

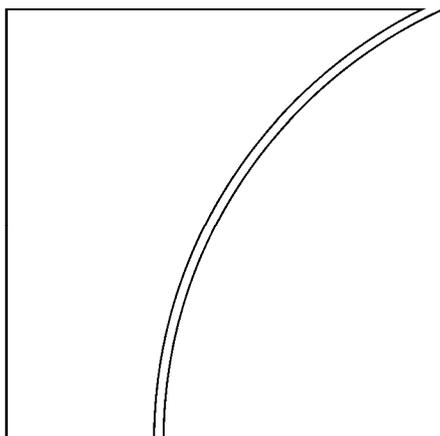


BANK FOR INTERNATIONAL SETTLEMENTS

BIS Quarterly Review

September 2010

International banking
and financial market
developments



BIS Quarterly Review
Monetary and Economic Department

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International banking and financial market developments

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Notations used in this Review

e	estimated
lhs, rhs	left-hand scale, right-hand scale
billion	thousand million
...	not available
.	not applicable
–	nil
0	negligible
\$	US dollar unless specified otherwise

Differences in totals are due to rounding.

Overview: growth concerns take centre stage

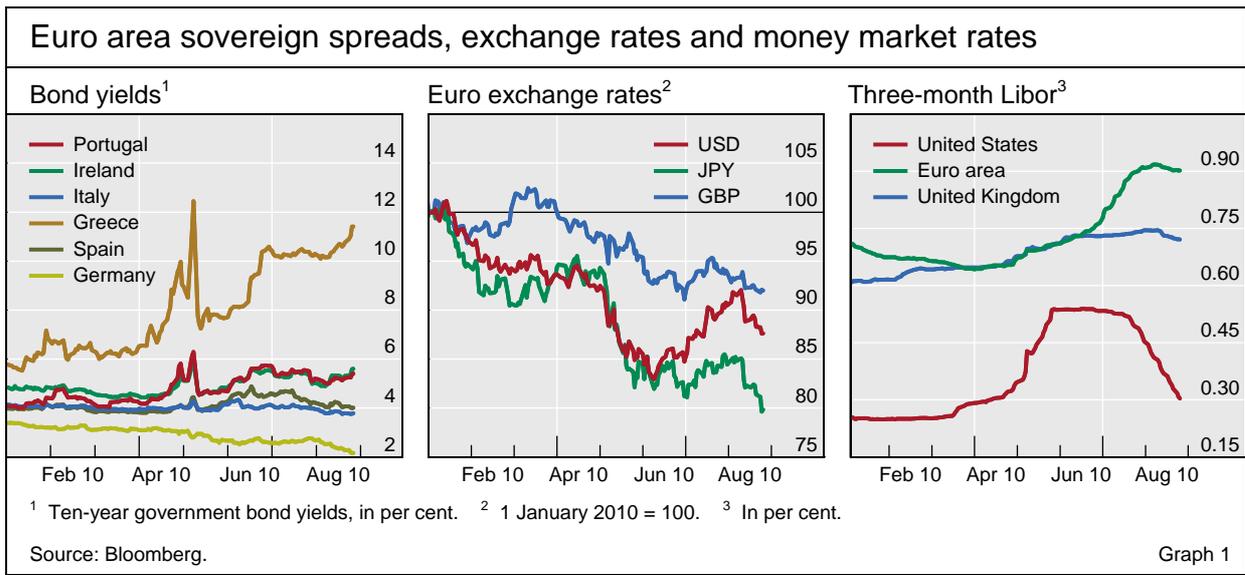
The period from early June to late August saw investors shift their attention from the funding problems of European sovereigns to the diverse global growth outlook and the implications for asset prices. In the early part of the period, improved access to funding for a number of European sovereigns and the reduced uncertainty following the release of the EU bank stress tests contributed to lower risk premia for most sovereigns and larger banks. Credit spreads declined and equity prices rose across the globe. Bank equity prices also responded favourably to a series of national and international regulatory announcements.

Starting in late July, increasing evidence of economic weakness in the United States led to lower inflation expectations and falling bond yields. During August, the decline in yields accelerated and equity prices fell as evidence of slower growth in a number of advanced economies mounted.

These developments contrasted with continued strong albeit somewhat lower economic growth in China, as well as in a number of Asian and Latin American economies. Inflationary pressures in faster-growing emerging economies, accompanied by rising asset prices, led some central banks to tighten policies. With higher interest rates, capital inflows rose and currencies appreciated.

Euro sovereign funding concerns subside

Euro area sovereign bond markets stabilised during the period. Yields on euro sovereign bonds declined from June to August for all countries except Greece, Ireland and Portugal (Graph 1, left-hand panel). A similar pattern was seen in credit default swap (CDS) spreads. Overall, access to market funding improved, with several governments issuing bonds. Over this period, the ECB's purchases of euro sovereign bonds also subsided. During June and July, the euro recovered against major currencies (Graph 1, centre panel) and European equity markets regained some of their previous losses. Having declined through June and July, yields rose for Greece, Ireland and Portugal from early August onwards. In Ireland, larger than expected losses at a government-supported bank increased government borrowing expectations. The euro declined against other major currencies over the second half of August.



Greece, Spain, Portugal and Ireland all passed crucial tests of their ability to issue bonds despite negative rating actions. Greek debt came under renewed pressure in mid-June after Moody's downgraded it to non-investment grade, resulting in its exclusion from key benchmark bond indices. Despite this, Greece returned to the primary markets in mid-July. This renewed bond market access was interpreted as a positive response to Greece's progress on key reforms in the face of public opposition. Despite being placed on watch for downgrade by Moody's, Spain held successful auctions in mid-June, and returned with another sale several weeks later. Portugal and Ireland also issued bonds on the day following downgrades of their debt. On 4 August the European Financial Stability Facility (EFSF) became fully operational, increasing investor confidence by providing an additional source of support. The EFSF was set up by the 16 euro area countries to provide a funding backstop should a member state find itself in financial difficulties, but did not issue any bonds.

As euro sovereign markets improved ...

The improved market conditions in euro area bond markets from mid-June to late July allowed central banks to begin to reduce their involvement in financial markets. In mid-June the Swiss National Bank stopped intervening in foreign exchange markets to slow the appreciation of the Swiss franc. From mid-June onwards, the ECB slowed its pace of government bond purchases and began unwinding its extraordinary liquidity operations. It reduced the size of its weekly purchases of government bonds via the Securities Market Programme and on 1 July its one-year longer-term refinancing operation became due and was not replaced. At the end of July, the ECB revised its collateral framework, increasing haircuts on lower-rated private sector securities. The gradual normalisation of ECB liquidity provision was partly reflected in the steady rise of the three-month Euribor rate (the rate at which banks lend to each other in euros) from early June to mid-August. Over the same period the equivalent US dollar rate declined, while the UK rate remained virtually unchanged (Graph 1, right-hand panel).

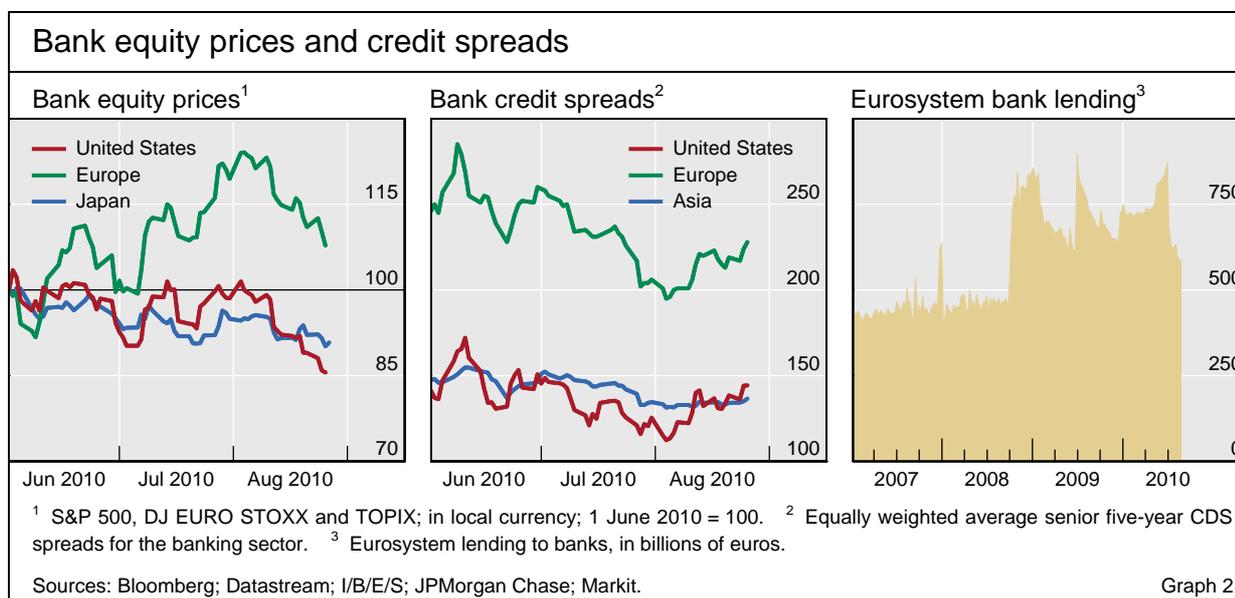
... the ECB began unwinding liquidity support

European bank stress tests increase transparency

Bank stress test results published

Investors' perceptions of the European banking system received a boost on Friday 23 July following the publication of stress tests for EU and Swiss banks. The EU bank stress test results provided much welcome transparency on the sovereign holdings of leading European banks, as well as a consistent set of disclosures about their balance sheets (see box). This enhanced transparency reassured investors. The Monday following the release saw a 2% rise in European banks' share prices and a 10–15 basis point decrease in their CDS spreads (Graph 2, left-hand and centre panels). Greater confidence in European banks also contributed to lower sovereign risk premia and improved conditions in European money markets, with ECB loans to Eurosystem banks declining (Graph 2, right-hand panel).

The release of the Basel Committee's modified capital and liquidity proposals on Monday 26 July led to a further rise in bank stock prices in the days that followed. Investors welcomed the cautious approach taken by regulators. Recognising that there is no precedent for a global liquidity standard, regulators are proceeding cautiously with the implementation and working to ensure a prudent but proportionate calibration. The Committee also announced that the net stable funding ratio will be subject to an observation period and become a minimum standard on 1 January 2018. It also made adjustments to the treatment of minority interests, investments in financials and mortgage servicing rights to address unintended consequences of the December 2009 initial proposal and to ensure a more balanced, but still conservative, definition of capital. The positive reactions to the bank stress test results and the Basel Committee's modified proposals was supported by a string of positive earnings announcements from European banks. Bank CDS premia decreased, with the iTraxx Europe Senior Financials index declining by 14.5% by the end of the week. In the weeks that followed, the primary markets reopened for business, with financial institutions – notably Spanish banks – issuing both covered and unsecured bonds.



EU bank stress tests: good for transparency

Michael Davies and Michael R King

The EU bank stress tests were designed to assess the resilience of the EU banking system to a range of adverse economic and financial market shocks. They were conducted by the Committee of European Banking Supervisors (CEBS), together with the ECB, European Commission and national supervisors. The tests covered 91 banks from 20 EU member states representing about 65% of EU banking assets and at least 50% of assets in each respective member state. Spain had the greatest coverage, with 27 banks participating, covering almost 100% of banking assets. Results at both an EU aggregate and individual banking group level were released on Friday 23 July after the close of European trading. The same day, the Swiss bank regulator FINMA also announced that the two largest Swiss banks had passed their stress tests.

The EU bank stress tests examined three macroeconomic scenarios over the two years ending December 2011: (i) a benchmark scenario reflecting the EU economic outlook of 1.0% GDP growth in 2010 and 1.7% in 2011; (ii) an adverse scenario where aggregate GDP dips 3% below the EU forecast over the two-year period; and (iii) the adverse scenario combined with a sovereign shock. The sovereign shock was modelled as an upward shift in the government yield curve in all EU countries, with additional country-specific increases in long-term government bond yields. The authorities provided a common set of macroeconomic variables across each scenario for each EU member state, the United States and the rest of the world. To pass the test, banks needed to maintain a Tier 1 capital ratio greater than 6% under each of the scenarios (vs the regulatory minimum of 4%).

Most of the banks easily passed the stress tests, with the EU aggregate Tier 1 ratio under the toughest scenario falling from 10.3% at end-2009 to 9.2% by the end of 2011. Under this scenario, aggregate loan impairment losses were €473 billion over the two years, trading losses were €26 billion, and the sovereign shock added €67 billion of losses. Banks' expected operating income over the two-year forecast almost exactly offset these losses.

Seven banks did not maintain a 6% Tier 1 capital ratio, and need to raise a combined €3.5 billion of capital. Another 20 banks had capital ratios between 6% and 7%. The banks with a capital shortfall were five Spanish savings banks ("cajas") (needing €1.8 billion), Hypo Real Estate of Germany (€1.2 billion) and Agricultural Bank of Greece (€0.2 billion). Authorities are working with these banks to raise their capital ratios or restructure them. Backstop facilities had already been put in place in some countries ahead of the release of the stress test results, while authorities in others have announced that government funds are available if needed.

Critics of the exercise argued the stress tests were not demanding enough. The tests did not consider the impact of a euro sovereign default, so they did not stress the prices of government bonds held in banking books (the vast bulk of banks' holdings). The tests also focused on existing Tier 1 capital ratios, rather than the more demanding core Tier 1 ratios, although the difference between measures is only important in some countries. Despite these criticisms, the market welcomed the greater transparency provided by the tests, particularly the consistent data on individual banks' holdings of EU sovereign bonds.

Over the weeks prior to the release of the EU stress test results, bank stocks outperformed the broader market indices and bank CDS spreads narrowed, possibly in anticipation of a positive outcome. The immediate market reaction after the release of the official results was positive, with European banks' share prices rising by 2% and their CDS spreads decreasing by 10 to 15 basis points on the first trading day after their release. Over the subsequent weeks, the rise in bank stocks and narrowing of CDS spreads continued, although the stress test effect cannot be distinguished from the response to the Basel Committee's updated capital and liquidity reform package. Also, a number of banks released positive earnings over this period. Access to market funding reportedly improved for the largest banks following the release. Consistent with this, bond issuance from European banks has increased, most notably for the biggest Spanish banks. But anecdotal reports suggest that medium-sized and smaller banks are still facing difficult financing conditions.

Asset prices reflect lower expected US growth

US economy slows down ...

In the period from June to late August a string of weaker than expected macroeconomic releases combined with a change in outlook from the Federal Reserve convinced market participants that the US economy was slowing down. This view, reinforced by a series of Federal Reserve speeches and testimony, resulted in lower long-run government bond yields, partly reflecting a lowering of inflation expectations.

... causing Treasury yields to decline ...

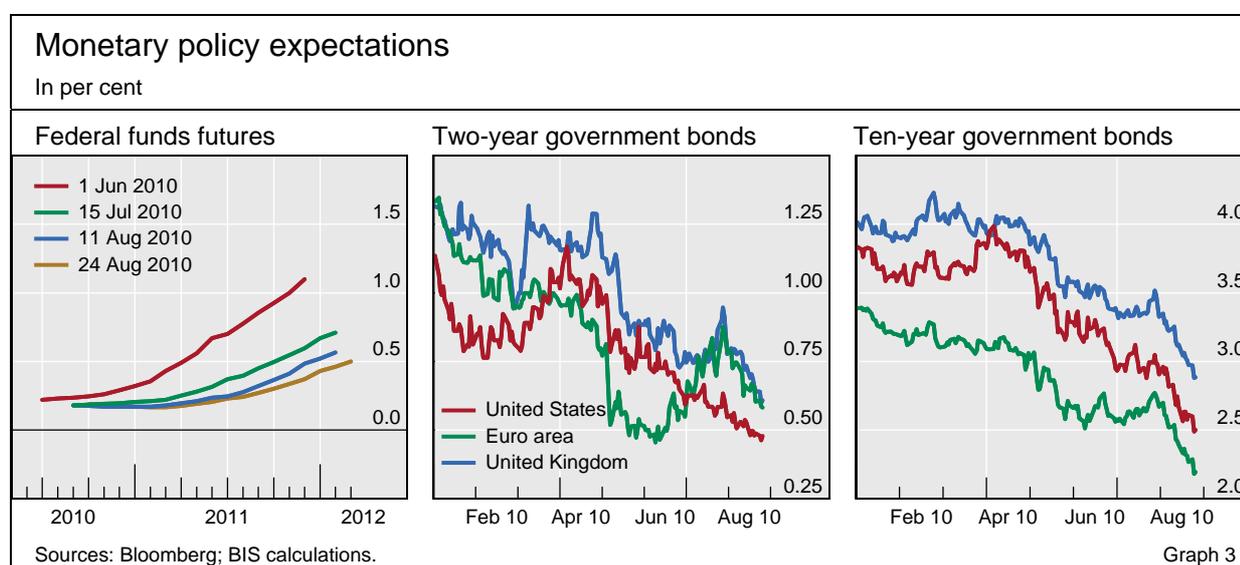
The change in outlook for US growth led investors to postpone the expected timing for the normalisation of monetary conditions, while fostering market expectations about possible further “quantitative easing”. Federal Reserve Chairman Bernanke’s testimony to Congress in late July, FOMC meeting minutes and Fed speeches were taken to mean that any normalisation of monetary conditions would be delayed further. The Federal Reserve also lowered its growth forecast following a string of disappointing US macroeconomic releases. The central bank’s decision on 10 August to delay reducing the size of its balance sheet by reinvesting funds generated by its mortgage portfolio into US Treasuries helped reinforce investors’ expectations of continued low policy rates. Following this announcement, prices of federal funds futures declined, implying that any policy rate increases would be likely to occur in the second half of 2011 or early 2012 (Graph 3, left-hand panel).

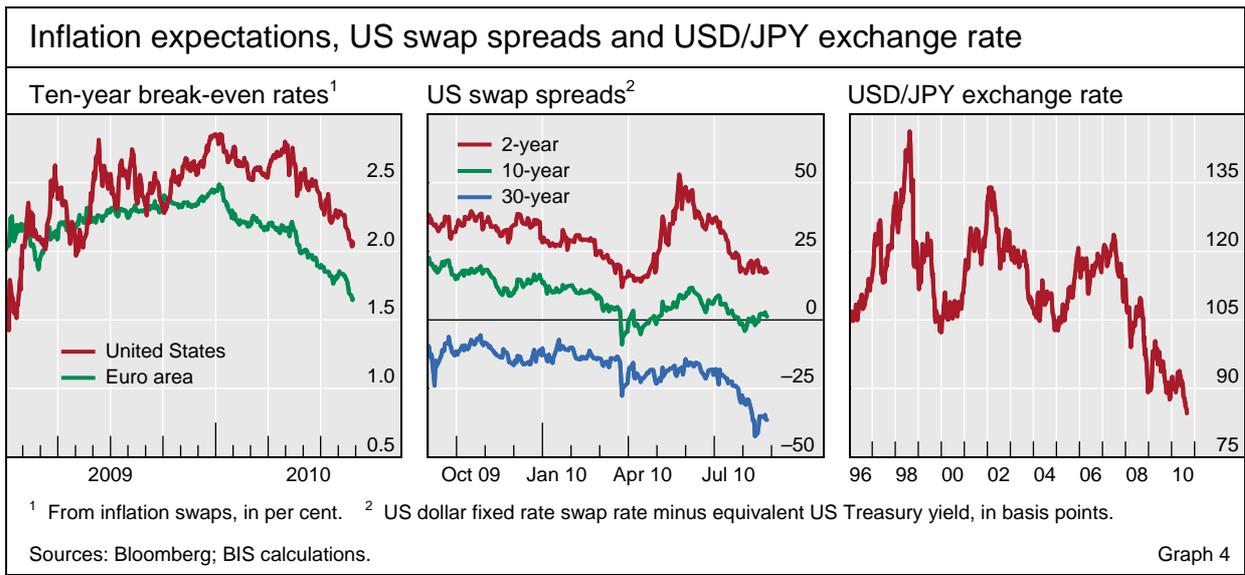
... and expected inflation to fall

The shape of the US yield curve reflected the changed growth outlook. Yields on two-year US Treasuries recorded an all-time low around 0.50% (Graph 3, centre panel). The 10-year rate fell below 2.5% – a level last seen during December 2008 – despite market expectations of greater US borrowing needs to finance increased fiscal deficits (Graph 3, right-hand panel). This decline in long-term Treasury yields is consistent with lower expected inflation. Inflation swaps implied a break-even inflation rate of around 1.7% for the next 10 years, down from 2% in late May (Graph 4, left-hand panel).

Swap spread turns negative

During the final week of July, the fixed rate paid on a 10-year interest rate swap fell below the yield on 10-year US Treasuries, leading to a negative swap spread for the second time this year (Graph 4, centre panel). Swap rates are

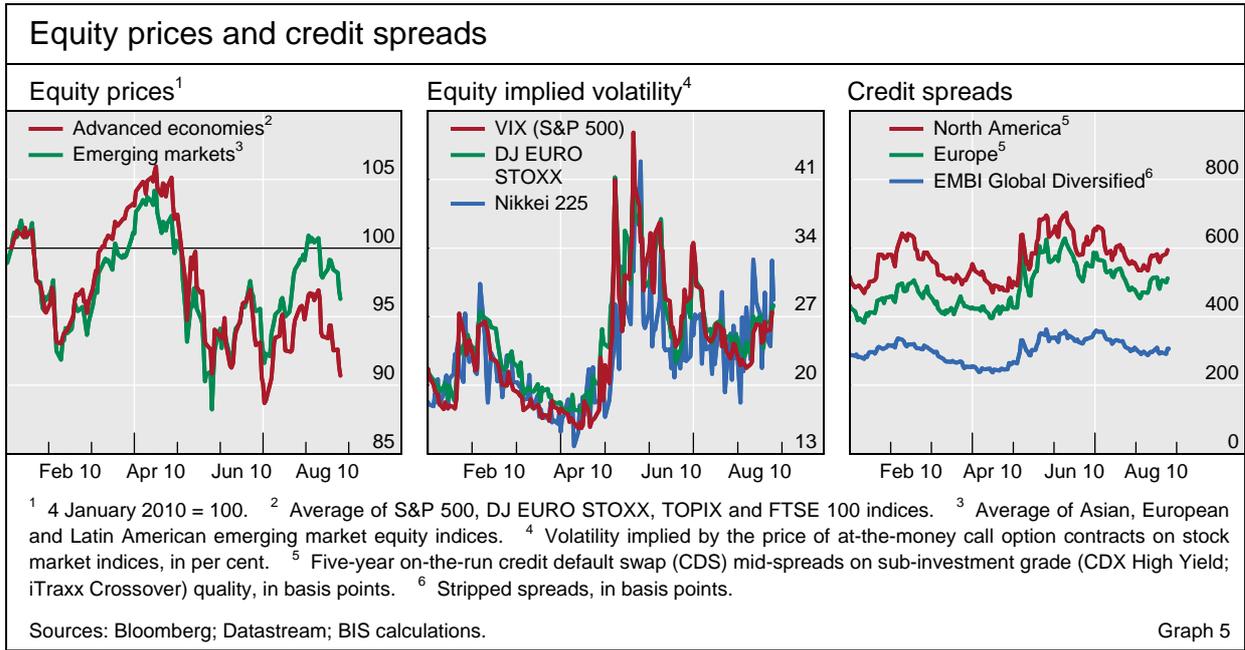




typically higher than Treasury yields as the floating payments are based on bank borrowing rates, such as Libor, that contain credit risk. Prior to March of this year, the 10-year US swap spread had never been negative, although the 30-year spread had been negative for some time. The negative 10-year swap spread may reflect hedging related to US corporate bond issuance, which rose sharply in July. Low long-term interest rates have made it attractive for investment grade borrowers to issue 10-year fixed rate bonds and convert them into floating rate liabilities by receiving the fixed rate on a 10-year swap. Market commentary suggests that banks in particular may have been quick to take advantage of this opportunity.

In the two months that followed the 9 June release of the Federal Reserve's report on regional economic conditions (the Beige Book), which pointed to subdued economic growth, the US dollar depreciated against all major currencies. Most notably, it reached a 15-year low against the Japanese

US dollar weakens



yen (Graph 4, right-hand panel). The rapid appreciation of the yen against the US dollar led Japanese authorities to express their concerns over the currency's strength and the possible negative impact on Japanese exports.

Corporate bonds outperform as investor caution remains

Bonds outperform equities ...

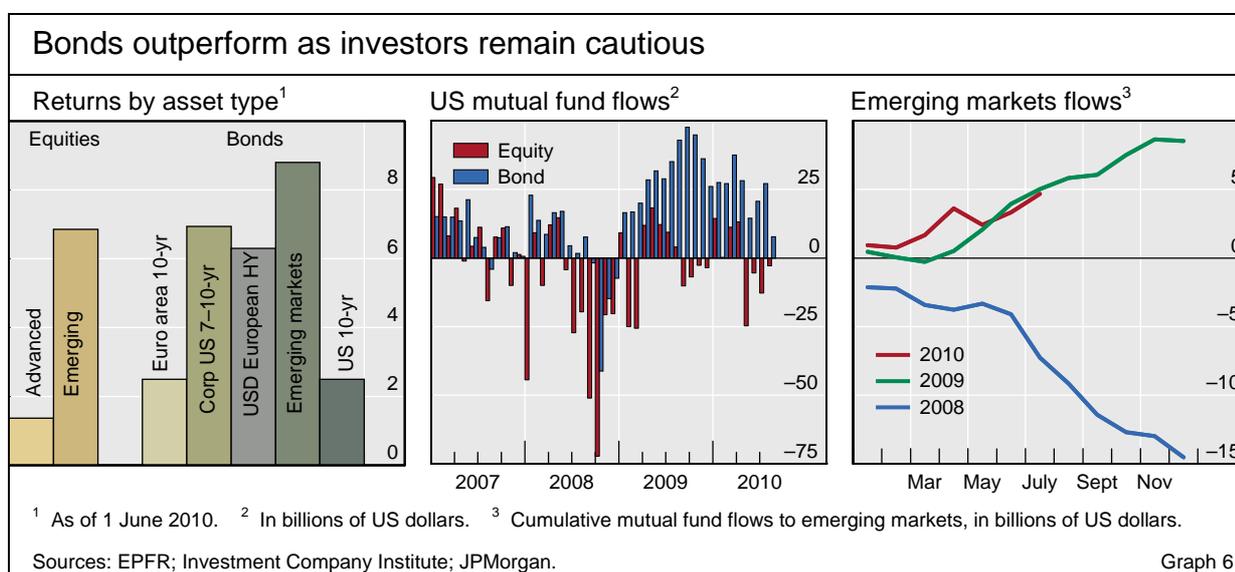
Increasing growth concerns led investors to remain cautious. Nevertheless, prices rose in both equity and corporate bond markets in response to the improved conditions in euro sovereign debt markets, positive US and European corporate earnings announcements and greater clarity on the regulatory agenda (Graph 5, left-hand panel). Equity volatility also declined (Graph 5, centre panel). Given the significant drops earlier in the year, however, North American and European equity markets remained flat or below their levels at the beginning of the year. In contrast, there were gains for some Latin American markets and large losses for Chinese, Japanese and Australian markets.

... as funds flow to emerging markets

Despite unchanged credit spreads (Graph 5, right-hand panel), both investment grade and high-yield corporate bonds generated large returns due to falling risk-free rates (Graph 6, left-hand panel). The superior performance of bond markets relative to equity markets was mirrored in global investment flows. In the United States, large outflows from equity mutual funds from May to July were offset by large inflows to bond mutual funds (Graph 6, centre panel). These inflows picked up again during July.

