

Irving Fisher Committee on Central Bank Statistics

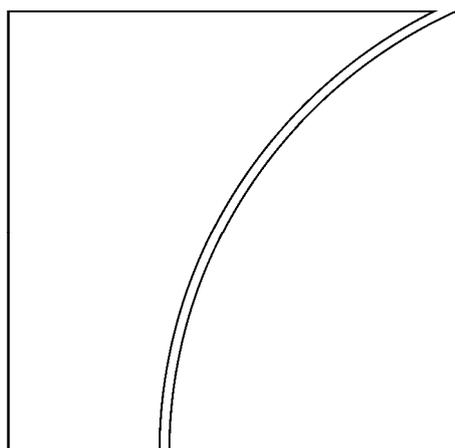
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Measuring financial innovation and its impact

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Opening remarks

Stephen Cecchetti¹

Good morning ladies and gentlemen. It is my great pleasure to welcome you to Basel and to the Bank for International Settlements for the fourth conference of the Irving Fisher Committee on Central Bank Statistics. The high turnout this year, with representatives from every region in the world, is a clear sign of the success of the Committee's activities as well as a signal of the value you all place in the variety of services we at the BIS provide. On behalf of my colleagues in the Monetary and Economic Department, where the Committee Secretariat is located, I would like to thank you for your participation in this conference as well as for your contributions to other IFC activities.

The conference theme chosen, "Measuring Financial Innovation", could not be more topical. In many ways it is long overdue. Financial innovation affects virtually every aspect of central bank operations, including traditional macroeconomic stabilisation policy, prudential regulation and supervision, and payments systems. I welcome all of your efforts to develop measures that track financial innovation and then assess its impact on the operation of central banks, financial markets and private financial institutions; as well as on mechanisms for economic growth and development.

In thinking about the work of the Irving Fisher Committee, and this conference in particular, I am reminded of the fact that monetary policy is about numbers. Traditional macroeconomic stabilisation policy requires central bankers to do things like set interest rates or exchange rates. And prudential supervision is about setting limits on the balance sheets of financial institutions. In all cases, what we need is numbers, so financial policy starts with financial statistics.

Looking a bit further, we can say that it is impossible for policymakers to achieve their objective – which I take to be low, stable inflation; high, stable growth; and a stable financial system – without understanding the nature and evolution of the financial system. To see why, we need look no farther than the monetary policy transmission mechanism. In order to adjust their operational instruments to meet their broad goals, monetary policymakers need to understand how their actions influence the economy. And since the financial system is the central bank's point of contact and influence, financial innovations have a direct impact on the size and timing of policy adjustments.

It is my strongly held view that, by improving the efficient operation of the economy, financial innovation is nearly always a good thing. Looking at developments in the mature economies, we see important changes since the mid-1980s. Prior to that, payment streams and risks tended to come bundled together. Bonds were sequences of coupons with a principal payment at maturity. Today bonds can be stripped so that coupons and principal can be purchased separately. More generally, it is normally possible to purchase or sell virtually any payment stream with any risk characteristics. This ability to separate financial instruments into their most fundamental pieces – the financial analogue to particle physicists separating atomic nuclei into protons and neutrons – has had profound implications for the way in which risk is bought and sold. Today, risk is much more likely to go to those people who are most able to bear it. The result is that we can insure virtually anything and engage in many

¹ Economic Adviser and Head of the Monetary and Economic Department, Bank for International Settlements.

activities we wouldn't have undertaken in the past. And, as a direct consequence of these financial innovations, for some time many economies have been more stable.

In emerging market economies, there have also been important changes. Some of these represent the development of financial arrangements that already exist in mature countries. Mortgage finance and consumer credit are examples of these. But while securitisation has been taking hold in the United States and Europe, micro-credit has developed in places as different as Bangladesh and Bolivia. And in Islamic countries, there have been important advances in providing financial services that meet the requirements of Shari'a.

As these various financial systems evolve, we need to insure that statistics keep pace. This is a tall order, but one that I am pleased to see you facing head on.

Before closing I would like to take the opportunity to thank Mr Jan Smets, the Chairman of the Irving Fisher Committee, for his leadership over the past three years. I understand that this conference marks the end of your term as Chairman. We all owe you our thanks for your leadership and the work that you have done, including the introduction of a proper governance structure for the Committee. As we all know, on any committee it is the Chair who does the real work. This is especially true of the organisation of a conference like this one, with contributions from 26 central banks on topics that include housing finance, securitisation and derivatives. I trust that you and all the participants will enjoy the conference at the same time that you help both the users and the compilers of statistics meet the challenges that the welcome (and largely unstoppable) innovations in the financial system inevitably create!

Thank you.

Opening remarks

Jan Smets¹

Good morning ladies and gentlemen, and welcome to the fourth conference of the Irving Fisher Committee on Central Bank Statistics.

Thank you, Mr Cecchetti, for your opening remarks. I am very pleased that you have the opportunity to see the Irving Fisher Committee in action relatively soon after your arrival at the BIS to take over the responsibility of Economic Adviser and Head of the Monetary and Economic Department. Your Department has significantly contributed to the activities of the IFC by providing a past chairman of the Committee, contributing analytical content to its discussions, and organising its various workshops and meetings. All of us were very pleased when the BIS agreed in early 2006 to host the IFC Secretariat, making the BIS our natural and official home. We have an equally important relationship, of course, with the International Statistical Institute. I would like to extend a warm welcome to Denise Lelieveld, President of the ISI. Denise, thank you for joining us here in Basel for this conference. Fifty-one of the IFC's 64 full institutional members are represented here today. I am also pleased with the participation of representatives from the European Fund and Asset Management Association, Statistics Sweden and Statistics Norway. Mr Olav Ljones, Deputy Director General of Statistics Norway is currently Chairman of the International Association for Official Statistics, one of our sister organisations in the ISI. Again, welcome to all!

If you allow me, ladies and gentlemen, I would like to take a few moments to report to you on the outcome of the meeting of the IFC Committee, which took place yesterday.

First, we elected a number of new members to the IFC Executive. They are Mrs Sicat from the Central Bank of the Philippines, and Mr Schubert from the National Bank of Austria. Mr Manuel Marfán, Board member of the Central Bank of Chile, was elected to succeed me as IFC Chairman. Finally we elected Mr Steven Keuning, ECB Director General Statistics, and a current member of the Executive, as one of the Vice-Chairpersons of the Committee.

We also reviewed the activities of the Committee. Our main focus in the near future will be on the various meetings in the context of the 57th Session of the ISI to be held in Durban next year. The IFC will organise a number of invited and contributed paper meetings at this Session. It will also sponsor a joint seminar with the central banks of the Southern African Development Community. The South African Reserve Bank has agreed to host this seminar. Let me take this opportunity to thank Mr Monde Mnyande, Chief Economist and Executive General Manager, for the extensive preparatory work already done and for the support we will receive from the Reserve Bank for our meetings in Durban next year. The other main event will be the organisation of a training event on National Accounts and Balance of Payments, for which the National Bank of Belgium will act as a major sponsor. Here, too, I would like to thank Mr Rudi Acx, Head of the General Statistics Department, for the support that he and his colleagues will provide. Finally, we informally discussed the possibility of co-sponsoring an event with the International Association for Official Statistics, and I am confident that the Executive will be able to consider a concrete proposal for this event in the not too distant future.

¹ Former Chairman of the Irving Fisher Committee on Central Bank Statistics and Director at the National Bank of Belgium.

Let me now turn to our conference. As Mr Cecchetti has noted, there is clearly a strong interest in the conference theme. We have 149 conference participants! Thirty-eight papers will be presented over the next two days by experts from 61 institutions from all around the world. Thanks in advance to the session chairs, presenters and discussants for their active contribution. In addition, I would already like to thank the IFC Secretariat and other BIS staff involved in the organisation of the conference.

One unpleasant but important task for the Secretariat has been to work with the different presenters in order to limit their PowerPoint presentations to a maximum of eight slides. This is to ensure that individual presentations do not exceed the time allotted to them by the respective chairpersons. I want to ask our presenters to be very disciplined in this regard. I herewith give the session chairs the instruction to enforce the agreed time limitation strictly (as in soccer games, we will be showing yellow and red cards). If you feel hampered by this discipline, you can blame it on me, not the chairpersons of the respective sessions. You might also have noticed that we do not have a discussant for every session, and not more than one discussant in those sessions where we have identified such a function. This is in order to leave as much time as possible for general discussion. After all, we are here to share views and experience. If we are disciplined in terms of timing, there should be ample opportunity in each session to do just that. I therefore look forward to the active contribution of all!

Let me just say a few quick words about the content of the programme:

The first session is meant to set the stage for our proceedings. We have chosen papers and presentation to illustrate the issues that will be discussed in more detail in the individual sessions. It's a bit like serving appetisers before a good meal. Mr Kohli of the Swiss National Bank and member of the IFC Executive will chair the session.

For Session 2 we will break out into two groups (2A and 2B), which will cover the same topic of housing finance. The chairpersons of these sessions will be Mrs Carballo from the Banco de Mexico and Ms Hoel from Statistics Norway.

After lunch we will reassemble for the third, plenary session on how to keep track of securitisation. Mr Keuning from the European Central Bank will be in the chair.

The fourth session today (4A and 4B) will again be in two parallel streams, both dealing with the compilation of derivative statistics. Our two chairpersons will be Ms Kaló Gódné, of the Hungarian National Bank, and Mr Schubert of the Austrian National Bank.

Tomorrow morning we will start with two parallel sessions (sessions 5A and 5B) covering micro and macro measures of financial risks. The sessions will be chaired respectively by Mrs Davies of the Board of Governors of the Federal Reserve System, and by Mr Mnyande of the South African Reserve Bank.

Session 6 will again be breakout sessions (6A and 6B), which will look at the impact of financial innovations on "traditional" economic and financial statistics. The organisation of the sessions will be in the competent hands of Mr Acx of the National Bank of Belgium and Mr Mink of the European Central Bank.

Finally, we will close the conference with a panel discussion on data issues in the context of the recent financial turmoil. Mr Cecchetti has already briefly referred to some of the issues that may be important. We have excellent panellists to introduce this discussion, including Mr Domanski of the Bank for International Settlements, Mr Frisell of the Sveriges Riksbank, Mr Delbecque from the European Fund and Asset Management Association, as well as Mr Keuning and Mr Marfán. Manuel's participation in the closing panel will be a good opportunity for you get to know him. We will formalise the handover of the IFC chairmanship during the concluding remarks tomorrow afternoon.

So let's get started!

Session 1

An overview of challenges related to measuring financial innovations

Chair: Ulrich Kohli, Swiss National Bank

Papers: Financial innovations and developments in housing finance in Mexico
Jazmin Carballo-Huerta and Juan Pedro González-Ibarra, Bank of Mexico

Compilation and analysis of data on securitised public debt in Kenya
Isaya Maana, Central Bank of Kenya

The possibilities and limitations of derivatives statistics collected by central banks
Winfried Rudek, Deutsche Bundesbank

Credit information in Thailand
Davina Kunvipusilkul, Bank of Thailand

Integration of new financial developments into the new worldwide statistical standards
Reimund Mink, European Central Bank

Financial innovations and developments in housing finance in Mexico

Jazmin Carballo-Huerta¹ and Juan Pedro González-Ibarra²

I. Introduction

In recent years, housing finance in Mexico has undergone important structural changes as a result of macroeconomic stability and financial innovations. These innovations have broadened both mortgage credit products and financial intermediaries' funding techniques. In particular, financial innovations have improved households' accessibility to mortgage credit. A stable macroeconomic environment, the increased availability of resources to finance the private sector, and the active role of public sector credit institutions in the mortgage credit market explain the recent mortgage credit expansion and the growing number of households with access to housing finance. However, housing gaps are still large; for instance, the ratio of mortgage credit to GDP is low compared to other countries' indicators. Therefore, there is huge potential for the growth of the mortgage credit market in Mexico.

This document describes and assesses the most relevant developments in housing finance in Mexico. Section II deals with the recent performance of the Mexican economy and the main macroeconomic factors that have supported mortgage credit growth. Section III describes the current structure of both the housing market and housing finance institutions, and shows the importance of public institutions in this market. Section IV presents relevant innovations in: i) the financial system regulatory framework and mortgage credit institutions; ii) funding sources of housing finance; and iii) housing finance products. Section V describes the recent developments in mortgage credit, and also gives a brief assessment of private financial institutions' solvency, mortgage credit delinquency rates, and the mortgage-backed securities market. Finally, section VI presents some conclusions.

II. Recent economic performance of the Mexican economy

This section describes briefly the economic crisis of the mid-1990s and the recent macroeconomic performance of the Mexican economy. First, it highlights the relevance of low and stable inflation and interest rates, the moderate use of financial resources by the public sector, and the process of financial deepening as key elements to support funds availability to finance the private sector. Second, the financial system strength and adequate regulatory and supervisory financial framework also play an important role in the sound performance of credit market.

During the early 1990s, the Mexican economy experienced an important credit expansion. In 1994, commercial bank credit to the private sector reached 34% of gross domestic product (GDP). This episode took place in an environment characterized by poor banking management and weak supervisory and regulatory practices. In the late 1994, as a result of

¹ Deputy Manager, Financial Information. Economic Research Division at the Bank of Mexico.

² Deputy Manager, Monetary Analysis. Economic Research Division at the Bank of Mexico. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Mexico. Roberto Bahena-González and Diana Morales-Arenas provided research assistance.

a sudden reversal of foreign capital flows, Mexico was forced to abandon the exchange rate peg and adopted a flexible exchange rate regime. As a result, the peso adjusted significantly – from 3.4 pesos per dollar in November 1994 to 7.5 pesos per dollar in November 1995 – and the annual inflation rate jumped from 7.1% in 1994 to 52% in 1995. Economic activity declined sharply, as nominal interest rates increased to levels close to 80%. Under these conditions, households and firms faced difficulties in servicing their loans; thus banks' non-performing credit portfolios increased markedly.

The second half of the 1990s was characterized by fiscal, monetary and exchange rate policies to stabilize the economy and to correct macroeconomic imbalances. In addition, a new set of financial regulations was introduced to strengthen the banking sector's supervisory and regulatory framework.³ As a result of the crisis, commercial banks' size – measured by total assets – contracted from 76.4% of GDP in 1994 to 63.9% in 2000. For one thing, the banking structure experienced a profound transformation characterized by banking mergers and acquisitions and increasing foreign banking participation. For another, households and firms underwent a period of adjustment in their financial balance sheets, and their credit demand contracted sharply. In 1994, the ratio of commercial banks' credit to the private sector to GDP was 39.5%, compared with 12.7% in 2000. Meanwhile, the ratio of private sector total financing to GDP dropped from 61.8% in 1994 to 30.5% in 2000.

In recent years, the private sector credit market in Mexico has been positively affected by the consolidation of a stable macroeconomic environment, supported by monetary and fiscal policies that have allowed a significant reduction of the inflation rate and subsequently its stabilization. The year-to-year inflation rate, measured by the Consumer Price Index (CPI), dropped from 12.3% in 1999 to 3.8% in 2007. Between 2001 and 2007 the average annual inflation rate was 4.3% (Chart 1). Moreover, the implementation of a sound fiscal policy has reduced the absorption of financial resources by the public sector. The public sector balance, measured by the public sector borrowing requirements (PSBR), decreased from 3.4% of GDP in 2000 to 1.3% in 2007 (Chart 2).⁴

The combination of a decreasing inflation rate and narrowing public sector borrowing requirements, among other factors, favored a decline in interest rates. In 2000, the nominal interest rate of federal government three-month bonds (91-day CETES) was, on average, 16.2%. In 2007, the average short-term nominal interest rate was 7.4%. Meanwhile, short-term real interest rates dropped from 7.8% on average in 2000 to 3.8% on average between 2004 and 2007.

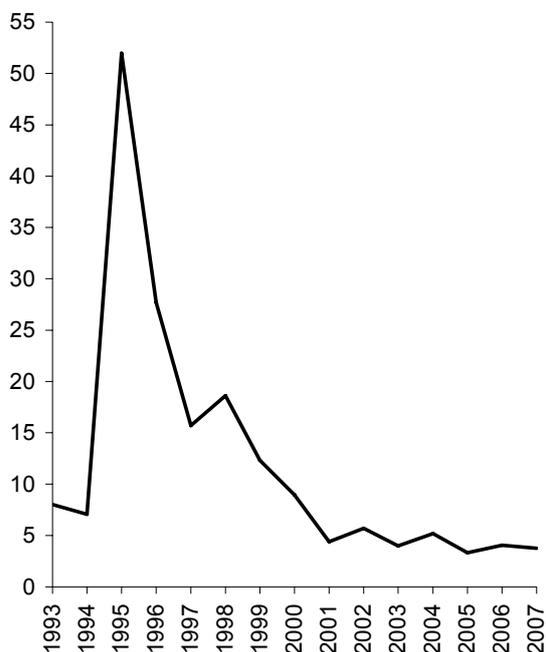
In recent years, a stable economic environment, financial deregulation, and the introduction of strategies to broaden the access to the banking system have favored financial deepening.⁵ The ratio of total financial savings, measured by the broad monetary aggregate (M4), to GDP increased from 41.7% in 2000 to 55% in 2007 (Chart 3).

³ Several financial reforms were implemented after 1995 to promote market discipline: i) establishment of a limit to deposit protection insurance; ii) disclosure requirements were increased to enhance market discipline; iii) credit bureaus; iv) capital adequacy rules; v) elimination of limits to foreign ownership (recapitalization); v) new accounting standards; vi) prudential regulation; vii) corporate governance; and, viii) creation of risk management units (see: J Sidaoui, *The Mexican financial system: reforms and evolution 1995–2005*).

⁴ Public sector borrowing requirements (PSBR) measure the financing needs of both public entities and non-public and social entities that act on the government's behalf. PSBR include, among others, i) the traditional public balance; ii) resources channeled to finance the private and social sectors; iii) IPAB's (Mexican deposit insurance corporation) borrowing requirements net of federal government transfers; iv) the financing needs of public investment projects financed by the private sector (PIDIREGAS); and v) the borrowing requirements of the toll road rescue program (FARAC).

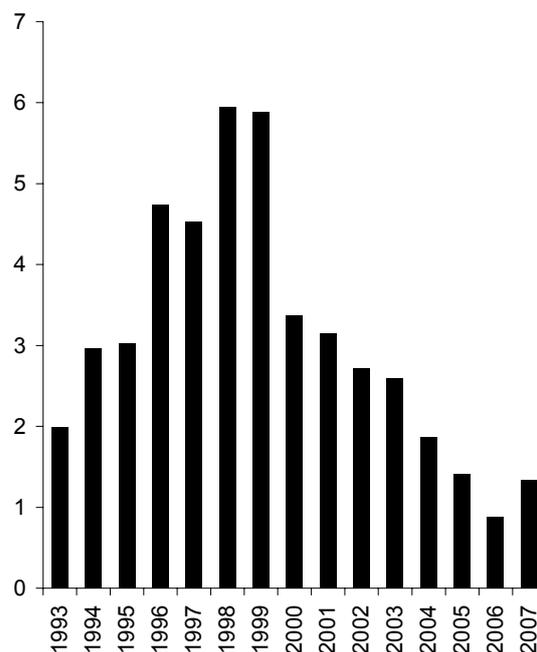
⁵ The number of banking accounts increased from 22.8 million in 2000 to 47.9 million in 2007. In addition, the number of investment funds accounts was 1.7 million in 2007, 1.2 million more than in 2000. (Source: *Comisión Nacional Bancaria y de Valores, CNBV*).

Chart 1
Inflation rate
Percentage year-to-year



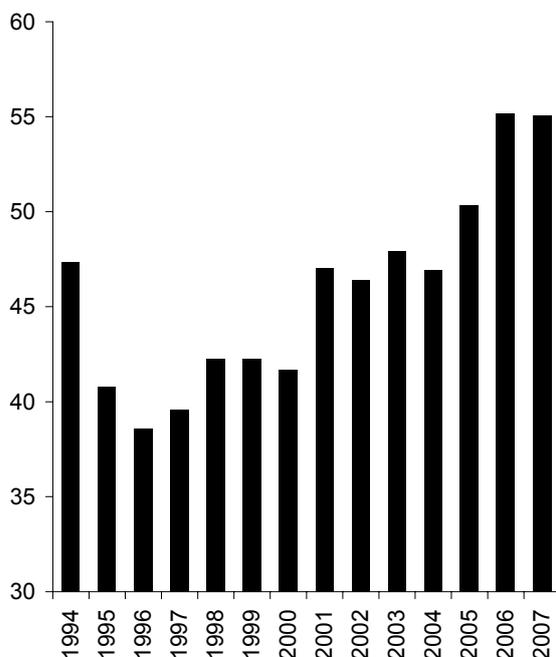
Source: Bank of Mexico.

Chart 2
Public sector borrowing requirements
Percentage of GDP



Source: Ministry of Finance (SHCP).

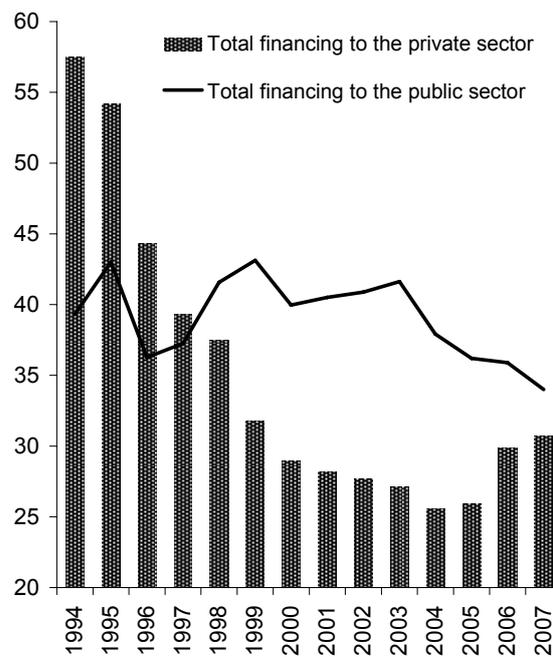
Chart 3
Total financial savings¹
Percentage of GDP



¹ Broad monetary aggregate M4.

Source: Bank of Mexico.

Chart 4
Total financing²
Percentage of GDP



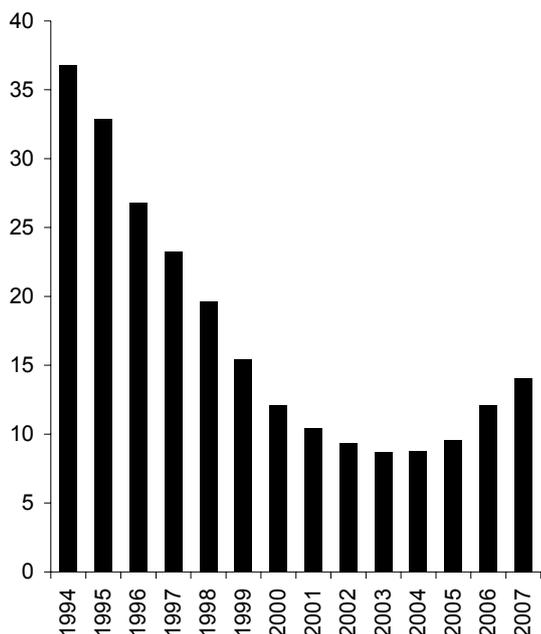
² Includes domestic and external financing.

Source: Bank of Mexico and Ministry of Finance (SHCP).

In this context, the private sector credit market started to show a more favorable performance. The supply of financial resources to finance the private sector has been positively affected by a growing availability of domestic savings, a decreasing public sector deficit, and the strengthening of banks' financial indicators. In addition, as individuals and firms restored their financial position and perceived a stable and certain economic environment, they have shown more willingness to demand credit from financial intermediaries. For instance, in 1994 the ratio of total financing to the private sector to GDP was 61.8% and reached its lowest level in 2004, 27.6%. Thereafter, total financing to the private sector followed a positive trend and, in 2007, it represented 32.9% of GDP (Chart 4).

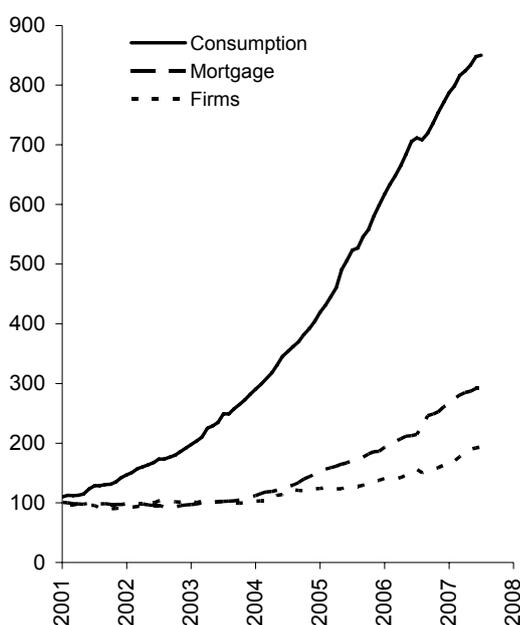
Recently, commercial banks have been recovering their role as primary players in financing private sector activities. From 2004, commercial banks' lending to the private sector rose as a result of both increasing bank deposits and the settlement of an important fraction of credit portfolios related to bank-restructuring programs (Chart 5).⁶ Commercial banks' participation in total financing to the private sector expanded. In 2007, it reached 45.8% of total financing, compared to 34.2% in 2004. The surge of commercial banks' credit portfolio to the private sector was not generalized; rather, it has been selective. It is possible to identify three stages in this process: i) in 2002, commercial banks began to increase their consumer credit portfolio, in particular, through credit card lending; ii) in 2005, they started to participate more actively in the mortgage credit market, primarily in the residential mortgage segment; and iii) in 2007, commercial banks began to increase their business credit portfolio (Chart 6).

Chart 5
Commercial banks' lending to the private sector
Percentage of GDP



Source: Bank of Mexico.

Chart 6
Commercial banks' lending to the private sector
2001=100 (real terms)



Source: Bank of Mexico.

⁶ In 1995, as a result of the financial crisis, the federal government established several banking rescue programs, which included the exchange of commercial banks credit portfolio for bonds backed by the federal government (Fobaproa bonds) with a maturity of 10 years. In 2004 and 2005, commercial banks liquidated a significant amount of these assets, making resources available for other purposes, in particular, to finance the private sector. In contrast, in 2007 bank deposits played a more important role as a source for commercial bank lending to the private sector.

III. The Mexican housing market structure

a. Mexican housing market overview

In order to have a better grasp of the housing credit market structure, the Mexican housing demand, housing stock, and residential real estate sector must be analyzed.

In Mexico, housing demand has been driven, among other factors, by shifts in the demographic profile. In particular, baby-boomers boosted the demand for new housing during the 1980s and 1990s. In recent years, this growth trend has been sustained by the aging population. Even though population growth rates have decreased, household growth rates have increased.⁷ Therefore, housing demand is expected to continue growing more rapidly than population during the coming years.

In the last decades, the housing stock in Mexico has changed in both quality and size. For instance, housing conditions such as dimension, regular features and availability of urban services, have improved in general (Table 1).⁸ Nevertheless, rural housing conditions are still limited compared to their urban counterparts. The significance of the housing market in the Mexican economy can be measured by several indicators. Mexican housing stock significantly increased in size over the last decades. In 2005, housing stock had more than tripled relative to the 1970s.⁹ Preliminary figures indicate that in 2007 the housing stock at replacement cost is estimated to have been 86% of GDP. In that year, the ratio of residential investment to GDP was 5.8% (Chart 7).

Table 1
Mexican housing conditions
% of housing units with

	1970	1980	1990	2000	2005 ²
Tap water	49.4	65.8	76.4	84.3	87.8
Sewerage	41.5	48.0	60.9	75.0	84.8
Electricity	58.9	74.8	87.5	95.0	96.6
One room ¹	40.1	29.9	27.0	23.1	na ²
Two rooms ¹	28.9	28.7	26.6	24.2	na ²
More than three rooms ¹	31.0	41.4	46.4	52.7	na ²

¹ Excludes the kitchen. ² na: not available.

Source: *Instituto Nacional de Estadística y Geografía*, INEGI.

The Mexican residential real estate sector is composed of two segments. On the one hand, the informal sector is characterized by the lack of well-defined property titles, tax-payments

⁷ From 1970 to 1990, population growth was 68.5%, while the number of households increased by 66.1%. Between 1990 and 2005, household growth (53.1%) surpassed population growth (27.1%). Source: *Instituto Nacional de Geografía y Estadística*, INEGI.

⁸ Urban services include tap water, electricity, gas for cooking, and sewerage.

⁹ In 1970, the total number of housing units was 8.2 million units, compared to 24.7 million units in 2005. Source: INEGI.

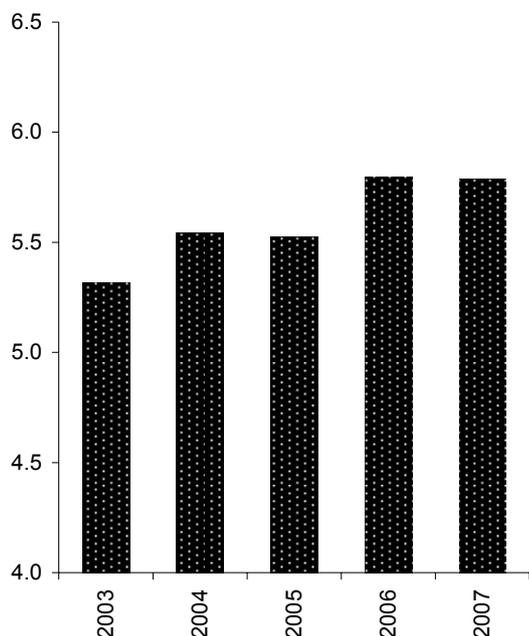
evasion, insufficient access to public services and utilities, and non-eligibility for conventional financing. A large portion of this housing stock was built by its owners (self-construction) with their own resources, since they have limited access to credit. Although informal housing represents a quick solution to fulfilling low-income households' needs, the Mexican government has been encouraging the development of formal construction. For instance, the government has supported self-construction housing programs and promoted the regularization of informal housing. On the other hand, the formal sector mainly includes housing units built and commercialized by real estate developers, as well as self-construction units under the standards established by the authorities. Therefore, these housing units have well-defined properties titles, are registered in the cadastre for tax purposes, and have access to public services and utilities. This segment of the housing market has access to housing finance, and home-owners are usually part of the formal sector of the economy.

Housing finance is highly correlated with developments in the economic activity, specifically in the formal sector of the residential real estate market. Although a large share of construction activity occurs outside formal channels, the formal sector has increased its participation in the total construction market in recent years. Available data on the residential real estate market showed a positive trend in the number of units built by real estate developers of the formal sector. For instance, in 2000 this figure was 282,000 units, compared to 512,000 in 2007; ie it increased by 81.5% in seven years (Chart 8). In the last five years, this market grew at an average annual rate of 8.7%. In 2007, the formal market accounted for around 55% of total housing construction in Mexico.¹⁰

Chart 7

Real estate residential investment

Percentage of GDP

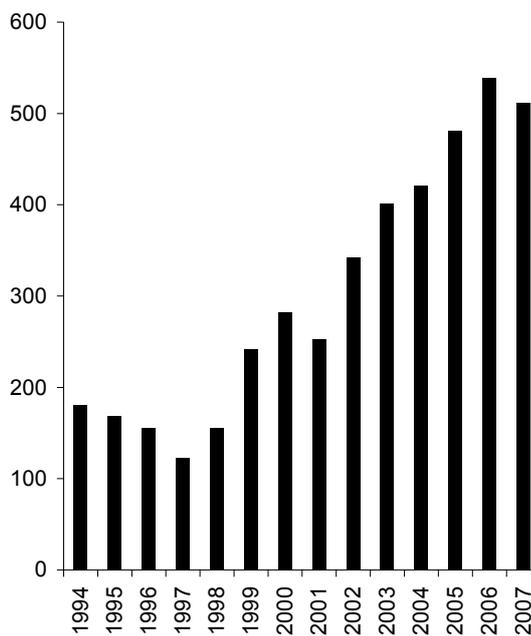


Source: INEGI.

Chart 8

Houses built by real estate developers

Units



Source: Mexican Housing Overview, Softec.

¹⁰ Source: *Mexican Housing Overview, 2008* (Softec).

b. Mexican mortgage market structure

In Mexico, several financial institutions participate in the mortgage credit market. These financial intermediaries can be classified according to different criteria, such as the population segment they serve, the products they offer, the regulation they are subject to, the sources of their funding, their market share, or the economy sector to which they belong. In this paper, intermediaries are classified, for simplicity, into two groups: public and private.

The most important public sector intermediaries (government-sponsored agencies) in the housing credit market are Infonavit and Fovissste.¹¹ Infonavit provides credit to households who belong to the formal private sector of the economy. Fovissste provides housing finance to employees of the public sector.¹² In general, these institutions are oriented to financing low-income households.¹³ However, Infonavit also provides credit to other segments of the market under different programs and initiatives. Fovissste and Infonavit obtain funding through a scheme based on employees' compulsory savings. Therefore, their sources of funding have a long-term profile to finance mortgage credit. Moreover, an important proportion of Infonavit's assets are channeled to finance mortgage loans (93.6% in December 2007).

Infonavit was created in 1972 to develop and build housing projects, and to give long-term mortgage credit to low-income workers. This institution was the primary regulator of low-income housing in Mexico. In 1993, Infonavit gave up its role as a constructor and price regulator in the housing sector. Ever since, it has focused on offering housing finance. The redesign of Infonavit's role changed the mortgage credit market in two ways. First, under the new regime, borrowers can freely choose the house they want to buy; under the former regime, Infonavit assigned the housing units mainly to unionized workers. Second, residential real estate developers take on the risk of funding, building and selling the properties.

Under the Infonavit scheme, employees of the private formal sector of the economy allocate a monthly contribution of 5% of their wage to an individual account.¹⁴ Households have two choices for accessing their resources. First, if they meet the eligibility criteria, they can use their accumulated funds to obtain a direct mortgage loan, or any other loan from other Infonavit-related programs.¹⁵ The resources are used as down payment or credit guarantee to purchase a house.¹⁶ Second, if the worker does not demand a mortgage loan by retirement age (around 65 years), the accumulated resources are added to his or her pension fund.

¹¹ *Instituto del Fondo Nacional de la Vivienda para los Trabajadores* (Infonavit), and *Fondo de la Vivienda del Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado* (Fovissste).

¹² Fovissste provides mortgage loans in pesos, with a credit limit of 341 monthly minimum wages (equivalent to US\$ 72,247 at purchasing power parity of 2007) and with a maximum term of 30 years.

¹³ Other public institutions that participate in the mortgage credit market are Fonhapo (*Fideicomiso Fondo de Habitaciones Populares*), and Orevis (*Organismos Estatales de Vivienda*). Their function is oriented to provide subsidized housing support to low-income households in the informal sector of the economy.

¹⁴ From 1992, as a result of the introduction of a new pension system based on well-defined contributions, workers' housing contributions have been deposited in individual accounts.

¹⁵ The eligibility criteria, based on a parametric model, consider age, salary, amount accumulated in the individual housing account, period of time contributing without interruption to the Infonavit, period of time working for the same employer, and amount of voluntary savings.

¹⁶ Infonavit's mortgage credit is granted at a fixed-interest rate and a monthly payment tied to the behavior of the minimum wage. The interest rate charged is between 4% and 10%.

The segment of private financial intermediaries comprises commercial banks and non-bank institutions specialized in mortgage credit: Sofoles and Sofomes.¹⁷ On the one hand, commercial banks obtain most of their funding through short-term deposits, and most recently through the securitization of their mortgage credit portfolio. Commercial banks usually finance medium to high-income households. On the other hand, non-bank institutions specialized in mortgage credit obtain funding from several sources, such as commercial banks, Sociedad Hipotecaria Federal (SHF) – the Federal Mortgage Company – and the securitization of their mortgage credit portfolio.¹⁸ These institutions are oriented to financing low- to medium-income households, mainly from the formal sector of the economy.

Between 1995 and 2007, the structure of the Mexican mortgage market changed considerably as a result of the financial crisis and reforms to the financial regulatory framework. After the economic crisis of 1995, commercial banks' market share declined significantly. Their position in the mortgage credit market was partially taken over by other financial intermediaries, such as non-bank institutions and public sector institutions, which nowadays play an important role in housing finance. For instance, Infonavit's market share of total housing financing increased considerably from 25.9% to 58.8% during this period.¹⁹ In fact, Mexico has one of the largest market shares of government-sponsored institutions in Latin America.²⁰ Commercial banks' market share decreased sharply from 72.6% in 1995 to 31.4% in 2007, during the same period (Chart 9). However, in recent years, commercial banks have been more involved in the mortgage credit market and have started to recover their importance. Credit bureaus have supported commercial banks' expansion in this market. They have provided updated credit records that help to assess credit applicants' default and prepayment risks.

Under this market structure, government strategies play an important role in housing credit market developments. Government strategies oversee, among other things, determining mortgage loan products characteristics and mortgage loan origination conditions. However, the behavior of the formal sector of the economy, in particular the labor market, affects public sector institutions' mortgage credit origination through different channels. First, available funding to allocate credit, which depends on workers' contributions, is closely related to employment and payroll levels. Second, applicants' credit score depends, among other things, on the number of consecutive periods contributing to the housing fund. Third, current and expected economic conditions affect households' mortgage credit demand.

The mortgage credit market is clearly segmented into public sector institutions and private financial intermediaries, depending on the population segment they serve. Based on data on the second semester of 2007, Infonavit provides most of its financing, 55% of total mortgage loans, to households with an income level below four times the minimum wage (a monthly income equivalent to US\$ 847.50 at purchasing power parity (ppp) of 2007).²¹ On the other hand, private commercial banks and other private credit institutions (Sofoles and Sofomes) allocate their total mortgage credit portfolio among households with income levels above four

¹⁷ Sofoles (*Sociedades Financieras de Objeto Limitado*) are special-purpose non-bank institutions, and Sofomes (*Sociedades Financieras de Objeto Múltiple*) are multiple-purpose non-bank institutions. These entities grant consumer credit, mortgage loans, and business credit. However, they are not depositary institutions and are subject to different supervision and regulation than banks. The main difference between Sofoles and Sofomes are that the latter are not specialized in only one credit market as Sofoles.

¹⁸ SHF is a development bank. It provides mortgage credit as a second-floor bank. See Appendix.

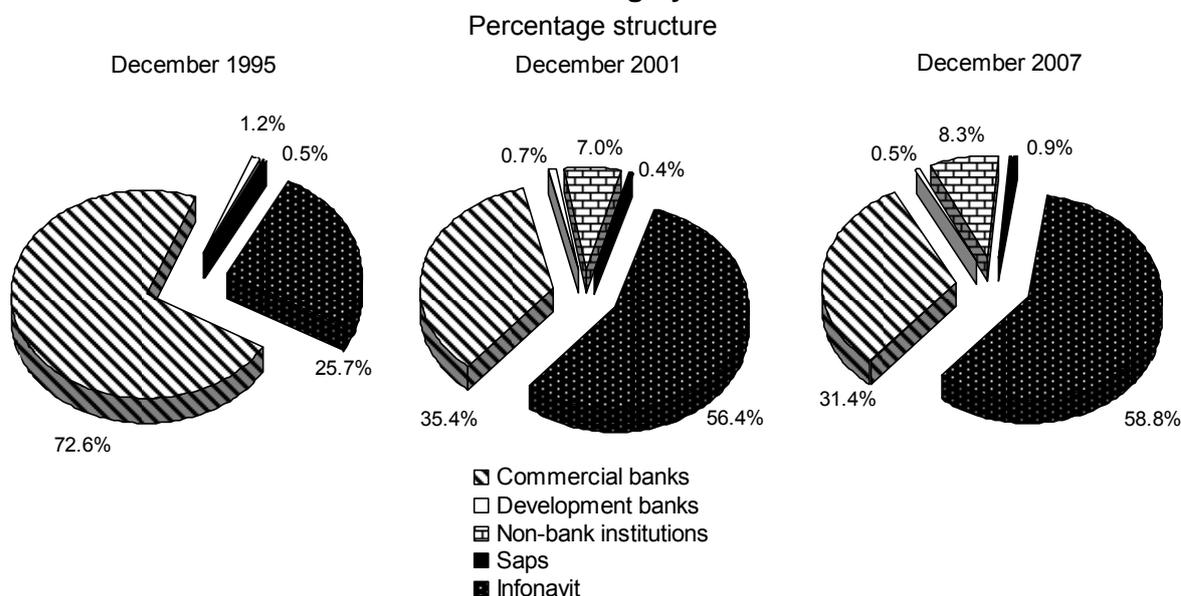
¹⁹ Fovissste is not included in the analysis due to the lack of reliable mortgage credit statistics.

²⁰ Government-sponsored mortgage agencies' market share in other countries of the region: 0% in Argentina and Chile, 6% in Colombia, 27% in Peru, and 56% in Jamaica.

²¹ In 2007, the monthly minimum wage was MXN 1,538, equivalent to US\$ 211.90 at purchasing power parity of 2007. Source: *Comisión Nacional de Salarios Mínimos* and World Bank.

times the minimum wage (Table 2). Regarding the use of mortgage loans, the mortgage credit market in Mexico is primarily oriented to finance the acquisition of new housing. For example, figures for the first semester of 2007 indicate that 85.7% of total mortgage loans granted by Infonavit were used to purchase brand-new housing units.

Chart 9
Residential real estate lending by financial institution



Total mortgage loans:
657.25 Billion Pesos
(real terms, Dec-2007)

Total mortgage loans:
612.11 Billion Pesos
(real terms, Dec-2007)

Total mortgage loans:
907.06 Billion Pesos
(real terms, Dec-2007)

Source: Bank of Mexico.

Table 2
Number of mortgage loans by credit institution and income level
Second semester of 2007

Institution	Income level				Total
	Up to four minimum wages ¹	Per cent	More than four minimum wages	Per cent	
Infonavit	134,370	55.0%	109,939	45.0%	244,309
SHF (development bank)	1,232	8.0%	14,162	92.0%	15,394
Fovissste	26,332	60.0%	17,554	40.0%	43,886
Financial intermediaries			116,268	100.0%	116,268
Other public institutions ²	68,932	93.9%	4,451	6.1%	73,383
Total	230,866	46.8%	262,374	53.2%	493,240

¹ In 2007, a monthly income of up to MXN 6,153, equivalent to US\$ 847.50 at purchasing power parity of 2007. Source: *Comisión Nacional de Salarios Mínimos* and World Bank. ² Includes Fonhapo (*Fondo de Habitaciones Populares*), Orevis (*Organismos Estatales de Vivienda*), ISSFAM (*Instituto de Seguridad Social para las Fuerzas Armadas Mexicanas*), Pemex (*Petróleos Mexicanos*), CFE (*Comisión Federal de Electricidad*) and Lyf (*Luz y Fuerza del Centro*).

Source: CONAVI.

IV. Financial innovations in the Mexican mortgage credit market

As mentioned, financial innovations have been implemented in different areas of the housing finance market. First, legal and regulatory frameworks have been modified to increase the mortgage market depth. Second, funding sources of financial intermediaries have been expanded. Third, public and private intermediaries have introduced new mortgage programs and products.

a. Financial system regulation and its institutions

In the last years, several regulation reforms fostered the development of housing finance.²² First, in 2000, a reform to the foreclosure law (*Ley de Recursos Mercantiles*) improved the conditions and reduced the waiting time for creditors to take over the collateral (real estate) in case of non-payment or bankruptcy. Second, during the same year, the reform to the credit operations law (*Ley General de Títulos y Operaciones de Crédito*) permitted certain financial intermediaries to act as a trustee in asset securitizations. Third, in 2001, modifications to the securities market law (*Ley del Mercado de Valores*) allowed the issuance of stock certificates, known as *certificados bursátiles*, which are the financial instruments used in assets securitization. Fourth, in 2004, the new law to foster transparency and competition in the credit market (*Ley de Transparencia y Fomento a la Competencia del Crédito Garantizado*) was approved. This law promoted the fee-free prepayment of loans and encouraged the standardization of mortgage credit contracts between financial institutions. Recently, in 2007, a reform to this law was passed, empowering the Bank of Mexico to supervise credit commissions and interest rates of financial intermediaries. Moreover, in order to foster both competition and transparency within the financial sector, financial intermediaries have to publish their annual percentage rate of change (*Costo Anual Total, CAT*) for each credit product they offer.²³

In addition, brand-new financial institutions have emerged in the last years. First, in 1997, the amendment to the law on credit institutions (*Ley de Instituciones de Crédito*) allowed Sofoles to participate in the mortgage credit market.²⁴ Ever since, Sofoles have played an important role as a mortgage lender. Since 2001, they have acted as the intermediary in charge of allocating the Federal Mortgage Company (SHF) financing resources among households (Chart 10).²⁵

Second, in 2001, SHF was created, with the main objective of fostering the primary and secondary mortgage credit market through its role as guarantor and liquidity provider.²⁶ The main functions of the SHF are to provide long-term financing to Sofoles and Sofomes, to act as collateral in non-bank institutions' issuance of mortgage-backed securities, and to supply mortgage credit insurances and financial guaranties. SHF does not give credit directly to

²² *Ley de Concursos Mercantiles* (2000), *Ley general de Títulos y Operaciones de Crédito* (2000), *Ley del Mercado de Valores* (2001), and *Ley de Transparencia y Fomento a la Competencia del Crédito Garantizado* (2004 and 2007).

²³ The term CAT (*Costo Anual Total*) refers to the total costs involved in taking a loan, such as commissions, interest rates, insurances and other fees.

²⁴ *Ley de Instituciones de Crédito*, 1997. The Sofoles were created in 1993 as a NAFTA (North American Free Trade Agreement) recommendation to create non-bank institutions in Mexico.

²⁵ Previously, Sofoles allocated FOVI's financial resources.

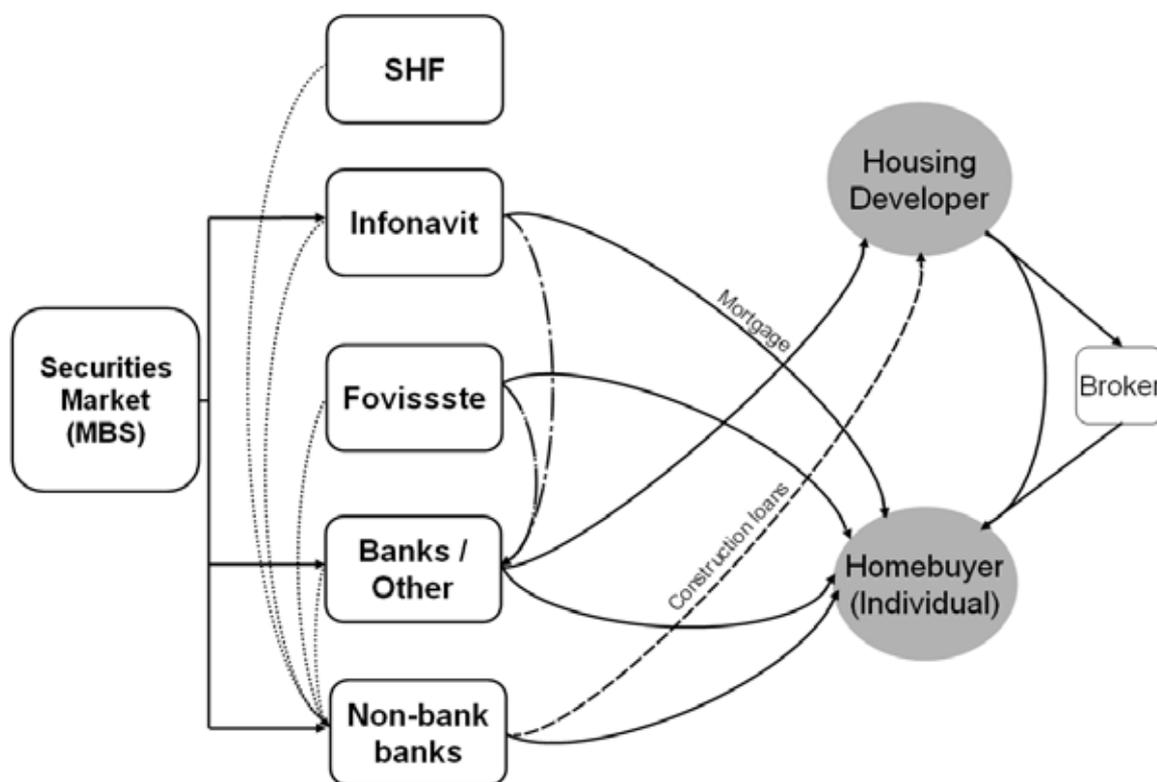
²⁶ SHF took over Fovi. In 1963, the federal government created Fovi (*Fondo de Operación y Financiamiento Bancario a la Vivienda*) as a Bank of Mexico trust. Its mission was to provide housing finance to low-income households.

households; however, through non-bank institutions, it provides the credit for construction, acquisition and renovation of housing – mainly to the medium- and low-income segment.

Third, in 2006, Sofomes were set up as financial intermediaries that can offer mortgage credit, among other things.

Chart 10

Housing financial intermediaries structure



Source: Bank of Mexico.

b. Funding sources

In the last few years, there have been a number of innovations that have affected the way mortgage loans are financed. For instance, securitization emerged as a convenient funding source, along with financial instruments to cover investors, and technological developments to improve its accessibility.

The development of the domestic bond market has had a positive impact on the expansion of the credit market. Economic stability has extended agents' planning horizon and the bond market has increased significantly in terms of the maturity and the duration of bonds, both public and private, issued in the domestic market. Before 2000, the yield curve considered only instruments with a maturity of up to one year. Now, the yield curve includes fixed-rate government bonds with a maturity of up to 30 years (Table 3). Moreover, these long-term government bonds are now used as a benchmark in the issuance of other long-term liabilities. In addition, the development of the bond market has facilitated the introduction of new instruments, for example asset-backed securities.

As mentioned, changes in the regulatory framework allowed financial institutions to put into practice asset securitization. In particular, securitization of mortgage credit portfolios speeds up financial intermediaries' asset turnover, increases the number of granted mortgage loans, and reduces the interest rates paid by borrowers. In Mexico, Infonavit, Sofoles, Sofomes,

commercial banks, and other entities issue mortgage-backed securities (MBS) in pesos and UDIs, through financial trustees.^{27,28} Since 2004, Infonavit has issued Cedevis (*Certificados de Vivienda del Infonavit*) to finance a portion of its mortgage loans portfolio.²⁹ Meanwhile, non-bank institutions and commercial banks have issued Borhis (*Bonos Respaldados por Hipotecas*) to fund part of their portfolio of bridge loans for construction and mortgage loans.^{30, 31}

Table 3
Initial public offering of fixed-rate bonds

	3 year	5 years	10 years	20 years	30 years
Date	Jan-00	May-00	Jul-01	Oct-03	Oct-06

Source: Bank of Mexico.

The issuance of mortgage-backed securities has contributed to the development of the private securities market in Mexico. Today, mortgage-backed securities represent 19.2% of this market, compared to 10.1% in 2005. Cedevis have gradually increased their market share; from 2% in December 2005 to 4.1% in December 2007. In 2002, Sofoles securitized Borhis for the very first time. Nowadays, non-bank institutions are still the most active players in MBS issuance (market share of 8.1% in December 2005 and 11.5% in December 2007). Banks started to issue Borhis in 2006, and by December 2007 their market share was 3.6% (Chart 11).

To reduce default risks, Borhis usually come with a cash flow hedging UDIs-minimum-wages swap, which allows debtors to obtain an indexed-to-inflation mortgage loan and pay it back in minimum-wages terms.³² This financial instrument covers Borhi holders in case of inflation volatility. Besides default risk, Borhi securitization involves other risks, such as prepayment risk, trustee risk, and credit management risk.³³ Consequently, the rating of Borhis (senior and subordinated bonds) depends on both institutions' ratings, the one that acquires the credit portfolio (trustee), and the one in charge of collecting the debtor payments (financial intermediary).

²⁷ Other entities are real estate construction companies. UDIs are Mexican inflation-linked units.

²⁸ In Mexico there is a match between the characteristics of the securitized bonds and the mortgages that back them (balance principle).

²⁹ Cedevis are only backed by Infonavit-originated loans. They do not include other-programs loans like *Apoyo Infonavit* or *Cofinavit*.

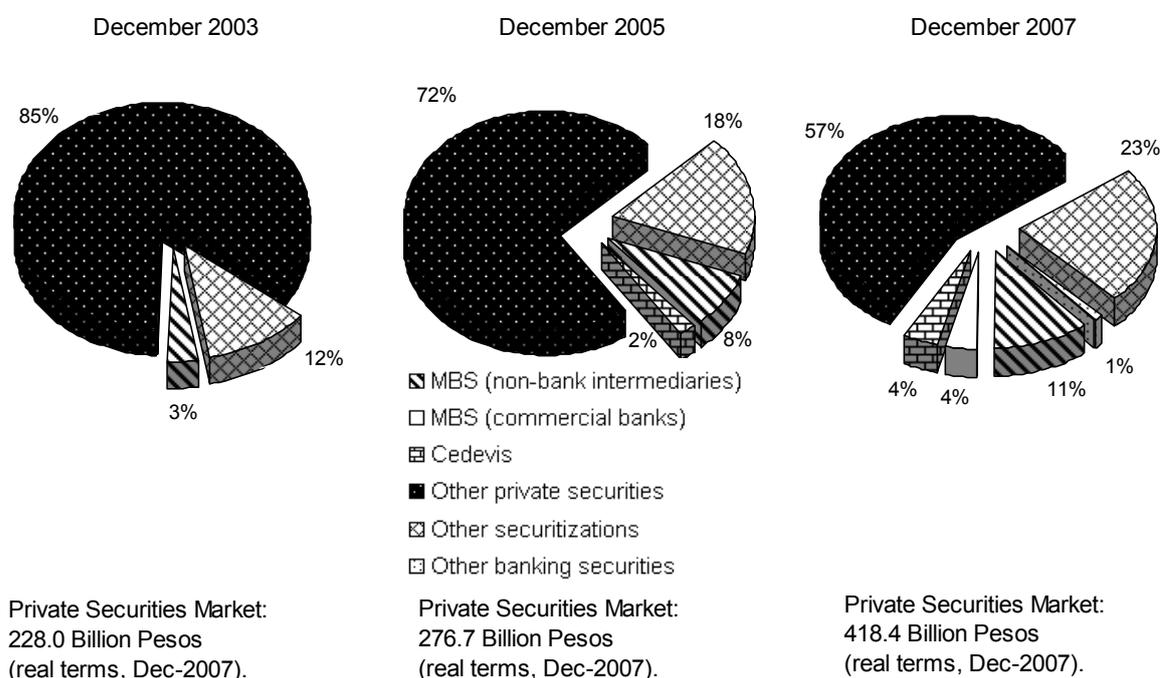
³⁰ Bridge loans are short-term loans that are expected to be paid back quickly through subsequent longer-term financing. These loans are provided to housing construction companies. Only Sofoles and Sofomes issue bridge loan Borhis.

³¹ Credit portfolio with average loan-to-value (LTV) up to 65% for loans in UDIs and 75% for loans in pesos.

³² The SHF funding to Sofoles and Sofomes will expire in October 2009. However, SHF will keep the role of securitization guarantor and guarantees provider (GPOs).

³³ Borhis are "pass-through" securities. That is, the characteristics of the outstanding MBS reflect the terms of the underlying mortgage portfolios (coupon type and term).

Chart 11
Securities market in Mexico
 Percentage structure



Source: *Bolsa Mexicana de Valores (BMV)* and *Instituto para el Depósito de Valores (Indeval)*.

SHF provides financial guarantees and mortgage credit insurance to promote the secondary market, improve Sofoles ratings, reduce financial costs of mortgage loans, and increase investors' certainty (Chart 12). For instance, on-time payment guarantees (GPOs) cover Borhi holders to up to 85% of the loan offered by commercial banks or non-bank institutions if the debtor does not pay on time. Moreover, SHF provides mortgage loan insurance (GPIs), which cover from the first loss of up to 35% of the unpaid balance due to default of delinquent loans.³⁴ The benefits of these financial innovations are, among others, market expansion to higher loan-to-value (LTV) segments, discipline in credit originations, credit enhancement for securitization, lower loss provisions, and increased lending opportunities.³⁵

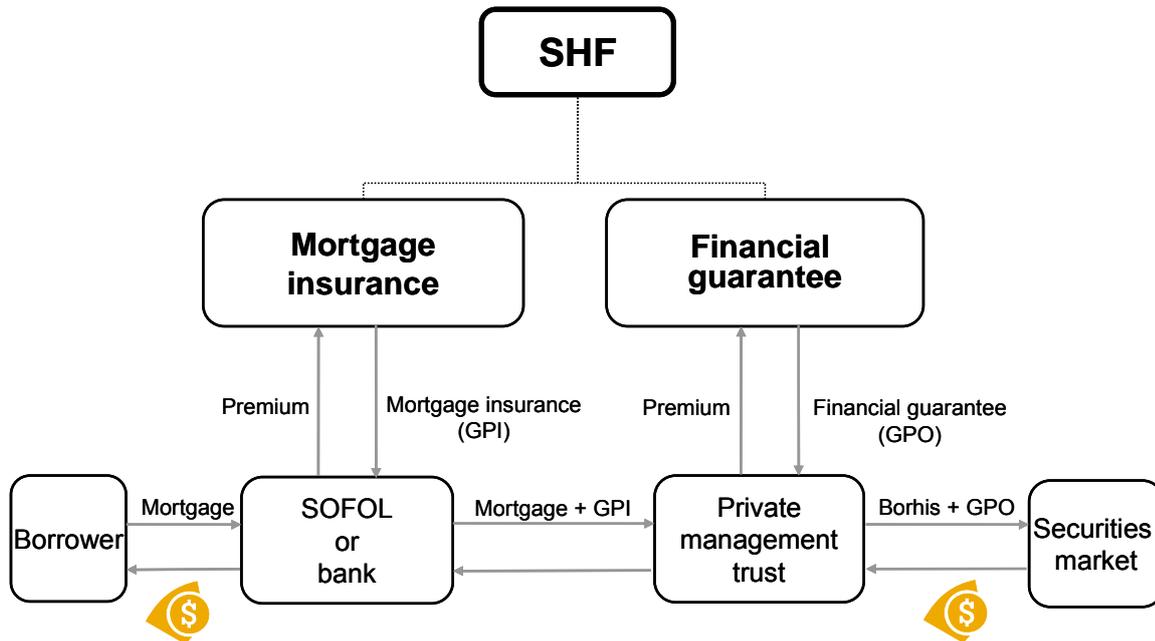
In 2006, Hipotecaria Total (HiTo) was established to implement a Danish business model to assist non-bank institutions in the securitization of Borhis. In order to reduce the funding rate and reduce market risk, HiTo promotes the use of a technological framework that allows non-bank institutions to access capital markets continuously to fund their mortgages at any time. The market risk mentioned arises between the origination and securitization of the mortgage portfolio (it takes approximately 28 months on average to take credit portfolios to the securities market).

³⁴ The insurance coverage is allocated to each loan based on the loan-to-value ratio (LTV).

³⁵ Mortgage loan insurance can be used as part of the down payment to promote loans with higher LTVs without increasing credit risk. In recent years, most down payments have decreased from 35% to 10% of the house value.

Chart 12

Description of the mortgage securitization model of Borhis



Source: SHF.

c. Housing finance products

Infonavit has had an active role in innovating credit products, some of which are now available to households that in the past did not have access to mortgage credit. Infonavit's mortgage credit is granted at fixed-interest rates and a monthly payment tied to the minimum wage behavior. The traditional fixed-rate mortgage credit has a limit of 180 monthly minimum wages (US\$ 38,136 at ppp of 2007), and the house value limit of this product is 350 times the monthly minimum wage (US\$ 74,154 at ppp of 2007). Additionally to its traditional fixed-rate mortgage credit, Infonavit implemented programs to support low-income workers, and two joint programs with banks and non-bank institutions for workers who earn more than four minimum wages.

First, Infonavit enforced the *Programa de Vivienda Económica* to support workers who earn up to four times the minimum wage. This program promotes the construction of houses with values of up to 118 times the monthly minimum wage (US\$ 25,000 at ppp of 2007). Workers are granted a long-term credit with a subsidized interest rate.

Second, in 2001, *Apoyo Infonavit* was launched to support workers whose income is usually more than 10 minimum wages (US\$ 2,118.70 at ppp of 2007) and who did not have access to mortgage credit from financial intermediaries (around 2.5 million workers or 15% of total workers). Under this program, a worker can qualify for a financial intermediary mortgage credit using his or her individual account in Infonavit as a non-default guarantee to cover against unemployment, and his/her monthly individual account contributions are taken as mortgage credit payments to reduce the mortgage credit term or monthly payments. There is no ceiling for the house value.

Third, *Cofinavit* is a program that allows workers to obtain a joint credit with Infonavit and a financial intermediary. The advantages include unlimited house value, individual account

periodic contributions that reduce credit payments, and the fact that the individual account balance can be used as part of the credit down payment.

Finally, with respect to the eligibility criteria, in 2007 Infonavit introduced a new set of rules to allocate mortgage loans in order to reduce the probability of default should debtors become unemployed.

In recent years, both *Apoyo Infonavit* and *Cofinavit* programs have positively affected the quality of financed housing units. In the past, the majority of households could afford low-income units only through Infonavit traditional housing credit. As a result of implementing the joint-credit programs, credit limits have broadened and some households can now afford medium-income houses.

The stabilization of the inflation rate and well-anchored inflation expectations have influenced the decision of private sector financial intermediaries to offer, in addition to UDI-denominated mortgage loans, peso-denominated mortgage loans at fixed interest rates. Today, financial intermediaries offer a wide variety of mortgage products besides *Apoyo Infonavit* and *Cofinavit*. These products have less stringent credit requirements for applicants – age and monthly income – than the same type of products have had in the past. Commercial banks have implemented mortgage credit products with higher LTVs, longer terms, and fee-free prepayments schemes.³⁶ In general, their products are in pesos, with fixed-interest-rate schemes. Meanwhile, non-bank institutions provide fixed-interest-rate mortgage loans in pesos and UDIs, with different schemes for payments – fixed or on minimum-wage terms.

Since the late 1990s, the federal government has fostered subsidized housing programs to support the low-income population.³⁷ For instance, in 1997 a subsidy program – *Prosavi (Programa Especial de Crédito y Subsidios a la Vivienda)* – was implemented to provide mortgage loans to households with income levels of up to five times the minimum wage in both the formal and informal sectors (US\$ 1,059.30 at ppp of 2007). Prosavi allocates its resources through SHF and non-bank institutions, offering an upfront subsidy that represents at least 20% of the house's value.³⁸ By 2001, Prosavi loans represented 35% of Sofoles' portfolio. However, in 2006, the number of loans decreased by 93% because of higher delinquency rates and increasing costs.³⁹

In addition, there are programs to support self-construction projects of lower-income households. Moreover, SHF has enforced programs to foster housing credit accessibility for specific population segments. For instance, SHF has implemented a leasing program for immigrants, with the option of buying through a housing credit. Also, remittance-backed mortgages were created to allow resident families of Mexican expatriates to obtain a mortgage credit from commercial banking or non-bank institutions. These mortgages are backed by savings accounts that are funded by remittances from relatives living abroad. SHF and Fonhapo launched a credit product to renovate or enlarge housing of low-income households of the informal sector of the economy – mainly in rural areas.

In 2007, a program to regulate mortgage-credit subsidies granted by the federal government through public and private intermediaries was implemented (*Programa de Esquemas de Financiamiento y Subsidio Federal a la Vivienda*), in order to promote house purchase among low-income households. Under this program, individuals with an income level of up to

³⁶ LTV of up to 95%, and credit term no longer than 30 years.

³⁷ Between 2001 and 2006, the federal government devoted around US\$ 1,800 million to place 243,000 subsidies (Source: CONAVI).

³⁸ The maximum subsidy is 8,000 UDIs (US\$ 4,240 at ppp of 2007) and the maximum house value is 40,000 UDIs (US\$ 21,202 at ppp of 2007).

³⁹ From 20,000 loans in 2001 to 1,400 in 2006.

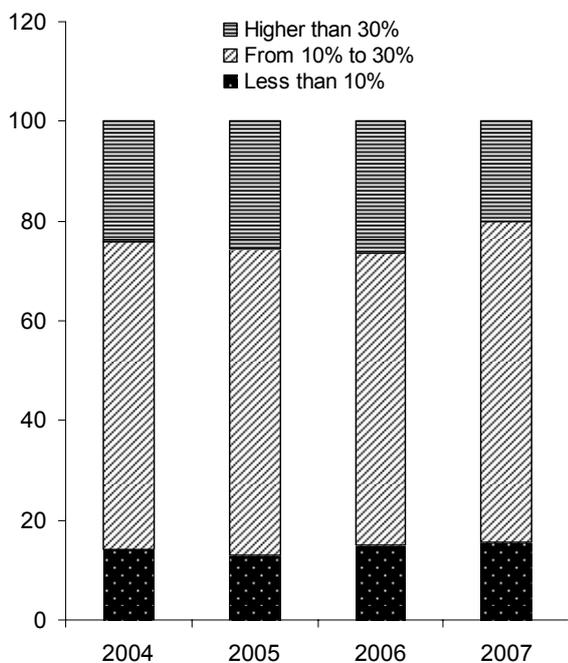
2.6 minimum wages (US\$ 511 at ppp of 2007), or married couples with a joint income of up to four minimum wages (US\$ 847.50 at ppp of 2007) can access a credit to buy or renovate a house with an upfront subsidy to complement the down payment; thus, this scheme basically reduces the LTV of the property. To qualify for this program, the worker needs to have savings equivalent to at least 4–5% of the house value. In addition, there is a house price limit of 148 monthly minimum wages (US\$ 31,144 at ppp of 2007) and the upfront subsidy limit is 33 monthly minimum wages (US\$ 6,992 at ppp of 2007); the subsidy decreases as the price of the house increases.

In 2007, Infonavit introduced the program *Esta es tu Casa*, designed to support households with an income level between one and 2.6 minimum wages (equivalent to a monthly wage of between US\$ 211.90 and US\$ 511 at ppp of 2007). The mortgage loans granted under this program include a governmental upfront subsidy to complement the down payment. This subsidy is awarded when the worker contributes a certain amount of savings.⁴⁰

Chart 13

Monthly payment to household income ratio

Per cent

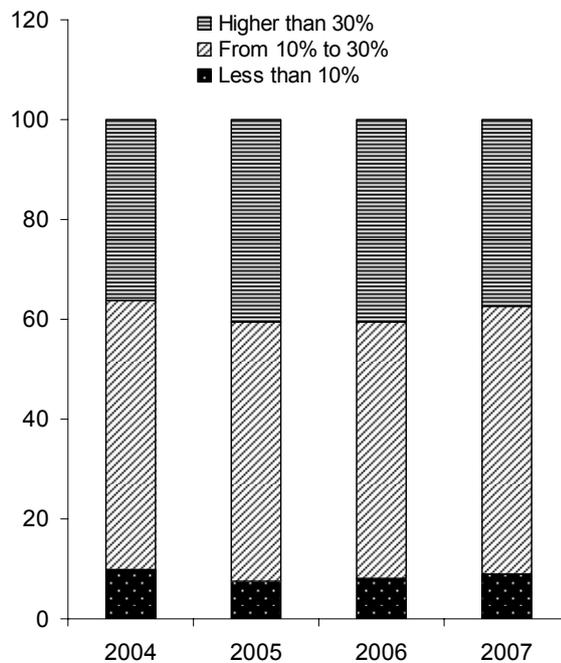


Source: Bank of Mexico. Financial System Report, 2007.

Chart 14

Down payment to house value ratio

Per cent



Source: Bank of Mexico. Financial System Report, 2007.

Despite the number of financial innovations introduced in recent years, mortgage credit products in Mexico are still conservative. In particular, the possibilities of equity withdrawal are very limited. A regular mortgage loan has the following characteristics: i) a fixed nominal interest rate; ii) a 15- to 20-year term; iii) a monthly payment that represents no more than 30% of the borrower income (Chart 13); iv) positive amortization; and v) fee-free prepayment.

⁴⁰ The maximum subsidy is MXN 37,000 (US\$ 5,096 at ppp of 2007), and to qualify for it the worker needs existing minimum savings of MXN 7,900 (US\$ 1,101 at ppp of 2007). This scheme is part of the Programa de Esquemas de Financiamiento y Subsidio Federal a la Vivienda.

In Mexico, households face several constraints and transaction costs in asset management, specifically equity withdrawal from housing wealth. The down payment to house-value ratio (one minus loan-to-value ratio) of mortgage finance by commercial banks represents around 30% (a loan-to-value ratio of 70%), and has remained stable in recent years (Chart 14).⁴¹ In general, mortgage loans from non-bank institutions show higher LTV ratios than commercial banks' loans. Moreover, the higher the house value, the lower the LTV is. In addition, mortgage credit refinancing is very costly. House purchase requires the payment of high legal fees and taxes, which represent 6–8% of the value of the property.⁴²

V. Recent developments in housing finance

From a macroeconomic perspective, lower inflation and interest rates, increased credibility in monetary policy conduct, financial market deepening, and decreasing public sector demand for financial resources have been the main reasons for the recent expansion of mortgage credit. In addition, there are other factors related to structural and regulatory issues that explain the recent developments in housing finance.

Innovations in housing finance have had an impact on the recent behavior of the residential real estate credit market in Mexico. In particular, innovations in the regulatory framework, funding sources and financial products have positively affected housing finance accessibility, origination, financial instruments, costs, products, and availability. This section describes the developments on mortgage credit market and mortgage-backed securities market in order to show the impact of financial innovations on these areas. The analysis focuses on the recent mortgage credit expansion, the behavior of mortgage credit delinquency rates, and the situation of the mortgage-backed securities market.

a. Mortgage credit expansion

Between 2001 and 2005, total mortgage credit remained relatively stable, and represented on average 8.1% of GDP. Afterwards, this indicator adjusted significantly upwards, and in 2007 the ratio of total mortgage credit to GDP was 9.2%, 1.1% points more than in 2005 (Chart 15). Still, this ratio is lower than those registered in other emergent market economies.⁴³ Between 2005 and 2007, the average annual growth rate of total mortgage lending was 7.2% in real terms (Chart 16).

The introduction of financial innovations, in terms of both products and sources of financing, might generate a sharp increase in housing finance and in some cases the presence of a credit boom in mortgage loan markets. Therefore, the analysis of the mortgage credit recent behavior is relevant in determining a credit boom in Mexico.

The standard Hodrick-Prescott methodology was applied to assess the existence of a credit boom in the mortgage market. This methodology decomposes series into trend and cyclical components. They help to identify abrupt changes in a given variable. The variable to test is the seasonal-adjusted portfolio of mortgage credit in real terms. Abnormal growth is defined,

⁴¹ The typical loan-to-value ratio in the United States and Japan is 80%; in the United Kingdom, Canada and France it is 75%; and, in Spain, Ireland and Germany it is 70%. Source: IMF, *The changing housing cycle and the implications for monetary policy*, 2008.

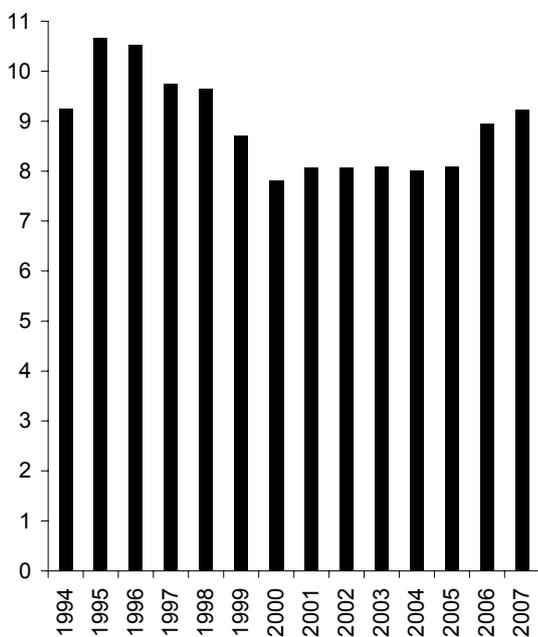
⁴² Source: Asociación de Banqueros de México (ABM).

⁴³ In 2006, housing finance in Chile represented 14% of GDP; in Canada 48.1%; in the United States, 73.3%; in Australia, 81.8%, and in New Zealand, 85.1%. Source: central banks' websites.

in general, as an episode in which credit expansion deviates more than the typical business cycle expansion. To detect an episode of abnormal credit growth, the deviation of the cyclical component from the long-term trend should be higher than a specific threshold.⁴⁴ The assumptions in the model are that the outstanding mortgage credit Y_t is integrated by a trend component T_t , related to the long-term behavior, and a cyclical C_t component as a result of business cycle shifts, plus a pure random component ε_t . That is: $Y_t = T_t + C_t + \varepsilon_t$. Therefore, an observation is considered as irregularly high when its cyclical component is above the established threshold; ie $\frac{C_t}{T_t} > \alpha$, where $\alpha = 2.5\%$. In addition, a period is regarded as a credit boom period in the market when its observations deviate constantly and significantly from the long-term trend.

Chart 15

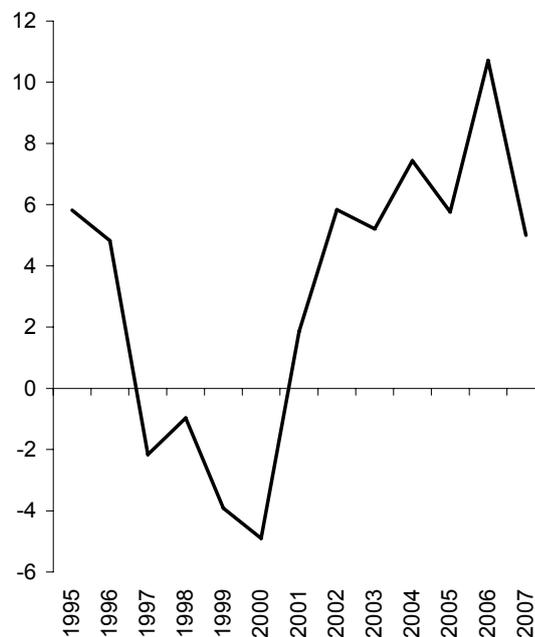
Mortgage credit
Percentage of GDP



Source: Bank of Mexico.

Chart 16

Mortgage credit
Real growth rate



Source: Bank of Mexico.

The analysis was performed on monthly seasonally adjusted data of real total mortgage credit from December 1994 to June 2008. Infonavit and private sector financial intermediaries' portfolios were included. The results of this test indicate no abnormal growth for total mortgage portfolio, as well as the Infonavit mortgage portfolio (Charts 17 and 19). Meanwhile, in the case of private credit institutions' mortgage portfolio, a sharp expansion of credit is evident during 2006. However, there is no evidence to support the existence of a mortgage credit boom (Chart 18).⁴⁵

⁴⁴ In this analysis, the threshold factor was set at 2.5%.

⁴⁵ As the Hodrick Prescott model suggests when analyzing monthly data, the test was performed with a "smoothing" parameter (λ lambda) of 14,400.

Chart 17
Total mortgage portfolio¹
 MXN billion, June 2002

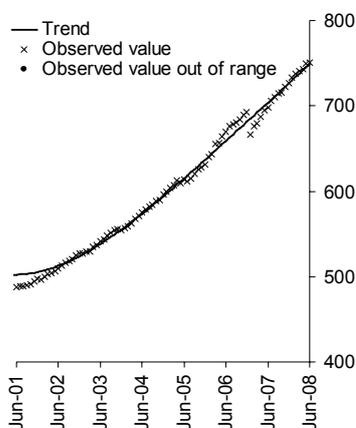


Chart 18
Private credit institutions' mortgage portfolio^{1, 2}
 MXN billion, June 2002

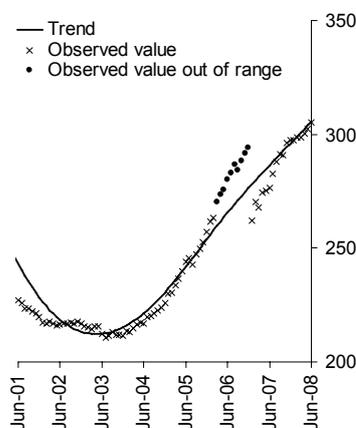
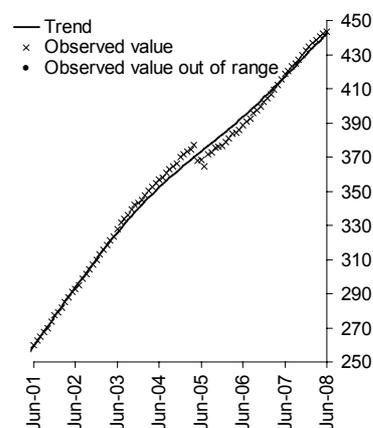


Chart 19
Infonavit mortgage portfolio¹
 MXN billion, June 2002



¹ In the model, the threshold factor was set at 2.5 percent. ² Commercial banks and non-bank institutions.

Source: Bank of Mexico and Infonavit.

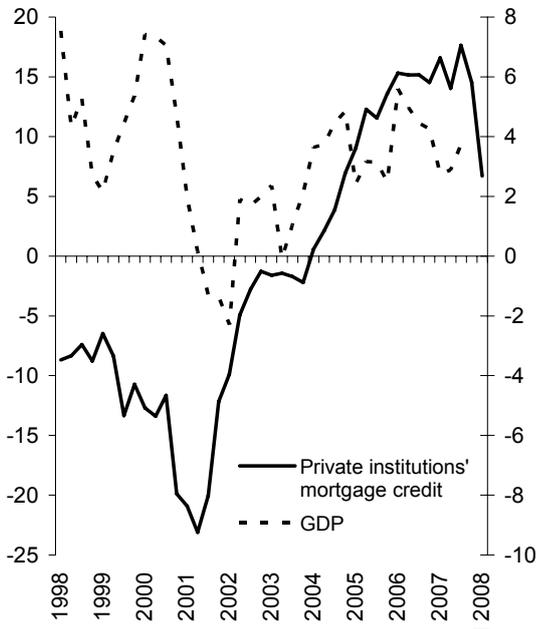
The recent mortgage credit expansion has been the result of several factors, such as:

- i. A sustained, but still moderate, growth of the Mexican economy in recent years (Chart 20).
- ii. The expansion took place after a long period of mortgage credit portfolio contraction. The ratio of total mortgage credit by private credit institutions to GDP reached its lowest level in 2003 (3.3%) compared to 6.6% in 1994.
- iii. The growing availability of resources in the private financial institutions, in particular commercial banks, and the decision to allocate more resources to the mortgage credit market. Basically, commercial banks decided to return to the mortgage credit market after years of poor participation. In addition, other private credit institutions (Sofoles and Sofomes) introduced more aggressive strategies to grant mortgage loans. In 2007, the number of mortgage loans awarded by private credit institutions was 223,800, compared to 71,900 in 2003 (Chart 21).
- iv. Innovations in the mortgage credit market have positively affected the behavior of housing finance. In particular, the relaxed credit conditions for households as a result of: a) accessibility to accumulated resources from the housing fund individual account to enhance a private credit institution mortgage credit, mainly to reduce down payments; b) the elimination of house-value ceilings in the co-financing schemes of Infonavit; and c) the use of Infonavit contributions to complement the monthly credit payment. Nowadays, most products offered by private credit institutions can be complemented with resources coming from housing-fund individual accounts. In 2003, the number of mortgage loans placed under the schemes *Cofinavit* and *Apoyo Infonavit* was 2,300. In 2007, this figure was 78,200 (Chart 22). The percentage of private financial institutions' mortgage loans awarded with Infonavit credit programs thus increased from 3% in 2003 to an average of 35% during the 2005–07 period.

Chart 20

GDP and private institutions' mortgage credit

Annual real growth rate (%)

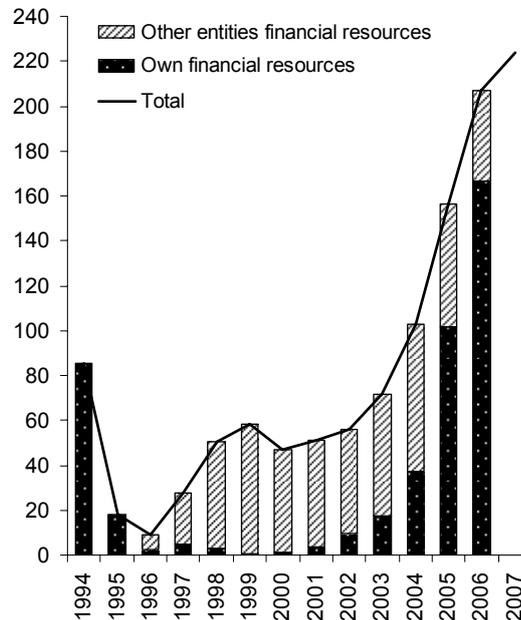


Source: INEG and Bank of Mexico.

Chart 21

Private credit institutions' mortgage loans by funding source

Thousands



Source: CONAVI.

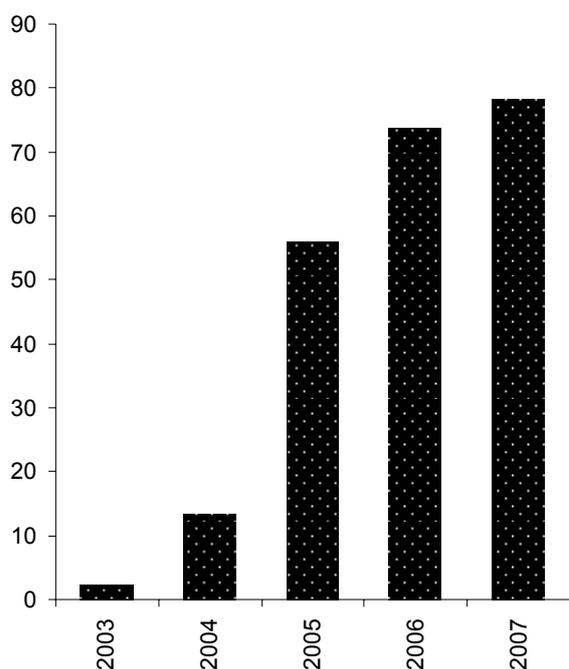
- v. Subsidy schemes have increased the access of low-income households to mortgage credit. For example, during 2007, 76,300 credits with an upfront subsidy were granted to purchase houses, compared to 71,200 during the first half of 2008.
- vi. Since 2003, households can deduct from their taxes the real component of paid interests on mortgage loans to finance their housing acquisition, construction, or remodeling. This deduction does not apply when households borrow money against the value of their house (mortgage equity withdrawal).
- vii. Subsidized interest rates on loans granted by public institutions. The interest rate charged on a standard loan ranges between 4% and 10% (according to household income level), below the average interest rate on a commercial bank loan (12–14%).⁴⁶
- viii. Finally, the mortgage credit expansion was not driven by a significant downward adjustment in its related costs. In 2006 and 2007, both mortgage interest rates and the CAT of commercial banks and Sofoles have remained relatively stable (Chart 23).

⁴⁶ The interest rate charged to an Infonavit credit ranges between 4% and 10%. Mortgage credits by Fovissste charge an interest rate of 4–6%.

Chart 22

Cofinavit and Apoyo Infonavit credit

Thousands

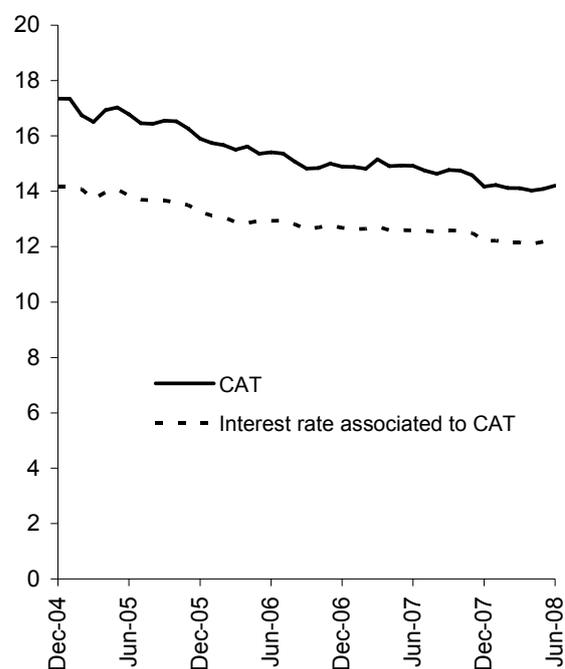


Source: Infonavit.

Chart 23

Mortgage loans' interest rates

Per cent



Source: Bank of Mexico.

b. Non-performing loans and solvency indicators

Delinquency rates and default rates of mortgage loans offer a picture of the non-performing loans behavior. In particular, Mexican mortgage credit market delinquency rates figures are closely related to the market segment served by different financial institutions. Also, some solvency indicators can be used to evaluate financial intermediaries' strength against credit risk.

Commercial banks offer mortgage loans mainly to households of middle and high-income segments with a well-established credit record. Since 2004, average delinquency rates of commercial banks mortgage credit have remained stable at around 2.6%, which represents a significant decline from high figures observed in past years (in 2004 it was 4.3%). In June 2008, commercial banks' delinquency rate of mortgage credit was 2.9% (Chart 24).⁴⁷ The default rate of mortgage loans by vintage – based on the year of loan origination – has remained relatively stable since 2002 (Chart 25). This behavior suggests that the mortgage credit origination criteria of commercial banks have been consistent over the years.

Sofoles primarily finance the house purchase of low- and medium-income segments of the population. Delinquency rates of the credit portfolio of these intermediaries are higher than commercial banks' rates because their market segment has higher default indices and the maturity of their portfolios is lower – around ten years. In addition, non-bank institutions apply the originate-to-distribute model, in which a real estate developer is responsible for

⁴⁷ The delinquency rate is defined as the ratio of non-performing credit portfolio to total credit portfolio. This is a measure of the risk level of a credit portfolio. This indicator depends on both borrowers' payment habits, and loan-loss reserves management.

originating mortgage loans. This model may promote a loosening of underwriting standards, because originators do not keep the loans, and they have strong incentives to sell as many units as possible. Recently, mortgage credit delinquency rates of Sofoles have increased considerably (Chart 24).

Chart 24
Delinquency rates¹
Per cent

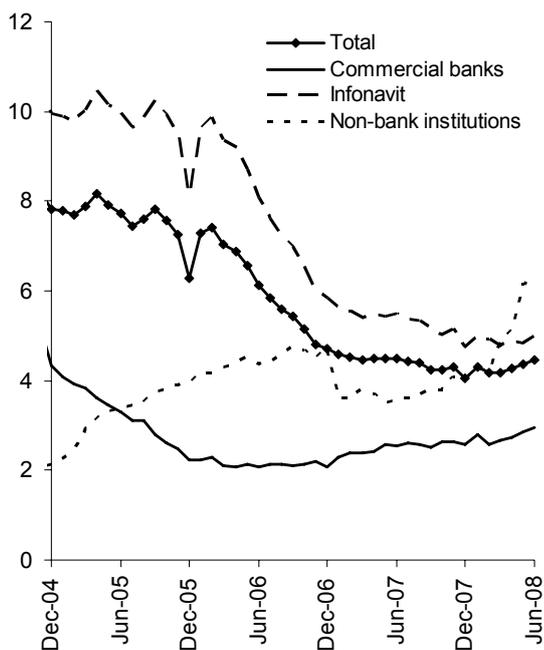
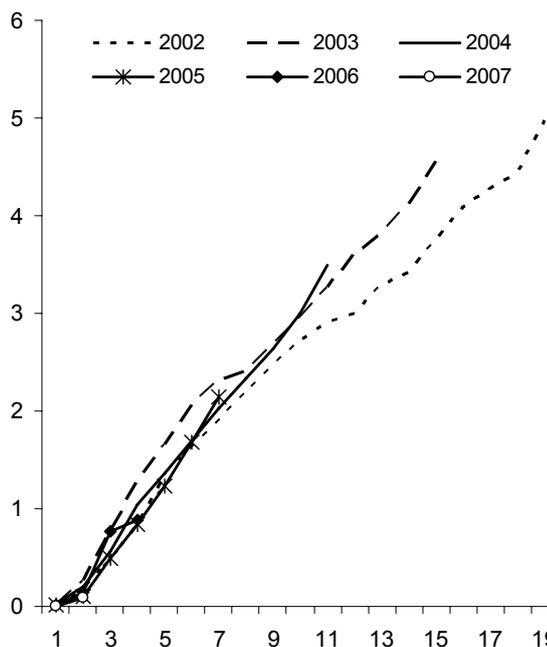


Chart 25
Default rate of commercial
banking mortgage loans
portfolio by vintage²

Per cent (Y) and passed quarters (X)



¹ Ratio of the amount of outstanding loans in pesos that are delinquent to the amount of total loans outstanding in pesos. ² Default rate is the ratio of the number of loans that cease payment for a given quarter to those who were up to date with payments during the same period.

Source: Bank of Mexico and Infonavit.

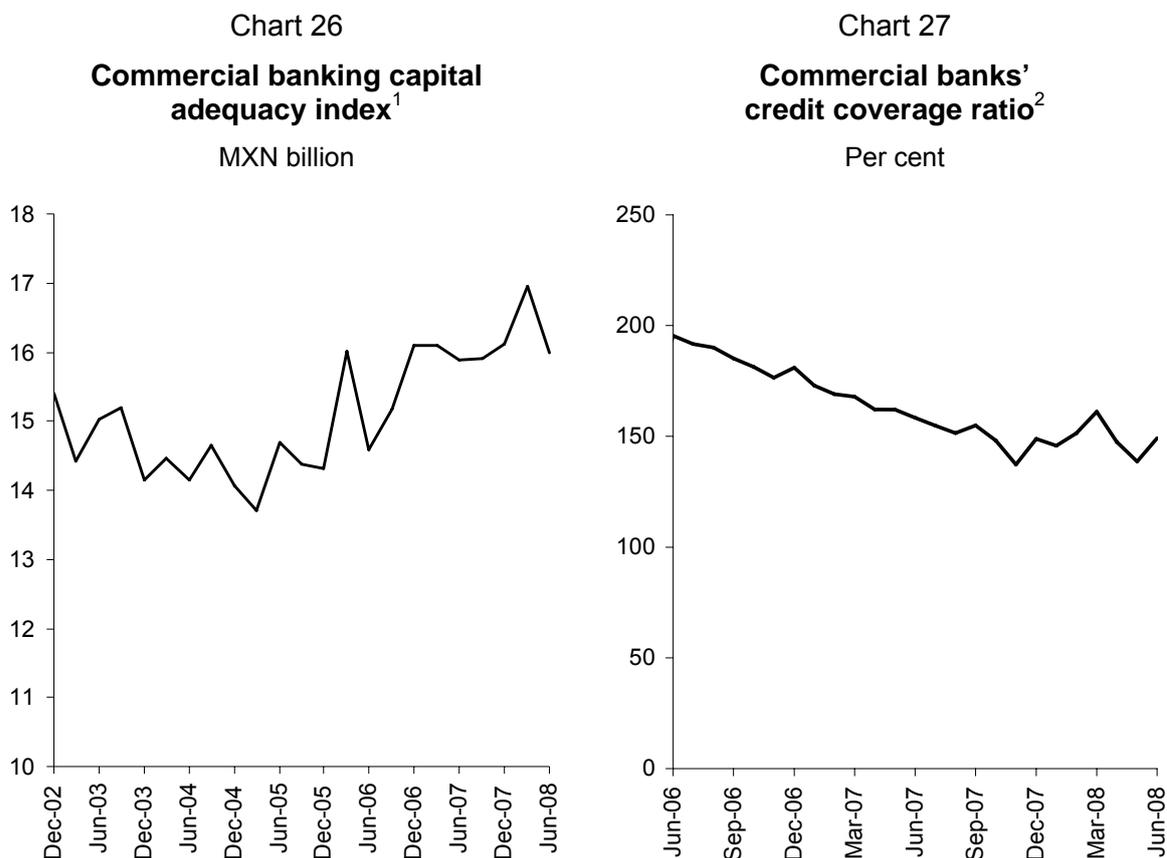
Public sector institutions' mortgage credit is mainly allocated within low-income segments. Despite the use of credit scoring models to obtain a better assessment of borrowers' credit risk, the average delinquency rate of Infonavit has remained high. For instance, it remained around 5.2% between 2006 and 2008 (Chart 24). As previously mentioned, Infonavit basically provides credit to low-income households. In particular, between 2005 and 2007, 25.7% of total mortgage loans were granted to households with an income level of up to 1.5 minimum wages, a segment that represents a higher credit risk.

In order to evaluate commercial banks' strength against credit risk, two solvency indicators are shown. First, regulators measure a bank's solvency with the capital adequacy index (*Índice de Capitalización*, ICAP). This indicator can be used to evaluate banks' resilience to the risk exposure.⁴⁸ ICAP is the ratio of regulatory capital to market and credit risk weighted assets.⁴⁹ In particular, commercial banks' ICAP showed a slight improvement between

⁴⁸ Source: Bank of Mexico, *Financial System Report 2006*, May 2007, pp 60–63.

⁴⁹ Regulatory capital is composed of Tier 1 and Tier 2 capital.

June 2006 and June 2008, from 14.6 to 16%, respectively (Chart 26). Second, credit coverage ratio provides information about commercial banks' coverage against credit risk.⁵⁰ The banking accounting standards stipulate the minimum amount of loan-loss reserves commercial banks have to hold based on the scoring of their credit portfolio. Although banks' credit coverage ratio has decreased from June 2006 to June 2008, commercial banks' loan loss reserves cover by 1.5 times the non-performing loans on average (Chart 27). Consequently, commercial banks' solvency and resilience to credit risk have not been disturbed by the recent mortgage credit expansion.



¹ Weighted average value of each bank's assets. ² Ratio of loan loss reserves to non-performing loans.

Source: Bank of Mexico.

c. Mortgage-backed securities (MBS) market

Initially, securitization of mortgage loans was an important funding source for non-bank institutions, and to a lesser extent for Infonavit and commercial banks (Chart 28). However, in December 2007, one of the most important commercial banks in Mexico started to issue MBS as part of a 5-year program. Therefore, commercial banks' participation in the MBS market is expected to increase over the next years. As of June 2008, most issuances were in UDIs (69 out of 87 total issuances). In June 2008, the total MBS securitization accrued amount was MXN 89,500 million pesos – 54% of non-bank institutions, 26% of Infonavit, and 19% of banks – (Chart 29). During the same period, the distribution of the total MBS securitization accrued amount was 46% in pesos and 54% in UDIs (Chart 30).

⁵⁰ Credit coverage ratio is defined as the ratio of loan loss reserves to non-performing loans.

Chart 28

Total MBS securitization by June 2008

Number of issuances

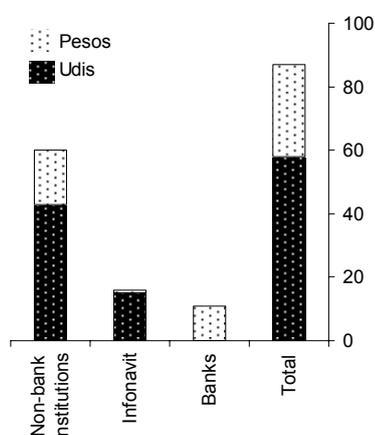


Chart 29

Total MBS accrued securitized sum by intermediary

MXN billion

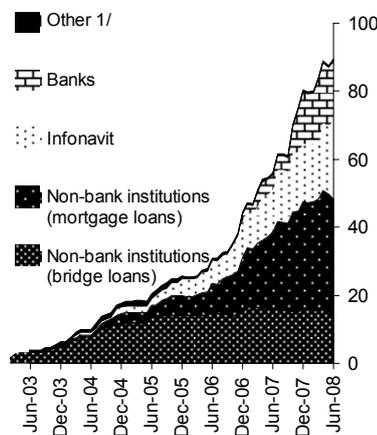
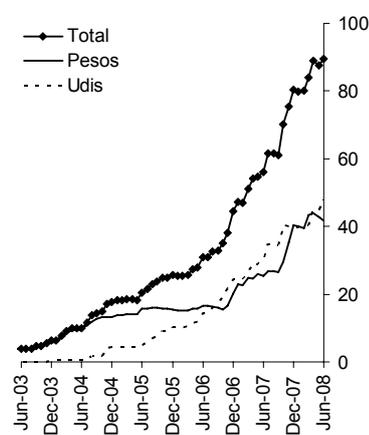


Chart 30

Total MBS accrued securitized sum by units

MXN billion



¹ Includes real estate construction companies.

Source: Bolsa Mexicana de Valores (BMV) and Instituto para el Depósito de Valores (Indeval).

Although securitization is regarded as a convenient funding source for non-bank institutions, its incidence is still low. In 2007, the highest number of MBS issuances was registered: 33 out of 87 total issues outstanding. However, securitization of mortgage loans does not represent an important share of the private securities market (18.6% in June 2008) (Chart 31).⁵¹ It also represents a small portion of the outstanding mortgage credit portfolio (7.4% in June 2008) (Chart 32). Therefore, the Mexican MBS market remains small-scale.

Regarding MBS credit ratings, all Cedevis issuances up to June 2008 have the same rating as government bonds (AAA on a local scale).⁵² High credit ratings respond to the Infonavit loans origination characteristics, such as direct payment through payroll deduction, and debtors insured against accidental death and serious injuries. Meanwhile, Borhis rating range is between A and AAA depending on the issue “tranche” structure (senior or subordinated). In general, MBS are attractive to pension funds’ and insurance companies’ managers because of their high credit rating, long-term (10–30 years) issue, real returns (UDIs denominated bonds), and slightly higher yields than government bonds.

⁵¹ The private securities market includes total securitization and private debt securities (financial and non-financial companies). Public sector securities were excluded from this calculation.

⁵² Cedevis have the highest S&P, Moody’s and Fitch ratings for debt securities in Mexico.

Chart 31

Total MBS securitized vs total debt securities¹

Per cent

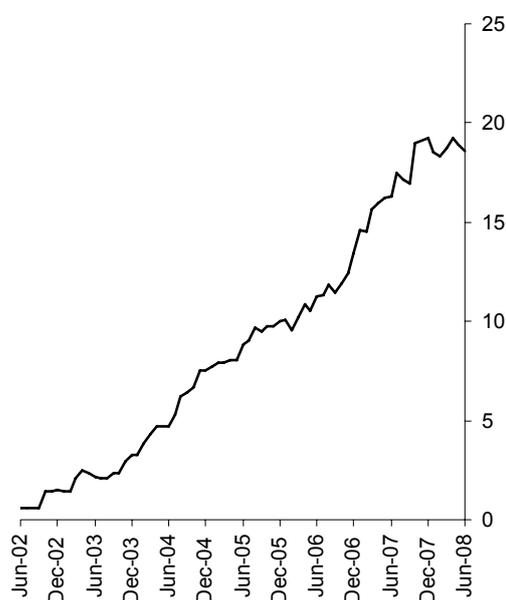
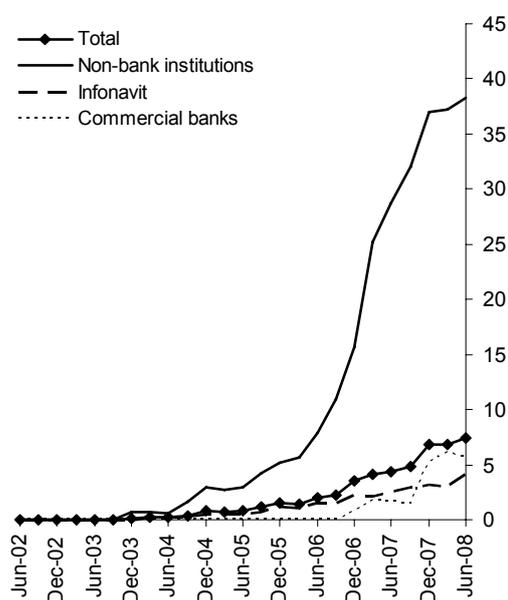


Chart 32

Total MBS securitized vs in-balance mortgage loans²

Per cent



¹ Includes private debt securities, MBS and other asset securitizations. ² Includes outstanding mortgage loans portfolio of commercial banks, non-bank institutions and Infonavit.

Source: Bank of Mexico, *Bolsa Mexicana de Valores* (BMV), and *Instituto para el Depósito de Valores* (Indeval).

VI. Final remarks

In Mexico, housing demand is expected to continue to rise in the coming years, as a result of increasing household growth rates. In particular, housing finance expansion will continue to play a key role in an effort to meet housing demand.

The recent macroeconomic stability and fiscal policies have supported higher financial resources availability for the private sector. Furthermore, public and private financial intermediaries have increased their supply of housing finance through innovations in their funding sources, and credit mortgage products. These innovations have been an important factor in recent housing finance expansion and commercial banking market penetration. However, the Mexican mortgage market is still conservative and small compared to other emergent market economies. In addition, given the size of the existing housing gap for the low-income end of the Mexican population, the government has to continue playing an important role in promoting the development of housing finance.

Although new funding techniques have emerged to enhance the traditional deposit-taking funding sources, they still remain small-scale. In particular, securitization of mortgage-backed assets is not a common practice in Mexico. In fact, it does not represent a significant portion of the total private issuance of securities. Moreover, only a small proportion of the total mortgage credit portfolio is put through securitization.

Developments in financial system regulation, along with mergers and acquisitions of Mexican banks, with foreign banks have encouraged better banking practices, higher competition, and a more transparent financial environment. Furthermore, the recent mortgage credit expansion in Mexico has not deteriorated commercial banks' solvency and credit coverage.

Appendix: The Federal Mortgage Company (SHF) and mortgage securitization⁵³

The Federal Mortgage Company (*Sociedad Hipotecaria Federal*) was founded in 2001 with the aim of developing the primary and secondary mortgage markets. Since then, the SHF has worked to create an alternative financing mechanism for financial institutions that grant mortgage loans, in particular for non-bank institutions. Portfolio securitization is one of the most efficient mechanisms that allow creditors to obtain funding to grant loans. The development of an active mortgage securitization market requires:

- A pool of mortgage loans originated and administered according to international best practices. The SHF has established minimum origination and administration guidelines that institutions receiving financing from the SHF must fulfill.
- Securitization structures with mechanisms to offset risk. SHF has granted two types of guaranties: 1) Mortgage credit insurance (GPI), which covers up to 35% of the initial loss of each mortgage; and 2) Partial financial or timely payment guaranties (GPO) to issuers of securities who fulfill certain criteria.
- Investors with long-term horizons. The SHF has increased the liquidity of Borhis by participating directly in the secondary market as market makers.
- Efficient mechanisms to allow continuous portfolio origination in order to reduce risk for those granting and administering loans.

The development of mortgage-backed securities (MBS) has enabled non-bank institutions to securitize their portfolio directly and allowed others to act as securitization pools, purchasing mortgages from smaller non-bank institutions to further securitize them.

To support the development of efficient portfolio origination mechanisms and make securitization easier for small and medium-size lenders, a company called *Hipotecaria Total* (HiTo) was set up, with the participation of the SHF. Its purpose is to create a platform that enables an integrated link between the creation of mortgage loans and capital markets. The HiTo model is based on the experience of Denmark. The development and technological aspects of the HiTo are carried out by the Danish Central Securities Depository. Some benefits expected from the HiTo are: i) a reduction in the time between loan placement and securitization; ii) direct and continuous access to capital markets for lenders; iii) more active participation of small and medium sized financial intermediaries; and iv) an interest rate stated at the moment of credit portfolio securitization, which will eliminate the market risk due to the time between the placement of a credit and its securitization.

⁵³ Source: Bank of Mexico, *Financial System Report 2006*, May 2007, p 107.

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Compilation and analysis of data on securitised public debt in Kenya

Isaya Maana¹

1. Introduction

This paper presents the framework for compiling and analysing data on securitised public domestic debt in Kenya, and the measures being undertaken to improve the quality of the data. Section 45 of the Central Bank of Kenya (CBK) Act provides the legal framework for the Bank to manage public domestic debt on behalf of the government. Compilation of data on securitised debt, and public debt in general, is guided by international standards specified in the IMF manuals. Kenya subscribed to the IMF GDDS and SDDS in 2002 with the aim of improving the quality, coverage, periodicity and timeliness of its macroeconomic data, and a commitment to improving the integrity and ensuring timely dissemination of data to the public. Comparability of data across time and countries requires that the compilation methodology be guided by certain principles.

Currently, securitised debt applies only to domestic debt as all external borrowings are undertaken through loans. According to the Budget Strategy Paper for June 2008, this situation will change in 2009 as the government plans to issue a sovereign bond in the international capital markets, which will give investors a long-term benchmark as well as providing the government with additional funds for infrastructure development.

Domestic debt in Kenya comprises central government debt incurred internally through borrowing in the local currency from residents. The government borrows from the domestic market using securities, overdrafts at the Central Bank of Kenya and advances from commercial banks. Securitised public domestic debt comprises of all government borrowings through treasury bonds, treasury bills held for fiscal and monetary policy purposes, and government long-term stocks.

According to the Annual Public Debt Management Report of 2007, securitised debt accounted for 99.6% of overall public domestic debt in Kenya in June 2007 (Table 1). Although securitised debt has been rising, its percentage in GDP dropped from 26.8% in June 2003 to 22.0% in June 2007 due to a faster growth of the economy. Domestic debt has been rising rapidly since 2001 due to reduced access to external funding and the need for domestic borrowing to finance the budgetary operations. However, domestic debt, as a percentage of GDP, decreased from 27.9% in June 2003 to 22.1% in June 2007 following improved performance of the economy.

With most of the debt held in treasury bonds in the period, the government made significant progress in achieving its debt management objective of restructuring domestic debt to longer-dated instruments. This is an important development and is crucial for reducing rollover and the market risks that characterise short-term borrowing.

The importance of accurate data on securitised debt has been underscored by Abbas and Christensen (2007). The study analysed optimal domestic debt levels in developing countries (including 40 sub-Saharan Africa countries) between 1975 and 2004 and found that

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moderate levels of marketable securitised debt as a percentage of GDP have significant positive effects on economic growth. The link between debt markets and economic growth is through the fact that domestic debt markets promote economic efficiency and financial depth.

Table 1
Trends in securitised domestic debt

	June 01	June 02	June 03	June 04	June 05	June 06	June 07
1. Total domestic debt (as percentage of GDP)	21.9	23.0	27.9	25.3	23.4	23.2	22.1
2. Total securitised domestic debt (as percentage of GDP)	20.6	22.1	26.8	23.9	22.4	22.7	22.0
3. Total securitised domestic debt (as percentage of domestic debt)	94.1	96.1	96.2	94.5	95.8	97.7	99.6
4. Treasury bills excluding repo bills (as percentage of securitised debt)	71.7	43.2	32.6	24.9	27.0	30.2	25.7
5. Treasury bonds (as percentage of securitised debt)	27.4	56.0	66.9	74.7	72.6	69.5	74.1
6. Long-term stocks (as percentage of securitised debt)	0.9	0.8	0.4	0.4	0.4	0.3	0.2

Source: *Annual Public Debt Management Report*, Ministry of Finance.

The need for quality, comprehensive, comparable and reliable data on securitised debt is therefore vital for informed decisions by policymakers, financial markets and other users. Timely and accurate data on domestic debt facilitates continuous monitoring of the macroeconomic risks associated with domestic borrowing, and implementation of necessary measures to mitigate the risks.

Compilation of securitised debt by instrument type, investor type and maturity structure is fundamental in facilitating the formulation of effective strategies of managing the macroeconomic risks associated with domestic borrowing (Christensen (2005)). A diverse investor base reduces the monopoly power of a particular group of investors in government securities, thereby bringing down the cost of borrowing and rollover risks. It also prevents excessive reliance on commercial banks funds, thereby reducing the risk of crowding out private sector lending (World Bank and IMF (2001)).

The paper is organised as follows: section 2 gives the overall coverage of securitised debt in Kenya, and section 3 provides the disaggregation of the statistics. The compilation methodology for securitised debt is presented in section 4, and plans for improving the statistics in section 5. Section 6 provides an analysis of the recent trends in public securitised debt, and section 7 concludes.

2. Coverage of the statistics

The general government in Kenya is made up of central government, public enterprises and local authorities. Currently, public enterprises and local authorities do not issue bills or bonds to raise funds. They are both funded mainly through their parent ministries under the central government. Domestic debt securities statistics therefore relate only to central government borrowings.

The Central Bank of Kenya (CBK) compiles daily data on domestic borrowing and domestic debt positions of the central government. Domestic debt is distinguished from external debt on the basis of residency, using the criteria recommended in the IMF Government Finance Statistics manual (2001). An institutional unit is classified as a resident in a country if it has a centre of economic interest in the economic territory of that country.

The debt is compiled from the accounts of the National Debt Office at CBK for all government securities. The CBK balance sheet is the source of advances to government and holdings of government securities by the CBK. Commercial banks' reports are the sources for data on their advances to government and their holdings of government securities. Securitised public domestic debt statistics comprise: outstanding amount; borrowed amount (net issues); interest payments amounts; maturity profile; and weighted interest rates.

Treasury bills were first issued in 1969 and have been issued mainly in maturities of 91 days and 182 days since 1996. However, nine-day, 16-day and 23-day treasury bills were issued in 1995, while 30-day and 60-day treasury bills were issued in 1993. Similarly, 28-day treasury bills were issued between September 1996 and June 1997.

On the other hand, treasury bonds were first issued in 1986 and are currently issued in maturities of between one and 20 years. The types of bonds issued are fixed rate, fixed coupon discounted, zero coupon, floating rate, and special fixed and floating rate. Special and restructuring bonds were issued with respect to pending bills, and recapitalization of government parastatals and agencies.

Government stocks are long-term debt instruments with a period to maturity ranging from five to 40 years. The first issues of Government stocks were in September 1980 in an attempt to lengthen the maturity structure of domestic debt. Interest rates were fixed and payable semiannually and ranged from 6% to 11% per annum for five-year and 40-year stocks, respectively. The instrument was not tradable, and therefore illiquid and less attractive to investors. It is consequently no longer issued.

Except for special and public entities restructuring bonds, all other government securities are issued weekly for treasury bills and monthly for treasury bonds through open-ended auctions. In July 2002, the government replaced the non-auction based system with a multiprice bid auction system for bonds to allow market determined yields and promote price discovery. Treasury bonds are tradable in the secondary market but treasury bills are not.

3. Disaggregation of the statistics

Securitised domestic debt statistics are disaggregated as follows:

- Type of instrument: treasury bonds; treasury bills; and long-term stocks.
- Type of creditor: commercial banks; building societies; insurance companies; pension funds; public enterprise; and other financial institutions.
- Maturity profile: outstanding treasury bills broken down into 91-day and 182-day maturities; outstanding treasury bonds broken down into maturities of between one and 20 years; and outstanding domestic debt securities broken down by days to maturity.

- Residency of creditor: outstanding treasury bills and bonds are also classified by residency of the creditor.
- Interest payments on outstanding domestic debt securities are compiled by instrument type: type of treasury bond (fixed rate, fixed coupon discounted, special, and floating rate); treasury bills; and long-term stocks.

4. Compilation methodology

Public securitised debt is compiled on a weekly basis as the sum of outstanding treasury bills, treasury bonds and long-term stocks. The securities are treated at face value (redemption amount) and not issue amounts, which may be discounted. This methodology is consistent with the criteria recommended in the GFS 2001 manual, which indicates that accrued but unpaid interest should be treated as part of the debtor's total liability. Therefore, accrued but unpaid interest is added to the principal of the underlying security.

Interest payments on securitised public debt are computed as the sum of the interest due on treasury bonds, treasury bills and long-term stocks. Since treasury bills and zero coupon treasury bonds are issued at a discount, the government is not required to make any payments to the creditors until the security matures. For this reason, interest payments on these instruments are due when they mature. In the case of fixed coupon discounted treasury bonds, the interest expense is compiled as the sum of the periodic payments, and the discount component when the instrument matures. For treasury bonds issued at a premium, the interest expense is compiled in the same way as that of a discounted bond, except that the premium is considered as negative interest expense.

The Central Bank of Kenya, Ministry of Finance and Kenya National Bureau of Statistics publish outstanding domestic debt securities statistics with varying time lags. The CBK publishes the statistics weekly in the Weekly Bulletin of Economic Indicators, monthly in the Monthly Economic Review, in June and December in the Bi-Annual Statistical Bulletin (longer time series), and annually in the Bank's Annual Report.

The Ministry of Finance and Kenya National Bureau of Statistics obtain data on securitised debt from the Central Bank of Kenya for dissemination through their respective publications. The Ministry of Finance disseminates the data quarterly in the Quarterly Budget and Economic Review, and in the Annual Public Debt Management Report. The Kenya National Bureau of Statistics publishes annual data in the Annual Economic Survey.

5. Plans for improvement

The government is in the process of documenting the methodological framework for compilation of public debt statistics in Kenya, which includes securitized debt. This is expected to build the institutional framework for compiling debt data, given the current high staff turnover and low capacity in the Debt Management Department at the Ministry of Finance.

Plans are also underway to improve the adequacy of the data on non-resident holdings of domestic debt securities to cover investment through commercial banks. Currently, non-resident holdings comprise only direct investment in securities through the Central Bank of Kenya. It is thought that most non-resident investors in government securities invest through commercial banks through nominee accounts. Since the banks do not disclose these holdings, a large proportion is not reported. Plans are underway to make it obligatory for banks to report these statistics to the CBK through the National Debt Office.

Participation of foreign investors in the domestic debt market promotes competition, thereby lowering the cost of domestic borrowing, and also increases efficiency in the domestic debt market since foreign participation introduces financial technology and innovation. Improving the adequacy of data on non-resident investment in government securities also enhances monitoring of foreign direct investment in the country.

Commercial banks have also been known to invest in government securities on behalf of individuals or institutions such as pension funds. Since these funds are part of what commercial banks declare as their own investments, statistics on holdings of government securities by banks could be overstated, while those on holdings by individuals could be understated. Therefore, making it statutory for the banks to declare these holdings to the CBK would increase the accuracy of statistics on holders of the debt.

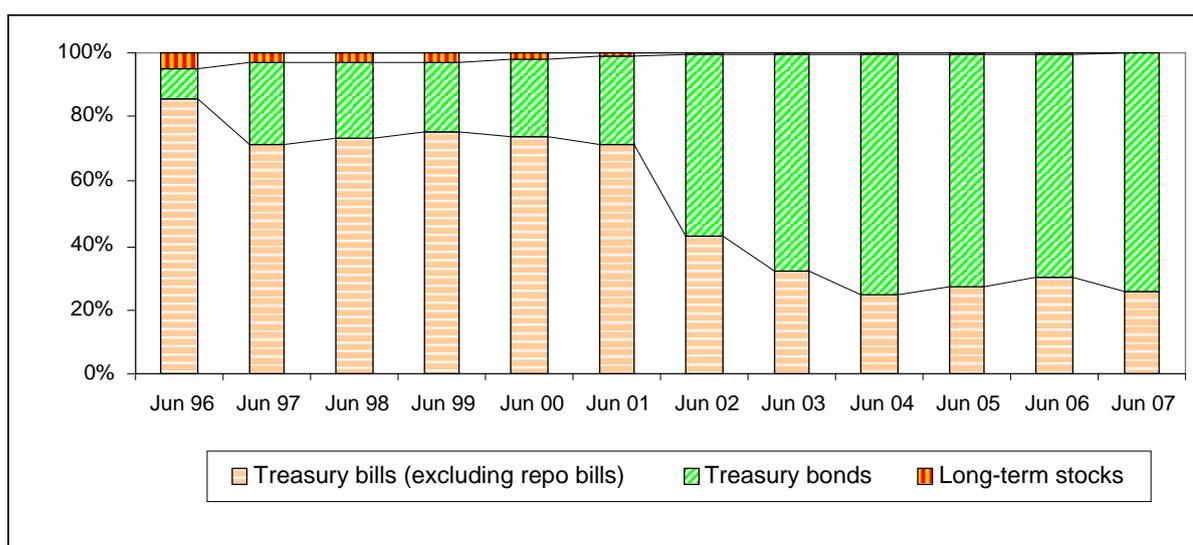
6. Recent developments in securitised debt

6.1 Maturity structure

Treasury bonds comprised the largest proportion of securitised debt between June 2002 and June 2007 (Table 1 and Chart 1). The proportion of treasury bonds increased from 27.4% in June 2001 to 74.1% in June 2007 while treasury bills dropped from 71.7% to 25.7% during the period.

The shift in the composition of domestic debt in favour of the longer-dated instruments followed a deliberate government initiative in May 2001 to restructure public domestic debt and develop the domestic debt markets. This was to restructure domestic debt from the short-dated treasury bills to the long-dated treasury bonds in order to minimise the risks of short-term borrowing, as well as develop a secondary market for government securities. The secondary market for government securities was envisaged to promote financial resource mobilization for both the public and private sector through the financial market.

Chart 1
Composition of securitised domestic debt by instrument
 Percentage of total



Source: Central Bank of Kenya.

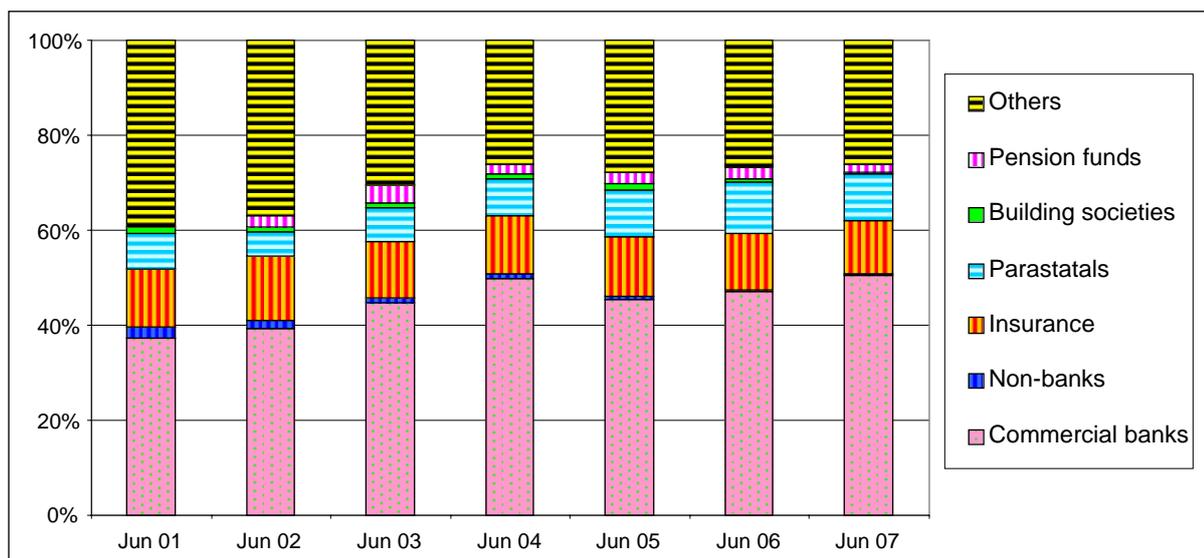
The success of the government bond programme during the period was largely attributed to reforms in pensions and insurance sectors, which required that a specific part of their investment must be in government securities.

There was also support from the financial market players through the Market Leaders Forum (MLF), which was constituted in May 2001. This is a consultative meeting held monthly to discuss market developments that may impact on the performance of new issues of government securities and strategies for debt market development.

6.2 Securitised domestic debt by investor

The largest proportion of securitised debt as at June 2007 was held by commercial banks. The proportion of the debt held by the banks increased from 37.2% in June 2001 to 50.7% in June 2007 (Chart 2). However, the proportion held by non-bank entities comprising non-bank financial institutions, pension funds, building societies, parastatals and individuals decreased from 62.8% to 49.3% during the period.

Chart 2
Securitised domestic debt by creditor
 As percentage of total



Source: Central Bank of Kenya.

A wide investor base plays a major role in ensuring that the government meets its domestic borrowing requirements at reasonable costs. A narrow investor base consisting mainly of commercial banks increases the risk of crowding out private sector investment, as private companies depend mainly on commercial bank financing.

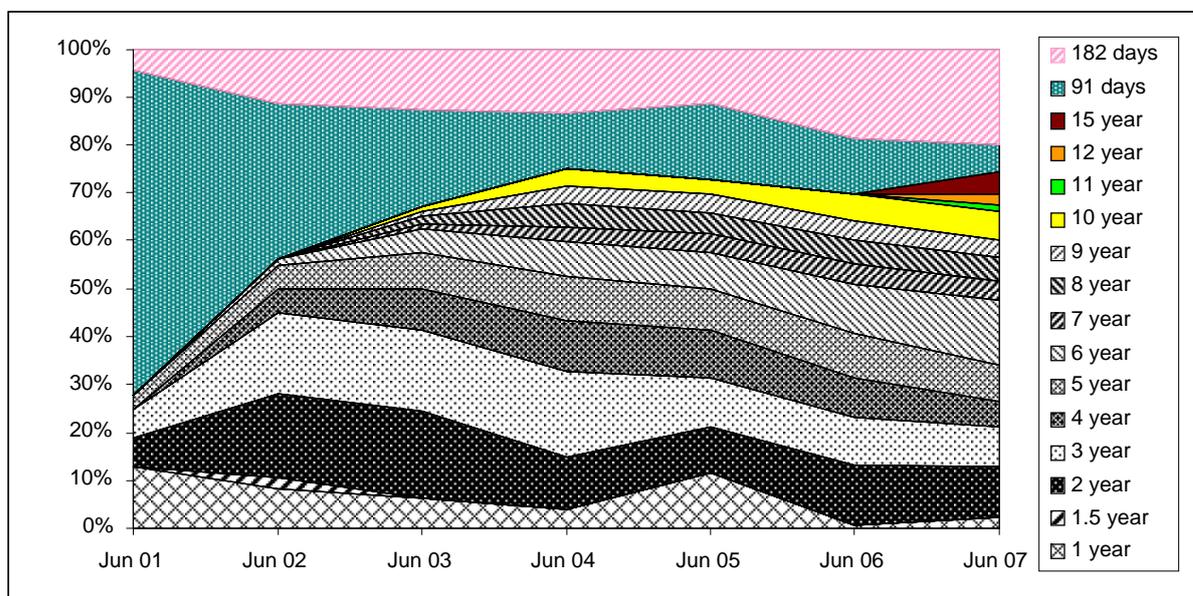
6.3 Composition of government securities by tenor

The proportion of 91-day treasury bills in outstanding government securities decreased from 68.1% in June 2001 to 6.1% in June 2007 while 182-day treasury bills increased from 4.3% to 19.7% in the period (Chart 3). Similarly, treasury bonds with tenors of five years and above increased from 2.7% to 47.8% during the period while the longest tenor for existing bonds increased from five to 15 years. However, a 20-year bond was issued in June 2008.

The 15-year bonds were introduced in 2007 and proved to be very popular with investors as their auctions were oversubscribed. Their popularity was also an indication of the confidence that investors have in the government securities market.

Chart 3
Composition of government securities by tenor

As percentage of total



Source: Central Bank of Kenya.

The average maturity profile of domestic debt by months to maturity increased from three months in May 2001 to three years and one month by June 2007. The issue of longer-dated treasury bonds during the period was important for institutional investors such as pension funds and insurance companies for matching their long-term liabilities with long-term assets.

The government reduced the interest rate risk on domestic debt, which is associated with fluctuations in the 91-day treasury bill rate, by increasing the proportion of the debt held in fixed rate treasury bonds from 12.1% to 88.2% during the period. The share of floating rate bonds in outstanding treasury bonds dropped from 85.8% to 0.3% during the period.

6.4 Impact of securitised debt on the government budget

Interest expenses on securitised debt account for about 99% of total interest payments on domestic debt. With a rising domestic debt stock, an important issue for debt management is the cost implications for the government budget. As shown in Table 2, domestic interest payments have been rising at a lower rate than growth in ordinary government revenue and GDP. Domestic interest payments, as a percentage of revenues, decreased from 12.1% in the fiscal year 2000/01 to 9.9% in the fiscal year 2006/07. The decline is attributed to strong revenue performance in the period.

Due to higher interest rates and rising domestic debt, the interest cost on domestic debt accounted for the largest proportion of total government interest expenditure during the period. Domestic interest payments, as a percentage of total interest expenditure, increased from 85.7% to 89.3% in the period. However, due to lower interest rates compared with those on domestic debt and various debt relief initiatives, foreign interest payments fell from 14.3% of total government expenditure on interest to 10.7% in the period.

Table 2

Debt service ratios and amounts

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
External interest (KES billion)	3.9	5.9	9.8	5.8	4.4	3.6	4.4
Domestic interest (KES billion)	23.2	23.7	27.6	23.3	23.4	31.4	36.9
External interest (percentage of revenue)	2.0	3.0	4.6	2.3	1.5	1.2	1.2
Domestic interest (percentage of revenue)	12.1	12.1	13.1	9.1	8.1	10.1	9.9
External interest (percentage of total interest)	14.3	19.8	26.2	20.0	15.9	10.4	10.7
Domestic interest (percent of total interest)	85.7	80.2	73.8	80.0	84.1	89.6	89.3
External interest (percentage of GDP)	0.4	0.6	0.9	0.5	0.3	0.2	0.2
Domestic interest (percentage of GDP)	2.3	2.3	2.5	1.9	1.7	2.0	2.0
Implicit interest rate on domestic debt (per cent)	11.0	10.1	9.5	7.6	7.4	8.8	9.1
Implicit interest rate on external debt (per cent)	1.0	1.6	2.4	1.3	1.0	0.8	1.1

Source: *Quarterly Budgetary and Economic Reviews*, Ministry of Finance.

The average implicit interest rates on domestic debt dropped from 21.7% in 1995/96 to 9.1% in 2006/07, and those on external debt dropped from 3.3% to 1.1% during the period. The implicit interest rates were computed by dividing the respective interest payments by the corresponding actual debt stocks in the previous year.

7. Conclusion

The aim of this paper was to present the framework for compiling and analysing data on securitised public domestic debt in Kenya and measures being taken to improve the quality of the data. Overall, there has been significant improvement in the management and compilation of securitised debt in Kenya. However, much more remains to be done to improve the quality of the disaggregated statistics of securitised debt held by commercial banks, pension funds, non-residents and other individuals. This underscores the importance of the ongoing project to improve the quality of the disaggregated statistics.

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The possibilities and limitations of derivatives statistics collected by central banks

Winfried Rudek¹

1. Introduction

Financial derivatives are undoubtedly part of the core area of financial innovations, the topic being addressed at this conference. There is plenty to discuss, particularly since credit derivatives are among the suspects for contributing to the financial troubles we are currently witnessing. However, when talking about derivatives, statisticians should not limit themselves to the credit derivatives segment. Rather, they should look at the derivatives market as a whole and thus also examine the market for interest rate, currency, equity and commodity products. If I am not mistaken, the BIS has until now always taken this broad approach with its derivatives statistics; and rightly so, as each area's conceptual and practical problems are closely linked to the others.

2. The need for derivatives statistics

2.1 Overview

Central banks, together with the BIS, are the most important producers of derivatives statistics. The demand for them to produce additional data has increased, motivated by a variety of expectations. However, there is no single type of derivatives statistics that can serve all purposes. I would like to emphasise that statistical aims and data collection and compilation methods are closely linked.

The first question we need to ask is why we are collecting derivatives statistics – what is our aim? Over time three aims have emerged, and are repeatedly restated:

1. Derivatives statistics should provide input for various national accounts and balance of payments aggregates
2. Derivatives statistics should provide data for monetary analysis purposes
3. Derivatives statistics should satisfy information needs in connection with macroprudential issues

2.2 National accounting needs

Let me start by looking at the first aim – the provision of input data for national accounting and balance of payment purposes. The methodological requirements for these data are clearly specified and are internationally binding. The current regulations can be found in the 1993 System of National Accounts (SNA 93) and fifth edition of the IMF Balance of Payments Manual (BPM 5) updates, which were adopted in 2000. From a national accounting perspective, the derivatives are obviously not of interest for their unique ability to

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isolate and take on risks, but solely in terms of their objective characteristic as financial assets, expressed by their individual market prices. Whether they are over-the-counter derivatives or traded on the stock exchange makes no difference. Compared to other financial assets, such as loans, deposits or securities, derivatives are by no means special from a national accounts perspective. Therefore all of the usual national account conventions also apply. One of these conventions is particularly important for us, namely that all data must be location-based. This means both that the sample must be defined according to the residency criterion, and also that the counterparty classification must be based on the domicile of the direct counterparty. Derivatives statistics for national accounts purposes are national statistics. The Bank of England has carried out ground-breaking work in this area. In recent years, many central banks have extended their collection systems correspondingly, with a desire to improve the balance of payments database as the decisive factor in many cases.

2.3 Monetary analysis needs

The second aim I would like to talk about briefly is the provision of data for monetary analysis purposes. Here the derivatives are no longer of interest as assets, but rather as risk transfer instruments, transferring interest rate, currency, credit or other risks. Here too, as in the case of national accounts, it makes no difference whether the derivatives are over-the-counter derivatives or are traded on the stock exchange. We need to address the question of how credit provision and the payment of deposits are influenced by the redistribution of risks induced by derivatives. In addition, the statistics must be produced in such a way that the link between the credit/deposits and the derivatives that change their risk profile can be traced. This means that, if they are to fulfil their task, the statistics must show hedging relationships.

There are serious doubts as to whether statistics can do this. In order to assess a derivative's hedging effect, the exposure that is to be hedged would have to be known. We do not know this, however, because we do not know the extent to which institutions have already hedged their positions, irrespective of derivatives, through offsetting transactions, collateral, securing guarantees and other measures to mitigate risks. Moreover, banks predominantly manage their risks on the basis of portfolios, which do not depend at all on the hedging relationship between individual transactions. If banks' transaction data are subsequently still consolidated and condensed within the context of statistical compilation, the results can hardly be expected to provide a deeper insight into the resulting risk redistribution.

However, demarcation issues also raise significant problems. This is because, like national accounts, which I mentioned briefly at the start, monetary analysis also has to comply with the residency principle, meaning that all aggregates – as in the case of the national accounts methodology – would have to be compiled on a local basis. However, this is not suitable for risk analysis, as the local unit is not liable for a bank's risks; the company is as a whole, including its branches and subsidiaries, regardless of location. Similarly, a bank's counterparty risks apply not only to its direct counterparties, but to the entire corporate group to which the counterparty belongs. This is complicated by the fact that top-performing, internationally active banks have centralised risk management, meaning that an underlying transaction and the hedging of this transaction can be completed and, of course, also posted in completely different places. Therefore, in the case of aggregates calculated on a locational basis, there is little chance of being able to identify the link between the underlying transactions and the hedging provided by derivatives.

In conclusion, the notion of developing derivatives statistics that are of great benefit to monetary analysis is very optimistic.

2.4 Macprudential needs

I would now like to address the third, perhaps most important aim to which derivatives statistics are commonly believed to contribute, namely the provision of information in relation to macroprudential issues. In terms of financial market stability, this is purely a matter of the damage potential of derivatives transactions. In other words, we are looking exclusively at a risk-oriented analysis. Here, we must make a distinction between over-the-counter derivatives and those traded on the stock exchange because each has a different level of potential risk. Asset issues, as in the case of national accounts, do not play a role and the issue of how a derivative transaction affects monetary aggregates is also of secondary importance. This has the methodological consequence that, from a financial market stability point of view, derivatives statistics must be calculated on a consolidated basis, and counterparties defined in accordance with the ultimate risk principle. It also means that the focus should be on large, systemically relevant banks. All in all, this is a typical banking supervision perspective.

Calculated on this basis, the relevant data may be quite interesting for the broader public. However, an individual central bank that usually has direct access to banking supervision sources gains only a small amount of information from the derivatives statistics of four, five or eight systemically relevant banks. The banking supervision departments are already familiar with the relevant figures before the statisticians have calculated the first amounts. The situation thus differs from that of national accounts and monetary analysis, for which statistics provide the only source of data.

However, central banks are not able to extract data from their own figures on the scope and structure of the markets in which the institutions they supervise operate. Depending on the circumstances, such data may only be obtained by collecting the findings of many individual central banks and forming a comprehensive picture from them. Thus, although the aggregation of banking supervision data promises hardly any additional benefits on a national level, it opens up new perspectives on a global level. It therefore makes sense for central banks to pass on their figures to the BIS, who will – currently at six-month intervals – use them to form global OTC derivatives statistics.

3. Usefulness of global aggregates

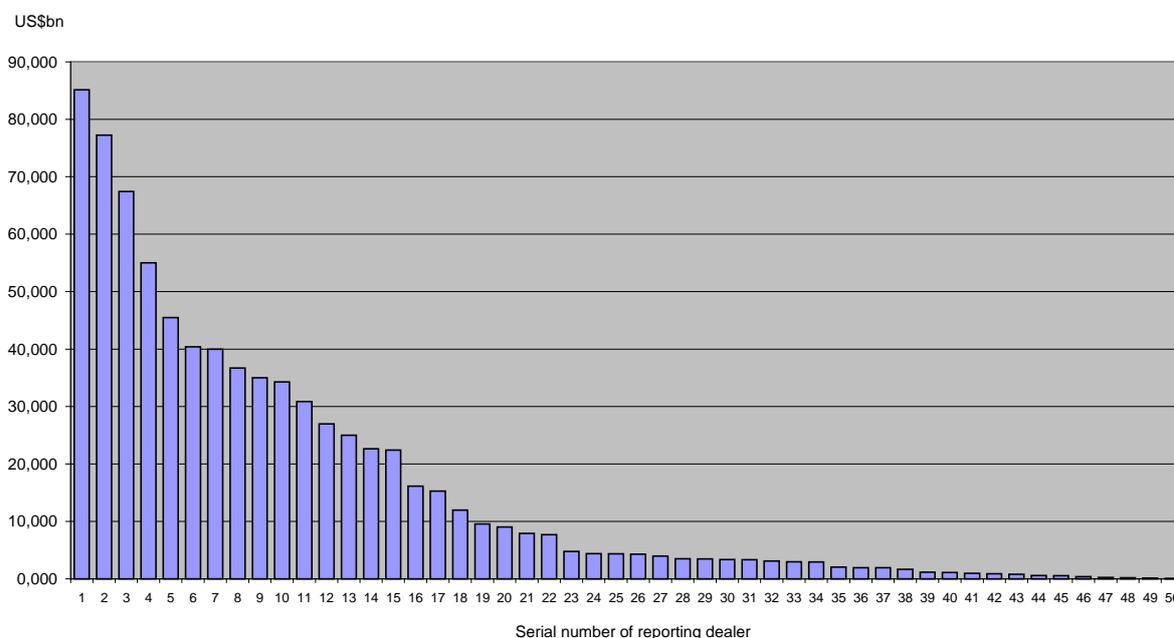
Admittedly, we must have realistic expectations. The conclusive risk transfer figures, which we would have been so pleased to calculate under the monetary analysis objective discussed above, cannot be ascertained from the BIS aggregates either. But we nevertheless find out who the decisive market players are and how great their commitment is. Here an important distinction must be made between reporting dealers, who dominate the market and provide liquidity, and the other market participants, who are not always, but are increasingly likely to be, end users. Important market parties, such as hedge funds, can be found among these end users. They are not governed by their own disclosure requirements, and information on their market position can, at present, simply be obtained from the counterparty information of the BIS reporting banks. In this area the BIS statistics still have hidden value.

However, if we take another look at the reporting dealers in the BIS statistics, we can see that they indeed form the backbone of the derivatives market. There are currently 55 banks who act on either side as the counterparty for almost 90% of the outstanding contract volume worldwide. However, the market shares are not evenly distributed among reporting dealers. The measures of concentration (Herfindahl indices) calculated by the BIS already indicate this. However, it is also evident in the corresponding figures from the published annual reports of the reporting dealers. I admit that examining such figures requires estimates here

and there, but these are unlikely to change the scale of the figures and this is what we are looking at here (see graph).

BIS semiannual OTC derivatives statistics
Notional amounts of OTC derivatives outstanding
at end-December 2007 by reporting dealer

In billions of US dollars



In the illustrative diagrams, the institutions that report for the semiannual OTC derivatives statistics are plotted on the x-axis according to the size of their derivatives transactions. I have recorded only 50 of the 55 reporting banks because I was unable to locate the corresponding figures for five smaller Japanese institutions. I have therefore treated these five banks, the contribution of which is not particularly significant, as a single institution.

The diagram is impressive as it shows that 20 rather than 55 banks actually set the tone in global derivatives transactions. In actual fact, 90% of all positions posted are attributable to the 20 largest institutions. From a stability perspective, this is a cause for concern. From an information efficiency point of view, the result is good. You need only to look at 20 banks to view (almost) all of the market.

What is the significance of this result for BIS derivatives statistics? First, it means that the measures of concentration are important. My example produces a Herfindahl index of 560, meaning that the total volume of outstanding contracts would be distributed between 18 banks if all institutions had equal market shares. You find an equal share equivalent of a similar size more often if you examine the Herfindahl calculations that the BIS carries out in great detail for individual risk categories and groups of instruments. You can therefore assume that the corresponding distributions are similarly unimodal, as in my example.

You could also conclude from the high concentration attributable to only a few reporting institutions that extending the sample, as has sometimes been considered, would be likely to increase the volume of reported amounts only slightly and would therefore be of no great benefit. This is certainly a good argument if we are talking about making the statistics workload more manageable and keeping the data compilation time to a minimum. However, not only the large aggregates should be examined. In the case of market segments that are not completely covered by the present sample, extending the sample would certainly make sense.

4. Conclusions

At the start I distinguished three aims that give us an incentive to compile derivatives statistics. The likelihood of achieving these aims varies:

1. A closed and largely practicable concept allows central banks to collect derivatives statistics so that they have a database for the national accounts and balance of payments.
2. By contrast, it is not possible to collect meaningful data for monetary analysis purposes as a result of the difficulties in recording hedging relationships statistically and the incompatibility of the statistical concepts for recording both risk positions and monetary aggregates.
3. Producing a global aggregate of national data, which is primarily banking supervision-oriented – for example, the OTC derivatives statistics of the BIS – provides important market information in macroprudential terms.

Credit information in Thailand

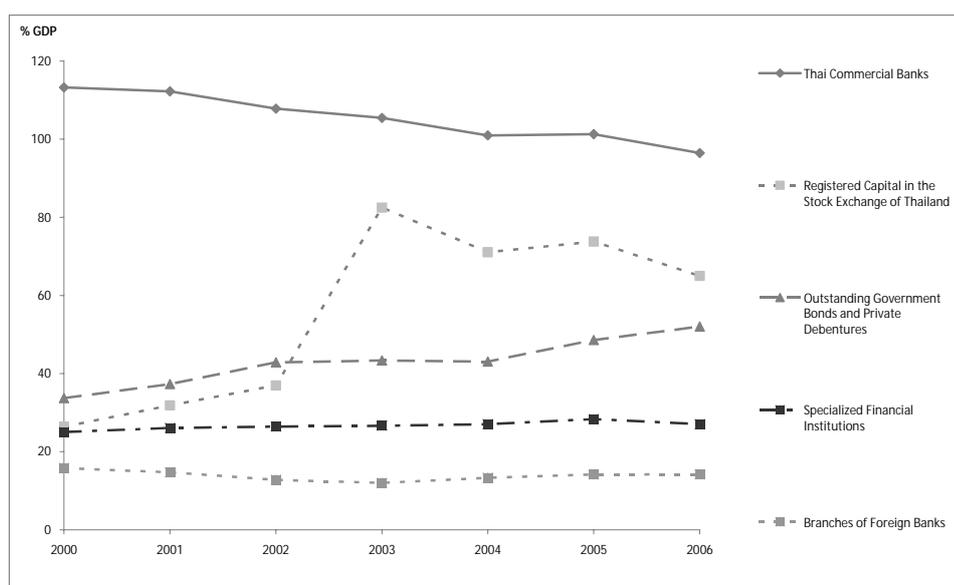
Davina Kunvipusilkul¹

1. Introduction

After the financial crisis at the end of the 20th century, commercial banks were greatly affected by non-performing loans and needed to tighten their lending practices. At the same time, large companies, drawn by lower cost, started to raise more funds from the capital market. While the assets of commercial banks as a proportion of gross domestic products have been declining, small and medium-sized businesses still depend on bank loans as their major source of funds. After the financial crisis, the government and the financial sector realised the need for better information, and credit reporting agencies were established.

Chart 1

Financial assets compared to GDP (current price)



Sources: Bank of Thailand, Stock Exchange of Thailand, Thai Bond Market Association.

From surveys and opinion polls conducted by the Bank of Thailand, businesses rank deposit and loan services as the most important services from financial institutions currently, and rank loan services to be the most important service in the future. However, despite the great importance, small and medium-sized enterprises report having difficulty in obtaining the service, with a large proportion not having access at all. Similarly, many individuals have problems with credit services from financial institutions and have to resort to alternative, less desirable providers, such as private money lenders. Some of the reasons cited are that the process is tedious, the number and types of documents required are burdensome, and/or the

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approval/rejection decisions take a very long time. Some respondents do not understand how the system works in general, and some have had problems in the past.

Financial institutions also recognise the importance of loans services and acknowledge the existing gap in the system. Some of the difficulties can be attributed to internal factors and government regulations, while others stem from the clients, such as inadequate financial statements, lack of collateral or just simply that the client does not meet minimum requirements.

Various authors, such as Avery *et al* [2], Frame *et al* [7], and Turner and Varghese [15, 16], have suggested that credit bureau information and credit scoring models can help increase credit access, improve the quality of credit decisions, decrease the time and cost of credit evaluations, and allow banks to assess their risks more accurately. Turner and Varghese [15] have shown that full-file, comprehensive credit reporting by private bureaus seems the most effective.

Credit reporting practices differ from country to country. Some countries, such as Australia, prohibit sharing of positive data, while some countries, such as the United States, allow for more comprehensive data collection. Available services range from simple data provision to credit scoring, loan monitoring, fraud detection and other services. The extent to which credit information can be used also varies widely. Some countries have only private bureaus, some only public bureaus, and some have both. There are almost a thousand credit reporting agencies (four to five main ones) in the United States, two main credit bureaus in Australia, and yet many Asian countries have only one.

Thus, the use of credit histories and/or credit scores from central credit reporting agencies may help to alleviate some of the problems faced by credit seekers and financial institutions in Thailand. This paper will be divided into three main sections: The Thai credit reporting industry; analysis; and limitations and possible improvements.

2. The Thai credit reporting industry

The credit reporting industry in Thailand is less than a decade old. Unlike in many developed countries, where credit bureaus developed naturally, Thai commercial banks used to rely on the Bank of Thailand for exchanges of information on high-volume borrowers. In 1999, two credit reporting agencies were established in Thailand as a result of government initiatives to promote more stability in the financial system, to increase efficiency in giving loans, to reduce risks and non-performing loans, and to allow the credit information business to develop.

At the beginning, there were no specific laws governing the credit information business and the two credit bureaus operated under the basis of civil and commercial codes. The Thai government later passed laws and amendments to regulate the credit information business: the Credit Information Business Acts B.E. 2545, 2549 and 2551 (in 2002, 2006 and 2008, respectively). The acts give relevant definitions and cover all aspects of the credit information business including operators, rights and obligations, privacy protections, and supervision.

Only a limited or public limited company can operate a credit information business. The company must obtain a licence from the Minister of Finance. More than half of the registered capital of a limited company or the paid-up capital of a public limited company must be held by Thai nationals. In addition, more than half of the board of directors must be Thai nationals. No other persons or entities may engage in the credit information business.

By law, credit information can be disclosed only to members or users who wish to use the information for credit analysis and evaluating credit card applications, and only with prior consent from the information owner. Credit reporting agencies can store both positive and negative information, but there is a limit on the length of time negative information can be stored: three years for consumer credit and five years for commercial credit. Fortunately,

Thailand has a national identity card system that gives each individual a unique identification number. This makes it much simpler to determine the identity of each account's owner and to reconcile all the accounts a person may have.

In 2005, the Ministry of Finance approved the merger of the two existing credit reporting agencies and National Credit Bureau, Co., Ltd. (NCB) was established. As of February 2008, NCB provides consumer and commercial credit reports to 81 members. It has information on approximately 56 million consumer accounts from 16 million consumers, and approximately 4 million commercial accounts from 200,000 business entities. NCB does not provide data to non-members and all members are required to submit data to NCB regardless of whether they make any inquiries, although the law allows for "user" members who do not submit data.

NCB currently handles about 1.1 million consumer credit inquiries per month, about 80% of which are for new credit analyses and the other 20% for credit line reviews. The hit-rate for consumer inquiries is over 80%. The demand for commercial credit reports, on the other hand, is much lower, at about 12,000 inquiries per month, almost all for new credit analyses. Members are required to pay a monthly fee of 50,000 baht (\$1,515). The cost of each inquiry by a member is 12 baht (\$0.35) for a consumer report and 100 baht (\$3) for a commercial report. NCB does not yet provide a generic credit score but plans to do so by 2009. Individuals can check their own credit histories for a fee, and can dispute any information they deem incorrect.

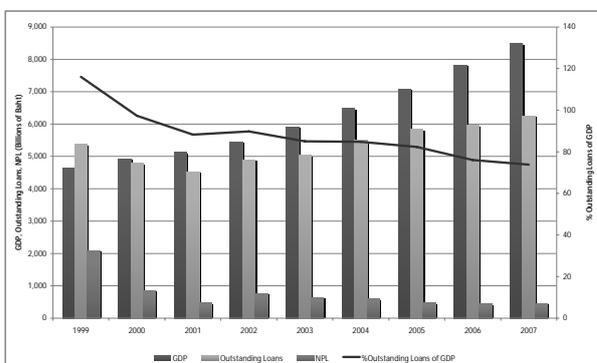
3. Analysis

To determine the impact of the credit information business on commercial bank lending practices, an analysis of the loan market in Thailand will be given in this section, starting with an overview of the market and continuing with a more in-depth analysis of personal loans, as interviews with commercial banks suggest that banks mainly use information from the credit bureau for their retail lending and credit risk management.

3.1 An overview of the loan market in Thailand

Chart 2

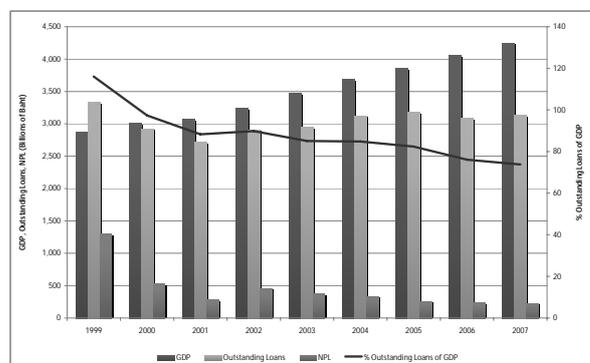
GDP, outstanding loans, NPL (current prices)



Sources: Bank of Thailand, Office of the National Economic and Social Development Board.

Chart 3

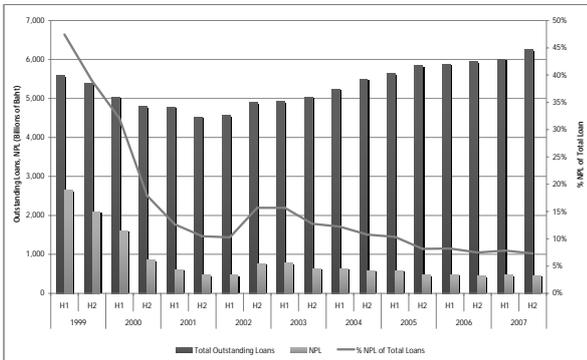
GDP, outstanding loans, NPL (1988 prices)



Sources: Bank of Thailand, Office of the National Economic and Social Development Board.

Chart 4

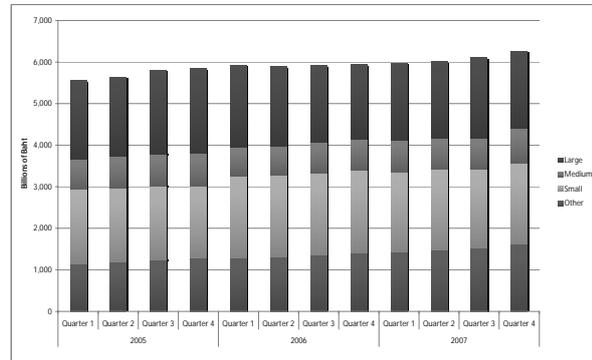
**Outstanding loans and NPL
(current prices)**



Source: Bank of Thailand.

Chart 5

**Total outstanding loans by
business size**



Source: Bank of Thailand.

From the data presented here, the condition of the loan market seems to have improved since the financial crisis at the end of the 20th century. In 1999, non-performing loans accounted for almost half of total outstanding loans. Since then, the amounts of non-performing loans have shown a decreasing trend, down to 7.31% at the end of 2007. However, the proportion of outstanding loans to gross domestic products decreased from 116% in 1999 to 74% in 2007, partly from banks tightening their business lending policies and partly from large companies raising their funds elsewhere.

Chart 5 gives a breakdown on total outstanding loans by business size. The business size is defined by the Ministry of Industry and does not mean loan size, although a loan taken out by a large business tends to be larger than one taken out by a small business. “Other” generally means personal loans. The amount of small business loans and personal loans account for approximately half of total outstanding loans. In addition, the amount of personal loans has increased steadily in the past three years from about 20% of all loans in the first quarter of 2005 to 25% of all loans in the last quarter of 2007. The number of personal loan accounts also increased from under seven million accounts in 2005 to over 10 million accounts in 2007. Moreover, when we consider the loans by purpose (ISIC-BOT), we find that approximately 23% of total outstanding loans at the end of 2007 are for personal consumption. Since credit scoring is especially useful when there are many small and almost homogeneous loans, it would seem that the Thai market – with a large percentage of personal loans – is an appropriate place to use credit scoring.

3.2 Loans for personal consumption

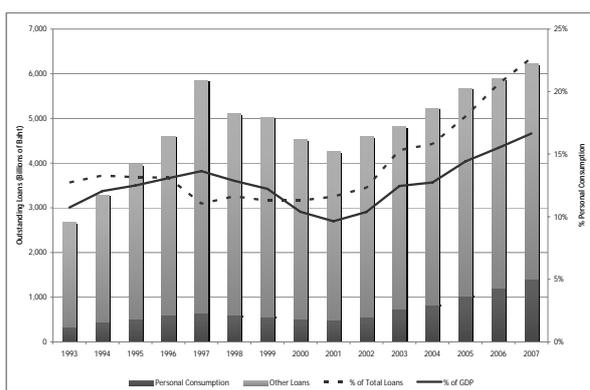
This section will cover all loans for personal consumptions according to the ISIC-BOT code, such as housing loans, automobile and motorcycle leases, loans for travel to work abroad, and other personal loans. At the end of 2007, housing loans accounted for about 55% of all outstanding personal loans, automobile and motorcycle leases accounted for 20%, and credit cards and uncollateralised personal loans accounted for about 24%.

Interviews and bank visits indicate that banks mainly use credit bureau information for their personal loans operations. That is, some banks have their own credit scoring models, which they have used for the past few years, and use credit bureau information to check the customer’s payment history and debt load. The input for application scores comes solely from information provided by the customer. Some banks also use behavioural scores, which are evaluated periodically, and check bureau information for behaviours that may indicate trouble, such as if the consumer starts making late payments to other lenders. Most scoring

models used by Thai banks are developed internally, while foreign bank branches use models from their headquarters. These banks report that they are able to reduce their application processing time significantly. On the other hand, banks that do not use credit scoring rely more on rule-based model or relationship-based lending. They report having to spend a lot of time verifying data and obtaining all the necessary documents. These banks also use credit bureau information to screen potentially risky clients, and would like the credit bureau to offer some sort of credit scores if possible.

Chart 6

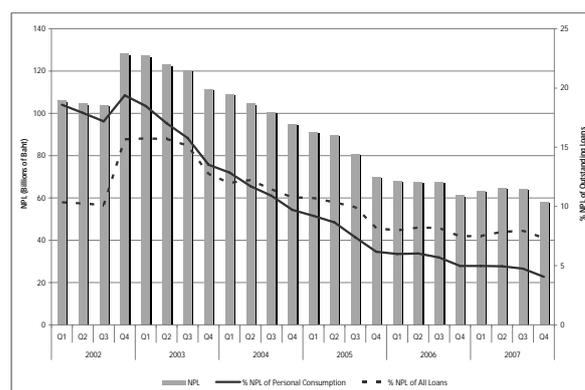
Outstanding loans for personal consumption



Source: Bank of Thailand.

Chart 7

NPLs for personal consumption



Source: Bank of Thailand.

As can be seen in Chart 6, the proportion of personal loans in total outstanding loans remained quite stable from 1991 to 1996, with a drop in 1997, and then remained stable until 2002. Since then, the amount of outstanding personal loans has grown at much faster pace than the rest of the loans and still continues to experience a steady increase, from 18% of all loans in 2005 to 20.6% in 2006 and 22.7% in 2007. Outstanding personal loans have also been growing faster than gross domestic products since 2001, despite the fact that the proportion of all outstanding loans in gross domestic product has declined. Thus, it is possible that the presence of credit information business helps increase the amount of loans granted.

Non-performing loans for personal consumption have decreased steadily, from 19% in the first quarter of 2003 to 4% in the last quarter of 2007. While it is impossible to claim that this decrease is completely due to the establishment of credit reporting agencies, banks have reported that information from the credit bureau has been extremely helpful in identifying bad applicants. In addition, the solid line in Chart 7 is the proportion of non-performing loans in outstanding loans for personal consumption and the dotted line is the proportion of non-performing loans in outstanding loans for all bank loans. At the beginning, the proportion of non-performing loans for personal loans is higher than for all bank loans, but after the second quarter of 2004, the proportion of non-performing loans for personal loans is lower than for all bank loans and the gap has been widening, possibly because banks are better able to evaluate risks for personal loans. Banks report that their improved ability to access risks has enabled them to make more loans with better profits.

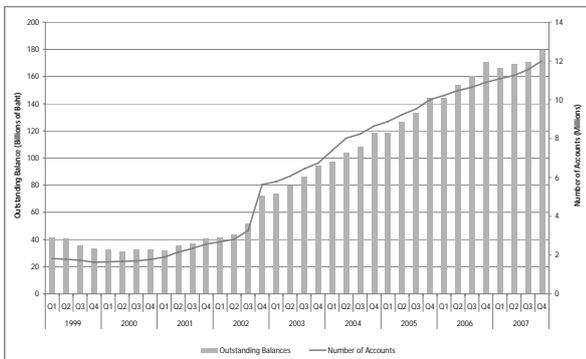
Credit cards and uncollateralised personal loans account for almost a quarter of all loans for personal consumptions. Since credit cards and uncollateralised personal loans are small, homogeneous loans most appropriate for credit scoring, we will analyse these loans in more detail.

3.2.1 Credit cards

The credit card data contains data from both commercial banks and other credit card issuing companies. Both the number of credit cards issued in Thailand and the amount of outstanding credit card loans has increased steadily over the past few years. The number of accounts increased from less than two million accounts in 1999 to over 12 million accounts in 2007, and the amount of outstanding loans increased from 41 billion baht at the beginning of 1999 to 174 billion baht at the end of 2007. There is a big jump in both the number of credit cards and the total outstanding credit card loans between the third and fourth quarter of 2002. This is probably a result of an announcement from the Bank of Thailand, effective at the end of September 2002, which relaxed minimum requirements and allowed financial institutions to set their own standards. The amounts of loans that are more than three months overdue range between 2.3–3.5% in the past three years.

Chart 8

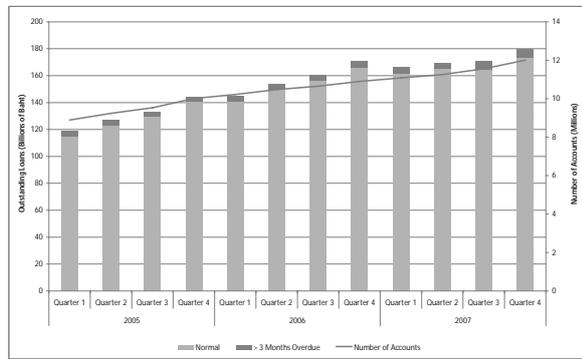
Outstanding credit card loans



Source: Bank of Thailand.

Chart 9

Outstanding credit card loans



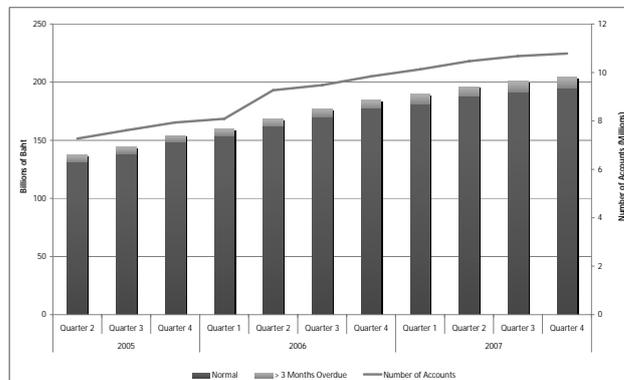
Source: Bank of Thailand.

3.2.2 Uncollateralised personal loans

Since 2005, the Ministry of Finance has authorised the Bank of Thailand to supervise uncollateralised personal loans business. The data here include both commercial banks and other personal loans companies under BOT supervision. This business has been growing from about seven million accounts and 135 billion baht in outstanding loans in 2005, to over 10 million accounts and 204 billion baht in outstanding loans in 2007. During this period, numbers of loans that are more than three months overdue are in the range of 3.5–4.6%.

Chart 10

Outstanding supervised personal loans



Source: Bank of Thailand.

4. Limitations and possible improvements of the credit information business

The credit information business in Thailand has been developing for the past decade and banks seem generally satisfied with the types and coverage of the collected data. Still, there is room for improvement. For instance, National Credit Bureau, Co., Ltd. has announced that it will start to provide credit bureau scores in 2009. There are also some limitations that stem from the laws. These issues will be discussed in the next section.

4.1 Credit bureau scores

The National Credit Bureau, Co., Ltd. has announced that it will start offering credit scores in 2009. These scores will be calculated from the payment data already collected. Some banks have already expressed interests in using these scores since they will be computed from a much larger customer pool than each individual bank has. Those with their own scoring model may use them as benchmarks while those without welcome the chance to use scoring to complement their rule-based or relationship-based lending. Still, some banks are taking the wait-and-see approach and cost is a consideration for some. The expected impacts of NCB scores, as well as possible measurements, are shown in Table 1.

Table 1
Impacts of credit bureau scores

Impact	Expectation			Measurements (sources)
	Large Thai banks with their own scoring models	Other Thai banks	Foreign bank branches	
Usage	Likely	Quite likely	Unlikely	<ul style="list-style-type: none"> Aggregate usage data (NCB)
Application processing time	Unlikely	Likely	Unlikely	<ul style="list-style-type: none"> Processing time Required documents (Bank interviews)
Risk	Likely	Quite likely	Unlikely	<ul style="list-style-type: none"> Expected loss for consumer loans before & after NCB scores Expected loss for consumer loans compared to other loans (Bank computations) NPL (Bank & BOT data)
Access	Unlikely	Likely	Unlikely	<ul style="list-style-type: none"> New loans Outstanding loans Number of customers (Bank data)

4.2 Other limitations

Most concerns about credit information in Thailand seem to stem from the laws governing the credit information business. In particular, commercial banks are interested in credit information of guarantors as well as applicants. However, the current interpretation of the laws does not allow for banks to inquire about a guarantor directly from NCB, even with the

guarantor's consent. Instead, the guarantor must go to NCB to self-inquire and then submit the information to the bank. This process is time-consuming and inefficient for all parties involved. Similarly, the law does not allow financial institutions to check credit information on an owner or board member of a business entity, even with consent, in case of a business loan. As has been shown in other countries that, for small business loans, the owner's credit history is a good indicator for loan payments, it is unfortunate that financial institutions are not allowed to access this information directly.

The law allows financial institutions to use a customer's credit information for credit analysis only. While the law does not prohibit financial institutions from using this information as input in a credit scoring model, it does not permit them to use it as part of model building/testing. As a result, they cannot use information from the credit bureau in their model because there is no way they can test the effects of this information.

It is important to protect the rights of consumers, but for guarantors and/or owners and in the case of model development the benefits may be worthwhile. The Credit Information Act already specifies that consent must be given; thus, a bank will not be able to check someone's information if that person does not give the bank consent to do so.

5. Conclusion

Since the financial crisis at the end of the 20th century, Thai commercial bank assets have been declining and the amounts of all outstanding bank loans in proportion to the gross domestic product have been decreasing as well. One reason is that large companies started to raise funds in the capital market while banks tightened their business lending practices. During this time, however, the personal loan market has been growing steadily. This growth coincides with the establishment of credit reporting agencies, which are most beneficial to personal loans. Not only have personal loans grown at a faster pace than gross domestic product and faster than all other bank loans, but non-performing loans for personal consumptions have also been declining at faster pace than other bank loans. Combining this observation with bank opinions, it seems that the credit information business has positive effects on the personal loan market.

There are still different aspects of the credit information business that could be improved, such as more services and legal limitations. Some of the legal limitations have resulted in more processing time and added inconveniences for customers, while some inhibit the ability of banks to improve their lending decisions. As for other services, National Credit Bureau, Co., Ltd. plans to offer credit scores soon. The effects of this service are unclear at the moment because they are contingent on how it is adopted. Still, one can gather from banks' opinions that the effect as a whole will be positive.

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Integration of new financial developments into the new worldwide statistical standards

Reimund Mink¹

1. Introduction

One key challenge of compiling and using economic accounts is ensuring that they continue to capture the structure of the economic and financial system and provide a level of detail that is useful for policymaking and research. This is especially true as the use of these accounts helps to expand our knowledge of economic and financial relationships and of the determinants of household and corporate behaviour. The methodological framework to compile the accounts is being revised in the context of the current update of the statistical standards, the System of National Accounts (1993 SNA) and the European System of Accounts (1995 ESA).² One reason for this update was to keep track of developments in a financial system impacted by globalisation, rapid financial innovation, deregulation and capital market integration.

The paper describes, in section one, how the remarkable growth of global financial markets in recent years has led to an acceleration of financial innovation, especially in the form of credit risk transfer instruments. Section two illustrates how such developments in the form of new financial instruments and the creation of specific financial institutions are integrated into the international statistical standards, taking into account their relevance for monetary policy and financial stability analysis. Some examples, the classification of financial corporations, new financial instruments and the treatment of securitisation activity are described in section three. In this context, the paper takes note of the new accounting standards for financial instruments under the International Financial Reporting Standards (IFRS) in section four.

2. A remarkable growth of global financial markets

The pace of change in global financial markets has been remarkable with an acceleration of financial innovation. In particular, the use of credit risk transfer instruments expanded dramatically, permitting the distribution, hedging and active trading of credit risk as “separate” financial assets. Even the year 2007 can still be regarded as prosperous – with a global economic growth at around 5% of GDP mainly attributable to the continued momentum of emerging economies, notably in Asia. Looking further backwards, the 1990s were characterised by broad economic and financial market liberalisation and deregulation, accompanied by political breakthroughs like the collapse of the Soviet Union and the enforced political and economic integration process observed in Europe with the foundation

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² In parallel to the update of the 1993 SNA, a new edition (the 6th) of the IMF’s Balance of Payments Manual (BPM6) has been drafted, and a new OECD benchmark definition of foreign direct investment has been released.

of the ECB 10 years ago. Specifically, the liberalisation and deregulation efforts of the financial markets were far-reaching. They have led to a wide participation of countries in a rather long expansionary phase of economic growth. Looking, for instance, at the stock of debt securities issued worldwide, there were annual increases of almost 10% from 2001 to 2006 (Table 1).

Table 1
Stock of debt securities issues
Amounts outstanding, end of period

Debt securities issues	World	Four major developed economies				Emerging countries			
		US	Euro area	Japan	UK		o/w Asia	o/w Latin America	
USD billion									
2001	41,792	36,670	18,504	9,492	6,925	1,748	2,345	1,270	694
2006	68,734	57,521	26,736	18,768	8,719	3,298	6,056	3,518	1,557
As a percentage of total issues									
2001	100.0	87.7	44.3	22.7	16.6	4.2	5.6	3.0	1.7
2006	100.0	83.7	38.9	27.3	12.7	4.8	8.8	5.1	2.3

Source: IMF, Global Financial Stability Report (various issues, latest issue in April 2008), Statistical Appendix, Table 3.

