VI. Closing data gaps to enhance systemic risk measurement

The recent financial crisis highlighted shortcomings in policymakers' ability to measure systemic risk. Gaps are evident in both the analytical framework and the available firm-level and aggregate data that policymakers and market participants use in making decisions. These gaps hinder market participants in pricing and managing risk and policymakers in monitoring and responding to vulnerabilities. This experience should prompt improvements in macro surveillance and data collection.

Systemic financial risk can be defined as the risk of disruption to financial services that results from an impairment of the financial system, with the potential to harm the real economy. It can arise anywhere in the financial system and may be amplified as market participants overreact to incomplete or incorrect information. How this risk is distributed across entities and sectors depends on the structure of balance sheet linkages, which can be complex.

Policymakers who monitor systemic risk therefore need an analytical framework to capture this complexity. This requires multiple indicators, based on a range of data, that provide a broad view of the financial system, ideally from several vantage points. Market participants too need better information about market structure and aggregate positions so that they can manage their risks appropriately.

Initiatives in two areas deserve high priority. First, an international data-sharing framework should be established to give supervisory authorities a common view of the balance sheet positions of the largest global financial institutions. For crisis prevention, regulators must be able to *jointly* analyse the balance sheets of *many banks* in order to detect, for example, common exposures to particular asset classes or concentrations in funding markets. As crises unfold, regulators shift their focus to *crisis management*. Here, their critical task is to assess counterparty credit risk in the interbank market in real time to gauge what effect the failure of a particular institution might have. This requires detailed and high-frequency information on *bilateral* linkages, that is, firm-level balance sheet positions including data on individual counterparties. To varying degrees, these types of data are already accessible to individual bank supervisors. But without their wider dissemination, nationally and internationally, a richer analysis of systemic risk is impossible.

The second area that deserves attention is the updating of standard *aggregate statistics* to reflect changes in the financial landscape over the past 25 years. Aggregate statistics for flow of funds and international investment positions,[1] for example, are essential tools for capturing balance sheets at the

[1] Other sets of aggregate data include balance of payments statistics; cross-border securities holdings captured in the IMF's Coordinated Portfolio Investment Survey; and cross-border banking positions captured in the BIS international banking statistics.

sectoral and country level. Yet these statistics were never designed to consistently capture sector-level balance sheet linkages in a globalised world, where financial institutions and corporations have operations in many countries. Improvements to these statistics would greatly enhance the ability to monitor system-level vulnerabilities in the non-bank sectors that lie *beyond the reach of regulators*. The enhanced aggregate statistics necessary to reveal sector-level stresses would then inform targeted analysis of firm-level data.

The first part of this chapter highlights some core elements of systemic risk – *common exposures, leverage* and *maturity transformation* – all of which involve measurement challenges and data gaps. The second part discusses the further issues that arise when we seek to measure these systemic vulnerabilities in a world of multinational financial institutions and corporations. The final part examines in more detail the areas in which more or better data are needed.

Systemic risk: where should we look?

Financial fragilities develop during tranquil periods …

Heightened systemic risk often results from unsustainable expansions in private sector balance sheets during periods of benign economic conditions, making these balance sheets more fragile when conditions change. This process may start with an increase in asset prices, triggered initially by some piece of good news or by financial innovation. Rising asset prices allow investors to take on more debt, thanks to the growing value of their collateral. Some of the increased borrowing may flow into the booming asset class, further raising asset and collateral values.

… and weaken the defences of financial institutions

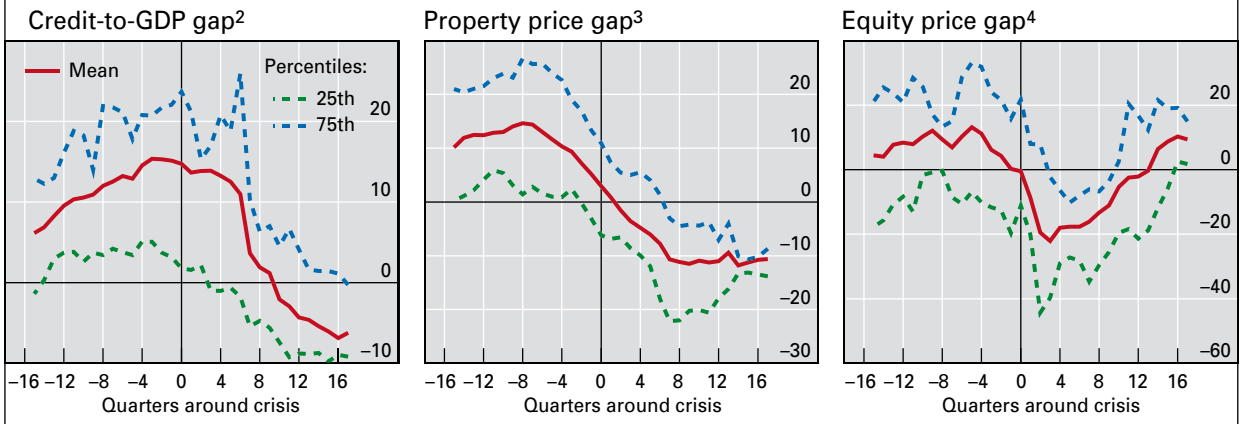
The boom can conceal growing risks: as market participants finance an increasing share of their assets with debt, *leverage* increases. This often entails an ever greater reliance on *short-term* debt, thereby heightening their maturity mismatch and thus their *funding liquidity risk*. Seemingly attractive investment opportunities and herding incentives mean that financial firms build up *common exposures* on both the assets side and the liabilities side of their balance sheets. Negative shocks will then affect many institutions simultaneously.