Gradual policy normalisation with diversity

Lower growth in advanced economies and historically low government bond yields increased investor demand for assets with higher expected returns in leading emerging market economies. The increased investor interest can be seen in surveys as well as data on investment flows. After experiencing large outflows in 2008, emerging market equity and bond funds saw large inflows in 2009 and the first half of 2010 (Graph 6, right-hand panel). Since the start of June, emerging market bonds have been one of the best performing assets

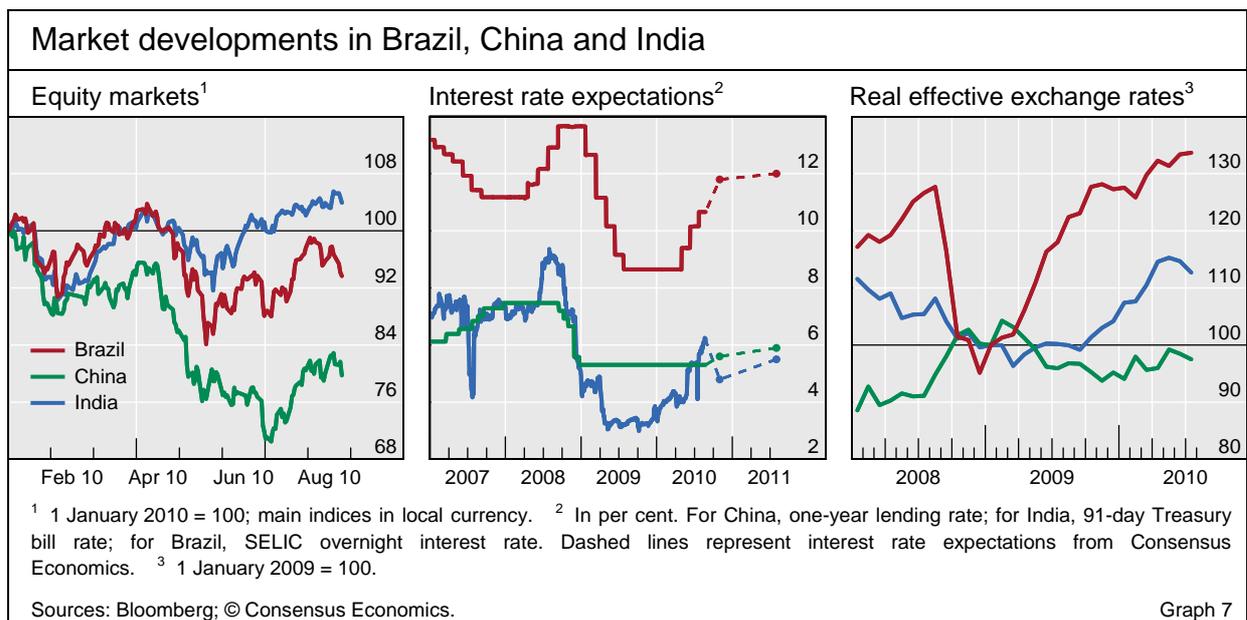


(Graph 6, left-hand panel). Bond and equity markets in Brazil, China and India, as well as Southeast Asia, which had declined in response to the higher volatility and increased risk aversion during the euro sovereign debt crisis, rebounded by 10% or more (Graph 7, left-hand panel). Sovereign CDS spreads for these countries declined, and their exchange rates appreciated (Graph 7, right-hand panel).

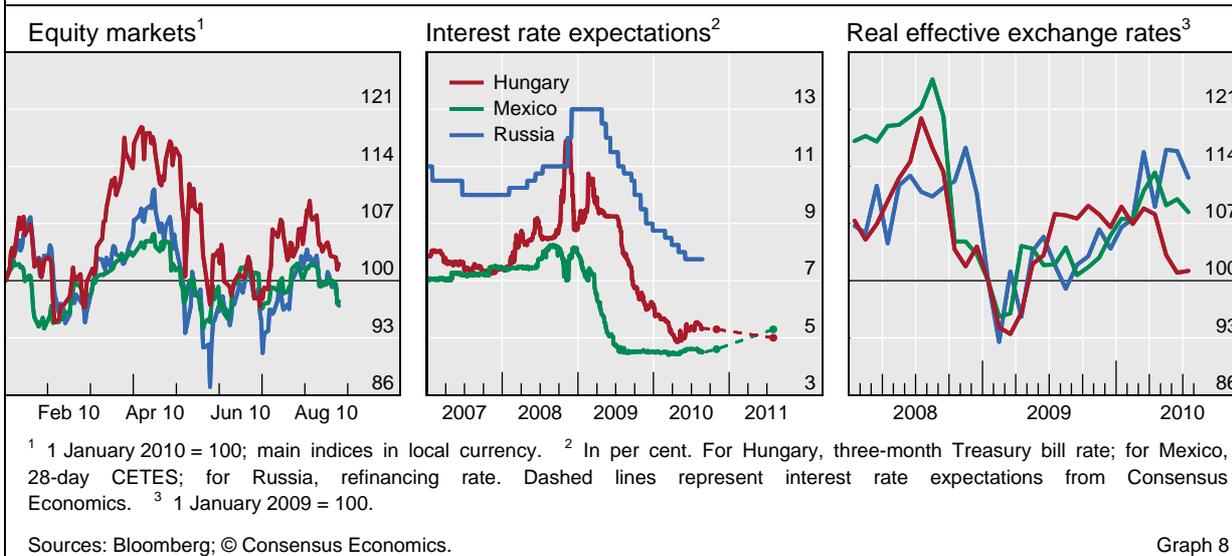
These asset price movements reflected investor expectations that major emerging economies would continue to experience high growth rates, despite domestic policy tightening and slower growth in advanced economies. On the monetary policy side, central banks in fast-growing economies sought to restrain inflationary pressures and rising asset prices through a combination of monetary policy rate hikes, exchange rate appreciation and macroprudential measures (Graph 7, centre panel). Consensus forecasts of inflation, which began to decline in July, suggested that market participants regarded the policy tightening as working.

Fast-growing economies tighten ...

China, for example, took several steps to reduce credit growth and normalise other policies over the recent period. On 19 June, the People's Bank of China (PBoC) announced that it would "proceed further with reform of the RMB [renminbi] exchange rate regime and to enhance the RMB exchange rate flexibility". This statement was seen by investors as marking the end to China's unofficial crisis measure of pegging the Chinese currency to the dollar. Following its announcement, the PBoC signalled that there would be no significant one-off revaluation of the renminbi by fixing the daily spot rate at the same level as prior to the announcement. The initial reaction in the non-deliverable forward (NDF) market was significant, with one-month NDF contracts implying a 6.7% appreciation against the US dollar, while one-year contracts implied a 2.7% rise. Despite the initial market expectations, by late August the renminbi had appreciated by less than 0.5% relative to the US dollar.



Market developments in Hungary, Mexico and Russia



... while others
lower rates

While a number of emerging markets experienced high growth and policy tightening, some in every region saw weaker growth and easier monetary conditions. Countries that cut policy rates include Mexico and Colombia in Latin America; Russia, the Czech Republic and Hungary in central and eastern Europe; and South Africa. Each of these economies faced different challenges, some domestic in origin and some external. Equity markets in Hungary, Mexico and Russia, for example, were quite volatile, rising over June and July but declining during late July and the first half of August (Graph 8, left-hand panel), as central banks lowered policy rates (Graph 8, centre panel). Expectations of weaker growth and lower interest rates contributed to a depreciation of the corresponding exchange rates (Graph 8, right-hand panel).

In Hungary's case, statements and actions by the new government contributed to the volatility in equity markets and the exchange rate. In early June, a government official suggested that a sovereign default could not be ruled out. This generated a sharp fall in the Hungarian forint and a rise in government bond yields. Adding to investors' concerns, the Hungarian government abruptly ended talks with the IMF in July over the terms of an IMF/EU loan package, holding up €4.4 billion of financing.

Highlights of international banking and financial market activity

The BIS, in cooperation with central banks and monetary authorities worldwide, compiles and disseminates several datasets on activity in international banking and financial markets. The latest available data on the international banking market refer to the first quarter of 2010. The discussion on international debt securities and exchange-traded derivatives draws on data for the second quarter of 2010.

The international banking market¹

The contraction of BIS reporting banks' international balance sheets that had begun in the fourth quarter of 2008 came to an end *during the first three months of 2010*. The turnaround was led by sizeable increases in international claims on residents of the United Kingdom and the United States. It was also boosted by continuing acceleration in cross-border claims on Asia-Pacific and Latin America and the Caribbean, which were the first two regions to experience positive post-crisis growth in international lending in the second quarter of 2009. Claims on the euro area and on emerging Europe continued to decline. Nevertheless, internationally active banks increased their exposures to Greece, Ireland, Portugal and Spain, mainly as a result of rising off-balance sheet items. BIS data reveal that, as of the end of March 2010, the euro area public sector portfolios of euro zone banks had a larger share of higher-yielding government debt than those of other major banking systems, which had a greater proportion of lower-yielding government debt.

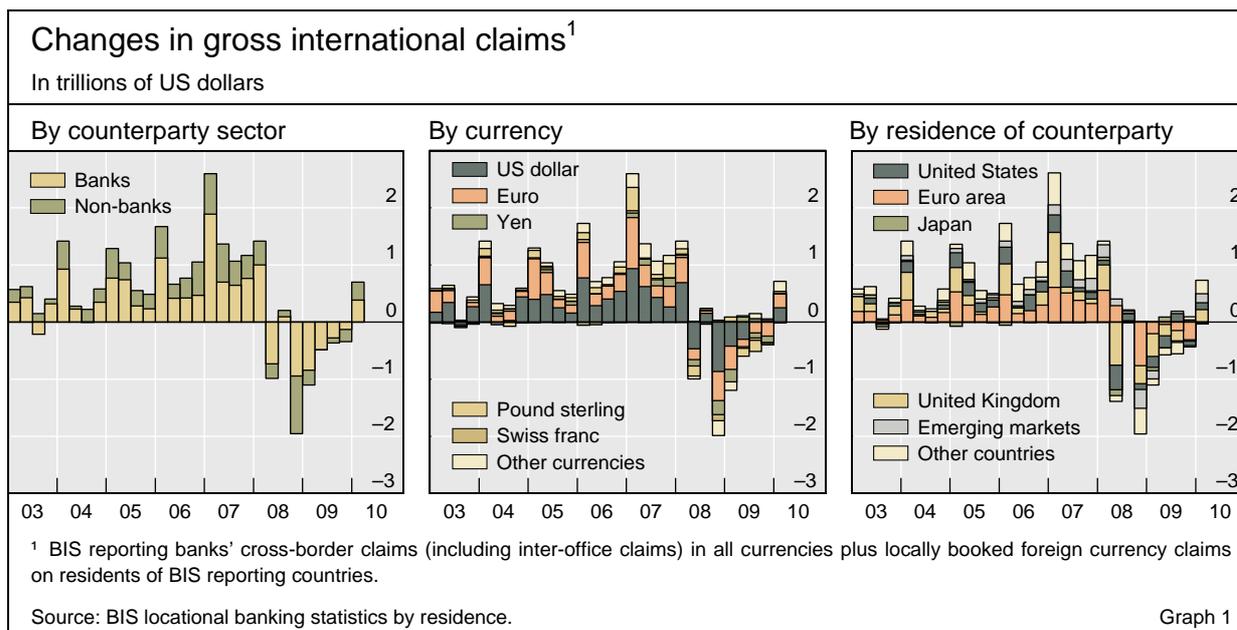
International claims expand for the first time in six quarters²

During the first three months of 2010, the international claims³ of BIS reporting banks rose for the first time since the third quarter of 2008. The \$700 billion

¹ Queries concerning the banking statistics should be addressed to Stefan Avdjiev.

² The analysis in this and the following subsection is based on the BIS locational banking statistics by residence. All reported flows in international claims have been adjusted for exchange rate fluctuation and breaks in series.

³ International claims consist of cross-border claims and local claims denominated in foreign currencies.



(2.1%)⁴ increase brought the aggregate stock of international claims to \$33.4 trillion (Graph 1, left-hand panel). The expansion was driven by solid increases in both interbank claims (\$383 billion or 1.8%) and claims on non-bank entities (\$317 billion or 2.5%).

The overall expansion in claims was broadly spread across currencies (Graph 1, centre panel). The largest increases were recorded in claims denominated in US dollars (\$253 billion or 1.9%) and in euros (\$238 billion or 1.9%). Claims denominated in sterling and yen also moved up, rising by \$30 billion (1.6%) and \$15 billion (1.3%), respectively. The only major currency showing a decline was the Swiss franc. Claims denominated in that currency fell by \$14 billion (2.1%).

The counterparty residence breakdown produces a more mixed picture (Graph 1, right-hand panel). International claims on residents of the United Kingdom expanded (by \$217 billion or 3.5%) for the first time since the first quarter of 2008. Reporting banks also increased their claims on US residents (by \$120 billion or 2.4%). By contrast, banks decreased their claims on residents of Japan (by \$9 billion or 1.0%) for the third quarter in a row. Furthermore, claims on residents of the euro area contracted by \$21 billion (0.2%), despite the fact that euro-denominated claims on the region increased by \$72 billion (0.9%). The overall decline largely reflected a \$100 billion (8.4%) shrinkage in US dollar-denominated claims on banks located in the area. More than a third of the latter reduction (\$37 billion) was reported by banks located in the United States.

Claims denominated in US dollars and euros expand significantly

Cross-border claims on Asia-Pacific and Latin America-Caribbean soar

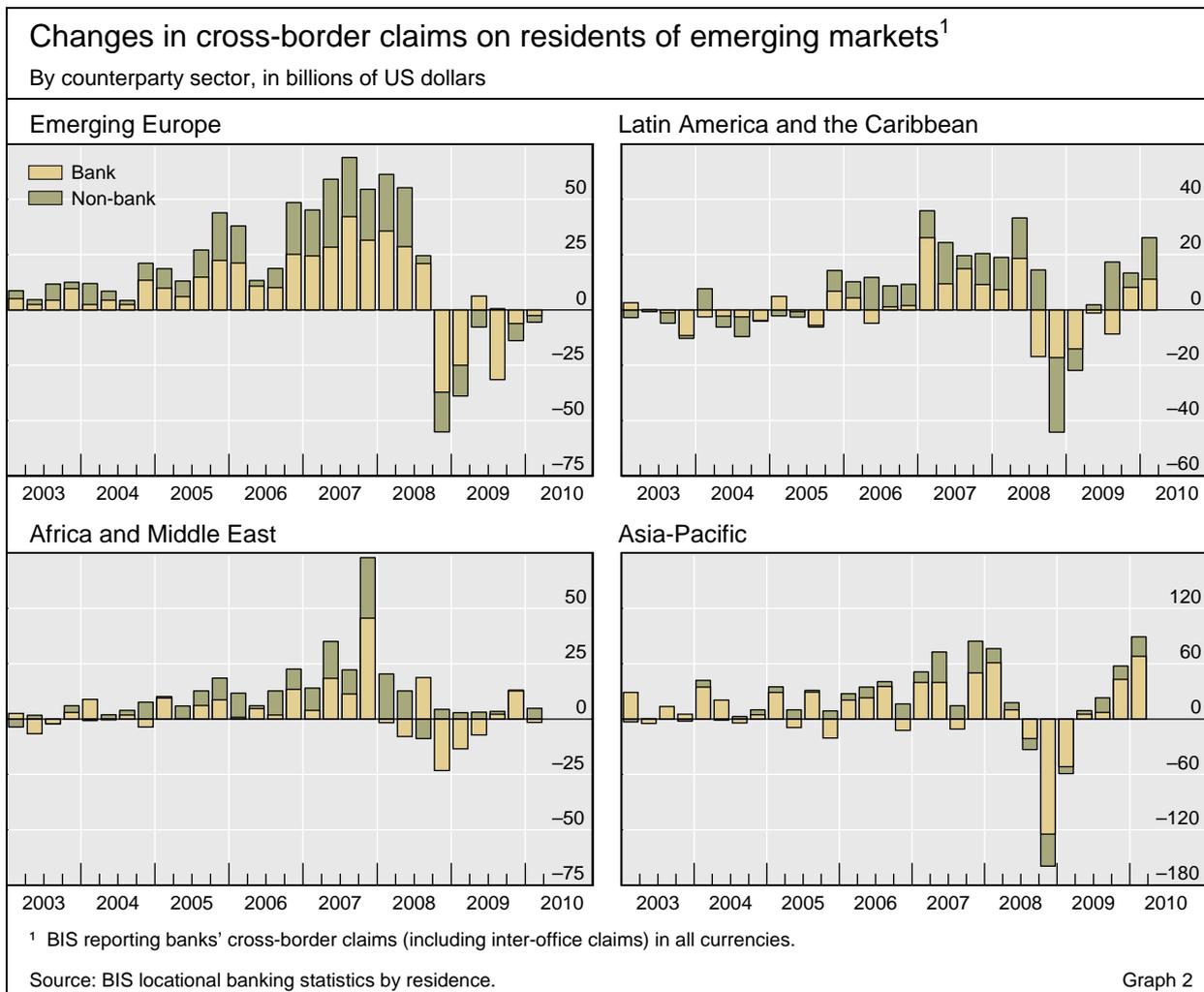
Cross-border claims on residents of emerging market economies grew for the fourth quarter in a row (Graph 2). The \$113 billion (4.6%) expansion in the first quarter of 2010 was about 40% larger than the combined increases of the

⁴ All percentage figures refer to changes over the stock at the end of the previous quarter.

previous three quarters. Most of it was due to a \$75 billion (6.4%) rise in interbank claims, although claims on non-banks also expanded significantly (\$38 billion or 3.0%). Just as in the previous three quarters, the overall increase was led by heavy borrowing by the residents of the faster-growing Asia-Pacific and Latin America-Caribbean regions. Conversely, claims on emerging Europe, where the recovery in economic activity has been much slower, declined for the sixth quarter in a row, albeit at a decreasing rate.

Growth in cross-border claims on Asia-Pacific ...

In line with the strong economic growth in Asia-Pacific, BIS reporting banks expanded their cross-border claims on residents of the region for the fourth quarter in a row. Almost half of the \$89 billion (11.4%) overall increase was due to an unprecedented \$42.1 billion (23.8%) surge in claims on residents of China. Meanwhile, claims on residents of India went up by \$18.1 billion (13.5%), the second largest increase on record. In addition, banks significantly expanded their cross-border lending to Korea (by \$11.0 billion or 5.5%), Chinese Taipei (by \$6.3 billion or 11.7%), Indonesia (by \$4.7 billion or 10.2%) and Malaysia (by \$2.9 billion or 7.6%). Some of those increases could be linked to carry trades that took place during the period as a result of the considerable interest rate differentials between some of the above-mentioned countries and the major developed economies (see Chapter IV of the BIS *80th Annual Report* for a detailed discussion of recent carry trade developments and trends).



Although somewhat smaller than the increase in lending to the Asia-Pacific region, the rise in cross-border claims on Latin America and the Caribbean during the first quarter of 2010 was also sizeable. The \$26 billion (6.4%) expansion was the fourth in a row and the largest since the second quarter of 2008. Once again, reporting banks directed most of their lending in the region towards Brazil. Cross-border claims on residents of that country grew by \$18.7 billion (11.3%). Claims on residents of Mexico also recorded solid gains, increasing by \$7.3 billion (7.7%). By contrast, lending to Argentina shrank for the seventh consecutive quarter (by \$0.3 billion or 2.3%). Nevertheless, the fall was by far the smallest since the start of the contraction.

... and Latin America and the Caribbean accelerates

The slower pace of economic growth in emerging Europe contributed to the sixth consecutive decline in cross-border claims on its residents. Nevertheless, the \$6 billion (0.7%) contraction was much smaller than the ones registered in the preceding two quarters. The countries that saw the largest declines in claims on their residents were Russia (\$4.2 billion or 2.9%), Croatia (\$1.6 billion or 3.5%) and the Czech Republic (\$1.5 billion or 3.3%). By contrast, claims on Poland expanded for the fourth consecutive quarter (by \$4.0 billion or 3.3%), while cross-border lending to Hungary increased slightly (by \$0.5 billion or 0.6%) ahead of the country's parliamentary elections in April.

Lending to emerging Europe continues to decline

Banks increase exposures to Greece, Ireland, Portugal and Spain⁵

BIS reporting banks increased their total exposures⁶ to residents of Greece, Ireland, Portugal and Spain in the first quarter of 2010, despite mounting market pressures on these countries (Graph 3). The \$109 billion (4.3%) combined expansion brought BIS reporting banks' aggregate exposures to that group of economies to \$2.6 trillion (Table 1).

Total exposures to Greece, Ireland, Portugal and Spain increase

Total exposures to Greece grew by \$20.7 billion (7.1%). The expansion was driven by a \$21.6 billion (29.3%) rise in BIS reporting banks' other exposures, most of which reflected an \$18.1 billion (54.0%) increase in their credit commitments to residents of the country. By contrast, foreign claims on residents of Greece declined by \$0.9 billion (0.4%). Claims on non-banks and claims on the public sector both went up (by \$4.0 billion (4.7%) and \$0.8 billion (0.8%), respectively). However, those increases were more than offset by a \$5.7 billion (16.9%) contraction in foreign claims on banks located in the country.

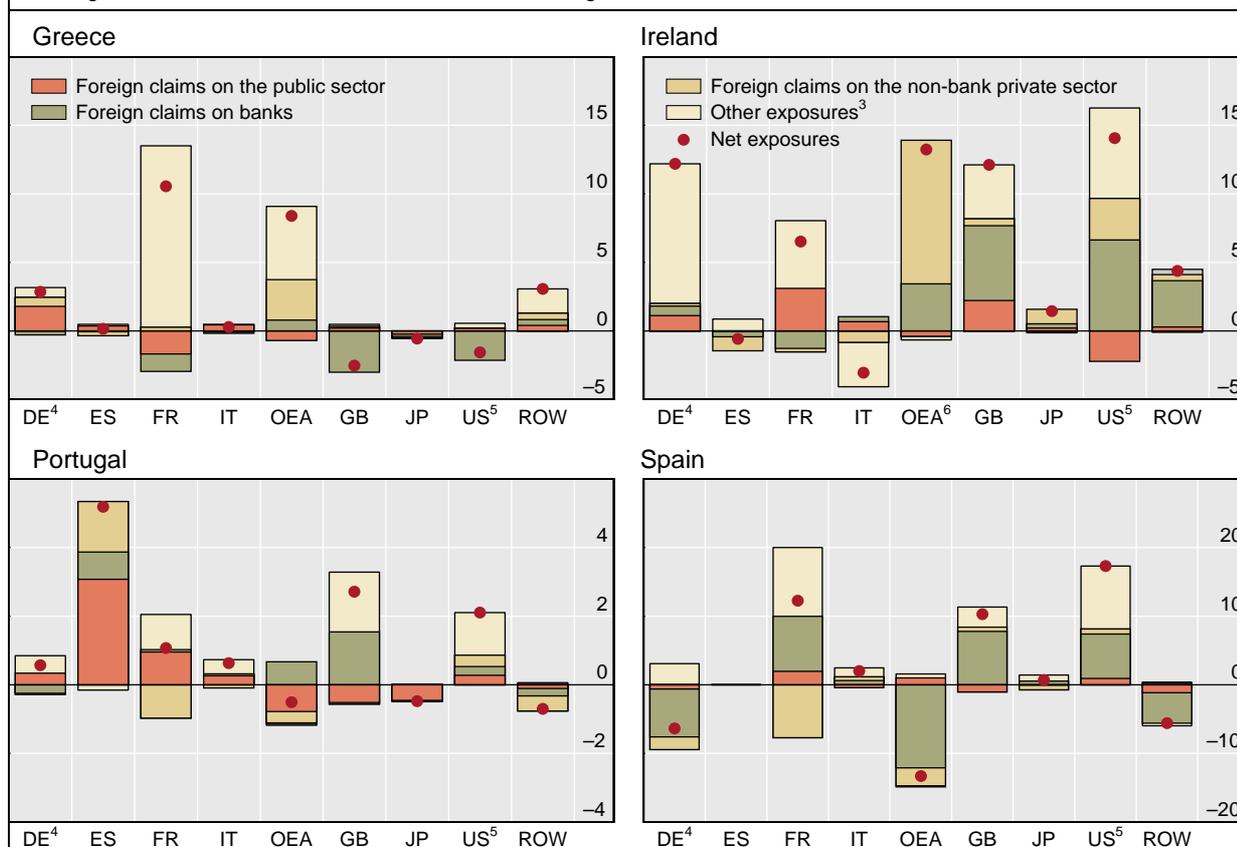
BIS reporting banks also increased their exposures to the residents of Spain and Portugal. Despite the fact that foreign claims on Spain declined by \$10.3 billion (1.2%) during the period, overall exposures to residents of the country expanded by \$17.3 billion (1.5%) due to a \$27.6 billion (11.8%) rise in

⁵ The analysis in the following two subsections is based on the BIS consolidated international banking statistics on an ultimate risk basis. Since this dataset does not contain a currency breakdown, we adjust all flow variables for exchange rate fluctuations by assuming that all exposures to residents of Greece, Ireland, Portugal and Spain are denominated in euros.

⁶ *Total exposures* consist of two main components: *foreign claims* and *other exposures*. In turn, *foreign claims* consist of cross-border claims and local claims in all currencies; *other exposures* consist of positive market value of derivative contracts, guarantees extended and credit commitments.

Foreign exposures to Greece, Ireland, Portugal and Spain, by bank nationality¹

Changes in Q1 2010, at constant end-Q1 2010 exchange rates;² in billions of US dollars



DE = Germany; ES = Spain; FR = France; IT = Italy; OEA = other euro area; GB = United Kingdom; JP = Japan; US = United States; ROW = rest of the world.

¹ Exposures of banks headquartered in the respective country are not included, as these are not foreign exposures. ² All exposures are assumed to be denominated in euros. ³ Positive market value of derivative contracts, guarantees extended and credit commitments. ⁴ Sectoral breakdowns of the claims of German banks are obtained based on international claims from the BIS consolidated banking statistics (immediate borrower basis). ⁵ Exposures of US banks to the countries in the panel headings are currently under review and are subject to revisions. ⁶ Exposures of "other euro area" banks to Ireland are currently under review and are subject to revisions.

Source: BIS consolidated banking statistics (ultimate risk basis).

Graph 3

banks' other exposures. Meanwhile, banks increased their total exposures to Portugal by \$10.6 billion (3.2%). Both foreign claims and other exposures went up (by \$5.8 billion (2.3%) and \$4.8 billion (6.1%), respectively). Spanish banks increased their exposures to residents of Portugal by \$5.2 billion (4.7%), more than banks headquartered in any other country.

Patterns in the composition of BIS reporting banks' public sector portfolios

The public sector portfolios of banks headquartered in the euro area had a significantly different composition from those of their US, UK and Japanese counterparts. As of the end of March 2010, holdings of euro area government debt represented a much higher share (54%) of the public sector portfolios of euro area banks than of the public sector portfolios of Japanese (30%), UK (24%) and US (23%) banks (Graph 4, left-hand panel). This is hardly surprising, given the ability of euro area banks to fund claims on euro area

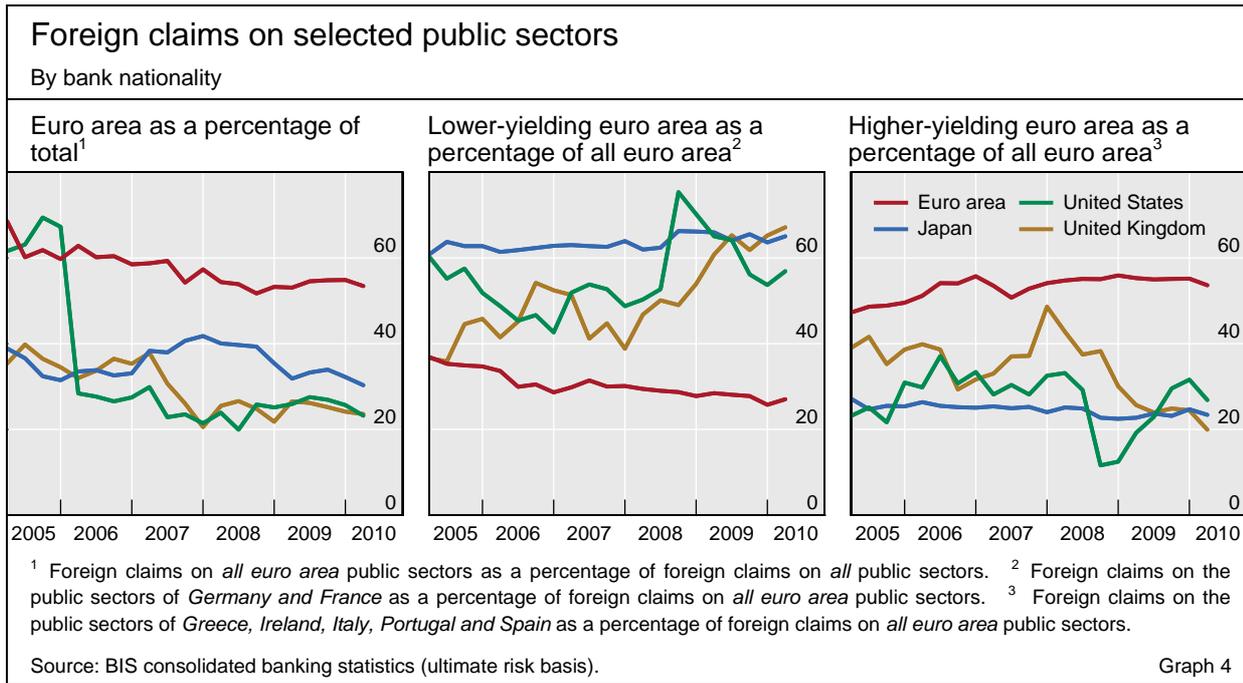
Foreign exposures to Greece, Ireland, Portugal and Spain, by bank nationality ¹											
End-Q1 2010; in billions of US dollars											
Exposures to	Type of exposures	Bank nationality									
		DE ²	ES	FR	IT	OEA	GB	JP	US	ROW	Total
Greece	Public sector	23.1	0.9	27.0	3.3	22.9	3.6	4.3	5.4	2.0	92.5
	+ Banks	10.5	0.0	3.9	1.2	2.6	2.2	0.5	3.1	2.1	26.1
	+ Non-bank private	10.0	0.2	40.2	2.2	14.5	6.0	0.9	5.2	3.9	83.2
	+ Unallocated sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	= Foreign claims	43.6	1.1	71.1	6.8	40.1	11.8	5.8	13.6	8.1	202.0
	+ Other exposures ³	7.4	0.5	40.5	2.0	7.8	4.7	0.2	27.5	4.6	95.2
= Total exposures	51.0	1.6	111.6	8.8	47.9	16.5	5.9	41.2	12.7	297.2	
Ireland ⁴	Public sector	3.4	0.2	8.7	0.9	3.8	7.3	1.8	1.9	1.8	29.7
	+ Banks	46.0	2.5	21.1	3.6	14.0	42.3	1.8	24.6	12.7	168.6
	+ Non-bank private	118.1	9.6	20.5	12.0	66.8	114.4	18.3	34.1	27.9	421.7
	+ Unallocated sector	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.8	1.1
	= Foreign claims	167.5	12.3	50.3	16.5	84.9	164.0	21.9	60.6	43.1	621.1
	+ Other exposures ³	38.3	3.9	35.4	12.1	7.6	58.4	1.0	53.2	12.7	222.7
= Total exposures	205.8	16.2	85.7	28.6	92.5	222.4	22.9	113.9	55.8	843.8	
Portugal	Public sector	9.9	10.6	20.4	2.2	11.5	2.6	2.3	1.6	1.7	62.9
	+ Banks	20.3	7.4	7.3	3.1	7.0	6.6	0.4	2.0	1.4	55.4
	+ Non-bank private	8.2	66.7	14.4	1.1	8.2	15.8	0.9	1.6	1.5	118.4
	+ Unallocated sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	= Foreign claims	38.4	84.7	42.1	6.5	26.7	25.0	3.6	5.2	4.6	236.7
	+ Other exposures ³	8.1	23.3	7.6	2.9	2.4	7.4	0.4	32.1	1.4	85.6
= Total exposures	46.6	108.0	49.7	9.4	29.1	32.4	4.0	37.3	6.0	322.4	
Spain	Public sector	30.0	.	46.9	2.3	19.1	7.6	12.5	4.9	4.4	127.6
	+ Banks	95.0	.	69.7	11.1	68.7	27.6	4.5	28.6	12.1	317.4
	+ Non-bank private	55.2	.	83.1	16.4	98.3	75.0	9.4	28.7	12.1	378.2
	+ Unallocated sector	0.0	.	0.0	0.0	0.1	0.0	0.0	0.0	0.7	0.9
	= Foreign claims	180.2	.	199.8	29.9	186.1	110.2	26.4	62.2	29.3	824.1
	+ Other exposures ³	37.7	.	44.4	12.6	14.4	31.5	3.6	124.1	10.0	278.5
= Total exposures	217.9	.	244.2	42.5	200.6	141.7	30.0	186.4	39.3	1102.6	

DE = Germany; ES = Spain; FR = France; IT = Italy; OEA = other euro area; GB = United Kingdom; JP = Japan; US = United States; ROW = rest of the world.

