BANK FOR INTERNATIONAL SETTLEMENTS

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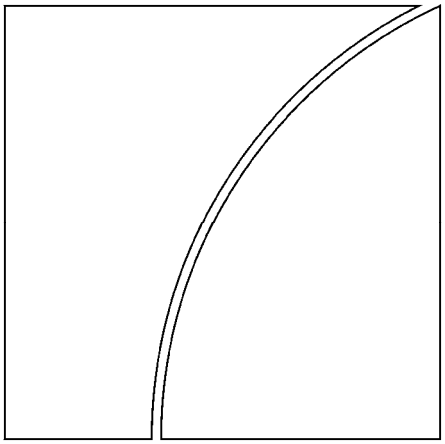
March 2012



International banking and financial market developments

BIS Quarterly Review
Monetary and Economic Department

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Special features

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.

The term “country” as used in this publication also covers territorial entities that are not states as understood by international law and practice but for which data are separately and independently maintained.

European bank funding and deleveraging[1]

Asset prices broadly recovered some of their previous losses between early December and the end of February, as the severity of the euro area sovereign and banking crises eased somewhat. Equity prices rose by almost 10% on average in developed countries and by a little more in emerging markets. Bank equity prices increased particularly sharply. Gains in credit markets reflected the same pattern. Central to these developments was an easing of fears that funding strains and other pressures on European banks to deleverage could lead to forced asset sales, contractions in credit and weaker economic activity. This article focuses on developments in European bank funding conditions and deleveraging, documenting their impact to date on financial markets and the global economy.

Funding conditions at European banks improved following special policy measures introduced by central banks around the beginning of December. Before that time, many banks had been unable to raise unsecured funds in bond markets and the cost of short-term funding had risen to levels only previously exceeded during the 2008 banking crisis. Dollar funding had become especially expensive. The ECB then announced that it would lend euros to banks for three years against a wider set of collateral. Furthermore, the cost of swapping euros into dollars fell around the same time, as central banks reduced the price of their international swap lines. Short-term borrowing costs then declined and unsecured bond issuance revived.

At their peak, bank funding strains exacerbated fears of forced asset sales, credit cuts and weaker economic activity. New regulatory requirements for major European banks to raise their capital ratios by mid-2012 added to these fears. European banks did sell certain assets and cut some types of lending, notably those denominated in dollars and those attracting higher risk weights, in late 2011 and early 2012. However, there was little evidence that actual or prospective sales lowered asset prices, and overall financing volumes held up for most types of credit. This was largely because other banks, asset

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managers and bond market investors took over the business of European banks, thus reducing the impact on economic activity.

Bank funding pressures and policy responses

European bank funding conditions deteriorated towards the end of 2011, as faltering prospects for economic growth and fiscal sustainability undermined the value of sovereign and other assets. Bond issuance by euro area banks in the second half of the year, for example, was just a fraction of its first half value (Graph 1, left-hand panel). Until December, uncollateralised issuance by banks in countries facing significant fiscal challenges was especially weak. Deposits also flowed out of banks in these countries, with withdrawals from Italy and Spain accelerating in the final quarter of the year (Graph 1, centre panel). At this time, US money market funds significantly reduced their claims on French banks, having already eliminated their exposures to Greek, Irish, Italian, Portuguese and Spanish institutions (Graph 1, right-hand panel). The pricing of long- and short-term euro-denominated bank funding instruments also deteriorated, both in absolute terms and relative to that of non-euro instruments, as did the cost of swapping euros into dollars (Graph 2).

