominal GDP weights.

The calculation of the weighted euro area and EU series is as follows.

- A moving five-year average of GDP weights is applied to the annual percentage change of the chosen data source for each available country. Euro area and EU aggregates are produced only when coverage of 70% is achieved as measured by the GDP weights.

[11] Data for Belgium, the Czech Republic, Spain, Hungary, Austria, Portugal and Sweden are treated in this way.

- This implies that, for EU and euro area aggregates, countries that are not covered are assumed to show the same dynamics as the GDP-weighted average of countries for which indicators of commercial property prices have been compiled.

4.2 Residential property price indicators

Indicators on changes in house prices have been compiled for several years, mostly outside the area of official statistics. Before statistical work has been intensified, changes in dwelling prices were sometimes derived from average prices, i.e. the arithmetic or geometric mean or the median of recorded price data. The meaningfulness of such average prices for measuring house price inflation depends on the way it is controlled for differences in the composition of the sample with respect to the characteristics of the houses or flats. Constant-quality price indices can be compiled by applying hedonic regressions which use information about the physical attributes of houses and flats and their location. In Eurostat's data set, several house price indices make use of hedonic regressions. Generally, hedonic regression analysis of house prices usually requires a well-defined set of data about housing characteristics.

By comparing purchase prices for the same dwelling over different points in time, a "repeat sales"-index controls for differences in the physical attributes and the location. However, the overall condition of a house or flat might have deteriorated between two sales; the location might have become more attractive, e.g. due to a better connection to public transport, and then the "repeat sales"-method does not necessarily measure pure price changes. Additionally, since only prices for dwellings are taken into account which are sold more than once, this might not be representative for the whole housing market. If house price values are appraised on a frequent basis, the latter problem could be overcome by covering also appraisal valuations. In cooperation with the Delft University of Technology the national statistical institute of the Netherlands recently developed a residential property price index which combines data of the Land Registry Office "Kadaster" and government appraisals. Price changes are derived from the change in the average ratio of sales prices and appraisal values in a base period and a comparison period (the "SPAR" approach).

When aggregating indicators across regions, house types or quality categories, an appropriate weighting scheme has to be chosen. Various approaches to weighting have been applied in practice. Using weights based on housing stock data usually implies a high degree of stability. If reliable information about the housing stock is not available, it is common practice to use population weights as a proxy.

The potential volatility of transaction weights may have a significant impact on the index measures, in particular if the weights are frequently updated and chain-linked indices are compiled. A positive correlation between price increases and transactions might even result in index values which deviate substantially from expected outcomes, if the weights differ substantially in the course of a house price cycle.

A way to limit the volatility stemming from concurrent transaction-value weights for new dwellings is to apply a more stable weighting structure, which reflects, e.g., the average number of purchases over several years. However, this might imply that in periods in which only a few houses are purchased in a certain segment of the market, the price changes might still get a high weight in the overall index resulting from former periods' high transaction values or volumes.

For residential properties, the ECB started in 2001 compiling a euro area aggregate. National price indicators are combined as an arithmetic average of the rates of change of the available national price indicators, weighted by shares in the euro area gross domestic product at current prices. Gross domestic product shares have been used for weighting, mainly due to availability and comparability of these data across EU countries. Data on transactions or housing stock which would provide more specific information about the structure of the housing market are not available for several countries. In order to get quantitative insights in the impact of alternative weighting schemes, the European Central Bank conducted test calculations, for which existing data gaps were filled by referring to proxies.[12] The results suggested that the general price trend was not significantly affected by the choice of the weights.

The ECB compiles also a long time series for the euro area. Back data for the bigger euro area countries were taken from sources of lower statistical quality compared to the headline indicator, while the cyclical dynamics reflected by these back data is considered to be sufficient for building a long series at the euro area level.

As a result of an EU-wide initiative by the statistical office of the European Union, Eurostat, and the national statistical institutes an almost complete set of official price indices for EU Member States was made available in early 2013. These price indices are provided at a quarterly frequency, based on transaction prices. A common index formula is applied, weights represent the market structure in terms of sales. Eurostat publishes a press release of the EU data set around three months after the end of the reference quarter.