¹ Exposures of banks headquartered in the respective country are not included, as these are not foreign exposures. ² Sectoral breakdowns of the claims of German banks are obtained based on international claims from the BIS consolidated banking statistics (immediate borrower basis). ³ Positive market value of derivative contracts, guarantees extended and credit commitments. ⁴ Exposures of "other euro area" banks to Ireland are currently under review and are subject to revisions.

Source: BIS consolidated banking statistics (ultimate risk basis).

Table 1



governments with domestic deposits and to use euro area government bonds as collateral when borrowing from the ECB.

The euro area public sector portfolios of euro zone banks differ substantially from those of UK, Japanese and US banks

The euro area public sector portfolios of euro zone banks had a considerably larger share of higher-yielding government debt (eg that of Greece, Ireland, Italy, Portugal and Spain) than those of banks headquartered in other regions, which had a greater proportion of lower-yielding government debt (eg that of Germany and France). As of the end of the first quarter of 2010, the foreign claims of UK, Japanese and US banks on the public sectors of Germany and France represented 67%, 65% and 57%, respectively, of their foreign claims on all euro area public sectors (Graph 4, centre panel). By contrast, that fraction was equal to only 27% for euro area banks. The ordering of these shares is completely reversed when one focuses on reporting banks' holdings of higher-yielding euro area government debt (Graph 4, right-hand panel). Euro area banks' claims on the public sectors of Greece, Ireland, Italy, Portugal and Spain represented close to 54% of their overall holdings of euro area government debt. By comparison, these fractions were equal to 27%, 23% and 20% for US, Japanese and UK banks, respectively.

There are a variety of possible explanations for these differences. First, it could be that banks headquartered outside the common currency area may have found it more difficult than their euro zone peers to assess the credit risk of a euro area member state. This would have naturally made them more cautious, thus causing them to invest relatively smaller fractions of their euro area public sector portfolios in higher-yielding government debt. Second, during the period under investigation, all euro area government debt could be used as collateral at the ECB on identical terms. As a consequence, the lower market liquidity of the debt issued by the governments of Greece, Ireland, Italy, Portugal and Spain (relative to that of German and French government debt)

Foreign currency borrowing in emerging Europe: households as carry traders

Robert N McCauley

Currency weakness in central and eastern Europe during the crisis highlighted the risk of foreign currency debt. Such debt can hedge exporters' cash flows. But households without foreign currency income can struggle with sudden hikes in the cost of servicing foreign currency mortgages.

This box first uses the BIS international banking data comprehensively to measure foreign currency borrowing in emerging Europe on the eve of the global financial crisis. Then it shows that a simple model can account for much of the variation across countries in the reliance on foreign currency debt and in the choice of foreign currency. In particular, a borrower weighs the interest savings of a foreign currency loan against the prospective instability of its servicing cost in domestic currency. In another context, this model is used to describe the opportunity of speculators who borrow in a low-yielding currency to fund investment in a high-yielding currency ("carry traders").

We find first that foreign currency lending in emerging Europe was larger than previously thought. Second, the extent of foreign currency borrowed in each country depended on the ratio of interest savings to currency volatility. Moreover, the same perspective can also explain why debtors in some countries borrowed mostly in euros while debtors in other countries borrowed more in Swiss francs. Thus, interest rate and exchange rate policies shaped the demand for foreign currency debt. The supply side adapted: Swedish banks lent euros in the Baltics, while affiliates of German, Italian and US banks, not Swiss banks, lent Swiss francs in Poland and Hungary.

How large was foreign currency lending in emerging Europe?

Emerging Europe had borrowed more in foreign currency by the third quarter of 2007 than has been appreciated. Including cross-border loans booked elsewhere in Europe reported to the BIS, the foreign currency share of loans had in aggregate reached about one half. It ranged from a quarter (Czech Republic) to almost 90% (Latvia). These shares are all higher than one observes in loans booked domestically in central and eastern Europe.⁹ While this phenomenon is often called euroisation, Swiss franc loans represented about 20% of foreign currency loans.

What accounts for the differences across countries in the share of foreign loans? The next section provides a partial answer to this question.

Households and firms as carry traders

The extent of foreign currency lending in emerging Europe can be understood to a large extent from the demand side. Private borrowers in these economies traded off the interest savings of foreign currency borrowing against the risk of having one's debt ratchet up in terms of domestic currency. Given interest rates in the euro and Swiss franc, this trade-off reflected policy differences across emerging Europe, both in the setting of interest rates and in the management of currencies.

One can think of households and firms in these economies as analogous to carry traders. Carry traders accept principal risk on their position in exchange for receiving net interest receipts ("positive carry"). Similarly, households and firms in the region accept principal risk on their mortgages or corporate loans, as translated into domestic currency, in exchange for lower interest rates. The trade-off between carry and risk for foreign currency borrowers is captured by the Sharpe ratio, which divides the interest savings in per cent by the volatility of the relevant exchange rate, also in per cent. The higher the ratio, the more attractive the position.

It is easy to see why there might be interest savings from denominating debts in euros or Swiss francs. Central and eastern European economies are catching up with their counterparts in western Europe, and so productivity is rising rapidly in the traded goods sector (eg auto production). If productivity improves less in services (eg haircuts), then the relative cost of services rises faster during the catch-up. Since traded goods tend to be priced similarly in an integrated market, this implies that inflation is higher in the country catching up, calling for higher policy interest rates.¹⁰

In fact, interest rates in central and eastern Europe have tended to be higher than in the euro area in recent years. Only in the Czech Republic have short-term interest rates tended to be lower than their counterparts in the euro area. Interest rates were even lower on Swiss franc borrowing.

A lower interest rate, the *gain*, had to be weighed against the potential *pain* of debt service rising in terms of the domestic currency. Some authorities managed their currencies tightly against the euro, but others allowed more movement. We measure the extent to which the exchange rate

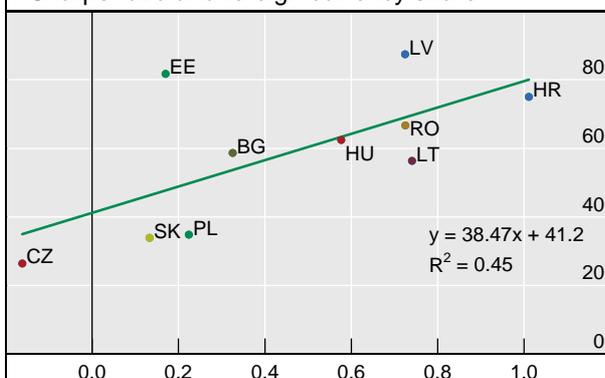
against the euro actually moved over the period from October 2004 to September 2007. The volatility – measured by the annualised standard deviation of daily percentage changes – of the domestic currency against the euro ranged from 0–2% in the Baltics, Bulgaria and Croatia to almost 8% in Hungary, Poland and Romania. A wide interest rate differential and low volatility (a high Sharpe ratio) favoured foreign currency borrowing, while a narrow interest rate differential and high volatility discouraged foreign currency borrowing.

Sharpe ratios and the choice

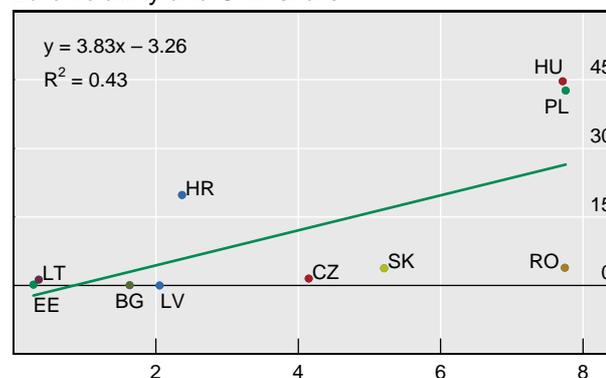
One can divide the decision-making into two steps. Households and firms first assess the attractiveness of the interest saving from euro-denominated debt in relation to the volatility of the domestic currency against the euro. For each currency, the average three-month interest differential between the euro and the domestic currency in October 2004–September 2007 is divided by the volatility of the bilateral exchange rate between the euro and the local currency. When this ratio is plotted against the share of foreign currency borrowing, countries with higher Sharpe ratios show higher fractions of foreign currency debt. The Sharpe ratio alone accounts for over 40% of the cross-sectional variation in such borrowing in the region (Graph A, left-hand panel).³

Foreign currency debt in emerging Europe

Sharpe ratio and foreign currency share¹



Euro volatility and CHF share²



BG = Bulgaria; CZ = Czech Republic; EE = Estonia; HR = Croatia; HU = Hungary; LT = Lithuania; LV = Latvia; PL = Poland; RO = Romania; SK = Slovakia.

¹ The x-axis shows the Sharpe ratio of the domestic currencies, where the numerator is the 36-month average of the three-month interest rate differential for the period October 2004–September 2007 and the denominator is the annualised volatility of the exchange rates of the respective local currency versus the euro over the same period; the y-axis shows all foreign currency loans as a percentage of all loans in September 2007. ² The x-axis shows the annualised volatility of the exchange rate of local currency versus the euro over period October 2004–September 2007; the y-axis shows the CHF loans as a percentage of all foreign currency loans in September 2007.

Sources: Brown et al (2009); Bloomberg; Datastream; national data; BIS calculations.

Graph A

The next step is to account for the choice of denomination of the foreign currency lending. In terms of the interest rate, there would be the same 1½% saving on a franc vis-à-vis a euro loan anywhere from the Baltics to Bulgaria. However, the exchange rate volatility would look very different from the various perspectives in the region. Where the local currency tracked the euro closely, the volatility of the Swiss franc versus the euro would make franc borrowing less attractive. Where, as in Hungary and Poland, the domestic currency fluctuated considerably against the euro, there was little incremental volatility to borrowing in the Swiss franc to offset the interest saving. The 1½% lower interest rate looked good when compared to the ½% (in Poland) or ¼% (in Hungary) additional volatility of Swiss franc debt, and in those countries its share is highest (Graph A, right-hand panel). Ironically, currency flexibility encouraged Swiss franc debt, which has proven painful to obligors given the 20% rise of the Swiss franc/euro rate from September 2007 to August 2010.

³ Cross-border loans reported to the BIS represented about 19% of the domestically booked loans that are reported by M Brown, M Peter and S Wehrmüller, "Swiss franc lending in Europe", *Aussenwirtschaft*, no 64(2), 2009, pp 167–81. ⁴ This assumes stable nominal exchange rates; see D Mihajek and M Klau, "Catching-up and inflation in transition economies: the Balassa-Samuelson effect revisited", *BIS Working Papers*, no 270, December 2008. ⁵ M Brzoza-Brzezina, T Chmielewski and J Niedzwiedzińska, "Substitution between domestic and foreign currency loans in Central Europe. Do central banks matter?", *ECB Working Paper Series*, no 1187, May 2010, show that foreign currency debt responds to Czech, Hungarian, Polish and Slovak interest rates.

was less of a concern for euro area banks than for other banks since the former could “liquefy” this debt in their operations with the ECB. Finally, banks usually hold government debt not only as a standalone investment instrument but also to support their derivatives trading operations. If non-euro area banks held smaller investment portfolios of euro area public debt but traded derivatives on euro-denominated interest rates, then the latter type of government debt holdings would have represented a higher fraction of their euro area public sector portfolios. Those holdings would have naturally been concentrated in the German and French benchmark government securities because of their liquidity and the relatively low credit risk associated with them.

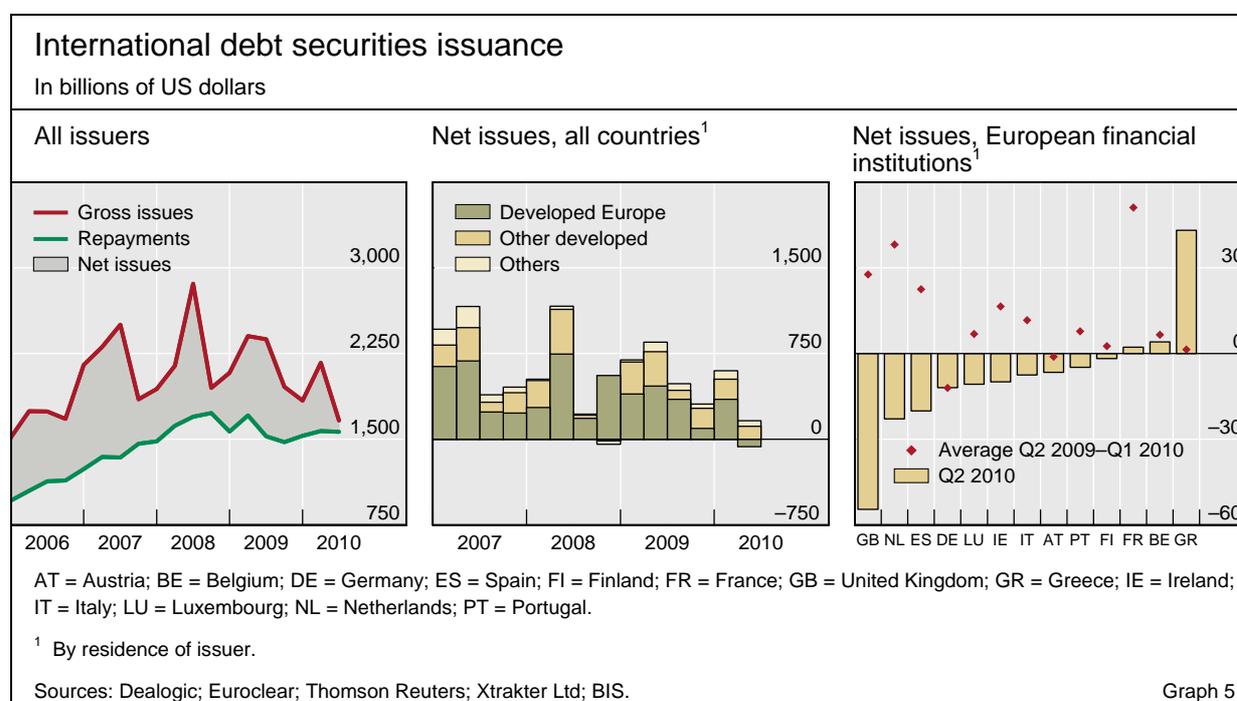
The international debt securities market⁷

The turbulence in the European sovereign bond market led to a sharp drop in activity in the primary market for international debt securities *in the second quarter of 2010*. Completed gross issuance fell by 23% to \$1,664 billion, the lowest since late 2005 and well below the levels seen during the financial crisis (Graph 5, left-hand panel). With stable repayments, net issuance dropped by 83% to \$99 billion, the lowest since the late 1990s.

Borrowers from the advanced economies in particular found it difficult to place debt at attractive conditions. Net issuance by residents in the developed world fell by 90% to merely \$51 billion (Graph 5, centre panel), with net repayments of \$64 billion in Europe, \$7 billion in Japan and \$3 billion in Australia. US entities raised \$94 billion, 38% less than in the previous quarter. By contrast, borrowing by residents in developing economies held up well,

Net issuance drops to lowest value since late 1990s

Sharp fall in developed country issuance contrasts with higher borrowing by emerging market residents



⁷ Queries concerning the international debt securities statistics should be directed to Christian Upper.

increasing by 20% to \$30 billion. International financial institutions tapped the market to raise \$31 billion – 28% less than in the previous quarter, but still well above the average quarterly net issuance in recent years.

Developed country issuance fell across all sectors, although financial institutions took the brunt of the hit. They recorded net redemptions of \$55 billion, after net issues of \$292 billion in the first three months of the year. Net government issuance fell by 78% to \$26 billion, and net non-financial corporate issuance declined by 31% to \$80 billion.

Net repayments by European financial institutions

Financial institutions in Europe accounted for by far the largest part of the net redemptions of the sector. Although completed gross issuance fell roughly in line with that of financial institutions in other regions (22%, compared to 26% in the United States, for example), almost unchanged repayments led to sizeable net redemptions. Net issuance turned positive in June, but this did not offset large net repayments during April and May.

Strong issuance by banks in Greece ...

The European aggregate masks large differences across countries, including among those at the centre of market attention. Greek banks raised \$43 billion in the international market, primarily through the issuance of covered bonds and government-guaranteed medium-term notes.⁸ Greek financial issuance was much larger than that of other countries, and a multiple of what it had been in previous quarters (Graph 5, right-hand panel). Financial institutions in most other European countries on net repaid debt. This includes institutions in Spain and Portugal, two countries which also saw a substantial rise in sovereign spreads. Between April and June, Spanish and Portuguese financial institutions reduced their international bonded debt by \$20 billion and \$5 billion, respectively.

... contrasts with net redemptions by financials in other European countries

Canadian residents raise amounts borrowed

One of the few developed economies (in addition to Greece) that bucked the trend of lower net issuance was Canada. Canadian residents raised \$30 billion on the international debt market, about three times as much as in the previous quarter and the highest since the second quarter of 2008. Canadian financial institutions issued approximately \$19 billion. Canadian provincial governments, led by Ontario, also borrowed sizeable amounts (\$9 billion), whereas non-financial corporations issued \$2 billion, slightly less than in the previous quarter.

Strong emerging market issuance

Emerging market issuers were much less affected by the worsened financial conditions and increased their international debt by 20% to \$30 billion. Non-financial corporate issuance was particularly strong, increasing by 84% to \$16 billion, similar to the levels seen in the second half of last year. Governments borrowed \$15 billion in the international market, 8% more than in the previous quarter. By contrast, emerging market financials repaid \$1 billion, after net issuance of \$2 billion between January and March.

Residents in Latin America and the Caribbean in particular sold more bonds than previously (\$17 billion, after \$11 billion in the first quarter).

⁸ It is not possible to assess how much Greek banks paid for their funding since issue prices are generally not available. However, the fact that some of this paper traded at steep discounts, on the order of 30–40%, just after issuance suggests that the costs of these funds may have been substantial.

Borrowers from Mexico and Brazil accounted for approximately two thirds of international issuance by residents in the region. They raised \$7 billion and \$5 billion, respectively, after \$4 billion and \$7 billion in the first three months of the year. Issuance in emerging Europe, a region closely linked to the euro area, rose by \$2 billion to \$9 billion. Residents in developing Asia-Pacific and in Africa and the Middle East cut their issuance by 59% and 9%, respectively, to approximately \$2 billion.

Exchange-traded derivatives⁹

Growth in activity on the derivatives exchanges decelerated somewhat in the *second quarter of 2010*, compared to the buoyant first quarter. Turnover measured by notional amounts of futures and options on interest rates, stock price indices and foreign exchange increased by 8% quarter on quarter to \$555 trillion between April and June, compared to a 16% rise in the previous three months. The relatively modest expansion reflected divergent developments in the United States and Europe. As euro area sovereign bond yield spreads widened relative to German bunds and the euro depreciated against major currencies (10% against the US dollar), turnover in euro-denominated options on these underlying risk types fell by almost 30%, far more than could be accounted for by the valuation effect alone, and turnover in euro futures barely budged. This contrasted with a 35% and 18% surge in all dollar-denominated options and futures, respectively. Open interest of exchange-traded financial derivatives, expressed in notional amounts outstanding, fell by 8% to \$75 trillion. While outstanding amounts of instruments denominated in dollars were unchanged, those of euro-denominated contracts dropped by 22% during the quarter, driven primarily by declines in interest rate instruments. Increased basis risk across sovereigns probably contributed to decreased use of exchange-traded derivatives for cross-country hedging of exposures in smaller euro area markets.

Divergent developments in the United States and Europe

The differences in activity growth across currencies were primarily driven by developments in the interest rate segment. Turnover in dollar money market contracts went up by 23% to \$235 trillion. By contrast, turnover in contracts on short-term euro rates fell by 15% to \$162 trillion. Similarly, turnover growth in derivatives on dollar bonds (up 22% to \$20 trillion) contrasted with a 3% turnover decline in long-term euro instruments, although outstanding notional amounts and contract numbers on eurobund options roughly doubled.

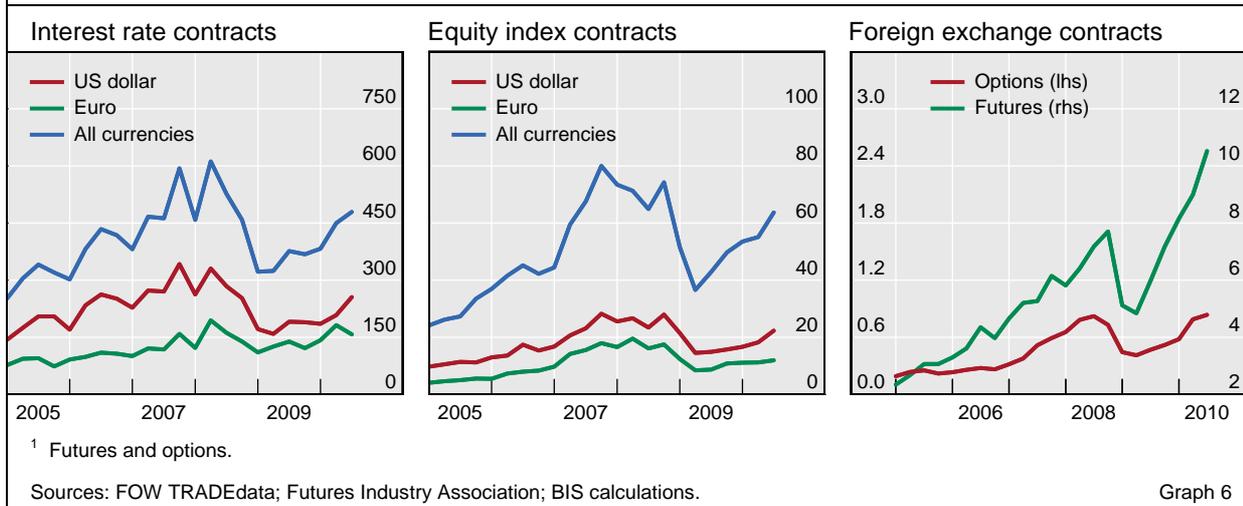
Eurobund options doubled

Activity in futures and options on stock price indices surged on the back of sharply higher stock price volatility. As stock markets first rose and then declined in the United States and Europe, option-implied volatility rocketed almost to levels last seen in the first quarter of 2009. Equity index derivatives turnover measured in notional amounts went up by 15% to \$64 trillion, after having remained almost stable in the first three months of 2010, when implied volatility had declined to the lowest level since early 2009. The number of stock

⁹ Queries concerning the derivatives markets statistics should be addressed to Karsten von Kleist.

Turnover of exchange-traded derivatives¹

Quarterly data, in trillions of US dollars



index contracts traded on the international derivatives exchanges increased by around 20% over the period. While turnover measured in notional amounts on US exchanges grew by 22%, that on European exchanges advanced only 5%. Trading volumes on many Asian exchanges also grew, with a particularly sharp increase in India (36%).

Turnover in FX futures well above previous 2008 peak

Turnover in futures and options on exchange rates increased, but amounts outstanding fell. Trading volumes of FX futures went up by 17% to \$11 billion, well above the previous peak in the third quarter of 2008 (Graph 6, right-hand panel). Open interest fell 12% to \$188 billion. Option turnover increased by much less (6%), with amounts outstanding falling 8% from the peak reached in the first quarter.

Turnover (measured in terms of the number of contracts, since notional amounts are not available) on the international commodities exchanges rose by 8%. There was a hefty 32% increase in activity in contracts on precious metals, as gold prices exceeded the previous peak reached in late 2009. Turnover in derivatives on non-precious metals and energy products went up 24% and 13%, respectively, with metal and oil prices dropping a fifth from the high reached at the beginning of the second quarter. Turnover in contracts on agricultural commodities fell 5%.

Debt reduction after crises¹

Financial crises tend to be followed by a protracted period of debt reduction in the non-financial private sector. We find that a period of debt reduction followed 17 out of 20 systemic banking crises that were preceded by surges in credit. Debt/GDP ratios fell by an average of 38 percentage points, returning to approximately the levels seen before the increase. If history is any guide, we should expect to see a much more significant reduction in private sector debt, particularly of households, than has so far taken place after the recent crisis. The costs of this process in forgone output are difficult to pin down, but there are reasons to believe that they need not be high provided that the banking sector problems that led to the crisis are fixed.

JEL classification: E21, E51.

Private sector indebtedness surged in several advanced economies prior to the global financial crisis. The ensuing “subprime” debacle was named for a particular segment of the US mortgage market that experienced very rapid growth up to 2007 and subsequently saw massive repayment problems. Yet this was the tip of a much larger iceberg. US households increased their indebtedness from close to 100% of disposable income in 2000 to more than 130% in 2007. Similarly, over the same period, British and Spanish households raised their debt by approximately 60 percentage points to more than 160% and almost 130%, respectively, of disposable income. The expansion in debt was not confined to households. Non-financial corporations in several, but not all, of these countries also increased their debt substantially, mainly to finance real estate, and subsequently experienced servicing problems.

Mounting loan delinquencies are a clear indication that this rise in indebtedness was not sustainable. Some of the debt will not be repaid and will have to be written off, if it has not already been. But debt reduction may not stop there. Lower house prices may induce households to reduce their desired levels of debt. Similarly, a lower level of output and tighter financial conditions could put firms under pressure to reduce their leverage.

This article looks at the historical record for guidance on a number of questions related to the debt levels of households and firms. First, how far will

¹ We thank Claudio Borio, Stephen Cecchetti and Robert McCauley for useful comments and suggestions. The views expressed are those of the authors and do not necessarily reflect those of the BIS.

debt fall after the crisis? Second, what are the implications of declining debt for output growth? Third, how can policy help the necessary adjustment in debt without disrupting economic growth? Of course, we are not the first to study past crises in search of insights about the present one. The most closely related study is that by Roxburgh et al (2010), who look at debt reduction episodes in 10 advanced and four emerging economies. However, instead of starting with crises and then studying the consequences, as we do, these authors search for episodes of debt reduction and then ask whether they were preceded by a crisis. As a result, they do not pick up crises that were not followed by debt reduction.

In what follows, we restrict our attention to debt of the non-financial private sector. The evolution of leverage in the financial sector has been documented elsewhere (eg BIS (2010), He et al (2010)). Public debt ratios actually fell in most countries prior to the crisis, before surging as expenditure soared and tax receipts collapsed.²

We find that what goes up tends to come down. In 17 of the 20 systemic banking crises in our sample that were preceded by a surge in credit, there was a subsequent reduction in private sector indebtedness. On average, the ratio of credit to the private sector to GDP fell by 38 percentage points after these 17 crises, returning to a level similar to the pre-boom situation. The decline in debt ratios is due in approximately equal parts to a fall in (nominal) credit outstanding, GDP growth and inflation.