These securities issues data also show the geographical rearrangements of global financial markets. The four most important financial “markets” – the United States, the euro area, Japan and the United Kingdom – still accounted, in 2006, for more than 80% of the global stock of debt securities issues. But the corresponding stock of regions with currently much smaller shares, such as the emerging countries in Asia and in Latin America, is growing rapidly. Their average annual growth rates for the period from 2001 to 2006 amounted to 23% and 18%, respectively, compared with a 9% annual increase of stock of debt securities issued by the “big four”.³

One important function of the financial system concerns the management of risks. The role of securitisation in the financial markets of developed countries has expanded dramatically in recent years.⁴ Examples for financial instruments used in this context are credit default swaps (CDS) and, in particular, structured credit products, through which portfolios of credit

³ See IMF, Global Financial Stability Report, April 2008, Statistical Appendix, Table 3. This table also covers other selected indicators on the size of the financial markets like total reserves minus gold, stock market capitalisation or bank assets.

⁴ See J.M. González-Páramo, Member of the Executive Board of the ECB, Financial turmoil, securitisation and liquidity. Keynote speech presented at the Global ABS Conference 2008, Cannes, 1 June 2008; and also: ECB, Securitisation in the euro area, Monthly Bulletin, February 2008. The Bank for International Settlements reported the notional amount on outstanding OTC credit default swaps to be USD 57.9 trillion in December 2007, up from USD 28.9 trillion in December 2006 and USD 13.9 trillion in December 2005. See <http://www.bis.org/statistics/otcder/dt1920a.pdf>.

exposures could be sliced and repackaged to suit the needs of investors better.⁵ This category includes, in particular, collateralised debt obligations (CDOs), backed by both cash instruments, such as “plain” securities, loans or asset-backed securities (ABS), and by financial derivatives, such as CDS and CDOs themselves. Monoline insurance corporations guarantee the timely repayment of debt security principal and interest when an issuer defaults.⁶ Insured securities range from municipal bonds and structured finance bonds to CDOs. The expansion of these financial products has contributed to a strengthening of the “originate to distribute” model of financial intermediation: rather than holding the credit they originated, credit institutions and other financial intermediaries would sell them, possibly after having repackaged them, into the financial markets.

Enhanced risk management schemes have contributed to helping corporations and households to manage risks. A function of the financial system is to reduce the costs of financing for borrowers, to facilitate the accumulation of wealth and to increase the efficiency of the financial system as a whole. Innovation in financial instruments has extended the choice of risk management products available to corporations and households. At the same time, efficient markets for risk depend on having complete information. Concerns have emerged regarding the information provision, in particular on securitisation, hedge funds and credit risk transfer markets, and to a lack of transparency on the identity of the ultimate risk holders.

3. Capturing the structure and detail of the economic and financial system

a. Mechanics of globalisation and financial innovation and statistical work

Understanding the impact of globalisation and financial innovation on the performance of the financial system is one of the main challenges for central bank policy analysis, research and decision-making. It also significantly impacts on the statistical work, as high-quality and timely macroeconomic statistics are a key ingredient. Accordingly, financial statistics and – in a broader context – integrated institutional sector accounts have to capture the structure of the economic and the financial system and to provide the level of detail useful and necessary for policymaking and research.

To integrate new economic and financial phenomena into existing statistical standards involves long time lags. While the various project phases and their timelines are determined in advance, there is still a need to fine-tune this work to take new and unexpected developments into account. Careful planning is needed when dealing with integrated systems of national accounts in which systems are designed in a way to comply with the various (horizontal, vertical and stock-flow) identities and restrictions. Expanding the boundaries of assets and liabilities or increasing the coverage of institutional units has to be assessed thoroughly before including new items into the system. Statistical work is closely related also to the design of international financial reporting standards as, in both cases, economic and financial market developments have to be monitored and to be “translated” into appropriate and generally accepted statistical standards or accounting standards.

⁵ See the paper of P. Poloni and J. Reynaud, ECB, How to measure credit risk transfer in EU, prepared for this conference.

⁶ They are so named because they provide services to a single industry. Insurance regulations prevent insurance corporations from offering financial guaranty insurance. The monoline industry claims that it has the advantage over multilines of sole focus on capital markets.

b. Update of the System of National Accounts

How can one keep international statistical standards that underlie high-quality macroeconomic statistics and national accounts up to date and in line with the changes in economies due to globalisation and financial innovation? In 2003, the United Nations Statistical Commission (UNSC) approved a work programme for updating the 1993 SNA with the assistance of an advisory expert group on national accounts (AEG). The Inter-secretariat Working Group on National Accounts (ISWGNA) – comprising Eurostat, the IMF, the OECD, the UN and the World Bank – was mandated to coordinate and manage the update project. The project website at <http://unstats.un.org/unsd/sna1993/snarev1.asp>, maintained by the UN Statistics Division, covers a broad documentation on project management, draft chapters and materials supporting the worldwide comment process, the list of issues agreed to be considered during the update and the development of a set of recommendations, the forward-looking research agenda, and meetings.

In its report to the UNSC in 2003, the ISWGNA set the scope for updating the 1993 SNA. It clearly indicated that new issues should be identified that are emerging in the new economic environment for trends such as globalisation or financial innovation. It was also emphasised by the ISWGNA that in the 10 years since its adoption, the 1993 SNA has shown a remarkable resilience in its usefulness in a changing economic environment, and is a robust framework that has gained broad appreciation.⁷

c. How to reflect financial innovations in the new SNA?

The current update of the new SNA is based on a list of 44 updating issues for discussion.⁸ Many of them are linked to topics related to relatively new financial phenomena such as the treatment of repurchase agreements, non-performing loans, index-linked debt instruments, or employee stock options in the accounts. Table 1 of the Annex provides an overview of these issues related to financial assets and liabilities.

To obtain a more complete picture of the updating process it is also necessary to look at the issues for discussion in the context of defining institutional units or of classifying sectors. One of the central topics refers to questions on how to determine the relevant features of institutional units and how to group them into institutional sectors or subsectors. Closely linked to these questions is the issue of how to separately identify financial corporations involved in financial intermediation activities like securitisation transactions, securities lending, and repurchase agreements. As many of these activities are increasingly cross-border, a related issue deals with the question of how to determine the main criteria of the residence of a unit (see Table 2 of the Annex). Looking more closely at the tasks of how to refine the current financial asset and liability classification and to subdivide the financial corporation sector, it is obvious that various new components have been included into the system as shown in Table 3 of the Annex.

Taking into account that many refinements of the SNA may have adverse effects on the continuity of the system, there is always some inertia towards substantially changing the system as a whole. This is also in line with the request of many researchers and analysts to keep macroeconomic time series as “stable” as possible over a rather long period of time. Nevertheless, financial innovations may have to be implemented into the SNA as

⁷ United Nations, E/CN.3/2003/9, Statistical Commission, 34th session, 4–7 March 2003, Item 4 (a) of the provisional agenda: Economic statistics: National accounts. Report of the Task Force on National Accounts. Note by the Secretary-General. Volume 1 of the 2008 SNA has been by the UNSC in 2008 and Volume 2 of the 2008 SNA will be approved in 2009.

⁸ These 44 issues for discussion are described on the UN website: <http://unstats.un.org/unsd/sna1993/issues.asp>.

recommended in the current update, keeping the overall relevance of the system in policy and analysis up to date.

4. Some examples of how the SNA is kept up to date

From an ECB monetary policy perspective, it is important to integrate new elements reflecting financial innovation into the wide range of statistics available at the ECB⁹ and, in particular, to the framework of euro area accounts, which provides a consistent overview of the inter-linkages among the transactions and positions of the various institutional sectors like households, non-financial corporations, financial corporations, and general government, which are classified by their role in the economy. The euro area accounts require precise specifications of the institutional units and their classifications. Economic activities are reflected in both, transactions and other changes in stocks, and the architecture of the system is based on a complete sequence of accounts, including balance sheets. This framework is currently based on 1993 SNA, 1995 ESA and on other statistical handbooks like the IMF manuals on balance of payments, government finance and monetary and financial statistics.¹⁰

a. How to integrate money into the new SNA?

An initial step has been made towards allowing the integration of money into the new SNA, taking into account the appropriate breakdowns of financial corporations and financial assets.¹¹ A three-dimensional system of the accumulation accounts and balance sheets, with a breakdown of the financial corporation sector and of the financial asset and liability categories as proposed for the new SNA, and by counterpart, opens up the possibility of identifying money in a matrix, and so analysing monetary developments in the widest possible financial framework and in a way that permits them to be related more easily to the economic developments recorded in the production and income accounts. The monetary aggregates comprise money stock, and changes in it, and are reflected in the developments of the so-called “counterparts of money”, which are derived by exploiting certain accounting identities. All countries measure monetary developments, in many cases considering that monetary growth is related to developments in economic activity and, over the longer term, in inflation, or that it contains valuable information concerning financial stability. Numerous definitions of money are possible; the national choice is likely to be an empirical matter, depending on what measure or measures best relate to developments in the national economy. Nevertheless, the proposed integration of money might lead to internationally comparable monetary data derived from the national accounts framework.

⁹ See ECB, Monthly Bulletin, 10th Anniversary of the ECB, 2008. An update of available ECB statistics has been published recently/ See <http://www.ecb.europa.eu/pub/pdf/other/ecbstatisticsanoverview2008en.pdf>.

¹⁰ The 1993 SNA, the 1995 ESA and the related manuals are seen as the global international statistical standards. In Europe, the 1995 ESA functions as the counterpart to the 1993 SNA. However, its importance goes far beyond that of the SNA, as it is a legal instrument with a very significant impact on key policy decisions in the EU. Among other things, this refers to the so-called excessive deficit procedure, contribution to the EU budget allocation of regional funds by the EU, and the contributions of Member States to the capital of the ECB. As a consequence, changes in the current 1993 SNA will be assessed in the current process of revising the ESA.

¹¹ This was already included in the 1995 ESA; see Annex 5.1: Link with measures of money of Chapter 5 on: Financial transactions.

A system is developed to identify the relevant holders, issuers, and financial assets, and, among the holders, to distinguish between financial and non-financial sectors, since their money holdings may have different implications for economic activity and inflation. The money-issuing sector is assumed to consist of the central bank, resident credit institutions and resident money market funds (MMFs), the monetary financial institutions (MFIs). Money holders are the remaining resident sectors, including the remaining subsectors in the financial corporate sector. Modifications might have to be incorporated in cases where central government is treated as a money issuer and only the remaining government subsectors as money holders. Holdings of money by the money-issuing sector itself are netted out. The rest of the world is assumed to be money-neutral, that is, neither the liabilities of non-residents, nor non-resident holdings of money issued by resident money issuers are counted in the national money stock.

Financial assets as monetary variables are considered to comprise currency (issued by the central bank), liquid deposits with the central bank and credit institutions (with an original maturity or period of notice of up to one year), marketable short-term debt securities issued by the money issuing sector (with an initial original maturity of up to one year), and shares or units issued by MMFs.¹²

b. Reviewing the categories of financial assets and liabilities

Beyond the specification of monetary variables as a subset, further refinements of the categories of financial assets and liabilities have been incorporated into the new SNA.

The accounting of repurchase agreements has been under discussion for some years. However, there is still insufficient agreement on how to improve the recording of repos. Nevertheless, some detailed changes have been included, for example that “on-selling is common” and that, in this case, a negative asset is recorded for the lender to avoid double-counting. Furthermore, repos should be covered in terms of a cash collateral as well as in terms of a security collateral, which also includes gold swaps, loans and deposits.

For securities, a more detailed breakdown is recommended: equity is split into shares (listed and unlisted), other equity and investment fund shares. For debt securities, a more comprehensive specification is foreseen, which takes into account the development of security-by-security databases. Debt securities are shown with breakdowns by (issuing and holding) sector, (original and residual) maturity, currency and type of interest. Specific attention is dedicated to the description of hybrids and asset-backed securities (ABS).¹³ For financial derivatives, borderline cases with securities are discussed. Furthermore, a distinction is made between options and forwards. Employee stock options are shown separately. Further breakdowns are suggested such as supplementary items, for example credit derivatives or embedded derivatives.

On the accounting treatment of insurance technical provisions, questions have arisen as to whether all types of pension entitlements should be covered within the system. This question is closely linked to the issue of how far provisions, as shown in business accounting, should be treated as assets and liabilities. The decision taken on this subject is to include all pension entitlements of private schemes within the asset boundary but not most of the pension entitlements incurred by defined-benefit schemes sponsored by government.

¹² R. Mink, Money, financial investment and financing; paper presented at the ISI Conference in Lisbon, August 2007.

¹³ See also the planned Handbook on Securities, prepared by the Working Group on Securities Databases.

Another modification refers to the enclosure as assets of standardised guarantees as a form of credit insurance.¹⁴

c. Subsectoring of financial corporations

The subsectors of the financial corporations sector have been expanded substantially to allow a more useful presentation of their activities in the context of financial innovation. The definition of which units make up the various subsectors of the financial corporation sector was changed to reflect the nature of their output (financial services) rather than their activities. Risk management and liquidity transformation were added to financial intermediation as activities that better capture the nature of the performance of the various financial corporations. Accordingly, the list of subsectors of the financial corporations sector has been expanded to accommodate the more detailed description of financial corporations as illustrated in Table 4 of the Annex.

Combining the subsectors “central bank”, “credit institutions” and “MMFs” coincide with “MFIs” as defined by the ECB.¹⁵ “Other monetary financial institutions” cover those financial intermediaries through which the effects of the monetary policy of the central bank are transmitted to the other entities of the economy. They are credit institutions and MMFs. Financial intermediaries dealing with the pooling of risks are included in the grouping “insurance corporations and pension funds”. The “other financial institutions” cover the subsectors, investment funds except MMFs, other financial intermediaries except insurance corporations and pension funds, financial auxiliaries and captive financial institutions and money lenders.

d. Classifying specific institutional units within the financial corporation sector

Some efforts have been made to clarify the classification of specific institutional units within the financial corporation sector. The units “financial vehicle corporations engaged in the securitisation of assets” (FVCs), institutions like “special purpose entities” (SPEs), “conduits” and “brass plate companies”, and “holding companies” are now included.

The new SNA foresees to classify *FVCs* as part of the subsector other financial intermediaries, except insurance corporations and pension funds (see Table 5 of the Annex). It has to be taken into account that a new Regulation of the ECB is currently in preparation to collect data on these types of financial corporations. According to the draft Regulation, FVCs are defined as institutional units carrying out securitisation transactions. They incur debt securities, the credit risk of which is transferred to the investors in these debt securities, and they also acquire assets underlying the issue of debt securities.¹⁶ FVCs may be constituted under the contract law (as common funds managed by management companies), the trust law (as unit trusts), the company law (as public limited companies) or any other similar mechanisms.

Compared to *FVCs*, *SPEs*, *conduits*, *brass plate companies* and the like are also seen as institutional units providing financial services. But most of their assets or liabilities are not

¹⁴ Three types of guarantees are distinguished in the new 2008 SNA: standardised guarantees, one-off guarantees (not to be included in the system) and credit default swaps (treated as financial derivatives). See also *IAS 37 on Provisions, Contingent Liabilities and Contingent Assets*.

¹⁵ See Regulation (EC) No 2423/2001 of the ECB of 22 November 2001 concerning the consolidated balance sheet of the monetary financial institutions sector (*ECB/2001/13*) and its corrections and amendments.

¹⁶ A draft Regulation (EC) of the European Central Bank is being prepared concerning statistics on the assets and liabilities of financial vehicle corporations engaged in securitisation transactions.

transacted on open financial markets. Some SPEs and trusts hold assets and receive property income solely for their owners. Other entities transact only within a limited group of units, such as with subsidiaries of the same holding company or entities that provide loans from own funds. Thus they should be distinguished from financial intermediaries, which usually interact with a large number of various counterparts on at least one side of their balance sheet.

The labels mentioned above are all applied to flexible legal structures in particular jurisdictions, which offer various benefits that may include any or all of low or concessional tax rates, speedy and low-cost incorporation, limited regulatory burdens, and confidentiality. Other purposes for which such structures are used are holding and managing wealth for individuals or families, holding assets for securitisation, issuing debt securities on behalf of related companies (such a company may be called a conduit), as holding companies that own shares in subsidiaries but without actively directing them, securitisation vehicles, ancillary companies in different economies to their parent, and performing other financial functions.

While there is no internationally agreed standard definition of SPEs, in economies where they are important, they may be identified separately, according to either a national company law definition, or in terms of a functional description, possibly referring to their limited physical presence and ownership by non-residents.¹⁷ Besides the fact that their owners are non-residents of the territory of incorporation, other parts of their balance sheets might also be vis-à-vis non-residents. Furthermore, they usually have few or no employees, and have little or no physical presence.

The “captive financial institutions and money lenders” subsector of financial corporations should cover: (a) Legal entities that are institutional units with the function of simply holding assets, such as, trusts, estates, agencies accounts, or some “brass plate” companies; (b) Units that provide financial services exclusively with their own funds, or funds provided by a sponsor to a range of clients and incur the financial risk of the debtor defaulting. Examples are money lenders and corporations engaged in lending (eg student loans, import/export loans) from funds received from a sponsor such as a government unit or a non-profit institution; (c) Pawnshops that predominantly engage in lending; (d) Financial corporations, such as SPEs that raise funds in open markets to be used by affiliated corporations (in contrast to FVCs); and (e) Conduits, intragroup financiers, and treasury functions when these functions are undertaken by a separate institutional unit.¹⁸

Depending on their activities *holding companies* are classified in different sectors and subsectors of financial corporations and non-financial corporations. There are holding companies as head offices that carry out some managerial control over their subsidiaries and undertake the strategic and organisational planning and decision-making on the basis of day-to-day operations of their related units. They are engaged actively in production. Depending on the type of their subsidiaries such head offices are classified as non-financial corporations (if all or most of the subsidiaries are non-financial corporations) or as financial

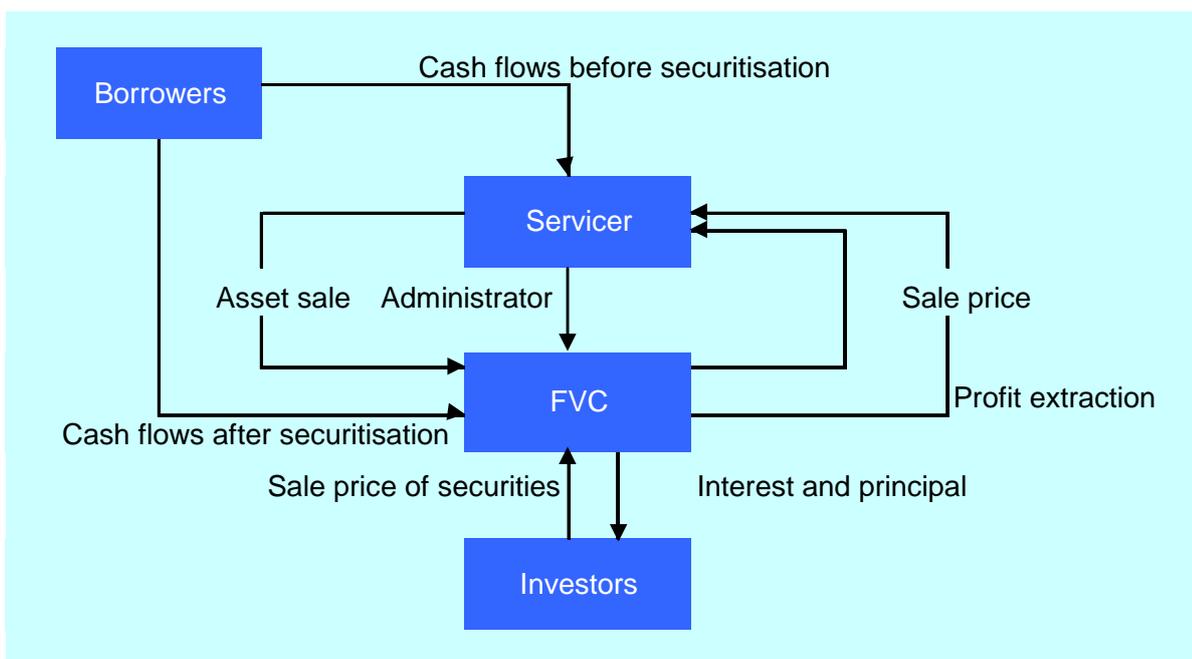
¹⁷ IFRS contain a broad definition of an SPE in SIC 12, paragraphs 1, 2 and 3. See SIC Interpretation 12, Consolidation – Special Purpose Entities. SIC 12 *Consolidation – Special Purpose Entities* was developed by the Standing Interpretations Committee and issued in December 1998.

¹⁸ Conduits are entities that raise funds on open financial markets for passing on to other affiliated enterprises. Often, the conduit’s liabilities are guaranteed by a parent company. If a conduit issues new financial instruments that represent a claim on the conduit, it is acting as a captive financial institution. Conduits are cases of “pass-through funds” or “funds in transit”. These are funds that pass through an enterprise resident in an economy to an affiliate in another economy, so that the funds do not stay in the economy of that enterprise. Such flows have little impact on the economy through which they pass. While SPEs, holding companies and financial institutions that serve other non-financial affiliates route funds in transit, other enterprises transmit funds in direct investment flows.

corporations (if all or most of the subsidiaries are financial corporations).¹⁹ Holding companies are distinguished by the assets held (owning controlling levels of equity) of a group of subsidiary corporations and by principal activities in owning the group. Such holding companies do not provide any other services to the businesses in which the equity is held, ie they do not administer or manage other units and do not undertake any management activities. They are classified as captive financial institutions even if all the subsidiary corporations are non-financial corporations. Table 6 of the Annex provides an overview of the several types of holding companies.

e. Securitisation activities

Taking into account the modifications in terms of financial assets and liabilities and of financial corporations, the updated SNA provides the ingredients for the recording of securitisation activities within the system. Securitisations usually encompass the issuance of debt securities through an off-balance sheet process involving an FVC or a trust. In particular, once the originator, usually a MFI, has selected a pool of assets from its portfolio, it then sells them to the FVC.²⁰ This entity legally separates the underlying assets from the originator and finances the purchase of the assets by issuing debt securities to investors, while holding the assets in trust.²¹ Once the debt securities are issued, the interest and principal of the underlying assets are collected and managed by a “servicer” and rechannelled to investors through the FVC. The diagram below describes the typical transactions with this separate institutional unit (usually referred to as an FVC or a special purpose vehicle (SPV) or, in the United States, as a special purpose entity (SPE).



¹⁹ There might also be holding companies that hold and manage subsidiaries and that may also have substantial operations in their own right. Such holding corporations are classified according to those operations if they are predominant.

²⁰ Usually assets are homogeneous, in terms of credit quality, maturity and interest risk.

²¹ Legal separation is important in the securitisation process. It determines whether, in the event of bankruptcy of the original holder, the assets pledged continue to service the issue on the terms originally agreed on, thus making the FVC “bankruptcy-remote”.

The FVC also insures the pool of assets against default, thus improving the quality of the underlying assets through a process known as credit enhancement. This can take several forms, including over-collateralisation (according to which the value of the assets exceeds the value of the debt securities issued), insurance contracts, letters of credit, subordination of tranches that absorb losses first, and the use of sponsor agencies (eg governments or multilaterals) to guarantee payments or reserve funds. A credit derivative is also generally used to change the credit quality of the underlying portfolio so that it will be acceptable to the final investors. A credit derivative is a financial derivative, the price and value of which derives from the creditworthiness of the obligations of a third party, which is isolated and traded. Credit default products are the most commonly traded credit derivatives and include unfunded products such as credit default swaps (CDS) and funded products such as synthetic credit default options (CDOs).

All assets can be securitised as long as they are associated with cash flows. Hence, the debt securities, which are the outcome of securitisation processes, are termed ABS. They are based on pools of assets, or collateralised by the cash flows from a specified pool of underlying assets. Assets are pooled, which can make otherwise minor and uneconomical investments worthwhile, while also reducing risk by diversifying the underlying assets. Securitisation makes these assets available for investment to a broader set of investors. These asset pools can be made of any type of loans like credit card payments, auto loans and mortgages. There are different securitisation and more complex techniques exist that can be applied to different asset classes and institutions. In developed markets, financial derivatives have allowed the introduction of synthetic securitisation in which the credit risk of the pool of securitised assets is transferred to a third party using credit derivatives rather than the direct transfer of ownership of assets.

In the context of national accounts, issues that need to be clarified depend on which types of securitisation transactions take place. Securitisations in the form of “true sales” imply that cash flows related to securitised loans are sold to a FVC together with all risks and rewards. This leads to the disposal of the loans by a financial institution (probably a MFI) and their acquisition by the FVC, which is being financed by the issuance of debt securities and the proceeds of which are paid back to the financial institution.

In the case of “synthetic securitisations”, only the credit risk is transferred from the financial institution (the credit protection buyer) to the FVC (the credit protection seller) by entering a CDS. The financial institution pays a premium to the FVC in return for a payment in the case of a credit default. The payment in the case of a credit default may be collateralised and financed by the FVC through the issuance of credit-linked notes or other debt securities.

A new ECB Regulation will facilitate the collection of data on FVCs and will cover transactions, other flows and positions of these institutional units vis-à-vis other market participants, specifically MFIs. Given the role of MFIs as originators and loan servicers for many FVCs, an integrated reporting scheme is necessary for FVCs and MFIs to limit the reporting burden as far as possible, and to achieve the best possible quality of statistics. Data on securitised loans will have to be reported which are granted by these institutions, but originated and continued to be serviced by MFIs and by other resident sectors and by non-residents. Questions will remain how to establish reporting schemes to collect supplementary data on synthetic securitisations and on FVCs created outside the euro area and by non-MFIs.

f. The balance sheet approach

Compared to the more traditional examination of transaction data, the balance sheet approach focuses on the analysis of stock data in an economy's sectoral balance sheets and its aggregate balance sheet, of financial and non-financial assets, liabilities and net worth.²² This approach – specially developed by the IMF, but also described in the context of euro area balance sheets – can be applied to the analysis of financial stability using an institutional sector approach. The innovative part is that the focus of attention is not solely on the activity and strength of the economy as a whole vis-à-vis the rest of the world, but also within the economy and in the interrelations between institutional sectors and subsectors, as described above. The sectors generally covered in the approach may be further divided into subsectors such as various kinds of financial institutions, eg the central bank, credit institutions and other financial intermediaries, as referred to above.

The balance-sheet approach is important for analysing financial stability. Institutions like the IMF or the ECB stress its advantages in monitoring and supervising financial activity, alongside the analysis of financial stability, on the basis of (i) assessing the quality and diversification of each sector's and subsector's portfolio of assets and liabilities; (ii) identifying points of weaknesses in the financial system; (iii) measuring exposure to sectoral financial risks; and (iv) mapping the connections between the sectors, and assessing the dynamics between them at times of shocks.²³

The framework for assessing balance sheet risks focuses on four types of balance sheet mismatches, all of which help to determine a country's, sector's or subsector's ability to service debt in the face of shocks: (i) maturity mismatches, where a gap between liabilities due in the short term and liquid assets leaves a sector or subsector unable to honour its contractual commitments if the market declines to roll over debt; (ii) currency mismatches, where a change in the exchange rate leads to a capital loss; (iii) capital structure problems, where a heavy reliance on debt rather than equity financing leaves a firm or bank less able to weather a shortfall in current revenue; and (iv) solvency problems, where assets are insufficient to cover all liabilities, including contingent liabilities. Maturity mismatches, currency mismatches, and a poor capital structure all contribute to solvency risk.

From this perspective, a financial crisis occurs when there is (i) a fall in demand for financial assets of one or more sectors; (ii) a loss of confidence in a country's ability to earn foreign exchange to service the external debt; (iii) a loss of confidence in the government's ability to service its debt; (iv) in the banking system's ability to meet deposit outflows; or (v) in the households' or non-financial corporations' ability to repay loans and other debt.

²² See, for example, Mark Allen, Christoph Rosenberg, Christian Keller, Brad Setser, and Nouriel Roubini, "A Balance Sheet Approach to Financial Crisis," IMF Working Paper, WP/02/210. 2002; Dale F. Gray, Robert C. Merton, and Zvi Bodie, "A New Framework for Analyzing and Managing Macrofinancial Risks," CV Starr/RED Conference on Finance and Macroeconomics, NYU 2002; Reimund, Mink, "Selected Key Issues of Financial Accounts Statistics," ECB, August 2004.

²³ See, for instance, the most recent issues of the IMF's Global Financial Stability Report, Washington, D.C., April 2008, and of the ECB's Financial Stability Review, Frankfurt, June 2008.

5. Aligning the work between international accounting standards and statistical standards

It is important to align international statistical standards with international financial reporting standards.²⁴ This has been clearly reflected in the various tasks of the working groups and committees contributing to the SNA review process. International initiatives have also looked at the consistency between government accounting practices and international statistical standards. This started with the release of the various IMF Manuals and their implementation. Valuable work has also been done by the *OECD/IMF Task Force on the Harmonisation of Public Sector Accounting*, which brought together government accountants and national accountants. Harmonisation of international statistical and accounting standards as far as possible will enable the same source data to be used for several purposes, which will contribute to the reliability of macroeconomic statistics and at the same time reduce the reporting burden for corporations.

The specific accounting standards that are relevant for the statistical standards are the *International Accounting Standards Board (IASB) Framework for the Preparation and Presentation of Financial Statements*. This framework was approved by the IASC Board in April 1989 for publication in July 1989, and adopted by the IASB in April 2001. It sets out the concepts that underlie the preparation and presentation of financial statements for external users and deals with: (a) the objective of financial statements; (b) the qualitative characteristics that determine the usefulness of information in financial statements; (c) the definition, recognition and measurement of the elements from which financial statements are constructed; and (d) concepts of capital and capital maintenance.

The accounting statements directly related to the measurement of financial positions are assets, liabilities and equity: (i) an asset is a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity; (ii) a liability is a present obligation of the entity arising from past events, the settlement of which is expected to result in an outflow from the entity of resources embodying economic benefits; and (iii) equity is the residual interest in the assets of the entity after deducting all its liabilities.

Accounting for financial instruments under the IFRS is complex. The revised IAS 32, the revised IAS 39 and the IFRS 7 are current references. The IAS 32 (*Financial Instruments: Presentation*) deals with the classification of financial instruments, from the perspective of the issuer, into financial assets, financial liabilities and equity instruments; the classification of related interest, dividends, losses and gains; and the circumstances in which financial assets and liabilities should be offset. The principles in this standard complement the principles for recognising and measuring financial assets and financial liabilities in *IAS 39 Financial Instruments: Recognition and Measurement*, and for disclosing information about them in *IFRS 7 Financial Instruments: Disclosures*. Examples of financial instruments within the scope of *IAS 32*, *IAS 39* or *IFRS 7* are shown in Table 7 of the Annex.

Looking at the various financial instruments according to IFRS, the asset categories shown in balance sheets generally include cash and cash balances; debt instruments; loans and advances; equity instruments; derivatives; tangible (fixed) and intangible (eg goodwill) assets, tax assets and other assets. On the liability side, the main categories are debt (mainly deposits in the case of banks), provisions, derivatives, tax and other liabilities and capital and reserves. Debt might be further broken down by counterpart and financial instrument, while provisions are shown separately for pensions and similar obligations.

²⁴ See R. Mink, P. Sandars, and N. Silva, Financial and non-financial accounts for monitoring financial stability, IFC Bulletin 23, October 2005.

Capital and reserves are split into issued capital, share premium, reserves and retained earnings.

For national accounts, the balance sheet items are mainly classified by type of instrument and liquidity. Although some obligations (eg provisions) are not always recognised as liabilities in the *SNA*, most of the national accounts instrument categories coincide with those of the balance sheet. Table 8 of the Annex provides a link between the *SNA* asset and liability categories and the corresponding financial instrument categories according to *IFRS*.

Annex

Table 1

**Issues related to new financial products
discussed in the context of the SNA update**

Issue	Item
1	Repurchase agreements
2	Employer retirement pension schemes
3	Employee stock options
4	Valuation of non-performing loans, loans and deposits
4.a	Non-performing loans
4.b	Valuation of loans and deposits; write-off and interest accrual on impaired loans
5	Non-life insurance services
6	Financial services
35	Tax revenue, uncollectible taxes, and tax credits (recording of taxes)
37	Activation of guarantees (contingent assets) and constructive obligations
42	Retained earnings of mutual funds, insurance corporations and pension funds
43	Interest and related issues
43.a	Treatment of index linked debt instruments
43.c	Fees payable on securities lending and gold loans
44	Financial assets classification

Source: <http://unstats.un.org/unsd/sna1993/issues.asp>.

Table 2

**Issues related to institutional units,
groupings of units and residence of units**

Issue	Item
24	Public-private partnerships (PPPs) (including buy-own-operate-transfer (BOOT) schemes)
25	Units
25.a	Ancillary units
25.b	Holding companies, special purpose entities, trusts; treatment multi-territory enterprises; recognition of unincorporated branches
25.c	Privatisation, restructuring agencies, securitisation and special purpose vehicles (SPVs)
38.a	Change of economic ownership (as term)
39	Residence
39.a	Meaning of national economy
39.b	Predominant centre of economic interest (as term)
39.c	Clarification of non-permanent workers and entities with little or no physical presence
C26	Currency unions
C.30	Financial corporations classification

Source: <http://unstats.un.org/unsd/sna1993/issues.asp>.

Table 3

**Financial assets and liabilities classification (issue 44)
by category (2008 SNA)**

Financial asset and liability category / subcategory	Issues discussed within the context of updating 1993 SNA and BPM5	Embedding			
		Money (liabilities of MFIs)	Household and corporate debt	Government debt	Credit (financial assets of MFIs)
Monetary gold and SDRs Monetary gold SDRs	Treatment of subcomponents of monetary gold Fees payable on gold loans (43c) SDRs as an asset and as a liability				
Currency and deposits Currency Transferable deposits Interbank positions Other transferable deposits Other deposits	Repurchase agreements (1); Valuation of loans and deposits (4b); Financial services (6)				
Debt securities Short-term Long-term	Treatment of index linked debt instruments (43a) Fees payable on securities lending (43c)	Additional breakdown by original maturity			
Loans Short-term Long-term	Repurchase agreements (1) Non-performing loans (4a) Valuation of loans and deposits; write-off and interest accrual on impaired loans (4b) Financial services (6)				

Table 3 (cont)
**Financial assets and liabilities classification (issue 44)
 by category (2008 SNA)**

Financial asset and liability category / subcategory	Issues discussed within the context of updating 1993 SNA and BPM5	Embedding			
		Money (liabilities of MFIs)	Household and corporate debt	Government debt	Credit (financial assets of MFIs)
Equity and investment fund shares					
Equity					
Listed shares	Valuation				
Unlisted shares					
Other equity					
Investment fund shares/units	Retained earnings of investment funds (42)				
Money market fund shares/units					
Other investment fund shares/units					
Insurance technical provisions	Retained earnings of insurance corporations and pension funds (42)				
Non-life insurance technical provisions (including provisions for calls under standardised guarantees)	Non-life insurance services (5) Activation of guarantees (contingent assets) and constructive obligations (37)				
Life insurance and annuity entitlements					
Pension entitlements	Employer retirement pension schemes (2)				
Financial derivatives and employee stock options					
Financial derivatives					
Options					
Forwards					
Employee stock options	Employee stock options (3)				
Other accounts receivable/payable	Tax revenue, uncollectible taxes, and tax credits (recording of taxes) (35)				
Trade credits and advances					
Other accounts receivable/payable					

Table 4

**Subsectors of the financial corporations sector
in the 2008 SNA and draft ESA**

2008 SNA / draft ESA	Groupings as described in the draft ESA	
Central bank	Central bank	Monetary financial institutions (MFIs)
Credit institutions Money market funds	Other monetary financial institutions (oMFIs)	
Investment funds, except money market funds Other financial intermediaries Financial auxiliaries Captive financial institutions and money lenders	Other financial institutions	Non-monetary financial institutions
Insurance corporations Pension funds	Insurance corporations and pension funds	

Table 5

Subsector *other financial intermediaries, except insurance corporations and pension funds* and its subdivision

Other financial intermediaries, except insurance corporations and pension funds

- Financial vehicle corporations engaged in securitisation transactions (FVCs)
- Security and derivative dealers
- Financial corporations engaged in lending
- Specialised financial corporations

Table 6

Holding companies

Holding companies are included in the subsectors financial auxiliaries, captive financial institutions or in the sector non-financial corporations according to which functions they undertake.		
Type of holding company	Unit holds equity in one or more subsidiary corporations but does not undertake any management activities.	Head office that exercises some aspects of managerial control over its subsidiaries. This may sometimes have noticeably fewer employees, and at a more senior level than its subsidiaries, but it is actively engaged in production.
Description	This class includes the activities of holding companies, ie units that hold the assets (owning controlling-levels of equity) of a group of subsidiary corporations and whose principal activity owns the group. The holding companies in this class do not provide any other service to the businesses in which the equity is held, ie they do not administer or manage other units.	This class includes the overseeing and managing of other units of the company or enterprise; undertaking the strategic or organisational planning and decision-making role of the company or enterprise; exercising operational control and manage the day-to-day operations of their related units.
Sector / subsector	Captive financial institutions even if all the subsidiary corporations are non-financial corporations.	Such units are allocated to the non-financial corporations sector unless all or most of their subsidiaries are financial corporations. Other entities that hold and manage subsidiaries may have substantial operations in their own right, in which case they are classified according to those operations if they are predominant.

Table 7

Examples of financial instruments within the scope of IAS 32, IAS 39 or IFRS 7

- Cash
 - Demand and time deposits
 - Commercial paper
 - Accounts, notes, and loans receivable and payable
 - Debt and equity securities. These are financial instruments from the perspectives of both the holder and the issuer. This category includes investments in subsidiaries, associates, and joint ventures
 - Asset backed securities such as collateralised mortgage obligations, repurchase agreements, and securitised packages of receivables
 - Derivatives, including options, rights, warrants, futures contracts, forward contracts, and swaps
-

Table 8

**Financial assets and liabilities (SNA, ESA)
versus financial instruments (IFRS)**

SNA, ESA	Broad financial instrument categories according to IFRS
Monetary gold and SDRs Monetary gold Gold bullion Unallocated gold accounts SDRs	Tangible assets Other financial assets and liabilities Debt instruments
Currency and deposits Currency Deposits Transferable deposits Interbank positions Other transferable deposits	Debt instruments
Debt securities Short-term Long-term	Debt instruments
Loans Short-term Long-term	Debt instruments Loans and receivables (holder)
Equity and investment fund shares Equity Listed shares Unlisted shares Other equity Investment fund shares Money market fund shares/units Other investment fund shares/units	Equity instruments
Insurance, pension and standardised guarantee schemes Non-life insurance technical reserves Life insurance and pension entitlements	Debt instruments
Financial derivatives and employee stock options Financial derivatives Forward-type contracts Options Employee stock options	Other financial assets and liabilities Equity instruments (at least in the case of warrants and stock options) (issuer) Hedging assets and liabilities (if the derivatives are used in hedging operations) (holder)
Other accounts receivable/payable Trade credit and advances Other	Debt instruments Loans and receivables (holder)

Session 2

Measuring developments in housing finance

Chair: Jazmin Carballo-Huerta, Banco de México and Marit Hoel, Statistics Norway

Papers: Housing finance in the Netherlands – the impact of structural developments on households and banks
Dirk van der Wal and Henk Lub, Netherlands Bank

Development of housing finance and its impact on socio-economic uplift in the emerging economy in Bangladesh
Khandaker Khalidur Rahman, Bangladesh Bank

EU housing statistics
Martin Eiglsperger and Wim Haine, European Central Bank

Housing finance in the Netherlands – the impact of structural developments on households and banks

Dirk van der Wal and Henk Lub¹

1. Introduction

In this paper we aim to describe how structural developments have affected the behaviour of households and banks with respect to the financing of home ownership. These structural developments relate to the housing market directly – for example the large extent of government interference – and to indirect factors. We mention supervisory rules, ie the impact of the Basel-I Accord, the seemingly perennial decline of inflation and the increased labour participation by women (chapter 2). Against the background of these structural factors we analyse the often interrelated consequences of the demand for mortgage loans, house prices, rising household debt ratios, securitisation by banks and other financial institutions, and the interest sensitivity of households (chapter 3). Finally, we review the impact on households and banks (chapter 4). At the end we offer our conclusions (chapter 5).

2. Structural developments

2.1 Government policy

For many decades, government policy has dominated the housing market in the Netherlands. The range of government measures encompasses both financial instruments – income tax deductions and subsidies – and regulatory activities. Examples of the latter are detailed urban development criteria and regulations affecting the environment, air quality and urban aesthetics. During the last 35 years, government policy has focused on making good (rental) housing affordable to low income classes and stimulating home ownership (box 1). Tenants enjoy caps on the level of rents, as these are regulated by a scoring system. They also benefit from ceilings to the annual rent increase – an issue that is hotly debated each year in the Dutch Parliament. Moreover, the government provides rent supplements for lower income categories. Home owners, on the other hand, may deduct interest payments on mortgage loans from taxable income. Further, potential first-time home owners are entitled to subsidies when they buy their first house. These measures have strongly stimulated the demand for housing.

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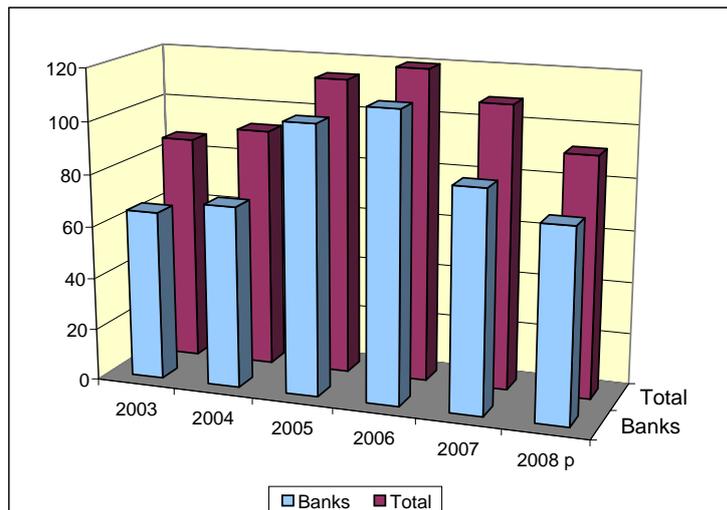
Box 1

Structural characteristics of the Dutch housing market

Around 16.5 million people live in the Netherlands. Because the area is small, the country is densely populated: 1000 inhabitants per square kilometre. This figure is only exceeded on islands like Taiwan or Hong Kong. Although the largest cities each accommodate fewer than 1 million people, together they form one agglomeration – the Randstad – that houses 6 million people. To a certain extent, density is reflected in tight housing conditions. In 2003, 419 dwellings per 1000 inhabitants were available. Neighbouring countries like Belgium and Germany have 462 and 472 dwellings per 1000 people, respectively. Spain and Portugal exceed 500.² 57% of the Dutch housing market is made up of private homes. Rental housing has a 43% share, three quarters of which is owned by housing corporations (social housing), and the remaining part by private landlords (buy-to-let market). Due to the government's rent policy (on, among other things, maximum rents, ceilings on annual rent increases, rent subsidies), tenants are not encouraged to circulate, so they live for many years – sometimes their whole life – in the same rented house. As a result the subsidised rental market is characterised by waiting lists and long waiting periods. Many people, therefore, have recourse to private homes.

The average house price is over EUR 240,000. The wealth of an ordinary household is about EUR 58,000 (deposits and securities). Households generally have to borrow in order to buy. They borrow from banks or their subsidiaries, insurers, pension funds and other mortgage providers without a deposit base. Mortgage loans do not have to be obtained directly from originators: they can also be taken at intermediaries that offer a wide array of lenders and products. Banks are the most important providers: in 2007 their market share for new mortgages was 75% (figure 1). Providers offer their customers a wide choice of mortgage types: linear, annuity, life, savings, interest-only, equity etc. Presently, interest-only loans are popular (2006: 44% of total). This marks a substantial shift with respect to some 30 years ago, when repayment of the principal was seen as normal, and annuity loans were standard. Contract periods are usually 30 years. The interest on mortgage loans varies from variable rate to fixed rate for more than 10 years. Government stimulates private home ownership by allowing home owners to deduct interest payments on their mortgage loan from taxable income.³ On the other hand, owners pay residential property tax and have to add a fraction of the value of their property to taxable income. Further, a transaction tax exists: buyers of an existing house have to pay 6% over the purchase price. This tax restricts home owners' mobility.

Figure 1
New mortgage contracts
EUR billion



Source: DNB.

² Nyffer 2008, p 22.

³ Conditional on a maximum length of 30 years and for the main residence (not for holiday cottages). There are further restrictions on tax deductibility for owner-occupiers who move to another home.

Unfortunately, housing supply has not kept up with the growth in demand. This is mainly due to time-consuming building permission procedures and complex regulations for constructing new dwellings, which has led to a shortage of construction sites and long construction times. As a consequence, new housing production has been unable to react to the price increase. The price of existing dwellings rose fourfold, while housing production actually declined. The Netherlands is rather unique with this inverse relationship between price and supply.⁴

Of course, this government policy of stimulating both the demand for rental dwellings and owner-occupied dwellings is a costly affair. The Netherlands Bureau for Economic Policy Analysis estimates that an amount of EUR 29 billion (in 2006) is involved, evenly divided over rental subsidies and subsidies of home ownership.⁵ The combination of these subsidies has resulted in rigidities in the Dutch housing market that are difficult to change because political parties have rallied behind interest groups. The Political Agreement behind the present government explicitly states that during this government's term there will be no change in housing policy. Demands for adjusting tax deductions for interest payments on mortgage loans have been dropped in exchange for maintaining the present system of rental subsidies. The result is stalemate.

2.2 Capital requirements Basel-I

In the first Capital Accord (1988) minimum requirements were laid down for the amount of own capital banks had to hold. Own capital should be at least 8% of the sum of the risk-weighted assets. For residential mortgage loans a weight of 50% applied. So, capital requirements were 4% of the amount of the claims. It turned out, however, that for the majority of mortgage loans the actual risk was lower than embodied in this requirement. Banks increasingly recognised they held too much capital against these low-risk assets. Therefore, they sought ways to reduce capital costs. Among other things, they found a solution by making mortgage loans marketable. Banks bundled these loans and sold them to entities, Special Purpose Vehicles (SPVs), which were deliberately created for this end. The SPVs bought the original assets and financed this by issuing mortgage-backed securities (MBS). This process is known as securitisation.

The advantages of securitisation were manifold: banks could reduce the pressure on the balance sheet to enhance their solvency position. The capital freed could then be used to finance other activities with a higher risk profile (and higher return). Another motive was to bring down financing costs. The SPV that buys the assets is usually assigned a high rating on the basis of the specific collateral provided. Banks used securitisation furthermore as a risk management instrument in order to mitigate the interest rate mismatch (caused by the difference between rates on long-term claims and short-term liabilities) or to reduce exposures to certain sectors or debtor categories. Finally, securitisation was used to achieve greater diversity of capital sources or to tap into new groups of investors.⁶

⁴ IMF (2006), p 74. See also DNB Quarterly Bulletin, March 2008, p 50.

⁵ CPB (2006), CPB (2008a).

⁶ DNB Statistical Bulletin, December 2002, p 17.

2.3 Decline of inflation

In many industrialised countries, inflation has declined since the start of the 1980s. This trend can be attributed to various factors, such as a stronger commitment by monetary authorities towards price stability, the adoption of more prudent fiscal policies – for European countries, these policy shifts were strongly encouraged by the establishment of EMU – and the global liberalisation of markets for goods, services and labour.⁷ Together with the reduction in inflation level the volatility decreased too. As a result, capital market rates and mortgage interest rates declined. This stimulated both the demand for and the supply of mortgage loans. Lower interest rates for households imply that they could afford to take up larger loans. They raised their leverage. Also, from the point of view of financial institutions households became more creditworthy. To maintain their market share, they scaled up the supply of residential mortgage loans. Lower interest rates in competing markets also induced financial institutions to speed up their search for yield and provide more loans in the mortgage market.

2.4 Increase in labour market participation of women

In the past 25 years, the participation of Dutch women in the labour market has increased from 33% in 1980 to 61% in 2007. This spectacular rise is manifested mostly in part-time jobs. Because males retained their full-time jobs, the household income increased structurally. As a consequence, households were able to borrow larger amounts for house purchase. This development was facilitated on the supply side. Banks progressively began to base their offer for mortgage loans on household income, instead of the income of the wage earner – mostly the male. As a result, demand for housing was stimulated.

3. Results of structural developments

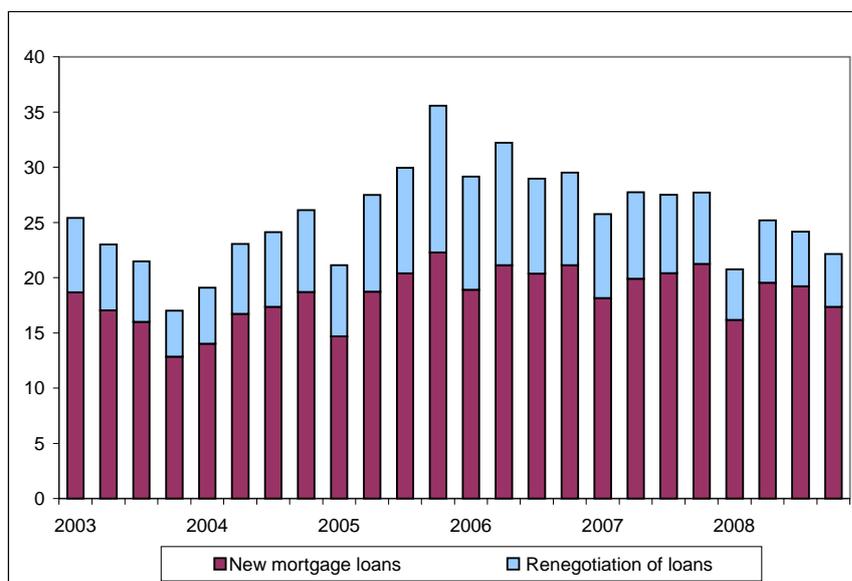
The above-mentioned structural developments have greatly affected the financing of the housing market in the Netherlands in recent years. Both sectors involved, households and financial institutions (mainly banks), have changed their behaviour. Of course, this has had consequences for the judgement of several aspects of their financial stability.

3.1 Surge in new mortgage loans

A major characteristic of the housing market in recent years was the large increase in borrowing capacity by households for house purchases. For the period 2003–07 this can be illustrated by the rise in new mortgage contracts (figure 2). The increase in new contracts was partly due to renegotiated mortgage loans. For instance, when interest rates declined, many borrowers took up new, lower interest rate loans and redeemed old, higher interest rate loans. It is estimated that 20 to 25% of new contracts were renegotiated. Still, a large increase in new loans resulted.

⁷ CGFS 2008, p 18.

Figure 2
New residential mortgage contracts
 EUR billion

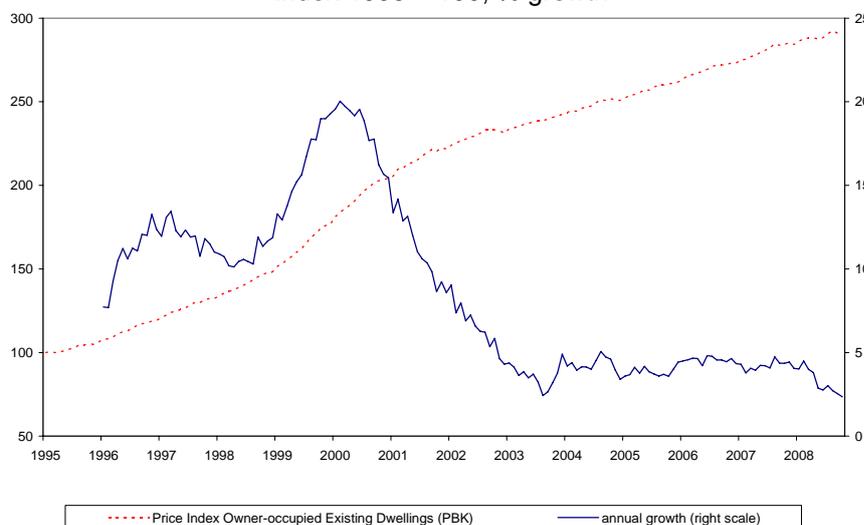


Source: Land Registry.

3.2 House price increases

The combination of stimulating demand across the board and a nearly frozen supply of new dwellings led to strong house price increases (figure 3). See also box 2 on the issue of measuring house prices. Towards the end of the last century, prices on the Dutch housing market exploded. In 1999, price increases peaked at around 20% on an annual basis. More recently, prices rose at a more moderate rate of between 3 and 5%. For more than 20 years, house prices have been growing faster than the general rate of inflation. Higher house prices also stimulated higher debt. In this respect a risky vicious circle was looming. However, lower economic growth since the burst of the Internet bubble and the accompanying decline in ECB interest rates eased tensions.

Figure 3
House prices
 Index 1995 = 100, % growth



Source: Land Registry.

Box 2

House price indexes in the Netherlands

Since the beginning of 2008, Statistics Netherlands (CBS) and the Dutch Land Registry Office (Kadaster) publish the Price Index Owner-occupied Existing Dwellings (Dutch acronym PBK), which they calculate in a common project. The PBK is the successor to the House Value Index Kadaster (Dutch acronym WIK), which had originally been developed by the Land Registry.

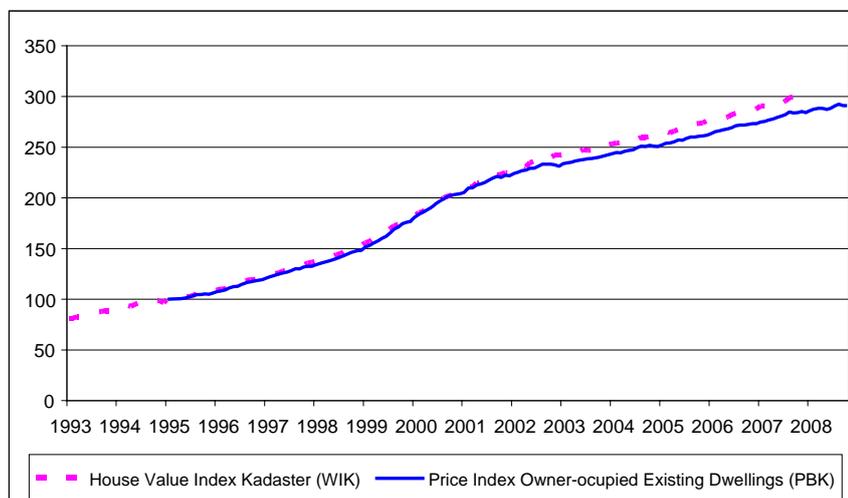
The PBK is based upon the Sale Price Appraisal Ratio method (SPAR). The PBK is calculated by combining information from two sources: sale prices recorded by the Land Registry and officially appraised values that are updated on a regular basis. (The latter are determined by municipalities, which use the appraisal values as the base for the residential property tax.) In essence, the SPAR calculates the price increase of houses in the current period compared to their appraisal value in the reference period after correction for the under- or overestimation between the actual selling price and the appraisal value in the reference period.

The WIK was based on the Repeat Sales Method. It was calculated from an estimation method based on sale prices that were recorded by the Land Registry and applied to dwellings that had been sold at least twice in the period to which the index applied.

Both SPAR and Repeat Sales Method have a strong advantage over alternative house price indices based on hedonic methods in the sense that they are rather easy to calculate. In a comparison between the two methods, however, SPAR scores higher than the Repeat Sales Method. The PBK can be considered a price index as the appraisal value is adjusted to quality changes of the house (for example through extensions or adding dormers – both very popular in the Netherlands) on a regular basis. Of course, the quality change is not captured if it occurred after the last appraisal date. In that case, however, the house sale may be left out as it results in being an outlier. The WIK is a value index. Of course, it compares the sales prices of the same house, but because of the longer period under consideration quality changes may play a larger role. Another advantage of the PBK is that data once published are not revised. WIK data are revised monthly as they are based on an estimation method that continuously adds new information that also affects the outcomes of previous periods.

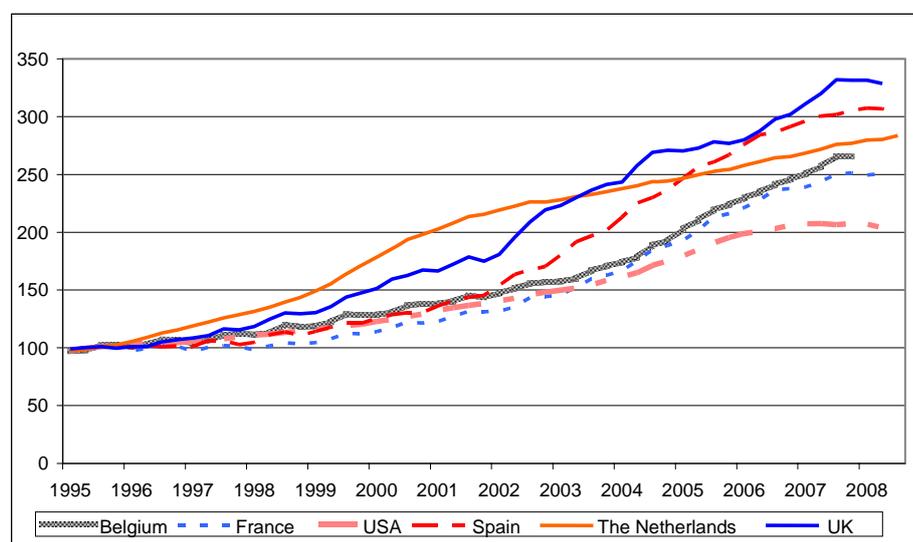
PBK and WIK show a rather similar development over the last decade or so (figure 4). However, the PBK is consistently growing a little more slowly. The difference is less than 0.4% per year. This is probably due to quality changes, for which the PBK provides a better correction. Interestingly, Bourassa et al argue that a SPAR index tends to increase more strongly than a Repeat Sales Index. In their view, houses that are sold more often tend to be of lower quality – typically houses for starters on the housing market – which rise less in price and, therefore, reduce the index. They found a confirmation for this assumption in New Zealand. Apparently, in the Netherlands the continuous drive by owners to improve and expand their homes is predominant.

Figure 4
Two house prices indices
January 1995 = 100



The strong increase in house prices in the Netherlands was not exceptional. In recent years, booming house markets have led to even stronger price rises in the United Kingdom and Spain (figure 5). Over the last year, house price increases levelled off in many countries. Prices even started to decline in quite a few countries, of which the United States, United Kingdom and Spain are most conspicuous. This led the IMF to assess the risk for decreasing house prices in developed economies.⁸ One of its conclusions was that house prices in the Netherlands were about 30% higher than was justified by fundamental developments. The publication of the IMF report led to strong – occasionally even acrimonious – reactions, from both policymakers and market parties. Of course, commercial interests were involved too. Real estate agents fear for their turnover if expectations of falling house prices induce potential buyers to postpone their house purchases. Banks face higher funding costs in financial markets when the value of their collateral is lower. In the hot debate, one important element seemed to be lost: the IMF study related to real house prices: so the interpretation that the IMF expected that house prices would fall by 30% was wrong.

Figure 5
House price developments in 6 countries
 Index 1995 = 100



Source: BIS.

In reaction to the IMF study, the Netherlands Bureau for Economic Policy Analysis (CPB) updated its own analysis of house prices in the Netherlands. The CPB found that the present level of (real) house prices corresponded to its long-term value. So the price level could be fully explained by the regression equation it used, in which both cyclical and structural factors played a role.⁹ In the scientific debate on this issue, it was stressed that structural factors – including the interest subsidy, the changing composition of family income, and the rigidities in the housing market in general – explained the high level of house prices and that these factors would continue to push prices upward. This does not mean, however, that in a weakening economy falling house prices can be excluded. As a matter of fact, house prices

⁸ IMF (2008), Box 3.1. Assessing vulnerabilities to housing market corrections.

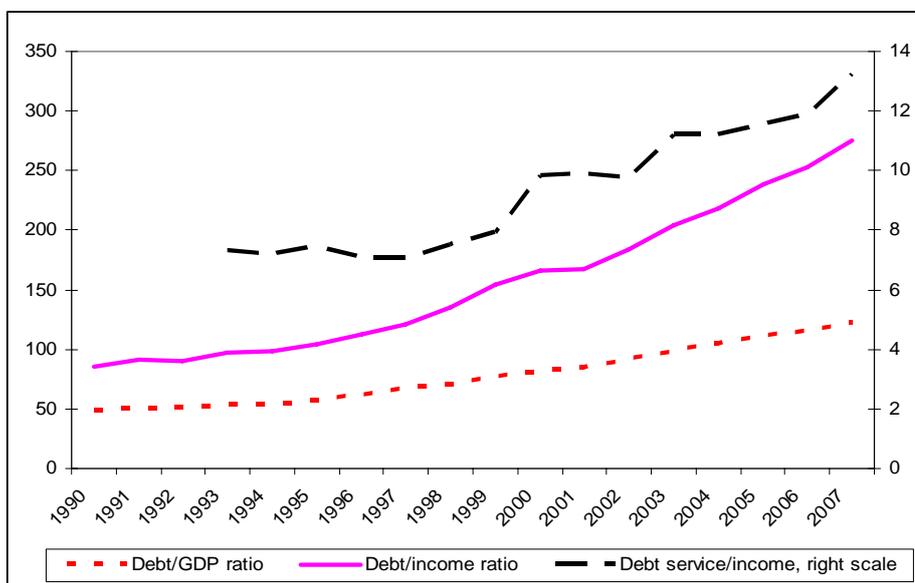
⁹ CPB (2008b), Are house prices in the Netherlands overvalued? (in Dutch only)

have levelled off completely in recent months. But in the present financial turmoil, while potential buyers postpone their decisions, the supply of new dwellings has a tendency to start falling behind as well. These two factors have opposing influences on the house price level.

3.3 Rising debt ratios

The surge in new mortgage loans has produced a rising debt/GDP ratio (figure 6). Compared with more than 10 years ago, the ratio of household debt has nearly doubled. For the most part, this was due to mortgage debt as consumer loans are a small fraction of total debt. In international perspective the Dutch level of 120% is relatively high. Only a few countries surpass it. Debt has also grown in relation to disposable household income. In 2007, household debt amounted to more than 2.5 times disposable household income. Internationally, the Netherlands is leading here.

Figure 6
Dutch household debt and debt service ratios
%



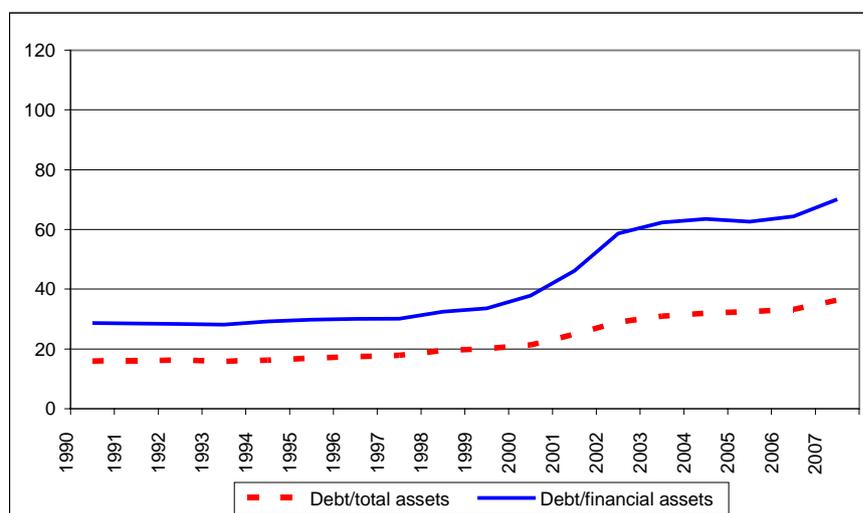
Source: DNB, nsi.

Many studies of housing finance take account of debt service payments (taken here as interest payments). The idea is that households have to service their debt out of their disposable income. After a steady level of about 7% in the 1990s, interest payments in relation to disposable income increased at the turn of the century. This occurred because of rising debt, and in spite of the mitigating effect of falling interest rates. At the end of 2007, debt service costs were 13% of disposable household income. This figure still underestimates debt service costs at an individual level, as household income also includes income earned by citizens who did not borrow any money for the purchase of their house or who live in a rented house.

Against this background, debt/asset ratios have increased since the turn of the millennium (figure 7). However, the rise was much lower than debt/income ratios. Financial assets of households have grown too. Also, non-financial wealth, mainly embodied in private homes, rose due to the price increase of dwellings. So the rise in total wealth mitigated the rise in the

debt-asset ratio to some extent. In international perspective, the Dutch debt/asset ratio is an average figure.¹⁰

Figure 7
Dutch households debt/asset ratio
 %



Source: DNB, nsi.

3.4 Securitisation via SPVs

Basel capital requirements led to the creation of a securitisation industry in the Netherlands. Its size is rather large: Dutch SPVs are responsible for 20% of European securitisations. There are several reasons for this. First, the Netherlands has a highly developed financial sector. There are large banks and also large pension funds and insurers. The Netherlands is also home to many special financial institutions.¹¹ Another reason for securitisation is the large market for mortgage loans, due to low interest rates and the strong rise in house prices, among other factors. Because many loans for house purchase were provided, this resulted in tensions on the balance sheet of mortgage suppliers. Additional financing was needed. Moreover, new entrants came into the market that financed themselves directly by bundling mortgage loans and transferring these to investors in the form of residential mortgage backed securities (RMBS). This resulted in a large supply of securitised loans. On the demand side, institutional investors were attracted in their search for yield. At the end of 2007, the balance sheet of SPVs amounted to EUR 270 billion, of which EUR 145 billion consisted of mortgage loans (figure 8).¹²

One of the major consequences of the securitisation process is that residential mortgage loans disappear from the balance sheet of originating financial institutions. This applies to true-sale securitisations. These transactions entail assets that are actually transferred to the SPV. In the case of synthetic securitisations the assets (mortgages) remain on the balance

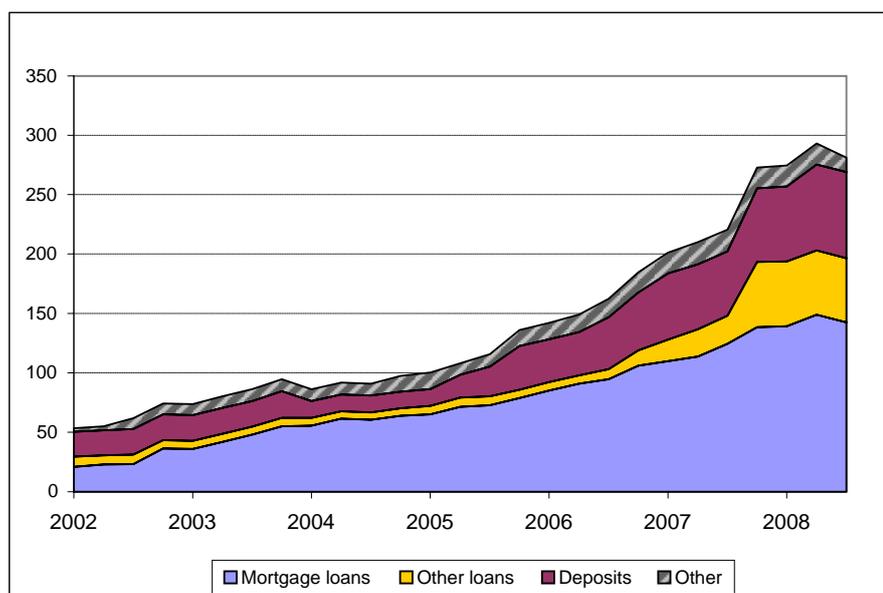
¹⁰ CGFS (2006).

¹¹ Special financial institutions (SFIs) are Netherlands based companies or institutions that specialise in raising funds from outside the Netherlands and on-lending or investing them outside the Netherlands.

¹² DNB Statistical Bulletin, June 2008.

sheet of the originator. Only the credit risk is transferred to the SPV by means of credit default swaps and credit linked notes. Banks in the Netherlands are dominant suppliers of mortgage loans. Because of true-sale securitisations, banks' balance sheets will give wrong signals. The credit growth derived from the balance sheet will underestimate the original loan supply. The calculation of total mortgage debt of households in particular might be distorted if it is derived solely from the balance sheets of banks and other important providers of mortgage loans.¹³

Figure 8
Assets of Dutch SPVs
 EUR billion



Source: DNB.

DNB collects data on securitisation transactions (see box 3). It is therefore possible to correct for these distortions. In essence, part of the balance sheet of Dutch SPVs is split between the originating loan providers. By assuming that the contribution from each group of financial institutions to the securitisation transactions will be reflected in stocks at end-of-period to the same degree, we are able to reconstruct the “true” growth of mortgage loans provided by banks. It appeared that the original amount of mortgage loans increasingly surpassed the data taken from the balance sheet (figure 9a). As a consequence, the banking data gave the wrong signals with respect to growth figures as well (figure 9b). Before and after correction for the impact of securitisation operations, the extension of mortgage loans showed a downward trend after 2001. It appears, however, that the actual growth of mortgage loans is seriously underestimated. The real growth is about twice as large as shown by the banks' balance sheet. In 2008, banking data even gave a misleading picture. Instead of a recovery of the market for mortgage loans, a further decline actually occurred.¹⁴

¹³ DNB Statistical Bulletin, December 2002, p 27.

¹⁴ Due to the financial turmoil in 2008, banks bought back part of the earlier sold mortgages. This increased balance-sheet growth.

Box 3

Compiling SPV data: the Dutch model

A special purpose vehicle (SPV)¹⁵ is a separate legal entity that buys financial assets from financial institutions. These can be banks or insurers, or other financial intermediaries, which are originators of loans. To finance its purchases the SPV issues marketable securities known as asset-backed securities (ABS). Debt instruments issued to finance the transfer of residential mortgage loans are known as residential mortgage-backed securities (RMBS). Debt servicing in respect of ABS or RMBS is paid out of the cash flows ensuing from securitised assets (like mortgages or company loans). DNB compiles data on SPVs from publicly available information. The policy of DNB is to shield financial institutions from an unnecessary reporting burden. In this case sufficient information is already available from other sources and can be retrieved at low cost. It should also be considered that there is no legal obligation to notify individual securitisation transactions as yet.

DNB identifies new issues of ABS or the establishment of new SPVs from several sources:

- commercial data providers (Telekurs)
- money and banking data on securitisations
- balance of payments data
- trust offices
- other public sources (papers, journals, and internet: eg pre-sale and investor reports).

As regards the SPVs' balance sheet, the amount of debt securities issued is taken from the data provider. To calculate the amount of securitised assets this source is tapped too, and investor reports are taken into account as well. Securitised assets can be classified into several types of credit, including residential mortgages. The update of quarterly data depends on available sources and trends. New information on loans and debt issued is derived from investor reports. Moreover, DNB compares data on redemptions received from the data provider with balance sheet data. Further, annual reports of SPVs are used. They can be downloaded from the Internet (Chamber of Commerce). In particular for those SPVs for which no other data are at hand (only a very limited number), quarterly data are updated by smoothing year-on-year changes over the quarters.

¹⁵ The ECB term is Foreign Vehicle Corporation.

Figure 9a
Banks' outstanding mortgage loans
 EUR billion

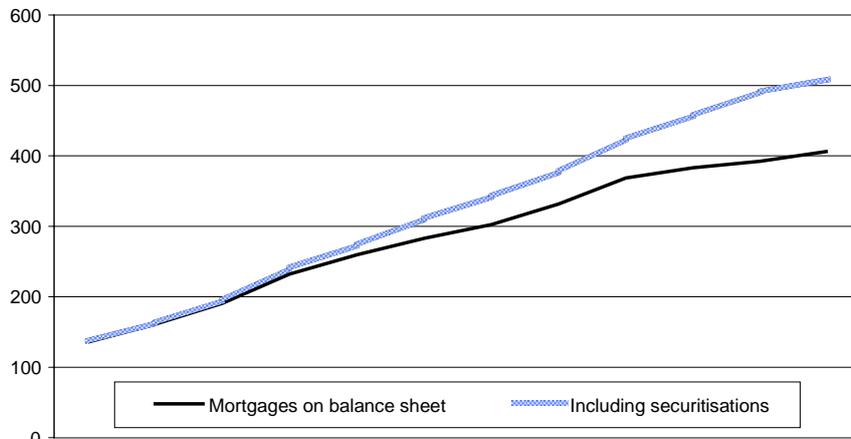
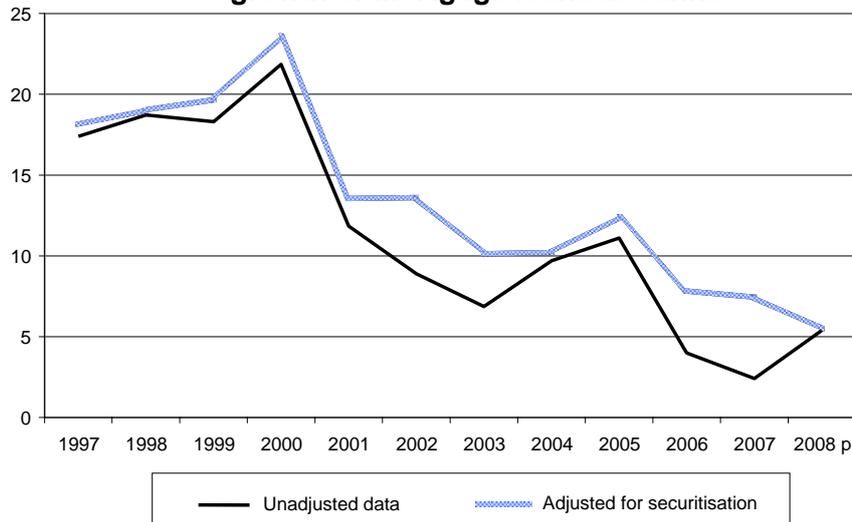


Figure 9b
% growth of mortgage loans at banks



Source: DNB.

3.5 Relation between interest rates and adjustable rate mortgages

The decline in interest rates on financial markets had an impact on the type of mortgage loan. Traditionally, the Dutch housing market relied predominantly on fixed rate products. When interest rates began their downward trend, loan providers introduced new products with variable rate elements. After the turn of the century, when historic low interest rates prevailed, variable rate loans and loans with a one-year fixation period became popular in the Netherlands. The decline in interest rates after 2000 boosted the demand for mortgage loans. In 2003 and 2004 the low level of short-term rates led to a sharp increase in demand for short-term mortgages loans (figure 10a, 10b). Households increasingly renegotiated their existing higher rate mortgage loans. Because of the structural increase of house prices, the collateral value of mortgage loans rose. This facilitated renegotiation by replacing loans. In addition, the borrowing capacity of households grew because of low interest rates. At the lowest point of the variable interest rate (3.15% in the second quarter of 2005), banks lent more than EUR 10 billion in new loans in the short-term segment.

As against the temporarily favourable effects of rising mortgage *volumes* for banks, the mortgage interest rate trend, particularly from 2005, combined with the interest rates payable on deposits, squeezed interest margins (figure 10a). In particular, this reflected the rate increases by the European Central Bank (ECB). The margin also came under increasing pressure as a result of competition in the mortgage market.¹⁶ Non-bank financial institutions and some foreign banks were attracted by the size of the Dutch market for mortgage loans. Rising interest rates restrained the demand for variable-rate mortgages. In response, demand from home owners shifted to the longer end of the interest fixation period. The flattened yield curve made fixed-rate mortgages more attractive. But in the course of 2006, rates gradually increased in this part of the mortgage market. The establishment of the Code of Conduct for Mortgage Financing – according to which financial institutions must more carefully scrutinise the financial position of households, in particular the capacity for debt servicing – is considered to have checked the supply of new loans to some extent. In sum, households reacted in an active way to changes in the level and in the steepness of the mortgage rate curve. By renegotiating debt, they tried to limit future interest expenses to some extent. In 2008 mortgages with a one- to five-year interest fixation period became more popular, at the expense of variable rate contracts.

Figure 10a
Mortgage rates and financing with euribor

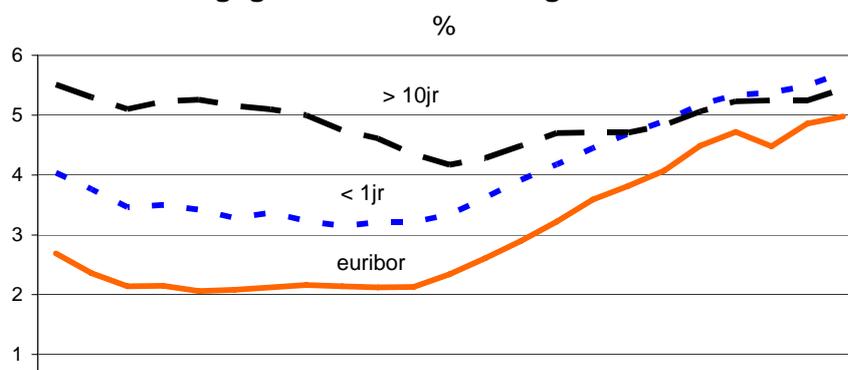
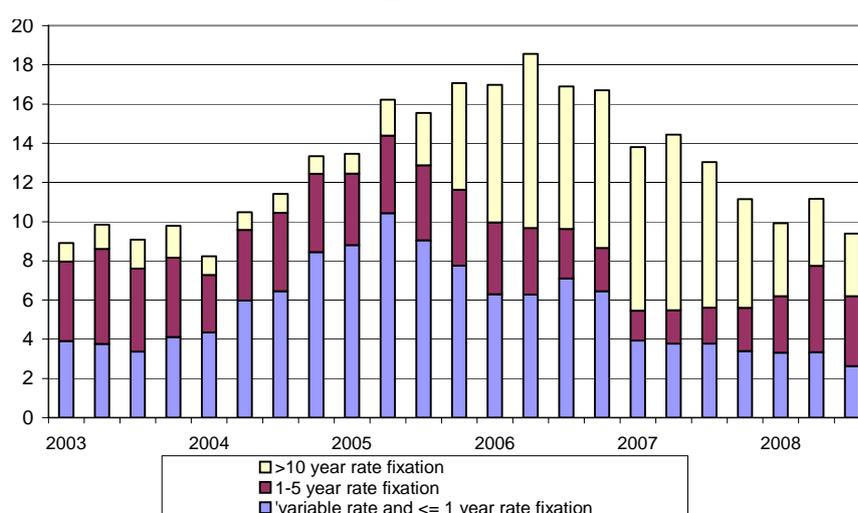


Figure 10b
New mortgage contracts provided by banks



Source: DNB.

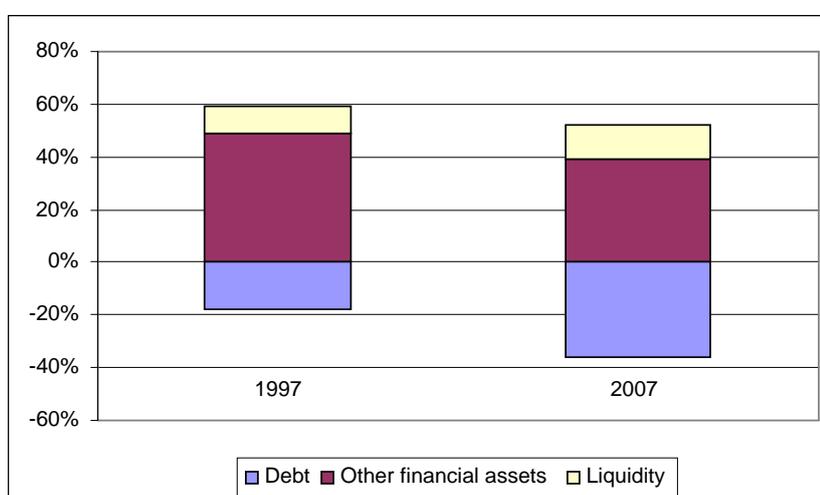
¹⁶ DNB *Annual Report 2006*, p 73, and WW Boonstra and JM Groeneveld (2006).

4. Impact on balance sheets of households and banks

4.1 Households

We saw above that households took an active stance in trying to restrict their interest rate expenses by a shift to mortgage loans with a long interest fixation period. Nevertheless, the developments in the past decades resulted in accumulation of debt on the balance sheet. Leverage of households thus increased: the ratio of debt to total households assets doubled from 18% in 1997 to 36% in 2007. The share of financial assets (excluding liquid assets) decreased by 10 percentage points to 39%. The share of liquidity remained more or less the same (figure 11).

Figure 11
Leverage at households
% of total assets



Source: DNB.

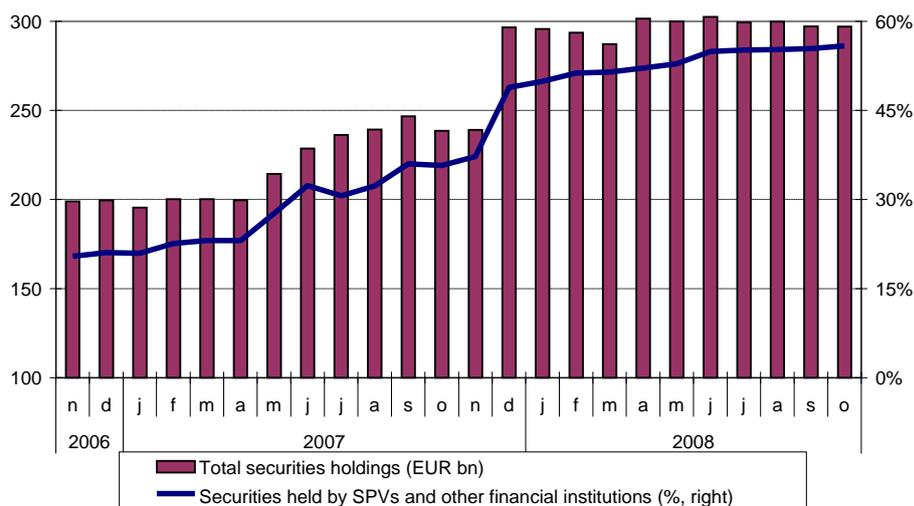
4.2 Banks

We have seen that banks have become active players in the securitisation of assets, in particular in mortgages. The usual business model of banks – attracting deposits and extending credits – changed to the so-called originate-to-distribute model (OTD). According to this model, a bank extends individual credits, bundles them and sells the package to investors via an SPV. In this model banks rely on financing in the capital market, rather than funding from deposits and savings accounts held by the public. In 1995, Dutch banks relied to 63% on traditionally entrusted funds from the public. This share has declined since and in 2006 it stood at 41%. When this form of capital market financing dries up, financial institutions that are dependent on this source have to refinance. Since the outbreak of the American mortgage crisis, investors avoid ABS and other structured products. Also in the Netherlands, a few institutions without a deposit base could not attract funds on reasonable terms any more. They stopped their activities, eg in mortgage finance along the OTD model. Likewise, the SPVs sponsored by banks were no longer able to place their debt in the markets. Banks bought these debt securities back. Further, they increased their holdings of bonds newly issued by affiliated and non-affiliated SPVs. In October 2008 banks held 56% of

total debt securities issued by domestic SPVs and other financial institutions (figure 12). Banks feared that possible failure of their vehicles could backfire on their own reputation. Therefore, they bought SPV bonds in the primary market.¹⁷ Banks also had another motive to invest in these bonds: liquidity reasons. ABS with a certain rating are eligible with the ECB in exchange for short-term loans. Because of the American mortgage crisis and the accompanying uncertainty in the financial markets, banks established a cushion to bridge periods of tightness on the money markets.

Figure 12

**Securities holdings of Dutch banks (EUR bn);
of which issued by Dutch SPVs (%)**



Source: DNB.

5. Conclusions

The housing market in the Netherlands is characterised by strong regulation, resulting in various rigidities. On the one hand, this has led to a considerable burden to the government budget; on the other, this has resulted in a situation in which supply has not reacted positively to the large house price increase. In the past decade, households have strongly increased their leverage, raising debt to finance their purchases of houses.

Banks, for their part, have become heavily involved in securitisation of their initial mortgage claims. Their role in financial intermediation has changed from a traditional model of on-lending their customers' deposits and savings account to an originate-to-distribute model. Due to the credit crisis the market for ABS dried up, and banks increased their holdings of bonds issued by SPVs. Via a detour, mortgages came back onto their balance sheets, now in a marketable form.

¹⁷ In calculating the size of the mortgage market, these bonds are counted as securities, not as mortgages, in order to prevent double counting.

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Development of housing finance and its impact on socio-economic uplift in the emerging economy in Bangladesh

Khandaker Khalidur Rahman¹

1. Introduction

Housing not only provides physical shelter but also has significant impact on the lives of the dwellers in terms of skills enhancement, income generation, increased security, health, self-confidence and human dignity. Housing finance development, therefore, plays a role in boosting equitable economic growth and reducing poverty through helping households build assets, improving living conditions, empowering the middle- and lower-income population, and strengthening communities. Despite its considerable economic and social potential, housing finance remains underdeveloped in Bangladesh. The House Building Finance Corporation (HBFC), which has traditionally dominated the housing finance sector, is now a declining player, in part because of decreasing government support, and in part because of its history of operational ineffectiveness. In its place, domestic and international commercial banks and a few new specialised institutions have entered the market, and have a significant potential for growth.

It is desirable to promote growth in home financing to a wider population group at lower cost. The government of Bangladesh recognises the importance of the housing sector and its potential to contribute to long-term economic development. Accordingly, it has taken steps to address present weaknesses and encourage the development of a more stable and vibrant housing sector. The present study builds on these efforts and attempts to formulate recommendations for improving access to housing credit for various groups of presently underserved urban and rural households.

2. The economic context of Bangladesh

Bangladesh faces continuous challenges in maintaining economic stability, improving public sector efficiency and inducing economic growth sufficient to alleviate the desperate poverty of a large segment of the population. This section briefly reviews current trends in the economic and financial environment with particular reference to the housing sector.

Since the 1980s, Bangladesh has moved towards establishing a liberal market-based and private sector driven economy. Prudent macro-economic and fiscal policies have resulted in the highest foreign reserve in decades, increased GDP and a boost to the value of the taka compared to other currencies in the region. It appears that the economic turmoil in East Asia has had only a small impact on Bangladesh.

The economy has been diversifying. The agricultural sector, which provided 62% of GDP in 1975, presently accounts for roughly 30% of GDP. The services sector is the largest and fastest growing, contributing 50% of GDP and growing at a rate of 6.5% during 1996. Housing services have remained at 7% of GDP in constant prices. By far the largest export

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product is garments. The garment industry has seen an unprecedented increase during the last decade, employing an increasing proportion of the labour force, of which female workers are the majority.

Inflation has increased in recent years, but remained modest. However, in February 2008, the year-on-year rate was 8.1%, while in previous years it had declined steadily to below 5%. Housing costs have risen faster than the overall CPI.

The Government of Bangladesh has contained spending by downwards adjustment of its Annual Development Programme (ADP). Unfortunately, the efficiency and cost-effectiveness of programming and implementing the ADP is considered inadequate across sectors, including the housing sector. Allocation to the housing sector is approximately 5 to 6% of the ADP.

Access to housing finance is a critical bottleneck for the majority of the population in developing countries. The lack of available and accessible housing finance has been identified by the Government of Bangladesh as one of the important hurdles in improving housing conditions for middle- and lower-income households. Although several potential sources of housing finance for mid- and high-income consumers exist, most of the low-income families' needs are still unmet.

Different tiers of the housing market:

The residential housing sector of Bangladesh is characterised by a three-tier market. **First** are those households with the highest disposable income (less than 3% of the housing market), who are able to afford high-quality housing in fully serviced neighbourhoods, and able to utilise bank financing or specialised housing finance institutions. The **second** tier is the relatively narrow stratum of middle-income households (representing 12 to 15 % of the housing market), who are the main users of specialised housing financial institutions such as Bangladesh House Building Finance Corporation (BHBFC). This group is the major beneficiary of available public subsidies and is composed predominantly of public servants and wage/salary earners of large private companies and public sector corporations. The **third and largest** of the tiers is low-income households, for which housing is provided largely by the private sector, often under illegal and unsatisfactory site conditions.

3. Housing conditions in Bangladesh

The poor economic situation and income inequality in the country is reflected in the quality of the housing stock. It was estimated that close to half of all housing units in the country were made of temporary materials and needed replacement within a one- to five-year period. Approximately one third of all houses in urban areas were constructed outside of the formal regulatory system, mostly on land to which the homeowner does not have a formal title.

Table I shows some characteristics of the housing sector compiled from different studies conducted by the Centre for Urban Studies.

Tragically, the recent floods have destroyed more than 900,000 houses, mostly in rural areas, and another 1.3 million houses were seriously damaged. Of course, most of the houses affected were in the low-income category.

The only detailed figures on the type of housing in urban areas are available for Dhaka. Although the data are old, the situation has not changed much for the better and it is, therefore, still relevant to provide a broad picture of the urban housing conditions. The higher and middle-income groups are housed in either low-rise single-family houses, or, increasingly, in multifamily apartment buildings. The lower-income households, approximately 70% of the urban households, are housed in a variety of house types that can be described as follows:

- Approximately half of the low-income housing units are in bustees, informal settlements areas that include both private rental and private ownership housing, built on either privately owned land or illegally occupied public land.
- Conventional tenement slums (rental and owner occupied) take up another quarter of the low-income sector. Overcrowding in these buildings has increased over the last years due to an influx of rural migrants to work in the expanding garment industry.
- Other categories of low-income housing include: government-provided squatter resettlement camps, plots of land with basic services that are provided on a leasehold basis; employee housing consisting mostly of small apartments in high-rise complexes provided by the government; squatters who have built makeshift houses on illegally occupied public or private land; and pavement dwellers.

Table 1
Housing sector characteristics of Bangladesh
 2006

Total number of dwelling units:	
Bangladesh	25,020,489
Rural	18,474,566
Urban	6,545,923
Per capita floor space:	
Bangladesh	54.9 square feet
Rural	53.5 square feet
Urban	62.3 square feet
Occupancy level in 2006:	
	5.48 people/dwelling unit
Access to clean water:	
Rural	78%
Urban	42%

Source: Centre for Urban Studies.

Housing production

Suppliers of housing are the public sector, and the formal and informal private sector, including owner-households and NGOs.

Rural housing

Housing in the rural areas is mostly produced incrementally by owner households. While most owners build on their own or rented land, informal occupation and squatting are increasing in rural areas. The Grameen Bank pioneered a housing loan programme that provided basic building materials for a simple new house for which repayment could take place over a 15-year period. Other NGOs have followed this example, with shorter payment periods and a total of approximately 700,000 housing units have been constructed using microfinance facilities from the time these programmes were put in place in the 1970s.

After the Liberation, the then government inaugurated a programme to rehabilitate the poor and the homeless in a number of *Guscho Gram* (cluster villages). Later, various governments developed different programmes to support the rural landless and homeless people. Sheikh Hasina's government initiated programmes like *Asrayon* (shelter), *Gharey Phera* (return home) and *Ekti Bari Ekti Khamar* (one homestead, one farm). *Grihayan Tahbil* (housing fund), administered by the Prime Minister's Office, provides low-cost funds to NGOs and private sector developers for the construction of houses for low- to moderate-income group people.

Urban housing

Because of the scarcity and high cost of buildable land in the large urban areas, most new formal sector residential construction in Dhaka and some other large urban areas has, over the last few decades, been in the form of multifamily units. In small towns single-family units prevail.

The public sector. Several public agencies are, or have been involved in the financing and development of housing and residential infrastructure projects: the Housing and Settlement Directorate (HSD) and Public Works Department of the Ministry of Housing and Public Works; the Local Government Engineering Department of the MLGRDC; and the City Corporations of the four larger cities. Their funds come mostly from foreign aid and to a lesser extent from national revenues. Both City Corporations and the central government are developing residential subdivisions for lease to upper- and upper-middle income households, and resettlement programmes and site-and-services schemes for lower- to middle-income groups. The tenant purchase and sales projects require large down payments (25 to 30%) and a small number of annual payments. Arrears are a major problem with all government projects. In addition, it has always been difficult to reach lower-income households with the site-and-services projects and the size of the combined public housing programmes has remained extremely small in relation to housing requirements and new construction. Altogether the public sector has only produced approximately 1–2% of total urban residential land and housing requirements (not more than 6,000 units per annum) over the past few years.

Non-governmental sector. The NGO sector has only been marginally involved in urban housing. The discrepancy between urban land and house prices, and incomes of the below-median income groups has made sustainable housing solutions difficult to conceive for this income group. Recently, the larger microfinance institutions have shown an interest in entering the multifamily residential market for moderate and lower-income households. Proshika and BRAC have plans to invest in large-scale low-and moderate-income housing developments 30 to 40 km outside Dhaka. Some projects will receive free government land. The plan is to develop hostel-type rental housing for urban workers and small low-cost family apartments for tenant-purchase. The NGOs have access to international funds, which they complement by borrowing and other income sources. Their cheap sources of funds make it possible for them to make long-term investments in social housing. None of these plans, however, has been implemented as yet.

The formal private and cooperative development sector. Private developers are increasingly important players in the urban land and housing markets, particularly in the market for apartment buildings. They operate as individuals or as businesses under the Companies Act, or form a housing cooperative and jointly develop a housing project partly for owner-occupation and partly for rental or sale. Interestingly, private developers feel that the higher-income apartment market is becoming saturated and they attempt to move down-market. The most serious constraint in doing so is the lack of *mortgage financing*. Finding accessible and *affordable land* for middle-income housing construction is another challenge, particularly in Dhaka. One of the largest developers in Dhaka felt, however, that there was sufficient land available for the foreseeable future, but the lack of long-term finance for

middle-income households would prevent them from expanding a middle-income line of housing production. *Infrastructure* provision is the third main concern hindering private sector production of middle-income houses. Services and infrastructure are the responsibility of the City Corporations and priority is given to their own land developments. It can take a long time for road networks and other services to be installed in new developments.

The formal or semi-formal individual homeowner construction sector. This is by far the largest housing supply system in all but the main metropolitan areas. Households acquire land, mostly on a freehold basis, and gradually construct their house with or without official approval of plans. Only a small proportion of households access housing finance.

Informal private rental housing sector. Landowners in urban areas construct high-density, low-rise housing units for rental, without adequate services, either for individual households or for group living (mess housing).

Squatting. People building makeshift houses on public or private land, or squat in buildings.

Sources of housing financing in Bangladesh

Besides the state-owned BHBFC, other sources of housing finance currently available in Bangladesh are commercial banks, employee loans, life insurance policies, and informal means. In the rural sector, the housing cooperatives are the major providers of housing finance. Recent survey of homeowners of newly constructed houses showed that the most important source of housing finance was household savings (more than one third). Loans from relatives and friends were the second most common form of finance, followed by the sale of other parcels of land.

Besides government efforts, a large number of NGOs are providing microcredits to the poor. The enactment of the Financial Institutions Act 1993 opened the door for private housing finance companies. There are now 23 private companies that extend housing finance in Bangladesh. Prominent among them are the Delta-BRAC Housing Finance Corporation Ltd. and the National Housing Finance and Investment Ltd. These companies make loans for the construction of houses, acquisition of flats and houses, extension and improvement of existing housing, and the purchase of housing plots. Most of the private sector players, though relatively new, have nonperforming loans (NPLs) of below 1%. But their interest rates are very high compared with the nationally owned BHBFC. For example, Delta-BRAC Housing charges interest rates as high as 16%, which is higher than that of BHBFC by 1%. The contribution of microcredit lenders (such as Grameen Bank, BRAC, ASA and Proshika) in this sector is very insignificant.

In the next section, we will briefly describe public, private and private-NGO collaborated financial institutions that are engaged in real estate financing in Bangladesh.

Bangladesh House Building Finance Corporation (BHBFC)

BHBFC provides credit facilities for construction, repair and remodelling of dwelling houses and apartments in cities, towns and other urban areas. In general, priority is given to civil servants, and within that group to those with the most years of service. BHBFC offers 15–20 year mortgages to individual households at commercial interest rates that increase as the loan amount increases.

BHBFC was funded by the Bangladesh Treasury, with a cost of 5% per year, an amount well below the market rate of interest. Moreover, the corporation enjoys a number of advantages – it is exempt from tax, has much laxer capital requirements than other financial institutions in Bangladesh, and its bonds are guaranteed by the national government. But since losing its direct government funding, its volume has stagnated, and its market share of mortgage debt outstanding has dropped in recent years.

A study group in 2007 identified some inefficiency in the operation of the state-owned BHBFC. First, BHBFC approval times were exceptionally long – sometimes as much as a year from application to approval. Second, because mortgages were issued at below market rates of interest, and were essentially granted by the government, they were allocated via rationing, rather than underwriting. The allocation process was political, rather than financial. Third, because BHBFC was for many years not held to performance standards, the agency had little incentive to service loans, and so loan performance was poor. Typically, 20% of loans would be in arrears. When BHBFC did foreclose, it would typically collect less than 50% of the outstanding loan balance.

In recent years, two private housing finance companies have been registered as public limited companies. We discuss these along with some other private housing finance companies and their contributions in this sector in the next section.

Delta-BRAC Housing Finance Corporation Ltd. (DBH)

DBH is the pioneer, the largest and the specialist housing finance institution in the private sector in Bangladesh. After commencing operation in the early 1997, the company registered commendable growth in creating home ownership among more than 7,500 families in Dhaka and other major cities of the country. At the same time, the company played an active role in promoting the real estate sector to broad cross sections of prospective clients who had an unfulfilled dream of owning a good home. Mortgage loans have a maximum term of 15 years and are discretionary adjustable-rate mortgages. The present rate is 16.5%. For owner-occupied properties, monthly payments cannot exceed 30% of household income and in higher risk cases, third-party guarantees are required.

National Housing Finance and Investment Ltd. (NHFIL)

NHFIL, a private sector housing finance company, provides loans for construction of houses, purchase of flats or houses, extension and improvement of existing houses or flats, and purchase of housing plots. Up to 30 June 2008, the NHFIL provided a total amount of term loans of BDT 5545 million.

The banking sector

Until recently, mortgage lending was never considered quite profitable for commercial banks, so that they imposed serious kinds of restrictions upon their mortgage business, in terms of both individual mortgages and size of mortgage portfolio. Only recently, some commercial banks, both public and private, specialised banks along with other financial institutions, invested a considerable proportion of their combined assets in housing.

The total housing related advances of the country's banking sector in 2007 was approximately BDT 24 billion, about two thirds of which was made up by the NCBs. The housing loans by the banking sector amounted to only 4% of their assets. The private banks have the largest proportion of housing-related assets (9%), and foreign banks have the least involvement in the sector (2%).

Table 2

**Percentage of outstanding housing sector advances
of different types of banks**

	2006	2005	2004	2003	2002	2001	2000
NCBs	41.17	45.35	50.26	53.97	62.75	59.56	62.87
SBs	3.01	2.98	2.57	0.87	2.21	3.27	2.87
FCBs	0.98	0.69	0.56	0.60	0.44	1.23	3.61
PCBs	54.84	50.98	46.61	44.56	34.6	35.94	30.65

Over the years, major problems in loan recovery began to plague the housing portfolios and the banks gradually decreased the proportion of advances for housing. The recovery rate of housing sector loans in the banking sector averages approximately 70%. The poor recovery rate is due mostly to older loans; recovery exceeds 80% on loans disbursed after 1990. Even the rural house lending programme sponsored by the government, through a 3% refinancing window at the Bangladesh Bank, was stopped because of alleged poor recovery rates.

Table 3

**Outstanding housing sector advances
with interest in billion taka – all banks¹**

	2006	2005	2004	2003	2002	2001	2000
Housing societies	14.52	13.00	10.64	11.83	8.98	3.26	2.19
Urban housing	43.47	40.19	36.33	29.94	30.18	22.91	22.37
Rural housing	1.66	1.08	1.14	1.47	1.79	1.66	1.63
Apartment housing renovation	2.26	–	–	–	–	–	–

¹ All banks include nationalised commercial banks (NCBs), foreign commercial banks (FCBs), specialised banks (SBs), and private commercial banks (PCBs) in Bangladesh.

Source: Scheduled Banks Statistics, Bangladesh Bank

From the above data, it is clear that NCBs were reluctant to extend lending to the housing sector. A number of NCBs only consider housing loans for clients that have other businesses with them and have the income and assets to support these loans. There is not much competition in the housing lending market and most banks offer the same terms for the different client options. All loans are for new house construction only, and banks only lend for urban housing in secure submarkets, which can easily be understood from the table above. Clearly there is an upward trend of contribution in housing societies and urban housing. The contribution towards rural housing is only boosted when the government takes initiatives like *Grihayan Tahbil* (housing fund) or extends credit to the commercial banks at lower interest rate. Only recently have commercial banks started extending credits for apartment renovation.

Housing cooperatives and credit unions

Although the cooperative movement is widespread in Bangladesh, particularly in the agricultural sector, it has not played a significant role in housing financing. Of the 145,000 cooperative societies in Bangladesh, only 144 are housing cooperatives.

4. Main challenges in expanding the formal housing finance system

There are several constraints that hamper the expansion of formal housing finance system in Bangladesh. They are:

Distortions in the savings rates and resource mobilisation

High interest rates offered by various government savings plans compared to that of private deposit taking institutions distort the financial system, which makes it difficult for private sector institutions to raise household funds.

Interest rate subsidies

Interest rate subsidies have some drawbacks apart from suppressing private mortgage market development, such as (1) a below-market interest subsidy encourages people to borrow as much as possible and repay their loans as slowly as possible; (2) the subsidies increase with inflation when interest rates go up, a poor link for subsidisation; and (3) the subsidies are not transparent.

Subsidy targeting

The government subsidises housing for middle- and upper-income households and a scattering of low-income households through BHBFC. The targeting of the existing interest rate subsidy system is inefficient. Subsidised loans are presently provided to those who could participate in the private market without assistance. BHBFC's sole objective is to provide credit facilities for construction, repair and remodelling of dwelling houses and apartments in cities, towns and other urban areas. So if any subsidy programmes are devised, only the city dwellers or government officials benefit.

Risks, affordability and mortgage instruments

There are only a few different mortgage instruments such as fixed rate mortgage (FRM), graduated payment mortgage (GPM) to address the perceived risks in mortgage lending or to make mortgage finance more affordable to middle-income households.

5. Alternative housing finance system

In recent years, as an alternative to the existing formal financing system, housing microfinance system has evolved. In addition to Grameen Bank, several other microfinance institutions (MFIs), such as Proshika, BRAC, and ASA now provide long- and short-term credit for housing in Bangladesh. Loans are made on the basis of established membership in lending programmes instead of collateral and a sound track record of repayments on previous loans. Group pressure and mutual support are used as guarantees for loan repayment. There is no recourse by the financial institution in the case of non-payment other

than the persuasive and legal ways to recover the loan and future exclusion of the borrower from the credit programme.

In the next section, we discuss the contribution of the largest MFIs in housing loan programmes.

Grameen Bank

Grameen Bank introduced the “*Moderate Housing Loan*” programme in 1984 with a current loan maximum of BDT 25,000. After the floods of 1987, the Bank introduced a “*Basic Housing Loan*”, which presently has a loan maximum of BDT 12,000. It targets the poorest rural households, similarly to income-generating credit. This programme has remained the most popular among its target population. There is also a loan programme for the purchase of small parcels of land and one for the repair of houses. The ratio of basic housing loans to original moderate housing loans is approximately 7:1. Besides these, another kind of housing loan called “Pre-Basic Housing (PBH)” loan amounting BDT 7,500 to 8,500 has been introduced to meet the demand of house dwellers in the northern part of the country. The interest rate of housing loans is 8% per annum.

The housing loan, like the other Grameen Bank loans, are provided without collateral, but the borrower must have a title to the land, must sign an individual pledge that includes a repayment obligation, and must obtain a pledge from all members of the group or centre, which commits them to repayment in case the borrower fails to do so. Repayment is made in weekly instalments, beginning five weeks after the start of construction of the house. The repayment period is calculated on the basis of repaying BDT 1,000 per year, which is the standard loan repayment for other loans by the Grameen Bank. There is a maximum repayment period of 10 years, but faster repayment is encouraged. To date the loan repayments have been excellent. As of September 1999, a total amount of BDT 7420.62 million (USD 185.09 million) have been disbursed as housing loans for 510,310 houses. The average loan size was about BDT 13,847 (only USD 277).

Proshika

Proshika started a housing programme for rural areas in 1988 and has provided assistance for the construction of more than 30,000 houses to date. Proshika’s housing loans are based within the group and the group selects the member most deserving of a housing loan under strict allocation rules; ie only three housing loans per year per group, housing loans can only be provided to groups that have been in existence for at least three years. Only those that have a loan for income-generating activities are eligible for a housing loan, in order to ensure repayment capacity.

BRAC

BRAC’s housing loans programme started just after the flood of 1988 and focused on the same rural poverty group. Only members who have successfully repaid an income-generation loan and have saved an amount equivalent to the monthly repayments for a housing loan are eligible for this loan.

BRAC is considering establishing a moderate-income rural housing loan programme with loans of up to BDT 20,000. It is also concerned about moving into this market in view of the massive defaults that plagued the housing portfolio of the Grameen Bank after the recent floods.

ASA

ASA started a rural housing credit programme in 1989–90. ASA's management considers housing loans to the lowest income group not feasible and intends to target the rural middle-class farmers for lending activity. Interestingly, a sizable group of borrowers (close to 15%) use part of the income-generating loans they receive for other purposes such as the improvement of their homes, even though that is explicitly forbidden. This is an indication that the demand for housing loans is large.

6. Policy challenges

The Housing Finance Group of the IFC has identified numerous challenges that must be overcome if the housing finance sector is to fulfil its objective of increasing the availability and affordability of residential housing in developing countries.

In the following section, we address the above issues one by one in more detail.

1. If the housing problems are to be addressed more effectively, housing policies, and especially financing issues, must be taken into consideration. Stronger, more effective enabling strategies must be developed by the public sector to allow housing markets for the various tiers to leverage the activities of the private sector.
2. The objectives of the subsidy scheme should be to assist those who do not qualify for a formal sector mortgage loan, thereby increasing the number of middle-income households that can avail themselves of housing finance. However, we need to keep in mind that subsidised funding for state-owned housing finance entities creates distortions in the market and it should be stopped. Fortunately, for the last few years, BHBFC could not avail itself of any subsidised funding through the government or government guaranteed debt.
3. Real estate loan recovery rate in the public sector is very low and well below that of the commercial banks. In the past a rural house lending programme, sponsored by the government through a 3% refinancing window at the Bangladesh Bank, was stopped because of alleged poor recovery rates. Over the years, major problems in loan recovery began to plague the housing portfolios and the banks gradually decreased the proportion of advances for housing.
4. In order to develop a primary mortgage market, financial assistance to different market players (eg banks extending housing loans, specialised housing finance originators) through equity participation, loans, credit lines and warehouse lines is needed.
5. National housing finance systems have failed to prove themselves competitive in mobilising and allocating capital efficiently. BHBFC has made only very limited progress in becoming self-sustained or in reaching lower-income households.
6. Age-old Insurance and Trust Acts are not facilitating lending by long-term investors in the housing sector. Sometimes developers are accused of not properly following the procedures for borrowing money from financial organisations. The involvement of all three parties (the developer, the landowner from whom the land was leased, and the apartment buyer) in the process makes the borrowing cumbersome.
7. However, it is evident that, over the last two government periods, most of the government-built houses were for the upper-grade government employees and political leaders, rather than lower-income government employees or poor people in general.

8. There are no incentives to promote the primary mortgage market and to establish a secondary mortgage market to provide alternative funding mechanisms to the primary lenders.

7. Analysis and main recommendations

7.1 Summary of main issues

One of the main determinants of housing affordability is the cost and availability of housing credit, both short-term construction credit and long-term mortgage credit. Urban housing, which is more expensive than rural housing because of land costs and higher building standards, and is increasingly dominated by multifamily housing, is particularly affected by the availability of credit. With the current high urbanisation rates in Bangladesh, the need for urban lower-middle and low-income housing is enormous and this drives the need for improvements in the housing finance system. Without upfront finance for house construction or purchase, delivery of formal sector housing, even to middle-income households, becomes impossible. In rural areas and informal urban areas, small non-collateralised loans for house construction or improvement can facilitate the improvement of housing conditions.

The present housing finance system in Bangladesh is extremely small and highly segmented:

- Formal mortgage finance is available only to households with incomes above BDT 25,000 per month (well above the 10th percentile of the urban income distribution) and is restricted to selected housing submarkets in Dhaka. Within this section of the market, government-subsidised housing finance through the BHBFC is most prevalent, while the NCBs are decreasing their housing loan portfolios. Recently, new private housing finance institutions have started to operate in this market.
- Non-collateralised credit for house construction by MFIs is available to only a small proportion of poor rural households that have participated in income-generation credit programmes.

7.2 Downward-market expansion of formal mortgage lending

The formal housing and housing finance sectors are in a state of transition. There is presently some tension between movements in the property market for space and the responsiveness of the asset market driven by developers.

Government-funded housing credit will remain limited and the weak financial position of the NCBs will prevent an increase of housing finance through those institutions. The expansion of the sector has to come through new private sector mortgage lenders. With existing capital constraints in the financial sector, the competition by government savings and lending institutions and the weak debt market, new HFIs face a challenge in mobilising funds and it is unlikely that the cost of longer-term funds will come down in the short term. In addition, the housing finance sector has to show that it can be a profitable investment sector with long-term potential. This is the dilemma faced by DHB and other new housing finance companies. When more technically and financially strong HFIs enter this sector, these should be transitional problems. With the right support and policy changes, the private development and housing finance sector could move down-market to serve a much larger proportion of middle-income households. In turn this will alleviate the pressure on lower-income housing. Several reforms and innovations could be considered and discussed.

Expanding financial resources available to the private housing finance sector.

- ***Changes in the trust laws and Insurance Act*** in order to allow long-term investors to participate more freely in the housing finance sector.
- ***Assistance in the development of a debt market*** that would facilitate the link between housing finance institutions and long-term investors. The World Bank is launching a project to support non-bank financial institutions through the establishment of a credit, bridge and standby facility and the development of debt and equity markets. While HFIs are excluded from participating in the first round of the project because of their short track record and specialised nature, it would be critical to include them in a later phase.
- ***Enforcement of the rules guiding participation in the Government of Bangladesh's special savings schemes*** to those lower-income individuals for whom these were intended.
- ***Encouragement to the larger and professionally run MFIs to set up banks or non-bank financial institutions*** in order to create a more vigorous domestic financial sector environment that can provide support for the emerging housing finance sector and its move towards middle-income lending. Encouragement of joint ventures between MFIs and new HFIs, as is the case in the new DBH.
- ***Stimulation of foreign investment in, and foreign lending and guarantees to the new HFIs*** by carefully selected parties (eg IFC, FMO, HDFC), to strengthen both technical ability and financial stability. In particular, arrangements are needed to deal with the foreign exchange risk of potential investors.

Levelling the housing finance playing field.

- ***Deciding on the role of BHBFC and detailing an implementation strategy.*** If it is perceived that it is unlikely for BHBFC to change to an efficient and innovative middle and lower-income mortgage lender, its borrowing / debt-raising privileges could be adjusted in order to discourage competition with the newly developing private HFIs for the same customers.

Increasing access to formal mortgage finance by middle-income households

- ***Discussion of introducing alternative subsidy instruments for presently under-served lower and middle-income households in specific housing markets*** that will not distort private mortgage market development and can be utilised by all mortgage lenders, public and private. These would replace BHBFC subsidised funds and public servant-subsidised government lending schemes.
- ***Decreasing the administrative costs related to mortgage lending.*** Presently, the administrative requirements and costs related to the construction and mortgaging of a house are considerable and have been identified by REHAB as an unnecessary hurdle to acquisition of a house.

Improving the efficiency of the primary mortgage market

- ***Training in state-of-the-art mortgage lending and servicing operations for those actively involved in changing the mortgage industry in the country.*** There are presently few professionals in Bangladesh with detailed knowledge of mortgage design, specific risk management issues related to mortgage lending and loan underwriting, and processing and servicing procedures necessary to establish a healthy mortgage sector.

- **Improving the regulatory system for new HFIs**, which is now divided between various agencies, none of which have experience with mortgage lending operations and risks.

7.3 Expanding access to microfinance for housing in urban and rural areas

Improving the sustainability of microfinance housing programmes

- **Limiting cross-subsidisation of housing loans.** If housing lending is to be extended to a variety of rural income groups and to urban lower-income households, it cannot depend on internal cross-subsidisation, which increases the cost of microcredit and will, by necessity, limit the scale of the housing programmes. It is, therefore, timely to consider separating longer-term housing finance in MFIs from the general microfinance portfolio, both in terms of sources of funds and as a credit programme with its own types of lending terms, conditions and break-even requirements.
- **Targeting borrower groups that can afford longer-term loans.** A second consideration to make housing credit programmes more sustainable is to target households that have already established a solid income base through previous income-generating credit programmes or microfinance loans.
- **Requiring savings accounts.** Carefully crafted income and employment requirements ought to guide the loan underwriting process. In addition, a more stringent savings requirement could be built into the housing loan package, not only for upfront payment for part of the house, but also as a savings account that would be accessible in case of possible delinquency.
- **Assessing housing quality and location for disaster vulnerability.** Housing loan programmes could analyse more carefully the minimum quality of housing required to withstand flooding or cyclones. Similarly, the location of funded houses should minimise the risk of the house's being damaged.

Extending microfinance for housing to urban households

- **Extending housing rehabilitation and extension options in housing credit programmes.** A housing improvement loan programme for owners of informal housing may be a starting point for the extension of microcredit to urban households, for example, in conjunction with existing services improvement projects (UNICEF) in bustees.
- **Analysing lending options for new urban lower-income housing.** Given that the cost of land is the main constraint for urban housing programmes, a possible collaboration with local government land allocation and development programmes may be explored. In addition, NGOs / MFIs could experiment with joint land ownership forms for low-income housing projects, where credit for ownership housing is provided for the unit only, but the land remains the ownership of the group.
- **Establishing more professional micro and mortgage lending programmes for housing.** Moving towards urban lending programmes for new house construction for lower-income households will require MFIs to develop a different set of underwriting criteria, equity and savings arrangements and interest rate structures based on the actual risks to which they are exposed. Subsidies may have to shift more towards land cost than the cost of finance.

Creating a funding and monitoring window for microfinance for housing through PKSF:

Expanding and professionalising the housing loan programmes by interested MFIs will require a more reliable source of finance earmarked for housing; an apex housing fund for low-income housing lending.

8. Conclusion

In conclusion it can be said that the formal mortgage market can expand its lending operations to middle-income households by improving efficiency, mobilising additional resources for housing lending from long-term investors, and redirecting present mortgage subsidies tied to government programmes and institutions towards demand-oriented programmes that can be implemented through the public and private mortgage lending sector. At the same time, non-collateralised housing credit can be expanded by the professional MFIs through increasing access to funds earmarked for housing, reducing the need to provide internal cross-subsidies for housing loans, broadening the target population to rural entrepreneurs and urban lower-income households in specific geographic locations, and developing more varied and professional housing finance products. The combination of these two approaches has the potential to increase access to housing credit and finance for low and moderate-income households dramatically, with related improvements in the quality of housing in Bangladesh.

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EU housing statistics

Martin Eiglsperger and Wim Haine¹

At the Fourth ECB Conference on Statistics, the President of the ECB, Jean-Claude Trichet, said that "... the ECB has the following high-priority requirements concerning the euro area statistics compiled by Eurostat and the NSIs [National Statistical Institutes]: 1. more comprehensive and timely statistics on ... housing markets ..."²

This paper provides information on the progress achieved by the European System of Central Banks (ESCB) in the field of (non-financial) EU housing statistics. In 2003 the ESCB Working Group on General Economic Statistics started contributing to the improvement of housing market indicators for ESCB analysis. Most of the indicators concerned – residential property prices, several structural housing indicators, and housing wealth – are not covered under any EU statistical regulation, and ***the collection of non-harmonised statistics from the ESCB Working Group on General Economic Statistics and the subsequent compilation of euro area and EU aggregates has filled important gaps.***

Non-harmonised national headline indicators for ***residential property prices*** are collected from all EU countries; semiannual estimates for the euro area are derived and published by the ECB. Conceptually, there are large differences between the national data. A major step forward can be expected in the medium term as a result of Eurostat's project on dwelling price statistics. Until then, the most important data shortcomings concern the infrequency of the data for Germany and Italy, and gaps in the coverage of the housing market in several national indicators.

As regards ***structural housing indicators*** (eg number of dwellings, housing completions and owner-occupancy rates), a set of statistics is collected by the ***ESCB Working Group on General Economic Statistics*** and has been used in ECB publications. Improvements to the coverage and timeliness of the data requires the use of non-official sources and increased use of estimations by national central banks and the ECB.

In the last two years the ECB has compiled and published euro area estimates for ***housing capital stock and households' housing wealth***, derived from data available from national statistical institutes and, for household wealth, national central banks. Although these estimates are surrounded by more uncertainty than other euro area statistics, simulations have shown the data to be sufficiently robust, in particular as regards growth rates. Desirable improvements concern national data availability (ie for countries for which currently no information is available other than housing investment data). Furthermore, the forthcoming new data on the value of the dwelling stock (excluding land) owned by households, as required by the revised ESA95 Transmission Programme, will be used to improve the estimates. Finally, the ECB's DG Statistics aims to integrate the experimental capital stock and wealth estimates into the euro area accounts.

¹ European Central Bank. Comments were provided by Werner Bier, Daniela Schackis and Richard Walton. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the European Central Bank.

² Trichet, J-C: "A strategic vision on euro area statistics: the ECB's view", speech given at the Fourth ECB Conference on Statistics, Frankfurt am Main, 24–25 April 2008 (<http://www.ecb.europa.eu/press/key/date/2008/html/sp080424.en.html>).

1. Background

In recent years, the analysis of euro area and EU housing markets has intensified and so has the demand for high-quality statistics on national, euro area and EU housing market supply and demand conditions, in particular changes in residential property prices over time. The quality of available non-financial statistics on housing markets is still far from satisfactory and the ECB is working with national central banks to improve availability and comparability globally. Since 2003, the ESCB Working Group on General Economic Statistics and the ECB's DG Statistics has contributed to improving housing market indicators for ESCB analysis. As most of the indicators are not covered by EU statistical regulations, the collection of non-harmonised statistics from national central banks and the compilation of euro area and EU aggregates by the ECB's DG Statistics contribute to filling an important gap, at least partly. This paper reports about the availability and the statistical quality of data on residential property prices (Chapter 2), structural housing indicators (Chapter 3) and housing wealth (Chapter 4).

2. Residential property price indicators

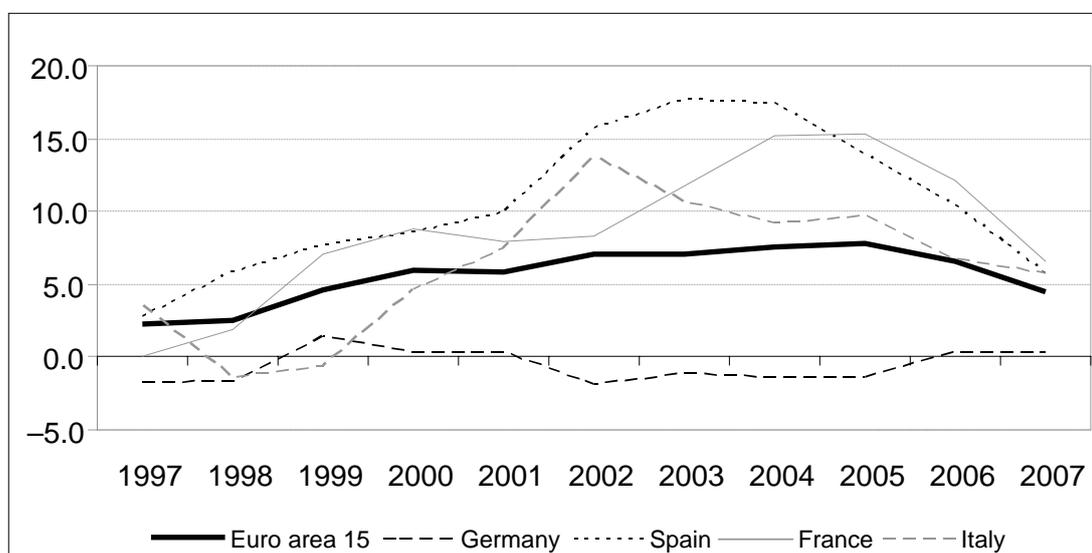
Official residential property price statistics, compiled by national statistical institutes, are lacking in several EU countries. In recent years the ECB expanded its regular collection of available non-harmonised indicators for changes in residential property prices from national sources, in cooperation with the EU national central banks, which are in several cases also the source of the data. The data for the euro area are published in the ECB Monthly Bulletin and can be downloaded from the ECB website.³ Non-confidential data for euro area countries are provided on request. Comprehensive metadata have been established in order to facilitate the use and comparison of these non-harmonised data. An overview of the available annual indicators for the EU 27 countries is included in Annex 1.

Euro area countries

Residential property price indicators are available for all euro area countries, but differ in terms of coverage of geographical area and types of dwellings (new and existing, houses and flats) as well as in the way price changes are controlled for changes of dwelling characteristics. Data for Germany, Cyprus and Luxembourg are reported only at an annual frequency. For Italy semiannual figures are compiled; in addition an experimental quarterly series has been provided by the Bank of Italy. For other countries, residential property price indicators are published quarterly or even monthly (the Netherlands, Portugal). The following chart compares the rates of change in residential property prices in Germany, Spain, France and Italy with the average growth rate for the euro area.

³ See <http://sdw.ecb.europa.eu/>.

Chart 1
**Residential property prices in Germany, Spain, France,
 Italy and the euro area**
 Annual percentage change



Source: National central banks and ECB calculations.

Other EU countries

Residential property price indicators are available for all non-euro area EU countries. The statistical quality varies even more than for the euro area countries. The price indices for Denmark, Sweden and the UK⁴ are well established and available quarterly or monthly (UK). For most of the new Member States, residential property price indicators have been made available only recently, mostly by the national statistical institutes. Furthermore, data for Romania are internal estimates by National Bank of Romania. Aggregated price data typically do not represent the complete national market. Indicators for Bulgaria, Estonia, Hungary and Romania refer to prices collected in the capital cities or in major cities. Available price indicators for Bulgaria, the Czech Republic, Estonia, Latvia, Hungary, Romania and Slovakia cover existing dwellings, mainly or exclusively flats. Most indicators are average prices per square metre of typical units. The statistical shortcomings of these series may be significant, in particular in view of the generally large quality differences between old and new dwellings, and between dwellings in different locations or regions. These indicators must therefore be used with caution.

Euro area aggregates

The ECB's DG Statistics compiles a euro area residential property price indicator from country data. The euro area index is a weighted average of the year-on-year rates of change of the national indicators, weighted together with GDP shares of a constant weight reference year. For the euro area, annual aggregate back data have been estimated for 1982–95,

⁴ For the UK several house price indices exist, referring to different data sources and applying different statistical concepts. (See, eg <http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/housingmarket/publications/communities-local/house-price-index/>.)

using alternative sources for those larger euro area countries whose headline indicators started only in the 1990s.

In October 2004, ECB's DG Statistics compiled for the first time semiannual estimates of the euro area residential property price indicator. Annual data for Germany and Luxembourg have been interpolated. A first estimate for the first half of the year is compiled around the end of the same year. First results for the second half of the year, and the year as a whole, are released in April of the following year. Generally, euro area residential property price indices are revisable, reflecting increased country coverage or revisions in some country indicators, which may also affect the back data.

Future developments

Looking ahead, Eurostat's pilot work on an HICP-based price index for the acquisition of owner-occupied dwellings is expected to also provide a new and harmonised euro area dwelling price index. Twelve EU Member States participated in the second stage of the pilot study, which finalised its work mid-2007. The pilot countries developed experimental price indices for the acquisition of residential dwellings. In the third and final stage of this pilot work, which started in the second half of 2008, the statistical quality of these indices will be further improved. In addition, it is planned that all EU Member States contribute to the development of price indices for dwelling purchases. Final results are expected by end-2009. However, given that many countries need to implement entirely new statistics and surveys in this field, it is as yet uncertain whether regular production can be achieved without a legal basis. Discussions on such a regulation have started, but it may take some time before it is implemented. Residential property prices have been proposed as addition to the list of Principal European Economic Indicators (PEEIs).

Improvements have been made, in the country coverage of the ECB data collection and semiannual releases of euro area aggregates. Major remaining caveats concern the differences between the statistical sources and methods used, and the infrequency of the data for Germany and Italy. Given that it may take some time before Eurostat regularly compiles harmonised quarterly dwelling price indices for the euro area and the EU, the ESCB Working Group on General Economic Statistics will continue its work in this field.

3. Structural indicators on housing

In 2003, the ESCB agreed on a set of six structural housing indicators, which were to be based on non-harmonised national definitions. The ESCB Working Group on General Economic Statistics collects annual data on the number of private households, the number of dwellings, vacancy rate, housing completions, housing transactions, and the type of tenure (owner-occupied and rented). The targeted timeliness is 18 months. However, since information on several of these indicators is collected in household surveys, meeting this target requires estimations. Reliable estimates are not always available, in particular for most recent periods. Therefore, it is challenging to produce complete and aggregate data sets for the euro area and the EU.

Calculation of European aggregates

The ECB's DG Statistics compiles results for the euro area and the EU. Gaps in the national data are filled by estimates conducted by the national central banks or the ECB. Annex 2 presents available information for the euro area. Euro area aggregates for the number of households, the number of dwellings, the vacancy rate, housing transactions, and the shares of rented and owner-occupied accommodations are available only until 2005.

Future developments

It is expected that the data collection on Structural Housing Indicators will continue over the next years. It is unlikely that data will become available from other European sources in the near future. Important exceptions are statistics on house sales, which have been proposed to the list of PEEIs. The ESCB will undertake further efforts to improve timeliness and to fill existing gaps in the reporting.

4. Euro area households' housing wealth

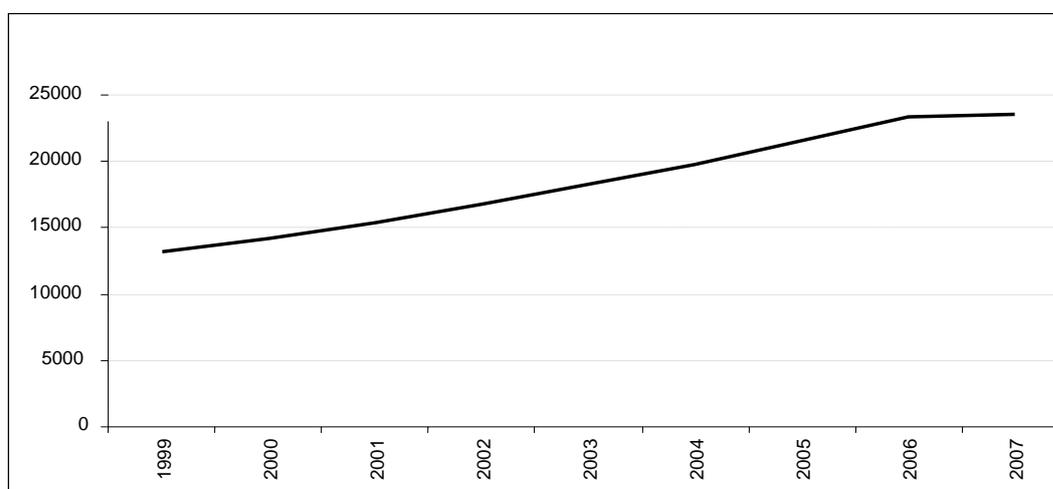
Housing capital stock is defined as the value of residential dwellings (excluding land) in use. Households' housing wealth covers the value of all residential dwellings, including the value of the underlying land, owned by households. The latter, in particular, is important for ECB analysis as housing wealth accounts for a large part of the total wealth held by households and can have significant effects on households' consumption, investment, saving and portfolio decisions. In the absence of official euro area aggregates, the ECB has compiled estimates for the euro area capital stock (including a breakdown by main asset types, of which housing) and the households' housing wealth. First estimates were published in 2005 and 2006, respectively.⁵ Euro area results are estimated using available national estimates by national statistical institutes' and national central banks' sources (covering about 80% of the euro area), and ECB estimates for missing data. These indicators – unlike the statistics on residential property prices and structural housing indicators – do not have yet a complete country breakdown.

Results

Chart 2 shows that euro area households' housing wealth is estimated to have increased from EUR 13,211 billion in 1999 to EUR 24,232 billion in 2006, with an average nominal growth rate of 9% p.a. Based on the development of the euro area residential property price index, the value of euro area households' housing wealth can be expected to have remained unchanged in 2007. The share of housing wealth in households' net worth (ie housing wealth plus financial assets minus liabilities) has increased from approximately 59% in 1999 to 68% in 2006 and 2007. Chart 3 shows households' net worth in the euro area (as a percentage of gross disposable income).

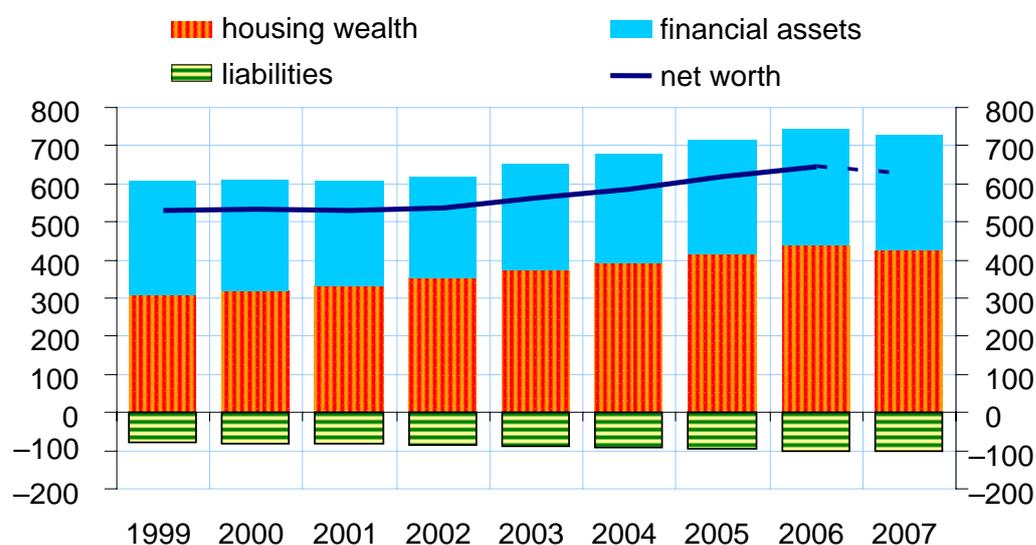
⁵ The euro area data are published on the ECB website, and have been introduced in the ECB Monthly Bulletin. See "Estimates of euro area capital stock", Box 4, *ECB Monthly Bulletin*, May 2006; and "Estimates of housing wealth for households in the euro area", Box 5, *ECB Monthly Bulletin*, December 2006.

Chart 2
Households' housing wealth in the euro area
 In billions of euros



ECB calculations.

Chart 3
Households' net worth in the euro area
 Percentage of gross disposable income



ECB calculations.

Future developments

The ECB's estimates for euro area capital stock and households' housing wealth help to close a data gap with regard to economic and financial analysis and projections. The experimental estimates are subject to a higher degree of uncertainty than most other euro area statistics. In particular this holds for households' housing wealth statistics, which include implicit estimates for the value of the land on which the dwellings have been built. Nevertheless, a sensitivity analysis has confirmed that the experimental estimates are sufficiently robust, in particular as regards development over time. Data quality is expected to

improve over time as more and better estimates will become available at the national level. In particular the revised ESA95 Transmission Programme requires national statistical institutes to provide estimates on the housing stock owned by households, and to transmit other detailed estimates on non-financial assets by institutional sector.

Finally, the ECB's DG Statistics is currently working on a project that aims to integrate the existing capital stock and households' housing wealth estimates in the framework of the euro area accounts by institutional sector.

**Annex 1:
Residential property prices for EU countries,
annual percentage change⁶**

	Belgium	Germany	Ireland	Greece	Spain	Italy	France
	New and existing houses: whole country	New and existing houses and flats: whole country	New and existing houses and flats: whole country	New and existing houses and flats: whole country	New and existing houses and flats: whole country	New and existing houses and flats: whole country	Existing houses and flats: whole country
1996	4.5	-1.1	-	9.9	1.4	2.4	-
1997	3.6	-1.9	-	8.2	2.8	3.4	0.1
1998	6.7	-1.6	22.6	14.4	5.8	-1.4	1.9
1999	7.8	1.4	22.5	8.9	7.7	0.8	7.1
2000	7.1	0.2	20.5	10.6	8.6	3.9	8.8
2001	6.2	0.2	14.0	14.4	9.9	6.0	7.9
2002	7.8	-1.9	6.1	13.9	15.7	12.6	8.3
2003	7.1	-1.2	14.3	5.4	17.6	7.2	11.7
2004	12.0	-1.4	11.5	2.3	17.4	7.0	15.2
2005	16.7	-1.5	7.2	10.9	13.9	8.6	15.3
2006	11.1	0.3	13.4	12.2	10.4	5.8	12.1
2007	9.2	0.3	0.9	.	5.8	5.0	6.6

	Luxembourg	Malta	Netherlands	Austria	Portugal	Finland	Euro area
	New and existing houses and flats: whole country	New and existing houses and flats: whole country	Existing houses and flats: whole country	New and existing houses and flats: whole country	New and existing houses and flats: whole country	Existing houses and flats: whole country	New and existing houses and flats: whole euro area
1996	4.0	8.8	10.8	0.4	1.7	-	2.0
1997	3.6	8.5	12.0	0.8	3.6	-	2.3
1998	3.6	4.9	10.9	-5.0	4.5	-	2.5
1999	6.4	3.2	16.3	-1.9	9.0	-	4.9
2000	7.3	8.4	18.2	-1.2	7.7	-	6.0
2001	11.4	5.0	11.1	2.2	5.4	-0.5	5.5
2002	10.8	8.7	6.4	0.2	0.6	7.4	6.8
2003	11.5	13.3	3.6	0.3	1.1	6.3	6.4
2004	14.0	20.3	4.3	-2.2	0.6	7.3	7.2
2005	11.7	9.8	3.9	5.1	2.3	6.1	7.6
2006	.	3.5	4.6	4.0	2.1	7.4	6.4
2007	.	1.1	4.2	4.1	1.3	5.9	4.3

For note and source, see the end of the table.

⁶ Data for Cyprus, Romania and Slovenia are confidential.

Annex 1:
Residential property prices for EU countries,
annual percentage change⁷ (cont)

	Bulgaria	Czech Republic	Denmark	Estonia	Latvia	Lithuania
	Existing flats: large cities	Existing houses and flats: whole country	New and existing houses: whole country	Existing flats: capital city	Existing flats: whole country	New and existing houses and flats: whole country
2000	–	13.5	6.5	1.6	–	–9.7
2001	0.3	9.5	5.8	34.3	–	23.8
2002	1.8	13.1	3.6	29.5	–	9.5
2003	12.2	11.4	3.2	12.9	2.7	18.1
2004	47.6	–0.8	8.9	27.8	2.3	9.9
2005	36.6	–0.6	17.6	31.0	20.0	51.7
2006	14.7	0.8	21.6	51.7	159.3	39.2
2007	28.9	.	4.6	10.1	45.1	33.5

	Hungary	Poland	Slovakia	Sweden	United Kingdom
	Existing houses and flats: capital city	New and existing flats: whole country	Existing houses and flats: whole country	Existing houses and flats: whole country	New and existing houses and flats: whole country
2000	–	–	–	11.2	9.8
2001	–	–	–	7.9	8.5
2002	–	–	–	6.3	17.4
2003	10.9	–	39.6	6.6	22.4
2004	9.1	–6.1	15.4	9.3	18.3
2005	0.8	20.0	–10.3	9.0	5.7
2006	–0.8	3.8	16.8	12.2	8.3
2007	1.6	.	23.9	10.4	9.4

Gaps in the euro area countries' back data have been filled by referring to other indicators or estimates.

Source: National central banks and ECB calculations.

⁷ Data for Cyprus, Romania and Slovenia are confidential.

**Annex 2:
Structural indicators of the housing
market in the euro area 12**

	1. Number of private households ¹	2. Number of dwellings ²	3. Vacancy rate ³	4. Number of housing comple- tions ⁴	5. Number of housing transac- tions ⁵	6. Type of tenure	
						6.1 Rented accom- modation ⁶	6.2 Owner- occupied ⁶
Unit	1,000,000	1,000,000	%	1,000	1,000	%	%
1990	102.2	127.9					
1991	111.4	129.2		1,508		38.1	58.2
1992	113.0	130.7		1,502		38.2	58.1
1993	114.6	132.1	11.4	1,583		38.1	58.1
1994	116.0	133.6	11.6	1,750		38.5	58.2
1995	117.0	135.2	11.8	1,787		38.1	58.6
1996	118.0	136.9	11.9	1,809		37.8	59.0
1997	119.1	138.7	12.1	1,663		37.3	59.6
1998	120.2	140.4	11.8	1,709	2,982	36.9	59.9
1999	121.5	142.2	11.8	1,755	3,121	36.3	60.8
2000	123.0	144.0	11.8	1,758	3,034	35.9	61.3
2001	124.5	145.9	11.8	1,771	2,978	35.7	59.3
2002	127.0	147.7	10.1	1,792	3,235	35.8	61.5
2003	128.7	149.6	10.6	1,746	3,254	35.4	61.8
2004	130.6	151.5	10.6	1,761	3,742	35.2	62.0
2005	132.0	152.7	10.5	1,880	3,846	36.1	60.9

Notes: Based on partially non-harmonised national data which are broadly in line with commonly agreed target definitions. Euro area aggregates are shown if a country coverage of at least 80% has been achieved; national data are sometimes estimates.

¹ Close to the ESA definition, ie "small groups of persons who share living accommodation and pool some/all of their income to consume goods and services, mainly housing and food" (ESA 2.75). ² Buildings that are used entirely or primarily as residence; includes all buildings, whether they are occupied or not. Partly includes secondary and tourist accommodation. ³ Share of vacant dwellings, ie not occupied or let by owners, in the stock of all dwellings. Partly includes secondary and tourist accommodation. ⁴ Number of housing completions during the period. ⁵ Number of transactions of dwellings during the period. Makes use of a variety of national data sources. ⁶ Shares of rented and owner-occupied accommodation do not add up to 100% as other types of tenure are excluded (eg accommodation let free of charge).

Sources: ECB calculations based on national data.

Session 3

Keeping track of securitisation

Chair: Steven Keuning, European Central Bank

Papers: How to measure credit risk transfer in the EU
Paolo Poloni and Julien Reynaud, European Central Bank

Experience with the collection and publication of data on structured products in Switzerland
Jürg Bärlocher, Swiss National Bank

Popular and controversial banking products for households in Norway
Gunnar Almklov, Statistics Norway

How to measure credit risk transfer in the EU

Paolo Poloni and Julien Reynaud¹

1. Introduction

“The recent financial turmoil highlights the impact of globalisation on the various areas of competence of central banks. It also illustrates the trade-off between the statistical response burden of reporting agents and a lack of consistent information to analyse the current economic and financial situation. In particular, there is a lack of sufficiently harmonised statistics to accurately measure the allocation of credit risk within the economy and the impact of cross-sector and cross-border credit risk transfers.”

José Manuel González-Páramo, Member of the Executive Board of the European Central Bank, ECB Statistics Conference (2008a).

Financial markets have been under considerable stress over the last 12 months, experiencing strains associated with a risk reappreciation of financial instruments designed to allow credit risk transfer (CRT). The opaque characteristics of these financial instruments, especially those issued to securitise the US mortgage market, and the absence of sufficient and reliable information on the distribution of risks related to these instruments, have made it difficult and cumbersome to identify the exact size and location of losses. This lack of information has, in turn, contributed to a loss of investors' confidence, exacerbating the financial stress.

Against this background, the ECOFIN, at its meeting in October 2007, endorsed a roadmap to deal with the turmoil. One of the main follow-up actions was to enhance the availability of information on credit markets. Among other actions, ECOFIN invited the industry to increase transparency in the credit markets² and, inter alia, the ECB and the Committee of European Banking Supervisors (CEBS) to contribute to the follow-up work proposed in this area.³

In parallel, the ECB and national central banks (NCBs, which together with the ECB form the European System of Central Banks) discussed the statistical implications of the financial turmoil, and reflected on the statistical gaps and needs arising from it. As a result, the ESCB initiated or contributed to a number of statistical initiatives at international and European level in order to identify possible further enhancements of data availability at the international

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² As a follow-up, on 17 July 2008 nine European and global trade associations released “Ten industry initiatives to increase transparency in the European Securitisation Markets”. Out of these ten initiatives, two (the “Draft industry good practice guidelines on securitisation disclosures under Pillar 3 of the CRD” and the creation of a new industry quarterly securitisation data report) are a direct response to the call by the ECOFIN. In addition, the eight additional issuer- and investor-focused initiatives that go beyond the ECOFIN request are designed to standardise issuer disclosure practices, broaden and facilitate investor access to transaction information, enhance usability and comparability of information, and strengthen good practice among investors.

³ Following a request from the ECOFIN, on 18 June 2008 the CEBS published its technical advice on banks' transparency on activities and products affected by the recent market turmoil. (CEBS, 2008a)

level, in particular by coordinating its work on enhancing credit risk transfer data with similar initiatives carried out in other global committees and fora.⁴

The main step undertaken to fill in the statistical gap is the development of harmonised statistics on Monetary Financial Institutions' (MFIs) securitisation and loan sales, integrated with balance statistics on Financial Vehicle Corporations (FVCs) engaged in securitisation. Steps were also taken to share with the ECB the EU countries' contributions to the BIS over-the-counter (OTC) derivatives and to the BIS Triennial Survey statistics (subject to confidentiality constraints), to analyse the underlying data from an EU and euro area perspective better. Furthermore, consideration may be given to ad hoc surveys of key players in the (highly concentrated) CRT market, possibly coordinated with the BIS and IMF as well.

While the ESCB statistical initiatives will be a significant step in providing CRT data in the EU, these statistics will not generally be available in the short term and will not be sufficient to provide a full picture of credit risk transfer. Against this background, the ECB is investigating the possibility of providing statistics in the short term based on existing data within the ESCB and the industry, and from commercial data providers. By combining granular data provided by the European Securitisation Forum (ESF) and the ESCB, the coverage of the existing publicly available data on EU securitisation can be expanded, and the related information on country of issuance and origination, sector of issuance and asset characteristics can be enhanced. On this basis, some first results can be provided on the developments that occurred during the summer 2007 turmoil and its impact on the EU securitisation market.

The remainder of this paper is organised as follows. Section 2 presents the key statistical issues at stake and briefly reviews user requirements for CRT related data. Section 3 describes the way forward to satisfy these statistical requirements currently undertaken at the ESCB level in the medium term. The final section elaborates a practical example of the work being done in the short term to develop a first measure of securitisation business in Europe using existing information.

2. Scope of CRT and users' requirements for CRT data

Innovation in financial markets is accepted as increasing market efficiency, enabling better diversification of portfolios and providing a wider range of techniques for risk management. Among the new financial instruments, those transferring credit risk have been the most important contributors in terms of market growth over the last decade. Yet, as already discussed in a report by the Committee on the Global Financial System (CGFS), "CRT instruments typically change the relationship between borrowers and lenders and establish new relationships between lenders and those to whom they may pass on credit risk" (2003). Traditionally, credit risk arising from creditor-debtor relationships has remained intrinsic to loans that were held by the originating bank until maturity. Credit risk was predominantly transferred or shared via insurance/banking products, such as credit insurance, loan syndication, loan sales and financial guarantees. The development of structured credit

⁴ This coordinated approach aims to improve statistical data availability and quality while keeping the reporting burden to a minimum. Where statistical needs can be satisfied only by imposing reporting requirements via an ECB Regulation, the ESCB follows a well-established procedure for carefully checking the balance between the merits and costs of such reporting requirements. The multiple dimensions of the current turmoil, in particular those related to the cross-sectoral/cross-border transfer of risk and to the valuation of complex, illiquid instruments, indeed call for more intensive statistical work to be undertaken at international level.

instruments has created new and potentially more complex channels for the transfer of credit risk, which has in turn raised new challenges for the CRT monitoring and assessment.

Looking at the ways in which credit risk recently became transferable, two rather distinct developments can be identified. First, credit risk is transferred by making the underlying loan negotiable. This has occurred through the use of true-sale securitisations that involved the issuance of securities in the form of asset-backed securities (ABS) by FVCs⁵ or securitisation special purpose entities (SSPEs)⁶ and via loan originators issuing (cash) collateralised debt obligations (CDO), in particular collateralised loan obligations (CLO). Second, a more recent phenomenon: credit risk is transferred by making the credit risk underlying those loans negotiable but not the loans themselves, which remain on the balance sheets of the originators. The credit risk is isolated from the underlying loans by stipulating credit derivatives contracts and is packaged into separate tranches according to different risk classes and OTC traded. This has occurred through the use of synthetic securitisations via FVCs and directly by originators, through the issuance of securities in the form of synthetic CDOs as well as credit derivatives (in particular credit default swaps, CDS), and hybrid instruments.⁷ These developments form the so-called “originate-to-distribute” (OTD) model, where banks do not hold the loans they originate (and/or the implicit credit risk) but repackage and securitise them.

The ECB has identified a number of high-priority data requirements on CRT for euro area monetary policy analysis and monetary operations, as well as for (macro) financial stability analysis. The key question is the identification of (and the size of CRT flows among) macroeconomic economic sectors/areas that originate and ultimately accept credit risk transfers (euro area MFIs, other resident sectors, non-residents). In measuring these CRT flows, valuation problems may arise in respect of both CDO and CDS since the markets in

⁵ The following definition of FVC is currently being developed for statistical purposes.

“FVC” means an undertaking:

- (a) which is organised to carry out one or more securitisation transactions; and
- (b) which issues, or may issue, securities and/or which holds, or may hold, assets underlying the issue of securities that are offered for sale to the public or sold on the basis of private placements; and
- (c) which is constituted pursuant to national or Community law under:
 - (i) contract law (as a common fund managed by management companies);
 - (ii) trust law;
 - (iii) company law (as a public limited company); or
 - (iv) any other similar mechanism;

The following are not included in the definition of FVC:

- MFIs within the meaning of Annex I to Regulation (EC) No 2423/2001 of the European Central Bank of 22 November 2001 concerning the consolidated balance sheet of the monetary financial institutions sector (ECB/2001/13); and
- IFs within the meaning of Article 1 to Regulation (EC) No 958/2007 of the European Central Bank of 27 July 2007 concerning statistics on the assets and liabilities of investment funds (ECB/2007/8).

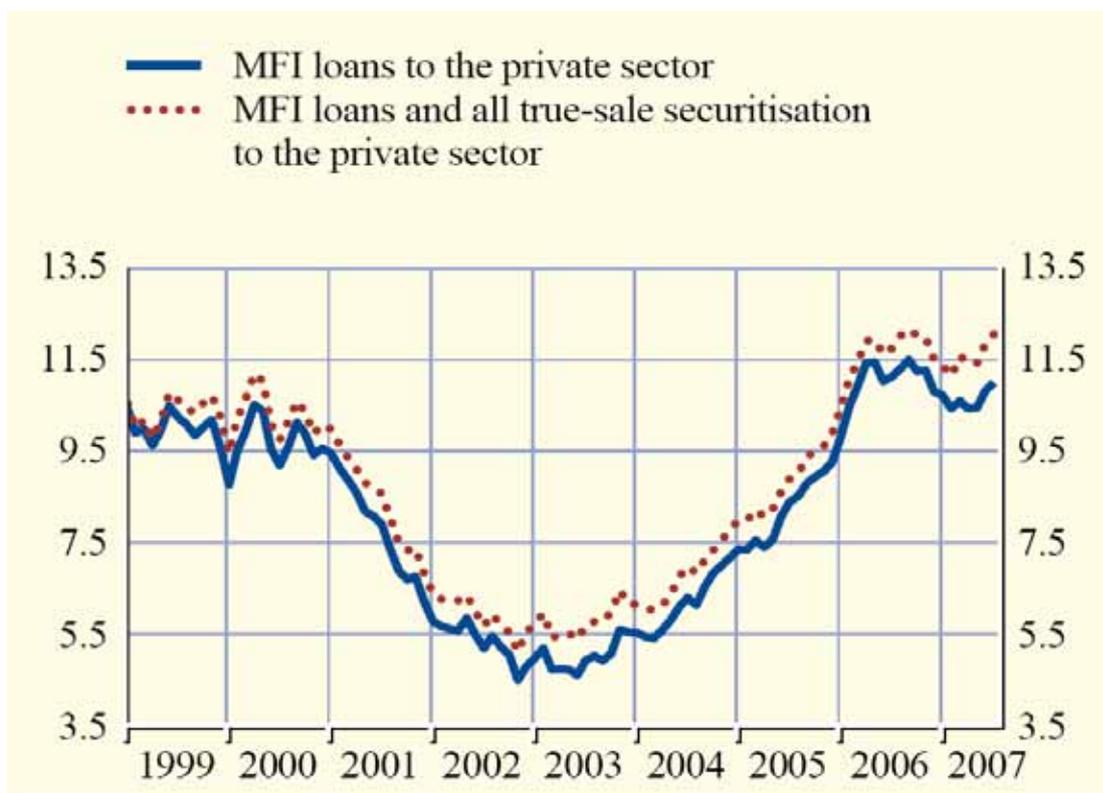
⁶ SSPE is the term used in the context of the Capital Requirements Directive (2006/48/EC), which is the EU transposition of the Basel II Accord, while the FVC definition will be contained in a forthcoming ECB regulation. Essentially, EU credit institutions will apply the FVC definition only for entities resident in the EU/euro area, while they apply the SSPE definition to any securitisation entities, regardless of their residence. Moreover, while FVCs may perform securitisation as a secondary activity (eg this case is relevant in Portugal), SSPEs are required to limit their activity to securitisation. In the Portuguese case, an entity may meet only the FVC definition but not the SSPE definition.

⁷ See Annex 1 for a stylised typology of CRT instruments and an overview of the current data availability.

which CDO are traded may be illiquid, while CDS are traded over the counter, so that in both cases it may not be easy to obtain an accurate valuation.⁸

For monetary policy analysis, aggregated data on structured securities (ABS/CDO) holdings/issues by sector/region would be required, at a quarterly (or even monthly) frequency and on a timely basis. Graph 1 shows how the available securitisation data should be factored in the analysis of credit developments, particularly in certain periods.⁹

Graph 1
Impact of true-sale securitisation on loans to the private sector
 Annual percentage changes



Sources: ECB, ECB estimates.

For the conduct of monetary operations, more disaggregated and higher frequency (even daily) micro data on individual structured securities (CDO, ABS etc) are needed, particularly those that may be eligible as collateral for market operations, as well as data on banks' positions in credit default swaps.

⁸ The scope of this paper does not allow the issue of valuation to be discussed in detail. For background information, see CEBS report, *Issues regarding the valuation of complex and illiquid financial instruments*, 18 June 2008. CEBS (2008b).

⁹ In certain periods, the impact of securitisation on the MFI data can be significant, eg in 2002–03 and 2006–07.

3. ESCB medium-term initiatives to improve the measurement of CRT

The ESCB is undertaking several medium-term initiatives to meet most of the above-mentioned data needs. The main focus of these initiatives is on enhancing the existing ESCB statistical framework. However, consideration is also being given to integrating and utilising other official statistical sources (specifically the BIS) and the ESCB Centralised Securities Database (CSDB).¹⁰ Furthermore, to the extent possible, it is intended to reuse supervisory data sources for statistical purposes, as well as to exploit other potential data sources (such as commercial databases and clearing houses) and to support market initiatives aiming at increasing transparency of market data.

The most important of these initiatives concerns integrated and harmonised euro area statistics on MFI loan securitisation (and loan sales) and FVC balance sheets. These statistics will be collected on the basis of ECB Regulations.¹¹ The ECB already collects harmonised statistical information (balance sheet and interest rates) from MFIs, and will in the near future also collect them from Investment Funds. Some unharmonised statistics on securitisation are also collected; these allow the compilation of estimates for the euro area, as shown above in Graph 1. The forthcoming harmonised statistics on securitisation will replace the current unharmonised data.¹²

The first reporting of the new data set is envisaged by mid-2010 (with reference to end-2009 data). In particular, MFIs will report quarterly information (gross flows and, if acting as servicers, also stocks) on traditional loan securitisations undertaken through an FVC; and on loans sales, with breakdowns by (original) maturity, purpose, residency/sector of debtors, and residency of these FVCs. Moreover, MFIs will report data on their own holdings of securities issued by FVCs, as well as further details to accommodate the reporting of securitisation under different accounting standards. This information will provide users with important insights into credit developments. Furthermore, the MFI securitisation statistics represent a measure of the share of MFI loans whose credit risk has been transferred, net of the FVC securities repurchased by MFIs.

With respect to FVCs resident in the euro area, complete balance sheet information covering their loan portfolio broken down by residency/sector of the originator, residency/sector of loan debtors, and (original) maturity, as well as a breakdown of their holdings of securities by (original) maturity and sector/residency of issuers will be compiled on a quarterly and timely basis (T + 28 working days).¹³ Within the balance sheet instrument breakdown, gross positions/flows in financial derivatives will be identified, as well as debt securities issued, broken down by (original) maturity, and deposits. When the FVC Regulation is issued, the ESCB will request FVCs to register in a list, which will be published. In the list, FVCs involved in true-sale and synthetic securitisations will be separately identified, thus enabling separate statistics for the two types of intermediaries (a hybrid category may be considered too).

Consideration may also be given to a possible collection of data on credit derivatives (reusing data already available at NCBs, or if insufficient, via a specific survey of the large

¹⁰ The CSDB is an ESCB-wide reference database on individual (debt and equity) securities and issuers. In the future, it may also support FVC statistics, securities issues statistics, and euro area financial accounts.

¹¹ The draft Regulation on FVC balance sheet statistics, which is currently being finalised, provides flexibility for national central banks to address reporting requirements directly to the FVCs or to use available information of comparable quality.

¹² Cf the securitisation reporting scheme for MFI in Annex 2.

¹³ Cf the securitisation reporting scheme for FVCs in Annex 3. It is intended to collect the information directly from FVCs or through other sources if they have an equivalent quality.

market players in the euro area). This could include separate information on gross positions in credit derivatives taken by MFIs and FVCs, broken down by residency and sector of counterparties. At the same time, the initiatives to expand the coverage and the detail of BIS derivatives statistics are supported and closely monitored, to avoid any double collection.

The measures described so far may however not be sufficient to provide a complete picture of CRT in the euro area, as such a picture would also require data covering the financial positions/transactions of key institutional investors' sectors. In this respect, the ESCB may consider the feasibility of separately identifying Investment Funds (IF) and Insurance Corporations and Pension Funds (ICPF) holdings of structured securities issued by MFIs and FVCs as a medium-term objective. Finally, the feasibility of collecting statistical data on MFIs' contingent credit exposures, such as those related to credit lines and other lending commitments, is also being investigated, with the possible reuse of data already collected by the national supervisory frameworks.

4. A first measure of securitisation business in Europe

The above-mentioned ESCB statistical initiatives will represent a significant step ahead in providing data on CRT. However, these statistics will be available only from 2010 onwards. Furthermore, they would not provide a full picture of credit risk transfer, for three reasons. First, by their very nature, ESCB statistics cannot provide a global perspective, ie beyond the euro area/EU. Second, the harmonised statistics may provide only a rather crude picture of (positions in) credit derivatives (synthetic securitisation). Third, as mentioned above, more information on holders of structured credit instruments would be needed.

Given the complex characteristics of CRT instruments, aggregated data may not suffice, with more micro-level and market data possibly providing significant value-added. This is discussed next.

4.1 Methodology

Apart from commercial data providers, the data provided by the ESF are currently the most used publicly available source of data on securitisation business in Europe. The ESF has provided data on European securitisation issuance since autumn 2001 and on outstanding amounts since the summer of 2007. Securities included in the calculations have collateral originating from a European country. For CDOs, only euro-denominated issuance is provided, regardless of the country of collateral. The ESF publishes a quarterly market data report in which it reports aggregate values by country, by collateral, and more recently by rating categories. The primary data source is a voluntary disclosure by securitisation desks of financial institutions. The ESF receives information on new issuances, which they accumulate in their database, and thereafter retrieve data on Bloomberg using the ISIN of the asset issued. The data cover all securitisation assets issued worldwide that are backed by EU collateral (this data source is henceforth referred to as the "ESF list").

In parallel, the ECB has asked the NCBs to identify resident FVCs and possibly to retrieve information on their securities issuance. The ECB has therefore built a provisional list of EU FVCs for end-2006 and end-2007 (the "FVC list").

By combining these two sources of information using ISIN codes as a matching device, it is possible to provide a broader picture of the securitisation business in the EU than has

hitherto been available.¹⁴ The two data sources have complementary characteristics: while the ESF data source covers securitisation assets based on EU collateral, it does not cover what is issued in the EU based on non-EU collateral. Conversely, the FVC list covers all securitisation assets issued in EU regardless of the country of collateral.

4.2 Some preliminary results

After carefully cross-checking the different data sources, a clean “golden copy” of the data was created and, on this basis, some first results were computed based on two reference dates, end-2006 and end-2007.

It should be noted, however, that a comparison of the 2007 results with those for 2006 is hampered by the fact that the quality and coverage of the information is significantly higher in the more recent year.

For securities issued in the EU by end-2006, the size of the securitisation business amounted to around €0.8 trillion for the euro area and €1.1 trillion for the EU. This compares to the ESF figure of €0.9 trillion for the EU at end-2006 (see Graph 2).¹⁵ Overall, the number of ISIN codes covered is over 11,000: 3,800 ISINs were found only in the ESF list, 3,700 in both the ESF and the FVC lists, and 3,500 only in the FVC list (see Graph 2). Around 1,000 ISINs were issued outside the EU with EU collateral. The reasons why some of the ISINs from the ESF list are not captured by the FVC list and vice versa are multiple: first, as explained above, the ESF list also covers securities issued outside EU and the FVC list covers securities issued in EU regardless of the collateral. Second, while the FVC list has gained in quality between the two reference dates, possibly capturing some private deals, this might not be the case for the ESF list.

Two thirds of the securities were issued in euro; the equivalent of around €230 billions is issued in sterling and €100 billion in USD, the latter mostly issued outside the euro area (see Graph 3). The original maturity of these securities appears to be rather long: on average around 15 years and with a median of 21 years. However, this result should be viewed with caution, as it is possible that a significant part of short-term paper has not yet been captured by the database, because these securities do not bear an ISIN code. Regarding coupon type and frequency, more than half of the securities have floating quarterly coupons. Turning to the country of issuance, the following five countries (in alphabetical order) make up 85% of total issuance: Ireland, Italy, the Netherlands, Spain and the UK. These countries, except Ireland, also dominate the origination of these securities. More than 95% of the issuers are categorised as FVCs. Around 65% of securities are originated by MFIs, the rest being originated by asset management companies, holding companies, mortgage loan brokers etc.

The same exercise was conducted using end-2007 data. Overall, the number of ISINs issued in EU covered increased to 14,000 in 2007. The FVC list coverage showed a significant increase of 35%, from 7,900 to 10,800 ISINs, indicating the increasing quality of reporting from NCBs. When matching the reference sources, 3,600 ISINs (–200) were found only in the ESF list, 5,100 (+1400) were contained in both the ESF and the FVC lists, and 5,300 (+1800) were found only in the FVC list (see Graph 2). As in 2006, around 1,000 ISINs were issued outside the EU with EU collateral in 2007. The increased reporting population from the FVC list induced a strong growth in outstanding amounts. The market was evaluated at end-2007 at €1.1 trillion for the euro area and €1.6 trillion for the EU (see Graph 4). The ESF evaluated the size of the market of all securities backed by EU collateral at €1.3 trillion. Regarding the currency of issuance, most of the new securities were issued in euros. While

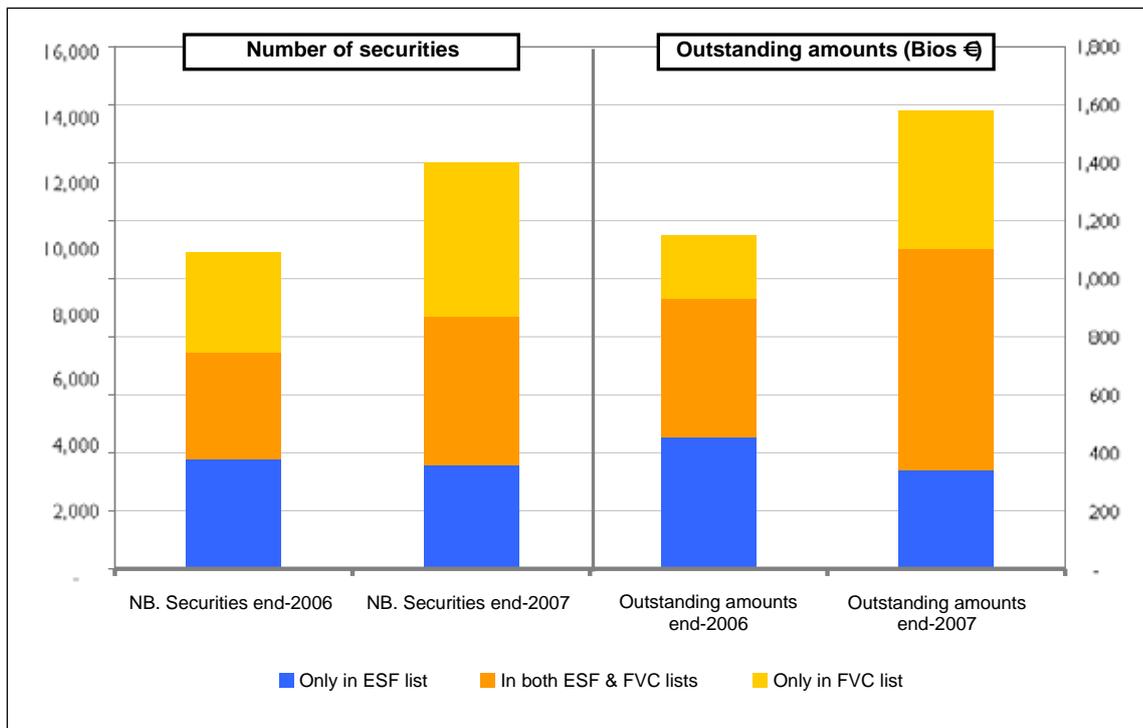
¹⁴ Both data sources have limitations in terms of coverage of private deals.

¹⁵ All securities backed by EU collateral amounted to €1.2 trillion according the ESF by end-2006 (ESF, 2008).

the share of sterling remained stable, the share of the USD increased from 9 to 11% of the total outstanding amount (see Graph 3). Regarding coupon type and frequency, 60% of the securities have floating quarterly coupons (see Graph 4). Finally, between end-2006 and end-2007, most of the new issuances were CDO and RMBS assets (see Graph 5).