The data set of house price indices as compiled by the statistical institutes in the EU have set new standards in terms of comparability. However, these time series are rather short. Index values have been made available as of the first quarter of 2005, for several countries time series start in the years 2007 or later. Therefore, these data do not yet allow analysing several cycles of the housing markets.

Most ESCB residential property price indicators cover time spans starting in the early 2000s or mid1990s. Recently, the Bank for International Settlements published a set of long time series which covers periods from the early 1970s. Long time series covering several decades often require linking of data sources that may differ in terms of definition and coverage. Therefore, international comparisons of non-harmonised national sources have to take into account that the quality of the data is usually lower for periods before the 1990s.

[12] See Ahnert and Page (2005), "Euro area residential property prices: the aggregation of non-harmonised national data", p. 299 and European Central Bank (2005), February 2005 issue of the Monthly Bulletin, p. 57.

5. Current data

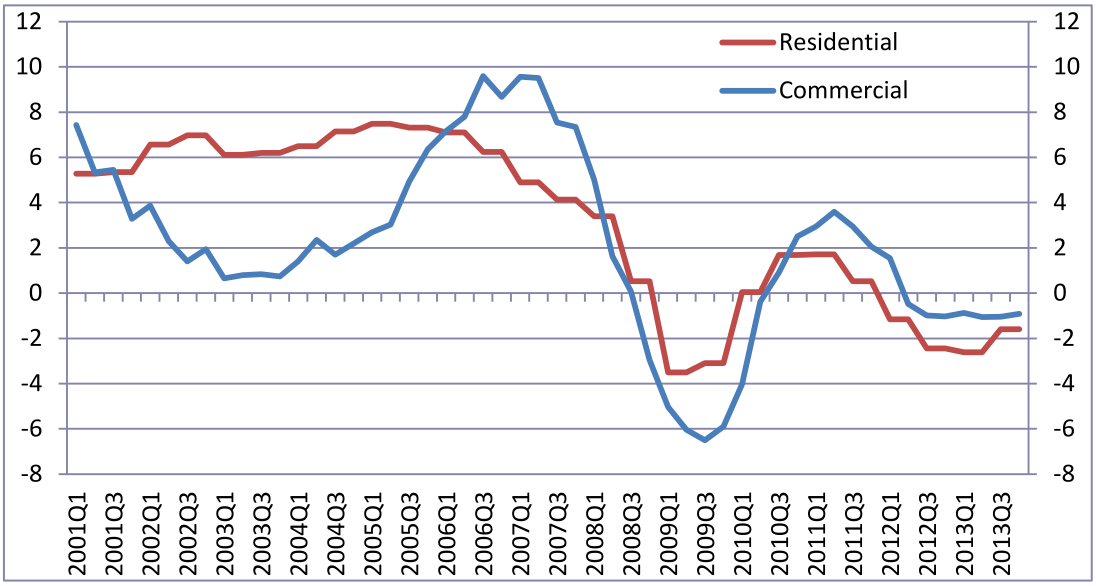
Commercial and residential property prices tend to follow similar but not identical trends. Overall, from the data it can be seen that the commercial property appear to be somewhat more volatile when compared to the Residential data. This perhaps reflects that residential property provides shelter – a necessity – while commercial property does not and hence is likely to be transacted more rapidly in response to economic conditions. An illustration of this is shown in Chart 1 which plots, for the euro area, both series.

In the more recent past both series show the sharp effects of the financial and economic crisis and a levelling off of changes.