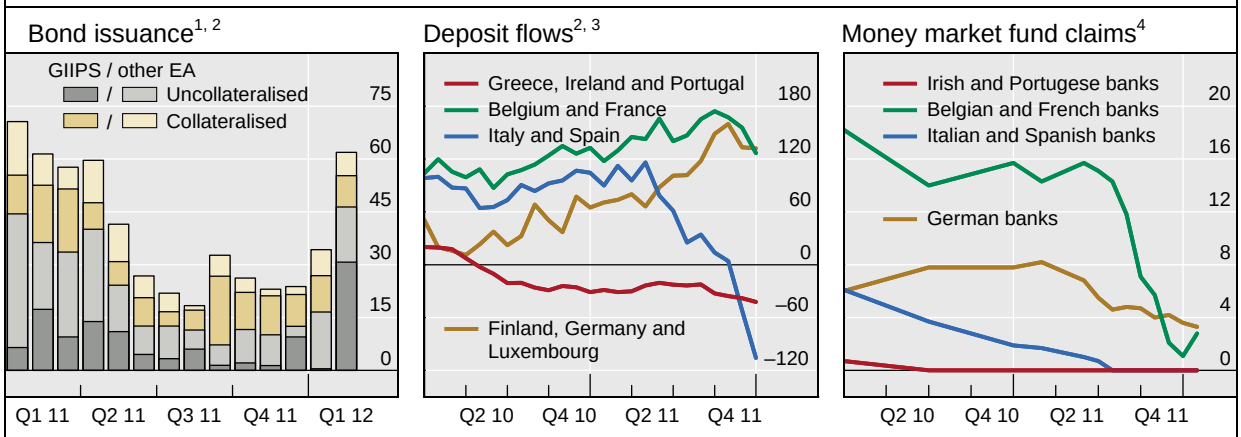
European bank funding conditions deteriorated in late 2011 …

The policy response

Around early December, central banks announced further measures to help tackle these funding strains. On 8 December, the ECB said that it would supply banks in the euro area with as much three-year euro-denominated funding as they bid for in two special longer-term refinancing operations (LTROs) on 21 December 2011 and 29 February 2012. At the same time, it announced that Eurosystem central banks would accept a wider range of collateral assets than previously. The ECB also said that it would halve its reserve ratio from

… until central banks announced new policy measures

Indicators of euro area bank funding conditions

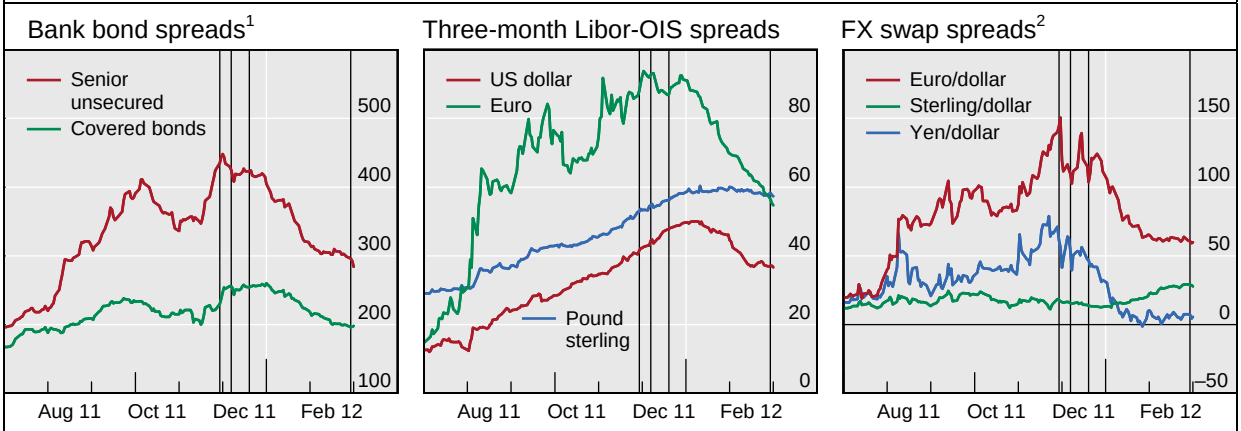


[1] Issuance by either Greek, Irish, Italian, Portuguese or Spanish (GIIPS) banks or other euro area (EA) banks. Collateralised debt is mainly covered bonds, but also includes smaller amounts of other bonds and asset-backed securities. Feburary 2012 data are preliminary. [2] In billions of euros. [3] Cumulated inflows of deposits from households and private non-financial companies over the preceding 12 months. [4] Claims on euro area banks of the 10 largest US prime money market funds; as a percentage of their assets under management. At end-2011, these 10 funds held $644 billion of assets and all US prime money market funds held $1.44 trillion of assets.