In short, common exposures, leverage and funding liquidity risk all feed into systemic risk. When the underlying market and balance sheet conditions are fragile – and systemic risk is high – a seemingly trivial shock can escalate into an outright crisis. At this stage, the reactions of market participants are virtually impossible to predict.

In an ideal world, policymakers would have a unified theoretical framework for identifying and quantifying systemic risk. Such a framework would capture all key drivers of systemic risk, such as market structure, institutional incentives, risk (mis)measurement and market participants' reactions to events. But no such framework exists. What is required, therefore, is a multipronged approach to systemic risk assessment that relies on a number of different indicators, each crafted from a different perspective.

Broad-level indicators derived from aggregate data can help reveal emerging vulnerabilities. Graph VI.1 clearly reveals boom-bust cycles of the

Credit and asset price behaviour around banking crises[1]



[1] The historical dispersion of the relevant variable is taken at the specific quarter across all crisis countries. Gaps are estimated using a one-sided rolling Hodrick-Prescott filter with lambda set to 400,000. [2] Deviations from trend, in percentage points. [3] Weighted average of real residential and commercial property prices with weights corresponding to estimates of their share in overall property wealth; the gap is in per cent relative to trend. [4] Equity prices are measured in real terms; the gap is in per cent relative to trend.

Sources: National data; BIS calculations. Graph VI.1

type discussed above: credit, property and equity prices all tend to rise above their long-run trends in the run-up to crises. These measures provide helpful leading indicators of financial stress, as they capture the most systematic and general signs of the build-up of vulnerabilities across sectors, countries and policy regimes.[2] But their lack of specificity means that such indicators can serve only as a starting point for a fuller analysis based on more detailed data.

Price data often act as *real-time* measures of stress

Often, though, market data on prices act more as *contemporaneous* indicators of financial stress than as *leading* indicators. As Graph VI.2 illustrates, spreads and volatilities were unusually low in the run-up to the recent crisis. As real-time measures of market stress, they rose only after the scale of the underlying balance sheet problems, which had been building for years, became clear.

It is thus essential to supplement market data on prices with data on *quantities* – specifically, data on balance sheet positions and balance sheet health – at both the firm and aggregate (sectoral) level. Such balance sheet data are critical to identifying any build-up of vulnerabilities in the financial system. The remainder of this section examines three key aspects of systemic risk – common exposures, leverage and maturity transformation – and highlights some of the critical data gaps that hindered risk assessment and crisis management in the recent episode.

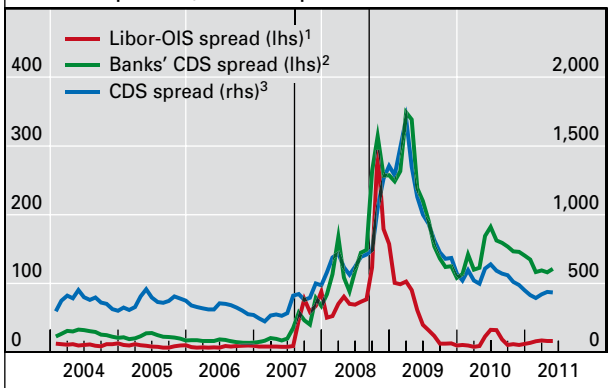
Common exposures

Common exposures increase systemic risk as they lead to a less diversified system. On the assets side, they arise when several financial institutions are exposed to the same institution or asset class. On the liabilities side, common

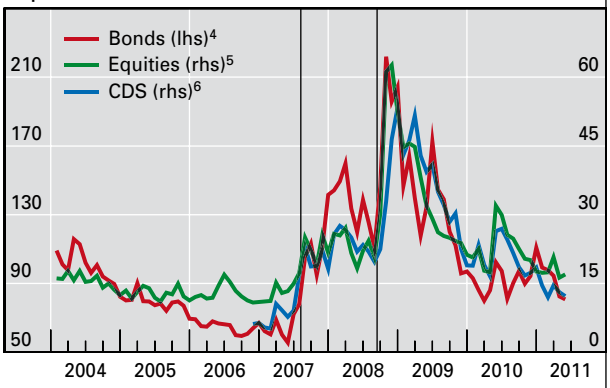
[2] For a detailed discussion of these aggregate indicators, see C Borio and M Drehmann, "Assessing the risk of banking crises – revisited", *BIS Quarterly Review*, March 2009, pp 29–46.

Market prices as contemporaneous measures of financial distress: the US example

Credit spreads, in basis points



Implied volatilities



The vertical lines mark 9 August 2007, the date when tensions in the money market first arose, and 15 September 2008, the date on which Lehman Brothers filed for Chapter 11 bankruptcy protection.