The structure of the article is as follows: the first section documents the increase in private sector indebtedness prior to the most recent crisis and the extent of debt reduction that has taken place so far. The second section looks at the debt dynamics around previous crises. The next two sections provide some tentative evidence on the macroeconomic costs of debt reduction and the role of public policy in facilitating the adjustment. A final section concludes.

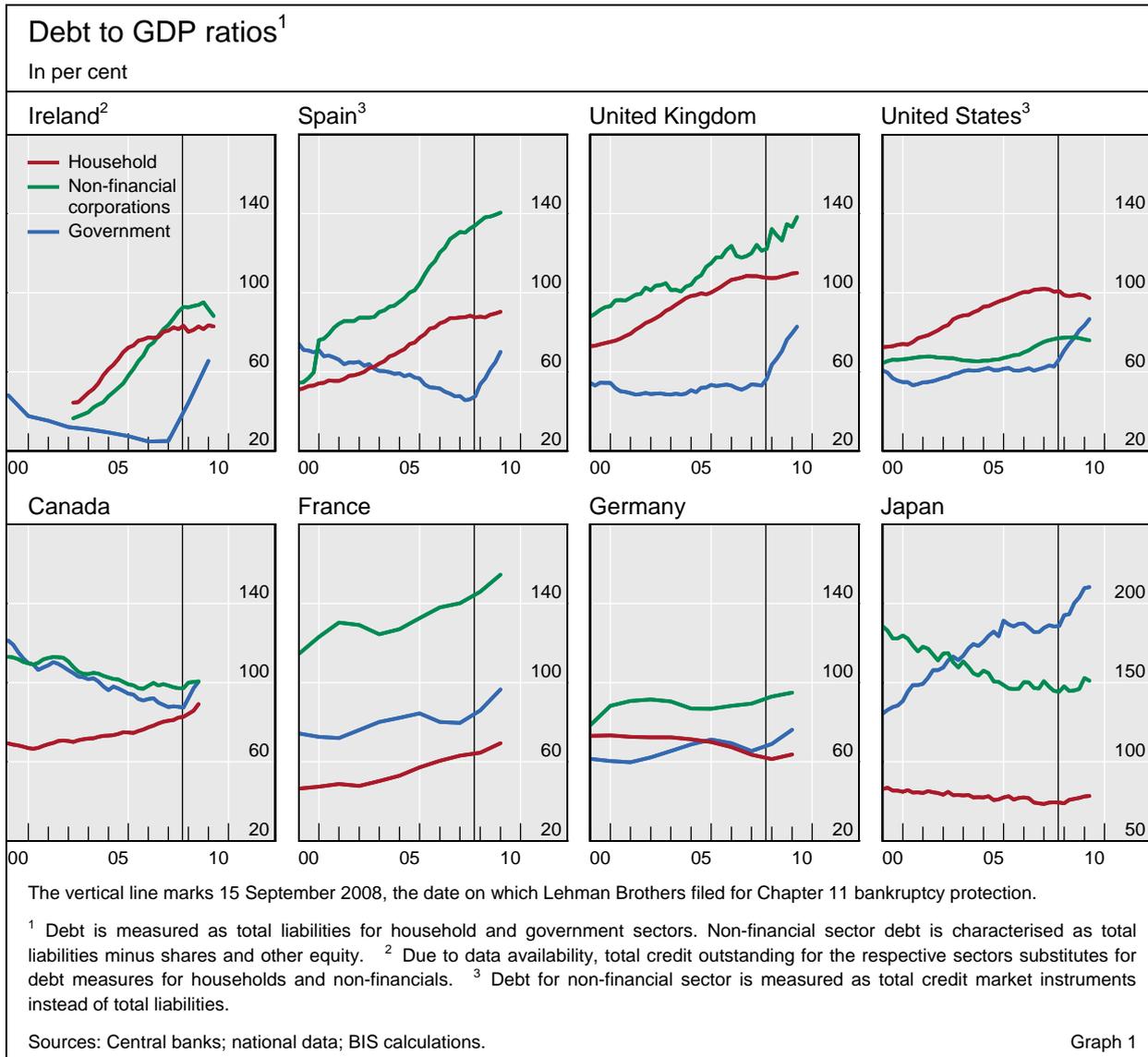
What has happened so far

House prices and the debt of the private non-financial sector increased rapidly in many advanced economies in the years before the recent financial crisis. Household debt (red lines in Graph 1) in particular rose considerably in the countries that experienced a housing boom (Ireland, Spain, United Kingdom, United States and, to a lesser extent, Canada and France).³ By contrast, households in countries with stable house prices (Germany, Japan) held their debt constant relative to GDP or even reduced it somewhat. Developments in the non-financial corporate sector were also associated with the housing boom, although the relationship was less immediate. Non-financial corporations sharply increased their debt in relation to GDP (green lines) in Ireland, Spain and the UK and, to a lesser extent, also in France. Real estate-related lending

Housing booms accompanied by soaring household and corporate debt

² Reinhart and Rogoff (2010) analyse the dynamics of public debt around financial crises.

³ We use total liabilities, stripping out shares and other equities where actual debt data is not available.



accounted for much of these increases (Bank of England (2009), Fraile Izquierdo and Martínez Carrascal (2010)). Corporate debt ratios were much more stable, or even declined, in other countries, including the United States. Finally, government debt (blue lines) remained rather stable in most countries. Notable exceptions were Canada, Ireland and Spain, where public debt fell in relation to GDP, and Japan, which saw a steep increase.

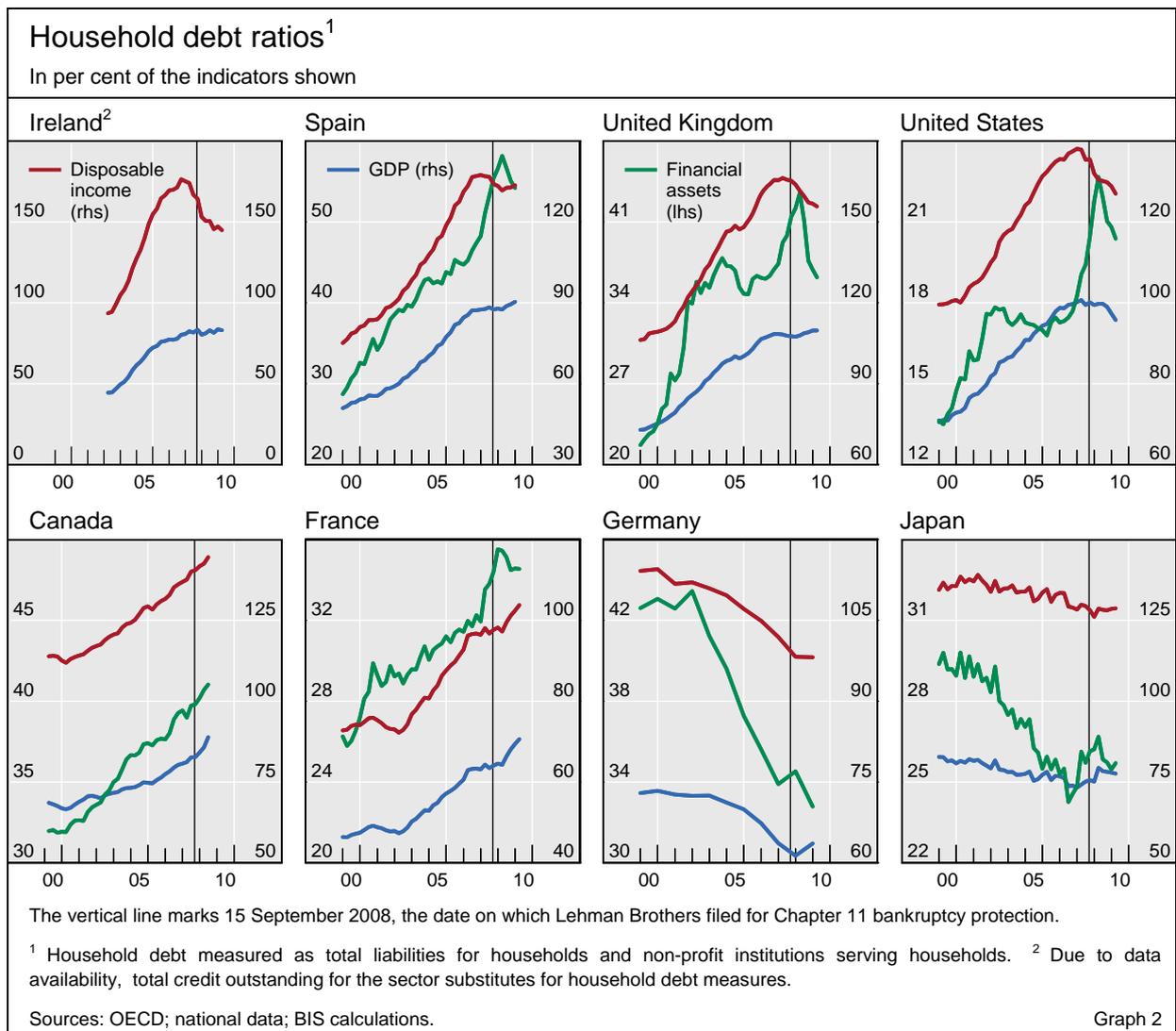
Households have begun to reduce debt ...

There are signs that households in some countries have started to reduce their debt. In the United States, both house prices and the ratio of household debt to GDP peaked in the middle of 2006 in the wake of higher interest rates and slowing economic activity. In other countries, house prices and household debt continued to go up at rates outstripping GDP growth for another couple of years. During the financial crisis, banks tightened credit standards and net credit growth slowed sharply or dropped into negative territory. Over the past three years, US households have been reducing their debt ratios, but the picture is less clear in the other countries that experienced a housing boom. The ratio of household debt to GDP fell by 5 percentage points in the United States, despite a sizeable fall in GDP. In Ireland, Spain and the United

Kingdom, household debt fell, but not by enough to offset drops in GDP that were even sharper than in the US case. It is perhaps more informative to look at household debt relative to disposable income or financial assets, shown by the red and blue lines in Graph 2.⁴ On these measures, household indebtedness also fell in Ireland, Spain and the United Kingdom. That said, households in all four countries remain substantially more indebted than at the outset of the housing boom, regardless of the measure used.

There were far fewer signs of debt reduction in the corporate sector after the crisis. On the contrary, corporate debt relative to GDP increased during the initial stages of the crisis in most countries, partly because firms drew on previously arranged credit lines. As the crisis deepened, corporations in most countries started to reduce their debt, although this did not translate into lower debt ratios owing to the sharp drop in GDP.

... but firms and the government have not



⁴ Ideally, one would prefer to measure household leverage by dividing debt by total assets, including real estate and the present value of future labour income. Unfortunately, data on the value of households' property holdings are available only for a very few countries, while future incomes are inherently unobservable.

Finally, government debt shot up in all countries shown in Graph 1, with particularly large increases in the countries that had been through sizeable housing booms showing in the top row.

Financial crises and the credit cycle

Methodology

How does the reduction in private sector debt to date compare with the experience after previous crises? We start with the same set of 40 systemic banking crises as Cecchetti et al (2009), although data availability forces us to restrict the analysis to a smaller number of events. For three crises, we do not have quarterly credit and/or GDP data. Seven crises took place in economies that were in the early stages of a transition from a centrally planned to a market economy and three occurred in an environment of hyperinflation.⁵ We believe that neither set is likely to provide useful insights for the current situation. This leaves us with a sample of 27 crises, listed in Table 1.

Due to the limited availability of flow of funds data, we cannot replicate the analysis at the sector level of the previous section for the past crisis. Instead, we are limited to measuring indebtedness as the ratio of domestic and foreign bank credit to the private sector of a country to its GDP.⁶ This means that we ignore other sources of financing, eg securities issuance. That said, this is much less likely to matter for past crises than for the current one, since bank credit was by far the dominant source of finance for both households and non-financial corporations in all the crises in our sample.

Credit booms common in run-up to crises ...

The data in Table 1 show that financial crises often take place after a rise in the ratio of credit to GDP, as happened in the recent crisis. Some 20 of the 27 crises in the sample were preceded by a period in which credit/GDP expanded for a number of consecutive quarters (column A). Many of these increases were strong enough to qualify as credit booms, although precisely how many depends on the definition. If we follow Mendoza and Terrones (2008) and define a credit boom as a period in which the credit ratio exceeds its long-term trend by a certain threshold (column B),⁷ then 13 of the 28 crises were preceded by credit booms. Finally, using a related definition by Borio and Drehmann (2009), 18 of the 28 crisis episodes were preceded by credit booms (column C).

⁵ Lack of data: Argentina 1980, Bolivia 1994, Estonia 1992. Transition: Bulgaria 1996, Croatia 1998, Czech Republic 1996, Latvia 1995, Lithuania (1995), Ukraine 1998, Vietnam 1997. Hyperinflation: Argentina 1989, Brazil 1990 and 1994.

⁶ Data on domestic credit and GDP are obtained from the respective central bank through the BIS databank. If these are not available, we use IMF data. The foreign component of credit is from the BIS consolidated banking statistics. For developed economies, this data became available only in 1999. We therefore use the ratio of domestic credit to GDP for earlier crises in these economies.

⁷ Mendoza and Terrones (2008) use annual data on per capita credit instead of quarterly data on credit/GDP. This has implications for the threshold that defines a credit boom. After some sensitivity analysis we settled on a somewhat simplified procedure and a threshold of 0.5.

Systemic banking crises and the credit cycle					
Country	Crisis date	Credit boom			Boom followed by bust
		A	B	C	
Argentina	01/1995	Yes	No	Yes	No
Argentina	12/2001	Yes	Yes	Yes	Yes
Chile	11/1981	Yes	No	No	Yes
Colombia	07/1982	No	No	No	...
Colombia	06/1998	Yes	No	Yes	Yes
Dominican Republic	04/2003	No	Yes	Yes	Yes
Ecuador	08/1998	Yes	Yes	Yes	No
Finland	09/1991	Yes	Yes	Yes	Yes
Ghana	01/1982	No	No	No	...
Indonesia	11/1997	Yes	No	No	Yes
Ivory Coast	01/1988	Yes	No	Yes	Yes
Jamaica	12/1996	No	No	Yes	...
Japan	11/1997	Yes	No	No	Yes
Korea	08/1997	Yes	No	No	No
Malaysia	07/1997	Yes	Yes	Yes	Yes
Mexico	12/1994	Yes	Yes	Yes	Yes
Nicaragua	08/2000	Yes	Yes	Yes	Yes
Norway	10/1991	yes	Yes	Yes	Yes
Paraguay	05/1995	Yes	No	Yes	No
Philippines	07/1997	Yes	No	Yes	Yes
Russia	08/1998	Yes	Yes	No	Yes
Sri Lanka	01/1989	No	Yes	No	...
Sweden	09/1991	Yes	Yes	Yes	Yes
Thailand	07/1997	Yes	No	No	Yes
Turkey	11/2000	No	Yes	No	...
Uruguay	01/2002	Yes	No	Yes	Yes
Venezuela	01/1994	No	No	Yes	...

A: Visible increase in credit/GDP in years prior to the crisis. B: Credit boom as defined by Mendoza and Terrones. C: Credit boom as defined by Borio and Drehmann. Table 1

A second finding in Table 1 is that what goes up tends to come down. More specifically, 17 of the 20 crises that were preceded by an increase in credit/GDP saw a subsequent reduction in that ratio.⁸ Exceptions are Argentina and Paraguay in 1995, and Korea in 1997. In Argentina and Paraguay, credit growth merely paused for a while, before continuing. In both cases, the crises were caused by the fallout from the Mexican crisis in late 1994 (the so-called tequila effect) rather than primarily domestic factors. In

... tend to be followed by sizeable debt reductions ...

⁸ None of the three crises without debt reduction experienced a credit boom as defined by Mendoza and Terrones. Debt ratios also declined in some of the crises that were not preceded by increases in credit/GDP. However, we exclude these to make our results more comparable to the current situation.

Korea, credit ratios barely slowed and continued to grow at a rapid pace after the crisis, unlike the experience of other East Asian economies at the time. However, the increase in the credit ratio went hand in hand with a change in the composition of credit from the non-financial corporate sector to the household sector.⁹

Both the build-up in private sector indebtedness before the crises and the subsequent reduction tended to be sizeable (Table 2). On average, private sector credit over GDP increased by 44 percentage points before the crisis, followed by a drop of almost the same magnitude (38 percentage points). Although there is significant variation across these means, it is striking that even the smallest amount of debt reduction (in Chile, where debt/GDP fell by 10 percentage points between end-1982 and the third quarter of 1983) was larger than what we have seen to date after the most recent crisis.

Our results show surprisingly little difference between developed and developing economies. The debt dynamics surrounding the four crises that

Debt reduction after systemic banking crises									
Country	Crisis date	Credit cycle dates			Change in credit/GDP ¹		Debt reduction decomposition ¹		
		First trough	Peak	Second trough	Up	Down	Credit	Real GDP	Price level
Argentina	2001Q4	1991Q4	2002Q2	2005Q3	28	-30	-14	-10	-6
Chile	1981Q4	...	1982Q4	1983Q3	...	-10
Colombia	1998Q2	1992Q1	1998Q4	2005Q1	17	-16	5	1	-21
Dominican Republic	2003Q2	1995Q2	2003Q2	2007Q1	29	-26	6	-6	-26
Finland ²	1991Q3	1980Q1	1992Q1	1998Q1	51	-44	-24	-11	-9
Indonesia	1997Q3	1993Q1	1998Q2	2002Q2	83	-104	-53	-19	-33
Ivory Coast	1988Q1	1984Q3	1988Q1	1994Q3	14	-27	-15	-5	-6
Japan	1997Q4	1980Q4	1999Q2	2008Q4	...	-26	-18	-19	12
Malaysia	1997Q3	1993Q3	1998Q1	2001Q1	72	-33	2	-24	-11
Mexico	1994Q4	1988Q3	1995Q1	1996Q4	24	-16	1	-1	-16
Nicaragua	2000Q3	1996Q2	2000Q4	2002Q1	19	-15	-11	-1	-3
Norway ²	1991Q4	1980Q1	1990Q2	1996Q4	66	-38	6	-25	-19
Philippines	1997Q3	1991Q2	1997Q4	2007Q3	60	-50
Russia	1998Q3	1996Q1	1999Q1	2001Q2	29	-27	13	-15	-25
Sweden ²	1991Q3	1985Q3	1990Q3	1996Q1	46	-35	-7	-12	-17
Thailand	1997Q3	...	1997Q4	2001q4	...	-78	-66	-7	-5
Uruguay	2002Q1	1995Q1	2002Q3	2007Q1	70	-64	-31	-11	-22
Average					44	-38	-14	-11	-14

¹ Percentage points. ² Domestic credit.

Table 2

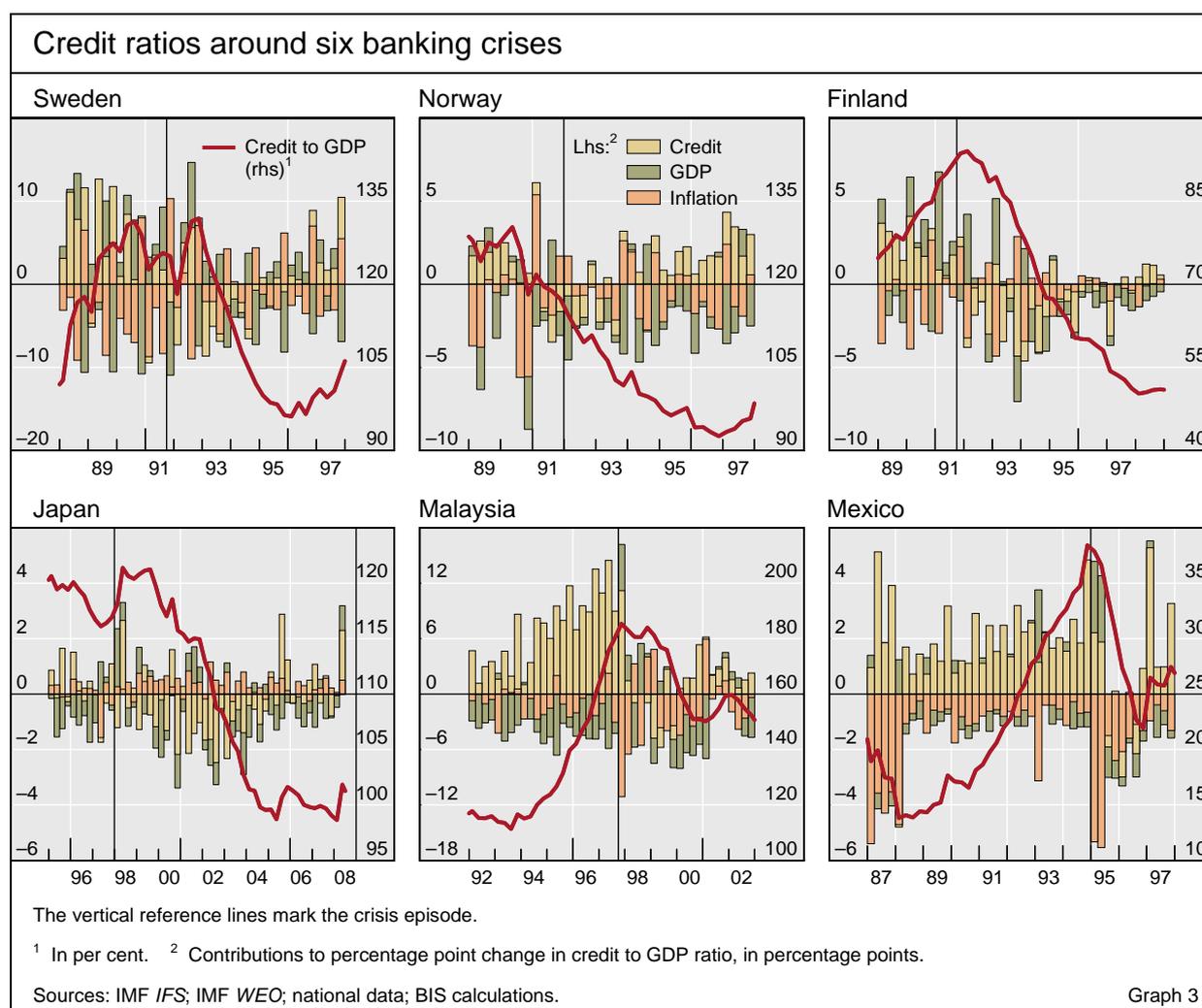
⁹ Data reported in Table 4 of Mohanty et al (2006) indicate that the share of housing-related lending in total bank credit increased from less than 10% shortly after the crisis to approximately one third five years later. Conversely, the share of business credit fell from 69% of total credit in 1999 to 47% in 2004. Consumer lending remained stable (in relative terms), at 17–18% of total bank credit. The share of lending to households also increased in Malaysia and Thailand over the same period, but credit ratios fell.

took place in developed economies (Finland, Norway and Sweden in 1991, Japan in 1997)¹⁰ were not much different from those found in the developing world. The amplitudes of the credit boom/bust cycles experienced by the Nordics were quite close to the sample average. Japan experienced a slightly smaller reduction in debt (27 percentage points compared to a sample average of 38 percentage points), but this was still well inside the bulk of the distribution.

Debt ratios can be cut in various ways: paying off or defaulting on debt outstanding (we cannot distinguish between the two on the basis of the available data), economic growth, or inflation. We find that all three effects played roughly similar roles. Of the average decline in credit to GDP of 40 percentage points (excluding Chile 1982 and Philippines 1997, where quarterly real GDP data is not available), inflation and lower credit contributed 14 percentage points each, and real economic growth a further 11 percentage points.

... involving reductions in credit, inflation, and economic growth

These averages hide a considerable amount of variation across countries, confirming that there is no single way to reduce debt. Usually, debt reduction is



¹⁰ See below for the dating of the Japanese crisis.

the result of a combination of factors. The exceptions were Colombia and Mexico, where the decline in debt ratios were (almost) entirely driven by inflation.

The importance of the various factors in the debt reduction process also varies over time. The stacked bars in Graph 3 show the decomposition of the quarterly changes in debt ratios in six economies. The graphs show that factors rarely have a consistently positive or negative impact on debt ratios, even if they explain a large proportion of the overall reduction. This is particularly true for real GDP growth (green bars). In the case of Finland, for example, GDP plummeted in 1990 and 1991. This pushed up debt ratios, as can be seen by the sizeable positive green bars. By 1992, however, the contraction bottomed out and the Finnish economy began to recover. As a consequence, GDP growth now exerted a downward pressure on debt ratios, as indicated by the negative green bars.

How costly is debt reduction?

Conflicting objectives: keep credit flowing and reduce debt

Public policy was caught on the horns of a dilemma during the crisis: on the one hand, the priority was to prevent a sharp contraction in the supply of credit to the private sector and, as a consequence, a collapse in economic activity. On the other hand, it was also vital for at least some sectors of the economy to repair their balance sheets, given that lax lending had clearly been a major factor leading to the crisis. In the light of these two seemingly contradictory aims, the big question is how to facilitate the necessary adjustment without disrupting economic growth. Since economic activity was already falling sharply between late 2008 and mid-2009, policymakers understandably leaned towards supporting credit rather than reducing debt. What can the crises of our sample tell us about the apparent trade-off between adjustment and supporting output growth?

A strict comparison of growth rates during the period of the surge in credit ratios with those during the debt reduction phase will not do the trick. The reason is that financial crises are often followed by a collapse in real activity. GDP fell by almost 8% on average after the 17 financial crises that were followed by a reduction in private sector debt to GDP.¹¹ Most of this decline took place during a relatively short period around the peak in credit ratios, in some cases before and in some after. This means that the average growth rates in the two periods are very sensitive to the choice of the sample and the exact dating of the peak.

Costs of crises not driven by debt reduction

Even so, there are reasons to believe that this sharp drop in output is not the consequence of the debt reduction process but would have occurred anyway. The first reason to suspect that debt reduction need not be costly is based on the dynamics of output and credit ratios after the crisis. Output often starts to contract before real credit, reaches a trough more quickly, and then

¹¹ Calculation based on data reported in Table 2 of Cecchetti et al (2009).

recovers at a rapid pace even though debt ratios are still falling. This makes it unlikely that the decline in credit ratios is the main driver of the output losses.

A second reason for doubting that the reduction in debt ratios is the main cause of output losses after crises is the experience of crises preceded by a credit boom but not followed by a debt reduction. As mentioned above, there were three such crises in our sample, of which two were followed by drops in output of a magnitude similar to those associated with the crises followed by debt reduction, although the third one was not. Output contracted by 6% in Argentina in 1995 and by 9% in Korea in 1997, whereas Paraguay experienced no output losses around its crisis in 1995.

Finally, there is also a theoretical argument that debt reduction need not reduce growth on a sustained basis. Biggs et al (2009) suggest that changes in the *flow* of credit (ie the second derivative of credit) are more relevant for output growth than changes in the *stock* (ie the first derivative).¹² This means that only the initial adjustment of households to new income levels leads to a drop in growth rates, but not the subsequent repayment of debt.