Sources: ECB; Dealogic; Fitch Ratings; BIS calculations. Graph 1

Pricing of bank funding instruments

In basis points



The vertical lines on 29 November 2011, 7 December 2011, 20 December 2011 and 28 February 2012 highlight the last end-of-day prices before, respectively, the reduction in the price of dollar funding from central banks, the announcement and allotment of the first and second three-year ECB funding operations.

[1] Indices of option-adjusted spreads over government bond yields of euro-denominated bonds. [2] Spreads between three-month interest rates implied by FX swaps and three-month dollar Libor.

Sources: Bank of America Merrill Lynch; Bloomberg; BIS calculations. Graph 2

18 January, reducing the amount that banks must hold in the Eurosystem by around €100 billion. A few days earlier, six major central banks, including the ECB, the Bank of England and the Swiss National Bank, had announced a 50 basis point cut to the cost of dollar funds offered to banks outside the United States. They also extended the availability of this funding by six months to February 2013.

These were widely used …

Euro area banks raised large amounts of funding via the ECB's three-year LTROs, covering much of their potential funding needs from maturing bonds over the next few years. Across both operations, they bid for slightly more than €1 trillion. This was equivalent to around 80% of their 2012–14 debt redemption, more than covering their uncollateralised redemptions (Graph 3, left-hand panel).

Banks in Italy and Spain made bids for a large proportion of the funds allocated at the first three-year LTRO (Graph 3, centre panel), while the funding situation of banks in other regions improved indirectly.[2] Banks in Germany, Luxembourg and Finland, for example, did not take much additional funding at the first LTRO. However, some of the allotted funds, perhaps after a number of transactions, ended up as deposits with these banks, boosting the liquidity of their balance sheets. In turn, they significantly increased their Eurosystem deposits (Graph 3, right-hand panel). There was also little change in the LTRO balance at the Greek, Irish and Portuguese central banks. However, banks in these jurisdictions had already borrowed a combined €165 billion before December and may have been short of collateral to use at the first LTRO.

[2] At the time of going to press, data on funding raised by banks in different countries at the second three-year LTRO were not available.

Bank funding conditions improved following these central bank measures. Investors returned to long-term bank debt markets, buying more uncollateralised bonds in January and February 2012 than in the previous five months (Graph 1, left-hand panel). US money market funds also increased their exposure to some euro area banks in January (Graph 1, right-hand panel). Indicators of the cost of long- and short-term euro-denominated bank funding instruments also turned, as did the foreign exchange swap spread for converting euros into dollars (Graph 2).

… and led to improved funding conditions

The nexus between sovereign and bank funding conditions

Funding conditions for euro area sovereigns improved in parallel to those of banks in December 2011 and early 2012. Secondary market yields on Irish, Italian and Spanish government bonds, for example, declined steadily during this period (Graph 4, left-hand panel). Yields on bonds with maturities of up to three years fell by more than those of longer-dated bonds (Graph 4, centre panel). At this time, these governments also paid lower yields at a series of auctions, despite heavy volumes of issuance. One notable exception to this trend was the continued rise in yields on Greek government bonds. This reflected country-specific factors, including the revised terms of a private sector debt exchange and tough new conditions for continued official sector lending.