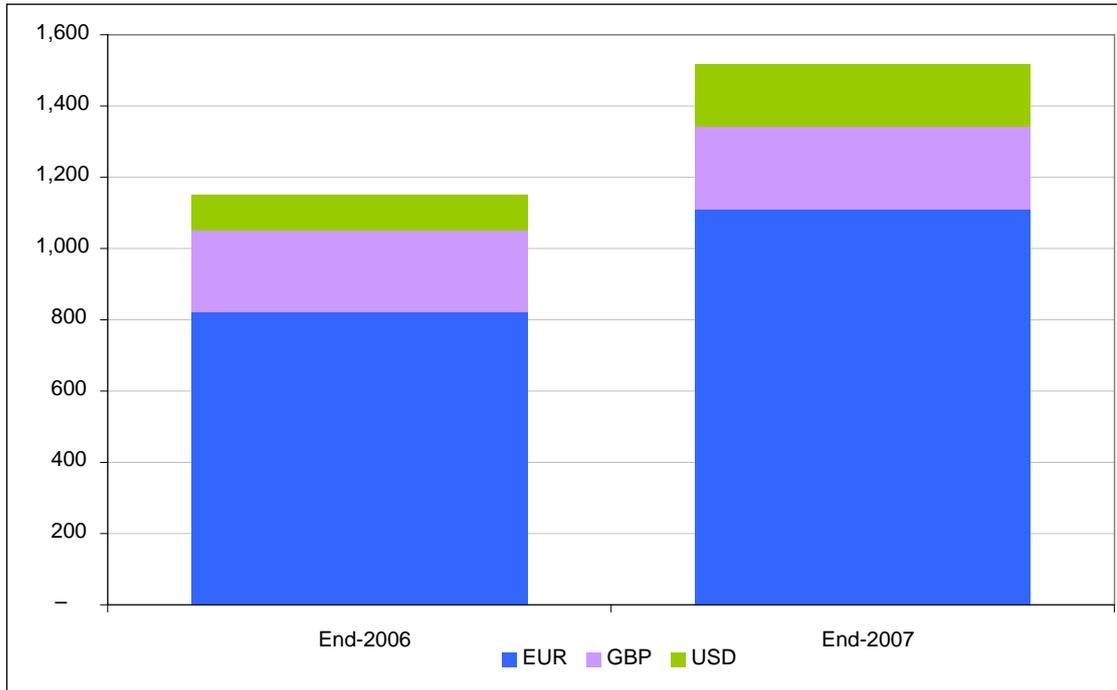
Graph 2

Coverage (number of ISINs – left-hand scale) and outstanding amounts (€billion – right-hand scale) of securities issued in EU



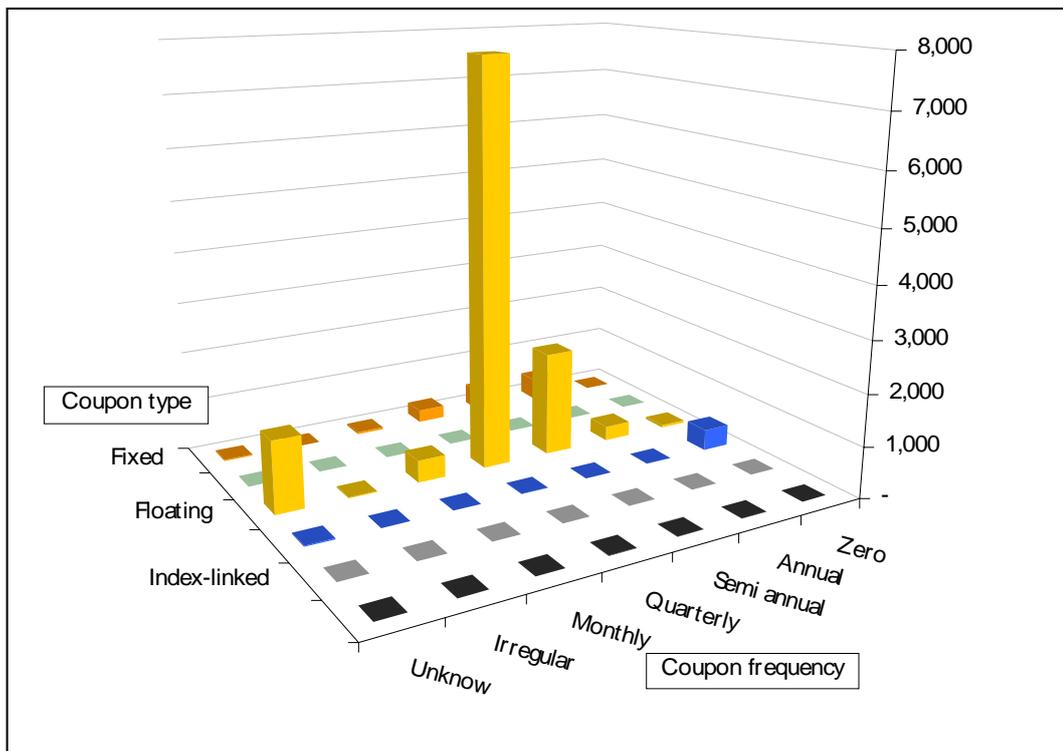
Source: ESF, ECB and ECB calculations.

Graph 3
**Principal currency of issuance in outstanding amounts (€billion)
of securities issued in EU**



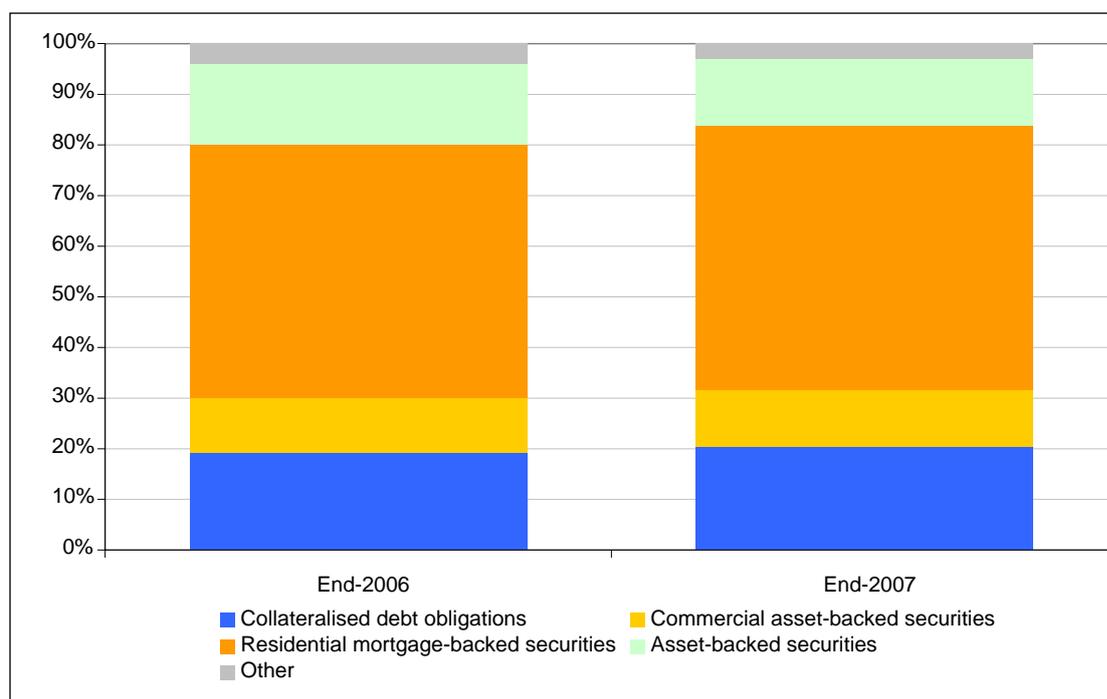
Source: ESF, ECB and ECB calculations.

Graph 4
Distribution of coupon types and frequencies of securities issued in the EU
Number of ISINs for end-2007



Source: ESF, ECB and ECB calculations.

Graph 5
Distributions of asset types
 ESF classification

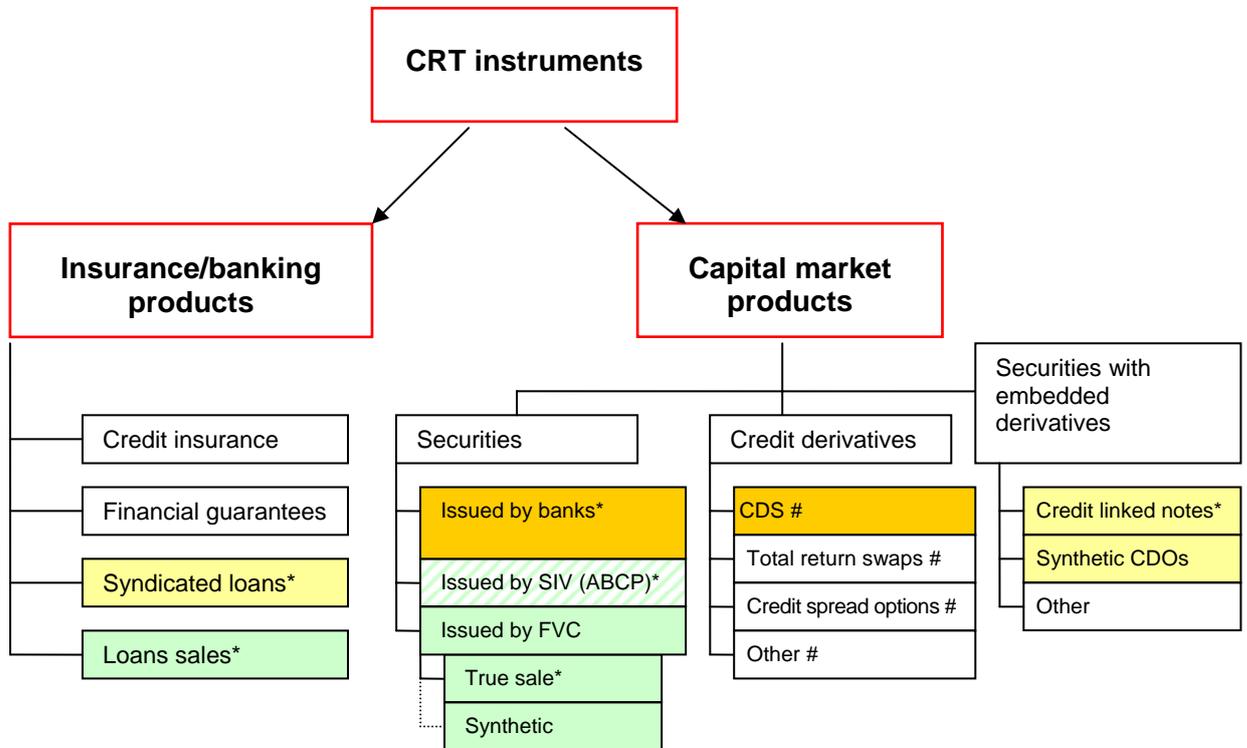


Source: ESF and ECB calculations.

5. Conclusion

In the context of the financial turmoil, the lack of sufficient statistical data to measure credit risk transfers (CRT) has emerged as an important issue for central banks. This paper provides an overview of the current ESCB statistical initiatives to improve the measurement of CRT, focusing on plans to introduce timely and harmonised euro area statistics on securitisation (in 2010). The paper also develops a first measure of securitisation business in Europe using existing micro information from commercial data providers, the industry (ESF) and the ESCB. By combining these different data sources, it was possible to reach an improved coverage of the securitisation market in the EU and to provide more granular and aggregated data by country of issuance, sector of issuance, asset type, coupon frequency and type, nominal currency etc. Indeed, it illustrates very well the benefits of maintaining micro databases, as also argued by J M González-Páramo (2008b) in a recent article on ECB statistics. Looking at further developments, the complementary approach discussed in this paper will be integrated into the harmonised securitisation statistics, which will become available in 2010.

Annex 1: Stylised typology of CRT instruments



* denotes funded CRT instruments

denotes breakdown potentially available from supervisory/market disclosure

Data enhancements as priority	Commercial data available	ECB stats may be available, pending classification issue
Low priority data	ECB stats are/will be available	

Table 5a
Securitisations and other loan transfers: monthly data

BALANCE SHEET ITEMS	A. Domestic						B. Other participating Member States					C. Rest of the world		
	General government (S.11)		Other resident sector				General government (S.11)		Other resident sector					
	Total	Other general government (S.112 + S.113 + S.114)	Total	Other financial intermediaries + financial auxiliaries (S.121 + S.124)	Insurance corporations and pension funds (S.125)	Non-financial corporations (S.11)	Households + non-profit institutions serving households (S.14 + S.15)	Total	Other general government (S.112 + S.113 + S.114)	Total	Other financial intermediaries + financial auxiliaries (S.121 + S.124)		Insurance corporations and pension funds (S.125)	Non-financial corporations (S.11)
1. Net flows of loans securitised or otherwise transferred transactions with impact on reported loan stocks calculated as disposals minus acquisitions														
1.1. Counterparty in the transfer is an FVC														
1.1.1. o/w counterparty in the transfer is a euro area FVC														
1.2. other counterparties in the transfer														
2. Net flows of loans securitised or otherwise transferred transactions without impact on reported loan stocks calculated as disposals minus acquisitions														
2.1. All counterparties in the transfer														
3. Outstanding amounts of loans serviced in a securitisation (?)														
4. Outstanding amounts of securitised loans not derecognised (?)														
4.1. Total														
4.1.1. o/w securitised through a euro area FVC														

Reporting scheme MFI securitisation statistics
Annex 2:

Table 5b

Securitisations and other loan transfers: quarterly data

BALANCE SHEET ITEMS	A. Domestic										B. Other participating Member States										C. Rest of the world
	General government (S.13)		Other resident sectors								General government (S.13)		Other resident sectors								
	Total	Other general government (S.1312 + S.1313 + S.1314)	Total	Other financial intermediaries + financial surpluses (S.123 + S.124)	Insurance corporations and pension funds (S.125)	Non-financial corporations (S.11)	Households + non-profit institutions serving households (S.14 + S.15)			Total	Other general government (S.1312 + S.1313 + S.1314)	Total	Other financial intermediaries + financial surpluses (S.123 + S.124)	Insurance corporations and pension funds (S.125)	Non-financial corporations (S.11)	Households + non-profit institutions serving households (S.14 + S.15)					
							Credit for consumption	Lending for house purchase	Other lending							Credit for consumption	Lending for house purchase	Other lending			
1. Net flows of loans securitised or otherwise transferred: transactions with impact on reported loan stocks calculated as disposals minus acquisitions																					
1.1. counterparty in the transfer is an FVC	M	M								M	M								M		
Loan purpose																					
up to 1 year																					
over 1 and up to 5 years																					
over 5 years																					
1.1.1. o/w counterparty in the transfer is a euro area FVC	M									M	M								M		
up to 1 year																					
over 1 and up to 5 years																					
over 5 years																					
1.2. Other counterparties in the transfer	M	M								M	M								M		
Loan purpose																					
2. Net flows of loans securitised or otherwise transferred: transactions without impact on reported loan stocks calculated as disposals minus acquisitions																					
2.1. All counterparties in the transfer	M	M								M	M								M		
3. Outstanding amounts of loans serviced in a securitisation																					
3.1. Loans serviced: all FVCs																					
up to 1 year																					
over 1 and up to 5 years																					
over 1 and up to 5 years																					
over 5 years																					
3.1.1. Loans serviced: of which euro area FVCs																					
up to 1 year																					
over 1 and up to 5 years																					
over 1 and up to 5 years																					
over 5 years																					
M	Monthly data requirements, see Table 5a.																				

(1) This item required at quarterly frequency only, see Table 5(b) for the reporting scheme.
 (2) Regarding the reporting obligation referred to in Annex I, Part 6, Section 5.2, only the row 'Total' is reported, and only at quarterly frequency.
 (3) Sole proprietors/unincorporated partnerships.

STATISTICAL REPORTING REQUIREMENTS

Table 1
Outstanding amounts and transactions

	A. Domestic						B. Other participating Member States						C. Rest of the world	D. Total					
	Total	MFIs	Non-MFIs	Total			Total	MFIs	Non-MFIs	Total									
				General Government (S.11)	Total	Other residents				General Government (S.11)	Total	Other residents							
				Total	Other financial intermediation + financial auxiliaries (S.123 + S.124) of which FVCs	Insurance corporations and pension funds (S.125)	Non-financial corporations (S.13)	Households + non-profit institutions serving households (S.14 + S.15)				Total	General Government (S.11)	Total	Other financial intermediation + financial auxiliaries (S.123 + S.124) of which FVCs	Insurance corporations and pension funds (S.125)	Non-financial corporations (S.13)	Households + non-profit institutions serving households (S.14 + S.15)	
ASSETS																			
1 Deposits and loan claims																			
2 Securitised loans																			
2a euro area MFI as originator																			
up to 1 year																			
over 1 year and up to 5 years																			
over 5 years																			
2b euro area General Government as originator																			
2c euro area OH (*) and ICFP (†) as originator																			
2d euro area NFC (‡) as originator																			
2e non-euro area originator																			
3 Securities other than shares (*)																			
up to 1 year																			
over 1 year and up to 2 years																			
over 2 years																			
4 Other securitised assets																			
4a of which euro area General Government as originator																			
4b of which euro area NFC as originator																			
5 Shares and other equity																			
6 Financial derivatives																			
7 Fixed assets																			
8 Remaining assets																			
LIABILITIES																			
9 Loans and deposits received																			
10 Debt securities issued (†)																			
up to 1 year																			
over 1 year and up to 2 years																			
over 2 years																			
11 Capital and reserves																			
12 Financial derivatives																			
13 Remaining liabilities																			

(*) Other financial intermediaries, except insurance corporations and pension funds.
 (†) Insurance corporations and pension funds.
 (‡) Non-financial corporations.
 (§) In accordance with Article 4(2), NCBs may choose to collect these items on a security-by-security basis.

Write-offs/write-downs

	D. Total
ASSETS	
2 Securitized loans	

Attributes	Description
Name	Name / description of the security.
ISIN code	<p>The International Securities Identification Number (ISIN) is a code that uniquely identifies a specific security or other financial instrument. It is based on the ISO 6166 standard and has been created in order to establish a global information network, which ensures that instrument-specific information can be obtained worldwide and within a minimum time delay.</p> <p>ISO standard 6166 defines the ISIN as comprising 12 characters:</p> <ul style="list-style-type: none"> – a prefix, which is the alpha-2 country-code specified in ISO 3166. <p>The next 9 characters represent the local security identifier assigned by the National Numbering Agency (NNA) in charge, such as the Wertpapierkennnummer (WKN, the CUSIP, the SEDOL etc. The last character is a check digit.</p> <ul style="list-style-type: none"> – the basic number, which is nine characters (letter or digits) in length. Where the existing national number consists of nine characters, this number shall be used. If the national number is less than nine characters, zeros shall be inserted in front of the national number. Where a national check digit exists, it shall be regarded as part of the basic number. – a check digit, computed using the modulus 10 “double-add double” formula. <p>For countries where a numbering agency exists, the responsible agency shall allocate the ISIN code following the above principles. If there is no numbering agency in a country, the designated substitute agency shall allocate the ISIN codes.</p> <p>A security may only possess one single ISIN code. XS prefix is employed by CLEARSTREAM and EUROCLEAR to identify international bonds (Eurobonds and global bonds).</p>
Short name	Short name given by issuer, to be defined according to the characteristics of the issue and the available information.
Debt type	Types of debt instrument (eg bond, medium-term note, bill, commercial paper, CD, convertible bond).
Asset securitised type	Field coded to indicate the type of secured asset.

Attributes	Description
ESA 95 instrument	Broad categories for the instrument breakdown following the ESA95.
Nominal currency	ISO code of the currency, in which “nominal value” and “amount issued” are given. This is the currency in which the security has been issued. For redenominated securities, this is the currency into which the security has been redenominated. ¹
Amount issued	Amount of this debt instrument that has been raised at issued (nominal value). For a strip this column indicates the amount at which the coupon/principal has been stripped. For a security issued in tranches this column indicates the cumulative amount issued so far. “Nominal currency” indicates the currency in which this amount is given.
Amount outstanding	Outstanding amount (in nominal value). For a security issued in tranches this column indicates the cumulative amount issued so far net of redemptions. “Nominal currency” indicates the currency in which this value is given.
Issue date	The date on which the securities are delivered to the underwriter by the issuer against payment, and the first date that securities are available for delivery to investors.
Coupon type	Type of the coupon (fixed, floating, stepped etc).
Coupon frequency	Number of coupons per year.
Coupon currency	ISO code of the coupon currency.
Issuer country	Describes the country of issuance.
ESA 95 issuer classification	Broad categories for the issuer breakdown following the ESA95.
Maturity date	The date at which the securities will mature.

¹ For example, a bond issued in DEM, which has – after the introduction of the EUR – been redenominated into EUR, should be given in EUR. If it has not been redenominated, it should still be in DEM.

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Experience with the collection and publication of data on structured products in Switzerland

Jürg Bärlocher¹

1. Introduction

In the context of this paper, structured products are defined as investment products whose repayment value derives from the development of one or more underlying assets. Structured finance products (asset-backed securities, collateralised debt obligations and similar products) for which the financing purpose or risk transfer is of central importance are beyond the scope of this paper.

Structured products are prepackaged investment strategies. They are often combinations of traditional investments in shares or bonds and financial derivatives. Traditional investments and derivatives are combined in a single financial instrument and securitised. Such “structuring” allows investment products to be created with risk-return characteristics that match the specific needs and expectations of investors. There is a vast range of publicly available structured products. In addition, there are tailor-made structured products for high net worth investors. The time to market for structured products is short, enabling them to react quickly to new trends in financial markets.

The Swiss market for structured products has seen considerable growth in recent years. This has prompted growing interest in data on this market, on the part of both economists and (potential) suppliers of structured products. Accommodating this interest has necessitated an expansion of the securities statistics and modifications to the financial accounts.

Section 2 of this paper describes structured products in general and defines categories of structured products. Features of the market for structured products in Switzerland are presented in sections 3 and 4. Section 5 describes data collection. The topic of section 6 is the classification of structured products in the financial accounts. Section 7 concludes.

2. Characterisation of structured products

2.1 General features

The structured products considered in this paper are investment products whose repayment value derives from the development of one or several underlying assets. Underlying assets are shares, bonds, foreign currencies, commodities etc. Legally, structured products are obligations for whose fulfilment the issuer is liable with all of its assets.

¹ Swiss National Bank. I would like to thank Yves-Alain Bicker and other colleagues from the Statistics Department of the Swiss National Bank for the fruitful discussions of earlier versions of this paper.

The views expressed in this paper are those of the author and do not represent those of the Swiss National Bank.

2.2 Categories of structured products

It is useful to distinguish the three categories defined by the Swiss Structured Products Association (SSPA): participation products, yield enhancement products and capital protection products. Their basic features are described below. For ease of exposition, only the most common underlying assets are mentioned: shares in the case of participation products, and shares and bonds in the case of yield enhancement and capital protection products. The investment strategies with payoff profiles equivalent to the three categories of structured products are shown in Table 1. Details on the structured product categories can be found in the Swiss Derivative Map published on the website of the SSPA (www.svsp-verband.ch).

Participation products:

The payoff of the basic participation product is tied to a share price index or to a basket of shares. The payoff may be one to one with the prices of the underlying shares, or with some leverage and certain discontinuities. However, unlike yield enhancement or capital protection products, the returns on participation products have neither a strict cap nor a strict floor.

Yield enhancement products:

Yield enhancement products offer returns well above those on traditional bonds if share prices move sideways or go up. The risk is that the investor will incur only a low return or even a loss if share prices fall. The price for the extra return in the case of stable share prices is a limit on the return (cap) if share prices go up. The payoff profile of the basic yield enhancement product is equivalent to that of an investment in a bond with the same maturity as the structured product plus the sale of a put option on a share, or – due to the put-call parity – a traditional investment in a share plus the sale of a call option on the same share.

There are two subtypes of the basic yield enhancement product: reverse convertibles and discount certificates. Reverse convertibles have coupons ten or more percentage points above the coupons of traditional bonds. Discount certificates have no coupon but are sold at prices below those of traditional investments in the underlying shares. The pretax payoff profiles of reverse convertibles and discount certificates are identical; despite this, the tax treatments differ.

Common extensions of the basic yield enhancement product are products with more than one underlying share and more complicated options. These extensions lead to significantly more complicated payoff profiles.

Table 1

Categories of structured products and equivalent investment strategies

Category	Investment strategy with equivalent payoff profile
Participation products	Investment in basket of shares, possibly with leverage
Yield enhancement products	Investment in bond plus sale of put option on share Investment in share plus sale of call option on same share
Capital protection products	Investment in bond plus purchase of call option on share Investment in share plus purchase of put option on same share

Capital protection products:

Capital protection products offer participation in the movements of share prices while guaranteeing a minimum return (floor). The floor is below the return on a traditional bond. The cost of the floor is usually less than one-to-one participation in upward movements in

share prices. The payoff profile of the basic capital protection product is equivalent to that of an investment in a bond with the same maturity as the structured product plus the purchase of a call option on a share, or – due to the put-call parity – to a traditional investment in a share plus the purchase of a put option on the same share.

The Swiss Derivative Map published by the SSPA includes a fourth category of investment products: leverage products. Leverage products are securitised options and futures. Since they do not differ fundamentally from the familiar OTC or standardised financial derivatives, they are not considered in this paper.

2.3 Maturity

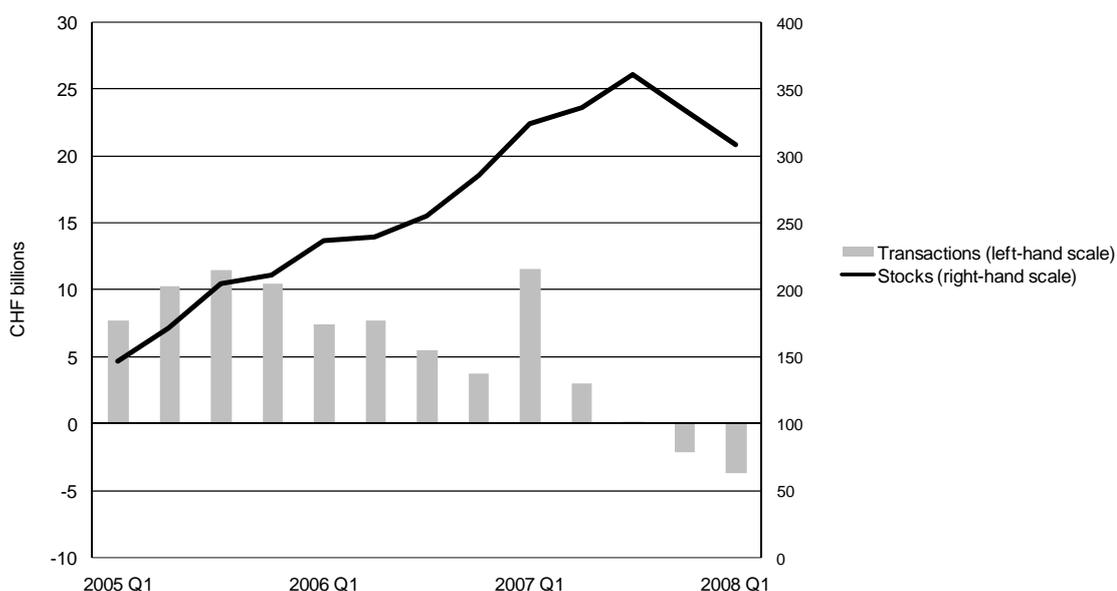
The maturity of participation products is usually between one and five years; some participation products are open-ended. The typical maturity for yield enhancement products is one year. Maturities for capital protection products are between three and five years.

3. Significance of the market for structured products

Data available on the Swiss market for structured products comprise the number of products listed on SWX’s Scoach platform, turnover on Scoach, and the value of stocks and transactions of structured products in custody accounts. Graph 1 shows transactions and stocks of all structured products in custody accounts at banks in Switzerland. The graph starts in 2005, when data on structured products were collected for the first time. Until the third quarter of 2007 there were impressive net acquisitions of structured products. Stocks of structured products more than doubled, from CHF 150 billion in the first quarter of 2005 to CHF 360 billion in the third quarter of 2007 (EUR 220 billion; USD 310 billion). The share of structured products in all securities in custody accounts rose in the same period from 4% to 7%. However, in the fourth quarter of 2007 and the first quarter of 2008 there were net disposals of structured products. This coincided with the first significant fall in share prices since the emergence of the market for structured products in its present form, and with turbulence in other financial markets.

Graph 1

Structured products in custody accounts at banks in Switzerland



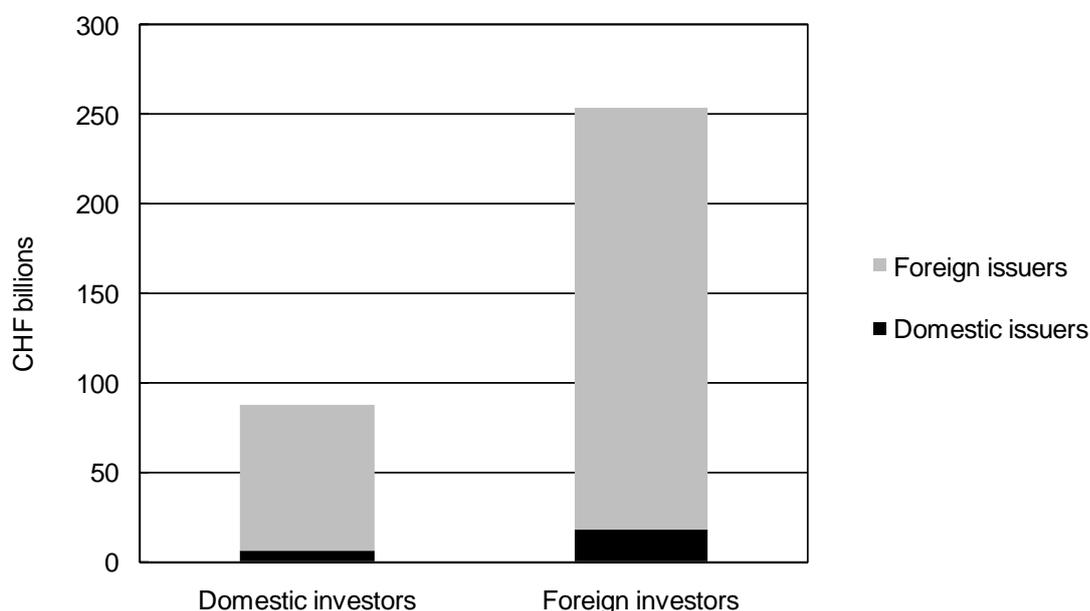
Source: Swiss National Bank.

A breakdown into product categories is not yet available for structured products in custody accounts. However, the number of listed structured products and turnover on Scoach suggest that the markets for participation and yield enhancement products are larger than for capital protection products.

Structured products in custody accounts at banks in Switzerland comprise products held by domestic and foreign investors and products issued by domestic and foreign issuers. As Graph 2 shows, at the end of 2007, CHF 254 billion worth of structured products were in custody accounts of foreign investors and CHF 87 billion worth were in custody accounts of investors resident in Switzerland. Graph 2 also shows that the majority of structured products are issued outside Switzerland; the reason for this will be discussed in the next section.

Graph 2

Structured products in custody accounts at banks in Switzerland by domicile of investors and issuers at the end of 2007



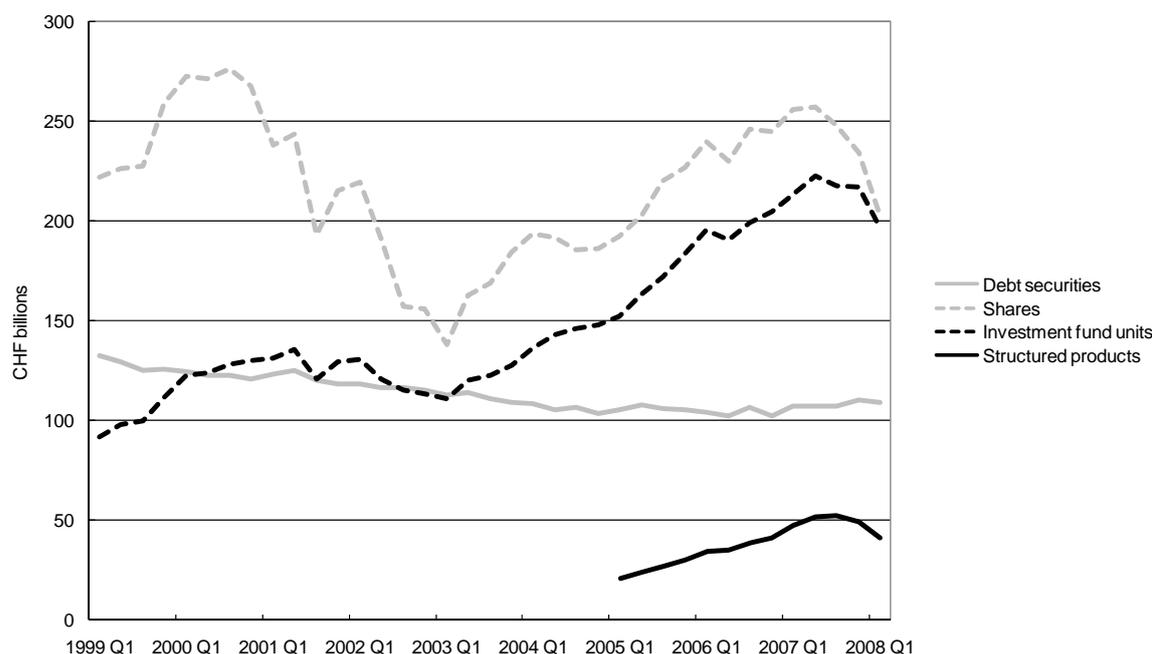
Source: Swiss National Bank.

In order to assess the significance of structured products, it is useful to look at structured products and other assets of specific groups of investors. Among those resident in Switzerland, the most important investors in structured products are households. In the third quarter of 2007 structured products held by households peaked at CHF 52 billion; at the end of 2007 they stood at CHF 51 billion. Holdings of structured products by insurance corporations and pension funds stood at CHF 12 billion at the end of 2007, as did holdings by the remaining financial institutions.

Graph 3 shows structured products held by households together with holdings of debt securities, shares and investment fund units. The graph puts the spectacular growth rates for stocks of structured products into perspective: measured in billions of Swiss francs, the changes in stocks of structured products were significantly below the corresponding changes in stocks of investment fund units. Compared to investment fund units or direct holdings of shares, the level of structured products is still rather modest. On the other hand, the level of structured products is almost half that of debt securities. As discussed in section 6, this has consequences for the interpretation of standard financial accounts data.

Graph 3

Securities held by households in Switzerland



Source: Swiss National Bank.

4. Organisation of the market for structured products in Switzerland

4.1 Managers and issuers of structured products

Most structured products are issued by banks. It is important to note that the lead manager and the issuer may be different units of the same bank group. In the case of Swiss banks supplying the Swiss market, lead managers are normally resident units but the issuers are often branches or subsidiaries abroad. The main reason is to avoid withholding tax and – in contrast to special purpose entities issuing asset-backed securities – not to limit bank liabilities. Coupon payments on structured products issued in Switzerland are subject to withholding tax. Payment of withholding tax is tilted towards the holder of the product at maturity. Thus, Swiss banks issue yield enhancement products (except for discount certificates) and capital protection products abroad.

4.2 Time to market

Investment funds can provide investments with risk-return profiles similar to structured products. Indeed, in view of the success of structured products, a range of such investment funds has been offered since 2007 under the name “exchange-traded structured funds”. While each fund needs approval from the Swiss Federal Banking Commission (SFBC), this is not the case for structured products. This allows structured products to react very quickly to new trends in financial markets. Recent evidence of this flexibility is the rapid growth in the number of structured products with commodities as underlying assets in the first half of 2008.

4.3 Distribution, market-making and listing of structured products

Private and institutional investors acquire a substantial part of their investments in structured products by subscription. Lead managers act as market-makers for their issued structured products. Roughly 6,000 structured products were listed on SWX's Scoach platform at the end of 2007. However, the majority of structured products are unlisted.

4.4 Hedging market risks of issued structured products

In principle, banks could hedge their liabilities by buying the traditional investments and financial derivatives that characterise the risk-return profiles of the structured products (static hedge). In practice, banks employ hedging techniques, which absorb only a fraction of the proceeds from the sale of the structured products (delta and vega hedging). Moreover, they manage market risks by considering structured products together with other trading book positions that have offsetting risk-return profiles.

Funds received from the issuance of structured products may be used to finance the trading books of banks or other investments. However, in contrast to convertible bonds issued by non-financial companies, profit margins rather than funding are the primary drivers of structured product issuance.

4.5 Swiss Structured Products Association (SSPA)

The SSPA was established in 2006 by the major issuers of structured products to represent their shared interests and to strengthen the image of structured products. An important task of the SSPA is the management of the Swiss Derivative Map, which defines categories and types of structured products. It is the aim of the SSPA to establish the Swiss Derivative Map as a standard in Europe.

5. Data collection

5.1 Securities statistics

The first indications of the growing market for structured products were a surge in advertisements for structured products in the financial market press and a significant increase in the "other securities" category of the securities statistics in 2003. The Swiss securities statistics compiled by the Swiss National Bank (SNB) are based on an aggregate reporting system. Thus, to accommodate structured products, it was necessary to expand the questionnaire; they were introduced as a separate category during a general revision of the questionnaire. The first data collection took place in March 2005. In order to take account of the variety of risk-return profiles of structured products, it has since been decided to collect data on the subcategories of structured products defined in the Swiss Derivative Map. The first collection of data on the subcategories will take place in December 2008.

Data are published by the SNB in the Monthly Bulletin of Statistics. They are a major statistical source for the market reports produced by the SSPA as well as for the financial accounts.

5.2 Identification of structured products in balance sheets of banks

In the financial accounts, structured products are recorded as assets of the investing sector and liabilities of the issuing sector. Therefore, in order to compile consistent financial

accounts, structured products on the liabilities side of banks' balance sheets have to be identified.

Ideally, banks would report their structured products issued as a separate category. However, this is not the case in the balance sheets currently collected by the SNB. The accounting rules (either IFRS or the accounting rules of the SFBC) are not very explicit concerning structured products. For instance, a bank may decompose reverse convertibles and capital protection products into bonds and financial derivatives. The bond part is reported under "bonds issued" (at nominal value) and the derivatives part under "positive/negative replacement values of financial derivatives" (at fair value). Participation products and discount certificates may be reported in full as part of "liabilities towards customers" (at fair value). Other reporting methods are also possible.

Owing to a lack of accurate information, for the purposes of the Swiss financial accounts it is currently supposed that all structured products are issued abroad. More qualitative and quantitative information on the reporting practices of banks combined with data on the sub-categories of structured products in the securities statistics should allow a more satisfactory solution in the future.

6. Classification of structured products in the financial accounts

Structured products as defined in this paper are not explicitly mentioned in the System of National Accounts (SNA93) or the European System of National and Regional Accounts (ESA95). It is not obvious how structured products should be classified in the financial accounts.

In the description of structured products in Section 2, the equivalence of the payoff profiles of structured products and investment strategies with traditional financial instruments and financial derivatives was stressed. Section 5 discussed how, in their balance sheets, banks decompose some categories of structured products into bonds and financial derivatives. However, it is not feasible to obtain decompositions of structured products using securities statistics. Nor would it, in my view, be in the spirit of ESA95: for convertible bonds, ESA95 recommends decomposition only if the underlying bond and the conversion option can be traded separately (ESA95, paragraph 5.62).

Having ruled out decomposition, it is necessary to compare the characteristics of the integral structured products with SNA93/ESA95 financial instruments. The results of such a comparison concerning initial payment, risk-return profile, counterparty risk and sector of the issuer (counterparty) are summarised in Table 2.²

Legally, structured products are obligations, like traditional bonds. However, assigning structured products to debt securities ignores the dependence of structured products on the prices of shares or other underlying assets. In the case of participation products in particular, but also for yield enhancement and capital protection products, investment funds provide investments with similar risk-return profiles. This makes it attractive to assign structured products to investment fund units. But the counterparty risk of investment fund units and the sector of the issuer are different from those of structured products. Like financial derivatives, the value of structured products depends on the price of the underlying assets. However, assigning structured products to financial derivatives extends this category to instruments with significant initial payments, whereas the initial payments on option-type and forward-

² The term "debt securities" adopted in the revision of SNA/ESA is used instead of the less specific, current SNA/ESA term "securities other than shares".

type financial derivatives are low or even zero. A consequence of the initial payment is lower leverage of structured products compared to traditional financial derivatives.

Table 2

Comparison of structured products with SNA93/ESA95 financial instruments

SNA93/ESA95 financial instrument	Similarities to structured products	Differences compared to structured products
Debt securities	Initial payment Counterparty risk Sector of issuer	Risk-return profile
Investment fund units	Initial payment Risk-return profile	Counterparty risk Sector of issuer
Financial derivatives	Risk-return profile Counterparty risk Sector of counterparty	Initial payment

Given the unsatisfactory result of the comparisons above, and taking account of the significance of and the great interest in the market for structured products, a new financial instrument category for structured products has been introduced into the Swiss financial accounts. Of course, financial accounts data transmitted to Eurostat and the OECD have to conform to the traditional financial instrument categories. It was decided to assign structured products to debt securities in the Eurostat/OECD data.

Table 3

National publication of Swiss financial accounts and data reported to Eurostat and OECD: stocks of financial assets of households

2007, CHF billions

	National publication	Data reported to Eurostat and OECD
Currency and deposits	458	458
Debt securities	121	172 (structured products: 51)
Shares and other equity	253	253
Investment fund units	225	225
Insurance technical reserves	813	813
Financial derivatives
Structured products	51	
Other assets
Total	1,921	1,921

.. Currently no data available.

Source: Swiss National Bank.

As an example, Table 3 shows the two different data sets for stocks of financial assets of households. For households, structured products make up almost one third of debt securities

in the Eurostat/OECD data. As a result, the capital gains and losses in the “debt securities” position are strongly influenced by share prices, rather than by interest rates alone, or possibly exchange rates as most data users would expect. This is the effect of the significant holdings of structured products as well as the relatively low share of debt securities in total financial assets. In the case of insurance corporations and pension funds – due to the significantly larger holdings of debt securities and the smaller holdings of structured products – as well as in the remaining sectors of the financial accounts, the consequences of assigning structured products to debt securities are less severe.

7. Concluding remarks

The considerable size of the Swiss market for structured products has required an expansion of the securities statistics and changes in data publication. Since none of the traditional financial instrument categories accommodates structured products well, a new category has been introduced into the Swiss financial accounts. In the financial accounts data transmitted to Eurostat and the OECD, structured products are assigned to debt securities. As a result, the “debt securities” position is significantly influenced by share prices. Data users are probably not aware of this fact. Whether measures at the international level to maintain and enhance the usefulness of the financial accounts are appropriate depends on the significance of structured products worldwide. This paper focuses on the Swiss market. It would be interesting to compare it to the markets for structured products in other countries.

Additional literature

Tolle, S, B Hutter, P Rütthemann and H Wohlwend (2007): “Swiss derivatives guide 2008”, supplement to the Swiss weekly *Handelszeitung* (in German only).

Kursner, I (2007): “Traitement comptable des produits structurées: L'exemple d'une banque universelle”, *L'expert-comptable Suisse*, 11/2007, pp 849–53 (in French only).

Popular and controversial banking products for households in Norway

Gunnar Almklov¹

1. Introduction

In the past three to four years, two new banking products have grown very popular among Norwegian households. These are credit lines secured on dwellings, which have more than quadrupled in two years, and structured investment products, most commonly known as guaranteed bonds or deposit investments with index-linked yield. Banks often offer loans to finance these investment products. However, hardly any investors made a profit on the investments when they were financed by loans. As a consequence, Kredittilsynet (the Financial Supervisory Authority of Norway) has introduced new and very strict rules for the sale and marketing of such products to households.

2. Credit lines secured on dwellings

Credit lines secured on dwellings are, as the name indicates, loans to customers who can offer good security in return. The loans are secured on dwellings, usually within a loan-to-value ratio of up to 80%. Banks promote these loans as equity release loans and an alternative to ordinary repayment loans secured on dwellings. Borrowers are able to draw on the credit line without having to apply each time ready funds are needed, and they pay interest only on the amount drawn at any time. These loans are far more flexible than ordinary repayment loans, and are growing far more popular. They can be used for both housing and other purposes, such as the refinancing of loans, buying a new car, going on holiday or other consumption purposes.

Sharp increase in credit lines secured on dwellings

Credit lines secured on dwellings have increased sharply since they were broadly introduced to the market in January 2006. Figures for June 2008 show that this trend continues. Banks' and mortgage companies' stock of such loans to households was NOK 271 billion at end-June², an increase from NOK 37 billion in January 2006.

The total stock of repayment loans secured on dwellings to households is still much larger than credit lines secured on dwellings, but the increase in repayment loans is much lower. The stock was NOK 1143 billion in June 2008, an increase of NOK 136 billion since January 2006. In the past two years, such loans have increased by around 9% compared with 370% for credit lines secured on dwellings. These figures clearly demonstrate which loan product is the more popular.

Graph 1 and Table 1 below illustrate that credit lines secured on dwellings are increasing at the expense of repayment loans (both with and without mortgage secured on a dwelling).

¹ Statistics Norway.

² http://www.ssb.no/orbofbm_en/tab-080-en.html (Statistics Norway).

From the first quarter of 2006 to the second quarter of 2008 the share of credit lines secured on dwellings increased from 3% to 15%, while the share of repayment loans with mortgage on a dwelling has decreased from 73% to 65%. This confirms the impression given by the banks' marketing; most banks now focus on selling credit lines secured on dwellings rather than ordinary (repayment) mortgage loans.

Graph 1
Credit lines' and repayment loans' share of total loans to households.

Q1 2006 – Q2 2008

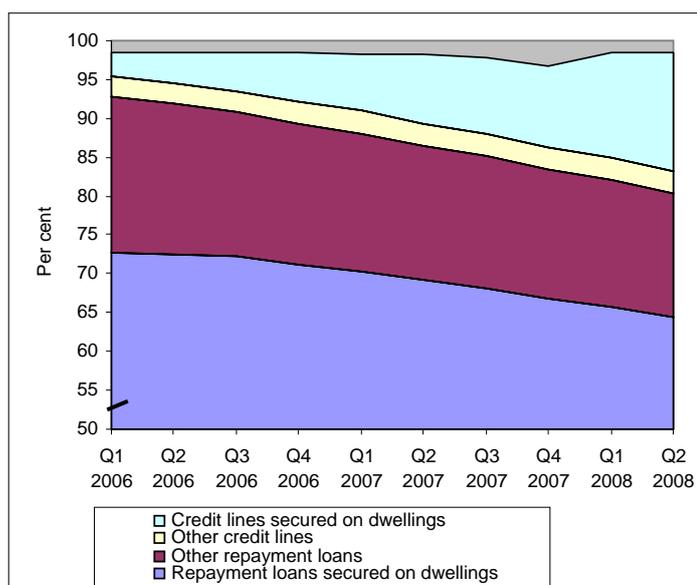


Table 1

Financial corporations' credit lines and repayment loans to households.

NOK billion. Q1 2006–Q2 2008

	Credit lines secured on dwellings	Repayment loans secured on dwellings	Other repayment loans	Other credit lines	Total loans to households
Q1 2006	44	1021	280	37	1403
Q2 2006	58	1050	279	38	1447
Q3 2006	73	1076	277	40	1490
Q4 2006	95	1095	281	44	1540
Q1 2007	116	1104	278	46	1570
Q2 2007	144	1123	278	46	1620
Q3 2007	162	1135	282	48	1665
Q4 2007	179	1145	284	49	1712
Q1 2008	235	1146	284	50	1742
Q2 2008	271	1143	284	52	1777

In light of the strong growth in equity release facilities, the Financial Supervisory Authority of Norway conducted a separate survey of banks' practice with regard to this product³ in autumn 2007. This survey is quoted in "The Financial Market in Norway 2007 – Risk Outlook"⁴:

The 15 most active banks reported qualitative and quantitative details of a selection of concrete equity release loans. Just over 46% of loans (ceiling granted) were within a 60% loan-to-value ratio, while 42% were between a 60 and 80% loan-to-value ratio. Almost all banks in the survey reported applying stricter loan-to-value criteria to equity release loans than to ordinary repayment loans. A majority allowed a loan-to-value ratio approaching 75–80% of property value. Internal guidelines for equity release facilities were reported to be the same as for ordinary repayment loans in a great majority of banks.

To conclude, equity release loans are a good, safe and flexible banking product for people who can offer good security, and from the banks' perspective these loans have a very low loan loss potential.

This brings us to the rise and fall of the other, and more controversial, banking products introduced in Norway a few years ago.

3. Structured investments products

In recent years, banks have increased their sale of structured investment products, also called guaranteed savings, or simply, structured products. In addition to selling these products, banks also offer loans to finance the customers' investments to increase the gearing of the investment. A wide variety of products fall within the structured products category. Statistics Norway compiles statistics on two of the main products (from December 2002) as well as statistics on the loan financing of such products (from December 2005). The two products concerned are deposits with index-linked yield, and index-linked bonds.

In this context, structured investment products can be defined as investment products that consist of a savings or bond component and a derivative component. The deposit or bond forms the basis for a guaranteed return for the investor, whereas the derivative component is meant to generate returns beyond the guaranteed amount. The derivative component is preferably an option linked to indices related to stock markets, currency markets, raw materials markets, interest markets etc; so the total return on the investment is linked to the same indices and markets. The customer is usually guaranteed the nominal value of the investment and a yield linked to the index if the index investment generates a positive yield larger than the bank charges when the contract matures.

In the past two years several economists have questioned the yield from investments in structured products. They have warned households about investing in such products due to the high charges by banks and other investment advisers. Economists and consumer advisers have also criticised the investment advisers' role as both adviser and seller of these products. This dual role may result in a situation where the investment advisers do not offer their customers the best advice. The media and the Norwegian Consumer Council have also criticised some investment advisers for arranging sales meetings in service centres for the elderly. The elderly normally have an investment horizon that is relatively short, but the

³ Home loan survey of equity release loans secured on dwellings.

⁴ http://www.kreditilsynet.no/archive/f-avd_pdf/01/04/TheFi007.pdf.

nature of these meetings has put great pressure on elderly people to put money into these long-term investments.

In autumn 2007, Kredittilsynet conducted a survey of structured products among 15 banks. The survey covered return, sales and marketing of structured products, in-house training of advisers/sales personnel, revenues from the products, and advisers/sales personnel's compensation related to sales of structured products. One conclusion from this report was that "calculations based on returns reported by the banks showed that the majority of products held to maturity as of the third quarter 2007 did not produce returns in excess of a risk-free investment. This is true both of equity-financed and debt-financed investments covered by the survey"⁵.

The survey also showed that about 55% of the structured products with 80% debt financing generated zero returns or less with a calculated average return on debt-financed products of about 2%. Product subscription costs reduce the return both on equity-financed and debt-financed investments. Assuming 4% subscription costs and a duration of four years, the average return on contributed equity is -3% with 80% debt financing.

On 1 February 2008, four of the 15 banks participating in the survey announced that they would no longer offer loan financing of structural savings products⁶.

On 12 February 2008, Kredittilsynet announced changes in the legislation concerning the sale of guaranteed savings products as of 1 March. Among other things, the changes in the regulations implied that those who offer guaranteed savings products would be obliged to investigate whether the products are suitable for the customer. This includes collecting information on the customer's knowledge and experience of guaranteed savings products, and the customer's financial situation. In connection with the changes, Kredittilsynet also advised banks against offering loans to finance investments in guaranteed savings:

The regulations will make the sale of structured products more difficult by posing a number of new requirements on the financial institutions. Kredittilsynet presupposes that the institutions should not sell structured products or other complex products to customers who cannot be regarded as professional investors. In addition, Kredittilsynet advises the financial institutions against offering loan financing when selling structured products. This is based on historically low returns on equity capital and the risk of significant losses for the customers on this form of financing.

The new regulations have led to a marked fall in investments in structured/guaranteed savings products and loans to finance such investments. We do not have any statistics on sales and redemptions, but the stock figures show a slight fall in the figures in the past two years and a sharp fall in the second quarter of 2008. For the proportion of the structured investments financed by loans, we face some statistical problems. Since Norwegian banks offer loans to finance investments in index-linked bonds from foreign banks within the same banking group, the loan financing shares may exceed 100%. However, the figures show signs of a decrease, and in the second quarter of 2008 the share was 77%.

⁵ Kredittilsynet, "The financial market in Norway 2007: Risk outlook.", Report, February 2008 http://www.kredittilsynet.no/archive/f-avd_pdf/01/04/TheFi007.pdf.

⁶ http://www.hegnar.no/personlig_okonomi/article250303.ece (in Norwegian only).

Graph 2

Banks. “Guaranteed” index-linked bonds and deposits with index-linked yield (total) and loans to finance these products.

December 2002 – May 2008

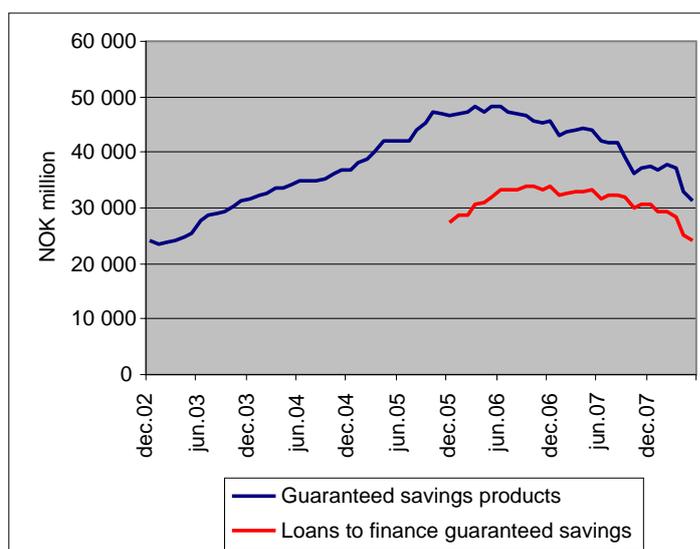


Table 2

Banks’ “guaranteed” index-linked bonds and deposits with index-linked yield, loans to finance these products, and loan financing shares

Q4 2005–Q2 2008. NOK million

Month	Deposits with index-linked yield	Index-linked bonds	Total	Loans to finance			Loan financing share. Per cent		
				Deposits with index-linked yield	Index-linked bonds	Total	Deposits with index-linked yield	Index-linked bonds ¹	Total
Q4 2005	25570	21104	46674	12124	15264	27388	47	72	59
Q1 2006	27475	20877	48352	13718	16812	30530	50	81	63
Q2 2006	30398	17959	48357	16407	16974	33381	54	95	69
Q3 2006	30733	15759	46492	17186	16653	33839	56	106	73
Q4 2006	32483	13205	45688	18054	15969	34023	56	121	74
Q1 2007	31317	12741	44058	17410	15512	32922	56	122	75
Q2 2007	30965	11212	42177	17475	14313	31788	56	128	75
Q3 2007	30033	8986	39019	18303	13725	32028	61	153	82
Q4 2007	29968	7412	37380	19477	11107	30584	65	150	82
Q1 2008	29776	7256	37032	18547	9682	28229	62	133	76
Q2 2008	24416	6158	30574	15349	8287	23636	63	135	77

¹ Only Norwegian banks are included in the statistics. The part of loan financed index-linked bonds exceeds 100%. This is due to the fact that foreign-owned (subsidiary or branch) banks in Norway give loans to finance index-linked bonds offered by other parts of the corporation.

In a press release issued on 12 February 2008, the Director General of Kredittilsynet said that “The new regulations mean in practice a complete stop to the purchase of structured products financed by loans. The regulations will also mean that banks and other financial institutions will normally not be selling such products to normal savers, who cannot be regarded as *professionals* in this context.”

Many people have interpreted the use of the word “professional” as a ban on the sale of these products to households, while others say that many people in the household sector can be regarded as professionals. As a result, many banks continue to sell these products to households, even though some of the larger banks no longer offer loans to finance them. After a long period of negative media focus, including stories about people who were “trapped” into investing in such products, the managing director of the Norwegian Financial Services Association (FNH), an institution that represents commercial banks, mortgage companies and insurance companies in Norway, wrote an article in Norway’s largest newspaper Aftenposten⁷ to justify some of these investment products. He reminded readers that while households traditionally only invested in bank deposits, they started investing in mutual funds in the 1990s and many lost their money when the stock exchange indices fell markedly. These new structured investment products are meant to give investors the safety offered by bank deposits and an opportunity to take part in a possible upswing in the stock markets. But everybody knows that there is no such thing as a free lunch; it is only natural that the upside will be limited as long as the investor is guaranteed to get back his/her investment. In a newspaper article in Norway’s largest financial newspaper (Dagens Næringsliv) on 4 July, commenting on Statistics Norway’s statistics on structured savings products (figures for May 2008),⁸ a representative from Norway’s largest bank stated that they no longer offer these investment products. In the same article the director of the Norwegian Consumer Council predicted that loan financing of these products would stop.

4. Conclusion

Structured products may be good investment products for some investors, while other investors should stick to bank deposits, securities funds or other markets. In my opinion, banks should be allowed to sell these products to households, but must follow the strict rules laid down by the MiFID etc. Furthermore, extreme caution should be exercised with regard to loan financing, and it is important to take the bank charges into consideration. The products themselves are interesting, but have a bad reputation due to high charges, irresponsible advisers/sellers and gearing. This means that the banks must do a better job of explaining the advantages of these products if they are going to offer them in the future.

Finally, credit lines secured on dwellings have been a major success for the banks as well as the customers, while we may draw the conclusion that we have witnessed the rise and fall of structured investment products in Norway.

⁷ Aftenposten, 3 July 2008, Kommentarer p 3.

⁸ http://www.ssb.no/english/subjects/10/13/10/orbofbm_en/ Marked fall in guaranteed savings.

Session 4

Challenges in compiling derivative statistics

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Cross-border derivatives exposures: how global are derivatives markets?

Sally Davies¹

Introduction

This paper attempts to answer the question: How global are derivatives markets? The answer has implications for financial stability. Most of the largest derivatives dealers around the world are large, systemically important financial institutions, many of them large internationally active banks.² The more global derivatives markets are, the more likely it is that financial shocks can be transmitted across countries. Although globalized derivatives markets can mitigate the effect on any one country of a financial disruption, it may also spread the disruption to other countries.³

In order to answer this question, I focus on U.S. data on the counterparty credit exposure arising from derivatives contracts (exposure from derivatives). The benefit of using the U.S. data is that they provide a longer time series and additional detail than do the BIS statistics of which they are a part. In addition, in some cases, it is useful to match data from the two sources for the same set of reporters, which I can do using the U.S. data. On the other hand, focusing on the U.S. data may limit the conclusions that can be drawn to the extent that the U.S. data are not representative of global OTC derivatives activity.

The data show that the activity of U.S. dealers within the global OTC derivatives market is quite international. That is, a large fraction of U.S. derivatives dealers' exposure from derivatives is to foreign (i.e., non-U.S. counterparties), although there is no evidence of a trend toward greater foreign exposure. It seems likely that the activity of other large, non-U.S. derivatives dealers is also quite international, although this remains a question for further research. The data also show that exposure from derivatives is concentrated in counterparties in developed countries, although there is a very modest trend toward greater activity in emerging market countries and financial centres. When exploring the sector of the counterparty, the paper runs into the issue that the sector breakdowns from the two data sources I use are not comparable. Foreign exposure from derivatives is concentrated in banks and the nonbank private sector. Global exposure from derivatives is concentrated in reporting dealers and all other the financial firms.

Data Sources

This paper makes use of two sources of U.S. data on exposures from derivatives. The Country Exposure Report, which is collected by U.S. bank supervisors on the FFIEC 009

¹ Division of International Finance, Board of Governors of the Federal Reserve System. The views expressed in this paper are my own, and do not necessarily reflect the views of the Board of Governors of the Federal Reserve System or its official staff.

² Although in the United States, some of our largest dealers are large investment banks, these institutions are nonetheless likely to be systemically important.

³ Greater globalization of derivatives markets also suggests that competition in derivatives markets is best judged at a global, rather than national, level.

report form, collects data on U.S. banks' exposure from derivatives by the country of residence of the counterparty.⁴ The FFIEC 009 is the source for the U.S. contribution to the BIS consolidated banking statistics, and it also collects data on other types of exposures to foreign residents. The Semiannual Report on Derivatives Activity, which is collected by the Federal Reserve on the FR 2436 report form, collects data on large U.S. derivatives dealers' global exposure from derivatives.⁵ The FR 2436 is the source for the U.S. contribution to the BIS regular OTC derivatives statistics, and it also collects data on the gross market values and notional values of outstanding derivatives contracts, broken out by type of contract and type of underlying risk.

For an individual reporter, the data on exposure from derivatives should be comparable across reports. Both reports collect data on a consolidated basis, and both permit netting of claims and liabilities from derivatives contracts only when the contracts are with the same counterparty and are covered by a legally enforceable master netting agreement. However, the reports do not collect data from the same group of reporters, which means that the aggregate data from the two reports are not entirely comparable. The Country Exposure Report (FFIEC 009) is collected from 65 U.S. banking organizations that have exposures to foreign residents above a (modest) reporting threshold. The Semiannual Report of Derivatives Activity (FR 2436) is collected from 7 large U.S. derivatives dealers: 3 large banks and 4 large investment banks.

The FFIEC collects data quarterly, as of each quarter-end. The report began collecting data on exposure from derivatives in March 1997. The aggregate data from the FFIEC 009 are not confidential and are published quarterly by the FFIEC.⁶ The FR 2436 is collected semiannually, as of end-June and end-December. That report was implemented beginning as of June 1998. Aggregate data from the FR 2436 have not been published on any regular basis. For both reports, reporter-level data are confidential.

Exposure from Derivatives

As a first step in answering how global derivatives markets are, I use data from both the FFIEC 009 and the FR 2436 to estimate how much business U.S. derivatives dealers do with non-U.S. counterparties. In particular, I obtain data for banks that file both reports and calculate what fraction of their total exposure from derivatives is exposure to foreign counterparties. As shown in Figure 1, exposures to non-U.S. residents range from about 55 percent to 75 percent of total exposures from derivatives. Alternatively, only about 25 percent to 45 percent of counterparty credit exposures of U.S. derivatives dealers are to U.S. residents, which suggests that derivatives markets are very international.

I then combine the share of derivatives exposures to U.S. residents with data on the distribution of foreign exposure from derivatives by country of counterparty, using data from the FFIEC 009 report. As is shown in Figure 2, as of end-March 2008, estimated derivatives exposures to counterparties in the G-10 countries was 75 percent of total exposure, about 40 percentage points of which was exposure to the U.S. residents. Estimated exposure to residents of other developed countries is about another 10 percent of total exposures from

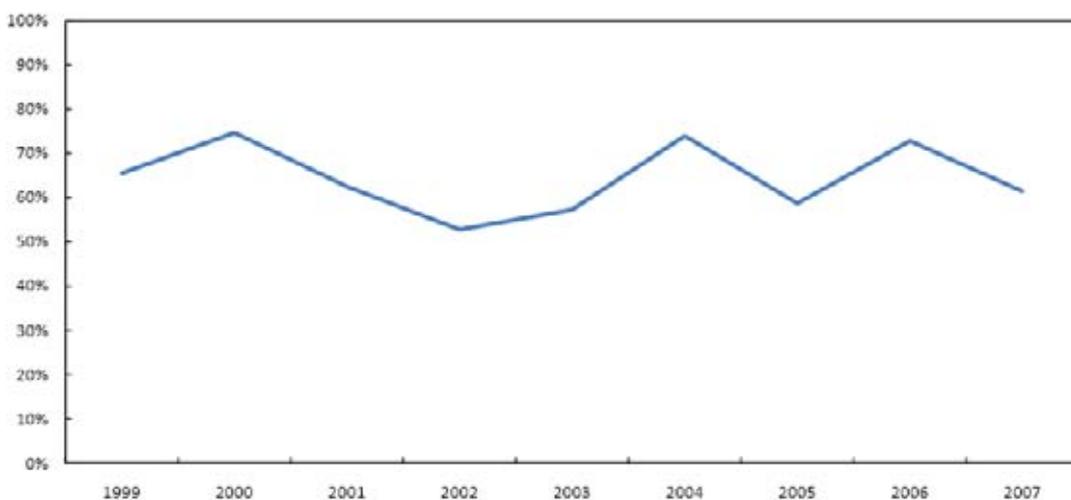
⁴ The report form and instructions for the FFIEC 009 can be found at http://www.ffiec.gov/PDF/FFIEC_forms/FFIEC009_20060331_f_i.pdf.

⁵ The FR 2436 report form for the can be found at http://www.federalreserve.gov/reportforms/forms/FR_243620090107_f.pdf, and the instructions can be found at http://www.federalreserve.gov/reportforms/forms/FR_243620090107_i.pdf.

⁶ The FFIEC's E.16 Statistical Release can be found at <http://www.ffiec.gov/E16.htm>.

derivatives. Thus, although derivatives exposures are quite international, they are concentrated in developed countries, mostly in the G-10. Estimated exposure to residents of emerging market (EM) countries was 8 percent and to residents of financial centres was 7 percent. The figure also hints at a gradual trend that has shifted exposures from developed countries and toward EM countries and financial centres.

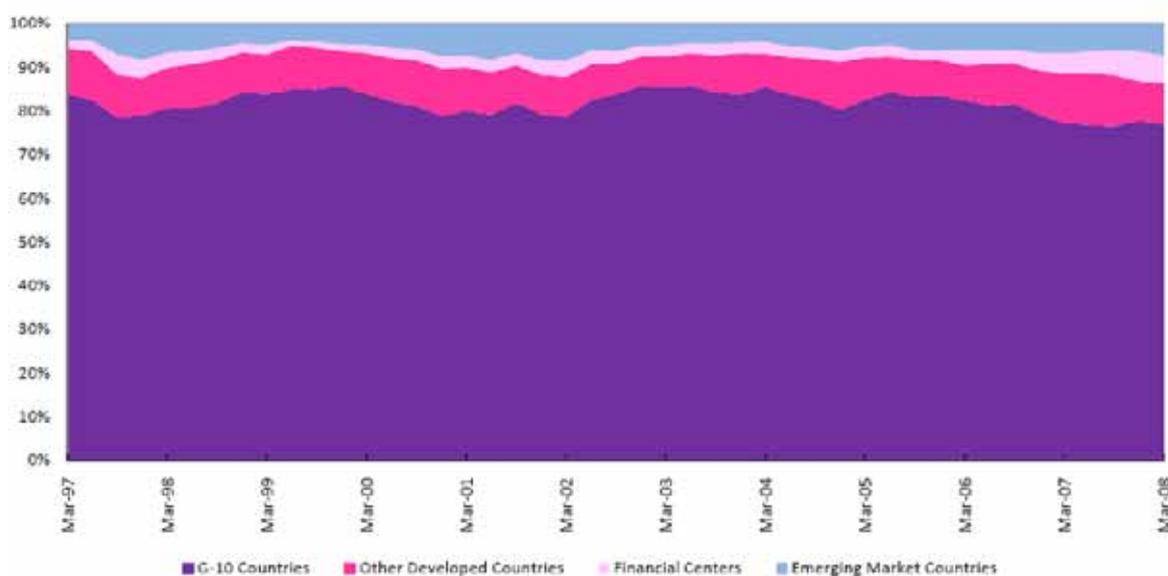
Figure 1
**Estimated foreign exposure from derivatives
as a percent of total exposure from derivatives**



Source: FFIEC 009 and FR 2436 reports.

Figure 2
**Estimated total exposure from derivatives
by country of counterparty**

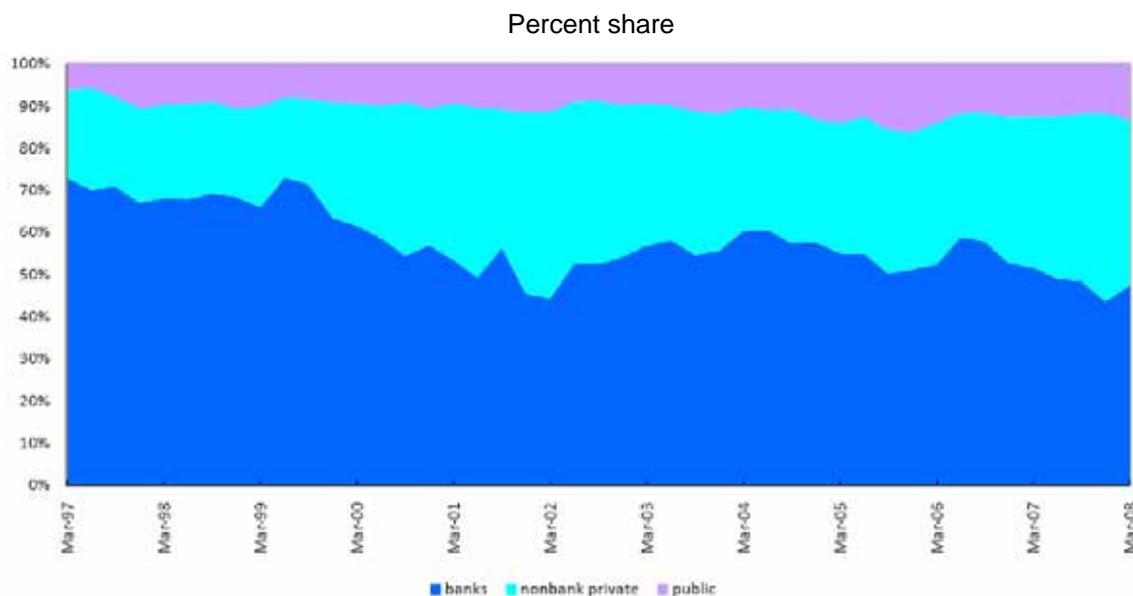
Percent share



Sources: FFIEC 009 report and author's estimates.

The FFIEC 009 data also include a breakdown by sector of counterparty of foreign exposure from derivatives. The three sectors are the banking sector, the public sector, and the nonbank private sector. The definitions of these sectors follow the definitions used for the sector breakdowns in the BIS consolidated banking statistics. As can be seen from Figure 3, almost half (47 percent as of end-March 2008) of foreign exposures from derivatives are to banks, and about two-fifths of foreign exposures are to the nonbank private sector (39 percent in March). A little over one-tenth (13 percent in March) of foreign exposure is to the public sector. As can be seen from the figure, there has been a trend toward greater exposure to the nonbank private and the public sectors over time.

Figure 3
**Foreign exposure from derivatives contracts
 by type of counterparty**



Source: FFIEC 009 report.

Figure 4 shows the sector distribution of exposure from derivatives for different country groups, as of March 2008. Two major differences across country groups stand out. First, banks account for the greatest fraction of exposure only in the G-10 countries.⁷ This almost surely results from the fact that the major derivatives dealers are headquartered in the G-10 countries and almost all of them are banks. Second, the nonbank private sector accounts for the greatest fraction of exposure in the other country groups, and particularly in the financial centres. In the financial centres, these nonbank private sector counterparties are very likely to be nonbank financial firms, and it seems likely that nonbank financial firms make up the bulk of nonbank private sector counterparties in the other country groups as well.

Data from the BIS regular OTC derivatives statistics suggest that financial firms are indeed likely to make up the bulk of nonbank private sector counterparties. Figure 5 shows the counterparty breakdown that is collected in the OTC derivatives statistics – which is reporting dealers, other financial firms, and nonfinancial entities.⁸ The breakdown is shown for the

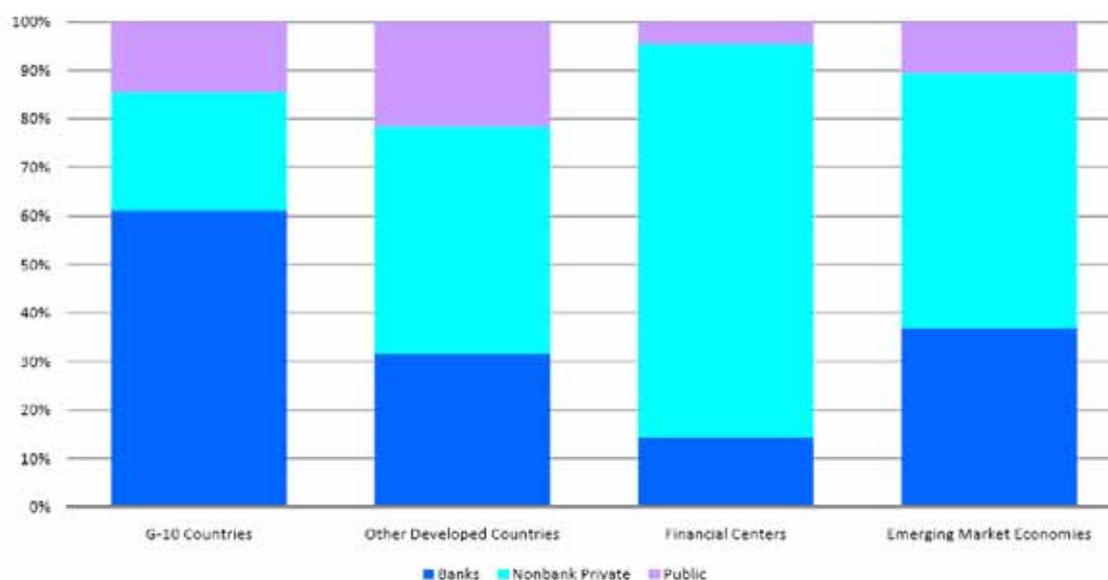
⁷ However, because exposure to G-10 counterparties make up the greatest fraction of all foreign exposures from derivatives, banks account for the greatest fraction of exposure globally.

⁸ The FR 2436, which feeds into the regular OTC derivatives statistics, uses these sector definitions.

gross market values of all interest rate, foreign exchange, and equity derivatives, because a full counterparty breakdown is not collected for counterparty exposures. The share of the gross market value of all derivatives contracts between reporting dealers has remained relatively stable at a little under 40 percent. The share of contracts with other financial firms – which are nonreporting banks and nonbank financial institutions – has risen somewhat in recent years, and is now a little under half. Contracts with nonfinancial entities – which include the public sector and nonfinancial corporations – are about 15 percent.

Figure 4

Foreign exposure by country group and counterparty sector

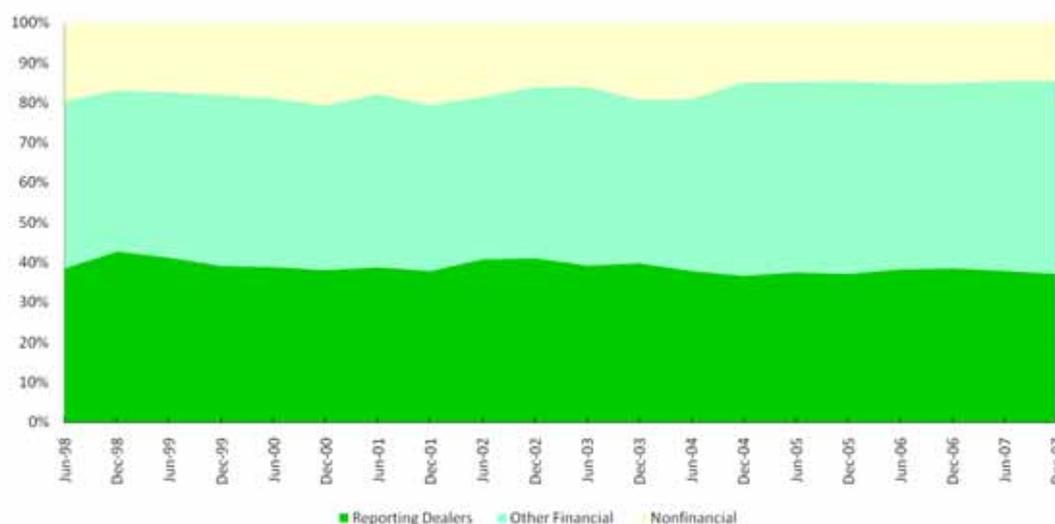


Source: FFIEC 009 report. Data as of end-March 2008.

Figure 5

Gross market value of derivatives contracts by type of counterparty

Percent share



Source: Regular BIS OTC Derivatives Statistics.

Conclusion

This paper looks at the distribution by country of the counterparty credit exposure of U.S. derivatives dealers, using data from two U.S. report forms. The data show that derivatives dealing is a very international business – well over half (and as much as three-fourths) of U.S. dealers' exposure from derivatives is exposure to foreign residents. Most of this exposure is concentrated in the G-10 countries, and other developed countries are the next most significant country grouping. The shares of exposure to emerging market countries and financial centres appear to be gradually trending up.

The data also show that foreign exposure from derivatives is concentrated in the banking sector, although this share has been declining. It is not possible to compare the counterparty breakdowns between foreign and domestic (or total) exposure from derivatives, because the breakdowns on the two separate reports differ significantly.

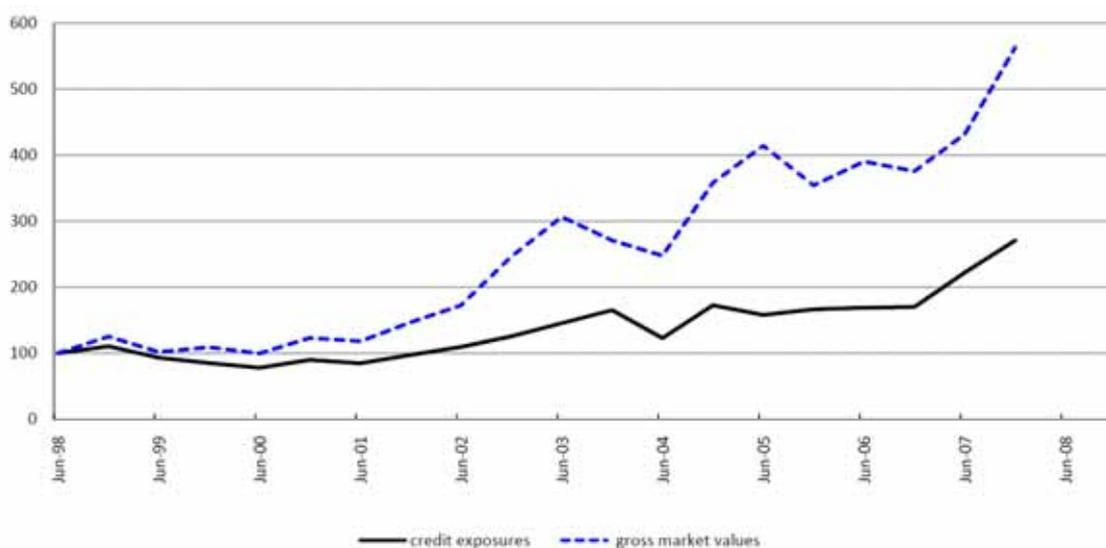
To what extent do these results allow us to draw conclusions about how global derivative markets are? Here are some caveats:

- U.S. data on exposure from derivatives may not be representative of the data for all derivatives dealers.
- Exposure from derivatives – which take account of netting when there are master netting agreements (that are legally enforceable) – may not be representative of other measures of derivatives activity, such as gross market values. For example, dealers will usually have master netting agreements with other dealers, because other dealers will be frequent counterparties. But dealers may be less likely to have a master agreement with a nonfinancial firm. As a result, business with between dealers will get less weight when measured by exposures than when measured by gross market values. Indeed, increased use of master netting agreements over the past decade to manage counterparty credit risk has caused credit exposures from derivatives to grow more slowly than the gross market values of derivatives contracts. This is shown in Figure 6.

Figure 6

Growth of the derivatives market

Index: June 1998 = 100



Source: Regular BIS OTC Derivatives Statistics.

Methodology for measuring derivatives at the Central Bank of Chile¹

Valeria Orellana and Paulina Rodríguez²

1. Introduction

Derivatives are increasingly being used in financial markets throughout the world, and Chile is no exception. Economic agents use these instruments to improve the allocation of resources and to better manage risks given the fact that derivatives can reduce costs, enhance returns, and therefore maintain the financial stability of the economy.

The Central Bank of Chile is responsible for ensuring that inflation remains low and stable. Since 1999 the Chilean economy has moved to a floating exchange rate system, which fosters the development of hedge markets that help protect companies from exchange rate fluctuations. Companies use hedging operations to fix exchange rate levels and therefore limit uncertainty and volatility until the real transaction takes place.

Even though the development level of the derivatives market in Chile still falls short of that in advanced economies, it has steadily grown into a reasonably active market over the last decade, given the size of our economy.

As a result, it is necessary to support the economic agents that participate in this process by providing statistical publications of the most commonly used underlying assets, such as interest rates, commodities, and foreign exchange.

The purpose of this document is to describe the Chilean compilation process. The second section presents a brief overview of the evolution of the derivatives market worldwide and specifically in the Chilean economy. It also compares our activity with the situation in other economies. The third section describes the legal framework underlying the information requirements. Sections four to six analyze the Chilean derivatives system, from data collection to current publications, and its subsequent application in the Central Bank. It also reviews some of their advantages and disadvantages. The last section presents the conclusions of this paper.

2. Evolution of the derivatives markets

2.1 Global market

The Bank for International Settlements (BIS) is the centre of global statistical activity in the derivatives market. It publishes figures semiannually on derivatives traded in the organized exchange markets, and every three years a worldwide survey is conducted to measure foreign exchange and derivatives activity carried out in the over-the-counter (OTC) market. In the 2007 survey, 54 countries and jurisdictions participated.

¹ The views and conclusions expressed in this paper are those of the author and do not necessarily represent the views of the Central Bank of Chile.

² Statistical Information Division, Central Bank of Chile.

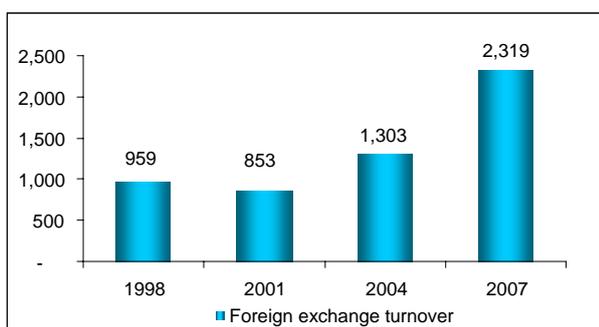
According to the latest survey, in 2007 global OTC derivatives turnover rose to an average of US\$ 2,319 billion traded daily, with a 78% increase between 2004 and 2007 (See Graph 1). Some reasons identified by the BIS for this were the diversification strategies made by long-term investors such as pension funds, and the growth of international trade in goods and services during the period. Another factor is the increasing importance of electronic brokering platforms, which have brought efficiency to the trading process.

In terms of currency pairs, the US dollar continued to be the most traded currency, with the euro following far behind in second place; 89% of transactions had one leg denominated in US dollars compared to 35% in euros.

Graph 1

Global OTC derivatives market turnover

Daily averages in April, billions of US dollars

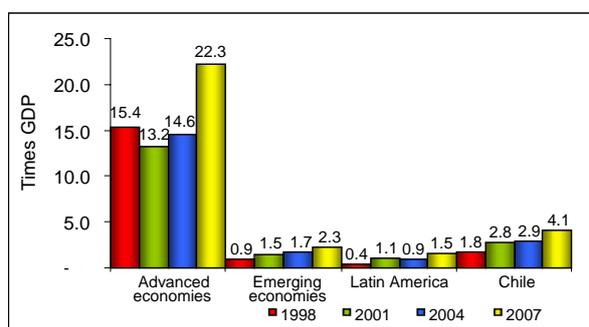


Source: BIS

Graph 2

FX derivatives activity OTC / GDP

Times GDP



Source: BIS and World Bank

The survey data were classified into three different groups in order to identify the Chilean FX derivatives market in the international context (see Appendix 1). The criterion used in this document for comparing information among countries is *depth*, which is associated with the frequency of FX transactions in an economy. The ratio normalizes annual FX derivatives activity (OTC) using GDP. The results show that Chile lies between the level of the advanced economies and the emerging economies, and ranks highly compared to Latin American countries. The ratio for all groups is increasing. The main reason for this is the exceptional global growth in FX derivatives transactions shown by the BIS data (Graph 2).

2.2 Derivatives in the Chilean market

The underlying assets traded in Chile are commodities, interest rates and foreign exchanges. According to the data collected by the Central Bank of Chile, approximately US\$ 726 billion were traded in 2007, of which 91% correspond to foreign exchange derivatives, 7% to commodities, and the rest is allocated to interest rate derivatives. This document will therefore focus on foreign exchange derivatives.

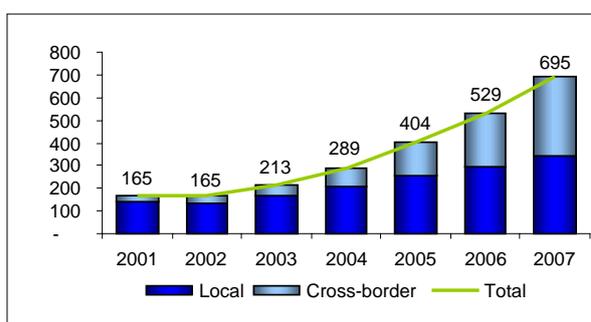
Banks are the main operators of the derivatives market in Chile. They are the counterparties of agents looking to hedge against exchange rate fluctuations, and speculators who take large risks, especially in anticipating future price movements, or who look for arbitrage opportunities in order to benefit from changes in local interest rates relative to foreign interest rates.

The volume of transactions has grown even faster in recent years, mainly because of the floating exchange rate system, and the hedging strategies of Chilean pension funds. The total foreign exchange turnover increased by 300% between 2001 and 2007, from US\$ 165 billion to US\$ 695 billion. It is worth noting that cross-border transactions increased

by 48% between 2006 and 2007, which is explained by the turbulence in international financial markets, the appreciation of the Chilean peso, and the interest rate spread between the US and Chilean economies. As a result the total foreign exchange turnover (local plus cross-border) rose by 31% in 2007 (Graph 4).

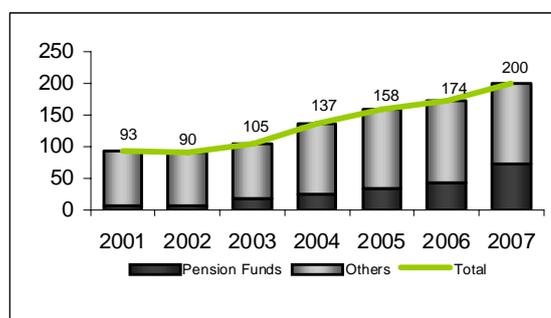
Moreover, the amount traded in the local market by pension funds increased from US\$ 7 billion in 2001 to US\$ 72 billion in 2007. The notable increase of 72% of transactions for the year 2007 is a result of the increase in the foreign investment limit from 30% in 2006 to 40% in 2007 (Graph 5). In addition, the pension funds raised their total share from 7% in 2001 to 36% in 2007, without considering interbank transactions.

Graph 4
Annual FX derivatives turnover
Billions of US dollars



Source: Central Bank of Chile

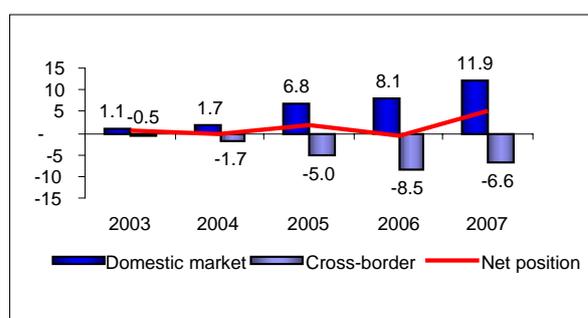
Graph 5
Annual FX derivatives turnover in local market
Billions of US dollars



Source: Central Bank of Chile

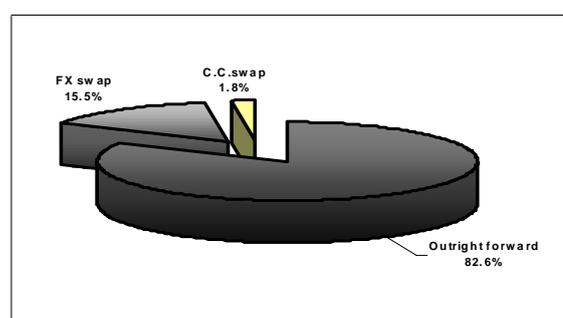
Even though it is difficult to know the purpose of each operation in the derivatives market, it is useful to monitor the outstanding positions of resident companies compared to cross-border counterparties, in order to observe how the interest rate differential causes them to vary. Between 2006 and 2007, the decrease in the seller's position in the cross-border market was due to an increase in the outstanding purchase contracts at the end of 2007, which in turn was mainly caused by the interest rate spread between Chile and United States (Graph 6).

Graph 6
Bank FX notional amounts outstanding
Billions of US dollars



Source: Central Bank of Chile

Graph 7
Type of traded instrument in 2007
Per cent



Source: Central Bank of Chile.

In Chile, outright forward contracts are the most traded financial instruments, although the share of FX swaps has increased in the last four years (Graph 7). It should be noted that currently all foreign exchange transactions reported are OTC.

3. Legal framework

The Basic Constitutional Act of the Central Bank of Chile empowers it to define the foreign exchange market regulations and to demand statistical data from the various economic agents that participate in this market. This information is used for financial stability analysis, to track foreign exchange market activity and to compile the balance of payments and international investment position.

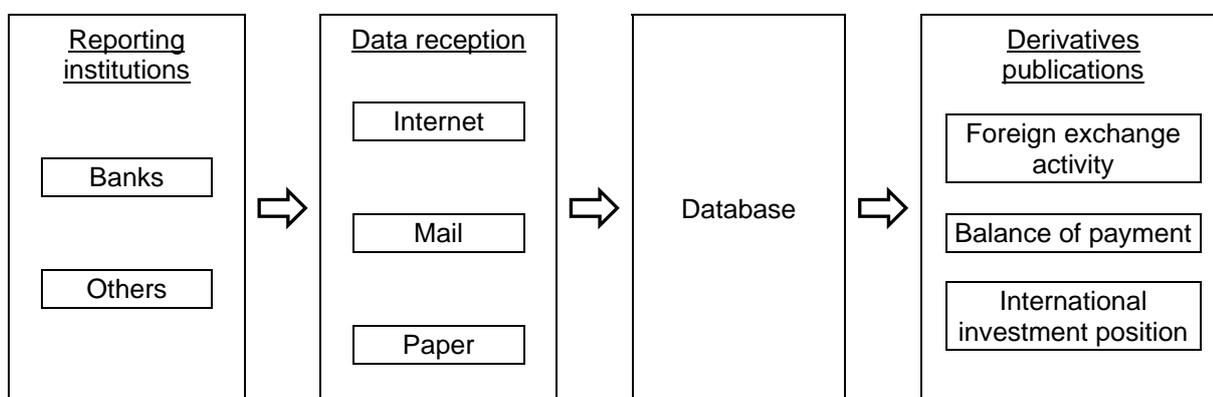
The statistical requirements are defined in the Compendium of Foreign Exchange Regulations, which establishes the standards applicable to foreign exchange transactions. Chapter IX of the Compendium defines the information requirements for Chilean entities regarding derivatives in the local and cross-border markets, for any underlying assets.

4. Compilation system

Derivatives are measured at both market value and notional amounts. This section explains the compilation of derivatives process, including reporting institutions, data collected, validation, and the valuation methodology utilized to calculate market value (Figure 1).

Figure 1

Data collection process



4.1 Data collection system

The Central Bank of Chile (CBCh) has a mixed data collection system that combines indirect reporting (eg banks reporting data from third parties, usually known as the International Transactional Reporting System (ITRS)), and direct reporting, such as surveys. The latter has increased its relevance due to new statistical requirements.

The Statistics Collection Department is in charge of gathering these data and the requirement forms are available at <http://www.bcentral.cl>.

Derivatives information is collected under a direct reporting system, transaction by transaction. The current collection system was inherited, when there were controls and

restrictions on foreign capital flows. At that time, reporters had to fulfill several requirements of providing information, which has resulted in reporting institutions have become used to reporting data to the Central Bank of Chile.

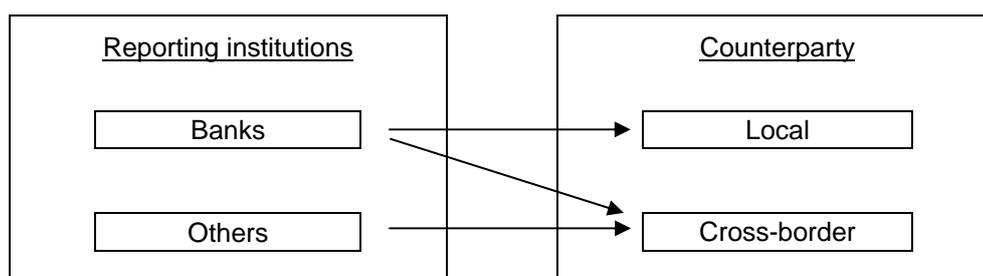
Studies of the possibility of changing the current collecting system to one with aggregated information have been made, but the conclusions are clear about an increase on the reporting burden given the fact that they would have to invest in new technology for adapting their systems to the new requirements.

4.1.1 Reporting institutions

Banks or companies that carry out transactions with derivatives such as forwards, FX swaps, options, cross-currency swaps and futures, must report their transactions if they are made in foreign currencies or if the cash settlement is made in a foreign currency.

Banks report data with both local counterparties (residents) and cross-border (non-resident) counterparties. Conversely, other reporting entities report only cross-border transactions, therefore avoiding double reporting (Figure 2).

Figure 2
Reported data



Currently, there are 25 banks reporting foreign exchange derivatives. Twelve of them are branches of non-resident banks and the rest are local institutions. Reports are made daily by 11:00. The contracts reported are those traded on the previous day.

Local counterparties of banks can be classified into institutional, non-financial, and financial sector excluding banks (Appendix 2, Table 2). The number of counterparties has risen during the last six years, from 750 in 2001 to 2,094 in 2007. This is mostly explained by the increase in the non-financial sector, from 877 in 2004 to 2,030 in 2007 (Appendix 2, Table 3).

On the other hand, there were 59 cross-border counterparties of banks in 2007, mainly banks and their branches (Appendix 2, Table 3). The number of this type of counterparties has been increasing since 2004, revealing a greater access to the cross-border market. Moreover, the internationalization of Chilean fixed and variable income instruments encourages the uses of FX derivatives.

Other companies reporting derivatives data (transactions with cross-border counterparties) can be classified into three groups: insurance companies, non-financial entities and investment banks. Monthly reports must be submitted to the Central Bank of Chile not later than the 10th of the month following the date of transaction.

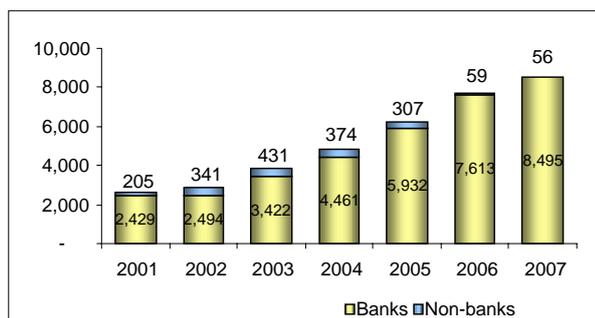
4.1.2 Data collected

All the information required from the reporting entities is contained in the terms of the contract, and therefore it is easy to report. The data requested in the reporting form include:

trade date, forward rate, currency buyer, currency seller, settlement currency, settlement date, valuation date and settlement (Appendix 2, Table 4).

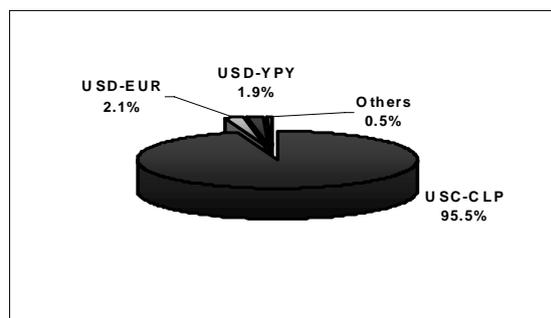
At present, on average 8,495 contracts are received monthly from banks, which include both local and cross-border market transactions, whereas 56 are received monthly in the case of others entities with cross-border counterparties (Graph 8). Banks' share of total turnover increased from 91% in 2001 to 96% in 2007, mainly explained by the rise in cross-border operations. In the local market, bank transactions – in terms of amounts – are mostly with other entities.

Graph 8
Average monthly received contracts
Contract units



Source: Central Bank of Chile

Graph 9
Most traded currency pair
Per cent



Source: Central Bank of Chile.

With respect to currency distribution, US dollars – Chilean peso are the most traded currency pair, accounting for 95% of the total. Next are US dollars–euro, and US dollar–yen, with 2.1% and 1.9% shares, respectively (Graph 9).

4.2 Validation

The reporting form on the Internet has data-entry validations to ensure that reporting entities do not enter incorrect data.

Interbank transactions have a special validation. The system checks that data reported by a bank must be the same as the data reported by its counterparty, according to the contract. For example, the amount purchased by a bank must be the same as the amount sold by the counterparty. Reporting banks can be contacted in order to amend the reported data.

Another validation tool is cross-checking data reported by the International Transactional Reporting System and the derivatives reporting forms, which are usually reported by different areas of the banks. This ensures that all operations are informed and classified under the correct transaction codes in the ITRS system; the type of settlement is also verified.

Furthermore, as data are published daily, consistency with the previous day is checked so that there are no anomalies.

4.3 Valuation methodology

The Central Bank of Chile collects notional amounts. Therefore, and in order to compile derivatives statistics for the balance of payments (BOP) and the international investment position (IIP), the market value of contracts must be calculated.

The value of a forward-type contract derives from the difference between the agreed contract (strike) price(s) and the prevailing, or expected, market price(s) on the day of the settlement, times the principal amount, appropriately discounted.

The market value of the contracts is calculated by the software database using the net present value technique. To create an interest rate curve, the system needs as inputs the risk-free interest rate of the different currencies and maturities for effective contracts at the valuation date, which are obtained from Bloomberg. The linear interpolation method is used to determine the value of missing interest rates. The market value is calculated using the exchange rate and interest rates for the selected date.

4.3.1 *International investment position and balance of payments*

The requirement to include statistical data on financial derivatives was first incorporated in the international manual of the System of National Accounts released in 1993 (SNA93) and the 5th Balance of Payments Manual (BPM5). These data were formerly classified within a portfolio investment subcategory. Since the financial derivatives market has grown in recent years, the International Monetary Fund established the treatment of financial derivatives as a separate functional category in 2000 to reflect its increasing importance.

The standard components of the international investment position are established in BPM5 (Figure 3).

Figure 3

Standard components of the international investment position

	Changes in position reflecting					Position at end of period
	Position at beginning of period	Transactions	Price changes	Exchange rate changes	Other adjustments	
Financial derivatives:						
1. Monetary authorities						
2. General government						
3. Banks						
4. Other sectors						

Source: IMF.

The derivatives system retrieves all the contracts at market value, so they have to be broken down by the institutional sectors that are required to publish the BOP and the IIP (Figure 3). The next step is to add up all the contract values that are positive on one side, and all the negatives on the other, to obtain the asset and liability positions. This is because if the net present value of a contract is positive (that is, the present value of future amounts receivable is greater than the present value of future amounts payable), the contract is a financial asset and has to be classified in the asset position. Conversely, if the net present value is negative (that is, the present value of future amounts receivable is less than the present value of future amounts payable), the contract is a financial liability and has to be classified in the liability position.

5. Data uses and statistics

The data on derivatives are used to help authorities to design financial and monetary policies and to assist market participants to better monitor activity patterns in the financial system.

Exchange-rate volatility in particular can affect the financial stability of economies in several ways. These effects can be observed on the balance sheets of companies through the currency denomination of assets and liabilities, as well as on the competitiveness of companies dedicated to external markets. In this context, financial derivatives are instruments available for economic agents to help them reduce their exposure to currency risk.

In order to analyze the impact on the exchange rate, outstanding positions (asset or liability) taken by the different economic agents are followed (eg the impact of raising the foreign investment limits of pension funds on the exchange rate).

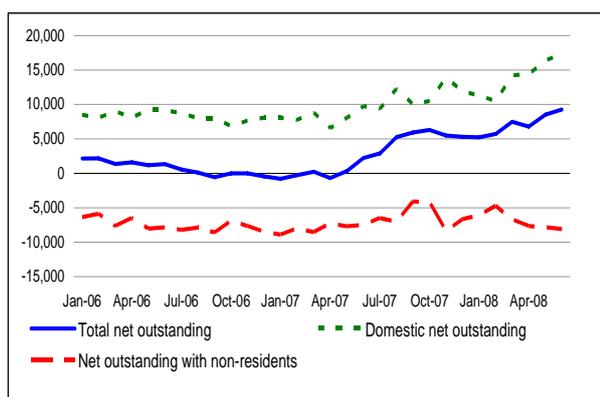
Derivatives figures can also be used to analyze whether arbitrage by cross-border agents is taking place. Given the current difference between local and foreign interest rates, the Central Bank of Chile and the market are closely following local outstanding positions with non-residents.

Graph 11 shows the evolution of the net balance of the total operations of the foreign exchange derivatives market, that is, the difference between the buying and selling positions, broken down by the residence of bank counterparties. The national agents have been selling rather than buying dollars. An example of this is institutional investors, who have been protecting themselves from exchange rate risks. On the other hand, foreign agents have been buying those dollars in the forward market. This would indicate that foreign agents are incurring debts in Chilean pesos at lower interest rates than they could obtain by investing, to take advantage of the exchange rate differential and carry trade with other countries of the region (Graphs 11 and 12).

Graph 11

Bank FX notional amounts outstanding

Millions of US dollars

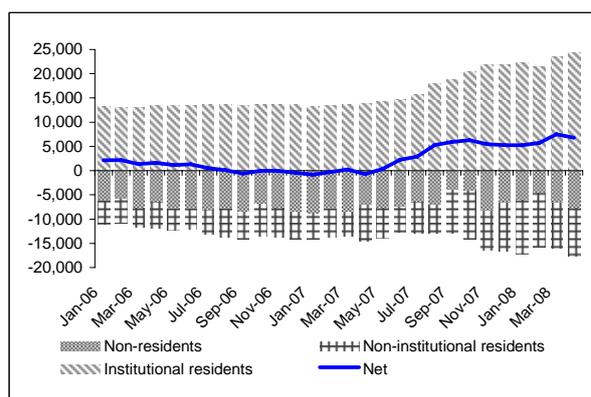


Source: Central Bank of Chile.

Graph 12

Local banking net outstanding position broken down by sectors

Millions of US dollars



Source: Central Bank of Chile.

Graph 12 was published in the article “Pension funds exchange rate hedging risk and its effect on local banking”, of the Financial Stability Report for the first semester of 2008.

As a result of the hedging needs of institutional investors, banks offer exchange rate risk hedging to other agents with foreign currency selling positions, but without natural hedging

against that risk (import companies or companies that have debts in foreign currencies) in order to hedge their foreign currency buying positions. In addition, banks also offer risk hedging to non-resident investors who need to have a selling position in Chilean pesos. On average, these investors have bought US\$ 7 billion in forward dollars. As a result, the difference between buying and selling positions has increased since September 2007, reaching US\$ 6,790 million in April 2008.

5.1 Statistics

The Central Bank of Chile publishes derivatives statistics to increase market transparency.

Derivatives statistics are published monthly in the balance of payments and quarterly in the international investment position at market value (Appendix 3). Likewise, they are used in semiannual financial stability reports, BIS reports, working papers, and are occasionally requested by members of the public.

Alternatively, turnover data and outstanding positions are published monthly in the Monthly Bulletin, with the following breakdowns:

a) Banking statistics

Turnover notional amounts are broken down by maturity, price, and average daily turnover between banks and third parties, as well as interbank operations. In addition, outstanding positions are broken down by local and cross-border market and by purchases and sales to third parties (Appendix 3).

b) Bank and company statistics

Turnover notional amounts are broken down by currency pair (domestic currency with US dollar), local and cross-border market, and counterparty (banks or companies).

Daily bank turnover data are also published in the Daily Bulletin, specifically the purchases and sales to third parties (meaning no banks), net amounts (purchases minus sales), and operations between banks (Appendix 3). It is important to mention that the Central Bank of Chile publishes only aggregated data because individual institutional data must remain confidential according to the Bank's legal obligations.

6. Advantages and disadvantages of the Chilean system

This section reviews the main advantages and disadvantages of the Chilean derivatives data collection system.

Advantages:

- Electronic receipt and automatic data downloading into the database minimize operational errors and reporting lag.
- High quality of the data available. The fact that the information provided is known by the reporting entities, since it is the same as in the contracts, ensures integrity, accuracy and reliability of the data.
- Low reporting burden as data providers just send the contract information without any changes. They are not required to make any special calculation such as aggregating data or obtaining market values for reporting.

- Daily publication periodicity. Thanks to daily reporting by banks, total derivatives FX turnover can be published on a daily basis. It thereby provides useful information for market participants.
- Detailed information received enables the provision and dissemination of information using different breakdowns.

Disadvantages:

- The system requires constant efforts in order to ensure a good coverage and scope with non-commercial banks. Checks are made by different sources to verify that all companies with derivatives abroad are reporting, because the derivatives deals that they make in the local market are reported by commercial banks. For instance, notes to the financial statements of the supervised companies are reviewed. Furthermore, as companies report other financial data such as foreign loans to the Central Bank of Chile, and those institutions have a strong likelihood to hedge currency risk, they are contacted as well.
- Transactions between two Chilean entities, when neither is a bank, are not recorded in the same way and frequency that the other operations previously described. Annual surveys have been implemented to measure this gap. Aggregate results have shown that the missing information accounts for only 7% of the information already collected.
- The system lacks information on those transactions related to the Chilean peso, involving two foreign entities interacting abroad. In this case, the Central Bank of Chile cannot legally demand the data, but international experiences have been reviewed, in order to survey international brokers.

7. Conclusions

In recent years, derivatives information has become an important variable for tracking Chilean FX markets, analyzing domestic financial stability, and helping policymakers. Therefore, the accuracy and quality of information collected is of great importance.

Chile has developed an efficient system for measuring derivatives statistics using detailed daily data from banks and monthly data from non-commercial banks. This information is available in over-the-counter" (OTC) contracts and is also received electronically through the Internet.

The quality of the information collected is high, and allows the Central Bank of Chile to publish reliable statistics. The detailed derivatives data collected by the Central Bank of Chile covers its information needs for policy decisions and for the analysis of financial stability.

Regarding the challenges facing the Central Bank of Chile, further work is required in the future to collect data that are not currently available. In this sense, international experience in collecting derivatives data for transactions between non-residents needs to be reviewed. Furthermore, it is important to develop a better coordination with supervising authorities in order to improve the quality of data on derivatives.

The impact of the international financial reporting standards (IFRS) on data collection must be taken into account, in order to verify whether those standards will require changes in the way data are collected currently.

Finally, a close relationship with the main actors in the market and constant learning are needed as derivatives market is growing very rapidly, in order to be aware of the new financial innovations and to understand them.

Appendix 1

Table 1
Country group list

Advanced economies	Emerging economies	Latin economies
Australia	Argentina	Argentina
Austria	Brazil	Brazil
Belgium	Bulgaria	Colombia
Canada	Chile	Mexico
Denmark	China	Peru
Finland	Colombia	
France	Hungary	
Germany	Indonesia	
Greece	Malaysia	
Ireland	Mexico	
Israel	Peru	
Italy	Philippines	
Hong Kong SAR	Poland	
Japan	Russia	
Luxembourg	South Africa	
Korea	Turkey	
Netherlands		

Appendix 2

Table 2
Economic sectors

Institutional sector	Non-financial sector	Financial sector excluding banks
Pension funds Insurance companies Mutual funds	Agriculture Construction Transportation and communications Mining Manufacturing Electricity, gas and water Wholesale and retail trade, hotels and restaurants Financial intermediation and business services Others	Investment banks Stockbrokers Securities agents

Table 3
Bank counterparties

	Local				Cross-border
	Institutional sector	No-financial sector	Financial sector excluding banks	Total	
2001	27	695	28	750	19
2002	22	723	29	774	20
2003	28	955	29	1,012	28
2004	21	877	26	924	40
2005	34	1,591	29	1,654	40
2006	37	1,593	30	1,660	48
2007	34	2,030	30	2,094	59

Table 4
Foreign exchange derivative reporting form

Counterparty data		Contract number	Trade date	Settlement date	Number of days	Settlement	Instrument	Purchases		Sales		Forward rate	Option premium
Name	Country							Currency buyer	Amount purchased	Currency seller	Amount sold		
Bank	USA	12345	02/07/2008	06/08/2008	35	Non-deliverable	outright forward	US dollar	30,000,000	CLP	5,540,000,000	518	0

Appendix 3

1. Balance of payments and international investment position

Central Bank of Chile

	2002	2003	2004	2005	2006
BALANCE OF PAYMENTS (D) (1) (US\$ million)					
II. Capital and financial account	1,518.7	1,511.1	-1,804.9	-51.4	-6,792.1
A. Capital account	83.0	0.0	5.1	41.2	13.3
B. Financial account	1,435.7	1,511.1	-1,810.0	-92.7	-6,805.4
Direct investment	2,206.8	2,701.2	5,609.6	4,750.6	5,076.1
Direct investment abroad (assets)	-343.2	-1,606.3	-1,563.1	-2,209.0	-2,875.6
Equity capital	309.6	-587.8	-506.5	-790.1	-1,006.9
Profits reinvestment	-231.3	-546.8	-824.3	-945.7	-956.3
Other capital	-421.4	-471.6	-232.3	-473.2	-912.4
Direct investment in Chile	2,549.9	4,307.4	7,172.7	6,959.6	7,951.7
Equity capital	1,309.2	1,546.4	1,242.9	796.2	1,957.5
Profits reinvestment	1,366.6	3,335.2	5,951.6	6,539.0	7,457.3
Other capital	-125.9	-574.2	-21.8	-375.6	-1,463.2
Portfolio investment	-2,317.3	-2,645.3	-3,308.5	-2,624.0	-10,008.2
Assets	-3,315.8	-4,699.0	-4,430.2	-4,218.4	-10,850.9
Liabilities	998.5	2,053.7	1,121.8	1,594.5	842.7
Financial derivatives	-123.7	117.8	-84.0	-62.5	303.8
Assets	1,788.4	1,840.2	638.9	1,244.4	1,500.8
Liabilities	-1,912.1	-1,722.4	-722.9	-1,307.0	-1,196.9
Other investment	1,868.5	971.8	-4,217.9	-441.1	-179.6
Assets	1,140.6	-571.4	-3,388.6	-2,399.4	-3,675.2
Commercial credits	685.5	-996.0	-1,600.5	-1,599.3	-1,080.6
Loans	427.0	43.6	0.4	-4.8	-243.0
Currency and deposits	28.1	441.1	-1,788.5	-795.4	-2,351.5
Other assets	0.0	-60.1	0.0	0.0	0.0
Liabilities	727.9	1,543.2	-829.3	1,958.3	3,495.5
Commercial credits	-59.6	-34.9	831.2	436.3	1,188.4
Loans	777.1	1,459.5	-1,576.4	1,547.8	2,283.3
Currency and deposits	12.3	120.8	-90.8	-26.4	26.7
Other liabilities	-1.9	-2.2	6.7	0.6	-2.9
Reserves assets	-198.6	365.6	190.8	-1,715.7	-1,997.4

International investment position (1) (Millions of US dollars)

Años 1997 a 2007

Para más información, haga clic sobre el número ubicado a la derecha de la casilla de verificación.

Para visualizar los datos en forma de gráfico, marque las casillas de verificación que desee y luego haga clic sobre "Gráficos".

	00	01	02	03	04	05	06	07
2.2.2.4 Otros sectores	-	-	-	0.0	0.0	0.0	0.0	0.0
3. Instrumentos Financieros Derivados	-	363.2	102.1	222.3	695.2	954.0	938.1	1,755.1
3.1 Autoridades monetarias	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.2 Gobierno general	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.3 Bancos	-	145.4	72.7	83.7	224.0	470.4	506.1	1,170.4
3.4 Otros sectores	-	217.8	29.3	138.6	471.2	483.6	432.0	574.7

2. Monthly bulletin tables

Spot position and banks' outright forward position

Millions of US dollars

Period	Spot position	Outright forward positions by counterparty					Outright forward positions by market		Outright forward position	Total position
		*Purchases to third parties		*Sales to third parties		Interbank (only local market)	Local market	Cross-border market		
		Local market	Cross-border market	Local market	Cross-border market					
2008										
January	-5,988	30,212	21,292	18,886	27,378	22,577	11,326	-6,086	5,240	-749
February	-6,475	30,610	19,029	20,166	23,760	22,994	10,444	-4,731	5,714	-761
March	-7,128	34,122	17,517	19,922	24,225	25,614	14,200	-6,708	7,492	364
April	-7,337	34,276	13,280	19,838	20,926	25,918	14,438	-7,646	6,792	-545
May	-9,077	35,660	12,640	19,285	20,479	24,270	16,375	-7,839	8,536	-540

* Purchases of banks to non-commercial banks

Banks' outright forward turnover (CLP-USD)*

Millions of US dollars

Period	Contract maturity period												Total turnover	
	Up to 7 days			8-30 days			31-42 days			Over 42 days			Amount	Price CLP/USD
	Amount	% of the total	Price CLP/USD	Amount	% of the total	Price CLP/USD	Amount	% of the total	Price CLP/USD	Amount	% of the total	Price CLP/USD		
2008														
January	12,019	20.1	480.67	15,949	26.7	481.01	14,088	23.6	480.06	17,614	29.5	483.99	59,670	481.60
February	12,127	20.3	466.45	16,816	28.2	467.57	7,505	12.6	466.45	10,541	17.7	473.17	46,989	468.36
March	13,737	23.0	442.48	17,854	29.9	441.60	14,671	24.6	442.56	15,162	25.4	447.97	61,425	443.60
April	14,721	24.7	447.55	16,401	27.5	447.59	13,859	23.2	449.63	13,881	23.3	449.10	58,862	448.42
May	12,719	21.3	470.97	13,497	22.6	472.25	13,864	23.2	472.39	10,494	17.6	476.25	50,574	472.80

* For obtaining the amounts, interbank trading is divided by two to eliminate double-counting.

Banks' transactions

Millions of US dollars

Period	Daily average derivatives turnover				Daily average spot turnover			Prices	
	Third parties	Interbank	Total	%(CLP/USD)	Third parties	Interbank	Total	Outright forward	
								CLP/USD	Spot
2008									
January	2,187	530	2,718	99.81	1,297	1,604	2,901	481.01	479.46
February	1,759	526	2,285	97.93	1,001	1,606	2,607	467.57	466.67
March	2,405	705	3,109	98.77	1,326	2,671	3,996	441.60	442.13
April	2,053	649	2,702	99.02	1,362	1,830	3,192	447.59	447.51
May	1,937	608	2,545	100.00	1,351	1,645	2,996	472.25	471.00

FX transactions with local and cross-border market
Millions of US dollars

Period	Turnover in CLP/USD	Percentage of the total	Turnover in CLF/USD	Percentage of the total	Turnover		
					Local market	Cross-border market	Total
2008							
January	63,110	100	177	0	33,856	29,431	63,287
February	49,594	98	993	2	31,335	19,252	50,587
March	63,230	99	748	1	38,640	25,338	63,978
April	61,411	99	583	1	37,638	24,356	61,994
May	52,458	99	303	1	33,826	18,935	52,760

FX transactions with cross-border market
Millions of US dollars

Period	Local currency against foreign currency									
	Outstanding position					Turnover				
	Banks	Percentage	Others	Percentage	Total	Banks	Percentage	Others	Percentage	Total
2008										
January	48,589	90.7	5,009	9.3	53,597	25,993	88.3	3,438	11.7	29,431
February	42,706	91.2	4,136	8.8	46,842	16,686	86.7	2,565	13.3	19,252
March	41,742	92.6	3,354	7.4	45,096	23,569	93.0	1,770	7.0	25,338
April	34,228	92.6	2,723	7.4	36,951	21,805	89.5	2,551	10.5	24,356
May	33,057	92.7	2,592	7.3	35,649	17,077	90.2	1,858	9.8	18,935

Period	Foreign currency against foreign currency									
	Outstanding position					Turnover				
	Banks	Percentage	Others	Percentage	Total	Banks	Percentage	Others	Percentage	Total
2008										
January	5,092	59.4	3,480	40.6	8,572	1,423	90.5	149	9.5	1,572
February	5,180	59.0	3,604	41.0	8,784	846	60.2	558	39.8	1,404
March	5,123	44.9	6,288	55.1	11,411	1,698	36.2	2,987	63.8	4,685
April	5,187	44.1	6,578	55.9	11,765	1,576	62.3	954	37.7	2,531
May	5,594	47.3	6,241	52.7	11,835	1,772	69.8	768	30.2	2,540

3. Daily bulletin table

	Spot market	Forward market	
		Local market	Cross-border market
Purchases from third parties			
Sales to third parties			
Interbank operations			
Net Position			

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Alternative tools of trade for central banks and other financial institutions: foreign exchange liquidity options¹

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1. Introduction

We propose a class of exotic derivative securities, called the foreign exchange liquidity options (FELO), to be offered by a central bank to the domestic banks to allow them to borrow foreign currency denominated short-term loans from the central bank reserves in the event of sudden up moves in a foreign currency to the domestic currency exchange rate. Since the FELO provide the option holder banks with foreign exchange liquidity when the spot price of the contract foreign currency crosses a predetermined contract level, they can be viewed as an insurance the central bank sells to the domestic banks against potential liquidity crises. The most distinguishing feature of the FELO is that they give their holders not the right to buy, but the right to borrow foreign currency from the central bank reserves, for a predetermined term at the then current foreign currency country default-free interest rates on the exercise date of the option, if the option gets exercised. Since the option holder is not default-free, the price of this insurance is the market price of the default risk of the option holder. Further, since the FELO do not involve transactions in which the domestic currency is exchanged for a foreign currency, they allow the central banks to provide foreign currency liquidity to the domestic market at times of liquidity crises without affecting the domestic money supply.

In terms of their effect on the central bank balance sheets, the FELO are similar to the gold loans by which the central banks earn interest on their gold reserves that otherwise earn none. Gold Fields Minerals Service Gold Survey (2005) estimates that the annual volume of gold loans by central banks nears 5,000 tones. The same survey reports also that the total annual mine production is roughly about 2,500 tones whereas the annual central bank gold sales are about 656 tones. These figures indicate how popular the gold loans are and how much liquidity they add to the gold market. One reason for this popularity is that by lending the gold they own, the central banks obtain interest on their idle gold without removing the rented gold from their reserves. As Takeda (2006) points out, the central banks are not required, only recommended by the IMF, to exclude the rented gold from their reported reserve totals.

As has been witnessed time and again over the past few decades, although the long run equilibrium of foreign exchange markets depends on the macroeconomic fundamentals, the global capital flows, international liquidity conditions of the global financial markets and expectations of the market participants may create short-term departures of the exchange rate from the equilibrium levels. The central banks in “dollarized” economies where the exchange rate pass-through to prices is high have been particularly sensitive to such

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exchange rate fluctuations, because in such economies the exchange rate stability is a prerequisite for price, as well as financial, stability. More often than not, the response of the central banks to such crises has been to intervene in the currency market either to “correct” such short run departures or to reduce the potential and/or observed exchange rate volatility.

The conventional tools the central banks use for foreign exchange management are the direct intervention, selling/purchasing auctions and foreign exchange warehouse utilities. In the case of the first two, the domestic currency is exchanged for a foreign currency whereas in the case of the warehouse utility, a foreign currency is rented out in exchange for a foreign currency denominated collateral. Since the FELO can be viewed as exchange rate contingent short-term reverse repurchase agreements into which the central bank enters with the domestic banks (in which the domestic banks borrow foreign currency from the central bank reserves using their foreign currency denominated debt as “collateral”), the FELO resemble the warehouse utility the most. The main difference is that the launch of a warehouse utility is totally under the discretion of the central bank and it is not used unless a severe crisis hits the economy. Under the FELO agreements, on the other hand, the domestic banks are assured to have access to foreign currency reserves whenever the contract conditions are met. Therefore, unlike the FELO, the warehouse utility is not an insurance against foreign currency liquidity crises and gets employed only after the fact.

The aforementioned conventional tools are not the only tools available to the central banks and several derivatives based alternatives have also been employed. Neely (2001) reports the following derivatives based central bank interventions: the 1993 sale of put options by Bank of Spain so as to induce the market participants to support the spot value of peseta; the 1996–2001 sale of put options on the US dollar by Banco de Mexico for reserve accumulation purposes; the 1997 forward market purchase of bath by Bank of Thailand; and the ongoing efforts of the Reserve Bank of Australia to sterilize some of its spot interventions via swap transactions in the foreign exchange market. In addition, Breuer (1999) reports the utilization of the Hong Kong dollar put/the US dollar call options by the Bank of China in order to support the currency peg in 1998 whereas Mandeng (2003) reports the option-based foreign exchange market interventions of the Central Bank of Colombia between 1999 and 2003 in order to accumulate/decumulate reserves and reduce exchange rate volatility, to name but a few. Although the central banks started to use the derivative products for foreign exchange management in the early 1990s, many of the theory papers proposing various derivatives instruments predate their practical use in central bank currency interventions by at least a decade, and the literature on such proposals is growing. We give a brief review of the literature below. To our knowledge, all of the proposed derivative products in the literature involve the sale of a foreign currency and, as we document in our literature review, such derivatives based interventions suffer from several drawbacks. Since in the case of the FELO the foreign currency is not sold but rented, the FELO are free from many of the drawbacks mentioned above.

The use of options to borrow is not new to central banks. For example, in 1999 the Federal Reserve Bank of New York auctioned the so-called millennium date change (Y2K) options which gave the option holder bond dealers to execute overnight repos with the Federal Reserve Bank of New York at 150 basis points above the prevailing target federal funds rate. Through Y2K options, the Fed assured the availability of a large amount of liquidity to the bond dealers around the millennium change. Sundaesan and Wang (2006) investigated the impact of Y2K options on the liquidity premium of the US Treasury Securities, and based on the implied volatilities of Y2K options and the aggressiveness of demand for the instruments, concluded that Y2K options indeed eased the fears of bond dealers, contributing to a drop in the liquidity premium. The similarities between the FELO and Y2K options are obvious. However, the FELO differ from Y2K options in two aspects: Firstly, in the case of Y2K options, the central bank assured the injection of domestic currency to the domestic market whereas in the case of FELO, the central bank assures the injection foreign currency to the domestic market. More importantly, in the case of Y2K options, the time at which a liquidity

crisis could occur was known in advance whereas in the case of the FELO, the time of the onset of such a crisis is uncertain.

It should be noted that the FELO are similar also to the state-contingent government bonds proposed by Holmstrom and Tirole (1996). The difference is that in our case the “government”, that is, the central bank, does not sell state-contingent “government” bonds, but sells state-contingent “foreign government” bonds from the central bank reserves. Based on their theory, Holmstrom and Tirole suggested that governments should issue state-contingent bonds that pay off only when the private sector experiences a shortage of liquidity. Later, Holmstrom and Tirole (1998) argued that state-contingent bonds were not used in reality because there was *“no aggregate, measurable state that unequivocally identifies times when firms should be provided more liquidity.”* Their view is that *“rather than the use of bonds that are contingent on a few foreseeable and verifiable variables, a discretionary policy may be more effective.”*

One problem with the FELO, as well as with all other derivatives based strategies, is that there is *“no aggregate, measurable state that unequivocally identifies times when”* the domestic banks should be provided with foreign exchange liquidity, either. Specifically, there are two issues with providing foreign exchange liquidity to the domestic banks through the FELO. The first issue is the timing: since the time a liquidity crisis begins is not foreseeable, when should the central bank offer the FELO? The second issue is the choice of the exchange rate barriers associated with the FELO: above (below) what exchange rate level does a liquidity crisis begin (end)? Neither of these questions has an answer.

Therefore, we suggest that central banks should sign the contracts whenever a domestic bank wishes to do so and give the timing discretion to the domestic banks so that the banks get insured whenever they perceive that a liquidity crisis is imminent. Since the insurance fee the banks are charged is the market price of their default risk, they would be indifferent between borrowing from the central bank and private lenders when they do not perceive an imminent liquidity crisis. Further, since the loans are short-term and the short-term information asymmetry between the central bank and the domestic banks is negligible, signing such contracts during normal times would allow the central bank to earn higher interest on its reserves for a small default risk. Furthermore, since the FELO are private contracts between the central bank and domestic banks, if a high risk bank approaches the central bank singularly, then the central bank can always discourage the bank by asking a large insurance fee.

As for the choice of the exchange rate barriers associated with the FELO, we suggest that the central bank should leave this decision also to the domestic banks, provided that the chosen barriers satisfy the simple conditions we spell out below. Since the barriers are among the variables that determine the contract price, the central bank is appropriately compensated for any choice. Further, if the central bank chooses the barriers, this could be interpreted as a signal by the domestic banks that the central bank is exchange rate targeting. In a floating exchange rate regime, the central bank neither can send such signals nor can target the exchange rate level.

The rest of the paper is organized as follows. In the next section, we specify the FELO in detail, review the related literature and discuss the monetary policy implications of the FELO. In Section 3, we price the FELO in a general setting and then specialize our result to the Republic of Turkey in a five-factor affine jump diffusion model. In Section 4, we discuss our estimation procedure, estimate the model and present our estimation results. In Section 5, we discuss the computation of the FELO price through Monte Carlo simulations first, and then present and discuss our results for a set of model parameters. Finally, In Section 6, we conclude.

2. The foreign exchange liquidity options

2.1 Review of the related literature

As Eaton and Turnovsky (1984) noted, proposals of derivatives based strategies as additional means to intervene in the foreign exchange market can be traced back to Keynes. Keynes (1930) wrote:⁴ *“I conceive of (Central Banks) as fixing week by week not only their official rate of discount, but also the terms on which they are prepared to buy or sell forward exchange on one or two leading foreign exchange centres and the terms on which they are prepared to buy or sell gold points.”* Of course, at the time Keynes made his proposal, the gold standard was still in place. Analyzing the role of forward exchange market in stabilizing domestic income against stochastic exchange rate disturbances after the demise of the gold standard and Bretton Woods, Eaton and Turnovsky (1984) found the following: *“Forward market intervention does not provide monetary authorities additional leverage in stabilizing income beyond unsterilized spot market intervention. Intervention rules based on reactions to both the forward and spot exchange rates, however, can outperform intervention policies responding to the spot rate alone, regardless of the market in which the intervention occurs.”* It is with this, and similar conclusions of other authors from their analyses of other types of derivatives based strategies, in mind that we propose our foreign exchange liquidity options to central banks as additional tools for foreign exchange management.

With the rapid expansion of derivatives transactions since the latter half of the 1980s, many central banks started to investigate the potential use of derivatives products in their foreign exchange management efforts in the late 1980s and early 1990s. A comprehensive survey of the literature after 1982 until 1993 can be found in Hali(1993). In 1995, two years after Bank of Spain sold put options to induce the market participants to support the spot value of peseta, Taylor(1995) suggested that central banks should buy put options written on the domestic currency in order to accumulate reserves at reasonable prices when there is a depreciating trend of the currency due to a speculative attack. In his proposal, he argued that central banks may then reinject the reserves accumulated through the put options to the market to mitigate the downward pressure on the domestic currency.

Breuer (1999) demonstrated that a strategy of central banks buying currency options is flawed because of the destabilizing impact on the exchange rate of the dynamic hedging by market makers, as well as because of a moral hazard incentive for the central bank to influence the spot exchange rate. He then suggested an alternative strategy whereby the central bank sells options, either individually or packages in a “strangle”. He argued that under certain conditions this strategy could lower exchange rate volatility, may boost the credibility of an exchange rate target zone and could have lower expected costs than spot market interventions. He pointed out, however, that selling options exposes the central bank to an unlimited loss potential.

In the same year, Wiseman (1999) suggested that central banks should commit themselves to frequent and regular auctions of short-dated physically-delivered foreign exchange options. His suggestion is very similar to that of Breuer(1999), since both mechanisms are based on the exchange rate volatility reducing delta hedges of the option buyers. Stremme (1999) analyzed the proposal of Breuer(1999) and Wiseman(1999) in scenarios in which market participants, rather than simply hedge their option positions, strategically exploit the leverage provided by such options. He concluded that options issued by central banks create an incentive for speculators to manipulate exchange rates which would otherwise not exist. Put differently, Stremme argued that rather than protecting the domestic currency against speculative attacks, options in fact create additional tools for such attacks. The FELO we

⁴ “A Treatise on Money”, p. 327.

propose are immune from such attacks for a number of reasons: Firstly, similar to Y2K options the Federal Reserve Bank of New York auctioned to the bond dealers only, we suggest that the FELO should be offered by the central bank to the domestic banks only. Secondly, we suggest that the FELO should not be auctioned by the central bank, but should be signed by the central bank and each domestic bank as over-the-counter contracts. Since over-the-counter contracts are private contracts between the central bank and each domestic bank, the terms of the contracts are private information which need not be disclosed publicly.

Later in 2000, Blejer and Schumacher (2000) questioned the rationale for central banks to use derivative products and contingent liabilities, and suggested a portfolio approach to analyze the whole spectrum of central bank contingent liabilities. They identified five essential reasons for central banks to use derivative products in foreign exchange management:

1. to support the development of the derivatives market;
2. to smooth the volatility in the spot market;
3. to attain a desired level or band of the exchange rates;
4. to sustain financial stability while defending a fixed exchange rate regime; and, finally,
5. to add to the existing tools an additional tool for foreign exchange liquidity management.

The FELO we propose are essentially for the second and fifth reasons Blejer and Schumacher identified, not to mention that we are concerned also with the financial stability of the domestic financial sector irrespective of whether the exchange rate regime is fixed or floating.

In closing our by no means comprehensive review of a broad literature, we mention also the recent notable work of Suh and Zapatero (2007). In this recent work, Suh and Zapatero introduce a class of new financial instruments that they call quadratic options, which are designed to mitigate the exchange rate volatility without the unlimited loss potential Breuer(1999) identified. Their literature review brings the interested reader up to date and we refer the reader to their review for additional coverage. Based on their quadratic options, they compare the spot only, option only, spot and option and no intervention strategies, and find that the best alternative for a central bank is to combine their options with spot intervention. Unfortunately, the stabilization potential of the contracts Suh and Zapatero propose rely heavily on the hedging activities of the issuer investment banks, as well.

2.2 Specification of the FELO

We consider three types of foreign exchange liquidity options. The first and simplest of these is a numerator currency loan commitment of the seller to the buyer such that if the numerator currency to the denominator currency exchange rate crosses a certain barrier above the current level, then the buyer has the right to borrow from the seller a prespecified amount and maturity date zero-coupon loan in the numerator currency at the then current numerator currency country default-free interest rates on the exercise date of the option. We call this option the plain vanilla foreign exchange liquidity option or the PFELO.

The second type extends the first type in such a way that if, after crossing the first barrier prior to the option exercise date, the exchange rate crosses a second barrier above the first after the option exercise date on or before the maturity date of the loan, then the buyer has the additional right to extend the maturity of the loan to a second prespecified date. We call this option the extendible foreign exchange liquidity option or the EFELO.

Finally, the third type extends the first type in such a way that if, after crossing the first barrier prior to the option exercise date, the exchange rate crosses a second barrier below the first

after the option exercise date on or before a second prespecified date prior to the maturity date of the loan, then the seller has the right to retract the maturity of the loan to the second date. We call this option the retractable foreign exchange liquidity option or the RFELO.

In this paper, we deal with the retractable foreign exchange liquidity options only since any plain vanilla foreign exchange liquidity option is a special case of a retractable foreign exchange liquidity option with the zero second exchange rate barrier whereas an extendible foreign exchange liquidity option is simply a long position in two plain vanilla foreign exchange liquidity options and a short position in a retractable foreign exchange liquidity option, provided the second barrier is chosen above the first. These will become clear after we write down the pricing formula for the retractable foreign exchange liquidity option.

To set the specific terms of the RFELO, let $t \in \mathbb{R}_+$ denote the time, where \mathbb{R}_+ is the field of non-negative real numbers, and consider the following four dates: $t = 0$ is the date on which the option contract is signed; $t = T$, such that $T > 0$, is the date on which the option contract expires; $t = L$, such that $L > T$, is the original maturity date of the loan, if the loan comes to life; and $t = S$, such that $T < S < L$, is the retraction date of the loan, if it gets retracted. Let $x(t)$ denote the natural logarithm of the exchange rate and consider two exchange rate barriers $x_T, x_S \in \mathbb{R}$ such that $x_T > x(0)$ and $x_S < x_T$. Therefore, if $x(t)$ crosses the first barrier x_T on or before the exercise date, that is, if there is some $t \in (0, T]$ such that $x(t) > x_T$, then the option holder exercises the RFELO and borrows an L -maturity zero-coupon loan from the central bank *at the L -maturity zero-coupon rate on date $t = T$ of the foreign currency country*. If, after the exercise of the option, $x(t)$ crosses the second barrier x_S on or before the retraction date S , that is, if there is some $t \in (T, S]$ such that $x_S > x(t)$, then the central bank retracts the loan to the retraction date S .

It is evident that the retractable foreign exchange liquidity option can be viewed as a portfolio of two retractable bonds, one defaultable, the other default-free: The option buyer has a short position in the defaultable retractable zero-coupon bond with a set maturity date and a long position in the default-free equivalent of this bond, each of which comes to life on the date the exchange rate crosses the first barrier before or on the option expiry date, if that happens. Clearly, the option seller has the opposite positions in these bonds. Provided that they come to life, both bonds retract to a predetermined retraction date before the original maturity date if the exchange rate crosses the second barrier between the option exercise date and the retraction date, if that happens. Of course, the defaultable bond of this portfolio is to be priced at the credit spread of the option buyer to the then current numerator currency country default-free interest rates on the date the contract is signed. This is the replicating portfolio of the option and in what follows we will price this portfolio.

2.3 Monetary policy implications

As the emerging market currency and several associated banking crises of the past three decades attest, with the ongoing liberalization of their financial markets since the late 1970s the emerging market economies are now vulnerable to undesirable side effects of the capital flows. The positive interest rate differentials of the emerging market economies not only attract large capital inflows, but also create incentives for the domestic banks to borrow in hard currencies to extend loans in their domestic currency. Especially during periods of excess global liquidity, large and continuous capital inflows suppress the hard currency exchange rates downward, creating an illusion of forever-cheap hard currencies in some agents of the domestic economy. Although not necessarily all the agents suffer from this illusion, some of those who do not may suffer from the alternative illusion that they can get out before a crisis.

As long as hard currencies remain cheap, the described carry trade is highly profitable to the domestic financial sector, deepening the illusions. However, since the resulting currency mismatch (not to mention the maturity mismatch resulting from the usual short-term borrowing and long-term lending) between assets and liabilities of the financial sector balance sheets is a source of substantial risk, the outcome of these illusions is a fragile domestic financial sector of the emerging market economies. This risk has to be removed by entering into offsetting off-balance sheet agreements with counter-parties abroad.

The problem is that most, if not all, of such agreements into which the financial sectors of the emerging market economies can enter with counter-parties abroad are short-term contracts. Covering short foreign exchange positions with short-term contracts, usually with maturities not longer than a month, is problematic because at times of severe exchange rate distortions rolling these contracts over becomes difficult, if not almost impossible. As a result, especially when the turmoil is long and deep, despite their robust net on and off balance sheet foreign exchange positions, the domestic banks begin to bid the spot prices up in the foreign exchange market, leading to an upward spiral.

As Blejer and Schumacher (2000) argue, state-contingent liabilities issued by central banks may release some of this pressure the market players put on the spot exchange rates at times of heavy speculation. The first implication of the FELO is then that they may scale the upward push in the spot foreign exchange market down by meeting the aforementioned artificial demand coming from the domestic banks at times of uncertainty. By assuming the counter-party role for a short period and guaranteeing foreign exchange liquidity to the domestic banks at times of uncertainty, the central bank may ease the fears of the domestic banks regarding rolling their short-term obligations over.

To have such an additional gadget to relax the foreign exchange market is important for highly “dollarized” economies such as the Turkish economy where the exchange rate pass-through to prices is high. For example, in the recent May 2006 foreign exchange turmoil in Turkey, although the high and volatile foreign exchange market lasted for only three months, together with the deteriorating expectations about the economy the inflation deviated from the target for an expected period of more than two years. The central bank operational borrowing rate was raised by 400 basis points in order to drive the inflation back into its decreasing trend prior to the turmoil, the obvious and unwanted side effect of which was increased incentives for continued carry trade by the domestic banks.

In addition, since under the FELO contracts a portion of the foreign reserves are rented rather than sold, the central bank may ease the fears of the domestic banks without depleting its net reserves during a crisis. The FELO transactions change the composition of foreign reserves held on the credit side of the balance sheet only: that is, they replace a fraction of the previously liquid assets with less liquid and riskier loans for a short period, a price any central bank would be willing to pay for the sake of domestic financial stability. Further, since the loan terms are short, the risk is minimal.

As we suggested in the introduction, the central banks should allow the domestic banks to choose the exchange rate barriers associated with the FELO contracts. For example, the central banks may offer a broad menu of exchange rate barriers and let the domestic banks decide which barriers meet their needs the best. This way, not only the central bank can avoid sending signals that may be misinterpreted, but also can collect valuable information regarding what exchange rate levels the domestic banks consider unsafe for their operations. This valuable information may help the central bank in overseeing the soundness of the financial system.

A potential moral hazard with allowing the domestic banks to choose the exchange rate barriers is that some banks may choose barriers that are higher than they believe they need to signal better than actual financial positions to the third parties. This potential moral hazard can be avoided if the barriers are kept private information between the central bank and each of the option holder domestic banks. For example, the central bank may enforce the public

nondisclosure of the barriers through appropriate clauses in the contract. Since in this case the option holder domestic banks cannot disclose the barriers as signals of soundness to the third parties, they would have no incentive to choose barriers that are higher than they believe they need. Even then, since the central bank may refuse to let or, by asking a large insurance fee, discourage high risk banks sign such contracts, being able to enter into FELO contracts with the central bank is still a positive signal to the third parties for a domestic bank and may improve the overall position of the domestic banks in the foreign exchange market.

Lastly, recall that we proposed three flavors of the foreign exchange liquidity options, namely, the plain vanilla, extendible and retractable flavors. Although the plain vanilla foreign exchange liquidity option may be sufficient for the central bank to provide hard currency liquidity to the domestic banks, since not only when a liquidity crisis begins, but also when it ends is not foreseeable, the extendible and retractable flavors offer additional insurance to the domestic banks. The extendible liquidity option provides additional insurance against the possible underestimation while the retractable foreign exchange liquidity option provides additional insurance against the possible overestimation of the length and severity of the potential crisis. We suggest that the central bank should offer all of the flavors in its broad menu of contracts and let the domestic banks choose the flavor depending on their perceived needs, as well. Not only this would allow the central bank to handle a potential crisis more flexibly, but also would help the central bank collect valuable information about the market sentiment.

3. The RFELO price

3.1 Mathematical preliminaries

We work in a filtered probability space $(\Omega, \mathcal{F}, \mathbb{F}, \mathbb{P})$ where, with $\mathcal{F}_\infty = \mathcal{F}$, the filtration $\mathbb{F} = (\mathcal{F}_t)_{t \in \mathbb{R}_+}$ satisfies the usual conditions and \mathbb{P} is the historical measure of the data. Further, the filtration \mathcal{F} is generated by an N -dimensional standard Brownian motion $W^\mathbb{P}(t)$ and a K -dimensional pure jump process $J(t)$ with jumps $\Delta J(t) \in \mathbb{R}_+^K$ where $\lambda^\mathbb{P}(t)$ is the arrival intensity of the jumps and $\nu^\mathbb{P}(z)$, such that $z \in \mathbb{R}_+^K$; is the jump amplitude distribution. The distributions of $W^\mathbb{P}(t)$, $J(t)$ and $\Delta J(t)$ are assumed independent.

Let $P^n(t, U)$ be the price at time t of the non-defaultable zero-coupon bond in the foreign currency country, maturing at time U where $U > t$, and consider an equivalent defaultable zero-coupon bond, whose price at time t is $P^d(t, U)$. Let \mathbb{Q} be an equivalent risk-neutral measure to the historical measure \mathbb{P} , which need not be unique in the presence of jumps. We will fix this risk-neutral measure when we write down our interest rate, spread and exchange rate models. Prior to this, however, we suppose that the market price of the jump risk is constant (see, Dai and Singleton, 2003, p. 650) and, for our RFELO pricing purposes, conveniently set it to 0. Consequently, we have $\lambda^\mathbb{Q}(t) = \lambda^\mathbb{P}(t)$ and $\nu^\mathbb{Q}(z) = \nu^\mathbb{P}(z)$ almost everywhere so that we stop distinguishing between them and drop the superscripts.

In the risk-neutral probability measure \mathbb{Q} , the price of the non-defaultable zero coupon bond is given by

$$P^n(t, U) = E^\mathbb{Q} \left[\exp\left\{-\int_t^U r(u) du\right\} \middle| \mathcal{F}_t \right] \quad (1)$$

where $r(t)$ is the default-risk free short rate in the foreign currency country, whereas for the defaultable zero coupon bond, following Berndt (2004), we adopt the recovery of market value convention of Duffie and Singleton(1999) and suppose that

$$P^d(t, U) = E^{\mathbb{Q}} \left[\exp\left\{-\int_t^U (r(u) + s(u)) du\right\} \middle| \mathcal{F}_t \right] \quad (2)$$

where $s(t)$ is the short credit spread. We refer the reader to Duffie and Singleton (1999) and Brendt (2004), as well as to Duffie, Pedersen and Singleton (2003), for discussions on the implications of this convention.

In closing this subsection, we define the non-defaultable and defaultable money market accounts $M^n(t) = \exp\left\{\int_0^t r(u) du\right\}$ and $M^d(t) = \exp\left\{\int_0^t (r(u) + s(u)) du\right\}$, respectively, for later use.

3.2 The RFELO price in a general setting

Taking up from where we left in the opening of the previous section, let us denote by $RFELO(t)$ the price at time $t \in [0, T]$ of our retractable foreign exchange liquidity option. As we explained, this option may be viewed as a portfolio of two retractable bonds as viewed by the buyer: a long position in a non-defaultable and a short position in a defaultable bond. We denote the prices of these non-defaultable and defaultable bonds by $R^n(t)$ and $R^d(t)$, respectively. Consequently, the price of our retractable foreign exchange liquidity option, as viewed by the buyer, is

$$RFELO(t) = R^n(t) - R^d(t) \quad (3)$$

Let us now define the stopping times

$$\tau_T = \inf\{t \in (0, T] | x(t) \geq x_T\} \quad (4)$$

$$\tau_S = \inf\{t \in (T, S] | x(t) \leq x_S, \tau_T < \infty\} \quad (5)$$

where, with ϕ as the empty set, we used the usual convention that $\inf \phi = \infty$. It is clear that our retractable bonds come to life on the exercise date T with maturity date L if $\tau_T \in (0, T]$, and if $\tau_S \in (T, S]$ then they retract to S . Therefore, the prices of these bonds in the risk-neutral measure \mathbb{Q} are given by

$$\begin{aligned} R^n(t) &= E^{\mathbb{Q}} \left[\exp\left\{-\int_t^S r(u) du\right\} \mathbf{1}(0 < \tau_T \leq T) \mathbf{1}(T < \tau_S \leq S) \middle| \mathcal{F}_t \right] \\ &\quad + E^{\mathbb{Q}} \left[\exp\left\{-\int_t^L r(u) du\right\} \mathbf{1}(0 < \tau_T \leq T) \mathbf{1}(\tau_S > S) \middle| \mathcal{F}_t \right] \end{aligned} \quad (6)$$

$$\begin{aligned} R^d(t) &= E^{\mathbb{Q}} \left[\exp\left\{-\int_t^S (r(u) + s(u)) du\right\} \mathbf{1}(0 < \tau_T \leq T) \mathbf{1}(T < \tau_S \leq S) \middle| \mathcal{F}_t \right] \\ &\quad + E^{\mathbb{Q}} \left[\exp\left\{-\int_t^L (r(u) + s(u)) du\right\} \mathbf{1}(0 < \tau_T \leq T) \mathbf{1}(\tau_S > S) \middle| \mathcal{F}_t \right] \end{aligned} \quad (7)$$

Although the above pricing formulae in the risk-neutral probability measure \mathbb{Q} can be computed numerically, an easier to compute and interpret alternative is to re-express them in the “so-called” forward measures in the manner of Jamsidian (1997), as we introduce below. To this end, let us define the non-defaultable forward measure \mathbb{Q}_U^n and the defaultable forward measure \mathbb{Q}_U^d through the Radon-Nikodým derivatives

$$\frac{d\mathbb{Q}_U^i}{d\mathbb{Q}} = \frac{P^i(U, U)}{P^i(0, U)M^i(U)} = \frac{1}{P^i(0, U)M^i(U)}, \quad i = n, d \quad (8)$$

where last of the above equalities follows from the fact that $P^i(U, U) = 1, i = n, d$. It is evident from the above that these forward measures depend on the maturity date of $P^i(t, U), i = n, d$ and, hence, the subscript U .

It then follows that the above pricing formulae can be rewritten as

$$R^i(t) = p_S^i(t)P^i(t, S) + p_L^i(t)P^i(t, L), \quad i = n, d \quad (9)$$

where

$$p_S^i(t) = E^{\mathbb{Q}_S^i}[1(0 < \tau_T \leq T)1(T < \tau_S \leq S)|\mathcal{F}_t], \quad i = n, d \quad (10)$$

$$p_L^i(t) = E^{\mathbb{Q}_L^i}[1(0 < \tau_T \leq T)1(\tau_S > S)|\mathcal{F}_t], \quad i = n, d \quad (11)$$

It is evident also that $p_S^i(t)$ and $p_L^i(t), i = n, d$ are the \mathcal{F}_t conditional probabilities of the i^{th} bonds with maturity dates S and L coming to life in the corresponding forward measures, respectively. This indicates that the pricing of our foreign exchange liquidity options boils down to an assessment of these probabilities, since the prices at time t of the S and L maturity date, zero coupon, non-defaultable and defaultable bonds can be read from the then current market conditions.

3.3 Specialization of the FELO price to the Republic of Turkey

As we promised earlier, with YTL as the domestic and USD as the foreign currency, we specialize our general pricing formulae to Central Bank of the Republic of Turkey in a five-factor affine jump-diffusion model. This requires an estimation of a US term structure model, a USD/YTL exchange rate model and a country credit spread model for the sovereign Eurodollar Bonds issued by Treasury of the Republic of Turkey, as well as its extension to individual domestic banks and foreign banks with domestic operations in the country.⁵ In doing this, we rely on the works of Duffie, Pedersen and Singleton (2003) and Brendt (2004), as well as on Brandt and Santa-Clara (2003), heavily.

The US term structure part of our five-factor affine jump-diffusion model is identical to that of Duffie, Pedersen and Singleton (2003). Therefore, in the manner of Brendt (2004), we could have taken their parameter estimates as the “true” parameter values. The reason for why we do not do this is that Duffie, Pedersen and Singleton (2003) estimated their model based on pre-1999 data whereas we are interested in post-2001 data since in February 2001, a structural change occurred in Turkey: In February 2001, Turkey had to let go off of its crawling-peg to the US dollar after a political crisis and switched to a floating exchange regime under the guidance of the International Monetary Fund. A scrutiny of the exchange rate data suggests that this structural change had taken place roughly between February 2001 and June 2001, after which the new regime appears to have settled down. Since in our model the correlations between the US short rate, Turkish sovereign spread and USD/YTL exchange rate play a significant role, we re-estimate the model of Duffie, Pedersen and Singleton (2003), together with the rest of our model, for the post-June 2001 data.

⁵ We are thankful to Central Bank of the Republic of Turkey for providing us with bank level loan data.

3.3.1 The model

To the already introduced short rate $r(t)$ and natural logarithm of the exchange rate $x(t)$, we now add the short rate volatility $v(t)$, and exchange rate volatility $w(t)$, and, with $s(t)$ representing the short sovereign Eurodollar spread of the Republic of Turkey, suppose that

$$s(t) = u(t) + \pi_v v(t) + \pi_w w(t) + \pi_r r(t) + \pi_x x(t) \quad (12)$$

where the country specific factor $u(t)$ follows the square-root process

$$du(t) = K_u^{\mathbb{P}}(\theta_u^{\mathbb{P}} - u(t))dt + \Sigma_u \sqrt{u(t)}dW_u^{\mathbb{P}}(t) \quad (13)$$

Although with this assumption we force the country specific factor $u(t)$ to be positive, as is evident, this does not mean that the sovereign spread $s(t)$ is forced to be positive also. The logical consistency of the possibility of negative sovereign spreads with their theoretical model, an extension of which we adopt here, has been discussed in Duffie, Pedersen and Singleton (2003) at length, and we refer the reader to their paper for this discussion.⁶

To complete the model, let us introduce the vectors $y(t) = (v(t), w(t), r(t), x(t))^{\top}$, $W_y^{\mathbb{P}}(t) = (W_v^{\mathbb{P}}(t), W_w^{\mathbb{P}}(t), W_r^{\mathbb{P}}(t), W_x^{\mathbb{P}}(t))^{\top}$ and $J(t) = (0, 0, 0, J_x(t))^{\top}$, and suppose that

$$dy(t) = K_y^{\mathbb{P}}(\theta_y^{\mathbb{P}} - y(t))dt + \Sigma_y \sqrt{S(t)}dW_y^{\mathbb{P}}(t) + dJ(t) \quad (14)$$

where

$$S(t) = \begin{bmatrix} v(t) & 0 & 0 & 0 \\ 0 & w(t) & 0 & 0 \\ 0 & 0 & v(t) & 0 \\ 0 & 0 & 0 & w(t) \end{bmatrix}$$

whereas $\theta_y^{\mathbb{P}}(t) = (\theta_v^{\mathbb{P}}(t), \theta_w^{\mathbb{P}}(t), \theta_r^{\mathbb{P}}(t), \theta_x^{\mathbb{P}}(t))^{\top}$,

$$K_y^{\mathbb{P}} = \begin{bmatrix} K_{vv}^{\mathbb{P}} & 0 & 0 & 0 \\ K_{wv}^{\mathbb{P}} & K_{ww}^{\mathbb{P}} & 0 & 0 \\ K_{rv}^{\mathbb{P}} & 0 & K_{rr}^{\mathbb{P}} & 0 \\ K_{xv}^{\mathbb{P}} & K_{xw}^{\mathbb{P}} & K_{xr}^{\mathbb{P}} & K_{xx}^{\mathbb{P}} \end{bmatrix} \quad \text{and} \quad \Sigma_y = \begin{bmatrix} 1 & 0 & 0 & 0 \\ \Sigma_{wv} & \Sigma_{ww} & 0 & 0 \\ \Sigma_{rv} & 0 & \Sigma_{rr} & 0 \\ \Sigma_{xv} & \Sigma_{xw} & \Sigma_{xr} & \Sigma_{xx} \end{bmatrix}$$

With the above, the formulation of our model is now complete. It is clear that the model we postulated is not the most general five-factor affine jump-diffusion model we could have postulated⁷, but even in the above restricted form there are far too many parameters in our model for it to be considered parsimonious. Further, we will have to add more parameters as we move along. We choose to sacrifice generality for the sake of manageability, which is not very easy even in the above restricted form. It should be noted also that, in the manner of Bates (1996), we allow jumps only in the exchange rate. We could have allowed jumps also in the US short rate, but, as can be seen from the pricing formula (9), it is the distributional properties of the exchange rate which play the significant role in the price of the RFELO

⁶ See, Duffie, Pedersen and Singleton (2003), p. 133.

⁷ See, Dai and Singleton (2000).

through their influence on the \mathcal{F}_t conditional probabilities $p_S^i(t)$ and $p_L^i(t)$, $i = n, c$. Consequently, we do not do that.

Finally, we fix our risk-neutral measure \mathbb{Q} along the lines of Dai and Singleton (2000)⁸ by specifying the market price of the risks associated with $W_u^{\mathbb{P}}(t)$ and $W_y^{\mathbb{P}}(t)$ respectively as $\sqrt{u(t)}\Lambda_u$, and $\sqrt{S(t)}\Lambda_y$, where $\Lambda_y = (\Lambda_v, \Lambda_w, \Lambda_r, \Lambda_x)^T$. With $W^{\mathbb{Q}}(t)$ as the corresponding standard Brownian motion in the risk-neutral measure \mathbb{Q} , it then follows that

$$dW_u^{\mathbb{Q}}(t) = dW_u^{\mathbb{P}}(t) + \Sigma_u u(t)\Lambda_u dt \quad (15)$$

$$dW_y^{\mathbb{Q}}(t) = dW_y^{\mathbb{P}}(t) + \Sigma_y S(t)\Lambda_y dt \quad (16)$$

and, therefore, in the risk-neutral measure \mathbb{Q} , we have

$$du(t) = K_u^{\mathbb{Q}}(\theta_u^{\mathbb{Q}} - u(t))dt + \Sigma_u \sqrt{u(t)}dW_u^{\mathbb{P}}(t) \quad (17)$$

$$dy(t) = K_y^{\mathbb{Q}}(\theta_y^{\mathbb{Q}} - y(t))dt + \Sigma_y \sqrt{S(t)}dW_y^{\mathbb{Q}}(t) + dJ(t) \quad (18)$$

where

$$K_u^{\mathbb{Q}}(\theta_u^{\mathbb{Q}} - u(t)) = K_u^{\mathbb{P}}(\theta_u^{\mathbb{P}} - u(t)) - \Sigma_u u(t)\Lambda_u \quad (19)$$

and

$$K_y^{\mathbb{Q}}(\theta_y^{\mathbb{Q}} - y(t)) = K_y^{\mathbb{P}}(\theta_y^{\mathbb{P}} - y(t)) - \Sigma_y S(t)\Lambda_y, \quad (20)$$

from which $K^{\mathbb{Q}}$ and $\theta^{\mathbb{Q}}$ are solved.

3.3.2 Determination of the non-defaultable yield curve

We know from Duffie and Kan (1996) and Dai and Singleton (2000) for the model we postulated that the non-defaultable pure discount bond price (1) takes the form

$$P^n(t, U) = \exp\{A_r(t, U) + B_r(t, U)^T y_r(t)\} \quad (21)$$

where $y_r(t) = (v(t), r(t))^T$ and $B_r(t, U) = (B_{rv}(t, U), B_{rr}(t, U))^T$. Since $P^n(U, U) = 1$, we must have the terminal condition

$$A_r(U, U) = 0, \quad B_r(U, U) = 0 \quad (22)$$

A straight forward application of the Feynman-Kac Theorem in view of (1) and (21) gives the ordinary differential equations

$$\partial_t A_r(t, U) + (K_{y_r}^{\mathbb{Q}} \theta_{y_r}^{\mathbb{Q}})^T B_r(t, U) = 0 \quad (23)$$

$$\begin{aligned} & \partial_t B_{rv}(t, U) - K_{y_r v}^{\mathbb{Q}} B_r(t, U) \\ & + \frac{1}{2} \left[\Sigma_{y_r}^T B_r(t, U) B_r(t, U)^T \Sigma_{y_r} \right]_{vv} + \frac{1}{2} \left[\Sigma_{y_r}^T B_r(t, U) B_r(t, U)^T \Sigma_{y_r} \right]_{rr} = 0 \end{aligned} \quad (24)$$

$$\partial_t B_{rr}(t, U) - K_{y_r r}^{\mathbb{Q}} B_{rr}(t, U) - 1 = 0 \quad (25)$$

⁸ See, p.642 of their paper.

where $\theta_{yr}^Q = (\theta_v^Q, \theta_r^Q)^T$, $K_{yrv}^Q = (K_{vv}^Q, K_{rv}^Q)$ whereas

$$K_{yr}^Q = \begin{bmatrix} K_{vv}^Q & 0 \\ K_{rv}^Q & K_{rr}^Q \end{bmatrix} \quad \text{and} \quad \Sigma_{yr} = \begin{bmatrix} 1 & 0 \\ \Sigma_{rv} & \Sigma_{rr} \end{bmatrix}$$

Although subject to the terminal condition (22) the equation (25) is easily solved to give

$$B_{rr}(t, U) = \frac{e^{-K_{rr}^Q(U-t)} - 1}{K_{rr}^Q}, \quad (26)$$

the equations (23) and (24) subject to the terminal condition (22) have no closed form solutions. Because of this, all researchers in the field use numerical solution methods such as various forms of the Runge-Kutta method to solve problems similar to the above. Here, we take a different approach: we obtain a power series solution to the above system of Riccati Equations. The advantage of doing this is that since the above system of Riccati Equations is a constant coefficients system, if found, its solution is analytic and, hence, its power series solution converges uniformly in $[0, U]$. Further, it is well known for uniformly convergent power series that their main diagonal Padé approximants converge rapidly.⁹ Consequently, these power series solutions can be summed with the use of main diagonal Padé approximants for economy in calculations, avoiding the often time consuming numerical integrations.¹⁰

To recall briefly, the $[m/n]$ -Padé approximant to any formal power series

$$f(x) = \sum_{k=0}^{\infty} f_k x^k \quad (27)$$

is the quotient $P_m(x)/Q_n(x)$ such that

$$P_m(x) = \sum_{k=0}^m p_k x^k, \quad Q_n(x) = \sum_{k=0}^n q_k x^k \quad (28)$$

and

$$Q_n(x)f(x) - P_m(x) = O(x^{m+n+1}), \quad x \rightarrow 0 \quad (29)$$

where $O(\cdot)$ is the big- O symbol with the usual significance. With the usual normalization $q_0 = 1$, one obtains from the above the following system of $m + n + 1$ linear equations in the remaining $m + n + 1$ unknowns:

$$\sum_{i=1}^{k \wedge n} f_{k-i} q_i = -f_k, \quad m+1 \leq k \leq m+n \quad (30)$$

$$p_k = \sum_{i=1}^{k \wedge n} f_{k-i} q_i, \quad 0 \leq k \leq m \quad (31)$$

where, as usual, $k \wedge n = \min(k, n)$. From now on, we will use the $[10/10]$ -Padé approximants as described above to sum our uniformly convergent power series solutions.

⁹ See, for example, Lubinsky (1995) and the references therein.

¹⁰ As will be clear in the next section, another important advantage of our approach is avoidance of the often cumbersome to compute Fourier Transforms; see, Duffe, Pan and Singleton (2000).

To obtain the power series solution of the system (23) through (25) subject to the terminal condition (22), let us set

$$A_r(t, U) = \sum_{k=0}^{\infty} a_{rk}(U-t)^k, \quad B_r(t, U) = \sum_{k=0}^{\infty} b_{rk}(U-t)^k \quad (32)$$

where $b_{rk} = (b_{rvk}, b_{rrk})^T$. Inserting these into (22) through (25) we then get

$$a_{r0} = 0, \quad b_{r0} = 0 \quad (33)$$

$$a_{r1} = b_{rv1} = 0, \quad b_{rr1} = -1 \quad (34)$$

$$(k+1)a_{r,k+1} = (K_{y_r}^Q \theta_{y_r}^Q)^T b_{rk}, \quad k = 1, 2, \dots \quad (35)$$

$$(k+1)b_{rv,k+1} = -K_{y_r,v}^Q b_{rk} + \frac{1}{2} \sum_{\substack{i_1+i_2=k \\ i_1, i_2 \geq 0}} \left\{ \left[\Sigma_{y_r}^T b_{ri_1} b_{ri_2}^T \Sigma_{y_r} \right]_{vv} + \left[\Sigma_{y_r}^T b_{ri_1} b_{ri_2}^T \Sigma_{y_r} \right]_{rr} \right\}, \quad k = 1, 2, \dots \quad (36)$$

$$(k+1)b_{rr,k+1} = -K_{y_r,r}^Q b_{rk}, \quad k = 1, 2, \dots \quad (37)$$

Determination of the non-defaultable yield curve as implied by our model is now complete. In the next section, we turn our attention to the defaultable yield curve.

3.3.3 Determination of the defaultable yield curve

To make progress, we need to specify the arrival intensity $\lambda(t)$ of the jumps and the jump amplitude distribution $\nu(z)$, first. Since we are working in an affine jump-diffusion framework, we set $\lambda(t) = \lambda_0 + \lambda_u u(t) + \lambda_y^T y(t)$, where $\lambda_y = (\lambda_v, \lambda_w, \lambda_r, \lambda_x)^T$, and suppose that $\ln z \sim N(\mu, \sigma^2)$ so that the jump amplitude distribution $\nu(z)$ is log-normal. Finally, we define the moments

$$M_k = \int_{\mathbb{R}_+} z^k d\nu(z) = e^{k\mu + \frac{1}{2}k^2\sigma^2} \quad (38)$$

of our jump amplitude distribution for later use in what follows.

Similar to the non-defaultable pure discount bond $P^n(t, U)$, we look for solutions of the form

$$P^d(t, U) = \exp\{A_s(t, U) + B_{su}(t, U)u(t) + B_s(t, U)^T y(t)\} \quad (39)$$

where $B_s(t, U) = (B_{sv}(t, U), B_{sw}(t, U), B_{sr}(t, U), B_{sx}(t, U))^T$ for the defaultable pure discount bond $P^d(t, U)$ given by (2). Since $P^d(U, U) = 1$, we again have the terminal condition

$$A_s(U, U) = B_{su}(U, U) = 0, \quad B_s(U, U) = 0 \quad (40)$$

A straight forward application of the Feynman-Kac Theorem in view of (2) and (39) then gives the following system of integro-ordinary differential equations:

$$\partial_t A_s(t, U) + K_u^Q \theta_u^Q B_{su}(t, U) + (K_y^Q \theta_y^Q)^T B_s(t, U) + \lambda_0 \int_{\mathbb{R}_+} (e^{B_{sx}(t, U)z} - 1) d\nu(z) = 0 \quad (41)$$

$$\partial_t B_{su}(t, U) - K_u^Q B_{su}(t, U) + \frac{1}{2} \Sigma_u^2 B_{su}(t, U)^2 + \lambda_u \int_{\mathbb{R}_+} (e^{B_{sx}(t, U)z} - 1) d\nu(z) - 1 = 0 \quad (42)$$

$$\begin{aligned} & \partial_t B_{sv}(t, U) - K_{yv}^Q B_s(t, U) + \frac{1}{2} [\Sigma_y^T B_s(t, U) B_s(t, U)^T \Sigma_y]_{vv} \\ & + \frac{1}{2} [\Sigma_y^T B_s(t, U) B_s(t, U)^T \Sigma_y]_{rr} + \lambda_v \int_{\mathbb{R}_+} (e^{B_{sz}(t,U)z} - 1) dv(z) - \pi_v = 0 \end{aligned} \quad (43)$$

$$\begin{aligned} & \partial_t B_{sw}(t, U) - K_{yw}^Q B_s(t, U) + \frac{1}{2} [\Sigma_y^T B_s(t, U) B_s(t, U)^T \Sigma_y]_{ww} \\ & + \frac{1}{2} [\Sigma_y^T B_s(t, U) B_s(t, U)^T \Sigma_y]_{xx} + \lambda_w \int_{\mathbb{R}_+} (e^{B_{sz}(t,U)z} - 1) dv(z) - \pi_w = 0 \end{aligned} \quad (44)$$

$$\partial_t B_{sr}(t, U) - K_{rr}^Q B_{sr}(t, U) + \lambda_r \int_{\mathbb{R}_+} (e^{B_{sz}(t,U)z} - 1) dv(z) - 1 - \pi_r = 0 \quad (45)$$

$$\partial_t B_{sx}(t, U) - K_{xx}^Q B_{sx}(t, U) + \lambda_x \int_{\mathbb{R}_+} (e^{B_{sz}(t,U)z} - 1) dv(z) - \pi_x = 0 \quad (46)$$

where $K_{yv}^Q = (K_{uv}^Q, K_{wv}^Q, K_{rv}^Q, K_{xv}^Q)$ and $K_{yu}^Q = (0, K_{wu}^Q, 0, K_{xu}^Q)$. We note that had the intensity parameter λ_u been 0, then the equation (42) would have been the usual CIR equation whose solution subject to the terminal condition (40) is:¹¹

$$B_{su}(t, U) = \frac{2(1 - e^{\Omega(U-t)})}{2\Omega - (\Omega + K_u^Q)(1 - e^{\Omega(U-t)})} \quad (47)$$

where $\Omega = (K_u^{Q2} + \Sigma_u^2)^{\frac{1}{2}}$. In Fig. 1, we compare this closed form solution, as well as the closed form solution (26) we obtained for $B_{rr}(t, U)$ in the previous section, with their corresponding [10/10]-Padé approximations for a set of model parameters K_u^Q , Σ_u and K_{rr}^Q , graphically.