How to reduce debt: lessons from Japan

What can public policy do to facilitate the necessary adjustment in debt while mitigating the adverse impact on output? We try to answer this question by taking a closer look at the dynamics of output and the debt reduction process surrounding the Japanese crisis of the 1990s, a particularly instructive case.¹³

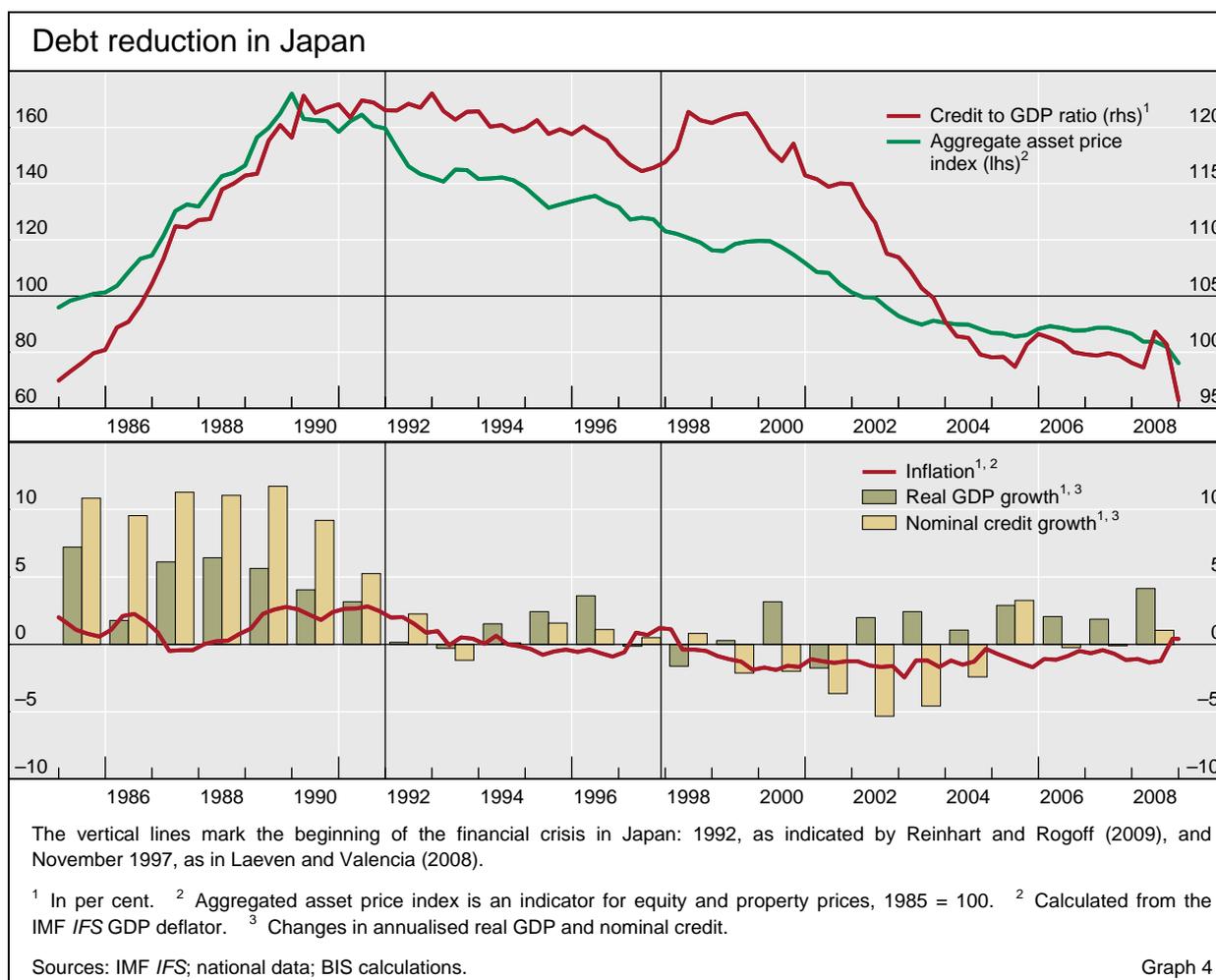
Japan actually went through two episodes of debt reduction, the first between end-1992 and mid-1997, when the ratio of credit to GDP fell by just 7 percentage points, and the second between mid-1999 and end-2008, when the debt ratio declined by 26 percentage points (Graph 4, top panel). Both phases showed moderate growth, the Japanese economy expanding at an average annual rate of 1.6% through 1993–97, and at 1.9% through 1999–2008. Despite the similar growth performance, the two periods were quite different in character.

The first period of debt reduction, between 1993 and 1997, culminated in the Japanese credit crunch. The bursting of the asset price bubble in the early 1990s and the subsequent years of stagnation had left Japanese banks with a large number of non-performing loans on their balance sheet. As a

Successful debt
reduction ...

¹² Mayer (2009) illustrates this point with some simple arithmetic: suppose a closed economy in which investment is funded entirely by borrowing: $I_t = \Delta D_t$. Since investment is equal to saving, $Y_t = C_t + \Delta D_t$ and $\Delta Y_t = \Delta C_t + \Delta \Delta D_t$. Biggs et al show that this holds true also in a more standard growth model.

¹³ Dating a financial crisis is often difficult, but rarely more so than in this case. Laeven and Valencia (2008), on which the crisis dating in Cecchetti et al (2009) and this paper are based, trace the beginning of the Japanese crisis to November 1997, when the problems in the banking sector finally surfaced. However, these problems were not new but had existed for many years. Other observers, including Reinhart and Rogoff (2009), thus date the beginning of the Japanese crisis to 1992, after the bursting of the bubble led to the bankruptcy of many *jusen* (a type of non-bank financial institution).



consequence, banks cut back their supply of new credit.¹⁴ Neither allowing banks to book real estate loans at higher values nor capital infusions by the government proved to be effective in stimulating new lending. Allen et al (2009) argue that this was the case because the measures did not force banks to deal with the non-performing loan problem on their balance sheets. It was only after a rigorous examination of banks' non-performing loan portfolios in 1998 and a second round of capital infusions that banks began to lend again. However, it was not this timid recovery in lending that ended the period of debt reduction, but the contraction of economic activity that pushed up the ratio of debt to GDP in 1998 (Graph 4, bottom panel), thereby offsetting most of the debt reduction of the previous years.¹⁵

¹⁴ See Watanabe (2007) for evidence on the credit crunch in Japan. Banks not only curtailed their supply of credit but also misdirected much of the lending that did take place to the wrong sector. Peek and Rosengreen (2005) argue that not forcing banks to write down loans (and shrink their lending) gave them incentives to evergreen loans, ie rolling over non-performing loans to firms that should have been bankrupt. This contributed to stagnation by preventing restructuring and thus curtailing profit opportunities for healthy firms (Caballero et al (2008)).

¹⁵ The reasons for the sharp contraction in the Japanese economy are manifold. The credit crunch may have been a contributing factor, but the external shock posed by the East Asian financial crisis certainly played a major role.

The second period in debt reduction that started in mid-1999 resulted in a much more substantial reduction in debt/GDP than the first period. Nominal credit outstanding fell considerably over the period, driving down debt ratios by 19 percentage points, although this was partly offset by deflation. The Japanese economy's return to growth in 1999–2000 and after 2002 also pushed down debt ratios. What is surprising is that there is much less evidence of restrictions in credit supply than in the first period, despite the much sharper fall in nominal credit outstanding. The likely reason is that this time Japanese policymakers had dealt with the problems in the banking sector that had been left lingering in the first period.

The Japanese experience offers a key lesson for policymakers on how to reduce private sector debt: fix the banking system first. This involves the early full recognition of losses and the restructuring of bank balance sheets. The latter requires raising the necessary amount of capital. Only then will banks be able to provide new loans.¹⁶

... requires banks to recognise losses and raise capital

Conclusions

Reducing private sector debt may not be on top of policymakers' minds when output is falling rapidly, as in late 2008 and early 2009. But as the economy recovers it is important to address the problems that led to the crisis in the first place. In addition to, and as a result of, inadequate regulation there was a sharp build-up in private debt, particularly mortgage lending to households, in several countries.

The historical record casts doubt on whether debt reduction can be avoided. Almost all the crises in our sample that were preceded by a credit boom were followed by sizeable drops in the ratio of credit to GDP. Of course, to quote Mark Twain, history does not repeat itself, but it rhymes. We are not aware of any compelling reason why this particular episode should be an exception. Admittedly, the low level of interest rates in most of the crisis countries may reduce pressures to adjust debt levels, but this could quickly change.

A possible concern is that a sustained period of debt reduction might lead to low growth in the future. Our analysis casts doubt on this. Growth rebounds rather quickly in most of our episodes, even though debt ratios continue to fall. We take this as indication that it is possible to reduce debt and still experience healthy growth. For this to be the case, policymakers have first to fix the problems in the banking system that led to the financial crisis. The experience of Japan, but also that of other crises, indicates that this requires essentially two things: to (i) recognise losses, and (ii) rebuild bank capital.

¹⁶ These lessons are not new. In their much more detailed analysis, Hoshi and Kashyap (2010) come to similar (and additional) conclusions. Similar lessons can be drawn from other crises. Borio et al (2010) argue that the Nordic banking crises of the early 1990s offer three main lessons: (i) problems have to be recognised early and measures have to be taken quickly, (ii) intervention has to be comprehensive (a point also raised by Hoshi and Kashyap), and (iii) systemic costs have to be balanced with moral hazard.

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The collapse of international bank finance during the crisis: evidence from syndicated loan markets¹

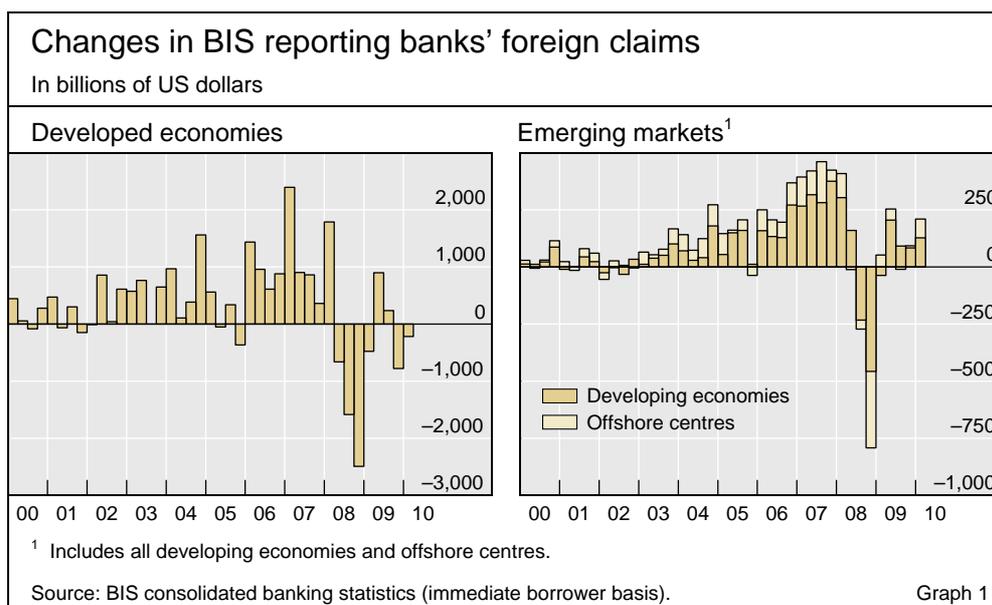
This article examines developments in the syndicated loan markets during the financial crisis. The investigation of deal structures and purposes suggests that supply constraints aggravated the sharp decline of syndicated lending. An econometric analysis confirms that balance sheet constraints of international banks played a significant part in the collapse of syndicated lending.

JEL classification: F34, G15, G21.

The sharp decline in international banking claims is one of the defining features of the financial crisis. During the six months to March 2009, BIS reporting banks' foreign claims – the sum of the banks' cross-border claims plus their foreign offices' local claims in all currencies – fell by a total of \$3.7 trillion, or almost 13%. This was the sharpest half-yearly decline since the BIS began collecting these international banking statistics in 1985. The contraction, which affected borrowers in both developed economies and emerging markets, marked the end of almost a decade of rapid expansion of banks' foreign claims (Graph 1).

To what extent have supply constraints in cross-border lending impeded global economic recovery? The answer to this question is not straightforward. Both supply and demand factors seem to have contributed to the contraction in international bank finance. Following the failure of Lehman Brothers in September 2008, funding markets froze temporarily (CGFS (2010)). This, together with rapidly growing credit losses, put bank balance sheets under severe stress towards the end of 2008. As a consequence, banks may have curtailed the supply of credit. At the same time, global economic activity fell sharply. In the fourth quarter of 2008, the value of exports of goods and services declined by 18% over the previous quarter. This reduced the demand for credit.

¹ The authors would like to thank Blaise Gadanecz and Carlos Mallo for useful comments and suggestions on data issues. Comments from Claudio Borio, Robert McCauley and Christian Upper are gratefully acknowledged. Eric Chan and Serge Grouchko provided excellent research assistance. The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS.



This article examines developments in the syndicated loan markets during the crisis to shed light on the decline in foreign bank lending.² Two particular features of the syndicated loan market help to identify the role of supply constraints in the contraction in international bank lending.

First, the syndicated loan market is more transparent than those for other types of lending. Competition among banks has encouraged the publication of detailed information on completed individual deals. These “tombstones” yield insights into the characteristics of borrowers and lenders, as well as the motivation and purpose behind such loans.³ It is therefore possible to construct time series of syndicated lending for individual banks.

Second, the supply of syndicated loans tends to be more sensitive to bank balance sheet constraints than long-standing lending relationships. Syndicated loan markets are highly competitive and characterised by arm’s length relationships. One, or a few, arranging banks typically negotiate the loan contract and a larger number of participating banks join the syndicate as providers of funding. While the lead banks (or arrangers) in a syndicate may seek fee income and to maintain the relationship with the borrower, the motivation for participating banks is primarily to generate interest income (Armstrong (2003)).⁴

² Not all syndicated loans are cross-border in nature, and participating banks can be a mix of international and local banks. But in most deals, the lead arranger(s) are international banks. Accordingly, syndicated loan issuance contains important information about the borrower-lender and arranger-participating bank relationships (see Esty (2001)). In addition, Gadanez and von Kleist (2002) find that the timelier syndicated loan data could provide important advance information on what later emerges from the BIS consolidated banking statistics.

³ Syndicated loan data used in this feature are from Dealogic’s *Loan Analytics* and Loan Pricing Corporation’s *DealScan*, which contain information on global syndicated loan issues by borrower and issuer and by country of origination, and on the deal type and the use of proceeds.

⁴ The managing agent negotiates the loan terms and coordinates the documentation process, the loan closing, the funding of loan advances and the administration of repayments (Dennis

This feature is organised as follows. The second section describes the main trends in syndicated loan markets during the past decade. The third explores what syndicated lending for specific financing purposes and changes in syndicated loan arrangements reveal about the importance of supply and demand factors. The fourth section employs a more formal test of the hypothesis that balance sheet pressures have reduced syndicated loan supply. The last section concludes.

Broad trends in syndicated loan markets

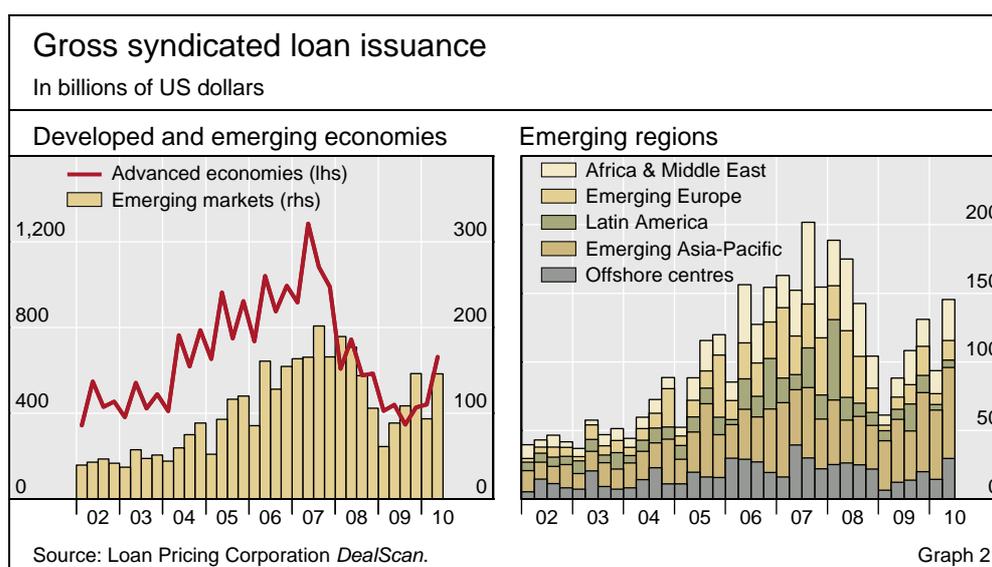
Syndicated loan volumes had grown rapidly prior to the crisis ...

Syndicated loans have become an important source of corporate funds in recent years. In 2009, international syndicated lending amounted to \$1.8 trillion, compared with \$1.5 trillion of borrowing by non-financial companies in international bond markets.

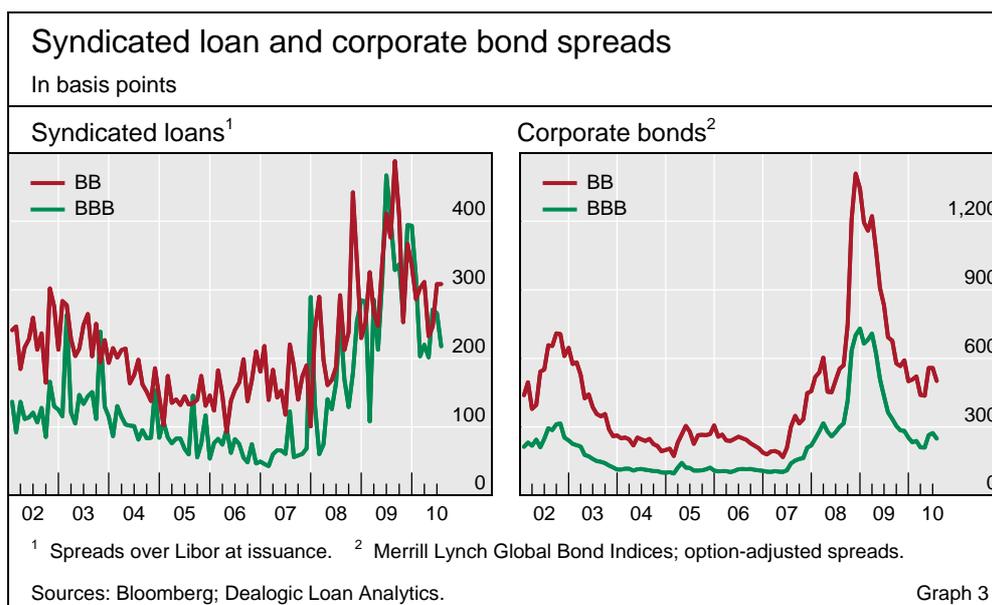
Like many other credit markets, syndicated loan markets grew rapidly in the run-up to the financial crisis. The gross amount of syndicated lending to developed economies rose from around \$400 billion per quarter in 2002 to almost \$1.3 trillion in the second quarter of 2007. Syndicated lending to emerging market borrowers followed a similar pattern, reaching a peak of almost \$150 billion in the third quarter of 2007. Syndicated lending held up relatively well until mid-2008.

... and collapsed in the second half of 2008

Following the Lehman bankruptcy, syndicated loan markets collapsed. During the second half of 2008, gross syndicated lending declined by 67% in developed economies (Graph 2, left-hand panel). A decline of a similar magnitude was also observed in emerging markets (Graph 2, right-hand panel), with Africa and the Middle East being particularly affected. Notwithstanding the recovery in global financial markets since the second quarter of 2009, syndicated lending only recently picked up somewhat.



and Mullineaux (2000)). Furthermore, as some loans are issued as a backup revolving facility, a facility (or "non-use") fee may be charged regardless of the level of drawings.



The crisis was also associated with a substantial widening of syndicated loan spreads (Graph 3, left-hand panel). Following a period of low spreads in the mid-2000s, average primary market spreads of both investment grade and sub-investment grade (commonly known as “leveraged”) syndicated loans rose sharply in late 2008, although by less than those on similarly rated corporate bonds. Towards the end of 2008, BBB-rated syndicated loan spreads reached 400 basis points, compared with about 750 basis points on corporate bonds with the same rating (Graph 3, right-hand panel). However, while corporate bond spreads have fallen significantly since early 2009, syndicated loan spreads seem to have remained wide until recently.

Sharp widening of syndicated loan spreads

The combination of lower lending volumes and higher spreads is consistent with reductions in both syndicated loan supply and demand. The two are difficult to disentangle, especially since spread changes are difficult to interpret owing to the severe disruptions to Libor, which serves as benchmark for most syndicated loans.

Factors affecting syndicated loan demand and supply

The pattern of syndicated lending by financing purpose and changes in syndication arrangements confirm the view that a combination of demand and supply factors contributed to the collapse in syndicated loan markets.

A first example is the drop in syndicated lending for acquisition finance. In 2007, syndicated loans used to finance mergers and acquisitions (M&As) accounted for 44% of total syndicated lending in developed countries;⁵ this share fell to 25% by end-2008, coinciding with a decline in corporate profits (Graph 4, left-hand panel). One could argue that reduced expectations for corporate profits also lowered the expected returns from M&As, and hence the

Reduced demand for credit to finance acquisitions ...

⁵ The buyout market in emerging economies has been relatively less developed, and syndicated lending for M&As represents only a small share of total issuance.

demand for acquisition finance. Indeed, expectations of rapid corporate profit growth had supported the boom in leveraged buyouts in advanced economies in the run-up to the crisis (CGFS (2008)).

... coincided with the drying-up of securities markets

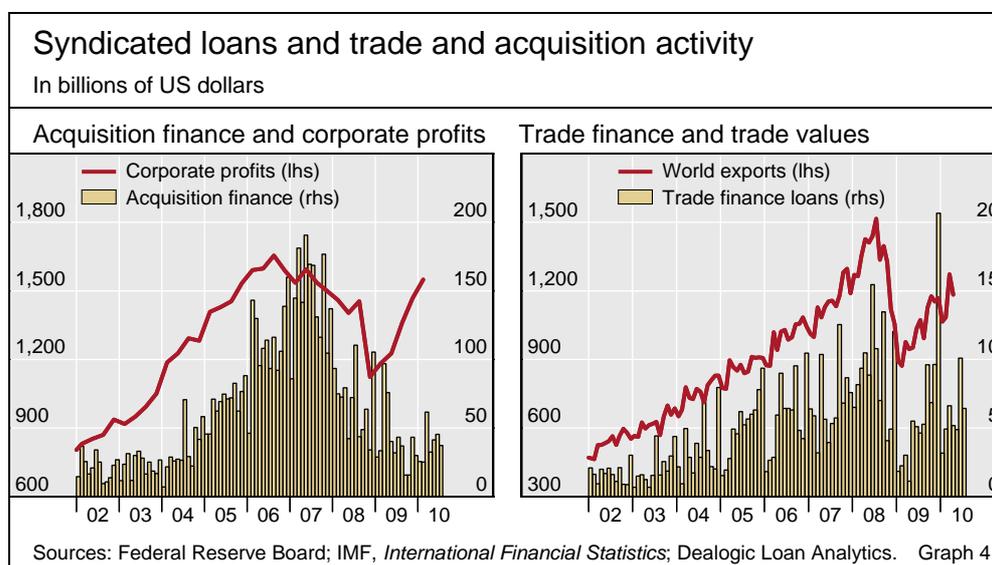
At the same time, however, supply constraints seem to have been at work. Non-bank investors, such as hedge funds and other asset managers, retreated from the secondary market for syndicated loans. The funding of structures used to securitise syndicated loans, such as collateralised loan obligations, evaporated. As a consequence, banks were unable to securitise and distribute leveraged loans at previously expected prices. At the beginning of 2008, banks held an estimated \$400 billion of leveraged loans that could not be securitised (CGFS (2008)). This intensified banks' funding constraints and may well have led them to reduce the supply of acquisition finance. In addition, corporate debt clearly became riskier during the crisis, which would have made investment in syndicated loans less attractive even for lenders without any balance sheet constraints.

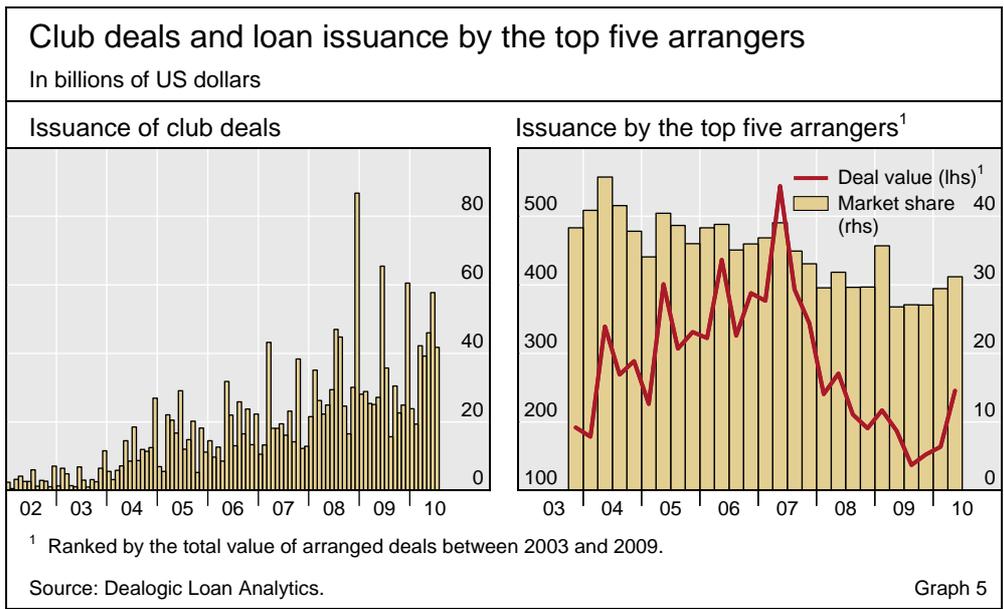
The global recession lowered trade financing needs ...

A second example for a simultaneous reduction of supply and demand is syndicated trade finance, which is much smaller than syndicated lending for M&As. The issuance of syndicated loans to finance trade virtually came to a halt around the end of 2008 (Graph 4, right-hand panel). The global economic recession reduced trade finance needs. For instance, exporters operating in global supply chains or in sectors particularly hard-hit by the global recession are reported to have been affected by the cancellation of orders and delays in buyers' payments (Malouche (2009)). Moreover, the sharp fall in commodity prices significantly reduced finance needs for a given trade volume. This had an impact on the demand for syndicated loans, which are mostly used for short-term commodity financing.

... while trade credit became much more expensive

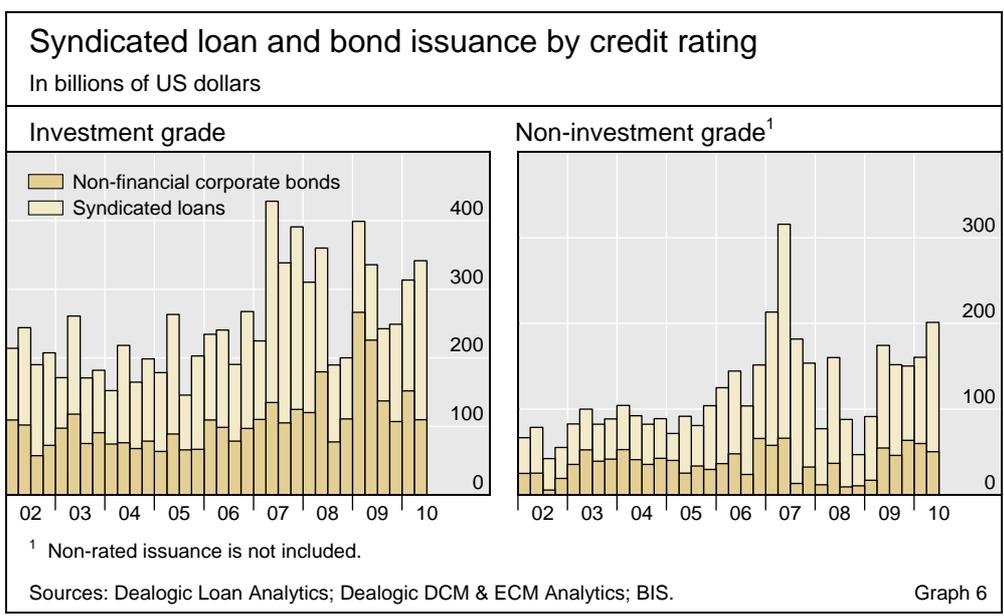
That said, like other forms of credit, trade finance became much more expensive. Trade finance deals were offered at 300–400 basis points over interbank finance rates at the end of 2008 (Malouche (2009)). There is evidence that banks did not accept other banks' letters of credit in trade financing, suggesting that the decline in syndicated trade finance was in part due to supply constraints.





Changes in syndication arrangements may be indicative of credit supply constraints. For instance, syndicated loan transactions in the form of “club deals” gained importance, increasing from 12% of total issuance in 2008 to 17% in 2009 (Graph 5, left-hand panel). A club deal is a loan syndicated by a small number of participating banks, which are not entitled to transfer their portion of the loan to a third party (White & Case (2003)). Such smaller syndicates result in lower restructuring and monitoring costs, and are thus preferred by lead arrangers when default is more likely. From this perspective, greater use of club deals might be an indication of both growing bank risk aversion and higher credit risk at a time of greatly increased economic uncertainty. This is consistent with Esty and Megginson (2003), who find that syndicate size is positively related to the strength of creditor rights and the reliability of legal enforcement.

Growing importance of “club deals” ...



... and substitution of syndicated loans with other forms of credit

The least ambiguous indication of supply constraints is perhaps the substitution of syndicated loans provided by international banks with other sources of finance. In developed countries, investment grade borrowers seem to have used capital markets as a funding alternative. Unusually strong investment grade corporate bond issuance in 2009 coincided with low syndicated lending (Graph 6). In some emerging economies (eg China), where domestic banks have the capacity and are willing to fill the funding gap created by the withdrawal of international banks, the issuance of syndicated loans continued to rise (see box). The top five banks' share in the syndicated loan market fell from over a third before the crisis to roughly one quarter in 2009 (Graph 5, right-hand panel).

A preliminary econometric analysis of bank-level data

This section presents a preliminary econometric investigation of the significance of credit supply effects at the level of individual banks. The panel analysis focuses on the relationship between the volume of syndicated loans issued by the world's largest 21 banks and bank-level measures of balance sheet stress for these banks during the 2005–09 period.