Euro area residential and commercial property prices

Annual percentage changes

Chart 1



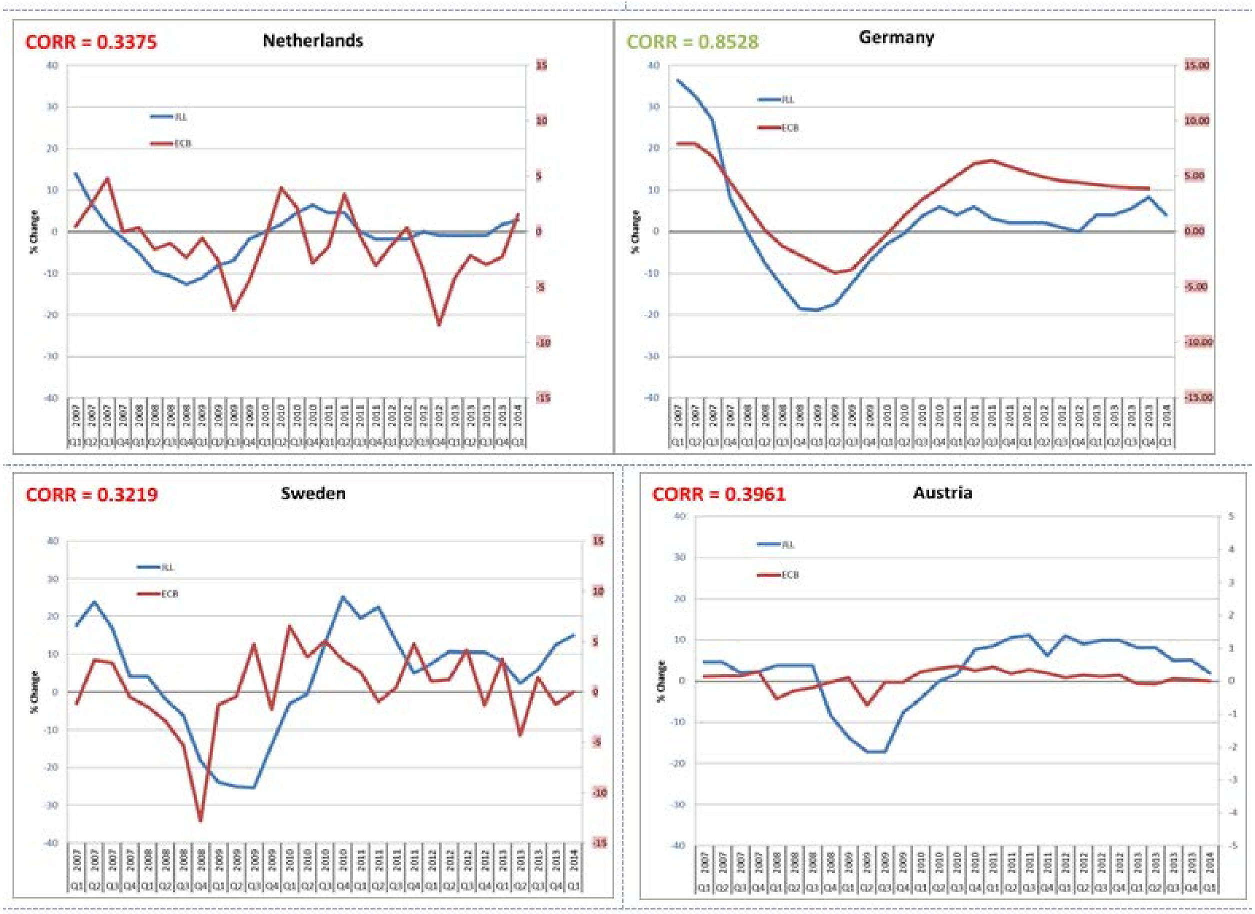
Source: ECB, WG GES.

The current data as compiled by the ECB for commercial property can differ in some countries from that supplied by other compilers. The reasons may be a result of very different compilation methods or assumptions. An example is the data published by Jones Llang Lasalle which uses expert judgement about the price of a fictitious property to create indices. To illustrate the differences Chart 2 shows the different results for a selection of countries.