Proceeding as before, we now set

$$A_s(t, U) = \sum_{k=0}^{\infty} a_{sk}(U-t)^k, \quad B_{su}(t, U) = \sum_{k=0}^{\infty} b_{suk}(U-t)^k, \quad B_s(t, U) = \sum_{k=0}^{\infty} b_{sk}(U-t)^k \quad (48)$$

where $b_{sk} = (b_{svk}, b_{swk}, b_{srk}, b_{sxk})^T$, insert these into the equations (40) through (46), Taylor expand $e^{B_{sz}(t,U)z}$ about 0, integrate the resulting Taylor series, equate the coefficients of the like terms and get:

$$a_{s0} = b_{su0} = 0, \quad b_{s0} = 0 \quad (49)$$

$$b_{su1} = -1, \quad b_{sv1} = -\pi_v, \quad b_{sw1} = -\pi_w, \quad b_{sr1} = -1 - \pi_r, \quad b_{sx1} = -\pi_x \quad (50)$$

$$\begin{aligned} & (k+1)a_{s,k+1} = K_u^Q \theta_u^Q b_{suk} + (K_y^Q \theta_y^Q)^T b_{sk} \\ & + \lambda_0 \sum_{j=1}^k \sum_{i_1+i_2+\dots+i_j=k} b_{sx i_1} b_{sx i_2} \dots b_{sx i_j} \frac{M_j}{j!}, \quad k = 0, 1, \dots \\ & \quad \quad \quad i_1, i_2, \dots, i_j \geq 1 \end{aligned} \quad (51)$$

¹¹ See, Cox, Ingersoll and Ross (1985), p. 393.

$$\begin{aligned}
(k+1)b_{su,k+1} &= -K_u^Q b_{suk} + \frac{1}{2} \sum_{\substack{i_1+i_2=k \\ i_1, i_2 \geq 1}} \Sigma_u^2 b_{sui_1} b_{sui_2} \\
&+ \lambda_u \sum_{j=1}^k \sum_{\substack{i_1+i_2+\dots+i_j=k \\ i_1, i_2, \dots, i_j \geq 1}} b_{sxi_1} b_{sxi_2} \dots b_{sxi_j} \frac{M_j}{j!}, \quad k = 1, 2, \dots
\end{aligned} \tag{52}$$

$$\begin{aligned}
(k+1)b_{sv,k+1} &= -K_{yv}^Q b_{svk} + \frac{1}{2} \sum_{\substack{i_1+i_2=k \\ i_1, i_2 \geq 1}} \{[\Sigma_y^T b_{sui_1} b_{sui_2} \Sigma_y]_{vv} + [\Sigma_y^T b_{sui_1} b_{sui_2} \Sigma_y]_{rr}\} \\
&+ \lambda_v \sum_{j=1}^k \sum_{\substack{i_1+i_2+\dots+i_j=k \\ i_1, i_2, \dots, i_j \geq 1}} b_{sxi_1} b_{sxi_2} \dots b_{sxi_j} \frac{M_j}{j!}, \quad k = 1, 2, \dots
\end{aligned} \tag{53}$$

$$\begin{aligned}
(k+1)b_{sw,k+1} &= -K_{yw}^Q b_{swk} + \frac{1}{2} \sum_{\substack{i_1+i_2=k \\ i_1, i_2 \geq 1}} \{[\Sigma_y^T b_{sui_1} b_{sui_2} \Sigma_y]_{ww} + [\Sigma_y^T b_{sui_1} b_{sui_2} \Sigma_y]_{xx}\} \\
&+ \lambda_w \sum_{j=1}^k \sum_{\substack{i_1+i_2+\dots+i_j=k \\ i_1, i_2, \dots, i_j \geq 1}} b_{sxi_1} b_{sxi_2} \dots b_{sxi_j} \frac{M_j}{j!}, \quad k = 1, 2, \dots
\end{aligned} \tag{54}$$

$$(k+1)b_{sr,k+1} = -K_{rr}^Q b_{srk} + \lambda_r \sum_{j=1}^k \sum_{\substack{i_1+i_2+\dots+i_j=k \\ i_1, i_2, \dots, i_j \geq 1}} b_{sxi_1} b_{sxi_2} \dots b_{sxi_j} \frac{M_j}{j!}, \quad k = 1, 2, \dots \tag{55}$$

$$(k+1)b_{sx,k+1} = -K_{xx}^Q b_{saxk} + \lambda_x \sum_{j=1}^k \sum_{\substack{i_1+i_2+\dots+i_j=k \\ i_1, i_2, \dots, i_j \geq 1}} b_{sxi_1} b_{sxi_2} \dots b_{sxi_j} \frac{M_j}{j!}, \quad k = 1, 2, \dots \tag{56}$$

With the above, determination of the defaultable yield curve is now complete.

Measuring cross-border derivatives in the United States

Thad Russell¹

1. Introduction

The United States recently began to include derivatives-related, cross-border claims, liabilities, and payment flows in its official international investment position and balance-of-payments data. The source of these data is the *Treasury international capital report of holdings of, and transactions in, financial derivatives contracts with foreign residents* (TIC D). This new reporting system was a collaborative effort of the US Treasury and Commerce Departments, the Board of Governors and the Federal Reserve Bank of New York (FRBNY). This paper discusses the reporting system, with a focus on aspects of its design, implementation and management that limit reporting burden and promote data quality.

2. Report design and consultation

As the need for information continues to grow, limiting reporting burden – to the extent possible in keeping with meeting information needs – is a key objective of US data collectors like the FRBNY. For any new data collection, the first way this goal is served is through consultations with prospective reporters during the design phase to discuss data needs, data availability, and the associated reporting burdens. This practice can lead to recommendations from reporters of ways to meet data needs more efficiently and with higher-quality data. It can also bring about clearer definitions and enhanced understanding of the information that is collected.

In the case of the new TIC D report, this consultative process was particularly important. The complexity of derivative contracts presented challenges for reporting; these difficulties were compounded by the fact that derivatives information is not needed on a balance-of-payments basis for reporters' operations or internal risk management. An important safeguard of data quality is aligning report data with the information of reporters' business operations and internal risk management systems. Additional complications were caused for some reporters by the many business units and assorted information systems that had to be accessed. The need to accumulate data on significant daily flows was particularly difficult for reporters. In these circumstances, the consultative process led to several changes to accommodate reporters, while still collecting the information needed by data users.

Once the report's requirements were finalized, reporters were given substantial lead time to develop their systems to meet its requirements. The new report's introduction was further eased by gradually phasing in different parts of the report according to a schedule that started with more readily available data, and progressed through the more difficult to most difficult report elements.

¹ Statistics Function, Federal Reserve Bank of New York. The views expressed in this paper are those of the author and do not necessarily reflect the views of the Federal Reserve Bank of New York or the Federal Reserve System.

3. Reporting burden, coverage and threshold

The Federal Reserve has collected derivatives information through several reporting systems for over 20 years. While none of these data collections could be used to meet the need for balance-of-payments information, other reports did provide established data definitions and useful perspectives for the design of the new report. In particular, experience with other reporting systems had revealed the concentrated nature of the derivatives markets. According to bank regulatory report data, for example, just five of more than 1,000 US banks with derivatives account for 97% of the notional values of all US bank derivatives. Such experience suggested that reasonable market coverage could be achieved – and reporting burden limited – through a relatively small panel of very large reporters. The initial reporting threshold, which was defined in terms of notional values, was therefore set at \$100 billion.

The new report's data confirmed that this approach was appropriate and further indicated that the threshold could be set yet higher without significantly impairing data coverage. For example, with the \$100 billion threshold, it takes half of the panel's smaller reporters to account for 1% of total reported cross-border fair values, and a somewhat larger proportion of net payment flows. In these circumstances, a proposal has been published to raise the reporting requirement to \$400 billion effective next year.² A provision has also been added to keep any reporter on the panel who has reported particularly large net payments or receipts.

While the new report collects information about the gross fair values of cross-border claims, liabilities, and payment flows, its reporting requirement was defined in terms of a different measure: the notional values of derivatives on a US-based, consolidated basis. This was done for several reasons. First, the requirement was set in terms of consolidated holdings of derivatives since determining cross-border outstandings would require extensive work sorting counterparties by legal location. As to the choice of notionals, while published financial statements in the United States have generally included the fair values of derivatives on an after-netting basis, these values are often netted and reported differently, thereby making comparisons across institutions or against a benchmark meaningless. Consolidated notional values are readily available for banks and foreign branches in the United States through regulatory reports. For non-banks, and especially the non-bank subsidiaries of foreign entities, however, notional values as well as any other measures of derivatives activity are often not publicly available. Alternatives to notional values for the TIC D report have been considered and discussed, and will certainly continue to be examined as published financial reporting requirements in the United States change. But for now, notionals still seem best for the terms of the reporting requirement.

4. The report and its elements

The TIC D report has three columns, "Gross positive fair values", "Gross negative fair values" and "Net settlements". It is broken down into two parts. Part 1 collects cross-border derivatives data by type. OTC contracts are reported by major risk type and instrument. Exchange-traded contracts are reported according to foreign resident contracts on US exchanges and US contracts on exchanges abroad, the reporter's own and its customers'. Part 2 obtains a breakdown of totals by country of counterparty.

The report avoids creating new data items and definitions to the extent possible. The definitions of derivatives and gross fair values are thus the same ones that reporters would use in their regulatory or published financial reports, but sorted by country of counterparty

² Federal Register, vol 73, no 106, June 2, 2008, Notices, pp 31543–4.

according to balance-of-payments definitions. The use of established definitions also promotes data quality, where possible by creating comparability with balance sheet and other report data.

Net settlements,³ the net flows of cash payments associated with all cross-border derivatives activity, constituted the hardest data gathering challenge for reporters. In view of the extensive netting of credit exposures and payments, reporters asked for payments to be reported on a net basis.

5. Inter-series comparisons and data quality

TIC D report data were reviewed extensively before being released to data users. This was an important safeguard. The TIC D is a unique data series, with no direct counterparts, but individual reporters' data are compared, reviewed and analyzed in several ways to help assure data quality. The concentrated structure of the derivatives market and the report's relatively small panel facilitates more in-depth analysis of individual reporters' data.

For many reporters, including all of the very largest, individual institutions' TIC D data can be compared to the reporters' global consolidated data. Through discussions with reporters about the nature of their business, and particularly where their major derivatives units are located and contracts booked, differences between the two series can be broadly understood, reconciled, or the need for corrections identified. The cross-border totals for the major OTC risk types of derivatives can be compared quarterly for bank holding companies, US branches of foreign banks, and semiannually for the very large dealers who file the *BIS Semiannual report of derivatives activity* with FRBNY. For US-based global institutions, the proportion of TIC D fair values to global consolidated fair values can vary substantially from dealer to dealer depending on which portions of the various derivatives business lines are based in the US or abroad. But for large dealers, the proportion tends to be fairly steady from quarter to quarter and if not, the factors leading to the shift can be identified and explained.

As noted, the TIC D report collects data for single currency interest rate contracts, foreign exchange, and other contracts. To permit more detailed comparisons, if approved, fair values for the fast growing credit and equity derivatives will be broken out from "Other contracts" and reported separately starting next year.

In contrast to gross fair values, the TIC D report's net settlements cannot be productively analyzed in terms of data of other reports. It has been useful, however, to calculate and review the quarter-to-quarter changes in derivatives valuations implicit in each reporter's data; in other words, the quarter-to-quarter changes in net fair values, plus or minus the current quarter's net settlements, scaled by the size of the portfolio. Note that reported changes in net fair value should reflect valuation changes from underlying price moves or time decay, or result from cash flows that are reported in net settlements. Portfolios with large positions should show the larger market value moves. The data of smaller reporters have sometimes shown very large implied valuations, which could be understood in terms of the reporter's particular positions or transactions.

³ Defined in the report's instructions as "all cash receipts and payments made during the quarter for the acquisition, sale, or final closeout of derivatives, including all settlement payments under the terms of derivatives contracts."

6. Data highlights

The new TIC D report has opened an interesting and useful window on the cross-border derivatives activity.

- The reported positive and negative fair values, reported on a pre-netting basis, are very large. However, the net claims are small in comparison.
- Counterparties in the UK, the location of many dealers, account for almost 60% of cross-border claims and liabilities related to derivatives.
- Net settlements related to derivatives represent a small portion of US balance of payments flows.

Compilation of derivatives statistics in Chinese Taipei

Pei-wen Chen¹

1. Introduction

The rapid development of derivatives activities brings new challenges to monetary policymaking. On the one hand, derivatives offer the opportunity to temporarily hedge against price fluctuations in financial markets, which may lengthen the time required for the central bank's monetary policy to take effect. On the other hand, by increasing asset substitutability, derivatives arbitrage may shorten the time necessary for monetary policy transmission through the asset price channel. Moreover, monetary policy is effective only when the financial systems are stable. Thanks to the low cost and high leverage features, derivatives facilitate speculative trading, which can become a source of risk and pose threats to financial stability.

In line with continuing expansion of derivatives activities and more complex derivatives introduced into the market in Chinese Taipei, the central bank compiles data on derivatives to capture current financial conditions, monitor potential risks, and provide useful references to monetary policymaking.

Broadly speaking, derivatives statistics compiled by the central bank can be grouped into three categories. For the first category of statistics, the central bank requires banks to fill out statements on derivatives transactions and positions when trading with local and overseas counterparties. This piece of statistics aims to measure banks' consolidated exposures to derivatives and is compiled by the Department of Financial Inspection of the central bank.

For the second category of statistics, the Department of Foreign Exchange of the central bank collects information on banks engaging in foreign exchange business, including foreign exchange derivatives operations, in the local market. This type of statistics focuses primarily on understanding the size and structure of foreign exchange activities and thereby enhancing surveillance over Chinese Taipei's foreign exchange market.

For the third category of statistics, the central bank compiles flow and stock data on cross-border derivatives activities based on the international transactions reporting system (ITRS) records and various surveys. The flow and stock data are separately reported in the balance of payments (BOP) and the international investment positions (IIP). Both the BOP and IIP statistics are prepared by the Department of Economic Research of the central bank.

To ensure the accuracy of the above-mentioned statistics and conform to the standards of international financial statistics, the central bank publishes instructions on how to fill out the declaration statements on derivatives, and routinely reviews the data submitted by reporting entities. The methodological details and some problems for compiling derivatives statistics are presented in Section 2. Section 3 analyzes the characteristics of Chinese Taipei's derivatives activities based on the release of derivatives statistics. Section 4 gives a brief conclusion.

¹ Department of Economic Research, central bank of Chinese Taipei. The views expressed in this paper are those of the author and do not necessarily reflect the views of the central bank of Chinese Taipei.

2. Methodologies for compiling derivatives statistics

2.1 Statistics on banks' consolidated derivatives exposures

In order to access banks' involvement in derivatives trading and their overall risk profile, supervisors need to collect relevant information with sufficient frequency and timeliness. Since 1998, the Department of Financial Inspection of the central bank² has required the banking sector to file derivatives statements on transactions data and positions data on a monthly basis.

The banking sector comprises all domestic banks (including their offshore banking units, OBUs, located in Chinese Taipei and overseas branches) as well as local branches of foreign banks (including their OBUs located in Chinese Taipei). In December 2007, 40 domestic banks and 32 foreign banks submitted reports to the central bank.

For derivatives statements on transactions data, banks are required to report data on notional amounts turnover, broken down by product, currency and counterparty. The product category is further classified by: (1) risk type – interest rate, foreign exchange, equities-linked, commodity, credit, and others; (2) market type – over-the-counter (OTC) and exchange-trade; and (3) instrument type – forwards, swaps, futures, and options. Within the currency category, a distinction is made between contracts involving the local currency (NT dollar) and those not. The counterparty category is subdivided into local customers, local banks, and overseas counterparties. All classifications are designed to capture the nature of banks' involvement in the derivatives activities.

In addition, concerning potential speculative trading in foreign exchange derivatives, the central bank requires additional information on banks' engaging in non-deliverable forwards (NDFs) involving the NT dollar, NDFs and non-deliverable options (NDO) involving Renminbi, as well as foreign exchange margin trading.

For derivatives statements on positions data, in compliance with the *Common Minimum Information Framework* recommended by Basel Committee on Banking Supervision and the Technical Committee of the International Organization of Securities Commissions (IOSCO), the central bank gathers various types of information important for assessing the impact of derivatives on banks' liquidity risk, market risk, credit risk, and earnings profile. These include notional amounts outstanding, gross positive and negative market values, as well as trading revenues. These three items are further broken down by risk category, with regard to instrument type and/or transaction purpose (trading and non-trading). Furthermore, banks are required to submit additional information on past-due derivatives and credit default swaps (CDS).

To provide a full picture of banks' undertaking of derivatives activities to the public, the derivatives statistics on monthly turnover and quarter-end notional amounts outstanding, with their main breakdowns, are available with a two-month lag on the central bank website at <http://www.cbc.gov.tw/mp2.html>.

2.2 Statistics on banks' foreign exchange derivatives business

In the past decade, for the purpose of further liberalizing the foreign exchange market and giving banks more flexibility in their operations, the central bank has continued to allow new

² The central bank, following the establishment of the Financial Supervisory Commission of the Executive Yuan in July 2004, has ceased to conduct general examinations of financial institutions. Nevertheless, it retains the right to conduct target examinations relevant to the implementation of monetary policy.

foreign exchange derivatives to be introduced into the market and removed restrictions on banks' foreign exchange derivatives positions. Currently, foreign exchange derivatives traded in the local market include forwards, foreign exchange swaps, cross currency swaps, options and margin trading.

As Chinese Taipei is a small and highly open economy, wild swings in the exchange rate are likely to have adverse influences on foreign trade and financial stability. In view of potential hazards associated with foreign exchange derivatives trading, the Department of Foreign Exchange of the central bank requires all authorized foreign exchange banks and the OBUs located in Chinese Taipei to report daily transactions and positions data of specific foreign exchange derivatives, such as forwards, foreign exchange swaps, and NDFs as well as options involving the NT dollar. In addition, to better understand the use of foreign exchange not involving the NT dollar in the local market, banks are required to fill out monthly reports on foreign exchange spot and derivatives transactions by currency, with further breakdowns by instrument and counterparty.

To increase market transparency and help market participants understand patterns of activities in the local foreign exchange market, the central bank releases monthly statistics on foreign exchange spot and derivatives turnover, with their main breakdowns. Data sources for these statistics are received from banks' statements conducted by the Department of Foreign Exchange and Financial Inspection. The above banks' information collected from the different data sources is partially overlapping, and thus can be used for double-checking.

2.3 Statistics of cross-border derivatives activities

In Chinese Taipei, flow and stock statistics on cross-border derivatives are compiled by the Department of Economic Research of the central bank, and are separately presented in the BOP on a quarterly basis and in the IIP on an annual basis.³ In principle, Chinese Taipei's cross-border derivatives statistics are compiled according to international standards and conventions described in IMF's *Financial Derivatives, A Supplement to the Fifth Edition of the Balance of Payments Manual (2000)*.

In terms of Financial Derivatives in Chinese Taipei's BOP, data are recorded on a net basis, which is acceptable under IMF's guidelines in case gross reporting is impractical. All settlement receipts/payments are recorded as reduction in financial assets/liabilities. In addition, consistent with international standards, derivatives are categorized into four resident sectors, namely monetary authorities, general government, banks, and other sectors.

For the banking sector, data on cross-border derivatives are based on monthly specific reports submitted by local banks. The latter comprise domestic banks, local branches of foreign banks, and their OBUs located in Chinese Taipei. As the existing derivatives forms collected by other departments of the central bank were ill-equipped to capture cross-border derivatives information, together with the incompleteness of the International Transactions Reporting System (ITRS) records on banks,⁴ the compiler developed new forms specifically

³ Beginning in 1997, the BOP has been reported in accordance with the Fifth Edition of the Balance of Payments Manual (BPM5) format, covering the period from the first quarter of 1981 to present. Since 2003, the IIP from 2000 onwards has been released in conformity with the framework of BPM5.

⁴ According to "Regulations Governing the Declaration Reporting of Foreign Exchange Receipts and Disbursements or Transactions", a person within the territory of Chinese Taipei who possesses or needs foreign exchange equivalent to NT 500,000 dollars or above, and engages in its receipts and disbursements or transactions shall make a declaration. In other words, in case receipts/payments of international transactions are placed in an overseas account, no declaration is necessary. As cross-border derivatives transactions undertaken by banks are mostly settled via overseas accounts, the relevant information will be omitted under the ITRS.

for BOP statistics.⁵ Minding banks' reporting burden, derivatives data collected via these forms are confined to the figures of net settlement payments, and no breakdowns by instrument or risk category are requested.

As for other sectors, data on cross-border derivatives transactions are derived from ITRS. To enhance the accuracy, the compiler routinely reviews the data declared by reporting entities. Regarding monetary authorities, data is currently not available. As for general government, no cross-border derivatives transactions are conducted.

In terms of Financial Derivatives in Chinese Taipei's IIP, banks' asset and liability positions are sourced from external balance sheets declared by local banks to the central bank. The positions of financial derivatives are recorded on a gross basis at market value.

For other sectors, in contrast to the transactions, there is no complete information on the derivatives asset positions. Therefore, the compiler uses the existing specific positions data, associated with the flow information recorded in the BOP, to extrapolate stock positions. That is, derivatives asset positions are estimated through year-end asset positions held by residents undertaking overseas futures transactions divided by a certain ratio. The data on year-end asset positions held by residents undertaking overseas futures transactions are obtained from an annual survey of 5 local futures intermediaries engaging in overseas futures brokerage. The ratio is calculated by the net flows on derivatives declared by the above futures intermediaries to those declared by total reporting entities during the reference period. As for derivatives liability positions, the data are directly derived from the positions reported by domestic custodians on behalf of their non-resident customers. The custody positions statements on non-residents' holding of securities and derivatives issued by residents are compiled by the Department of Foreign Exchange of the central bank.

In line with the trend of international financial statistics compilation and to enhance information disclosure, the central bank regularly releases Chinese Taipei's BOP and IIP statistics. Quarterly BOP data are disseminated with a two-month lag, and year-end IIP data are released at the end of the next June. Both data sets are available on the central bank website and in the *Balance of Payments Quarterly*, Chinese Taipei.

2.4 Some problems for compiling derivatives statistics

The rapid growth in derivatives activities across sectors and financial innovation challenges the existing methodologies on compiling Chinese Taipei's derivatives statistics. In this subsection, some problems for compiling cross-border derivatives and potential improvement on existing data sources and reporting frameworks are discussed.

To date, less cross-border derivatives information on the non-bank private sector's activities is available to the central bank than on the banking sector's activities. For other sectors in the IIP statistics, although specific stock data associated with corresponding flow data provide an initial source for estimating derivatives asset positions, the compiler needs to develop a more complete source, namely enterprise surveys, to enhance the quality of statistics. Survey lists may firstly focus on financial institutions with active trading, such as insurance companies and securities firms, and then expand to private enterprises.

In addition, financial innovations such as structured products add ambiguity to the definition and measures of financial derivatives. According to the IMF's guidelines, an embedded

⁵ The contents of the new forms for the BOP statistics not only contain cross-border derivatives but also investment income as well as financial services. From the second quarter of 2007, the compiler began to use the monthly reports submitted by domestic banks and local branches of foreign banks instead of the ITRS records to compile relevant components of the BOP.

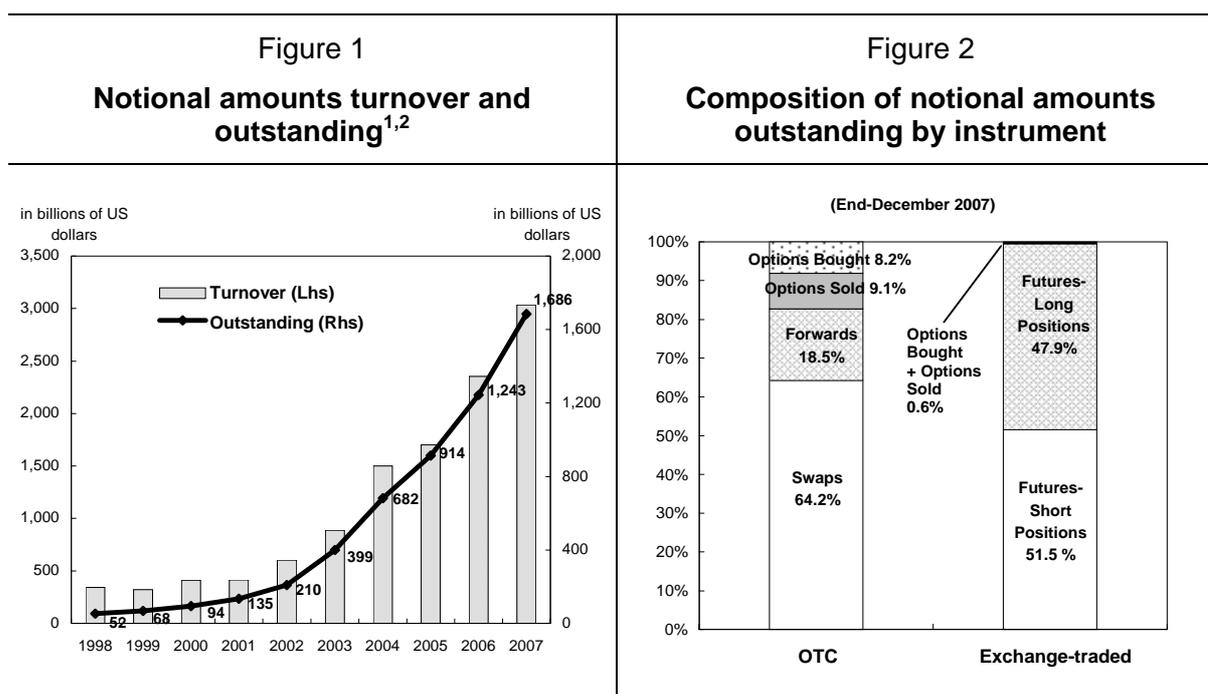
derivative (a derivative feature that is inserted in a standard financial instrument and is inseparable from the instrument) is not considered a financial derivative for BOP purpose. In practice, most declarers other than banks under ITRS are not familiar with the coverage of derivatives recorded in the BOP, and may view an embedded derivative as a derivative. This, in turn, may undermine the accuracy of statistics classifications in the BOP and IIP.

Furthermore, the compilation of existing derivatives statistics by the central bank is owned by three different departments. Concerning reporting entities' burdens, compilers should coordinate with each other and avoid repeatedly requesting similar information from the same group of declarers.

3. The main findings of derivatives statistics

3.1 Analysis of banks' derivatives business

Banks' derivatives business has grown rapidly in the past decade. Notional amounts turnover grew from US\$342 billion in 1998 to US\$3,034 billion in 2007. Positions in derivatives grew at an even faster pace than turnover. Notional amounts outstanding expanded from US\$52 billion at the end of December 1998 to US\$1,686 billion at the end of December 2007 (Figure 1).



¹ Annual turnover. ² Notional amounts outstanding at the end of year.

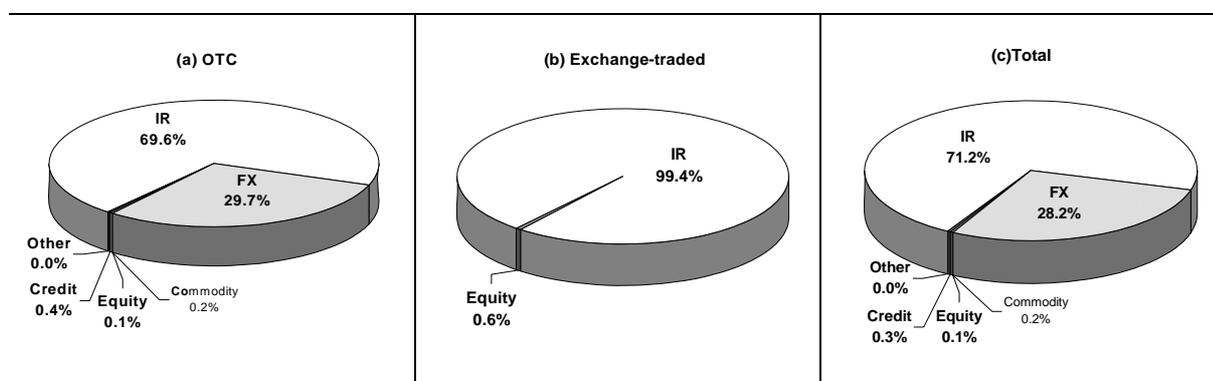
Source: Department of Financial Inspection of the central bank.

The end-December 2007 data on notional amounts outstanding highlights several important features of banks engaging in derivatives activities. First, the scale of transactions in the OTC market was very large, accounting for 94.7 percent of the total amount, while that of the exchange-traded market represented 5.3 percent. Among OTC contracts, swaps occupied the largest share with 64.2 percent, followed by forwards with 18.5 percent, options sold (9.1 percent), and options bought (8.2 percent) (Figure 2).

Second, a risk breakdown on notional amounts outstanding shows that single currency interest rate (IR) is the most important risk traded, accounting for 71.2 percent of total contracts. Foreign exchange (FX) made up 28.2 percent. The share of credit, commodity, equity and other contracts taken together was 0.6 percent (Figure 3(c)).

Third, growth accelerated in all instruments and all risk categories, when compared with the end of last year. While most of the growth in the amounts outstanding was driven by increases in IR and FX derivatives, there has been a proliferation of credit derivatives. Notional amounts outstanding of IR derivatives rose by 43.7 percent to US\$1,199 billion, those of FX derivatives by 18.7 percent to US\$475 billion. Growth in notional amounts outstanding of credit derivatives was at 40.9 percent, taking the positions to \$5.6 billion.

Figure 3
Composition of notional amounts outstanding by risk
 (End-December 2007)



Source: Department of Financial Inspection of the central bank.

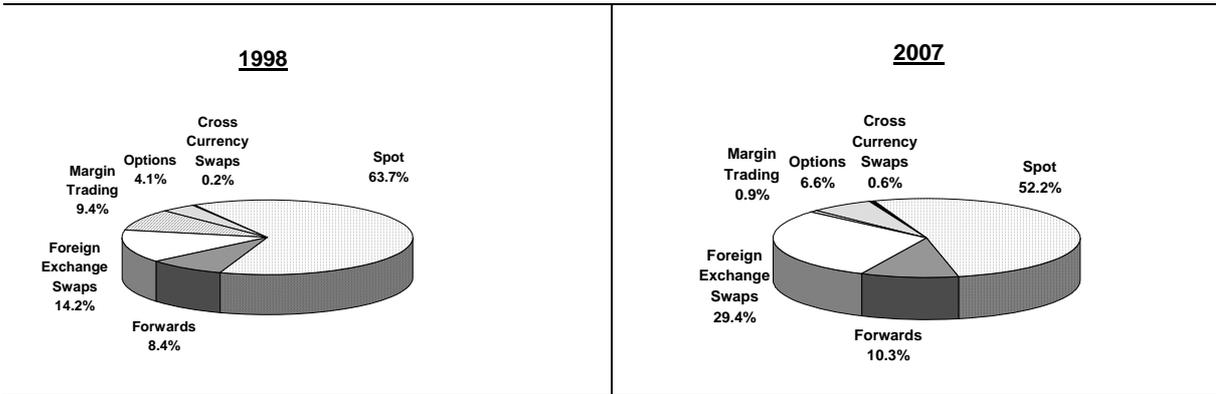
3.2 Development of the foreign exchange derivatives market

Against the background of increased exchange rate volatility, together with the expansion of international trade and intensive cross-border investment activities, foreign exchange derivatives have become increasingly common in Chinese Taipei's foreign exchange market, and thereby broadened the scale of the market. After deducting double counting on the part of inter-bank transactions, total net foreign exchange trading volume grew from US\$1,172 billion in 1998 to US\$4,634 billion in 2007. Among them, total net trading volume of foreign exchange derivatives expanded from US\$426 billion in 1998 to US\$2,215 billion in 2007.

With respect to types of transactions, in 2007, the share of spot transactions in total foreign exchange transaction volume declined to 52.2 percent from 63.7 percent in 1998, while foreign exchange swaps transactions accounted for 29.4 percent, followed by forwards (10.3 percent), options (6.6 percent), margin trading (0.9 percent), and cross currency swaps (0.6 percent) (Figure 4).

Figure 4

Composition of foreign exchange transactions by instrument



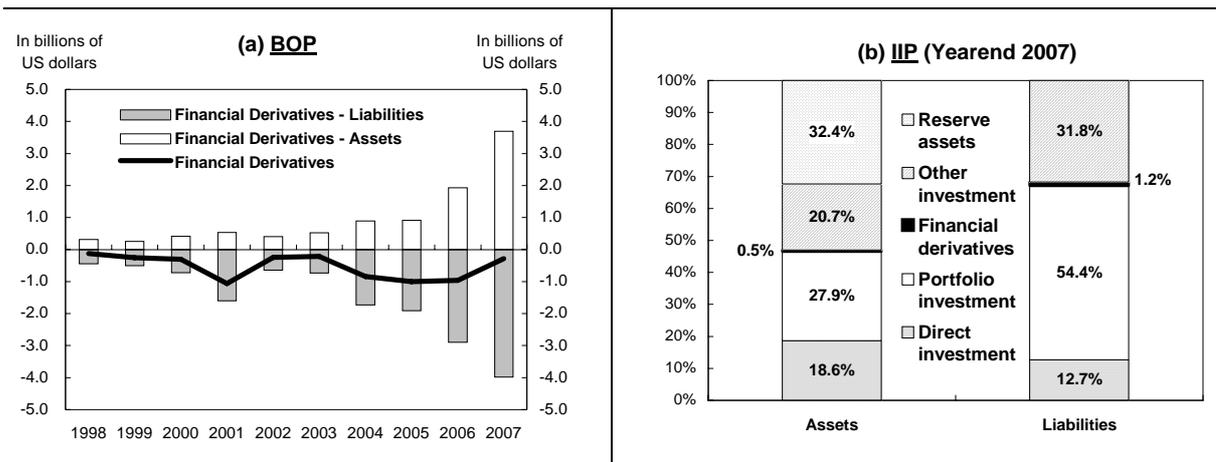
Source: Department of Foreign Exchange of the central bank.

3.3 Cross-border derivatives activities

In the past decade, cross-border derivatives transactions reported in the BOP varied substantially and all posted net outflows, reflecting the gains from derivatives deals by non-residents surpassing those by residents. For 2007, derivatives net settlements amounted to outflows of US\$0.3 billion, or 0.7 percent of the 38.7 billion in total financial outflows represented in the BOP (Figure 5 (a)). The gross positions in derivatives merely occupied a small share of Chinese Taipei's external financial positions, when compared with those of other financial instruments. At year-end 2007, the asset positions of derivatives amounted to US\$4.1 billion, or 0.5 percent of the 850.0 billion in total external assets reported in the IIP, while the liability positions in derivatives amounted to US\$4.6 billion, or 1.2 percent of the 383.3 billion in total external liability (Figure 5 (b)).

Figure 5

Cross-border derivatives activities



Source: Department of Economic Research of the central bank.

4. Conclusion

This paper has introduced methodologies on compiling derivatives statistics at the central bank. Derivatives statistics include measurements on banks' consolidated derivatives exposures, their foreign exchange derivatives business, and cross-border derivatives activities. These statistics are compiled for supervisory purposes and in line with the trend of international financial statistics. Derivatives statistics are essential to increase market transparency as they provide a full picture of the development of derivatives in the local and cross-border market to the public. Furthermore, derivatives statistics are important for the central bank to assess financial situations, monitor potential risks, and are utilized as effective references to monetary policymaking. Nevertheless, the rapid growth in derivatives activities and financial innovation challenges the existing methodologies on compiling Chinese Taipei's derivatives statistics, and therefore improvements on existing data sources and reporting frameworks should be considered.

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Compilation of statistical data on new financial instruments: the case of the Czech Republic

Rudolf Olšovský¹

1. Introduction

This paper analyses the system for compiling statistical data on new financial instruments in the Czech Republic. After a general overview of the financial derivatives methodology, the development of the use and statistical monitoring of new financial instruments is described. Furthermore, the experience with financial innovations during economic transition, changes in accounting, and data availability for the monetary and supervisory statistics are narrated. The statistical reporting system now covers the banking system, but data on trading in new financial instruments on the Prague Stock Exchange are also available. The closing part of this paper also covers further plans for the compilation of statistical data on new financial derivatives.

2. Definitions of financial derivatives

The fifth edition of the IMF Balance of Payments Manual (BPM5) originally included financial derivatives under portfolio investment. The increasing importance of financial derivatives led to separate functional categories being created, and a supplement to BPM5 was published in 2000. Special attention is given to financial innovation in the sixth edition (BPM6), as accelerating growth in new financial instruments and arrangements has been visible among institutional units over the past two or three decades. Paragraph 5.75 of BPM6 states, “A financial derivative contract is a financial instrument that is linked to another specific financial instrument or indicator or commodity and through which specific risks (such as interest rate risk, foreign exchange risk, equity and commodity price risks, credit risk, etc) can be traded in their own right in financial markets. Transactions and positions in financial derivatives are treated separately from the values of any underlying items to which they are linked”. Paragraph 8.33 of BPM6 states “Transactions involving financial derivatives may arise at inception, on secondary markets, with ongoing servicing (such as for margin payments), and at settlement.”

Statistical monitoring of derivatives stocks is clearly described in international BoP manuals (the IMF Balance of Payments Manual; the ECB manual on the EU balance of payments/international investment position). But the monitoring of derivatives transactions is not so clearly defined in these manuals. It is not possible to derive flows from derivatives stocks at market value.

¹ Balance of Payments Division, Czech National Bank.

3. New financial instruments and their monitoring in the Czech Republic

3.1 Development of financial derivatives trading in the Czech Republic

The Czech economy's first contact with financial innovations came in the fourth quarter of 1995, immediately after the adoption of the new Foreign Exchange Act no 219/1995 in October.² The Czech koruna was adopted as a clearing currency in the international clearing system. Euro-obligations denominated in CZK issued by non-residents were accepted in Euroclear and the CEDEL Bank as from the fourth quarter of 1995. Significant growth in koruna-denominated instruments issued by non-residents (usually multinational financial corporations with AAA or AA+ investment ratings) was recorded in 1996 and at the beginning of 1997. The main reasons for these transactions were the existing interest rate differential between the Czech koruna and other currencies, the fixed exchange rate and the continuing convergence of interest rates in EU countries. Due to high inflation, the interest rate in the Czech market was over 10% in this period. In the first phase of issuance of Czech koruna-denominated eurobonds, non-residents increased the demand for koruna. The exchange rate of the domestic currency showed an appreciation tendency, while interest rates in the domestic interbank deposit market declined. The opposite tendency was visible when the bonds were amortised. There is no doubt that these financial instruments (cross-currency interest rate swaps) were one of the reasons for the monetary and currency turbulence that the Czech Republic faced in May 1997.

Table 1

Issuing activity of non-residents in Czech koruna-denominated eurobonds

Quarter or month/year	III.Q.95	IV.Q.95	I.Q.96	II.Q.96	III.Q.96	IV.Q.96	January/97	February/97	March/97
Number of issue	0	4	3	5	7	11	13	13	9
Amount in CZK bn	0	5,5	4,6	6,5	10,5	12	20	17	10

Source: CNB, Report on Monetary Developments in the first quarter of 1997, p 37.

Statistical monitoring was covered directly from Euroclear and the CEDEL Bank.

3.2 Statistics on derivatives in the Czech Republic

Foreign banks in the Czech market (operating via branches or by mergers with and acquisitions of existing Czech commercial banks) started to offer derivatives instruments to residents. The market value of derivatives is recorded in banks' balance sheets; the notional value of derivatives is recorded as an off-balance sheet item. The active market value of a derivative (sell or buy) is part of the asset side and the negative market value of a derivative (sell or buy) is part of the liability side of the balance sheet. For the purposes of the

² The new Foreign Exchange Act declared the convertibility of the Czech koruna on the basis of Article VIII of the IMF Treaty and also in conformity with the OECD Codex on liberalisation of capital flows.

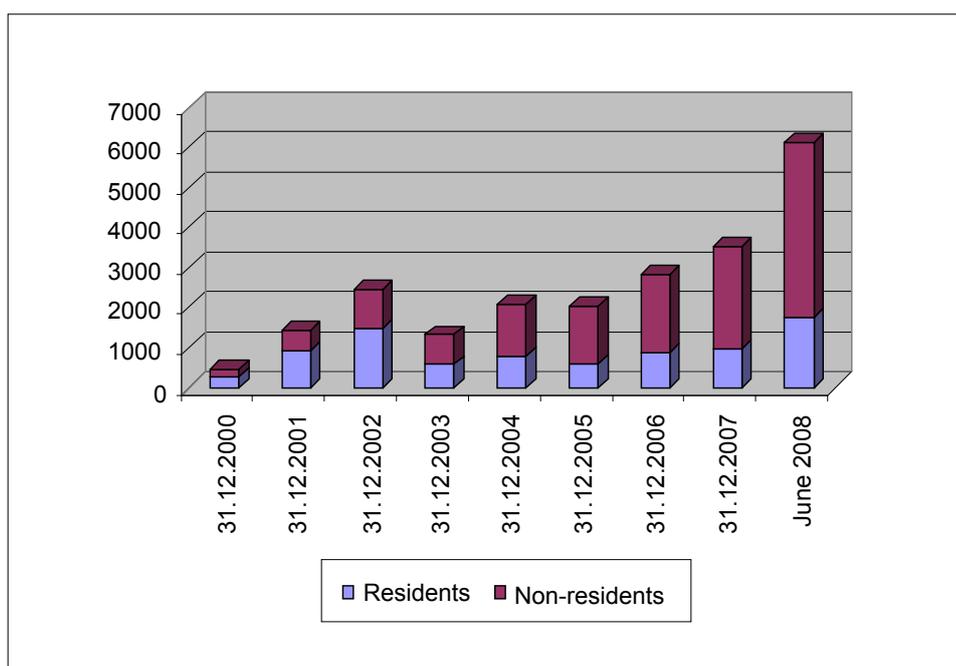
international investment position, monitoring of derivatives was implemented in 2000, when these instruments became important from the macroeconomic point of view. Monitoring of flows (eg for BoP purposes) has not yet been implemented in the Czech Republic.

Significant changes in the accounting of derivatives were implemented in January 2004 before accession to the European Union on 1 May 2004. A new amendment to the Income Tax Act distinguishes between hedging derivatives and speculative derivatives. The costs (profit or loss) of hedging derivatives are compensated in the accounting system by the profit of the company. The profit (or loss) connected with speculative derivatives is compensated by core capital. The position in a single derivative may also consist of two components – hedging and speculative. There is no scope for the unit to choose the accounting method, as it has to choose either protection of the real amount or protection of risk. For example, options are treated not as hedging derivatives but as speculative ones.

The development of the derivatives market in the Czech Republic over the past almost 15 years has been remarkable. But it was not covered by consistent accounting methods and statistics from the beginning. Derivatives trading was initially concentrated in the banking sector, the prevailing form being OTC derivatives (forward, swaps and options). The first statistical survey on derivatives in the banking sector was conducted by the Czech National Bank’s banking supervision department in September 1994. The birth of the derivatives market in the Czech Republic was connected with currency instruments, currency forwards and currency swaps without interest payments. These types of derivatives covered 80% of all derivatives traded in 1996.

The use of new types of financial instruments expanded in the period 1996–2001, when interest rate instruments were implemented for trading (FRAs, interest rate swaps, interest rate futures, interest rate options). Currency options were introduced for monetary policy purposes.

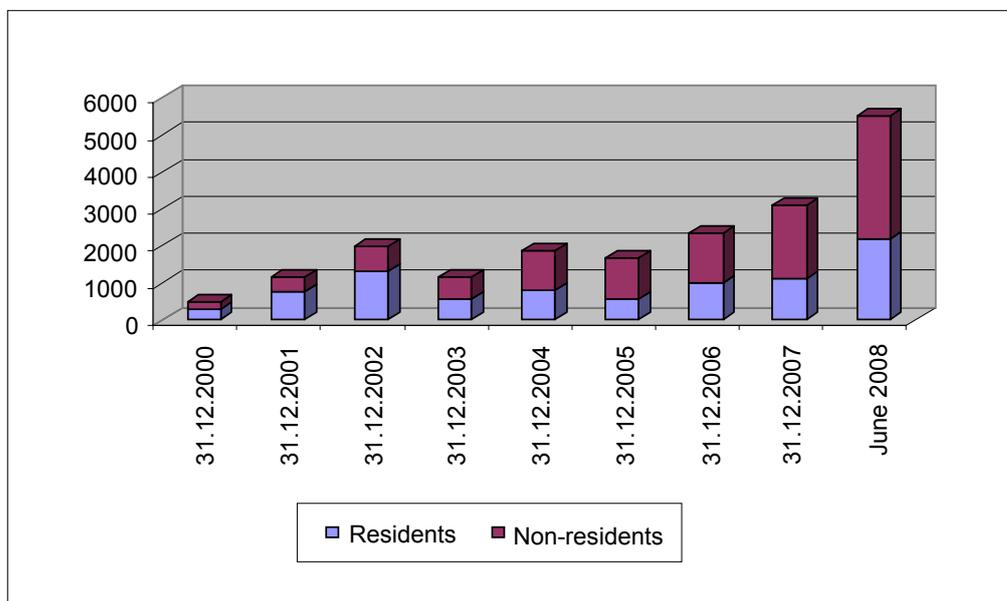
Graph 1
**Market value of derivative assets held by Czech banks
with non-residents and residents**
in EUR millions



Source: Czech National Bank, Monetary and Financial Statistics.

The accounting system for derivatives and their statistical monitoring has changed several times and no consistent time series are available. Therefore, to describe the development and structure of financial derivatives in the Czech banking sector consistently, it is necessary to select time series starting from 2000 and 2004. The main reasons are changes in the Czech banking sector due to mergers and acquisitions by foreign banks. These takeovers were connected with changes in hedge accounting. Moreover, International Accounting Standards (IAS 39) were adopted in the Czech Republic in 2004. These changes in banking accounting allowed the implementation of the market value of derivatives held in assets and liabilities vis-à-vis non-residents in the international investment position.

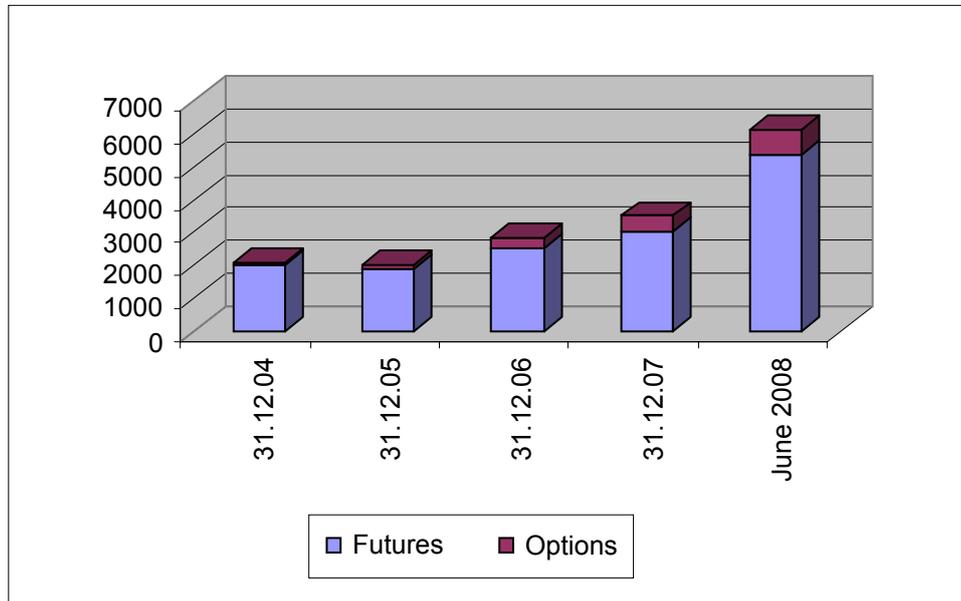
Graph 2
**Market value of derivative liabilities held by Czech banks
 with non-residents and residents**
 in EUR millions



Source: Czech National Bank, Monetary and Financial Statistics.

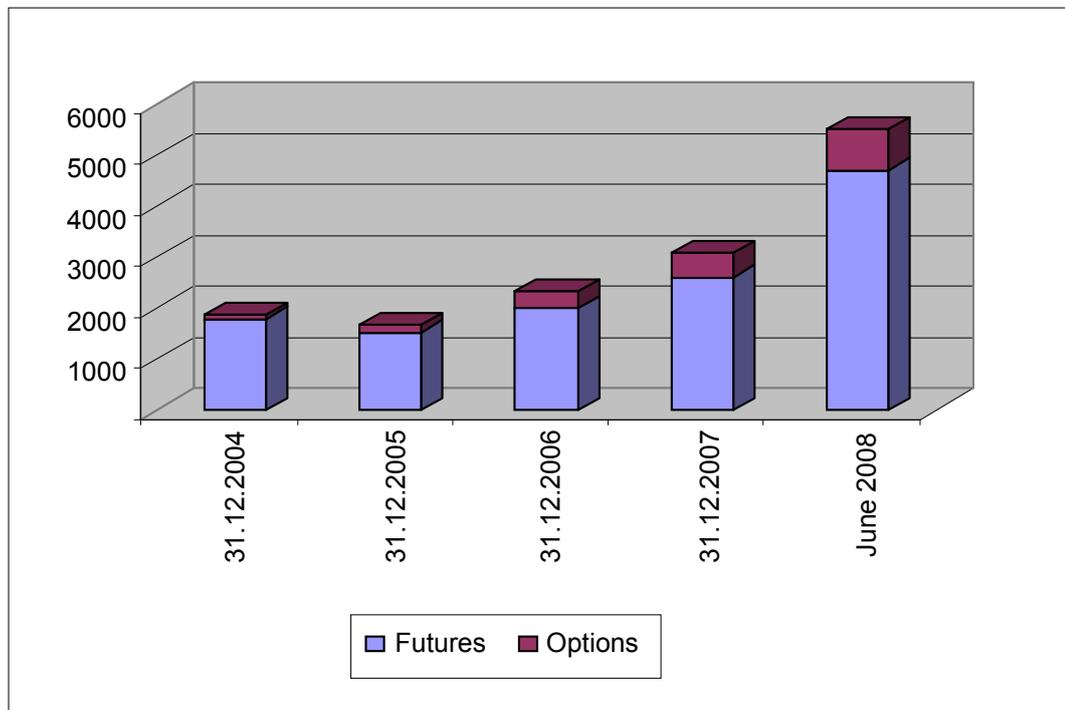
From the point of view of the main categories of derivatives, it is clear that forward-type contracts (futures) predominate, while options play only a minor role. The share of options contracts in the total value is rising steadily. The structure is the same on both the asset and liability sides.

Graph 3
Market value of derivative assets held by Czech banks
in EUR millions



Source: Czech National Bank, Monetary and Financial Statistics.

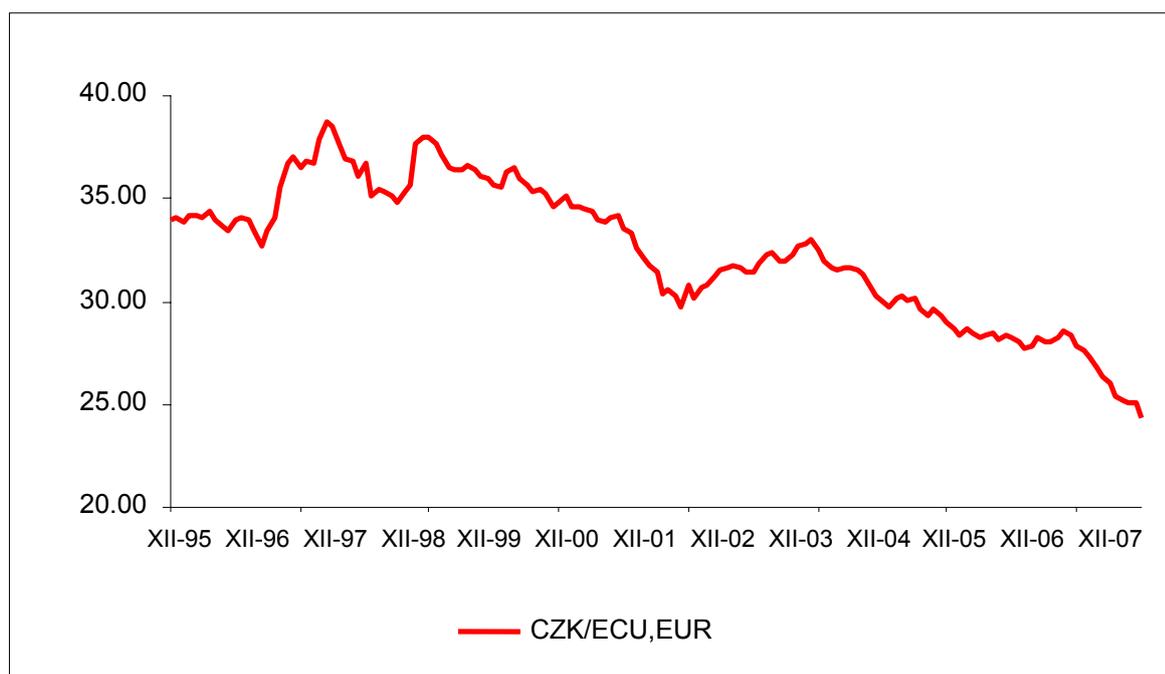
Graph 4
Market value of derivative liabilities held by Czech banks
in EUR millions



Source: Czech National Bank, Monetary and Financial Statistics.

The Czech koruna has been appreciating over the last couple of years due to excellent performance in foreign trade in goods and services (a growing surplus since 2004) and capital inflows into the Czech Republic (foreign direct investment), increasing labour productivity, and partially also due to the undervaluation of the domestic currency at the beginning of the economic transition, from the purchasing power parity point of view. The convergence of the price level in the Czech Republic with that of the EU 15 is proceeding more through the exchange rate channel than via inflation.

Graph 5
Foreign exchange rate CZK/ECU, EUR
 monthly average



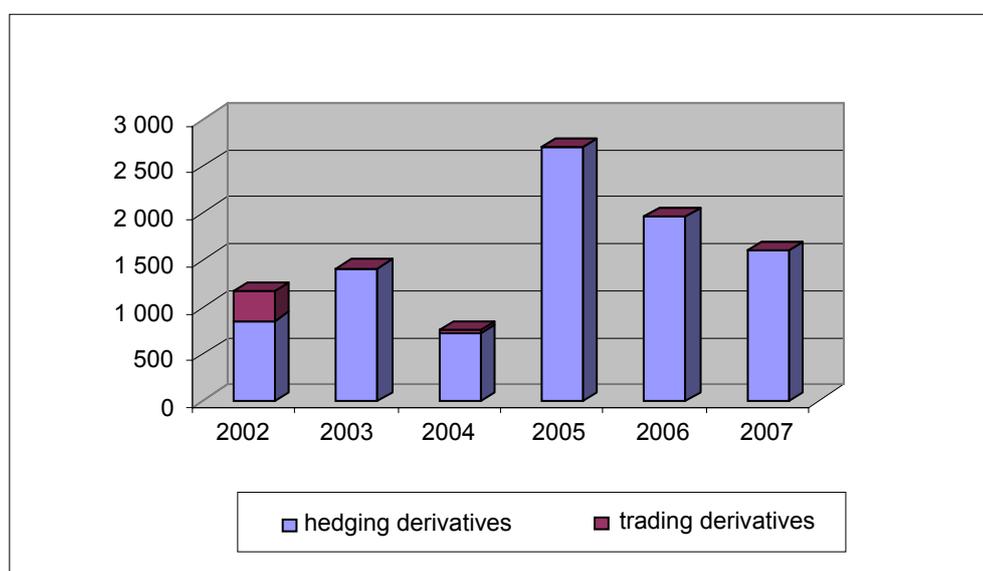
Source: Czech National Bank, Monetary and Financial Statistics.

To avoid foreign exchange risk due to the nominal appreciation of the domestic currency, companies are hedging with currency futures contracts. The breakdown by type of derivative instrument shows that currency derivatives have accelerated mainly in the past three years, accompanied by the simultaneous appreciation of the domestic currency.

The bulk of the interest rate derivatives are interest rate options, FRAs and interest rate swaps. The currency derivatives consist mainly of currency forwards, currency options and futures. New phenomena are visible in other derivatives. These are connected not only with stock exchange derivatives, but also with stock derivatives and commodity derivatives.

These figures do not cover companies hedging directly abroad against currency risks and commodity price risk. The number of such companies (mostly foreign affiliated) is increasing. Therefore, the Balance of Payments Division of the Czech National Bank will implement a survey of new financial instruments covering the market value of derivatives. For example, the largest car company in the Czech Republic, Škoda Auto (a member of the Volkswagen Group), publishes the notional value of its derivatives in its annual reports. It is clear that most of Škoda's export production is hedged against foreign exchange risk.

Graph 6
Notional value of derivatives - Škoda Auto
 in EUR millions



Source: Škoda Auto Annual Reports 2002–07.

The annual reports of other companies also reveal that other private- or state-owned companies are involved in financial derivatives transactions, for instance the Czech power utility ČEZ. Dairies, too, have long-term contracts for deliveries abroad connected with financial derivatives. They sell milk for processing in Germany, have fixed contracts in EUR for more than two years and prefer income in CZK. A German bank therefore executed a currency swap in EUR/CZK to cover this demand. A new kind of instrument that is widely used is commodity derivatives. These are connected with contracts for crude oil, natural gas or other commodities, due to the rapid growth in commodity prices over the past two years.

Generally speaking, the hedging instruments used by Czech exporters to cover their foreign exchange risks are one of the factors affecting the CZK/EUR exchange rate in the spot market and driving the appreciation of the Czech koruna.

3.3 Derivatives trading on the Prague Stock Exchange

The Czech Securities Commission granted the Prague Stock Exchange (PSE) permission to organise a public market for selected options and futures contracts (subject to certain conditions) in a decision dated 2 August 2001. The granting of the licence by the KCP (the official market regulator) is an expression of the opinion that the PSE has proved its preparedness for organising derivatives trades not only from the technical perspective, but also from the legal, business and personal standpoints. This decision expands the licence currently held by the PSE as a public securities market organiser, since it includes permission to organise both the supply of, and the demand for, the following capital market instruments at a fixed place and time:

1. Options whose value is derived from the official price index;
2. Futures whose value is derived from the official price index;

3. Futures whose value is derived from the interest rate commonly used in the Czech financial market;
4. Futures whose value is derived from the public bonds basket.

The entire process of preparation of the organised derivatives market comprises not only the licensing of the PSE and UNIVYC (joint stock company authorised settlement of trades in securities), which has applied to the Czech Securities Commission for the relevant permission, but also the licensing of brokers firms, brokers' examinations and the preparation of traders' (dealers') systems. The objective of the preparation process is not only to implement a trading system of an appropriate standard, but also to set up a derivatives trade settlement system of equal quality. Experience abroad shows that markets that have introduced derivatives trading have also seen some improvement in liquidity in the prompt market. The PSE expects that the same could happen in its market.

On 17 December 2001, the Czech Securities Commission granted UNIVYC permission to settle derivatives trades concluded on the PSE. UNIVYC's current licence, covering settlement of PSE trades, has been expanded to include settlement of trades in the following capital market instruments:

1. Futures whose value is derived from the price index;
2. Futures whose value is derived from the interest rate commonly used in the Czech financial market;
3. Futures whose value is derived from the government bonds basket.

A further necessary condition for the launch of organised trading in derivatives on the Czech capital market is the granting of derivative licences to relevant PSE members, which must meet the capital, technical, organisational and personal requirements set by the Czech Securities Commission.

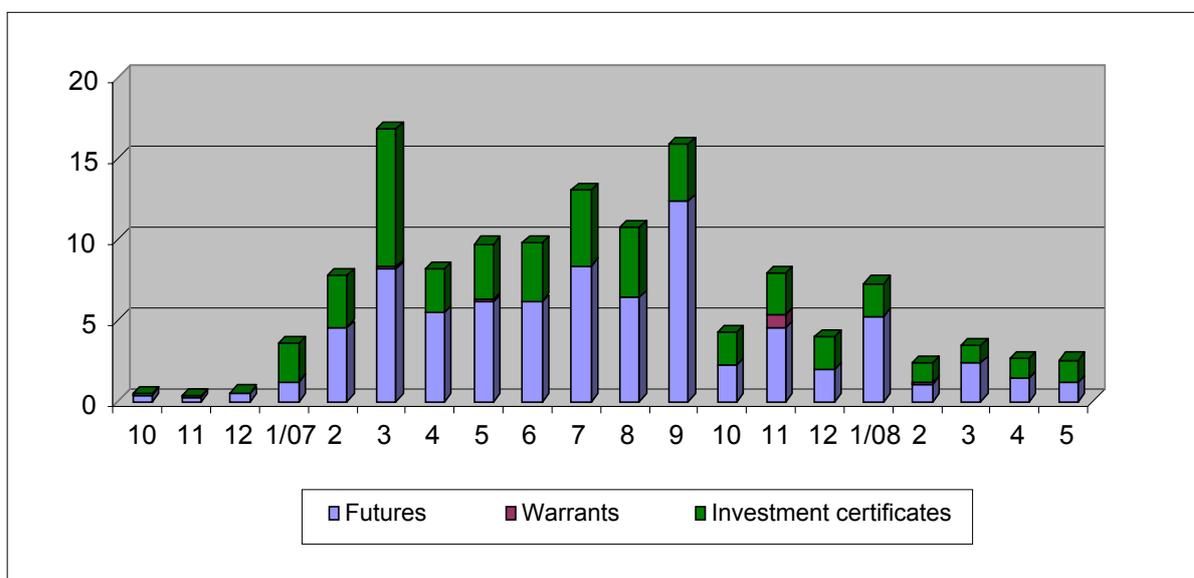
It took several years to prepare derivatives trading on the PSE. In the meantime, all the institutions of supervision of the financial market were merged into the Czech National Bank (in April 2006). Therefore, on 18 July 2006, the Czech National Bank awarded the PSE an extended licence to trade new types of investment instruments, namely leveraged certificates, option certificates and warrants. The new licence also extends the scope of the underlying assets for futures trading.

The following may now be used as underlying assets for futures trading:

- Stock admitted to trading on an organised market based in an EU or OECD country,
- Stock market indices from EU or OECD countries, including indices comprising stock from more than one country and baskets of such indices,
- The currency of an EU or OECD country,
- The price of and/or yield on government bonds issued by an EU or OECD country denominated in the currency of an EU or OECD country, including baskets of such bonds,
- The price of issue certificates determined by an organised market based in an EU or OECD country,
- The price of a commodity determined by an organised market based in an EU or OECD country.

The current derivatives market organisation licence held by the PSE since 2001 allows for exchange trading of only a selected portfolio of investment instruments. Foreign market experience shows that derivative products have high potential and are very popular with investors.

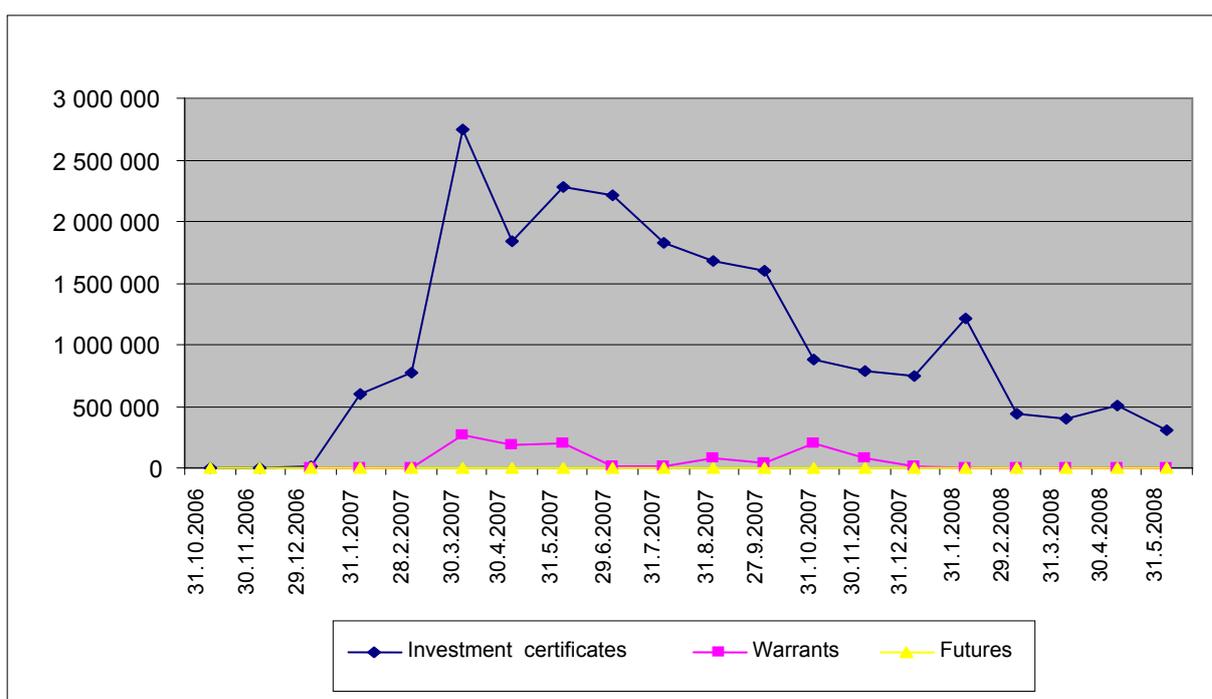
Graph 7
Derivatives trading on the Prague Stock Exchange
in EUR millions



Source: Prague Stock Exchange.

Trading in the new financial instruments is limited, and trading in standardised contracts is only just beginning. Compared to OTC transactions executed by banks with non-residents and between themselves, derivatives trading is on a much smaller scale.

Graph 8
Number of instruments traded on the Prague Stock Exchange



Source: Prague Stock Exchange.

4. Conclusions

Data on derivatives stocks held by banking sector are collected in aggregated form in banking statistics, and breakdown by type of instrument is available for supervisory purposes in the Czech Republic. The methodology and accounting have changed several times, so it is difficult to present a consistent time series and structure of financial derivatives. Furthermore, it is relatively easy to monitor stock data on the market value of derivatives, but it is hard to define flows, for instance for BoP purposes.

Data show that derivatives trading is becoming an important part of the balance-sheet trading of financial and non-financial institutions in the Czech Republic. Local banks, mostly foreign owned, have not been hit by the subprime mortgage crisis, as they did not invest in US securities connected with this instrument, focusing instead on the Czech market. New consumer credit and new mortgages provided by Czech banks to citizens are booming. But an acceleration in new financial derivatives is also visible in the balance sheets of Czech institutions. Domestic demand for financial derivatives accelerated in 2007 and the first half of 2008. This demand is concentrated in currency derivatives, but clients are also starting to invest in commodity derivatives as a result of the growth in commodity prices. The main reason for the use of financial derivatives in the Czech Republic is to avoid foreign exchange risk due to the continuous nominal appreciation of the domestic currency (the Czech koruna).

The main Czech exporters cover their foreign exchange and other risks not only with domestic banks, but also directly abroad. Therefore, statistical monitoring of stocks of new financial instruments for the balance of payments statistics will be extended to include the balance sheets of companies (the biggest players) as from 1 January 2009.

To conclude, the bulk of the domestic demand for new financial instruments in the Czech Republic is connected with risk aversion instruments, not with speculative trade. Most of the financial derivatives instruments used in the Czech Republic are forward contracts, specifically non-exchange traded futures. In most cases, forward contracts are executed after the contract expires and the underlying asset is bought or sold at the pre-agreed price.

Financial derivatives statistics are becoming increasingly important. Consequently, it seems essential to unify at international level the statistical rules for monitoring not only stocks, but also transactions in new financial instruments for BoP statistics and National Accounts Statistics purposes.

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Session 5

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Financial markets' appetite for risk – and the challenge of assessing its evolution by risk appetite indicators

Birgit Uhlenbrock¹

1. Introduction

When reading a market report on how stocks fared relative to government bonds over the short run, one will often find that changes in investors' general demand for risky assets relative to assets considered rather safe are attributed not only to changes in assets' perceived riskiness,² but also to investors' average or aggregate attitude towards risk.³ Such changes in investors' narrowly defined appetite for/aversion to risk over time might not only affect the size of the compensation market participants require per unit of risk, but could also influence how markets react to shocks. Bad news in a market situation where investor risk appetite is already low is likely to result in a much greater repricing of risky assets than in periods where it is high. The dynamic stance of the risk appetite of market participants as a sentiment could thus serve as an important contributing factor in the transmission of shocks through the financial system. Furthermore, as it might itself be influenced by the situation in financial markets, it could work as a multiplier. Accordingly, taking into account the risk appetite/risk aversion of investors and its evolution has become an important element of assessing the condition and stability of financial markets.

A number of indicators have therefore been proposed in the literature for quantifying the evolution of investors' general risk appetite (for an overview see eg Illing and Aaron (2005)). Some of them are based on theoretical models, while others are more atheoretic or ad hoc in the sense that they only aggregate the information contained in market data without relying on a theoretical framework. But the notion of risk appetite underlying these indicators is not necessarily identical. Under a narrow interpretation of risk appetite, one faces the difficulty of having to disentangle the effects of changes in investors' risk appetite on investors' relative demand for risky assets from those of changes in risk assessments. For this, one can try to

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² In a stochastic environment, a priori the total return on an initial investment will generally be uncertain and subject to various kinds of risk, such as market risk, liquidity risk, and default risk. Assuming that changes along such risk dimensions lead to an immediate repricing of assets in financial markets, in the sections below, the asset (return) riskiness measure of interest will be based on variances or covariances of (relatively short-term) realised asset returns.

³ Traditionally, models often assume that an individual investor's fundamental degree of risk aversion is a characteristic parameter that remains constant. But this does not preclude a change at the aggregate (cross section) level if eg investors are not all identical, but are characterised by different individual degrees of aversion to risk, and if the composition of investors actively participating in the markets changes over time, see Kumar and Persaud (2002). Furthermore, the behavioural finance theory argues that the degree of risk aversion of an individual investor may also change over time depending on previous investment decisions' outcomes. Thus, a row of positive results might cause an investor to become overconfident and less averse to taking on risk, while the opposite may happen after significant losses.

rely on particular modelling assumptions when developing indicators. Alternatively, one may choose to circumvent the problem by simply focusing on the combined effects reflected in changes of the relative demand for risky assets. This leads to indicators for a more broadly defined concept of risk appetite. Finally, in theory the stance of investors' general risk appetite is likely to affect all risky financial market segments. In terms of actual results, however, the various risk appetite indicators often vary in their coverage of financial market segments, which is another potential source of heterogeneity.

It is therefore maybe not altogether surprising that the different indicators do not always suggest a similar stance of investors' risk appetite. What is even more problematic, it might not always be one that coincides well with given priors around critical periods in financial markets (see eg Illing and Aaron (2005)). Such findings raise concern about the usefulness of applying risk appetite indicators in the first place. A better understanding of how individual indicators work thus seems clearly warranted and might offer ways of potential improvement down the road. The paper contributes to this evolution, concentrating on the so-called Global Risk Appetite Index (GRAI) class of indicators.

This indicator concept, originally developed by Kumar and Persaud (2002), rests on the assumption that at a given point in time the price of a risky asset will already reflect an assessment of its risk. The authors assume that a significant monotonic relationship between excess returns and past measures of perceived riskiness for a cross section of risky assets should then be observed only if markets participants' aggregate risk appetite has changed. Focusing on the foreign exchange market segment, Kumar and Persaud (2002) assess the significance of risk appetite changes using cross-sectional Spearman rank correlation coefficients between monthly or quarterly excess returns of assets and assets' past volatilities.⁴ Conversely, Wilmot, Mielczarski et al (2004) and the Deutsche Bundesbank (2005) assume linear relationships between excess returns and past riskiness. Furthermore, they apply a linear-regression indicator approach to data from not only one financial market segment at a time, but considering stock and bond markets together. Finally, to emphasise investors' aggregate risk aversion as the dual concept to risk appetite, Coudert and Gex (2006) choose to define their linear Global Risk Aversion Index as the negative of the cross-sectional linear correlation between excess returns of assets and past volatilities.⁵

Its intuitiveness and simplicity makes the GRAI class a popular choice among the theory-based risk appetite indicators. The ability to cover a larger cross section of indices from several financial market segments in an integrated way is another attractive feature. However, one also has to keep in mind some caveats. Despite having a similar model in mind, (G)RAI indicator results will also finally depend on particular specification and input choices, such as the choice between a merely monotonic or a more restrictive linear relation between assets' excess returns and measures of riskiness, the selection of assets/financial market segments, the length of the period over which to calculate the respective (excess) returns, and how to proxy for riskiness as perceived by investors. For the latter, a common practice in the literature is to rely on volatilities or variances of individual asset returns. However, in a portfolio context, this effectively amounts to assuming that covariances

⁴ They applied their indicator to specific segments of financial markets, primarily the FX market, but also to the US stock market, where they examined a cross section of US sector equity indices. For details, see Kumar and Persaud (2002), p 414. To avoid any overlap of the period over which volatilities and returns were calculated, the volatilities were derived for a period of 250 business days prior to the excess return period.

⁵ For their linear correlation-based index they used the abbreviation GRAI, while the negative corresponding cross-sectional regression coefficient was dubbed Risk Aversion Index (RAI). They applied the indicators to two sets of cross-sectional data (one of foreign exchange rates, and another of international stock indices) separately like Kumar and Persaud (2002); however, they used a lower frequency of monthly rather than daily data.

between asset returns do not significantly contribute to the riskiness of assets.⁶ Misina (2006) therefore suggests taking the full variance-covariance (VCV) matrix of asset returns into account in his extended factor-based rank-correlation risk appetite indicator, called RAI-MI. Since he wanted to compare results of his RAI-MI with the preferred indicator of Kumar and Persaud (2002), however, his paper focused on international FX markets.

The present paper broadens the investigation into the relative pros and cons of the Misina factor extension, as well as the other necessary choices to be made when deriving a GRAI-type risk aversion indicator. However, we introduce an important additional restriction to the Misina (2006) factor extension, which leads to our modified version of the factor-extended rank-correlation Global Risk Aversion Index (F-GRAI).

The remainder of the paper is organised as follows: the next section contains a short presentation of the theoretical background to the GRAI class of risk appetite indicators. Section 3 then moves on to an empirical analysis of the GRAIs as global risk aversion indicators, where in terms of financial market coverage we focus first on international stock markets and later on stock and bond markets combined. The recent stressful phase of financial market turmoil from mid-2007 onwards serves as an important yardstick for evaluating the plausibility of results and how that is affected by the factor extension as well as the other implementation decisions.⁷ Finally, Section 4 summarises the main results.

2. Methodology: the GRAI indicator – theoretical motivation and the Misina critique

Apart from adding the assumption that “investors have the same, but changing risk appetite”, Kumar and Persaud (2002) in principle rely on a simplified capital asset pricing model (CAPM)⁸ for theoretically motivating their indicator’s key hypotheses. These are that a rank correlation between a cross section of asset price movements at time t and the assets’ riskiness at $t - m$ should be weak for a contemporary change in general risk, but strong for a change in the general appetite for risk. With some measure of volatility as a proxy of asset riskiness, they then used the rank correlation between asset excess returns and past volatilities from the beginning of the return period as their risk appetite indicator.

Under the usual assumptions of the CAPM, the expected return of a risky asset i in period $t + 1$, $E(R_{t+1}^i)$, in equilibrium should exceed the risk-free rate R_{t+1}^f by a risk premium (excess return) equal to the representative investor’s degree of risk aversion ρ times the asset’s systematic risk. Since the latter is determined by how the asset return covaries with the return R_{t+1}^M of the market portfolio, this gives the familiar equation:

$$E(R_{t+1}^i) - R_{t+1}^f = \rho \text{cov}(R_{t+1}^i, R_{t+1}^M) = \rho \cdot \sigma_{i,M}. \quad (1)$$

⁶ In the portfolio context that might be used to motivate the GRAI class of indicators theoretically, asset returns’ covariances will be zero in the case of independence, see also Coudert and Gex (2006).

⁷ Of course, another interesting empirical question in terms of the usefulness of a risk appetite indicator might be to explore whether factors that are considered influential for the evolution of investors’ risk appetite, eg the degree of liquidity in financial markets, can be related to the dynamic evolution of investors’ aggregate risk appetite over time. See eg ECB (2007a).

⁸ For details on their simplified version of a CAPM, see Kumar and Persaud (2002), p 409 ff. However, the CAPM model used below is closer to eg Coudert and Gex (2006).

A portfolio return is the sum of the returns on the portfolio's individual assets times their given portfolio weights α_i , ie $R_{t+1}^M = \sum_i \alpha_i \cdot R_{t+1}^i$, with $\sum_i \alpha_i = 1$. The covariance $\sigma_{i,M}$ can thus be rewritten as

$$\sigma_{i,M} = \text{cov}(R_{t+1}^i, R_{t+1}^M) = \alpha_i \cdot \sigma_i^2 + \sum_{j \neq i} \alpha_j \cdot \sigma_{ij}, \text{ with } \sigma_i^2 = \text{var}(R_{t+1}^i) \text{ and } \sigma_{ij} = \text{cov}(R_{t+1}^i, R_{t+1}^j) \quad (2)$$

and substituted into (1) in order to obtain

$$E(R_i^{\text{ex}}) = E(R_{i,t+1}^{\text{ex}}) = E(R_{t+1}^i) - R_{t+1}^f = \rho \cdot \sigma_{i,M} = \rho \cdot (\alpha_i \cdot \sigma_i^2 + \sum_{j \neq i} \alpha_j \cdot \sigma_{ij}). \quad (3)$$

A change in expected excess returns can then arise from a change in risk aversion or a change in the riskiness of asset i stemming either from a change in its own return variance or changes in its covariances with the other asset returns in the portfolio:

$$\begin{aligned} dE(R_i^{\text{ex}}) &= \frac{\partial E(R_i^{\text{ex}})}{\partial \rho} \cdot d\rho + \frac{\partial E(R_i^{\text{ex}})}{\partial \sigma_{i,M}} \cdot d\sigma_{i,M} \\ &= \frac{\partial E(R_i^{\text{ex}})}{\partial \rho} \cdot d\rho + \frac{\partial E(R_i^{\text{ex}})}{\partial \sigma_i^2} \cdot d\sigma_i^2 + \sum_{j \neq i} \frac{\partial E(R_i^{\text{ex}})}{\partial \sigma_{ij}} \cdot d\sigma_{ij} \end{aligned} \quad (4)$$

According to (4), an autonomous change in the degree of risk aversion ρ should thus produce a change of asset excess returns in proportion to their riskiness $\sigma_{i,M}$,

$$\frac{\partial E(R_i^{\text{ex}})}{\partial \rho} = \sigma_{i,M}, \forall i. \quad (5)$$

In the model, a change in risk aversion should therefore be accompanied by a significant correlation between asset excess returns and their riskiness. However, for an empirically feasible GRAI indicator, observable proxies must be substituted for the quantities on both sides of (5). Changes in expected asset returns are thus replaced by short-term realised (ie ex post) returns defined in terms of observed changes in log asset prices.⁹ The practice of approximating asset return riskiness by their own past volatilities or variances alone, as in Kumar and Persaud (2002), may lead to a different ranking of assets in terms of riskiness than if one considered the covariances with the market portfolio, however. As shown by equation (2), only for covariances between the individual asset returns equal to zero and asset weights either equally large or increasing with the asset return variances it would be guaranteed that both approaches give the same asset return riskiness rankings. Misina (2003) argues, however, that the independence of asset returns has a further benefit when applying the GRAI. For independent returns, a common shock to the riskiness of all assets can – with given weights – occur only through a simultaneous increase or decrease of all variances. In that case, a rank correlation effect between assets' excess returns and their past variances could not a priori be excluded, unless one assumed equally weighted portfolios (see Misina (2003), pp 15–16). However, when returns are not independent, also a change in the covariance between two asset returns could cause a rank correlation effect – again unless assets were assumed to have equal weights (see Misina (2003), p 13 ff).

⁹ Assuming that any repricing of assets to effect a change in risk premia takes place immediately at time t while expectations concerning future asset values remain unchanged, one obtains $d(E(R_i^{\text{ex}})) = -dP_t^i$. See eg also Coudert and Gex (2006).

This shows that assumptions concerning the weights and the independence of asset returns are important for nesting the empirical GRAI approach of Kumar and Persaud (2002) within the theoretical portfolio context of a CAPM. When returns are not independent, Misina (2006) proposes the pragmatic solution of using an eigenvalue/eigenvector decomposition of the variance-covariance (VCV) matrix of asset returns to transform the original GRAI rank correlation problem into one that considers orthogonal factors and their past variances. Rewriting (1) respectively (3) in matrix notation,

$$ER_{t+1}^{ex} = \rho \cdot \Sigma_R \cdot \alpha, \text{ with } ER_{t+1}^{ex} = \begin{bmatrix} E(R_{1,t+1}^{ex}) \\ E(R_{2,t+1}^{ex}) \\ \vdots \\ E(R_{n,t+1}^{ex}) \end{bmatrix}, \Sigma_R = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & \dots & \sigma_{1n} \\ \sigma_{21} & \sigma_2^2 & \dots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{n1} & \dots & \dots & \sigma_n^2 \end{bmatrix}, \alpha = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \vdots \\ \alpha_n \end{bmatrix}, \quad (6)$$

the VCV matrix is decomposed into $\Sigma_R = B \cdot D \cdot B'$, with D the diagonal matrix of eigenvalues (ordered from greatest to smallest, ie $D_{ii} \geq D_{jj} \forall 1 \geq i > j \geq n$) and B the matrix of the corresponding normalised eigenvectors (in columns). The inverse of B can then be used to obtain orthogonal factors from the assets returns at time t,

$$R_t = B \cdot f_t \leftrightarrow f_t = B^{-1} \cdot R_t, \text{ with } R_t = \begin{bmatrix} R_{1,t} \\ R_{2,t} \\ \vdots \\ R_{n,t} \end{bmatrix}, f_t = \begin{bmatrix} f_{1,t} \\ f_{2,t} \\ \vdots \\ f_{n,t} \end{bmatrix}. \quad (7)$$

Misina (2006) argues that the factors can be interpreted as returns on derivative assets constructed from the range of original assets (Misina (2006), p 9) and proposes taking the correlation between the ranks of the orthogonal factors and those of their variances (ie the ranks of the already ordered diagonal elements of D) as an alternative to the Kumar and Persaud (2002) indicator.¹⁰

Unlike argued by Misina, however, the normalisation of eigenvectors alone cannot guarantee to avoid problems of non-uniqueness as normalisation only enforces the restriction that the sum of squared elements of an eigenvector must add up to one (ie that the eigenvector will have unit length). This still leaves the problem that multiplying all elements of a normalised eigenvector by -1 will again result in a valid normalised eigenvector. Therefore, we will ensure fully unique eigenvectors in B by conducting a “normalisation-plus”. This imposes the additional restriction that the sum of the elements of each normalised eigenvector must be non-negative.¹¹

¹⁰ One could formulate an equilibrium relationship corresponding to (1) between expected returns and riskiness for the factors, ie $E(f_{t+1}) - R_{t+1}^f = \rho \cdot D \cdot B' \cdot \alpha = \rho \cdot D \cdot \tilde{\alpha}$. As argued by Misina (2006), due to an identical profile of (expected) risk over (expected) return, investors should be indifferent between holding a portfolio of original assets with weights α' or a corresponding portfolio of derivative assets with the weights $\alpha' B$. But the CAPM model for the factors as derivative assets is not identical to the one for the original assets, as can be seen when premultiplying (6) by B^{-1} .

¹¹ This assumption is plausible from a theoretical point of view as well: for the factor CAPM model (see footnote 10) with equally large positive elements in α this restriction guarantees that also the new weights $\tilde{\alpha} = B' \cdot \alpha$ will at least all be positive.

The factor extension is not a perfect solution. Again, whether the rankings of factors in terms of true riskiness might be different from the one obtained based on factor variances alone depends on the (now transformed) weights $\tilde{\alpha}$. The problem of potentially observing a correlation effect between the ranks of factors and the ranks of their (lagged) riskiness proxies which might in fact be unrelated to changes in risk aversion is not fully eliminated either.¹² Another empirically relevant aspect is that the orthogonality of derived factors will to some extent be violated as VCV matrices of asset returns change over time. Such caveats must be taken into account and we have to acknowledge the assumptions made implicitly when applying the factor-extended rank-correlation GRAI. In the end, though, the main question is the usefulness of the factor extension when actually applying the GRAI approach. We will explore this in the next, empirical section.

3. Empirical results

3.1 Data and indicator inputs

The first data set for which risk appetite indicators are calculated consists of a selection of MSCI developed and emerging stock market indices (for details see Table 1 in the Appendix), with the secondary rate on three-month US Treasury Bills used as a proxy for the risk-free rate. (End-of-) Wednesday observations of the data are selected for calculating the risk appetite indicators at a weekly frequency.¹³ A second data set of Merrill Lynch indices (for details see Table 3 in the Appendix) covers the bond market segment. In addition to a US government bond index as a relatively safe asset, it includes indices for investment-grade US corporate bonds of different sector/rating segments, high-yield bonds, asset-backed securities (ABS), and non-investment grade emerging market bonds of different rating segments.

Implementing the GRAI with stock index data has the advantage that they refer to comparable and liquid instruments. Since the stock market is considered to provide aggregate information on the stance of the real economy, it is also likely to react to any major shock that affects the economy, or more narrowly the financial system, from the outside. Accordingly, equity markets typically play a prominent role when gauging the general risk appetite stance of investors.

Furthermore, despite the assumption that a change in investors' general risk appetite should lead to a repricing of risky assets across a number of market segments, there might also be some element of idiosyncrasy in the appetite for specific asset classes' risk at a given point

¹² The potential for a rank correlation effect after a common shock to the factor variances now depends on the asset weights in the original portfolio and the elements of B. Furthermore, even for a constant weight vector α with equal-sized elements for the original portfolio of assets, the weights in the CAPM formulated for the factors, $\tilde{\alpha} = B'\alpha$, are likely to be affected by changes of B, eg if the covariances between the original dependent asset returns change over time.

¹³ Daily data of the MSCI indices (all with USD as the reference currency) were taken from MSCI/Bloomberg, while the data for treasury bill rates were downloaded from the FRED website of the Federal Reserve Bank of St. Louis (stlouisfed.org). Based on the three-month T-bill rate given in p.a., a proxy for a one-week risk-free

rate can be calculated as
$$rf_t^{weekly} = \left(1 + \frac{r_t^{3m-Tbill,p.a.}}{100} \right)^{\frac{1}{52}} - 1$$
 assuming 52 weeks per year, see also

Bollerslev, Engle et al (1988). Proxies for the risk-free rates corresponding to alternative return periods can be obtained accordingly.

in time. That is to say, one important empirical question is how informative the changes in risk appetite implied for one segment of financial markets are for the common or general risk appetite stance indicated when considering different financial market segments simultaneously. Given the implications of the subprime crisis in mid-2007, it therefore seems particularly interesting to compare the stock market GRAI with results for data sets covering only, or in addition, different bond indices. Combined data sets of stock and bond indices were also used in Wilmot, Mielczarski et al (2004) and Deutsche Bundesbank (2005). However, they looked at cross-sectional linear regressions between asset excess returns and past risk measures. Thus, one focus of the present paper is to compare the results obtained under a more restrictive linear (RAI) approach with those from the less restrictive rank-correlation GRAI approach.

There exist arguments both for and against considering different asset classes together when it comes to developing risk appetite indicators. On the one hand, a larger cross section of assets with different degrees of riskiness should, all other things being equal, lead to an increase in efficiency.¹⁴ On the other hand, assets from different asset classes will be subject to different kinds of risk. From an investor's point of view, these kinds of risk might be more or less important at different times. The recent subprime crisis, for example, quickly put credit and liquidity risk aspects very high on investors' worry lists. When applying the GRAI indicator to a broad cross-segment portfolio, a cross-sectional averaging effect might therefore lead to the loss of information on the risk stance towards more specific asset classes. Furthermore, the factorisation already adds another level of complexity. Expanding the data set thus might be a greater challenge to the robustness of results in the F-GRAI case. The F-GRAI also has by construction a broader range of riskiness degrees covered, it exploits the information concerning the original assets' riskiness more efficiently.¹⁵ For the F-GRAI in particular, it might therefore not a priori be clear whether to prefer an integrated or disaggregated approach.

Apart from the choice of assets to be included in the data set, one has to make four additional central decisions to actually obtain a (G)RAI type risk appetite indicator empirically.

The first decision is how and over what length of period to calculate the (excess) returns of the assets. For the following empirical applications, the asset returns of interest are the log index changes. More precisely, the return on index i at time t is calculated as the difference between the log index values at time t and some previous time $t - m$, with the lag m corresponding to the chosen return period length. Excess returns are then derived by subtracting the risk-free rate for a corresponding period of length m at time $t - m$.

Price or valuation changes in opposite directions observed from day to day or even week to week may average out to some extent over time. On the other hand, the cumulative impact of a row of weekly changes in the same direction is more visible if returns are calculated over a longer period. The pattern of returns thus becomes smoother and more distinguishable for longer return periods (see also Figure 1 in the Appendix). Accordingly, quarterly or even six-month returns are often preferred when implementing a (G)RAI type of risk appetite indicator, since a smoother GRAI seems easier to interpret (see eg also Coudert and Gex (2006) and Deutsche Bundesbank (2005)). Unless otherwise noted, we therefore focus on the (G)RAI results obtained for a longer return period of 12 weeks.

¹⁴ Kumar and Persaud (2002), p 413, suggest using as many asset returns and as long a history as possible in order to reduce the risk of a chance correlation between risks and returns.

¹⁵ As Wilmot, Mielczarski et al (2004) argue, their approach rests on the availability of a set of assets that differ sufficiently in terms of their degrees of riskiness. But using the factorisation approach, derivative assets are constructed that cover a much broader range of degrees of riskiness (in terms of the difference between maximum and minimum riskiness) than the original range of assets.

A second decision has to be made regarding how to proxy for assets' riskiness. This holds true even when deciding to use lagged asset return variances (ie variances calculated at time $t - m$) as proxies, as in the empirical GRAI literature. Intuitively, a 12-week return period might suggest considering the lagged variances of 12-week asset/index returns as well. However, to calculate the variance of 12-week returns from non-overlapping observations, one would need at least 7–9 years of data (30–39 observations). While this is the statistically correct approach, once one allows for changing variances, one may question whether such a measure, in which current developments can have only minimal impact, is a good proxy for an asset's riskiness as perceived by real-life investors. Therefore, the GRAI literature typically considers a much shorter window of asset return observations for calculating volatilities/variances. Kumar and Persaud (2002), for example, use one year of daily data.

In the current situation, one might thus decide to use the variance of weekly returns calculated for a short window of 52 weeks, but appropriately scaled to match the return-period length, as an alternative. While a long-term risk concept seems more relevant for a long-term portfolio investor, over the shorter periods of the GRAI context the scaled proxy certainly holds a particular appeal, too.¹⁶ Because a return over 12 weeks might be approximated by the sum of the one-week returns over the respective 12 weeks, an alternative is to construct an approximate measure for the 12-week return variance via a temporal aggregation approach.¹⁷ For estimating an approximate 12-week return VCV matrix at time t , this approach takes into account the covariances between weekly returns at different lag lengths in addition to the most recent and lagged estimates of the VCV matrix of weekly returns. The simple scaling of variances, on the other hand, focuses only on the most recent information regarding short-term asset return riskiness. A priori it is not clear which approach might be preferable in the current context. Hence, we apply both the scaling and the temporal aggregation approach to the construction of asset return variances and covariances. For the construction of the GRAIs, the estimated variances and VCV matrices of asset returns are then appropriately lagged to avoid any overlap with the period over which the cross section of asset excess returns is calculated.

As argued above, however, even when assuming equal portfolio weights for the different assets, the riskiness of asset returns does not only depend on asset returns' own variances, but also on their covariances. While Misina (2006) suggests deriving factors from dependent asset returns and an eigen decomposition of the asset return VCV matrix, the true VCV matrix is unknown and may even change over time. Accordingly, the historical VCV matrix calculated at time $t - m$ is used as an appropriately lagged, but *ex post* necessarily imperfect estimate in the factorisation step. This implies, however, that the factor portfolio returns actually realised for time t are no longer guaranteed to be independent by construction. However, one can still expect that the problem of dependence between returns is smaller with than without the factorisation adjustment.

Based on the decomposition of the lagged asset return VCV matrix estimate $\Sigma_R = B \cdot D \cdot B'$ (with B as the matrix of "normalised-plus" eigenvectors in columns), the factors corresponding to the observed original asset returns at time t are thus calculated as

¹⁶ Furthermore, if changes in the implied or revealed risk appetite behaviour of investors at least partly reflect the changes in riskiness seen over a shorter period, longer-term measures of variances – while being less variable proxies – might not resolve the real identification issue of capturing the evolution of riskiness as perceived by the average investor either.

¹⁷ See in this context eg also Brandt (2008), p 16.

$$f_t = B^{-1} \cdot R_t, \text{ with } R_t = \begin{bmatrix} R_{1,t} \\ R_{2,t} \\ \vdots \\ R_{n,t} \end{bmatrix}, f_t = \begin{bmatrix} f_{1,t} \\ f_{2,t} \\ \vdots \\ f_{n,t} \end{bmatrix}.$$

As in Misina (2006), the correlation between the ranks of the factors and the ranks of their lagged variances (ie the respective diagonal elements of the matrix D) is then used for the factor-based GRAI indicator.

However, this step actually involves another decision, namely whether to calculate the risk appetite or aversion indicator assuming a linear or a monotonic relationship between the cross section of asset excess returns at some time t and appropriately lagged past measures of their riskiness. The former corresponds to a linear cross-sectional correlation or regression approach, the latter to the Spearman rank correlation approach of Kumar and Persaud (2002) (see also Misina (2006), p 5). In the following presentation of empirical results, GRAI stands for a rank correlation indicator and RAI for the linear RAI indicator, either as a linear correlation (RAI-C) or linear regression version (RAI-R). The usage of asset excess returns or factor returns, if not otherwise noted, is indicated by adding the prefix R- or F- to the indicator abbreviation. To emphasise the dual concept of changes in risk aversion rather than risk appetite, the respective cross-sectional regression or correlation coefficient estimates are multiplied by -1 so that positive values correspond to increases in risk aversion (see Coudert and Gex (2006)). Our (G)RAIs therefore represent global risk aversion indicators.

Figure 2 in the Appendix compares the variance proxies for the 12-week MSCI US and Indonesia index returns with those of the first factor(s) obtained for the corresponding setups.¹⁸ Since the factor variances are obtained as the ordered eigenvalues of a VCV decomposition, the variance of factor 1 must always be greater than that of factor 2. This difference in magnitudes (together with the different scales of factor returns) has important implications when applying the linear regression/correlation RAI indicators instead of the rank-correlation GRAI approach to a cross section of factors and their variances. For a linear F-RAI indicator, the values will often be almost identical to the negative of the first factor's ratio of excess returns to variance, as the first factor is dominating by construction and the linear model's results tend to be strongly affected by large outliers.¹⁹ This suggests that a combination of the factorisation extension together with the rank correlation approach of the GRAI might be more promising for obtaining an indicator for assessing investors' average risk aversion stance.

3.2 Equity-only (G)RAI results

Since both the original Kumar and Persaud indicator (2002) and the factor-extended one proposed by Misina (2006) are of the rank-correlation type, it seems natural to focus particularly on the GRAIs in the following discussion of indicator results.

One reasonable assumption is that times of higher stress in financial markets are more likely to be associated with decreasing than increasing risk appetite at the aggregate level. This suggests that for a plausibility check of the indicator results one might want to look

¹⁸ Note that the factors are not directly comparable as they come from different factorisations under the two setups.

¹⁹ Intuitively, the first factor represents the factor portfolio of underlying assets with the maximum variance. The larger the cross section of risky assets across which one can aggregate in the risk dimension, the larger this maximum factor variance is likely to be relative to the minimum factor variance.

particularly at their behaviour during such periods. Some periods of likely higher financial market stress are therefore highlighted in the indicator graphs in the Appendix. The exact dating of these periods is given in Table 2 of the Appendix. For the most part it closely follows González-Hermosillo (2008). Apart from small adjustments due to the weekly frequency of the current analysis, in only two cases did it seem advisable to deviate from the choices made by González-Hermosillo (2008). The first deviation concerns the beginning of the stress episode following 11 September 2001, where for the purposes of this study the highlighted period starts on 12 September 2001.²⁰ Furthermore, the end date for the US subprime mortgage crisis and ensuing liquidity squeeze episode was left open, since – as also noted by González-Hermosillo (2008) – the crisis was clearly still ongoing at the end of the sample period used for the following analysis (12 March 2008). Of course, the non-statistical method of dating these periods implies that there is a certain degree of discretion involved, particularly in terms of choosing the precrisis part of the highlighted periods.²¹ Furthermore, longer-term cyclical dynamics that overlay shorter-term dynamics in financial markets probably also contribute to the evolution of investors' general risk appetite.

In addition, some of the figures in the Appendix also include horizontal lines corresponding to the critical values for a two-sided significance test of the rank correlation at a 5% significance level (for the critical values see Zar (1972)).

Overall, the graphs of the GRAI indicators for 12-week factor returns in Figure 3 of the Appendix appear more in line with priors concerning changes in risk appetite/aversion around critical periods than the results based on the original 12-week index returns. Despite the 12-week return periods, the GRAI patterns still retain a certain volatility. However, in all of the highlighted periods the F-GRAs are either already in the positive domain or start to increase noticeably after the actual crisis event. At first sight, the crisis episode of the Ford and GM downgrades (no 8) appears to be different in this respect. The F-GRAs drop immediately after 16 March 2005, the crisis event date given in González-Hermosillo (2008), when Moody's announced their intention of reviewing GM's credit rating. However, the crisis episode actually was played out over a protracted period and in different phases.²² In fact, the problems of Ford and GM already started to become more and more obvious in late 2004.²³ The F-GRAs seem better than the R-GRAs at capturing this by moving from a significantly negative territory associated with still increasing risk appetite into a stance of eventually even increasing risk aversion. The initial increase is much more pronounced for the F-GRAI calculated from the lagged scaled VCV matrices of weekly returns than for the F-GRAI derived from temporally aggregated (co)variances of asset returns, however.²⁴

²⁰ González-Hermosillo (2008), on the other hand, chose a later date for her analysis, as some markets were closed for a few days.

²¹ Alternatively, one may choose a more statistical approach of directly dating such crises. Coudert and Gex (2006) used the CMAX indicator of Patel and Sarkar (1998) for dating stock market crises.

²² With the GM earnings warning of 16 March 2005 and the subsequent further ratings revisions the crisis in the automotive sector reached another level. However, already on 14 October 2004, the losses from automotive sales in the United States and the resulting worsening of earnings prospects had made headlines, with the S&P rating for GM subsequently being lowered to the lowest investment-grade level. The crisis in the US automotive sector thus developed over a longer time. It reached another level of intensity when on 8 October 2005, the automotive parts company Delphi Corp., a former GM daughter, filed for Chapter 11 bankruptcy protection.

²³ At the time the announcement for the review actually came, it might have not been such a shock for investors any more; their general risk appetite, although previously affected, might by that time have had a brief, temporary recovery.

²⁴ However, in both cases the F-GRAs still fall short of crossing the upper critical value bound. So even for the F-GRAI based on weekly return (co)variances, we cannot reject the null hypothesis of insignificance at the corresponding significance level (5% for a two-sided, 2.5% for a one-sided test)

One potential explanation of why the F-GRAs might be more affected than the R-GRAs by choosing to calculate the (co)variances as either a very short-term risk measure or a risk measure for a medium-term period could be that for the F-GRAs this not only influences the risk rankings of assets. Due to the factorisation of the corresponding VCV matrices, it also has implications for the composition of the factors as portfolios of the underlying original assets. While the first factor is constructed to have a higher riskiness – ie variance – than the other factors, it will be constructed in the first case to exhibit the highest short-term riskiness of all factors. In the second case, however, it will rank higher than the remaining factors in terms of medium-term risk. Thus, for the F-GRAs, the difference in the variance-covariance calculation translates into a different composition of the factors as derivative assets. This might produce a slightly less similar pattern for the F-GRAs than for the R-GRAs across the two methods of deriving riskiness proxies.²⁵

While there is some similarity in the graphs of the indicators, the choice of factor returns instead of the original asset returns seems to have a clear impact on the results. One interesting period in this respect is early 1998, before the outbreak of the Russian crisis. Unlike the R-GRAs, the F-GRAs suggest at least a short period of significantly increasing risk appetite for early 1998, ie in the wake of the 1997 Asian financial crisis.²⁶ Second, for the stock market downturn in 2002, the F-GRAs – in contrast to the R-GRAs – indicate significantly increasing risk aversion only at a later stage. This seems to fit in with the strongest stock market downturns occurring only in July and September of that year. Third, after the crisis of the Ford and GM downgrades, only the F-GRAs give a clearer suggestion of actually declining risk appetite after 16 March 2005.

When comparing their overall patterns, the R-GRAs appear at times more volatile and prone to very sharp corrections than the F-GRAs. Before the Turkish crisis of 2006, the R-GRAs still gave a strong indication that investors' risk appetite was increasing. However, after the outbreak of the crisis the R-GRAs again very significantly indicate a switch to increasing risk aversion. The F-GRAI changes take longer and are more muted, reaching a peak only towards the end of the highlighted period or even slightly later. Given the critical values, only for the F-GRAI based on temporally aggregated (co)variances is the implied increase in risk aversion weakly significant. But actually, regarding the timing of the increasing risk aversion as suggested by the F-GRAs, one might also want to note another cause for concern around that time. Beginning in summer 2006, problems in the US housing market were mentioned more frequently.

This brings the discussion to the evolution of the indicators during the most recent crisis, the US subprime mortgage and liquidity crisis of 2007 and 2008.²⁷ Given the level of stress observed in financial markets at that time, it seems strange that the equity-based R-GRAs remain in the negative domain all through the summer of 2007, thus giving no indication of an increasing risk aversion around that time. The F-GRAs, on the other hand, clearly suggest a decline of investor risk appetite after the outbreak of the crisis, and even point towards a significant increase in investors' general risk aversion stance around August/September 2007. This initial increase of the F-GRAI is even more pronounced and longer-lasting when based on temporally aggregated (co)variances. In the latter case it was also matched by a stronger – and at the end of November/beginning of December 2007

²⁵ For the period 5 January 2000 to 12 March 2008, the correlation between the 12-week GRAI indicators across the two methods of calculating the (co)variances is approx 0.71 between the F-GRAs and 0.93 between the R-GRAs.

²⁶ The R-GRAs, on the other hand, remain in the positive domain, and as they are significant in early 1998, this suggests increasing risk aversion at that time.

²⁷ A more detailed view of this period is given in the third panel of Figure 3, which covers only the year 2006 and later.

briefly significant – decline of risk aversion. However, early and mid-December 2007 brought a return to increasing risk aversion as far as the F-GRAs are concerned. The R-GRAs also suggest a change to increasing risk aversion, but in their case the change appears less pronounced. From February 2008 onwards, the R-GRAs tentatively suggest an increasing risk appetite again, while the F-GRAs lead us to conclude that investors' risk aversion was still increasing overall. Looking at the end of the estimation period (mid-March 2008), it is possible only for the R-GRAs and the F-GRAs derived from temporally aggregated (co)variances to reject the hypothesis of zero rank correlation. However, while the F-GRAs would suggest significantly increasing risk aversion at that time, the R-GRAs suggests the opposite. In light of the markets' worries about Bear Stearns during that period, this does not seem very likely. Considering the magnitude of the recent crisis, the results for the equity-only F-GRAs are more in line with intuition. The modified Misina extension for the GRAs thus seems empirically useful, as it delivers more plausible results for the sample of international stock market indices.

Robustness of GRAs results to the choice of alternative return period lengths

Figure 4 in the Appendix compares the GRAs for 12-week returns with results obtained for four-week and 24-week returns in order to explore the sensitivity of results to the return period length.²⁸ The results clearly show that the averaging effect of longer return periods has both benefits and downsides. When comparing results for 24-week with those for 12-week return periods, it seems that the downsides outweigh the benefits for 24-week returns. This is visible in the behaviour of the GRAs indicators not only during the latest crisis, but also to some extent after the 2006 crisis. While the 24-week return R-GRAs at least suggest a significant increase of risk aversion sometime in the second half of 2006, the relatively long delay makes it somewhat difficult to see the direct connection to the crisis of 2006. Relative to the results for 24-week returns, the graphs of the four-week return period GRAs indicators appear more plausible. However, they are also more prone to strong corrections from time to time. The averaging effect of longer return periods implies that one loses potentially relevant information on short-term temporary effects on the stance of investors' risk appetite changes. The GRAs indicators based on 12-week returns therefore reflect those changes only with a lag and/or in a much more muted fashion.

For the stress period starting in the summer of 2007, the results for a 12-week return period suggest a significant increase in investor risk aversion based on the F-GRAs, but not for the R-GRAs. For a four-week return period, the F-GRAs suggest that investor risk aversion has started to increase even slightly earlier (already during June 2007). However, the change after the crisis event appears less pronounced than for the 12-week return F-GRAs. The four-week return R-GRAs, on the other hand, show a strong increase in indicator values after 7 July 2007. This indicates a shift to increasing risk aversion between early August and early September.²⁹ But the significantly negative values of the four-week R-GRAs from early September until around mid to late October 2007 suggests that the earlier period of increasing risk aversion was followed by a temporary correction period in which investor risk appetite started to increase again early on as well. Overall, the priors concerning the crisis effects on the confidence of investors are easier to reconcile with the graphs of the F-GRAs than with the completely different scale of investor risk appetite recovery suggested by the four-week return R-GRAs. The tendency of sharp corrections for four-week return GRAs is

²⁸ A corresponding six-month period was used in eg Wilmot, Mielczarski et al (2004) and Deutsche Bundesbank (2005). However, a shorter period of one month instead of the preferred quarterly returns was also applied in Kumar and Persaud (2002), to demonstrate its effect on the indicator.

²⁹ With the four-week return R-GRAs even being above the critical value for a short period of time in between, which suggests a significant increase in risk aversion.

also very visible after the 2006 crisis. While suggesting a significant increase in risk aversion right after the outbreak of the crisis, the four-week R-GRAs turn significantly negative even before the end of the highlighted stress period. Then, they temporarily shift back to being significantly positive again in September 2006. Balancing the trade-off between the information loss of longer and more volatile corrections with shorter return periods, 12-week return periods therefore appear to be a good compromise. In the following analyses they will be the preferred choice.

Comparison of GRAs with (linear) RAI results (12-week return period length)

If the relationship between excess returns and proxies for past riskiness is approximately linear and not only monotonic, the rank correlation results should be similar to those of a linear correlation approach (see also Misina (2006)). On the other hand, for a merely monotonic relationship the rank transformation should reduce the influence of extremes on estimating an aggregate or average relationship.

The first factor clearly is an extreme case, as by construction it will always have the highest historical variance within the set of given factors. One might therefore expect that the distinction between the rank and simple linear correlation approach should matter particularly for the results obtained when using the factor extension. This is also demonstrated in Figure 5 of the Appendix. The more pronounced amplitudes of the RAI-C indicators relative to the GRAs suggest that the corresponding cross-sectional monotonic relationships exhibit some degree of non-linearity. This holds true even for the original asset returns. However, the difference in amplitudes – and thus the degree of the implied non-linearity – is much greater for the factor returns.

While the correlation-based indicators have the benefit of naturally bounded outcomes, the linear regression RAI-R indicators seem more popular in the literature. But as the factor extension exacerbates the non-linearity problem, it leads to the obvious question of the extent to which factor-based RAI-R results might be driven by the first factor. Figure 6 in the Appendix illustrates this problem. For the period of 2002–07, the graph of the RAI-R indicator using factor returns almost exactly overlaps the graph of the negative of the return/variance ratio for the first factor alone. Accordingly, the large t-values for the factor-based RAI-R indicators should be read as a further indication of the problem of applying a linear approach to a cross-section of such factors returns. However, Figure 6 also suggests that the indicator implied by the first factor alone might be another valuable risk appetite indicator – but with a different target group in mind. While the GRAI concentrates on the general or average risk appetite of investors overall, the risk appetite indicator implied by the first factor alone is concerned with the risk compensation for the derivative asset with highest risk. Thus, it may be regarded as informative concerning the risk appetite/aversion changes of a hypothetical marginal investor investing only in portfolios of the highest risk.

3.3 GRAs – extending the coverage to bond market segments

This section extends the coverage of financial market segments to bond markets, which are represented by a sample of Merrill Lynch bond and ABS indices (for details see Table 3 in the Appendix). Using a 12-week return period, Figure 7 compares the results for the GRAs obtained for three data sets. For easier comparison, the results for the previous set of international stock indices are included as a first case (equity), in addition to the results for a second data set composed of corporate and ABS bond indices plus a US government bond index (bonds/USG). Finally, the two sets are merged into a third set of international stock and

bond indices (equity/bonds/USG). While Figure 7 covers the period from 2000 onwards, Figure 8 is a snapshot of the period starting in 2006.³⁰

The graphs support the notion that investor risk appetite changes are sometimes different for the various market segments. However, the GRAIs for the merged set exhibit a greater degree of co-movement with the GRAIs derived from the stock indices alone than with the respective bond-only indicators.³¹ The highest degree of correspondence between the respective GRAIs for the merged and the bond set is obtained when using the factor extension combined with scaled one-week return VCV matrices.³² But as before, the choice of how to calculate the respective (co)variances has a greater overall impact on the F-GRAIs than on the R-GRAIs. This holds true for both the bonds-only and the merged data set.³³

Focusing on the respective GRAI results before and during the latest financial stress period in Figure 8, one observes a strong increase of the bond-only R-GRAIs already in May 2007. Given the lack of a significant increase in the equity-set R-GRAIs around that time, this can be interpreted as risk aversion having increased in the bond market segment first. As this is the financial market segment immediately affected by the subprime mortgage crisis, this is plausible. However for equity and bond markets combined, the merged-set R-GRAI still suggests a significantly increasing risk appetite right up to 7 July 2007. After a short period of significantly increasing risk aversion around mid- to end of August 2007, it again implies a significantly increasing risk appetite at the merged-set level between October to mid-December 2007. However, considering the overall situation, the earlier increase and the later less significant reduction of the merged-set F-GRAI appear altogether more in line with common intuition. The differences are less pronounced when one takes into account that the significant risk aversion changes implied by the merged-set R-GRAIs were to some degree balanced by significant changes of opposite sign after the outbreak of the latest crisis period. Nevertheless, overall, the merged-set F-GRAIs are conservative in the sense that they less often suggest significant changes in investors' risk appetite in the first place.

The choice of indices always involves some discretion. Due to its size and generally high degree of liquidity, the US government bond market plays a special role for international financial markets.³⁴ The reference bond data set therefore includes only an index for the US Treasuries, but no government bond index for another major developed country. Hence Figure 9 in the Appendix compares the results obtained in the 2006–08 period for merged sets that differ slightly in terms of the government bond indices from developed countries

³⁰ Apart from the highlighted periods of financial market stress, the figures also include the critical values for a two-sided significance test of the rank correlation at a 5% significance level for a cross section of $n = 46$ (ie for the merged set of 24 international stock indices and 22 bond indices including the USG index). For the critical values see again Zar (1972).

³¹ For scaled VCVs and 12-week return periods eg the correlation between equity-only and merged-set F-GRAIs (R-GRAIs) in the period of 5 January 2000 to 12 March 2008, is roughly 0.72 (0.78) versus 0.55 (0.42) between bond-only and merged-set F-GRAIs (R-GRAIs).

³² For 12-week return periods, the correlation between the equity/bond/USG and bond/USG-only F-GRAIs (R-GRAIs) in the period of 5 January 2000 to 12 March 2008 is approx. 0.55 (0.42) under the scaling approach versus 0.28 (0.47) under the temporal aggregation approach to calculating VCVs.

³³ The correlation between 12-week return period F-GRAIs (R-GRAIs) obtained with the two methods of calculating VCV matrices for the period of 5 January 2000 to 12 March 2008, is roughly 0.46 (0.98) for the bonds/USG set and 0.67 (almost 1) for the merged set.

³⁴ US Treasuries are also often referred to as a kind of "safe haven" asset for international investors in stressful times.

they include.³⁵ These small modifications, however, have only a negligible impact on the respective GRAI results.

3.4 A caveat – the GRAIs and the role of risk ranking stability

Apart from the plausibility of results, an important criterion for judging indicators is the validity of core assumptions on which they are based. When constructing the GRAI for time t , it is conditional on the ranking of assets in terms of their return riskiness at the beginning of the m -week return period, ie at time $t - m$. Thus, one implicitly makes the simplifying assumption that this initial risk ranking of assets remains relevant to investors throughout the return period.³⁶ However, investors may change their assessment of assets' riskiness during the weeks of the return period, and the risk rankings of assets so most likely change as well. While the assumption is therefore likely to be violated to some extent, large violations obviously pose a problem. This holds true even if one is interested only in a broader risk appetite/aversion interpretation of the GRAI.³⁷

One might expect this problem to grow with the length of the return period. Furthermore, the factor extension of the GRAI adds another dimension of complexity. This is particularly relevant for larger cross sections. Finally, whether the scaling or the temporal aggregation approach to calculating (co)variances is used can also matter. An analysis of the potential susceptibility of the different GRAI variants to great intraperiod changes in risk rankings is thus warranted. It also seems useful as a further criterion by which to judge their relative merits.

For the equity-only and combined-set F-/R-GRAIs, Figures 11–13 in the Appendix depict the maximum and minimum changes of (factor) asset variance ranks over the respective return period at each point in time, as well as the respective max-min spread. As expected, a longer return period is accompanied by larger max-min spreads of risk ranking changes. Furthermore, as illustrated by Figure 14, the method of obtaining VCV matrices via scaling overall produces smaller max-min spreads of (derivative) asset risk rank changes than the temporal aggregation approach. This holds true particularly for the F-GRAI, but generally also for the R-GRAI. Accordingly, for the equity-only data set, the F-GRAI has an advantage over the R-GRAI in terms of the risk ranking stability criterion, particularly when using scaled covariances and 12- and 24-week return periods. For the merged data set, the evidence of a risk ranking stability advantage of the F-GRAI over the R-GRAI is more mixed, as results depend on the combination of return period length and approach to calculating (co)variances. However, with respect to overall risk ranking stability, the combination of F-GRAI with scaled VCV matrices and longer return periods remains the preferred choice also for the merged equity-bond data set.³⁸

³⁵ Considering the combinations of USD valued government bond indices for the United States, United Kingdom and Canada, plus, in a second step, also Germany, Australia and Japan; however, the case of including no government bond index is also considered.

³⁶ Misina (2006) argued that any additional conclusion or interpretation of whether the GRAI might reflect changes in investors' more narrowly defined fundamental degree of risk aversion was conditional on the likelihood of common shocks having occurred. As a proxy for the latter, he used the number of factors whose volatilities had changed in the same direction over the return period. The question of risk ranking stability considered here is of course related but still different, as it is concerned only with the question of the extent to which such changes of factor variances were so great as to have produced changes in (implied) risk rankings.

³⁷ The greater the extent to which the assumption seems violated, the more problematic it becomes to interpret the signals of significant GRAI values as indicating at least changes of a broadly defined risk-aversion stance of investors.

³⁸ Figure 15 in the Appendix also investigates whether a significant value of the GRAI coincides with a significant rank correlation between the asset/factor return variance changes over the return period and the past

3.5 A correlation-based comparison with alternative indicators

The number of risk appetite indicators presented in the literature is ample evidence of the lack of consensus on how best to assess the evolution of investors' risk appetite or the changes in the risk appetite. Nonetheless, assuming that the different indicators are all imperfect proxies for investors' risk appetite/aversion changes, a principal component analysis (PCA) could be used to recover a potential common component as the common information contained in the individual indicators. However, when performing a PCA for nine market- and five theory-based risk appetite indicators, the ECB (2007b) found that the first two principal components together were able to explain only about 56% of the overall variance of the indicators. They therefore concluded that "differences in methodologies and underlying data" represented too big a problem when trying to recover "a common component between several commonly followed [market-based and theory-based] indicators", which could "explain large proportions of their variance". Accordingly, they derived their common component risk appetite indicator for the set of chosen market-based indicators alone.

It is thus important to understand better the extent to which these apparent differences between theory-based and market-based indicators depend on decisions made when constructing the indicators. Accordingly, not only GRAIs but also corresponding RAI variants are included in the following comparison with four alternative market-based risk sentiment indicators. We follow the ECB (2007b) and exploit the dimension-reducing properties of a PCA on the set of alternatives, however. Table 4 in the Appendix presents the correlation coefficients for each of the equity-only and merged-set (G)RAI variants and the first principal component of the four alternative market-based indicators, with values of 0.45 or greater highlighted.³⁹ The results for the longer period of 8 November 2000 to 12 March 2008 can be summarised as follows:

- Comparing the correlation coefficients across the two methods of calculating the variance-covariance matrices, the differences are generally relatively small. The exception is the merged-set F-GRAI with 12-week return periods.
- Shortening return periods is usually accompanied by an increase in the correlation coefficients, all other things being equal. Market-based alternative indicators are likely to be relatively volatile given the continuous adjustments to changing market conditions. Hence, longer return periods might make it more difficult to capture this via the (G)RAI indicators, due to the implied smoothing effect. However, for the merged-set F-GRAI and the equity-only R-RAI-C, the choice of a 12-week return period resulted in higher correlation coefficients than either 24- or four-week return periods.

(ie beginning-of-period) variances. If there is a significant rank correlation between past variances and in-period variance changes with the same sign as the significant GRAI, one cannot exclude the possibility that the GRAI results might only reflect an adjustment of relative demand for riskier assets in response to the changes in the risk dimension, but not necessarily changes in the risk appetite/aversion stance of investors in a narrower sense. On the other hand, if the two are significant but opposite, this could tentatively be interpreted as a signal for increasing investor appetite for risk. The results in Figure 15 suggest that at times such interpretative problems could even be observed for the F-GRAs. However, this is not the case at the beginning of the latest stress period, particularly when looking at equity markets, but also initially for the equity-bond data set. This further supports the notion that investor risk aversion itself increased during the initial stage.

³⁹ The first principal component (explaining about 71% of the overall variance) was calculated for weekly (Wednesday) observations (from 1 April 1998 to 12 March 2008) of the following four indicators: the Citi Macro Risk Index (Bloomberg Ticker: MRI CITI Index), the risk aversion indicator implied by the Morgan Stanley Global Risk Demand Index (Ticker: STGRDI Index), the Westpac Risk Aversion Index (Ticker: WRAIRISK Index), and the UBS G10 Carry Risk Index Plus (ULTAFXRI Index). Where necessary, values were multiplied by -1 to correspond to a risk-aversion interpretation. Data for the original alternative indices were downloaded from Bloomberg.

- For the most part, the factor-extended (G)RAIs exhibit a higher correlation with the first principal component of the alternative indicators than the corresponding (G)RAIs without the factor extension. For the merged equity-bond data set, however, such a correlation advantage is obtained only for the 24-week return F-GRAI. The difference between the correlation coefficients obtained for the merged-set 12-week return F-GRAI based on scaled VCV matrices and for the corresponding merged-set R-GRAI is negligible, however.

The second panel of Table 4 explores the stability of results by focusing on the last five years of the sample period. The correlation coefficients obtained for the preferred combination of scaled VCV matrices and 12-week returns over this shorter recent period tend to be smaller. An exception is the corresponding merged-set F-GRAI. There we find an correlation advantage over the respective merged-set R-GRAI calculated with scaled (co)variances and 12-week returns.

Overall, the correlation analysis therefore supports the conclusion that the gap between market-based and theory-based indicators can be considerably reduced when accounting for such specification effects in the construction of indicators. For the last few years in particular, the F-GRAs obtained with the preferred setup of scaled VCV matrices and 12-week return periods are not only more appealing from a theoretical point of view. They also exhibit a higher degree of co-movement with the common component of the market-based risk aversion indicators than the corresponding R-GRAs.

However, the greatest correlation coefficient across all GRAI variants is observed for the four-week return merged-set R-GRAI without the factor extension. This implies that a correlation analysis is illustrative but should not be a major criterion on which to base preferences concerning the specification of an indicator. The correlation between two series only measures their degree of co-movement. However, apart from the problem that aggregating across several alternative indicators still does not necessarily produce an ideal yardstick of investor risk appetite changes, other considerations are more important criteria, like the plausibility of results and underlying assumptions. As Figure 16 shows, during the latest crisis period the 12-week return equity-only and merged-set F-GRAs delivered more plausible results and so seem preferable to the four-week return merged-set R-GRAI. The F-GRAs are also more in line with the common component of the alternative market-based risk aversion indicators.

4. Summary and conclusions

Changes in investors' risk appetite are increasingly being recognised as important factors in assessing financial markets stability. While this creates an obvious need for quantification, currently available risk appetite indicators are not satisfactory. Thus it is essential to gain a better understanding of how existing indicators actually work.

Focusing on the (G)RAI class of indicators, this study analyses how indicator results obtained for samples of stock indices, or stock and bond indices combined, are shaped by the various choices made when constructing such an indicator. Initial decisions include the choice of the length of return periods and how to proxy for the asset riskiness at the beginning of the return period. For the latter, we consider two options: using short-term asset risk measures based on scaling weekly return (co)variances, or longer-term risk measures derived via a temporal aggregation of weekly return (co)variances over a few weeks. One also has to decide whether to assume a monotonic or a linear relationship between asset excess returns and appropriately lagged risk measures when deriving the risk aversion indicator. Furthermore, one has to choose whether to derive it as a correlation- or regression-based indicator. The Kumar and Persaud (2002) GRAI indicator on which we focus is a rank-correlation indicator and thus based on the more general case of a monotonic relationship. Finally, another decision when constructing a GRAI concerns whether to account for a dependence between asset returns by applying a factor extension as proposed by

Misina (2006). Aside from analysing how all these decisions influence the final indicator produced, the main goal of this study is to find a combination of decisions that overall delivers the best empirical performance of the resulting risk aversion indicator in terms of certain plausibility and consistency criteria.

For comparability, Misina (2006) applied his indicator to an FX data set similar to that used by Kumar and Persaud (2002). One contribution of the current paper therefore consists of applying the factor-extended GRAI approach not only to individual financial market segments, but also to a large pooled data set covering equity and bond markets together. Furthermore, a spuriously different behaviour of GRAIs from their factor-extended versions can arise as a consequence of the normalisation of eigenvectors alone, unlike argued by Misina (2006), being insufficient for defining unique vectors. We therefore introduce a normalisation-plus restriction for the factorisation step to ensure the uniqueness of eigenvectors. This leads to our modified factor-extended rank-correlation F-GRAI as another major contribution of the present paper. Finally, we systematically investigate to what extent the factor extension in combination with the other construction choices leads to an improvement of the GRAIs' empirical performance. Our most important guideline in this respect is the overall plausibility of the indicators with respect to the implied aggregate risk appetite changes during crisis times, in particular the recent period of financial market turmoil. However, another contribution of this paper is the development of additional consistency criteria for evaluating eg the relative attractiveness of F-GRAIs versus R-GRAIs. These criteria are based on violations of an important implicit assumption used in the construction of the GRAIs, namely intra-return period asset risk ranking stability.

Summing up the main empirical results, based on asset risk ranking stability considerations, we prefer the use of scaled VCV matrices when constructing the weekly GRAI indicators for the equity-only and the merged equity and bond data set. Furthermore, a return period length of 12 weeks appears to be a good compromise between the smoothness supplied by longer return periods and the loss of potentially important short-term information. Finally, for deriving an indicator for changes in average investor risk aversion, the GRAI rank-correlation approach seems preferable overall to the linear correlation or regression RAI variants. This holds particularly when the factor extension is applied. Focusing more narrowly on the GRAIs obtained for the preferred combination of 12-week returns and scaled (co)variances, we find in the equity-only case that the plausibility of results during the latest crisis benefits strongly from applying the rank correlation of Kumar and Persaud (2002) combined with our modified version of the Misina (2006) factor-transformation extension. For the larger cross section of the merged set of bond and stock indices, on the other hand, the GRAI without factor extension also indicates a significant increase in investor risk aversion, at least for some time in August 2007. However, although the larger cross section is likely to pose a challenge due to the additional complexity of the factorisation step, the merged-set factor-extended GRAI still fares quite well in terms of overall plausibility. Finally, over the period of March 2003 to March 2008, both the equity-only and the merged-set factor-extended GRAIs are also more closely correlated with the first principal component (PC) obtained for four market-based risk aversion indicators than the corresponding GRAIs without factor extension. This demonstrates the importance of taking into account indicator construction decisions as one way of potentially reducing the gap between market-based and theory-based indicators noted in ECB (2007b).

At the end of this paper, we have thus obtained two new feasible factor-extended GRAIs – one for stock markets alone, and one for stock and bond markets combined – which seem very promising for financial stability supervision purposes and future empirical applications. However, that is only one of this paper's major achievements. Most importantly, we have gained a much better understanding of the chosen risk appetite indicator concept, and we have seen how strongly the quality of indicator results depends on technical implementation decisions. It is therefore absolutely essential to take this into account when using such indicators in practice.

Appendix

Table 1
MSCI stock indices
 USD

Name	Ticker	Abbreviation
MSCI USA	MXUS Index	US
MSCI Canada USD	MSDUCA Index	CA
MSCI Japan USD	MSDUJN Index	JN
MSCI UK USD	MSDUUK Index	UK
MSCI Germany USD	MSDUGR Index	GR
MSCI France USD	MSDUFR Index	FR
MSCI Ireland USD	MSDUIE Index	IE
MSCI Austria USD	MSDUAT Index	AT
MSCI Belgium USD	MSDUBE Index	BE
MSCI Netherlands USD	MSDUNE Index	NE
MSCI Italy USD	MSDUIT Index	IT
MSCI Spain USD	MSDUSP Index	SP
MSCI Finland USD	MSDUFI Index	FI
MSCI Norway USD	MSDUNO Index	NO
MSCI Sweden USD	MSDUSW Index	SW
MSCI Australia USD	MSDUAS Index	AS
MSCI New Zealand USD	MSDUNZ Index	NZ
MSCI Hong Kong USD	MSDUHK Index	HK
MSCI Emerging Markets Indonesia	MSEUSINF Index	INF
MSCI Malaysia USD	MSDUMAF Index	MAF
MSCI Emerging Markets Turkey	MSEUSTK Index	TK
MSCI Argentina	MXAR Index	AR
MSCI Brazil	MXBR Index	BR
MSCI Emerging Markets South Africa	MSEUSSA Index	SA

Sources: MSCI (Morgan Stanley Capital Intl.), Bloomberg.

Table 2

List of special events' periods highlighted in figures

Financial distress periods 1998–2008: datings

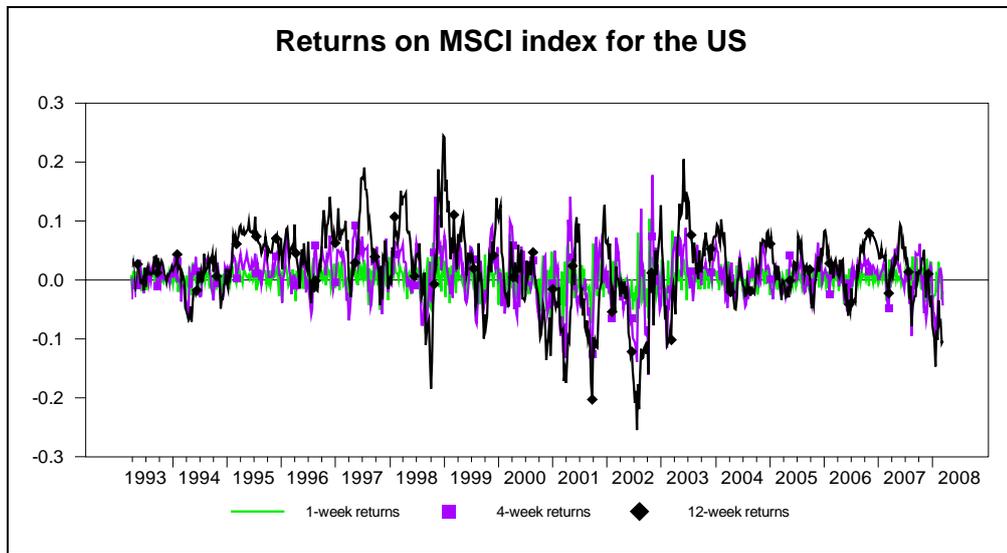
No	Crisis episode	(Pre-)crisis period: start	Crisis start	Crisis end	Highlighted in figures (weekly entries)		
					Highlighting – start	Marked by vertical line	Highlighting – end
1	Russian Default and LTCM Crisis	01.06.1998	17.08.1998	14.10.1998	03.06.1998	19.08.1998	14.10.1998
2	Brazil's Crisis	06.01.1999	13.01.1999	29.01.1999	06.01.1999	13.01.1999	03.02.1999
3	NASDAQ Bubble Burst	10.03.2000	03.04.2000	10.05.2000	15.03.2000	05.04.2000	10.05.2000
4	Turkey's Crisis	05.02.2001	19.02.2001	05.03.2001	07.02.2001	21.02.2001	07.03.2001
5	September 11th, 2001	11.09.2001	11.09.2001	06.11.2001	12.09.2001	12.09.2001	07.11.2001
6	WorldCom Scandal and Brazil's Elections	23.04.2002	19.06.2002	29.10.2002	24.04.2002	19.06.2002	30.10.2002
7	Run-up to US Federal Reserve Monetary Policy Tightening Cycle	02.04.2004	02.04.2004	30.06.2004	07.04.2004	07.04.2004	30.06.2004
8	Ford and General Motors Downgrades	14.02.2005	16.03.2005	19.05.2005	16.02.2005	16.03.2005	25.05.2005
9	Turkey's Crisis (and Previous Iceland Crisis)	31.03.2006	11.05.2006	24.07.2006	05.04.2006	17.05.2006	26.07.2006
10	China's Stock Market Correction	27.02.2007	27.02.2007	19.03.2007	28.02.2007	28.02.2007	21.03.2007
11	US Subprime Mortgage Crisis and Subsequent Liquidity Squeeze	15.06.2007	09.07.2007		20.06.2007	11.07.2007	12.03.2008

Notes: Except for the table entries highlighted/in boldface, the dating of the (pre-) crisis periods follows González-Hermosillo (2008). Given the weekly frequency applied in the analysis, the last three columns indicate the corresponding (following) Wednesday dates for the highlighted/marked entries in the later figures.

Sources: González-Hermosillo (2008); own adjustments.

Figure 1

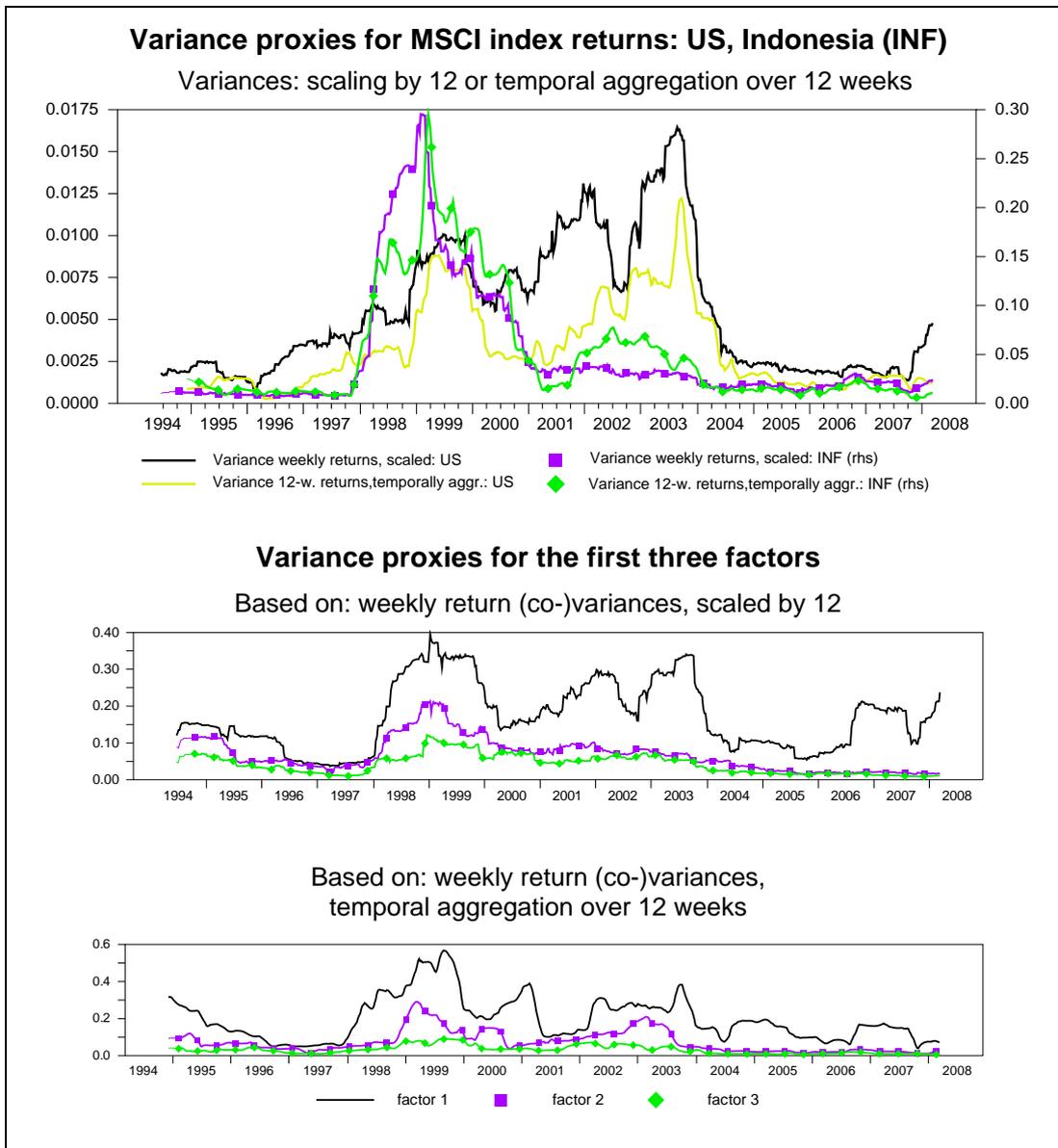
**Returns on MSCI index for the US:
returns over 1, 4, and 12 weeks**



Sources: MSCI, Bloomberg. Own calculations.

Figure 2

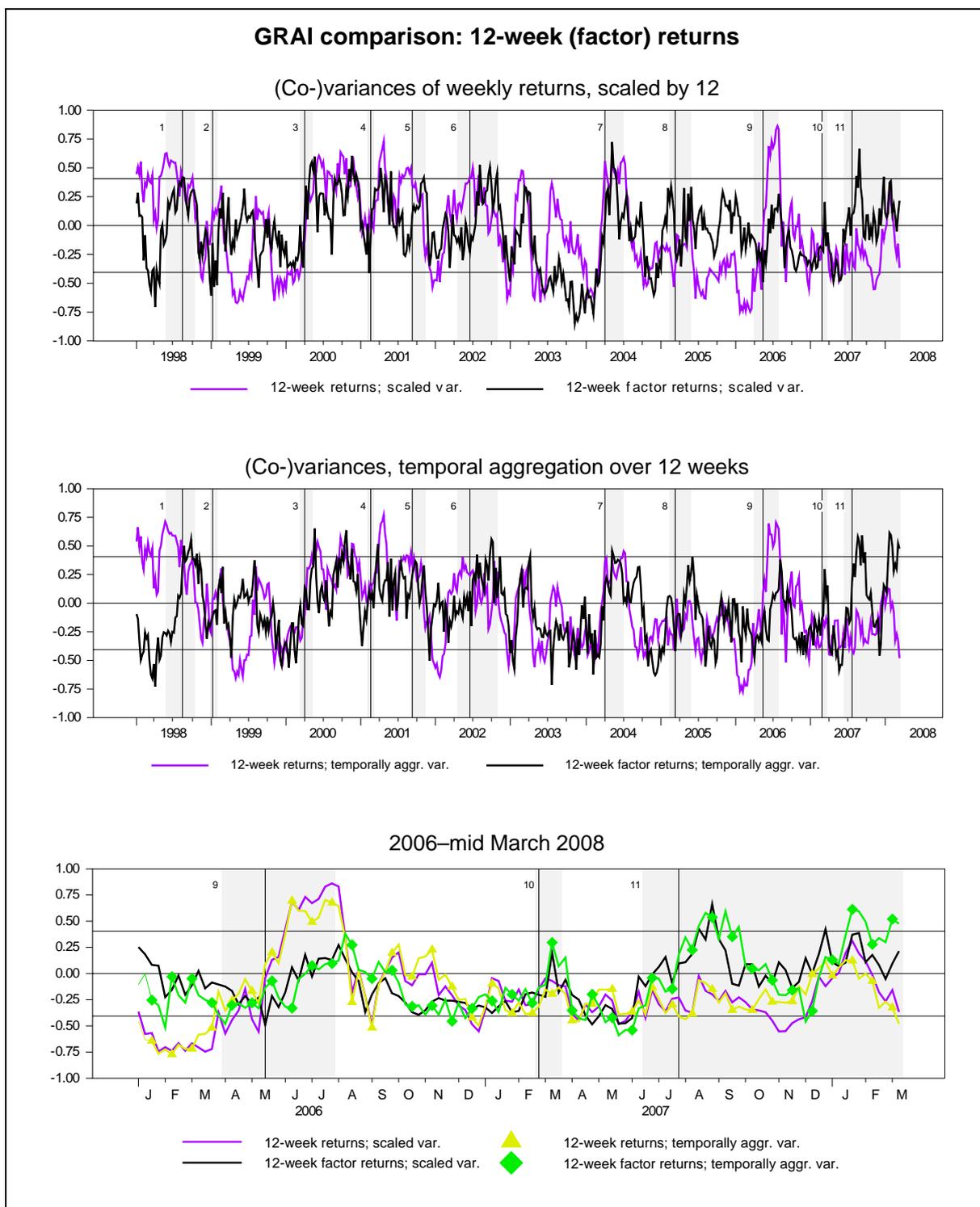
**Variance proxies: MSCI index returns
(United States, Indonesia), first three factors**



Sources: MSCI, Bloomberg. Own calculations.

Figure 3

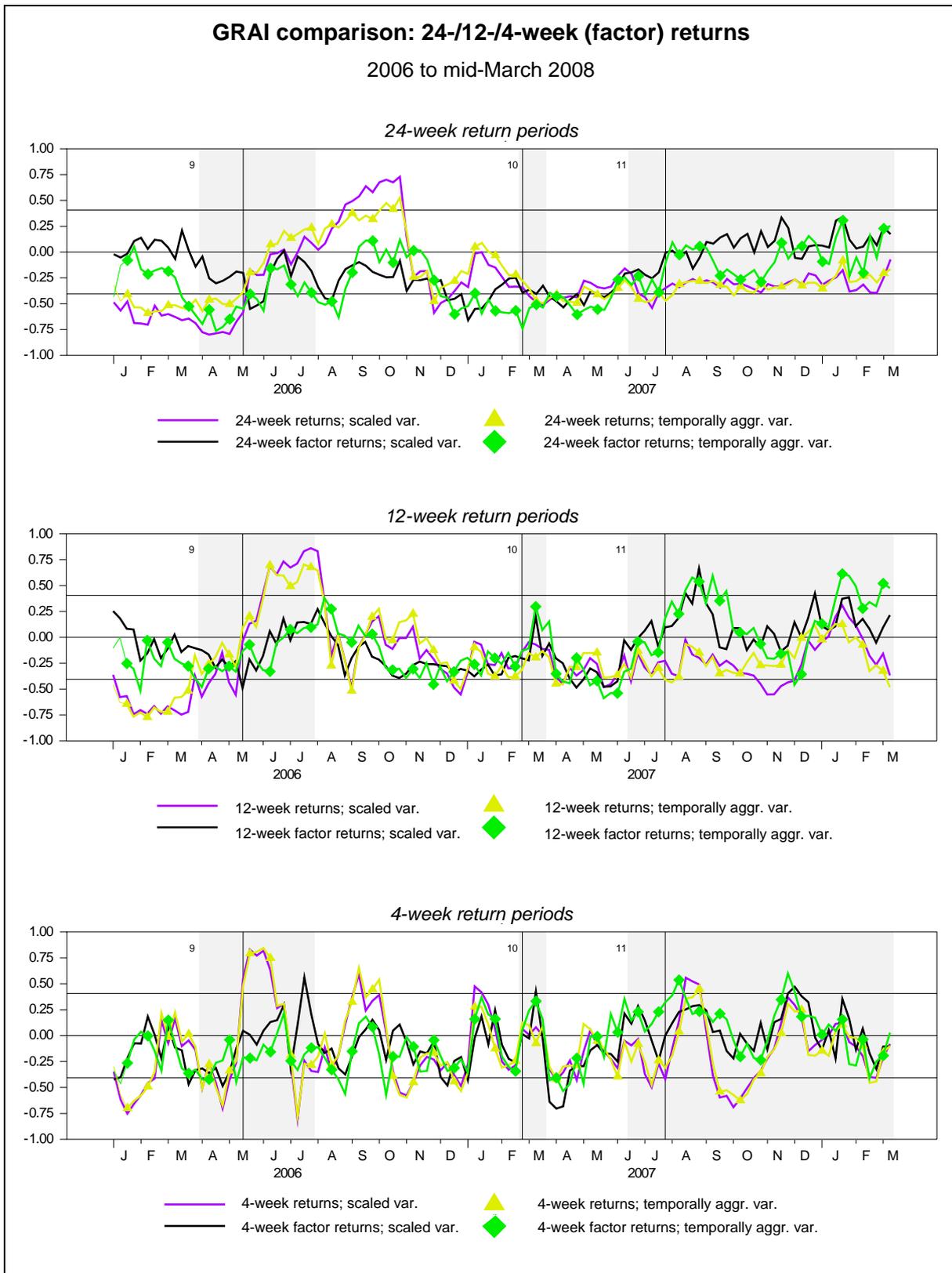
GRAIs (12-week return periods): equity-only



Sources: MSCI, Federal Reserve, Bloomberg. Own calculations.

Figure 4

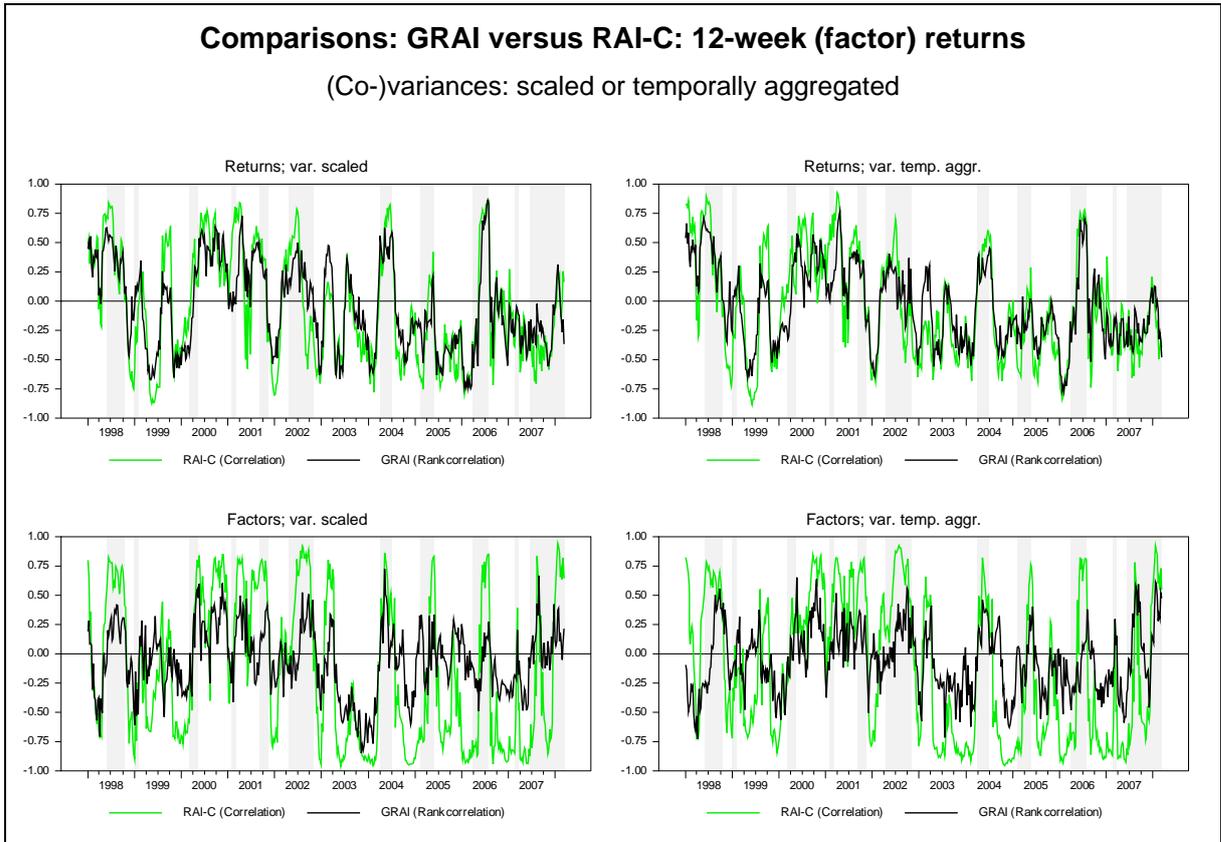
GRAIs (24-/12-/four-week return periods): equity-only – since 2006



Sources: MSCI, Federal Reserve, Bloomberg. Own calculations.

Figure 5

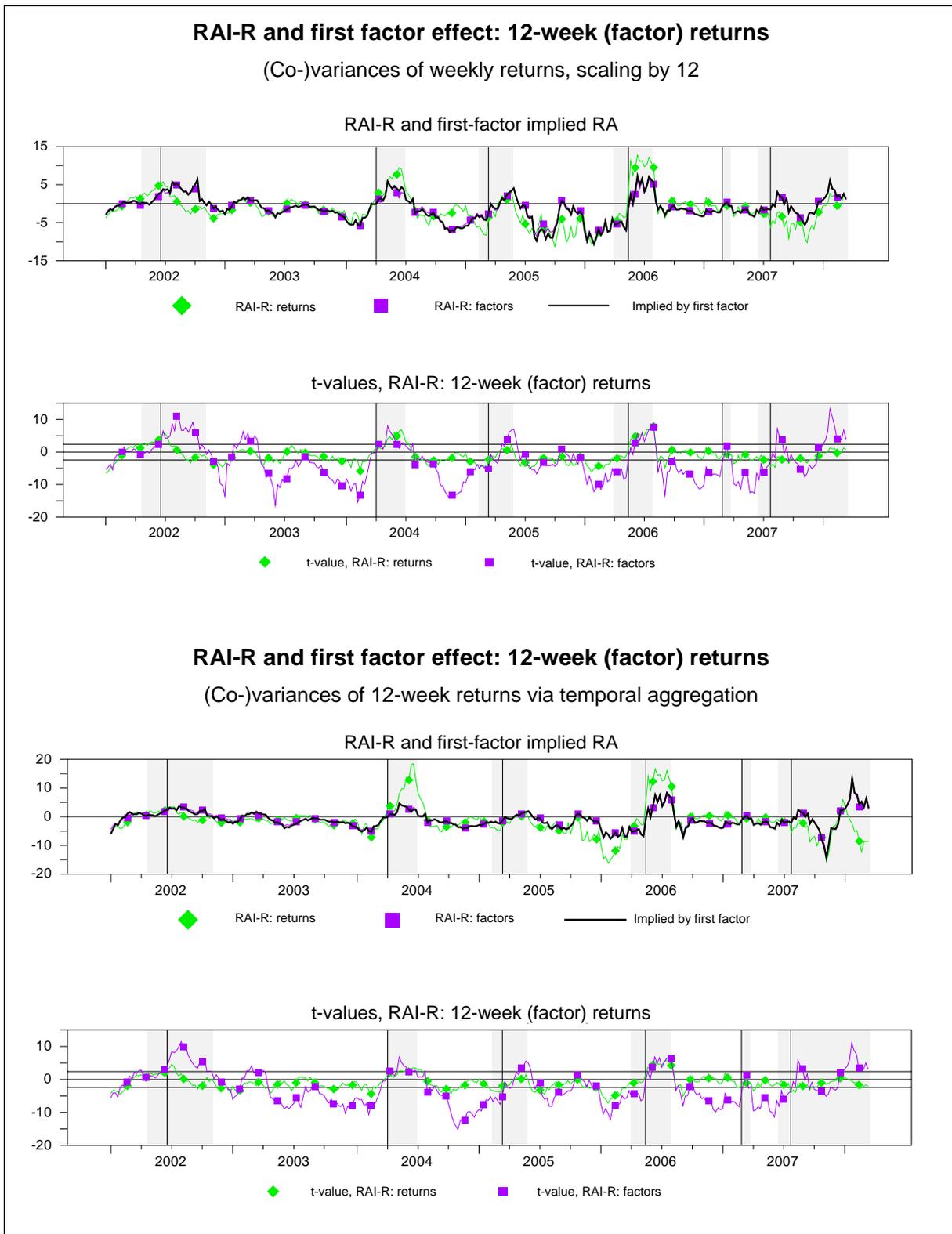
GRAI versus RAI-C (12-week return periods): equity-only



Sources: MSCI, Federal Reserve, Bloomberg. Own calculations.

Figure 6

RAI-R vs RA implied by first factor (12-week return periods): equity-only



Sources: MSCI, Federal Reserve, Bloomberg. Own calculations.

Table 3

List of Merrill Lynch indices

TRR (total return) indices, val. in USD

Name	Ticker	Abbreviation
US Treasuries, 7–10 years	G4O2	USG
Corporate bonds, US industrials, AA–AAA rated	C6E0	USINDA
Corporate bonds, US industrials, BBB–A rated	C6F0	USINDB
Corporate bonds, US utilities, AA–AAA rated	C6H0	USUTILA
Corporate bonds, US utilities, BBB–A rated	C6I0	USUTILB
Corporate bonds, US financials, AA–AAA rated	C6K0	USFINA
Corporate bonds, US financials, BBB–A rated	C6L0	USFINB
Corporate bonds, US banks, AA–AAA rated	C6X0	USBKA
Corporate bonds, US banks, BBB–A rated	C6Y0	USBKB
ABS, HEL (home equity loans), AAA rated	R0H1	ABSHEA
ABS, HEL (home equity loans), BBB–AA rated	R0H2	ABSHEB
ABS, manufactured housing, AAA rated	R0M1	ABSMHA
ABS, manufactured housing, BBB–AA rated	R0M2	ABSMHB
ABS, automobiles, AAA rated	R0U1	ABSAUA
ABS, automobiles, BBB–AA rated	R0U2	ABSAUB
ABS, credit cards, AAA rated	R0C1	ABSCCA
ABS, credit cards, BBB–AA rated	R0C2	ABSCCB
USD BB-rated EM sovereigns	I1GV	EMSOVBB
USD B-rated EM sovereigns	I2GV	EMSOVB
USD CCC and lower-rated EM sovereigns	I3GV	EMSOVCCC
US high yield, BB–B rated	H0A4	HYBB_B
US high yield, CCC-rated and lower	H0A3	HYCCC

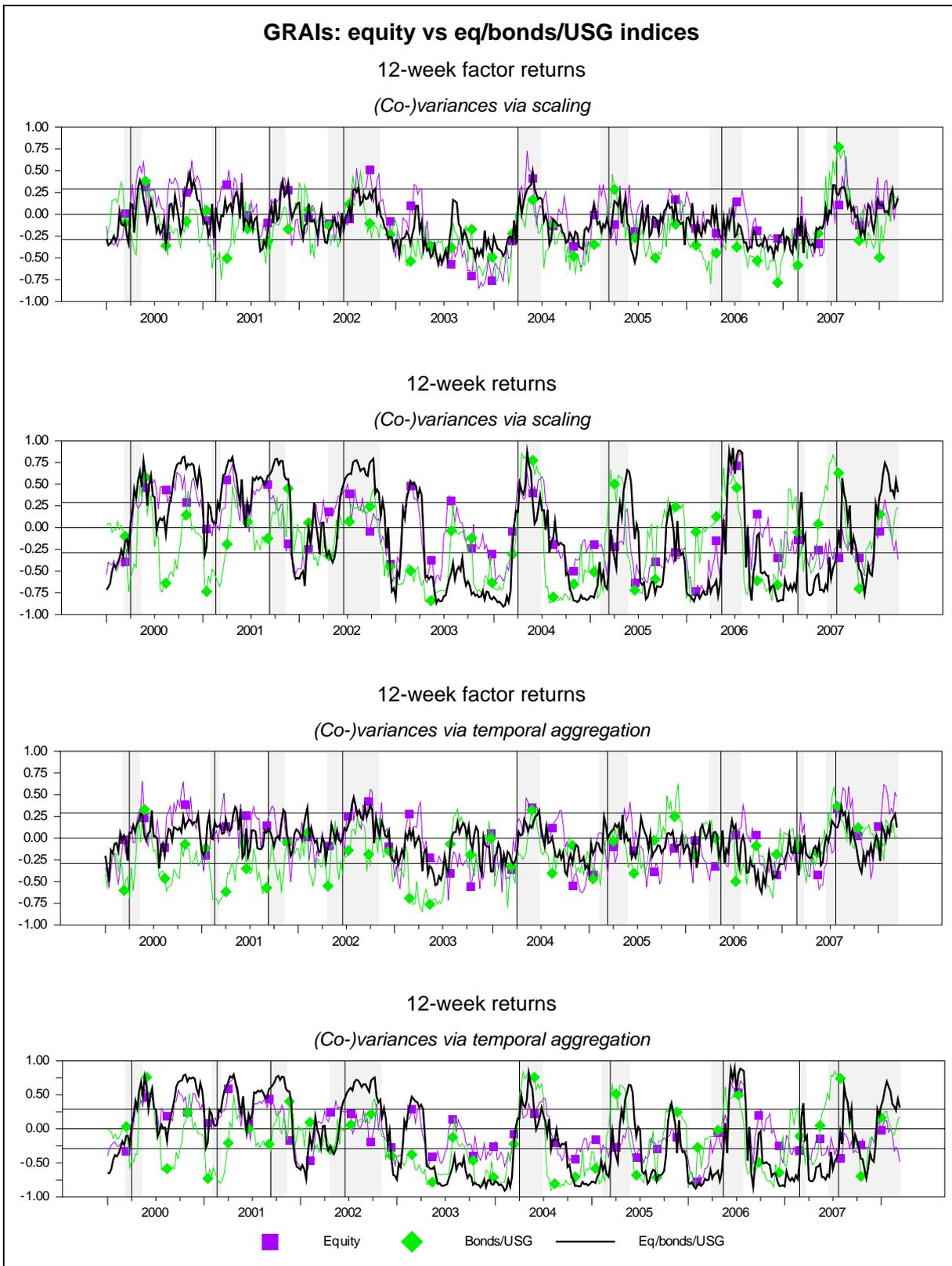
Extended lists: also

Canadian governments, 7–10 years	G4C0	CAG
Japanese governments, 7–10 years	G4Y0	JPNG
UK gilts, 7–10 years	G4L0	UKG
German Federal governments, 7–10 years	G4D0	BDG
Australian government, 7–10 years	G4T0	ASG

Sources: Merrill Lynch, Bloomberg.

Figure 7

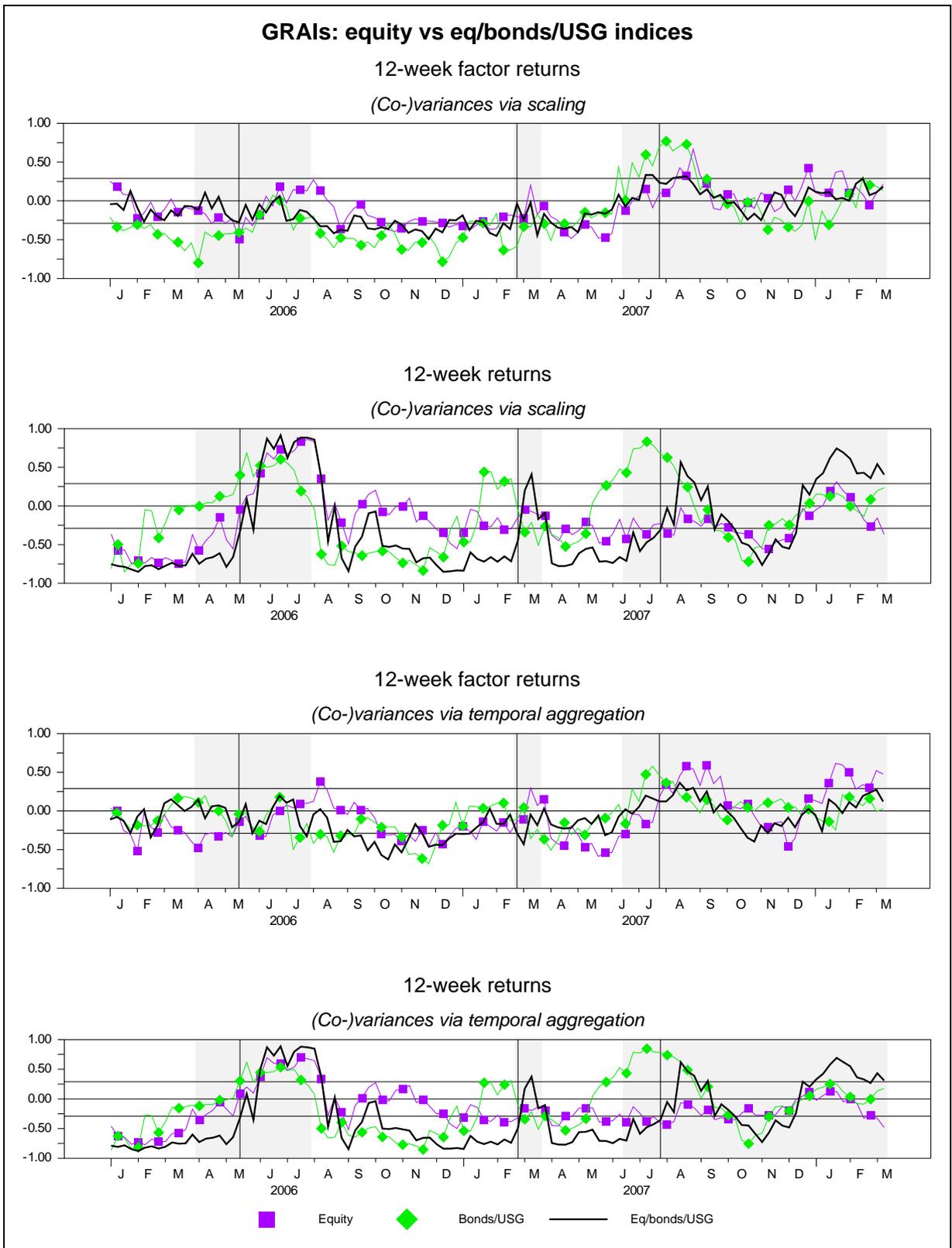
GRAIs (12-week return periods): equity vs bond/US government bond indices



Sources: MSCI, Merrill Lynch, Federal Reserve, Bloomberg. Own calculations.

Figure 8

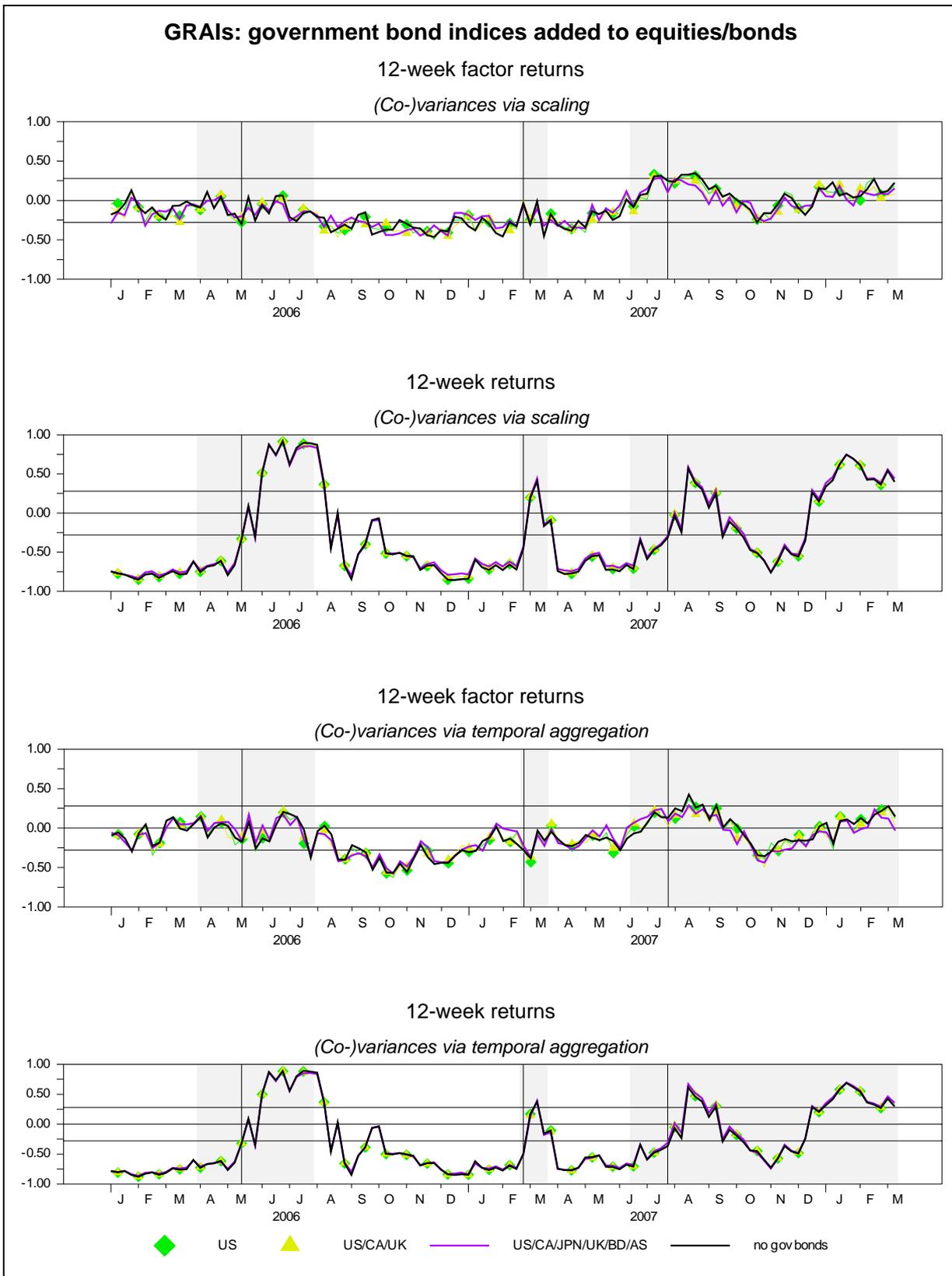
GRAIs (12-week return periods): equity vs bond/US government bond indices – since 2006



Sources: MSCI, Merrill Lynch, Federal Reserve, Bloomberg. Own calculations.