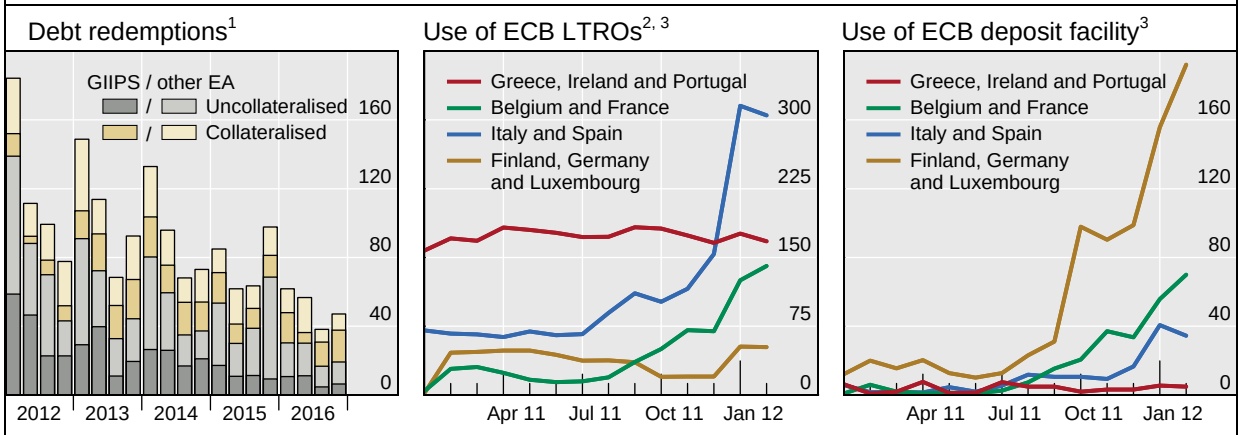
Sovereign funding conditions also improved …

Part of the decline in government bond yields appeared to reflect diminished perceptions of sovereign credit risk. This was consistent with declines in sovereign CDS premia. In turn, part of the reduction in sovereign credit risk probably reflected improvements in bank funding conditions. This could have worked via two channels. First, any reduction in the likelihood of banks failing because of funding shortages would have cut the probability of government support for these banks. Second, any easing of pressure on banks

… reflecting the better situation of banks …

Euro area bank debt redemptions and use of ECB facilities

In billions of euros

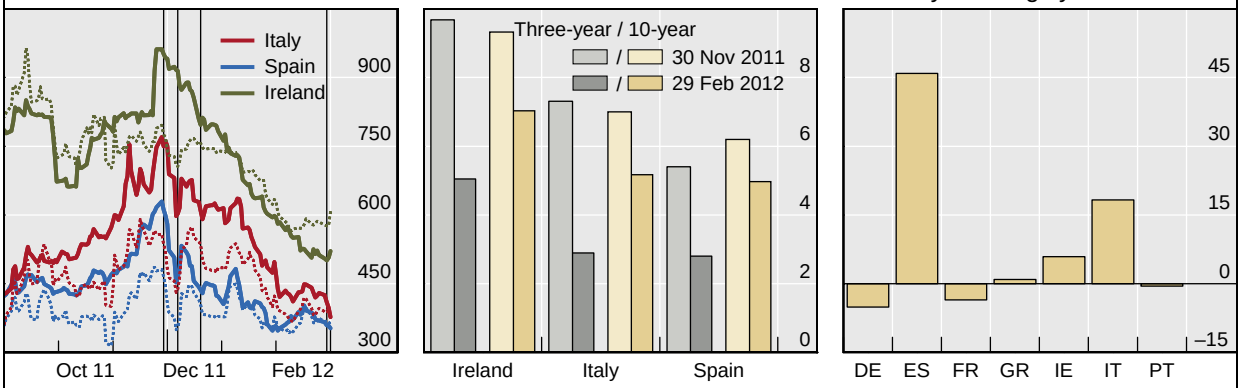


[1] Redemptions of either Greek, Irish, Italian, Portuguese or Spanish (GIIPS) banks or other euro area (EA) banks. Collateralised debt is mainly covered bonds, but also includes smaller amounts of other bonds and asset-backed securities. [2] Longer-term refinancing operations. [3] Data are end-of-month balance sheet positions of national central banks vis-à-vis domestic monetary financial institutions (MFIs). For France, the data show average of daily values over the maintenance period beginning in the same month. For Greece, December 2011 values are assumed equal to November 2011 values, as overall lending to MFIs changed little. For Spain, data show average values for the following calendar month, since LTROs tend to be conducted towards month-ends.