We chose an indirect approach to estimate supply effects, employing a rather general reduced-form equation. The dependent variable is the log of the amount of syndicated loans issued by a bank. The observable right-hand variables consist of predetermined variables that capture supply function shifts: five-year bank CDS spreads, as an indicator of market perceptions of a bank's riskiness and funding availability, a leverage ratio and cumulative capital injections. Economic growth in the bank's home country is used to control for domestic economic conditions that might affect a bank's international lending behaviour.⁶ Besides the observable right-hand variables we include a bank-specific fixed effect in the regression. The bank fixed effect represents all unobserved time-invariant characteristics of the loan supply of a bank (eg the business model).

A time-specific fixed effect is regarded as a control for the time-variant worldwide demand for loans, which is common to all banks. It should, however, be noted that this catch-all variable may also capture supply shocks common to all banks not represented by the observable regressors. Hence, so interpreted, the results may even underestimate the importance of supply factors.

The results of the panel regression are reported in Table 1. The coefficient estimates for the loan supply determinants are negative as expected. The CDS spread is economically and statistically highly significant. An increase in CDS spreads of 100 basis points leads to a loan supply reduction of approximately 13% in the following quarter. The leverage ratio coefficients estimate is statistically insignificant, but capital injections are significant at the 5% level.

Econometric results ...

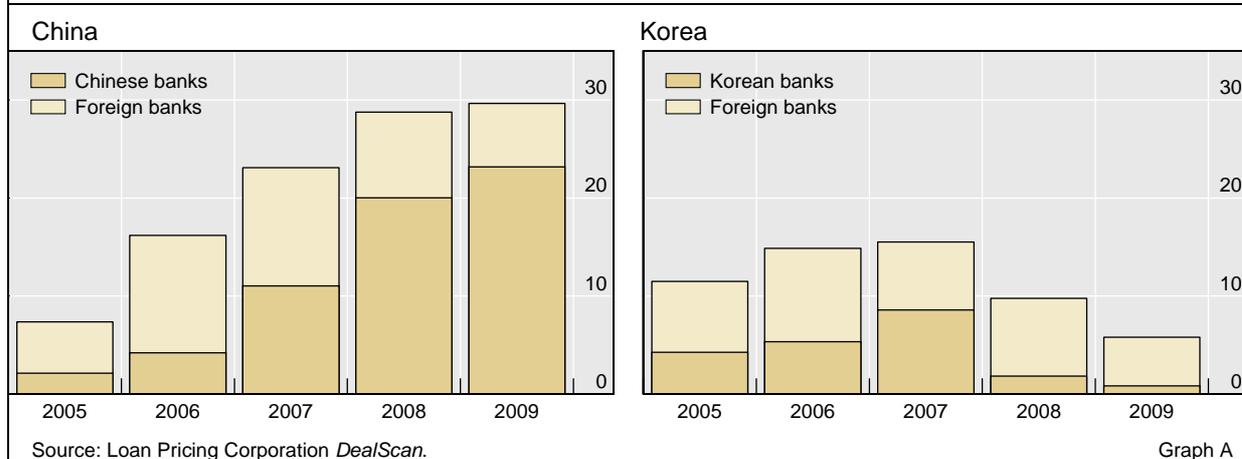
⁶ All explanatory variables are lagged one quarter in order to avoid simultaneity problems. Moreover, the lagged dependent variable is included as an additional regressor in order to allow for dynamic adjustment.

Syndicated loans in China and Korea

The cases of China and Korea illustrate how conditions in domestic banking systems have affected syndicated loan markets. China was one of the few countries where syndicated loan issuance continued to grow through the global financial crisis. An important factor that has contributed to the expansion in China was the ample supply of bank credit by local banks. Traditionally, international banks dominated in the mandated manager “league table” of syndicated loan issuance to Chinese borrowers. However, starting from 2007, the annual volume of syndicated loans issued in China with domestic banks as mandated managers has increased markedly, more than offsetting the withdrawal by international banks (Graph A, left-hand panel). By contrast, the amounts of syndicated loans with local banks as mandated managers fell more than proportionately in Korea, contributing to the substantial decline in syndicated loan issuance over that period (Graph A, right-hand panel).

Mandated arrangers of syndicated loans in China and Korea

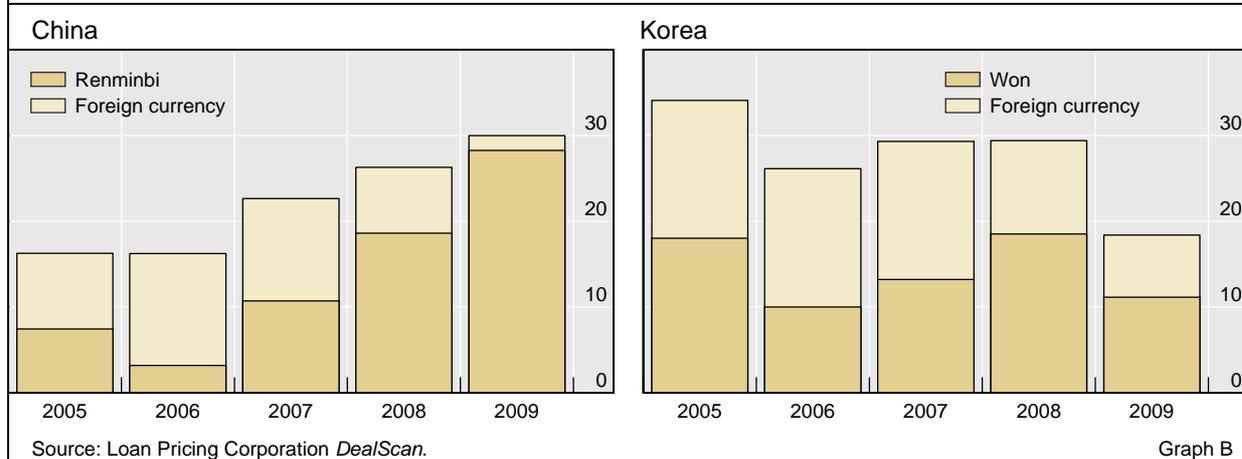
Issuance volume, in billions of US dollars



The unwillingness of international banks to participate in loan syndicates during the crisis was also evidenced in the issuance data by currency. In 2006, almost 80% of syndicated loans issued in China were denominated in foreign currencies, mainly US dollars. Since then, the share of foreign currency denominated loans in total has contracted sharply, to less than 5% in 2009 (Graph B, left-hand panel). Given that the capacity of foreign banks to lend in renminbi is rather limited, this indicates that local banks have played an important role in supporting syndicated lending in China. In Korea, in contrast, both won-denominated and foreign currency denominated syndicated lending fell in 2009 (Graph B, right-hand-panel).

Syndicated loan issuance in China and Korea by currency

Issuance volume, in billions of US dollars



Demand and supply factors in syndicated loan issuance ¹						
Q1 2005–Q4 2009						
Variables	Constant	Lagged dependent variable	CDS spreads ²	Leverage ³	Capital injection ⁴	Output Growth ⁵
Coefficient	4.0360***	0.2394***	-0.129***	-0.001	-0.3323**	-0.351*
	Demand					
Time fixed effect ⁶	Q4 2005	Q4 2006	Q4 2007	Q3 2008	Q4 2008	Q1 2009
Coefficient	0.3587	0.4347	0.4106	-0.2752	-0.1432	-0.6326
R-squared	0.89					
<p>*, ** and *** denote coefficients significantly different from zero at the 10%, 5% and 1% level, respectively.</p> <p>¹ The dependent variable is the syndicated loan issuance by 21 banks (logarithmic). The model is estimated through panel regression using bank- and time-specific fixed effects. ² Senior five-year CDS spreads, in percentage points; average for the period. ³ Total assets divided by common equity. ⁴ Capital injected divided by common equity. ⁵ Banks' home country output growth; annual change, in per cent. ⁶ Some are shown for illustration. The bank fixed effect is not reported here.</p> <p>Sources: Bloomberg; Loan Pricing Corporation <i>DealScan</i>; Markit; national data. Table 1</p>						

The coefficient estimates indicate that a 10% capital injection, including both capital-raising in the markets and capital support provided by governments, is followed by a reduction in the supply of syndicated loans of about 3.3%. A decline in GDP growth in the home country of 1% is followed by a 3.5% decline in loan supply. The coefficient of the lagged dependent variable is clearly statistically significant but is relatively small (0.24).⁷ This indicates that the syndicated loan supply is adjusting quickly, consistent with the arms length's character of the loans.

Both bank and time fixed effects are highly statistically significant. Of the banks in the sample, the bank fixed effects show, for instance, that Citibank and Rabobank have the largest (smallest) amount of loans outstanding, *ceteris paribus*. The time effects are positive or only slightly negative up to the fourth quarter of 2008. For 2009 they are strongly negative. This pattern is in line with the course of the recent worldwide recession and, subject to the caveat noted above, supports a loan demand interpretation of the period fixed effect.⁸

Overall, these preliminary results support the view that especially concerns about the soundness of large international banks, and the resulting funding pressures, constrained the supply of syndicated loans. The average increase in CDS spreads of the banks in our sample of about 180 basis points between end-2007 and the second half of 2008 could explain a decline in syndicated loan issuance of about one quarter until early 2009. However,

... confirm the importance of credit supply constraints

⁷ This clearly shows that our estimation does not suffer from a spurious regression problem which implies a lagged dependent variable coefficient of 1. However, given the small period sample we have available, it does not make sense to test for unit roots and cointegration.

⁸ Finally, it should be mentioned that the results with respect to our loan supply determinants are essentially the same when we adopt a first-difference specification. However, we get a strongly negative coefficient estimate for the lagged dependent variable, which indicates that this alternative specification suffers from an over-differencing problem. In addition, using current values of the loan supply determinants only leads to a slight decrease in the R-squared with marginal changes in the coefficient estimates.

understanding the precise nature and transmission of balance sheet constraints requires further investigation. For instance, it is not clear how to interpret the reduction of syndicated loan supply following capital injections. One possibility is that those banks that received the largest capital injections had the weakest balance sheets and faced the most severe lending constraints. Another explanation is that capital injections created a bias in favour of domestic assets. Indeed, in several advanced economies government capital support programmes contained clauses aimed at ensuring that fresh capital was used to sustain domestic lending (Panetta et al (2009)).

Conclusion

Both demand and supply factors contributed to the decline in syndicated loan issuance during the financial crisis. The investigation of deal structures and purposes suggests that supply constraints aggravated the sharp decline of syndicated loan issuance. Regression analysis confirms that balance sheet constraints of international banks played a significant part. These preliminary results broadly confirm the findings of similar studies on the significance of supply effects.⁹

The results raise at least two issues. The first concerns the extent to which constraints in syndicated loan supply can be expected to ease in the near term. Dysfunctional securitisation markets might constrain the ability of banks to place syndicated loans in the secondary market for a while. Moreover, repairing bank balance sheets takes time. But the sensitivity of syndicated loan supply to changes in bank CDS spreads may suggest that measures that alleviate concerns about banks' soundness and ease bank funding pressures could have significant positive effects on credit supply even in the near term.

Second, recent developments in syndicated loan markets might be indicative of structural changes in credit markets. The gradual return to more normal functioning of the corporate bond markets could have eased funding constraints for banks and corporations. In particular, those with an investment grade rating might be more reliant on market finance in the future. Moreover, looking forward, emerging market banks may play a much bigger role in syndicated loan markets, and in international banking more generally, than in the past. The syndicated loan market with its role in financing trade and mergers and acquisitions might be one key area of expansion for these banks.

⁹ Takáts (2010), using the BIS locational statistics, finds that the impact of supply factors was stronger than that of demand factors in causing the sharp decline in bank lending to emerging market economies during the financial crisis. McGuire and Tarashev (2008) also find that deterioration in bank health is associated with a decline in the growth of credit to emerging markets in the 1990s.

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Options for meeting the demand for international liquidity during financial crises¹

The financial crisis has heightened the awareness of the risk of a sudden shortage of foreign currencies. Governments and central banks are looking for ways to obtain “liquidity assurance”, ie the assurance of having access to international liquidity if they need it. This article discusses how such assurance might be provided, whether by multilateral means, such as reserve pooling or structures such as the IMF; by bilateral means, such as swap arrangements; or unilaterally, by building up foreign exchange reserves. All of the possible solutions have advantages and disadvantages, and a diversity of approaches therefore seems likely. If international arrangements are deemed to be inadequate, unilateral actions will continue.

JEL classification: E58, G01, F31.

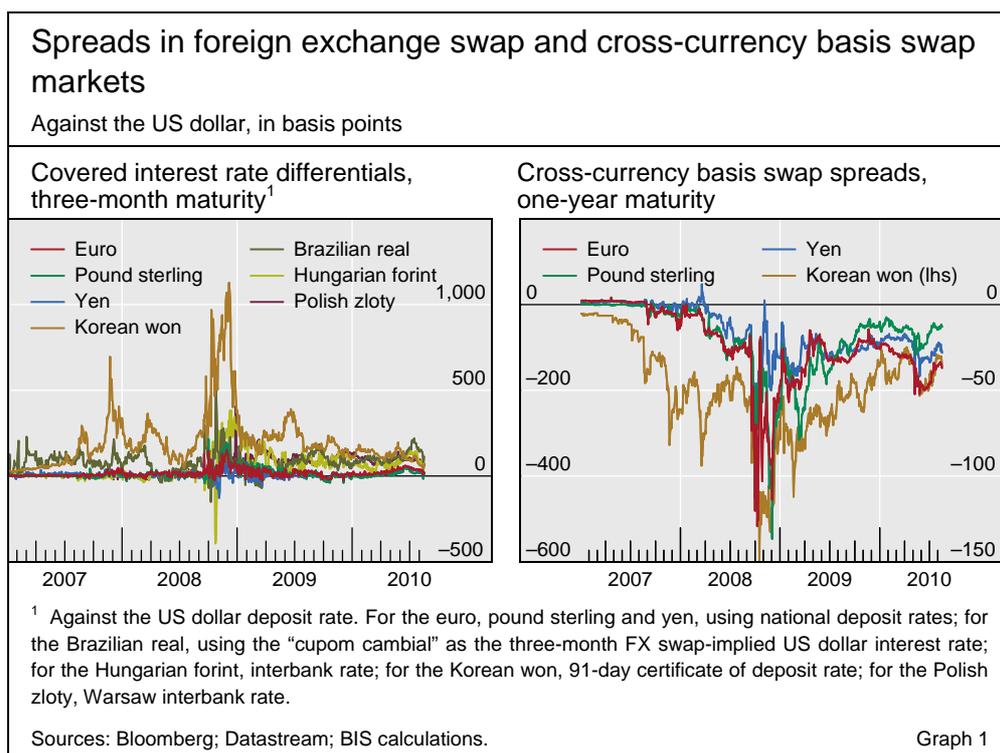
The demand for foreign currency liquidity increased suddenly in many countries during the financial crisis of 2008–09 as a result of large international flows of funds to the United States and Japan. Wholesale interbank markets and foreign exchange swap markets were disrupted. Much of the demand was accommodated and the resulting disruptions eased by the provision of central bank swaps, mainly by the Federal Reserve. After the financial crisis, things cannot go back to where they were, because governments and central banks, like commercial banks and non-financial companies, want greater assurance of adequate international liquidity as protection against another financial crisis.² This article considers various ways in which they could obtain such assurance.

International liquidity problems during the recent financial crisis

After the failure of Lehman Brothers in September 2008, concerns about counterparty credit risk were magnified and the demand for liquid assets

¹ We are grateful to Claudio Borio, Maria Canelli, Stephen Cecchetti, Corrinne Ho, Tim Ng, Philip Turner and Christian Upper for helpful comments and discussions. We are also grateful to Bilyana Bogdanova and Agne Subelyte for excellent research assistance. The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS.

² By “international liquidity” we mean access to means of international payment.



surged. Liquidity dried up in wholesale interbank markets, as well as in foreign exchange and cross-currency basis swap markets. The scale of the disruption is illustrated by the widening of the spreads shown in Graph 1 (Baba and Packer (2009), Baba et al (2008)).

There were large international flows of funds to the United States and Japan (Table 1). One important reason for the flows to the United States was that banks operating there had to meet previous explicit or implicit lending commitments which they had brought onto their balance sheets. Banks located

Flows of funds ...

Exchange rate adjusted changes in banks' net external liabilities in the second half of 2008¹

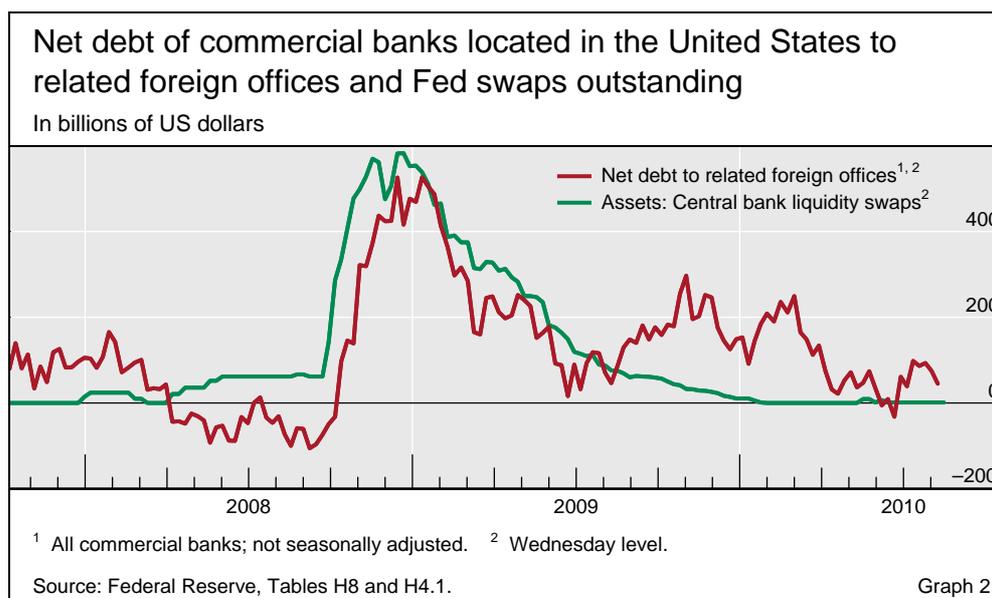
In billions of US dollars

	Total	Domestic currency	Foreign currency
Australia	-82.1	12.6	-94.6
Denmark	-29.7	-10.1	-19.7
Euro area	-311.4	88.2	-399.6
Japan	134.8	129.8	5.1
Korea	-37.8	0.0	-37.8
Sweden	-35.7	14.9	-50.5
Switzerland	73.5	28.3	45.2
United Kingdom	9.9	-47.5	57.4
United States	256.8	269.7	-12.9

An increase in the net external liabilities of the commercial banks in any country indicates an inflow of funds into that country.

¹ For economies where commercial banks' total net external liabilities changed by more than \$30 billion in the fourth quarter of 2008.

Source: Derived from BIS international locational banking statistics (Table 2). Table 1



in the United States, especially foreign banks, drained US dollar liquidity from their non-US affiliates in large amounts in the last four months of 2008 in order to build up their liquid assets, even though there were large shortages of dollars elsewhere (Graph 2; Allen and Moessner (2010)). A second factor was a flight of precautionary balances to the United States, where the most liquid US dollar markets are located.³ The large flows to Japan probably reflected an unwinding of yen carry trades as foreign exchange volatility rose and assets which had been financed with borrowed yen fell in price.⁴

... led to liquidity shortages and swap lines

These international flows of funds created severe shortages of foreign currency liquidity, most notably in US dollars, and dislocation in interbank and foreign currency swap markets in many countries. Such problems had occurred previously in emerging market countries, eg during the Asian crisis of 1997–98, but this was the first time since the 1930s that they had affected western Europe, for example. The shortages were largely relieved by massive emergency liquidity assistance, including across borders through bilateral foreign exchange swap lines between central banks (Allen and Moessner (2010)). The Federal Reserve provided the largest amounts of foreign currency liquidity, peaking at \$583.1 billion on 17 December 2008 (Graph 2).

Options for providing “liquidity assurance”

Countries want liquidity assurance ...

In the light of this experience, many governments and central banks are now anxious to obtain greater “liquidity assurance”, ie the assurance of having access to international liquidity in any future crisis. Moreover, some observers are concerned that banks in emerging markets have to operate at a

³ McGuire and von Peter (2009) explain why European and Japanese banks had structural US dollar funding requirements. In addition, write-offs of dollar-denominated assets by non-US banks led to outright purchases of dollars.

⁴ See Bank of Japan (2009), pp 60–6.

disadvantage in international competition because it is relatively difficult for them to obtain emergency liquidity support in the major world currencies (Park (2010)).

Prevention

The best assurance would be provided if banking problems could be prevented from occurring in the first place. Regulation is being tightened in the wake of the crisis, as regards both capital and liquidity. Regulatory responses which are particularly relevant in the context of international liquidity are the new liquidity standards proposed by the Basel Committee on Banking Supervision, self-sufficiency rules for liquidity purposes in the new liquidity regime of the UK Financial Services Authority, and proposed limits to banks' exposures in the European Commission's capital requirement directive (BCBS (2009), FSA (2009), European Commission (2008)). These rules are likely to lead to smaller currency or maturity mismatches. That said, prevention may not be fully effective, so it is important to consider how to deal with international liquidity crises if they do happen.

Evaluating techniques for providing liquidity assurance

Satisfactory techniques for providing liquidity assurance should meet the following criteria (as endorsed by Cecchetti (2010)):

- They should provide the countries that need it with adequate reassurance that their international liquidity needs will be met.
- They should avoid excessive moral hazard, and in particular avoid giving countries in "fundamental disequilibrium" the means to delay necessary adjustment.
- They should avoid placing unreasonable burdens on liquidity providers.

It is possible to design multilateral or bilateral structures for providing liquidity assurance that enable countries to get credit in case of need. Such structures provide, in effect, a "lender of last resort" in international financial markets, at least up to the limit of the available credit facilities. All techniques which involve credit also involve moral hazard, however. If credit is made available automatically, then borrowers with short-term horizons have an incentive to over-borrow. In normal circumstances, the lender conducts a full credit assessment before providing funds. However, in a financial crisis, quick decisions are often essential. There may not be time for a full assessment.⁵ The Fed's speed of reaction in 2008 was crucial to the effectiveness of its swap operations.⁶ In the absence of adequate multilateral or bilateral structures, a country can obtain liquidity assurance by building up its own foreign exchange reserves so that it has access to the funds it thinks it might need. This is self-insurance.

... which they can arrange by themselves, or which can be arranged internationally

⁵ Bagehot (1892, pp 199–200) emphasises the importance of speed in responding to panics.

⁶ See Allen and Moessner (2010).

Techniques for providing liquidity assurance				
Type	Technique	Example	Advantages	Disadvantages
Multilateral	Reserve pooling	Chiang Mai	Economy in reserve holding	Moral hazard and possible delays Not all participants can draw at the same time
	Pooling including own currency	IMF	Economy in reserve holding	Moral hazard and possible delays
Bilateral	Swap network managed by reserve currency country	Fed, 1962–98 Fed, from December 2007	Quick access to funds assured Economy in reserve holding; requires only bilateral negotiation	Moral hazard Choice of recipient countries Burden on provider of funds
	Individual country lending from own FX reserves	Denmark, Norway, Sweden lending to Iceland, 2008	Requires only bilateral negotiation	Moral hazard and possible delays Provision of funds may not be assured
	Central banks accept foreign currency collateral located outside home territory from commercial banks	Canada, Hong Kong, 2008	Requires no international negotiation	Not likely to be enough on its own
Unilateral	Reserve accumulation for self-insurance	East Asian countries after crisis of 1997–98	Requires no international negotiation Quick access to funds assured	Diversion of resources into low-yielding assets Global macroeconomic consequences of reserve accumulation

Table 2

We begin by discussing possible multilateral and bilateral techniques, before going on to the unilateral actions that countries can take, namely self-insurance by accumulating reserves. The range of possible techniques and their principal advantages and disadvantages are summarised in Table 2.

Multilateral techniques

All multilateral techniques involve a group of countries agreeing to make funds available to each other in case of need.

In reserve pooling schemes, participating countries can draw on the pool when they need funds, and can thereby have access to more funds than if there were no pooling. It is in the nature of reserve pooling that the reserves in question are not the liability of any of the participating countries. Pooled reserves could be used in a crisis to provide foreign currencies to banks in any of the participating countries. However, the advantage of pooling might be lost in a general liquidity crisis if most or all of the participating countries wanted to draw funds at the same time.

The Chiang Mai structure is a reserve pooling scheme in East Asia. It was set up in the aftermath of the Asian financial crisis of 1997–98 to enable East Asian central banks to provide mutual financial support in the event of a future

crisis (Kawai (2007)). In May 2009 the ASEAN+3 countries⁷ agreed to bring forward the timetable for multilateralising the Chiang Mai Initiative, which had until that time been a network of bilateral swap agreements, none of which had ever been drawn on. The new multilateral facility has created a pool of \$120 billion of reserves, from which each participating country can draw up to a predetermined country-specific amount. However, only the first 20% of the committed amount is available unless the country meets conditions specified by the IMF. With the two largest reserve-holding countries, China and Japan, among the participants, there is not much risk of all the participants wanting to draw at the same time.

The IMF is a financial pooling scheme of a broader kind, in that member countries contribute their quota subscriptions mainly in their own currencies, but also partly in foreign exchange. Its lending is in part financed by quota subscriptions, and its resources have been augmented by the General Arrangements to Borrow and the New Arrangements to Borrow. These resources can then be drawn on by member countries as foreign currency loans. Therefore the IMF can potentially recycle very large sums from creditor to debtor countries. IMF lending has been used in the past (eg during the Asian crisis of 1997–98) to help countries overcome the consequences of banking crises.

Reactions to a financial crisis can be accelerated if credit lines which can be drawn on in case of need have been pre-agreed. The IMF's Flexible Credit Lines were set up in March 2009 to provide timely lending to economies with good economic fundamentals and policies, and without the conditionality (and associated stigma) associated with other forms of lending by the IMF. They are of finite (one-year) duration, to reduce moral hazard. Colombia, Mexico and Poland received credit lines in 2009, none of which, however, had been drawn on by June 2010.

Bilateral techniques

Bilateral techniques involve one institution accepting a commitment to provide funds on demand to foreign central banks. One possible bilateral solution would be the institutionalisation of swap lines provided by individual central banks in their own currency.⁸

The Federal Reserve used swap lines extensively in the recent crisis, but they are not new. The Fed maintained a structure of bilateral swap lines for many years. The network was established in 1962 (Toniolo (2005)). The swap arrangements were usually for three months, and could be renewed or maintained on standby if both parties agreed (Coombs (1976)). They could be drawn at the borrower's option. The network grew rapidly from around \$2 billion at the end of 1963 (involving 11 foreign central banks, including the Bank of

⁷ The ASEAN member countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam) plus China, Japan and Korea.

⁸ Aizenman et al (2010) discuss many of the issues discussed in this paper and conclude that "there are clear limits to substitutability between swaps and reserves".

England and the Bundesbank, and the BIS at end-November 1963) to \$10 billion and \$30 billion at the end of 1969 and 1978, respectively. It survived the breakdown of the Bretton Woods system, even though its main initial purpose had been to help defend the Bretton Woods parities of the dollar and the official dollar price of gold. It was also intended to aid the provision of international liquidity in the longer term: "In the long run, to provide a means whereby reciprocal holdings of foreign currencies may contribute to meeting needs for international liquidity as required in terms of an expanding world economy." (FOMC (1962)). These swap lines were maintained until the late 1990s, when the Federal Reserve allowed all its swap lines except those with the central banks of Canada and Mexico to lapse, in the light of the introduction of the euro and their disuse for the preceding 15 years.⁹

Bilateral central bank swap lines have the advantage that they can provide adequate liquidity assurance. However, in addition to moral hazard, there is the problem of how the recipient countries are chosen. Clearly, the liquidity provider would make this decision, since the provider runs the associated risks, such as exposure to sovereign risk of the recipient country (Allen and Moessner (2010)). But political issues might prevent economically desirable outcomes in the choice of recipient countries.¹⁰ More generally, the liquidity-providing central bank would need to be able to argue convincingly to its own legislature that taking on a commitment of this kind was consistent with its mandate and in the national interest. While it may be possible to make a compelling case for providing swap lines in an economic emergency on national interest grounds, a permanent commitment would be harder to justify.

A second bilateral technique is for an individual country to provide foreign currency liquidity to another country out of its own foreign exchange reserves. For example, in the recent crisis, the central banks of Denmark, Norway and Sweden provided euros to the Central Bank of Iceland by means of swap lines. However, they had made no prior commitment to provide funds. Countries with large foreign exchange reserves could be in a position to provide foreign currencies to several countries, and might even make commitments to provide funds in case of future need, provided they were persuaded that such commitments were in their own interests and that the problem of moral hazard could be managed.