Differing sources of commercial property prices

Annual percentage changes; JLL right hand scale, ECB, left hand scale

Chart 2

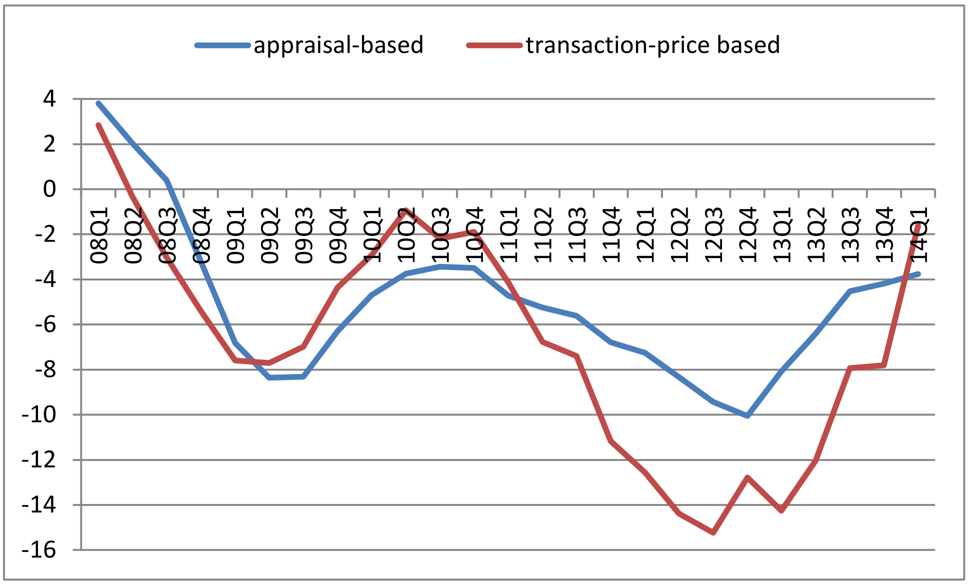


As can be seen in some cases the two methodologies are giving similar results while in others there is no obvious connection between the series. These aspects highlight that the issue of data comparability is extremely pertinent in this field.

For residential property price indicators, the example for Spain of appraisal-based indices and transaction price indices (Chart 3) illustrates that the main difference may not be the dating of turning points, but the intensity of upswings and downswings reflected by the price statistics.

Residential property price indicators for Spain – appraisals and transaction prices

Annual percentage changes | Chart 3



Source: ECB, WG GES.

It may be argued that indicators based on varying data sources and according to different methods enrich the picture for macro-prudential and macro-economic analyses. However, this requires that detailed metadata are provided. The availability of such data is currently often not entirely sufficient. Differences which are mainly caused by statistical methods may remain undetected by users, bearing the risk of drawing inappropriate conclusions. This calls for identifying headline indicators, in particular for cross-country comparisons and compilations of euro area and EU aggregates. Both aspects are of high importance for international institutes engaged in policy, like the ECB.

6. Conclusions and outlook

The ESCB's collection of price statistics on residential and commercial properties has been used for filling data gaps while official indices are worked upon by the ESS. Official house price indices for the euro area have become available in 2013. By contrast, statistical work on commercial property price indicators has started only recently. Under the auspices of Eurostat, a Handbook on Commercial Property Price Indictors is being drafted in which the conceptual and methodological framework is set. The ESCB's work on the compilation of indicators is currently the only project in the area of official statistics from which practical experience can be gained.

The ESCB intends to continue developing the commercial property price data, by addressing the limitations mentioned before, until official and more harmonised data become available. In this respect, the ESCB has set the following quality enhancement objectives, both at a national level and for the IPD dataset, for the forthcoming years:

- An ongoing exploration of alternative data sources for the countries which are not currently covered by the available source data. The same procedure will be undertaken for information which can increase the coverage of transactions. With this in mind, the exploitation of national sources identified in the stocktaking exercise is a possible avenue for future development.
- A regular review of the data against other data sources and/or economic indicators, in order to examine the robustness of the indicators.
- While data are available for transaction and valuation-based breakdowns by type of property (offices, retail, industrial, etc.), indicators analogous to the hybrid headline indicator have not yet been calculated. Investigations will be undertaken into how they might be calculated.
- The establishment of related indicators, such as rents and vacancy rates, in order to aid in the analysis of the data.
- An exploration of whether it is possible to integrate information on property under development into the index or if a separate indicator needs to be provided.
- An investigation to establish whether weighting solutions can be found to correct the anomalies, both within a country and when aggregating to the European levels. As described above, the individual valuation/transaction data are simply summed to a country aggregate using the total information for each of the properties reported by data respondents. This could mean that, for instance, the index is dominated by office properties, while the structure of the market is different.
- Interpolation methods will be reviewed. At present, data for a particular country supplied less often than quarterly are interpolated linearly. It may be that explanatory variables can be found that would allow this process to be enhanced.
- Geographical information will be exploited. To further enhance the transaction-linked data, a successful research project was conducted by the ECB on a subset of IPD data pertaining to the Netherlands which examined the geographical location of individual properties and used spatial[13] autocorrelation to improve estimates. Subject to data availability, the methodology may be applicable to other Member States.
- Quality adjustment will be developed, although the methods used are data intensive and this is a technically challenging area for longer-term research.
- Further data which can increase the coverage of transactions will be incorporated as they become available. These data will replace estimates based on the IPD database or will otherwise be incorporated into the dataset if not covered by the IPD.