[1] Three-month Libor minus corresponding overnight index swap (OIS) rate. [2] Average credit default swap spread for Bank of America, Citibank, Goldman Sachs, JPMorgan Chase and Morgan Stanley. [3] Five-year on-the-run CDX.NA.HY 100 spread. [4] Merrill Lynch Option Volatility Estimate (MOVE) index for US Treasury bonds. [5] VIX (implied volatility on the S&P 500 Index), in per cent. [6] Implied volatility on the five-year on-the-run CDX.NA.HY 100 spread, in basis points.

Sources: Bloomberg; Datastream; JPMorgan Chase; Markit; BIS calculations. Graph VI.2

exposures result from concentrated funding dependencies – ie when many financial institutions borrow from the same source, for example from money market funds.

Importantly, simply encouraging institutions to diversify their portfolios is not enough to ensure sufficient diversification at the system level. If all institutions have diversified in the same way, each may be individually less likely to fail, but they are all equally vulnerable to the same shocks. As the crisis showed, the financial system was anything but well diversified. Many institutions had crippling exposures to the same toxic assets, and the resulting illiquidity in funding markets affected virtually the entire system.

Analysis of multiple failures requires ...

In principle, the likelihood of multiple failures arising from common exposures could be empirically assessed and the drivers appropriately monitored. Regulators would have full information about the level and riskiness of exposures and the capacity of institutions to absorb risk (in terms of both capital and liquidity), and they would know in detail how shocks are transmitted (through direct interlinkages as well as market reactions). This would amount to a unified framework to measure systemic risk.

... detailed firm-level information ...

A first step in this direction is to obtain data that identify common exposures, especially for banks. While banks are not the only institutions policymakers are concerned about, they are the core of the credit intermediation process and thus a high priority. A key data gap during the crisis was the lack of information on banks' asset and liability positions broken down by currency, counterparty sector, counterparty country and instrument type. For example, no public information was available on large banks' exposures to structured products. As late as February 2008 (when financial statements for end-2007 had already come out), the publicly available data were still patchy and lacking in comparability (Table VI.1). The resulting market uncertainty about the

Large banks' disclosure of exposures to structured instruments

Information released up to February 2008

	Banks disclosing exposure[1]	
	Number	Percentage
Consolidated		
Residential mortgage loans	15	60
Subprime loan component	9	36
ABS[2]/RMBS[3] holdings	8	32
Breakdown by instrument	3	12
Collateralised debt obligations	15	60
Breakdown by instrument	8	32
Assets of consolidated entities[4]	13	52
Breakdown by asset class	9	36
Unconsolidated		
Assets of unconsolidated entities[4]	9	36
Breakdown by asset class	8	32

[1] Twenty commercial banks and five investment banks. [2] Asset-backed securities. [3] Residential mortgage-backed securities. [4] Includes structured investment vehicles, asset-backed commercial paper conduits and special purpose entities.

Sources: Securities and Exchange Commission filings; quarterly financial reports; bank press releases.

Table VI.1

location of risks in the financial system prompted some institutions to hoard or withhold liquidity, contributing to funding problems even at institutions which had no direct exposures.

... that takes account of risk mitigants

The starting point for any analysis of common exposures is consistent information about key aspects of financial institutions' balance sheets that can affect their capital or funding. That information must include all on- and off-balance sheet exposures such as committed credit lines. Data are also required on both gross exposures and exposures *net of risk mitigants* such as collateral, third-party guarantees or hedges. For example, a bank that owns $10 billion in structured products backed by subprime debt may have a much smaller ultimate exposure if the credit risk is hedged by other instruments.

Risk is more difficult to assess at the system level than at the institutional level, where measures of net and gross exposures are fairly straightforward. The systemic impact of a shock to a particular asset class may be much larger than the sum of the firm-level direct net exposures to this asset class if, for example, hedges are concentrated among particular counterparties and thus do not work as expected. American International Group (AIG), which was ultimately rescued by the US authorities, was the counterparty to more than $440 billion in notional positions in credit default swap contracts; its failure would have ramified throughout the financial system.

Crisis management requires timely information on firm-to-firm exposures

Such problems show that data on banks' exposures to other large individual counterparties (that is, bilateral data) are critical for crisis management purposes. These data requirements go beyond the above-mentioned high-level breakdowns that are used to assess common exposures to specific asset classes. During a crisis, authorities must make quick decisions

that take into account how the failure of one institution will affect others. To that end, financial institutions must be able to produce updates of their bilateral exposures at short notice, something which was lacking in many countries during the recent crisis.

Leverage

Multiple bank failures are more likely if the system's capacity to absorb losses is low. This is the case when financial firms are highly leveraged. Usually defined as the ratio of total assets to equity, leverage is a useful indicator of institutional fragility.[3] In essence, it is a multiplier tracking the magnitude of the change in capital arising from a change in asset values. For instance, a financial institution with $100 billion in assets and $5 billion in capital has a leverage ratio of 20. Thus, a 1% drop in the value of the institution's assets would lead to a 20% drop in the value of its equity.

The leverage ratio is a crude measure of fragility. First, it does not take account of how risky banks' assets may be. Second, it excludes off-balance sheet exposures such as credit and liquidity lines. Economically, this leverage is present, but it is beyond the scope of conventional balance sheet analysis. Regulators are now working on reforms aimed at eliminating hidden leverage by ensuring that banks clearly consolidate all their exposures on their balance sheets (see Chapter V).