Cross-border collateral arrangements can also help to provide foreign currency liquidity. These involve the central bank in one jurisdiction providing domestic currency liquidity to eligible financial institutions against collateral placed by their offices in another jurisdiction into the liquidity-providing central bank's account at the local central bank.¹¹ Strictly speaking, such

⁹ See FOMC (1998). The swap lines with Canada and Mexico were retained because they were associated with the North American Framework Agreement, in which the Federal Reserve participated.

¹⁰ A historical example of such political difficulties is provided by the 1931 negotiations about an international loan to Austria after the collapse of Creditanstalt. See Toniolo (2005, pp 88–97).

¹¹ See CGFS (2010).

arrangements do not increase the amount of foreign currency available to governments and central banks, but they do reduce the amounts of foreign currency that governments and central banks might need to provide in a crisis to banks located in their territory. Some central banks already accepted cross-border collateral in their normal operations or on an emergency-only basis before the recent crisis, including the central banks of Sweden, Switzerland, the United Kingdom and the United States (CPSS (2006)). Other central banks started accepting cross-border collateral during the crisis, as part of the widening of collateral accepted. For example, in June 2008 the Bank of Canada started accepting US Treasury securities held in the United States as collateral for its Standing Liquidity Facility; and from October 2008 until March 2009, the Hong Kong Monetary Authority expanded the range of securities eligible as collateral for its Discount Window lending to include US dollar assets of credit quality acceptable to the HKMA.

Unilateral actions

If multilateral or bilateral structures do not provide countries with as much liquidity assurance as they desire, then they are likely to resort to unilateral actions. They can hold foreign exchange reserves which they can use in a crisis to provide foreign currency liquidity to domestic banks.

If international arrangements are not sufficient, countries will self-insure

In the recent crisis, Korea, among other countries, provided US dollars to domestic banks out of its foreign exchange reserves in FX swap auctions, in addition to disbursing funds drawn on the Fed's US dollar swap line. Although it provided large amounts, market tensions persisted. There are grounds for thinking that there was some market anxiety about the adequacy of Korea's international reserves, even though they were the sixth largest in the world in mid-2008. The swap facility augmented these reserves and thus contributed to stabilising the market.¹² This may help to explain Baba and Shim's (2010) empirical finding that liquidity provided out of Korea's foreign exchange reserves was not as effective as liquidity drawn from the Fed swap line in reducing tensions in won/dollar foreign exchange swap markets, as measured by won/dollar foreign exchange swap spreads.

In Brazil, the central bank provided US dollars to domestic banks using instruments (derivatives such as FX swaps) that allowed it to limit the impact on reserves, and without drawing on its Fed swap line. Foreign currency liquidity was also provided via collateralised loans to banks (specifically for export financing), sales of US dollars with repo auctions, currency swap contracts (with the central bank short in US dollars) and outright sales of US dollars.¹³ These measures seem to have reduced the relative onshore cost

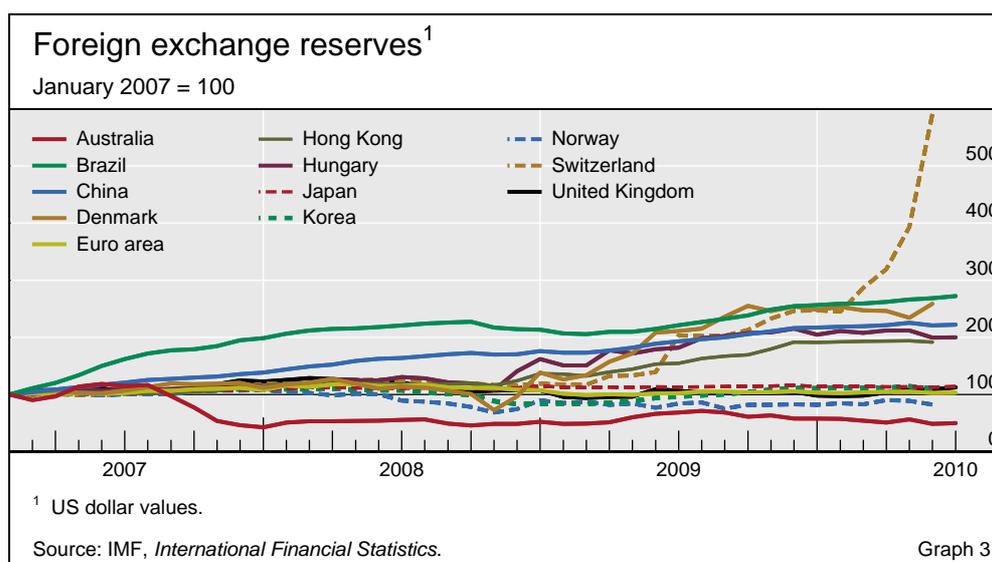
¹² See Kim (2010, page 9). The Bank of Korea commented that "The establishments of the currency swap themselves actually had a positive announcement effect in stabilizing the financial market unrest, as price variables have shown rapid recoveries" (Bank of Korea (2009)). Aizenman et al (2010) comment that "in the case of Korea, declining reserves themselves intensified market fears and concerns, forming a vicious cycle in which adverse market sentiment drives down reserves via FX market intervention and the decline in reserves, in turn, further dampens market sentiment".

¹³ See CGFS (2010).

of dollar liquidity, with the effects of announcements being larger than the effects of the actual interventions.¹⁴

Some countries which experienced severe shortages of foreign currency liquidity during the crisis seem already to be accumulating reserves for self-insurance purposes. For example, the dollar value of foreign exchange reserves increased by 85% in Denmark from the start of 2009 up to April 2010, by 60% in Sweden, by 41% in Hungary, and by 29% in Brazil (Graph 3). Not all of the recent build-up of foreign exchange reserves has been due to self-insurance motives, however. China's foreign exchange reserves were already \$1.9 trillion at the start of 2009, amply sufficient to provide self-insurance, and it is therefore unlikely that any of the 30% increase between then and April 2010 can be attributed to any desire for additional self-insurance. And the very large increase in foreign exchange reserves in Switzerland (by 234%) has been the result of foreign exchange intervention by the Swiss National Bank, whose declared objective has been to prevent a further appreciation of the Swiss franc against the euro. Nevertheless, the SNB provided dollar liquidity drawn on the Fed swap line to commercial banks during the crisis, and the insurance that the recently acquired additional reserves provide may be welcome.¹⁵ Not all economies that relied on swap lines during the crisis have increased their reserves: for example Australia, the euro area and the United Kingdom have not done so materially.

Advantages of self-insurance are that a country has certainty of access to foreign currency liquidity, and that there is no need for coordination. Drawbacks of this option include the costs of holding foreign exchange reserves to the economy, as the funds held as reserves must be invested in liquid assets. Moreover, it may turn out that the amount of foreign currency liquidity provided by the FX reserves is not sufficient. And a coincident effort by a large number of countries to build up reserves, whether by selling their domestic currencies



¹⁴ See Stone et al (2009).

¹⁵ See Allen and Moessner (2010).

in the foreign exchange market or by official long-term borrowing, is likely to affect the global macroeconomic situation. For example, outright purchases of foreign exchange might cause the currencies of the reserve-building countries to depreciate so that global expenditure switches to their domestic products, perhaps generating current account imbalances. And borrowing of foreign currencies would add to the pressure to raise long-term funding in global capital markets. Such effects might be comparable in nature to the effects of the build-up of foreign exchange reserves in East Asia after the 1997–98 crisis.¹⁶

Conclusion

After the recent financial crisis, some countries want greater assurance of access to international liquidity in any future crisis. There are several possible multilateral or bilateral arrangements which could provide more liquidity assurance. Each has advantages and disadvantages; no single option seems optimal and a diversity of approaches therefore seems likely. If the range of internationally agreed multilateral and bilateral facilities does not provide adequate liquidity assurance to the countries that wish to have it, then self-insurance by countries building up foreign exchange reserves is likely to continue.

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Bank structure, funding risk and the transmission of shocks across countries: concepts and measurement¹

This article outlines a broad framework for assessing system-wide funding risks and analysing banks' role in the transmission of shocks across countries. It highlights the need to complement essential data on banks' consolidated balance sheets with information that provides a geographically disaggregated picture of those balance sheets. It then discusses how far the BIS international banking statistics, which have several though not all of the desired statistical properties, can go in providing measures of system-wide funding risk.

JEL Classification: F34, G15, G21, Y10.

The recent financial crisis has sparked broad discussions about the types of information needed for financial system surveillance at the global level.² Particular emphasis has been placed on measures of *system-level maturity mismatch* (hereafter, simply called “funding risk”³) and *leverage*, metrics that could have signalled the build-up of imbalances in specific sectors, and that could have provided some guidance on the extent of maturity transformation in the system.

This article lays out a framework for thinking about such measures, and discusses some of the related data issues. Its key premise is that the geography of banks' international activities matters, and should be taken into account in the measurement of systemic vulnerabilities. Internationally active banks are complex organisations, with local offices (branches and subsidiaries) around the world. These offices provide credit to and raise funds from affiliated and non-affiliated counterparties in the host country and elsewhere. Hence, local offices can have unique *funding structures*, and it is often on these local balance sheets (rather than at the holding company or “group” level) that

¹ The views expressed here are those of the authors and not necessarily those of the BIS.

² For an example, see FSB-IMF (2010) and Issing Committee (2009).

³ The term funding risk is meant to capture the degree of *effective maturity* mismatch on a financial institution's balance sheet. This can arise from actual mismatches in the residual maturities of assets and liabilities in addition to an inability to liquidate assets quickly (liquidity risk) and/or to tap new or roll over existing sources of funding (rollover risk).

problems first develop. As a result, problems can be obscured when only the globally consolidated balance sheet, with positions netted across locations, is considered.

In measuring funding risk, ideally one would have data which provide a *geographically disaggregated picture* of banks' consolidated balance sheets. That is, data in which the *structure* of banks' global operations (for both assets and liabilities) is visible, and which contain some level of information on banks' operations in various locations, and on the interlinkages between these local offices (ie inter-office positions) and with non-affiliated entities.

No dataset exists with this level of detail, or is likely to any time soon. The purpose of this article is thus to explore the extent to which the existing BIS international banking statistics, which have some but not all of the desired properties, can help in the measurement of system-level funding risk.

To set the scene, the first section provides simple examples of banks' international lending and funding activities, and highlights the importance of taking into account bank structure when analysing how shocks are transmitted across countries. The following section discusses the implications for system-level surveillance, and shows the extent to which the geography of banks' activities is captured in the BIS banking statistics. The third section then illustrates how these data can be used in the monitoring of funding risks and of interlinkages in bank balance sheets across office locations. The final section concludes.

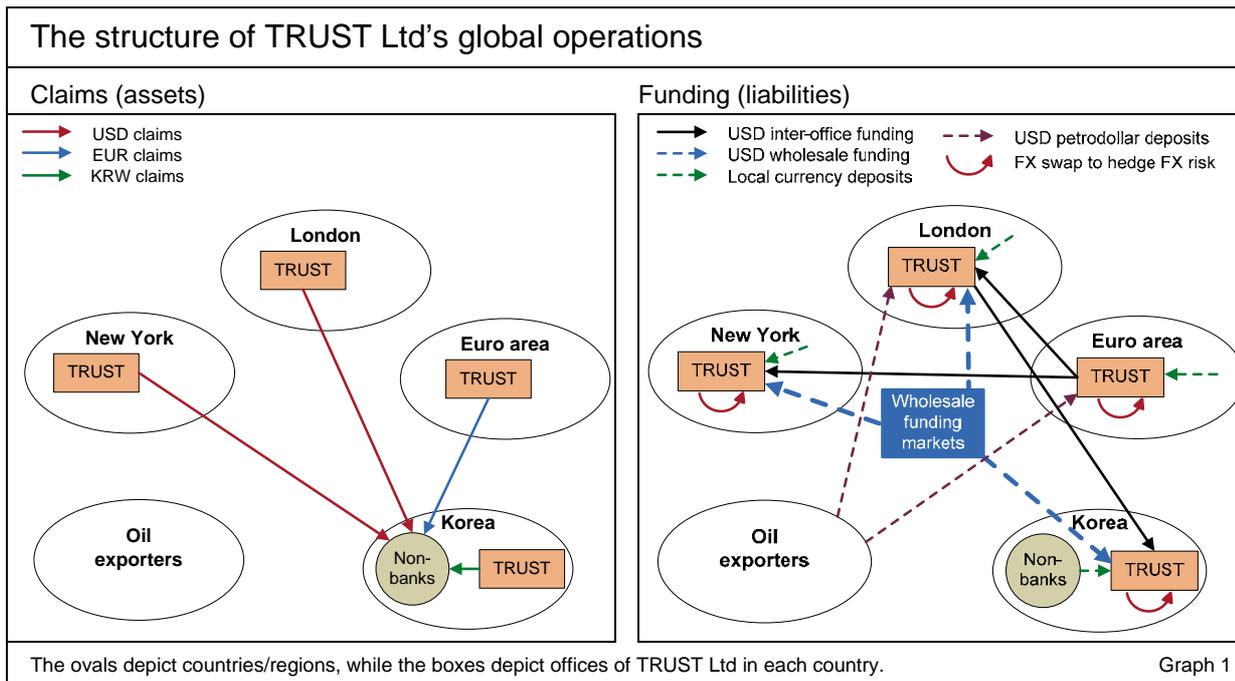
Why bank structure matters

Large, international banks tend to have offices in many different countries. A key implication of this geographically diverse setup is that the cross-border interlinkages of individual office locations can determine how shocks are transmitted from one location (country) to another. In terms of funding risk, *only if* resources available at one office location can immediately be used elsewhere (ie, if banks' internal transfers of funds are perfectly frictionless) will group-level consolidated data provide an adequate picture of any vulnerabilities. And *even if* internal funds transfers are frictionless, knowledge about banks' local balance sheet positions – and how they compare across locations – can convey important information for policymakers on *where* balance sheet adjustments might actually take place in response to any adverse shocks. In turn, this can shed some light on the identity of the borrowers that might ultimately be affected.

Bank structure influences the transmission of shocks

To see why this is the case, consider how a hypothetical European bank – call it TRUST Ltd – might set up its global operations (Graph 1). At the group level, the bank is assumed to have \$100 billion in exposures to non-banks in a particular economy – say Korea. Suppose that \$40 billion of this is booked by TRUST Ltd's home office in the euro area, while \$20 billion is booked by each of its local offices in New York, London and Korea. That is, four different offices of the same global entity lend to non-banks in Korea.

What does this imply? With such a geographically dispersed structure, the *stability* of the credit provided by TRUST Ltd to its Korean non-bank customers



(meaning its willingness or ability to continue to roll over said funds) is inherently tied to the funding structures in each of TRUST's subsidiaries, and these structures are likely to be different. In the example in Graph 1, the liabilities booked in the euro area (home) office could be local currency deposits which are lent cross-border to non-banks in Korea, or sent to affiliates elsewhere (black arrows, right-hand panel). At the same time, the lending from the London office could be supported by a combination of wholesale dollar borrowing, petrodollar (or Asian surplus) deposits and the proceeds from swapping inter-office funding in euros with dollars in the foreign exchange (FX) swap market. The positions booked by the New York office, in turn, could be funded with wholesale borrowing and commercial paper issuance to money market funds, and those booked in Korea could be supported by local currency deposits and inter-office transfers of funds. That is, four different liability structures support the four components on the claim side discussed above.

Netting a bank's balance sheet positions across offices ...

As a result, when viewed from outside the bank using group-level (globally consolidated) data, stresses at the office location level can be masked, possibly generating a misleading picture of the overall degree of funding risk. An example from the recent crisis helps to clarify this point. In the run-up to the crisis, offices of foreign banks (ie those headquartered outside the country) in Korea (and other emerging economies) borrowed US dollars offshore and from their affiliated offices at home, in London or in other financial centres. These dollar funds were then swapped (assuming banks hedge their exchange rate risk) into local currency and invested in local assets in the host country. Concurrently, these same banks' offices in London, New York and in the home countries were funding purchases of US dollar securities by borrowing dollars wholesale and by swapping domestic currency deposits into dollars.

... can mask funding risks at the local level

In short, in some office locations (Korea and other emerging markets), these banks were dollar providers to the FX swap market, while in others (eg home countries, London) they were US dollar borrowers. In principle, at the

group level, banks could thus be net zero in dollar FX swaps. But there would still be potentially significant dollar funding risks across the different office locations.⁴ Netting across offices using group-level data effectively assumes that the resources in one office can immediately be used elsewhere (ie perfectly frictionless internal transfers of funds) – a rather strong assumption.

To see this, consider the following. At the height of the crisis (and again more recently), European banks faced problems borrowing dollars in their home and London offices. What to do? In principle, the Korean office could simply send the dollars it had obtained earlier to cover (part of) the needs of the London office. Yet, in practice, the extent to which this is possible depends on a variety of factors, including the nature of the local currency positions financed with these US dollars, and whether these (and the FX swaps used to obtain local currency) can be unwound in a timely fashion. This unwinding can be particularly difficult in an environment where many banks are trying to do the same thing or are facing problems or restrictions in the relevant location. And when more than one location is involved, adjustments made in one of these may have implications for what will happen in the others.⁵

More broadly, frictions in banks' internal funds transfers can include the following.⁶ First, host countries' capital and liquidity requirements may restrict a local office's ability to make significant balance sheet adjustments to support affiliates elsewhere. Second, to the extent that funds transfers involve correspondent banks, these relationships may be disrupted in times of stress. And third, ownership structure may play a role as well. When the foreign entity is a branch, the parent may have complete control. Yet when the foreign entity is a partially owned subsidiary, with its own corporate culture and management, it is less clear how much access there is to the subsidiary's funding resources.

Implications for system-level surveillance

If the structure of banks' business activities matters, then this should be reflected in the way financial stability is monitored. In particular, the relevant data may have to be collected in ways that preserve the geographical information on funding risks (and other potential vulnerabilities). This calls for joint reporting of group-level and location-based information.

⁴ The emerging market offices face funding risk in rolling their direct US dollar offshore interbank (and possibly inter-office) borrowing. The home and London offices face funding risk in rolling their US dollar FX swap funding.

⁵ In late 2008, foreign banks in Korea rushed to shed won assets. Domestic banks, in turn, faced difficulties in borrowing in the interbank market and much higher costs of obtaining short-term US dollar financing through FX swaps. See Baba and Shim (2010) and Lee (2010).

⁶ See Cetorelli and Goldberg (2008) and de Haas and van Lelyveld (2010) on the role of internal transfers of funds in international shock transmission.

Data dimensions

When thinking about the data needed for financial surveillance, discussions often revolve around the creation of bank-level datasets. The idea is to generate matrices of bilateral exposures of systemically important banks (eg TRUST's exposure to other banks) and of their common exposures to particular sectors or counterparties.⁷ Information like this would be based on the globally consolidated (group-level) positions of the relevant sample of individual banks. While this is important to consistently relate a bank's overall exposures to the capital base ultimately supporting them (or to the headquarters location where the key managerial decisions are being made), group-level data miss the geography of *both* the bank's balance sheet structure (ie the balance sheets by office location) and the location (country) of its counterparties.

Data on bank geography can enhance macro-monitoring

As a result, financial system surveillance efforts might be enhanced with data that provide a geographically disaggregated perspective. Specifically, better gauging funding risks and, more broadly, the role of banks in the transmission of shocks across countries calls for information on (1) the balance sheets of bank entities (ie branches and subsidiaries) in particular *locations* (countries), (2) the *interlinkages* between these entities via banks' inter-office funding, and (3) the interlinkages between these entities and *counterparties* in other countries – that is, the data on banks' *directional* asset and liability positions as depicted by the arrows in Graph 1. Of course, *entity-level* data with this amount of detail would prove difficult to collect and analyse. As discussed in the next section, the BIS banking statistics provide some information along the lines mentioned above, albeit at a higher level of aggregation.

The BIS banking statistics

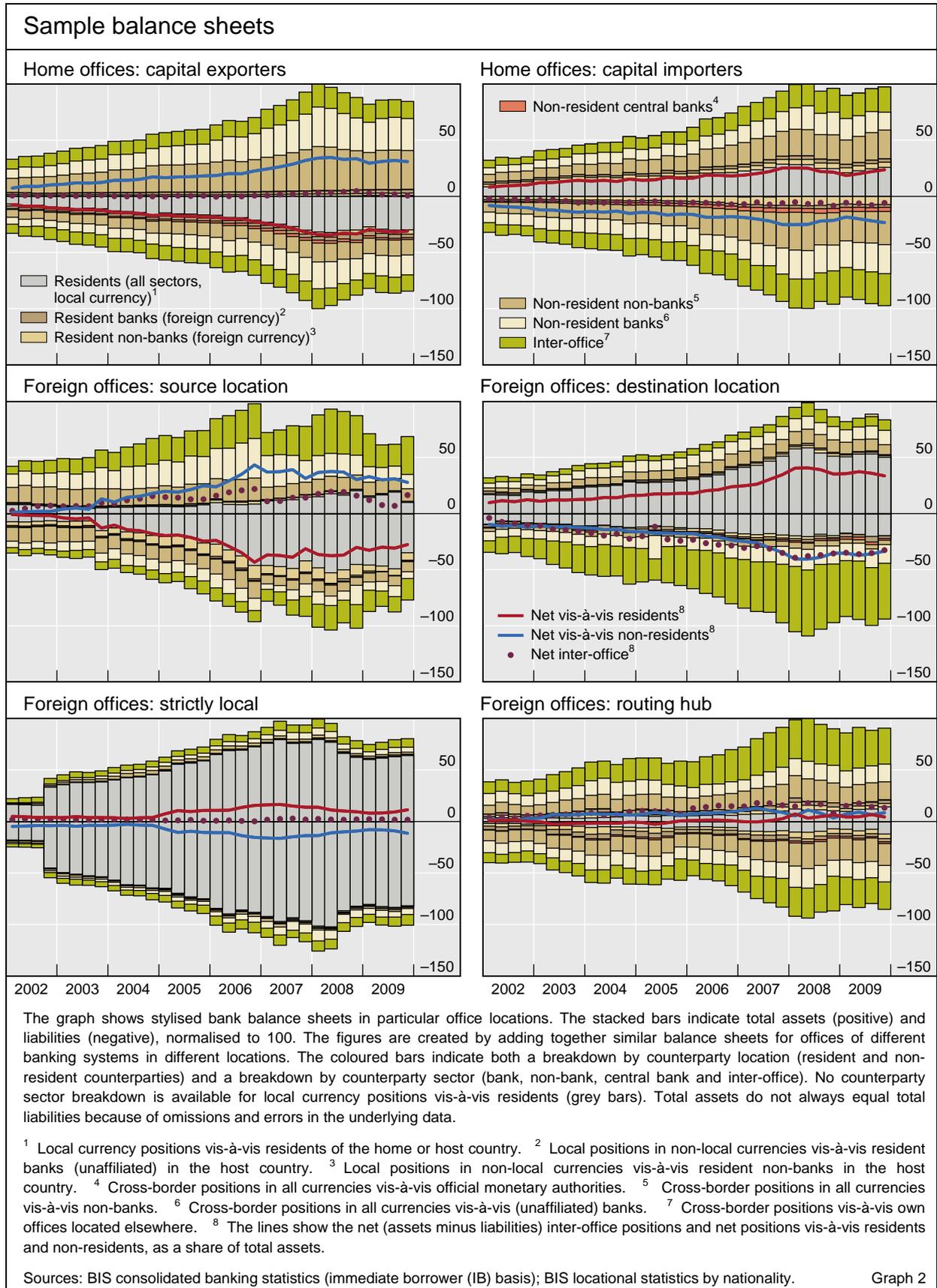
The BIS international banking statistics have several, but not all, of the desired statistical properties. The underlying data can be used to construct consolidated bank balance sheets which are *aggregated*, in the sense that no data on individual banks are available. But the data are *disaggregated* in two important ways. First, for each national banking system (as defined by banks' *headquarters* location), the data provide a picture of the aggregated balance sheet of the underlying entities by office location (country level). Second, for each of these banking system-office location pairs, there is a partial breakdown of the location of the counterparties, for both assets and liabilities. Thus for, say, German banks' offices in France, the data show the total balance sheet broken into positions vis-à-vis residents of the host country (France) and cross-border positions (vis-à-vis all countries), along with further breakdowns by currency and counterparty type.

BIS data show balance sheets by office location

In short, the underlying structure of the BIS banking statistics provides some information on the currency, type and direction of banks' funding and lending activities, *both* at the level of their consolidated international balance sheets

⁷ See FSB-IMF (2010), recommendation #9, for an example.

(group level) and at the office location (country) level. That said, the data have a number of gaps.



To get a sense of what these data do and do not contain, Graph 2 portrays stylised balance sheet types. They are created by aggregating (and scaling to 100) the underlying, partially confidential, data for particular banking system-office location pairs with similar characteristics. The purpose is to provide as concrete a view as possible of what the underlying BIS banking data reveal at the office location level. Across types and over time, the stacked coloured bars show banks' assets (positive) and liabilities (negative) vis-à-vis residents and non-residents of the host countries. These positions are further broken down (to the extent possible) by counterparty sector (bank, non-bank, central bank, inter-office).⁸

The top two panels depict examples of banks' *home offices*, split into whether the home offices are net exporters of capital from the home country (top left-hand panel) or net importers (top right-hand panel). The former include Japanese, German and Swiss banks' home offices, which are all headquartered in current account surplus countries. Not only do these home offices engage in direct cross-border lending to counterparties elsewhere (blue line), they are also major sources of inter-office funding for their offices abroad (positive olive bars). Since much of the assets are in foreign currencies financed with local currency deposits from home-country residents (grey bars), there are large off-balance sheet FX swap positions implicit in these offices' balance sheets, which can add rollover risk.

In contrast to these offices, the home offices depicted in the top right-hand panel (eg Spanish and Australian banks' home offices) import capital to the home country via net inter-office funding from foreign offices and direct borrowing from non-resident non-affiliated counterparties. If in foreign currency, this involves the additional step of swapping these funds *into* the home currency before lending them on to residents.

The remaining four panels of Graph 2 show stylised pictures of banks' operations *outside* their home countries. The "destination location" type (centre right-hand panel) includes offices in host countries such as Spain and Korea. Many foreign banks' offices there have large local currency claims on residents (grey bars), and fund these positions through some combination of inter-office and offshore borrowing. In some bank/host country combinations (eg some European banks' offices in Spain), the local currency asset position and the cross-border liability positions are in the same currency (euros). In others (eg the Korea example in the previous section), the local position is funded by non-local currencies (often US dollars) offshore, again implying an FX swap hedge into the local currency.

In the "strictly local" office types (bottom left-hand panel), typified by foreign banks' offices in Mexico and Brazil, operations on the assets side look similar to the "destination" type above. But, here, the local currency assets are mainly financed locally in the local currency. Such a structure, which does not

Some offices
finance local
currency activity
offshore ...

⁸ This breakdown is incomplete since no counterparty sector information is available for local positions in local currencies (the grey bars in Graph 2).

require any FX swap hedges, is arguably more insulated from shocks external to the host country.⁹

By contrast, in the so-called “source location” type (eg European banks’ offices in Belgium and Luxembourg), local sources of funds (ie the domestic deposit base) are tapped, in part, to finance *international* activities. This is done via inter-office transfers or direct cross-border lending to non-residents.

... while others tap local funds to finance lending elsewhere

Finally, there is the “routing hub”, where strictly local activities are overshadowed by international lending and funding, via both wholesale markets and inter-office transfers of funds. Examples include host countries such as the United Kingdom and Switzerland (eg TRUST Ltd’s assumed activities in London in Graph 1). One distinguishing feature is that foreign banks’ offices in these host countries have relatively small positions vis-à-vis residents (red line), and thus contribute little to the countries’ domestic credit figures. At the same time, the large cross-border asset and liability positions of these banks can have a significant impact on the host countries’ balance of payments figures, even if such movements have little to do with exposures of the country’s residents (see box).

To sum up, the BIS banking data suggest that the activities of banks’ offices in individual country locations are, to some extent, unique to that location. Activities can be very similar across banks in a particular location, while being different across locations. In turn, the types of funding risks which can arise are likely to be at least partially location-specific as well. As a result, to capture these geographical patterns, funding risks would be best measured at as disaggregated a level as possible. This issue is taken up in the next section.

Measuring system-level funding risk: how far can we go?

A prominent feature of the recent financial crisis was the dislocation in funding markets. The problem developed when a large number of institutions found themselves in need of US dollars that they had incorrectly assumed they could either borrow directly or obtain through the foreign exchange swap market. Measuring these vulnerabilities requires knowledge of banks’ consolidated balance sheets (rather than the balance sheets constructed along national borders). At the same time, as argued above, further information on local funding is needed beyond the globally consolidated positions to understand interlinkages and related risks.