Figure 9

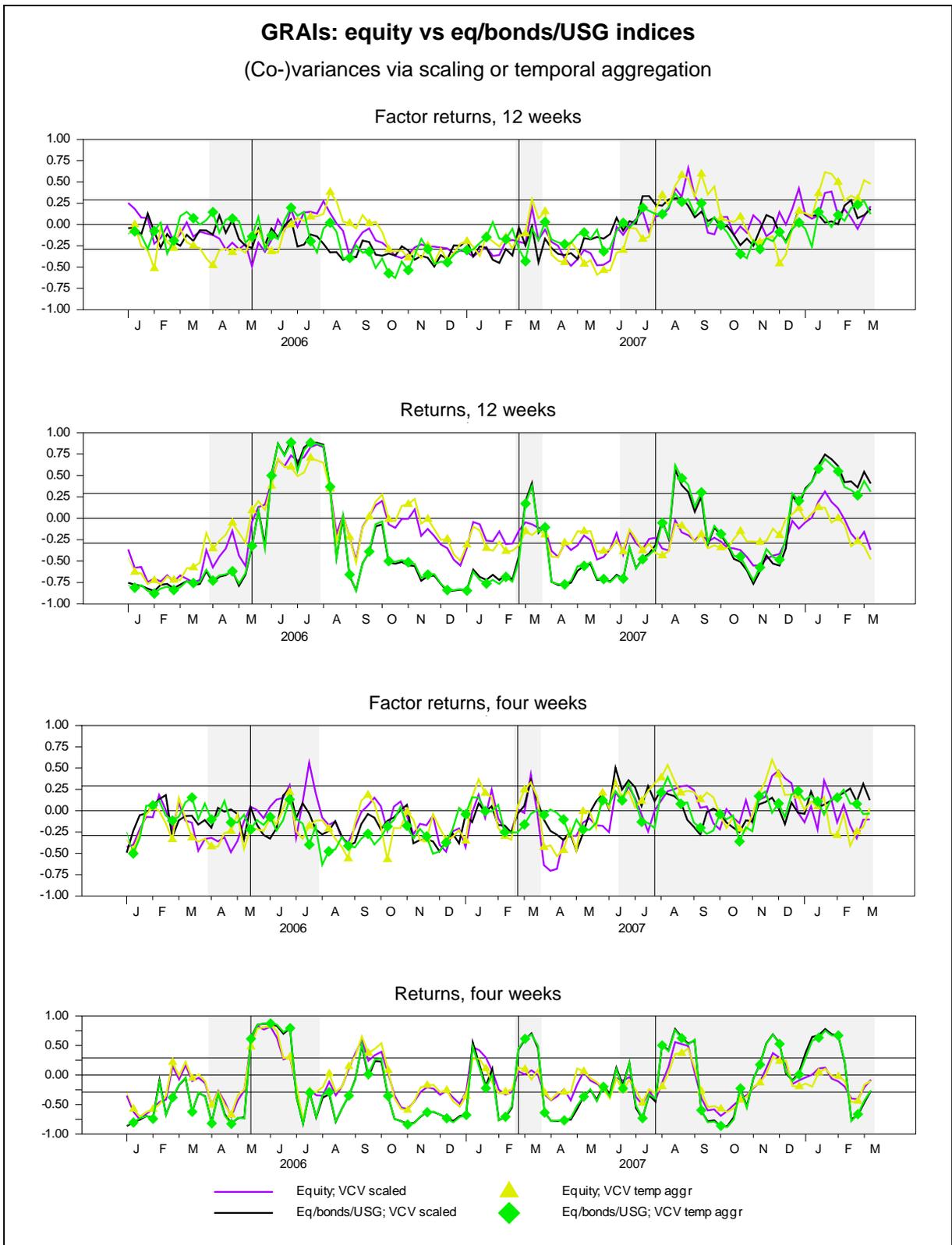
GRAIs (12-week return periods): adding government bond indices – since 2006



Sources: MSCI, Merrill Lynch, Federal Reserve, Bloomberg. Own calculations.

Figure 10

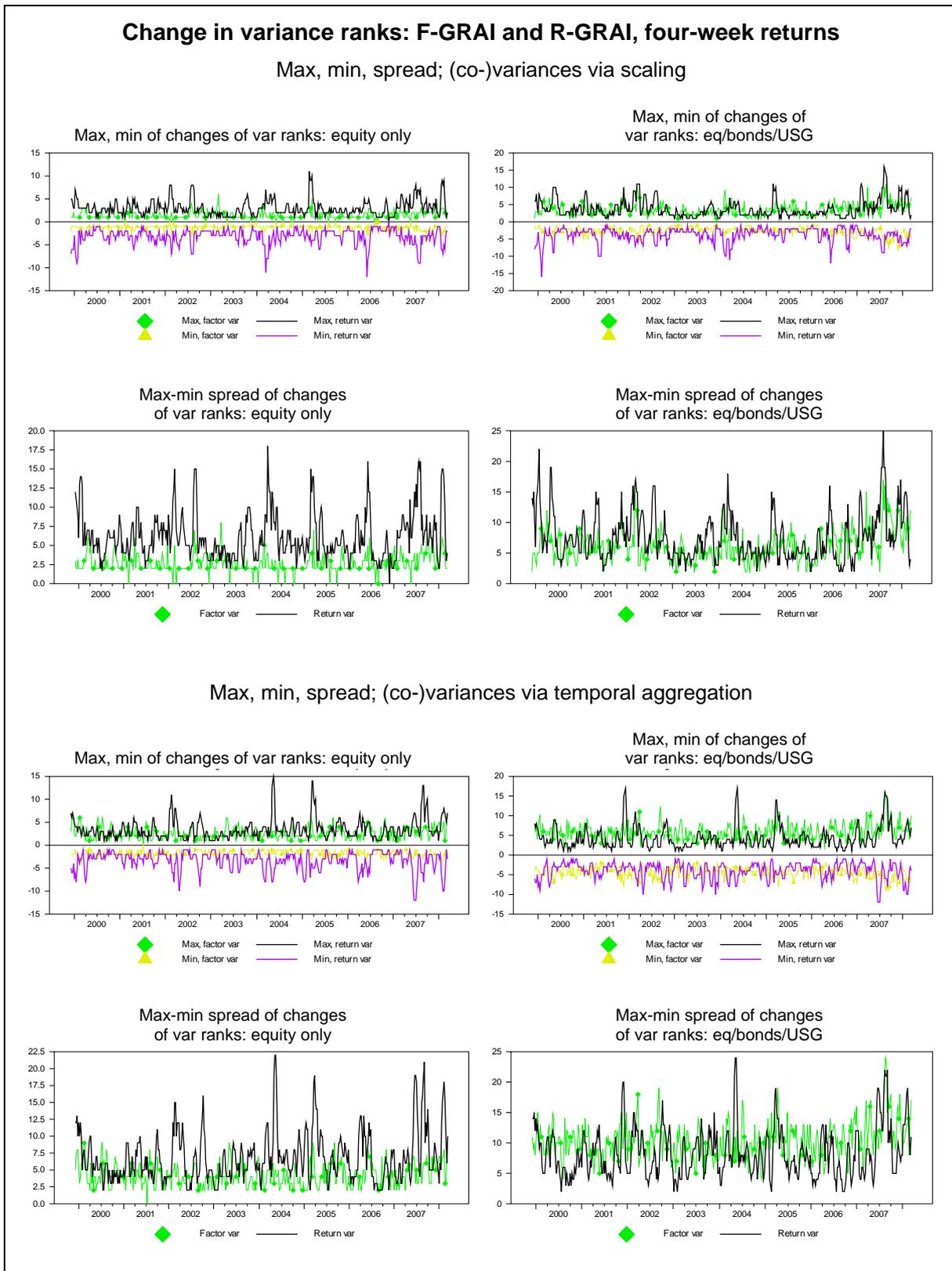
GRAIs (12-/4-week return periods): equity vs equity/bond/US government bond indices



Sources: MSCI, Merrill Lynch, Federal Reserve, Bloomberg. Own calculations.

Figure 11

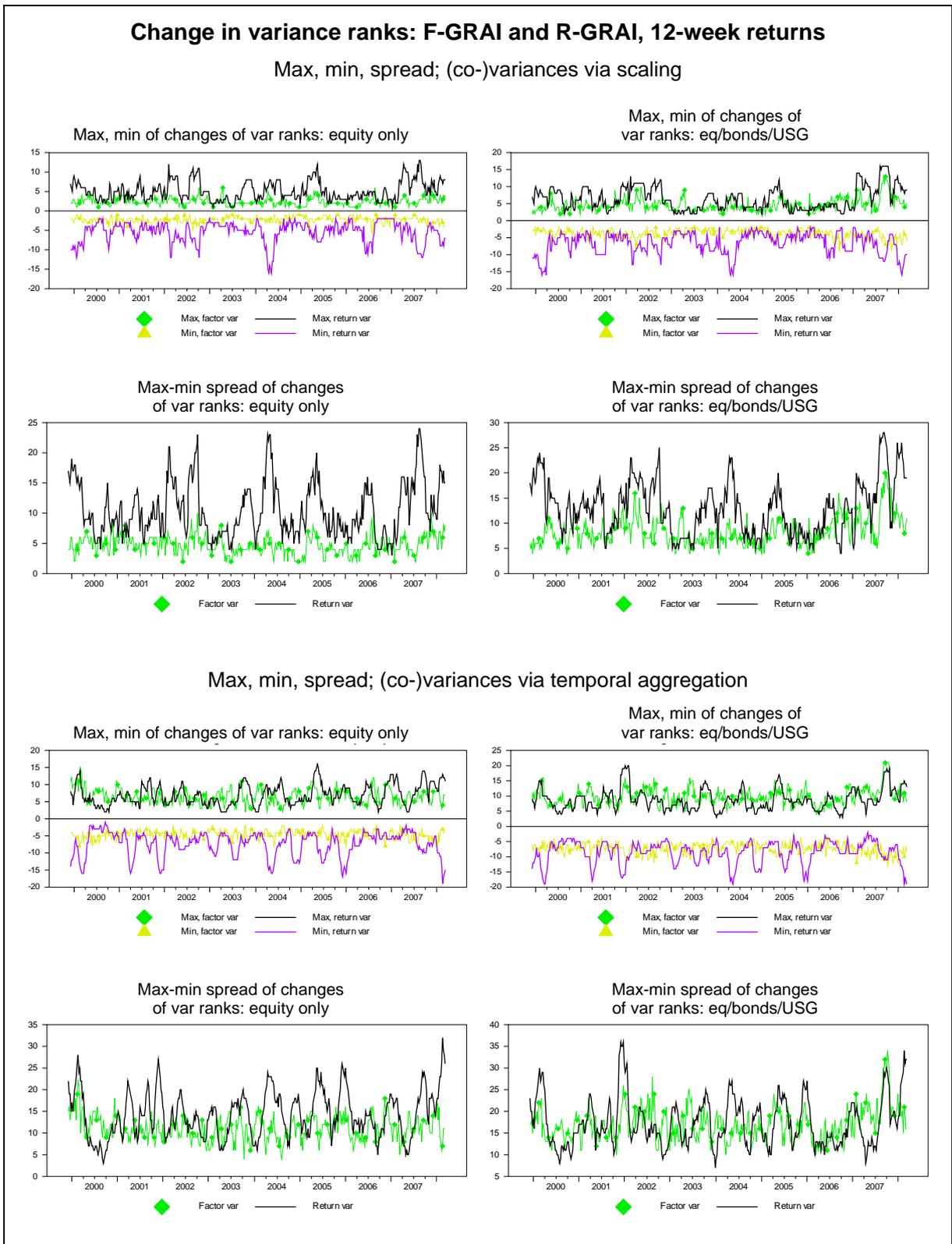
Max, min, spread: change in variance ranks / GRAIs (four-week return periods)



Sources: MSCI, Merrill Lynch, Federal Reserve, Bloomberg. Own calculations.

Figure 12

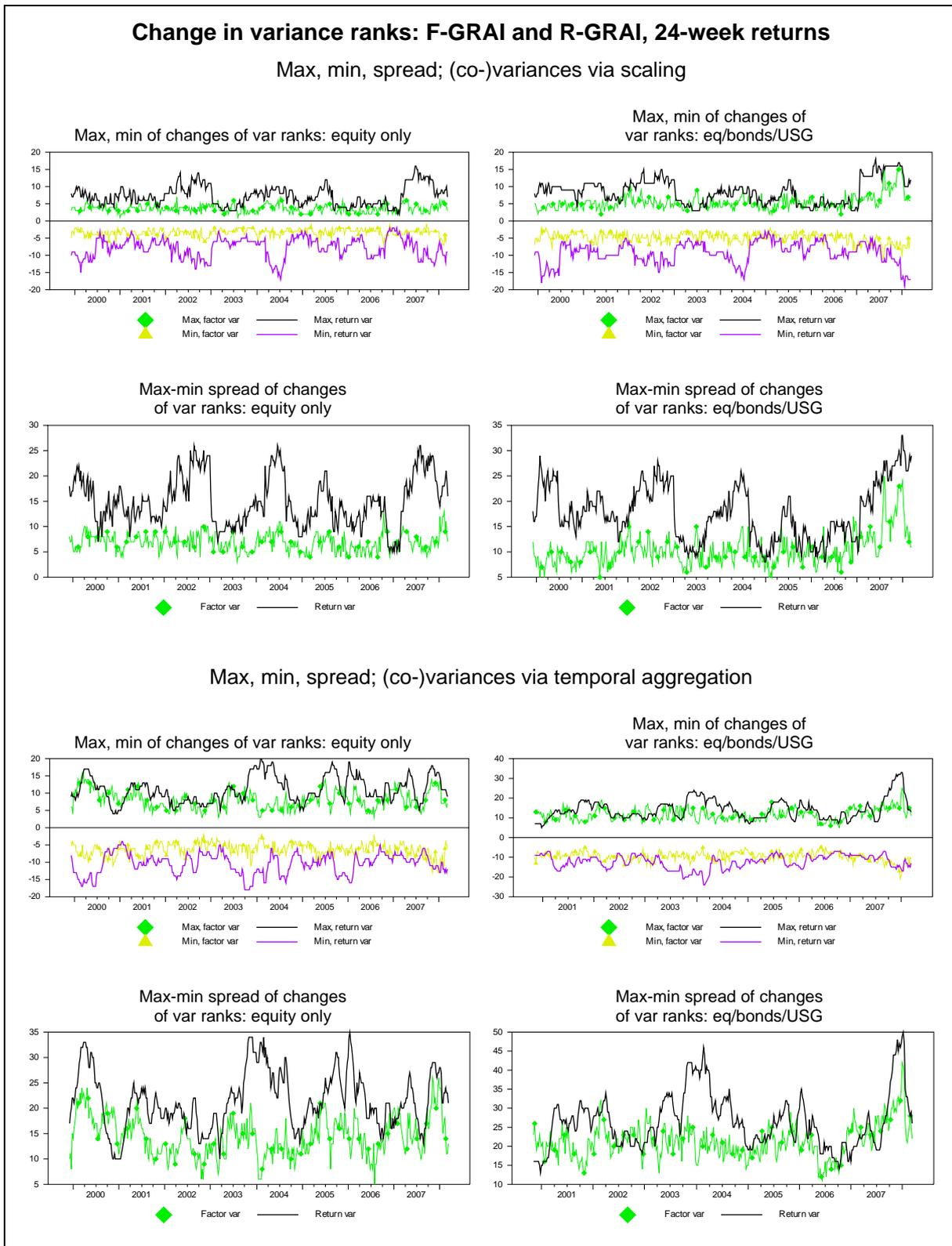
Max, min, spread: change in variance ranks / GRAIs (12-week return periods)



Sources: MSCI, Merrill Lynch, Federal Reserve, Bloomberg. Own calculations.

Figure 13

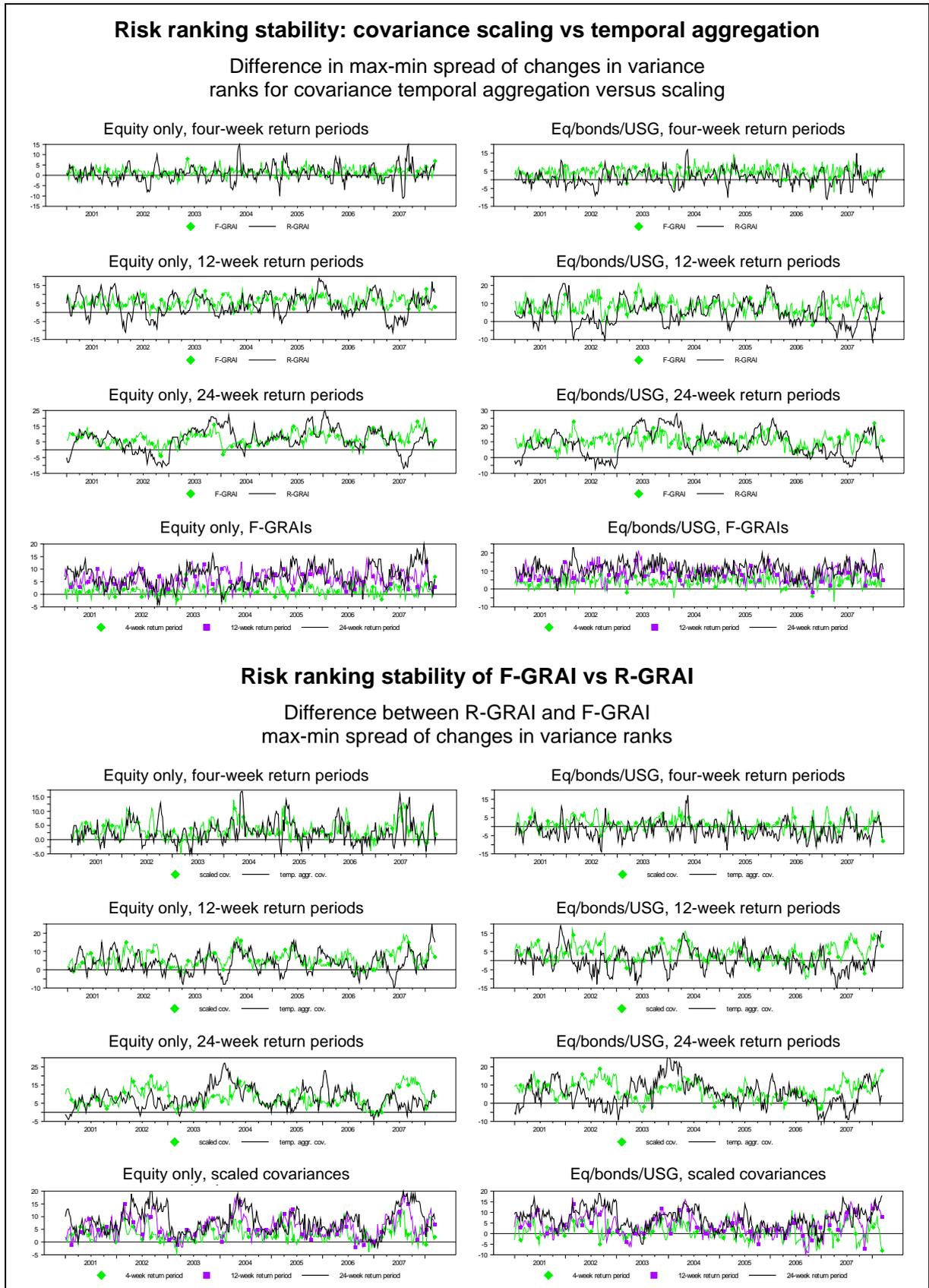
Max, min, spread: change in variance ranks / GRAIs (24-week return periods)



Sources: MSCI, Merrill Lynch, Federal Reserve, Bloomberg. Own calculations.

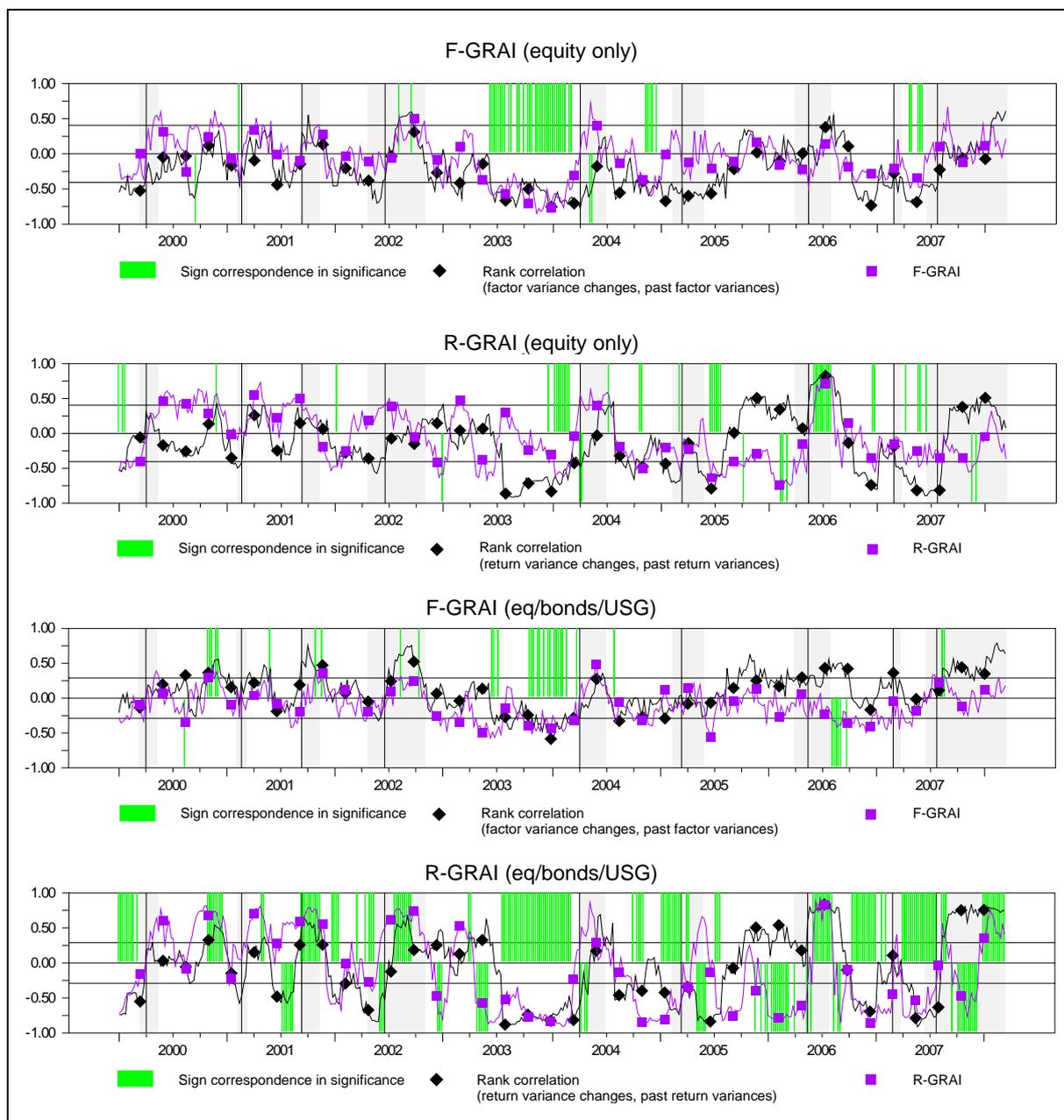
Figure 14

Risk ranking stability criterion and GRAIs



Sources: MSCI, Merrill Lynch, Federal Reserve, Bloomberg. Own calculations.

Figure 15
GRAIs and variance changes over return periods
 12-week return periods, scaled (co-)variances



Notes: Critical values for two-sided significance test of rank correlation at 5% level (see Zar (1972)).

Sources: MSCI, Merrill Lynch, Federal Reserve, Bloomberg. Own calculations.

Table 4

**Correlations of (G)RAIs with first principal component
of four market-based risk aversion indicators**

	RAI-R	RAI-C	GRAI	RAI-R	RAI-C	GRAI
	Scaled (co-)variances			Temporally aggregated (co-)variances		
Period: 8 November 2000–12 March 2008						
For: four-week return periods						
Stock indices; factor returns	0.541	0.575	0.424	0.529	0.580	0.392
Stock & bond indices (+US GovB); factor returns	0.556	0.592	0.407	0.538	0.593	0.328
Stock indices; returns	0.249	0.246	0.340	0.212	0.228	0.312
Stock & bond indices (+US GovB); returns	0.446	0.472	0.600	0.410	0.464	0.603
For: 12-week return periods						
Stock indices; factor returns	0.436	0.522	0.408	0.395	0.518	0.410
Stock & bond indices (+US GovB); factor returns	0.451	0.537	0.496	0.416	0.524	0.360
Stock indices; returns	0.208	0.305	0.302	0.146	0.300	0.302
Stock & bond indices (+US GovB); returns	0.352	0.439	0.500	0.299	0.443	0.509
For: 24-week return periods						
Stock indices; factor returns	0.238	0.232	0.250	0.287	0.227	0.273
Stock & bond indices (+US GovB); factor returns	0.253	0.244	0.329	0.285	0.231	0.254
Stock indices; returns	0.023	0.145	0.114	0.095	0.183	0.086
Stock & bond indices (+US GovB); returns	0.139	0.183	0.233	0.170	0.194	0.230
Shorter period: 12 March 2003–12 March 2008						
For: four-week return periods						
Stock indices; factor returns	0.520	0.590	0.390	0.517	0.597	0.398
Stock & bond indices (+US GovB); factor returns	0.534	0.607	0.393	0.526	0.612	0.314
Stock indices; returns	0.258	0.278	0.314	0.207	0.245	0.279
Stock & bond indices (+US GovB); returns	0.449	0.508	0.595	0.412	0.488	0.598
For: 12-week return periods						
Stock indices; factor returns	0.366	0.493	0.403	0.343	0.530	0.384
Stock & bond indices (+US GovB); factor returns	0.388	0.520	0.564	0.378	0.544	0.361
Stock indices; returns	0.132	0.241	0.224	0.067	0.252	0.252
Stock & bond indices (+US GovB); returns	0.289	0.397	0.479	0.242	0.422	0.491
For: 24-week return periods						
Stock indices; factor returns	0.138	0.101	0.234	0.164	0.119	0.205
Stock & bond indices (+US GovB); factor returns	0.165	0.131	0.402	0.175	0.128	0.218
Stock indices; returns	-0.134	-0.070	-0.136	-0.065	0.018	-0.113
Stock & bond indices (+US GovB); returns	-0.003	-0.003	0.125	0.022	0.038	0.146

Correlation (1 April 1998 to 12 March 2008) between...

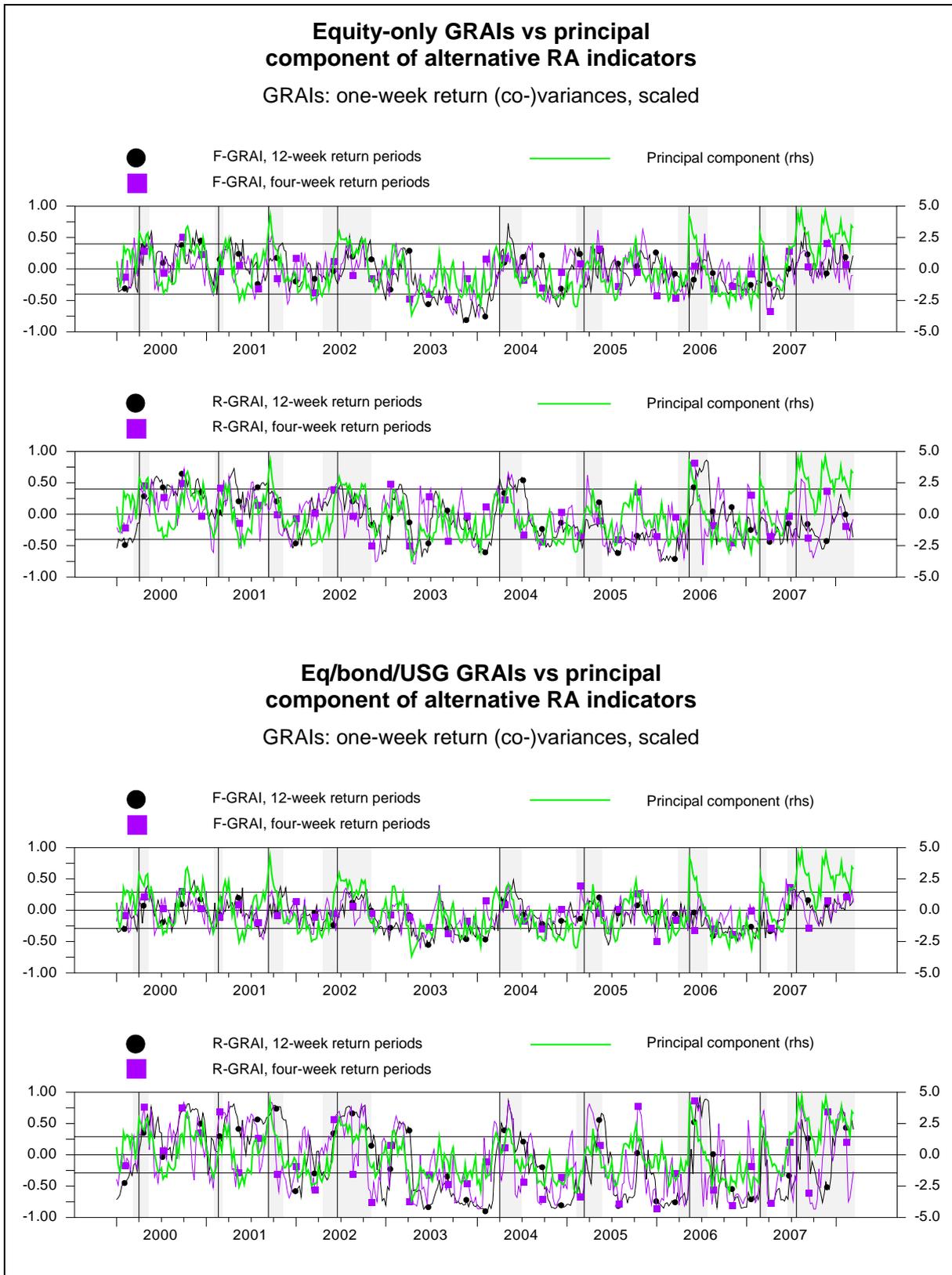
	RAI_MS	RAI_WP	RAI_UBS
RAI_MC	0.482	0.562	0.648
RAI_MS		0.798	0.600
RAI_WP			0.557

Notes: Principal component calculated for weekly (Wednesday) observations (1 April 1998 to 12 March 2008) of the following four indicators: the Citi Macro Risk Index (RAI_MC), the risk aversion indicator implied by the Global Risk Demand Index (RAI_MS) of Morgan Stanley, the Westpac Risk Aversion Index (RAI_WP), and the UBS G10 Carry Risk Index Plus (RAI_UBS). Data for the indices were downloaded from Bloomberg. Where necessary, values were multiplied by -1 to correspond to a risk aversion interpretation. Correlations between (G)RAIs and principal component calculated for weekly (Wednesday) observations over the indicated periods. Correlation coefficients with absolute values larger than 0.45 highlighted/in boldface.

Sources: MSCI, Merrill Lynch, Federal Reserve, Citigroup Global Markets Inc., Morgan Stanley, Westpac Strategy Group, UBS, Bloomberg. Own calculations.

Figure 16

**GRAIs vs first principal component of
four market-based risk aversion indicators**



Sources: MSCI, Merrill Lynch, Federal Reserve, Citigroup Global Markets Inc., Morgan Stanley, Westpac Strategy Group, UBS; Bloomberg. Own calculations.

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Rating migration matrices: empirical evidence in Indonesia

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1. Introduction

Credit risk remains the dominant problem confronting banks. Nevertheless, banks need to identify, monitor and control credit risk as well as ensure capital adequacy to anticipate the risk (Basel Committee on Banking Supervision (1999)). Basel II confirmed that financial institutions must have the ability to analyse credit models and internal ratings to ensure the model is calibrated to measure credit risk consistently and meaningfully. Furthermore, credit risk is the main risk faced by financial institutions. Van Deventer and Imai (2003) specifically mentioned that credit risk is the major reason for bank default.

BIS (2005) also confirmed that the main reason for bank failure is low credit quality and poor credit risk evaluation. Poor credit risk evaluation tends to neglect the use of capital requirements to expedite a precise evaluation and tight control of credit risk exposure to a bank.

There are several difficulties in determining credit risk solutions that cover a number of companies. First, credit risk has different types and sizes. Second, the different types of credit risk are generally managed centrally, and are closely monitored. The source of credit risk also varies widely; from corporate or sovereign bonds, credit derivatives, over-the-counter derivatives (such as interest rate swaps), commercial lending, retail mortgages and credit cards. Third, banks tend to manage their credit risk separately from market risk.

In measuring credit risk, Kamakura Risk Information Services (KRIS (2004)) applied three quantitative approaches to model default probabilities, namely: Jarrow Chava model, Merton structural model and Jarrow Merton hybrid model. The three approaches incorporate information regarding a company's equity market prices and interest rates, so that prevailing market expectations can be accommodated in the default probability estimates. Van Deventer and Wang (2003) use this model by estimating default probability explicitly using logistical regression with a historic default database.

In addition to default probability estimates, credit risk analysis can also be performed using risk migration analysis (migration probability of the bond rating). The bond rating is an important indicator to evaluate a company's credit quality, as well as their default probability. A change in a company's rating reflects the credit quality of that company, either improved (upgrade) or deteriorating (downgrade). Analysis of the rating transition, including default, is

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useful in the credit risk model to measure future credit loss. Thus, the matrix containing rating transition probability (transition matrix) plays an important role in credit risk modelling.

Theoretically, the transition matrix can be estimated for the desired transition horizon. However, the matrix commonly used is an annual or five-yearly transition matrix. Specifically, a transition matrix illustrates the default risk and high migration volatility of a low quality portfolio. The default likelihood increases exponentially with a decline in grade. All transition matrices exhibit the same characteristic; they all have high probabilities in a diagonal matrix; the obligor tends to maintain its current rating. The second largest probability is around the diagonal. Meanwhile, the farther from the diagonal, the lower the rating transition (Violi (2004)). A study by Kryzanowski and Menard (2001) shows that the probability of a bond remaining at its initial rating reduces as the time horizon analysed becomes longer.

The discussion on credit modelling not only focuses on the probability of default, but also analyses what is happening to credit that is close to default (McNulty and Levin (2000)). For that reason, researchers began to focus on the probability of credit rating transition from one level to another. One of the representative ways of presenting such information is through a transition matrix.

2. The objective of the research

This research aims to estimate a credit rating transition matrix, specifically used to identify:

- Rating migration at a certain period;
- The heterogeneity of rating migration; and
- The volatility level of rating migration.

3. Literature study

Transition matrix rating

Credit migration, or a transition matrix, indicates changes in the quality of settled credit at a particular company. Transition matrices are the main input in various applications of risk management. One example, in the New Basel Accord (BIS (2001)), capital requirement is based on the rating migration. In 1999, the Basel Committee on Banking Supervision (BCBS) confirmed the use of transition matrices and has since advocated their use as a basis to fulfil the securitisation framework.

Credit rating is a process where any credit rating observation can form one of several state ratings. In this research, it is assumed that the credit rating process follows the Markov chain process. This means that the probability placed on one state can only be determined by knowing the state from its previous observation. The assumption of Markov chain in the credit rating process implies that the credit transition is more time invariant or time homogenous, where the transition probability remains the same towards time and constant during the predetermined horizon.

If one Markov chain has state space $S = \{1,2,\dots,k\}$, the probability of the credit rating process in state j for one observation after being in state i in a previous observation, is denoted by P_{ij} . This P_{ij} is known as the transition probability from state i to state j . A matrix with a transition probability from state i to state j is known as the transition matrix of the Markov chain (Anton and Roses (1987)). Subsequently, the transition matrix is denoted with P . The general format of the one step transition probability matrix is as follows:

$$P = \begin{pmatrix} p_{11} & p_{12} & p_{13} & \cdots & p_{1k} \\ p_{21} & p_{22} & p_{23} & \cdots & p_{2k} \\ \vdots & & & & \vdots \\ p_{j-1,1} & p_{j-1,2} & p_{j-1,3} & \cdots & p_{j-1,k} \\ 0 & 0 & 0 & \cdots & 1 \end{pmatrix} \quad (3.1)$$

At equilibrium (3.1) above, P_{ij} verifies the transition probability from state i at time t to state j at time $t+1$. In addition, the Markov chain transition matrix above has the characteristic that all entries on one line equal 1. Mathematically, that characteristic can be written as follows:

$$p_{i1} + p_{i2} + \dots + p_{ik} = 1 \quad (3.2)$$

The state vector $X(t)$ for one Markov chain observation with state space $S = \{1, 2, \dots, k\}$ is defined as the vector of column x where the i component, namely x_i , is the probability of state i at time t . The column vector can be formulated as:

$$\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_k \end{bmatrix} \quad (3.3)$$

According to theorem by Anton and Rorres (1987), if P is the Markov chain transition matrix and $x(n)$ is the state vector at observation n , it makes:

$$\mathbf{x}^{(n+1)} = P\mathbf{x}^{(n)} \quad (3.4)$$

From 3.4, it is known that:

$$\mathbf{x}^{(n)} = P\mathbf{x}^{(n-1)} = P^2\mathbf{x}^{(n-2)} = P^n\mathbf{x}^{(0)} \quad (3.5)$$

In other words, Equation 3.5 verifies that the previous state vector $x(0)$ and transition matrix P reveal the value of state vector $x(n)$.

4. Specification of the transition matrix approach used

In this study, a transition matrix is constructed for both discrete and continuous timescales. Based on the discrete approach, changes in the obligor rating (credit score) are only monitored after a certain period of time (fixed), such as six months, nine months, one year or other specific periods. Meanwhile, based on the continuous approach, any change in rating can be monitored at any time, even minute-by-minute (Ahmed et al (2004)).

Building a transition matrix using the discrete approach follows Jafry and Schuermann (2004). Meanwhile, the transition matrix based on the continuous approach was adapted from Lando and Skødeberg (2002).

Transition matrix, discrete timescale: cohort method (frequentist)

One method to calculate changes in probability from the data estimated using a discrete timescale is the cohort method. The cohort method has been widely used as it applies simple calculations, although sometimes the results are less efficient.

Transition matrix, continuous timescale:

Constructing a transition matrix using a continuous timescale approach has fascinated many modellers in recent years. Ahmed et al mentioned two key elements when applying this approach:

1. To facilitate the transition probability estimation where the transition to a certain rating rarely occurs, for example an indirect default (default through a sequential downgrade)
2. To facilitate the construction of a transition matrix for all lengths of time (for example the 73-day transition matrix)

Continuous method with the assumption of time homogeneity

Using this approach, we get a K-state Markov chain where state 1 is the highest state and state K is default. The transition probabilities for a certain period are calculated in matrix $P(t)$ $K \times K$ where ij is the migration probability from state i to state j during period t . The generator matrix with $K \times K$ dimension is Λ with non-negative, off-diagonal entries and the number of lines equal to zero (Israel et al, 2001), where (Lando and Skødeberg (2002)):

$$P(t) = \exp(\Lambda t), t \geq 0 \quad (3.6)$$

Matrix Λt is matrix Λ multiplied by t for each entry and the exponential function denotes the exponential matrix. The entry for matrix Λ is:

$$\lambda_{ij} \geq 0, \text{ for } i \neq j$$

$$\lambda_{ii} = -\sum_{j \neq i} \lambda_{ij} \quad (3.7)$$

This entry explains the probabilistic behaviour of holding time in state i as it is exponentially distributed with parameter λ_i , where $\lambda_i = -\lambda_{ii}$ and the probability of shifting from state i to j is λ_{ij}/λ_i .

The transition probability for each time horizon is the function of the generator. Thus, we can obtain the maximum likelihood estimator from the transition probability matrix using the estimation from the generator. This is subsequently applied to the exponential matrix for the maximum likelihood estimation of that generator.

Based on the assumption of time homogeneity, the element from the matrix generator is calculated using the maximum likelihood estimator as performed by Kuchler and Sorensen (1997):

$$\hat{\lambda}_{ij} = \frac{N_{ij}(T)}{\int_0^T Y_i(s) ds} \quad \text{for } i \neq j \quad (3.8)$$

Where:

$N_{ij}(T)$: number of transitions from state rating i to state rating j in the period.

$Y_i(s)$: number of companies with state rating i during s .

In other words, the denominator from Equation 3.8 shows the number of “firm-years” of all companies included in the sample that were initially state i . Thus, the state of each company for each period is also counted in the denominator.

The continuous method with the assumption of time non-homogeneity:

According to a study carried out by Lando and Skødeberg (2002), one of the means to calculate a transition probability matrix from continuous data, assuming non-homogeneity, is by applying the Aalen-Johansen estimator. Based on Jafry and Schuermann (2003), the Aalen-Johansen estimator, or non-parametric product limit, obtained is consistent. The construction of transition matrices using this method follows the cohort method over a very brief period, such as on a daily basis (Landschoot (2005)).

In estimating the transition matrix using a continuous timescale and assuming non-homogeneity, $P_{(s,t)}$ is the transition probability matrix for period [s,t]. Element ij from the matrix notes the Markov probability process, beginning with the transition from state i at time s to state j at time t. Then, if several m transitions are identified during the period [s,t], $P_{(s,t)}$ can be estimated by applying the Aalen-Johansen estimator (Jafry and Schuermann (2003)).

$$\hat{P}_{(s,t)} = \prod_{i=1}^m (I + \Delta \hat{A}(T_i)) \quad (3.9)$$

Evaluating rating quality

To intensify the analysis results, several indicators must be observed. One of the most important indicators in evaluating the quality trend of corporate ratings is rating activity. According to Carty and Fons (1993), rating activity can be calculated from the sum of rating shifts, both the upgrades and the downgrades, divided by several issuers operating at the beginning of the year. Another important indicator is rating drift. Rating drift is the dependency on previous ratings and is identified as non-Markovian behaviour (Lando and Skødeberg (2002)). Rating drift is calculated by the total number of upgrades subtracted by the number of downgrades and divided by the number of issuers operating at the beginning of the year. Based on the sample given by Carty and Fons (1993), a rating change from BBB to A represents one rating, whereas from BBB to AA is a change of two ratings.

The discrete hazard model

A credit risk model used to analyse credit risk is known as the hazard rate model. The hazard rate model is a method to measure bankruptcy by including default intensity. The model is widely used in operational measurements. One of the applications of this model is for pricing, bankruptcy and estimating the probability of company default. There are two types of hazard models, discrete hazard rate and continuous hazard rate. The difference between the two models is in the survival function applied. This research paper focuses on discrete hazard. The discrete hazard model is an appropriate model to analyse data consisting of binary observations, time-series and cross-sectional data, as in cases of bankruptcy. The hazard rate is defined in economic studies as the transitional risk of different states. In financial literature, the hazard rate indicates credit default risk.

5. Data sources

The data used originates from PT Pemeringkat Efek Indonesia (Pefindo). Company ratings as well as debt specific ratings published by Pefindo from February 2001 to June 2006 were used to calculate the transition matrices, using both with discrete and continuous methods. However, several bond ratings published by Pefindo also contained the bond rating given by other rating agencies, such as KASNIC.

The rating agency data published during the period consists of a semiannual publication, published every February and August. The publication in February year *i* is the rating agency data from 31 December year *i*-1, whereas the publication in August year *i* is the rating data from 31 June year *i*. Meanwhile, bond rating data used in the estimation is for the period of 2001–05, published monthly by Pefindo, from July 2003 to June 2006; and a semiannual publication from 2001 to 2002. The data from Pefindo comprises of 115 company ratings and 412 bond ratings from 119 companies. However, not all the data could be included in the estimation due primarily to a lack of available data at the beginning of the estimation period.

6. Analysis results of the transition matrix

6.1 Evaluating rating quality

Figure 6.1 illustrates that the corporate rating quality of the sample, in general, showed improvement. This is indicated by the decline in the percentage of downgraded companies during 2001–04 (from 25% to 3.23%). Nonetheless, in 2005, the percentage of downgraded companies increased to 4%. On the other hand, higher corporate rating quality was evidenced by a rise in the number of upgraded companies, from 10% in 2001 to 14.3% in 2003. However, the percentage declined again in 2004 and 2005. Since 2003, the number of upgraded companies has exceeded the number of downgraded companies. This is a preliminary indication of an improvement in the conditions of the sample companies.

Figure 6.1

Number of upgraded and downgraded companies

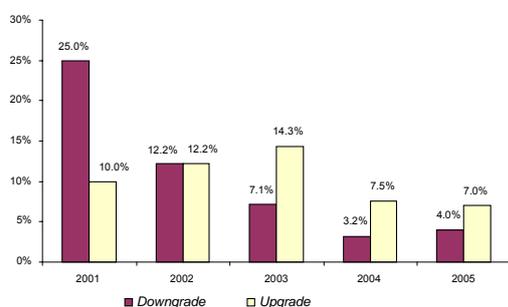
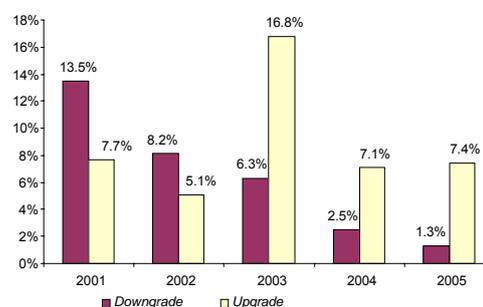


Figure 6.2

Number of upgraded and downgraded sample bonds



Source: Pefindo (processed)

This is further emphasised in Figure 6.2, where the percentage of downgraded bonds has shown a declining trend over the past five years. In 2001, the percentage of downgraded sample bonds was 13.5%, while in 2005 it was only 1.3%. In brief, Figures 6.1 and 6.2 indicate initial improvements in the creditworthiness of sample companies issuing bonds. This was buttressed by the fall in both downgraded companies and bonds, as well as the rise in the percentage of upgrades.

Rating activity and rating drift:

A positive (+) rating drift shows that the number of upgrades has surpassed the downgrades, more specifically indicating an improvement in rating quality. Conversely, a negative (–) rating drift shows that the number of downgrades has surpassed the upgrades, ergo a decline in credit quality. In brief, rating drift indicates whether a rating shows any improvement or decline over a certain period of time.

The rating activity and rating drift of sample companies during 2001–05 is presented in Figure 6.3. It can be seen that there was a regression in letter activity rating of the sample companies from 2001–04. However, in 2005, rating activity increased to 15%.

Even though the percentage of rating activity showed a decline, conversely, the rating drift experienced an escalating trend. This indicates that despite an unsatisfactory activity rating for the sample companies over the past few years, the rating is beginning to show improvement. In 2001 and 2002, the rating drift was negative (–), which means that the number of downgrades exceeded the upgrades. However, the rating drift has declined since 2004 but not as severely as during 2001 and 2002.

Figure 6.3

Letter rating activity and rating drift of a sample companies

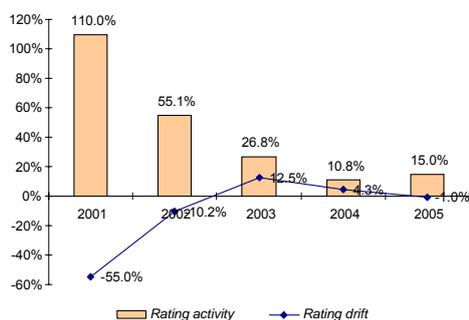
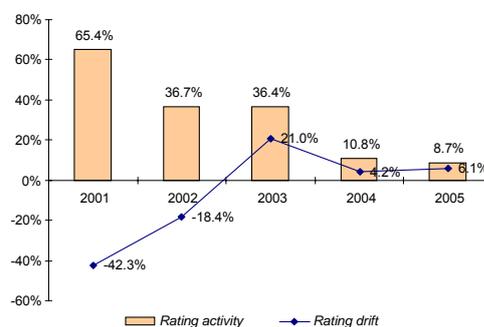


Figure 6.4

Letter rating activity and rating drift of sample bonds



Source: Pefindo, processed

Figure 6.4 shows the letter rating activity and rating drift of sample bonds from 2001–05. The percentage of letter rating activity of sample bonds has declined, from 65.4% in 2001 to 8.7% in 2005.

Despite a decline in rating activity, rating drift improved, which is shown by its escalating trend. This means that even though the percentage of activity rating over the past few years experienced a decline, the rating still showed improvement.

In 2001 and 2002, the rating drift was negative, which means the number of downgrades exceeded the upgrades. However, the rating drift continued to increase reaching 21% in 2003, which indicates that the number of upgrades outperformed the downgrades, as experienced by the rating drift in sample companies.

More concisely, it can be concluded that the percentage of rating activity and sample bonds during 2001–05 declined relatively. Nevertheless, rating activity showed improvements as indicated by the positive rating drift. This is initial evidence of improved creditworthiness for sample bonds over the past few years.

6.2 Analysis of the transition rating matrix

There are two main approaches to estimating a transition matrix: the cohort method and the continuous/discrete method. The continuous method was identified based on time homogenous and time non-homogenous assumptions. In this study, the transition matrix is estimated using the cohort method and continuous method assuming time homogeneity.

In constructing a transition matrix based on a discrete timescale, the cohort method was used derived from Jafry and Schuermann (2004). Meanwhile, the transition matrix based on a continuous timescale approach was adapted from the study by Lando and Skødeberg (2002).

Company rating transition matrix:

Cohort method

The company rating transition matrix was estimated using the cohort method annually, semiannually (2004–05), every three years (2003–05), every four years (2002–05) and five years (2001–05). To summarise, a few salient matrices are presented.

The five-year transition matrix (2001–05):

Based on the cohort method, the total number of transitions during 2002–05 was 19, with one “not rated” transition. The results are presented in Table 1. The estimation results for 2001–05 show no symmetrical relationship between rating stability and rating level. This is indicated by the diagonal value, which does not represent stability waning in line with a deterioration in the rating.

The estimation results also show that rating activity remained concentrated around the diagonal, even though several ratings displayed extreme changes. This implies that in a five-year period, there is the possibility of significant credit migration.

Table 1 shows that there is a 14.29% probability of upgrading an AA rating, but also a 4.76% chance of downgrading. Another rating that experienced an upgrade was BBB with a probability of 44.44%. Furthermore, a BB rating has the same transitional probability as a B rating, namely 66.67%, to a higher rating. The improvement in rating BBB is negated by the 11.11% decline of rating B. In addition, rating CCC also experienced a transitional probability of 100% to a higher rating. However, there is only one observation at the beginning of the period for this rating.

Table 1
Corporate rating transition matrix based on the cohort method
%, 2001–05

	Number of companies at period end	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	1	100	0	0	0	0	0	0	0	0
AA	2	0	50	50	0	0	0	0	0	0
A	21	0	14.29	61.90	4.76	0	0	4.76	14.29	0
BBB	9	0	0	44.44	44.44	0	11.11	0	0	0
BB	3	0	0	0	66.67	0	0	0	0	33.33
B	3	0	33.33	33.33	0	0	33.33	0	0	0
CCC	1	0	0	100	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0
NR	0	0	0	0	0	0	0	0	0	0
Total	40									

From 2001–05, the majority of rating transitions tended to be positive both for companies of investment grade and also speculative grade ratings. In general, it can be concluded that the sample of company ratings improved over the long term.

The probability distribution of a five-year default transition matrix did not have any correlation with the probability distribution of default from two-year, three-year or four-year estimations. With such differing patterns, it can be seen that in the five-year period, using the cohort method, the probability of default is 14.29% for the A-rating category. It can be demonstrated that the probability of default in the five-year estimation is strongly influenced by the default cases of 2001.

In conclusion, the rating stability pattern for investment grade businesses showed a symmetrical relationship. Figure 6.5 illustrates that higher ratings tend to have greater stability. Likewise, the stability level for investment grade companies was likely to decline in 2002 and 2003. Nevertheless, such conditions did not endure. In 2004, the deteriorating rating rebounded strongly. However, the exception was BBB, which continued to fluctuate. Of this general distribution, one can note that during 2001–05, the most stable categories were AAA and A, whereas AAA and BBB continued to fluctuate.

Figure 6.5

Corporate rating stability level of the investment grade group, based on the cohort method

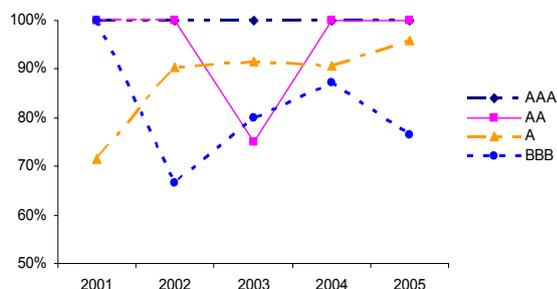
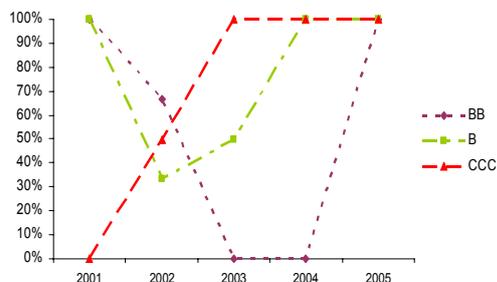


Figure 6.6

Corporate rating stability level of the speculative grade group, based on the cohort method



In contrast to the distribution achieved for investment grade companies, the distribution of the speculative rating category was unstable in nature. Instability is reflected in excessive declines and hikes over the short term (shown in Figure 6.6). However, it is important to note that the number of observations in this speculative grade was very limited; therefore, any change in the rating of one company has a great impact on fluctuations of the category as a whole.

The continuous method assuming time homogeneity

Estimations were made using a continuous approach on an annual, semiannual (2004–05), three-yearly (2003–05), four-yearly (2002–2005) and five-yearly (2001–2005) timeframe. The most salient matrices are presented here.

The five-year transition matrix (2001–05):

During 2001–05, the total number of transitions based on the continuous method assuming time homogeneity was 38, with two not-rated transitions. The probability distribution of the five-year default transition matrix was similar to the four-year pattern. Moreover, the distribution of transitional probability in 2001–05 was wider spread.

Table 2
Corporate rating transition matrix based on the continuous approach
 %, 2001–05

	Number of companies at beginning of period	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	1	100	0	0	0	0	0	0	0	0
AA	5	0	94.31	5.42	0.06	0.04	0	0.05	0.06	0.02
A	20	0	4.51	86.72	2.02	1.31	0.23	1.37	2.19	0.70
BBB	7	0	0.38	14.61	82.87	0.13	0.24	0.13	0.17	1.39
BB	0	0	0.10	5.50	27.41	41.40	1.40	13.48	10.32	0.28
B	2	0	0.03	1.55	7.70	4.94	78.33	5.18	1.29	0.07
CCC	1	0	0.56	19.19	2.59	6.82	8.99	39.50	21.43	0.11
D	3	0	0	0	0	0	0	0	100	0
NR	1	0	0.61	21.89	1.29	0.94	20.61	0.97	0.41	52.31
Total	40									

In terms of a symmetrical relationship between rating stability and rating quality, the estimation results for 2001–05 illustrate a similar relationship for the transition matrix of two, three and four years. The rating stability level declined in line with a drop in rating, reaching BB. Furthermore, rating B has greater stability than BB.

Transitional probability generally declined in line with the wider gap in transitional distance, although several ratings displayed a fairly high probability of migration.

After five years, the possibility of transition emerged from speculative grade to the investment grade and vice versa. However, the transition direction of upgraded ratings surpassed the downgraded ratings. This implies that the sample companies, over the long term, improved in terms of creditworthiness, although several companies also experienced a decline in credit quality.

Over the five years measured, companies also faced the probability of default or being downgraded to rating D. Even companies rated AA and A faced the possibility of default. The safest companies are the ones rated AAA. This is similar to the results of the four-year transition matrix. The probability of default increases with a decline in rating quality, except for BBB and B.

In terms of rating stability, the five-year and four-year transition matrices show that the investment grade category maintains fairly high stability. Meanwhile, the speculative rating category also displayed relatively high stability for companies rated B and C for the four-year transition matrix and rated B for the five-year transition matrix.

Corporate rating stability based on the continuous method assuming time homogeneity

The distribution of rating stability for investment grade companies is illustrated in Figure 6.7, whereas the non-investment and speculative grade categories are illustrated in Figure 6.8. From Figure 6.7, it can be seen that the investment grade generally maintains a stability level above 65%.

Rating A experienced an escalating stability trend from year to year. Meanwhile, ratings AA and BBB experienced significant fluctuations.

Figure 6.7

Corporate rating stability for the investment grade group based on the continuous method

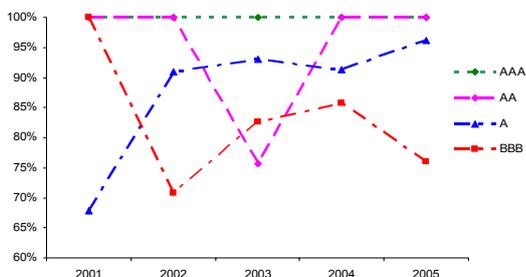
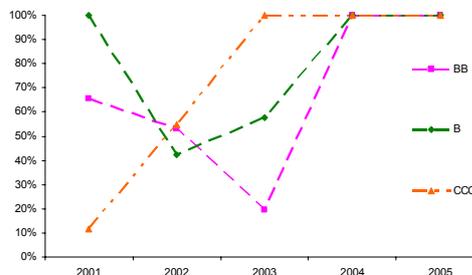


Figure 6.8

Corporate rating stability for the speculative grade group based on the continuous method



Sample companies rated AAA maintained high stability from year to year. This indicated that issuers rated AAA tend to maintain high stability and are somewhat resistant to negative market influences. However, it is noted that the number of observations for this rating was very limited and, therefore, not fully representative of market conditions. On the other hand, the most unstable rating among the investment grade is BBB with the smallest stability percentage.

Figure 6.9

Corporate rating stability for the investment grade group using various timescales

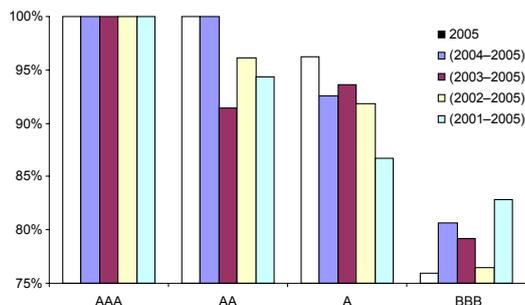


Figure 6.10

Corporate rating stability for the speculative grade group using various timescales

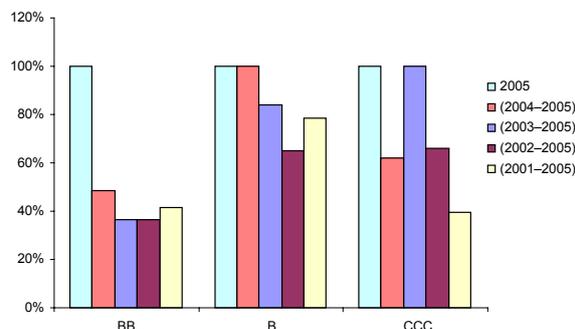


Figure 6.9 illustrates the rating stability of the investment grade category for each estimation period. For the five estimation periods, rating stability remains relatively high, always above 75%. In general, higher ratings lead to greater stability. Figure 6.9 also implies that the rating stability will continue to decline as more periods are added. Slightly different from previous estimations, the BBB rating shows fluctuations.

Rating stability of the speculative or non-investment grade category generally experienced a decline in stability as the estimation period lengthened (Figure 9.10). However, fluctuations were also visible, particularly for rating CCC.

Transition matrices for corporate bonds

Cohort method

The transition matrices to estimate bond ratings applying the cohort method in this study use annual, two-yearly (2004–05), three-yearly (2003–05), four-yearly (2002–05) and five-yearly (2001–05) timeframes. To summarise, not all matrices are presented.

The five-year transition matrix (2001–05)

During 2001–05, the number of bond rating transitions, based on the cohort method, was 22. The estimation results for 2001–05 are presented in Table 3.

Table 3
Transition matrix of bond ratings based on the cohort method
%, 2001–05

	Number of bonds at beginning of period	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	0	n.a.	0	0	0	0	0	0	0	0
AA	1	0	100	0	0	0	0	0	0	0
A	27	0	22.22	55.56	3.70	0	0	0	18.52	0
BBB	11	0	0	9.09	81.82	0	9.09	0	0	0
BB	2	0	0	0	50	0	0	0	50	0
B	8	0	12.50	12.50	0	12.50	50	0	12.50	0
CCC	3	0	0	0	0	66.67	0	33.33	0	0
D	0	0	0	0	0	0	0	0	100	0
NR	0	0	0	0	0	0	0	0	0	0
Total	52									

The probability distribution for the five-year default transition matrix was similar to the four-year distribution. Moreover, the distribution of transitional probability for period 2001–05 showed a larger default probability.

The estimation results for 2001–05 showed no relationship between rating stability and rating level. A falling level of stability did not correlate to the rating regression. Rating BBB is more stable than A.

In addition, and not shown in Table 3, transitional probability declines as the magnitude of transitional distance widens. It is interesting to note that the probability of upgrading a CCC rating to BB is 66.67% after five years. In terms of rating stability, the five-year and four-year transition matrices indicate that investment grade ratings have a higher probability of upgrading than downgrading.

The speculative grade rating category (BB and B) has a tendency to migrate, with a migration probability to BBB of 50%, to A of 12.5% and to AA of 12.5%.

The stability distribution of sampled bond ratings of investment grade is illustrated in Figure 6.11. The figure shows the AAA rating as the most significant mover, with a stability

level from 0% to 100%. However, this was due to no sample bond data found with an AAA rating in 2001 and 2002. An AAA-rated bond only appears in the 2003 sample, where the stability level remained at 100%.

Figure 6.11

Stability of investment grade bond ratings based on the cohort method

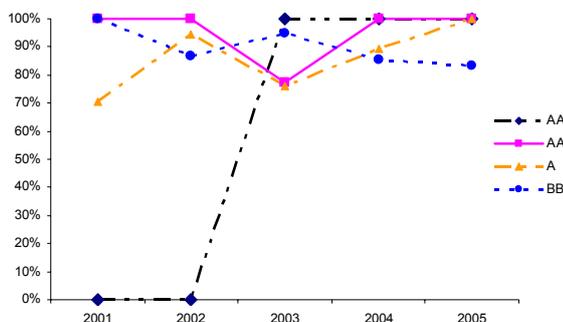
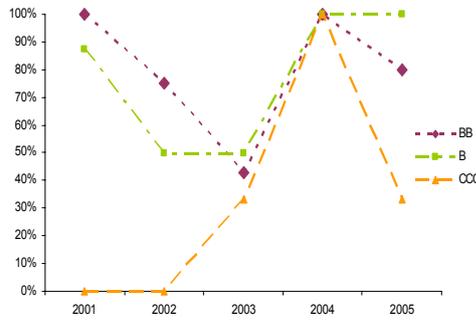


Figure 6.12

Stability of speculative grade bond ratings based on the cohort method



The transition distribution of speculative grade rating stability can be seen in Figure 6.12. It is clear that speculative rated bonds are generally unstable compared to investment grade bonds (Figure 6.11). The speculative rating tends to have a high fluctuation rate.

Figure 6.12 shows that, in contrast to BB and B ratings, which experienced a high probability of downgrade in 2001–03, bonds rated CCC during the same period experienced a relatively high probability of upgrading. However, every level of bond rating in the speculative grade deteriorated.

Continuous method assuming time homogeneity

The five-year transition matrix (2001–05):

In the given period, the total number of bond rating transitions based on the continuous method was 29 with two not rated. The estimation results for 2001–05 are presented in Table 4.

The stability of bond ratings during 2001–05 was sufficiently high, at around 88–100%, except for the CCC rating at only 50.58%. It is due to its junk bond or speculative grade status, implying a low quality bond with a relatively high default probability. Since investment grade bonds are stable, such bonds are not speculative but for investment. On the other hand, speculative grade bonds with high rating fluctuations are often used by speculators to generate high returns.

Table 4 illustrates that a CCC rating has a transition probability to upgrade to a B rating of 22.48%, to a BB rating of 23%, a BBB rating of 1.72% and an A rating of 0.03%. However, the CCC rating has a default probability of 1.32%.

The transition matrix for 2001–05 did not return a symmetrical distribution. The farther from the diagonal, the magnitude of rating transition varied and the probability did not always decline. Even from the stability side (diagonal side), there was no consistent distribution. Lower bond quality leads to less stability.

Regarding the five-year transition matrix, only A- and BB-rated bonds (investment grade category) displayed a small transitional probability towards the speculative grade. In addition, all speculative grade bonds (BB, B and CCC) show a positive transitional probability to become investment grade.

Table 4
Transition matrix of bond ratings based on the continuous method
 %, 2001–05

	Number of bonds at beginning of period	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	0	100	0	0	0	0	0	0	0	0
AA	1	0	100	0	0	0	0	0	0	0
A	27	0	7.14	86.76	0.99	0	0.01	0	5.10	0
BBB	11	0	0.18	4.54	93.58	0.03	1.47	0.04	0.16	0
BB	2	0	0	0.14	5.82	87.96	0.05	0	6.03	0
B	8	0	0	0.15	6.13	3.77	82.29	4.43	3.23	0
CCC	3	0	0	0.03	1.72	23.87	22.48	50.58	1.32	0
D	0	0	0	0	0	0	0	0	100	0
NR	0	0	0.04	1.22	39.66	6.85	6.95	26.98	0.30	18.01
Total	52									

Bond rating stability using the continuous homogenous method

The stability of bond ratings from 2001–05 can be analysed separately between investment grade and speculative grade respectively. The stability of investment grade bonds is higher than speculative grade bonds. Figure 6.13 illustrates that investment grade bond stability is around 70–100%. Furthermore, from Figure 6.14 it can be determined that speculative grade bond stability is around 20–100%. The graph showing investment grade bonds was flatter compared to the speculative grade. Among investment grade bonds, AAA rated are the most stable, followed by AA, BBB and A. The highest quality rating is AAA, which also represents the most stable. The stability of BBB outperforms A, which is illustrated by the flatter line compared to line A. However, the stability trend of A increases from 2001 to 2005. This is contrasted against the BBB rating, which regresses.

Figure 6.13

Stability of investment grade bond ratings based on the continuous method

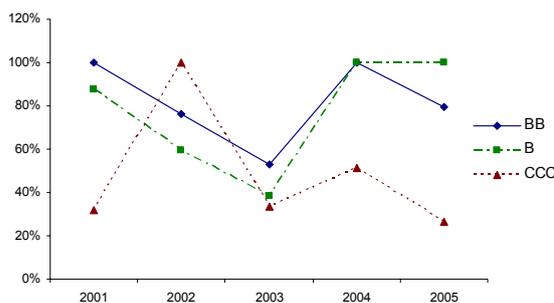
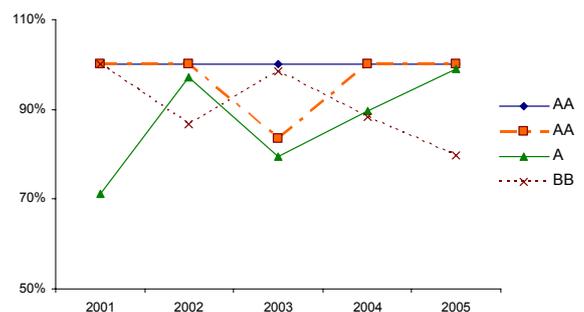


Figure 6.14

Stability of speculative grade bond ratings based on the continuous approach



The stability of bond ratings from 2001–05 fluctuated wildly, as shown by increasing and decreasing shifts on the graphs. In terms of the speculative grade, the BB rating is the most stable followed by B and CCC ratings. From Figure 6.14, it can be concluded that the lower the bond rating quality, the lower the stability level will be.

7. Conclusion of estimation results and policy implications

7.1 Rating activity and rating drift

The analysis of corporate credit quality is a major consideration in terms of investment evaluation. It is in the interest of investors to be aware of credit quality since no investor wishes to suffer a loss due to a decline in rating quality. Two indicators that can be monitored to evaluate credit quality are rating activity and rating drift. These two indicators can highlight rating movement trends and can provide an indication of the creditworthiness of bond issuers.

In brief, from the analysis results it was concluded that the sample of bond issuers improved their creditworthiness over time. This was evidenced by a decline in the percentage of downgraded companies and bonds as well as a rise in upgrades.

In addition, it was also concluded that the percentage of rating activity of the sample of companies and bonds during 2001–05 decreased relatively. However, the current trend of rating activity is improving, which is reflected by an increase in rating drift. This implies that the creditworthiness of the sample of companies and bonds has improved over the past few years.

Estimation results of the rating transition matrix

The transition matrices were constructed using two approaches, the cohort method and the continuous method with time homogeneity. The cohort method is based on Jafry and Schuermann (2004), and the continuous method is adapted from the study by Lando and Skødeberg (2002).

As mentioned by Lando and Skødeberg (2002), the cohort method offers a simple estimation process. However, the method has a very rigid assumption that time is discrete; therefore, rating activity cannot be analysed holistically. The method considers the rating position or company bonds at the beginning and end of a period only, excluding the dynamic process found within the period.

Estimations using the continuous method provide more efficient results than the cohort method. Furthermore, the method also facilitates indirect estimations of a rating in a sequential way. Additionally, the method facilitates the construction of transition matrices that are able to accommodate the dynamic factors of rating activity throughout the period, not just at the beginning or the end. The cohort method produced a transition matrix with an uneven probability distribution concentrated around the diagonal. Meanwhile, estimations using the continuous method are best for corporate or bond ratings, producing transition matrices with a more spread probability distribution. This spread facilitates the probability of distant migration far from the diagonal (extreme transition), even to default without direct transition to that rating, and is possible through indirect transition through other ratings. The type of probability distribution shown is primarily illustrated by the estimation results for a period longer than one year. In addition, estimations using the cohort method failed to show the relationship between stability and rating; indicated by the rating stability level not declining in line with the drop in the rating level. This mainly occurred for estimation results using a one-year period. Meanwhile, several estimation results for periods of longer than one year

indicated a symmetrical relationship between rating stability and rating level, but only when investment grade ratings were used.

Estimations using the continuous method showed the contrary. Most estimations, for various time periods, indicated consistent results: that there is a symmetrical relationship between rating stability and rating level. This distribution was mainly found at the investment grade rating. The stability level of the rating varied, but was generally above 65%.

Ratings in the speculative grade fluctuated and did not show a consistent distribution due to a limited number of samples, both corporate and bonds. Thus, a one-sample transition in the speculative grade category had a significant impact on the migration probability distribution.

In terms of the rating migration trend, estimation results using cohort and continuous methods provided relatively consistent results. Rating migration tends to upgrade, which is consistent with the analysis conducted on rating activity and rating drift.

It can be concluded that using the continuous method, assuming time homogeneity, produced a transition matrix, which is more efficient. The matrix indicated the possibility of rating migration where historically it had rarely occurred. For example, to experience default through an indirect default mechanism.

In addition, the estimation results for both the cohort method and the continuous method indicated that the sample of companies and bonds improved in creditworthiness over time. This was expressed by the rating migration trend, which leaned towards higher ratings. However, the major constraints of this study were the limited number of periods and samples. This is also true for rating activity variation, which is shown by the limited number of rating transitions.

Such a brief sample period prevented any long-term transition matrix estimations and, unfortunately, the timescale did not date back far enough to the Indonesian recession post Asian crisis. Consequently, the limited number of samples caused a one-rating transition to have a substantial impact on the probability distribution.

This mainly affected samples in the speculative grade category. This prevented any creditworthiness analysis of bond issuers in this category.

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Financial soundness indicators (FSIs): framework and implementation

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1. Introduction

The financial turmoil of the late 1990s highlighted the need for macroprudential analysis. This was seen as important for identifying vulnerabilities in the financial system as a whole, including vulnerability to international capital flow reversals as well as to shocks to the corporate and household sectors. The recent turbulence in subprime mortgage markets, which has adversely affected the balance sheets of banks and other financial corporations and has led to a credit and liquidity squeeze, has again pointed to the need for improved information on the soundness of financial systems. The paucity of data in this area, and a lack of dissemination and cross-country comparability have been recognized as key stumbling blocks.

In response, the IMF has worked closely with national agencies and regional and international institutions to develop a set of Financial Soundness Indicators (FSIs). FSIs are aggregate measures of the current financial health and soundness of the financial institutions in a country and of their corporate and household counterparties. This paper will cover the development of FSI methodology; the results of an internationally coordinated compilation exercise (CCE) undertaken by the IMF and participating member countries; a comparison of the data needed for FSIs with the data available in monetary statistics; and the next steps in the work on implementation of FSIs for all IMF member countries.

2. Development of FSI methodology

The FSI project grew out of the need for better data and tools to monitor financial risks and vulnerabilities of national financial systems. This was a new area of work. The IMF has been collecting monetary statistics from countries, but these statistics do not focus on the compilation of soundness and risk information. Information about bank soundness is available to national supervisors; however, it focuses on the soundness of individual banks. Translating this type of individual bank information into information for the sector as a whole was not necessarily straightforward, and called for a careful investigation of the types of information needed to assess aggregate soundness and risk, as well as of data availability. The IMF began this process in 1999 by calling a meeting of a group of experts and officials of countries, regional and international organizations, and standards setters. They confirmed that there was an urgent need for this type of information and identified a number of important indicators that should be compiled. However, they concluded that there was no generally accepted model that identified the types of information to collect.

To gain further information, in mid-2000 the IMF conducted a *Survey on the Use, Compilation, and Dissemination of Macroprudential Indicators*. The survey asked member

¹ Division Chief and Deputy Division Chief, respectively, Financial Institutions Division 2, Statistics Department, International Monetary Fund. We are grateful for the views and inputs of Florina Tanase, Phousnith Khay, and Xiuzhen Zhao. The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

countries about the types of indicators they needed, the availability of the data, and the standards they used for compiling the data. There was a very strong response from over 100 countries, allowing the IMF to identify a core set of financial soundness indicators that all countries should compile, and an encouraged set of important indicators that countries might choose to compile depending on national circumstances. The survey also provided important information about accounting and compilation practices for the indicators. On the basis of the survey information and after several rounds of extensive consultation with experts from international agencies, standard setting bodies, and member countries, the IMF completed and published its *Compilation Guide: Financial Soundness Indicators (Guide)*.²

The *Guide* provides guidance on the concepts and definitions, and sources and techniques for the compilation and dissemination of internally consistent, cross-country comparable set of indicators that could provide information about the current soundness of the aggregate financial system. The methodology in the *Guide* aimed to combine elements of macroeconomic frameworks (including monetary statistics), bank supervisory frameworks (as embodied in the work of the Basel Committee on Banking Supervision), and international financial accounting standards (to a great extent referring to the International Financial Reporting Standards (IFRS)).

3. The coordinated compilation exercise

With the completion of the *Guide*, the focus shifted to promoting compilation of the indicators. The IMF launched a coordinated compilation exercise (CCE) with voluntary participation of 62 systemically important countries. The CCE aimed at (1) developing the capacity of member countries to compile FSIs important to the surveillance of their financial systems; (2) promoting cross-country comparability of FSIs; (3) coordinating efforts by national authorities to compile FSIs; and (4) disseminating the FSI data along with metadata, to increase transparency and strengthen market discipline. The participating countries agreed to compile the 12 core FSIs and could choose to also compile some or all encouraged FSIs (see Table 1 on core and encouraged FSIs above). For comparability, countries were asked to apply the methodology in the *Guide* and to prepare data for a common time period – year-end 2005 for position data and year 2005 for flow data. In addition, the participating countries were requested to prepare detailed metadata (textual descriptions of the data), including information on data sources and compilation methodology.

A total of 58 out of the 62 countries have finalized their FSI data and metadata, which can be found on the IMF website.³ To facilitate cross-country comparisons, the data and metadata are presented in the website in a uniform manner using a standard format, and extensive query and search facilities for the metadata are made available to data users.

The CCE revealed the status of countries' capacity and practices in compiling FSIs, provided information about the extent of adherence to the recommendations of the *Guide*, identified areas where the methodology recommended in the *Guide* should be amended, and helped ascertain countries' technical assistance needs in compiling and disseminating FSIs.⁴

² The *Guide* was released in electronic format in 2004 and issued as an official IMF publication in 2006 (<http://www.imf.org/external/pubs/ft/fsi/guide/2006/index.htm>). It has been translated into French, Russian, Spanish, and Chinese. An Arabic version is forthcoming.

³ <http://www.imf.org/external/np/sta/fsi/datarisl.htm>

⁴ A more detailed discussion of the experience with the CCE is described in *Financial Soundness Indicators – Experience with the Coordinated Compilation Exercise and Next Steps – Background Paper*, posted on the IMF website.

Table 1

Financial soundness indicators: the core and encouraged sets

Core Set	
Deposit takers	
<i>Capital adequacy</i>	Regulatory capital to risk-weighted assets Regulatory Tier 1 capital to risk-weighted assets Non-performing loans net of provisions to capital
<i>Asset quality</i>	Non-performing loans to total gross loans Sectoral distribution of loans to total loans
<i>Earnings and profitability</i>	Return on assets Return on equity Interest margin to gross income Non-interest expenses to gross income
<i>Liquidity</i>	Liquid assets to total assets Liquid assets to short-term liabilities
<i>Sensitivity to market risk</i>	Net open position in foreign exchange to capital
Encouraged set	
Deposit takers	Capital to assets Large exposures 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 Trading income to total income Personnel expenses to non-interest expenses Spread between reference lending and deposit rates Spread between highest and lowest interbank rate Customer deposits to total (non-interbank) loans Foreign currency denominated loans to total loans Foreign currency denominated liabilities to total liabilities Net open position in equities to capital
Other financial corporations	OFCs' financial assets to total financial assets OFCs' financial assets to GDP
Non-financial 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 ¹ Average daily turnover ratio in the securities market ¹
Real estate markets	Residential real estate prices Commercial real estate prices Residential real estate loans to total loans Commercial real estate loans to total loans

¹ Or in other markets that are most relevant to bank liquidity, such as foreign exchange markets.

The CCE results showed that data availability for deposit takers, which are central to financial soundness analysis, is better than for other sectors. All countries compiled the core FSIs, which focus on deposit takers. Encouraged FSIs for deposit takers were also compiled more often than FSIs for other sectors. FSIs for households and non-financial corporations were least compiled. The CCE also revealed that there is diversity of methodologies for compiling FSIs among CCE participating countries, which may be attributed to factors such as (1) different supervisory and accounting practices across CCE participating countries; (2) data availability; (3) availability of resources to collect additional data needed to compile FSIs following the *Guide's* recommendations; and (4) different views of countries on the compilation methodology that is best suited for their analytical needs. The diversity of methodologies used to compile FSIs further emphasized the importance of adequate metadata. The extensive metadata prepared during the CCE permit the construction of peer groups of countries for more meaningful comparisons.

The diversity of compilation methodologies used by CCE participating countries implied methodological departures from the *Guide*. The main deviations were on consolidation basis,⁵ the elimination of certain positions and flows between institutions included within a certain population (intergroup consolidation adjustments), and on certain accounting issues under the IFRS.

In view of the experience of the CCE, amendments to the recommendations of the *Guide* in specific areas were deemed necessary. These amendments were discussed by the IMF Executive Board in November 2007 and summarized in a standalone document, *Amendments to the Financial Soundness Indicators: Compilation Guide*, posted on the IMF website.⁶ The areas that were amended refer by and large to the major methodological departures discussed above. In particular, the *Guide's* original recommendation for a domestically controlled cross-border consolidation basis for deposit takers has been amended. The new recommendation is the (1) cross-border, cross-sector consolidation basis for all domestically incorporated deposit takers and/or (2) the domestically controlled, cross-border and cross-sector consolidation basis.⁷ The *Guide* has ceased to recommend consolidation adjustments of intergroup positions and flows, although it leaves this option open if countries want to make these adjustments. The *Guide* now defers to the IFRS as the standard on most accounting issues, except on matters such as consolidation basis and accounting of loans and provisions. It has also been clarified that the *Guide* explicitly defers to Basel I and II for compiling supervisory-based data while acknowledging that there could be national variations in implementation. Finally, certain definitions of FSIs and underlying series have been modified.

4. Monetary statistics and FSIs: a comparison

FSIs for deposit takers are compiled from sectoral financial statements (which include an income and expense statement, a balance sheet, and extensive memorandum items) that have been put together explicitly for the purpose of compiling these indicators. These

⁵ Consolidation basis refers to the nature of the groupings of related institutions that comprise the population of institutions, for which FSIs are compiled. These groupings do not necessarily imply that the financial statements of the institutions that comprise them are consolidated (ie the data of these institutions could be reported on a solo basis and then simply aggregated for the compilation of FSIs).

⁶ <http://www.imf.org/external/pubs/ft/fsi/guide/2008/pdf/071408.pdf>

⁷ Cross-sector coverage would be limited to exclude subsidiaries of deposit takers that are insurance companies and non-financial corporations.

statements provide data with specific definitions and incorporate specific accounting principles. Therefore, utilizing alternative sources of data for deposit takers – such as the sectoral balance sheet for other depository corporations (ODCs) from monetary statistics – permits the compilation of only a fraction of core and encouraged FSIs for deposit takers because of the outright absence of certain types of data from such statistics. Moreover, even when an item in a monetary statistics presentation is broadly similar in concept to a certain FSI-underlying series, there are often significant departures from FSI standards regarding definitions and accounting.

The table below broadly summarizes the main differences between data in sectoral financial statements that are put together explicitly for the compilation of FSIs (as recommended by the *Guide*, including its recent amendments) and data available in the sectoral balance sheet for ODCs that are put together in the first instance for producing monetary statistics.

Table 2

MFS and FSIs: main methodological differences

Main areas of differences	FSIs (sectoral financial statements)	Monetary statistics (sectoral balance sheet for ODCs)
Data sources	Balance sheet and income statement	Balance sheet
Consolidation basis	(i) Domestically controlled, cross-border, cross-sector consolidation basis and/or (ii) Cross-border, cross-sector consolidation basis for all domestically incorporated entities ¹	Domestic consolidation basis ²
Definition of deposit taker	(i) Parent institutions in the population include all institutions that are legally considered as banks (ie are subject to banking law), even if their liabilities are not part of broad money (ii) Money market funds are excluded from the coverage of parent deposit takers	(i) Parent institutions in the population do not include institutions legally considered as banks if their liabilities are not part of broad money (ii) Money market funds are included in the population if their liabilities are part of broad money
Intragroup consolidation adjustments (positions and flows) ³	All intragroup consolidation adjustments for positions and flows are carried out	No intragroup adjustments are carried out for balance sheet positions, except those between parents and branches
Valuation of assets	Held-to-maturity investments are valued at amortized cost using the effective interest method	Held-to-maturity investments are valued at market or fair value
Recording of total assets	Total assets are net of specific provisions	Total assets are recorded on a gross basis (provisions for losses on impaired assets are not netted out)

¹ Cross-border, cross-sector consolidation basis for all domestically incorporated entities: this includes the data of domestically controlled entities and of local subsidiaries of foreign entities in the sectors that are domestically incorporated, along with the data of these entities' branches and subsidiaries, which can be either domestic or foreign residents, including subsidiaries in other sectors. Domestically controlled, cross-border, cross-sector consolidation basis: this includes the data of domestically controlled and incorporated entities, their branches (domestic and foreign), and all their subsidiaries (domestic and foreign) that are classified in the same sector as well as in other sectors. ² Domestic consolidation basis: this includes the data of resident entities along with those of their branches and subsidiaries in the same sector that are resident in the domestic economy. ³ Intragroup consolidations adjustments refer to the elimination of positions and flows between parents, subsidiaries, and their branches that comprise the groupings defined by a given consolidation basis.

5. Next steps in the IMF's FSI work

In the November 2007 IMF Executive Board meeting, the Executive Directors made a positive assessment of the CCE and underscored the importance of continued IMF engagement with regard to FSIs. In this context, the Directors saw clear value in the regular collection and dissemination of FSIs by the IMF, with the creation of a centralized public FSI database that would be available to member countries, international institutions, and markets. Directors agreed that countries should be encouraged – but not required – to report FSIs to the IMF, with flexible periodicity. In coordination with other IMF departments, the IMF Statistics Department is in the process of preparing for implementing the regular collection and dissemination of FSIs by the IMF. The initiation of regular submissions to the IMF (starting with countries that participated in the CCE) is currently expected to take place at the end of the first quarter of 2009, with dissemination following soon thereafter.

Financial innovation and the importance of modern risk management systems – a case of Zambia

Mankolo Beyani¹ and Raphael Kasonde²

1. Introduction

The current banking environment in Zambia has become highly competitive as banks scramble for a share of the customer deposits on the liability side and good quality credit on the asset side of their balance sheets. In light of this and the need by banks to maintain their profitability, Zambia has witnessed considerable change in the financial landscape. The rapid rate of change in the financial sector no doubt calls for an assessment of the efficacy of risk management systems of financial institutions on one hand and devising appropriate regulatory responses to the challenges that these changes may pose, on the other. In this paper, we proposition that the time has come for the Zambian banking sector to learn from the recent global market turmoil which has demonstrated that weak and ineffective risk management systems of financial institutions and at the same time these institutions taking on greater risks contributed to their incurring of huge losses. From this perspective, it is important that all banks in Zambia fully embrace modern risk management practices. This is because it is much easier to take corrective action in times of relative financial stability, as the situation in Zambia is currently, than in stressed market conditions.

According to Greuning and Bratanovic (2009), “effective risk management, especially for larger banks and for banks operating in deregulated and competitive markets, requires a formal process. In developing economies, especially those in transition, unstable, economically volatile, and shallow market environments significantly expand the range and magnitude of exposure to financial risk. Such conditions render risk management even more complex and make the need for an effective risk management process even more acute.”

This paper is divided into four sections. The next section, which shows how the banking sector in Zambia has evolved over the years, consists of three parts; part one gives a historical overview of the banking sector in Zambia from independence to date while part two discusses the current trends in the sector and part three gives a description of the supervisory approach in place. Section 3 reviews some theoretical literature on financial innovation and risk management systems. In conclusion, Section 4 makes an analysis of the Zambian banking sector.

2. Overview of Zambia’s banking sector activities and performance

2.1 Historical overview

At the time of independence in 1964, the financial system in Zambia comprised foreign commercial banks established in the colonial era, namely, Standard Chartered Bank (1906),

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Barclays Bank(1918) and Grindlays Bank (1956, now Stanbic Bank since 1992). Following the introduction of the nationalisation policy in 1968, Government took control of a substantial segment of the financial system. At the centre of policies introduced were the creation of various state-owned financial institutions and the assumption of administrative controls over the foreign exchange market, interest rates and to a limited extent, credit allocation (Beyani, 2006). This was in line with Government's economic strategy of nationalisation and import substitution industrialisation adopted in 1968. The government envisioned a financial system that would finance its development plans in line with its economic strategy and provide long term finance for investment and funding for domestic firms.

Despite their good intentions, most of the Government policies and programmes failed to create the robust financial system Government envisioned, as the financial system remained small and undiversified. Overall, government involvement in the financial sector, coupled with deteriorating macroeconomic conditions, resulted in an inefficient system, not appropriate for financial sector development. Only a few private banks, therefore, entered the market between 1970 and 1990 as profit margins were depressed and the banking business not lucrative (Maimbo & Mavrotas, 2003).

Following the change of Government in 1991, major financial reforms were undertaken which brought about radical market-oriented economic reforms. The most significant reforms were the liberalisation of the foreign exchange markets and interest rates in 1992/3, the restructuring of and liquidation of government-owned financial institutions and the reformation of the prudential regulation and supervision system of the Bank of Zambia in 1994 (Ibid).

The liberalisation of the financial system led to a proliferation of both foreign and private domestic financial institutions in the sector. Between 1991 and 1995, nine local private banks entered the banking sector. Banking became very attractive mainly because prospects for profitability increased. Banks could earn super profits, mainly from foreign exchange dealings and investment of their funds in government paper. However, by the mid-1990s, it became increasingly difficult to maintain the high levels of profitability because inflation began to decline and stabilise (Ibid) and to maintain their earnings, banks resorted to riskier banking activities. This, coupled with failure to meet prudential requirements, resulted in the closure of ten banks between 1995 and 2000.

2.2 Current position – activities and performance

The financial system in Zambia is currently dominated by the banking sector and as at end-December 2007 accounted for 30% of GDP. There are fourteen commercial banks;³ eight are subsidiaries of foreign banks, four are private indigenous banks, one is jointly owned by the Governments of Zambia and India while another is jointly owned by the Government of Zambia and Rabo Financial Institutions Development of the Netherlands (Rabo). The banking sector is concentrated in and dominated by five large banks.

The current banking environment in Zambia has become highly competitive mainly because of the stable macroeconomic conditions attained since 2002. Zambia experienced positive real GDP growth averaging 5.1% per annum from 2001 to 2007. Further, inflation continued to take a downward trend, falling to 8.9% in 2007 from 18.7% in 2001. As a result, lending rates have also taken a downward trend during this period.

Prior to 2005, the banking industry's balance sheet was significantly concentrated in Government Securities. This was because Government Securities offered highly attractive yield rates (with zero credit risk) compared to other asset types. The move by Government to

³ This was as at 31 October 2008 and one of the banks just commenced operations in August 2008.

reduce borrowing to 1.8% of GDP in order to encourage lending to the private sector led to a significant fall in Government Securities yield rates. This, coupled with stability in the foreign exchange markets, made it increasingly difficult for banks to sustain their profitability. In order to remain profitable, banks have had to become innovative and resorted to riskier banking activities, including those perceived to be conservative in their activities. This resulted in a shift in the asset structures of most banks from predominantly Government Securities holdings to an expanding loan portfolio which offered a higher return (see *Table 1* below).

Table 1
Asset types and average interest rates

Asset Type (% of Total Assets)	2002	2003	2004	2005	2006	2007
Government Securities	22.4	26.2	20.5	24.5	20.0	17.2
Net Loans and Advances	19.1	23.3	27.0	29.7	33.8	38.7
Average Interest Rates (%)						
Government Securities Weighted Yield Rates	38.5	22.1	19.4	19.6	10.9	14.1
Weighted Lending Rates	50.1	43.8	37.1	33.9	27.9	24.4

Source: Bank of Zambia.

While banks resorted to financial innovation,⁴ most of them had limited knowledge of the potential risks that were associated with the new products and services. The introduction of new services and products, particularly the expansion of the total loan book and loan-type products, brought in a myriad of new risks associated with the new lending activities. A number of banks, particularly the smaller local banks, did not have adequate risk management structures to adequately evaluate and monitor the risks and challenges associated with those products and services.⁵ Studies have shown that increasing financial innovation and deepening of financial markets brings with it challenges and risks, which if not well addressed, can threaten the health of the financial system and could cause havoc to the stability of a financial system.

As noted by Frame and White (2002), “profit-seeking enterprises and individuals are constantly seeking new and improved products, processes and organisational structures that will not only give them greater profits, but reduce their costs of production and better satisfy their customer demands”. Whereas the need for better risk management has been the main driving force behind the recent wave in innovation in more advanced markets, this has not been the case in Zambia. The drive towards financial innovation in Zambia can largely be attributed to the need to maintain profitability. However, rapid growth not commensurate with improvements in risk management systems can pose a threat to financial system stability. Financial stability depends largely on the adequacy of risk measurement and management systems of financial institutions. Lack of effective and/or failure of risk management systems by the large banks or a number of smaller ones would threaten not only the solvency of the concerned institutions but also the health of the whole system (Bernanke, 2007).

⁴ The term “financial innovation” is defined later in Section 3 of this paper.

⁵ In 2005, the Bank of Zambia conducted a Risk Management Survey to gauge the extent to which banks had in place risk management frameworks for identifying, measuring, monitoring and controlling or mitigation risk and to what extent the frameworks address risk. The survey found out that a number of the local banks did not have adequate frameworks in place.

2.3 The supervisory approach

The current prudential supervisory approach in Zambia has largely been the capital-adequacy approach (focus on minimum quantitative capital requirements) as opposed to a consistent principles-based and risk-focussed approach, which takes account of not only the benefits of financial innovation but also the accompanying risks. This assertion can be supported by the gravity of supervisory sanctions that a bank with deficient capital may be subjected to.⁶ Supervisory sanctions for failure to meet capital adequacy requirements include directives to the bank to either increase its capital or reduce its assets and off-balance sheet exposures within a period of three months. Additional sanctions include the suspension of branch network expansion and all capital expenditure, suspension of the lending privilege and the suspension of a bank's directors. However, there are no such express sanctions given in case of risk management deficiency.

According to Greuning and Bratanovic (2003), regulators should concentrate on creating an environment in which the quality and effectiveness of risk management can be optimized and should oversee the risk-management process exercised by the boards and management personnel of individual banking institutions. They have pointed out that regulation may either take a prescriptive or market-oriented approach; and that in practice, regulations in most major countries combine both approaches, leaning one way or another, depending on individual circumstances.

A prescriptive approach usually limits the scope of activities of financial institutions and often results in attempts to promulgate regulations for all risks known to the regulators. The danger of such an approach is that regulations quickly become outdated and cannot address the risks stemming from financial innovation. In contrast, a market-oriented regulatory approach is premised on the belief that markets, by definition, function effectively and are capable of managing financial risks and should therefore be allowed to operate as freely as possible. The role of the regulator should be focused on the improvement of risk management. In Zambia, because of the stage of market development which is still in its infancy, the approach taken leans more towards a prescriptive (prudential) approach.

The role of a bank's supervisory authority is moving away from the monitoring of compliance with banking laws and old-style prudential regulations. In this regard, a more appropriate mission statement for supervisory authorities today would be: *"To create a regulatory and legal environment in which the quality and effectiveness of bank risk management can be optimized in order to contribute to a sound and reliable banking system."* (Ibid)

3. Literature analysis on financial innovation and risk management

According to Mathews and Thompson (2008), the term "financial innovation" is an over-used term meant to describe any change in the scale, scope and delivery of financial services. Akhtar (1983) has defined financial innovation as to include new or altered financial instruments as well as issues of securities in money and capital markets and also changes in the market structure and institutions; and goes on to list five broad categories of financial changes which seem to reflect the major long-term trends in the financial systems of industrial countries. These categories are: (1) the increasing use of interest-sensitive funds by banks and other financial institutions; (2) the variable rate lending or borrowing and maturity shortening; (3) the growth of financial markets and of marketable financial instrument; (4) the changing shape of retail banking; and (5) the diversification of sources of financial services.

⁶ Statutory Instrument No. 184 (Capital Adequacy) which can be accessed from: www.boz.zm.

As pointed out by Frame and White (2002), innovation is clearly an important phenomenon of any sector of a modern economy. Successful financial innovation must reduce costs and risks or provide improved services to users. This notwithstanding, certain aspects of financial innovation may pose significant risks which should not be taken lightly. According to Mathews and Thompson (2008), by opening their doors to new products and activities, banks also let in a myriad of new risks associated with this activity. The rapid rate of innovation in the financial sector no doubt calls for an assessment of the efficacy of risk management systems of financial institutions on one hand and devising appropriate regulatory responses to the challenges that financial innovation may pose, on the other. It is important that risk management systems should keep pace with the financial innovations that take place. According to Greuning and Bratanovic (2003), risk rises exponentially with the pace of change, but bankers are slow to adjust their perception of risk. In practical terms, this implies that the market's ability to innovate is in most circumstances greater than its ability to understand and properly accommodate the accompanying risk. (ibid)

Dowd (2005) attributes the emergence of financial risk management as a discipline to the following factors: (1) phenomenal growth in trading activity (2) massive increases in the range of instruments traded and trading volumes over the past two or three decades; (3) the huge growth of financial derivatives activity, and (4) the rapid advance in the state of information technology.

Financial risks are risks mainly relating to the management of a banks' balance sheet; and these have broadly been categorised as credit risk, liquidity risk and interest rate risk. As a result of the introduction of sophisticated products such as derivatives and structured products, banks have also become increasingly exposed to other equally important risks such as market risk and operational risk. In response, risk management systems have also been evolving and as a result of, the current trend has been the integration of the management of the various financial risks. According to Gallati (2003), the concept of total risk management is "the development and implementation of an enterprise-wide risk management system that spans markets, products and processes and requires the successful integration of analytics, management and technology."

Moles (2004) suggest that risk management follows a logical process. At its simplest it involves three steps: an *awareness* of the risks being taken by the firm; *measurement* of the risks to determine their impact and materiality; and *risk adjustment* through the adoption of policies or a course of action to manage or reduce the risks. A major challenge however to any risk management framework is the measurement of risk. As financial products and institutions evolve, the measurement of risk has also become more sophisticated. Accurate measurement of risk is the essential first step for effective risk management (Allen et al, 2004).

Risk measurement has been the subject of many academic studies and a number of models have been advanced. By mid-1990s, Value at Risk (VaR) had already established itself as the dominant measure of financial risk and has been the widely adopted model. The model was extended to cover more types of instruments and the methodology itself was extended to deal with other types of risks such as credit risk, liquidity risk and operational risk (Dowd, 2005).

The benefits of financial risk management cannot be underestimated. This has been highlighted by observations made by Dowd (2005) that: (1) risk management helps to increase the value of the firm in the presence of bankruptcy costs, because it makes bankruptcy less likely; (2) the presence of informational asymmetries means that external finance is more costly than internal finance, and good investment opportunities can be lost. Risk management helps alleviate these problems by reducing the variability of the corporate cash flow; and (3) risk management helps investors achieve a better allocation of risks because the firm would typically have better access to capital markets.

The major attractions for VaR-based risk measurement approaches over traditional risk measurement approaches such as gap analysis, duration-convexity analysis, probability of default and credit expert systems for example are mainly that: (1) VaR provides a common measure of risk across different positions and risk factors (for instance, risk associated with a fixed-income position can be compared to risk associated with an equity position); (2) VaR

can aggregate the risks of sub-positions into an overall measure of portfolio risk and in so doing, take account of the ways in which different risk factors correlate with each other; (3) VaR is holistic in that it takes full account of all driving risk factors whereas many traditional approaches either only look at risk factors one at a time and also focuses assessment on a complete portfolio, often at the firm-wide level; (4) VaR is probabilistic and gives a risk manager useful information on the probabilities associated with specified loss amounts; and (5) VaR is expressed in the simplest and most easily understood unit of measure namely, “lost money” (Ibid).

Despite being a popular risk measurement tool, the VaR has also been heavily criticised, mainly on grounds of the validity of the statistical and other assumptions underlying its use. The most questionable assumption is that of normality (Allen et al, 2004). The normal distribution ignores the fat tail phenomenon of distribution of returns (known as kurtosis risk) which has empirically been proven to exist. Historical analysis of markets shows that returns have fat tails where extreme market movements occur far more frequently than the normal distribution would suggest (Gallati, 2003).

In order to overcome some of the weaknesses of the model, the common practice to any VaR risk measurement model is to combine it with stress testing, as this gives a more comprehensive picture of risk (Ibid). Stress testing is used as a tool by risk managers to understand the firm’s risk profile and to conduct contingent planning in times of market stress and allocation of capital. Stress testing analyses the effect of extreme price movements and tests the capacity of the bank to withstand the impact of plausible but unusual market conditions. Stress tests at the portfolio level are designed, in part, to examine potential vulnerabilities faced by the firm that may not be revealed by quantitative risk management models (Mathews & Thompson, 2008). Stress testing is also a requirement under the Basel Committee’s “Amendment to the Capital Accord to incorporate Market Risks” which was introduced in 1996 and updated in November 2005. Banks that seek to have their capital requirements based on their internal models are required to have in place a rigorous and comprehensive stress testing programme. The stress-testing-based analysis typically proceeds in one of two ways: (1) it examines a series of historical stress events (historical scenarios) and (2) it analyses a list of predetermined stress scenarios (hypothetical scenarios) (Allen et al, 2004).

4. Financial innovation and risk management – a case of the Zambian banking sector

As already pointed out, the current prudential supervisory approach in Zambia has largely been the capital-adequacy approach. Without downplaying the important role that capital plays in fostering financial stability, it is important to note that over-reliance on the quantitative measure of capital has some shortcomings. High levels of regulatory capital cannot be a substitute for proper risk management, but rather adequate capital and effective risk management should complement one another.

The above assertion can be supported by a study undertaken by the Senior Supervisors Group (2008) to assess risk management practices during the recent market distress and turmoil which began in the second half of 2007. The study which involved major financial services organisations noted that the sample organisations and firms entered the turmoil in relatively sound financial conditions and with capital well above regulatory requirements. The study observed that despite having capital well above regulatory requirements which was able to absorb significant losses, the prolonged disruption in market liquidity stressed their liquidity and capital. It also revealed that institutions without proper and adequate risk management systems were not able to recognise on time and mitigate emerging and future risks which could lead to huge losses, thereby threaten their capital reserves and solvency. According to the study, institutions with more comprehensive systems were able to deal more successfully with the turmoil (Ibid). They were able to use developed information

systems to adjust their business strategies, risk management practices and exposures promptly and proactively in response to changing market conditions. In contrast, those institutions that had not established rigorous systems faced significant challenges. It must be understood and appreciated that the issue is not just about having a risk management system in place; but more importantly, that the system in place must be comprehensive, adequate and ideal for the risk profile of the institution. Experience has shown that despite having in place extensive risk management frameworks, the recent market strains can be attributed to gaps in the design or implementation by major institutions. In other cases, overly aggressive risk-taking decisions appear to have been made despite having sound risk-management inputs (Institute of International Finance, 2008)

In making decisions about the amount of capital that they need to hold, banks must be aware of the benefits and costs of doing so. The benefit of holding higher capital is that it reduces the likelihood of bankruptcy, hence secures the investment of the owners of the bank. Holding high capital reserves, however, has a number of limitations or weaknesses. It is costly to maintain higher levels of capital because the higher the level of capital, the lower will be the return on equity for a given return on assets (Mishkin, 2007). According to Allen et al (2004), among other short comings of the BIS capital requirements was the neglect of diversification benefits in measuring a bank's risk exposure. Thus, regulatory capital requirements tended to be higher than economically necessary, thereby undermining commercial bank's competitive position vis-à-vis largely unregulated investment banks. This is true for the Zambian banking sector where some banks, especially those with ineffective risk management frameworks, have very high capital adequacy ratios.

During the 1990s, Zambia experienced a number of bank failures mainly due to weak corporate governance and risk management structures. For example in 1995 alone, the Zambian banking sector experienced a turbulent period with three commercial banks failing. This included the biggest failure in the history of Zambian banking. None of these failures was attributable to capital deficiency. According to the Financial System Supervision 1995 Annual Report, the major causes of the bank failures were attributed to three factors namely; (1) insider abuse by the shareholders and related parties, (2) incompetent management coupled by ineffective Board of Directors; and (3) foreign exchange exposure risk.

The importance of risk management can also be seen from a macro perspective in terms of the overall financial system stability. Financial stability has largely been defined in terms of preconditions and one such definition is that financial stability is said to exist when all financial risks are adequately identified, allocated, priced and managed (Orr, 2006).

The analysis below, based on a case of a Zambian bank, further illustrates that institutions without proper and adequate risk management systems are not able to recognise on time and mitigate emerging and future risks which could lead to huge losses, thereby threatening their capital reserves and solvency. The adequacy of a bank's regulatory capital should therefore, be premised on a sound risk management framework.

Illustration: scenario from the Zambian banking sector

According to published financial statements of one bank in Zambia, its overall financial performance and condition has been marginal over the last three years, in particular its earnings performance and profitability. Its profitability has been fluctuating between losses and marginal profits during this period. The poor performance has been attributed mainly to lack of a robust risk control and management framework. During the period 2005–2007, the bank invested in lending structures that were more risky than anticipated. The bank, whose balance sheet had been dominated by investments in government securities, grew its loan book without having in place an effective credit monitoring and appraisal system to assist in monitoring and evaluating its credit risk. This resulted in a large non-performing loan portfolio, warranting for high loan loss provisions which impacted negatively on the profitability of the bank.

Further, the bank's balance sheet has not been well managed, especially the liabilities side. Consequently, the bank relies heavily on expensive deposit liabilities and borrowings from

the inter-bank market to meet its liquidity needs. This has resulted in high interest expenses which have affected the bank's profitability. Despite these weaknesses, the bank maintains high capital reserves. For instance, as at 30 June 2008, the bank had US\$10,181 million in excess of its minimum capital requirement of US\$4,975 million. The bank's capital adequacy ratios were 21.3% for primary capital and 30.5% for total regulatory. Both ratios were way above the prudential regulatory requirement of 5% and 10%, respectively.

This example is consistent with the study findings of the Senior Supervisors Group that institutions that had weaker controls over their potential balance sheet growth and liquidity tended to have greater problems during times of turmoil.

Empirical Study done

The Bank of Zambia risk management survey which was conducted in August 2005 as a precursor to the issuance of the Risk Management Guidelines in 2007 revealed that a number of banks did not have a comprehensive approach to risk management. Further, these banks did not have adequate risk management policies and procedures and lacked the requisite expertise to develop and implement the desired risk management practices. This is a clear indication that risk management systems have not kept pace with the financial innovations that have taken place.

For purposes of this paper, the thirteen banks⁷ in the industry surveyed have been grouped into two categories; Category 1 banks and Category 2 banks. Category 1 banks comprises four banks with superior risk management systems while Category 2 banks is the remainder of the nine banks with weak or poor risk management systems.

Table 1 below summarizes responses to some of the key areas of the questionnaire, while Table 2 gives a summary of the variability in the annualized monthly return on assets and capital adequacy ratios for the Category 1 and Category 2 banks, for the thirty six months period from January 2005 to December 2007.

Table 1 reveals that out of the 13 banks, only four were using an advanced risk measurement tool, the Value at Risk model and three of these banks were also using the Earnings at Risk model. These four banks belonged to Category 1.

Table 2
Summary responses of the risk management survey

Questions	Responses		Total
	Yes	No	
1. Does your institution have a comprehensive risk management framework (RMF)?	7	6	13
2. Does your institution have an independent Risk Review Function?	11	2	13
3. What tools do you use to assess the significance of your identified risks?			
(a) Value at Risk	4	9	13
(b) Earnings at Risk	3	10	13
(c) Basic measures	3	10	13
(d) No metric currently used	6	7	13

⁷ This was at the time of the study in 2005.

Table 2 (cont)

Summary responses of the risk management survey

Questions	Responses		Total
	Yes	No	
4. What are your potential barriers to implementing your RMF activities for maximum benefit?			
(a) Lack of appropriate technology	12	1	13
(b) Lack of tools	6	7	13
(b) Cost	5	8	13

Source: Bank of Zambia Risk Management Survey 2007.

The subsidiaries of some foreign banks have benefited from their parent networks in terms of superior risk measurement and management systems. Although the indigenous banks, comprised of small-to-medium sized banks, have also been expanding rapidly both in terms of asset size and product offering, their risk management systems have remained embryonic. As has been pointed out in various studies, rapid growth not commensurate with improvements in risk management systems can pose a threat not only to the solvency of these institutions but also to financial system stability. The combined size of these small-to-medium sized banks is significant and therefore poses systemic risk. This is despite the fact that overall, this category of banks has high levels of excess regulatory capital compared to the Category 1 banks.

From *Table 2* below, we note that the average return on assets (ROA) for Category 1 banks was slightly higher than that of Category 2 banks. Further, the variability⁸ in the ROA was slightly lower for Category 1 banks than that for Category 2 banks. In terms of the capital adequacy ratio (CAR) however, Category 2 banks, on average, had a higher CAR and the variability in the CAR was twice as high as that for Category 1 banks.

The results indicate that Category 1 banks with more superior risk management systems, on average, earned a higher return on assets and were better able to manage the variability in the ROA and CAR.

Table 3

Empirical Study Results

Statistic	Return on Assets		Capital Adequacy Ratios	
	Category 1 Banks	Category 2 Banks	Category 1 Banks	Category 2 Banks
Mean	4.3	4.1	20.0	28.5
Median	4.0	3.3	19.5	28.5
Std. Deviation	2.4	2.6	2.9	6.2
Minimum	0.8	-0.1	16.4	19.7
Maximum	12.0	10.2	25.7	41.2

Source: Bank of Zambia/Own Computations.

⁸ Variability is the standard deviation measure of risk. All other things being equal, the higher the deviation, the higher the risk.

Conclusion

The paper concludes that the Zambian banking sector should draw lessons from the recent global market turmoil which has demonstrated that weak and ineffective risk management systems of financial institutions contributed to their incurring of huge losses. From this perspective, it is therefore, important that all banks in Zambia fully embrace modern risk measurement and management systems.

Banks must also formulate forward looking risk measurement systems and sound practices for managing risks, particularly in times of rapid growth in new products or markets. This is because as pressure mounts up on banks to increase their market share, combined with unrealistic expectations about growth and performance prospects, they fail to adhere even to the basic risk management principles. It is obvious that bankers themselves will be unfamiliar with a new product and therefore will have less or no experience in evaluating the risks that come with it. As new products and transactions emerge or take on new characteristics, different or heightened levels of risk also emerge over time.

Consequently, if not well recognised in advance, possible risks may remain hidden during the normal times and may only manifest during times of stress and may result in devastating effects on the financial condition of the institution.

Further, as pointed out in the paper, capital requirements and adequate risk management systems should not be treated separately, but rather as complimentary. High levels of regulatory capital cannot be a substitute for proper risk management, but rather adequate capital and effective risk management must be complementary. Banks must therefore, establish a good link between their risk exposures and capital.

The challenges that financial innovation poses for public policy and the regulatory framework in ensuring financial stability are enormous and cannot be over-looked. The supervisory approach must therefore, take account of the benefits as well as the risks that accompany financial innovation and the appropriateness of regulatory responses. From a central banker's point of view, the objective of ensuring financial stability remains critical. In light of the evolving financial landscape, financial stability can be said to be dependent on the adequacy of risk management and control systems by market participants, on one hand, and appropriate supervisory responses by the regulator, on the other hand. It is therefore imperative for the Bank of Zambia that as regulator to take a more proactive role, using a combination of both the prescriptive and market-oriented approach, in laying a strong foundation in the proper practice of risk management systems by banks in Zambia. The Bank of Zambia must be seen to be taking a continuous and leading role in providing leadership in research on the latest developments in the field of financial innovation and risk management.

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Changes in investors' risk appetite – an assessment of financial integration and interdependence¹

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1. Introduction

Investors' attitude towards risk has increasingly been cited as a key factor driving the movement in asset prices. A systematic shift in investors' attitude towards risk, or a decline in investors' risk appetite, may cause correlation among prices of different financial assets, thus undermining financial stability and heightening the risk of financial contagion. Therefore, it is important to central banks to have the necessary tools that allow the policy makers to track the dynamics of investors' risk appetite and understand the possible linkages between risk appetites across different markets. However, in recent studies, the focus is mainly on developing indicators to measure the risk appetite and showing the coincidence between episodes of financial turmoil in individual countries and abrupt declines in market sentiment from risk seeking to risk avoidance.⁵

This paper contributes to the literature by applying the risk appetite measure to central banks' monitoring work in two aspects. First, it investigates whether changes in the risk appetite are correlated among different economies (the United States (US), the United Kingdom (UK), Germany, Japan and Hong Kong SAR (HK SAR) in this paper) and provides a measure of financial integration between them. Second, by examining the degree of co-movement between the risk appetite measures and the stock and bond market performance, it sheds the light on the interdependence between the stock and bond markets in these economies, which may give rise to possible contagion risk during financial market turmoil.

The remainder of this paper is organised as follows. In Section II, we provide a brief discussion on how we derive the risk appetite measures for the five economies. In this study, the derivation of the risk appetite measures is based on the methodology recently proposed by Gai and Vause (2006). Section III reviews the issues related to financial integration and provides the various integration indicators used in this study. The estimation results of the integration indicators and the empirical evidence of financial market interdependence based on dynamic conditional correlations are presented in Section IV. Section V is a summary and conclusion.

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⁵ A survey of risk appetite indicators can be found in Illing and Aaron (2005).

2. Measure of investors' risk appetite

The degree of investors' risk appetite can not be observed directly in the market. In the literature, there are different market-based and theory-based risk appetite measures proposed by financial institutions, central banks as well as international organisations for monitoring purposes.⁶ In this study, we utilise the methodology recently developed by Gai and Vause (2006) to derive the risk appetite measure which has its origin from the basic pricing equation in the asset pricing theory.⁷ While the analysis of asset pricing shows that risky assets can be priced by evaluating the expectation of discounted payoffs in terms of investors' subjective probabilities about various states of the world, risk-free asset can be equivalently determined by discounting payoffs using the risk-free rate and evaluating expectations based on a set of risk-neutral probabilities. In their paper, Gai and Vause show that the measure of risk appetite can be determined once the subjective and the risk-neutral probability density functions over future asset returns are estimated.

This study follows Gai and Vause's method and estimates the investor's subjective and the risk-neutral probability density (RND) functions over future asset returns, in this case the stock market returns. The underlying stock market indices of the five economies where investors' risk appetite measures are derived are:

Economy	Benchmark stock market index
The United States	S&P 500 Index
The United Kingdom	FTSE 100 Index
Germany	DAX 30 Index
Japan	Nikkei 225 Stock Average
Hong Kong SAR	Hang Seng Index

The benchmark stock market indices are taken from CEIC. Historical S&P 500 Index Option data are provided by the Chicago Board Options Exchange (CBOE), while the index option data of other stock market indices are taken from Bloomberg. For each underlying stock market index, seven spot month contracts are considered for the RND estimation. These seven contracts have strike prices at the current index level and at three strike intervals above and below the current index level.⁸ The risk-free interest rate used in the RND

⁶ Examples of risk appetite measures include the JPMorgan Liquidity, Credit and Volatility Index (LCVI), the Merrill Lynch Financial Stress Index, the State Street's Investor Confidence Index, the Credit Suisse First Boston Risk Appetite Index, the Goldman Sachs Risk Aversion Index, the Chicago Board Options Exchange Volatility Index (VIX), the Kumar and Persaud (2002) Global Risk Appetite Index (GRAI) used by the IMF, the Tarashev et al. (2003) Risk Appetite Index used by the BIS, and the Gai and Vause (2006) Risk Appetite Index used by the Bank of England and the HKMA. Illing and Aaron (2005) provide a brief survey of these risk appetite measures.

⁷ The approach by Gai and Vause (2006) has some advantages over other alternative measures. For instance, the index developed by Gai and Vause is easier to interpret than the JPMorgan LCVI because of the latter's ad hoc methodology to aggregate different financial risks.

⁸ The strike interval is different for different stock market index options. It is 5 index points for the S&P 500 Index Option, 25 index points for the FT100 Index Option, 50 index points for the DAX 30 Index Option, 500 index points for the Nikkei 225 Stock Average index Option, and 200 index points for the Hang Seng Index Option.

estimation is the one-month interbank rate of the respective economy.⁹

According to Gai and Vause (2006), the unit price of risk (λ_t) at time t can be derived as:

$$\lambda_t = \frac{1}{R_{t+1}^f} \text{var}\left(\frac{f_{t+1}^*(s)}{f_{t+1}(s)}\right)$$

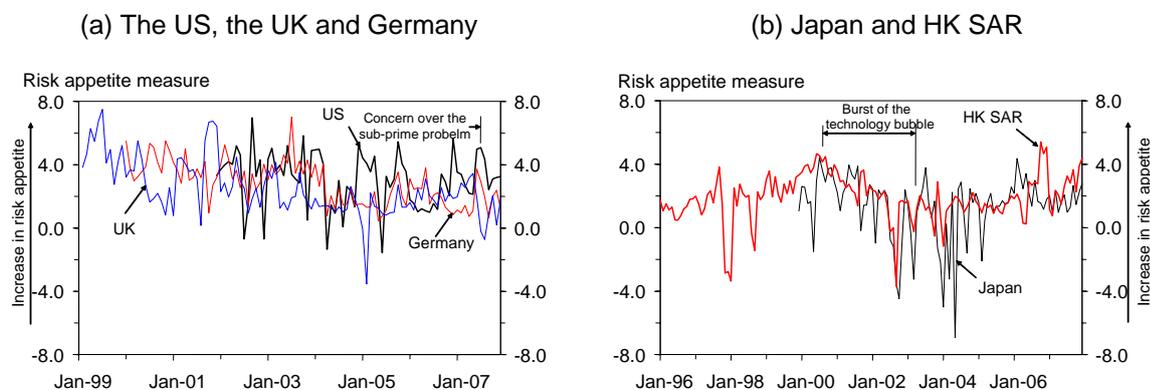
where R_t^f is the gross risk-free rate of return at time t , $f_t^*(s)$ is the RND of the asset price s at time t , $f_t(s)$ is the subjective history implied density function of the asset price s at time t , and $\text{var}(\cdot)$ is the variance operator. The unit price of risk λ is the expected excess return that investors require to hold each unit of risk of an asset in equilibrium. Risk appetite, which is the willingness of investors to bear risk, can therefore be defined as the natural logarithm of the inverse of λ .

In this study, similar to Gai and Vause, the subjective probability distribution of future asset returns is derived from the GARCH (1,1) model, while the risk-neutral density function is estimated by option prices using the two-lognormal mixture models. Full details of the estimation methodology are given in Appendix I.

Figure 1 shows the movements of the derived risk appetite measures for investors in the stock markets of the US, the UK, Germany (Figure 1a), Japan and HK SAR (Figure 1b) from their earliest data available up to December 2007.¹⁰ Higher values of this measure are interpreted as an indication of higher risk appetite (higher investor tolerance of risk) for investors.

Figure 1

Risk appetite measures of different stock markets



Source: HKMA staff estimates.

⁹ For the US, it is the US dollar London Interbank Offered Rate (LIBOR). The British Pound LIBOR for the UK, the Frankfurt Interbank Offered Rate for Germany, the Tokyo Interbank Offered Rate for Japan and the Hong Kong Interbank Offered Rate for HK SAR. Data are taken from Bloomberg.

¹⁰ The starting dates of the risk appetite measures vary due to the availability of index option data. The risk appetite measure for the US starts from December 2001. It is February 1999 for the UK, January 2000 for Germany, December 1999 for Japan and January 1996 for HK SAR.

Similar to the observation by Illing and Aaron (2005), the risk appetite measures in the two graphs in Figure 1 are quite volatile. Despite this, they generally conform to the asset price swings in recent episodes of extreme market sentiment. For example, in the case of the US in Figure 1a, the risk appetite measure declined when the sub-prime problem and the subsequent credit crunch emerged in July-August 2007. In the case of HK SAR in Figure 1b, the risk appetite measure dropped abruptly to a low level during the period between October 1997 and January 1998 amid the speculative attack against the HK SAR dollar resulting in great financial market distress. The burst of the “technology bubble” in mid-2000 and the subsequent bear market until the end of 2002 coincided with the gradual decline of the risk appetite measure. The bull run in the HK SAR stock market starting from the second half of 2006 was also reflected in the sharp rise of the measure.

In the analyses that follow, we investigate the financial market integration and contagion issues through the examination of the risk appetite measures and their interactions with the stock and bond markets.¹¹

3. Financial integration and integration indicators

There is, in general, no universal definition of financial integration. Financial openness, free movement of capital and integration of financial services are part of a broad range of definition frequently cited in the literature.¹² One commonly used definition of financial integration is that financial markets are said to be integrated when the law of one price holds. Korajczyk (1995) notes that if markets are financially integrated, the price of risk should be the same across markets. Since the Gai and Vause’s measure of risk appetite is defined as the inverse of the price of risk, we make use of their measure and study the issue of financial integration by investigating whether investors’ willingness to bear risk is the same across different markets.

For monitoring purposes, it is desirable for policy makers to have indicators that are frequently available. In this study, we use monthly data to construct several indicators to measure different dimensions of market integration in the five stock markets (namely the US, the UK, Germany, Japan and HK SAR), including

1. cross-market dispersion and correlation;
2. the component factors based on the principal component analysis;
3. time-varying β estimated via Haldane and Hall (1991) Kalman filter method; and
4. dynamic conditional correlation.¹³

These indicators are mainly model-based and provide high frequency measures for regular monitoring purposes (see Table 1 below for a summary of the integration indicators in this study). Detailed discussions on the methodologies of constructing these indicators and their interpretation are presented in Appendix II. Given that the construction of these indicators is

¹¹ The examination is based on both the changes of these measures and also the levels when it is appropriate.

¹² In some studies, regulatory and institutional factors such as the relaxation of capital controls, financial liberalisation, prudential regulations, efficiency of the legal systems and the standardisation of market framework are also cited as measures of financial integration. These measures, however, are less popular than price-based measures in a regular monitoring framework as they are not timely available.

¹³ Changes in risk appetite are used for the derivation of the cross-market dispersion and correlation, the Haldane and Hall (1991) Kalman filter indicator and the dynamic conditional correlation, while both levels and changes are used respectively in the principal component analysis.

subject to technical limitations and modelling assumptions, as well as the rather short data sample available, these indicators should be interpreted with caution and taken as indicative but not conclusive evidences on the general trend of the integration process.

Table 1
Summary of integration indicators

Method	Indicator	Indication of market integration
Cross-market dispersion and correlation	Hodrick-Prescott filtered dispersion and correlation	Falling dispersion and high level of positive correlation imply higher convergence and larger co-movement
Principal component analysis	The factors derived from the principal component analysis	The identification of a small number of common factors which are able to explain a high proportion of total variance among the risk appetite measures
Haldane and Hall (1991) Kalman filter method	Time-varying β estimated via Kalman filter	Average β moving towards zero indicates an increasing sensitivity to regional influence
Dynamic conditional correlation (DCC) model	Time-varying correlation estimated from the DCC model	The higher the correlation, the larger the co-movement between markets is

4. Estimation results

4.1 Integration indicators and financial integration

The risk appetite measures of investors in the stock markets of the US, the UK, Germany, Japan and HK SAR, as shown in Figure 1, are used to examine the financial integration between these stock markets. This is done by looking at whether investor sentiment (as indicated by these risk appetite measures) spreads over national boundaries.

As a preview, Tables 2 and 3 provide the simple cross-market correlation coefficients between these risk appetite measures in their levels and their changes respectively.

Table 2
Cross-market correlation matrix of risk appetite measures

(a) Common sample (December 2001 to December 2007)

	US	UK	Germany	Japan	HK SAR
US	1.000	0.002	0.272*	-0.155	-0.103
UK		1.000	0.277*	0.102	-0.047
Germany			1.000	-0.099	-0.279*
Japan				1.000	0.385*
HK SAR					1.000

Table 2 (cont)

Cross-market correlation matrix of risk appetite measures

(b) Pair-wise bilateral sample

	US	UK	Germany	Japan	HK SAR
US	1.000	0.002	0.272*	-0.155	-0.103
UK		1.000	0.219*	0.068	0.188
Germany			1.000	0.090	0.047
Japan				1.000	0.421*
HK SAR					1.000

* indicates significance at the 5% confidence level.

Source: HKMA staff estimates.

Table 2 shows that in their levels, the cross-market correlation coefficients range from -0.28 to 0.42. Less than half of the cross-market correlation coefficients are statistically different from zero, suggesting a very limited co-movement between these risk appetite measures. The pair of risk appetite measures that has the highest (positive) correlation coefficient is Japan and HK SAR at 0.385 (common sample) and 0.421 (pair-wise bilateral sample), while the correlation coefficients between the US and Germany as well as the UK and Germany are around 0.2 and 0.3.

Table 3

Cross-market correlation matrix of risk appetite measures

(a) Common sample (January 2002 to December 2007)

	US	UK	Germany	Japan	HK SAR
US	1.000	-0.054	0.127	-0.116	-0.219
UK		1.000	0.124	0.027	-0.067
Germany			1.000	-0.177	-0.207
Japan				1.000	0.128
HK SAR					1.000

(b) Pair-wise bilateral sample

	US	UK	Germany	Japan	HK SAR
US	1.000	-0.054	0.127	-0.116	-0.219
UK		1.000	0.070	-0.096	0.058
Germany			1.000	-0.166	-0.188
Japan				1.000	0.093
HK SAR					1.000

Source: HKMA staff estimates.

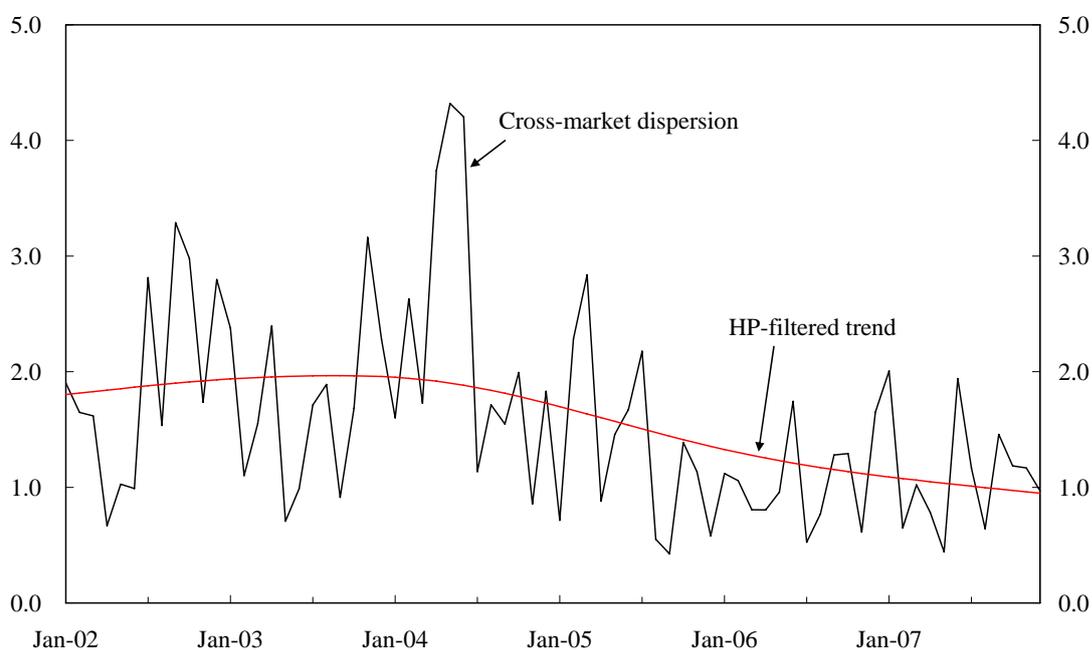
For the changes in their risk appetites, the co-movement is even smaller. The correlation coefficients range from -0.22 to 0.13 and none of them is statistically different from zero, suggesting that there is little connection between the changes in risk appetite among these economies.

4.1.1 Cross-market dispersion and correlation

The cross-market dispersion approach suggests a sense of convergence between the changes in the risk appetite measures if their discrepancy is falling and becoming small. The series of dispersion is filtered using the Hodrick-Prescott (HP) smoothing technique to reveal the long-term trend component of the series.

Figure 2

Cross-market dispersion indicator

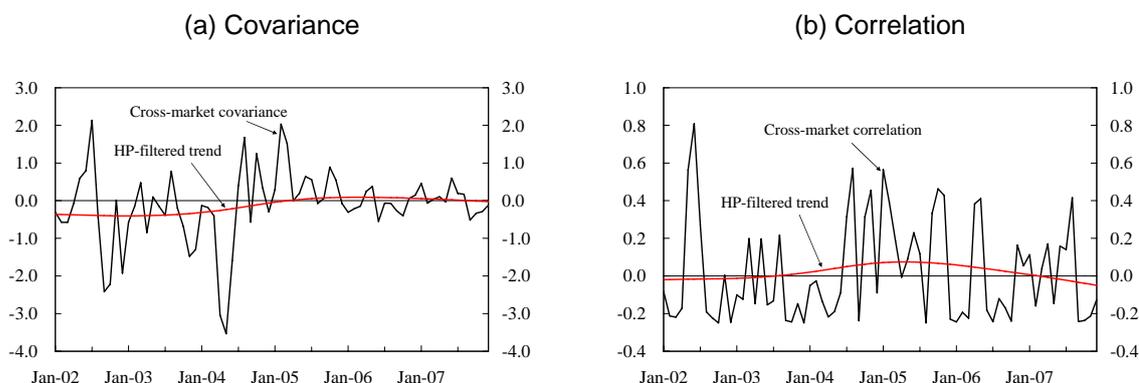


Source: HKMA staff estimates.

Figure 2 shows that the dispersion depicts a gradual decline since mid-2004, suggesting that the variation between the changes in the risk appetite measures has narrowed and some kind of convergence process may have taken place but then stalled since mid-2006. As the dispersion indicator does not provide any indication of co-movement, Figure 3 illustrates the cross-market covariance and correlation.

Figure 3

Cross-market covariance and correlation of the changes in the risk appetite measures



Source: HKMA staff estimates.

The cross-market correlation is defined as the ratio of cross-market covariance to the square of cross-market dispersion. An increase in the correlation can stem either from an increase in the covariance or from a reduction in the dispersion. The cross-market correlation as shown in Figure 3b varies and ranges from -0.25 to 0.81. From the HP filtered trend line, it is shown that the only significant positive correlation was around late 2004 to early 2006 (which coincides with the gradual decline in the dispersion and the increase in covariance). The cross-market correlation was slightly negative by the end of 2007. Judging from the cross-market dispersion and the correlation of the risk appetite measures, even though the dispersion indicator has narrowed, it has stalled since mid-2006. With the low level of cross-market correlation, the extent of market integration between these five stock markets is not apparent.

4.1.2 Principal component analysis

The main objective of principal component analysis (PCA) is to find a small number of factors that can explain most of the variation in the original data series. In many studies, the PCA has been used regularly as one of the tools for the identification of a common factor among different risk measures. For instance, with a set of eight risk premia on corporate bond spreads and swap spreads of the euro area, the US and emerging markets, Coudert and Gex (2006) are able to derive the first component factor which explains 68% of the common variation of these risk premia. With the risk aversion indicators of the US, the UK and Germany, Tarashev et al. (2003) derive the first principal component which accounts for 80% of the overall variation in its constituent series. This is interpreted as a common factor driving the dynamics of the three risk aversion indicators. In this section, the risk appetite measures of the five stock markets in both their levels and changes are used in the PCA to extract a list of common factors.¹⁴ Table 4 reports the PCA result based on the level.

¹⁴ The PCA is conducted after mean centering the original risk appetite measures, either in their levels or changes. For the definition of mean centering and other details, please refer to Appendix II.

Table 4
Principal component analysis result
 (based on the levels)

Eigenvalue	Value	Proportion of variance explained
1	1.424	0.285
2	1.183	0.237
3	0.939	0.188
4	0.789	0.158
5	0.664	0.133

Each eigenvalue represents the proportion of variance accounted for by the corresponding principal component (PC). Normally, the first principal component accounts for as much of the variability in the data as possible, and each succeeding component accounts for as much of the remaining variability as possible.

Source: HKMA staff estimates.

Two criteria are used to choose the number of principal components in this analysis. The Kaiser (1960) criterion keeps those principal components with their corresponding eigenvalues greater than one. The Joliffe (1972) criterion discards those remaining principal components once the percentage of explained variance reaches a certain threshold (for example 80%). The result shown in Table 4 indicates that the first two principal components, PC1 and PC2, satisfy the Kaiser criterion as their corresponding eigenvalues are greater than one. However, these two PCs account for only 52.2% of the variability in the data, with the PC1 explaining a mere 28.5% of the common variation. Based on the Joliffe criterion, it takes a total of four PCs against the five risk appetite measures in order to account for about 87% of the total variance of these measures.¹⁵ These findings seem to suggest that there does not exist one common factor that drives these risk appetite measures.

The systematic shift in investors' risk appetite across financial markets can also be assessed by how the changes in the risk appetite measures are correlated. Table 5 reports the PCA result based on the changes in the risk appetite measures in the five economies.

¹⁵ If the underlying series are highly correlated, normally it takes only a few component factors to explain a large bulk (for example 80%) of the total variance, and the first component factor, which is generally interpreted as the common factor of the underlying series, usually constitutes the largest proportion (60% to 70%) of the common variation.

Table 5

Principal component analysis result
(based on the changes in the risk appetite measures)

Eigenvalue	Value	Proportion of variance explained
1	1.314	0.263
2	1.058	0.212
3	1.036	0.207
4	0.827	0.165
5	0.765	0.153

Each eigenvalue represents the proportion of variance accounted for by the corresponding principal component (PC). Normally, the first principal component accounts for as much of the variability in the data as possible, and each succeeding component accounts for as much of the remaining variability as possible.

Source: HKMA staff estimates.

Based on the Kaiser criterion, the first three PCs are chosen as their corresponding eigenvalues are greater than one. Nevertheless, these three PCs account for less than 70% of the total variance, with the first PC explaining only 26.3% of the variability of the original data. In terms of the Jolliffe criterion, a total of four PCs is needed to reach the threshold of 80% explained variability. Therefore, similar to the results based on the level measure, there does not exist any significant factor driving the changes in the risk appetites in these economies.

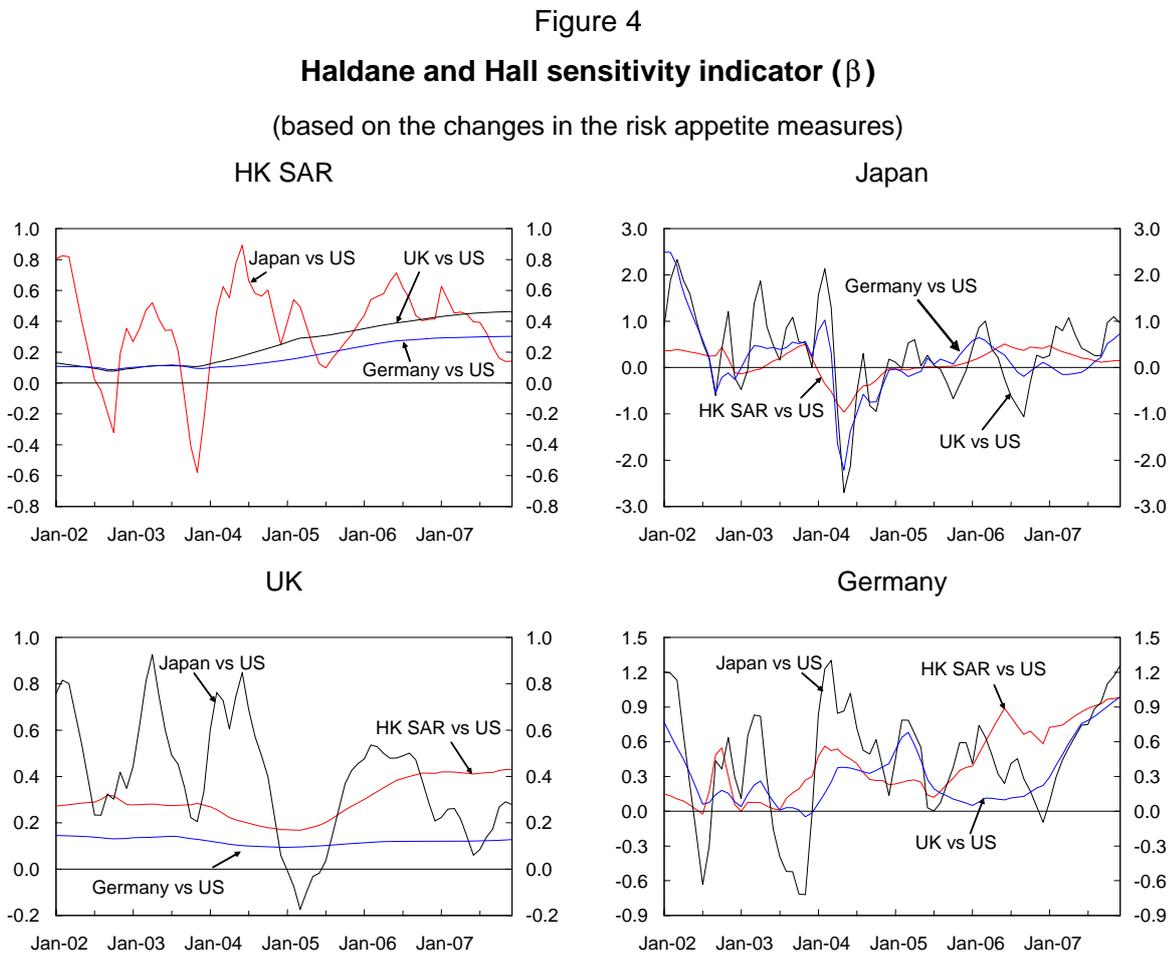
From the above PCA, the dynamics of the risk appetite measures, either in levels or changes, are likely to be driven by more than one factor. As a result, the five stock markets together are hardly integrated.¹⁶

4.1.3 Haldane and Hall (1991) Kalman filter method

For this indicator, we take the changes in the US's risk appetite measure as the dominant source. Based on the signal equation of Equation (A10) in Appendix II, the estimated β measures the sensitivity of an individual economy's risk appetite changes to that in the US relative to that in another economy. An economy's risk appetite changes which are more sensitive to the changes in the risk appetite in the US will show β s trending close to one, a sign interpreted as a convergence (or integration) with the US market. A tendency for β to approach towards zero suggests a convergence with another market. Negative values of β or β s greater than one suggest that the market drifts away from the US and the other

¹⁶ It is noted that Tarashev et al. (2003) obtain the first principal component which accounts for 80% of the overall variation in its three risk aversion indicators of the US, the UK and Germany. To examine whether this is still true in recent years, we also apply the PCA on the risk appetites of these three economies using our risk appetite measures. The new PCA results show that the first principal component only accounts for 44% of the common variation in the three risk appetite measures in their levels and 38% in their changes respectively. The new results suggest that there is only a weak common factor driving the dynamics of the risk appetite measures in these three economies.

markets. Figure 4 shows the patterns of the β estimates for each of the market other than the US.



A tendency for β to approach towards one suggests a convergence with the US's risk appetite change.

Source: HKMA staff estimates.

From Figure 4, in the case of HK SAR, its β estimates are found to be more sensitive to the changes in the risk appetite measures of the UK and Germany, as the respective β estimates were closer to zero (around 0.1) than one in the period between January 2002 and September 2003. They began to trend upward in 2004, suggesting an increase in the sensitivity of the changes in HK SAR's risk appetite to the US's changes. The β estimates varied with respect to Japan and the US. But since 2007, the sensitivity to the change in Japanese risk appetite had increased. Such results appear to suggest an increased influence from Japan and a gradual decline in the sensitivity with the UK and Germany. The situation is very much the same in Japan, where the influence from the UK and Germany had completely been dominated by that from the US, while the sensitivity to that of HK SAR had also increased since 2007. For the UK, the pattern of its β estimates indicates that it had been consistently more sensitive to that from Germany than from the US. While its sensitivity to that of HK SAR had declined, influence from Japan had picked up. Finally, for Germany, its β estimates for the past two years pointed to an increased sensitivity to that of the US, as the β estimates trended towards one. The overall results from the Haldane and Hall

approach suggest some sorts of market segmentation between the five stock markets. While the risk appetite measures of HK SAR and Japan in their changes are very sensitive to each other, the influence of the US on them has been increasing. The German's risk appetite changes are highly influenced by that of the US, while that of the UK is closer to the German's. As the convergence processes from these four markets (with the US as the major source of influence) did not point to any particular market as a dominant factor, these five markets are not highly integrated.

4.1.4 *Dynamic conditional correlation (DCC)*

A GARCH(1,1)-DCC model using a two-step estimation procedure as outlined in Appendix II is estimated with monthly changes in their risk appetite measures. Basically, higher and positive correlation between the changes in the risk appetite measures implies higher co-movement and greater integration between the markets. Table 6 highlights the average pair-wise dynamic conditional correlation between the changes in these risk appetite measures.

Table 6
Average pair-wise conditional correlation
(based on the changes in the risk appetite measures)

	US	UK	Germany	Japan	HK SAR
US	1.000	-0.078	0.140	-0.030	-0.100
UK		1.000	0.138	-0.058	-0.076
Germany			1.000	-0.111	-0.181
Japan				1.000	0.167
HK SAR					1.000

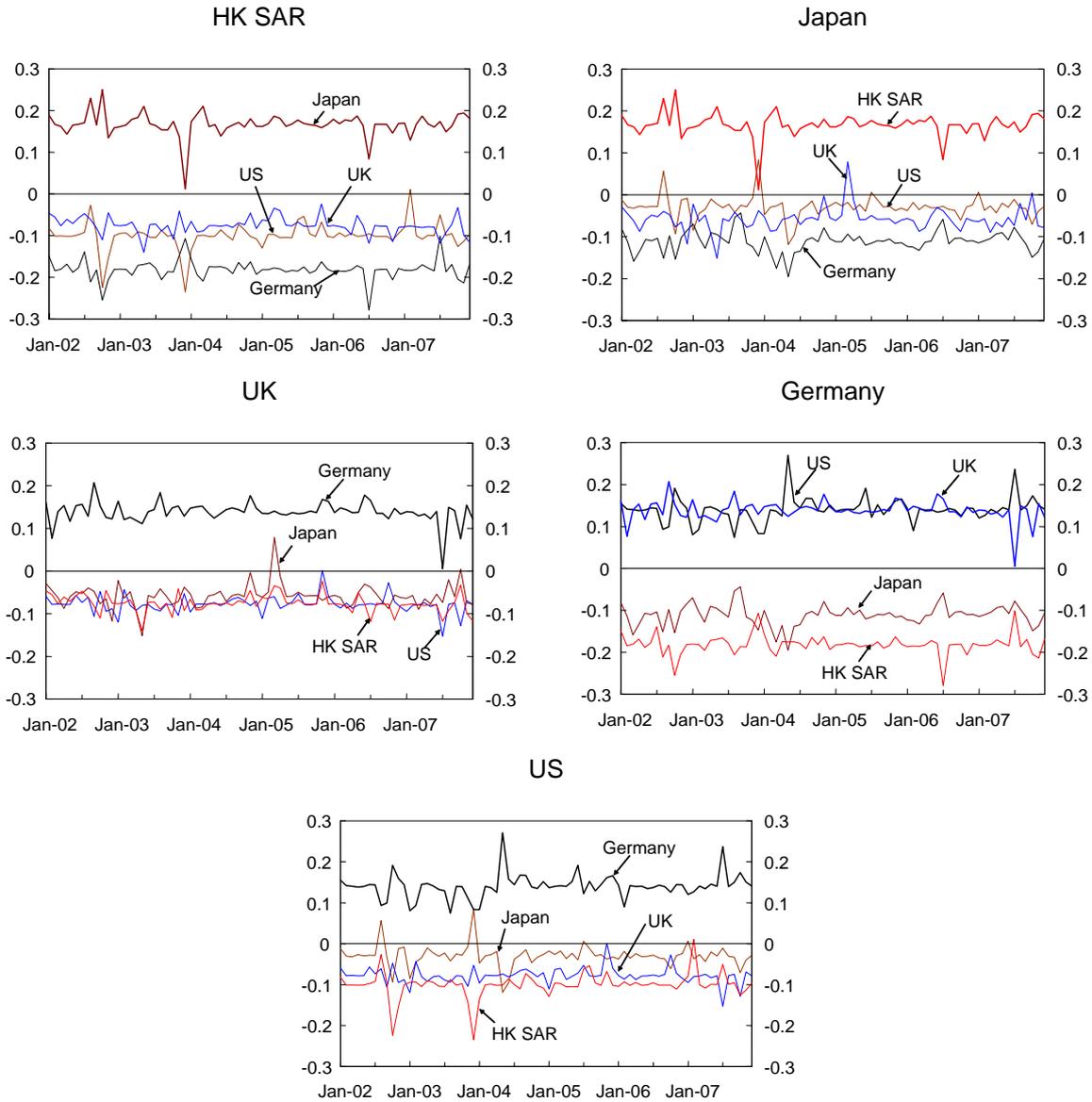
Source: HKMA staff estimates.

The table shows that, in general, the co-movements between the changes in the risk appetite measures are not high with their conditional correlations ranging from -0.030 to 0.167 only. Of the ten pair-wise risk appetite measures, only three pairs are positively correlated. The result is similar to that reported in Table 2 based on simple correlation. The three positively-correlated pairs are HK SAR – Japan, US – Germany and UK – Germany. Again, the results coincide with the findings from the Haldane and Hall approach which show that the changes in HK SAR risk appetite is highly sensitive to that of Japan, the German market is more influenced by the US market and the change in the UK risk appetite is closer to that of Germany. Figure 5 shows the time-varying conditional correlations between the five risk appetite measures.

Figure 5

DCCs of risk appetite measures

(based on the changes in the risk appetite measures)



Source: HKMA staff estimates.

From the graphs in Figure 5, the conditional correlations are in general smooth with only occasional spikes. For those economies with their changes in the risk appetite positively correlated, their conditional correlations are low and less than 0.3. Given that the conditional correlations are at a low level with only three pairs of the risk appetite measures are positively correlated, and their conditional correlations are not even increasing, the five financial markets do not appear to be integrated.

Overall, our four integration indicators suggest a limited degree of integration between the stock markets in the US, the UK, Germany, Japan and HK SAR. The only encouraging sign is from the dispersion indicator which shows a gradual declining trend in the discrepancy but the process appears to be stalled since mid-2006. Even if the risk appetites in these markets are not equal, it is still possible that a shift in investors' risk appetite in one particular

economy has an influence on other economies' financial markets because of the participation of international investors in their domestic markets. The next section investigates the interdependence between financial markets arising from changes in investors' risk appetite.

4.2 Financial market interdependence

Apart from examining the issue of financial integration, the risk appetites in the five economies are also used to assess the interdependence between financial markets. This is done by examining the co-movement between these risk appetite measures and the performance in the stock and bond markets using the dynamic conditional correlation method (DCC). In the analysis that follows, for the stock market the DCC is conducted in terms of the changes in the risk appetite measures and the stock market returns. In general, one would expect a positive relationship (positive DCC) between the changes in the risk appetite measures and the stock market returns. Hence, an increase (decrease) in investors' risk appetite is associated with a rise (fall) in the stock market. For the bond market, the DCC is related to the risk appetite levels and the benchmark bond yields of different maturities. The "flight-to-quality" phenomenon of the bond market suggests a positive relationship (positive DCC) between the risk appetite levels and the bond yields. For instance, if investors become more risk averse (their risk appetites fall), they seek a "safe haven" by investing in the bond markets, thus bidding up bond prices and leading to a fall in bond yields. In addition to the intra-economy co-movement between an individual economy's risk appetite measure and its stock and bond markets, we are also interested in the inter-economy spillover effect across another economy's stock and bond markets. Such an analysis should provide insight on the possible contagion risk arising from a systemic shift in investors' risk appetite. We must emphasise that the analyses are not examining the causal relationship or the transmission mechanism between risk appetite changes (level) and stock (bond) market performance, but simply looking into their co-movement and correlation.

Table 7 shows the average conditional correlations between the changes in the risk appetite measures and the monthly return of the stock market benchmark indices.¹⁷

		Stock market				
		US	UK	Germany	Japan	HK SAR
Risk appetite	US	0.031	-0.058	-0.011	0.137	0.047
	UK	-0.119	-0.160	-0.190	-0.020	-0.117
	Germany	-0.235	-0.181	-0.253	-0.076	-0.099
	Japan	0.176	0.242	0.317	0.146	0.077
	HK SAR	0.175	0.244	0.264	-0.024	0.128

Source: HKMA staff estimates.

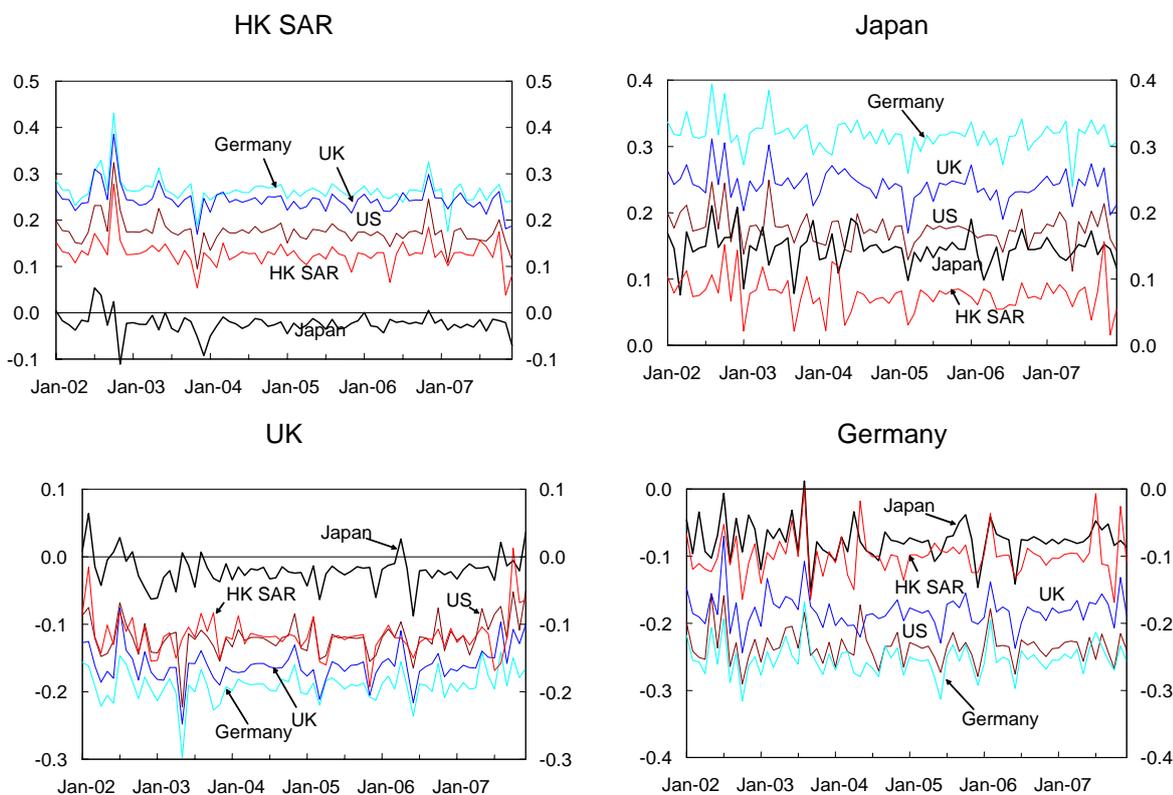
¹⁷ The monthly return of the stock market is calculated as the log difference of the stock market benchmark index.

The diagonal elements in the table show the intra-economy conditional correlation between the changes in the risk appetite measures and the stock market return. It is shown that for the US, Japan and HK SAR, the intra-economy conditional correlations are positive, while for the UK and Germany, they are negative. Thus, the conventional intuition that an increase (decrease) in investors' risk appetite is associated with a rise (fall) in the stock market can be applied to the stock markets in the US, Japan and HK SAR, but not to those in the UK and Germany.

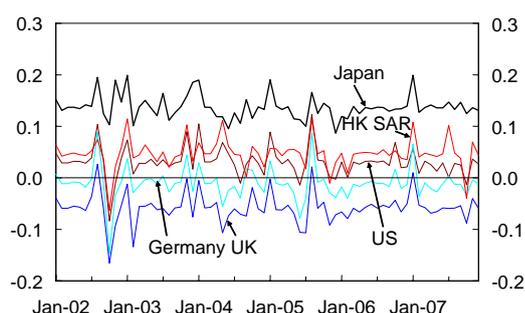
The results from inter-economy conditional correlations (the off-diagonal elements) are more revealing. It is shown that the changes in the risk appetite in Japan and HK SAR are positively related to the stock market returns of other economies (with the exception of HK SAR's risk appetite changes and Japan's stock market return performance). Hence, a drop in investors' risk appetite in either Japan or HK SAR will be associated with falls in other economies' stock markets. Changes in the US's risk appetite are also positively related to the stock market returns in Japan and HK SAR, while they are negatively related to that in the UK and Germany. Thus, there may be possible contagion effect between the changes in the risk appetites in the US, Japan and HK SAR and the stock market returns, given that they are positively interdependent. On the contrary, risk appetite changes in the UK and Germany are negatively associated with other economies' stock market return. Figure 6 shows the time-varying conditional correlations between individual economy's risk appetite and their stock market performance.

Figure 6

DCCs of individual economy's changes in the risk appetite and the stock market return



US



Source: HKMA staff estimates.

The graphs in Figure 6 show that the conditional correlations vary a lot but in general move in a tight range with occasional spikes. For those positive conditional correlations, they are generally low and less than 0.4. There is no clear indication of particular trend or pattern in the conditional correlations.

To assess the interdependence in the bond market, we examine the interaction between the risk appetite measures and the yields of 3-month as well as 10-year government bonds respectively.¹⁸ The results may reveal whether the “flight-to-quality” phenomena from stock to bond markets are apparent in these five economies. Table 8 provides the average conditional correlations between the risk appetite measures and the government bond yields.

Table 8

Average conditional correlation between risk appetite measures and government bond yields

		<u>(a) 3-month government bond</u>					<u>(b) 10-year government bond</u>				
		US	UK	GER	JAP	HK SAR	US	UK	GER	JAP	HK SAR
Risk appetite	US	0.65	0.63	0.67	0.23	0.44	0.08	0.12	0.20	0.01	0.17
	UK	0.62	0.56	0.63	0.25	0.28	0.21	0.10	0.28	0.19	0.30
	GER	0.76	0.67	0.78	0.30	0.49	0.17	0.13	0.29	0.31	0.45
	JAP	0.23	0.28	0.27	0.19	0.27	0.23	0.01	-0.09	0.19	0.08
	HK SAR	0.52	0.58	0.56	0.15	0.39	0.28	0.13	0.05	0.18	0.09

The abbreviations in the table are as follows: GER for Germany and JAP for Japan.

Source: HKMA staff estimates.

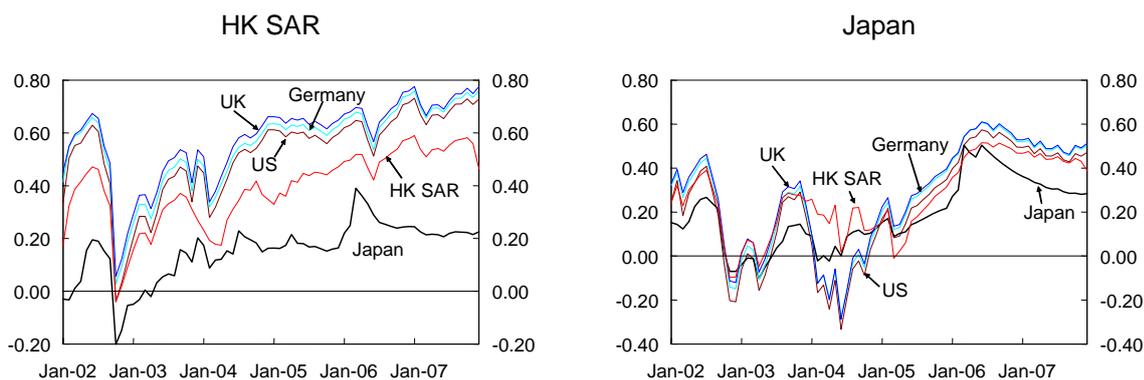
¹⁸ All yield data are the yields of the benchmark government bonds and are taken from CEIC. Note that for HK SAR, the 3-month government bill yields are those of the 3-month Exchange Fund Bills, while the 10-year government bond yields are those of the 10-year Exchange Fund Notes. For Germany, the 3-month yield is the 3-month EURIBOR.

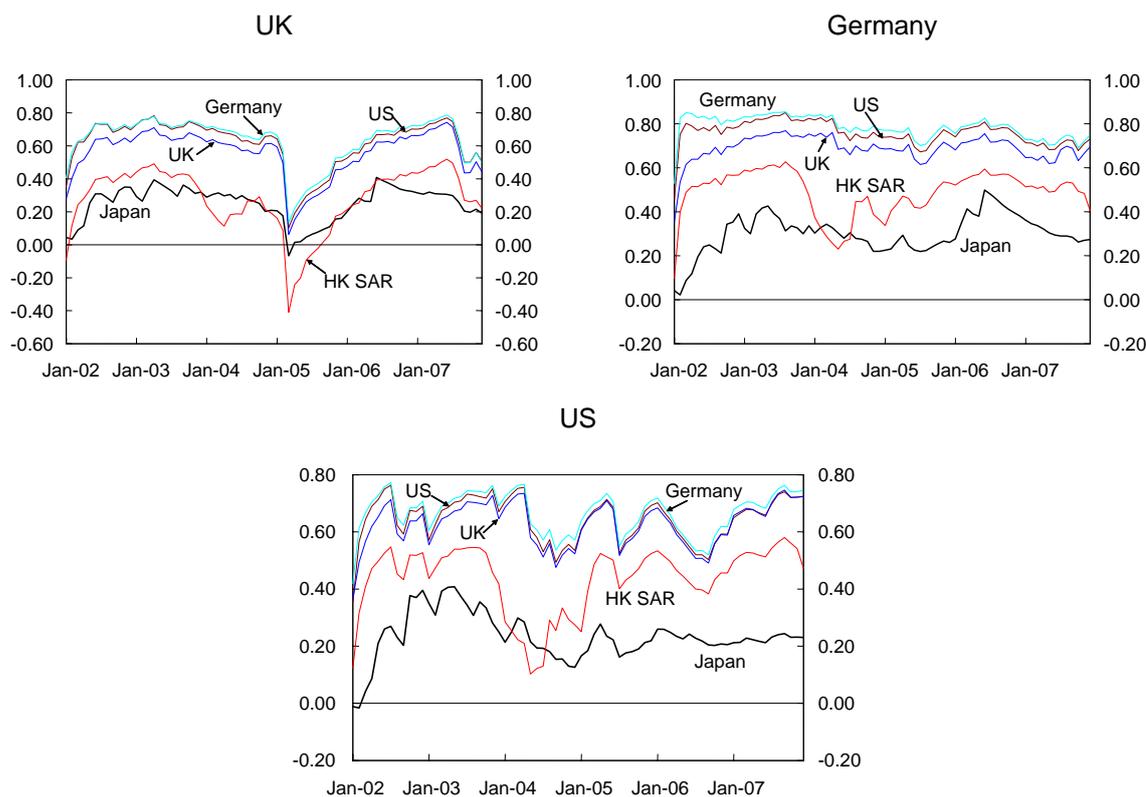
The conditional correlations as shown in Table 8 are mostly positive regardless of the maturity. The conditional correlations between the risk appetite measures and the 3-month yields (ranging from 0.15 to 0.78) are, in general, higher than those between the risk appetite measures and the 10-year yields (from -0.09 to 0.45). This suggests that the relationship between the risk appetite measure and the bond yield is stronger for bonds with a shorter maturity than those with a longer maturity. The diagonal elements under the two maturities show the intra-economy conditional correlation between an economy's risk appetite and its corresponding government bond yields. It is shown that the intra-economy conditional correlations are all positive. Such a positive relationship suggests that, to a certain extent, there exists a "flight-to-quality" phenomenon in the bond market of these five economies. As investors become more risk averse (their risk appetites fall), they seek a "safe haven" by investing in the bond markets, thus bidding up bond prices and leading to a fall in bond yields.

The results from inter-economy conditional correlations are also consistent with the "flight-to-quality" phenomenon as all but one off-diagonal conditional correlation are positive. The only exception is the conditional correlation between Japan's risk appetite and German's 10-year bond yield which is negative but at a low level. The degree of positive association between the risk appetite level and the bond yields in the economies are also different to each others. For instance, the conditional correlations between the risk appetite measures in the US, the UK and Germany and the 3-month bond yields (from 0.23 to 0.78) are much higher than the correlations between the risk appetite measures of their Asia counterparts and the 3-month bond yields. Meanwhile, between the two Asian economies, the conditional correlations between the risk appetite measure in HK SAR and the 3-month bond yields (from 0.15 to 0.58) are higher than the risk appetite measure in Japan and the 3-month yields (from 0.19 to 0.28). The results highlight the "flight-to-quality" phenomenon in the bond market of the five economies when investors in a particular economy are becoming risk averse. The time-varying conditional correlations between individual economy's risk appetite measures and the bond market performance are given in Figures 7 and 8.

Figure 7

DCCs of individual economy's risk appetite measures and 3-month bond yields

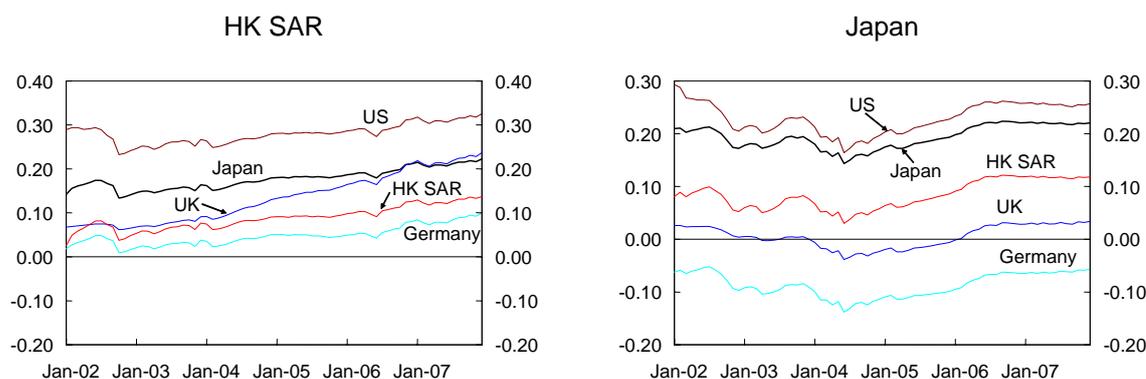


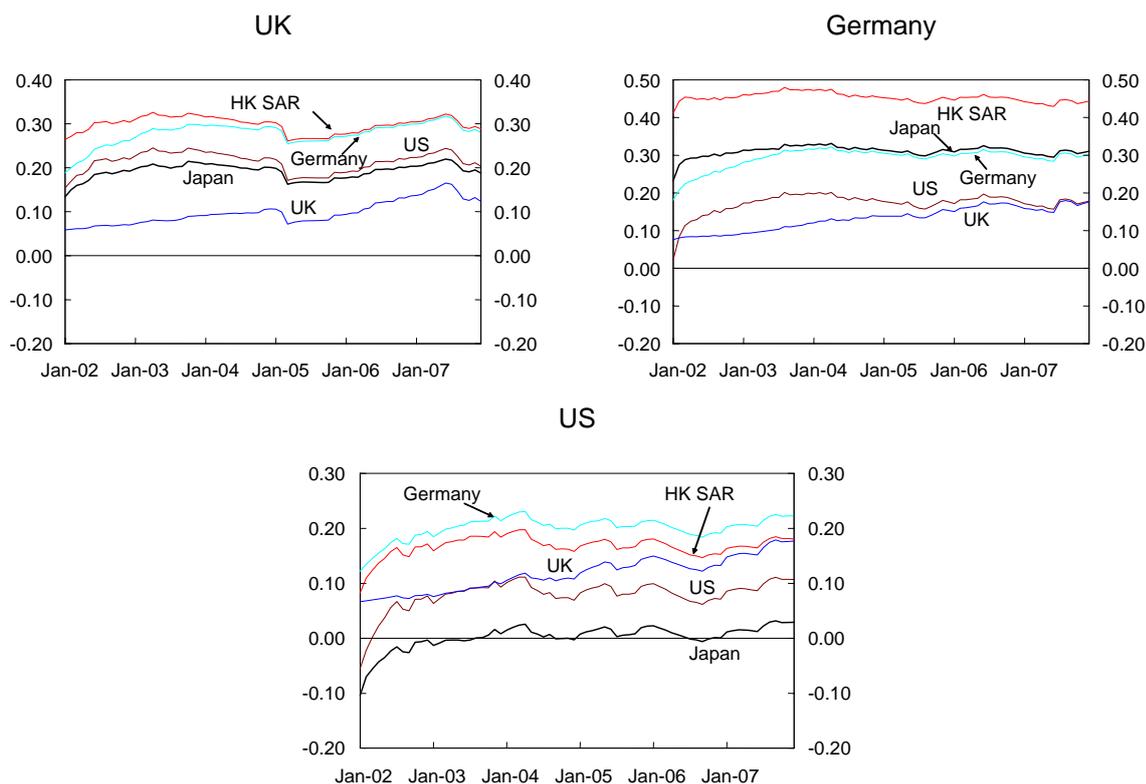


Source: HKMA staff estimates.

The graphs in Figure 7 show that the conditional correlations between the risk appetite measures and the 3-month bond yields vary and in a few occasions they turn into a negative relationship. Such a negative correlation is the most obvious between the risk appetite measure in Japan and the 3-month bond yields during mid-2002 to mid-2003 and the whole year of 2004. Note that during these two periods, the risk appetite measures in Japan were at a low level (see Figure 1b), which was associated with higher 3-month bond yields (lower bond prices) in the five economies, suggesting a possible contagion effect for bonds with a short maturity when Japanese investors became risk averse. Nonetheless, the conditional correlations are mostly positive over the study period and many of them were at a high level (above 0.5) at the end of 2007.

Figure 8
**DCCs of individual economy's risk appetite measures
 and 10-year bond yields**





Source: HKMA staff estimates.

The conditional correlations between the risk appetite measures and the 10-year bond yields in Figure 8 are very smooth. For the risk appetite measures in the US and HK SAR, their correlation with other economies' 10-year bond yields were trending upwards, suggesting an increasing relationship between the two. The correlations between Japan's risk appetite measure and 10-year bond yields also increased but have levelled off since early 2006. For the UK and Germany, the conditional correlations between their risk appetite measures and the bond yields were also at a relatively high level, suggesting evidence of "flight-to-quality" due to the stock market turmoil near the end of 2007.