[13] Spatial dependency is the covariation of properties within geographic space: characteristics at proximal locations appear to be correlated, either positively or negatively.

The ESCB's collection of indicators on changes in prices of residential properties has provided useful insights, while requirements in terms of comparability have only recently been fulfilled with the release of Eurostat's data set. In terms of back data the ESCB's data set remains useful.

The European Central Bank and national central banks will continue to jointly develop datasets on commercial and residential property price statistics. In the area of commercial property price statistics, the ESCB's experimental work will most likely remain the most comprehensive effort within official statistics towards reaching a data set for the euro area. Both for commercial and residential property price indicators several minor and major improvements have been achieved over the recent years. However, the fact that most national central banks are not directly involved in the collection or compilation of residential property price information limits the further improvements that can be achieved.

BIS Collection and publication of residential property prices

Michela Scatigna and Robert Szemere[1]

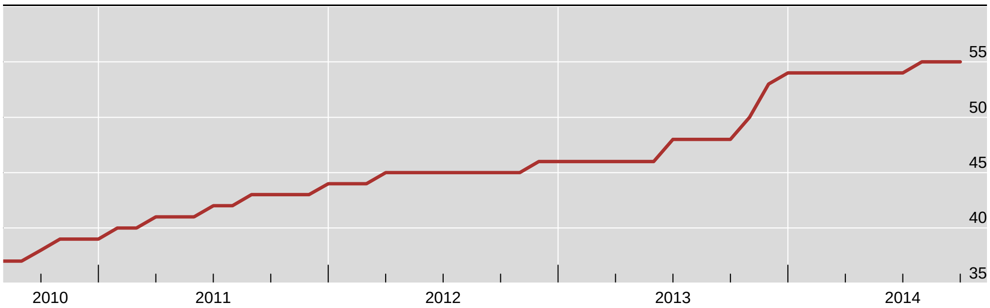
Background

In 1989 the BIS started to collect residential property price for research purposes. The first research paper based on residential property prices was published by Borio, Kennedy, Prowse in 1994.

Later, in 2009 the BIS got an explicit mandate to collect and publish residential property prices in the context of the G20 Data Gaps Initiative. In particular, the financial crisis and information gaps report to the G-20 finance ministers and central bank governors published in 2009 stated in its recommendation 19 that the BIS and member central banks investigate the dissemination through the BIS website of publicly available data on real estate prices.

In July 2010, after approval of central banks the BIS started the regular monthly publication of residential property prices. The coverage of these statistics has increased from 37 countries at that time to 55 to date, among which 18 of the G20 countries, and a full coverage of the EU 28 countries. The number of series published today is above to 300, as some central banks report series referring to different types of dwellings and/or areas.

Number of reporting countries — Graph 1



Source: BIS.

[1] Respectively, Senior Research Analyst (michela.scatigna@bis.org) and DBS Statistical Analyst (robert.szemere@bis.org), Bank for International Settlements.

Main usage of residential property price statistics

The country coverage of the BIS residential property price database is the largest among institutional organisations. It is extensively used both outside the BIS and within the institution.

External usage

International organisations rely on the residential property price published by the BIS for constructing their own databases. Namely, the European Central Bank uses the BIS Data Bank to collect data for EU countries, while the OECD used the BIS series to build its own research database. The BIS data set is widely used by central banks, by academics, and by private sector participants (investment banks, analysts, and journalists). The data published by the BIS are also disseminated by commercial data vendors. The number of downloads of the BIS residential property price by external users is above 10 000 per month (including the access through the ECB's database).

Internal usage

The RPP data set is used in notes and research papers. The BIS has recently started publish a Quarterly note on real residential property price developments. The data is also frequently analysed in the BIS Annual Reports and in background notes for the Governors' meetings. The additionally published long series are used for the identification and monitoring of asset price gaps and financial cycles.

General characteristics of the RPP statistics published on the BIS website

All series of the RPP data set are reported by central banks. They somehow differ from country to country in terms of type of property, area covered, property vintage, priced unit, compilation method and seasonal adjustment.