Standard measures of leverage can mislead because of inconsistent data

Even though leverage ratios require only two inputs (total assets and equity), they epitomise the broader problems associated with the cross-country comparability of data. Differences in regulatory regimes and listing requirements mean that data released to the public are not comparable across institutions. Nor are the confidential data accessed by supervisors necessarily comparable, since data needs differ across jurisdictions. Finally, accounting differences can have a first-order impact. For example, netting of derivative positions with counterparties, which is allowed under US generally accepted accounting principles (GAAP) but not under International Financial Reporting Standards (IFRS), greatly reduces the amounts outstanding. While the top five US banks reported almost $5.4 trillion in gross derivative positions at the end of 2010, their net derivative position was less than 6% of this amount. In turn, including gross rather than net derivative positions in these banks' total assets yields an average leverage measure that is 80% higher than otherwise.

Tracking system-wide as opposed to firm-specific leverage poses further challenges. Consider a simple system-level analogue: the ratio of aggregate assets to aggregate capital for a particular group of banks. One problem with this measure is that it may not truly reflect the multiplier effect that a change in aggregate asset values has on aggregate capital. On the one hand, double-counting occurs when assets and equity are aggregated by simply summing positions across banks. Balance sheet interlinkages in the form of lending, off-balance sheet positions or cross-shareholdings by construction mean that one institution's asset is another's liability, which should be netted out in the

[3] Basel III defines the leverage ratio inversely as equity over total assets, in line with other regulatory capital ratios that reflect the ratio of capital to risk-weighted assets.

aggregate. On the other hand, system-wide losses are not simply the sum of initial losses at individual institutions. The same balance sheet interlinkages can amplify shocks in a non-linear fashion, as the chain of bilateral exposures can lead, for example, to cascading defaults. Quantifying these effects ex ante is difficult as they are inherently driven by market reactions and the particular structure of balance sheets at the moment when stress materialises.

That said, the ability to monitor leverage ratios – even simple weighted sums of firm-level leverage – consistently across different parts of the financial system would represent a big step forward in tracking systemic risk. It would require, at a minimum, internationally comparable measures of total assets and equity for individual financial institutions. Importantly, the measure of total assets would have to include all off-balance sheet positions that could affect a bank's capital.

Maturity transformation and funding risk

Many parts of the financial sector – banks, in particular – use short-term funding to finance long-term investments. While maturity transformation performs an important economic function, it exposes financial institutions to funding liquidity risk, ie the risk that they will not be able to meet cash commitments as they come due.

Tracking funding risk presents its own set of difficulties. In principle, it is straightforward to measure *contractual maturity mismatches* (that is, differences in the remaining maturities of assets and liabilities) on an institution's balance sheet. And it is also possible, at least in principle, to track off-balance sheet positions that are tied to funding (eg contingent commitments or foreign exchange swaps and options). But key determinants of liquidity risk, such as rollover risk (the inability to roll over short-term funding) on the liabilities side or market liquidity risk (the inability to sell at a moment's notice and with little loss) on the assets side, are difficult to measure since they depend on rapidly changing market perceptions at times of stress.

The introduction of minimum liquidity requirements under Basel III will improve the measurement of risks concerning funding liquidity at the firm level and will enhance liquidity risk management more generally (see Chapter V). The new liquidity rules should make internationally comparable data on individual banks' funding liabilities available for the first time, thereby enabling supervisors to monitor funding pressures across key institutions.

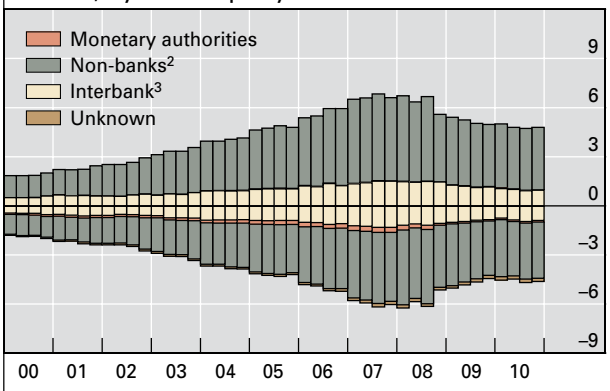
Funding vulnerabilities went undetected before the crisis …

However, the measurement of maturity transformation at the system level requires an even broader perspective. Throughout much of the crisis, but particularly following the collapse of Lehman Brothers in September 2008, the scale of the global demand among European and Japanese banks for US dollar funding took both policymakers and markets by surprise. In the end, banks' dollar liquidity needs could be met only through the establishment of central bank swap lines. The lines were re-established in May 2010 as concerns over European banks' exposures to sovereign risk intensified. These experiences have given central banks a keen interest in monitoring the extraterritorial use of their currency. To that end, they will need comprehensive information – for a much larger universe of financial institutions than just banks – covering