5. Summary and Conclusion

This study extends the use of investors' risk appetites in central banks' monitoring work in two aspects, namely financial integration and cross-border financial market interdependence. Various integration indicators are constructed to gauge the relationship between the risk appetites derived for five economies: the US, the UK, Germany, Japan and HK SAR. Furthermore, we examine the degree of co-movement between the risk appetite measures and the stock and bond market performances in these economies. The evolution of such co-movements provides some insights to policy makers on the interdependence between stock and bond markets in these economies, which may give rise to possible contagion risk during financial market turmoil.

Table 9 provides a summary on the financial market integration aspect from the indicators derived using the risk appetite measures.

Table 9

Summary of financial market integration

Method	Indication of market integration	Result
Cross-market dispersion and correlation	Falling dispersion and high level of positive correlation imply higher convergence and greater co-movement	Even though the dispersion indicator has narrowed, it has stalled since mid-2006. The degree of positive cross-market correlation is also at a low level
Principal component analysis (PCA)	The identification of a small number of factors which are able to explain a high proportion of total variance among the risk appetite measures	The PCA results (based on levels or their changes) are less than satisfactory and we fail to obtain a first component factor that can account for a large proportion of the common variation between the risk appetite measures
Haldane and Hall (1991) Kalman filter method	Average β moving towards zero indicates an increasing sensitivity to regional influence	The overall results suggest some degrees of market segmentation between the five stock markets, and no particular market acts as a dominant factor in influencing the risk appetite of another economy
Dynamic conditional correlation (DCC) model	The higher the (positive) correlation, the larger the co-movement between markets is	For those positive conditional correlations, they are generally low and less than 0.4. There is no clear indication of particular trend or pattern in the conditional correlations

From Table 9, despite the different focus of each of these indicators, the picture that emerges from the empirical results is quite uniform. In terms of co-movement, both the cross-market correlation and the DCC point to a low level of correlation between the changes in the risk appetite measures. While the dispersion has narrowed, the process has halted since mid-2006. Results from the Haldane and Hall approach suggest that there is no indication of a particular economy whose changes in risk appetite play a dominant role in influencing other economies' risk appetite changes. Finally, as the first component factor derived from the PCA is unable to account for a high proportion of the common variation among the risk appetite measures (either in their levels or changes), it is difficult to conclude that a common factor is driving the dynamics of these risk appetite measures. There may only be a weak integration between the five financial markets and our integration indicators suggest some degrees of market segmentation in the process. For instance, the risk appetite measures of Japan and HK SAR, either in their levels or changes, are negatively correlated with the first common factor from the PCA, when other economies' risk appetite measures are positively related to that common factor. Furthermore, results from the Haldane and Hall approach also indicate that the changes in risk appetite measures of HK SAR and Japan are very sensitive to each other. Meanwhile, the risk appetite in Germany is highly influenced by that of the US, while that of the UK is closer to the German risk appetite measure.

While there is limited financial integration among the five stock markets, however, the risk appetite measures reveal the interdependence between shifts in the risk appetite measures and financial market performance. For the stock market, the results from the dynamic conditional correction indicate that there may be possible contagion risk between changes in the risk appetites in the US, Japan and HK SAR and the stock market performance, given that they are positively interdependent. For the bond market, with mainly positive correlations between the risk appetite measures and the 3-month or 10-year government bond yields, the "flight-to-quality" phenomenon is apparent in the bond market of the five economies.

Given the information contained in investors' risk appetite measures and the evidence of interdependence in the stock markets, policy makers should continue monitoring their movements for financial stability reasons. However, as investors' risk appetite is not directly observable in the market and the development of the methodology for the derivation of investors' risk appetite is still an on-going process, the application of the risk appetite measure in central banks' monitoring framework should be used with caution.

Appendix I: Methodology for the derivation of the risk appetite measures

This Appendix provides a brief description of the Gai and Vause (2006) methodology for the derivation of the risk appetite measures. As mentioned in the main text, the derivation of the investor's risk appetite requires the estimation of the option-implied risk-neutral probability density (RND) function and the subjective history implied density function. The following sections describe the methods for finding these two functions.

AI.1 Estimating the RND by fitting the two-lognormal mixture distribution

The prices of European call and put options at time t can be written as the discounted sums of expected future payoffs:

$$c(X, \tau) = e^{-r\tau} \int_X^{\infty} f^*(S_T)(S_T - X) dS_T \quad (\text{A1})$$

$$p(X, \tau) = e^{-r\tau} \int_0^X f^*(S_T)(X - S_T) dS_T \quad (\text{A2})$$

where $c(X, \tau)$ and $p(X, \tau)$ are the call and put prices respectively. The option prices are functions of the strike price (X), the time to maturity (τ), the asset price at the expiry (S_T), the risk-free interest rate (r) and the density function of the asset price as at expiry ($f^*(S_T)$). Assuming that the density function is a two-lognormal mixture, $f^*(S_T)$ at time t can then be expressed as:

$$f(S_T) = \sum_{i=1}^2 \theta_i L(a_i, b_i; S_T) \quad (\text{A3})$$

where:

$$a_i = \ln S_t + (\mu_i - \frac{\sigma_i^2}{2})\tau \quad (\text{A4})$$

$$b_i = \sigma_i \sqrt{\tau} \quad (\text{A5})$$

$L(a_i, b_i; S_T)$ is the i -th lognormal density function with parameters a_i and b_i , θ_i is the weight of the i -th density in the mixture and the mixtures are summed to unity, μ_i and σ_i are the mean and volatility (in standard deviation) of asset return respectively. At any time t , five parameters ($a_1, b_1, a_2, b_2, \theta_1$) in the two-lognormal density functions are estimated by solving the following minimisation problem:

$$\text{Min}_{a_i, b_1, a_2, b_2, \theta_1} \left\{ \sum_{n=1}^N [c(X, \tau) - c_{obs}]^2 + \sum_{n=1}^N [p(X, \tau) - p_{obs}]^2 \right\} \quad (\text{A6})$$

where N is the number of possible expiry asset price, c_{obs} and p_{obs} are the observed call and put prices at t respectively. By substituting the estimated parameters from (A6) into (A3), the probability density at different prices can be calculated accordingly.¹⁹

AI.2 Estimating the subjective probability by the threshold GARCH model

The subjective history implied probability is estimated by the threshold GARCH model of the underlying stock market index return (r_t)²⁰:

$$r_t = \beta + \varepsilon_t \quad (A7)$$

$$\sigma_t^2 = \phi_1 + \phi_2 \varepsilon_{t-1}^2 + \phi_3 \varepsilon_{t-1}^2 D_{t-1} + \phi_4 \sigma_{t-1}^2 \quad (A8)$$

$$D_t = 1 \text{ if } \varepsilon_t < 0 \text{ and } 0 \text{ otherwise} \quad (A9)$$

where r_t is the return of the stock market index at t , σ_t is the volatility of the return which follows the threshold GARCH (1,1) model. To derive the risk appetite measure at time t , we need to obtain the forecast of the subjective probability as at $t+1$. For this purpose, we first estimate the GARCH model by the data up to time t . In order to have monthly estimates of the mean return and the variance, and in view of the possible structural change in the data series, the GARCH estimation is based on a 10-year rolling sample. The expected return and variance of the return as at $t+1$ can then be forecasted by (A7) and (A8). Plugging these forecasts into the lognormal density function of asset price gives the subjective probability of the stock market index.²¹

¹⁹ Note that L is the standard lognormal density function: $L_i = \frac{e^{-\frac{(\ln S_T - a_i)^2}{2b_i^2}}}{S_T b_i \sqrt{2\pi}}$

²⁰ Different specifications for GARCH model, such as AR(1) and AR(2) for the mean equation, GARCH (1,2) and GARCH(2,2) for the GARCH equation have been tried and they make no or insignificant difference on the resulting density. Therefore, the simplest one (GARCH (1,1)) is chosen for the sake of convenience.

²¹ As the underlying stock market index is assumed to be lognormally distributed, its log-return should be normally distributed. Therefore the normally distributed GARCH-implied return and the corresponding variance can be directly plugged into the lognormal distribution function.

Appendix II: Indicators of financial market integration: Methodology and interpretation

This Appendix provides in details the methodologies of constructing the different indicators for assessing financial market integration and their interpretation. All integration indicators are derived based on changes in the risk appetite measures, with the principal component analysis also considering the level of the risk appetite measures. The sample period for the estimation of these integration indicators is from December 2001 to December 2007.

i. Cross-market dispersion and correlation

The idea behind the cross-market dispersion approach introduced by Solnik and Roulet (2000) is simple and intuitive. This can be used as an alternative to the time-series approach to estimating the level of correlation of financial markets. Following the law of one price, identical or comparable assets across different economies should generate the same return. If there is a large discrepancy in financial market returns across economies, as measured by the cross-market dispersion indicator, it will imply that the financial markets are not fully integrated. In this measure, a low level of dispersion implies a higher degree of market integration and vice versa. The method has been applied by Adjaoute and Danthine (2003) and Baele et al. (2004) to assess the equity market integration in Europe. While the method is commonly used on financial asset returns, we apply the method on the changes in the risk appetite measures.

To construct this measure, for N economies, the monthly change in the risk appetite measure of economy i at month t (R_t^i) is specified as:

$$R_t^i = RA_t^i - RA_{t-1}^i$$

where RA_t^i is the risk appetite measure of economy i at month t . The cross-market dispersion indicator is defined as:

$$\text{Cross-market dispersion at month } t = \sqrt{\frac{1}{N} \sum_{i=1}^N (R_t^i)^2}$$

In addition to the cross-market dispersion indicator, the cross-market correlation is also derived. First, we obtain the cross-market covariance, which is defined as:

$$\text{Cross-market covariance at month } t = \frac{1}{N^2 - N} \sum_{i=1}^N \sum_{\substack{j=1 \\ j \neq i}}^N R_t^i R_t^j$$

The cross-market correlation is then calculated as the ratio of the cross-market covariance to the square of the cross-market dispersion.²² While the cross-market dispersion measures the degree of discrepancy across markets, the cross-market covariances and correlations provide an alternative mean to track the co-movement at each point in time.

²² The derivation of the dispersion indicator, as well as the cross-market covariance and correlation follows Adrian (2007).

ii. **Principal component analysis**

If a set of series are correlated, it may be the case that their co-movements are driven by one or more common factors which are not directly observable. To estimate these factors, a factor analysis method such as the principal component analysis (PCA) is needed. In this study, the PCA is applied on the levels as well as the changes of the risk appetite measures in order to identify the respective common factors in their variations. The first component factor is generally interpreted as the common force driving the dynamics of these risk appetite measures.

PCA involves the calculation of the eigenvalue decomposition of the data covariance matrix.²³ From a set of n mean-centered series which are supposed to be correlated with one another, PCA extracts a new list of p variables called “factors” f_1, \dots, f_p ($p \leq n$) which are uncorrelated among one another. The common factors are constructed as linear combinations of the initial n series. The proportion of total variation accounted for by the first k factors ($k < p$) represents the overall quality of the PCA.²⁴ One usually hopes to account for most of the original variability using a relatively fewer number of component factors. In this study, the degree of integration is measured by two criteria: a) the number of the first k factors required to explain over 80% of the common variation – the less the number the better; and b) the percentage of the common variation explained by the first factor – the higher the percentage the better.

iii. **Haldane and Hall (1991) Kalman filter method**

The notion of convergence or integration is that the difference between two (or more) series should become arbitrarily small or they converge to some constant c as time elapses, such that $\lim_{k \rightarrow \infty} E(X_{t+k} - Y_{t+k}) = 0$ or c , where X and Y are the two series. The convergence may be a gradual and on-going process over time. If we expect the convergence process to take place over time from a lower to a higher level, we need a measure which would allow for such dynamic structural change. This measure will be useful in describing the process of structural change in terms of both degree and timing. The Kalman filter approach suggested by Haldane and Hall (1991) is a method that can be used to measure the time-varying convergence dynamic.²⁵

In this study, the Haldane and Hall method estimates a simple equation via Kalman filter estimation with the signal equation as:

$$R_t^B - R_t^i = \alpha_{i,t} + \beta_{i,t} (R_t^B - R_t^{US}) + \varepsilon_{i,t}, \quad \varepsilon_{i,t} \sim N(0, V) \quad (\text{A10})$$

and the state equations as:

$$\begin{aligned} \alpha_{i,t} &= \alpha_{i,t-1} + \xi_t, & \xi_t &\sim N(0, U) \\ \beta_{i,t} &= \beta_{i,t-1} + \mu_t, & \mu_t &\sim N(0, W) \end{aligned} \quad (\text{A11})$$

²³ Before calculating the eigenvalue of the data matrix, the original data series are pre-treated by subtracting the mean from each of the original data series of interest. The mean subtracted is the simple average of the respective original data series. This procedure is called mean centering.

²⁴ For more details see Johnson and Wichern (1992).

²⁵ Serletis and King (1997) and Manning (2002) use the Haldane and Hall approach to measure convergence of European Union and South East Asian equity markets respectively. Yu et al. (2007a, 2007b) also apply the approach to assess the stock and bond market integration in Asia.

where R_t^i is the monthly changes in the risk appetite measure of economy i at time t , R_t^B is the monthly changes in the risk appetite measure of another economy other than the US at time t and R_t^{US} is that of the US.

We obtain the estimated parameter β_i over time via Kalman filter. From Equation (A10), it is easy to show that if R^i and R^B converge (the changes in risk appetite of economy i converge to that of another economy other than the US), we would expect β_i to approach zero. Conversely, if R^i and R^{US} converge (the changes in risk appetite of economy i converge to that of the US), we would find β_i to approach one. In this measure, a tendency for β_i moving towards one or towards zero indicates an increasing sensitivity (and implies a higher degree of convergence) of economy i 's risk appetite change to that of the US or of another economy.^{26, 27}

iv. Correlation using dynamic conditional correlation (DCC) model

Simple (or rolling) correlation analysis is among the simplest method for examining the co-movement of financial markets. Basically, higher correlation between markets implies higher co-movement and greater integration between the markets. The DCC model, proposed by Engle and Sheppard (2001) and Engle (2002), is a new class of multivariate model which is particularly well suited to examine correlation dynamics among assets. The DCC approach has the flexibility of univariate GARCH but without the complexity of a general multivariate GARCH. As the parameters to be estimated in the correlation process are independent of the number of series to be correlated, a large number of series can be considered in a single estimation. Furthermore, Wong and Vlaar (2003) show that the DCC model outperforms other alternatives in modelling time-varying correlations.

To measure conditional correlations, a two-step estimation procedure of the DCC model is used. Univariate GARCH models are first estimated for each series. The standardised residuals from the first step are then used to estimate the dynamic conditional correlations between those series. Specifically, let $z_{i,t}$ and $z_{j,t}$ be the standardised residuals of the series of economy i and j at time t respectively, $i \neq j$. The GARCH process, as suggested in Engle (2002), is as follows:

$$q_{ij,t} = \bar{\rho}_{ij} + \alpha(z_{i,t-1}z_{j,t-1} - \bar{\rho}_{ij}) + \beta(q_{ij,t-1} - \bar{\rho}_{ij}) \quad (\text{A12})$$

and

$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}q_{jj,t}}} \quad (\text{A13})$$

²⁶ By re-arranging Equation (A10), we obtain the following equation:

$$(1 - \beta_{i,t})R_t^B + \beta_{i,t}R_t^{US} - \alpha_{i,t} - \varepsilon_{i,t} = R_t^i$$

It can be seen from the above equation that when β_i approaches zero, the movement in R^i would be increasingly influenced by that in R^B , suggesting that the two series are converging. On the other hand, when β_i approaches one, the influence from R^B is reducing while that from R^{US} is increasing, which suggests R^i and R^{US} are converging.

²⁷ One caveat of the Haldane and Hall approach is that the conclusion of whether an economy's risk appetite is converging or diverging may well differ according to the choices of the other two economies in the signal equation.

where q_{ij} is the off-diagonal elements of the variance-covariance matrix, $\bar{\rho}_{ij}$ is the unconditional expectation of the cross product $z_{i,t}z_{j,t}$ and $\rho_{ij,t}$ is the conditional correlation between the series of economy i and j at time t .²⁸ In the main text, DCCs are derived for the relationships between the changes in the risk appetite measures and the stock market return performance, as well as between the levels of the risk appetite measures and the 3-month as well as the 10-year government bond yields.

The Ljung-Box tests for serial correlation, as shown by the Q statistics in Table A1, provide evidence of serial correlation in most of the squared level series of the levels as well as the changes in the risk appetite measures, the returns (in log differences) of the stock market indices as well as the 3-month and 10-year government bond yield series. Thus, the specification of a GARCH model is appropriate.

Table A1
Ljung-Box Q(3) statistics for serial correlation test

	Risk appetite measure		Stock market index	3-month bond	10-year bond
	(squared level)	(squared change)	(squared return)	(squared yield level)	
US	1.81	4.40	10.67**	213.62**	106.37**
UK	9.47**	4.87	23.04**	193.37**	124.61**
Germany	45.41**	7.01*	11.20**	175.69**	159.47**
Japan	1.75	36.39**	3.12	185.06**	150.38**
HK SAR	33.03**	7.85**	3.22	184.24**	92.08**

** indicates significance at the 5% confidence level. * indicates significance at the 10% confidence level. Q(3) is the Ljung-Box statistic based on the squared level of the monthly return series up to the third order. The statistics are asymptotically distributed as $\chi^2(3)$. The critical value of $\chi^2(3)$ at the 5% level is 7.81, at the 10% level is 6.25.

Source: HKMA staff estimates.

²⁸ See Engle (2002) for a detailed description of the simple DCC model and the estimation procedure.

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Financial innovation and corporate default rates

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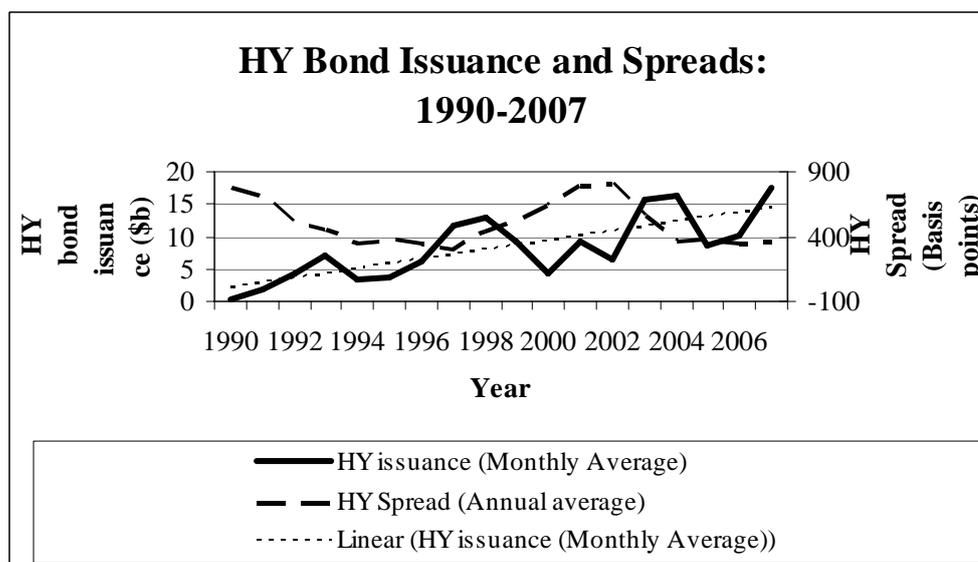
I. Introduction

Measured default rates are currently at historically low levels. Compared to a historical average of 2%, Moody's 12-month trailing corporate default rate was 0.50% in September 2007. Even more striking, the default rate had fallen since January 2007 whereas some measures of economic fundamentals had worsened over this period of time. For example, the equity implied volatility had more than doubled, and high-yield corporate bond credit spreads had increased more than 100 basis points during this period. In fact, it appears that measured default rates have been lower than predictions by forecasters and ratings agencies at least since 2006.²

One reason for over-prediction of default rates may be that the historical relationship between existing model variables has changed. For example, it may be that default rates have become less sensitive to equity volatility and more sensitive to corporate profits which had continued to grow from January to May 2007, according to flow of funds data.

Figure 1

US high-yield bond issuance and spreads: 1990–2007



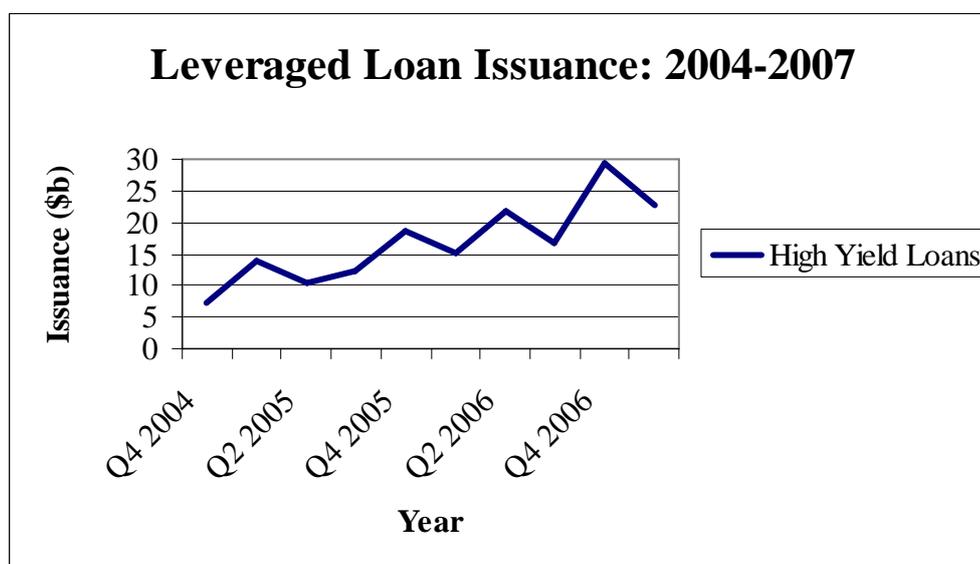
The figure plots monthly averages of US high-yield bond issuance and high-yield corporate credit spreads for 1990 to October 2007. It also shows the linear trend in bond issuance.

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² See "Junk keeps defying gravity", by Jane Sasseen, *BusinessWeek*, January 29 2007.

Figure 2

Leveraged loan issuance



The figure plots the quarterly issuance of leveraged loans from the fourth quarter of 2004 go the first quarter of 2007.

In this paper, we explore an alternative possibility: that due to financial innovation new variables had been introduced into the default forecast models. Firms with high credit risk have had an expanded menu of financing sources. Issuance of high-yield bonds have been high (even accounting for trend) while high-yield credit spreads have been low by historical standards (see Figure 1). At the same time, financial innovations in the debt markets have resulted in new sources of financing becoming available. In particular, high-yield or leveraged loan volume has grown from essentially zero in 2004 to more than \$80 billion in 2006 (see Figure 2). A portion of leveraged loans are used for so-called “rescue financing”, or loans to distressed firms who are unable to tap traditional sources of financing.³ While previously rescue financing was geared towards firms near bankruptcy, in recent years it has been used by firms wishing to substitute bonds with loans in their capital structure, ostensibly due to the greater financial flexibility of loans.⁴

Structured financing vehicles have helped in the growth of leveraged loans. For example, managers of collateralized loan obligations, or CLOs, are major buyers of such loans. In addition, by repackaging risky bonds or loans into CDO products which re-distribute risk and return of the portfolio through “tranching”, investors who traditionally stay away from distress investing can enter the market through investing in the safe tranche of a CDO investment product. As more capital is channeled in and becomes available to even highly risky borrowers companies that might have to default otherwise can survive longer, a phenomenon underlying the observed low default rates accompanying the recent financial innovations.

What are the implications for these new developments for default rates? In theory, the role financial innovations play in corporate default dynamics is unclear. Default rate could be low simply due to cyclical factors which are unrelated to financial innovations. Furthermore, the impact, if any, can be permanent or transitory with opposite directions, depending on factors

³ See “Rescue finance for troubled firms”, by Bernard Wysocki Jr., *The Wall Street Journal*, June 12, 2007.

⁴ A main reason why such loans may afford greater flexibility is that they are privately negotiated. See “Banks warn of risk to rescuers”, by Heidi Moore, *Financial News Online US*, August 15 2007.

identified in theory. For example, if the marginal firms affected are those in need of funding for available positive-NPV investment opportunities, additional capital channeled through innovation would have permanent positive benefits for the company and possibly the economy as a whole. On the other hand, if the marginal firms tend to be distressed borrowers without viable investment opportunities, innovations might simply fund a temporary “survival” option to the borrowers who will ultimately default in later stage with poorer recovery. A even worse possibly outcome for the second type of the firm, as discussed in Jensen and Meckling (1976), is that given the newly available capital, the close-to-distress companies might be further incentivized to risk shift more, in which case the net effect of innovations might be an increase in the default risk, *ceteris paribus*.

We hypothesize that one observable effect of financial innovation is the possibility of “delayed default”. In the context of structural models in the spirit of Merton (1974), a borrower defaults when its assets V fall below a threshold V^* . Financial innovation may affect default rates either by changing V or V^* or both. Given V^* , new financing increases V and either delays the time when the firm hits its default threshold or avoids bankruptcy altogether. Alternatively, given V , the new financing lowers V^* (by, for example, increasing the time to debt maturity, as in Leland and Toft (1996)). Both channels have the effect of reducing the average time to default relative to the period when new financing was not available.⁵

The hypothesis of delayed defaults implies that the percent of early defaults is lower in recent years. We examine the hypothesis by considering bonds outstanding as of June 1 of each year (starting in 1980) and then estimating the percent of bonds that default within a particular horizon (say 2 years). We find that the percent of high-yield bonds defaulting within 2 years or less is unusually low from 2003 to 2005, compared to earlier years as well as compared to the overall default rates of high-yield bonds during those years. The same conclusion applies when considering a horizon of 3 years or less.

As expected, the percent of early defaults is correlated with the business cycle. In particular, the percent of early defaults tends to be high in the year before and during recessions. To account for business cycle effects, we regress the percent of early defaults on a recession dummy, changes in the unemployment rate and the credit spread. We continue to find a large decrease in the percent of early defaults after controlling for business cycle effects.

While the firm level analysis is broadly consistent with firms delaying defaults after accessing new forms of financing, the analysis does not explicitly link default rates and financial innovation. Moreover, the analysis does not allow us to study 2006 and 2007 (due to data constraints) when the impact of financial innovation is presumably maximized. In light of these considerations, we next turn to an analysis of aggregate default rates at the monthly level.

We estimate a prediction model for aggregate corporate default rates using variables identified in earlier studies to have strong predictive power (Fons (1991), Jonsson and Fridson (1996), Helwege and Kleiman (1997), Keenan, Sobehart and Hamilton (1999), Duffie, Saita and Wang (2007)). Since we cannot reject the null of unit roots in the time series of default levels, we predict *changes* in default rates rather the level. We find that changes in the default rate is significantly predicted by the distance to default and stock returns, growth in corporate debt (as reported in flow of funds data), macroeconomic conditions (ie the term spread and changes in the unemployment rate), measures of credit quality, and bond aging effects. The model has an adjusted R-squared of 53% and it has robust out-of-sample predictive properties.

⁵ The main difference between the two channels is in the effect on recovery rates which are expected to vary inversely with V^* .

Initially, we estimate the model without using proxies for financial innovation. While the model generally predicts actual default rates reliably, it consistently over-predicts the default rate since 2006. If financial innovation is partly responsible for the low measured default rates as distressed firms avail themselves of new sources of financing, then the prediction error should be partly explained by proxies of financial innovation. Indeed, we find that past increases in leveraged loans predict lower prediction errors. Similarly, past increases in collateralized debt obligations (CDOs) also predict lower prediction errors. In contrast, traditional forms of financing (eg banks' commercial and industrial (C&I) loans, commercial paper issuance, changes in commercial bank loan standards) are unrelated to the prediction errors. These results explicitly link measured default rates to the financial innovation of recent years.

To the best of our knowledge, this is the first systematic evidence that financial innovations are negatively related to aggregate default rate changes. We believe this finding is important. First, existing structural models of default risk have not taken into explicit considerations the role of financial innovations in affecting aggregate default rate dynamics. Although many structural models have the potential flexibility to incorporate the exogenous changes of financial innovation, the current literature does not have clear implications on through which parameter the impact could enter the model. For example, innovations could be viewed as exogenous shifts that lower the debt financing cost of the borrower, extend the effective maturity of the existing debt (like a debt rollover), or lower the default threshold parameter via replacing existing debt with cheaper debt financing. Related to the latter possible channel, several papers have endogenized the default event (eg Leland and Toft (1996) and Anderson, Sundaresan, and Tychon (1996)) by making the default threshold endogenous. However, the evidence in this paper appears to suggest a mechanism of affecting the default threshold differently.

Secondly, as very much discussed and debated in the recent credit market turmoil, regulators face the task of assessing the net impact of financial innovations on the economy. Although our findings suggest a positive role of financial innovations in lowering default rates in the short run, it remains to be investigated whether the impact is persistent. Furthermore, theories suggest that the impact of financial innovations on default risk is likely to be different (even opposite), depending on the investment opportunity set and the financial state of the borrower. We are currently further investigate these questions.

The rest of the paper is organized as follows. In Section II, we describe the data used in this study. In Section III, we present summary statistics and stylized facts on delayed defaults in recent years. We introduce a default prediction model for aggregate default rate changes in Section IV. In Section V, we explicitly link the prediction errors from the default rate changes model to financial innovation. Section VI concludes.

II. Data

In this section, we discuss the sources of data used in the paper.

Corporate bond default rate

We use Moody's Default Risk Database, which features comprehensive data on Defaults, Recovery from Default, and Rating Changes (at both the security and issuer level) for all corporate issuers of long-term bonds that have carried a Moody's rating since 1970. Moody's definition of default includes three types of credit events:

- A missed or delayed disbursement of interest and/or principal, including delayed payments made within a grace period;

- Bankruptcy, administration, legal receivership, or other legal blocks (perhaps by regulators) to the timely payment of interest and/or principal; or
- A distressed exchange occurs where: (i) the issuer offers debt holders a new security or package of securities that amount to a diminished financial obligation (such as preferred or common stock, or debt with a lower coupon or par amount, lower seniority, or longer maturity); or (ii) the exchange had the apparent purpose of helping the borrower avoid default.

We focus on rated bonds that are domestically outstanding by industrial issuers during the period of 1984–2006. The sample includes only “regular” bonds which excludes bond with non standard features such as convertibility.

Rating cohorts are formed at the end of June in each year, using all outstanding bonds with the cohort rating. We then follow each cohort for 2 years to calculate a forward-looking measure of cohort default rate. Lastly, for aggregate default rate changes, we use data provided by Moody’s Default Research Service.

Financial innovations

We use two measures to proxy for recent financial innovations in the U.S. credit market. First, we use data on aggregate CDO issuance from the SIFMA web site, based on the observation of the boom in this type of structured finance product.

III. Early defaults: descriptive statistics

Table Ia
Annual number and face amount
of investment-grade bonds outstanding by rating class

Year	Investment Grade							
	Aaa		Aa		A		Baa	
	# of bonds	Face Amount (\$MM)	# of bonds	Face Amount (\$MM)	# of bonds	Face Amount (\$MM)	# of bonds	Face Amount (\$MM)
1984	17	3,587	190	29,610	228	19,976	49	5,406
1985	18	7,232	233	41,845	362	32,959	74	16,327
1986	35	12,532	343	56,136	561	63,958	122	17,913
1987	48	14,582	388	65,810	696	87,150	192	23,202
1988	111	33,786	417	75,730	843	105,171	248	32,940
1989	168	44,867	412	75,450	920	122,084	295	48,189
1990	202	51,142	397	77,693	935	132,141	379	59,787
1991	209	53,172	279	50,496	1,116	180,848	461	72,406
1992	241	61,907	263	52,591	1,222	212,504	573	93,787
1993	271	66,775	260	54,204	1,304	226,879	716	137,517
1994	247	64,386	272	58,883	1,516	280,098	687	132,302
1995	262	65,862	358	77,473	1,705	320,224	674	115,120
1996	326	63,605	457	89,071	2,252	369,967	914	147,779
1997	435	55,013	748	123,722	3,097	435,523	1,322	197,816
1998	487	55,651	1,186	163,638	4,361	489,860	1,776	285,200
1999	526	64,635	1,867	245,232	4,751	530,960	2,202	366,732
2000	502	66,020	2,190	287,507	5,084	590,717	2,001	360,646
2001	410	56,630	2,264	288,151	4,714	583,086	1,751	358,061
2002	462	58,595	2,341	285,987	4,338	515,185	1,753	381,708
2003	525	60,058	2,265	257,029	4,959	492,957	1,674	381,372
2004	953	85,894	2,506	285,803	6,335	466,242	1,707	390,379
2005	1,115	82,721	2,768	356,911	5,274	394,861	3,556	459,149
2006	1,304	89,360	5,270	471,300	3,370	394,010	1,408	368,009
2007	1,572	126,513	6,147	1,667,338	2,816	454,449	1,618	397,473

Table 1b

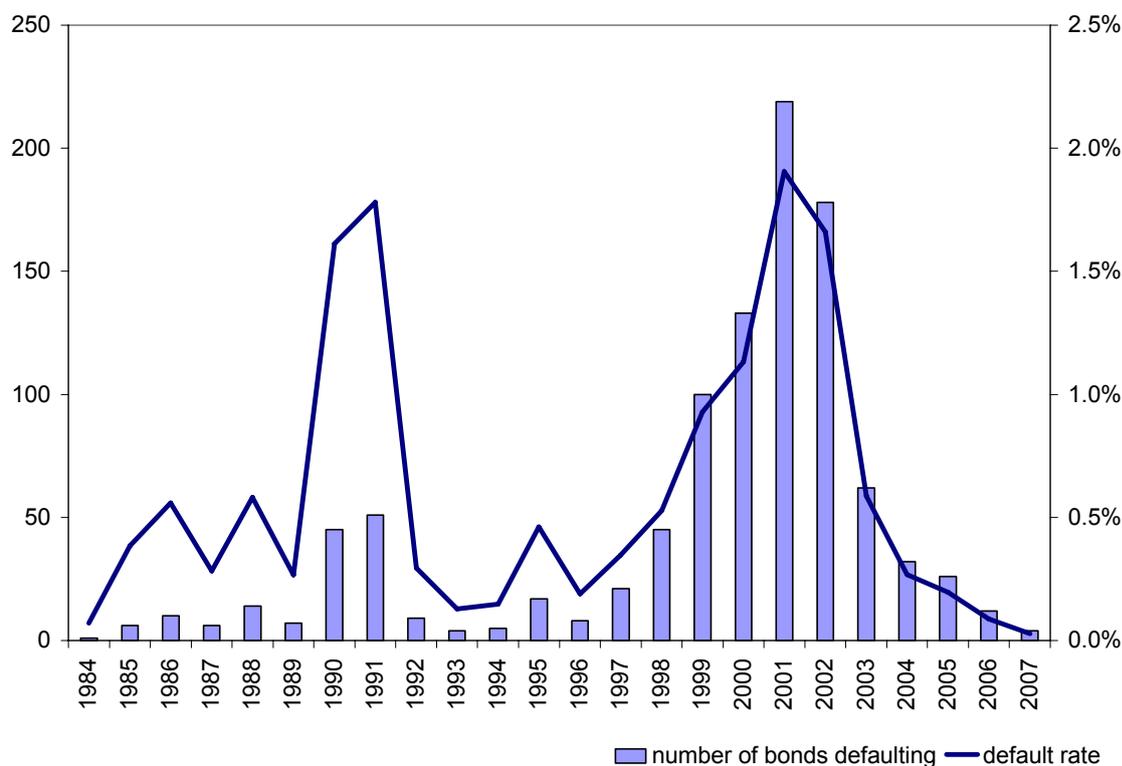
**Annual number and face amount
of speculative-grade bonds outstanding by rating class**

Year	High Yield Grade									
	Ba		B		Caa		Ca		C	
	# of bonds	Face Amount (\$MM)	# of bonds	Face Amount (\$MM)	# of bonds	Face Amount (\$MM)	# of bonds	Face Amount (\$MM)	# of bonds	Face Amount (\$MM)
1984	22	2,194	29	2,090	1	30	.	.	-	.
1985	34	4,296	49	4,721	4	366	.	.	-	.
1986	54	11,861	98	12,281	6	430	1	136	-	.
1987	95	20,374	160	24,518	9	710	9	1,171	-	.
1988	99	22,142	218	34,328	10	1,749	11	1,371	-	.
1989	109	18,299	278	53,063	11	1,731	17	2,224	3	250
1990	116	17,531	281	55,268	26	4,489	35	7,178	6	695
1991	137	31,100	235	41,859	47	6,480	61	10,209	6	1,035
1992	177	33,496	209	40,204	45	5,898	57	9,113	5	770
1993	217	48,441	274	50,164	38	6,019	24	2,965	2	222
1994	245	46,586	395	68,596	32	5,490	12	1,011	2	222
1995	292	57,238	465	76,853	42	7,546	14	1,893	1	100
1996	350	67,294	565	101,682	69	11,817	22	2,558	2	185
1997	468	79,600	708	125,808	79	13,187	25	3,454	5	931
1998	509	103,233	1,129	189,563	157	25,939	32	5,336	6	1,206
1999	492	104,819	1,133	195,536	249	42,503	60	9,395	19	4,474
2000	498	107,130	955	176,917	292	50,896	78	12,441	37	8,733
2001	527	115,428	783	151,269	348	57,860	122	25,982	24	3,815
2002	543	129,100	552	103,461	290	58,762	107	27,353	32	7,753
2003	487	112,706	429	83,761	264	50,295	75	19,998	22	5,776
2004	435	100,231	374	77,816	211	40,590	43	10,467	7	1,083
2005	418	95,977	272	62,983	150	27,933	32	8,837	3	410
2006	1,983	142,568	327	74,289	97	18,786	20	7,456	18	2,769
2007	1,161	106,230	656	81,824	126	39,260	11	2,121	2	300

We start by presenting summary statistics of the rating data. Table 1a and 1b present the annual number and face amount of outstanding bonds by rating for investment-grade and speculative-grade bonds, respectively, in the period of 1984–2007. In the past two decades, there were significant increases in the number and aggregate face amount of bonds in each rating group.

Figure 3

Historical annual number of defaults and default rates (1984–2007)



The aggregate defaults tend to exhibit a cyclical pattern (see Figure 3). During the 1980s, less than 0.6% of outstanding bonds in our sample defaulted in a given year. Though the 1990–91 recession was brief, more than 50 bonds defaulted during each calendar year, representing a peak annual default rate of nearly 1.8%. Defaults declined to their previous levels until the late 1990s, gradually rising as economic expansion gave way to the dot-com bubble and recession. The default rate reached nearly 2% in 2001, and did not moderate substantially until 2003. Since 2004, default rates have been below 0.3%, declining to historically low levels in 2006 and 2007.

We further track the default experience of the rating cohorts for 2 years subsequent to the cohort formation. As expected, the 2-year-forward default rates of all investment-grade cohorts are fairly low, and we report the 2-year forward default rates for two high-yield cohorts – “Ba and B” and “Caa and below”.

Figure 4a

**Two-year forward default rates
for rating cohort “Ba and B Rated”**

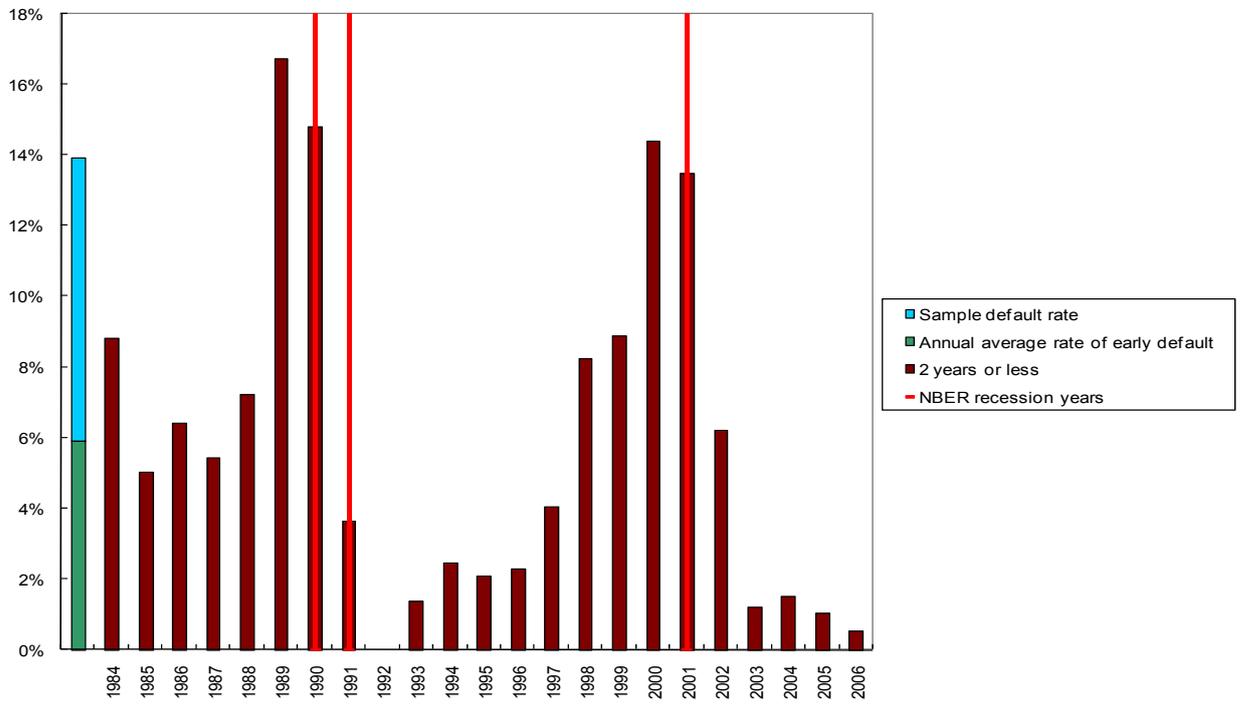


Figure 4b

**Two-year Forward Default Rates
for Rating Cohort “Caa and Below”**

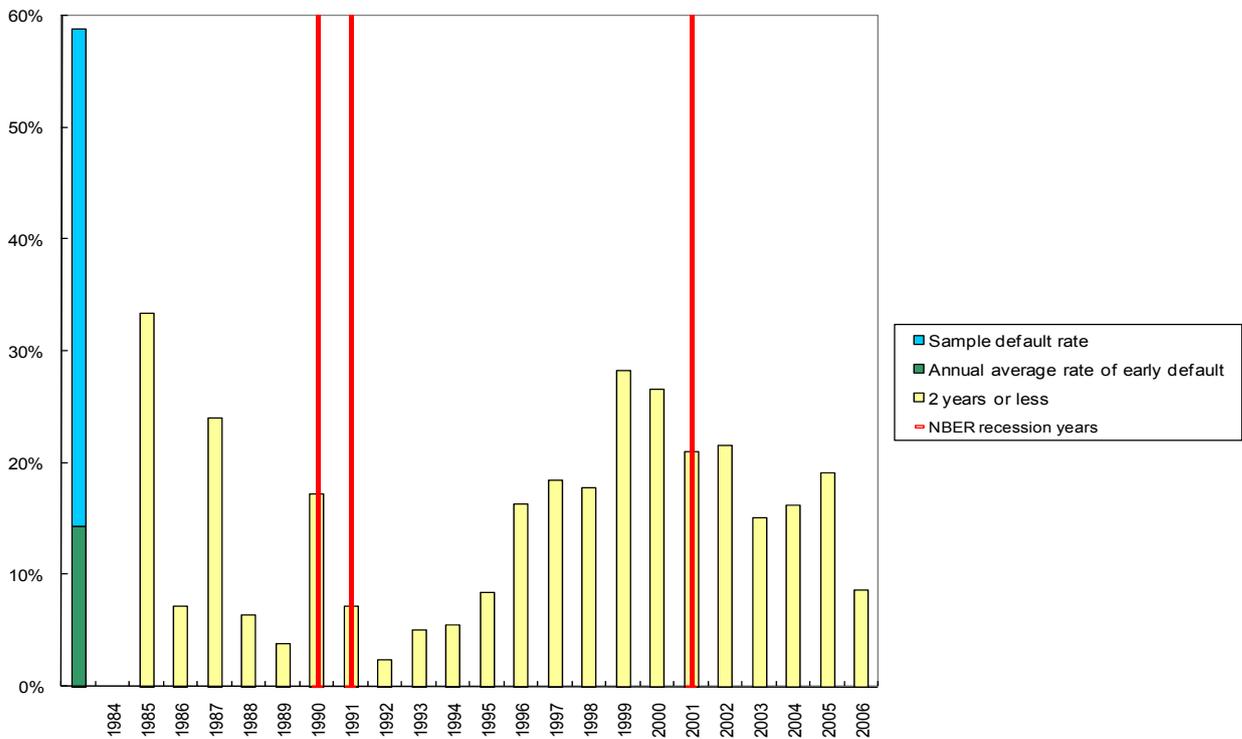
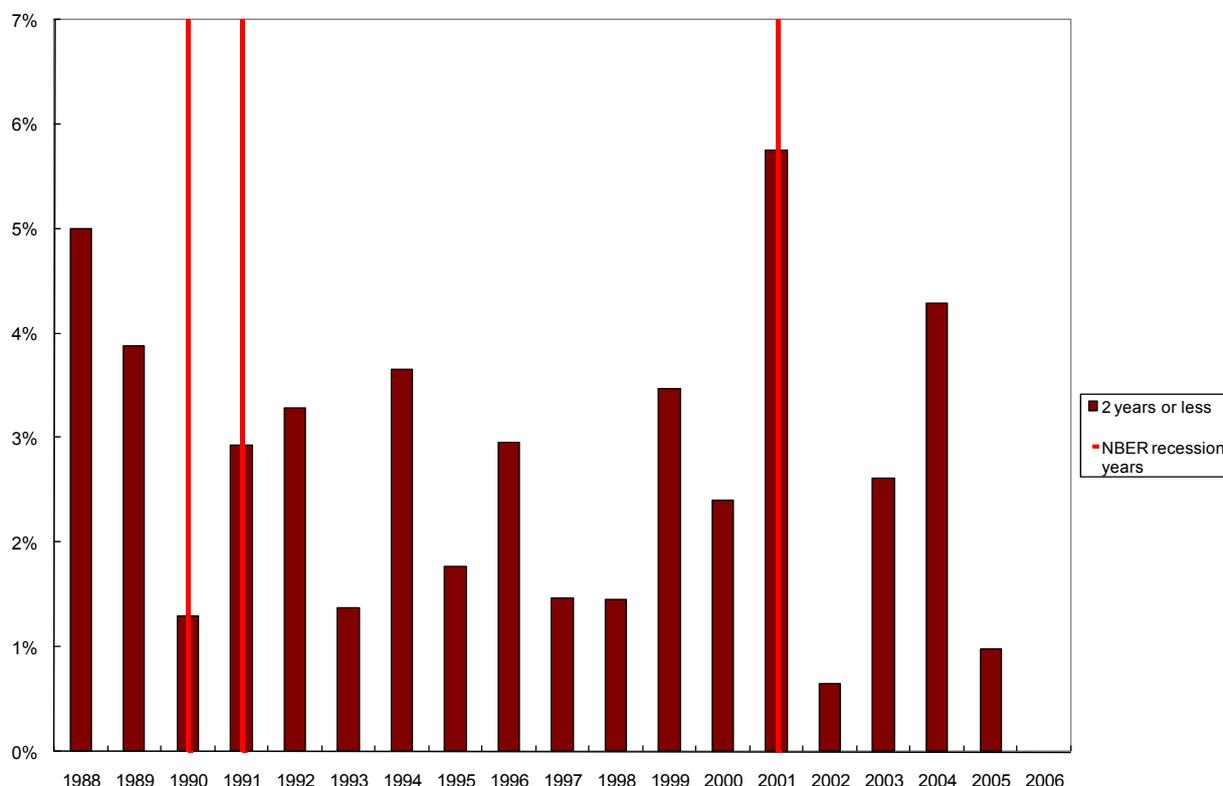


Figure 4a shows the 2-year default experience subsequent to the cohort formation for bonds that are originally rated Ba or B. In the graph, the left-most bar indicates the sample average unconditional default rate and the average default rate conditional on “early default” – default within two years after joining the cohort. The 2-year forward default rates clearly exhibits a cyclical pattern, with defaults peaking before recession periods defined by NBER. Related to the question in this study, the 2-year early defaults in 2003 through 2006 are significantly lower than the sample average. Figure 4b depicts a similar picture for bonds rated Caa or lower. The pattern is much weaker for these lower-rated bonds, though the 2-year early defaults in 2006 are still lower than the sample average. Particularly for bonds rated Ba or B, these stylized facts are consistent with the notion that, controlling for credit risk (rating), early defaults have significantly decreased in recent periods.

Figure 5
**Two-year forward default rates of cohort “Ba and B” –
 adjusted for business cycle effects**



Since the observation above apparently suffers from the “business cycle” effect, ie the fluctuation in default due to economic conditions, we use a regression model to adjust the 2-year forward default rates by taking out the effect of several macro-economy related variables – the volatility of equity returns, GDP growth (lagged by 1 month), yield spread of investment grade bonds, and NBER’s indication of economic recession. Figure 5 shows the 2-year forward default experience for bonds rated Ba or B after the “business cycle” adjustment. We plot the residuals from the regression model and adjust by adding the absolute value of the most negative value to each bar to make them all non-negative. The overall pattern appears to be different, but continues to show an unusually low forward default rate in 2005 and 2006, the most recent years in our sample for which 2-year subsequent default data is available.

The stylized facts are robust with respect to using a 3-year horizon for calculating the forward default rates, and to using newly issued bonds instead of outstanding new and aged bonds.

Taken together, the picture is consistent with current observations (eg Altman (2007)) of a low aggregate default rate and suggests the decrease in early defaults as a potential interesting angle for further investigation, which we turn to in the next section.

While the firm level analysis is broadly consistent with firms delaying defaults after accessing new forms of financing, the analysis does not explicitly link default rates and financial innovation. Moreover, the analysis does not allow us to study 2007 and 2008 (due to data constraints) when the impact of financial innovation is presumably maximized. In light of these considerations, we now turn to an analysis of aggregate default rates at the monthly level.

IV. Predicting aggregate default rates

In this section, we develop a model for predicting aggregate defaults while omitting the use of financial innovation measures as explanatory variables. The aim is to show that the prediction errors from this model are significantly related to measures of financial innovation but unrelated to measures of traditional financing.

Aggregate default rates, obtained from Moody's, are trailing 12-month default rates. They are calculated, for month t , as

$$D_t = \frac{\sum_{t-11}^t Y_t}{I_{t-11}}, \quad (1)$$

where D_t is the trailing 12-month default rate, Y_t is the number of defaulting long-term debt issuers and I_t is the number of issuers remaining in month t . The number of issuers is adjusted to reflect withdrawal from the market for some issuers so that the denominator reflects the number of issuers who could potentially have defaulted in the subsequent 12-month period.⁶ The set of issuers comprises the entire Moody's-rated universe (all-corporate). Thus, the calculations do not include the non-rated sector, which is a small market segment and for which accurate default information is difficult to obtain, according to Moody's.

Since we cannot reject the null hypothesis of unit roots in the time series of default levels, we predict *changes* in default rates rather the level. Thus, our dependent variable is:

$$\Delta D_t = D_t - D_{t-1} = \frac{\sum_{t-11}^t Y_t}{I_{t-11}} - \frac{\sum_{t-12}^{t-1} Y_{t-1}}{I_{t-12}}. \quad (2)$$

In general, the change in default rates depends on changes in Y_t for the entire prior 12-month period. However, according to Keenan, Sobehart and Hamilton (1999), the numerator of (2) is a slow moving value and so, approximately, $I_t \approx I_{t-1}$. Therefore, we can rewrite (2) as:

$$\Delta D_t = D_t - D_{t-1} \approx \frac{Y_t - Y_{t-12}}{I_{t-12}}. \quad (3)$$

Thus, while in general we expect the explanatory variables to impact ΔD_t at lags of up to 12 months, it is possible that the longer lags have a bigger impact than shorter lags.

⁶ See Keenan, Sobehart and Hamilton (1999) for further details of how the adjustment for withdrawals is implemented.

We estimate a prediction model for ΔD_t using variables identified in earlier studies to have strong predictive power. The explanatory variables may be grouped as follows:

Distance to default and Growth in debt of the corporate sector. In standard structural models (Black and Scholes (1973), Merton (1974), Fisher, Heinkel and Zechner (1989), and Leland (1994)), the default rate is completely determined by the distance to default. The latter is defined as the number of standard deviations of asset growth by which the asset level exceeds the firm's liabilities. Following equation (19) in Duffie, Saita and Wang (2007), the distance to default is:

$$DDEF_t = \frac{\ln(V_t / L_t) + (\mu_A - 0.5 * \sigma_A^2) * 12}{\sigma_A \sqrt{12}}, \quad (4)$$

V_t is the sum of equity market value (from CRSP) and the book value of debt L_t (short term plus long-term debt, from Compustat). The ratio V_t/L_t is obtained at the quarterly level and then interpolated to obtain monthly values. μ_A is the sample mean and σ_A is the sample standard deviation of V_t . $DDEF_t$ is obtained for each firm and then averaged. We use the one-month lagged value of $DDEF_t$.

Firms where leverage is growing quickly are likely to hit the default threshold quicker. This is an aspect of the strong non-linearities between model inputs and the default rate found in calibration exercises (Tarashev (2008)). We use the quarterly debt growth reported in the Flow of Funds database and interpolate to obtain monthly numbers. We use the one-month lagged value of debt growth $LEVGR_t$.

Macroeconomic conditions. A firm's financial health is likely to depend on general macroeconomic conditions. Certainly, aggregate default rates tend to be high just prior to and during economic recessions and relatively low during economic expansions. We use the term spread, defined as the difference between constant maturity 10-year rates and the 3-month rate. The 12-month lagged value of the term spread has been shown to be a reliable predictor of recessions (Estrella and Hardouvelis (1991)). We also use three lags of the change in the unemployment rate which is a strong predictor of the equity risk premium (Sarkar and Zhang, 2007).

We also tried other macroeconomic variables used in the literature, such as growth in GDP, industrial production and personal income, but none of these variables were significant in the regressions.

Credit quality and bond aging effects. Fons (1991) found that 51% of the variation in historical default rates could be explained by credit quality and economic conditions. Credit quality is typically measured as the relative weight of high-yield bonds in the economy, where the weight could be high-yield default rates (Fons (1991)) or the relative size of speculative-grade issuers (eg the percent of issuers rated B3 or lower, as in Jonsson, Fridson and Zhong (1996)). We use a measure related to that of Fons (1991): the difference in credit spreads between high-yield and investment-grade issuers. We use 12 monthly lags of this variable.

Helwege and Kleiman (1996) added an "aging" factor to credit quality and were able to explain 81% of the variation. Since defaults are more likely to occur three years after issuance, they use the dollar amount of B3-rated issues lagged three years. We use lagged values of high-yield issuance but only use the four monthly lags since the longer lags were not significant.

Stock returns. Duffie, Saita and Wang (2007) use the trailing one-year return of the S&P 500 index and find it statistically significant (although the sign is positive, indicating higher returns increase default rates). We use 12 monthly lags of returns on the Wilshire 3000 index.

Table II

Definition table

The table presents definitions of variables used in subsequent tables

Variable name	Definition
ΔD	Monthly changes in Moody's 12-month trailing corporate default rates.
DDEF	Distance to default, a volatility-adjusted leverage ratio defined as described in the text.
CH_TERM	Changes in the term spread, defined as the difference between constant maturity 10-year and 3-month rates.
CH_UEM	Changes in the unemployment rate.
CH_CQ	Changes in credit quality, defined as the difference in high-yield and investment-grade credit spreads
HYIS_GR	Growth in high-yield bond issuance
SRET	The return on the Wilshire 3000 index.

Results

Table III

Predicting aggregate corporate default rates

Explanatory variable	Distance to default and debt growth		Macroeconomic conditions		Credit quality		Stock returns	
	Estimate	t-stats	Estimate	t-stats	Estimate	t-stats	Estimate	t-stats
Dependent variable: ΔD								
Intercept	-0.01**	-4.08	-0.01**	-4.57	-0.00*	-2.22	-0.00*	-2.37
DDEF, Lag1	-0.09**	-3.65	-0.10**	-4.10	-0.05*	-1.97	-0.05*	-2.05
LEVGR, Lag1	0.01**	3.94	0.01**	4.44	0.01**	3.51	0.01**	2.63
CH_TERM, Lag12	-	-	-0.01**	-2.99	-0.08*	-2.39	-0.08*	-2.28
Variables with multiple lags								
CH_UEM, 3 Lags								
+, N	-	-	1		1		1	
-, N			0		0		0	
CH_CQ, 12 Lags								
+, N	-	-	-	-	3		1	
-, N					0		0	
HYIS_GR, 4 Lags								

Table III (cont)

Predicting aggregate corporate default rates

Explanatory variable	Distance to default and debt growth		Macroeconomic conditions		Credit quality		Stock returns	
	Estimate	t-stats	Estimate	t-stats	Estimate	t-stats	Estimate	t-stats
Variables with multiple lags								
+, N	–	–	–	–	0		0	
–, N					1		1	
SRET, 12 Lags								
+, N	–	–	–	–	–	–	0	
–, N							1	
12 Lags of ΔD included?	yes		yes		yes		yes	
Adj-R2	0.41		0.52		0.52		0.53	

Note: The table shows results from a regression of the monthly change in aggregate default rates ΔD on the distance to default DDEF, growth in corporate debt LEVGR, macroeconomic factors, credit quality, growth in high-yield issuance HYIS_GR and the stock return SRET. Credit quality is the change in the difference in high-yield and investment grade bond credit spreads CH_CQ. Macroeconomic factors are changes in the term spread CH_TERM and the change in the unemployment rate CH_UEM. All variables are defined in the definition table III. The regression also includes 12 monthly lags of ΔD . For variables with multiple lags, we indicate the number of lags N with a positive + or negative – sign significant at the 1% or 5% level. Estimates of DDEF, LEVGR and CH_TERM are multiplied by 100. Data is from Bloomberg, CRSP, Compustat, Haver and Moody's. The sample period is January 1990 to September 2007. The regression uses 200 observations. Standard errors are corrected for autocorrelation ** (*) indicate, at the 1% (5%) level or less, whether the coefficient estimates are significantly different from zero.

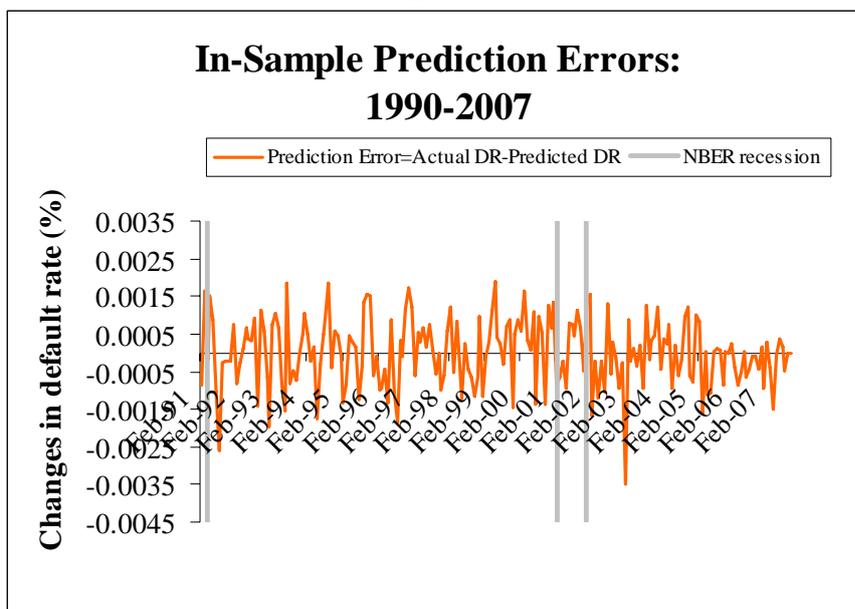
Table III shows results from regressing the change in default rates on the various explanatory variables. The estimation is carried out sequentially on the distance to default and debt growth variables, the macroeconomic variables, the credit quality variables, and the stock return. The results are shown in the table following the above pattern. Starting from the first group of results, we find that an increase in the distance to default significantly reduces the probability of default, consistent with Duffie, Saita and Wang (2007). In addition, the growth in aggregate corporate debt predicts an increase in the default rate. The latter result indicates that even though the distance to default is a function of the leverage ratio, nevertheless it may be unable to capture the dynamics of leverage changes. These two variables, along with the 12 lags of default rate changes, are sufficient to explain more than 40% of the variation in default rate changes.

For the second group of estimations, we add the macroeconomic variables. The year-ago change in the term spread is negative and highly significant. Since a reduction in the term spread predicts recessions 12-months-ahead (Estrella and Hardouvelis (1991)), this variable captures the business cycle effect on default rates. Changes in the unemployment rate also capture the business cycle effect, but not as well. Only out of the three lags in this variable is significant, although the sign is as expected: it is positive and significant at the 5% level. The addition of the macroeconomic variables increases the adjusted R-squared to 52%.

The final two groups of variables (credit quality, including high-yield issuance, and stock returns) are less effective in predictive changes in default rates. There are a total of 28 lags of these variables that are included in the regression, yet the adjusted R-squared only

increases 1%. However, the signs of the estimated coefficients are of expected signs, even though few of them are statistically significant at the 5% level. For example, an increase in the difference between high-yield and investment-grade credit spreads predicts an increase in the default rate, consistent with a decrease in credit quality overall. An increase in the stock return predicts a decrease in the default rate. Finally, an increase in high-yield issuance predicts a decrease in the default rate. This result likely reflects the fact that high-yield issuance generally increases during good economic times.

Figure 6

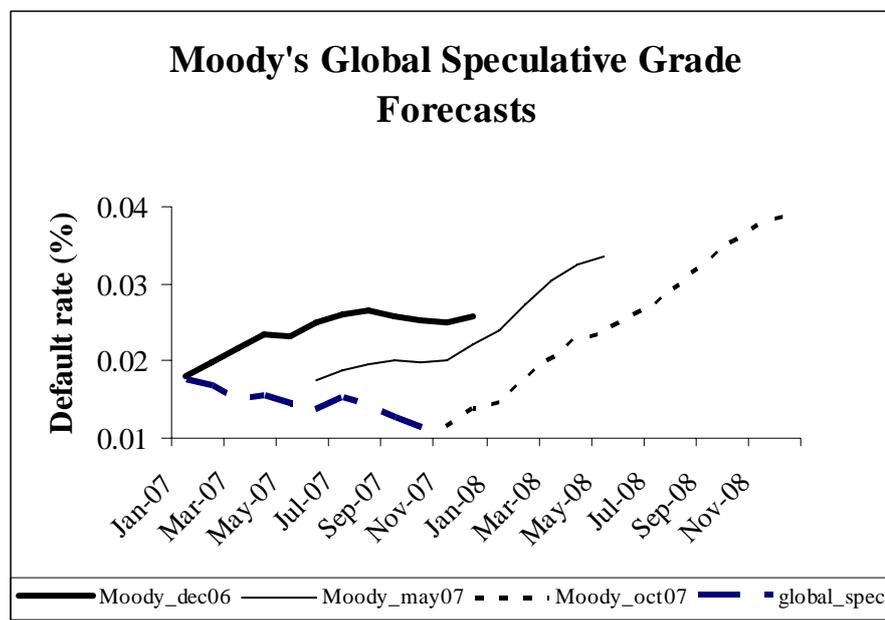


The figure plots the in-sample prediction errors from the aggregate default prediction model. The model is estimated over the period 1990 to September 2007. The change in default rates are regressed on distance to default, growth in corporate leverage, macroeconomic and credit quality variables, high-yield issuance and stock returns.

Overall, our prediction model does a good job of explaining the in-sample variation in aggregate default rates. Although some previous work has achieved higher R-squared, those results applied to regressions of default rate *levels*. Given the high persistence in default rates, it is expected that levels regressions should achieve higher R-squared. Figure 6 plots the prediction errors and they cluster around zero for most of the sample period. It is notable, however, that the prediction errors turn consistently negative since 2006. This is consistent with results obtained by economists and ratings agencies. The “over-prediction” of default rates is apparent in Figure 7 which illustrates Moody’s predicted and actual default rates for global high-yield bonds for 2007.

Figure 7

**Moody's forecasts of defaults
in global speculative grade bonds**



The figure plots Moody's forecasts of global speculative grade corporate default rates made in December 2006, May 2007 and October 2007, along with the actual global speculative grade default rates for January to October 2007.

While in-sample fit is desirable, even more emphasis should be placed on the out-of-sample fit. To that end, we first investigate the stability of the estimated relationships.

Stability tests

To ascertain the stability of the results, we perform a number of structural break tests, including the Chow Breakpoint test, the Andrews test for an unknown breakpoint and the Ramsey RESET test. While the tests of the different results are not completely consistent (as they generally tend not to be), a conservative conclusion points to a break in 2002. Consequently, we re-estimate the regression from 2003. Stability tests do not indicate any further structural breaks. In the remaining analysis, therefore, we use estimates using only the sample from 2003 onwards. However, we have repeated all of our results using the full sample, and confirmed that the results are robust to the sample period estimated.

V. Financial innovation and aggregate default rates

So far, we have not explicitly tied our analysis of default rates to financial innovation. We turn to that task in this section. We explore the channel that financial innovation makes new sources of financing available to distressed firms, thus reducing the measured default rates. In terms of the prediction model, financial innovation may be viewed as an omitted variable. If we do not account for it, our predicted default rates will be too high for the recent years. Once we account for financial innovation, we should obtain smaller prediction errors. In other words, the prediction errors and measures of financial innovation should be negatively correlated.

We could introduce the financial innovation measures and re-estimate the original model. Instead, we first obtain the prediction errors from the original model (without introducing financial innovation) and then regress the errors on lagged values of financial innovation measures. Both approaches give similar results, so the choice of method is not germane.

Our first measure of financial innovation is the growth in leveraged loans. As discussed in the introduction, this measure (along with second-lien loans, for which we have no data) is the key channel through which high credit risk firms have been financed. Our second measure of financial innovation is the growth in aggregate CDO issuance.

Table IV
Financial innovation and aggregate corporate default rates

Explanatory variable	Leverage loan growth		CDO issuance growth		Leveraged loan and CDO issuance growth	
	Estimate	t-stats	Estimate	t-stats	Estimate	t-stats
Intercept	0.00*	2.11	0.00	1.82	0.00*	2.38
<i>LL_GR, Lag1</i>	-0.14*	-2.57	–	–	-0.07	-0.97
<i>LL_GR, Lag2</i>	0.02	0.40	–	–	0.02	0.63
<i>LL_GR, Lag3</i>	-0.07	-1.06	–	–	-0.12	-1.72
<i>LL_GR, Lag4</i>	-0.00*	-2.14	–	–	-0.01*	-2.60
<i>LL_GR, Lag5</i>	-0.02**	-10.07	–	–	-0.02**	-10.44
<i>CDO_GR, Lag1</i>	–	–	-0.12**	-3.10	-0.16	-1.42
Adj- R^2	0.28		0.06		0.30	

Note: The table shows results from a regression of the residuals from the regressions in Table III on lagged measures of financial innovation. The residuals are prediction errors from predicting monthly change in aggregate default rates while omitting to include measures of financial innovation in the model. The measures of financial innovation are growth in leveraged loans *LL_GR* and growth in aggregate CDO issuance *CDO_GR*. Estimates have been multiplied by 1000. Data is from Bloomberg, CRSP, Compustat, Haver and Moody's. The sample period is January 2005 to September 2007. The regression uses 27 observations. Standard errors are corrected for autocorrelation ** (*) indicate, at the 1% (5%) level or less, whether the coefficient estimates are significantly different from zero.

We regress the prediction errors on five lags of the growth in leveraged loans. Results are shown in Table IV. As hypothesized, four of the five lags are estimated to have negative signs; and three of these are significant at the 5% level or less. Therefore, past increases in leveraged loans result in smaller prediction errors: once we incorporate financial innovation variables, the predicted default rates are less likely to over-shoot the measured rates. The adjusted R-squared is 28%, indicating this variable by itself can explain almost one-third of the variation in prediction errors.

Figure 8.

**Aggregate CDO issuance growth
and subsequent default rate changes**

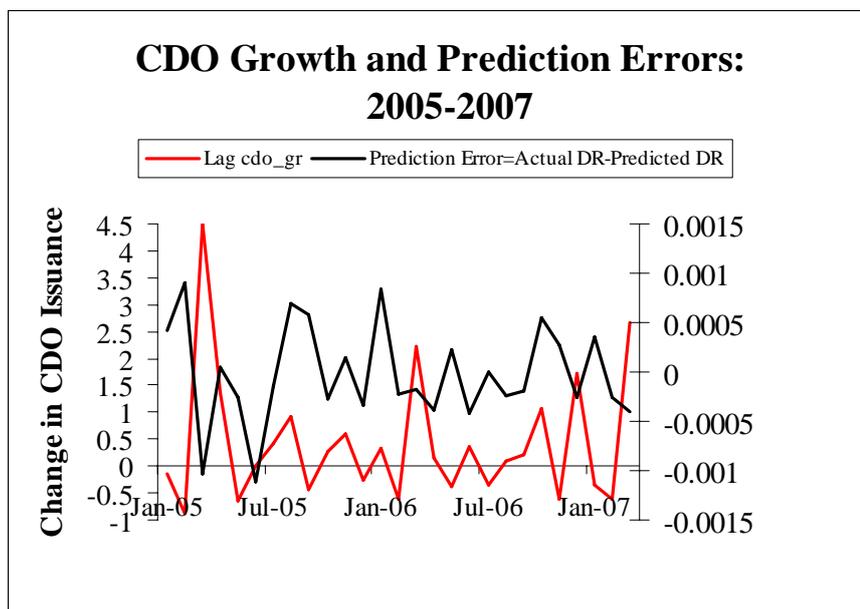
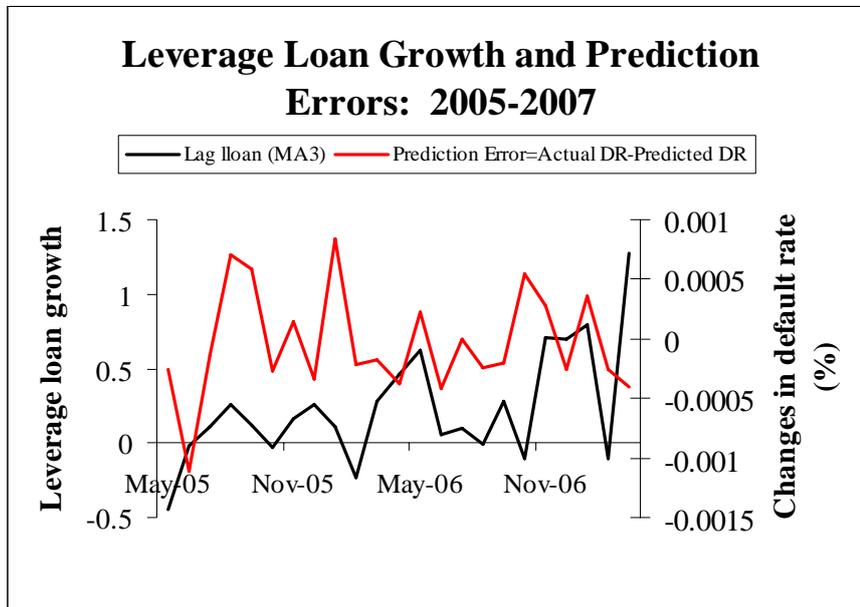


Figure 9

**Aggregate leverage loan growth
and subsequent default rate changes**



We next regress the prediction errors on one lag of the growth in CDO issuances and find the same result. The estimated coefficient is negative and significant. Once again, the size of innovations is negatively related to the prediction errors. Together, leveraged loans and CDO issuances can explain 30% of the variation in prediction errors. Figures 8 and 9 illustrate the path of prediction errors and changes in our measures of financial innovations.

Table V

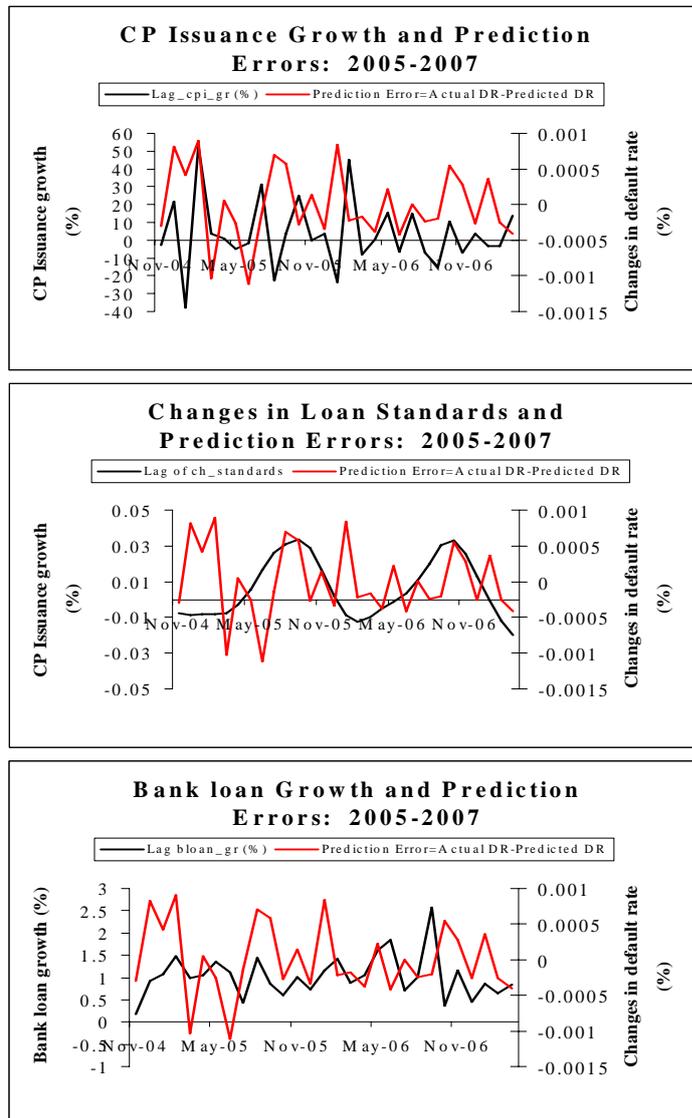
Traditional financing and aggregate corporate default rates

Explanatory variable	Leverage loan growth		CDO issuance growth		Leveraged loan and CDO issuance growth	
	Estimate	t-stats	Estimate	t-stats	Estimate	t-stats
Intercept	0.00	0.00	0.00	0.06	0.00	0.00
<i>CI_GR, Lag1</i>	-0.16	-0.04	-	-	-	-
<i>CP_GR, Lag1</i>	-	-	-0.09	-0.28	-	-
<i>CP_GR, Lag2</i>	-	-	-0.07	-0.24	-	-
<i>CP_GR, Lag3</i>	-	-	0.08	0.33	-	-
<i>CH_STAN, Lag1</i>	-	-	-	-	-0.16	-0.10
Adj- R^2	-0.01		-0.05		-0.06	

Note: The table shows results from a regression of the residuals from the regressions in Table III on lagged measures of financial innovation. The residuals are prediction errors from predicting monthly change in aggregate default rates while omitting to include measures of traditional financing in the model. The measures of traditional financing are growth in commercial and industrial loans *CI_GR*, growth in commercial paper issuance *CP_GR* and changes in lending standards *STAN_CH*. Estimates have been multiplied by 1000. Data is from Bloomberg, CRSP, Compustat, Haver and Moody's. The sample period is January 2005 to September 2007. The regression uses 27 observations. Standard errors are corrected for autocorrelation ** (*) indicate, at the 1% (5%) level or less, whether the coefficient estimates are significantly different from zero.

Figure 10.

Traditional financing and prediction errors



An objection to our results is that, since during this period, issuances of all kinds were rising, our results reflect the positive effect of general lending growth on default rates, and hence is not special to financial innovation. To address this issue, we repeat our previous tests using various measures of traditional financing. These are: growth in commercial banks' commercial and industrial loans, growth in commercial paper issuances and changes in commercial banks' lending standards. These results are shown in Table V. We find that no measure of traditional financing has a significant effect on the default prediction errors. The t-statistics are very small, all less than 1. Moreover, in all cases, the adjusted R-squared is negative. These results are a sharp contrast to the significant relation between prediction errors and financial innovations. Figure 10 illustrates the paths of prediction errors and changes in traditional financing measures.

VI. Conclusion

In recent years, two trends emerged in U.S. credit market – the boom in structured finance activities manifested a strong trend in financial innovations, and a very low default rate

among U.S. borrowers (Altman (2007)). Increasingly, anecdotes and media discussions suggest a link between the two – development of financial innovations in credit market have both opened new channels of credit financing for borrowers, and created new investment opportunities for investors (capital suppliers) with different risk preference and risk-return tradeoff. For example, by repackaging risky bonds or loans into CDO products which redistribute risk and return of the portfolio through “tranching”, investors who traditionally stay away from distress investing can enter the market through investing in the safe tranche of a CDO investment product. As more capital is channeled in and becomes available to even highly risky borrowers companies that might have to default otherwise can survive longer, a phenomenon underlying the observed low default rates accompanying the recent financial innovations.

In theory, the role financial innovations play in corporate default dynamics is unclear. Default rate could be low simply due to cyclical factors which are unrelated to financial innovations. Furthermore, the impact, if any, can be permanent or transitory with opposite directions, depending on factors identified in theory. For example, if the marginal firms affected are those in need of funding for available positive-NPV investment opportunities, additional capital channeled through innovation would have permanent positive benefits for the company and possibly the economy as a whole. On the other hand, if the marginal firms tend to be distressed borrowers without viable investment opportunities, innovations might simply fund a temporary “survival” option to the borrowers who will ultimately default in later stage with poorer recovery. A even worse possibly outcome for the second type of the firm, as discussed in Jensen and Meckling (1976), is that given the newly available capital, the close-to-distress companies might be further incentivized to risk shift more, in which case the net effect of innovations might be an increase the default risk, *ceteris paribus*.

In this paper, we empirically investigate the relationship between financial innovations and U.S. corporate default rates. Using rating cohort-level evidence and a regression analysis to better control for business cycle effect, we first document that aggregate default rates in recent years (2006–2007) are indeed unusually low. More importantly, we find strong evidence that past growth in financial innovations is associated with subsequent default rates that are unusually low as suggested by a default prediction model.

Specifically, we first form annual rating cohorts and investigate the two-year forward default rates of each cohort through time. The “Ba and B” and “Caa and below” cohorts formed in 2004 and 2005 both exhibit default percentages in two years after cohort formation that are significantly lower than the 20-year sample average. After we remove the business cycle effect embedded in the time variation of the forward default measure, we continue to observe the 2005 “Ba and B” cohort carrying the third lowest 2-year forward default rate in the sample.

If financial innovations indeed drive default rates lower, we would expect to observe a negative relation between changes in innovation activities and subsequent changes in default rates. To test this hypothesis, we first build a default prediction model which explains more than 50% of the time variation in monthly changes of the U.S. historical aggregated default rates. The prediction errors for aggregate monthly default rate in 2006 and 2007 are regressed on proxies for financial innovations, namely the aggregate CDO issuance and leverage financing volume. Our results show that higher aggregate CDO issuance or leverage financing volume is negatively associated with subsequent changes in aggregate default rates.

To the best of our knowledge, this is the first systematic evidence that financial innovations are negatively related to aggregate default rate changes. We believe this finding is important. First, existing structural models of default risk have not taken into account explicit considerations the role of financial innovations in affecting aggregate default rate dynamics. Although many structural models have the potential flexibility to incorporate the exogenous changes of financial innovation, the current literature does not have clear implications on

through which parameter the impact could enter the model. For example, innovations could be viewed as exogenous shifts that lower the debt financing cost of the borrower, extend the effective maturity of the existing debt (like a debt rollover), or lower the default threshold parameter via replacing existing debt with cheaper debt financing. Related to the latter possible channel, several papers have endogenized the default event (eg Leland and Toft (1996) and Anderson, Sundaresan, and Tychon (1996)) by making the default threshold endogenous. However, the evidence in this paper suggests a mechanism of affecting the default threshold differently.

Secondly, as very much discussed and debated in the recent credit market turmoil, regulators face the task of assessing the net impact of financial innovations on the economy. Although our findings suggest a positive role of financial innovations in lowering default rates in the short run, it remained to be investigated whether the impact is persistent. Furthermore, theories suggest that the impact of financial innovations on default risk is likely to be different (even opposite), depending on the investment opportunity set and the financial state of the borrower. We are currently further investigating these questions.

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Stress testing with incomplete data: a practical guide

Stacia Howard¹

1. Introduction

With the ever-increasing diversification and inter-connectedness of financial systems, regulators have been dedicating more resources to understanding the relationships within their financial systems and investigating any inherent vulnerability. As such, a number of methodologies have been developed to analyse the stability of the financial sector. One of the more popular ways in which financial stability is assessed is through the use of stress tests. Stress tests, in the commercial banking literature, refer to assessing the impact of a rare but plausible shock to the financial system. Countries have to determine whether the financial institutions to be included in the analysis would conduct their own individual stress tests and then the regulator would aggregate the submitted data to arrive at a macro stress test; or whether the regulators would collect the necessary data and conduct one stress test based on the information received. Based on the stability reports published by various regulatory bodies throughout the world, the preference seems to be to collect the data to perform the stress test rather than rely on individual institutions to submit their results.

The first step is usually to determine what risks will be stressed and specifying the scenarios, as this will assist in determining the methodology to be used and the data requirements. In most instances historical data is employed to evaluate the sensitivity of commercial banks' balance sheets to various shocks to macro fundamentals and then utilising the estimated coefficients to simulate the impact on the financial system of possible stress scenarios in the future. Three broad techniques have been used to implement the stress testing approach: (1) time series analysis; (2) panel data regressions, and, (3) structural models (see Sorge and Virolainen, 2006 for more details).

Time series models are perhaps the simplest technique to apply. Kalirai and Schicher (2002), Hoggarth and Zicchino (2004) and Delgado and Saurina (2004) estimate models of the determinants of loan write-offs or non-performing loans. The coefficients from these regression equations were then employed to assess by how much one of the macro fundamentals would have to change before the system experiences severe stress. Rather than focus on one or two indicators of financial stress, Hanschel and Monnin, (2005) develop a stress index using market price, aggregate balance sheet, non-public information and other structural data. After estimating the stress index, the authors then try to forecast the index by using macroeconomic imbalances.

One of the drawbacks of aggregate or time series models is that they aggregate the microeconomic defaults that lead to financial stress. Panel data regressions can account for bank-specific factors that may be highly correlated with financial stress at a particular institution. Bangia et al. (2002) use credit migration matrices (which show the expected changes in credit quality of borrowers) to provide the linkage between macroeconomic conditions and asset quality. Using the credit ratings history of 7328 borrowers between 1981 and 1998, largely corporate institutions, the authors attempt to estimate the migration matrix, or the probabilities of being in a particular debt-rating grade. The stress test is therefore done

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by analysing how the portfolio value distribution changes during expansions and recessions. During recessions, Bangia et al. (2002) estimate that the level of economic capital needed is 30 percent higher than during an expansion year.

Panel regression approaches have also been employed to evaluate the effects of the introduction of new regulatory approaches. One of the main concerns regarding the Revised Framework on bank's capital agreed by the Basel Committee on Banking Supervision is that it could potentially impact the level of lending to small- and medium-sized enterprises. Since small and medium-sized enterprises have higher probabilities of default, banks would have had to charge higher rates of interest or reduce the amount of lending to these firms in order to comply with higher capital requirements. Using a large sample of Italian firms, Fabi, et al. (2005) perform stress tests to compare the change in the overall risk of lending operations using the new internal ratings based approach and previously utilised techniques. The authors report that the two measures tend to be highly correlated, suggesting that the new capital adequacy framework should not significantly influence lending to small- and medium-sized enterprises. In contrast, Peura and Jokivuolle (2004), also using a stress testing framework to evaluate the effects of the new rating-sensitive capital charges of the Revised Framework on bank's capital, argue that the new framework is indeed likely to have a significant impact. The simulation-based approach conditions the rating transitions on the business-cycle phase, and provides estimates of actual bank capital and minimum capital requirements simultaneously. The joint dynamics of these determine the necessary capital buffers, given a confidence level for regulatory capital adequacy chosen by bank management. The numerical results indicate that the introduction of rating sensitive capital requirements will oblige banks to hold higher bank capital buffers than are currently observed due to the increased volatility of the minimum capital requirement.

de Bandt et al. (2008), in contrast to previous studies, apply the stress testing framework to investigate the effects of macroeconomic shocks on the corporate segment of the debt market. The study derives the equilibrium in the corporate debt market in terms of the interest rate and the volume of debt of non-financial corporations by simultaneously estimating a supply and demand schedule for debt. The model is estimated using data on corporate firms in France, Germany, Italy and Spain between 1993 and 2005. Two scenarios are considered: (1) a significant reduction in world demand and (2) a significant increase in oil prices. The results from the stress test suggest that the equilibrium depends to a large degree on the change in the default rate: in the second scenario the real debt burden is about 25 basis points higher relative to the recession scenario, as higher oil prices lead to higher short-term interest rates and second round effects on inflation trigger a reduction in real GDP growth.

Structural models attempt to embed loan default models into structural macroeconomic models. Basu et al. (2006), for example, outline a framework for augmenting the IMF's financial programming approach with a module to stress test the financial sector. The proposed framework can also be used to conduct sensitivity analysis of the aggregated financial sector to various types of risks, including foreign exchange, interest rate, and credit risk. Similarly, Drehmann et al. (2005) develops the Bank of England's Medium-Term Macroeconometric Model to explain the relationship between the between write-off rates and liquidation rates for the corporate and household sector based on various macroeconomic fundamentals.

As a complement to the techniques described above, Čiják, (2007) proposes a framework that allows the clear mapping of the macroeconomic shock onto the balance sheets of financial institutions but could also stand on its own and rely more heavily on the judgement of the analyst. In this way, if econometric techniques are difficult to implement, analysts are still able to map the impact of a macroeconomic shock and arrive at reasonable results. Furthermore, this framework permits contagion and feedback analysis, areas that are often overlooked by other models.

It is clear based on this preceding summary that the conduct of stress tests, regardless of the methodology chosen, requires a great deal of data to adequately examine the various risks identified for a given financial system. Quite a bit of work has already been done on the methodologies that may be employed to conduct stress tests of the financial system (see Blaschke et. al. (2001) and Sorge (2004) for good surveys of existing methodologies). There is, however, a dearth of work related to the data itself. Often what prevents a country from including stress tests within their surveillance tools or, if included, prevents a comprehensive stress test with useful results, is some form of data constraint. For example, the information needed may not be collected, there are inconsistencies or there are concerns regarding the accuracy of the data. Countries are often forced to compromise when it comes to data and this can have a negative impact on the results. For those countries now introducing stress tests to their supervision operations, there is limited advice available on how to work around the data constraints. The main goals of this study are to address some of the data problems encountered when conducting a stress test as well as suggest some possible solutions.

Following this introduction, section 2 of the paper outlines the minimum data requirements of stress testing. Its seven sub-sections provide discussions of the most common macroeconomic shocks considered as well as the various risks commonly analysed when conducting stress tests (namely, interest rate, exchange rate, country, credit, interbank and liquidity risks). Each sub-section offers a brief description of the methodology used, the resulting data requirements and constraints and the solutions suggested (wherever possible). Section 3 uses the example of the country of Barbados to show how some of the common data deficiencies were surmounted. The final section concludes by offering suggestions on the direction of future work in the area.

2. Minimum data requirements

2.1 Macroeconomic Shocks

Before delving into the specifics, there is information that forms the basis of stress testing, regardless of methodology, without which the entire process becomes next to impossible: (1) macroeconomic data, and; (2) commercial bank financial statement data. In terms of the macroeconomic data, the minimum the approach requires are estimates of aggregate nominal or real GDP. Depending on the methodology to be employed, the explanatory variables to be stressed and the level of preciseness required for the exercise, information could also be collected on the following commonly used variables:

- National Accounts data by economic sector
- National Accounts by expenditure
- Inflation
- Nominal exchange Rates
- International reserves
- Unemployment
- Current account balance
- Nominal interest rates
- Foreign direct investment
- Money supply

The impact of these shocks should be transferred onto the financial statements of the institutions included in the stress test exercise. As such, the analyst would also need to

collect financial statement data for the financial system; the level of disaggregation needed would once again depend on the risks to be analysed. As a guide, the minimum data from the financial statements should include:

- Economic Capital
- Capital Adequacy Ratio
- Net Income

The remainder of this paper assumes that at least either the economic capital, capital adequacy ratio or net income figure is available, as any one of these could form the basis of evaluating the impact of the shock on the viability of the financial institution. The preference is to use either a capital adequacy ratio or economic capital because there are international guidelines set forth by the Bank for International Settlements, and this allows for comparison across countries.

2.2 Interest Rate Risk

Once the basic information requirements have been fulfilled, the main goal of stress testing is to assess the impact of various risks on the financial system. One of the most fundamental risks to be assessed is interest rate risk. Stress testing for interest rate risk attempts to determine the impact on financial stability of a change in interest rates through the consequent effect on interest income/expenses as well as the interest sensitive components of the balance sheets of financial institutions. Blaschke et. al. (1988) explains that interest rate risk develops as a result of other risks, namely repricing risk, yield curve risk, basis risk and options risk. As indicated in Čiják (2007), interest rate risk can be sub-divided into direct and indirect impacts, with direct interest risk occurring when a change in rates results in a mismatch of interest rate sensitive assets and liabilities (mainly the risks identified in Blaschke et al (1988)) and indirect risk referring to the impact of the change in rates on the creditworthiness of borrowers and their ability to repay. Given this aim, information must therefore be available on interest rate sensitive assets and liabilities within either individual portfolios or on aggregate basis as well as fairly detailed information on the clients of the financial institutions.

In order to address direct risk, a number of frameworks exist ranging from Excel spreadsheets (see Čiják (2007)) to econometric models (see Sorge, 2004). Nonetheless, the following information, at a minimum, should be collected from the reporting institutions:

- interest rate sensitive assets, broken down into maturity buckets determined by time to maturity (including loans, long- and short-term fixed income assets, interest bearing deposits owned by the institution, etc.);
- interest rate sensitive liabilities, broken down into maturity buckets determined by time to maturity (including outstanding loan obligations, long- and short-term fixed income obligations, interest bearing deposits liabilities, etc.), and;
- the settlement date, maturity date, coupon, yield, frequency of coupon payment of each fixed-income asset held by reporting institutions in order to determine the average duration of the fixed income assets.

To successfully investigate indirect risk, econometric models would probably be necessary to do justice to the exercise (see Basu et. al 2006) and further information would need to be sought on:

- credit ratings for corporate borrowers (Standard & Poors, Moodys and other rating agencies as well as reporting financial institutions);
- default rates for loan customers, broken down into useful categories (reporting financial institutions);

- historical data on nonperforming loans (reporting financial institutions);
- income growth rates (national labour organisations, trade unions, etc.);
- measures of indebtedness (national surveys, consumer advocacy institutions, etc.);
- degree of collateralisation of loans (reporting financial institutions), and;
- real interest rates.

2.3 Exchange Rate and Country Risk

Exchange rate risk is defined by Papaioannou (2006) as “*the possible direct loss (as a result of unhedged exposure) or indirect loss in the firm’s cash flows, assets and liabilities, net profit and, in turn, its stock market value from an exchange rate move*”. The definition offered by Blaschke et al (1988) differentiates between direct and indirect impact of exchange rate risk – a direct impact would result from the institution holding a position in a foreign currency whereas an indirect impact would result from the effect on the creditworthiness of the institution’s borrowers or counter-parties – and explains that institutions could also be impacted if they hold local currency assets that are indexed to foreign exchange rates.

The data requirements for exchange rate measurement are summarised below:

- For each currency
 - all asset items, including accrued interest, denominated in the currency in question
 - all liability items, including accrued interest, denominated in the currency in question
 - all amounts to be received under forward exchange transactions, including futures and the principal on currency swaps not included above
 - all amounts to be paid under forward exchange transactions, including futures and the principal on currency swaps not included above
 - guarantees (and similar instruments) that are certain to be called and are likely to be irrecoverable
 - all other items representing a profit or loss in foreign currencies
- Exchange rates for each currency

Country risk is tied to exchange rate risk and is often not tested separately to exchange rate risk. Nonetheless, it is worth noting because some countries issue debt in a currency other than their national currency. An institution holding this debt on their books, therefore, becomes exposed to both the risk associated with the country issuing the debt as well as the risk emanating from the currency in which the debt is denominated.

2.4 Credit Risk

Credit risk is perhaps the most studied form of financial risk and a number of methodologies have developed to measure an institution’s exposure. Credit risk can be considered as the risk of default of the financial institutions’ debtors. An important distinction must be made between expected and unexpected losses when measuring credit risk, as expected losses (which are uncertain but occur on average) are covered by provisioning arrangements within the institution and unexpected losses (which occur with unknown frequency) are not. The main concern when stress testing, therefore, is the extent of the credit risk stemming from unexpected losses and some frameworks (such as Čiják (2007)) consider evaluating the

provisioning arrangements for expected losses as creating the foundation for the remainder of the analysis.

Assessing credit risk varies from country to country with the changing characteristics of the financial system. Accordingly, the data requirements would be broader with highly developed financial markets than with less developed markets. The variables listed below do not attempt to address every possible scenario; rather, they represent only those variables likely to be necessary even in the more underdeveloped financial systems.

- Non-performing loans, preferably by sector
- Performing loans, preferably by sector
- Values for top 5 (minimum) large exposures

2.5 Contagion Risk

Contagion risk refers to “the risk that an initial (bank) failure may spill over to the rest of the (banking) industry and cause further (bank) failures” (see Schoenmaker). A number of studies have been dedicated to measuring the extent of contagion risk in the banking sector. Chan-Lau et al (2007) attempted to determine the likelihood of a large shock to one major bank causing stress to another large bank using a binomial LOGIT model. They first established the extent of an individual bank’s default/solvency risk and then calculated percentage changes in this risk. Banks with corresponding changes were interpreted as being interdependent and this measure was assumed to have incorporated all potential channels of contagion. This methodology avoids the need to explicitly identify the various interbank links and channels of contagion.

Other methods, however, are more data intensive, such as that proposed by Degryse and Nguyen (2007), where they tested contagion risk using a $(N \times (N + M))$ matrix of interbank bilateral exposures, X . Čiják (2007) also relies on quite granular data on interbank exposures in order to simulate the likely impact of the failure of one institution. The information needed for these types of studies include:

- Interbank exposures, by bank
- Interbank exposures, by instrument

2.6 Liquidity Risk

According to the Bank for International Settlements, “liquidity is ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses”.² Given this definition, liquidity risk is the risk of not meeting obligations as they come due without incurring unacceptable losses. From the point of view of an institution conducting its own internal investigation into liquidity risk, all of the necessary information on obligations as well as expected increases in asset categories would be available. From a supervisory perspective, however, much of this detail is absent and would be time consuming to collect and analyse on a frequent basis. As such, examiners often have to rely on the institution to adequately account for liquidity risk, based on authority-determined definitions of liquid assets. Assumptions are then made in order to deal with the varying methodologies that may be employed by different institutions. It is difficult to streamline these definitions across countries given the varying market structures; however, the International Monetary Fund

² *Principles for Sound Liquidity Risk*, Basel Committee on Banking Supervision, BIS.

(IMF) considers liquid instruments as those that can be sold at, or close to, full market value on short notice.³ The information that should be collected would therefore depend on the national definition of liquid assets/liabilities, but at a minimum would include:

- Cash
- Treasury bills
- Transferable deposits

3. A case study of Barbados

3.1 Introduction

Barbados is a small island economy in the Caribbean of about 274,000 inhabitants. It is an open economy and therefore is fully exposed to the risks tied to international developments. In addition, its membership of the CARICOM Single Market and Economy (CSME) exposes the country to the risks common in high levels of regional integration. The existence of both international and regional financial institutions in the country's financial sector also adds another level of global exposure. As with many countries in the world, the Barbadian financial sector is heavily bank-based, with commercial banks accounting for 66 percent (2006) of total financial system assets. In addition to the commercial banks, there are merchant banks, trust and finance companies, mortgage finance companies, credit unions, pension funds, insurance companies, asset management companies and a stock exchange. The activities of these institutions are monitored by four regulatory bodies: the Central Bank of Barbados (commercial banks, merchant banks, trust and finance companies and mortgage finance companies), the Department of Cooperatives (credit unions), the Supervisor of Insurance (insurance companies and pension funds), and, the Securities Commission of Barbados (the stock exchange and associated brokerage firms).

The country of Barbados was chosen as the case study for a number of reasons. Firstly, it is one of the highest ranked developing countries in the world (as per the Human Development Index of the UNDP) and, as such, is dealing with some of the financial problems faced in advanced economies while still hampered by the institutional framework of many developing countries. In the opinion of the author, this offers a good example of what the average developing country is facing, or could face in the near future, in their financial systems. Secondly, it is a small open economy and is therefore exposed to international financial developments with limited scope to impact global developments. Stress testing such an economy requires a slightly different approach than commonly found in the existing literature and often calls for additional data that may not be incorporated in the stress tests of advanced economies. Thirdly, as part of a common market with goals of a monetary union – the CARICOM Single Market and Economy (CSME) – it is part of a regional integration movement similar to that of the European Union and this presents its own set of challenges, especially with respect to the financial sector. Fourthly, the country is currently involved in an effort to improve its monetary and financial statistics, with the assistance of the International Monetary Fund, and the findings thus far may be of use to other countries.

As part of its surveillance of the financial systems, the CBB conducts stress tests in conjunction with the IMF and World Bank during the Financial Sector Assessment Programmes (FSAP) conducted by these international financial institutions. For the last FSAP (in 2008), two different stress tests frameworks were utilised by the CBB: (1) a macro

³ *Monetary and Financial Statistics Manual*, International Monetary Fund.

framework using the top-down approach, and; (2) a more micro stress test using an adaptation of the framework developed by Martin Čiják. The *macro* framework is linked to the CBB's financial programming model and so is dependent on the forecasts in the financial programming model. This obviously allows for a consistent view of the future of the economy as a whole, with the stress test model operating like a satellite model; but it also presented some challenges because it becomes dependent on the forecasts. The *micro* framework has the advantage that it could be linked to the financial programming model, but it could also stand alone and still present solid results.

While the first framework was used by the CBB in previous FSAP missions, the second framework was tested internally for the first time in 2008 and its results compared with the first methodology to check for robustness. Both methodologies called for some of the same data but the "*micro*" framework had additional data requirements. Although the more information available the more all-encompassing the results are likely to be, regardless of framework, a trade-off must be made between accuracy and computational difficulty and this balance must be borne in mind by countries when designing their data collection process. For the purpose of this paper, more attention will be paid to the micro framework given that it had the greater data requirements.

3.2 Description of stress test framework

3.2.1 Introduction

The framework chosen is adapted from Čiják (2007) and is built in Microsoft Excel.

This basic analysis was augmented using a technique formalised in Worrell (2008). For each macroeconomic shock, the variable was stressed until the system failed to ascertain how long or how much stress it would take before systemic failure. This is a useful exercise because it permits policymakers a further gauge of the resilience of the financial system as well as contributing to the development of early warning systems.

The Barbadian banking sector has six banks, none of which are domestically owned. For three of the institutions, there was no useful estimate of capital, with the largest bank (measured by total assets) included. Given that the results of stress tests tend to be expressed in terms of their impact on capital, the absence of this information for half of the institutions and more than half of the assets of the banking sector presented a significant challenge. In order to surmount this problem and still arrive at useful results, the results of the stress tests were expressed in terms of their impact on the return on assets of the institutions and as a percentage of nominal GDP. In this way, the macroeconomic as well as profitability impacts of the various vulnerabilities could be easily identified, communicated and understood. It, still however, does not allow for an assessment of whether the stress was sufficient to cause the bank to fail. Therefore, comparisons were made to times in the past when similar levels of loss or bank failures were experienced to give an idea of the severity of the stress.

3.2.2 Interest rate risk

The tests for interest rate risk incorporated maturity gap analysis, net interest income impact and repricing impact of various changes in the level of nominal interest rates. It required information on:

Interest rate sensitive assets, broken down by time to maturity

The existing data collection forms utilised by the CBB only requested a breakdown of loans by time to maturity. A breakdown of the other interest rate sensitive assets by time to maturity was not available from the reporting institutions. The maturity dates of government securities, however, were available from the department of the CBB that deals with

government debt (this information could also be sourced directly from government either through statistical digests or a direct request). Other interest rate sensitive assets were not available by time to maturity so, in order to be as conservative as possible, these assets were originally assumed to fall into the most liquid category. This gave an unrealistically pessimistic view of the interest rate risk of the banks, given the proportion of these assets to total assets, and so adjustments were made following discussions with bank examiners to give a more realistic approximation.

Interest rate sensitive liabilities, broken down by time to maturity

The existing data collection forms utilised by the CBB requested a breakdown of deposits by original maturity and this was used as a proxy for deposits by time to maturity. A breakdown of the other interest rate sensitive liabilities by time to maturity was not available from the reporting institutions. Therefore, in order to be as conservative as possible, these assets were assumed to fall into the most liquid category. Similar to the treatment of similar missing asset data, discussions were held with the Bank Supervision Department and adjustments were made to give a more realistic approximation.

The settlement date, maturity date, coupon, yield and frequency of coupon payment of each fixed-income asset held by reporting institutions

As corporate bonds are rare in the Barbadian financial system, the data focused on government paper as it represented the vast majority of fixed income assets of the banks (based on conversations with commercial banks). As such, the information was sourced from the department within the CBB that deals with government debt but this information could also have been sourced directly from either government or the financial institutions included in the sample. The settlement date, maturity date, coupon, yield and frequency of coupon payment were collected for each fixed income asset and each bank. Based on this data, the duration was calculated for each instrument, and then averaged for each bank.

3.2.3 Credit risk

The tests for credit risk incorporated tests for underprovisioning, broad-based increases in non-performing loans, sectoral shocks to non-performing loans and default of large exposures. It required information on:

Performing loans (pass loans and special mention loans) and non-performing loans (substandard loans, doubtful loans and loss loans)

This data was already being collected by the CBB.

Provisioning rates for each category of loan

This data was already being collected by the CBB.

Sectoral distribution of total loans (eg agriculture, tourism, manufacturing etc.)

This data was already being collected by the CBB.

Sectoral distribution of non-performing loans (eg agriculture, tourism, manufacturing etc.)

A framework to collect this data had been distributed to the reporting institutions, but data had not yet been received from all of the institutions.⁴ However, information had been

⁴ The CBB requested reporting institutions to submit this information from the beginning of their financial year. This date varied from one institution to another.

received from two institutions up to the time of conducting the stress test and was included. The information for the remaining four institutions was estimated based on the figure submitted for total non-performing loans and discussions with the bank examiners.

Values of top five large exposures

This data was already being collected by the CBB.

3.2.4 Liquidity Risk

The tests for liquidity risk incorporated tests for a liquidity run on all banks and a flight to safety test. It required information on:

Total deposits, divided into demand (demand and savings deposits) and time deposits

This data was already being collected by the CBB.

Total liquid assets

In the case of Barbados, the CBB currently defines commercial banks' liquid assets as cash, assets due from the CBB, assets due from other local banks and government treasury bills. All of this information was already being collected by the CBB. A framework to collect more precise data on liquid assets (ie all assets with a maturity of less than 12 months) is being designed within the CBB and would provide a more accurate estimate of liquid assets.

3.2.5 Exchange Rate Risk

The tests for exchange rate risk incorporated tests for both direct and indirect exchange rate risk. It required information on:

Total foreign currency denominated assets, by currency

The CBB only collected information on assets by country. This was used as a proxy for assets by currency since most of the assets by country are denominated in the currency of the country. A framework has been developed to collect both a country as well as a currency breakdown given that there are some assets that are denominated in a currency other than the national currency of the country.

Total foreign currency denominated liabilities, by currency

The CBB collected information on total foreign currency deposits. Given the fixed exchange rate regime of the country – the Barbados dollar is pegged 2:1 to the US dollar – the vast majority of foreign currency deposits are held in US dollars. Therefore, all foreign currency deposits were assumed to be held in US dollars as a breakdown was not available. Information on total liabilities by country was available and this was used as a proxy for liabilities by currency since most of the liabilities are denominated in the currency of the country. Similar to foreign assets, a framework has been developed to collect both a country as well as a currency breakdown given that there are some liabilities that are denominated in a currency other than the national currency of the country.

Foreign Currency Loans

This data was already being collected by the CBB.

3.2.6 Contagion Risk

The tests for contagion risk incorporated tests for pure contagion risk (this would result from selected institutions failing to meet their interbank obligations) and macro contagion risk

(which would result from the negative impact of a macroeconomic shock). It required information on:

Interbank borrowing and lending by creditor and debtor

This data was already being collected by the CBB.

4. Conclusion

The data requirements of stress testing are one of the main hindrances for many countries when trying to assess the vulnerabilities within their financial systems. This paper attempted to outline the main variables for which data needed to be collected in order to measure the most commonly analysed risks. In addition, it gave examples of how some data constraints could be surmounted using Barbados as a case study. Further work, however, needs to be done in the area of coming up with proxies for missing data, especially financial statement data, as the implementation of new data collection forms is a complicated process that often takes more time than is available. In addition, measurement of equity and commodity price risks should be incorporated into future work.

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The use of security-by-security databases to monitor the interest rate of private debt securities and to measure credit risk premium – the Portuguese case¹

João Miguel Coelho²

1. Introduction

The recent turmoil in financial markets brought new challenges and demands to the compilers of statistics. The current set of statistics on financial markets seemed insufficient for an appropriate and prompt intervention of policy-makers. With the present knowledge about the holdings of mortgage-backed securities or asset-backed securities, it proved very difficult to find who ultimately bears the risk of default of underperformance loans. Only more recently, after the presentation of companies' losses, is becoming possible to measure the extent of the damage caused by the subprime loans crisis. To appropriately answer the new demands that statisticians face in this new context, the introduction of risk categories in the current set of statistics compiled by central banks should be taken into account, as well as the compilation of new statistics, able to monitor risk. In this article, the author explores the use of the Portuguese security-by-security database on issuances to monitor the interest rate of private debt securities and their corresponding spreads. Spreads are obtained from the comparison of the underlying rates of debt securities and market risk-free interest rates of similar maturity, giving a measure of the credit risk premium.

The proposal presented in this document is based on a security-by-security database on issuances, a tool increasingly used within the scope of the European System of Central Banks (ESCB). These databases were developed to comply with the obligations that were defined by European Central Bank (ECB) guidelines on several statistics. With developments in financial markets worldwide, securities statistics have increasingly gained importance. In this context, security-by-security databases enable a more efficient and harmonised production of statistical data. The security-by-security system managed by Banco de Portugal, an integrated system that includes data on issues and portfolios and covers all the economy's institutional sectors, makes it possible to cope efficiently with most information requirements in the field of securities statistics and thus of financial markets.

The coupon rates associated with debt securities, along with the dates of coupon payments, are included in these databases mostly because they are needed to calculate accrued interest and interest payments in the framework of the financial accounts and the balance of payments/international investment position. They can also be used to examine the coupon rates of private debt securities and their corresponding spreads. The regular use of security-by-security databases for this purpose is encouraged by the author as an extension of the analysis based on Monetary Financial Institutions Interest Rate (MIR) statistics, since micro data on securities and issuers are available on those databases, and also as an alternative to the use of commercial databases, the typical source for this type of analysis.

¹ The views expressed herein are those of the author and do not necessarily reflect those of the Banco de Portugal. The author wishes to thank Ana Almeida, Carmo Aguiar, José Faustino and Homero Gonçalves for their valuable comments.

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The article is organised as follows. After the presentation of the motivation in the Introduction, in the second section the characteristics of the Portuguese database are described. The third section contains an exploratory analysis of the results. Finally, suggestions are made for the further use of security-by-security databases in this domain.

2. Database and methodology

Statistical data on securities are compiled through the security-by-security system managed by Banco de Portugal (SIET, the Portuguese acronym for Securities Statistics Integrated System). This system was developed by the Statistics Department of Banco de Portugal with the purpose of gathering in a single repository all the information deemed necessary to comply with reporting statistical requirements on securities. SIET was designed to meet the user needs, at both national and international level.

In the segment of issuances, information is collected on securities issued by resident entities in Portugal, either issuance in the Portuguese market or in external markets. Data on issues are collected from several sources, namely, from the institutions that register and act as a depository for commercial paper, the listings in the Lisboa Euronext Bulletin, the Government Gazette, the Portuguese Government Debt Agency, the Monetary Financial Institutions (including the Banco de Portugal) and the entities that issue the securities, mainly when they are made in external markets. In accordance with Article 13 of the Organic Law of Banco de Portugal and the Guideline of the ECB on monetary, financial institutions and markets statistics (ECB/2007/9) of 1 August 2007, Banco de Portugal shall ensure the production of securities statistics covering issues by Portuguese residents and it may require from any public or private body the direct supply of information deemed necessary for the compilation of these statistics.

SIET stores information on the type of instrument, the institutional sector, prices (quotations), transactions and positions associated with securities issues (issues, redemptions and outstanding amounts), interest rate coupons, interest payments and maturity dates. Classification of securities and entities follows the European System of National and Regional Accounts (ESA/95), which is complemented by the ECB Guideline mentioned above. Securities are preferably identified through the ISIN code (International Securities Identification Number) and resident issuers through the NPC (Portuguese acronym for Legal Person Identification Number).

Securities issues statistics are reported to international organisations, namely the ECB and the Bank for International Settlements (BIS). In the case of the ECB, the Portuguese database also contributes to the Centralised Securities Database (CSDB). The purpose of the CSDB is the set up of a database with complete, consistent, validated and updated information on all securities relevant to the ECB's statistics. This database uses information from commercial databases and other sources, among which are the National Central Banks (NCBs) that maintain security-by-security databases.

In order to develop the analysis of this article, the following data were extracted from the database: issuer identification number, institutional sector, amount of issuance, interest rate coupons, market interest rates, issue dates and maturity dates. In the study 19,975 observations (securities) were used, 18,301 from non financial corporations and 1,674 from financial corporations.

The coupon rates are obtained from each debt security at the time of issuance and the weighted average of the coupon rates was determined by the amount issued according to the following expression:

$$\frac{\sum_{i=1}^n C_i \cdot w_i}{\sum_{i=1}^n w_i}$$

In which C_i is the coupon interest rate of security i , weighted by the amount issued each period, which is represented by w .

Spreads were obtained as the difference between the coupon rates of each security issued and the market interest rates. For every security, the same original maturity was used to compare both, coupon and risk-free market interest rates, in order to obtain the credit spread. The reference rates adopted were the Euribor (Euro Interbank Offered Rate) for short term maturities and the yields on Portuguese Treasury bonds for long term maturities. As so, spreads are represented by the expression:

$$\frac{\sum_{i=1}^n (C_i - R_i) \cdot w_i}{\sum_{i=1}^n w_i}$$

In which R_i represents the risk-free market interest rate for the same original maturity of security i .

3. Exploratory findings

This chapter contains an exploratory analysis of the results. The coupon rates for the financial institutions are described in chart 1.

The coupon rates are very much in line with the market risk-free interest rates for the period under observation. Note that under these coupon rates there is a mixture of several maturities, different amounts issued and distinct financial institutions, including banks, financial intermediaries and financial auxiliaries, whose characteristics are rather different between them. After examining the coupon rates, it is also feasible to obtain the spreads associated with each issue. Credit spreads reflect the particular characteristics of an obligation. For example, private debt generally has lower credit quality than sovereign debt. They also reflect the financial condition of the issuer, the issuer's industry and the issuer's home country (the country risk). If an obligation has both credit and liquidity spreads, it may be difficult to separate these into two distinct spreads. The same maturity must be used when comparing both rates, coupon and market rates. Chart 2 illustrates the results obtained for the financial sector. It can be seen that the spread is not constant over time. A negative spread means that the financial institutions were able to finance their activity by selling bonds directly to their costumers, most likely as substitutes to time-deposits. On the opposite,

Chart 1
Financial Institutions
coupon rates

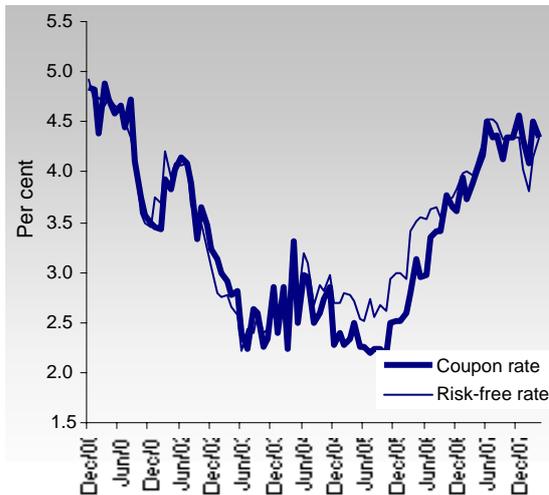
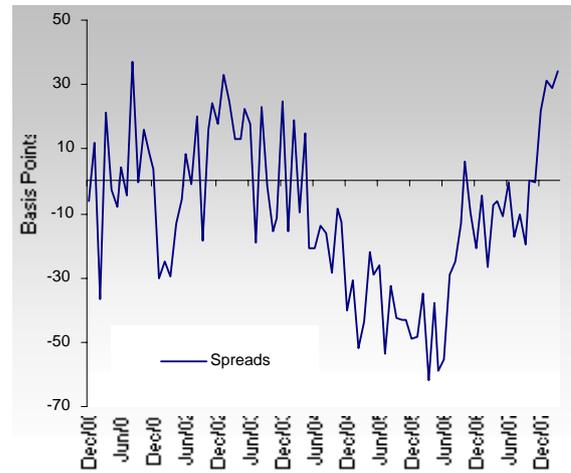


Chart 2
Financial Institutions
Spreads



spreads are positive when the financial institutions are out of available alternatives to finance their activity in the interbank market. Of course, high spreads may also reflect the poor conditions of one financial institution. If it really captures the financial conditions of the issuer, it was relatively high during 2001–2003, a bearish moment in the financial market, decreased until mid-2006, alongside the expansion of the world economy, and rose steadily since then, accompanying the upturn of interest rates, augmented by the recent liquidity constraints in the interbank money market. To conclude further, this analysis should be complemented with more indicators, such as the scoring attributed by rating agencies and the turnover of the money market. For the seven years under examination, the average spread was around –10 basis points, indicating that the financing through debt securities was an advantageous alternative to interbank loans.

A more detailed analysis by type of financial institution is also possible. As an example, the coupon rate associated with one particular institution (bank A) can be isolated from the dataset. Chart 3 and 4 allows the comparison between the financial sector and a single institution.

Chart 3
Financial vs Bank A
coupon rate

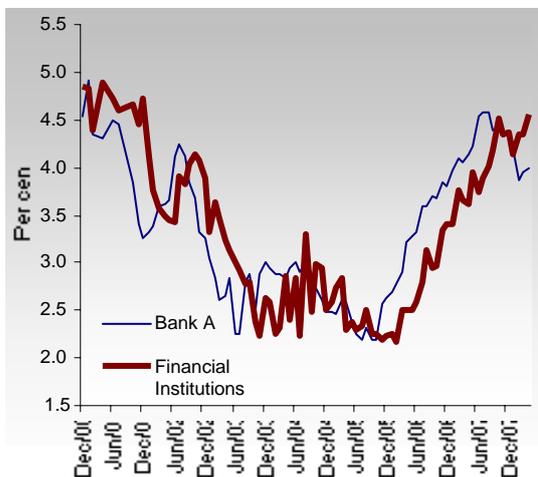
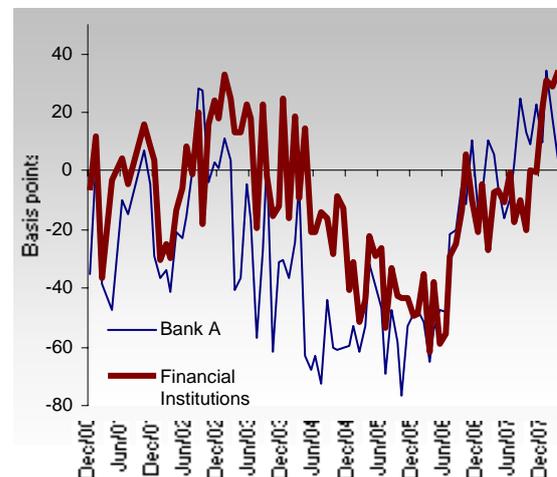


Chart 4
Financial vs Bank A
spreads



In the case of the non financial corporations, the return paid on debt securities is generally higher than the return on government bonds. The high probability of default of the debt issued forces non financial corporations to pay a premium for the higher risk – the risk premium. Chart 5 illustrates the difference between the coupon rates of the underlying securities and the corresponding risk-free rates. The coupon rates closely follow the market rates.

Chart 5
Non financial corporations
 Coupon vs risk free rates

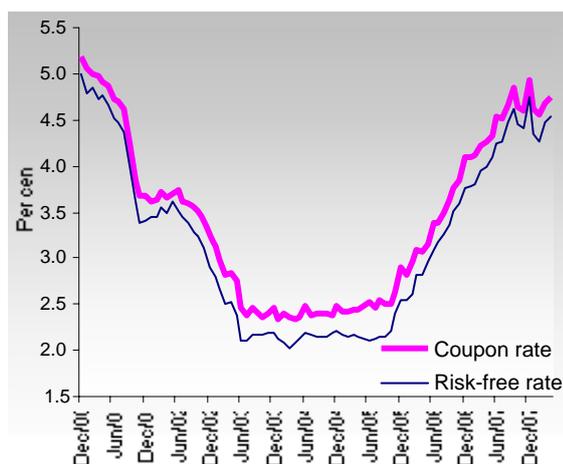
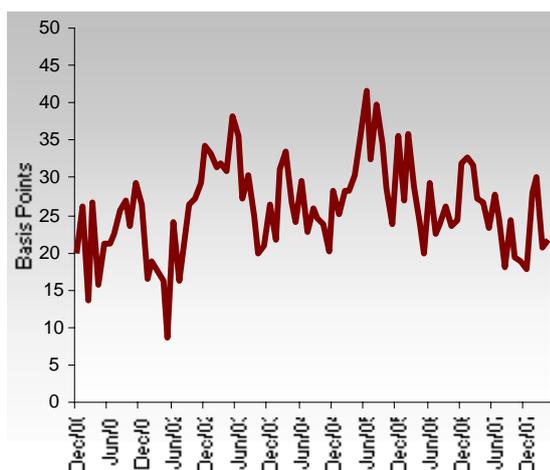


Chart 6
Non financial corporations
 spreads



When examining spreads (chart 6), one can conclude that they were always positive, reflecting the underlying risk premium. Spreads vary between 9 and 42 basis points and the average spread during the period under analysis was 26 basis points. As expected, this spread was high above the average spread obtained in the case of the financial institutions (–10 basis points). The rather irregular pattern observed may be explained by the asymmetric characteristics of the Portuguese market, with a large number of small and medium business enterprises and few big companies.

Another interesting analysis is the comparison of the spreads between financial and non financial corporations. Chart 7 shows that the spreads of the latter are usually higher, as expected, but they were similar at some stages between 2001 and 2003 and more recently since end-2007. This may be explained by the difficulties that financial institutions are facing in order to finance their activity in the interbank market. A more detailed analysis of non financial corporations by size and by sector of economic activity would be interesting, since it would highlight the differences between them. That kind of analysis is not made in this document, but it would be relatively easy to gather that information from SIET. It is also possible to analyse the coupon rates by original maturity. Chart 8 illustrates this purpose.

Chart 7
Financial vs non financial
spreads

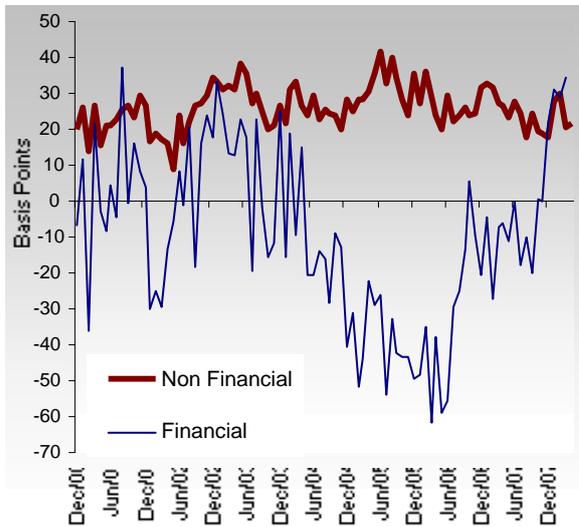
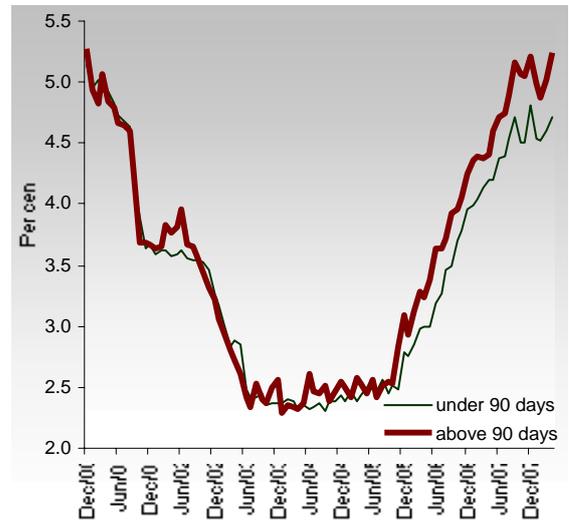


Chart 8
Non financial corporations
Original maturity



It can be concluded that, markedly since 2005, the coupon rates were higher for issues with more than 90 days of original maturity, accompanying the general increase of the interest rates and reflecting the positive slope of the yield curve since then. The reason behind this is that long term securities are less liquid compared to short term securities and investors expect a liquidity premium for investing in longer maturity securities.

A comparison can also be made between the coupon rates and the MFI³ Interest Rates statistics (MIR) of new loans to non financial corporations (above 1 million euros), which are regularly compiled by the National Central Banks of the ESCB. The following charts illustrate this comparison.

Chart 9
Non financial corporations
Coupon vs MIR statistics

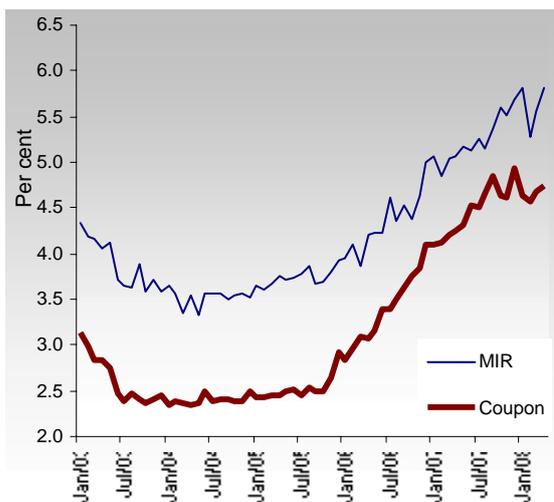
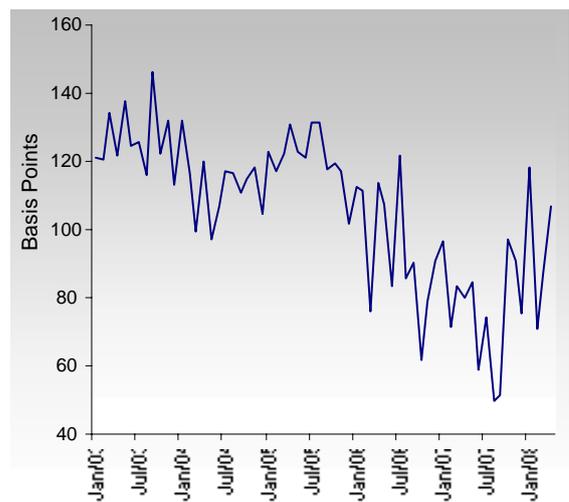


Chart 10
Non financial corporations
Coupon – MIR statistics



³ Monetary and Financial Institutions.

Both rates are very much in line for the period under observation and the coupon rates are always below the MFI interest rates indicating that the direct financing through the issuance of securities proved to be an advantageous alternative to the traditional financing borrowing next to financial intermediaries. Possible explanations for the difference found are i) the higher costs associated with the institutional arrangements of securities issues, which are not reflected in the coupon rate, and the fact that these are usually supported by large companies, financially well structured, whose issues involve large amounts ii) since securities are available to numerous investors, there is more competition in the market. It seems to be a matter of supply (investors) and demand for funds (issuers), which brings a spread advantage over traditional borrowing from financial intermediaries. One can also observe that the difference between both indirect and direct financing of non financial corporations decreased until mid 2007, the latter becoming less attractive. Since mid 2007, the issuance of securities appeared to be a good alternative to overcome the credit restrictions imposed by financial intermediaries.

Chart 11

Non financial corporations
Securities / Loans (financial accounts
outstanding amounts)

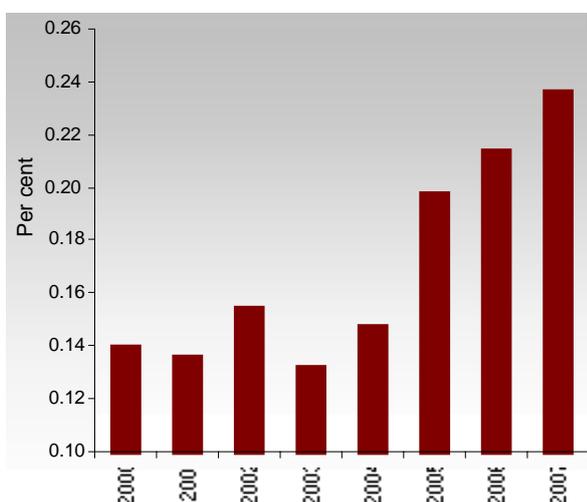
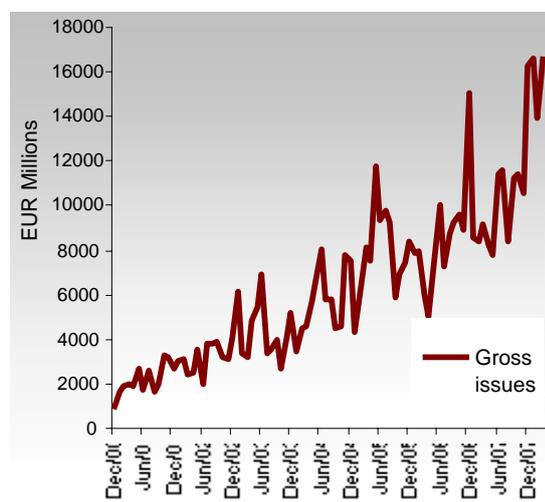


Chart 12

Non financial corporations
Gross Securities Issues



Finally, charts 11 and 12 illustrate the growing importance of the direct financing through securities. It can be concluded that the direct financing via securities gained importance, markedly since 2005, and that the gross issues rose steadily since 2000.

4. Steps forward

In the previous chapter, some exploratory findings were presented in order to illustrate the vast capability of the analysis of the coupon rates associated with securities issues. In this chapter, various steps forward are proposed. In the case of the financial institutions, since underneath the coupon rates estimated there is a mixture of several maturities, different amounts issued and distinct financial institutions, including banks, other financial intermediaries and financial auxiliaries, whose characteristics are rather different between them, a more detailed analysis by type of financial institution is also possible and desirable. When comparing the coupon rates with the interbank interest rates, positive spreads were found possibly indicating that the financial institutions were out of available alternatives to finance their activity. To conclude further, this analysis should be complemented with data on the investors of the securities issued and with more indicators, such as the scoring attributed by rating agencies and the turnover of the money market.

Concerning the non financial corporations, a more detailed analysis by size and by sector of economic activity would be interesting, since it would highlight the differences between them. That kind of analysis is not made here, but it would be relatively easy to gather that information from the SIET database. Another possible extension would be the introduction of solvency and financial debt ratios by company, with the aim of measuring the degree of differentiated spreads. These ratios by company can be straightforwardly obtained from the Central Balance-Sheet Database, which is also maintained by the Banco de Portugal. The analysis of interest rates based on security-by-security databases could also be used as an extension of the MFI Interest Rate statistics (MIR), which are defined under a Regulation (ECB/2001/18). It would allow the examination of the different characteristics of non financial corporations, since micro data by company and issuance would be available. Then, the reasons for the positive difference between MIR and coupon rates could be analysed.

Additionally, security-by-security databases could also be used to calculate spreads as a replacement for commercial databases, which are the most common source for this type of output.

5. Summary

More than a deep analysis of the coupon rates or the risk premium of Portuguese private institutions, this article presents an idea: the use of security-by-security databases to explore the interest rate of private debt securities and their corresponding spreads. The proposal presented in this document was based on one of the databases used within the scope of the European System of Central Banks. The coupon rates associated with the debt security, along with the dates of coupon payments, are included in these databases mostly because they are needed to calculate the accrued interest and the interest payment in the framework of the financial accounts and the balance of payments/international investment position. This paper explores the use of the Portuguese security-by-security database on issuances to monitor the interest rate of private debt securities and also to measure credit risk premia through spreads. Spreads were obtained from the comparison of the underlying rates of debt securities and market risk-free interest rates of similar maturity, giving a measure of the credit risk premium. Some exploratory findings were presented and various steps forward were proposed. Among other findings, the coupon rates and spreads were examined for financial and non financial corporations and some extensions were tested, such as the split by original maturity.

The analysis of interest rates based on security-by-security databases could also be used as an extension of the MFI Interest Rate statistics (MIR), which are defined under a Regulation. It would allow the examination of the different characteristics of non financial corporations, like dimension and sector of economic activity, since micro data by company and issue would be available. Like MIR, these coupon interest rates would enable an additional assessment of the impact of monetary policy on the economy and facilitate an analysis of the transmission mechanism of monetary policy, in particular of the extent and the speed of the pass-through of official rates to the borrowing of non financial corporations. Additionally, security-by-security databases could also be used to calculate spreads as a replacement for commercial databases, which are nowadays the most common source for this type of output. Since the security-by-security databases are widely used within the ESCB, it would be a less expensive alternative and it could be extended to the CSDB. Finally, as security-by-security databases also cover portfolios, the compilation of assets by risk category and by institutional sector might also be feasible in the future.

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Measures of financial stability – a review

Blaise Gadanecz and Kaushik Jayaram¹

Introduction

Unlike price stability, financial stability is not easy to define or measure given the interdependence and the complex interactions of different elements of the financial system among themselves and with the real economy. This is further complicated by the time and cross-border dimensions of such interactions. However, over the past two decades, researchers from central banks and elsewhere have attempted to capture conditions of financial stability through various indicators of financial system vulnerabilities. Indeed, many central banks through their financial stability reports (FSRs) attempt to assess the risks to financial stability by focusing on a small number of key indicators. Moreover, there are ongoing efforts to develop a single aggregate measure that could indicate the degree of financial fragility or stress. Composite quantitative measures of financial system stability that could signal these conditions are intuitively attractive as they could enable policy makers and financial system participants to: (a) better monitor the degree of financial stability of the system, (b) anticipate the sources and causes of financial stress to the system and (c) communicate more effectively the impact of such conditions.

The approach to the development of these measures of financial system stability has changed over the years as the locus of concern moved from micro-prudential to macro-prudential dimensions of financial stability. From the analysis of early warning indicators to monitor the state of the banking system, particularly the risk of default of individual institutions, the focus has shifted to a broader system-wide assessment of risks to the financial markets, institutions and infrastructure. More recently, the analytical focus has further concentrated on the dynamics of behaviour, the potential build-up of unstable conditions as well as the so called transmission mechanisms of shocks. A key issue underlying these analytical developments is the need to bridge the data gaps in several areas. Clearly this is an ongoing debate and a work in progress.

This paper is a modest contribution to review the work done towards developing quantitative measures of financial stability and their use in published FSRs. The paper is structured as follows. In Section I, we look at definitions of financial stability and what they mean for identifying key variables, which we discuss in Section II. In Section III, we review how these individual variables might be combined into composite indicators for the purposes of monitoring key sectors of the economy and assigning critical values. In Section IV, we provide a comparative view of the main variables and indicators used in selected FSRs. In Section V we discuss recent attempts to construct a single aggregate measure of financial stability. The final section concludes.

I Definition and identification of key financial system vulnerabilities

Financial stability is difficult to define and even more difficult to measure. Strictly speaking, a financial system can be characterised as stable in the absence of excessive volatility, stress

¹ Monetary and Economic Department, Bank for International Settlements. The views expressed in this paper are those of the authors and do not necessarily reflect those of the BIS.

or crises. This narrow definition is relatively simple to formulate, but fails to capture the positive contribution of a well-functioning financial system to overall economic performance. Indeed, broader definitions of financial stability encompass the smooth functioning of a complex nexus of relationships among financial markets, infrastructures and institutions operating within the given legal, fiscal and accounting frameworks. Such definitions are more abstract but are more inclusive of the macro-economic dimension of financial stability and interactions between the financial and real sectors. From this perspective, financial stability can be defined as “a condition in which the financial system – comprising financial intermediaries, markets and market infrastructure – is capable of withstanding shocks and the unravelling of financial imbalances, thereby mitigating the likelihood of disruptions in the financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities” (ECB (2007)).

Given the imprecise nature of the broader view of financial system stability, most analysts concentrate on the risks and vulnerabilities of the financial system as these are relatively easy to understand and quantify. However, there are difficulties arising from the narrow definition too, insofar as a crisis is difficult to define. Different countries have been hit by different types of crises (banking crises, currency crises, debt crises, equity crises) over time and there are several ways of defining a crisis of each type, from purely binary indicators (failure of a bank, suspension of debt payments by a sovereign creditor) to other more quantifiable variables (eg number of insolvencies, magnitude of banking losses, GDP loss, magnitude of exchange rate fluctuation, decline of stock market index). Also important is the time horizon over which to measure a crisis. For instance Frankel and Rose (1996) define a currency crisis as a nominal depreciation of at least 25% that exceeds the previous year's change by a margin of at least 10 percentage points. Patel and Sarkar (1998) identify equity-market crises using an a hybrid volatility loss measure in a window of 1 to 2 years. The interpretation of, as well as the benchmarks for, financial stability measures depend on the definition of crises. Nevertheless, several attempts have been made in the literature to try to identify and predict crises.

II Key financial stability segments and variables

Policymakers and academic researchers have focused on a number of quantitative measures in order to assess financial stability. The set of Financial Soundness Indicators developed by the IMF (IMF (2006)) are examples of such indicators, as are the monitoring variables used in Hawkins and Klau (2000), Nelson and Perli (2005) and Gray et al (2007) which focus on market pressures, external vulnerability and banking system vulnerability.

Table 1 summarises the measures commonly used in the literature, their frequency, what they measure, as well as their signalling properties. The focus is on six main sectors.

Firstly, the *real sector* is described by GDP growth, the fiscal position of the government and inflation. GDP growth reflects the ability of the economy to create wealth and its risk of overheating. The fiscal position of the government mirrors its ability to find financing for its expenses above its revenue (and the associated vulnerability of the country to the unavailability of financing). Inflation may indicate structural problems in the economy, and public dissatisfaction with it may in turn lead to political instability.

Secondly, the *corporate sector's* riskiness can be assessed by its leverage and expense ratios, its net foreign exchange exposure to equity and the number of applications for protection against creditors.

Thirdly, the *household sector's* health can be gauged through its net assets (assets minus liabilities) and net disposable income (earnings minus consumption minus debt service and principal payments). Net assets and net disposable earnings can measure households' ability to weather (unexpected) downturns.

Table 1
Commonly used variables

Sectors	Measure	Frequency	What do they measure	Signalling properties
Real Economy	GDP growth	Q or A	Indicative of the strength of the macro-economy, GDP is a key measure especially used in conjunction with measures such as credit expansion, fiscal deficit.	Negative, or low positive values would indicate a slowdown; excessively high values may show unsustainable growth
	Fiscal position of government	A, Q or M	Ability of government to find financing, vulnerability of sovereign debtor to unavailability of financing	High deficit values relative to GDP can mean unsustainable government indebtedness and vulnerability of the sovereign debtor
	Inflation	M or A	Rate of increase of various price indices	High levels of inflation would signal structural weakness in the economy and increased levels of indebtedness, potentially leading to a tightening of monetary conditions. Conversely, low levels of inflation could potentially increase the risk appetite in the financial markets.
Corporate sector	Total debt to equity	Q or A	Corporations' leverage	Excessively high levels may signal difficulties in meeting debt obligations
	Earnings to interest and principal expenses	Q or A	Corporations' ability to meet payment obligations relying on internal resources	Excessively low levels of liquidity may signal inability to meet debt obligations
	Net foreign exchange exposure to equity	Q or A	Currency mismatch	High levels of this ratio may signal difficulties in the corporate sector arising from adverse currency moves
	Corporate defaults	Q or A	Insolvencies in the corporate sector	High values can signal future problems in the banking sector, if insufficiently provisioned
Household sector	Household assets (financial, real estate ¹)	A, Q or M	Assets and debt can be used to compute net household assets	Net household assets and disposable income can measure households' ability to weather (unexpected) economic downturns
	Household debt	A, Q or M		
	Household income (labour income, savings income)	A, Q or M	Income, consumption and debt service payments can be combined to compute net disposable income	
	Household consumption	A, Q or M		
	Household debt service and principal payments	A, Q or M		

Table 1 (cont)
Commonly used variables

Sectors	Measure	Frequency	What do they measure	Signalling properties
External sector	(Real) exchange rates	D	Over-/undervaluation of a currency	Over- or undervaluation of currency can trigger a crisis (capital outflows, massive inflows or loss of export competitiveness)
	Foreign exchange reserves	D	Ability of country to resist external shocks	Reserves below short-term foreign debt, or below three months' worth of exports can signal problems
	Current account/capital flows	A, Q or M	Trade position of country	Significant trade deficits require large capital inflows in order to be financed; this raises sustainability issues about such inflows
	Maturity/currency mismatches	A, Q or M	Disparity in the currency/maturity composition of assets and liabilities	Maturity and currency mismatches can expose the economy to adverse shocks in case of adverse currency movements or sudden reversals of capital inflows
Financial sector	Monetary aggregates	M	Transactions, saving, credit	Excessive growth can signal inflationary pressures
	(Real) interest rates	D	Cost of credit, ability to attract deposits sustainability of debt.	Real interest rates above a threshold likely to exceed the trend rate of economic growth, making debt/GDP ratios explosive; negative real rates may mean banks will struggle to attract deposits
	Growth in bank credit Bank leverage ratios, NPLs	M Q or A Q or A	Riskiness of the banking sector	Very rapid loan growth has often accompanied declining loan standards/greater risk. Excessively high loan losses, leverage ratios and risk premia can foreshadow a banking crisis. Loan losses/GDP can measure cost of a banking crisis for economy
	Risk premia (CDS); credit risk component of 3 month LIBOR – OIS spreads	D		
	Capital adequacy	Q or A	Banks' capital cushion size to address expected or unexpected losses	Excessively low levels of this ratio points to potential defaults and can be a forerunner of a banking crisis
	Liquidity ratio	Q or A	Ratio of banks' readily available short-term resources that can be used to meet short-term obligations	Excessively low levels of this ratio can lead to a systemic crisis
	Standalone bank credit ratings	Irregular	Individual strength of banks, after the effect of government or other guarantees has been taken into account	Possible coincident indicator of banks' condition, likely to influence their future funding costs

Table 1 (cont)
Commonly used variables

Sectors	Measure	Frequency	What do they measure	Signalling properties
Financial sector (cont)	Sectoral/regional concentration, systemic focus	Q or A	Concentration or diversification of banks' lending strategy	Can proxy for speed of propagation of shocks in the economy
Financial markets	Change in Equity Indices	D	Net worth of, present value of future cash-flows of firms comprising the index	Above-trend growth in index, or very high levels of market to book value can be indicative of an equity price bubble
	Corporate bond spreads	D	Riskiness of debt compared to risk-free instruments	Spikes in spreads can suggest higher levels of risk, changes in risk appetite, changes in the incorporation of news into prices by the market
	Market liquidity (Government bonds, liquidity risk component of 3m LIBOR – OIS spreads)	D	Price attached by the market to the ease with which liquid instruments can be traded	Spikes in these premia can reflect disruptions in market liquidity
	Volatility	D	Intensity of price movements on markets Ease of trade on the market	Low volatility can be indicative of a calm market, but also of failings in the price discovery process. High volatility can mirror a disruption of market liquidity.
	House prices	Q, A or M		House price bubble, consumption boom fuelled by equity withdrawals, potential losses to financial sector in case of downturn in prices

Note: A = annual Q = quarterly M = monthly D = daily. Data available with a high frequency may sometimes be used with a lower frequency for FS monitoring.

¹ Measuring the financial assets of households is complicated by the measurement issues related to house price measures and the treatment of owner-occupied housings. These issues were discussed at an IFC conference held in August 2006 in Basel. The conference proceedings have been published in IFC Bulletins 25 and 26.

Source: compiled by the authors.

Fourthly, the conditions in the *external sector* are reflected by real exchange rates, foreign exchange reserves, the current account, capital flows and maturity/currency mismatches. These variables can be reflective of sudden changes in the direction of capital inflows, of loss of export competitiveness, and of the sustainability of the foreign financing of domestic debt.

Fifthly, the *financial sector* is characterised by monetary aggregates, real interest rates, risk measures for the banking sector, banks' capital and liquidity ratios, the quality of their loan book, standalone credit ratings and the concentration/systemic focus of their lending activities. All these proxies can be reflective of problems in the banking or financial sector and, if a crisis occurs, they can gauge the cost of such a crisis to the real economy.

Lastly, variables relevant to describe conditions on *financial markets* are equity indices, corporate spreads, liquidity premia and volatility. High levels of risk spreads can indicate a loss of investors' risk appetite and possibly financing problems for the rest of the economy. Liquidity disruptions may be a materialisation of the market's ability to efficiently allocate surplus funds to investment opportunities within the economy.

Typically financial stability analysis would use several sectoral variables either individually or in combinations. The use of such measures including the financial soundness indicators as key indicators of financial stability depends on the benchmarks and thresholds which would characterise their behaviour in normal times and during periods of stress. In the absence of benchmarks, the analysis of these measures would depend on identifying changes in trend, major disturbances and other outliers (Worrell (2004)).

III Composite indicators

A financial system consists of a number of key sectors, and interactions² between these sectors. The situation is further complicated by the non-linearities that can affect the propagation of shocks and their transmission from one sector to another (White (2004), ECB (2005)). For instance, there are links between monetary and financial stability, as monetary conditions will be affected by asset prices and vice versa. For all intents and purposes, it is not enough to focus on deviations from benchmarks in individual sectors for an overall assessment of financial stability. Whilst individual variables and indicators are useful in analysing the functioning of the financial systems, various studies have attempted to develop composite indicators which would better signal or predict the onset of financial distress. Beginning with the studies on early warning indicators attempts are ongoing to develop leading indicators which would signal conditions of stress. When multiple indicators are available, it would be necessary to combine them in ways that would best capture the interactions between relevant individual indicators. Composite indicators are such combinations of the individual variables (eg bank credit related to GDP) which can be

² For instance, problems in the *real sector* can affect the household sector (through job losses, loss of income, inability of the government to provide social benefits), the external sector (through loss of foreign investor confidence), the corporate sector (through reduced demand) and the financial sector (through its exposures to defaults in the corporate and household sectors). A sudden reversal of *external capital flows* can negatively affect all sectors of the economy. Difficulties in the *financial sector* can hit all sectors of the economy adversely by reducing the availability of funding. Problems in the *corporate sector* can translate into an economic downturn, can create losses in the financial sector through exposures and directly affect households through changes in remuneration and employment levels. A *household sector* in bad health can adversely influence the real economy (through reduced consumption) and the financial sector (through losses on household exposures). Lastly, disruptive *financial market* conditions can directly affect the health of the financial sector, to the extent that financial institutions are market participants. Households can also be negatively affected by adverse financial asset price movements insofar as they invest on financial markets or own real estate.

assigned benchmark or threshold values for the purposes of monitoring key sectors of the economy and serving as leading indicators of crises.

A number of studies applied the early warning indicator methods initially developed in the literature for currency and balance of payments crises to banking crises. Earlier work includes, among others, Calvo et al (1993), Eichengreen et al (1996), Turner and Goldstein (1996) Frankel and Rose (1996). Demirgüç-Kunt and Detragiache (1997) use a multivariate Logit approach to identify determinants of banking crises in a large panel of developing and industrialised countries: slow GDP growth and high inflation, vulnerability to sudden capital outflows, low liquidity in the banking sector, a high share of credit to the private sector, past credit growth, explicit deposit insurance and weak institutions. Kaminsky and Reinhart (1999) identify early warning indicators of twin (banking and balance of payments) crises, such as credit and equity prices, by looking at the ability of such variables to predict crises 12 or 24 months ahead, while minimising the noise³ to signal ratio. Borio and Lowe (2002) and Borio and Drehmann (2009) build on the techniques developed by Kaminsky and Reinhart (1999). Like the latter, they define threshold values for the indicators, but unlike them, they look at cumulative processes rather than just growth rates over one year, they use ex ante information (ie information which was available to the policymaker prior to the crisis) and, for the first time, they consider combinations of indicators and look at multiple time horizons.

Goodhart et al (2006) state that financial crisis monitoring can effectively be done with an indicator of banking sector profitability as well as the probability of default. Gerdrup (2003) uses banking indicators (number of banks, balance sheet indicators) and market indicators (asset prices) as determinants of the Norwegian crisis, controlling for non-financial sector indebtedness and macroeconomic factors. It has also been recognised in the literature (Nelson and Perli (2005), ECB (2005), Van den End (2006)) that in addition to balance-sheet based information, there is need for market information, not least because of the interactions between bank- and non-bank financial intermediation.⁴

Illing and Liu (2003) and Van den End (2006) provide a good descriptions of how one might attempt to build a composite indicator of financial stability. To begin with, relevant variables need to be selected. The choice is most often based on the early warning indicators literature (Demirgüç-Kunt and Detragiache (1998), Kaminsky, et al (1998), Bordo and Schwartz (2000)) and typically covers the banking system, the foreign exchange market and the equity market. Risk spreads and market liquidity are the two concepts most often used. Obviously, the choice of variables must also reflect the structure of the country's financial system. For instance, more importance should be attached to banking system indicators in countries where bank intermediation is more significant than market financing (ECB (2007)). Then, the single aggregate measure is calculated as a weighted average of the variables previously identified, each with a suitable lag. One important aspect of the weighted average construction is the weights. These can be determined in five different ways. Firstly, common

³ Failure to predict a crisis or a false alarm.

⁴ A number of desirable properties of a good composite indicator can be noted. It must be internationally comparable, if the analysis is conducted on several countries. Geršl and Heřmánek (2006) underline that differences in national accounting standards do not allow full cross-country comparison for some of the core set of the IMF's Financial Soundness Indicators. Furthermore, as pointed out in Čihák (2007), a good indicator must be easy to calculate, as well as to interpret; the assumptions that support it have to be robust, its theoretical underpinnings clear. For instance, backing out risk aversion measures from prices observed on the market rests on the assumption that prices can be observed on the market at all times. This assumption of market liquidity is not necessarily robust in the sense that liquidity can evaporate in times of stress. Lastly, although formalising the outcomes of tail events is important, a composite indicator has to be a useful measure of stress (eg it has to measure the build-up of imbalances) in the system even in the absence of extreme events.

factors analysis can be performed.⁵ Secondly, a weight representing the importance (size) of the market which it proxies for can be assigned to each factor. Thirdly, sample cumulative distribution functions can be estimated.⁶ Fourthly, the results of economic simulations with a macro-economic model can be used to determine the weights.⁷ Fifthly, the variance-equal method can be chosen. This latter approach is the one most commonly used in the literature and consists of normalising each variable and then assigning equal weights.

IV Use of indicators and variables in financial stability reports

Most analyses of financial stability as reflected in the financial stability reports⁸ (FSRs) extensively focus on various market segments and the variables listed in Table 1. However, the use of composite indicators is not very widespread in published financial stability reports. Table 2 provides a summary of the key indicators used by selected central banks in their FSRs. The selected sample represents a mix of industrial and emerging market economies with a diversified geographical distribution. Included in the list are a number of institutions whose reports compute composite measures in one form or the other.⁹

Key sectors and variables

When it comes to specific variables used in the FSRs, there are several common areas. Not surprisingly, the focus depends on the specific conditions in the economy and areas of observed and perceived vulnerabilities. Past episodes are also a guide. Many emerging market economies extensively focus on capital inflows, the balance of payment situation and exchange rate movements, while industrial countries focus on their banks' exposure to emerging markets. Banking ratios are extensively analysed in most reports although there are differences. Some reports tend to concentrate on the banks' performance and risks in considerable detail, while the others include insurance, hedge funds and other forms of non-bank financial intermediation. Where banking is the main form of intermediation, the available information would also depend on the level of supervisory input in preparing the report. Appropriately, many FSRs focus on systemically important banks as well as regions or sectors. For instance, the Austrian FSR has a strong focus on the developments in eastern European markets while the HKMA report extensively analyses the developments in south east Asia and China. With some exceptions, the FSRs reviewed here do not discuss monetary policy variables. A likely explanation is that central banks use other channels such as monetary policy statements or Inflation Reports for that purpose.

⁵ Such analysis consists in extracting weighed linear combinations of a number of variables, maximising the variance of each linear combination, while minimising the variance around it. The purpose of the exercise is to reduce the number of variables and detect the structure in the relationships between variables.

⁶ Each variable is transformed into percentiles, so that the highest (lowest) levels of stress are characterised by the 99th (first) percentile. Then, the transformed variables are averaged using chain linked arithmetic and geometric means.

⁷ Using a backward-sloping IS curve, Van den End (2006) estimates the impulse of changes in financial soundness indicators on GDP is estimated to determine weights.

⁸ Over 40 central banks regularly publish financial stability reports either annually or bi-annually.

⁹ The institutions/countries included in Table 2 represent an eclectic sample merely to illustrate typical use and is not intended as an exhaustive coverage of all published reports.

Table 2
Data including composite indicators in selected FSRs

Sector/Indicators	AT	AU	BR	CA	CH	CZ	ES	GB	HK	HU	ID	SE	TR	ECB ¹	IMF
Composite index								++ ²			+ ³				+ ⁴
Banking index					+ ⁵	+			+				+		+ ⁶
Financial conditions index						+ ⁷		+ ⁸		+				++ ⁹	+ ¹⁰
Monetary conditions index									+						
Real sector															
GDP	+		+	+, St	+	+	+	+	+	+	+		+	+	+
Fiscal deficit			+			+				+	+	+	+	+	
Inflation	+			+, St		+		++	+	+	+	++	+	+	
Household finance	++	++		+		++	++	++	+	++	+	++	++	+	+
Corporate finance	++	++		+	+	+		++	+	++	+	++	++ ¹¹	+	++
Policy rate ¹²	+	+		+, St				+	+	+			+		+
Monetary aggregates						+		+	+		+	+	+		++
External sector															
FX rates	Vo		Vo, St	+	Vo	Vo	+	++	Vo	+, Vo	Vo		Vo	Vo, Vi	Vo
FX exposures			++, Vo				+		+	+	+		+		++
BOP	+					+		+	+	+	+		+	+	++
Capital flows	+		+	+				+	+	+	++		+	+	++
Reserves			+					+	+		++		+	+	++
Financial sector ¹³															
Profitability	+	++	+	+	+	+	++	+	+	+	+	+	+	+ ¹⁴	+ ¹⁵
Capital ratios	+, St	+	+	+	+	+	++	+	+	+	+	++	St	+	+

Table 2 (cont)
Data including composite indicators in selected FSRs

Sector/Indicators	AT	AU	BR	CA	CH	CZ	ES	GB	HK	HU	ID	SE	TR	ECB ¹	IMF
Credit (Loans)	+	++	+		+	+	+	+	+	++	+	++	++		+
Liabilities (deposits)	+	++	+		+	+	+	+	+	++	+	+	+		+
Liquidity	+, St	+						+	+	+, St	++	++, St	++	+, St	+
Credit Risk	+	++	+, St	+	++		+, Vo	+, St	+, St	+, St	+	+, St	+, St	+, St	++
Market risk	+	++	+, St		VaR					+	+, St		+, St		++
Interest rate risk	+		+, St		+ ¹⁶ , St				+	+	+, St	St			++
Asset quality ¹⁷	++	+	++	+	+	+ ¹⁸	++	++	+	++	+	+	+	+	
Sectoral/Regional	+	+	++				++	++	+	+	+	+	+	+	+
Systemic focus	+		++		+	+	++	++	+		+	+		+	++
Financial Markets															
Government Bonds	Y		Y	Y, St		Y				Y	Y	Y, Sr	Y, Sr	Sr, Y, Vi	Y, Sr
Corporate Bonds	Sr, Vo	Sr, Vo	+	Y, Sr	Sr	Sr, Vo		S, Vo, V		Sr, Vo, Y	Y, Sr, R	Sr, Vo, Vi	Sr	Sr, Vi, Vo, Sr	Sr, Y
Money markets	Vo	Sr, Vo	Vo	Sr	Sr, Vo	Y ¹⁹		S, Vo, Vi	Sr	Sr, Vi, Y	Y, Sr	Sr, Vo	Sr	Vi, Vo	Sr, Sr
Equity prices	Vo	Vo	Vo	Vo	Vo	Vo	Vo, Vi	Vo, Vi	Vo	+, Y	Vo	Vo, Vi	Vo	Vo	Vo, Vi
Real estate prices	Vo	Vo		Vo	Vo	Vo	+	Vo	Vo	+		Vo			Vo

Notes: R – ratings, St – Stress test based, Sr – riskiness and liquidity spreads, Vo – observed volatility, Vi – implied volatility, VaR – Value at risk, Y – Average yield, + denotes the use of one indicator, ++ denotes the use of several indicators.

¹ Euro area indicators as well as global comparisons. ² Qualitative assessment based on sources, likelihood and impact of tail risks on six key vulnerabilities in the financial system. ³ Single aggregate index of financial stability. ⁴ Global financial stability map summarising risks and prospects of macro-financial environment. ⁵ Stress index for Swiss banks. ⁶ Separate composite indices for volatility and trading and market liquidity. ⁷ Separate indexes for creditworthiness and market liquidity. ⁸ A composite financial market liquidity index. ⁹ Multiple composite measures are used to estimate credit/equity/GDP gaps, financing gaps for non-financial companies and composite inter-bank liquidity indicator. ¹⁰ Banking stability index. ¹¹ Including a Real Sector Confidence index. ¹² CB monetary policy rate. ¹³ In most cases these indicators refer to Banking Sector only. ¹⁴ Large complex banking groups. ¹⁵ Including estimates of losses from write-downs of exposures. ¹⁶ 10 day VaR figures. ¹⁷ Typically includes non-performing loans, observed and estimated default rates and loss provisioning. ¹⁸ NPL and doubtful assets to gross loans. ¹⁹ 1 Yr yield average.

Source: compiled by the authors, based on Central Banks' FSRs.

Four sets of specific variables are used at the ECB (ECB (2007)). Firstly, the banking sector's balance-sheet (reflecting the continued significance of bank-based financial intermediation in the euro area), especially profitability, asset quality and capital adequacy. Particular attention is devoted to large and complex banking groups (LCBGs). Secondly, major sources of risk to the financial sector. This would include an assessment of competitive conditions in the banking sector, credit growth and banking exposure concentrations. More generally, it would cover asset price developments, business cycle and monetary conditions as well as measures of financial fragility in the counterpart sectors to banks (primarily households and non-financial corporations). Thirdly, the resilience of the financial sector based on its risk-absorption capacity (market-based and qualitative). Fourthly, forward-looking measures derived from securities prices (option implied risk-neutral distributions, direct default risks for LCBGs based on Moody's KMV, bid-ask spreads for EONIA swaps as a proxy for liquidity in the euro area money market, historical and implied volatilities, shape of the yield curve, term premia, options-implied skewness coefficient for German ten-year bonds).

Other central banks (BoE, Riksbank, Bank of Canada) also look at various components of financial stability through specific variables. In terms of their usage of market data, these central banks are fairly consistent with one another by their focus on equity prices, corporate and sovereign credit risk spreads, liquidity premia and volatility. As far as the real sector is concerned, GDP forecasts, incoming portfolio investment, official interest rates and sub-prime mortgage delinquency rates versus foreclosure rates are monitored.

In relation to the financial market turbulence that started in the summer of 2007, industrial economies' central banks have followed the market for mortgage backed securities. In particular, they have monitored issuance volumes, together with the maturity-related characteristics (in particular, duration and convexity) of such securities in order to estimate by how much long-term interest rate shocks are likely to be amplified by mortgage-related hedging flows. The BoE carries observed and market-expected losses on sub-prime mortgages and asset backed securities, in addition to house prices and a range of housing market activity measures (site visits, net reservations, new buyer enquiries net balances, sales to stock ratio and number of loan approvals fore house purchases).

Data on individual financial institutions are based on surveys and supervisory returns, as well as market data such as CDS spreads or indices. In order to monitor funding conditions for systemically important banks, several industrial economies' central banks look at the difference between three-month interbank rates relative to expected policy rates. That difference can then be further decomposed into liquidity and credit risk premia. Aggregate balance sheets of the national banking systems are typically published, broken down by geography, sector, maturity, riskiness. A number of additional measures of the banking system are analysed, eg annual write-off rates, customer funding gaps, intraday liquidity buffers, funding sources, profitability, capitalisation, equity returns, income mix (fees vs spreads), cost efficiency, share price volatility. Common large exposure counterparts are flagged. Some central banks also monitor funds' (eg hedge funds', pension funds') performance and trading events. The systemic importance of such funds, given the size of the assets under their management and the fact that they are counterparties to large systemically important banks (which act as prime brokers for them) arguably warrants this kind of monitoring.

In their monitoring of non-financial corporations in industrial and emerging economies, many industrial economies focus on CDS spreads, together with corporate finance data and default probabilities computed from Moody's KMV model. Using these individual default probabilities, multiple default probabilities can be calculated, which presumably do a better job of identifying market-wide distress than individual default probabilities.

Aggregate measures

The use of aggregate measures in some of the FSRs listed in Table 2 is very recent and in many cases not more than one or two years old. It is early as yet to make an assessment of their performance.

Of the composite measures used, the Czech National Bank (CNB), the Swiss National Bank (SNB), and the Hong Kong Monetary Authority (HKMA) use an aggregate measure to reflect banking stability or fragility. The SNB stress index for the banking sector is calculated from market data, balance sheet figures and non-public data from the supervisory authority. This continuous indicator measures stress in terms of deviation from the historical trend. The HKMA has developed a Probit model¹⁰ to estimate early warning indicators of banking distress. It uses quarterly panel data on macroeconomic fundamentals, estimates of default risk of individual banks and non-financial companies, asset price movements and contagion factors. The HKMA also computes a monetary conditions index which would reflect the monetary aggregates in the economy.

The CNB computes a banking stability index using weighted average of sub-indicators of banking sector soundness including capital adequacy, profitability, balance sheet liquidity, asset quality, credit and currency risk. The constructed index of financial ratios is expressed in terms of the standard deviation from its historical average. Additionally, the CNB also computes composite indices of financial conditions to reflect liquidity and creditworthiness of non-financial companies.

The Central Bank of Turkey calculates a financial strength index as a weighted average of partial indicators of the financial soundness of banks. The index combines six areas of financial soundness indicators, viz capital adequacy, profitability, liquidity, asset quality, interest rate risk and exchange rate risk.

The ECB computes a composite indicator of financial market liquidity in the euro area, similar to the market liquidity indicator of the BoE. The ECB indicator combines several measures covering four different markets and three different dimensions of market liquidity (tightness, depth and resilience) as well as liquidity premia. The National Bank of Hungary also calculates a liquidity index along these lines.

The IMF is developing a banking stability index. For this purpose, it considers the banking system as a portfolio, and based on the market-based probability of default of each individual bank it estimates the joint default probabilities, ie the expected number of bank defaults in the system, given that at least one bank defaults (see IMF (2008)).

Most such indexes are constructed as a series going back over several years; the Czech Index, for instance, goes back to 1997 whilst the SNB stress index goes back to 1987. These indices correlate well with past episodes of financial stress and reflect the risks that have already materialised. What is not clear, however, is their ability to predict the onset of a crisis. Given that the banking sector is predominant and the construction of the index depends on the use of balance sheet data, it is likely that exposures not reported in the balance sheet might not be fully reflected. On the other hand, a more broad based measure of financial conditions such as market liquidity or market risk which relies on market data would be better able to signal conditions of stress in the short term.

¹⁰ The model draws on a number of earlier studies including Kaminsky and Reinhart (1999) and Demirgüç-Kunt and Detragiache (1998).

V Towards a single aggregate measure of financial stability

As described in the previous section, some central banks have started developing aggregate measures that reflect the conditions of a key sector such as banking or key financial market conditions. There are very few instances of a single overarching aggregate measure of financial stability. However, some institutions have begun to present a consolidated view of the risks and prospects qualitatively through charts, heat maps or assessment grids. There are also instances of single quantitative indexes.

The IMF has started publishing a global financial stability map which presents an assessment of the risks and the underlying conditions for the global financial system. The shifting contours of credit risk, market and liquidity risks, as well as the macro-financial conditions from the previous period reflect the IMF's view of the risks and prospects ahead. Quantitative analysis underpins the construction of this map although the final positioning is based on judgement. Leading indicators in six broad areas are considered: monetary and financial conditions in leading industrial countries, risk appetite in global financial markets, macro-economic risks in G3 and OECD countries, emerging market risks credit risks and market risks (IMF (2008)).

The BoE presents its assessment of the outlook and prospects, presented in qualitative terms, which are underpinned by quantitative modelling of the key vulnerabilities of the UK financial system. As such, an overview of the financial system is presented in the form of an assessment based on the sources, likelihood and impact of tail risks on six key vulnerabilities in the financial system. In addition, a composite financial market liquidity index is computed (which is a simple unweighted average of nine liquidity measures, normalised on the period 1999–2004). Prospects for the UK financial system, as well as the corollary risk mitigation, are assessed.

Along the lines described in Illing and Liu (2003) and Van den End (2006), respectively, the Bank of Canada and the Nederlandsche Bank construct single aggregate measures of financial stability (albeit not published in their FSRs). Illing and Liu (2003) argue that their single aggregate measures compare favourably in their ability to flag crises with composite partial measures commonly used in the literature. Van den End (2006) notes that by combining market and balance sheet information on financial institutions, the Financial Stability Conditions Index of the Netherlands Bank appears to make a significant contribution beyond a traditional financial conditions index which might only look at one sector.

Bank Indonesia computes a broad based financial stability index which, in addition to the banking sector indicators uses leading macro-economic and external sector indicators on a monthly basis to reflect the financial system stability more generally.

Although the Board of Governors of the Federal Reserve System does not publish a financial stability review, it has an index of financial fragility, constructed in two steps (Nelson and Perli (2005)). First, the information contained in 12 individual variables¹¹ is reduced to 3 summary statistics, their rate of change and their correlation. Second, a Logit model is estimated to obtain the probability that, at any given time and based on the three summary

¹¹ Based on interest rates and asset prices, a number of market liquidity proxies are monitored: bid-ask spreads, trading volumes, liquidity premia (difference in spread between highly liquid and less liquid securities). Risk spreads are also followed, in particular swap spreads (proxies for the credit quality of the banking sector and market liquidity), agency spreads and commercial paper spreads. Equity premia are analysed, although interpreting them is difficult, as it is difficult to disentangle economic information changing agents' earnings expectations, changes in certainty about economic outcomes and changes in risk appetite. Finally, implied volatilities derived from option prices, bearing in mind that risk-neutral PDFs contain market participants' risk aversion.

statistics, the behaviour of financial markets is analogous to that of high stress events (eg 11 September 2001).¹²

Conclusion

In theory, composite indicators of financial stability are better suited for the definition of threshold or benchmark values to indicate the state of financial system stability than individual variables. Moreover, they are useful measures of stress (eg they can be used to gauge the build-up of imbalances) in the system even in the absence of extreme events. However, as Geršl and Heřmánek (2006) point out, the construction of a single aggregate measure of financial stability is a difficult task given the complex nature of the financial system and the existence of complex links between various sectors. In the absence of an overarching aggregate, partial composite measures such as a banking stability index or a market liquidity index are used in several FSRs. Regardless of whether a single aggregate measure of financial stability is constructed or not, FSRs would need to analyse key variables in the real, banking and financial sectors as well as variables in the external sector.