This diversity reflects two facts: first, the process associated with buying and selling a property, and hence the data coverage and compilation methods vary between countries, and second, the international methodological standards for property price statistics are guidelines with little binding character.

In particular, the Handbook on Residential Property Price Indices (HRPP) published by Eurostat in 2013 gathers recommendations on best practices for compiling residential property price indices, and presents these in the context of the different user needs. The HRPP builds on work undertaken by a number of international organisations (including the BIS) over recent years to identify the user requirements for improved RPP data from an economic, monetary and financial stability perspective.

While the compilation of many of the series included in the BIS database are based on the HRPP recommendations, in some countries further efforts would be needed in this field.

Main cross-country differences[2]

Coverage

The data coverage differs across countries. For some of them there is a single series covering the whole market. Such series include all types of dwellings in the whole country both in the new and existing dwelling markets. Conversely, for other countries the coverage of the reported series is more limited, either in terms of types of dwellings, markets or from a geographical perspective (ie some series are limited to the capital city).

Number of series, and breakdowns

The number of series reported by countries also varies. This reflects two aspects: first, the number of available breakdowns (for example new and existing dwellings, or dwelling types) and second, the existence of a single or many distinct compilers.

Compiling organisation and source of data

The compiling organisation varies from statistical offices, central banks, land registries, mortgage banks or real estate agents reflecting the diversity in the source of data. Transaction prices are recorded by notaries or land registries, data appraisals are made and registered by mortgage banks, while advertised prices are collected by real estate agents.

Unit

Series are either indices with a fixed reference period or nominal amounts in national currencies.

Quality adjustment

Quality adjustment refers to taking into account specific characteristics of each transaction (i.e. age and size of dwelling) in the construction of the indicators. Such a quality adjustment is not implemented in all countries. Where the data are not quality-adjusted, data are expressed as price per dwelling or as price per square meter.

Where data are adjusted for quality, one of the following methods is typically applied: hedonic regression, stratification or mixed adjustments, repeated sales, appraisals method.[3]

[2] For more details see: Residential property prices across the globe (article from the BIS Quarterly Review, September 2014).

[3] For more details see Chapter 12 of the HRPPI.

Recent developments

Streamlining the presentation of the property price data set

As the detailed dataset has been growing significantly overtime and up to around 300 series, users demanded guidance about which series would be more representative for each country. Therefore, the BIS has selected a single residential property price indicator per country, and included them in a specific subset. In most cases, this series covers all types of dwellings in the whole country, in both new and existing dwelling markets.

The selection has been based on the criteria listed in the HRPP as well as on the metadata provided by central banks. The applied selection process resulted in a subset as homogenous as possible, which is very suitable for cross-country comparison.

Nevertheless, significant discrepancies remain in sources and compilation methods as the recommendations of the HRPP have not yet been implemented in all countries. These selected series are presented at a quarterly frequency and updated once in each quarter. Where the frequency of the collected series is monthly, the quarterly data is calculated as the average of the monthly observations. Series have been rebased, deflated, and growth rates were calculated. The following four series are published for each country:

- Nominal value; average of 2010 = 100
- Real value, deflated by the consumer price index; average of 2010 = 100
- Nominal value; year-on-year percentage changes
- Real value, deflated by the consumer price index; year-on-year percentage changes

A Quarterly note on real residential property price developments[4] accompanies the quarterly publication, analysing the recent evolutions of these indicators.

The BIS will keep publishing the detailed data set, as sophisticated users are interested in the all available breakdowns. Furthermore the detailed data set provides all series with their original frequency and unit. This can be especially valuable for those countries where monthly series are available.

Long series on residential property prices

For many years the BIS has promoted the analysis of long-term movements in residential property prices, which are particularly key for financial stability purposes. Borio et al presented for the first time in 1994 a dataset of long historical time series of nominal residential property prices in 13 advanced economies. Since then, interest in this dataset has steadily increased among researchers as well as policy makers and private sector practitioners.

4 For extracts see Appendix.

The recently published research data set on long series on residential property prices includes quarterly time series for 18 advanced economies for which long historical data could be obtained going back as far as 1970 Q1 or 1971.