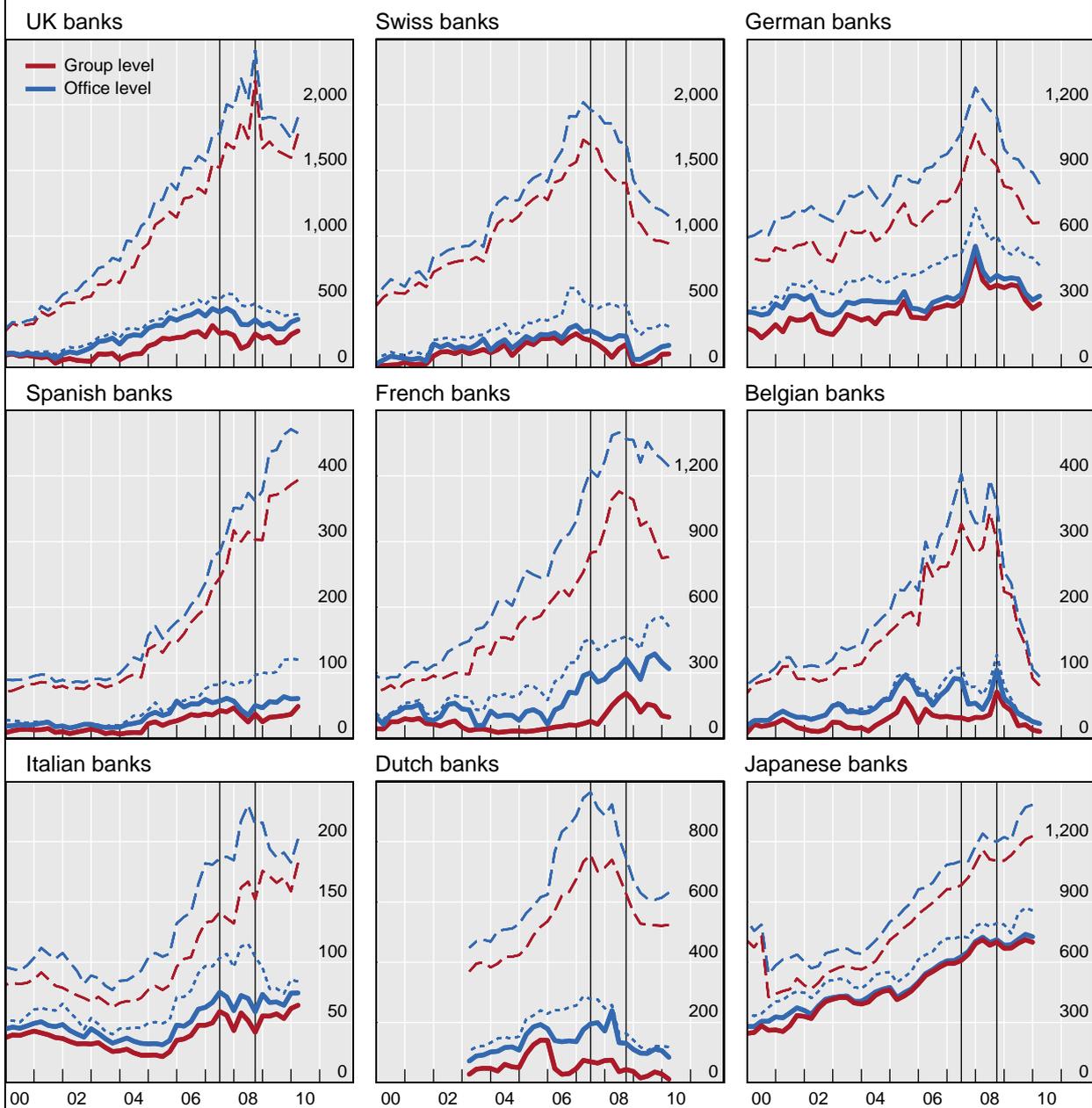
An illustration of this argument is provided in Graph 3, which takes the analysis of funding risks to the office location level. The graph shows upper- and lower-bound measures of US dollar funding risk for nine banking systems. These measures are meant to capture the net amount of short-term dollar funding that must be rolled over, either via direct borrowing or via the FX swap

System-level funding risk should be measured ...

⁹ On the pros and cons of a more decentralised model of international banking, in which a greater portion of lending to residents of a particular country is funded, managed and supervised by offices in the country, see CGFS (2010). Kamil and Rai (2010) present empirical evidence on the relative stability of banks’ local activities in Latin America during the recent crisis.

Indicators of US dollar funding risk, by national banking system¹

In trillions of US dollars



The two vertical lines are placed on end-Q2 2007 and end-Q3 2008.

¹ The graph indicates two sets of measures of US dollar funding risk, constructed as described in footnote 10. The group-level estimates (red lines) are constructed by aggregating banks' global balance sheets into a consolidated whole, and then calculating funding risk on this aggregated balance sheet. The office-level estimates (blue lines) are constructed by calculating funding risk at the office location level, and then aggregating the series up across office locations for each banking system. By construction, the office-level estimates should at least be as large as the corresponding group level.

Sources: BIS locational banking statistics by nationality; BIS consolidated banking statistics (IB basis); BIS calculations.

Graph 3

Country-to-country banking interlinkages

To illustrate the importance of *both* group- and office-level balance sheet data in the analysis of interlinkages, it is instructive to see the results that can be obtained from analysing only *one* of these data dimensions. In the main text, the discussion starts at the consolidated level to then show why office location can be important. This box uses the BIS locational banking statistics *by residency*, perhaps the most familiar of the four international banking datasets maintained by the BIS, to look at interlinkages at the country level. These statistics include the size, currency, counterparty type and, critically, the counterparty location of claims and liabilities of banks in one country to borrowers located in another country. They do not contain information on the *nationality* of the reporting banks in each location. Thus, the data provide a particular picture of *geographical* (ie country-to-country) *interlinkages* and the flow of funds between them, but are less well suited for more structural balance sheet analysis.

A broad-level illustration of these geographical interlinkages between banks' local operations is presented in Graph A, where the nodes depict countries or regions where banks are *located*. In the top panels, the size of the nodes is proportional to the share (in the global total) of cross-border bank assets and liabilities booked by banks located in that country node. The thickness of the lines, in turn, is a measure of the amount of finance (size of the linkage) across nodes, shown separately for US dollar- and euro-denominated positions.^① The lower panels show the cumulative net *flow* of capital (in all currencies) which was transacted across bank balance sheets in the seven years before the start of the crisis and the three years since. The estimated net capital flows, depicted by the thickness and direction of the arrows, take into account changes on the assets *and* liabilities side of the balance sheets of all reporting banks located in *both* countries in each bilateral pair.^②

At least two key points emerge from Graph A. First, capital flows saw a phenomenal reversal in the wake of the recent crisis (lower panels), in particular out of the United States. Up to mid-2007, banks facilitated international capital flows out of Japan and the euro area as well as from Asian financial centres and oil-exporting countries. Banks routed these funds via offices in the United Kingdom and in Caribbean financial centres, ultimately transferring them to borrowers in the United States and in emerging markets. After the start of the crisis, the direction of many of the bilateral flows reversed, in part generated by capital movements back to the United Kingdom, and in part reflecting asset writedowns.

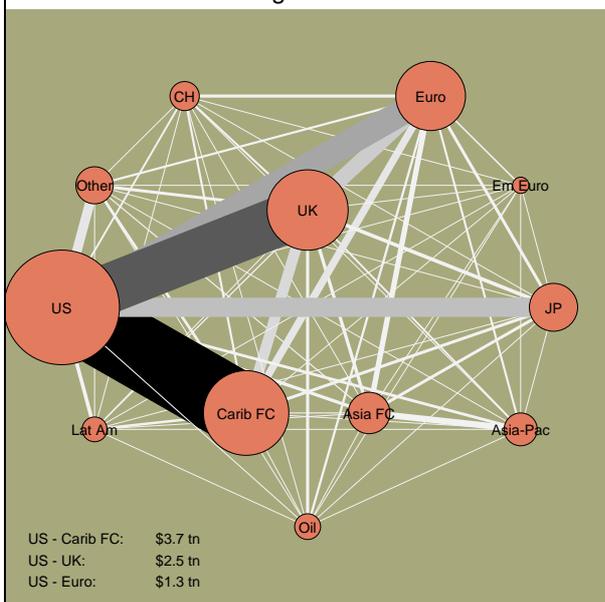
Second, and more important, cross-border banking is very concentrated in a few locations (top panels). That is, a large chunk of the world's cross-border banking business is booked (or has a counterparty) in the United Kingdom and a few other key banking centres. As McCauley et al (2010) discuss, however, the activity on the ground in these locations can be largely driven by the activity of *foreign* banks (ie affiliates of foreign-headquartered institutions). Thus, these location-level linkages say little about the actual consolidated exposures of residents of a given country or of the banks that are headquartered there.

In short, Graph A, and similar more detailed analyses with these data, can be used to illustrate *what happened* to the financial linkages between countries before and after the crisis: cross-border financial flows to borrowers in the United States and many emerging market countries surged, and then reversed direction. Yet it offers little information on *why* this happened, since the strictly residency-based perspective effectively aggregates the balance sheets of entities from different banking groups in a particular location, thus precluding any serious analysis of balance sheet stresses. Uncovering these stresses requires a deeper, more structurally based view of banks' balance sheets – one that combines the location-based information in Graph A with headquarters-based consolidated reporting, as discussed in the main text.

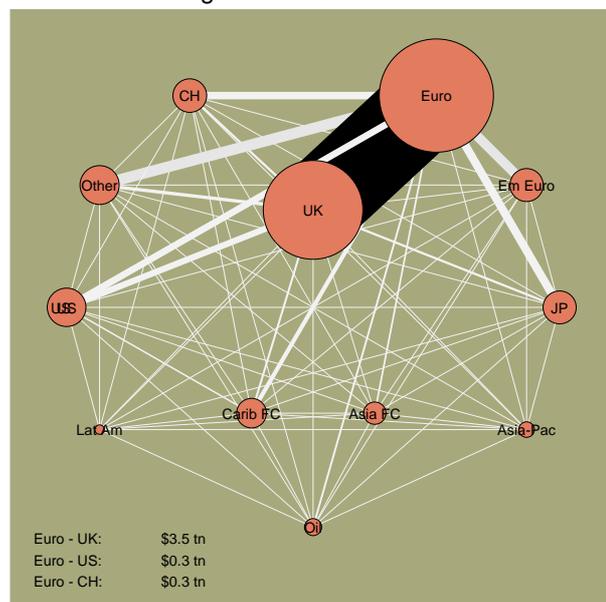
^① See footnote 1 in Graph A for a definition of the term linkage. There is nothing special about this choice of definition, other than that it nicely summarises the relative strength of the overall banking connection across countries. Similar charts based only on assets or liabilities, or only on interbank positions, are also possible. ^② A fundamental problem in the flow calculation is that banks increasingly rely on *debt securities* liabilities and, unlike with deposits, they often do not know the identity and location of the holder, since the securities are bought and sold in secondary markets. *Bilateral* net flow figures are thus biased. The calculations in the bottom panels of Graph A attempt to correct for this by backing out the counterparty location using debt securities *claims* on the assets side of the balance sheet, and allocating the remainder of the liabilities to counterparty countries using weights based on observable liabilities. See McGuire and Tarashev (2007) for more details.

Linkages in the international banking system

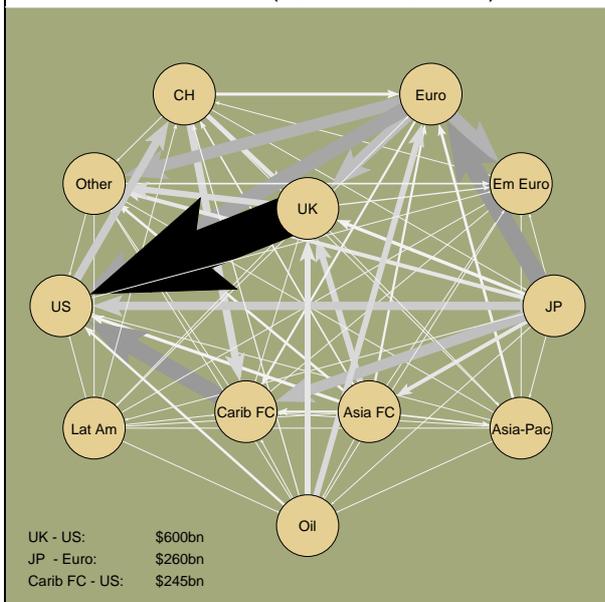
US dollar stocks linkages at Q1 2010¹



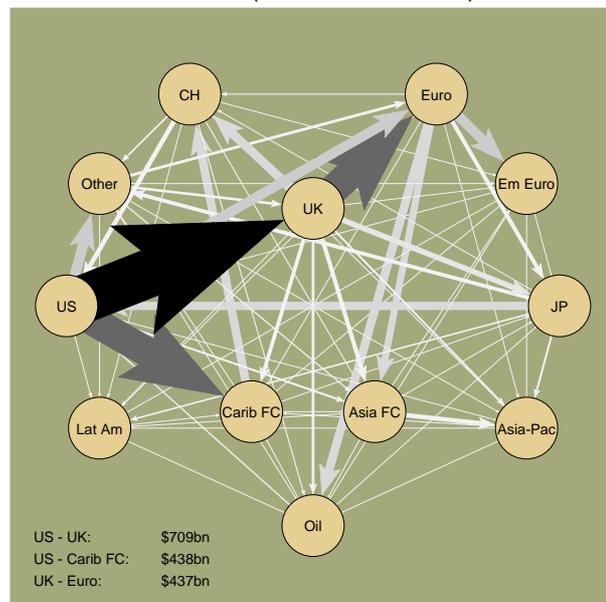
Euro stocks linkages at Q1 2010¹



Cumulative net flows (Q1 2000–Q2 2007)²



Cumulative net flows (Q3 2007–Q1 2010)²



Asia FC = Asian financial centres (Hong Kong SAR, Macao and Singapore); Asia-Pac = China, Chinese Taipei, India, Indonesia, Korea, Malaysia, Pakistan, the Philippines and Thailand; Carb FC = Caribbean financial centres (Aruba, the Bahamas, Bermuda, the Cayman Islands, the Netherlands Antilles and Panama); CH = Switzerland; Em Euro = emerging Europe (Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia, Turkey and Ukraine); Euro = euro area member states excluding Slovakia, Slovenia, Cyprus and Malta; JP = Japan; Lat Am = Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela; Oil = OPEC member states (excluding Indonesia) plus Russia; Other = Australia, Canada, Denmark, New Zealand, Norway and Sweden; UK = United Kingdom; US = United States.

¹ The size of each circle is proportional to the stock of cross-border claims and liabilities of reporting banks located in the particular geographical region. Some regions include non-reporting countries. The thickness of a line between regions A and B is proportional to the sum of claims of banks in A on all residents of B, liabilities of banks in A to non-banks in B, claims of banks in B on all residents of A and liabilities of banks in B to non-banks in A. ² Exchange rate adjusted flows, expressed at constant end-Q1 2010 exchange rates. The thickness of an arrow is proportional to the amount of net bank flows between regions, and is comparable across panels. An arrow points from A to B if net flows in this direction are positive, calculated as changes in net interbank claims (assets minus liabilities) of banks in A on banks in B, plus net claims of banks in A on non-banks in B, minus net claims of banks in B on non-banks in A. (This last component is missed if B is not a reporting country.) See "Tracking international bank flows", *BIS Quarterly Review*, December 2006.

Sources: BIS locational banking statistics by residence; authors' calculations.

Graph A

market.¹⁰ The calculation is performed twice. In the first instance, *group-level* estimates are generated by first consolidating the banking system's global balance sheet across office locations and then calculating the funding risk measures on the basis of these total positions (solid and dashed red lines). In the second, *office-level* estimates are generated by calculating the measures separately for each office location and then adding them up across locations for each banking system (solid and dashed blue lines). To this second set of estimates is added a mid-measure (dotted blue lines), which adds net inter-office US dollar funding to the lower-bound, office-level estimate. This helps to establish a banking system's reliance on this type of funding and thus to gauge the scope for spillovers across locations arising from these funds.

These measures are rough, with very wide ranges between bounds, limiting their effectiveness in policy analysis. In part, this is because actual information on the residual maturity of banks' US dollar positions is unavailable.¹¹ Even so, the indicators do seem to confirm that funding risks are actually larger than consolidated data would make them appear – a result of the netting of interbank and FX swap positions in the group-level estimates. Effects like this can be rather large, as suggested by the differences in the lower-bound indicators for French, Dutch and Belgian banks. Moreover, analysis of the underlying office location-level funding risk measures (not shown) indicates that a significant portion (as high as 80%) of the total dollar funding risk is attributable to a given banking system's *foreign offices*, about which home country regulators may have only limited information.

This suggests that the full extent of system-wide bank funding risk may be impossible to measure without geographically disaggregated data. Such data, in turn, may be difficult for any one supervisory authority to construct: (1) home country authorities may not have ongoing access to detailed supervisory data on their banks' foreign offices, and (2) host country supervisors will tend to see only the positions of local branches and subsidiaries in their respective jurisdictions. That is, the assessment of total bank funding risk – and, by implication, the possible demands for central bank liquidity if and when banks

... starting at the
office location level

¹⁰ Specifically, it is assumed that banks' claims on non-banks (ie their retail and wholesale lending, and holdings of securities) approximate their "desired" US dollar-denominated investment portfolio. These exposures are of varying maturities but, on average, are likely to be longer-term than the funding that supports them. If *liabilities* to non-banks are all assumed to be long-term, then the lower-bound estimate of these banks' overall US dollar funding gap is net interbank borrowing (if positive) plus net borrowing from the FX swap market, which is backed out from the balance sheet identity. To this, any net US dollar borrowing from official monetary authorities is added. The upper-bound estimate results from adding liabilities to non-banks to the lower-bound measure, under the assumption that these are short-term. See McGuire and von Peter (2009) and Fender and McGuire (2010) for more details. For measures of funding risk based on input-output analysis methods, see Lee (2010).

¹¹ Because of missing pieces of information on residual maturity, instrument type and, to a lesser extent, counterparty type in the BIS banking statistics, approximations have to be made to gauge funding risk. For example, the argument implicit in the previous footnote is that "maturity" can be inferred from information on counterparty types, which itself is not very detailed (bank, non-bank, official monetary authority, inter-office). As regards instruments, the nature of funds provided (eg commercial paper, retail or corporate deposits, long-term bond issuance) is unknown. The same applies on the assets side, where securities holdings, loans to non-bank corporates and loans to non-bank financials cannot be distinguished.

in particular locations find themselves without access to sufficient (foreign currency) funds – may require information along the lines of the office-level data used to calculate the measures in Graph 3.¹²

Geographical shocks

The analysis outlined in the previous section relies on consolidated (by banking system) but geographically disaggregated (by office location) data with a number of key breakdowns of assets and liabilities. But even this level of detail cannot capture all types of funding risks that policymakers might be interested in. In particular, these data miss exposures to *geographical (or geopolitical) shocks* from any concentrations of funding obtained from residents of individual countries – a form of country risk.¹³

Understanding how shocks to particular funding sources ...

Consider some concrete examples. Many banks, in particular those located in London and the United States, receive an estimated 5–7% (at end-2009) of their dollar funding from residents of oil-exporting states (primarily the Middle East). These same banks also rely on deposits of foreign exchange reserves by central banks in reserve-accumulating countries. Even more significant, banks' liabilities structures are intimately tied, in complex ways, to offshore financial centres: they book a significant amount of their total liabilities (roughly 15% at end-2009) in their offices *in* offshore financial centres, and their offices elsewhere report that roughly 14% of their cross-border liabilities have counterparties located in these jurisdictions.

Were any one of these sources of funding to be disrupted in some way, or migrate into a different currency, which banks would be most affected? And how would this affect these banks' lending to borrowers elsewhere? Answering these questions requires an understanding of how funding shocks are transmitted internationally – the task of fully uncovering the relationships depicted in Graph 1. This, in turn, would involve stress tests tracing an assumed initial shock through banks' disaggregated balance sheets, an analysis that would rely on a large number of behavioural assumptions. And when individual global banks consist of, literally, hundreds of separate entities across the globe, the consistent collection and compilation of the necessary data is likely to be impossible.

... might affect borrowers elsewhere ...

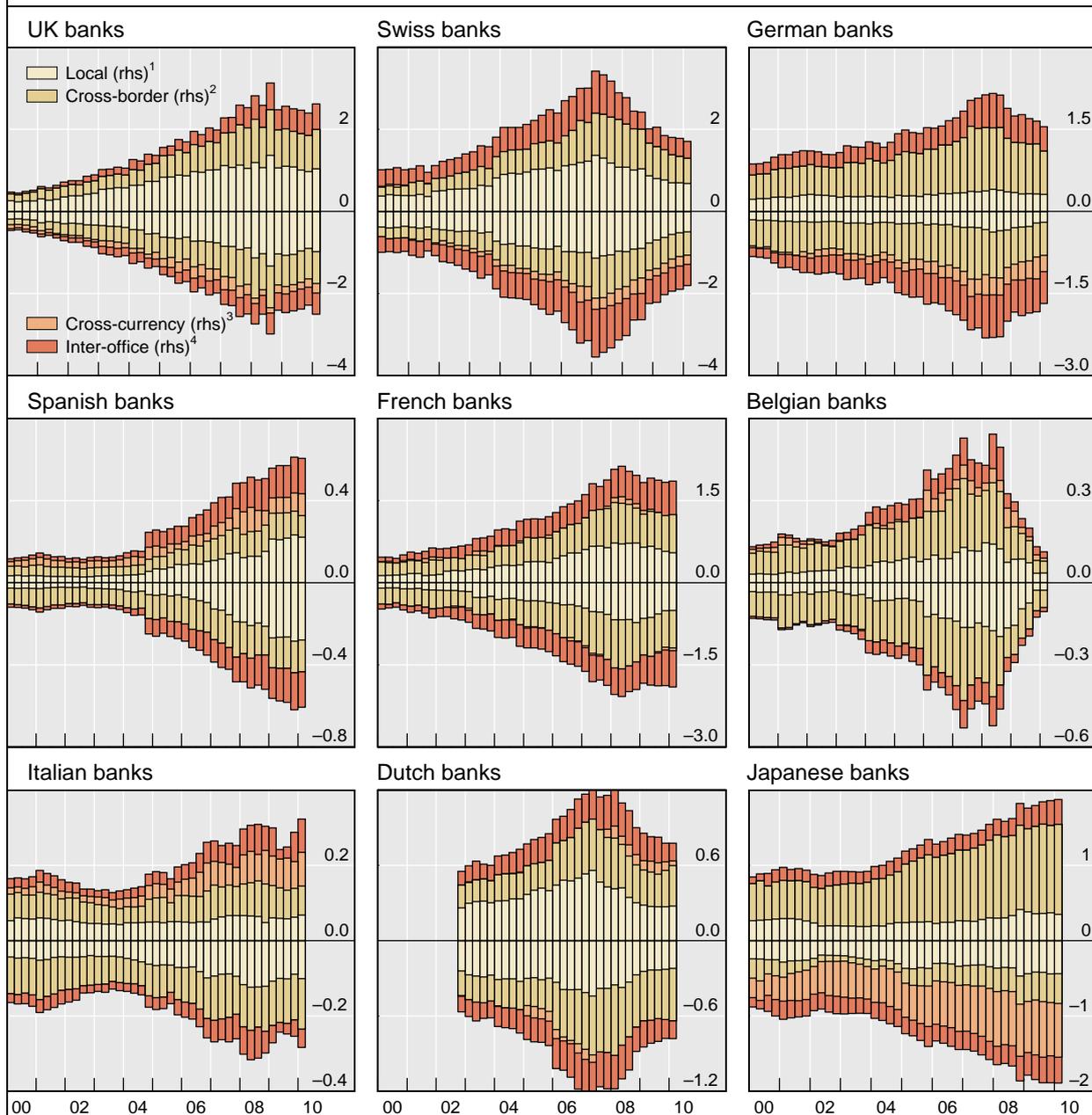
That said, even being able to determine the initial stress points in the event of a shock would help inform markets and policymakers. For example, suppose that German banks, across their worldwide operations, lend roughly equal

¹² Note that similar arguments apply to measures of banks' (on-balance sheet) leverage. As a result, information on bank capital and total assets, as already reported for the BIS consolidated banking statistics by some countries, could be combined with similar data at the office location level to construct indicators of system-wide leverage corresponding to the funding gaps depicted in Graph 3.

¹³ The BIS consolidated banking statistics provide measures of country risk (assets side) for consolidated banking systems. However, given the consolidated reporting basis, they provide no information on international positions at the office location level. Moreover, these statistics provide no information on international *liabilities*. For an analysis of the transmission of shocks using these statistics see, for example, Cetorelli and Goldberg (2010). Espinosa-Vega and Sole (2010) present an analysis of interbank contagion based on the same data.

Reporting banks' US dollar foreign positions, by type

In trillions of US dollars



¹ Local positions are those booked by a bank office in a given home country vis-à-vis residents of that home country. ² Cross-border positions are those booked by a bank office in a given jurisdiction vis-à-vis residents of other jurisdictions. ³ Cross-currency funding position implied by the balance sheet identity. ⁴ Cross-border positions vis-à-vis offices within the same banking group. Inter-office assets and liabilities are not always equal because of omissions and errors in the underlying data.

Sources: BIS consolidated banking statistics (ultimate risk and IB basis); BIS locational banking statistics by residency.

Graph 4

amounts to residents in Brazil and Korea. If oil prices were to drop by 50%, in which of these countries would non-banks be more likely to see a reduction in credit from German (and other) banks? A first-pass estimate would simply be to look across German banks' office locations to see which one(s) booked the exposures to Brazilian and Korean non-banks, and then examine the extent to which each of these is effectively funded by petrodollars. This requires joint

... is hampered by incomplete data

reporting of bank nationality, bank location and counterparty location – data that are not currently available in sufficient detail.¹⁴

To get a sense of how significant this lack of geographical transparency of the location of counterparties is, consider Graph 4. It shows the US dollar book for the same set of banking systems that was presented in Graph 3.¹⁵ Here, gross stocks of assets and liabilities are plotted by adding up the US dollar positions booked by offices in each host country, broken down in terms of the location of the counterparty. *Local positions* (light tan bars) have a counterparty resident in the host country – a known location. *Cross-border positions*, those with a counterparty outside the host country, are further broken down into inter-office positions (shaded pink bars) and those vis-à-vis non-affiliated entities (dark tan bars).¹⁶ The location of the counterparty, essential for any indicator of geographical funding risk, is unknown for *both* of these components of cross-border positions. As a result, much more is known about the funding sources of banks with decentralised operations (eg Spanish banks), which have a large share of locally booked and funded positions, than of those banks (eg German or Swiss banks) that rely on a more centralised lending and funding model (McCauley et al (2010)).

Conclusion

This article sketches a broad framework for the assessment of system-wide bank funding risks and the transmission of shocks across countries. A key point stressed throughout the discussion is that analysing these issues requires data on banks' consolidated balance sheets that are complemented with a *geographically disaggregated dimension* of those balance sheets – one in which the *structure* of banks' global operations (on both the assets and liabilities side of the balance sheet) is visible.

While no dataset currently delivers all the detail necessary to establish such a fully geographically disaggregated view, the BIS international banking statistics turn out to have several of the desired properties. In particular, the

¹⁴ In the context of the BIS locational banking statistics, each reporting central bank collects cross-border asset and liability positions from resident banks, broken down by currency, counterparty sector and location (country) of counterparty. It reports to the BIS these aggregates (across bank nationalities in that location) with a complete counterparty location breakdown in the *locational banking statistics by residency* (see box). The central banks then mask the counterparty location breakdown, provide totals for cross-border positions broken down by the *nationality* of the underlying reporting entity, and report these in the *locational banking statistics by nationality* (the only source of information on the currency composition of banks' *international liabilities* on a consolidated basis). Thus, in principle, joint data on bank nationality, bank location and counterparty location are already collected from the underlying population of banks, and exist in the central banks which report to the BIS.

¹⁵ Similar decompositions of banks' euro and Japanese yen books are also possible with the BIS banking statistics.

¹⁶ To these three is added either a long (positive) or short (negative) implied *cross-currency* funding position (light pink bars), which depicts net borrowing of dollars from (if negative), or net provision of dollars to (if positive), the FX swap market. This estimate simply equates total observed dollar assets with observed dollar liabilities, under the assumption that the banking system has no open currency positions on its balance sheet.

underlying structure of the BIS data allows for the monitoring of consolidated banking systems' international funding and lending activities, both at the group level and by office location.

Would better data (eg enhanced counterparty breakdowns, residual maturity buckets, counterparty locations) have helped to spot the build-up of unchecked and (what turned out to be) excessive maturity transformation on bank balance sheets in the run-up to the crisis? It is difficult to say. The most honest answer is perhaps that the extent of system-wide maturity transformation in 2006, had it been possible to measure, would have simply been attributed, by supervisors and market participants alike, to better financial technology. Still, if properly constructed, data of the type described above could, in the future, be used in a two-step approach to monitoring the system-level funding risk that contributed to the recent crisis. That is, with more geographical detail on counterparties, any imbalances showing up in the aggregate data (ie banking system-office location pairs) will yield the critical pieces of information – *nationality* of entity, *location* of entity and *risk type* – to inform targeted assessments of any vulnerabilities on the basis of more granular (supervisory or other) data at the firm or market level.¹⁷

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¹⁷ See Cecchetti et al (2010); Eichner et al (2010) make a similar point.

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