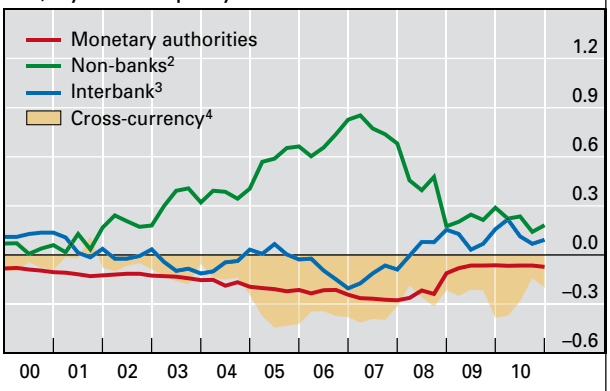
On-balance sheet USD positions at long-USD European banks[1]

In trillions of US dollars

Gross, by counterparty sector



Net, by counterparty sector



[1] Estimates are constructed by aggregating the worldwide on-balance sheet cross-border and local positions reported by internationally active banks headquartered in Germany, the Netherlands, Switzerland and the United Kingdom. [2] International positions vis-à-vis non-banks plus local positions vis-à-vis US residents (all sectors) booked by banks' offices in the United States. No sectoral breakdown is available for these positions. [3] Estimated net interbank lending to other (unaffiliated) banks. [4] Implied cross-currency funding (ie FX swaps), which equates US dollar assets and liabilities.

Sources: Bloomberg; JPMorgan Chase; BIS consolidated banking statistics (immediate borrower basis); BIS locational statistics by nationality. Graph VI.3

aggregate international balance sheet positions by currency, including gross and net currency derivatives.

... because of analytical gaps ...

It is now clear that data available before 2008 could have helped to identify, albeit imprecisely, the growth in non-US banks' dollar funding needs in the run-up to the crisis. Graph VI.3 (right-hand panel) shows the net US dollar asset and liability positions of the major European banks since 2000. Information on the counterparty type (monetary authority, non-bank, interbank) is used to proxy for the (unavailable) remaining maturity of positions, where interbank positions and net foreign exchange swap ("Cross-currency") positions are assumed to have a shorter average maturity than positions vis-à-vis non-banks. The graph is highly suggestive of a growing funding risk prior to the crisis, as the longer-term investments in non-banks became increasingly dependent on short-term foreign currency funding. But only broad tendencies can be identified: there are no actual data on remaining maturities or on the use of foreign exchange swap markets (see box).

... and lack of data

Data needs in a globalised world

The frameworks for data collection must take into account the global scale of many financial institutions and their complex organisational structures. According to their annual reports, the 10 largest global banks on average have 3,500 subsidiaries located in about 80 countries. Some bank operations outside the home country are more systemically relevant than domestic operations; a significant part of European banks' US dollar portfolios, which deteriorated so significantly during the crisis, rested on the balance sheets of their branches and subsidiaries in the United Kingdom and the United States.

The BIS international banking statistics: uses and enhancements

The BIS international banking statistics (IBS) are a long-established dataset for monitoring internationally active banks' foreign positions. The IBS actually combine several datasets, each collected with a different objective in mind. Collectively, they are a key source of information for analysing financial stability issues including banks' country risk, funding risks in different currencies and role in the transmission of shocks across countries. This box describes the characteristics of the IBS data that make them useful in these analyses, and outlines some initiatives designed to improve their usefulness.

Country risk

The BIS consolidated banking statistics (CBS) track banks' worldwide consolidated gross claims and other exposures to individual countries and sectors.[1] They thus provide internationally comparable measures of national banking systems' exposures to *country risk*. The statistics were expanded in the early 1980s after debt crises in emerging markets highlighted the need for information on banks' *transfer risk*, ie the risk associated with policy measures that have a territorial jurisdiction, such as capital controls and payments moratoriums. By the time of the Asian financial crisis, attention had shifted from transfer risk to the broader concept of *country risk*, or the risk associated with the economic, business, political and social elements of the environment in which the debtor operates. In the late 1990s, the statistics were expanded again to capture guarantees and other credit enhancements that result in the reallocation of reporting banks' risk exposures from the immediate borrower to another (ultimate) obligor. These *ultimate risk* data have recently proved useful in tracking banks' exposures to troubled European sovereigns.

The global financial crisis revealed some shortcomings in these data. First, the counterparty breakdown (bank, non-bank private sector and public sector) is too coarse to permit analysis of banks' exposures to particular parts of the non-bank private sector, in particular non-bank financials and households. Mortgage lending by foreign banks in many countries has been rising significantly over the past decade. Similarly over this period, banks' exposures to special purpose vehicles, securities brokers, hedge funds and other non-bank financials have built up significantly. A second shortcoming in the data is that banks do not report exposures vis-à-vis residents of their home country. These are generally large and thus should be included in any assessment of banks' overall country risk.

Funding risk

The IBS are also a key source of information on the currency composition of banks' balance sheets. Indeed, the BIS locational banking statistics (LBS) were originally established to track the growth in US dollar deposits outside the United States in the late 1960s. The LBS follow balance of payments accounting and are collected on a *residence basis*, meaning that the reporting unit is a bank located in a given country. Because reporting countries also provide information on the nationality (ie the home country) of the reporting banks in their jurisdiction, the statistics can also be aggregated along the lines of consolidated national banking systems, as in the CBS described above. These data provide a broad picture of the currency breakdown of banks' consolidated foreign positions. When combined with the CBS data, they help to track, at the bank nationality level, banks' cross-currency funding and investment patterns (Graph VI.3), which proved fragile during the crisis.