This work has been driven by the BIS in close coordination with national authorities, based on existing data. While for the most recent period the long series coincide with the selected indictors, for older periods standard statistical techniques were applied in estimations.

The existing data originate from various sources such as central banks, national statistical offices, research institutes, private companies and academic studies. They rely on different methodologies and can cover heterogeneous types of geographical areas and types of dwellings.

The way forward

The BIS in cooperation with the central banks will continue to expand the coverage of its residential property price data sets both in term of the number of countries both by collecting series with better coverage. Furthermore the BIS aims at constructing long series for additional countries in the coming years.

Country coverage

While generally speaking the country coverage is rather large, there are still important missing countries. In order to meet the recommendation 19 of the IMF-FSB Data Gap Initiative, the BIS aims to collect data from the two missing G20 countries.

Dwelling coverage

The targeted coverage is the entire residential property market: whole country, both new and existing dwellings, all types of dwellings. Where this coverage is not available data on existing dwellings in the whole country or metropolitan area can be used as proxy indicator.

Quality adjusted data

Based on the HRPP one of the following methods is recommended: stratification or mix-adjustment, hedonic regression methods, repeat sales, and appraisal-based methods (ie, the SPAR method)[5]. Where no quality adjustment is implemented, price per square meter is preferred over price per dwelling.

Start date

The start date of the reported series should be as early as possible, but ideally at least as from 2007. To allow the BIS to further expand the country coverage of its

[5] For more details see Chapter 12 of the HRPPI.

long series database, additional series with a starting date of 1970 are welcomed for countries where they are not yet available. These additional series used in the initial parts of the long series may have a limited coverage, or may measure construction costs, which can be a proxy for residential property price developments. In case the additional series cannot be published for confidentiality reasons, the BIS could only use their growth rates to complement publicly available series with a later start date.

Source

The BIS has no preference in the type of compiler (public or private). Where good quality data is available from several sources, the transmission of all available series with their respective metadata is preferred.

References

M Scatigna, R Szemere and K Tsatsaronis (2014): "Residential property prices across the globe", *BIS Quarterly Review*, September, pp 62–70, http://www.bis.org/publ/qtrpdf/r_qt1409h.pdf.

Handbook on Residential Property Price Indices (2013), Eurostat.

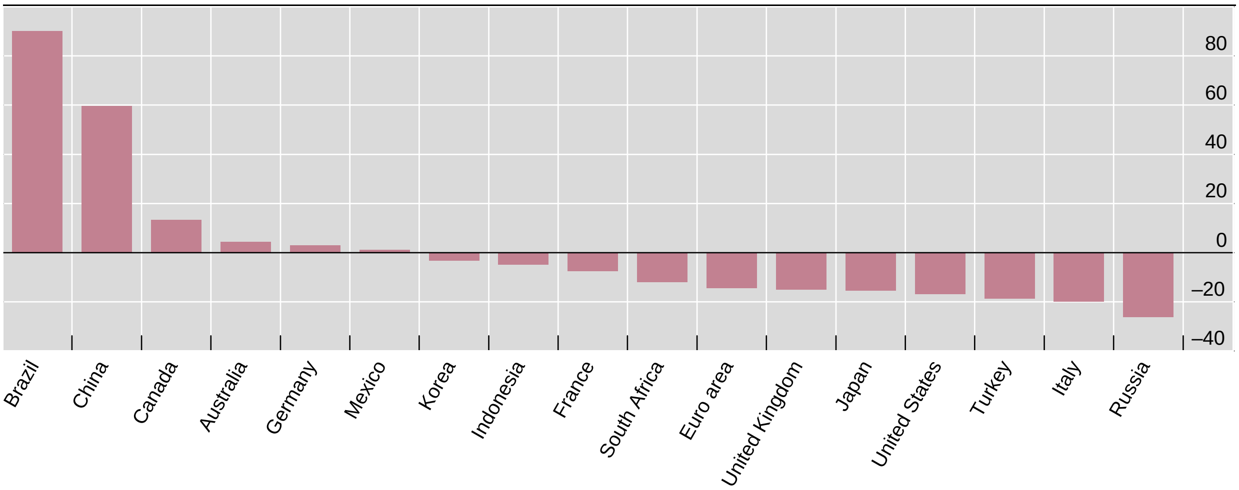
Appendix: Residential property price developments between the end of 2007 and 2013[6]