There is some diversity in construction and use of the key indicators. For broader cross-country comparisons it would be useful to have an appropriate template and methodology for such indicators, although countries' individual circumstances make such an exercise difficult (due, notably, to the varying relative importance of individual financial system components and to differing degrees of openness of the economies concerned). If one goes a step further and tries to compute a single aggregate measure of financial stability, the weightings of the different variables that constitute such an aggregate measure have to reflect this accordingly. For instance, a maturity mismatch between short-term liabilities and long-term assets may have to be assigned a low weight, because maturity transformation is a common feature of the banking business and banks can successfully manage part of this risk using interest rate derivatives. Likewise, the fact that low volatility on a market can mean stable conditions as well as failings in the price discovery process should be considered when assigning a weight to market volatility.

Although some central banks have experimented with computing single aggregate measures of financial stability, no such measures can be used without knowledge and use of other – quantitative or qualitative – instruments. Moreover, although single aggregate measures reflect the financial system conditions well post facto, it is not yet clear how well they would perform in signalling the onset of financial stress.

¹² The private sector has also made attempts at computing single aggregate measures of financial stability. Illing and Liu (2003) note that the Bank Credit Analyst produces a monthly stress index which incorporates major banks' share price performance, credit spreads, private sector indebtedness, stock market leverage, overall stock market performance, consumer confidence, the slope of the yield curve and stock and bond issuance. Bordo, Dueker and Wheelock (2000) construct a financial instability index with lags, incorporating bank failures, non-financial business bankruptcies, an ex post real interest rate and an interest rate quality spread. Commercial and investment banks produce indices, such as the JP Morgan Liquidity, Credit and Volatility Index, the Credit Suisse First Boston Emerging Markets Risk Indicator, the Deutsche Bank Alarm Clock and the Goldman Sachs GS-Watch.

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Session 6

Impact of financial innovations on economic and financial statistics

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Do financial systems converge? New evidence from household financial assets in selected OECD countries

Giuseppe Bruno and Riccardo De Bonis¹

1. Introduction

The last three decades have witnessed a growing pressure on financial systems from liberalisation and globalisation. These events have made the study of differences and similarities between national systems more important than in the past. There is renewed interest in institutional economics, with a focus on comparing capitalist economies and, more specifically, their financial systems.² A specific issue is their trend to converge or no. While we have a theory and many empirical applications on per capita income convergence, there is neither a theory of financial systems convergence, nor of an “optimum financial system”.³ On the other hand one might expect that globalisation, deregulation, economic integration, harmonization of regulations and corporate governance rules lead to a convergence of financial systems characteristics. For example some authors have claimed that the classical distinction between “bank-based” and “market-based” systems does not hold anymore. According to this point of view the European continental financial systems have become more similar to the Anglo-Saxon ones (on this discussion see Allen and Gale, 2000, and Rajan and Zingales, 2003).

The investigation of financial convergence is an empirical issue, that has been studied using different methods and indicators. In this paper we offer a new perspective, analysing convergence of the main financial assets in household portfolios. We assume that household asset allocation, relative to disposable income, provides information on the general characteristics of financial systems. Shares and other equity, especially quoted shares, and insurance products are more common in “market-based” systems like those of the UK and the US than in continental Europe. Assets like currency and deposits are more important in Germany, Italy and Japan, often defined as “bank-based” systems.

Convergence is a long run concept. The novelty of our paper is to take advantage of a dataset containing annual data since 1980 for nine OECD economies: the USA, Japan, Germany, France, the United Kingdom, Italy, Canada, Spain and Austria. This reconstruction is the outcome of a joint project among the OECD, Pioneer Investment (a financial company) and some national central banks. Using these statistics and disposable income as a scale variable, we measure β - and σ -convergence for household total financial assets and their main components: currency and deposits, securities other than shares, shares and other equity, insurance technical reserves.

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² See Djankov et al (2003).

³ On the risks of doing “measurement without theory” see Koopmans (1947), Kydland and Prescott (1995) and Klein (1977).

The paper is divided into five sections. After this introduction Section 2 summarises the literature on convergence studies and methodologies. Section 3 describes the dataset. In Section 4 we present the econometric results while Section 5 concludes.

2. The convergence approach

In this section we first review some contributions on financial convergence, focusing on those that studied household financial instruments (2.1)⁴; then we summarise the statistical methods used in the paper (2.2).

2.1 A brief review of the literature

Convergence of financial systems may be studied using three types of indicators: price-, news- or quantity-based measures. Price-based measures look at differences in price or returns of financial instruments caused by their geographic origin. This approach often aims to test the validity of the law of one price. News-based indicators analyse the impact that common factors – for example the availability of new public information – have on the movement of an asset yield. Quantity-based measures have the goal to quantify the effects of frictions on the demand and supply of investment opportunities. Previous studies have often examined the ease of market access, as shown by cross border activities: these holdings would proxy the portfolio home bias.⁵

In this paper we follow the third line of research, picking up, among quantity-based indicators, household financial assets. As anticipated in the introduction, we assume that the relative weights of household financial instruments in each country provide information on the peculiarities of national financial systems.

Other papers have followed a similar route, concentrating on quantity-based measures of convergence to draw conclusions on the general features of financial structures. These studies looked at convergence without theoretical a priori, often focusing on the effects of institutional breaks like the creation of the European common market or that of the euro area. Studying seven European countries for the years 1972–1996, Murinde, Agung and Mullineux (2004) found convergence of equity issues, but not of issues of securities other than shares. Di Giacinto and Esposito (2006), using a panel with observations from 1995 to 2003, found convergence for indicators of financial development of 13 European countries, but not for banking products. Examining financial assets in euro-area countries, Hartmann, Maddaloni and Manganelli (2003) found that the dispersion of currency and deposits increased between 1995 and 2001; bond investment, on the contrary, became more uniform. Studying 12 European countries in the period 1995–2000, Bartiloro and De Bonis (2005) found β -convergence but not σ -convergence for the ratio of financial assets held by residents to GDP. Analysing a longer period, from 1980 to 2000, Byrne and Davis (2002) found some evidence of σ -convergence, towards a more market-oriented financial system, for the balance sheet structures of the UK, France, Germany and Italy. Schmidt, Hackethal and Tyrrel (1999) found that particularly France moved towards a more market-oriented system. Bianco, Gerali and Massaro (1997)

⁴ We will not deal here with other important issues like convergence of market interest rates, inflation, public finance indicators, and real convergence. On these subjects see Calcagnini, Farabullini and Hester (2000), Lane (2006).

⁵ On these issues see Baele et al (2004) for the general framework; Baele and Ferrando (2004) on bond and equity market integration; Manna (2004) on integration of banking systems; Baltzer et al (2008) on integration in new EU member states; Affinito and Farabullini (2006) on convergence of bank interest rates.

presented a comparison of six developed countries' financial systems, based on their characteristics in the mid Nineties. The analysis suggested that convergence across financial systems was still limited and major changes were under way only in France.

It is difficult to draw a conclusion from this literature, because it refers to different periods, financial products and countries and uses different statistical and econometric methods. In short we can say that convergence has been found more frequently for equity instruments than for banking indicators. This seems reasonable because integration of capital markets is easier to reach than that of banking systems where asymmetries of information and local market characteristics remain central. We will come back later on this issue. The novelty of our work is to exploit statistics starting from 1980 (see Section 3 for a precise description), while previous papers looked at household financial assets considering shorter time series and a less precise instrument breakdown.

2.2 The statistical methods

The task of measuring convergence for different economies has been approached using time series, cross-section and panel data techniques mainly in the context of economic growth models. There is no universally accepted definition of the term convergence, nonetheless an intuitive meaning of the term is easily understood.

In this paper we adopt the approach based on β - and σ - convergence⁶, originally developed in the growth empirical literature (eg Baumol, 1986; Barro and Sala-i-Martin, 1992 and 1995; Mankiw et al., 1992; Sala-i-Martin, 1996). This literature is typically based on regression models where the average growth rate of per capita income is assumed to be dependent on its initial level:

$$\frac{1}{T} \log(y_{i,t+T} / y_{i,t}) = \alpha + \beta \log(y_{i,t}) + \varepsilon_{i,t} \quad (1)$$

In this equation there is absolute β -convergence if $\beta < 0$. β -convergence implies that poor economies tend to grow faster, and therefore to catch up with richer countries ("the lower you start, the quicker you go").

On the other hand a group of economies satisfy σ -convergence if the dispersion of their real per capita GDP levels tends to decrease over time. That is, if

$$\sigma_{t+T} < \sigma_t \quad (2)$$

where $\sigma_t = \sqrt{\sum_{i=1}^N (\log(y_{i,t}) - \bar{y}_t)^2}$, is the time t standard deviation of $\log(y_{i,t})$ across i. The

concepts of σ - and absolute β - convergence are closely related. If we take the sample variance of $\log(y_{i,t})$ from (1) we will get:

$$\sigma_{t+1}^2 = (\beta + 1)^2 \cdot \sigma_t^2 + \sigma_\varepsilon^2 \quad (3)$$

From this equation we see that σ_t^2 will get asymptotically to a steady state level if and only if $-2 < \beta < 0$. If the GDP levels of two economies get closer over time, the poor economy must be growing faster and the GDP levels dispersion shrinks or grows over time depending on the steady state value of σ_t^2 . In other words, β -convergence is only a necessary condition

⁶ See Adam et al (2002) for a similar approach applied to interest rates.

for σ -convergence. Assuming the initial dispersion of $\log(y_t)$ is smaller than its steady state value we might have β -convergence without σ -convergence.⁷

Heterogeneity across economies, eg a different saving rate, often prevents absolute convergence. Nonetheless, it is relevant to pin down the determinants hampering absolute convergence. Researchers have introduced the concept of conditional convergence. Conditional β -convergence is measured by introducing country specific variables in the model (1) in the following way:

$$\frac{1}{T} \log(y_{i,t+T} / y_{i,t}) = \alpha + \beta \log(y_{i,t}) + \gamma X_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $X_{i,t}$ is a vector including the variables required to hold constant the steady state growth rate for country i . If the estimate of β is negative the dataset will exhibit conditional β -convergence.

3. The dataset

Recently, the OECD, the Economic Research Unit of Pioneer Global Asset Management, and some national central banks have started a project aimed at extending back in the past the time series of the financial accounts of OECD countries.⁸ Until the beginning of the Nineties the OECD used to publish the national financial accounts in yearly booklets known as the “Golden Books”. This publication was interrupted when the System of National Accounts of 1993 (SNA93) and the European System of Accounts of 1995 (ESA95) introduced new definitions of financial instruments and institutional sectors. The new classification based on the SNA93 and on the ESA95 has made it necessary to reconcile past data with the new series.

Even if statistics would potentially make it possible to analyze all the institutional sectors, in this initial stage data reconstruction has focused on households and non-financial corporations for stocks of assets and liabilities from 1980 through 2005. We focus on β - and σ -convergence of the ratio of household financial assets and their main components to disposable income. Here we provide a short description of the four financial instruments under consideration.⁹

- a) **Currency and deposits:** this item includes currency in circulation, transferable deposits, other non transferable deposits, repos.
- b) **Securities other than shares:** this item includes bearer financial assets that are negotiable on the market, such as securities issued by the general government, firms and banks.
- c) **Shares and other equity:** this category includes financial assets that represent property rights on corporations and quasi corporations. These assets are divided into quoted shares, unquoted shares and other equity. Following ESA95 the item includes also mutual fund shares.

⁷ This circumstance is closely related to what is referred to as Galton’s fallacy of regression towards the mean. See Quah (1993).

⁸ For further information on the construction of the time series see De Bonis, Fano, Sbano (2007), Sbano (2007).

⁹ Households may also have loans on the asset side of their balance sheet but the figures are zero in some countries and negligible in others. For example we may refer to loans of households to cooperatives.

d) **Insurance technical reserves:** this item includes the provision of insurance corporations and pension fund products for future payments to beneficiaries. According to the current international statistical rules this category does not include the assets linked to public pension schemes.

In the Appendix we present the percentage composition of household financial assets in the nine countries from 1980 to 2005. Figures 1–2 show the log of ratios of total financial assets and their main component to gross disposable income from 1980 to 2005. All the countries experienced an increase in the ratios of household total financial assets, a fact that confirms the financial deepening of the main economies (fig. 1). Turning to the single financial instruments, the ratios of insurance products and shares and other equity to disposable income grew in all the countries of our sample. On the contrary the behaviour of securities other than shares and currency and deposits was more diversified. Looking at figure 2 convergence is quite evident for some instruments, but in other cases a more sophisticated approach is needed.

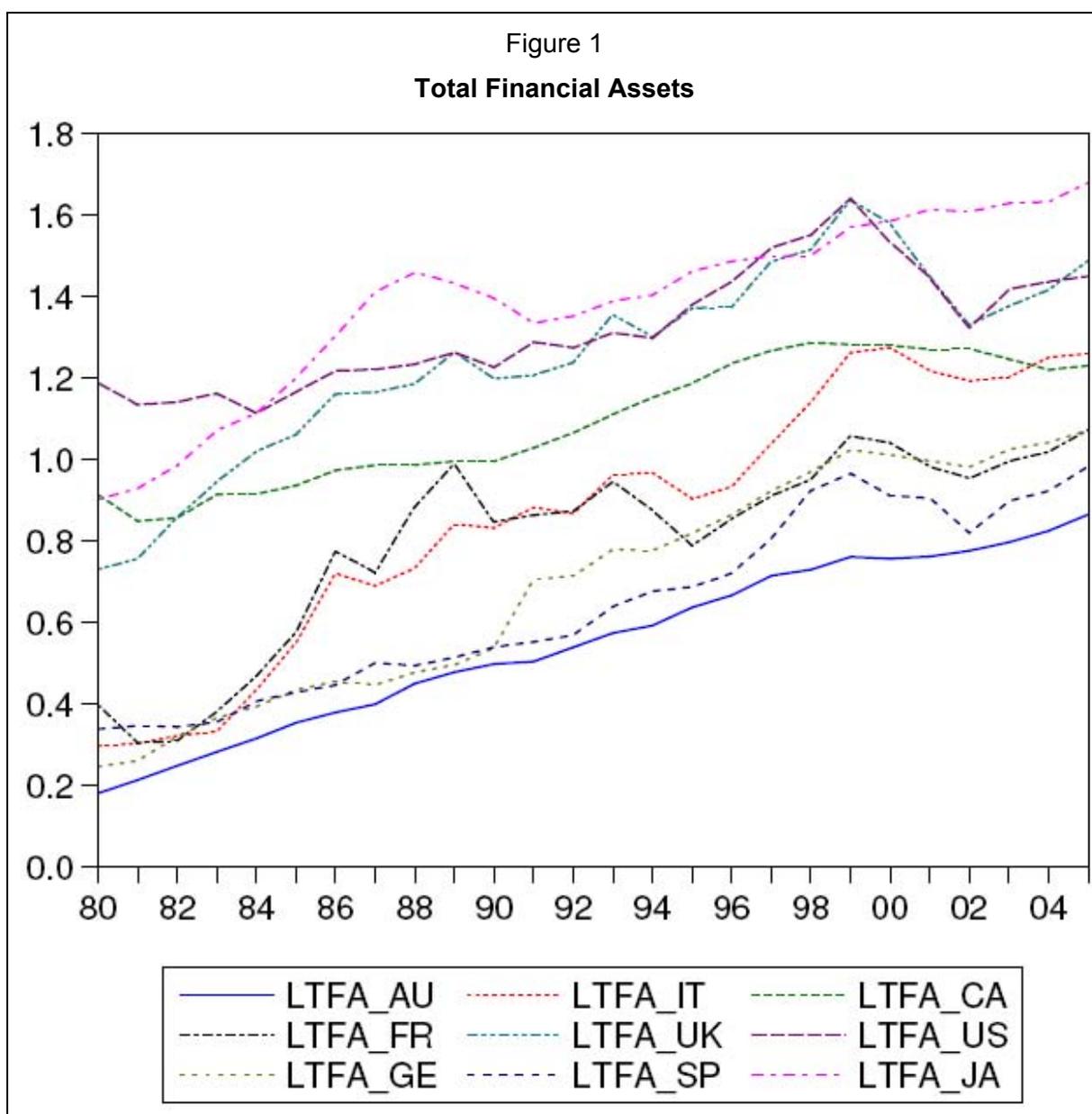
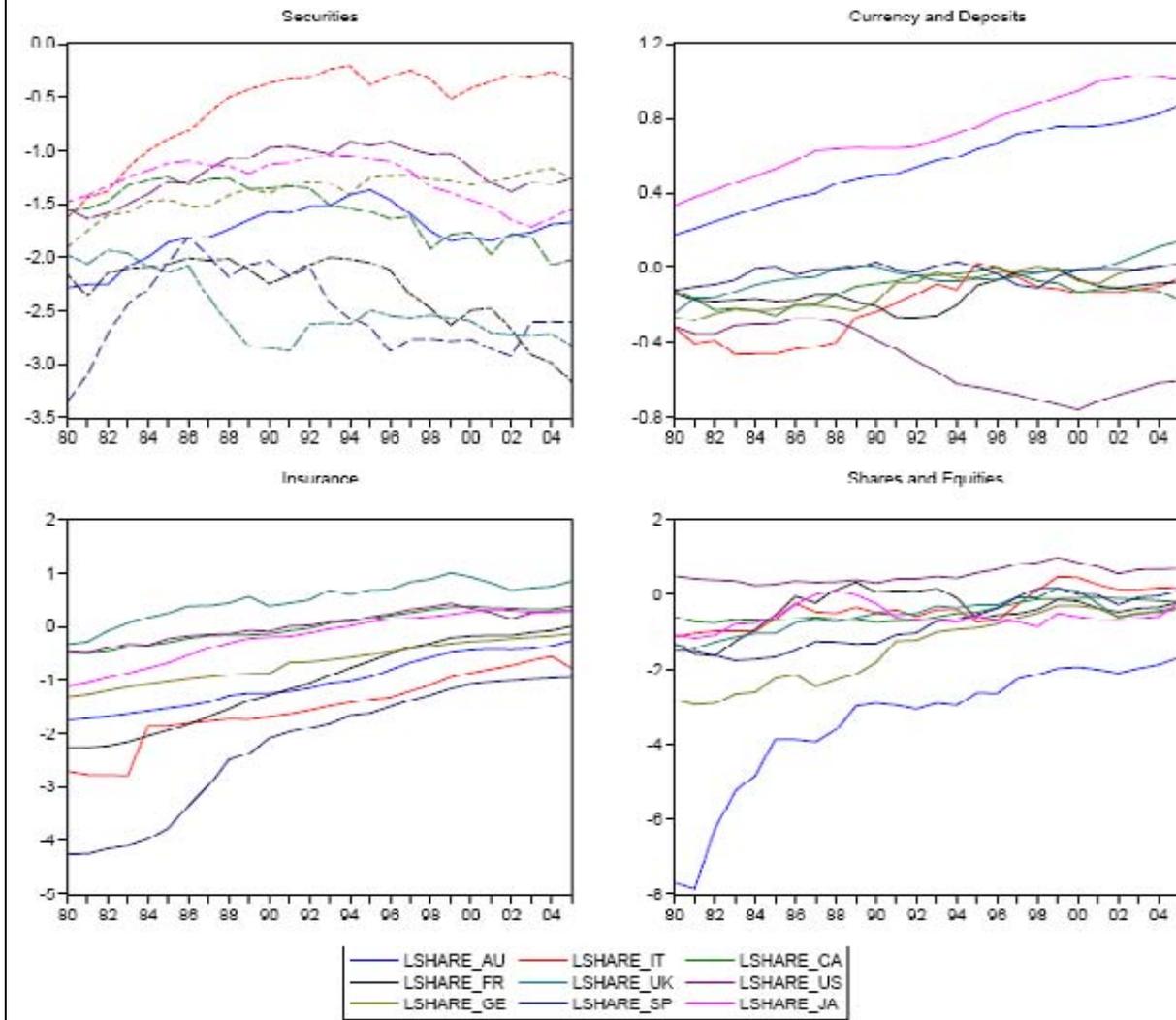


Figure 2



4. The results

In subsection 4.1 we focus on absolute β -convergence; in subsection 4.2 we deal with conditional convergence; in subsection 4.3 we concentrate on σ -convergence.

4.1 Absolute β -convergence

Following Islam (1995) we used the time dimension of the entire panel data to carry out exercises of absolute β -convergence. An important technical issue in switching from a single cross section to a panel data framework is the choice of the time span dividing the total time range. We picked the value of 5 years. This seems a reasonable trade off between the competing needs of increasing the available observations and reducing short term disturbances. The value of 5 years appears to be less sensitive to the business cycle

fluctuations and serial correlations in the residuals.¹⁰ Given the temporal extension of our dataset, this choice produces a total of $2005-1980+1=26/5=5$ observations for each of the countries. The results are robust to a different choice of the time interval (see the following of this subsection for further details). A lower frequency (less than 1 observation every 5 years) would yield too few observations.

We run three different estimation methods against our available dataset: pooled OLS, random and fixed effects. Pooled OLS is the easiest method from the computational standpoint. OLS technique provides a simple benchmark but the estimated β coefficient is inconsistent when the unobservable country effects are correlated with other explanatory variables. For this reason we also add the random-effects estimator that introduces a random country specific element. With this method, when the unobservable country specific component is uncorrelated with the regressors, we have consistency for the estimated β coefficient. Aiming also at efficiency we finally flanked our results with the fixed-effect estimation which includes a country specific constant mirroring all the unmeasured country effects. The use of different estimation methods provide us with a sound robustness check (see Cellini, 1997 and Islam 1995 for the same approach).¹¹ Gross disposable income is used as a scale variable.

The numerical results for the estimate on total financial assets are shown in table 1 (t-statistics are under the coefficients with a smaller font; the same convention holds in the other tables).

Table 1
 β -convergence for household total financial assets
Dependent variable: Total financial assets average growth rate

Method	OLS	Fixed effects	Random effects
Constant	0.17875 5.83	0.24644 5.41	0.18366 5.89
$\text{Log}(y_{t-1})$	-0.07646 -2.42	-0.15240 -3.08	-0.08196 -2.57
R^2	0.12	0.35	0.13
S.E. regression	0.08	0.08	0.08
N. obs.	45		
Cross sections	9		

Table 1 shows β -convergence according to all the three estimation methods. Countries having a lower ratio of financial assets to disposable income grew faster than those where financial deepening was already high, in a general context of greater integration and globalization of financial systems.

On the contrary Table 2 shows the absence of a robust β -convergence for the item currency and deposits. β -convergence was found only using the fixed effects method. Cellini (1997)

¹⁰ This issue is still under debate. Cellini (1997) and Adam et al (2002) use yearly growth rate for the dependent variable when performing convergence exercises.

¹¹ For example Islam (1995) noted "In the following we present the results from both LSDV(fixed effects) and MD (minimum distance) estimation. It is reassuring that the results are very similar to each other".

stated that the fixed effect estimator is the appropriate one when studying convergence in a panel data framework.

Table 2

β -convergence for household currency and deposits

Dependent variable: Currency and deposits average growth rate

Method	OLS	Fixed effects	Random effects
Constant	0.03546 2.59	0.01565 1.23	0.03546 3.01
$\text{Log}(y_{t-1})$	0.04160 0.96	-0.31343 -3.36	0.04160 1.12
R^2	0.02	0.41	0.02
S.E. regression	0.09	0.078	0.09
N. obs.	45		
Cross sections	9		

While banking disintermediation is common to all OECD countries, the importance of deposits still remains different. This result is similar to the evidence reported in Di Giacinto and Esposito (2006). Also other studies found that the weight of safe assets in household portfolios differs across countries. This result may be influenced by national peculiarities, such as fiscal treatment of deposits, the forms of competition between banks and other financial intermediaries, the different weight of the Post office, and regulatory and institutional factors that influence the offer of deposits.

Table 3 refers to insurance products. The β -coefficients are always negative and statistically significant. Countries where public pension schemes were relevant in the past followed the example of financial systems where private insurance and pension products were traditionally more common among households. We may refer to the catching up of Spain and Italy (see figure 2). Population ageing is a trend common to all industrialised countries and leading to important restructuring of the financial industry, such as a growing role of insurance technical reserves. International statistical standards will change: the new System of National Accounts will recognize pension entitlements for the public sector that today are not included in the official statistics.

Table 3

 β -convergence for household insurance products

Dependent variable: Insurance products average growth rate

Method	OLS	Fixed effects	Random effects
Constant	0.13796 4.26	0.09257 2.15	0.13796 4.24
$\text{Log}(y_{t-1})$	-0.14928 -6.28	-0.20364 -4.91	-0.14928 -6.24
R^2	0.48	0.57	0.48
S.E. regression	0.172	0.173	0.172
N. obs.	45		
Cross sections	9		

Table 4 reports the regressions for β -convergence of the item shares and other equity. The three estimates provided a negative and statistically significant β coefficient. The growing weight of capital markets is a common trend to all the economies. We may refer to the increasing importance of quoted shares and mutual fund units in household portfolios. The increase of financial deepening was thus accompanied by a greater dissemination of financial instruments traded directly on the markets. The shift in portfolio composition in favour of non-intermediated assets was particularly intense in the period 1995–2000, during the positive cycle of world stock markets.

Table 4

 β -convergence for household shares and other equity

Dependent variable: Shares and other equity average growth rate

Method	OLS	Fixed effects	Random effects
Constant	-0.05849 -0.85	-0.20729 -2.51	-0.05849 -0.89
$\text{Log}(y_{t-1})$	-0.38354 -9.50	-0.53906 -8.29	-0.38354 -9.91
R^2	0.68	0.76	0.68
S.E. regression	0.381	0.365	0.381
N. obs.	45		
Cross sections	9		

Table 5 reports the results for the item securities other than shares. In this case the β coefficients are always negative but they are statistically significant only in the fixed effects estimates. We are not able to claim that the ratios of household securities to disposable income converged in last years in our sample of nine OECD countries. This evidence confirms that General government, bank and corporate bonds have still a different weight in national household portfolios. Corporate securities remain more important in the UK, the US and Japan than in continental Europe. Moreover, it is well known that the ratio of public debt to GDP differs across countries, leading to a different composition of financial saving.

Table 5

 β -convergence for household securities

Dependent variable: Securities average growth rate

Method	OLS	Fixed effects	Random effects
Constant	-0.11668 -0.87	-1.11588 -5.66	-0.17184 -1.59
$\text{Log}(y_{t-1})$	-0.08729 -1.18	-0.68132 -5.91	-0.12008 -2.01
R^2	0.03	0.57	0.05
S.E. regression	0.323	0.240	0.316
N. obs.	45		
Cross sections	9		

In order to check for robustness of these results, we have modified the estimation procedure in the following way:¹²

- removing one country at a time and using the remaining cross-sections for the estimations. The upshot of this sort of “jackknifing the sample” confirmed the β -convergence results previously reported;
- increasing the sample observations by reducing the time range over which we take average growth rate from 5 to 4 and 3 years did leave unchanged the statistical significance of the estimates.¹³

The Hausman test has been carried out for all the panel models. The results are summarized in table 6.

Table 6

Hausman test

Dep variable	Hausman test	Probability
Tot financial asset	3.48	0.062
Currency_deposit	17.17	0
Securities	32.34	0
Share & Equities	8.85	0.003
Insurance	2.57	0.108

¹² E-Views/LIMDEP code and numerical results are available upon request.

¹³ We also tested convergence of the percentage composition of household assets. Example of convergence analysis on percentage compositions can be found in Baltzer et al (2008) (see figures 21–25) and Yildirim and Öcal (2006). Our new exercises confirmed the previous evidence.

At a 5% significance level the test rejects the null of no correlation among the unobserved individual effects and the explanatory variables for four variables. Only for the insurance products the random effects model can replace the fixed effects one.

4.2 Conditional convergence: does legal origin matter?

For currency and deposits and securities other than shares we checked whether the absence of absolute β -convergence is caused by the country legal origin. As emphasized in a large strand of literature (see for example La Porta et al, 1998, Shleifer and Vishny, 1997, and Shleifer and Wolfenzon, 2002) the structure of a country commercial law may matter for firm and investor behaviour. This literature is rooted on a broad taxonomy splitting up the countries in two major families according to their legal codes: common law and civil law. Within the civil tradition it is possible to further partition the countries according to the three following families: French, German and Scandinavian.

In our set up the database includes only 9 countries: therefore we could not go beyond the main dichotomy between common/civil laws, so as to keep the degrees of freedom at a reasonable level. We allocate the US, the UK and Canada to the common law structure and the remaining six countries to the civil law category. This assumption is reasonable. Many scholars stated a similarity between the German and the French legal system while Scandinavian countries are not in our statistics.

After the introduction of a binary variable indicating the membership to common/civil laws origins we ran another set of β -convergence regressions.¹⁴ The results confirm the outcome of the absolute convergence exercise. The coefficient for the variable indicating the country legal origin is never statistically different from zero. We interpret this result as a signal that legal origin did not affect the trend of the ratios of currency and deposits and securities other than shares to household disposable income.

Now we turn to the σ -convergence exercises.

4.3 σ -convergence

As we underlined in Section 2, β -convergence is a necessary but not a sufficient condition for σ -convergence. The statistical results for the σ -convergence are summarized in figures 3 and 4.

¹⁴ The tables for the estimates are available from the authors upon requests.

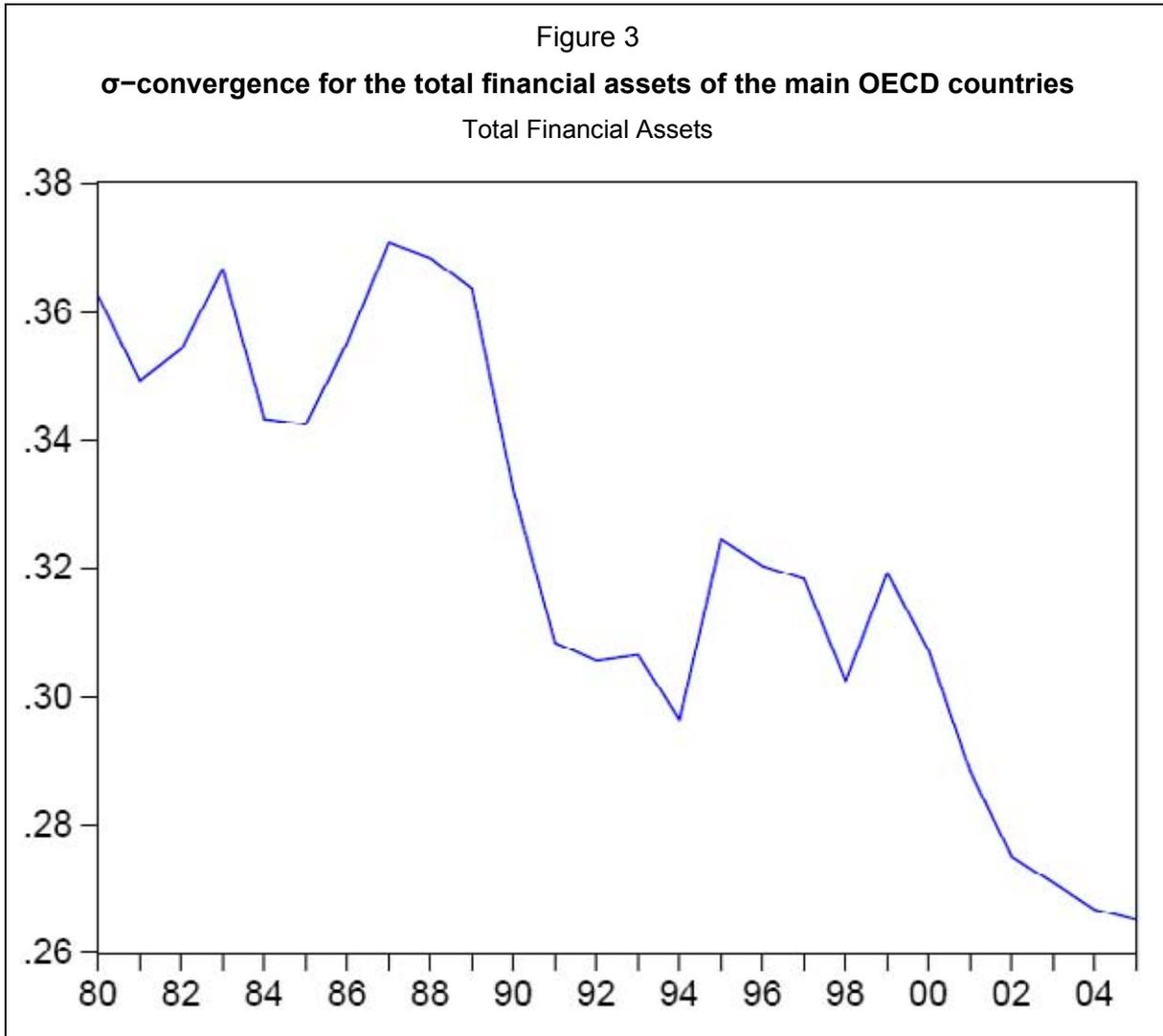


Figure 3 shows a downward behavior for the standard deviation of the ratio of household total financial assets to disposable income. This result provides us an evidence of σ -convergence.

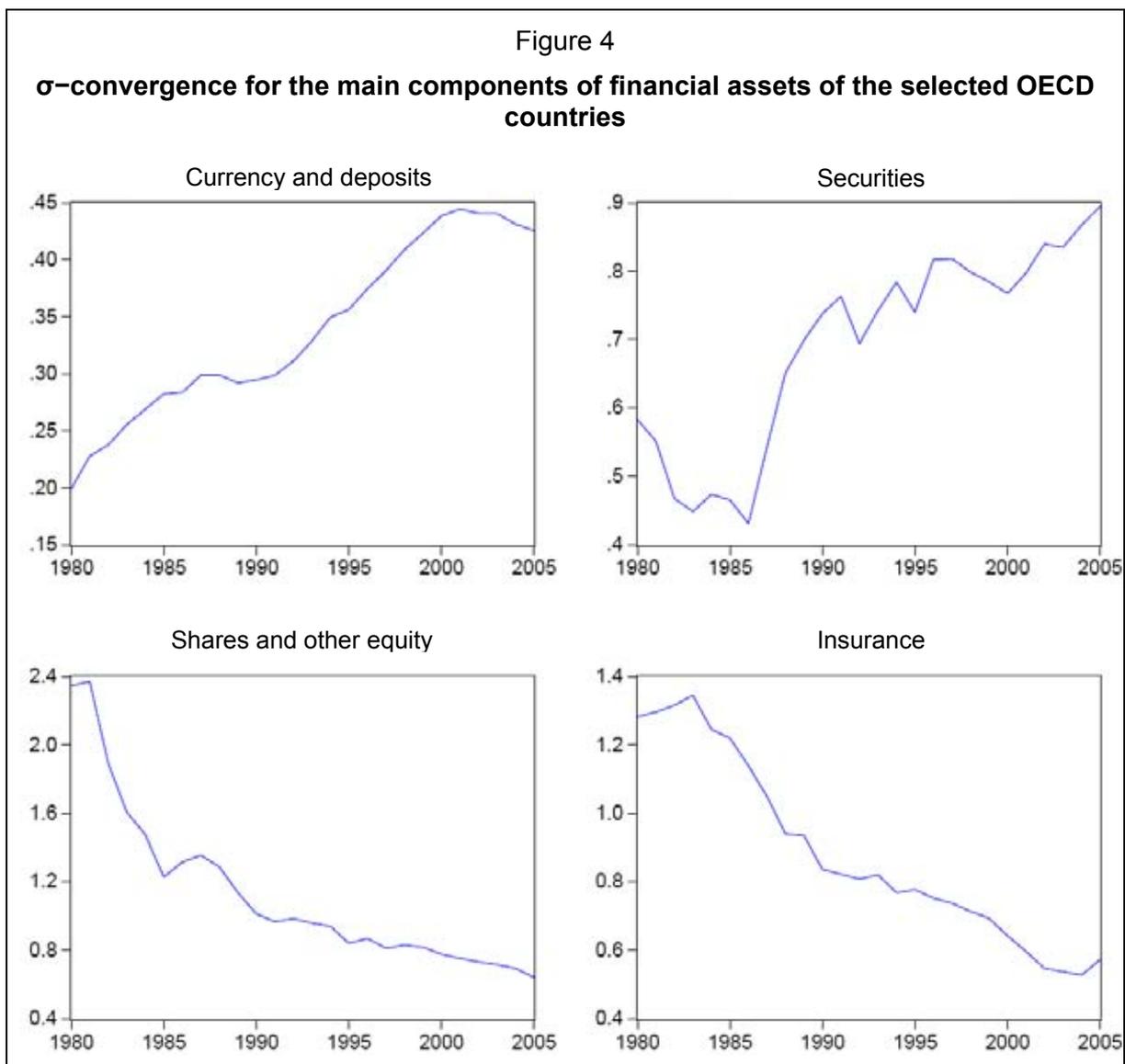


Figure 4 indicates σ -convergence for shares and other equity and for the insurance products. These results strengthen the β -convergence results we got in Section 4.1 for these two financial instruments.

On the contrary the cross-section variance of currency and deposits increases over time. Also the ratio of household securities to disposable income lacks σ -convergence. These results are consistent with the β -convergence evidence discussed in section 4.1.

The small number of observations in the cross-sections (9 countries) has prevented us from applying the classical F tests or likelihood-ratio test proposed for example by Carree and Klomp (1996) for confirming the graphical results.

5. Concluding remarks

In this work we investigated the presence of β - and σ -convergence for the ratios of household financial instruments to gross disposable income. We assume that the composition of household portfolio provides information on the features of financial systems. We found evidence of convergence for total financial assets, shares and other equity, and

insurance products. Financial globalization, the growth of capital markets and the crisis of public pension schemes are the main explanations of our empirical findings. Mixed results, and often no convergence, are found for currency and deposits and securities other than shares. With reference to deposits, the intensity of bank disintermediation was different in OECD countries: banking and postal deposits lost weight in the US because of the competition coming from money market funds; on the contrary the importance of deposits remained strong in Japan, Italy, Austria and Germany, countries which we may still define as bank-based. As far as securities other than shares are concerned, also their importance remains different in OECD countries. While the Italian households still hold large amounts of banking and General government securities, their weight is lower in the other nations. Households have different combinations of bank securities and deposits in their portfolios, because of various fiscal treatments or different loan maturity. Also the role of corporate bonds differs across countries. While firms' issues of securities other than shares are important in the UK, the US, Canada and Japan, they are negligible in countries like Italy and Germany. Our results are compatible with the idea that households have different propensities to risk across countries (see IMF, 2005).

We plan to extend the paper in different directions. First, a further collection of statistics might lead us to consider other countries in the empirical exercises. Second, conditional β -convergence exercises might take into account the impact of variables like inflation and the exchange rate that may influence the shape of financial structures. Third, pending further statistical harmonization, it would be interesting to study convergence of narrower categories of financial instruments: a simple example is the split between quoted and unquoted shares. These subjects are in our research agenda.

Appendix

Composition of household financial assets (percentages)

Italy										
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
Currency and deposits	54.0	36.5	34.5	41.7	24.5	26.1	26.7	26.9	26.0	26.8
Securities other than shares	14.5	23.6	29.9	27.4	18.4	20.7	22.6	21.8	22.1	20.1
Loans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shares and other equity	24.3	30.4	27.3	19.4	44.5	39.2	35.3	34.7	34.9	34.9
Insurance technical reserves	5.0	9.2	8.1	10.5	11.9	13.5	14.8	16.0	16.5	13.1
Other accounts receivable	2.2	0.3	0.2	1.0	0.7	0.6	0.6	0.6	0.5	5.0
Spain										
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
Currency and deposits	63.5	65.4	60.4	50.7	39.8	40.2	43.7	40.2	39.9	38.3
Securities other than shares	2.5	8.4	7.7	3.6	2.5	2.3	2.4	3.0	2.9	2.7
Loans	13.3	9.2	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Shares and other equity	16.1	12.4	16.1	29.8	40.2	39.7	34.0	37.8	38.2	41.1
Insurance technical reserves	1.0	1.5	7.3	10.0	13.9	14.4	16.1	15.4	15.3	14.6
Other accounts receivable	3.5	3.1	8.6	5.0	3.6	3.3	3.8	3.6	3.7	3.3
Austria										
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
Currency and deposits	76.7	72.3	66.4	61.9	55.1	55.3	55.7	55.2	53.4	50.9
Securities other than shares	8.5	10.9	12.5	13.4	7.6	7.3	7.7	7.7	8.1	7.9
Loans	0.0	2.6	3.0	2.0	2.4	1.8	1.9	1.7	2.3	2.2
Shares and other equity	0.0	1.5	3.3	3.9	6.8	6.4	5.7	6.3	6.8	7.8
Insurance technical reserves	14.7	15.3	17.6	20.8	30.4	30.9	30.1	30.0	31.0	32.7
Other accounts receivable	0.0	0.0	0.1	0.0	0.1	0.1	0.7	0.7	0.7	0.7

Composition of household financial assets
(percentages)

Canada										
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
Currency and deposits	35.5	30.5	34.0	30.0	24.5	25.1	25.3	25.6	26.2	24.6
Securities other than shares	8.5	11.3	9.5	6.3	4.8	3.9	4.8	4.7	3.7	3.9
Loans	1.9	1.4	1.4	1.5	1.1	1.1	0.9	0.8	0.7	0.6
Shares and other equity	22.5	20.1	17.5	19.3	25.1	25.7	25.3	25.3	25.1	24.0
Insurance technical reserves	24.7	29.5	32.5	35.7	40.9	40.1	39.7	40.1	41.2	43.0
Other accounts receivable	6.9	7.2	5.1	7.2	3.6	4.1	3.9	3.5	3.1	3.9
Usa										
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
Currency and deposits	22.3	23.1	20.0	13.3	10.1	11.5	13.6	12.7	12.8	12.8
Securities other than shares	6.4	8.6	11.1	9.7	6.7	6.4	6.6	6.6	6.4	6.7
Loans	1.6	1.6	1.4	1.1	1.6	1.8	1.9	1.9	2.0	1.9
Shares and other equity	50.3	41.7	40.5	45.2	51.0	49.3	46.7	47.2	46.8	46.6
Insurance technical reserves	19.3	25.1	27.0	30.6	30.6	31.0	31.2	31.7	32.0	32.0
Other accounts receivable	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japan										
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
Currency and deposits	56.7	51.2	47.1	49.3	52.8	54.0	55.1	55.0	54.3	51.0
Securities other than shares	9.2	9.8	8.0	7.8	4.7	4.3	3.8	3.5	3.8	4.0
Loans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shares and other equity	14.0	17.2	19.5	13.5	11.5	10.4	10.3	10.5	11.0	15.0
Insurance technical reserves	13.3	15.4	20.5	25.3	27.4	27.6	27.4	25.9	26.1	25.3
Other accounts receivable	6.8	6.3	4.9	4.0	3.6	3.7	3.3	5.0	4.8	4.8

Composition of household financial assets
(percentages)

France										
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
Currency and deposits	58.6	47.0	35.0	41.5	33.3	34.1	34.7	33.7	33.3	31.8
Securities other than shares	7.7	7.2	4.5	5.9	2.9	3.2	2.7	2.0	1.8	1.4
Loans	1.4	1.3	1.0	1.7	0.9	0.9	0.8	0.9	0.7	1.0
Shares and other equities	18.3	33.3	46.0	24.3	29.7	26.3	24.5	25.8	25.9	28.0
Insurance technical reserves	7.1	8.1	11.9	24.0	29.8	32.0	32.9	33.3	33.7	34.5
Other accounts receivable	6.9	3.1	1.6	2.6	3.4	3.6	4.4	4.3	4.6	3.3
Germany										
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
Currency and deposits	60.1	52.1	48.9	41.9	34.0	34.0	36.3	35.6	35.7	35.0
Securities other than shares	11.6	15.0	14.3	12.6	9.7	10.2	10.7	10.8	11.0	9.7
Loans	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shares and other equities	4.7	7.0	9.6	18.2	27.1	25.8	21.2	22.4	22.0	23.7
Insurance technical reserves	21.3	23.4	24.6	26.2	27.9	28.8	30.2	29.7	29.9	30.2
Other accounts receivable	2.0	2.3	2.4	1.1	1.3	1.3	1.6	1.4	1.4	1.4
United Kingdom										
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
Currency and deposits	38.0	32.3	30.3	24.0	20.4	23.3	27.3	27.1	27.1	25.9
Securities other than shares	6.7	4.0	1.7	2.1	1.5	1.6	1.7	1.6	1.6	1.3
Loans	0.9	0.3	0.5	0.3	0.2	0.2	0.3	0.2	0.2	0.0
Shares and other equities	12.9	12.4	18.6	19.4	22.8	18.4	14.7	15.3	15.9	16.3
Insurance technical reserves	35.0	45.1	44.5	50.8	52.4	53.6	52.9	52.7	52.0	53.3
Other accounts receivable	6.5	5.9	4.5	3.4	2.7	3.0	3.2	3.1	3.1	3.2

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Data modelling – merging supervision, statistics and monetary analysis data into a joint data set for financial enterprises

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1. Introduction

This paper is based on experiences gathered in creating optimal data sets and structures by data modelling procedures in Norway. Our main vision is to create well structured data sets serving multiple purposes: financial statistics, supervision, analysis and research of the various financial sectors, on a micro and macroeconomic level.

Cooperation between government agencies is vital in small countries such as Norway due to quite limited resources and few available experts. The legal framework in Norway also requires coordination of data specifications and data set sharing between government agencies. Besides this there are ongoing projects led by the Ministry of Industry to ensure simplification and reduction of the data reporting burden of private and public enterprises.

The first efforts on data structuring for financial enterprises started in 1975 with joint collection² and compilation of 38 different forms for statistics and supervision purposes for the financial sector – mainly banks.

In 1986 this financial statistics collection and computing system of balance sheets and profit and loss accounts, interest rates, capital adequacy etc. was restructured into six matrix based data sets which were stored in a shared data base³ accessible by all three government agencies. In this new computing system electronic submission of data was also implemented and was later (in 1996–98) strengthened with web-based, automated reporting and check-routines handled by the reporting entities themselves. The data model, data sets and computer system – ORBOF – still comprise the main source of information for statistics, supervision and analysis in Norway in 2008. A revision of the data model was made in 2007 and a change of technical environment is planned from 2009.

In the following I will describe some efforts and challenges we have met and also give some input on future development ensuring high quality data sets serving statistics, supervision and analysis.

2. The role of Statistics Norway as collector, adviser and data provider of financial statistics for end users – data modelling

Statistics Norway (SSB) has defined duties serving other government agencies and reporting entities as official statistics provider and intermediary to the public, to national analysts and

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² Statistics Norway, The Financial Supervision Authority of Norway and The Central Bank of Norway developed this form and computer based system together, but the data structure was initially very raw with only a few cross-checking routines to establish a moderate level of consistency between the datasets.

³ The technology used in the data base and computing system is Adabas and Natural from Software AG.

as reporter of data to international organizations. The statistics functions of SSB are legally based on the Statistics Act, which defines the major tasks. Statistics Norway is the main, domestic government agency for statistics production, but its duties also encompass advisory services to every data collection system suitable for official statistics purposes – independent of who collects and computes the data. The advisory role gives Statistics Norway wide authority in all major domestic data collection and compilation systems.

Thus, for financial statistics purposes Statistics Norway has been the key government agency from 1986 to 1996 and again from 2007 performing data structuring and modelling, data collection and compilation and acting as data base host for Statistics Norway, The Central Bank of Norway and The Financial Supervision Authority of Norway. The financial statistics computing system consists of accounting based data sets organized in a shared data base serving financial statistics, financial sector supervision, monetary policy and financial stability analyses.

Serving these four “functions” is a difficult task with few data matrixes / data sets, as the requirements of the cooperating government agencies are different. There is always a danger of collecting too many details and then also making too complex and large data structures when serving many data requirements. However, Statistics Norway’s main goal has been to harmonize the data requirements into a common structure based on a comprehensive data matrix. The matrix is built from core balance sheet data and profit and loss data on which attributes and variables of statistics information of institutional sector, industry, country and other attributes such as currency, risk, interest rates, etc. are added. Relations between the different data, variables and attributes are defined clearly and monitored continuously.

The comprehensive data matrix model was developed in 1986. The model has been extended according to changes in data requirements stemming from changes in international and national standards and needs, but its main features remain the same. In 2007 the inclusion of IAS/IFRS changes was not very complex as it necessitated inclusion of only a few new variables and attributes in the model. However, the challenge of every large change is to handle and link time-series data, and IFRS was no exception at this point.

A redesign of the data model, data matrixes plus the technical system is planned from 2009.

3. Implementation of standards for statistics, accounting, supervision into the data model and data sets

3.1 Overview

Traditional financial statistics may often be built on standards and methods used for national accounts, standards for institutional sectors, balance of payment standards etc. In Norway we also have implemented official accounting standards and data specifications in the definitions and the data structure, to ensure consistency and high, stable quality between published official financial statements and the financial statistics data sets.

We believe that precise definitions and defined links between the actual, official financial statements of accounting data and the financial statistics data set are crucial for both reporting entities, authorities and end users of data; as a single, reconciled data set should be the basis for statistics, supervision and analysis.

However, there is a change of focus from national accounts based data towards new data better fitted for financial stability analysis and supervision, where new attributes and variables are implemented. The change is strengthened by mergers and acquisitions among financial enterprises on a cross border and cross sector base which implies a need for reporting entities based on different consolidation principles. These changes have to be implemented

in existing and new data sets, both on the variable/attribute side and on the reporting entity side. New reporting entities covering the legal entity then have to be implemented alongside the financial sector based reporting unit. New variables and attributes defining risk, weighting, estimation of value, multiple sectors (direct versus ultimate risk counterparties), maturity etc. have also to be considered in the data modelling activities and in a change of data structure as well.

When restructuring data sets and redesigning data models, there are several choices to be made:

3.2 Full integration of all variables in a single, comprehensive data matrix

If this is the choice, then in principle all data – entities, variables and attributes – are collected and stored once in a detailed full information data matrix. The matrix does not use marginal distributions or aggregates, and all information can be extracted directly on a detailed level – and might be transformed to the different uses by extraction by “rule based” computer programs.

Pro: All data are defined and reported in a detailed way, and double and multiple reporting and storage is avoided. This may also ensure full consistency in the data set and will throw light on missing variables and attributes and slumps in data quality when reports are sent in from reporting entities and automated quality checks are made.

Contra: Large, detailed data sets may be difficult to collect, compute, store, correct and extract in a data base. The base might be too large and too costly to maintain. Reporters and users might lose their overview of the data – it might simply be too large. The data base may have many “missing observations”, which may be difficult to handle technically and practically.

3.3 Partial integration of variables in a few data matrixes

If this is chosen separate data sets or smaller matrixes directly suited for statistics, supervision and analysis might be constructed. Data should be collected and stored as few times as possible, suited for the purpose at hand. In such a structure it is important to define a core data set that is the basis for reconciliation of the different matrixes / data sets.

Pro: Data defined and reported in a more aggregated way than the single data matrix method might be more easily handled, collected, stored, collected and extracted. Acceptable consistency in the data set may be achieved by implementation of automated check routines. Data sets can be made smaller than the single matrix method, positive for costs for the authorities.

Contra: There may be multiple reporting and storage of data, and it may be difficult to establish full consistency and transparency of data in and between the different data sets. The danger of inconsistency may affect the end users of statistics, supervision and analysis if actions are based on partially reconciled data in different parts of the data base. Errors and omissions in the data might be concealed by aggregated data. Cross checking routines might be mistaken for data quality check routines. However, for the reporting entities the preparation of different forms and aggregates that need to be reconciled might easily be at least as resource consuming as the comprehensive data matrix method. The reason for this is that what often matters most for the reporting entities, accounting routines, reconciliation and computer systems preparing data sets for the authorities, are the total number of variables and attributes.

3.4 Recommendation

Based on our experience in Norway a single, comprehensive data matrix method is the best data model solution, when data quality and avoidance of multiple storage and collection of data is concerned. Also when it comes to flexibility of analysis and research activities, a detailed matrix should be the first choice. However, in practice the level of detail which will be the product of the number of variables and attributes, might lead to a huge data set that is difficult to handle. The choice is then often the partial integration of data requirements into a few data matrixes. Then these data sets/matrixes should still consist of quite detailed number of variables and attributes to ensure reporters focus on data quality of the data input into the reporting financial statistics system. Its also essential to establish the core data set giving the key to relevant reconciliation among the different data sets. A core data set should be based on balance sheet data and profit and loss accounts data preferably strongly linked to the official financial statement of each reporting financial enterprise.

4. Reporting burden and data specifications

Enterprise reporting burden has been a key issue in Norway for at least ten years. As previously mentioned, Norwegian legislation (the Act on business reporting obligations and the Statistics Act) requires government agencies to cooperate and harmonize data specifications, definitions and share data collected from financial and non-financial enterprises. The legislation not only encourages but requires harmonization and cooperation.

Another important issue relevant for the data specification process is that all domestic public authorities have to have in mind that each reporting entity meets the sum of all data requests from each government agency and that the harmonization of data to a few consistent data sets without too many different reports is important to reduce the reporting burden. To structure, redefine and cut off irrelevant marginal reports and aggregates and coordinate and share data between government agencies is crucial in this work.

Lately there is also an efficiency improvement project lead by The Ministry of Industry where all official data reports to government agencies (including tax authorities) are scrutinized and actions of harmonizing data are to be planned within 2009. The professional and industrial associations of the financial corporations take part in this project. The main objectives in the efficiency improvement project are to further develop web-based data collection and response systems, reduce rules and costs of reporting and map and reduce the authorities' reporting burden on financial and non-financial enterprises.

The professional and industrial associations of the financial corporations also initiate input and actions to harmonize and simplify the reporting of financial data to the authorities. For this purpose Statistics Norway has established a forum for financial enterprises, their professional associations and computer service companies to meet, discuss, prepare and implement changes in the financial reporting system. This forum meets several times each year and working groups are also established solving specific issues. Lately the future IFRS changes are on the agenda of this group, and changes are planned implemented in 2009.

5. International organizations, standards and reporting requirements

Most international organizations (OECD, IMF, ECB, Eurostat, BIS) use the official national accounts statistics standards and related standards as a base for reporting requirements. Many international organizations also share and exchange data between themselves.

However, when it comes to accounting standards and data requirements for financial stability purposes and data specifications in country reports to different international organizations,

there are a large number of specifications and additional data, consolidation and estimation activities to be made on the national level. Data requirements may at times seem to be determined from theoretical needs and models, but general theoretical needs are often hard to meet in several countries.

Sometimes standards may seem paradox. For instance the IFRS-standards might express transparency in official financial statements for the end user, but also encourage flexibility of the data presentation of the financial statements. However flexibility might hamper the comparison of financial statements between financial enterprises without a thorough study of statements and annotations. Flexibility might then mean a more complex and resource consuming analysis of financial statements.

Unfortunately, different reports to international organizations still use different definitions, and different data specifications and templates. This means that the national statistics agencies both have to collect additional data from the reporting units and make several estimations on the data beyond the available details on the national level. Additional data specifications and different definitions increase the reporting burden on the reporting enterprises and is also a threat to data quality when the reporting unit cannot understand the usefulness of the additional, slightly different specifications.

In the case where a national statistics agency has to estimate data for non-identified observations in the available data sets, based on key figures that often may be debatable, we may question the quality of the data sent to international organizations.

In my view, efforts should be made on further harmonization of definitions, data sets and data exchange between international organizations to ensure highly reliable data at an acceptable cost to reporters, national authorities and international organizations.

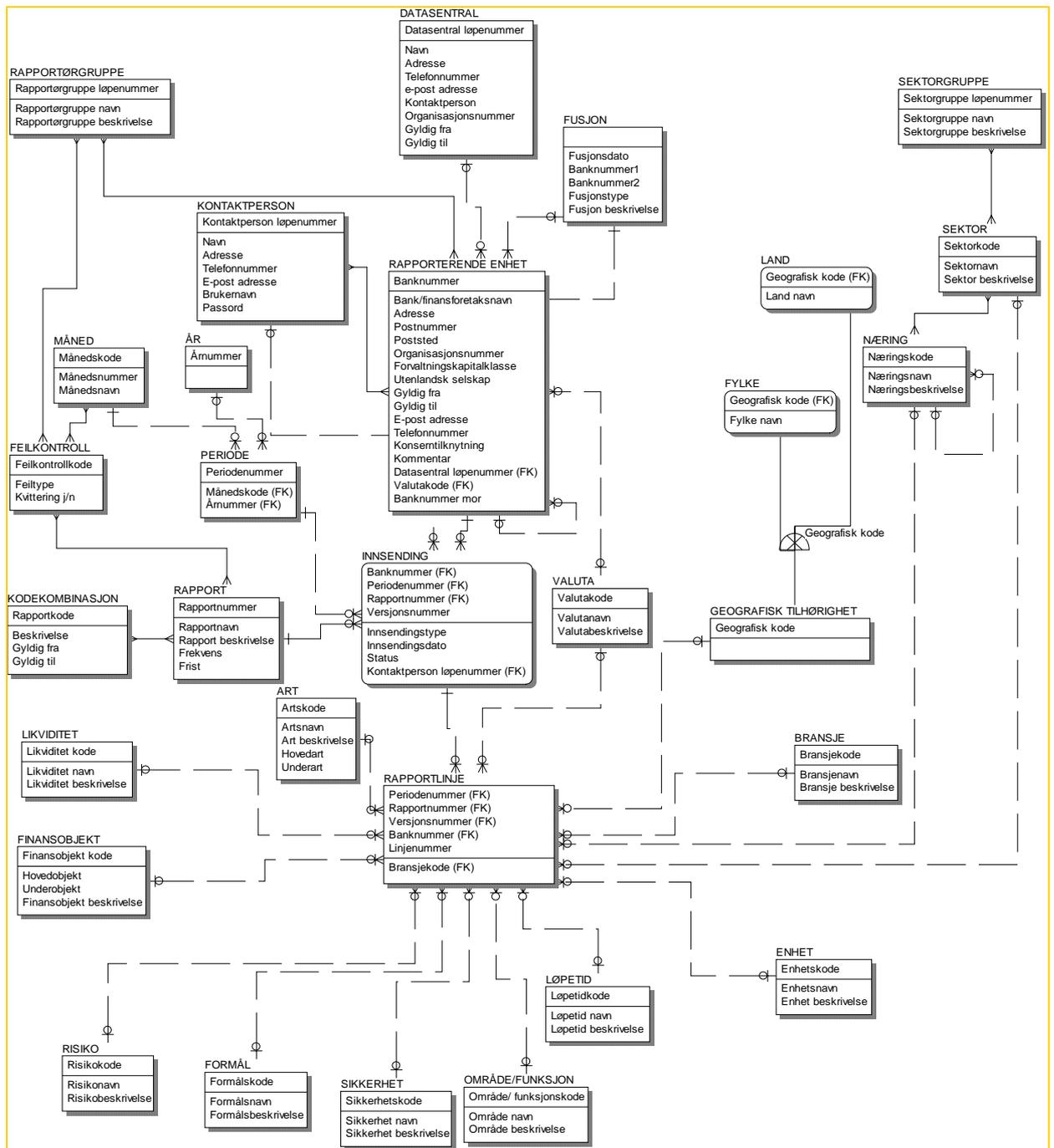
6. Recommendations

To sum up:

- The creation of a comprehensive data matrix based data set within a consistent data model is crucial for data quality, data collection, compilation and use of data.
- The data set should cover data requirements for statistics, supervision, analysis and research purposes.
- Data requirements and specifications should be harmonized more thoroughly:
 - National authorities and reporting entities should develop data sets in cooperation.
 - Statistics authorities should take part in the development of standards for accounting etc. where data also is relevant for and will be used for financial statistics purposes.
 - International organisations should work together to harmonize definitions, data sets and templates.

All participants in the standardization and harmonization process must focus on simplification and consistency of the data. Data sets should be quite few and with relevant detail ensuring good quality. Data should be easily reconcilable and handled within a well structured data model.

Data model – ORBOF – revised for 2009



Further enhancing monetary analysis with more data at short notice

Striking the balance between the regular collection of detailed micro data and the need for supporting ad-hoc surveys to capture financial innovation

Björn Fischer and Frank Mayerlen¹

1. Introduction

Recent financial markets developments have demonstrated the need for detailed, timely and high quality information on financial instruments to enhance monetary analysis in real time.² Prominent and recent examples of these information needs have been in the area of “structured products” or “sub-prime” debt. To the extent that such instruments are structured as marketable securities, such information requirements can be supported by modern security-by-security databases which are capable of storing information available from the market and other sources at a very high level of detail. Moreover, these databases are of help to identify “where to look further” in case they can’t provide the necessary information immediately. For this step, it is important to have an additional facility at hand for the collection of well specified complementary information from selected market participants via ad-hoc surveys at short notice.³

With relevant real-time examples, this paper tries to verify that analysing and handling security-by-security information is worth the effort and that such analysis has contributed successfully on a number of occasions to reduce substantially the uncertainty inherent to real-time monetary analysis.

2. Problem statement

It is well known that the policy decision process within central banks is challenging due to the high uncertainty under which real-time⁴ policy decisions have to be made. Indeed, there is considerable “economic” uncertainty about the nature of exogenous shocks and about the functioning of the interaction between policy, private sector expectations and economic

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The views expressed in this paper are those of the authors and do not necessarily reflect those of the European Central Bank. Comments made by Steven Keuning, Huw Pill, Jean-Marc Israël, Patrick Sandars, Henning Ahnert, Antonio Matas Mir, Paolo Poloni and Richard Walton have been much appreciated.

² See for example Stark (2008).

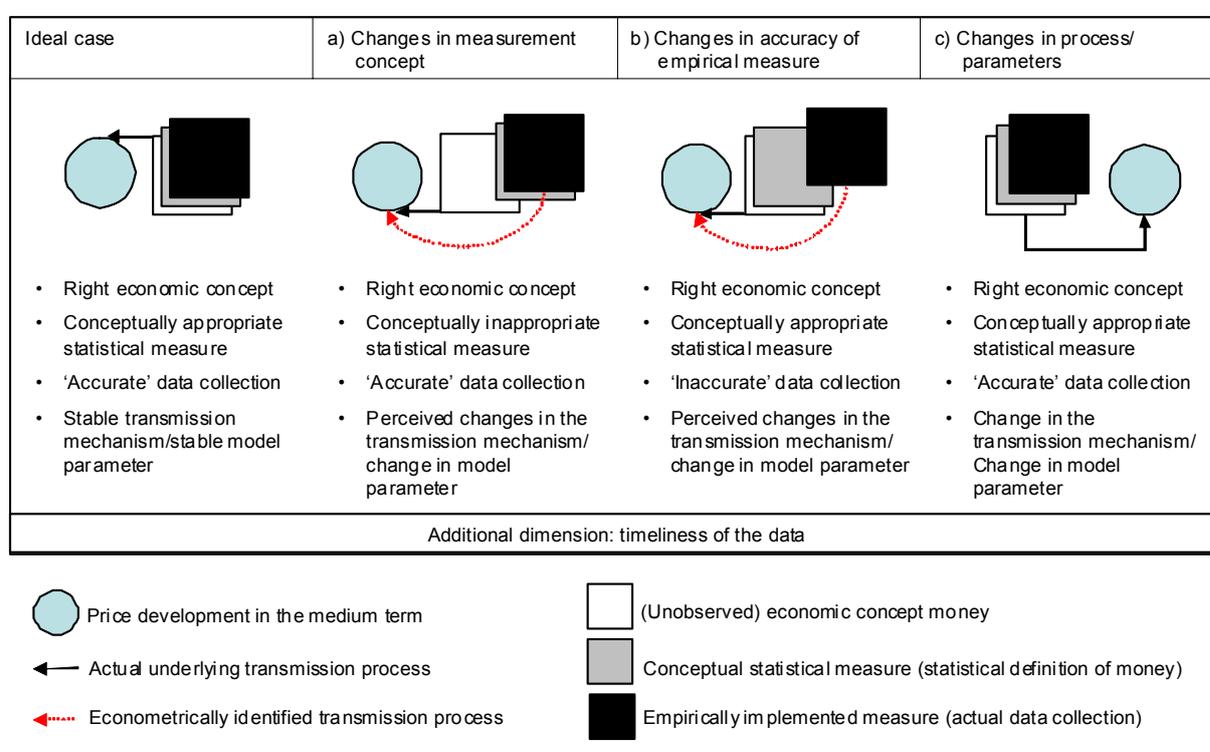
³ See also section 2.2 of the medium-term work programme for the ECB’s statistical function at <http://www.ecb.europa.eu/stats/html/workprogramme.en.html#>.

⁴ Real-time analysis should be understood as reflecting the situation (point in time), when policy makers have to make their decisions, i.e. a state in which information on current developments is incomplete, or still subject to revisions and where new (innovative) developments might not have yet been fully identified and captured.

development. Statistics, which constitute the link between economic theory and reality, add some “statistical” uncertainty about the current state of the economy due to delays with which they are collected and due to the uncertainty about potential measurement problems. Financial innovations,⁵ which may refer to financial products and their trading, financial processes or financial institutions, can add to these uncertainties by either leading to a conceptually inappropriate statistical measurement of unobserved economic concepts (see Figure 1 case a), or by impacting on the actual measurement quality of empirical measures (case b), or by changing the relationship between economic variables via a changed transmission processes or changed process parameters (case c). Those uncertainties may all occur simultaneously and are – for the real-time analyst – often equivalent and undistinguishable, although they have distinctly different consequences for policy interpretation.⁶

Figure 1

Uncertainties for monetary policy making in real time



Financial innovation is increasing the uncertainties for monetary analysis in real time, but at the same time often increases its relevance

In recent years, financial innovations have played a much more prominent role than in previous periods, potentially due to the creation of common euro area money- and financial markets, globalisation and global risk sharing, deregulation and technological progress

⁵ For a detailed definition of financial innovation, see Tufano (2003).

⁶ It may also be that the “economic concept” is inaccurate. An example would be a concept which relies on an “industry” breakdown of corporate loans, while manufacturing industries are (correctly) classified within the services sector in national statistics after having outsourced production to emerging economies.

allowing the efficient design of customer specific financial products in real time.⁷ Recent financial innovation has been triggered in addition by the globally low level of interest rates in recent years, stimulating a rapid rotation of assets, also creating “search for yield” strategies by financial market participants. In the area of monetary analysis, the increased importance of financial innovation complicated considerably the channels through which monetary developments influence prices. At the same time, as has been experienced during the recent financial market turmoil, financial innovation has increased considerably the importance of monetary statistics and analysis for monetary policy.

This increased complexity in combination with the higher importance of monetary analysis for the overall policy process increases the need to put real-time monetary analysis on a broad basis. This requires the timely provision of a fully consistent break-down of aggregated data. In concrete terms, financial innovation might have a number of consequences:⁸

- First, financial innovation might significantly change the conceptual measure of the economic variable “money”. A recent example, although the practical consequences are far from being straightforward, has been the move of the business model of MFIs⁹ from originate-to-hold to an originate-to-distribute model, in which loans are originated, but sold subsequently. Under such circumstances, the statistical measurement concept of money and credit, defined as certain liabilities and assets from the MFI balance sheet, may start to shift away from the economic concept “money” and “credit”.¹⁰ (→ *uncertainty in the statistical measurement concept*)
- Second, financial innovation might modify the border between monetary and non-monetary assets, thereby driving a wedge between the conceptual measure of “money” and the empirical statistical measurement of monetary aggregates, endangering the indicator quality of the latter measure. One recent example, developed further below, has been the financial innovation concerning debt securities with embedded derivatives that distort the statistical category “holdings by the money holding sector of short-term debt securities issued by MFIs”. This category is considered to be part of “money”, but may now include assets that are not clearly capital certain and hence do not fulfil one of the defining criteria of money. (→ *uncertainty in the statistical measurement concept; uncertainty in the empirically implemented measure*)
- Third, innovation might influence money demand, especially via changes in the interest rate elasticity, possibly endangering money demand stability. (→ *uncertainty in the parameters of the actual underlying transmission process*)
- Fourth, the money supply might be influenced by portfolio changes on the asset and liability side of the MFI balance sheet, thereby influencing the link between the monetary base and broader monetary aggregates. This might lead temporarily and/or permanently to changes in the velocity of broader aggregates. (→ *uncertainty in the actual underlying transmission process*)

⁷ Such instruments may be tax optimised and/or may have very customer specific risk/return profile.

⁸ See for example Issing (1997)

⁹ Monetary Financial Institutions (MFIs) are defined as financial institutions which together form the money-issuing sector of the euro area. This group mainly consists of the Eurosystem, resident credit institutions (as defined in Community law) and resident money market funds.

¹⁰ At the same time, it is crucial to understand that the application of the International Accounting Standards IAS 39 in a number of countries has resulted in a considerable lower impact of this change of business model on the analysis of MFI loan data than generally thought. This is due to the fact that IAS 39 makes even a partial de-recognition of loans from MFI balance sheets unlikely after a loan had been sold, as soon as part of the risks remain on the balance sheet of MFIs.

- Fifth, financial innovation might influence the transmission mechanism, possibly affecting the way monetary policy actions impact on the economy. This may work for example via an increased importance of the asset price channel and may thus modify at least the timing between the link of trend increases in money growth to trend increases in inflation. (→ *uncertainty in the actual underlying transmission process, but higher relevance*)

Statistical data are required in real-time to monitor the impact of financial innovation

An efficient and timely statistical coverage of financial innovation is thus a task that is crucial for the real-time assessment of monetary developments concerning risks to price stability, in particular as it helps to reduce uncertainties. A valid support for such coverage can be supplied by appropriate statistical tools allowing the real-time identification and monitoring of financial innovation. This needs to include the ability to answer statistical ad hoc questions at rather short notice and to identify financial innovation in certain products at an early stage. In particular, this is true for securities, which represent a very innovative segment of the financial market, but it does of course also relate to other market segments, e.g. (loans and) derivatives.

The European System of Central Banks (ESCB) is developing the “Centralised Securities Database” (CSDB), a micro database, holding detailed information at the level of the individual security. The CSDB will allow the ESCB to explore security related data at a much more granular level without further recourse to the reporting agents and, in turn, will reduce the burden for reporting agents by relieving them from detailed statistical classification and valuation requirements.

After presenting briefly the main features of the Centralised Securities Database, this note will address the question of how to make use of micro data to provide monetary analysis that works on a macro-level with the right data at short notice to assess the impact of financial innovation on the signalling quality of monetary developments on medium- to longer-term risks to price stability. The note aims to demonstrate (based on concrete real-time cases)¹¹ how available micro data has been used in real-time to support three broad approaches, depending on the issue:¹²

- To answer an economic question directly by providing the right statistics
- To narrow significantly the area where further investigations are required to answer a question (find out where to look further)
- To identify financial innovation or structural developments at an early stage, i.e. before potential distortions impact significantly on the signalling quality of money.

¹¹ Relying on concrete real-time cases is deemed as a good hedge against overly ambitious aims that fail to work in practical applications or are constructed only in retrospective

¹² Since the more powerful CSDB “Phase 2” is currently still being implemented, some of the ideas presented below are not yet implemented as permanent solutions but are currently rather being used ad-hoc and on a case-by-case basis. Most real-time examples provided in this paper thus had been based on ad-hoc security-by-security information collected from various sources including the CSDB. However, the CSDB database structure will have the potential to combine those sources.

3. The Centralised Securities Database as a flexible tool to support monetary policy in real time

A security-by-security database covering more than 4.5 million individual securities

The CSDB is a micro database, holding detailed information on more than 4.5 million securities.¹³ The information, which is stored at the level of the individual instrument, covers so far reference information on issued securities. Holder information is collected and compiled via different channels by National Central Banks (NCBs), but is not included in the CSDB. More specifically, the database covers for example the international security identifier (ISIN code), issuing currency, statistical instrument classification, issue and redemption date, issuer name, sector and residency, as well as information on outstanding amounts, prices and income related variables. The CSDB is already being used in a simplified “Phase 1” version, while a more advanced “Phase 2” system is currently being implemented and is expected to go-live by end-2008. This Phase 2 system, which will enhance the information sharing between the ECB and EU NCBs, will be able to accommodate security-types beyond straight debt and equity and is therefore well prepared to cope with financial innovation also in the future.

The CSDB can be used for statistical production and for ad-hoc research

As a first use, the CSDB Phase 2 system will support the production of euro area external statistics and investment fund statistics in NCBs. In practice, this means that reporting agents can provide their statistical reports at the level of the individual security issued, held or transacted, without any further aggregation and in a format which does not require any statistical classifications and valuations. This reporting approach is much closer to the procedures used in the internal business systems of reporting agents. Relevant statistical information required will be sourced from the CSDB and will be matched during the statistical production process to the raw data provided by the reporting agent. Both datasets will be matched by using the international securities identifier (ISIN code) as a unique key. Overall, this will reduce the statistical burden for the reporting agent and will at the same time provide more flexibility on the statistical side, as it allows for different aggregations without changing the requirements addressed to the reporting agent. Furthermore, the CSDB can also be used to analyse developments in securities issues in real time and to identify any new patterns, e.g. caused by financial innovation, at a very early stage. This use is detailed further in the three case studies below.

Statistical coverage of the Centralised Securities Database

The CSDB supports and satisfies the statistical needs to conduct the single monetary policy for the euro area. In addition, the database will be used by individual euro area NCBs to produce statistics for domestic needs. In terms of instruments, the CSDB covers debt securities, including “hybrid” instruments with embedded derivatives, equity and investment fund shares. Financial derivatives are currently not covered. With regard to its geographical coverage, the database aims to include all instruments denominated in euro worldwide, regardless of where the issuer is located, all issues by issuers resident in the euro area,

¹³ The CSDB allows to mark in a “focused list” those securities which are most relevant for the production of certain statistics, i.e. which are issued, held or transacted by the reporting agents. An exercise conducted for the production of external statistics led to the identification of around 350,000 most relevant securities. The quality of these instruments is checked with the highest priority.

regardless of the issuing currency, and all securities potentially being held by euro area residents (required, for example, for the compilation of external statistics).

A joint effort by the European System of Central Banks

The CSDB is a joint effort by the European System of Central Banks (ESCB). The database is fed with data sourced from 5 commercial data providers and with additional national contributions from many of the 27 ESCB National Central Banks (NCBs). As the different data sources of course overlap, the CSDB has a “compounding” algorithm which derives – in an automated way – “golden copy” information based on the available information. This compounding process is fully traceable to the database operator and the results can be cross-checked at the level of the individual security by the NCBs, as part of their contribution to the ESCB data quality management network.

4. Case study A: Using micro data to identify financial innovation directly and study its consequences

Looking into the aggregate data in more detail

At present, National Central Banks (NCBs) of the Eurosystem provide the ECB with statistical data which are pre-aggregated by sector and statistical category (i.e. instrument type) and which do not allow to identify at euro area level the contributions by individual reporting agents. As a consequence, it is not possible to analyse relative developments within the euro area reporting population. Growth in a certain statistical category may for example reflect a uniform development across all euro area reporting agents or it may reflect a much more uneven development. Any substitution effects within a largely unchanged euro area aggregate are impossible to detect.

The availability of security-by-security data also allows “replicating” the aggregates covering securities issued, as reported by NCBs, not only on an issuer-by-issuer level but even at the level of detail of the individual instrument. This allows identifying and analysing relative developments between reporting agents and permits the analysis of individual instruments issued, including, for example, their original and remaining maturity.

Practical example 1: refinancing schedule of asset-backed commercial paper (ABCP)

In general, the change of the banking model from “originate-to-hold” to “originate-and-distribute”, i.e. from a model where loans were created and kept on balance sheet to a situation in which loans are created by MFIs and on-sold, is a good example where the statistical measurement concept of monetary aggregates and loans might shift away from the unobserved economic concept of “money” and “credit”, making the creation of a new measurement necessary.¹⁴ So far, it cannot be claimed that security-by-security data have

¹⁴ In practice, however, it turned out that the impact of this changing model on the definition of money and loans has been considerably lower than expected due to the fact that MFIs remained exposed to risks of sold loans, at the very least reputation risks. In addition, due to accounting frameworks and some financial prudential measures, loans remained fully on the MFI balance sheet in a number of euro area countries, even when they were sold to Special Purpose Entities.

helped to assess in real time the changes in the business model.¹⁵ Still, security-by-security information has already provided crucial information for liquidity policy purposes in assessing in 2007 potential end-year frictions based on refinancing needs for maturing asset backed commercial paper (ABCP). Indeed, even without significant defaults in their asset structure, many ABCP issuing entities (structured investment vehicles (SIVs) or conduits) had difficulties in refinancing maturing liabilities since investors were increasingly uncertain about the inherent risk of these papers. Typically the SIVs and conduits are holding longer-term instruments on the asset side (mainly ABS) which are refinanced by the revolving issuance of short-term paper. A maturity mismatch arises where the amount of long-term debt to be refinanced remains broadly unchanged at least over several months, while the respective liabilities need to be renewed on a permanent basis through the issuance of short-term securities.

Practical relevance of example 1 for real time monetary analysis

Security-by-security information allows the identification of SIVs or conduits issuing ABCP and, by using information received from commercial data providers, allowed estimating the re-financing need for the next few months by an analysis of the maturity dates of the liabilities issued.¹⁶ Given that most of these entities had explicit or implicit liquidity support from an MFI, such information helped to predict potential liquidity problems of euro area MFIs at the end of 2007, thereby helping to shape the preparation of appropriate liquidity operations during this problematic period. The use of crude proxies for real-time analysis, as done in this case, might considerably benefit from the availability of more detailed information on the issuance of asset-backed securities combined with information on holders of those securities and guarantees/support given to these vehicles by third parties. This will allow drawing some further and more elaborate conclusions (including forward looking scenarios) on the situation of the sponsoring MFIs. Indeed, in the current financial tensions, it has been crucial to understand potential risks stemming from MFIs' engagement in those securities, not only for financial stability reasons but in particular to advise the policy maker, in how far liquidity support by MFIs to related SIVs might impact on their ability to grant loans to the private sector, which in turn impacts on investment and output in general.

5. Case study B: Using micro data to significantly narrow the area in which further research is required to understand financial innovations

It is unlikely that security by security databases will by default hold information to always answer all statistical questions directly. This is in particular true for some financial innovations, where certain features of a security become very relevant and may be developed further at high speed and where very detailed data but also a good understanding of the economic context will be required for a complete assessment of the development. Indeed, some data may already be covered by the database in some form but some "background knowledge" is required to understand the business case and to query the database in the right way with the highest efficiency.

¹⁵ It should be noted that the collection of security-by-security information in this case may be hampered, as part of the securities can be private placements. For more details on the measurement of credit risk transfer in the EU see: Poloni and Reynaud (2008).

¹⁶ In spite of potential gaps which may exist due to private placements, these data are deemed very helpful.

Identifying quickly whom to ask for further information

A security-by-security database can be of great help in narrowing down very quickly the number of issuers from whom more detailed information should be collected on an ad-hoc basis. In the example of ABS, security-by-security information would allow identifying those issuers with the highest outstanding amount and/or with the most significant increase in outstanding amounts. Those institutions could then be contacted or surveyed on an ad-hoc basis to collect further information. Such a combined approach, where the CSDB would be used in a first step to identify those institutions where ad-hoc interviews or data collections should be conducted in a second step, would be very beneficial to increase both the timeliness and the efficiency of the information collection process. Issuers of potential relevance can be identified quickly and further information needs to be collected only from those institutions. Other issuers will not be subject to any burden.

Not every ad-hoc question can be covered

Whether the “permanent” information in the CSDB should be further supported with data required and collected during an ad-hoc collection, needs to be decided on a case-by case basis. In principle, such information should only be included after a cost benefit analysis which takes into account (i) whether the phenomenon will be persistent; (ii) whether even more detailed CSDB information could be exhaustive or whether a significant additional amount of “soft” information would be required in any case. In the latter case, even more detailed CSDB data are unlikely to provide all information required, although it may shift the relative relevance of initial CSDB information and additional ad-hoc inquiries. Experience of the past years showed that enriching the CSDB based on very detailed one-off ad hoc data requirements would not have helped to capture future financial innovation up-front as this innovation may happen in a different area. Moreover, many innovations tend to be of a temporary nature, and thus do not warrant a permanent data collection.

Practical example 2: Euro Commercial Paper issued by state guaranteed banks

During the years 1999 and 2000, a strong expansion of short-term debt securities issued by MFIs could be observed in Germany. From the aggregate figures it was not evident whether this development had been caused by a certain type of institution, by a certain type of instrument or both or had been a broad-based phenomenon. However, security-by-security information allowed identifying that the development was mainly driven by a strong growth in the issue of Euro Commercial Paper (ECP) denominated in foreign currencies, by around 5 MFIs which had a state guarantee at that time. Subsequently, it was easy to meet all of them to collect the additional information that their securities had been considered as very close substitutes to government bonds, in particular by investors located outside the euro area, given their state guarantee at that time.

Practical relevance of example 2 for monetary analysis in real-time¹⁷

The identification of a specific sector increasing strongly its issuance of short-term ECP, in particular those denominated in foreign currencies, gave rise to the observation that this increase reflected a very dynamic non-resident demand for marketable instruments. Previously it had been assumed that these securities were in the hands of residents and had been assumed to be part of the monetary aggregate M3 to the extent that they were not held

¹⁷ For a detailed technical description, see Fischer et al. (2008), or ECB (2001a) and ECB (2001b).

by MFIs.¹⁸ Not excluding non-resident holdings of short-term marketable instruments upwardly distorted the annual growth of the monetary aggregate M3 by a maximum of 150 basis points in early 2001.

Based on security-by-security information, ad-hoc corrections were included in the monetary analysis using, as a first proxy, a grossing up approach based on the development of Euro Commercial Paper issued in foreign currencies by euro area MFIs. In order to solve the problem in the longer-term, information on the residency of holders of short-term debt securities was then derived mainly from aggregate information provided by international security settlement systems. With the implementation of this statistical enhancement, M3 data were corrected officially for the non-resident holdings of negotiable instruments in November 2001, while the general public had already been kept informed on the potential distortion during the months before. This official correction influenced the monetary policy assessment at that time, as evident from the Editorial of the May 2001 Monthly Bulletin that states:

[...] there have been indications that the monetary growth figures are distorted upwards by non-euro area residents' purchases of negotiable paper included in M3. [...] Taking into account these factors, the slowdown in M3 over the last few months was more pronounced than previously thought [...]. Overall, it can now be concluded that there is no longer a risk to price stability over the medium term signalled by the analysis of the first pillar.

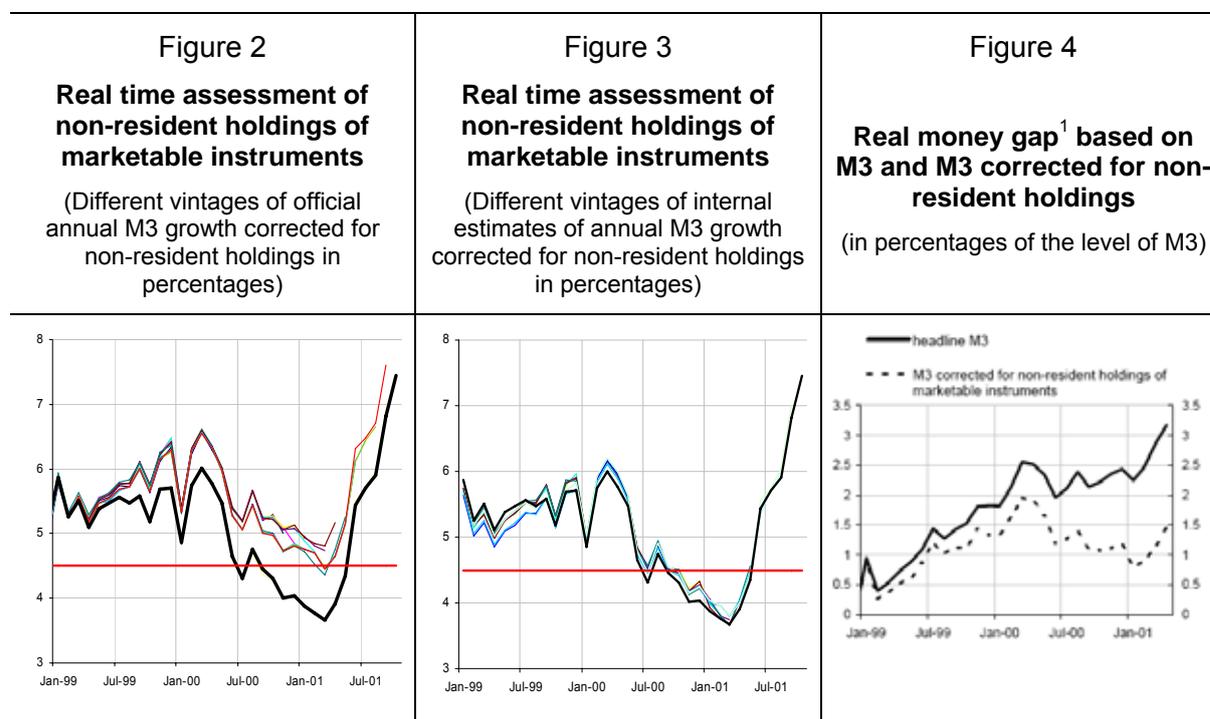
Example 2 provides the value-added of information derived on a security-by-security level for real time monetary analysis. Figure 4 presents a potential measure of excess liquidity, namely an estimate of the real money gap as available in May 2001. Looking at the estimated real money gap using headline M3 growth as available at that time, the message is clear: Since early 1999, a liquidity overhang built up. For a real-time assessment of that date, the following questions would need to be answered: Does the increase in the money gap point to upward risk to price stability? Does the increase in the gap indicate changes in the transmission mechanism or signs of instability in money demand in general? Has the increase been caused by measurement problems (either in the statistical concept or in the empirical measure)?

The answers to these real-time questions cannot easily be provided by econometric models. A "yes" to any of the questions raised above would result in the same empirical outcome (for example changes in the process parameters of the empirical model), although with considerably different consequences for monetary policy. It is therefore essential to undertake a broad monetary analysis that includes an analysis of financial innovation based on statistics at a disaggregated level. The relevance of the questions changes considerably, when looking at the estimate of the real money gap based on the measure of M3 corrected for the non-resident holdings. First, the uncertainty on measurement problems is reduced. Second, between mid 2000 and early 2001, the measure now indicates a correction of a liquidity overhang that has built up in previous periods. This not only changes the policy message but reduces the relevance of the questions concerning the stability of the transmission process or the stability of the process parameters. The message based on corrected M3 was thus not only different from the mechanical message derived from official

¹⁸ While the statistical concept of money does include those short-term debt securities which are held by the euro area money holding sector, the empirical measure could at the time not capture separately (and exclude) holdings by non-euro area residents due to measurement problems. Indeed, capturing the holding of negotiable securities has proven difficult as, given their negotiability, the issuing institution typically does not know (all) holders. However, until the appearance of the case described above, non-euro area resident holdings had been deemed rather low and stable over time.

M3 measures, but in addition the strength of the policy message had a considerably higher weight than the strength of the message based on the headline M3 figures.

Impact of non-resident holdings of short-term debt securities on the monetary analysis



¹ The measure of the real money gap is defined as the difference between the actual level of M3 deflated by the HICP and the deflated level of M3 that would have resulted from constant nominal M3 growth at its reference value of 4½% and HICP inflation in line with the ECB's definition of price stability, taking December 1998 as the base period.

6. Case Study C: Using micro data at an early stage to identify measurement problems induced by financial innovation

Statistical categorisation may hamper the early identification of new financial products

For the purposes of macroeconomic analysis, financial instruments are classified into different statistical categories. This allows building time series as a basis to monitor developments over time. At the same time, the definition of such categorisation always needs to achieve the right balance between the number of categories and the size and uniformity of each individual category. Increasing the number of categories will in principle lead to “cleaner” categories with less intra category variation. At the same time, the analysis may become difficult with too many categories and there may be substantial substitution effects between different categories. Moreover, data collection and compilation costs increase substantially with more categories. Relying on fewer categories should reduce the substitution effects but bears the risk that too different instruments are categorised into the same category.

Independently from their definition, categories may to some degree be perceived as a “black box” which does not easily allow monitoring of the actual content. In other words, it would not necessarily be visible if specific instruments included in a certain category would develop new features or new instruments emerge, i.e. the case of financial innovation. An example would be short-term debt securities which start to have embedded derivatives, i.e. a substantially

changed risk/return profile, thereby driving a wedge between the aim of the statistical measurement concept and the empirical statistical measures.

The CSDB allows to “screen” statistical categories to identify financial innovation

The micro data provided by the CSDB can be used to build statistical aggregates in a very flexible way, following various aggregation procedures to meet different needs. Furthermore, the availability of micro data, covering different statistical attributes, allows to “screen” data within categories to identify any variation. This may comprise just a visual and labour-intensive screening of instrument names but may also include a more statistical and automated approach. As an example, the CSDB data would allow to compile the distribution of yields of the securities included in a certain category. With regard to short-term debt securities issued by euro area MFIs in euro, one would expect a rather narrow distribution of yields, around the Euribor rate plus a certain risk premium, assuming that any difference in the rating of the issuing MFI plays only a minor role for such short original maturities.¹⁹ If the above mentioned category of short-term debt securities also included any instruments with embedded derivatives, those would have a different risk/return structure and would hence most likely pay a very different interest rate. As a consequence, such instruments could be identified by statistical analysis for further investigation.

Such statistical analysis may, for example, also be used for the screening of debt securities price data or of currency distributions within certain statistical categories. Moreover, it is possible to produce concentration measures, such as the Herfindahl index or just the relative share of the most relevant *n* issuers in terms of outstanding amounts, number of securities, or both. Such screening methods could be applied to the database as an ad hoc exercise and would be much more useful when applied over time, to generate time series. Moreover, the screening methods could be applied to all statistical categories in a fully automated way. After the calibration of the system at the beginning, filters can be used to monitor the developments over time and to identify significant developments which would require further manual investigation.

“Significant” developments need to be analysed manually

Identified “outliers” require further action. Assuming that they are not caused by erroneous input data, the securities concerned apparently have features which “deviate” from the statistical category where they are allocated. Further analysis needs to reveal whether these securities need to be allocated to a different category or whether they should represent a “new”, separate category, i.e. whether they are a result of financial innovation.

A more detailed investigation should also cover, for example, an analysis of the risk/ return profile and of the targeted investor base. Any decision on the statistical classification of financial instruments needs also to take into account how instruments are “perceived” by the investors and whether any substitution effects may play a role. Given the granular structure of a security-by-security database, changes to the aggregation can be implemented without any need to address reporting agents.²⁰

¹⁹ Depending on the shape of the yield curve, the maturity brackets investigated may need to be narrowed appropriately to reduce a possible bias.

²⁰ Provided that expired securities are kept in the database, such a change in aggregation can also be done retroactively, with limited effort.

Practical example 3: short-term debt securities with embedded derivatives

Short-term debt securities issued by euro area MFIs initially included only plain vanilla instruments which may pay an interest close to the respective Euribor rate. As of 2001, a new type of instrument appeared first in Germany, which could be identified with micro-data, as it paid an unexpectedly high interest of up to 20% p.a. After a first screening of the data and identification of “unexplainable outliers in the remuneration”, a more detailed investigation revealed that the respective instruments, so called “reverse convertibles” deviated significantly from plain vanilla debt instruments as they had embedded option style elements. Over time, short-term debt securities with embedded derivatives developed further into a very diverse group of instruments called “certificates” or “hybrid instruments”. Such instruments seem to have a persistent relevance for retail investors and they are by now heavily marketed in several euro area countries.²¹

Practical relevance of example 3 for real time monetary policy analysis

The occurrence of the above-described instruments posed a problem as they do not fulfil the defining criteria for money (in this case the criterion capital certainty) and should as a consequence not be included in M3. This poses two immediate statistical questions: 1) what would be the separation criteria; 2) where to classify these instruments instead. To further add to the complexity, the risk of the product may differ considerably from a holder (investor) perspective. Indeed, issuing institutions often classify retail derivatives into two groups: “investment products” and “leveraged products”. Investment products have in some cases a (partial) nominal capital guarantee or a payoff structure comparable to a share, a share index or a commodity. Although some of these products may suffer substantial losses, depending on the market developments, a complete loss of the investment is unlikely. On the other hand, the leveraged products are more comparable to pure derivatives and a complete loss of the investment is possible, dependent on the market development. Leveraged products have usually an original maturity below two years while investment products can also have longer maturities. Both product types are very liquid, although for some investment products only limited secondary market trading occurs, the issuing institution publishes price information on a permanent basis and is willing to trade the instruments on a daily basis until redemption. At least in Germany, most of the products are also exchange tradable, for example on the Stuttgart exchange (EUWAX segment).

The timely statistical identification of the emergence of short-term debt securities with embedded derivatives, classified as part of the broad monetary aggregate M3, by analysing micro-data (via the identification of “unusual” yields), allowed to avoid the risk that this financial innovation could in real-time impact on the indicator quality of the monetary aggregate M3 concerning risks to price stability:

- For the immediate monitoring, ad-hoc data collection exercises had been undertaken allowing to monitor the (development of the) quantitative relevance of those instruments. As a result it has been agreed to separately identify in the MFI balance sheets certain types of short-term debt securities with embedded derivatives in the future.

²¹ According to the Deutsche Derivate Verband (DDV), July 2008 has been the month with the highest new issue of such instruments so far (investment- and leveraged products), with a total new issue of close to 60,000 new instruments with a total number of outstanding instruments of 352,000. Some of these instruments have original maturities above 2 years and are therefore outside the maturity band which is covered by M3. (Frankfurter Allgemeine Zeitung, 13 August 2008, page 19). It should be mentioned that, given their retail character, these instruments have sometimes very small amounts outstanding which are not comparable to the respective amounts for other short-term debt securities, such as e.g. ECP.

- To support this identification and monitoring of these instruments in the future, an appropriate statistical category within the MFI balance sheet has been defined by the ECB, based on the following reasoning: A general separation of all instruments with (implicitly) embedded derivatives seems difficult, since this would also include convertible bonds where the holder has the right but not the obligation to convert and would also include certain “investment” certificates where the nominal capital is guaranteed to 100% at redemption. The latter products have the same capital certainty as cash, when abstracting from the default risk of the issuing MFI.²² Furthermore, there may be a problem when separating euro denominated certificates with an embedded currency option while accepting at the same time straight non-EUR denominated short-term paper as a component of M3.

Against the above, the ECB will in due time publish separate statistics on those short-term debt securities with an original maturity up to two years, where the contractual redemption amount in the issuing currency may at maturity fall below the amount initially invested, i.e. which are not capital certain in nominal terms.

The timely identification and assessment of financial innovation within an existing statistical classification has therefore ensured that monetary analyses can be conducted based on accurate and reliable data.

7. Conclusion:

Financial innovation which may refer to products, processes and institutions, is a normal and ongoing process within a dynamic and efficient economy. As a consequence, “real-time analysis” is required to monitor and assess its potential impact. This is crucial in order to support the policy assessment. At the heart of the problem, from a statistical view, is the question, whether the measurement concept or the empirical measure are affected by financial innovation. For this purpose, one needs to regularly monitor the quality and the economic meaning of certain statistical aggregations and definitions, also with the help of micro databases. As demonstrated with a number of examples, the CSDB and national databases have the potential to support real-time monetary policy assessment.

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²² According to recent press articles, investors seem not yet to properly take into account differences in the issuer ratings. There is evidence that those certificates which (have to) pay relatively higher returns due to the lower rating of their issuer are preferred by investors. See, for example, “Schwache zeigen Muskeln” in *Handelsblatt* 16/17/18 August 2008, page 34.

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Foreign portfolio investors in Africa: the case of Zambia

Isaac Muhanga and Kombe Soteli¹

1. Introduction

The rapid growth in foreign investors' exposure to African debt markets is one of the most invasive developments going on in recent times. In Zambia, foreign holdings of Government securities has rapidly risen from less than 0.5% of outstanding issues in 2005 to around 17% by the turn of 2008. Whereas benefits of foreign capital inflows in a developing economy can least be questioned, so can potential risks. We explore in this paper the growing exposure of foreign investors to the Zambian financial markets and the main reasons behind this rather phenomenal growth in exposure. We also review the nature of the exposure, and the major policy implications and challenges of this development. Although portfolio investments in a country can be far and varied across its economic sectors, we concentrate our discussion on the Government securities market for which disaggregated data is readily available.

The paper is organized as follows. A brief overview of economic policies pursued by Zambia since its independence in 1964 is highlighted in section II followed by a discussion of trends, causes and effects in the build-up and structure of the non-residents' portfolio of Government securities in section III. Section IV discusses policy implications of the increasing foreign investors' exposure to the Zambian markets while section V concludes the paper.

2. Overview of economic and financial policies

Zambia, one of Africa's dynamic economies, got its independence in 1964 with a rudimentary financial market system that was designed to facilitate colonial economic interests. Post-independence, the financial system was re-oriented mainly to support the new Government's socialist economic policies which continued way into the 1980s' decade. During this era, the economy was systematically dominated by massive parastatal structures with tentacles permeating virtually all economic activities in the country. In order to provide finance to the Government's development efforts, financial market structures were designed to facilitate direct allocation of credit to the Government's preferred sectors at non-market interest rates. In cases where public sector deficits arose, they were financed by either outright monetization or issuances of Government securities to a captive investor base, such as commercial banks and the state-owned pension system.

The results of such financial policies are now well-known. Credit was often misallocated and the preferred sectors never performed as expected. In addition, Government's consistent monetization of its deficit created a serious inflationary environment such that economic output in virtually all aspects consistently collapsed and systematically pauperized the citizenry with per capita GDP falling from an average of US\$558 in the 1970s to US\$369 in the 1990s (Table 1).

¹ Both authors are economists in the Financial Markets Department of the Bank of Zambia. Views expressed in this paper are entirely those of the authors' and do not necessarily reflect the position of the Bank of Zambia. All data used in the paper is sourced from Bank of Zambia unless stated otherwise.

Table 1
Inflation and growth

Period averages

	1970–80	1980–90	1990–00	2000–07
Inflation %, y-o-y	10.4	46.3	74.8	17.9
Real GDP Growth %, y-o-y	0.2	0.8	0.9	4.8
GDP per Capita (USD)	558.3	441.5	368.8	555.0

Source: Bank of Zambia, CSO Zambia.

Following the dismal performance of these policies, Zambia embarked on a new set of political and economic reforms in the 1990s. A new Government was elected in 1991 and immediately embarked on dismantling the economic policies which had been pursued for almost 30 years. Top on the economic reform agenda was the restructuring of the financial sector. Adopting a fairly ambitious reform pace, the Government embarked on a full liberalization of the money and foreign exchange markets in the early 1990s. Controlling of interest rates was abandoned in October of 1992 while exchange controls were done away with in January 1994. Another key development was the introduction of a market-based system of issuing Government securities in 1993 and a stock exchange in 1994. Participation on both the bond and stock markets was fully open to not only residents but non-residents as well.

3. Non-residents holding of assets

Trends

Despite the lack of restrictions on participation on Government securities market, demand from foreign investors remained docile. It was until 2005 that there was a consistent growth in non-resident investors' appetite for the country's financial assets, particularly Government securities and to some extent, equities. Accounting for less than 1% of the total Government securities outstanding at mid-2005, non-resident holdings grew rapidly to about 18% by mid-2006 before tapering off to about 13% in later periods (Figure 1).

Within the Treasury bills portfolio, preference has been held largely in the 364-day maturity which accounts for an average of 60% of the total bills held by non-resident investors (Figure 2). The shortest maturity of 91-days typically accounts for about 5% of the investors' portfolio. Although initial exposure was concentrated in short maturing Treasury bills, there has been a consistent growth of appetite towards long term Government bonds (Figure 3). The Government bonds portfolio is itself dominated by the 5-year maturity, which until August 2007 was the longest tenor. However, it is expected that investors will dominate their portfolio with the newly-introduced longest maturity terms of 7, 10, and 15 years (Figure 4).

That foreign investors have expressed an increasing appetite for long term maturity portfolios is not entirely surprising for two reasons. First, it seems a combination of double-digit yields on these securities and an expectation of a strengthening local currency provides enough respite to maturity risk concerns. Second, the international capital market's capability to synthesize and repackage such risk exposures through derivatives that meet different tastes of various investors has been cited as one of the most powerful drivers of the increasing demand for emerging markets' local currency long term bonds (BIS, 2007).

Figure 1
Foreign investors' holdings of government securities

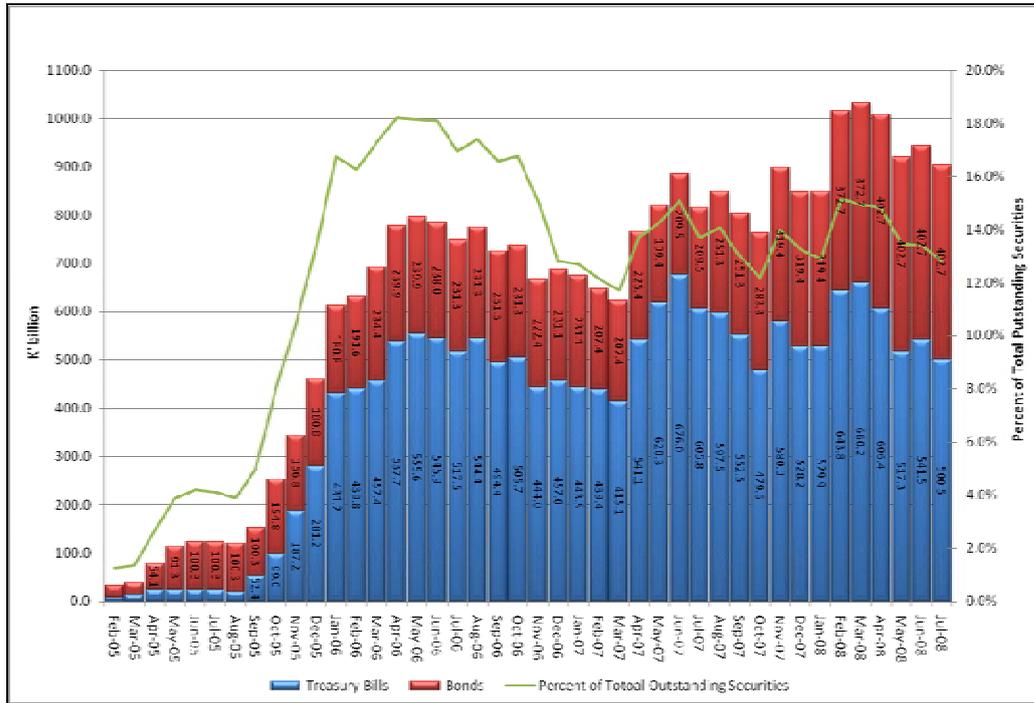


Figure 2
Foreign investors distribution of treasury bill portfolio
% of total held per week

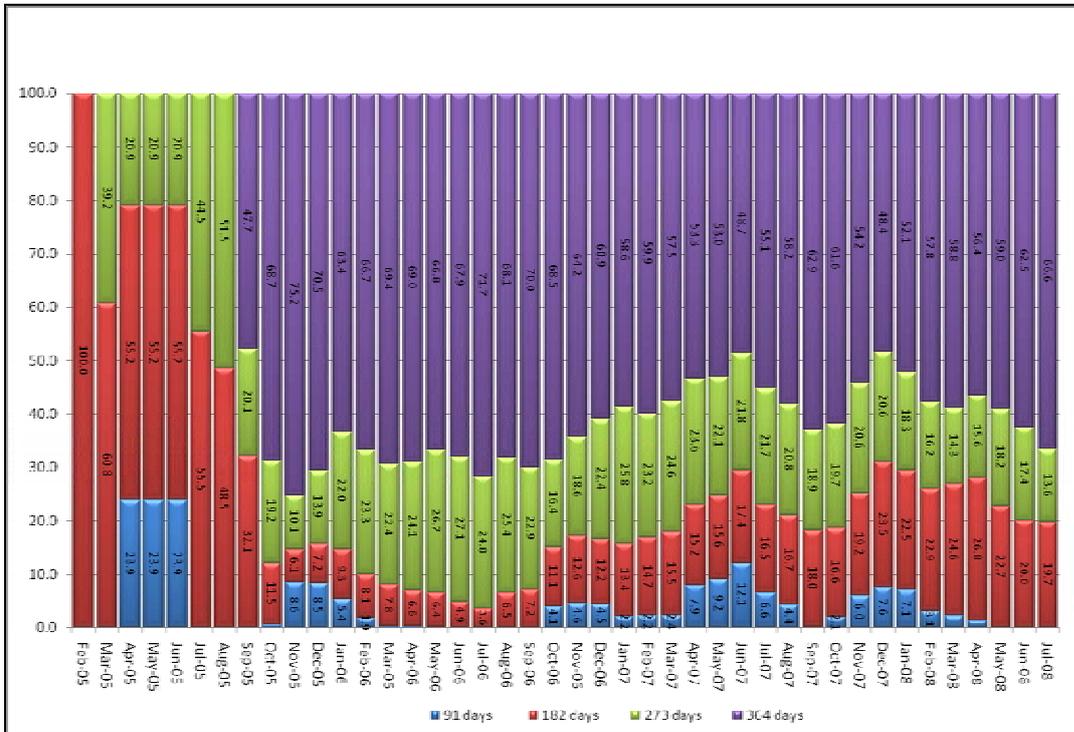


Figure 3
Distribution of govt securities portfolio
 % of total holdings

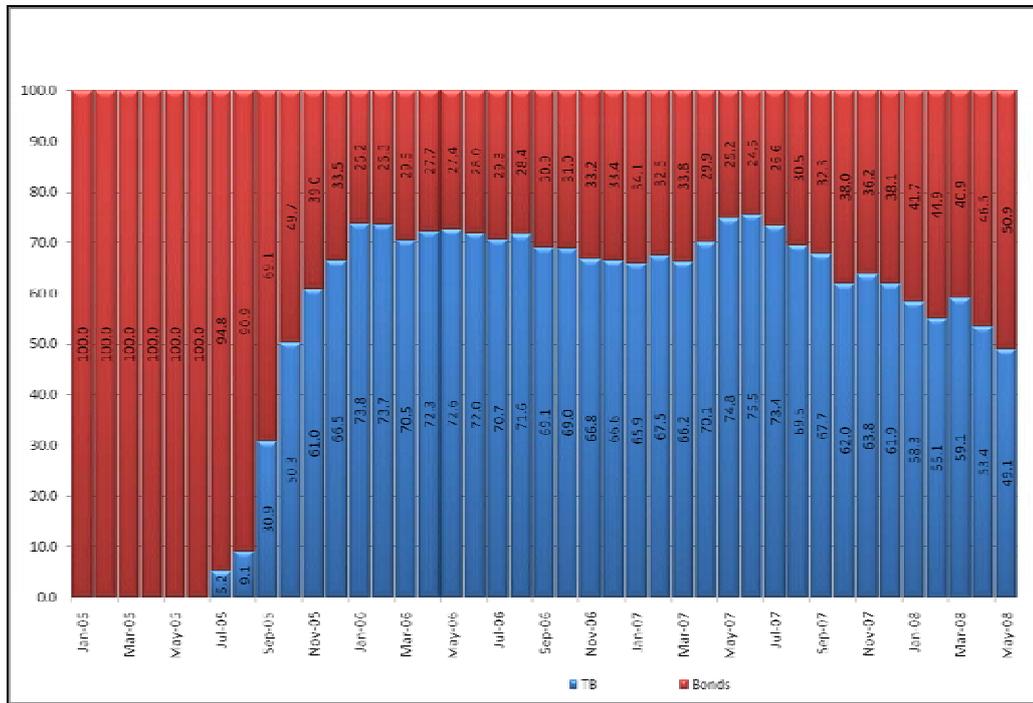
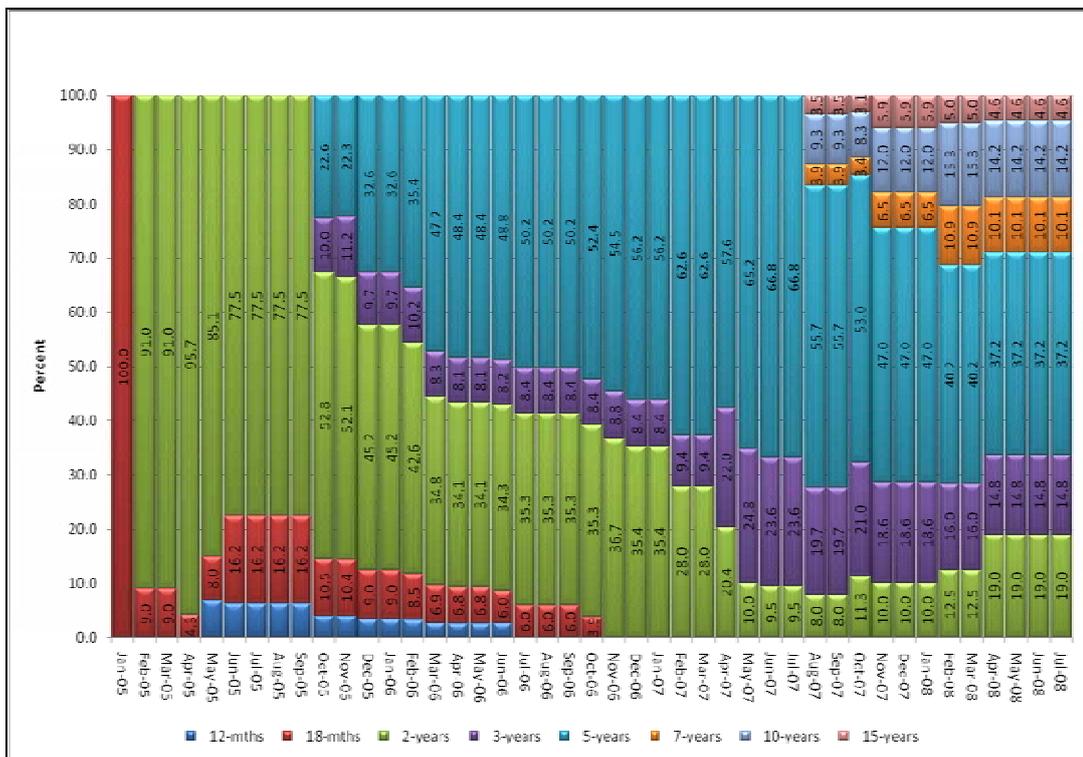


Figure 4
Foreign investors' holdings of government bonds
 % of total held



Causes

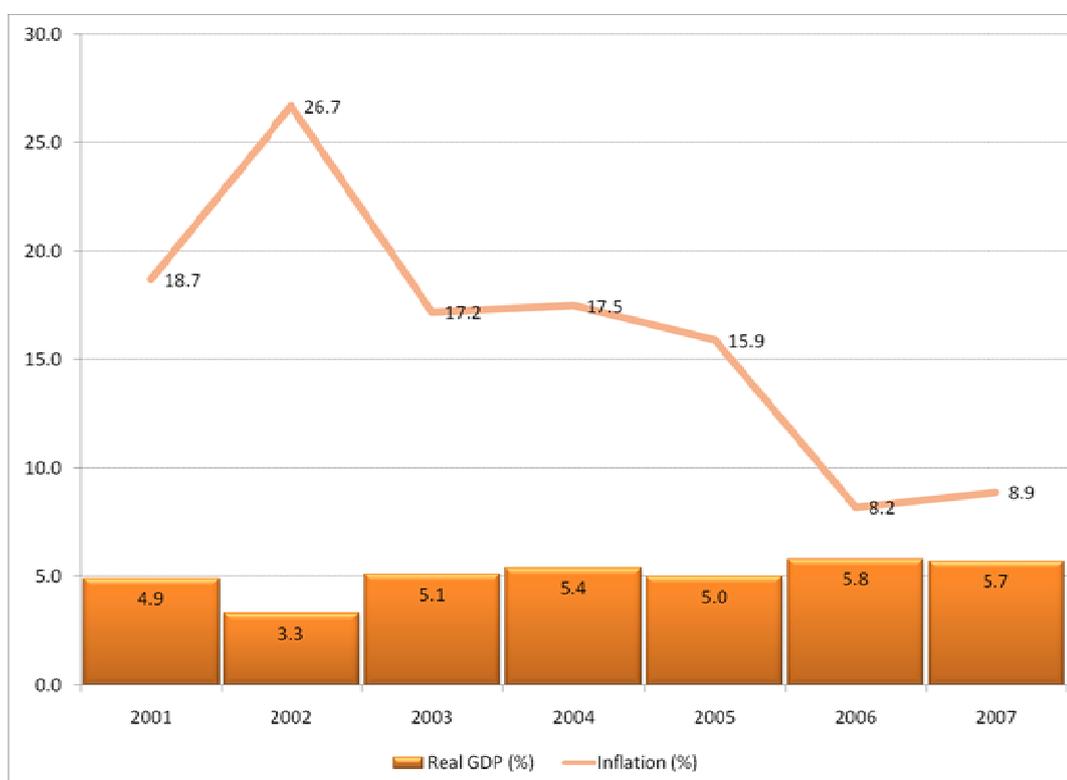
In general, research on the major drivers of foreign portfolio investments into developing economies distinguishes two broad categories of factors. The first set of influences is classified as global or “push” factors which are somewhat independent of the domestic environment in the capital importing nation. The second group are local or “pull” factors which refer to the macroeconomic conditions specific to the capital recipient country (Calvo et al, 1993; Chuhan et al, 1993; Fernandez-Arias, 1994). Both push and pull factors appear to be behind the rapid influx of foreign portfolio inflows into the Zambian government securities market.

Following the low interest rates environment in mature markets, investors and fund managers have generally gone searching for better yield elsewhere. Such searches, though by far targeted towards Eastern Europe, Latin America and Asia, are finally finding their way to African markets. Concerns about political and economic policy risks seem to have been marked down over time. Better information, in-depth analysts’ research, and indeed the consolidation of democratic governance structures have ensured that investors start to understand that Africa is not the same. Country-specific domestic policies are actively being looked at closely in appropriately choosing portfolio structures, in some instance, even creating dedicated African funds outside South Africa. Such global developments have contributed to the growth in foreign investor demand for Zambian assets.

Besides the search-for-yield effects, macroeconomic developments in Zambia have also been arguably a major push for non-resident investors increased appetite for the country’s assets. In recent times, Zambia – a typical commodity-based economy – has had its good fortunes that can only be possibly rivaled by its post-independence state in the 1960s and early ’70s. Buoyed by a combination of a US\$6.5 billion debt write-off in April 2005 and rising world copper prices in the last few years, the economy has experienced a sustained growth averaging 5% over the last 7 years.² These developments have been complimented by improved macroeconomic policy implementation, particularly increased fiscal prudence and a tight monetary policy stance, which has contributed by ensuring an attainment of single-digit inflation for the first time in more than 30 years (Figure 5).

² Until April 2005, Zambia’s external debt stood at US\$7.1 billion.

Figure 5
GDP growth and inflation
 year-on-year percent change



Effects

In the wake of these macroeconomic developments, both official and private capital flows have increased, leading to a rapid build-up of international reserves and a rather strong appreciation of the exchange rate (Figure 6). On the monetary front, money supply growth has stayed at levels that are not entirely consistent with the policy objective of a single-digit growth rate range. Largely aided by capital inflows, money supply growth momentum seems sustained at above the 20% growth range, although down from the highs of the 2006 second-half and the 2007 first-half. In contrast with pre-July 2005, the banking system's buildup of net foreign assets (reflecting capital inflows) contributed strongly to monetary growth in periods beyond July 2005. In order to tame the inflationary impact of these events, a countercyclical monetary policy stance was adopted that ensured at least domestic credit growth's contribution to money supply remained benign (Figure 7)

Figure 6

Gross international reserves and exchange rate developments

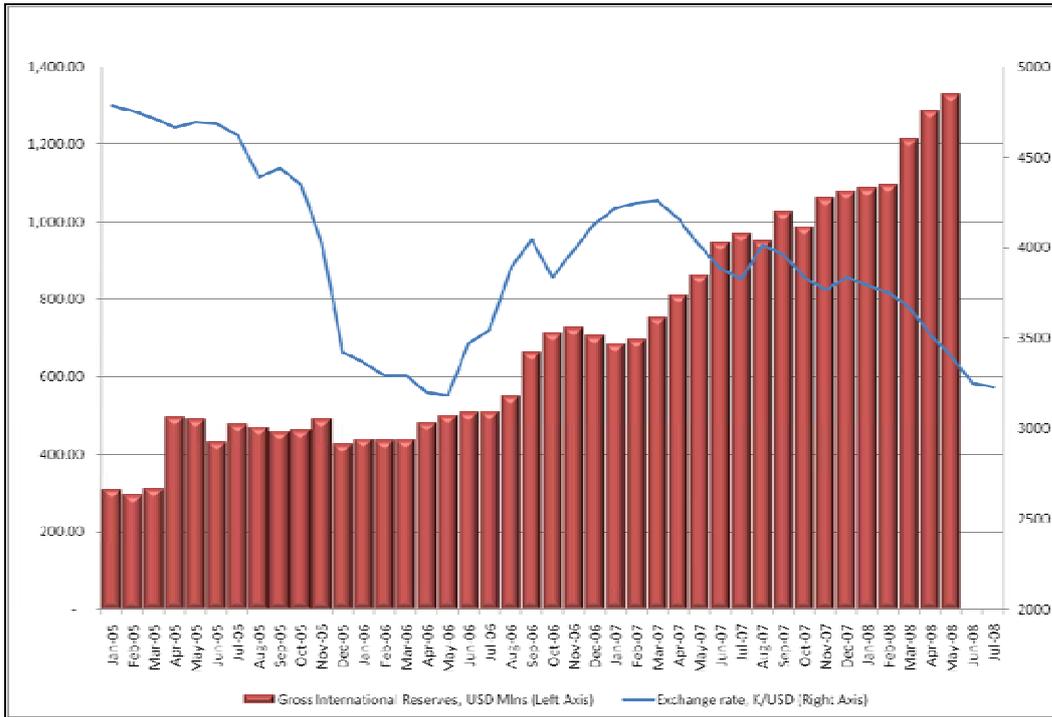
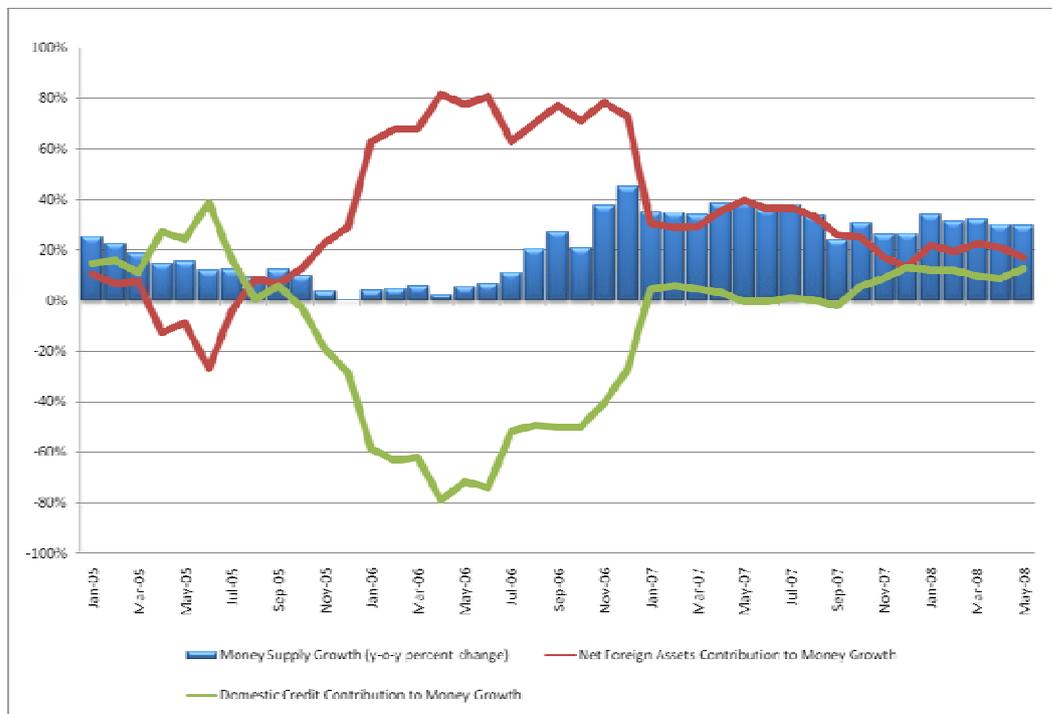


Figure 7

Monetary developments



Notwithstanding the growth in money supply, inflation has remained fairly contained, helped by a stronger currency and increased food production in the last few years. In addition, the

central bank's sterilization efforts to a great extent kept base money from fueling further demand pressures in the economy.

4. Opportunities and challenges

One of the main benefits associated with international financial integration is that financial risks are no longer domesticated but dispersed and shared between residents and non-residents leading to lower interest rates and a smoothed consumption pattern (IMF, 2007). Indeed, the presence of foreign investors has contributed to diversifying the investor base of Government securities, which in the process has led to lower interest rates, particularly on Treasury bills.

Foreign participation in local markets can help in deepening Zambia's financial markets and in the process increase asset liquidity. In particular, international capital market activities that somehow generate demand for secondary transactions in the local market are critical in this aspect.

Capital inflows generally boost the supply of liquidity necessary for undertaking growth-enhancing investments in a country. This can happen for instance through loan syndications or indeed through outright stake-buying into privately held companies at costs of capital that are lower than without such inflows.

At a micro-level, the presence of foreign investors also increases the probability of the Treasury raising the required amounts of borrowing at lower interest rates which would otherwise not be the case where few resident investors dominate the Government securities auctions.

Though local markets can benefit in this manner, international portfolio flows are so far known to be volatile and can be a major source of market instability. Local bond markets therefore need to build capacity to withstand a sudden demise of non-residents' demand for assets. Local investors need to effortlessly step in where foreign investor demand has dried. But this capacity can be built and inculcated if foreign participation is encouraged to flourish in the local secondary market. Zambia should continue to vigorously develop structures that provide support and incentives for secondary market trading of financial assets.

Studies and surveys have consistently established that many foreign investors tend to gain exposure to developing-country financial markets through derivative transactions. The implication of this is that data on foreigners' outright holdings of financial assets may only provide a partial picture of the total exposure (BIS, 2007). Although indicators of capital flows can be obtained from the banking system's financial statements, it is not easy to fully monitor the final destination, and in some instances the quantity of foreign capital inflows. Statistical requirements for appropriate surveillance are therefore of immediate need and financial system supervisory authorities will need to build capacity to generate adequate surveillance for such developments.

With increased capital flows, domestic credit is bound to rapidly grow, and in the process breed an inflationary environment particularly in circumstances that promote consumer borrowing. Although credit to the private sector in Zambia has indeed been growing at about 35% year-on-year, with credit to households accounting for 30% of total bank loans, it is not entirely clear to what extent foreign capital inflows have played a role. To the extent that the banking system finances domestic credit by increasingly using foreign capital, a possibility of a financial crisis in the event such inflows abruptly stop should worry policy makers. Although this is not the case in Zambia, the challenge still remains that banking supervision should continue to be strengthened to monitor and measure these exposures to the greatest extent possible.

Unfettered capital inflows could precipitate a sustained local currency appreciation, which in turn could hurt Zambia's fledgling non-mineral export sector. Mindful of this, authorities are challenged to pursue policies aimed at avoiding a real exchange rate appreciation by ensuring that domestic inflation is contained.

5. Conclusion

After undergoing a long period of stagnation, precipitated by inappropriate economic policies, the Zambian economy has made a positive turnaround over the last few years. Of particular significance is the influx of foreign portfolio capital into the Government securities market which has grown at a rapid pace since mid-2005. This phenomenon appears to have been driven by both "pull" and "push" factors, consistent with the vast literature on the drivers of foreign inflows into emerging economies. The pull factors largely relate to the macroeconomic reforms that have improved the country's policy framework and investment climate while the push factors refer to the low yield rates in developed markets which has forced international investors to seek alternative investment destinations.

Among the effects associated with the increase in foreign portfolio inflows has been the rapid build up in international reserves, the strong appreciation of the Kwacha and above target money supply growth. The domestic economy's increasing integration in international financial markets brings several opportunities for the continued growth of the economy. External sources of financing could help deepen the local financial markets and provide additional and cheaper funds much needed for the country's investments.

Although, Zambia's share of portfolio inflows to emerging economies is minute, it still poses serious challenges to policy makers in managing these inflows given the high risk of sudden reversals or stoppages. This therefore requires authorities to adopt sound policies which will address these concerns. In particular, a stable macroeconomic environment needs to be maintained in order to sustain the favorable investment climate and investor confidence. Financial regulation and supervision also needs to be strengthened to avert any build ups in balance sheet vulnerabilities of the banking sector. For effective surveillance, it is also imperative that authorities improve the capacity to collect accurate and timely data regarding the composition and destination of these inflows.

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Innovations in retail payments and the BIS statistics on payment and settlement systems

Marc Hollanders¹

1. Introduction

In 1988 the BIS began to collect statistics on payment and settlement systems for the G10 countries, later expanded to include Hong Kong SAR and Singapore. Starting in 1988 the statistics have been published yearly in the so-called “Red Book” on *Statistics on payment and settlement systems in selected countries*. The latest Red Book was published in March 2008 and contains figures for 2006. It provides general reference statistical information (eg on GDP and population size), and data on retail (or small-value) payment instruments, interbank funds transfer systems, and securities and derivatives trading, clearing and settlement. Data are organised in country tables and summarised in comparative tables. The statistical methodology used to compile the data is given in the back of the report. The methodology for payment instruments and payment systems was changed starting from the 2004 figures and that for the sections relating to securities starting from the 2006 figures.

After the introduction of various electronic money schemes in the mid-1990s, the BIS undertook several surveys of these and other innovations in retail payments. A *Survey of electronic money developments* was published in 2000 and 2001 followed by a *Survey of developments in electronic money and internet and mobile payments* in 2004. This latest survey included data from 95 countries and territories and contained information on electronic money, both card-based products and network- or software-based products, as well as on internet and mobile payments. The survey also briefly reviews a number of policy issues related to electronic money and to internet and mobile payments.

In the next sections this paper will give a brief presentation of the BIS statistics on payment and settlement systems followed by a short description of (relatively) recent innovations in retail payment instruments. It will then look at the way these innovations are captured, and sometimes not captured, in the statistics, before ending with a short section on the potential use of the statistics for conducting research into payments economics.

2. The BIS Statistics on payment and settlement systems

2.1 Overview

The BIS statistics on payment and settlement systems are published yearly in the so-called Red Book. The latest edition of the Red Book was released in March 2008 and contains figures for 2006. Data are organised in 14 country tables (13 countries plus the euro area)

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and summarised in comparative tables. The Red Book provides data on e-money, but not on internet and mobile payments.

2.2 Country tables

The statistical information in the Red Book is organised, for each country, in four sections for a total of 26 tables. The first section contains general information, such as basic statistical data, the settlement media used by non-banks (cash in circulation and transferable deposits) and by banks (transferable balances held at the central bank and at other banks), banknotes and coins issued, and the number and types of institutions offering payment services to non-banks. Two of those tables give information on e-money (the value outstanding and the number of electronic money institutions – more details will follow below).

The next section provides statistics on retail payment instruments: the table on payment card functions and accepting devices contains information on the number and types (cash, debit, credit, etc) of cards issued in the country and the number and types (automated teller machines (ATMs) or point of sale terminals) of terminals located in the country. This is followed by a table with indicators of the use of payment instruments and terminals by non-banks, both in volume and value of transactions. The most important payment instruments are credit transfers, direct debits, payment cards and cheques. These tables contain information on prepaid cards and e-money transactions respectively.

The third section contains information on interbank funds transfer systems. First there is information on the number of participants in the most important interbank funds transfer systems – these include both large-value and retail payment systems. Then there are tables on the payments processed by these systems, both in volume and value of transactions. Here as well are some data on e-money transactions. The last two tables give information on the use of SWIFT, a global provider of secure financial messaging services: the participation in SWIFT by domestic institutions and the SWIFT messages sent to and received by domestic users.

The last section is on securities and derivatives trading, clearing and settlement. It contains 14 tables with information on three topics: exchanges and trading systems, central counterparties (CCPs) or clearing houses, and central securities depositories. This section does not contain information on innovations in retail payments.

2.3 Comparative tables

The comparative tables, with small exceptions in the tables on payment systems and securities, are fully based on the country tables. However, in addition to allowing comparisons between countries, they also contain many new indicators calculated on the basis of the data in the country tables. For example, the table on the use of payment instruments by non-banks contains, in addition to the volume and value of transactions per payment instrument given in the country tables, also data on the relative importance of payment instruments (both in volume and value of transactions), the increase in the volume and the real value of transactions, the number and the value of transactions per inhabitant, the average value per transaction, and the value of transaction as a ratio to GDP. A similar extended range of data is given for payment cards and terminals. Both sets of data give detailed information on e-money payment transactions and cards with an e-money function.

3. Innovations in retail payments

3.1 Overview

Over the last 10 to 15 years a number of innovative products for making retail payments have been developed, taking advantage of technological progress. These new products are accounting for an increasing proportion of the volume and value of both domestic and cross-border retail payments. Broadly speaking, two categories of payment products can be distinguished: electronic money instruments and internet and mobile payments.

3.2 Electronic money

Electronic money (or e-money) products are defined as stored-value or prepaid products in which a record of the funds or value available to a consumer is stored on an electronic device usually in the consumer's possession. The electronic value is purchased by the consumer and is reduced whenever he or she uses the device to make a purchase. E-money products need to be distinguished from so-called access products which typically allow consumers to use electronic means of communication to access otherwise conventional payment services (see next section). Two types of e-money products exist:

(1) Card-based products, also known as prepaid cards (and often called electronic purse or electronic wallet), are designed for making face-to-face payments of small value (such as at newspaper stands, in bakeries, etc) and for use in vending machines and parking meters. The prepaid value is typically stored in a microprocessor chip embedded in a plastic card. Electronic purses are intended to complement rather than substitute for traditional retail payment instruments such as debit and credit cards. They are, however, in direct competition with coins and (small denomination) banknotes. Prepaid cards are intended to be used as a general, multipurpose means of payment, in contrast to the many existing single-purpose cards (such as those used for public transport) which are not considered e-money.

(2) Network-based or software-based products use telecommunication networks, such as the internet, to make small-value payments, usually as a substitute for credit cards. Network-based products use specialised software installed on a standard personal computer or laptop for storing the value.

3.3 Internet and mobile payments

The rapid growth in the use of the internet and mobile phones has led to the development of new payment mechanisms capable of exploiting the speed and convenience of these new technologies. Internet payments and mobile payments are defined by the channel through which the instruction to make a payment is entered into the payment system. Though some new payment methods, mostly for use over the internet, were developed (eg PayPal), the large majority of internet and mobile payments makes use of traditional payment instruments (mostly payment cards and credit transfers) that are entered into, and processed through, existing payment systems. Internet payment services are predominantly offered by banks, whereas both banks and non-banks provide the possibility to make mobile payments.

4. Data on electronic money and internet and mobile payments

4.1 Overview

This section will discuss the data available on e-money in both the Red Book and the 2004 Survey and the information on internet and mobile payments from the 2004 Survey.

4.2 Electronic money – Red Book^{2,3}

The first statistic concerns outstanding value on e-money storages, which is given in the table on settlement media used by non-banks. This is the value stored on all e-money instruments, and separate figures are given for card-based products and for software- or network-based products. This represents the difference between the value of cash loaded onto an e-money storage and the value spent. Only 6 out of 13 countries report an outstanding value on e-money storages – all of it on card-based products. The largest amount is noted for Italy (EUR 400 million). The other countries (Belgium, France, Germany, the Netherlands and Singapore) are all between EUR 90 and 30 million. The only reference to outstanding value on software- or network-based products is in the table of the euro area with an amount of EUR 10 million.

The next statistic can be found in the table on institutions offering payment services to non-banks. The table gives the number of electronic money institutions, defined as an undertaking or any other legal person other than a bank which issues means of payment in the form of electronic money, and the outstanding value on e-money storages with such institutions. This figure differs from the one in the table mentioned in the paragraph above as it includes both banks and non-banks. Six countries (the above minus Belgium plus Switzerland) report the existence of electronic money institutions (between one and five) and three give the outstanding value (between EUR 14 and 330 million).

The table on payment card functions and accepting devices provides data on the number of cards with an e-money function, with a separate figure for those that have been loaded at least once, and the number of e-money card terminals. The terminals are divided in the number of e-money card loading/unloading terminals and the number of e-money card payment terminals. Some explanation: cards with an e-money function are reloadable multipurpose prepaid cards which can be used at several service providers for a wide range of purchases. Those that have been loaded at least once can be considered as activated. The number of terminals distinguishes between the terminals allowing the transfer of electronic value from an issuer of e-money to the holder of a card with an e-money function and vice versa, and the terminals located at the point of sale permitting the holder of e-money to transfer e-money value from his/her e-money card to the balance of the merchant or other beneficiary. All countries which report on e-money provide some statistics on cards and terminals. While all seven provide the number of cards with an e-money function, only two of them (Belgium and France) give the number of the cards that have ever been activated. The share of activated cards against the total of e-money cards is very different: 28% in Belgium versus 4% in France. With respect to terminals, with the exception of Singapore, all countries report figures for both types of terminals – those for loading/unloading transactions and payment transactions. Singapore only provides the number of terminals for e-money card payment transactions.

For data concerning cards and terminals it is more interesting to look at per capita figures than at absolute numbers. These relative numbers are provided in the comparative tables. Looking at the number of cards with an e-money function per inhabitant, Singapore with 2.69 is far ahead of the other countries. It is followed by the Netherlands with 1.11 and Belgium with 1.02, Germany (0.80) and Switzerland (0.61) are next, and last – with some distance – is Italy with 0.08 cards per inhabitant. Concerning terminals, the differences between countries are especially big for the e-money card loading/unloading terminals: per million

² Unless otherwise indicated the statistics for the euro area are not included because: (1) there are no details available at the level of the individual countries, only the aggregate amounts for the 15 eurosystem countries; and (2) the euro area only provides 6 of the 26 tables provided by the participating countries.

³ All Red Book figures mentioned are for 2006.

inhabitants Belgium has 12,238 terminals, followed by Switzerland with 2,418. The other countries are between 699 and 207, with an average of 1,021 for the reporting countries. For the e-money card payment terminals the highest number is again in Singapore with 19,399 terminals per million inhabitants, followed by the Netherlands with 13,125. The other countries have between 8,399 and 1,298 terminals; the average across all countries is 3,711 terminals.

A very interesting source of information on the use of e-money can be found in the tables on the use of payment instruments and terminals by non-banks, both in volume and value of transactions. These tables provide information on e-money payment transactions and on transactions at e-money card payment and loading/unloading terminals, each time in number and value of transactions. The difference between e-money payment transactions and transactions at e-money card terminals is that the former, in addition to card payments, also includes transactions through other e-money storages. Though data can be provided for both cards and other storages, Italy is the only country that reports transactions with other e-money storage, namely 10.61 million transactions for EUR 620 million. For the number of transactions by cards, after Singapore with 1,691.02 million, the other countries range from 164.65 million in the Netherlands to 18.8 million in Switzerland. With respect to the value of card transactions, Italy leads with EUR 1.64 billion, followed by Singapore with EUR 710 million and Belgium and the Netherlands with both EUR 440 million. The value in the remaining three countries is between EUR 100 and 40 million. The data for the terminals provides only information for the e-money card loading and unloading transactions. (Either no data for the card payment transactions at the terminal is given, or the data given under the payment transactions is repeated.) For loading/unloading, with Singapore providing no data, the highest figures are for Italy and the Netherlands with 27.39 million and 23.74 million transactions respectively. For value Italy reports EUR 5.26 billion, followed by the Netherlands and Belgium with EUR 480 and 460 million respectively. Figures for other countries are much lower.

The last reference to e-money in the Red Book country tables appears in the tables on payments processed by selected interbank funds transfer systems in volume and value of transactions. Unfortunately, only two countries (Belgium and Italy) provide figures for e-money transactions processed by their domestic system.

In the comparative tables some additional information can be found, such as the relative importance of e-money payment transactions vis-à-vis the use of payment instruments by non-banks. In volume, aside from Singapore with a share of 84.2%, no other country has more than 5%. In value terms, except for Singapore with 0.2%, the share in the other countries is too small to be captured by the statistics. Figures for the increase in the number of e-money transactions are diverse: Switzerland and especially Belgium show a decrease in e-money transactions, while the other countries have a small growth, the highest being France with 17.8%. Singapore has around a 4% growth and the Netherlands and Germany are both around 12%. The increase in the real value of e-money payment transactions is big in Italy with 72.4%, small in two countries, and three countries see a small decrease. Singapore is also much ahead in the number of e-money transactions per inhabitant (377.1) compared to the other countries, which lie between 0.3 and 10.1. Another interesting statistic is the average value of an e-money payment transaction: in Italy it is US\$ 83.4, in the other countries between US\$ 2.5 and 5.7 except Singapore where it is only US\$ 0.6 per transaction. The value of e-money transaction per inhabitant is by far the highest in Singapore with US\$ 213.7, followed by the other countries ranging from US\$ 52.1 in Belgium to US\$ 0.8 in France. The last statistic gives the value of the e-money payment transactions as a ratio of GDP: the highest ratio is 0.73 in Singapore, the lowest (in France and Germany) are too small to be significant.

4.3 Electronic money – 2004 Survey

The BIS published surveys on e-money developments in 2000, 2001 and 2004. The latest survey was expanded to also include data on internet and mobile payments (see below). It contains information from 95 countries and territories and, in addition to providing statistical information, also briefly summarises a number of policy issues related to these innovations.

At the end of the 2004 Survey there are two tables on e-money: the first summarises the design features of the e-money products available in the participating countries and territories, the second table provides data on the use of e-money products in the same places. The following figures are provided for each e-money system: number of issuers, number of cards issued (or home PC users), number of merchant terminals (or merchant PCs), amount outstanding, volume of daily (purchase) transactions, value of daily (purchase) transactions, and average value of (purchase) transactions. Though the information is very limited, the Survey is nevertheless very valuable because it provides information on a much wider group of countries/territories than the Red Book.

4.4 Internet and mobile payments – 2004 Survey

The only source of information on internet and mobile payments is the 2004 Survey. It provides information on the traditional payment instruments that are used over the internet and also details of new instruments. As said before, statistical data on internet and mobile use are relatively limited. Some countries only provide information on specific internet and/or mobile payments schemes, whereas other countries also include internet banking (ie access through the internet to "regular" bank accounts).

Like the information on e-money products, the information on internet and mobile payments is summarised in two tables. The first table gives the design features of internet and mobile payments, whereas the second table provides statistical data on internet and mobile payments. The following information is given for each scheme in each of the 95 countries and territories: number of issuers, number of users, number of acceptance points, volume of daily (purchase) transactions, value of daily (purchase) transactions, average value of (purchase) transactions, and market share. However, since a large part of the boxes carries the label "not available", the table does not provide so much statistical information.

5. Capturing retail innovations in payment statistics

It is clear from the previous sections that all innovations in retail payment systems are not, at least in statistics, treated equally. There is a lot of data available with respect to electronic money, but few data exist on the use of internet and mobile payments. There are a number of reasons for this difference in treatment.

Starting with e-money, it is helpful to go back to the early stages of the development of e-money in the middle of the 1990s when central banks studied the potential implications of the introduction of e-money. A BIS study (1996) showed that e-money products could raise a number of policy issues for central banks because of the possible implications for seigniorage revenues and monetary policy.⁴ The basis for this concern was the fact that e-money has the

⁴ Other areas of concern to central banks related to the central bank oversight function for payment systems and the banking supervision function for central banks with supervisory responsibilities. In addition policy issues of primary concern to other public authorities (and of interest to central banks) were identified – these related to consumer protection, competition, access, security, money laundering and legal issues.

potential to challenge the predominant role of cash for making small-value payments. The need for a response, therefore, depends largely on the extent to which e-money replaces cash. The report found that, in case the spread of e-money would be moderate – which, so far at least, turns out to be the case – the decline in seigniorage revenues and the accompanying shrinkage in central bank balance sheets would likely be limited. In these circumstances, the only measures that central banks would want to take with respect to the formulation of monetary policy would be to adapt the monetary aggregates to incorporate e-money issued in the domestic currency. This explains why the outstanding value of e-money is included in the tables on settlement media used by non-banks (ie traditional monetary aggregates). Though e-money is typically issued by banks that are normally subject to statistical reporting requirement for monetary statistics, there are also non-bank institutions that issue e-money. For these issuers, which are called e-money institutions, the outstanding value of e-money is given separately in the table on institutions offering payment services to non-banks.

A possible next step, in case e-money would become very popular and lead to a substantial decline in the banknotes and coins in circulation, would have been for central banks to take steps to offset the shrinkage of their balance sheets. One policy option identified in the BIS report would be to expand the coverage of reserve requirements to cover e-money. To date, however, this measure has not yet been introduced by any country.

Turning to the other retail innovations, internet and mobile payments have never provoked such concerns. As mentioned above, these new payment methods make use of traditional payment instruments, mainly payment cards and credit transfers. Such payments are settled through bank accounts, ie these instruments are actually an instruction to debit one account and credit another account. As such they do not replace cash but facilitate the transfer of money between bank accounts. Hence there is no compelling need to collect specific information on these payments. In addition, these new retail payment methods tend to be difficult to classify, being often very similar to already existing payment instruments. Furthermore, adding to the lack of motivation for collecting statistical data, the adoption of these innovations by the general public has so far been limited, with the possible exception of internet banking.

A simple example might clarify this better: when making a payment through internet banking, a consumer is really initiating a traditional credit transfer, albeit using a new access channel, namely the internet. A bank receives many credit transfers, both in paper – though declining considerably over the last years – and in electronic form. The distinction between paper-based and non-paper-based credit transfers is easy to make for the bank executing the payments, and both types of credit transfer are already captured separately in the Red Book statistics. It is arguably more difficult to distinguish between electronic credit transfers: they can be sent to the bank by phone (via phone banking), by PC (via internet banking), by computers using dedicated lines and by ATM (through the banks own telecommunication system). It would, of course, be possible to develop different codes for each type of electronic credit transfer, but for the reasons given above there does not seem to be a convincing case for doing so.

6. The use of payment statistics for research

In addition to the statistics on innovations in retail payment systems covered in this paper, the BIS statistics also contain a number of other data of particular importance for research in the economics of payments, an area where research is carried out on all aspects of payment systems. Examples are data on the credit extended by the central bank, which includes intraday credit, overnight credit and longer-term refinancing operations; the concentration ratio in terms of volume and value, which gives the market share of the five largest senders

of payment messages in each system; and the value of transactions as a percentage of GDP. Other interesting data can easily be calculated using the available figures, for example the turnover ratio, which is the ratio of the value of total payments made to the sum of overnight reserves and intraday credit. This ratio would give an indication of the maximum liquidity needed to settle all payments in the system on a given day. Finally, payment system data can, in principle, also be used to track developments in turnover in financial markets as well as to study the microstructure (eg counterparty relationships) of these markets.

7. Conclusions

The BIS statistics on payment and settlement systems are a valuable source of information for understanding and analysing the use of payment instruments and systems and for detecting and observing new (and old) trends in the payments landscape. Some innovations in retail payments, like e-money, show up in the statistics, other innovations like internet and mobile payments are much harder to capture. The reason for this is that internet and mobile payment methods are to a large extent extensions of traditional instruments which are very much cleared and settled through traditional mechanisms. In fact, very often the only new feature of some of these instruments is the new channels they use to access existing payment arrangements. Anecdotal evidence suggests that, with the exception of internet banking where customers access their bank account over the internet, the adoption of these new payment methods is limited. Where statistics are available, as in the case of e-money, they show only a mixed success. In some countries it is gaining popularity, but in most countries it remains relatively little used.

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The influence of note financing on credit aggregates

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1. Overview

Because of its “low risk and high return” virtue, note financing is increasingly recognized and favored by financial institutions. In addition to energetically developing traditional note financing business, financial institutions have designed new note financing businesses such as repo-typed, outright sale-typed and synchronized outright sale-typed note financing. They have also introduced innovation products such as risk participation and quasi-securitization. These businesses have spread from the inter-bank market to the whole financial market. The rapid development of note financing has influenced the credit total and risk control of financial institutions. This paper analyses the influence of note financing on consolidated credit data of financial institutions from the accounting perspective, taking the operating flow of note financing into account, then puts forward the corresponding framework of financial statistics to reflect the actuality of note financing comprehensively, objectively and precisely.

2. The types of note financing and corresponding accounting methods in China

There are many types of note financing. The major ones are as following:

(1) Discount. Discount is the traditional way of note financing. It means that a nonfinancial institution that holds an undue note pays a certain amount of interest to a financial institution, then endorses the note over to the financial institution in order to finance funds before the maturity of the note. When a financial institution records a note discount transaction, “discount” on the asset side is increased by the par value of the note and the corresponding asset position is decreased by the funds paid out. The difference between them is recognized as deferred income on the liability side and amortized in the following periods according to accrual accounting principle.

(2) Inter-bank discount. It means the transfer of undue note from a non-central bank financial institution to other non-central bank financial institutions. At present, there are three forms of inter-bank discount: repo-typed, outright sale-typed and synchronized outright sale-typed.

a. Repo-typed inter-bank discount means that the note transferor finances funds by discounting the note and promising to repurchase the same note at par on a promised date in the future. The note transferee increases “reverse repo” on the asset side by the par value of the note and decreases the corresponding asset position by the funds paid out. The difference between them is recognized as deferred income on the liability side and amortized in the following periods according to accrual accounting principles. In the mean time, the note transferor increases “repo” on the liability side by the par value of the note and increases the corresponding asset position by the funds financed. The difference between them is recognized as deferred expense on the asset side and amortized in the following periods according to accrual accounting principles.

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b. Outright sale-typed inter-bank discount means that the note transferor pays a certain amount of interest to the note transferee, then endorses the undue note over to the note transferee in order to finance funds. In current practice, financial institutions use two accounting methods to deal with “outright sale-typed inter-bank discount”:

- (a) Some financial institutions consider that according to the provision in “Negotiable Instruments Law” in our country that the note transferee has the right of recourse to the prior holder of the endorsement, the risk and the return of the note is still kept by the note transferor, so the note transferor should only increase the liabilities, not decrease the assets. The accounting records are: the note transferee increases “outright sale-typed inter-bank discount” on the assets side by par value of the note and decreases corresponding asset position by the funds paid out. The difference between them is recognized as deferred income on the liability side and amortized in the following periods according to accrual accounting principles. The note transferor increases “inter-bank discount” on the liability side by par value of the note and increases corresponding asset position by the funds financed. The difference between them is recognized as deferred expense on the asset side and amortized in the following periods according to accrual accounting principles.
- (b) Other financial institutions consider that at present in our country, for note discount, especially banker’s acceptance discount, it’s nearly impossible that the recourse right is exercised against the note transferor. According to the accounting rule “substance over form”, the note transferor should decrease the assets. The accounting records are: the note transferee increases “outright sale-typed inter-bank discount” on the assets side by par value of the note and decreases corresponding asset position by the funds paid out. The difference between them is recognized as deferred income on the liability side and amortized in the following periods according to accrual accounting principles. The note transferor decreases the asset that was discounted by its par value, increases the corresponding asset position by the funds financed and decreases deferred income on the liability side, which was produced by the discount and was not amortized yet. The difference between them is recognized as current profit or loss.

c. Synchronized outright sale-typed inter-bank discount means that the note transferor and transferee sign two outright sale-typed inter-bank discount contracts, one is that the transferor outright sells the note to the transferee, the other is that the transferee outright sells the same note to the transferor at a promised price on a promised date in the future. At present, there are two ways to operate a synchronized outright sale-typed inter-bank discount: one is to view two inter-bank discount contracts as a repo transaction, and the accounting is the same as repo-typed inter-bank discount; the other is to view this business as two separate outright sale-typed inter-bank discounts, and the accounting is the same as outright sale-typed inter-bank discount.

(3) Rediscount. It means that a financial institution pays a certain amount of interest to the central bank, then endorses the undue note over to the central bank in order to finance funds. In practice, the accounting records are: “rediscount fund” on the liability side is increased by par value of the note and corresponding asset position is increased by the funds financed. The difference between them is recognized as deferred expense on the asset side and amortized in the following periods according to accrual accounting principles.

(4) Note purchase and sale. It means that an undue note is transferred without right of recourse between a financial institution and a non-financial institution for the purpose of financing funds. Note purchase and sale business has two forms: one is simple direct note purchase and sale, and the other is to pack and sell several notes to companies or sell them as financial products, which is essentially a securitization of note assets. As the note transferor, the banking institution decreases the asset that was discounted by its par value, increases the corresponding asset position by the funds financed and decreases deferred income on the liability side, which was produced by the discount and was not amortized yet.

The difference between them is recognized as current profit and loss. As the note transferee, the financial institution increases “notes” on the assets side by par value of the note and decreases corresponding asset positions by the funds paid out. The difference between them is recognized as deferred income on the liability side and amortized in the following periods according to accrual accounting principles.

(5) Note risk participation financing. This happened among banking institutions by signing the risk participation agreement. The note holder transfers part of the risk of the note to risk participants, and risk participants pay money to the note holder based on their risk shares. Generally, the counter parties do not endorse the note. When the note is due, the note holder collects the funds and pays them to the risk participants. If a collection loss occurs, the risk participants bear the loss according to their agreed risk shares. In accounting, the note holder is the same as note transferor in note purchase and sale, and the risk participant is the same as note transferee in note purchase and sale.

3. The influence of different note financing methods on credit aggregates

(1) The influence of valuation method on loans statistics

Firstly, under the current financial system, the valuation of note financing and that of loans are different. Loans are valued as the funds paid out, while note financing is valued at par value, which is the sum of funds financed and accrued interest at maturity. Secondly, current valuation method of note financing is different from the IMF’s recommendation on loans valuation as well. IMF recommends in Monetary and Financial Statistics Manual, “The value of a domestic currency loans should be the amount of the creditor’s outstanding claim (equal to the debtor’s obligation), which comprises the outstanding principal amount plus any accrued interest (ie interest earned but not yet due for payment).” But “discount”, “note”, “inter-bank discount” and “inter-bank discount fund” are all valued at par value of the note, which equals the sum of funds actually financed at maturity (principal amount) and accrued interest. Before maturity, the par value is constantly greater than the sum of fund financed and accrued interest, and the difference between them is the deferred asset or liability that is not amortized yet. So, the current statistical method of note financing is not in accordance with that of loans, overestimates the size of note financing and compromises the accuracy of loans statistics.

(2) The influence of non-unified accounting methods used by counterparties on loans statistics

a. When an “outright sale-typed inter-bank discount” occurs, the note transferee recognizes an increase in “outright sale-typed inter-bank discount” on the assets side, but the note transferor may deal with this transaction in two different ways.² If the note transferor considers that the risk and the return of the note are not transferred, it will keep the asset that was discounted and increase the liabilities. Thus, the “discount” and the “outright sale-typed inter-bank discount” assets would both be classified as note financing, and one financing transaction would be reflected as two transactions in statistics.

b. The counter parties have different recognitions of the “synchronized outright sale-typed inter-bank discount” business and use non-unified accounting methods, which bias the statistics of note financing. In some cases, the note transferor treats it as a repo, while the note transferee treats it as an outright sale-type discount. The transferor recognizes a “repo”

² For different ways to deal with this transaction, see the two accounting methods to deal with “outright sale-typed inter-bank discount” used by the financial institutions on Page 2.

asset while maintaining the “discount” asset, and the transferee just recognizes an “outright sale-typed inter-bank discount” asset. Thus, the transferee and the transferor both recognize this note as their assets. The “discount” and the “outright sale-typed inter-bank discount” assets would both be sorted as note financing, while “repo” would be sorted as inter-bank transaction, which implies that one note transaction is counted twice as note financing. In some other cases, the note transferor treats it as an outright sale-typed discount and decreases the assets, while the note transferee treats it as a repurchase. The transferor recognizes a “repo” asset while maintaining the “discount” asset, and the transferee just recognizes an “outright sale-typed inter-bank discount” asset. The transferor does not maintain the assets or the liabilities, while the transferee recognize a “reverse repo” asset. Thus, only an inter-bank transaction was reflected in statistics, and the note financing is zero. Obviously, the size of the note financing is underestimated.

Table 1

Possible cases in financial statistics when dealing with synchronized outright sale-typed inter-bank discount

Note Transferor			Note Transferee			Consolidated Statistics	Statistical result of Note Financing
Business definition	Accounting	Statistical Result	Business definition	Accounting	Statistical Result		
Repurchase	Recognize a “repo” liability without decreasing the original asset.	A “discount” in note financing and a “repo” in inter-bank transactions.	Repurchase	Recognize a “reverse repo” asset.	A “reverse repo” in inter-bank transactions.	A “discount” in note financing.	Right.
	Recognize a “repo” liability without decreasing the original asset.	A “discount” in note financing and a “repo” in inter-bank transactions.	Outright sell	Recognize an “outright sale-typed inter-bank discount” asset.	An “outright sale-typed inter-bank discount” in note financing.	A “discount” and a “outright sale-typed inter-bank discount” in note financing, a “repo” in inter-bank transactions.	Wrong. Double counting of note financing.
Outright sell	Recognize a “repo” liability without decreasing the original asset.	A “discount” in note financing and one more inter-bank transaction.	Repurchase	Recognize a “reverse repo” asset.	A “reverse repo” in inter-bank transactions.	A “repo” in note financing.	Right.
	Recognize a “repo” liability without decreasing the original asset.	A “discount” in note financing and one more inter-bank transaction.	Outright sell	Recognize an “outright sale-typed inter-bank discount” asset.	An “outright sale-typed inter-bank discount” in note financing.	A “discount” and a “outright sale-typed inter-bank discount” in note financing, a “repo” in inter-bank transactions.	Wrong. Double counting of note financing.
	Decrease the original asset.	None.	Repurchase	Recognize a “reverse repo” asset.	A “reverse repo” in inter-bank transactions.	Note financing is 0.	Wrong. Note financing is understated.
	Decrease the original asset.	None.	Outright sell	Recognize an “outright sale-typed inter-bank discount” asset.	An “outright sale-typed inter-bank discount” in note financing.	An “outright sale-typed inter-bank discount” in note financing.	Right

c. For note risk participation financing business, according to the form agreed by counter parties, it is a partial outright sale of the note, and risk participants take the right and the risk based on their agreed share. But, according to Article 33 of Chinese "Negotiable Instruments Law": "The endorsement which transfers part or the entire amount on the draft to two or more persons is invalid", risk participants do not enjoy the rights and obligations to the note. The corresponding debtor is the risk seller, and the essence of this business is the embedded debtor-creditor relationship between banking institutions connected to note risk. Under the current statistical system, this transaction is reflected precisely in consolidated loans statistics of banking institutions, but is distorted in the loans statistics of a single institution.

(3) The influence of note financing participant expansion on total risk

In recent years, the note financing market in China has grown rapidly, and securities, insurance, financing for clients products and non-financial companies gradually entered this market. The identities of these participants evolved from pure note transferor to both transferor and transferee. The entrance of these new note financing participants has had a new influence on the statistics of current total risk. Take financing for clients for example, when the bank packs the notes and sells them to the financing for clients products of its own as a note transferor, the notes disappear from the bank's balance sheet, with the credit risk decreasing accordingly. But to guarantee the credit rate of the securitized note products, the bank always repurchases some of them. To improve the attraction of the financing for clients' products, the bank always promises that the principal and the return of these products are guaranteed. These two kinds of credit risk do not show in the bank's balance sheet. Thus, the credit risk of the bank is underestimated.

4. The design idea of the note financing statistics framework

(1) Breakdown by transaction forms

In order to depict the development of note financing of financial institutions more comprehensively and more particularly, we sort note financing businesses by their transaction forms into rediscount, discount (including note sales) and outright sale-typed inter-bank discount (including synchronized outright sale-typed inter-bank discount), and divide them further into domestic notes and notes abroad. Also, the financing of bankers' acceptance should be listed separately to reflect the assets abroad owned by financial institutions through note financing and the participation of bank's credit in note financing.

(2) Breakdown by counter parties in note financing transactions

When consolidating data of each level of the financial sector such as other depository corporations subsector, depository corporations subsector and financial institutions subsector, intra-subsector transactions should be netted completely and precisely. Thus, detailed classification of statistics by counter parties should be provided.

(3) Satisfy the requirement of adjusting the bias of the loans statistics

Under the current statistical system, because of the usage of different accounting methods, the data that reflect note financing in financial institutions' consolidated financial statements are biased. To ensure the completeness and accuracy of the statistics, statistics of financial institutions should be adjusted on the base of adequate data. Firstly, unify the accounting method used by financial institutions to deal with note sales, realize symmetric accounting, eliminate discrepancies in statistics because of the usage of different accounting methods,

and define that every financial institution should treat “synchronized outright sale-typed inter-bank discount” as a repurchase transaction. Secondly, require that every financial institution should strictly follow the rules in valuation and reflect the notes hold accurately. When consolidating “synchronized outright sale-typed inter-bank discount” and “outright sale-typed inter-bank discount”, offset “discount” asset by an “inter-bank discount fund” liability recognized by one institution and offset “deferred expense” asset by a “deferred income” liability. Thus, the influence on loans data is eliminated through adjustments in statistics. Lastly, set off-sheet statistical indicators to show the type and number of sold notes and quasi-securitized notes and reflect their risk precisely. Sort sold notes and quasi-securitized notes into bankers’ acceptances and non-bankers’ acceptances, then sort bankers’ acceptances further into bankers’ acceptances of the bank itself and bankers’ acceptances of other banks, and sort non-bankers’ acceptances further into notes signed by the bank itself and notes signed by other banks. View bankers’ acceptances of the bank itself and notes signed by the bank itself in non-bankers’ acceptances as credit extension and measure their risk according to their counter parties; measure the risk of bankers’ acceptances of other bank according to their acceptors; measure the risk of notes signed by other banks in non-bankers’ acceptances according to their transferees.

Table 2

The statistical adjustments in Inter-bank discount business

Note Transferor			Note Transferee			Statistical Adjustments	Consolidated Statistical Result
Business definition	Accounting	Statistical Result	Business definition	Accounting	Statistical Result		
Outright sale-typed inter-bank discount	Recognize a “inter-bank discount fund” liability without decreasing the original asset.	A “discount” in note financing and an inter-bank transaction.	Outright sale-typed inter-bank discount	Recognize an “outright sale-typed inter-bank discount” asset.	An “outright sale-typed inter-bank discount” in note financing.	Offset “outright sale-typed inter-bank discount” by “inter-bank discount fund”	A “discount”. The statistical result is right.
	Decrease the original asset.	None.		Recognize an “outright sale-typed inter-bank discount” asset.	An “outright sale-typed inter-bank discount” in note financing.		

(4) Satisfy the requirement to adjust the loans valuation

At present, financial institutions do the accounting based on par values, but par values are different from the funds actually financed. So, we need to adjust the par value to the funds actually financed on the condition that relevant data are available. The adjustment is as following: the banking institution that receives the note recognizes the relevant asset at par value. The par value is greater than the funds paid out, and the difference between them is recognized as deferred income on the liability side. As time goes by, the deferred income is gradually amortized, and the amount amortized each period is the accrued interest of note financing at that period, therefore par value minus unamortized deferred income equals outstanding claim of note financing. When a banking institution recognizes liabilities as note transferor, a similar procedure applies.

Assessing the contribution of financial innovations to the production of implicit services of financial intermediation in Costa Rica

Adolfo Rodríguez Vargas¹

1. Introduction

The ongoing discussion about the effects of financial innovation has been reinforced by the recent events in financial markets: there is discussion about the impact of innovation on competition, the challenges it poses to financial regulatory authorities or its effect on the transmission of monetary policy. However, there has not been much empirical research to inform the debate.

One line of discussion that has been less prominent is the effect of financial innovation in economic statistics. Partly because of the lack of systematised data on innovation, it has been difficult to incorporate it into measures of production, credit or prices, and that prevents policymakers from having a useful diagnostic tool.

In this study we attempt to make a small progress in that direction in the case of Costa Rica. The financial system of Costa Rica is relatively small and concentrated in a few intermediaries, where State-owned banks play a leading role. However, recent years have seen a drive for modernisation in banking practices that has made product and process innovation more prevalent. This led us to try to gauge how important are product innovations for the provision of intermediation services in Costa Rica.

More specifically, in this study we measure the contribution of product innovations to the output of intermediation services of the State-owned banks of Costa Rica, as measured by a user-cost approach. The remaining sections are ordered as follows: section 2 defines financial innovation and presents previous empirical studies on financial innovation, section 3 explains two methods of measurement for the output of intermediation services, section 4 lays out the methodological aspects of the study and sections 5 and 6 presents results and final comments.

2. Financial innovation

2.1 What constitutes financial innovation?

Frame and White (2002) define financial innovation as "...something new that reduces costs, reduces risks or provides an improved product/service/instrument that better satisfies participants' demands..." within a financial system. Innovations can emerge due to technological changes, as well as a response to increased risk or to new regulations. When defining financial innovation the usual approach is to categorize it into three groups, according to where innovations occur.

¹ The views expressed in this study are those of the author and do not represent the opinion of the Central Bank of Costa Rica.

Process innovation refers to new production processes that allow the provision of new or existing financial products and services. Two examples commonly cited are loan tracking systems and credit scoring. Process innovation is usually aimed at increasing the efficiency in the production process, and it is often associated with technological change.

Organizational innovation encompasses new institutions or organizational structures within institutions where the production process is held. This kind of institutional innovation can influence the financial system as a whole, spawning new types of intermediaries. Internet-only banking is a prime example of this type of innovation.

Product innovations are new products or services created to meet market needs, thus constituting a client-focused kind of financial innovation. Product innovations help the intermediaries to differentiate themselves from their competitors, by providing solutions to unattended needs of the customers. Examples of product innovation in finance are widespread: from adjustable-rate mortgages to home equity loans, from variable rate bonds to zero-coupon bonds, financial product innovation has been a staple of the last 30 years. As it has been stated, this paper is focused on this type of innovation. But how to define exactly what constitutes product innovation?

Figure 1
Strategies in product development

		Markets	
		Existing	New
Products or Services	Existing	Increase in market share	Market extension
	New	Product development	Diversification

Source: adapted from López, Luis; Rodríguez, Luis & Colindres, Antonio (1995). Impacto de la innovación en la banca costarricense. Revista INCAE, VIII (2), pp 69-78.

Innovation is an organizational process that is mainly the result of strategy, so the definition of innovation could be framed in strategic terms. Figure 1 shows options of strategy regarding product development in a firm. The first option is the *increase in market share*, whose objective is selling more of already existing products or services to the current clients. The second strategy, *market extension*, implies introducing existing products or services into new markets, while the third, *product development*, aims at developing and selling new products to current costumers. With the last strategy, *diversification*, the goal is to create new products and introduce them to new markets. Then, these last two strategic options constitute innovation, both of them implying the development of new products.

To define what can be considered as a new product, we follow Bátiz-Lazo and Woldesenbet (2006). In their study of the dynamics of innovation in British banking, they decided to adopt a broad definition that sees innovation as “...an idea, product, process, service, hardware or software application that is perceived as new by an adopting organisation or unit.” The idea of the perception of novelty by the intermediary as the criterion to define when an innovation occurs is useful since products or practices already available in some markets could

constitute a relevant departure from current business practices for intermediaries in other markets. Thus, if an intermediary starts offering a product that it did not previously offer, that product becomes an innovation for that intermediary, even if that product already exists.