Again, however, the crisis has highlighted some limitations in the data. Estimates of banks' US dollar funding needs are approximate at best since there is no actual information on the maturity of banks' assets and liabilities in specific currencies, nor on banks' use of foreign exchange swaps or other currency options. And the counterparty sector split that is used to proxy for residual maturity is very coarse. Moreover, the IBS only cover banks' international activities, not their domestic currency positions against residents of their home country. This incomplete picture of banks' balance sheets makes it difficult to monitor system-level funding risks in other currencies, particularly the euro.

Country-to-country linkages

Both the CBS and LBS have a *bilateral* component, that is, information on the financial linkages between banking systems and countries. Thus, it is possible to partially assess the impact that shocks in one

[1] See "What the BIS banking statistics say (and what they do not) about banking systems' exposures to particular countries and sectors", *BIS Quarterly Review*, March 2011, pp 16–17; and P McGuire and P Wooldridge, "The BIS consolidated banking statistics: structure, uses and recent enhancements", *BIS Quarterly Review*, September 2005, pp 73–86.

market or region might have on borrowers elsewhere. For example, in the LBS, shifts in the investment patterns of residents of surplus countries show up as changes in the amount, the location and the currency of deposits placed in BIS reporting banks. Similarly, in the CBS, banks distinguish between their cross-border claims on particular countries, on the one hand, and their *local operations*, on the other. This information is valuable because, for example, the problems of banks in advanced economies might have less severe consequences for borrowers in emerging market economies if most of the claims are booked in the local operations and funded with local liabilities. By the same token, this structure could also help limit the extent to which an economic shock in a given country affects internationally active banks.

Enhancements

Forthcoming enhancements to the IBS will help to address some of the above shortcomings. In broad terms, these enhancements will (i) provide more information on banks' counterparties, specifically on their location and sector; and (ii) extend the coverage of the statistics to banks' entire balance sheets, not just their foreign positions.

One key enhancement is to include an additional dimension in the LBS. Currently, it is not possible to simultaneously see a bank's location, its nationality and its counterparty's location (eg liabilities to Middle East oil exporters booked in the UK offices of Swiss-headquartered banks). To use the example of Graph VI.4, the data provide a picture of the balance sheet for TRUST Ltd's operations in each oval but no information on the arrows. Starting in late 2012, information on the *country location* of banks' counterparties should be available for the main bank nationalities in each reporting jurisdiction. This will facilitate a more detailed analysis of how shocks in one part of the world might affect borrowers elsewhere.

Second, the coverage of the LBS will be broadened so as to capture banks' financial assets and liabilities in their entirety. That is, banks will start to report their local currency positions vis-à-vis residents of the host country. This will make it easier to assess system-level funding risks across a much wider range of currencies. It will also allow the scale of banks' international activities to be compared with their total balance sheets. Similar enhancements to the CBS are being considered for the longer term. The possible inclusion of banks' claims against residents of their home country would give a more complete picture of the overall size of their balance sheets and their exposures to home country risk.

The BIS has been working to improve its dissemination of the IBS to central banks and the public. Besides providing regular commentary on the full set of statistics in the *BIS Quarterly Review* and other publications, the BIS makes available the data behind the graphs that appear in these publications. It has also simplified access by launching a new online database for the IBS. Finally, the level of detail on banks' credit exposures to particular countries and sectors has been significantly increased.[2]

[2] See "Table 9E: Consolidated foreign claims and other potential exposures – ultimate risk basis" on the BIS statistics website, www.bis.org/statistics/consstats.htm.

The geographical location of financial institutions' operations ...

The nature of the data needed to reveal the risk profiles of institutions which operate globally is determined by the question asked. Many analyses need a group-level view, where all of an institution's operations are consolidated into a single global entity. For instance, leverage ratios should be based on banks' consolidated balance sheets, since only these consistently relate exposures to the capital base ultimately supporting them. Similarly, any effort to identify common exposures across banks to particular sectors or counterparties will require a complete picture of all their exposures, including those of subsidiaries. In short, many of the analytical questions that concern policymakers can be answered with *institution-level* data collected on a *globally consolidated basis*.

... is lost in consolidated balance sheet data ...