Residential property prices generally peaked in real terms in 2006–07 in most advanced economies. Since then, they have decreased by 14% in the euro area, with a fall of around 40% or more in a number of countries such as Greece, Ireland and Spain. The cumulated fall in real prices has been more moderate in the United Kingdom and the United States (around 15%). Some other advanced economies, such as Austria, Canada, Norway, Sweden and Switzerland, have continued to register property price growth. Among the major emerging economies, real residential property prices have almost doubled in Brazil since 2007, risen by more than half in China and declined substantially in Russia (by one quarter).

Real residential property prices in major advanced economies were still well below the levels reached at the end of 2007, by 17% in the United States, 15% in Japan, 15% in the United Kingdom and 14% in the euro area. In contrast, real prices remained higher than their 2007 levels in a number of countries, such as Canada (+13%), Switzerland (+30%) and Sweden (+16 %). Real prices were close to the levels observed six years previously in Australia.

Real residential property prices in selected G20 countries[1]

Cumulative changes from end-2007 to end-2013, in per cent



[1] For China and Turkey, BIS estimates based on market data.

Sources: See documentation on selected representative property price series.

Within the euro area, the 14% decline in real prices observed since 2007 masks some important disparities. Significant declines were observed in Ireland (–47%), Spain (–43%), Greece (–40%), the Netherlands (–28%) and Italy (–20%). A smaller decline was observed in France (–8%) and real prices went up slightly in Germany over the period (+3%).

[6] Extracts of the note on residential property price development -fourth quarter of 2013

In contrast to the situation in advanced economies, real residential property prices were well above their end-2007 levels in a large number of emerging market economies. This was particularly the case in Asia, especially in Hong Kong SAR (+77%), Malaysia (+35%) and China (estimated at well over 50%). Real prices were also higher in a number of Latin American countries, having doubled since 2007 in Brazil and Peru (but they barely moved in Mexico).

The main exceptions to this situation in emerging markets were Russia, where real prices have fallen by 26% from 2007, and some major central European countries: prices are estimated to have decreased by around 40% in Romania and around 10% in the Czech Republic (Graph B).

Closing remarks and announcement of Young Statistician Award

Muhammad Ibrahim, IFC Chairman

Dear participants

We have come to the end of our meeting.

I would like to thank everyone present today for contributing to the seventh IFC Biennial Conference. We are also very thankful to the BIS and to the IFC Secretariat, which has worked so diligently to make this conference a success.

I am very impressed with the level of participation of delegates over the last two days. I hope the networking among us has increased as a result and I hope it will serve each of us well in our respective areas of responsibility.

All the papers and presentation materials are now available on eBIS. The Secretariat will be drafting a summary of key insights from all these materials and will share it with you.

It is now time to announce the winner of this year's Young Statistician Award. Nine papers were submitted to the IFC Secretariat. They were carefully assessed by the members of the Executive and were also presented to you during the conference. You will certainly agree with me that all the papers were excellent and particularly topical. I would like to thank all the participants, and also their respective institutions, for having entered the competition.

I am pleased to announce that the winners of the IFC 2014 Young Statistician Award are Ms Zlatina Balabanova from the European Central Bank and Mr Ruben Peter van der Helm from the Netherlands Bank, for their paper "Enhancing euro area capital stock estimates". The paper presents interesting insights on a new approach to filling gaps in euro area-wide balance sheet data, including major breakdowns, and thus, provides practical guidance for countries who are not publishing these data yet.

Dear colleagues

It has been an honour and pleasure for me to chair the IFC Executive for almost three years. Now that I have almost completed my term, I would like to emphasise the great opportunity I have had to work with the group of dedicated members of the Executive and to benefit from the professional and dedicated support of the BIS, which is hosting the IFC. This teamwork has enabled us to further strengthen the sense of community among central bank statisticians, and beyond.

Before closing I would like to say again that I look forward to welcoming you to the next IFC events, the IFC Satellite Seminar and the ISI Regional Statistics Conference, which will take place in November in Kuala Lumpur.

Thank you.

IFC Conference

Thursday 4 to Friday 5 September 2014

Chaired by Muhammad bin Ibrahim
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