Furthermore, it is useful to qualify innovations according to degree of novelty. Radical innovations imply significant change in the activities of an organization, whether in its processes, in its structure or in its offer. They might lead to the transformation of firms or industries. Incremental innovations, however, are largely the result of marginal improvements based on existing products or practices of the organization. These improvements are aimed at increasing efficiency and enhancing the competitiveness of the firm in its market.

Since in this study we focus on product innovations, it is more likely that we will be dealing with incremental rather than radical product innovations. The development of product innovations, by its nature, is often an incremental process. New types of bonds, for instance, often represent modified versions of already existing products: bonds in a previously not available currency, zero-coupon bonds, and so forth. The same could be said about different types of mortgages and loans.

2.2 Empirical studies on financial innovation

There are relatively few empirical studies on financial innovation considering how prevalent the talk about its importance is. The majority of studies on financial innovation are of a descriptive nature, and most often deal with issues like the effects of regulation and technological change on innovation, or the profitability of specific innovations, but little is said about the direct effect of innovation on the measurements of output.

A comprehensive review of empirical studies on financial innovation was done by Frame and White (2002). They classified a study as empirical according to two principles:

- whether the article formally presented data and tested hypotheses
- whether the article examined a financial product, process or organization during a time when it was regarded as a novelty.

Up until 2002 they could only find 24 studies that could be considered empirical. Of these, however, none tried to measure the impact of innovation in the measured output of the adopting institution. Product and process innovations were the focus of the majority of the studies, at least 17 of 24.

They organized the studies according to four research categories, with the following findings:

- a. Environmental conditions that encourage innovation.** Two studies were found in this category: one tested the hypothesis that regulatory constraints induce innovation and the other focused on financial patenting.
- b. Customers for and users for innovation.** Seven studies were found. They focused on the implementation by banks of Internet banking and credit scoring, and the use by costumers of electronic bill payments, debit cards and ATM cards.
- c. Diffusion.** Three of the five studies found dealt with ATM deployment by banks.
- d. Consequences: Profitability and social welfare.** Twelve studies were found. Of them, five focused on specific product innovations, three focused on process innovations and four on the same organizational innovation.

Frame and White offered several explanations for this dearth of empirical studies: a poor research and development tradition in financial institutions, the lack of industrial organization training, scarcity of patent counts for financial innovations and, most critically, insufficient or nonexistent data.

This last problem is the greatest obstacle for the existence of more empirical studies on financial innovation, particularly on product innovation. The data most widely available for financial institutions does not yield information that can be used directly to make calculations and test hypotheses. In financial statements, bank call reports and other supplementary information provided to regulatory institutions for purposes of supervision, the data is usually presented in an aggregate way, so that information related to innovations cannot be differentiated from information for traditional products.

There are understandable reasons to this: financial intermediaries are not likely to divulge critical information about products or processes that grant them a competitive advantage in their market. In the case of the estimation of output of financial services, for example, the information required would include detailed data about deposits, securities issuance and the amount of interest paid and received. This information might be available in aggregate, but would hardly be published on a regular basis for particular products.

The limitations mentioned above suggest that a more fruitful route of action to obtain detailed data on new products, services or processes could be direct request to the financial institutions. This can include surveys as well as interviews with the authorities of the institutions of interest. The latter is the method we decided to adopt to gather the information required to carry this study, as will be explained in section 4.

3. Measurement of intermediation output

3.1 Measurement of production in financial intermediaries

The System of National Accounts 1993 (SNA 1993) defines financial intermediaries as institutions "...that incur liabilities on their own account on financial markets by borrowing funds which they lend on different terms and conditions to other institutional units." (p139). Financial intermediaries put themselves at risk when channelling funds between lenders and borrowers, and hence the rates of return they receive are generally higher than the rates they pay. With this rate arrangement the intermediaries do not have to charge each customer individually for the services provided.

The calculation of the value of intermediation services faces a critical limitation: most, if not all, financial intermediaries do not charge explicitly for their intermediation services. There are no receipts for sales, no explicit prices to use for measurement because the charge for the service is implicit in the difference between interest rates mentioned above. Fees and other explicit charges may exist in some intermediaries, but they usually represent only a minor component of the total value of the intermediation service.

Hence, to obtain the output of intermediation services it is necessary to add the value of any explicit charges and the value of the implicit services of intermediation. Within the framework of the System of National Accounts 1993 the standard measure for these implicit services is the financial intermediation services indirectly measured (FISIM), which are defined as follows:

6.125. The total value of FISIM is measured in the System as the total income receivable by financial intermediaries minus their total interest payable, excluding the value of any property income receivable from the investment of their own funds, as such income does not arise from financial intermediation. (SNA 1993, p139)

Since this measure is based on the total interest flows paid and received by the intermediary, it is of little use to identify the contribution of particular financial products. Another method of measurement more in tune with that goal is the user cost approach, which uses balance sheet data detailed by type of asset and liability to obtain estimates of their contribution to the

output of financial intermediation services. This method makes use of a reference rate and is expected to be the standard for the calculation of FISIM in the next revision of the System of National Accounts. We review this approach in the next section.

3.2 User cost of money

The concept of user cost of a financial asset is derived from a framework originally developed for non financial assets. It was later applied to banking by Hancock (1985), Fixler (1993) and Fixler and Zieschang (1999). The exposition presented here follows Fixler, Reinsdorf and Smith (2003).

Assuming a competitive market, the profits from renting out fixed capital assets must be zero. Hence, the amount paid for the rental of an asset must equal the difference between the initial value of the asset and the present value of that asset at the end of the rental period. That is, the user cost of the asset is given by:

$$UC_t = p_t - \frac{p_{t+1}}{1+r_t} \quad (1)$$

where p_t and p_{t+1} are, respectively, the values of the asset at the beginning and at the end of the rental period and r_t is a reference rate of interest.

Depreciation and changes in the asset price from period t to period $t+1$ can be incorporated in the analysis by assuming that they are reflected in the rate of change of the asset's value. If δ_t is the depreciation rate and π_t is the rate of increase in the asset price, then $p_{t+1} = p_t(1 + \pi_t - \delta_t)$ and expression (1) can be rewritten as:

$$UC_t = p_t \left[1 - \frac{(1 + \pi_t - \delta_t)}{1 + r_t} \right] = p_t \left[\frac{(r_t - \pi_t + \delta_t)}{1 + r_t} \right] \quad (2)$$

If the user cost is paid at the end of the period, then expression (2) becomes

$$UC_t = p_t(r_t - \pi_t + \delta_t)$$

This framework can be developed for financial assets as well. The user cost of holding a financial asset must then equal the difference between its current cash value and the present value of the cash flows generated by the asset at the end of the period.

Let us assume a financial asset A with a cash value of $V_{A,t}$ in period t and a rate of return r_A . In period $t+1$, thus, income of $r_A V_A$ is received and the asset can be sold for $V_{A,t+1} = V_A(1 + \pi_t)$. Here, π_t incorporates changes in the asset price as well as expected changes in value associated with creditworthiness if the asset is a debt instrument.

Let us assume also that a rate r_t can be earned on an asset that does not imply any cost or risk to the borrower. This rate represents the opportunity cost of financial capital for the intermediaries, and can be used to discount the future value of cash flows associated with assets. Treating the reference rate r_t as a risk-free rate is the general practice in the literature, including the 1993 System of National Accounts.

The user cost of holding asset A can be expressed as:

$$uc_t = V_{A,t} - \frac{V_{A,t}(1 + \pi_t) + r_A V_{A,t}}{1 + r_t}$$

which is equivalent to the more tractable expression

$$uc_t = V_{At} \left[\frac{r_r - r_A - \pi_t}{1 + r_r} \right] \quad (3)$$

Expression (3) can be modified to measure the implicit services of financial intermediation associated with assets and liabilities. The first modification is to set π_t to zero, effectively assuming that there are no net holding gains. The main reason to assume this is that the concept of income measured by the national accounts excludes holding gains and losses.

A second modification concerns the moment of valuation of the user cost. Expression (3) assumes that the asset and its user cost are valued at the beginning of the period, while interest flows are received at the end of it. Since interest flows are received and paid throughout the year and, it is more reasonable to value the user cost at the end of the period. The resulting expression for the user cost valued at the end of the period would simply be the difference between the reference rate r_r and the rate of return on the asset, r_A :

$$uc_t = (r_r - r_A)$$

For assets, the user cost is usually negative, since the rate of return on the asset is typically higher than the reference rate. For liabilities, the reference rate is usually higher than the rate of return, resulting in a positive value for the user cost. In view of this, the user-cost *price* of an asset i is defined as the negative of the user cost:

$$p_{A_i} = r_{A_i} - r_r$$

while the user-cost price of a liability i is defined as equal to its user cost:

$$p_{L_i} = r_r - r_{L_i}$$

The imputed output *IO* of an intermediary can be expressed as the sum of the user-cost price of each asset or liability times its volume:

$$IO = \sum_i p_{A_i} A_i + \sum_i p_{L_i} L_i \quad (4)$$

Hence, the imputed output of intermediation services can be obtained as the sum of the output derived from each asset and each liability held by the intermediary. This framework allows to measure the amount of imputed output contributed by financial innovations associated with certain assets or liabilities, and to assess its relative importance on the total output of the intermediary.

4. Methodology

4.1 Intermediaries included in the study

The intermediaries included in the study are the three banks that constitute the sector of State-owned commercial banks of Costa Rica: the Banco Nacional de Costa Rica (BNCR), the Banco de Costa Rica (BCR) and the Banco de Crédito Agrícola de Cartago (BCAC).²

² Respectively: National Bank of Costa Rica, Bank of Costa Rica and Bank for Agricultural Credit of Cartago.

The reason to circumscribe the study to them is that they comprise the majority of the assets of all banks, as well as the majority of the credit in the financial system. In December of 2007, state-owned commercial banks accounted for 47,6% of the active credits among all 17 banks operating at the time and for 53,5% of all assets (see Table 1). If we consider the totality of the Costa Rican financial system, these shares remain very high: 39,9% and 45,4%, respectively. Thus, gathering information about product innovation on only these three banks is an effective way to cover a significant part of the financial system with relative ease. Besides, these three banks account for 50,7% of the output of financial intermediation services of all banks, according to estimates for 2006. By measuring the effect of product innovation on their output it is possible to assess the effect on the aggregate output of all banks.

4.2 Sources of data

A user-cost framework was employed to calculate the weight of FISIM output derived from product innovations on total FISIM output. For the calculation of total output of the intermediaries selected the data used came from the General Superintendency of Financial Entities. For the calculations of output from the innovations the data was requested directly to the intermediaries.

Table 1
**Costa Rica. Share of State-owned commercial banks
on selected aggregates. 2006, 2007**

	Assets	Active credits	Profits	Output of intermediation services 1/
Share of all banks	53,5%	47,6%	65,3%	50,7%
Share of national financial system 2/	45,4%	39,9%	47,3%	-

1/ Estimates for 2006, all other shares correspond to December 2007.

2/ Includes banks, non-banking financial corporations, cooperatives and foreign exchange bureaus.

Source: General Superintendency for Financial Entities (SUGEF) and Central Bank of Costa Rica

Data for total FISIM output

All Costa Rican financial institutions must submit detailed balance-sheet data to the General Superintendency for Financial Entities (SUGEF) for purposes of supervision. This information can be readily obtained through the SUGEF website. The monthly reports used for this study include data of the stock of assets, liabilities and total equity, as well as the accumulated income and expenses, all of it broken down by counterpart sector of the transaction. Crucially, interest income and expenses can be easily matched with the corresponding asset or liability that generated them. For FISIM calculation we used the accumulated interest income and expenses for the year and the average for the year of the monthly stocks of assets and liabilities.

Data for product innovations

Since financial statements and information submitted for supervision do not include a detailed breakdown of assets and liabilities by product, we opted to obtain data for product innovations by requesting them directly from intermediaries. The requests were made through a series of meetings with officers of the intermediaries. In these meetings we asked to identify new credit and deposit products that met two criteria:

- Have resulted from strategies of diversification and product development, that is, being completely new products rather than modifications of characteristics of already existing products.
- Have been introduced in the last three years (2005, 2006, 2007). An exception was made for a single credit product, introduced in 2004 but with significant importance in the following three years.

We followed the criterion of Bátiz-Lazo and Woldensebet (2006) outlined in section 2: the products should be new to the offer of the intermediary, even if they already exist in other markets.

The information provided included interest flows as well as detailed data on the stock of the asset products and liability products for all three years considered. For the study, we used the accumulated interest flows for the year and the average of the stocks. It was agreed that the information provided would not be published individually by product, but rather presented in an aggregate way, and that neither the innovations nor the intermediaries would be identified by their names.

4.3 Calculation of FISIM output

It must be pointed out that in the national accounts of Costa Rica FISIM is computed as indicated in paragraph 6.125 of the SNA 1993: interest receivable minus interest payable, excluding interest from own funds. The calculation done for the study, hence, is a departure from official estimates, although it might be useful for benchmarking purposes once the new method of FISIM estimation is implemented.

Instruments and transactions included

It was considered that only credit and deposit instruments produced services of intermediation, since it is primarily for these instruments that intermediaries can control interest rates. Furthermore, we excluded transactions between financial intermediaries since they represent services that intermediaries provide to each other which should not be included in the amount of services provided to the other sectors.

Reference rates

For the internal reference rate we used the weighted average of the effective rates on loans granted and deposits taken by all the institutions of the national financial system of Costa Rica (see Annex 1) with all sectors in the economy. This average rate is equivalent to:

$$r^* = \frac{\text{accumulated interest flows from loans and deposits}}{\text{average of monthly stock of loans plus deposits}}$$

This reference rate fell slightly from 6,33% in 2005 to 6,29% in 2006 and more noticeably to 5,20% in 2007. However, it is consistently below the effective rates for asset instruments and consistently above the effective rates for liabilities, thus preventing the estimation of negative FISIM. Besides, the 2005-2006 FISIM estimates obtained by using this reference rate resulted in a growth rate (11,2%) close to that of the official estimate of FISIM for the intermediaries considered (13,0%). This reference rate is similar to the reference rate used

by the Australian Bureau of Statistics, which uses the mid-point between the average interest rate on loans and the average interest rate on deposits.

Another reference rate considered was the annual average of the daily rate in the interbank money market of Costa Rica. However, this rate was not adopted because of its volatile behaviour and the short-term character of Costa Rica's interbank market. FISIM estimates using this reference rate resulted in a growth rate for 2005-2006 significantly higher than the official estimate for the intermediaries included (34,9% versus 13,0%).

Of the transactions with non-resident sectors, only those that result in exports of FISIM should be included. However, for the years considered no loans were granted to or deposits were taken from non-resident sectors, and hence there was no calculation for imputed FISIM exports.

Taking into account the elements described above and using the user cost framework described in section 3, we carried out calculations for the total output of FISIM and for FISIM output stemming from the product innovations. The results are discussed in section 5.2.

5. Results

5.1 Product innovations

Table 2 presents a summary of the information about product innovations in the intermediaries included. Since anonymity was agreed, we do not identify the banks or their products by name.

For the period 2005-2007 the three banks considered reported a total of 11 credit and deposit product innovations. Of these, six product innovations belong to a single bank, four to another and a sole product innovation was reported by the third bank. Most of these innovations are credit instruments: of the 11 innovations, eight are credit products and only three are deposit products.

The credit products comprise, essentially, personal loans for consumption and loans for housing. All three banks reported to have started a program of personal loans for consumption (1A, 1B and 1C) whose characteristics differ from those of traditional loans. For example, the minimum amount of the loans is lower, fewer requisites are asked and the loans are approved more quickly. This kind of loan is common in the informal sector and was first adopted with success by non-banking financial institutions. According to the officers from the banks, these loans target primarily low-income workers who are traditionally outside the financial system because of cultural restrictions. Very often a segment of the population in need of a loan is put off by what they perceive to be very restrictive requirements in formal financial entities. An additional credit innovation aimed primarily at consumption is offered by Bank C, and consists in early withdrawals of the Christmas bonus which must be paid once the bonus is received.

Loans for housing comprise the remaining four credit innovations. Bank B offers a loan denominated in a virtual currency, which is indexed by inflation (2B). It proved to be a genuinely innovative product for the conservative Costa Rican credit market. The stock of 2B loans grew steadily since its introduction in 2004 until reaching a maximum in February of 2007, when it started a continued descent. The three other credit products, offered by Bank C, were housing loans with innovative conditions. However, these last three product innovations were short-lived: as of June of 2008 they are no longer part of the offer of Bank C, and were replaced by a single credit product with two options of interest rate.

Only three deposit innovations were reported and two of them are deposits in Euros. Bank B offers these deposits since February of 2005 and Bank C since January of 2007. In 2007, Bank B held more than 90% of the deposits of the two banks and is the only one to pay any

interest on them. In the last quarter of 2007 there was a marked increase in the volume of deposits denominated in Euros, reflecting a significant appreciation of the local currency with respect to the US Dollar.

The other deposit innovation is savings deposits with specific purpose, in this case, travel expenses. Once the deposit attains a certain pre-established level the depositor can withdraw the amount saved. Although introduced in 2005, during this year the total of these savings deposits remained relatively low compared with the much higher levels attained from January 2006 on, when the bank started to promote the product more widely.

5.2 Total FISIM calculation

Tables 3, 4 and 5 present the estimates of total FISIM for the three banks considered. Each table presents information for all assets and liabilities, including those which do not enter FISIM calculation. Column (1) presents the average for the year of the monthly stock of each line, and column (2) contains the accumulated interest income or expense for the year. In column (3) the average rate of interest for the assets and liabilities entering FISIM calculation is then computed as the interest in (2) divided by the stock in (1). The user cost price of each asset and liability is calculated in column (4) as the average rate of interest minus the reference rate, for assets, or as the reference rate minus the average rate of interest, for liabilities. Finally, in column (5) the imputed intermediation output derived from each line is computed as the user cost price times the average balance.

The user cost price of loans fell consistently during the period: from 2,01% in 2005 to 1,41% in 2006 and 0,85% in 2007. This reflects a similar downward movement in the average interest rate and the reference rate. Total services of intermediation derived from loans fell from 20 507.3 millions of colones in 2005 to around 16 500 millions of colones two years later.

Table 2

Costa Rica. Product innovations in State-owned commercial banks. 2005-2007

	Product	Type	Characteristics	Year of introduction
Bank A	1A	Credit	Personal loan for consumption	2007
	1B	Credit	Personal loan for consumption	2006
Bank B	2B	Credit	Loan denominated in a virtual currency indexed to inflation	2004
	3B	Deposit	Deposits in Euros	2005
	4B	Deposit	Savings deposits with specific purpose (travel)	2005

Table 2 (cont)

Costa Rica. Product innovations in State-owned commercial banks. 2005-2007

	Product	Type	Characteristics	Year of introduction
Bank C	1C	Credit	Loan for consumption, pre-approved by client profile	2005
	2C	Credit	Early withdrawal of a percentage of the Christmas bonus	2007
	3C	Credit	Loan for housing, stepped rate	2006
	4C	Credit	Loan for housing, fixed payment	2006
	5C	Credit	Loan for housing, capitalizable	2007
	6C	Deposit	Deposits in Euros	2006

Source: own elaboration with data from BNCR, BCR and BCAC.

The user cost price for demand deposits, the most important deposit instrument, remains between 4,5% and 5% . The rate for time deposits, however, falls steadily from 2,69% in 2005 to around 2% two years later. Nonetheless, total imputed services of intermediation derived from deposit instruments grew from around 87 500 millions of colones in 2005 to more than 113 000 millions in 2007.

As expected, total FISIM estimates obtained through the user cost approach are lower than official estimates calculated as the difference of interest received and paid: the user cost estimates for 2005 and 2006 represent 71% and 70% of current estimates of FISIM. User cost estimates grow 11,2% from 2005 to 2006, close to the 13,0% growth of official estimates, and 8,1% from 2006 to 2007.

5.3 Imputed output from innovations

Table 6 presents the calculation of FISIM derived from the product innovations reported by the three banks considered. As requested by the intermediaries, we aggregated the stocks for the credit and deposit instruments as well as the interest flows derived from them.

The main result is that the weight of output derived from product innovations on total imputed output is relatively low, although it is growing. Output stemming from the 11 product innovations reported represented only 2,4% of all output in 2005, 3,1% in 2006 and in 2007 it more than doubled to 7,3%. It is clear that the vast majority of the services of intermediation of these three banks are provided through traditional financial products and that the contribution of innovation to that provision is marginal. It is difficult to assert just how low these weights since we could not find comparable empirical studies. However, we did expect to see a rising importance of innovation output on total intermediation output, as effectively occurred. Considering that these three banks comprise more than 50% of total implicit services of intermediation for the financial system, it is likely that the weight of implicit services of intermediation derived from product innovations would remain low for the system as a whole.

The upward trend in the weight of output derived from innovations is due to the fact that it grew much faster than total imputed output in the period considered. In 2006 and 2007, FISIM derived from innovations grew 42,1% and 1,58 times, respectively, compared to 11,2% and 8,1% for total intermediation output.

It must be noted that these estimates do not include any fees or other explicit charges associated with the product innovations. These charges might constitute a significant source of income for the intermediaries, as suggested by data received from one of the informants. According to data from Bank B, in 2007 fees income represented around 17% of interest income from a credit innovation. Hence, total intermediation services from product innovations would be significantly underestimated if only FISIM output were considered in the measure.

Credit innovations contribute more than 95% of the imputed intermediation output for all innovations. It is important to single out that user cost prices for credit innovations are consistently higher than user cost prices for total loans. In 2007 this difference is most notable, as the user cost price of credit innovations is more than 4% while that price remains below 1% for total loans. If the user cost price of a financial product is positive, it helps to increase profits. In this sense, it could be argued that the user cost prices of credit innovations suggest a higher potential for profit than traditional products, which is consistent with the idea that firms innovate to gain a competitive edge and increase profits.

The user cost prices of deposit instruments show a noticeable anomaly: in 2005 that price was negative, resulting in a small negative imputation of FISIM from deposits. This is due to the high amount of interest paid reported by one of the informant institutions for one of the credit innovations.³ The data in question was verified again by the informant, and deemed correct. Hence, we used the information as presented. User cost prices for deposit instruments rose from 4,6% in 2006 to 4,92% in 2007. However, output derived from these deposit instruments more than doubled.

³ The average rate of interest for this instrument (not presented) was 12% in 2005, whereas in subsequent years it dropped to 1,7% and 0,2%.

Table 3
Costa Rica. Imputed gross output of intermediation services for State-owned banks, user cost approach. 2005
 Millions of colones

	(1)	(2)	(3)=(2)/(1)	(4)	(5)=(4)x(1)
	Average balance	Interest income / expense	Average rate of interest	Average user cost price a/	Imputed gross output
Assets	2.809.981,9 6				
Cash and banks					
Cash balances	43.823,39				
Demand deposits in Central Bank of Costa Rica	274.736,54				
Checking accounts and demand deposits: national financial institutions	3.685,28	10,01			
Checking accounts and demand deposits: foreign financial institutions	80.787,39	744,69			
Other, cash and banks	37.577,80				
Investment securities and time deposits					
Time deposits	45.752,03	1.315,97			
Investment securities, Government and Central Bank of Costa Rica	866.753,48	45.033,03			
Other investment securities	219.809,09	4.889,81			
Loans	1.022.521,4 4	85.232,93	8,34	2,01	20.507,32
Accounts receivable	33.428,32				
Bank premises and equipment	98.195,08				
All other assets	82.912,11				

Table 3 (cont)
Costa Rica. Imputed gross output of intermediation services for State-owned banks, user cost approach. 2005
 Millions of colones

	(1)	(2)	(3)=(2)/(1)	(4)	(5)=(4)x(1)
	Average balance	Interest income / expense	Average rate of interest	Average user cost price a/	Imputed gross output
Liabilities	2.554.395,8 8				
Obligations with the public					
Demand deposits	1.234.008,4 2	18.157,62	1,47	4,86	59.955,12
Other demand obligations	12.839,10	586,31	4,57	1,76	226,41
Time deposits	1.015.193,8 4	36.950,42	3,64	2,69	27.311,35
Other obligations with the public	79,92	0,91	1,13	5,20	4,15
Obligations with the Central Bank of Costa Rica	608,26	47,59			
Obligations with financial entities	197.797,62	2.368,15			
Other liabilities with non financial entities	93.868,72	48,35			
Total equity capital	255.586,07				
TOTAL IMPUTED GROSS OUTPUT					108.004,35

a/ Reference rate: 6.33.

Source: own elaboration with data from SUGEF, BNCR, BCR and BCAC.

Table 4
Costa Rica. Imputed gross output of intermediation services for State-owned banks, user cost approach. 2006
 Millions of colones

	(1) Average balance	(2) Interest income / expense	(3)=(2)/(1) Average rate of interest	(4) Average user cost price a/	(5)=(4)x(1) Imputed gross output
Assets	3.445.574,62				
Cash and banks					
Cash balances	54.590,00				
Demand deposits in Central Bank of Costa Rica	402.746,72				
Checking accounts and demand deposits: national financial institutions	3.439,55	30,63			
Checking accounts and demand deposits: foreign financial institutions	59.211,47	1.441,84			
Other, cash and banks	36.496,58				
Investment securities and time deposits					
Time deposits	54.150,48	3.304,81			
Investment securities, Government and Central Bank of Costa Rica	748.118,57	40.624,66			
Other investment securities	475.473,99	13.402,60			
Loans	1.360.560,59	104.819,68	7,70	1,41	19.240,41
Accounts receivable	36.179,00				
Bank premises and equipment	120.613,85				
All other assets	93.993,82				

Table 4 (cont)
Costa Rica. Imputed gross output of intermediation services for State-owned banks, user cost approach. 2006

Millions of colones

	(1) Average balance	(2) Interest income / expense	(3)=(2)/(1) Average rate of interest	(4) Average user cost price a/	(5)=(4)x(1) Imputed gross output
Liabilities	3.106.522,50				
Obligations with the public					
Demand deposits	1.498.635,02	19.854,45	1,32	4,97	74.409,69
Other demand obligations	14.001,28	518,61	3,70	2,59	362,07
Time deposits	1.229.468,68	51.240,53	4,17	2,12	26.093,05
Other obligations with the public	847,09	6,82	0,81	5,48	46,46
Obligations with the Central Bank of Costa Rica	478,16	23,10			
Obligations with financial entities	235.464,85	3.453,69			
Other liabilities with non financial entities	127.627,42	13,77			
 Total equity capital	 339.052,12				
TOTAL IMPUTED GROSS OUTPUT					120.151,69

a/ Reference rate: 6.29.

Source: own elaboration with data from SUGEF, BNCR, BCR and BCAC.

Table 5
Costa Rica. Imputed gross output of intermediation services for State-owned banks, user cost approach. 2007
 Millions of colones

	(1) Average balance	(2) Interest income / expense	(3)=(2)/(1) Average rate of interest	(4) Average user cost price a/	(5)=(4)x(1) Imputed gross output
Assets	4.065.044,15				
Cash and banks					
Cash balances	66.711,89				
Demand deposits in Central Bank of Costa Rica	487.935,72				
Checking accounts and demand deposits: national financial institutions	3.915,56	26,07			
Checking accounts and demand deposits: foreign financial institutions	49.397,86	837,30			
Other, cash and banks	46.433,86				
Investment securities and time deposits					
Time deposits	58.370,88	2.034,92			
Investment securities, Government and Central Bank of Costa Rica	679.744,74	26.502,23			
Other investment securities	440.662,71	10.216,95			
Loans	1.938.497,39	117.300,36	6,05	0,85	16.498,49
Accounts receivable	40.902,38				
Bank premises and equipment	138.775,79				
All other assets	113.695,37				

Table 5 (cont)

Costa Rica. Imputed gross output of intermediation services for State-owned banks, user cost approach. 2007

Millions of colones

Liabilities	3.657.208,43				
Obligations with the public					
Demand deposits	1.936.078,42	13.187,52	0,68	4,52	87.488,56
Other demand obligations	17.470,38	243,61	1,39	3,81	664,85
Time deposits	1.257.048,91	40.161,38	3,19	2,01	25.205,16
Other obligations with the public	934,64	9,62	1,03	4,17	38,98
Obligations with the Central Bank of Costa Rica	434,62	10,22			
Obligations with financial entities	284.694,96	3.966,26			
Other liabilities with non financial entities	160.546,50	24,63			
Total equity capital	407.835,72				
TOTAL IMPUTED GROSS OUTPUT					129.896,04

a/ Reference rate: 5.20.

Source: own elaboration with data from SUGEF, BNCR, BCR and BCAC.

Table 6

Costa Rica. Imputed gross output of intermediation services for product innovations from State-owned banks. 2005–2007

Millions of colones

	2005					2006					2007				
	Average balance	Interest income/expense	Average rate of interest	Average user cost price	Imputed gross output	Average balance	Interest income/expense	Average rate of interest	Average user cost price	Imputed gross output	Average balance	Interest income/expense	Average rate of interest	Average user cost price	Imputed gross output
Assets															
Credit innovations	104.702,25	9.306,04	8,89	2,56	2.678,38	159.959,02	13.590,06	8,50	2,21	3.528,64	207.125,50	19.831,4	9,57	4,37	9.060,87
Liabilities															
Deposit innovations	1.279,79	156,14	12,20	-5,87	-75,13	3.728,71	62,93	1,69	4,60	171,60	9.827,42	27,05	0,28	4,92	483,97
<u>Imputed output from innovations</u>					<u>2.603,26</u>					<u>3.700,24</u>					<u>9.544,85</u>
<u>Total imputed output for the banks</u>					<u>108.004,35</u>					<u>120.161,69</u>					<u>129.896,04</u>
Weight of output from innovations					2,4%					3,1%					7,3%

Source: own elaboration with data from SUGEF, BNCR, BCR and BCAC.

6. Concluding remarks

The results of the study show that the banks considered rely heavily on traditional products for the provision of their intermediation services. This reflects the conservative character of State-owned banks in Costa Rica, and might indicate the weight of innovation output across the whole financial system. However, given that in the Costa Rican private financial intermediaries traditionally have been more innovative, it would be only natural to extend the scope of the study to include data on product innovations from a more heterogeneous group of intermediaries. The success of such endeavour, as in this study, depends critically on the disposition of the intermediaries to provide information.

Although it is still low, the importance of innovations on total intermediation output grew steadily during the period considered. Several intermediaries have reported that new products were planned to be introduced during 2008, like loans specific for payment of tuition costs and several deposits with specific purpose. Hence, it is likely that such upward trend continues, because the drive for innovation in the Costa Rican financial system persists.

Annex 1

Costa Rica. Institutions of the National Financial System. 2007

	Number of institutions	Share of active credits	Share of total assets
State-owned banks			
State-owned commercial banks	3	39.9%	45.4%
Banks created by special laws	2	10.1%	10.8%
Private banks	12	33.8%	28.7%
Savings and credit union of the National Teachers Association (ANDE)	1	2.2%	1.8%
Non-banking financial institutions	7	2.1%	1.6%
Savings and credit cooperatives	31	8.8%	7.6%
Mutual savings institutions (from the National Financial System for Housing)	2	3.2%	4.1%
Exchange bureaus	3	0.0%	0.0%

Source: General Superintendency of Financial Entities of Costa Rica

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Monetary statistics: integration of revisions in the *System of National Accounts 2008*

Randall Merris¹

1. Introduction

Introduction of revised methodology for the System of National Accounts (SNA) – as incorporated in the *System of National Accounts 2008 (2008 SNA)*, Volume 1 – will result in a relatively modest set of modifications in the economic sectorization, financial asset classification, and accounting rules for the monetary statistics. In particular, the SNA revisions do not lead to major changes in the Standardized Report Forms (SRFs), which the IMF introduced in 2005 for monthly reporting of countries' monetary data.

Revisions in the monetary statistics methodology are facilitated by the pre-existing frameworks in which a single set of definitions and concepts, classifications, and accounting rules is applied in the *System of National Accounts 1993 (1993 SNA)* and the IMF's *Monetary and Financial Statistics Manual (MFSM; 2000)*. Some of the new methodology in the *2008 SNA* has already been incorporated in the IMF's *Monetary and Financial Statistics: Compilation Guide (MFS Guide; 2008)*. The other revisions in the *2008 SNA* will be accommodated by including new memorandum items in the SRFs and the Supplementary Data Report Forms (SDRFs), which are at the pilot-project stage. The SDRFs are designed for reporting of quarterly data on financial corporations' balance-sheet accounts disaggregated by maturity (the short-/long-term classification in the SNA) and by other criteria, as well as for reporting several categories of off-balance-sheet data.

The descriptions provided in this paper directly apply only to the methodology for the monetary statistics that non-EMU countries report to the IMF.² The European Central Bank has produced extensive documentation (available on-line at www.ecb.int) of the methodology of the monetary statistics for the European Monetary Union (EMU) and the individual EMU countries. The ECB and IMF closely collaborate on the harmonization of the monetary statistics for the EMU members and non-EMU countries. In place of the SRF-based reporting, the EMU countries rely on the ECB for efficient electronic transmission of each countries' monetary statistics to the IMF. These data are published in the EMU country pages and Euro Area page of the IMF's *International Financial Statistics*.

2. Harmonization of the monetary and national accounts statistics

The major objective is to collect and compile monetary data that are consistent with the financial asset/liability data in the Financial Account and related accounts of the SNA, recognizing that each statistical system has unique requirements for data presentations.

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² The descriptions in this paper refer only to the monetary statistics, given that the financial statistics in the *MFSM* and *MFS Guide* are synonymous with the Financial Account and related accounts of the SNA. Revision of the financial statistics entails direct implementation of the new methodology in the *2008 SNA*.

Data sets in the two macroeconomic systems are designated as *consistent* if (1) data are the same, (2) data discrepancies can be explained (and eliminated, if possible), or (3) data in one system can be constructed from “building blocks” of data from the other system. Data for financial corporations’ assets and liabilities are obtainable from a single source – namely, the accounting records of these institutional units. However, specific data requirements and analytical presentations for the monetary statistics depart from the data requirements and presentations of the Financial Account and related accounts of the SNA. For example, the monetary statistics methodology disaggregates deposit liabilities of financial corporations into separate components for (1) deposits included in the national definition of broad money and (2) deposits excluded from broad money. Such disaggregation is not found in the SNA.

3. The financial corporations sector

A major change in the sectorization of an economy is the revision in the subsectors of the financial corporations sector. The five subsectors of the financial corporations sector in the 1993 SNA, MFSM, and MFS Guide and the nine subsectors in the 2008 SNA are shown in Table 1. In the 2008 SNA, *Other depository corporations (ODCs)* has been renamed *Deposit-taking corporations except the central bank*. *Insurance corporations and pension funds* has been divided into separate subsectors, and new subcategories of *Other financial intermediaries, except insurance corporations* have been delineated.

The financial corporations sector in the MFSM and MFS Guide consists of the five subsectors in the 1993 SNA. However, the data lines in the SRFs contain disaggregation only for the *Central bank*, *ODCs*, and *Other financial corporations (OFCs)* – a composite subsector consisting of *Other financial intermediaries, Financial auxiliaries, and Insurance corporations and pension funds*. In the future, the OFC subsector will comprise *MMFs* (except those issuing liabilities included in broad money), *Non-MMF investment funds*, *Other financial intermediaries except insurance corporations and pension funds*, *Financial auxiliaries*, *Captive financial institutions and money lenders*, *Insurance corporations*, and *Pension funds*.

Table 1

Financial Corporations Subsectors

1993 SNA, MFSM, and MFS Guide

1. Central bank
 2. Other depository corporations
 3. Other financial intermediaries, except insurance corporations and pension funds
 4. Financial auxiliaries
 5. Insurance corporations and pension funds
-

2008 SNA

1. Central bank
 2. Deposit-taking corporations except the central bank
 3. Money-market funds (MMFs)
 4. Non-MMF investment funds
 5. Other financial intermediaries except insurance corporations and pension funds
 6. Financial auxiliaries
 7. Captive financial institutions and money lenders
 8. Insurance corporations
 9. Pension funds
-

Aggregate (unconsolidated) data for separate subcategories of financial corporations in the OFC category can be obtained by sorting and aggregating the data reports, by OFC type. This approach can also be applied to obtain aggregate data for other subcategories of financial corporations. Aggregate data can be compiled using various criteria for disaggregation to obtain aggregate data for large/small ODCs, offshore financial corporations, government-owned ODCs, foreign- and domestic-owned insurance corporations, etc.

4. Financial asset classification

The financial asset classification in the 1993 SNA, MFSM, and MFS Guide and the revised classification in the 2008 SNA are shown in Table 2. The revisions include new terminology and new subcategories within the major categories of financial assets.

Table 2

Financial Asset Classification

1993 SNA, MFSM, MFS Guide, and 2008 SNA

<ul style="list-style-type: none"> Monetary gold and SDR holdings <ul style="list-style-type: none"> Monetary gold (New subcategory in 2008 SNA) SDR holdings (New subcategory in 2008 SNA) Currency and deposits <ul style="list-style-type: none"> Currency Transferable deposits <ul style="list-style-type: none"> <i>Inter-bank positions</i> (New subcategory in 2008 SNA) <i>Other transferable deposits</i> (New subcategory in 2008 SNA) Other deposits (Specifically includes unallocated gold deposits in MFS Guide and 2008 SNA) Securities other than shares (<i>"Debt securities"</i> in 2008 SNA) Loans Shares and other equity (<i>"Equity and investment fund shares"</i> in 2008 SNA) <ul style="list-style-type: none"> <i>Equity</i> (New subcategory in 2008 SNA) <i>Investment fund shares/units</i> (New subcategory in 2008 SNA) <ul style="list-style-type: none"> <i>Money market fund shares/units</i> (New subcategory in 2008 SNA) <i>Other investment fund shares/units</i> (New subcategory in 2008 SNA) Insurance technical reserves (<i>"Insurance, pension, and standardized guarantees schemes"</i> in 2008 SNA) <ul style="list-style-type: none"> Net equity of households in life reserves (<i>"Life insurance and annuity entitlements"</i> in 2008 SNA) Net equity of households in pension funds (<i>"Pension entitlements"</i> in 2008 SNA) Prepayment of premiums and reserves against outstanding claims (<i>"Non-life insurance technical reserves"</i> in 2008 SNA) <i>Claims of pension funds on sponsors</i> (New subcategory in 2008 SNA) <i>Provisions for calls under standardized guarantees</i> (New subcategory in 2008 SNA) Financial derivatives¹ (<i>"Financial derivatives and employee stock options"</i> in 2008 SNA) <ul style="list-style-type: none"> <i>Options</i> (New subcategory in 2008 SNA) <i>Forwards</i> (New subcategory in 2008 SNA) Other accounts receivable/payable

¹ Included in *Securities other than shares* until 1997 revision in the 1993 SNA text: *The Statistical Measurement of Financial Derivatives* (IMF, November 1997).

Monetary gold and SDR holdings. The MFSM, MFS Guide, and 2008 SNA contain separate classifications for monetary gold and SRD holdings.

Inter-bank positions. The framework of the *MFSM* and *MFS Guide* contains comprehensive and separate data categories for (1) central bank claims on and liabilities to ODCs and OFCs, respectively; (2) ODC claims on and liabilities to other ODCs; (3) ODC claims on and liabilities to OFCs, and (4) OFC claims on and liabilities to other OFCs. These data are used in the consolidation for compilation of the *ODC Survey* (consolidation of the ODC accounts), *Depository Corporations Survey* (consolidation of the central bank and ODC accounts), *Other Financial Corporations Survey* (consolidation of the OFC accounts), and *Financial Corporations Survey* (consolidation of the entire financial corporations sector's accounts).

Unallocated gold deposits. Deposit claims on gold (as opposed to title claims on physical gold) are included in *Deposits* in the *MFS Guide*, as well as in the *2008 SNA*.

Employee stock options. The *MFS Guide* describes the classification and valuation of employee stock options and includes these options in *Financial derivatives*. The SDRFs will include a memorandum item for separate data on employee stock options.

Investment fund shares/units. In the *MFSM* and *MFS Guide*, investment fund shares are included indistinguishably in *Shares and other equity*, but money market shares included in the national definition of broad money are classified as *Deposits included in broad money*. Data for liabilities in the form of *Money market fund shares* and *Investment fund shares other than money market fund shares* are reported in the SRFs for MMFs and non-MMF investment funds, respectively.

Provisions for calls under standardized guarantees. The SDRFs will include credit guarantees in the memorandum section for off-balance-sheet items, which will also include data lines for loan commitments and credit lines. The credit guarantee series in the SDRFs will show the total amounts of loans and securities covered by credit guarantees, rather than the amount of credit guarantees that are expected to be activated by credit defaults (*Provisions for calls under credit guarantees*).

Options and forward contracts. In the SRFs, the asset/liability accounts for financial derivatives are disaggregated by debtor/creditor sector, but not into the separate categories of options and forward contracts. The SDRFs will include balance-sheet data disaggregated by option/forward contract (and by subcategories of options and forward contracts). The memorandum items in the SDRFs will include off-balance-sheet data for the notional principal amounts for futures contracts and interest-rate and currency swap contracts.

Asset/liability classification by currency of denomination. In the *MFSM*, *MFS Guide*, SRFs, and SDRFs, all assets/liability categories are disaggregated, where applicable, into separate categories for those denominated in national currency units and those denominated in foreign currency. The *2008 SNA* categorically recommends cross-classification by currency of denomination only for *Other deposits*.

Asset/liability classification by maturity. The *1993 SNA* and *2008 SNA* contain supplementary classification of loans and debt securities by maturity (short-term and long-term). The SDRFs will be used to report data for loans disaggregated by short/long term to maturity, and for debt securities disaggregated in separate categories for zero-coupon, other short-term, and long-term securities. In the SDRFs, loans and securities are also disaggregated into separate categories for instruments with fixed or variable interest rates.

5. Valuation and other accounting rules

The *1993 SNA*, *MFSM* and *MFS Guide* generally agree with respect to the rules for initial valuation and revaluation of financial assets/liabilities, specification of the time of recording of transactions in financial assets/liabilities, and other accounting rules. A major exception is valuation of liabilities in the form of *Shares and other equity*. In the monetary statistics methodology, equity liabilities are recorded at book value (on the basis of financial

corporations' balance-sheet records) and are divided into separate components for *Funds contributed by owners* (paid-in capital and surplus), *Retained earnings*, *General and special reserves*, and *Valuation adjustment*. In the 1993 SNA and 2008 SNA, equity liabilities are valued at market prices (or market price approximations). Equity valuations in the SNA and monetary statistics methodologies are harmonized through use of memorandum items for the market value of equity (disaggregated by sector of equity holder), which accompany the financial corporations' balance sheets in the monetary statistics. This departure from the SNA methodology for equity valuation is to be maintained in the monetary statistics.

The 2008 SNA revisions in the accounting rules that are of relevance for the monetary statistics pertain to treatment of non-performing loans, the recording of unfunded liabilities for defined-benefit pension funds, valuation of non-quoted equity shares, accounting for reinsurance corporations' transactions and positions, and recording of SDR allocations.

Non-performing loans. In the 1993 SNA, 2008 SNA, MFSM, and MFS Guide, total outstanding loans in nominal amount are recorded on the balance sheets of financial corporations. Non-performing loans are not covered in the 1993 SNA. The 2008 SNA includes a memorandum item for the *Market value of loans* (in the MFSM terminology, *Realizable value of loans*). The MFSM and MFS Guide include (1) *Provisions for loan losses* as a balance-sheet category within *Other accounts payable* and (2) memorandum items for *Expected loan losses* disaggregated by debtor sector. Harmonization of the monetary and SNA data is apparent from the derivation of *Realizable value of loans* (MFSM and MFS Guide) and the derivation of *Expected loan losses* (2008 SNA). In the MFSM and MFS Guide, the *Realizable value of loans* equals *Outstanding loans* minus *Expected loan losses*; in the 2008 SNA, *Expected loan losses* equals *Outstanding loans* minus *Market value of loans*. In addition, the MFSM, MFS Guide, SRFs, and 2008 SNA include memorandum items for interest and principal arrears on non-performing loans.

Unfunded liabilities of defined-benefit pension funds. The 1993 SNA (¶13.88) states: "It is recommended that the present value to households of promises by these schemes to pay future benefits be shown as a memorandum item in the balance sheet as assets of households. Liabilities of equivalent amount may also be shown as memorandum items for the employer sectors...." In the MFS Guide and the 2008 SNA, actuarial-based estimates of the present values of liabilities for future payments from fully funded, partially funded, and unfunded defined-benefit pension funds are recorded on the balance sheets of employers.

Valuation of unquoted equity shares. In the 1993 SNA and the MFSM, the present-value and market-capitalization methods are presented for the estimation of fair values of equity shares for which market-price quotations are unavailable. Additional estimation methods are described in the MFS Guide and the 2008 SNA.

Accounting for reinsurance corporations. The 1993 SNA (Annex IV, 28) states: "Reinsurance transactions between resident insurance corporations should be consolidated... without regard to the division between direct insurance and reinsurance." In the MFSM, MFS Guide, and 2008 SNA, reinsurance corporations are recognized as separate institutional units, and the stocks and flows for the balance-sheet accounts of all insurance and reinsurance corporations are presented on a gross basis.

Recording of an SDR allocation (central bank liability). In the 1993 SNA and MFSM, an SDR allocation enters the central bank accounts as an OCVA entry. In the 2008 SNA and the *Balance of Payments and International Investment Position Manual*, 6th edition (forthcoming), an SDR allocation enters the accounts as a transaction and is included in the category of *Debt securities*. In the revised monetary statistics, an SDR allocation will be recorded as a transaction, but will continue to be included in *Shares and other equity*.

6. The future of the *MFSM* and *MFS guide*

The *MFSM* and *MFS Guide* will be revised to incorporate the new terminology, sectorization, financial asset classifications, and other revisions in the *2008 SNA*. The *MFSM* and *MFS Guide* will be combined in a single publication (title not yet chosen) that will not coincide with the release of *2008 SNA, Volume 1* and *2*, but should follow relatively soon thereafter. At that time, the SRFs and SDRFs will be revised to incorporate the revisions in the *2008 SNA*.

Recent innovations in inter-bank electronic payment system in Mexico: the role of regulation

José Negrín,¹ Diadelfa Ocampo² and Alejandro de los Santos³

1. Introduction

One of Banco de Mexico's (BM) main responsibilities is the proper functioning of the payment systems, in particular those considered to have systemic importance. Therefore, Mexico's Central Bank has directly been involved in the promotion and deployment of efficient payment systems. The prime example of this responsibility is the set up of the Interbank Electronic Payment System (SPEI)⁴ which is owned and operated by BM. SPEI is a hybrid system that combines the advantages of a real time and a multilateral settlement system. It has a low operational cost for banks and it does not impose a transaction amount limit, blurring thus the separating line between a large and a small value payment system.

SPEI is aimed at sending electronic transfers between financial institutions and their clients. It started to work in August 2004 and replaced another large value payment system, named SPEUA,⁵ which was also run by BM. Soon after SPEI was implemented, it took over all the transactions that were previously carried through SPEUA.

In the nearly four years SPEI has been in place, the number of transactions it carries has multiplied by a factor of eight. During this period, BM has promoted a number of institutional changes, regulatory measures and agreements with banks in order to foster SPEI usage. This process has extended SPEI's character from a large value payment system used mainly for financial market transactions among banking institutions and large treasuries, to a rather widespread mechanism to send electronic transfers between private persons.

The main goal of this paper is to test the impact that institutional adjustments and BM regulatory measures have had over SPEI's adoption process. We model such adoption process by means of an S-shaped learning curve (logistic curve). This type of model has frequently been used to represent the adoption process of innovations in several markets, including payments (Snellman and Vesala, 1999).

In this model three parameters are estimated: the saturation point or maximum fraction of payments that will be carried by SPEI in the long run, the point at which the rate of adoption is the highest (inflexion) and the adoption rate (slope of the curve). We define the variable of

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⁴ In Spanish, Sistema de Pagos Electrónicos Interbancarios.

⁵ In Spanish, Sistema de Pagos Electrónicos de Uso Ampliado.

interest as the fraction of payments made with SPEI over the total number of transactions made with its substitutes, which includes direct debits, checks, a t+1 electronic transfer system (EFT), and SPEI. We then obtain the impact that institutional changes have had over the parameters described above. Additionally, we measure the impact that macroeconomic (demand) variables may have had over SPEI's adoption process.

We find that some of the measures adopted had a significant impact on the adoption process. In particular, the minimum amount for a SPEI transaction was removed and an important reduction in the price of transfers under 100 thousand pesos was agreed; the latter was achieved through the setting of a price cap on those transactions. Such a price cap was set up by the largest banks. The joint action of these measures has had a positive impact on the maximum fraction of total payments that is carried out with SPEI.

A secondary goal of this paper is to test differences in adoption levels of the clients of different banks. We find that indeed, the adoption process is not homogeneous across banks. Moreover, the impact of institutional changes varies across banks. Given that SPEI's originating orders are usually provided through the internet, those banks that have developed an efficient internet access, register distinctly higher adoption rates.

All banks participate in SPEI. Therefore, there is not an adoption issue at the bank level. The adoption decision is really in the hands of account holders that choose the means to make their payments; however, banks' decisions have an impact on consumer payment choices in several ways. In the first place, banks affect consumers' choices through the prices they charge for the services. In the case of SPEI, they also have an impact through the infrastructure of internet transactions they provide to their clients, since that is the most common channel to send SPEI payments.

There have been a number of institutional changes, regulatory decisions and industry agreements that have allowed SPEI to be rapidly adopted in recent years. After it was introduced, SPEI inherited the transactions that were carried out through SPEUA and, temporarily, even some of its practices. Due to technical constraints SPEUA had a minimum transaction amount which banks also imposed on their same day payment services; banks adopted a similar practice when SPEI was first introduced, although it was not caused by a technical constraint. Moreover, there were no standards for customers to readily identify the originator in third party transactions because SPEUA's mainly carried payments between banks. Also, it was until 2005 when banks started introducing systems to allow their clients to make SPEI payments through the internet. Additionally, banks priced low value electronic transfers out by setting high charges to them, in relation to checks. When these constraints were removed, either by regulatory changes or agreements between banks, the adoption of SPEI moved at fast rates, and the average value of transactions decreased across time. Furthermore, in order to improve competition, BM has recently allowed non-banks to participate directly in SPEI.

The rest of the paper is organized in the following way. The second section contains a technical description of SPEI. The third section describes SPEI evolution and its importance among the non-POS non-cash total payments. The fourth section includes a description of the institutional changes and regulatory measures undertaken by BM to promote the use of SPEI. The fifth section describes the methodology and data. The sixth section presents estimation results and the last section briefly concludes.

2. SPEI's features

SPEI is a large-value fund, near real time payments system to make transfers between participant institutions among themselves and on behalf of their customers. It began operating on August 13, 2004. Bank's costumers use SPEI for their time critical or important payments since the system's rules force Banks to send and credit SPEI transfers within

minutes, besides each payment order contains information allowing identification of the issuer accountholder and the beneficiary and that information is included in the beneficiary's account statement at no cost.⁶ Consequently, SPEI has become the central system for the settlement of large value payments and urgent client-to-client payments in Mexico.

2.1 Technical characteristics

SPEI effectively combines the characteristics of a real time gross settlement system with the liquidity savings of a multilateral netting system. This is achieved by running very frequent settlement cycles, during which a heuristic algorithm chooses a subset of payments pending of settlement that can be netted, on a multilateral basis, and settled with the participants' balances. In the BIS classification SPEI is a hybrid system.⁷

Within the system, participants may assign high priority to particular payments and reserve part of their account balance to settle only these payments. As payment orders enter the system, they are kept in a pending-payments queue. SPEI runs a process frequently – on the order of seconds – to decide which payments can be settled with the participant balances held at the moment. If a payment cannot be settled due to a sender's lack of liquidity, the payment is held in the queue until the next cycle takes place.

Participant banks must send customers payment orders to recipient banks within 10 minutes after an order is accepted. Recipient banks must credit payments to their customers within 10 minutes after a payment is received. In case the beneficiary account cannot be credited, the receiving institution has 20 minutes to return the funds to the issuing institution.

Pending payments are canceled at the end of the day. Afterwards, the SPEI account balances are transferred to the corresponding accounts in the system that manages the bank's Current Accounts in BM (SIAC).⁸

Safety in the SPEI system is based on digitally signed messages. Participants must use authorized digital certificates and passwords obtained in accordance with the rules of the Public Key Infrastructure⁹ developed by BM. Communications in SPEI use an open protocol (ie system communication rules are public). The protocol allows participants to develop automatic processes (Straight Through Processing), in order to provide improved services to their customers.

In SPEI neither participants nor the BM, grant any credit lines. No overdraft is allowed in the system and the participants have to manage the liquidity in their account. SPEI is connected to SIAC and the Mexican Security Settlement System, so that participants can efficiently transfer funds across them.

⁶ See, Banco de México, Circular 1/2006.

⁷ Committee on Payment and Settlement Systems – Bank of International Settlements, “New developments in large-value payment systems”, CPSS Publications, No. 67, May 2005

⁸ SIAC is the system that administers the current accounts that all banks and some financial institutions have in the Central Bank. This system is also used by BM to provide liquidity to participants. SPEI (and other payment systems) has its end-of-the-day settlement in SIAC.

⁹ In Mexico, Infraestructura Extendida de Seguridad.

2.2 The process of a payment

The process of a typical SPEI transaction is as follows:

1. The issuer accountholder instructs, usually via the internet, his bank to make a transfer through SPEI.
2. Provided the costumer's account has enough funds to perform the transaction and all security checkpoints have been cleared, the issuer institution sends to BM a digitally signed instruction to transfer the money. As mentioned before, the issuer accountholder is allowed to include information to specify the purpose of the payment and to identify the sender.
3. BM verifies the syntax and digital signature of the transfer. If everything is correct, an acknowledgement is sent to the issuer and the transfer is queued to be processed in the following settlement cycle.
4. If the issuer institution has enough liquidity, the transfer is settled in the following settlement cycle and both issuing and receiving institution are notified.
5. After the receiving institution gets the notification, it credits the amount of the transfer in the beneficiary's account, using the information included by the issuer accountholder.

BM charges the originating institution a per transaction fee.¹⁰ The issuing institution charges the issuer accountholder a fee, usually fixed, per transaction, while the receiving institution does not charge a fee to the receiving accountholder. It is worth mentioning that SPEI does not allow receiving banks to charge an interbank fee in order to finish the transaction up.

3. Evolution of SPEI

As SPEI started to work in August 2004, it substituted SPEUA, another electronic transfers system. SPEUA was introduced in 1995 and was used to perform large value transactions mainly between financial institutions. After SPEUA started to work, it showed very high rates of growth until 1997 and from that point on, the number of transactions grew slowly (see Figures 1a and 1b).¹¹

The behavior of SPEI differs from the adoption process experienced by SPEUA. Since its introduction, SPEI has been adopted at high rates, achieving during the last year an average annual accumulated rate of growth of 50%. Thus SPEI did not only take over the transactions previously carried out with SPEUA but it increased dramatically the processing of low value operations.

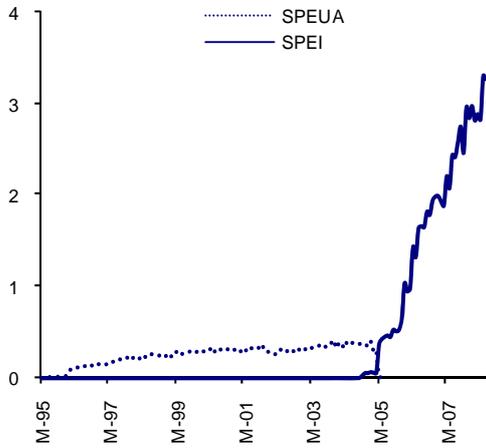
¹⁰ Until December 2007 it also charged a fixed annual fee; this has been eliminated.

¹¹ We assume that high value transactions, which were rapidly adopted, are originated by financial institutions while low value operations are transfers sent between individuals.

Figure 1

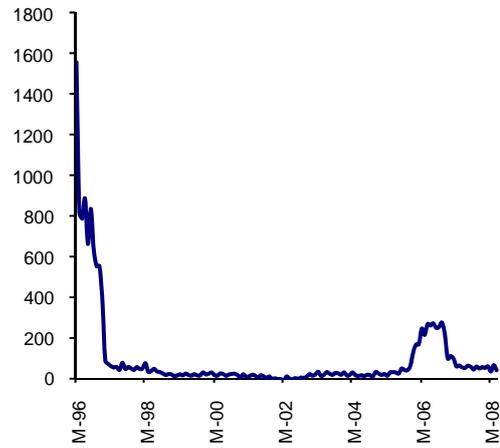
a) SPEUA and SPEI transactions

Million transactions



b) SPEI transactions

Annual Growth Rate (%)



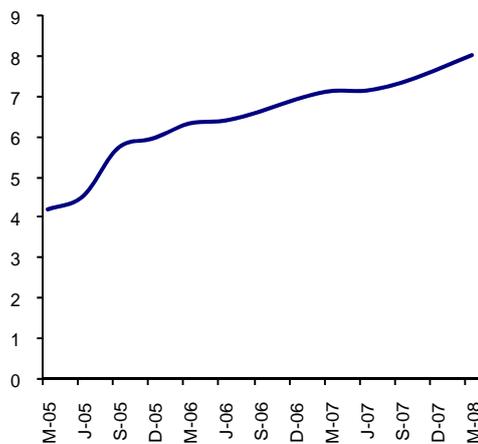
Source: Banco de Mexico.

The rapid adoption of SPEI and the increasing number of low value transactions are expressions of the growing penetration of electronic payments in Mexico. This is related to the rising access of accountholders to perform transactions over the internet who have the ability to carry out SPEI transactions directly (see Figures 2a and 2b). In the last case, there seems to be a network externality effect over the total number of SPEI transactions since a new accountholder can send and receive transfers to and from all the other previously existent account holders.

Figure 2

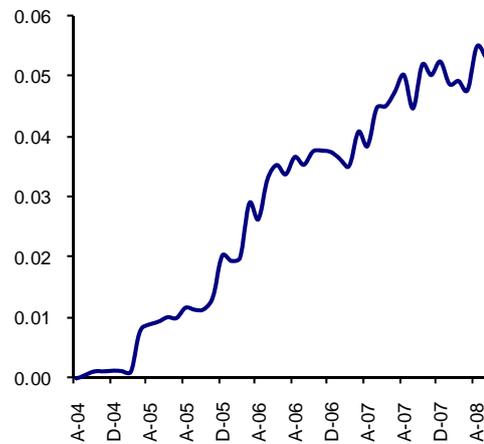
a) Accountholders that perform electronic transfers over the internet

Million accountholders



b) SPEI monthly transactions per account

Transactions

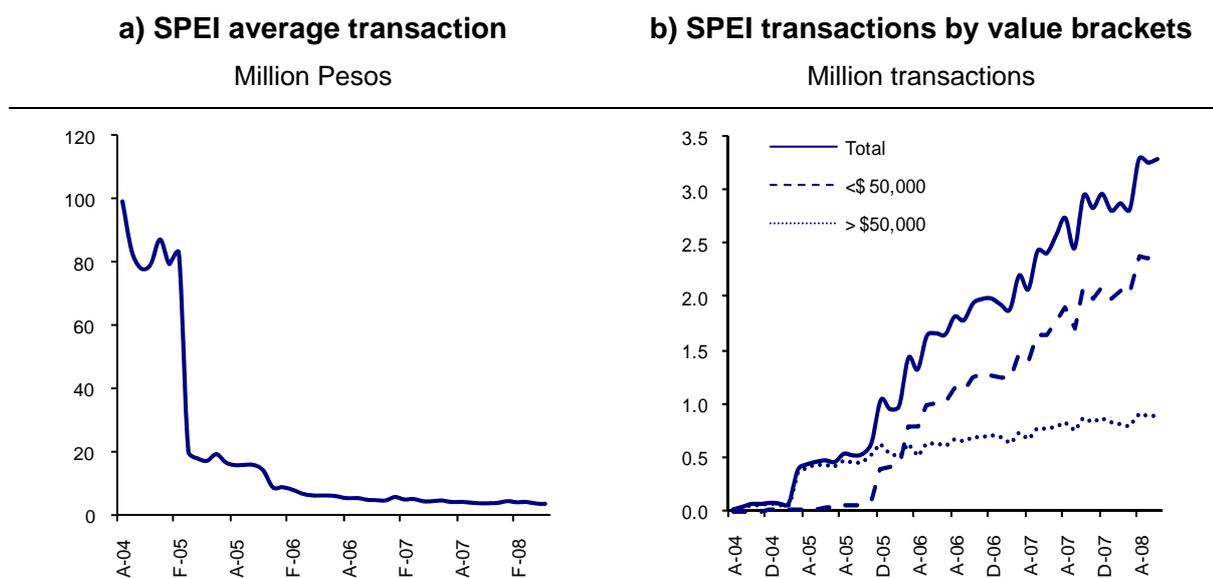


Source: Banco de Mexico.

Given that low value transactions are taking off, the average transaction value of SPEI has dramatically decreased. The mean value depicted in Figure 3a is still high since some very large value transactions are sent through SPEI. However, transactions over 1 million pesos only represent 10% of total number of processed operations.

The rate of adoption is heterogeneous across transaction value brackets; while low and medium value transfers are showing the highest growth rates, large value transactions are growing at stable rates. That is, the adoption process of high value transactions in SPEI occurred almost instantaneously; however, low value transactions are still being adopted at high rates (see Figure 3b). This can be attributed to the fact that high value transactions are mainly carried out between institutions while personal transactions tend to be low value.

Figure 3



Source: Banco de Mexico.

3.1 The relevance of electronic payments in Mexico

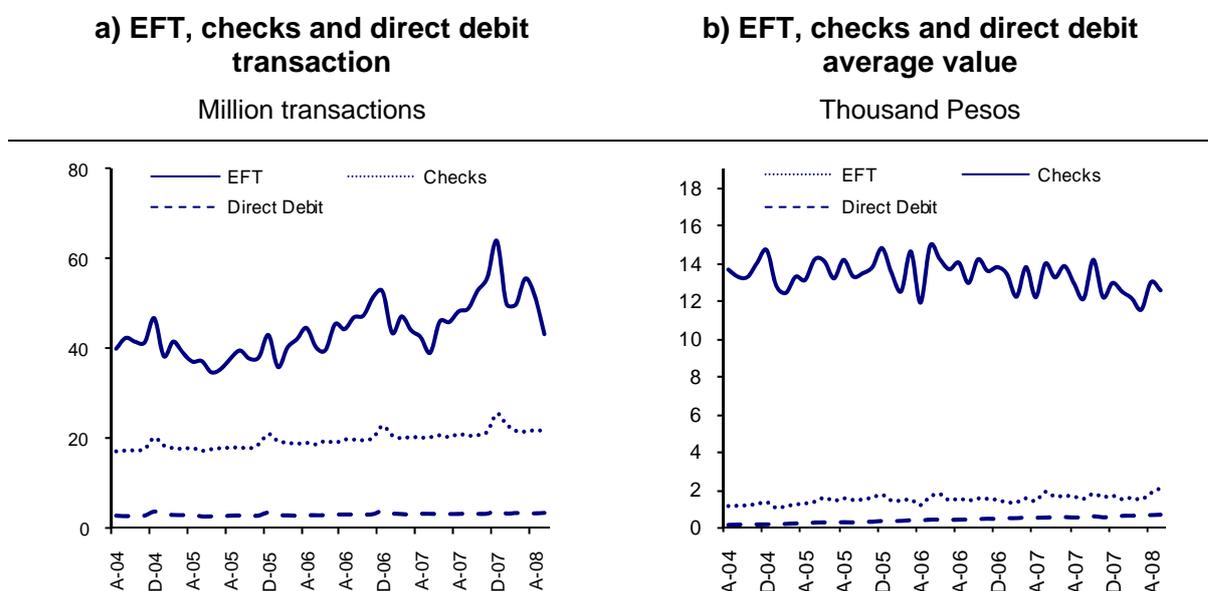
Not all payment mechanisms are close substitutes. For instance, in Mexico bank cards cannot be considered good substitutes of checks because the latter are generally not accepted at points of sale. Therefore, in order to study SPEI's adoption, we restrict our scope to those payment mechanisms that could be its closest substitutes; that is, direct debits¹² and deferred electronic transfers (EFT)¹³ among the electronic payments and checks among the paper based payments.

¹² Direct debit is a transaction instructed in advance by the accountholder that authorizes his bank to transfer a fixed amount of money to a predefined account (beneficiary's account) at the request of the beneficiary's bank. In Mexico, direct debits, checks and EFT are registered and compensated by a privately run Automatic Clearing House (Cecoban S.A. de C.V.), but the settlement takes place in a system run by BM, SIAC, one day after they are sent, on the basis of the information sent by Cecoban.

¹³ EFT is a system of deferred transfers of funds between clients of different banks which is particularly useful for payroll distribution. In this case, the account of the client that sends the payment is immediately affected, although the money is not credited in the account of the transfer recipient until next day.

Electronic payments have been on an expansion path in the current decade; simultaneously, transactions performed with checks have remained stagnant. Despite the noticeably higher growth rate of electronic payments, checks are still the single most used mechanism.

Figure 4



Source: Banco de Mexico.

If the transactions made with SPEI, EFT, direct debit and checks were expressed as percentage of total operations performed with these mechanisms, SPEI would register the most dynamic behavior, accounting for 13.9% of the total at the end of 2007 after representing only 2.9% in 2005. Furthermore SPEI seems to be substituting the usage of checks whose participation has fallen equivalently (see table 1) while the percentage of payments performed with EFT remains quite stable. The latter may be related to the fact that some banks still tend to promote the use of EFT over SPEI for certain transactions, in order to keep the float for a day.

Table 1

Percentage of payments

Year	SPEI	EFT	Direct Debit	Checks	Total
2005	2.9	8.8	1.6	86.6	100.0
2006	9.3	8.5	2.4	79.7	100.0
2007	13.9	8.9	3.1	74.1	100.0

Source: Banco de Mexico.

It is relevant to contrast the importance of SPEI in Mexico with similar systems in other countries. Comparing first with other Latin-American countries of similar development, the penetration of SPEI measured by the value of transactions as a proportion of GDP is similar to that of large value payments in Chile and higher to equivalent systems in Brazil and Argentina. Nonetheless, compared to large value payments in developed countries, SPEI's penetration remains rather low.

Table 2

Large value payments

Value of transactions as a percentage of GDP (in %)					
Country	2002	2003	2004	2005	2006
Belgium					
ELLIPS	4,983.60	4,935.10	5,065.80	5,718.60	6,136.50
France					
TBF	5,891.90	6,040.00	6,530.10	7,096.60	7,542.80
Germany					
RTGSplus	5,822.40	5,940.60	5,714.80	6,170.30	6,492.80
Italy					
BI-REL	1,941.70	1,854.20	2,019.00	2,310.60	2,559.50
Japan					
BOJ-NET	3,672.40	3,828.40	4,098.60	4,314.10	4,985.00
FXYCS	1,246.90	982.9	863.4	801.9	868.8
Netherlands					
TOP	5,363.70	5,509.90	6,042.90	6,031.00	5,989.40
Singapore					
MEPS	6,335.50	6,125.80	5,458.80	6,478.40	6,627.60
Sweden					
E-RIX	60.6	75.4	68.1	76.3	63.9
Switzerland					
SIC	10,305.00	10,204.20	9,289.10	8,854.60	9,221.60
United Kingdom					
CHAPS Euro	2,403.60	2,689.50	2,704.70	2,985.00	3,240.80
CHAPS Sterling	4,537.90	4,560.00	4,373.20	4,210.10	4,478.60
United States					
Fedwire	3,875.60	4,081.30	4,098.50	4,170.40	4,340.00
European Union					
TARGET	5,467.00	5,681.20	5,788.00	6,155.70	6,418.90
Mexico					
SPEI	-	-	-	1,251.88	1,425.27
Argentina					
MEP	172.66	205.22	237.43	261.49	275.65
Brazil					
SITRAF	n.a.	52.43	104.14	127.07	121.23
Chile					
LBTR	n.a.	n.a.	1,267.12	2,100.17	986.67

Sources: BIS. Statistics on payment and settlement systems in selected countries. Committee on Payment and Settlement Systems of the Group of Ten Countries, Banco de México, INEGI, Brazil Central Bank, Argentina Central Bank, Chile Central Bank.

4. The regulation and measures adopted by BM to promote SPEI

The legal framework that justifies BM activism in SPEI's promotion comes from three laws: BM Law, the Payment Systems Law (PS Law) and the Law of Transparency and Financial Services Restructuring (LTOSF). The mandate of this set of laws is such that BM has a responsibility not just with the deployment of payment systems, but with the design of an efficient payments industry.

BM Law provides it with the authority to regulate the payments industry and to promote the usage of the most efficient payment means. This law states as one of BM's main purposes "...promoting the sound development of the financial system and fostering the proper functioning of payment systems" (Art. 2). Additionally, in December 2002, the PS Law was

promulgated, giving BM powers to oversee and supervise the administrators of the systemically important payment systems, in order to assure their proper functioning (Art. 19).

The LTOSF is mainly directed towards the protection of consumers of financial services. This law states that BM is “entitled to regulate commissions ... charged by financial entities in order to promote the proper functioning of the payment systems” (Art. 4).¹⁴ From BM’s perspective, SPEI is the most secure and efficient payment mechanism; since it does not have a minimum payment limitation, it can be used to perform almost any transaction; that is, the difference between large and retail payments is blurred in this system. BM has adopted regulatory measures and promoted agreements between agents to foster SPEI, in order to achieve a more efficient payment industry; to that effect, it has used or threatened to use, the regulatory powers provided by the law (Negrin, 2005).

Within the above legal context, the intervention of BM has addressed several issues that may have affected SPEI’s adoption. BM set standards in order to facilitate banking interconnection; it has tried to make SPEI more attractive for banks and consumers through cost and price reductions, and it has attempted to level the playing field between participants by granting direct access to SPEI to non-banks. It is worth mentioning that these efforts are inscribed in the reform process that BM launched in 2004 in order to encourage the use of the most efficient payment systems and to foster banking competition (Negrin, 2005, Ortiz, 2005). In the following paragraphs we review different measures adopted by BM that may have affected SPEI’s adoption. We then identify those measures whose impact will be analyzed in the econometric model.

One of the main problems that the development of electronic payments has faced in Mexico is bank’s reluctance to adopt intercommunication standards. Even though SPEI’s formats always included information so that the receiver of the transfer could easily identify the sender, banks were not sending or processing that information. This was also due to the fact that in some other services receiving banks used to charge the receiver for identifying the sender. This situation hindered the adoption of SPEI since the lack of identification standards caused many transactions to be rejected. Therefore in July 2005, BM issued a regulation that forced banks to identify the sender of the transaction and to provide that information to the recipient, free of charge, over the internet and in written statements. It is relevant to mention that in SPEUA banks were neither forced to get identification information from the sender nor to provide it to the receiver.

SPEUA imposed a minimum transaction amount for transfers that went through it.¹⁵ On technical grounds SPEI did not require such a limit; however, banks needed time to set up their infrastructure in order to carry the larger volume of transfers expected by allowing transactions of lower amount. Therefore, they did not permit their customers to send payments lower than 50,000 pesos, disallowing low-value transactions to be sent through SPEI.¹⁶ Once BM considered that the adjustment period had passed, it agreed with banks to remove such constraint in SPEI transfers.¹⁷ Despite this, BM detected that some banks kept on setting minimum transfer restrictions and issued regulation that, forced banks to eliminate such limits by February 2007. Again, this regulation has been fundamental in SPEI’s

¹⁴ In Mexico there is a Commission for the Protection of Financial Services’ Consumers (Condusef). However, this commission has no regulatory powers. Its main function is to protect consumers from banks’ abusive practices, by providing them with information, free legal advice and by mediating with the banks (Condusef Law Art. 5).

¹⁵ Such limit was declining over SPEUA’s life time. In the end the minimum transfer was set at 50,000 pesos.

¹⁶ These transfers were processed by EFT and settled one day after they were sent.

¹⁷ Banks started to allow transactions below 50,000 pesos at different times. However, from December 2006 on, it’s clear that all banks had adopted this agreement.

adoption process because it has greatly widened the transactions that may be carried out through the system.¹⁸

Another relevant barrier to SPEI's adoption has been the way banks price these transactions. Not only were SPEI prices for final customers unrelated to the cost of the transaction for the issuing bank, but they were much more expensive than substitute payment mechanisms like EFT and checks. In 2005, sending a SPEI transfer was almost 10 times more expensive than issuing a check and twice as expensive as sending an EFT (Castellanos et al, 2008). Moreover, banks usually offer a number of free of charge transactions with checks. It has been found that this kind of price distortion acts as an obstacle for checks replacement in other countries (Humphrey, et al, 2000).

BM and the largest banks in the system agreed that it was necessary to correct this distortion, considering that SPEI transfers are much more efficient than alternative payment mechanisms. Therefore, in March 2006 the largest banks decided to set a cap of 11 pesos on the price of SPEI transfers whose value was under 100,000 pesos, provided the transfer was instructed via Internet. It is important to point out that this does not represent a price agreement because each bank sets its own price under the constraint that it could not be higher than the 11 pesos ceiling; this can be confirmed in table 3. The rest of the banks followed through in this agreement by May of 2007.

There are several other measures that were not expected to have a large impact on adoption, but that were necessary in order to increase efficiency and to enhance competition in financial markets in general; they are described below.

In order to promote SPEI's usage among banks, BM has reduced the fees it charges to them. In the first place, the per transaction fee charged to the sender was reduced from 1 to 0.5 pesos in April 2006. Moreover, in February 2008 the system started receiving payment instructions during the night charging for them 0.1 pesos per transaction. Secondly, the annual fixed fee charged to participating institutions was eliminated in January 2008. As a consequence, it was expected that the reduction in costs would make SPEI more attractive for banks. Notice that these measures will only have an impact on SPEI's adoption by customers to the extent that they are passed on to final prices.

In terms of participation, when SPEI was conceived, only banks were allowed to be a part of it. Therefore, non-bank financial institutions could only participate in the system through a bank. This put financial institutions other than banks at a competitive disadvantage since charges for their transactions were set by their banks. In order to remove this competitive barrier, BM issued a regulation in May 2006 to allow the direct participation in SPEI of non-bank institutions such as stock brokers, insurance companies, exchange dealers, investment societies, pension funds administrators (Afores) and other non-bank financial institutions (Sofoles y Sofomes). As of June 2008, 29 non-bank institutions participated in SPEI. The regulation states that non-banks are subject to almost the same rules as banks in their participation in SPEI; nonetheless they are free to decide whether or not to participate in the system. It is important to indicate that this measure is not expected to have a large impact on adoption since most non banks were already sending their transactions by SPEI and its main impact is expected to be on competition. In fact, non-bank institutions originate less than 3% of the total number of transactions.

¹⁸ Additionally, a bilateral agreement that was used to send transfers between the two largest banks was eliminated since it infringed the LTOSF.

Table 3
SPEI's fees

Bank	Personal Accounts		Firms' Accounts	
	Less than 100,000 pesos	Greater than 100,000 pesos	Less than 100,000 pesos	Greater than 100,000 pesos
ABN AMRO	*	*	10	10
Afirme	11	50	11	50
Azteca	11	11	24	24
Bajío	11	60	11	60
Banamex ^{1/}	10	10	10	10
Banjercito	7	30	7	30
Bank of America	*	*	from 2.50 to 11	from 12 to 85
Banorte	5.5	5.5	5.5	75
Banregio	0	0	3	75
Bansi	0	0	0	0
BBVA Bancomer	7	80	8	80
Inbursa ^{2/}	0/10	0/10	10	10
IXE	10	50	10	50
Mifel	11	70	11	70
Monex	5	5	5	5
Santander	5	5	5	50
Scotiabank	10	50	10	50
Tokyo	15	15	15	15

Bank	Personal and Firms' Accounts			
	Less than 50,000 pesos	From 50,000 to 100,000 pesos	From 100,000 to 1 million pesos	Greater than 1 million pesos
Bx+	0/25	0/75	0/75	0/75
HSBC	5.5	11	35	40

Figures at October 2007 in Mexican pesos.

Source: Information provided by the institutions.

* The bank does not offer the service.

1/ The fee charged on personal accounts is a monthly payment that allows to perform an unlimited number of transfers while the fee charged on firm accounts is per transaction.

2/ The personal account "Inbursa CT" does not charge a fee on SPEI. The rest of the accounts offered by the bank charge a fee of \$10 per transaction.

Finally, BM started to offer a free of charge service in its web page ("MI SPEI") that allows SPEI's users to track the status of their transfers. There are two tracking numbers that can be used in MISPEI: a number provided by the accountholder at the time of issuing the transaction or a number provided by the issuer institution once it accepts the instruction. As a result users know immediately the time when the transaction enters the system, when it is sent to the recipient's bank and whether the transaction could be completed. Table 4 presents a summary of the measures adopted and described throughout this section and its starting date.

Table 4

Start date of measures adopted

Measures Adopted	Start date
SPEI enters	August 04
SPEUA shuts down	March 05
Generalized provision of SPEI through Internet	July 05
Sender identification standard set	
Price cap agreement	March 06
Fee's reduction to 0.5 pesos	April 06
Non-banks entry to SPEI	May 06
Introduction of MISPEI	Sep 07
Remotion of fixed fee	January 08

Source: Banco de Mexico.

5. Methodology and data

In order to describe the adoption of SPEI and to measure the impact of the regulations that BM has taken, we use a logistic model which depicts the adoption process as a symmetric S-shaped curve. This type of model has been frequently used to describe the adoption process of innovations. In this model, adoption rates are low in the immediate period after the innovation is introduced, followed by a period of rapid growth and, finally, there is a phase of stable adoption rates until the innovation reaches its saturation point.

Geroski (2000) asserts that the S-shape of the adoption process can be explained by the epidemic and the probit models. In the first of them adoption is an increasing function of the information available about the technology, which in turn, will be a positive function of the number of adopters. This implies that early adopters provide non-adopters with information about the new technology and its benefits. As adoption increases, the number of non-adopters decreases and as a result the growth rate of adoption declines and approaches the maximum number or proportion of potential adopters. This model also assumes that early adopters need very little information to start adopting the innovation.

The Probit model assumes that different firms or individuals decide to adopt at different times. Thus, in order for a person to adopt a new technology, she must satisfy a minimum value of some variable (for instance, income) and assumes that such characteristic is distributed among the population as a normal random variable. As the minimum value required decreases (for example because it is cheaper to adopt the innovation), a greater proportion of the population decides to adopt; however the bell shaped distribution implies that the growth rate will tend to increase approaching the maximum and will decrease from that point on. Thus, adoption is characterized by an S-shaped curve.

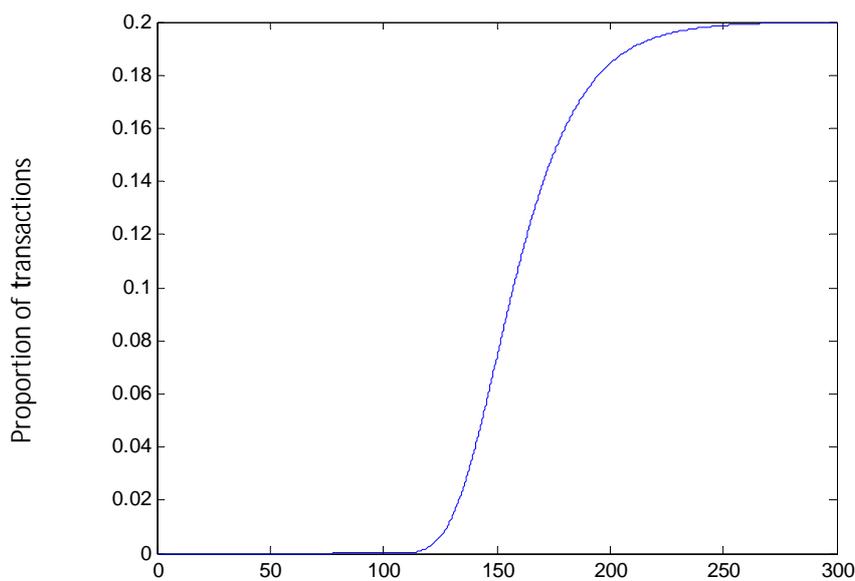
In terms of the payments, a logistic approach was followed by Snellman and Vesala (1999) to forecast the "electronification" of payments in Finland. They applied the S-shaped learning curves to several transaction types and found that the S curves fit the data well and, among other things, that cash displacement in Finland was getting close to its saturation point. However, Jyrkönen (2004) found that when the time series analyzed is extended for the case of Finland, no S shape is visible; she then proposes dynamic regression models to forecast the electronification process.

Given that any amount may be sent through SPEI, this system can be considered a substitute for direct debits, t+1 EFTs and checks. These non-cash payment options constitute the universe of transactions where SPEI's importance is defined.

The functional form of the logistic curve is presented in equation (1) and Figure 5 shows a typical curve.

$$S_t = \frac{a}{1 + c \exp(-bt)} + e_t \quad (1)$$

Figure 5
Logistic curve



In equation (1) S_t is the proportion of transactions carried out with SPEI, calculated as the number of SPEI transactions over the total number of possible substitute payments; the latter is the sum of direct debits, electronic transfers (including both SPEI and EFT) and checks. In other words, S_t is the fraction of SPEI adopters over the total number of possible transactions (adopters plus non-adopters).

In the logistic curve presented above a is an asymptote of S_t ie $\lim_{t \rightarrow \infty} S_t = a$. This implies that

as time passes, the adoption process converges to a saturation point a . Furthermore, the parameter c is the inflection point of the S-curve, thus it shifts the curve back and forth without changing the shape, ie it can increase or decrease the period at which the maximum rate is achieved. The parameter b determines the slope of the curve or the rate of adoption in the following way:

$$\frac{dS_t}{dt} \left(\frac{1}{S_t} \right) = b \left(\frac{a - S_t}{a} \right)$$

The rate of adoption showed above reaches its maximum at the inflexion point and tends to zero as the proportion of adopters approaches the saturation point.

In order to model the adoption of SPEI, we apply this methodology to two different datasets in order to obtain the three parameters described above. We test several hypotheses both, at the industry aggregated level and at the individual banks level.

The first dataset encompasses monthly aggregated information of the number of SPEI transactions. The dependant variable that we used is the fraction of the number of SPEI transactions over the total number of non-cash non-POS transactions number.

The second dataset comprises quarterly information of SPEI transactions number, disaggregated at the bank level, from March 2006 to March 2008. This data set includes eight banks that account for more than 80% of the total transactions processed in the system.¹⁹ As it will be mentioned later, the fact that only quarterly information is available implies that we cannot test the individual impact of all the regulations that we have identified, since in some cases more than one regulation was adopted during the same quarter. With this data set we will test if the process of adoption varies across banks and if regulations affect banks in a differentiated manner.

In both types of estimations we analyze the impact that several regulations had over the saturation point (the proportion of SPEI transactions performed in the long run), the adoption rate and the inflexion point. Furthermore, in line with Snellman and Vesala (1999) we use the proportion of the number of transactions and not the proportion of the value because the efficiency of the payment system is better reflected by the number of transactions it handles. Transaction value does not bear relationship with the amount of the resources needed to process such payments.

In order to assess the effect of regulation passed by BM at the aggregate level, parameters **a** and **b** and **c** are estimated in the following way:

$$a = \beta_i X_i + \delta_j D_j$$

$$b = \gamma_i X_i + \varphi_j D_j$$

$$c = \phi X_i + \kappa_j D_j$$

Where, X_i are control variables obtained from the growth rate of accounts (demand control variables), and D_j is a vector of dummy variables that defines the months in which regulations were first put in place, that is:

$$D_j \begin{cases} 0 & \text{if } t < t^* \\ 1 & \text{if } t \geq t^* \end{cases}$$

where t^* denotes the month when each regulation started.

At the bank level a_i (the saturation point for bank i) is defined in two alternative ways:

$$a_1 = a_k B_k + \beta_i X_i + \delta D$$

$$a_2 = a_k B_k + \beta_i X_i + \delta D + \lambda_k B_k D$$

And the rate of diffusion and the inflexion point are specified in the following way

$$b = b_k B_k + \delta D + \gamma X_i$$

$$c = \delta D + \phi X_i$$

At the bank's level B_k stands for dummy variables that identify each of the banks included. These parameters capture any omitted variable at the institution level related to the adoption

¹⁹ We included the 6 largest banks plus two smaller institutions that promote the performance of transactions through the internet and that are oriented to high income clients.

of SPEI such as the degree of sophistication of clients or the Internet infrastructure offered by each institution.

In a_1 we let the effect of the regulation be the same across banks, while in a_2 the impact of the regulation could vary across institutions.

At first glance, prices seem to be a rather relevant variable for the adoption process. However, we did not include them in the models because the series of maximum SPEI prices that we have (at the bank level), does not show enough volatility to be of any relevance.

As we have mentioned, SPEI was introduced in August of 2004. Up until March 2005 SPEI and SPEUA were simultaneously functioning; therefore SPEI could not be adopted completely even for the transactions carried out by SPEUA until then, which were mainly institutional. Moreover, SPEI could not be adopted by final users until identification standards were set, in July 2005; approximately at the same time, during June and July of 2005, banks started the provision of SPEI through their internet sites.

We consider that it was not until these institutional conditions were met – identification standards and internet provision – that SPEI could be adopted by the typical bank clients. Before that, SPEI did not really have a chance to become a massively used payment mechanism. Consequently, our adoption analysis is restricted to the period March 2005 to August 2008.

During this period several institutional changes and regulations were adopted aiming at fostering SPEI's usage, as we mentioned in section 4. Some regulations were not expected to have a considerable impact on adoption, like the reduction in the fees that BM charges to banks; therefore, we mainly consider two measures empirically:²⁰

1. Removal of the minimum amount to send a transaction through SPEI (starting from December 2005).
2. Banks' agreement to impose a cap on SPEI's fee (adopted in March 2006).

At the aggregated level, since we use monthly data, both measures were tested separately; nevertheless, at the bank level where we only have quarterly data, we tested the joint effect of both measures given that they occur during the same quarter.

Given the Jyrkönen (2004) criticism of the use of a logit model to represent electronic payments adoption, it is necessary to justify the usage of an S-shaped function for the analysis of SPEI's adoption in Mexico. In other words, we need to show that the process presents an S shape during the properly defined period of analysis.

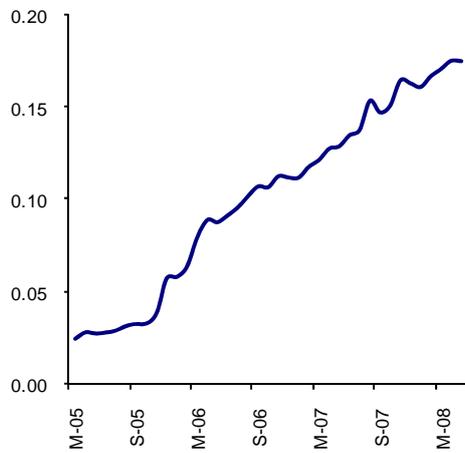
The following Figures show that starting from July 2005, when the standards of identification were properly set and clients could perform SPEI transactions over the internet, there is first a lower adoption rate and then it increases from January 2006, achieving a maximum value in July 2006. After that period the growth rate starts to decrease. This behavior is in line with the logistic model we propose.

²⁰ We did test all other regulations and they had no significant impact on adoption.

Figure 6

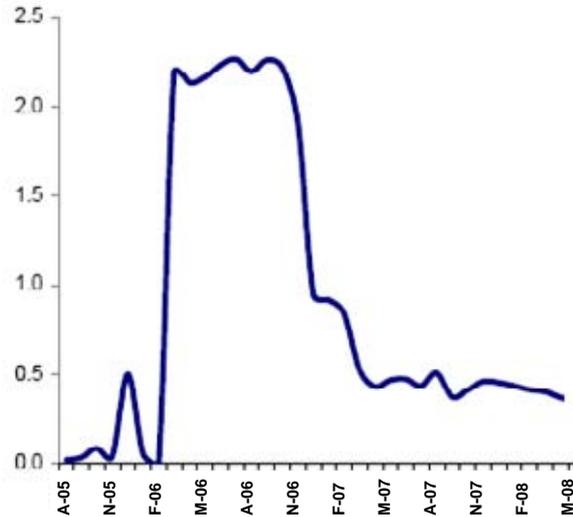
a) Proportion of Transactions Performed with SPEI

Proportion of payments



b) Growth Rate of the Proportion of Transactions Performed with SPEI

%



Source: Banco de Mexico.

Basic statistics for the variables used in the different models are shown in table 5. The variable of interest, the proportion of transactions with SPEI, has a mean of 11% and achieves a maximum value of 17.4% at the end of the period.

Table 5

Descriptive statistics of variables included in the model

Variable	Mean	Standard deviation
Proportion of Transactions with SPEI	0.11	0.04
Growth Rate of the Economic Activity (%)	3.94	1.95
Growth Rate of Accounts	0.01	0.02

Source: Own calculations with information provided by Banco de Mexico, INEGI and CNBV.

Finally Table 6 presents the variable of interest disaggregated at the bank level. From it is clear that institutions show different levels of adoption. This may be caused, among others, by the quality of the internet service provided and the degree to which banks promote SPEI transfers.

Table 6

Proportion of transactions performed with SPEI by institutions

Institution	Mean	Standard Deviation
Bank1	0.13	0.02
Bank2	0.05	0.02
Bank3	0.16	0.03
Bank4	0.03	0.00
Bank5	0.05	0.02
Bank6	0.11	0.02
Bank7	0.06	0.02
Bank8	0.17	0.05

Source: Own calculations.

6. Results

At the aggregate level we found that both the agreement that set up a cap to SPEI's price and the measure that allowed low value transfers to go over SPEI had a positive and significant effect on the proportion of transactions carried out with SPEI in the long run (saturation point). At the bank level, we found that adoption across banks is a heterogeneous process that strongly depends on banks' characteristics, such as their internet infrastructure and client type (level of income, education, etc.). We also found a positive and significant effect on the saturation point of the agreement on SPEI's price and the possibility to send low value transactions.

Tables 7 and 8 present the estimation results at the aggregate level, where the dependent variable is the proportion of transactions carried out with SPEI over the total number of transactions. The difference between both is that the model included in the latter control for demand variables. Table 7 presents in Column I the basic specification where the adoption process is only a function of time. In this model the three parameters are significant and have the expected positive signs; the saturation point (a) is reached at 17% of the total transactions and the growth rate (b) is positive. Finally, the inflexion point (c) is reached 23 months after July 2005. This model constitutes the point of reference for the rest of the estimations.

Columns II, III and IV test the separate effects of the regulations over the saturation point, the rate of adoption and the inflexion point, respectively. Model II shows that the agreements that set a price cap and removed the minimum transaction value had a positive and significant effect on the saturation point. This implies that this measure tended to increase the maximum proportion of transactions performed with SPEI from 12% to almost 24%. Additionally, as can be seen in the second column of Table 8, this result is not changed by the introduction of demand related variables.

In model III we found that both measures had a negative effect on the adoption rate, which implies that these regulations tended to slow down the process. This could be attributed to the fact that the adoption of low value transactions (favored by both measures) occurred later and at a slower pace compared to high value transactions.

Finally, model IV shows that the effect of the measures on the inflexion point is negative and significant. This implies that as a result of the agreements the maximum rate was achieved at an earlier period.

Table 7
Results at the aggregate level

Variables	I		II		III		IV	
Saturation point	0.17	***	0.12	***	0.27	***	0.24	***
Rate of adoption	0.13	***	0.07	***	0.10	***	0.07	***
Inflexion point	23.44	***	30.40	***	34.08	***	43.20	***
Effect of measures on the saturation point								
No minimum value of transactions			0.04	**				
Price reduction			0.08	***				
Effect of measures on the rate of adoption								
No minimum value of transactions					-0.02	***		
Price reduction					-0.02	***		
Effect of measures on the inflexion point								
No minimum value of transactions							-4.21	**
Price reduction							-8.44	***

*Significant at the 10%, **significant at the 5%, ***significant at the 1% level.

In Table 8 we present the same model but we control for the effect that demand variables (the growth rate of the economic activity and of the number of bank accounts) may have over the three parameters of interest mentioned before.

The sign of the effect of the measures is not different to the one presented in the previous tables, since in many cases demand variables turned out to be non-significant. This result could be due to the fact that these variables may tend to affect all transactions in a very similar way leaving unchanged the ratio of transactions performed with SPEI.

Table 8
Results at the aggregate level including demand variables

Variables	I		II		III		IV	
Saturation point	0.20	***	0.16	***	0.32	***	0.29	***
Rate of adoption	0.10	***	0.06	***	0.08	***	0.06	***
Inflexion point	28.39	***	34.55	***	42.04	***	48.51	***
Effect of measures on the saturation point								
No minimum value of transactions			0.04	*				
Price reduction			0.07	***				
Effect of measures on the rate of adoption								
No minimum value of transactions					-0.02	**		
Price reduction					-0.02	**		
Effect of measures on the inflexion point								
No minimum value of transactions							-3.68	*
Price reduction							-7.84	**
Effect of demand variables on the saturation point								
Growth rate of the economic activity	-0.11		-0.35		-0.72		-0.60	
Growth rate of accounts	-0.01		-0.01		-0.02	***	-0.01	
Effect of demand variables on the rate of adoption								
Growth rate of the economic activity	-0.14		-0.18		0.12		-0.04	
Growth rate of accounts	0.01	*	0.00		0.01	***	0.00	
Effect of demand variables on the inflexion point								
Growth rate of the economic activity	-16.31		-33.54		-79.01		-63.40	
Growth rate of accounts	-1.01	**	-1.17		-2.70	***	-1.43	

*Significant at the 10%, **significant at the 5%, ***significant at the 1% level.

Results at the bank level are presented in Table 9. Column I presents the basic model that includes dummy variables to allow for the saturation point and the growth rate of transactions to vary across institutions. In order to avoid perfect multicollinearity of dummies, we excluded one institution. The excluded institution is a small modern bank which mostly serves high

income clients. Thus we expect the customers of this bank to have a higher and faster adoption process than that experienced by the clients of other banks.

Model II adds to the first model the effect of the regulation on the saturation point as a homogenous effect on all banks controlling for demand variables. The results show that the combined effect of measures that capped the price and allowed accountholders to send low value transactions had a positive effect on the proportion of transactions performed with SPEI. Furthermore, almost all dummies included at the bank level affecting the saturation point and the rate of adoption are significant, which supports the idea that banks have different adoption curves. In this sense, banks with better infrastructure to perform transactions over the internet tend to have higher saturation points.

Columns III and IV show the effect of regulation on the rate of adoption and the inflexion point, respectively. As can be observed, the combined effects of measures tended to decrease the rate of adoption; while the effect on the inflexion point is not different from zero.

Finally, column V shows a model where the timing of measures is interacted with banks' dummies, allowing for the effect of measures on the saturation point to be different across banks. The results show, that at least for two banks, it seems plausible to assert that policy measures affected banks' saturation point in a differentiated and positive way.

Table 9
Results at the bank level

Variables	I		II		III		IV		V	
Saturation point	0.22	***	0.20	***	0.22	***	0.24	***	0.22	***
Rate of adoption	0.66	***	0.61	***	0.75	***	0.39	***	0.64	***
Inflexion point	2.14	***	2.06	***	2.09	***	3.12	***	2.12	***
Effect of measures on the saturation point										
Measures			0.02	**						
Measures*bank1									0.04	**
Measures*bank2									0.02	
Measures*bank3									0.03	
Measures*bank4									-0.02	
Measures*bank5									0.02	
Measures*bank6									0.09	***
Measures*bank7									-0.04	
Effect of measures on the rate of adoption										
Measures					-0.22	**				
Effect of measures on the inflexion point										
Measures							-0.90			
Effect of demand variables on saturation point										
Growth rate of the economic activity			0.00						0.00	*
Growth rate of accounts			0.00						0.00	
Effect of demand variables on the rate of adoption										
Growth rate of the economic activity					0.00					
Growth rate of accounts					0.01	*				
Effect of demand variables on the inflexion point										
Growth rate of the economic activity							-0.04			
Growth rate of accounts							0.05			
Saturation point's dummies										
Bank 1	0.01		0.01		0.01		-0.01		-0.02	
Bank 2	-0.15	***	-0.14	***	-0.15	***	-0.16	***	-0.16	***
Bank 3	0.05	***	0.05	***	0.05	***	0.04	***	0.03	*
Bank 4	-0.16	***	-0.16	***	-0.17	***	-0.18	***	-0.15	***
Bank 5	-0.14	***	-0.14	***	-0.15	***	-0.16	***	-0.16	***
Bank 6	-0.04	***	-0.04	***	-0.04	***	-0.06	***	-0.10	***
Bank 7	-0.14	***	-0.13	***	-0.14	***	-0.15	***	-0.10	***
Rate of adoption's dummies										
Bank 1	-0.55	***	-0.52	***	-0.47	***	-0.29	***	-0.57	***
Bank 2	-0.21		-0.23		-0.14		0.00		-0.27	
Bank 3	-0.48	***	-0.45	***	-0.40	***	-0.24	***	-0.50	***
Bank 4	-0.67	***	-0.66	***	-0.57	***	-0.38	***	-0.58	***
Bank 5	-0.20		-0.23		-0.14		-0.02		-0.26	
Bank 6	-0.51	***	-0.49	***	-0.43	***	-0.25	**	-0.59	***
Bank 7	-0.32	*	-0.31	*	-0.23		-0.10		-0.22	

*Significant at the 10%, **significant at the 5%, ***significant at the 1% level.

7. Final comments

Banco de México has taken steps to set up an institutional environment free of obstacles for SPEI's adoption. As claimed by Snellman and Vesala (1999), in a favorable institutional environment, the adoption of electronic payments may advance very fast, as depicted by a sigmoid function. Moreover, the adoption process will not reach its potential unless the barriers that may exist in the market are removed. In Mexico, standards have been set,

prices have been (partially) rearranged, and barriers to participation have been eliminated in order to permit SPEI's development. These policies seem to have been quite successful.

As a consequence, SPEI has changed from being a system oriented to very large value electronic transfers (like its predecessor SPEUA) to a system also used massively for relatively small value transactions. This has increased the efficiency of general payments in Mexico and improved the benefits to users of the service. As a clear piece of evidence of the increase in efficiency, in the structure of non-cash non-POS number of payments (which includes checks, direct debit, a t+1 electronic transfers service and SPEI), SPEI went from representing 2.9% in 2005 to 13.9% in 2007; checks went in the opposite direction when they passed from representing 86.6% of such payments to 74.1% during the same period. This represents a leap in efficiency not just due to the displacement of paper based transaction (checks) but a movement to use the most efficient electronic transfer mechanism (SPEI) which reduces the risks incurred in payments.

The main result of this research is that SPEI adoption is still going to keep on growing until it reaches the 23% fraction (now is 17.5%), which the model forecasts as the saturation point. Of course this estimation may change if other regulations that affect SPEI's adoption are implemented in the future. We find that the agreements and regulations put in place by BM and other participants have been very important in SPEI's adoption process; in particular, they have moved SPEI's saturation point by 6 percentage points. Of particular significance was the agreement between banks to reduce the distortion existent between the price of SPEI and the prices of its substitutes; banks did not agree on a price, but on a cap on SPEI transactions.

In terms of the differences across banks, we find that the process of adoption of SPEI is not homogeneous; banks with better internet infrastructure and higher income clients have superior adoption rates than banks that have decided to keep on running business mainly through their branches. Additionally we found that the regulation adopted affected banks in a differentiated manner.

Finally, we found that in most cases demand variables do not seem to be significant in SPEI's adoption. What this really means is that these variables affect all payment mechanisms in the same proportion, so that SPEI's importance among its substitutes does not increase as demand variable changes.

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Measuring the economic impact of private equity funds: the South African experience

Barend de Beer¹ and Zeph Nhleko²

1. Introduction

Private equity financing is undertaken for various reasons: from increasing the working capital base to restructuring the ownership and management of a business. In line with financial globalisation over the past few decades, the private equity industry has grown significantly both in value and geographic extension. This has raised concerns about the global impact of private equity and underlined the need to understand it well. With private equity funds increasingly flowing between developed and developing economies, important questions have emerged on the measurement and impact of private equity on employment, corporate strategy, financial markets and the macroeconomy in general.

This paper seeks to analyse the international landscape of the private equity industry alongside the corresponding developments in South Africa. The ultimate aim is to outline the measurement and economic impact of private equity in financial markets and for balance of payments purposes using the South African experience.

2. Structure of the private equity market

Over the past few decades, financial investors in developed countries have increasingly diversified their portfolios with a view to broadening their exposure to different sectors and regions within an ever-changing global financial arena, while still seeking higher returns on invested capital. This phenomenon was a main driver behind the formation of alternative and innovative asset classes such as private equity.

Private equity refers to medium- to long-term shareholder capital investment in private companies as opposed to publicly listed companies. The average lifespan of a private equity investment is ten years (Fourie, 2008). In its broadest sense, private equity encompasses various activities aimed at securing funds from investors, utilising those funds in a range of investment transactions and eventually delivering a superior return on investment to the investors. The overarching idea of private equity is thus to invest in companies that are not publicly listed or to delist traded companies through a negotiated process where the buy-out can be friendly or hostile, depending on whether or not the negotiation is with the party that has the controlling interest. The private placement of new shares or the sale of pre-existing shares by the controlling interest or minority shareholders characterises most private equity deals (Chandrasekhar, 2007).

Although various private equity models can be utilised, the model for a specific transaction is determined by the particular requirements of the issuers of private equity. Chandrasekhar (2007)

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identifies the distinguishing feature of such investors as their reliance on private equity experts to assess companies and deliver on expectations with probable success, rather than on criteria such as the relative performance of a security. Given the longer-term nature of private equity investments, investors generally require a higher return. Therefore, in most cases investors have the intention of acquiring a controlling stake in a company in order to influence the operational activities and performance of that company.

According to Prowse (1998), the growth in private equity is a very good example of how organisational innovation coupled with regulatory and tax structures can lead to increased interest and activity in a specific market. The primary purpose of private equity was initially to fund risky start-ups and provide management support for such start-ups. The private equity market has seen significant growth since the early 1980s and has become an important mechanism for channelling capital through national and international markets, and funding business activities at various stages of development. In general, however, the private equity market has received relatively little attention in academic literature compared with other financial innovations. This may partly be due to the nature of private equity transactions; information about which is not always easily accessible.

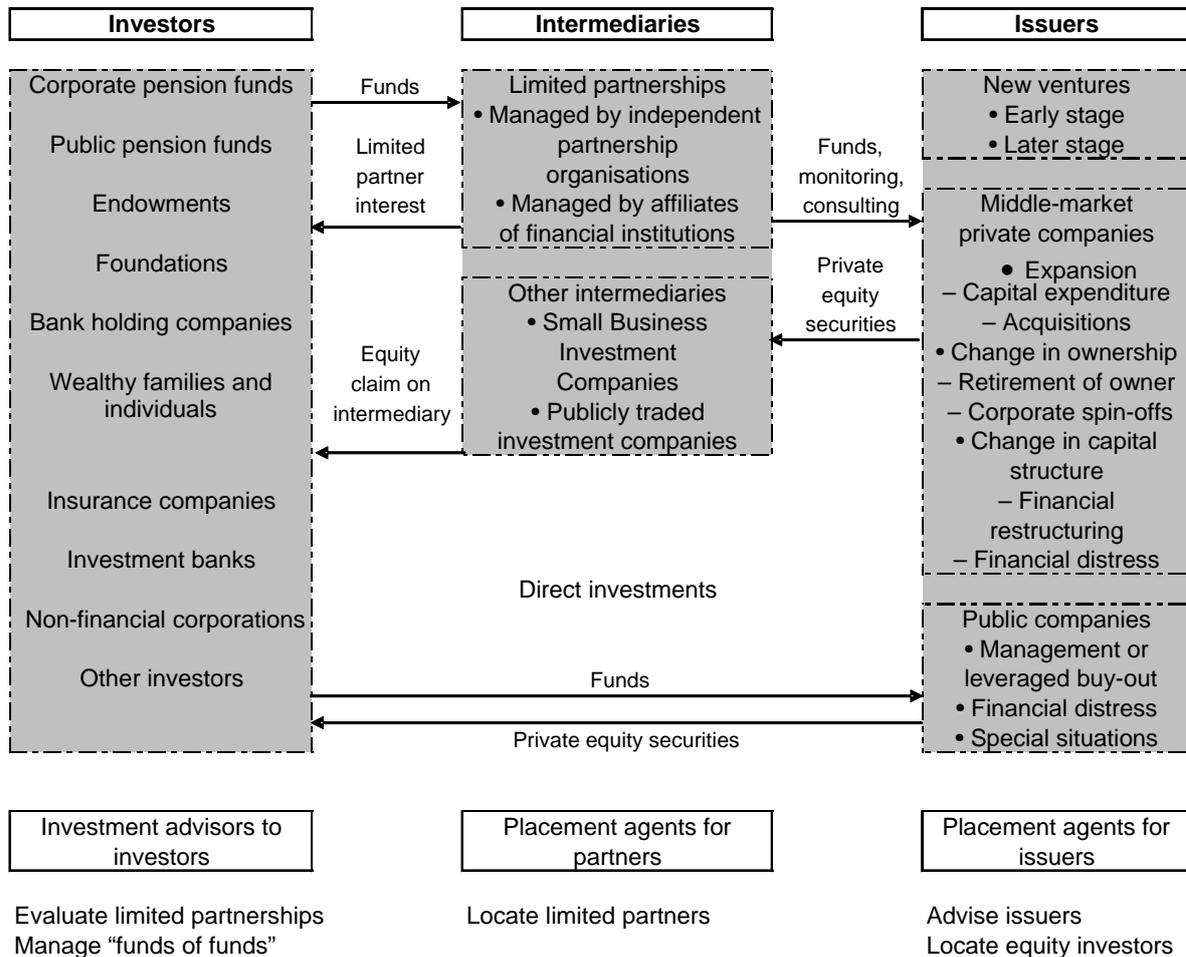
The basic structure of the private equity market is explained in Figure 1. The organised private equity market has three main role-players, namely (1) investors, (2) intermediaries and (3) issuers of private equity. The arrows in Figure 1 indicate the activity and the flow of that activity between the role-players. Pension funds, insurers and other investment companies are the main contributors on the investment side. The main reasons institutional investors may choose to invest via a private equity model is the expectation that risk-adjusted returns³ will be higher than on other investments, as well as the implied benefits that diversification into private equity brings into their overall portfolio. The relationship between the investors and intermediaries often takes the form of a partnership.

Partnerships generally consist of limited partners, who provide funding, and a team of professional general partners, who are actively involved in the sourcing of funds, investments and eventual management of the private equity investment. General partners or fund managers have a direct interest in developing and growing the business model, because they derive a return that is directly proportional to the growth of the business. Private equity companies that are affiliated to larger holding companies are known as “captives” and can be divided into various sub-categories, such as government and non-government captives. Intermediaries in developed nations are mainly made up of limited partners who manage approximately 80 per cent of private equity investments, while the developing nations utilise various other mechanisms for fund structuring due to a lack of legal structures that allow the establishment of limited partnerships (Lerner and Schoar, 2004).

³ This may be subjectively modelled from fund of fund.

Figure 1

Structure of private equity market



Source: Adapted from Prowse (1998).

The issuers (targeted investments) of private equity vary considerably in their size and motivation for raising funds through this channel. One of the common characteristics shared by smaller issuers is the difficulty they have in raising financing from debt or public equity markets, and they thus opt for the more expensive private equity market (Prowse, 1998). The last set of role-players in the private equity industry is the “information producers” or agents and advisors who advise on possible target companies, identify sources of funds for private equity partnerships and evaluate partnerships for potential investors. The three main private equity investment stages, as explained in Table 1, involve venture capital, development capital and buy-out funding.

Table 1

Private equity investment stages

Equity category	Stage of business development	Application
Venture capital	Seed capital, start-up and early stage	Funding for developing a concept, new or young businesses (one to three years old)
Development capital	Expansion and development	Funding for growth and expansion of a sound business
Buy-out	Leveraged buy-out and replacement capital	Purchasing business from owners or purchasing existing shares

Source: Adapted from KPMG and the South African Venture Capital and Private Equity Association (2008).

The final phase in a private equity investment transaction is the exit strategy in which, if things worked out as planned, the investors liquidate their private equity investment profitably. Exit strategies can take various forms, including, but not limited to, the following:

- direct sale to new investors
- listing on stock exchanges
- dividend payments to investors through debt recapitalisation
- secondary buy-out by another private equity firm.

3. Global private equity industry

The globalisation of industries has become the norm across the world, and the private equity industry is no exception. The global value of transactions related to private equity funds has increased dramatically over the past few decades. Figure 2 provides a breakdown of the investment and fund-raising trends on an annual basis for the period 1998 to 2007. Since 2004 the private equity industry fund-raising has experienced exceptional growth that has not been matched in the history of this equity sub-class. The private equity industry registered record fund-raising activities in 2006 and 2007. The ratio of funds invested to funds raised is illustrated in Figure 3.

Figure 2
Funds raised and invested¹

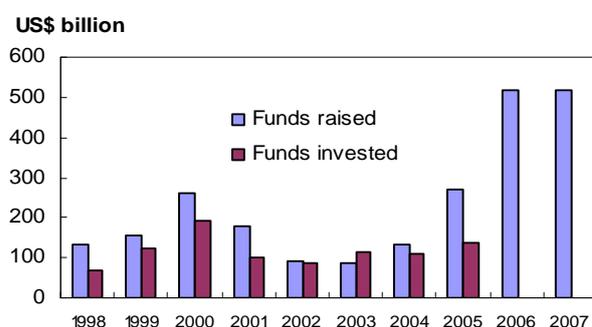
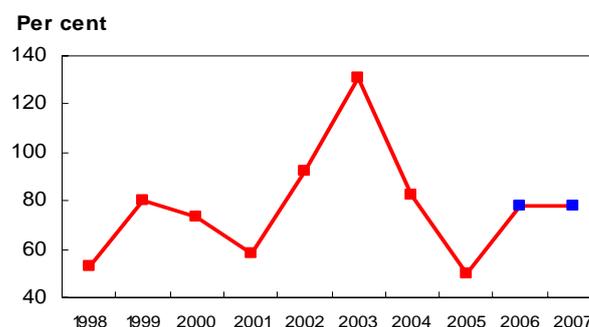


Figure 3
Ratio of funds invested¹



¹ Data on funds invested for 2006/07 not available. Ratio based on average investment ratio for 1998 to 2005.

Source: PricewaterhouseCoopers, Emerging Markets Private Equity Association.

The main developed countries remain the most active in private equity by a large margin. The most recent global private equity survey released by Pricewaterhouse Coopers (PWC) in 2006 confirms that the United States of America (US) is still the most active investment country, with the United Kingdom (UK) in second place.

Table 2 provides a breakdown of the top 20 investment countries in 2005. North America, comprising the US and Canada, was the largest private equity market, with total funds raised during 2005 amounting to US\$160,5 billion. Of these funds, almost US\$48 billion were invested during 2005, which was only marginally up from the US\$46,1 billion in 2004. During 2005 Europe, consisting of the UK, France, Germany, Sweden, Spain, the Netherlands, Italy and Denmark, continued its vibrant private equity activity, with funds amounting to US\$84,1 billion being raised and US\$55,1 billion invested.

Table2

Top 20 countries based on private equity funds raised and invested in 2005

US\$ billions

Country	Funds raised	Funds invested	Percentage change in funds invested from 2004 to 2005
1. United States of America	159.00	46.41	6
2. United Kingdom	53.48	27.92	25
3. China	2.14	8.81	328
4. France	13.42	8.55	40
5. Japan	4.42	7.95	13
6. Singapore	0.74	4.41	241
7. Sweden	2.25	3.52	85
8. Germany	3.37	3.16	-28
9. Spain	1.20	3.12	35

Table2 (cont)

Top 20 countries based on private equity funds raised and invested in 2005

US\$ billions

Country	Funds raised	Funds invested	Percentage change in funds invested from 2004 to 2005
10. Netherlands	2.86	2.74	41
11. Italy	1.58	2.56	48
12. Australia	2.08	2.32	7
13. Korea	2.52	2.10	35
14. India	2.48	1.94	45
15. Denmark	1.17	1.24	167
16. Canada	1.49	1.24	4
17. Israel	1.34	1.08	-11
18. South Africa	0.40	0.89	-29
19. New Zealand	0.22	0.75	200
20. Indonesia	-	0.56	694

Source: PricewaterhouseCoopers.

The evolution in size and influence of the private equity industry has led to increased transparency and awareness with regard to good corporate governance practices, particularly in respect of early stage investments. Owing to the unique nature of private equity investments, private equity managers have a high degree of involvement in the companies in which they invest and therefore play a leading role in promoting good corporate governance in these companies (Sullivan and Lim, 2004). Another emerging characteristic of the global private equity landscape is the increase in private equity activity in developing nations. Lerner and Schoar (2004) attribute this to two main reasons. The first reason is the accelerated integration of emerging nations into the world economy. Many of these nations have undertaken radical reforms in various areas, such as the reduction in trade and financial barriers (eg exchange control relaxations), the improvement of financial and regulatory systems, and overall commitment to technological innovations and improvements. These economic and structural reforms have increased emerging nations' attractiveness as private equity destinations.

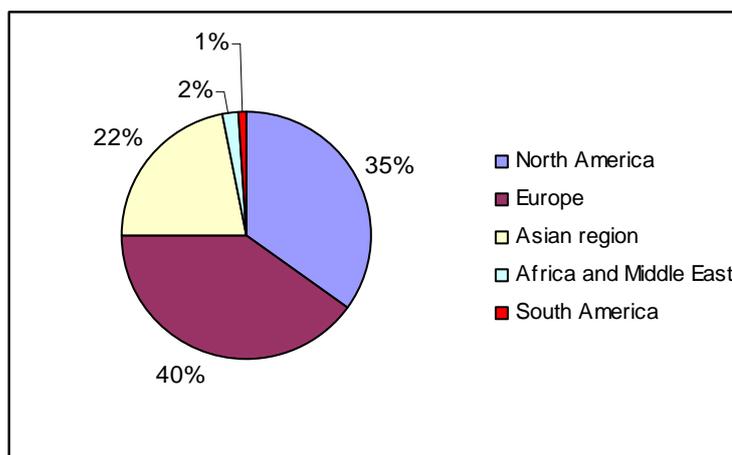
The second reason revolves around the changing views of, and conditions in, developed nations. Owing to the maturity of private equity in these countries and smaller returns on investments resulting from increased competition, these nations have embarked on reassessing the returns obtainable from, and risk associated with, developing country investments, and have generally found them favourable. For example, in 2007 many South African private equity funds reported gross internal rates of return above 40 per cent, while net internal rates of return in the US and Europe remained below 20 per cent (KPMG and SAVCA, 2008). In a study conducted by Deloitte (2007), it was found that of the sample respondents, 40 per cent indicated they had been attracted to emerging markets private equity partly due to tax incentives, free trade zones or other incentive structures, while 69 per cent indicated that more than half of their investments in emerging markets was meeting or exceeding their revenue expectations.

It is thus not surprising that one of the main trends, as seen in Table 2, is the rise of funds invested in the Asian region, thereby making it a significant player in the global private equity market. The combined value of investments in the Asian region amounted to US\$25,8 billion in 2005. Of the Asian region countries, China and Indonesia showed exceptional growth over this period, with funds invested in China increasing by 328 per cent and in Indonesia by 694 per cent. Although the amounts invested are relatively small compared with other regions, the increase between 2004 and 2005 shows a significant shift to developing markets. Figure 4 illustrates the geographical breakdown of funds invested in 2005.

A further characteristic of the evolving private equity landscape is that for many of the emerging countries the investments made exceeded the funds raised in these countries, indicating that capital was transferred from North America and Europe into these economies. From a macroeconomic perspective, this may have a material impact on balance of payments positions. This point is discussed further in the section dealing with the analysis of South African private equity (refer to section 4).

Figure 4

Geographical breakdown of funds invested during 2005



Source: PricewaterhouseCoopers.

The Emerging Markets Private Equity Association (EMPEA) (2007) listed the following highlights in its survey of limited partner interest in emerging markets:

- Emerging markets will deliver superior returns for the foreseeable future
- Limited partners expect to increase their commitments to emerging market private equity over the next five years
- Governance of, and communication by, emerging market private equity funds have improved
- Asia, Central and Eastern Europe will continue to dominate activity in emerging markets.

Table 3
Emerging market private equity fund-raising by region

US\$ billions

Year	Emerging Asia	Central and Eastern Europe / Russia	Latin America and Caribbean	Sub-Saharan Africa ¹	Middle East and North Africa ¹	Pan – Emerging Market	Total
2003	2,2	0,4	0,4		0,4	0,1	3,5
2004	2,8	1,8	0,7		0,5	0,6	6,4
2005	15,4	2,7	1,3	0,8	1,9	3,6	25,7
2006	19,4	3,3	2,7	2,4	2,9	2,6	33,3
2007	28,7	14,6	4,4	2,3	5,0	4,1	59,1

¹ Individual data for 2003 and 2004 not available.

Source: Adapted from Emerging Markets Private Equity Association.

Table 3 depicts the most recent fund-raising data released by EMPEA, which indicate that 204 funds collectively raised US\$59,1 billion in capital in 2007; an increase of 78 per cent over the US\$33,3 billion raised in 2006.

Although Africa and the Middle East have also benefited from the expansion of private equity into emerging markets, the private equity industry in these areas remains small in comparison to the North American, European and Asian regions. However, according to the African Venture Capital Association, there are a number of reasons for private equity investment activity in Africa to accelerate in the coming years, including (Financial Mail, 2008a)

- high economic growth in sub-Saharan Africa, which has averaged between 5 and 7 per cent in recent years, coupled with relatively low inflation and interest rates
- high commodity prices
- a significant improvement in governance and policy formulation
- reduction in foreign public debt levels resulting from the global economic initiative to aid heavily indebted poor countries.

4. South African private equity industry

South Africa has one of the most sophisticated private equity industries among the emerging economies, with funds invested at various business development stages. The Southern African Venture Capital and Private Equity Association (SAVCA) currently has 62 full members and 28 associate members. Together with the traditional uses of private equity, a more recent application in South Africa is the facilitation of black economic empowerment (BEE) investment as discussed later in this paper.

4.1 Structure of private equity in South Africa

Alongside global developments, the South African private equity industry was further boosted by leveraged and management buy-outs of multinationals disinvesting from South Africa in the 1980s. Private equity in South Africa has since distinguished itself as a separate sub-

asset class of equities and, as a result, benefited from foreign investment. The domestic private equity firms are divided between independents – who manage funds on behalf of third parties – and captives – who manage on-balance sheet investments that are funded by a parent company or a group. Captives include the funds of governments, financial companies and other corporates (KPMG and SAVCA, 2008). In South Africa, there are no specific laws aimed at regulating the private equity industry, but institutional-sector legislation and regulations are fully applicable to participants.

4.2 Investment activity in the South African private equity industry

As at the end of 2007, total funds under management amounted to R86,6 billion; an increase of 46 per cent from 2006. Independents accounted for 49 per cent and financial captives for 31 per cent of total funds under management. Funds are mostly sourced from major banks, institutional investors and independent private equity houses in the US and Europe (Ewing and Butler, 2007). Funds are mainly invested in buy-outs, and expansion and development ventures. In 2007, funds invested amounted to 3 per cent of gross domestic product and of the total funds under management, more than R30 billion (an increase of 25 per cent from 2006) were still undrawn at 31 December 2007.

Figure 5

Funds under management

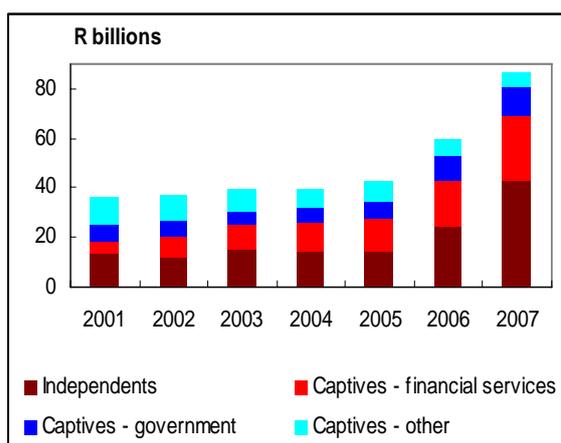
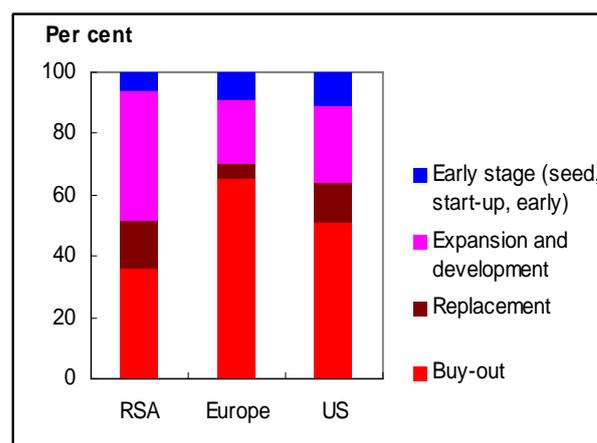


Figure 6

Investment by stage, 2007



Source: KPMG and South African Venture Capital and Private Equity Association (2008).

In 2007, South Africa was ranked 11th as a private equity investment destination and 18th in terms of fund-raising activity on a global scale (PWC, 2007). Expansion and development investment were the biggest investment types in terms of volume (47 per cent), while buy-outs constituted the largest investment type in terms of value (65 per cent). In most cases, South African private equity investment takes place in established businesses (later-stage investment) rather than start-up or early stage (Ewing and Butler, 2007). Table 4 details the ten largest private equity transactions per funds raised in 2007, with a combined value of approximately US\$8,1 billion. Of this amount, the four largest transactions made up 88 per cent. Compared with listed equity, private equity investments yielded double in terms of their internal rates of return.

Table 4

Ten largest private equity transactions based on total funding raised, 2007

Name of investment	Equity provider/s	Debt provider/s	Total funding raised (R millions)	Type of investment	Private equity fund's equity interest	BEE ownership (post-deal)
Edcon	Bain Capital Barclays Private Equity Absa Capital Private Equity	Barclays Capital Absa Capital	27 132	LBO	Controlling	Not empowered
Alexander Forbes	Actis Africa Ethos Harbourvest Capital International OTPP CdpQ	RMB Investec bank Nedbank JP Morgan Goldman Sachs	8 982	LBO	50,1 per cent	Black-influenced
Primedia	BRAIT	RMB OMIGSA Vantage Capital	7 300	LBO	18,3 per cent	38,8 per cent
Consol	BRAIT OMIGSA Sanlam Private Equity Harbourvest Capital International	Citibank JP Morgan	6 600	LBO	61,5 per cent	26,0 per cent
Steinfurn	Absa Capital Private Equity	Absa Capital	1 580	LBO	49,9 per cent	Black-empowered
Premier Foods	BRAIT	NA	1 500	MBO	NA	NA
Tsebo Outsourcing Group	Absa Capital Private Equity	Investec bank Vantage Capital	1 435	LBO	45,0 per cent	Black-empowered
Brandcorp	Ethos Sphere	Absa Capital Nedbank	1 420	LBO	Controlling	Black-influenced
Vox Telecom	Lereko Metier Capital Growth Fund	Investec bank	490	Later Stage Expansion Capital	23,3 per cent	Black-empowered
Mvelaphanda Holdings	Absa Capital Private Equity	NA	450	Later Stage Expansion Capital	NA	Black company

Source: Adapted from KPMG and South African Venture Capital and Private Equity Association (2008).

4.3 The role of private equity in South Africa

A unique aspect of the South African private equity industry is its facilitation of BEE. The Broad-Based Economic Empowerment Act, 2003 (Act No. 53 of 2003) (The BBEE Act) and other industry-specific empowerment agreements between government and economic sectors (charters) have placed pressure on businesses to provide employment and give business to black people, and to allow them to own assets in South Africa in an attempt to redress the skewed economic distribution of resources. Accordingly, private equity has played a major role in broadening the scope for black people to participate in business activities. Most private equity deals concluded in recent years have a significant BEE component.

The BEE codes, as issued by government (Department of Trade and Industry), stipulate the conditions under which ownership arising from a private equity fund may be treated as held by black people. The conditions stipulate that a private equity firm must ensure that

- more than 50 per cent of the exercisable voting rights associated with the equity instruments through which the private equity fund manager holds rights of ownership is held by black people
- more than 50 per cent of the profits made by the private equity fund manager after realising any investment made accrues to black people
- the private equity fund manager is a BEE-owned company
- over a ten-year period, the private equity fund must have more than 50 per cent of its investments made in black-owned enterprises that have at least 25 per cent direct black ownership.

As at 31 December 2007, 69 per cent of total funds under management were classified as black-influenced, that is, had at least 5 per cent black ownership. The number of BEE investments increased by 15 per cent from 2006 to 2007 – reflecting the growing importance of BEE-related transactions in the South African private equity industry. In 2007, the average BEE transaction amounted to R30 million – up from R14 million in 2006.

In an unpublished SAVCA-commissioned private equity economic impact study (2005) it was found that private equity generally boosted economic growth in South Africa and was superior when compared with other forms of funding because, among other things, it

- enabled higher gearing
- was sometimes the only source of funding for companies facing unit closure
- enabled product development
- offered added value by sharing expertise, identifying investment opportunities, creating brand value and strategy development
- facilitated BEE (as discussed earlier).

Improved corporate governance as a result of improved compliance with existing legislation, such as the BBEE Act, and improved management effectiveness as a result of implementing management buy-outs were noted as important private equity benefits. According to KPMG and SAVCA (2008), private equity does not only transfer capital, but also has an impact in terms of productivity, skills development (competitiveness) and job creation (transfer of know-how).

4.4 Measurement of private equity in South Africa

This part of the paper investigates the measurement and economic impact of private equity in financial markets and on the balance of payments.

4.4.1 Private equity in financial market statistics

A major reason for analysing private equity and its impact on financial markets is to establish the extent to which the delisting and subsequent relisting of companies affect the stock exchange configuration. The initial delisting of a listed company targeted for private equity investment has the effect, albeit small, of reducing both the market capitalisation of the stock exchange and portfolio diversification options for investors, particularly if the delisted companies are industry leaders. Since the South African share market (JSE Limited (JSE)) is used as an exit mechanism for private equity, the possible subsequent initial public offerings have the potential to boost the JSE and particularly the Alternative Exchange (AltX) for medium-sized entities further by ensuring that good-quality entities are listed on the AltX (Ewing and Butler, 2007).

In 2007, the total capital value of the four largest companies that delisted for private equity reasons amounted to approximately 1 per cent of the JSE market capitalisation which was R5,7 trillion (\$839 billion). This was deemed too small to affect the JSE materially. Thus far in South Africa, the largest private equity deals have involved industry leaders and may have impacted negatively on portfolio diversification. Continuous monitoring of the private equity asset class on the JSE is undertaken by several parties, including the South African Reserve Bank.

4.4.2 Private equity in balance of payments statistics

Initially, most private equity funds were raised and invested domestically and thus had limited or no balance of payments impact. However, since 2005 this has changed with some of the largest and most recent fund-raising exercises by South African-based general partners

being largely foreign funded (75 per cent and more). For example, in September 2007 Pamodzi Investment Holdings announced the launch of Pamodzi Resources Fund I, a US\$1,3 billion (R9,8 billion) resources fund that was completely funded from foreign sources. This has led to the US overtaking South Africa as the main source of funds raised in 2006 and 2007. South African-based funds have also started investing outside South Africa, which may have additional balance of payments implications.

The South African Reserve Bank compiles South Africa's balance of payments position and includes private equity data in the official balance of payments statistics. The data on the private equity industry in South Africa are obtained and used at three levels, as illustrated in Table 5. SAVCA provides an overall profile of the industry in South Africa to the central bank. This includes aggregated private equity industry data, industry participants and individual contact details of private equity fund managers. Regular meetings are scheduled with the leading private equity funds where all aspects of their private equity transactions are discussed and the necessary data obtained by the central bank. The private equity funds are housed in a survey database that is used to obtain quarterly data on fund raising, drawdown and investment activities.

Table 5
Private equity data sources

Data collection level	Institution	Interaction	Frequency
Level 1	SAVCA	Meets periodically Provides data on the overall South African private equity industry	Annually
Level 2	Private equity funds (general partners)	Meets periodically with main private equity funds Provides data on fund-raising activity, targeted investments and disinvestments	Quarterly
Level 3	Targeted investment companies	Meets regularly to discuss the impact on the balance of payments Included in the South African Reserve Bank survey database and provides all relevant balance of payments data through this channel	Quarterly

Further data are obtained at targeted company level. After a private equity transaction, meetings are arranged with the targeted company where the new post-private equity group structure is discussed. It is determined which companies in the group should report on a regular basis and these companies are included in the normal SARB B-survey database.

During the life cycle of a typical private equity investment, balance of payments statistics are influenced in the following phases:

- *Fund-raising and drawdown:* Initial sourcing of funds and drawdown into South Africa if foreign sourced.
- *Value creation and monitoring of investment targets:* During the life of the investment the main balance of payments impact will result from flows due to interest, dividends and fees.
- *Exit from investment and repatriation or reinvestment of funds by investors:* At the disinvestment stage of the private equity transaction there could also be a balance of payments impact. This depends on the initial investors' decision to retain their funds in the domestic economy, either by reinvesting in a new private equity fund or in another type of asset in the economy; or to liquidate their investment and repatriate the funds to their countries. At present the bulk of South African foreign-sourced investments has not reached the exit stage yet; there are roughly seven years left before this starts happening.

Although the exact structuring of a private equity transaction may have various permutations with varying degrees of influence on balance of payments statistics, there are certain standard characteristics. Table 6 illustrates a typical private equity transaction where a foreign-based private equity fund acquired a listed South African company, and its treatment in the balance of payments and related accounts.

Table 6

Recording of private equity transactions in balance of payments and related accounts: Foreign-based private equity fund acquisition

Balance of payments	Item	Frequency	Impact
Current account	Interest payments	Quarterly	Outflow
	Fees	One-off / Quarterly	Outflow
	Dividend payment	Annually / Biannually	Outflow
Financial account: liabilities			
Direct investment	Equity	One-off	Inflow
	Debt	One-off	Inflow
Portfolio investment	Payment to non-resident shareholders	One-off	Outflow
	Foreign bond issue	One-off	Inflow
Other investment	Bridging finance ¹	One-off	Inflow
Foreign debt	Bonds or negotiated loans	One-off	Inflow
International investment position	Liability position	One-off	Increase

¹ Should this type of finance and the bond issue be within the same measurement period, then the bridging finance will not be entered into the balance of payments.

4.4.2.1 Private equity treatment in the current account

The most common private equity transaction entries in the current account are transaction fees, interest payments and dividend flows. Fees can be broken down into advisory fees resulting from the structuring of the initial buy-out and management fees that accrue to the

general partners throughout the period of the investment. Whereas advisory fees are generally a one-off entry, management fees accruing to non-resident general partners may be recorded for several periods during the life of the investment. Interest payments on foreign-issued debt are also recorded quarterly or biannually in the current account. Owing to the substantial leveraging of private equity transactions, the payment of dividends has thus far not been a regular feature for most of the South African transactions. The normal treatment would be to record such payments in the current account if they occur.

4.4.2 Private equity treatment in the financial account

The bulk of the entries into the financial account is recorded on the liability side, because most of the limited partners in the large South African private equity funds are non-residents and hence funding is sourced from international markets. Under direct investment there are typically two entries. The first represents the pure equity injection made by the private equity fund and is usually a one-off transaction. A further entry in this category represents debt, where the remainder of the capital injection is done as a shareholder loan with an indefinite period.

There are also two entries in the portfolio investment category. The first entry represents a one-off outflow of funds as payments to non-resident shareholders. This is normally the case where the targeted investment is a listed entity, with a percentage of the listed equity held by non-residents. The second entry occurs where international debt markets are accessed with the issue of debt instruments. This is recorded as an increase in portfolio liabilities within the period that the debt instrument is issued and the funds introduced into the country. In several of the large South African private equity transactions these debt issues have been utilised to substitute intermediate bridging finance that was initially used to acquire the shares from the existing shareholders. Assuming that bridging finance is obtained from a foreign third party such as a bank, and the utilisation of this debt and the substitution with long-term debt does not take place in the same measurement period, it will be recorded in the other investment category of the balance of payments. Otherwise only the long-term debt is recorded.

4.4.3 Private equity treatment in foreign debt statistics

Apart from the compilation of the official balance of payments statistics, the South African Reserve Bank is also responsible for the compilation of the country's official foreign debt statistics. Given the very definite and useful link between the data used in the financial account of the balance of payments and foreign debt data, the two independent sets of data supplement each other to a large extent. As such, the long-term foreign debt (eg bonds) raised for private equity purposes is included in the official foreign debt statistics of the country when these bonds are issued. The entity in which the debt is housed is added to the foreign debt survey database in order to record principal and interest payments. This information is entered into the appropriate balance of payments accounts over the period of the investment or loan.

4.4.4 Private equity impact on the international investment position

The South African international investment position is measured annually by recording positions as at 31 December. Private equity transactions that occur throughout a year and result in changed asset and liability positions with non-residents are included in the international investment position. In the South African case the impact is mainly on the liability side of the international investment position, causing an increase in direct and other investment liabilities and both an increase and a decrease in portfolio liabilities.

5. Conclusion

This paper analyses the international landscape of the private equity industry alongside the corresponding private equity developments in South Africa. Globally the industry has expanded significantly, both in value and geographic extension over the past few decades. Developed economies have increased their utilisation of private equity across all the private equity categories, with North America and the developed European economies registering record fund raising and investment activities since the start of the twenty-first century. Together with this, one of the most prominent characteristics of the evolving private equity landscape has been the increased private equity activity in developing economies. This should be seen as part of the accelerated integration of developing economies into the world economy. The expansion of private equity in developing nations suggests that this is the preferred route for private equity investors, given that the potential for similar investments in developed nations is reaching saturation levels. An inevitable consequence of this expansion has also been the rise of foreign-owned assets in developing nations.

The impact of private equity activities in the South African financial markets was found to be quite limited. However, private equity activities may have affected portfolio diversification for specific industries from which targeted companies were delisted. The impact of private equity in financial markets will be monitored on an ongoing basis. The extension of private equity transactions across nations has also accentuated the impact these transactions have on a country's balance of payments position. In the case of South Africa, private equity transactions by both foreign and South African private equity firms that source their funding from non-residents have led to capital flows that affect the balance of payments materially. Apart from affecting balance of payments positions, these private equity transactions also influence the South African foreign debt and international investment position. Although private equity-related inflows may assist in financing a current account deficit, the longer-term nature of these investments and their impact on the balance of payments should be understood. Realising this, the South African Reserve Bank has endeavoured to understand and measure private equity and its impact as thoroughly as possible.

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Interview

Interview with J. P. Fourie, South African Venture Capital and Private Equity Association Executive Officer on private equity issues, Johannesburg, 22 May 2008.

Session 7

Panel on data issues in the context of the recent financial turmoil

Chair: Jan Smets, Former Chairman of the Irving Fisher Committee on
Central Bank Statistics and Director at the National Bank of Belgium

Papers: Data issues in the context of the recent financial turmoil
(27 August 2008)
Paul Van den Bergh, Bank for International Settlements

Panel summary
Paul Van den Bergh, Bank for International Settlements

Data issues in the context of the recent financial turmoil (27 August 2008)

Paul Van den Bergh¹

Financial markets, particularly those for credit instruments in the more mature financial centres, have witnessed major turmoil since the summer of 2007. Already a number of suggestions have been made by policy makers and market participants to improve the functioning of the financial system. However, unlike earlier periods of stress or crisis, there have been no major calls for new data or improvements to existing datasets.² This does not mean that central banks, individually and collectively, have not faced major challenges in monitoring market developments against the background of evolving pressures and have not struggled to obtain timely and relevant data to assist in formulating their policy response. This note illustrates a number of specific issues that may have arisen in this context.

Prices of financial assets

The variables most readily used to track ongoing developments in the financial system are data for prices of financial assets. They typically include prices and indices for equities and bonds as well as a range of interest rates and exchange rates. A new class of price data have become available in recent years, in line with ongoing financial innovations. Prices exist for futures, option and swaps on a wide range of financial products (interest rates, exchange rates, commodities). Markets for credit default swaps have developed rapidly in recent years and, as a result, prices are now available for a broad range of private and sovereign credit risks. Indices based on CDS are also available. In the money markets, overnight interest rate swaps have grown rapidly. Prices of many of the newer financial instruments can be used to derive additional information, such as implied volatilities, expected default rates and expectations of future policy interest rates. They have also been used by some to develop measures of risk premia, market liquidity or risk appetite/aversion.

Most data on prices of financial assets are available from, or are calculated by, commercial data providers. Some of the indices produced by them, in particular CDX, iTraxx, CMBX, have become widely-used benchmarks.³ However, the methodologies used to calculate these prices and the derived indices are not always clear. Moreover questions have been asked about the representativeness of prices available from commercial data sources in the context of much-reduced (or even absent) trading in various instruments.

¹ The views in this note are those of the author and not necessarily those of the BIS or its member central banks. For any questions, please contact Mr Paul Van den Bergh, Head of Information, Statistics and Administration, Monetary and Economic Department, Bank for International Settlements: paul.van-den-bergh@bis.org, +41 61 280 8432.

² Experience with emerging market debt crises prompted the development of the BIS consolidated banking statistics. After the Asian financial crises recommendations were made to improve balance-of-payment statistics and to develop financial soundness indicators. Various episodes of tension in commercial paper markets in major financial centres have resulted in the collection of comprehensive data on these instruments.

³ An important data provider in this context is Markit, which produces an index for subprime mortgages (ABX), commercial mortgages (CMBX), CDS for European (iTraxx) and US (CDX) companies.

Measures of the overall size and key segments of securities markets

The turmoil originated in the market for securitised sub-prime mortgages in the United States but quickly expanded to other markets. Comprehensive official statistics on securities issuance and holdings proved difficult to come by, even in the case of the most developed financial centres. Official data sources were available for particular segments, such as the commercial paper market in the US and euro area.⁴ Data on specific instruments (eg mortgage-backed securities, CDO's) could be obtained from market participants as well as from commercial data providers. Even so, it was very difficult, if not impossible, to track to what extent asset-backed securities were included in the asset pool underlying the issuance of CDO's and how the latter were again included in the pools underlying asset-backed commercial paper (the issue was even more complex for securitised products referring to actively managed pools of assets). The treatment of securitisation will be one of the major challenges in the development of a handbook for securities statistics, a joint project that has recently been initiated by the BIS, ECB and IMF.

Estimates of the size and key characteristics of special purpose entities

One reason why it was difficult to distil useful statistics even from large securities-by-securities databases resulted from the fact that in recent years a number of securitised instruments had been issued through special conduits, special investment vehicles (SIV's) and other special purpose vehicles. Little information was available publicly on the size and key characteristics of these entities, many of which had a formal or informal relationship with banks.

Relevant data to monitor developments in housing finance markets

Perhaps fortunately for data compilers and analysts, the problems related to housing and housing finance markets have affected first and foremost the United States, where data on these markets are relatively detailed and easily available from a wide range of sources. The table in Annex 1 gives just a very short overview of the key variables that have been used to track developments in housing, from a real as well as financial perspective. In countries other than the US similar data are much more difficult to come by. In fact, for many countries it continues to be difficult to find a reliable official statistic for house prices. And where such indices are available there is a wide range of methodologies and sources used to compile them so that their international comparability is not always straightforward (an initiative to develop a manual for residential property prices has only recently been taken by Eurostat under the auspices of the Inter-Secretariat Working Group on Price Statistics).

Impact of the method of calculating output of financial services

The measurement of output (value added) from financial services in the system of national account is particularly challenging. In most cases the financial intermediation services are indirectly measured (FISIM) using the difference between a reference rate (typically a risk-

⁴ Data on asset-backed commercial paper were more difficult to find for the euro area.

free rate such as that for Treasury certificates or and interbank rate) and a representative bank lending and deposit rate. This method could have had an unexpected effect on measures of output during the turmoil. As underlying spreads were rising, indirectly measured output from financial intermediation would have been rising whilst banks were, at the same time, posting record losses, restructuring or even defaulting. It is not clear to what extent these factors affected published GDP measures in different countries.

Provisioning and loss data disclosed by individual institutions

With the introduction in recent years of International Accounting Standards, International Financial Reporting Standards, disclosure requirements issues by supervisors and web-based technology, it could have been expected that it would be relatively straightforward to collect information on the impact that the turmoil had on key elements of the balance sheets of financial institutions. Once the severity of the turmoil became clear, there was a keen interest by policymakers and market analysts to collect disclosed accounting data on provisioning and losses by banks and other financial institutions, as well as any quantitative information on risk exposures such as value-at-risk. This proved much more cumbersome than some might have expected. Relevant information disclosed in public statements proved difficult to compare and was mostly available in commentaries (often footnotes) rather than standardised elements in electronic templates of balance sheets that could be easily downloaded and tracked over time.⁵ One commercial data provider developed a rather comprehensive database on bank writedowns and capital raising, but the data are only available on-screen and are neither printable nor downloadable.

OTC derivatives, including CDS

New derivative instruments, in particular credit default swaps (CDS), are increasingly being used to transfer credit risk between different participants in the financial system. Though aggregate statistics exist for OTC/CDS derivatives, various potential shortcomings have been identified in this area in terms of frequency and timeliness; instrument, counterparty, currency and residency breakdown; measures of net exposures after taking account of netting and collateral; and country coverage.⁶ It is also difficult to compare or combine relevant data between OTC and exchange-traded markets. Data from clearing and settlement systems for the respective markets could possibly be mined further.

⁵ The Financial Stability Forum has proposed a disclosure template for progress in implementing it has been slow.

⁶ The BIS OTC derivative statistics are produced only semi-annually based on reporting from major dealers in 11 major centres (which are estimated to cover around 90% of global transactions). They have (limited) breakdowns for counterparties and instruments and cover gross notional amounts, gross market values as well as gross credit exposures (ie gross market values after taking account legally enforceable bilateral netting agreements).

Data on central bank money market operations and central bank balance sheets

In response to the market turmoil central banks have adapted their money market operations, for instance in terms of type of operation, maturity of operation and accepted underlying collateral. In some cases, new financing facilities have been introduced. Much information is published by central banks on their operations and their impact is, over time, reflected in central bank balance sheets. It has been difficult to find comparable time series data to allow a comparison of operations in different countries (eg maximum and marginal rates, bid-to-cover ratios and allotment structures in auctions).

The calculation of representative money market interest rates

Interbank money market rates are a key variable for central banks. As the turmoil evolved questions came to be posed about the representativeness of key benchmark rates, including LIBOR published by the British Bankers Association. It was unclear how much the calculation of market benchmarks was based on rates that accurately reflected borrowing and lending conditions in interbank markets. Improvements have been suggested and in some cases new benchmark rates have been developed. It should be noted that, apart from the harmonised methodology introduced by the ECB for the euro area, there are no standards for the calculation of representative interest rates. As in the case of other key benchmark prices for financial variables, such as stock indices and bond yields, there are sometimes significant differences between countries.

Measures of the developments in interbank markets

The focus of attention during the turmoil has been on the interbank money markets. It has been very difficult to document statistically the reported reduction in trading volumes in these markets. Amounts outstanding of interbank claims and liabilities are not part of monetary statistics and even official banking statistics do not always provide this information. The exception has been the BIS international banking statistics, which separately identify interbank positions. Even where data are available little quantitative information has been available on the maturity distribution of interbank positions (eg to document the reported shortening of maturities during the turmoil) or on separate developments in collateralised and uncollateralised money markets.

The usefulness of turnover data from payment and settlement systems

Turnover data (value and volumes) exist for a number of payment and settlement systems both from national sources and from publications by the BIS-based Committee on Payment and Settlement Systems. In principle such data is available at high frequency (ie daily). It has been used to evaluate how individual systems have coped with operational pressures, if any, during the turmoil. But the data could also be used, in principle, to monitor indirectly transactions volume in money, foreign exchange, securities and exchange-traded derivative markets. Moreover, detailed transactions data can be mined to study trading patterns in particular markets, for instance with respect to the selection of counterparties. In a few cases such type of information is used to calculate indices of financial stress.

Regular and ad hoc information from bank lending surveys

An important question during the financial turmoil has been how changing monetary and financial conditions would affect bank lending. In this context the information collected through regular surveys of bank lending conditions by a number of central banks received increasing attention. In at least one case the survey was brought forward and in some cases specific questions were added to assess specific situations. Some specific questions about evolving credit conditions were also added to surveys of businesses and/or households which some central banks also carry out regularly. A particular challenge has been to reconcile the information obtained through bank lending surveys with actual bank credit data compiled in the money and banking statistics.⁷

Regular and ad hoc information from consumer and business sentiment surveys

Irrespective of whether they conduct the surveys themselves, central banks, like market analysts, have monitored closely the results from regular consumer and business sentiment surveys. In many cases these are seen to leading indicators of economic developments (eg production, consumption, investment). Of particular interest has been the evolution of inflation expectations. Questions are sometimes raised about the methods used to translate qualitative information from such surveys (which typically ask respondents whether they expect an increase, decrease or no change in a particular variable) into quantitative indicators.

Measures of the size and characteristics of institutional investors

Prior to the outbreak of the turmoil concerns had been raised about the lack of appropriate, internationally comparable data on institutional investors, including pension funds, insurance companies, and investment/asset-management companies. Users and compilers had started to address the question as to whether how limited data on these non-bank financial sectors could be improved. Discussions had also been initiated on obtaining data on hedge funds.⁸ Whilst attention during the turmoil was mainly focused on “banks”, institutional investors continued to be important actors. Other classes of institutions may have to be included in this category, such as private equity firms. Finally, data on sovereign wealth funds are also becoming important, as these institutions are becoming significant players in global financial markets.

⁷ In some countries bank lending surveys indicated a significant tightening in conditions for bank lending to corporations and households, which were not reflected in subsequent declines in actual credit to these sectors reported in money and banking statistics. It was unclear to what extent this was the result of the reintermediation of credit flows through the banking system.

⁸ Apart from the interest in the overall size and composition of hedge fund portfolio's a particular issue has been to get a sense of bank lending to these institutions (and the potential disorderly unwinding of such exposures).

Making operational a number of new concepts

In recent years efforts have been made by researchers and analysts to develop operational measures for concepts such as market liquidity, leverage/gearing, risk appetite/aversion, and even financial stability. New indicators have been explained and included in central bank publications, including Financial Stability Reports. The period of turmoil has served as a test case for the usefulness of such measures, in particular to determine to what extent they are leading, concurrent or lagging indicators.

This is, of course, just a selection of the data issues and challenges that central banks may have faced in trying to monitor economic and financial developments during the recent period of turmoil. It has not only been a challenge for many to compile and interpret data on new elements of the financial systems such as securitisation, housing finance or derivatives. It has also been a challenge to use or improve data from existing statistical frameworks and compilation exercises. It would probably be useful for central banks, not only those from major financial centres where the turmoil has been most pronounced, to take stock of these issues and draw lessons from the way they have been, or have tried to be, addressed in different countries. Of particular interest, for instance, could be the need to improve securities market statistics as well as indicators of developments in housing markets.

Annex:
**Examples of relevant indicators
of housing markets and housing finance**

House price index (with proper breakdowns by region, classes of property)

Appraisals vs market prices

New permits

Housing starts

Pending home sales

House sales (existing houses and new houses)

Vacancy rates (stock of unsold property)

Construction activity

Contribution of housing to GDP (nominal and real)

Loan to value ratios in mortgages (for new and existing mortgages)

Home equity withdrawals

Loan approvals

Mortgage loans (with proper breakdown between type of loans, risk category, first and second mortgages)

Arrears (on prime and non-prime mortgages)

Loan delinquencies/non-performing loans

Foreclosures

Mortgage-backed securities (with proper breakdowns)

Loan provisioning

Panel summary

Paul Van den Bergh

The conference closed with a panel discussion on data issues in the context of the financial turmoil, which had created significant uncertainty among market participants and policy makers. The panel was chaired by *Jan Smets* of the National Bank of Belgium and outgoing IFC Chairman. He noted that various innovations such as new housing finance instruments, the use of special purpose vehicles, securitisation and derivatives, had played a key role in changing the economic and financial landscape before and during the turmoil, both individually and through a number of linkages amongst them. He referred to the background issue paper prepared by *Paul Van den Bergh* of the BIS that identified a number of possible data issues in the context of the turmoil. The key question was whether better information, including statistics, might have helped authorities to anticipate potential problems and to navigate through the turmoil more easily. Looking forward, the issue was whether there were lessons for statisticians in terms of producing better information to avoid similar difficulties in the future.

Mr Steven Keuning of the ECB noted that one of the main issues during the turmoil had been the lack of transparency, including with respect to a number of financial innovations. These could have been monitored more closely. At the same time, it had to be recognised that the problems did not originate from a lack of macro-economic or financial statistics. If micro-data are lacking, this cannot be remedied by any statistics. Besides, new data collections, including those to capture innovations, are costly and take time to implement. It is important that statisticians are proactive and try to anticipate the data needs in advance. The ECB, for instance, has initiated the compilation of quarterly institutional sector accounts (financial accounts) for the euro area, to ensure a complete and consistent analysis of euro area economic and financial developments. Combining non-financial transactions from the national accounts and financial balance sheet information facilitates a coherent and comprehensive analysis of the financial and non-financial positions of the non-financial sectors, including households, as well as the role of financial institutions in financing them. Moreover, integrated accounts provide evidence on the impact of the financial crisis, particularly on the profitability, financing and financial investment of the euro area institutional sectors and as the most crucial feedback loops.

In terms of the way forward, *Mr Steven Keuning* offered a number of suggestions. First, central banks should attempt to monitor structural change and significant financial innovations with their regular statistical frameworks, using “agile” international statistical standards. For instance, an enhanced methodology of compiling financial intermediation services indirectly measured (FISIM) is under consideration in international statistical groups. It could involve a more adequate treatment of credit default risk and the term premium as part of the interest receivable on loans and payable on deposits.

Second, for “real-time” analysis one needs to regularly monitor the quality and economic meaning of certain statistical aggregations and to flexibly and quickly apply new classifications and definitions with the help of micro databases. As an example, in the case of the ECB, the centralised securities data base (CSDB) permits the early identification of new types of instruments and the institutions issuing them. The establishment of appropriate micro databases may require a substantial once-off investment, however, and should be carefully planned.

Third, close cooperation with other areas in the central banks such as market operations, financial stability and supervisory departments is essential since these have an in-depth knowledge of markets and also collect and assess much intelligence useful to understand

financial innovations. Since innovations are increasingly global, close international cooperation is also of key importance.

Fourth, it was useful to find mechanisms to collect supplementary data quickly and on an ad hoc basis from key players, such as selected financial institutions, operators of financial infrastructures or representatives of industry associations. The ECB, for instance, was cooperating with the European Federation of Asset Management Associations and the European Securitisation Forum. With respect to securitisation more specifically, experience has shown that it is necessary to understand the increasingly complex structures used for securitisation in order to develop a statistical framework which appropriately captures the phenomenon. At the same time, it was important to ensure consistency of any such framework with international statistical standards.

Finally, there were key gaps in housing statistics, not only for residential property prices, but also on housing finance (eg mortgage credit), structural housing indicators, housing capital stock and households' housing wealth. Good cooperation with the national statistical institute was essential in this respect.

Mr Dietrich Domanski of the BIS noted that the recent turmoil could result in a paradigm shift with respect to statistical data needs. Indeed, it had become clear that information on prices was mostly readily available whilst high-quality data on quantities, volumes, and exposures were not. The hope had been that recent financial innovations would have contributed to make financial markets more complete (eg structured products would, in principle, have made many types of credit tradable and therefore explicitly priced). And indeed, in recent year price indicators had mushroomed, and as long as liquidity did not matter, prices could be counted on to always reflect all information. This paradigm has been challenged by the crisis. The questions of market analysts and policy makers could not be answered with market price data alone. The size and composition of structured finance markets, for instance, became unknown. Credit risk transfer across sectors could not be measured comprehensively. It was unclear how large and concentrated bank exposures to certain types of credit risks were, how fast banks were deleveraging and what impact this had on credit supply. At the international level it was difficult to monitor and compare central bank liquidity injections, although some progress was achieved in this respect in various BIS committees.

Looking forward, four issues needed to be addressed. First, timeliness and flexibility of statistics are crucial in a dynamic financial environment, to capture financial innovation and to understand the direction financial markets are taking. Second, more detailed breakdowns of counterparties and instruments should be provided by key players. Adequate standardised disclosure on important elements of financial institutions' balance sheets, including risks and exposures, was required. It was disappointing how little useful comparable information had been disclosed by individual institutions even one year after the start of the crisis. Third, methodological concepts needed to be refined as, for instance, with the BIS OTC derivatives statistics which should ideally include information on expected losses. Finally, more careful thinking was required on the perennial question of how to aggregate exposures for both on and off-balance position across individual institutions and markets.

Mr Lars Frisell of the Sveriges Riksbank said that, during the crisis, it was realised that crucial data needed to monitor and understand ongoing developments was missing, particularly at the micro level. One example was the funding and liquidity risk of individual institutions. Central banks without supervisory responsibilities were often starved of necessary data. Though it was not responsible for banking supervision, the central bank of Sweden has an explicit mandate to collect all necessary data from banks, so it increased the requested reporting during the turmoil. This created some additional burden for banks, which were, however, modest against the background of the risks that had developed and needed to be contained.

The types of data that were covered by the additional reporting included information on maturing debts; currency composition of assets and liabilities; counterparty credit exposures, for instance with respect to the 15 largest exposures as well as inter-group exposures; the use of hedging instruments; and the size of off-balance sheet items. In order to identify risks in the system as a whole data were also collected on actual liquidity positions as well as banks' assumptions with respect to their liquidity needs; the use of credit lines; the size of inter-bank flows; and patterns in payment system traffic.

These were all extremely sensitive data that revealed banks' core business strategies and related risks. A very important issue therefore had been how to obtain this information and identify risks whilst preserving strict confidentiality. Regular informal communication between the central bank Governor and CEOs of banks had helped very much. At some point weekly evaluations were implemented, including discussion of the result of banks' stress tests (eg how many days of positive cash flows were expected). At some point better regulation, reporting and disclosure would be needed but this would take time to develop and implement, so ad hoc information gathering would remain important for some time.

Mr Manuel Marfán of the Banco Central de Chile remarked that the world was now in a sense upside down with the turmoil developing in the major financial centres and the developing world needing to assess its impact on local economic and financial conditions. It was becoming increasingly clear that emerging markets were not going to decouple from developments in the industrialised economies. What was also becoming clearer was that the ongoing financial turmoil was not an accident but that there had been many signs and indications, including through various statistics that unsustainable pressures had built up in the global economy and financial system.

With respect to data issues, he pointed out that the problem with asset prices, even when they were available, was that they included many different elements, including various risk premia which needed to be estimated and separated out. Because of contagion effects, emerging market bond indices and spreads were no longer a reliable measure of individual default risks. Ratings did not contain much accurate information about the risk position of individual creditors. CDS might be a good additional indicator of default risk but they were not available for all creditors and only the 5-year maturity was really sufficiently deep to yield reliable prices. At the same time, information from indexed bonds was very useful in order to calculate so-called break-even inflation rates (the latter were showing that inflation expectations had increased substantially in many emerging markets).

Finally, *Mr Bernard Delbecque* of the European Federation of Asset Management Associations (EFAMA) said that his association was ready to help the ECB to formulate a regulation on statistics on investment funds. He suggested that any new data collection in this area should be organised globally, using the same methodology. He also noted that the private sector was now more readily accepting central bank regulation to collect more data, but that it wanted to be more involved in identifying and discussing the details. This included commercial data providers, who would welcome discussions on their data collection with central banks, for instance with respect to implementing better definitions and methodologies. Central banks were recognised to have a key advantage as standard setters in the statistical area, compared to commercial data providers. They also had much experience in reaching consensus on international standards, as was exemplified by the BIS data collection exercises (the UN process was rather slow and much less efficient). At the European level the ECB initiatives to harmonise European data was another good example of successful and efficient data collection.

With respect to ad hoc information collection from key players at crisis times, EFAMA had conducted two highly confidential supplementary surveys during the crisis to inform the European Commission. In general he thought that main aggregate results of central bank surveys should be shared with survey participants, in order to enhance respondents' incentives to participate.

It was important that central banks widen their statistical coverage beyond banks and investment banks since many financial innovations have involved a wider range of financial institutions, in particular with respect to risk transfers. So far insurance companies were little affected by regular statistical reporting. Another area where reporting standards should be strengthened in line with innovations related to money market funds. Users of information on these institutions, including investors, were rather confused as to the potential exposures of such funds and their vulnerability to the financial turmoil.

During the *general discussion* it was noted that banking crises seem to have become more widespread and regular. Was this the result of innovations which often resulted in a good idea being overextended into inappropriate areas with negative consequences for financial stability? Could statistics show where such overextensions occurred so that crises could be avoided? Could statistics measure innovations more pro-actively?

There was agreement that statistics should be adapted more proactively. At the same time adapting statistical frameworks in order to capture temporary phenomena, such as developments with respect to money market mutual funds or the impact of certain investors on commodity prices, should be avoided. It was always necessary to develop appropriate conceptual frameworks to respond to structural data needs, but this could not be left to users alone. Statisticians should engage more in these conceptual issues in order to anticipate future data requests based on structural developments. Users would welcome this dialogue with compilers.

Another issue that was raised and discussed was the burden imposed on reporters of financial information, which seemed to be always increasing. Perhaps it was time to consider a comprehensive reform of banks' reporting system. A unified reporting system may be difficult to implement but it might have significant benefits. Admittedly there would always be competing analytical needs, so a diversified and flexible approach might be needed. However, it might be possible to establish relationships between different data collection exercises, domestically and internationally. Such a multi-use data collection would, of course, need to be coordinated with all users. One important difficulty would continue to be the fact that financial systems differ, sometimes considerably, from country to country, which would make it difficult to unify statistical data collection to capture early significant innovations.

One consideration that could be given more thought was to start collecting the data at the most micro level possible, for instance for individual securities. This could reduce aggregation and reporting costs for individual reporting institutions. If confidentiality issues could be overcome it might even be possible to consider sharing micro-level data for statistical purposes across countries and with and between international institutions. Those remained very sensitive issues, however, particularly with respect to proprietary data. Respondents must be absolutely convinced that micro data will remain confidential. Central banks may not have enough experience in this area at the moment though they are often guardians of important confidential data sets and could therefore develop their comparative advantage further. More reflection on this issue could perhaps be organised by the IFC in the future.

It was noted that the current situation may provide a good window of opportunity to improve statistics and to seek complementarity with private sector data providers. There was a better recognition that statistics were a public good and reporters might now better realise that they also need certain data in order to support their strategic decisions. The knowledge and experience of central bank statisticians may not always be sufficiently known to market participants so central banks should be more proactive in delivering the data and the concepts behind them to market analysts. More use could be made of ad-hoc surveys to gauge the impact of a particular market development and to seek the views of key players on potential financial stability issues. These ideas could avoid the burden of heavy regular reporting systems.

Closing remarks

Manuel Marfán¹

Thank you very much, Jan.

As I said yesterday at the meeting of the IFC Committee, it is an honour and pleasure for me to take over the Chairmanship from you. I knew about the activities of the Committee through the formal decision we took in 2006 at the Central Bank of Chile to become an institutional member of the IFC. I also received positive feedback from my colleagues on the past meetings organised by the IFC. I have now seen the Committee in action over the last two days and am very impressed. It is clear that IFC member central banks send very competent and motivated officials to participate in the IFC conferences, to present papers, to act as discussants and to chair sessions. I have learned a great deal at the conference, both in terms of the key issues we discussed and the sharing of experience across a broad range of countries from all different regions of the world. I really look forward to participate in future IFC events.

I realise it will be a challenge for me to continue in your footsteps. Thanks to your efforts a proper governance structure has been put in place for the Committee. I will be able to work with a competent Executive and will benefit from the professional and dedicated support of the Secretariat at the BIS. Opportunities have been created to strengthen the cooperation with the ISI and its various groups. And, of course, a number of activities are already planned for the coming year. To a large extent I can follow the road that you have traced.

We are all very grateful to you for the leadership you have provided to the Committee over the last three years. Your commitment and enthusiasm has been clear to all of those who have worked with you during the period of your chairmanship. We have greatly valued your diplomatic skills, your experience and wisdom, and the energy you have spent on moving the Committee forward. On behalf of all of us I would like to sincerely thank you for everything you have done and achieved! You will now become an honorary member of the Committee and we hope to see you at future meetings, in particular at next year's meeting in Durban.

Ladies and gentlemen, before closing I would like to say again that I look forward to chairing the Committee and to work closely with all the institutional members, the ISI and the BIS. This is your Committee and I welcome any suggestions and proposals that you might want to make with respect our future activities or our internal governance. Please feel free to contact me directly or through the Secretariat. I look forward to seeing you or other colleagues from your organisation next year in Durban.

Thank you.

¹ Chairman of the Irving Fisher Committee on Central Bank Statistics.

**Annex:
Participants in the conference**

Algeria	Bank of Algeria Mustapha Abderrahim Branka Achari-Djokic (Ms)
Argentina	Central Bank of Argentina Alberto Karlen Ivana Termansen (Ms)
Armenia	Central Bank of Armenia Martin Galstyan
Austria	Austrian National Bank Michael Andreasch Aurel Schubert
Bangladesh	Bangladesh Bank Khandaker Khalidur Rahman
Barbados	Central Bank of Barbados Stacia Howard (Ms)
Belgium	National Bank of Belgium Rudi Acx Jan Smets
Brazil	Central Bank of Brazil Renato Gerheim
Bulgaria	Bulgarian National Bank Emil Dimitrov
Cambodia	National Bank of Cambodia Rath Sovannorak
Cameroon	Bank of the Central African States Simplice Duclair Lonkeng Commission Bancaire de l’Afrique Centrale Salao Aboubakar
Canada	Bank of Canada Scott Hendry
Chile	Central Bank of Chile Manuel Marfán Valeria Orellana (Ms) Gloria Tapia Peña (Ms) Ricardo Vicuña

China	People's Bank of China Bo Lili (Ms) Chen Zhili Li Hailong Wang Dongni (Ms)
Chinese Taipei	Pei-wen Chen (Ms)
Costa Rica	Central Bank of Costa Rica Adolfo Rodríguez Vargas
Croatia	Croatian National Bank Igor Jemric
Czech Republic	Czech National Bank Rudolf Olšovský Petr Vojtisek
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Estonia	Bank of Estonia Kristiina Kibin (Ms) Jaanus Kroon Ain Paas
Finland	Bank of Finland Elisabeth Hintikka (Ms) Helka Jokinen (Ms) Harri Kuussaari
France	Bank of France Jean Cordier
Germany	Deutsche Bundesbank Winfried Rudek Ursula Schipper (Ms) Almut Steger (Ms) Birgit Uhlenbrock (Ms)
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India	Reserve Bank of India Allamraju Ramasastry
Indonesia	Bank Indonesia Dwityapoetra Besar Ismet Inono
Iraq	Central Bank of Iraq Sahar Majid Hamid Najeedee (Ms)
Israel	Bank of Israel Tzahi Frankovits Inon Gamrasni
Italy	Bank of Italy Giuseppe Bruno Grazia Marchese (Ms)
Japan	Bank of Japan Satoru Hagino Kazuhiko Ishida Masato Sakata
Kenya	Central Bank of Kenya Isaya Maana
Korea, Republic of	Bank of Korea Lee Young-Bog
Latvia	Bank of Latvia Agris Caune
Lithuania	Bank of Lithuania Rimantas Vaicenas
Macau SAR	Monetary Authority of Macao Man Ngan Leong (Ms)
Macedonia	National Bank of the Republic of Macedonia Maja Andreevska (Ms)
Malaysia	Central Bank of Malaysia Atiah Abdul Razak (Ms) Chew Siew Kheam (Ms) Norlizah Mohamed Shariff (Ms)

Mexico	Bank of Mexico Jazmin Carballo-Huerta (Ms) Diadelfa Ocampo (Ms)
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Slovakia	National Bank of Slovakia Ivan Horvath

Slovenia	Bank of Slovenia Janez Fabijan Janez Kosak
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