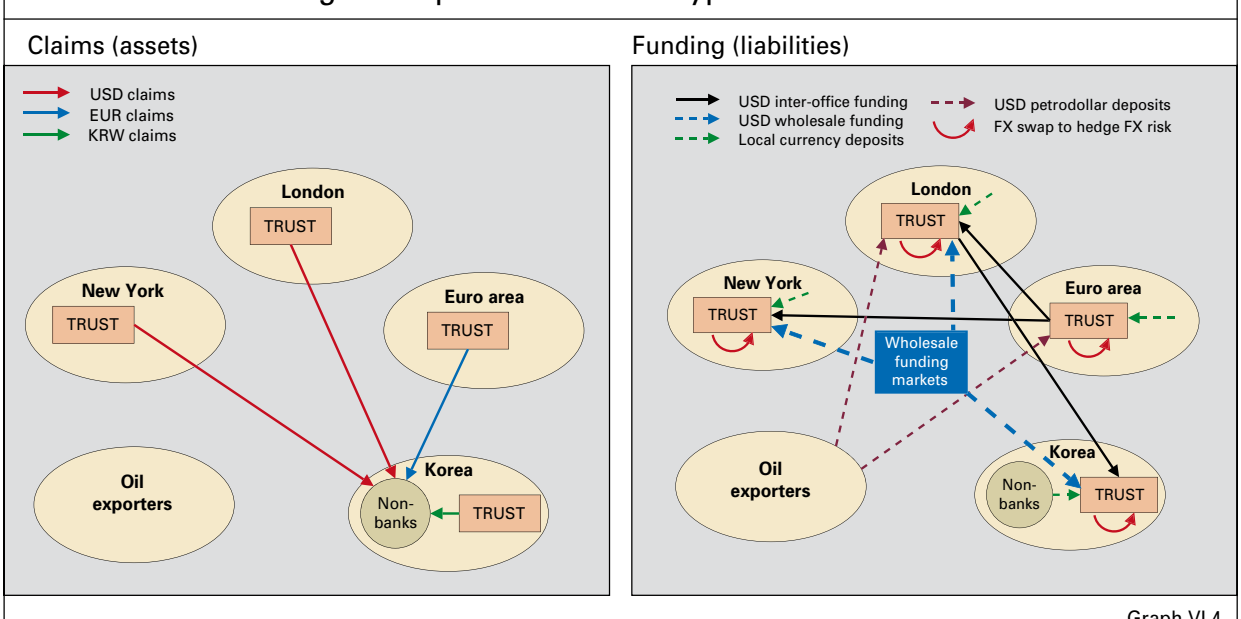
But consolidated data are not enough. Some analyses require information about the geographical structure of banks' global operations. Funding risks can arise in particular subsidiaries or countries but, as explained below, they

can easily go undetected in consolidated data. Similarly, analysing how stress may propagate across sectors and national borders depends on being able to see balance sheet linkages across locations. Complementary information about the location of activities is necessary for a complete analysis.

To see what is lost when data are consolidated, it helps to visualise the operational structure of a hypothetical institution. TRUST Ltd, shown in Graph VI.4, represents any multinational financial or non-financial institution with a large balance sheet and offices in different jurisdictions connected via inter-office funding. In this example, four different TRUST Ltd offices have claims in three different currencies on non-banks in Korea. In turn, TRUST Ltd's liabilities are a combination of euro deposits, wholesale dollar borrowing, commercial paper issuance, petrodollar deposits and euro inter-office funds swapped for dollars. That is, across the four locations, four different liability structures support the four components on the assets side.

Consolidated data can provide only a limited picture of the funding risks embedded in TRUST Ltd's global balance sheet. In such data, offices that are dollar providers to the foreign exchange swap or wholesale interbank markets are netted against those that are dollar borrowers, yielding an overall net borrowing figure for the consolidated entity. This netting implicitly assumes that resources in one location can immediately be used elsewhere – in other words, that the institution's "internal capital market" is frictionless. However, this is unlikely to be the case, given that assets would have to be liquidated and hedges unwound to free up funds – a potentially costly process during a crisis. Moreover, a host country's capital and liquidity regulations might prevent a local office from making large balance sheet adjustments to support affiliates elsewhere. For instance, in the recent case of Icelandic banks, foreign authorities restricted the transfer of their assets across jurisdictions.

The structure of the global operations of the hypothetical firm TRUST Ltd



Graph VI.4

... hindering cross-border analysis

More broadly, consolidated data are of limited use in anticipating how shocks might propagate across sectors and national borders. Given a world with many multinational banks like TRUST Ltd, consider what might happen if one of the funding sources – wholesale funding or petrodollar deposits, say – were suddenly to dry up. Which banks would be hit hardest and which borrowers in which countries would bear the brunt of the impact? Determining this with any precision is impossible without making a host of assumptions about how banks and borrowers would react to the shock. But data on the geographical structure of banks' operations are useful, as they can help to gauge the likely scale and propagation path of the impact. Such analysis is especially useful for countries where the non-bank sector relies heavily on cross-border credit.

It is difficult if not impossible to fully trace the linkages depicted in Graph VI.4 at the micro level. An attempt to do so would require data from all the individual entities which make up TRUST Ltd, complete with information on the location and sector of each entity's full set of counterparties. In practice, any such attempt would be ruled out by the amount of data required, the cost of collection, and the confidentiality issues it would raise.

The task is to find a data mix that will give policy analysts a detailed enough picture of key institutions and their activities. Consolidated balance sheets are the only suitable tool for policymakers who need detailed breakdowns by sector, country, currency and instrument. By contrast, unconsolidated information must be less detailed if it is to be tractable. As described in the following section, an unconsolidated view of the financial sector (and other sectors) could for example be derived, with improvements, from existing *aggregate statistics*.

Filling the data gaps

The recent financial crisis highlighted the need to supplement microprudential supervision with a macroprudential analytical framework based on a broader view of the system. A comprehensive approach to identifying and responding to systemic risks requires a broad range of measures and indicators to be generated and monitored.

Data collection is, however, costly for both reporting institutions and compilers. Further, significant confidentiality and legal issues arise in sharing data. Firms are naturally sensitive about revealing private information that could reduce their profit opportunities – which is why firm-level data are protected by strict confidentiality rules even within national governments. Yet the extent to which the recent crisis spread across markets, different types of institution and national borders strongly suggests that effective systemic stability assessment will require information about individual firms' balance sheets to be shared more widely than before. Given the challenges involved, existing reporting frameworks should be used as much as possible.

Wider sharing of existing supervisory data can enhance risk assessment ...

A top priority is to obtain better and more consistent firm-level data on balance sheet positions for the financial sector. Existing supervisory data might be used to assemble a global picture of the financial sector if a formal

international framework could be devised to address the legal and confidentiality concerns that restrict information-sharing. To that end, the BIS strongly supports the ongoing G20 data gaps exercise, which aims to develop an institution-level data template for global systemically important financial institutions and a framework for data access and usage.[4]

Given the confidentiality issues, much of this detailed information will have to remain in the hands of supervisory teams charged with systemic risk analysis. However, a critical output would be the aggregation and dissemination of key indicators so as to strengthen market discipline by allowing market participants to better price and manage systemic risk.

... as can improved aggregate statistics

At the same time, if updated to reflect the modern global financial landscape, existing sets of aggregate statistics (eg flow of funds or balance of payments data) can help to identify pressure points in many non-bank sectors over which regulators have a limited reach.[5] A further advantage is that confidentiality issues generally do not arise in the sharing of such data. Many sets of aggregate statistics need updating because they were designed for a less internationally integrated world and therefore often lack the information on currencies and instruments needed to track the types of vulnerabilities discussed in previous sections. Most critically, however, they lack the nationality data essential to the construction of *consistent sectoral balance sheets*.[6] That is, because existing aggregate statistics are collected on a residence basis, the balance sheet positions of all entities *located* in a particular country are aggregated regardless of the reporting entity's nationality (ie country of incorporation). While such a perspective may be valid for the household and government sectors, which operate almost entirely domestically, problems arise for the financial and non-financial corporate sectors, which have operations in many countries.

Constructing consistent balance sheets at the sectoral level ...

The limitations of strictly residence-based reporting are illustrated by the case of the US automotive industry when it encountered financial difficulties in 2009. Market participants and policymakers worldwide struggled to identify the sectors and countries that would be affected by any credit event at a US carmaker. The potential implications for the European insurance sector at the aggregate level, for example, could not be discerned because European insurance companies operate globally, and investments are made by their offices outside Europe. Similarly, some of the bonds purchased by these insurance companies are issued by US carmakers' operations outside the United States. Thus, it was not possible to capture European insurers' worldwide consolidated exposures given that the aggregate data were collected on only a residence basis.

[4] See recommendations 8 and 9 in IMF-FSB, *The financial crisis and information gaps: report to the G20 Finance Ministers and central bank Governors*, 29 October 2009.

[5] Several of the recommendations (eg nos 10, 12, 14 and 15) in IMF-FSB, op cit, call for enhancements to the Coordinated Portfolio Investment Survey, the international investment position and flow of funds statistics, and other aggregate statistics more generally.

[6] For further discussion, see S Cecchetti, I Fender and P McGuire, "Toward a global risk map", *BIS Working Papers*, no 309, May 2010.

... requires data on the location and nationality of both reporters and counterparties

To provide a view of sector or country exposures on a consolidated basis, residence-based aggregate data would have to convey four pieces of information: the reporter's location and nationality (eg German insurance companies in Germany, German insurance companies in the United States); and the borrower's location and nationality (eg US automobile companies in the United States, US automobile companies in Brazil). If aggregate data collected in all countries reflected all four components – location and nationality for both the reporting company and the borrower – it would be possible to construct a worldwide consolidated balance sheet for a particular national sector (here, the German insurance sector) as well as for its counterparty (here, US automobile companies worldwide). Such a reporting system could provide a picture of the exposure of (consolidated) sectors or countries to *each other*.

Existing sets of aggregate statistics capture one or more of the four pieces of information specified above, but none captures all of them simultaneously. That said, several current initiatives are moving in the right direction. For example, improvements to the BIS banking statistics, which cover only internationally active banks, are currently being worked on. These include the expansion of coverage to three of the four fields, which would deliver a sector-level view of national banking systems akin to that for TRUST Ltd in Graph VI.4 (see also box). Similar improvements to the other sets of aggregate statistics are also desirable since they are the primary source of information on the balance sheet positions of non-banks, which are generally beyond the reach of regulators.

Summing up

Better data will not prevent the next crisis, but they can help policymakers to measure and monitor systemic risk, identify pressure points and see where targeted investigations are needed. Arrangements which facilitate the broader sharing of firm-level data among policymakers will support financial stability policy decisions. A complementary element would be the regular analysis of aggregate data that track risk factors in both regulated and unregulated sectors of the economy, thus providing a broad picture of where vulnerabilities are building. And the provision of timely data on aggregate market positioning will improve market participants' ability to price and manage their risks.

To stay current and relevant, improved data frameworks require enhanced review mechanisms so that they will continue to reflect new developments in the global economy. Finance will continue to evolve, and new financial instruments will emerge. Over time, moreover, institutions will find ways of concealing risks in the data they report. Here, transaction-level data from data warehouses and trading platforms can provide helpful additional information, including early indications of changes in market structure or business lines. These, in turn, could guide ad hoc data collection efforts and inform adjustments to established data templates.