Sources: ECB; Dealogic; national data; BIS calculations. Graph 3

Indicators of euro area government funding conditions

Bond yields and CDS premia[1] | Government bond yields[2] | Net purchases of government bonds by banking system[3]



The vertical lines on 29 November 2011, 7 December 2011, 20 December 2011 and 28 February 2012 highlight the last end-of-day prices before, respectively, the reduction in the price of dollar funding from central banks, the announcement and allotment of the first and second three-year ECB funding operations.

DE = Germany; ES = Spain; FR = France; GR = Greece; IE = Ireland; IT = Italy; PT = Portugal.

[1] Five-year government bond yields appear as solid lines and five-year dollar-denominated CDS premia as dotted lines, in basis points. [2] In per cent. [3] Net purchases in December 2011 and January 2012; in billions of euros.

Sources: ECB; Bloomberg; Markit; national data; BIS calculations. Graph 4

to shed assets would have boosted the outlook for economic activity and, hence, public finances. In addition, some of the improvements in perceptions of sovereign credit risk during this period probably reflected announcements made at the 8–9 December EU summit. These outlined arrangements to strengthen fiscal discipline in the union and to bring forward the launch of the European Stability Mechanism.

... and their intermediation of funding to sovereign assets

A further part of the decline in yields on government bonds appeared to reflect the additional cash in the financial system available to finance transactions in these and other securities. This was consistent with government bond yields declining by more than CDS premia.[3] Banks in Italy and Spain, for example, used new funds to significantly boost their holdings of government bonds (Graph 4, right-hand panel). While other euro area banks were less active in this respect, they may have committed new funds to help finance positions in government bonds for other investors. Or they may have purchased other assets and the sellers of those assets may have invested the resulting funds in government bonds.

This fed back positively into bank funding conditions

These improvements in funding terms for euro area sovereigns fed back into bank funding conditions. In particular, higher market values of sovereign bonds enhanced the perceived solvency of banks, which made them more attractive in funding markets. However, this link earlier worked in reverse and could potentially do so again.

[3] New CDS positions require very little funding compared with an equivalent position in a bond. So, while changes in CDS premia mainly reflect changes in the compensation requirements of investors for credit risk, changes in bond yields may additionally reflect changes in the conditions of funding those bonds.

Deleveraging prospects and consequences

Before funding strains eased, fears over deleveraging grew ...

The sharp rise in funding costs and growing concerns over adequate capitalisation toward the end of 2011 added to existing market pressures on European banks to deleverage. Deleveraging is part of a necessary post-crisis adjustment to remove excess capacity and restructure balance sheets, thus restoring the conditions for a sound banking sector. That said, the confluence of funding strains and sovereign risk led to fears of a precipitous deleveraging process that could hurt financial markets and the wider economy via asset sales and contractions in credit. The extension of central bank liquidity and the European Banking Authority's (EBA) recommendation on bank recapitalisation, however, played important parts in paving the way toward a more gradual deleveraging process.

Deleveraging prospects: capital-raising and asset-shedding

... compounded by new capitalisation targets

The European bank recapitalisation plan announced in October 2011 brought fears of deleveraging to the forefront of financial market concerns. It required 65 major banks to attain a 9% ratio of core Tier 1 capital to risk-weighted assets (RWA) by the end of June 2012, and the authorities identified a combined capital shortfall of €84.7 billion at 31 major banks as of end-September 2011 (see box). Banks can deleverage either by recapitalising or by reducing RWA, with different economic consequences. In order to safeguard the flow of credit to the EU economy, supervisory authorities explicitly discouraged banks from shedding assets.

These were later allayed by capital-raising plans ...

Banks thus planned to meet their shortfalls predominantly through capital measures, and some made progress in spite of unfavourable market conditions. Low share prices, as at present, cause a strong dilution effect, drawing resistance from incumbent shareholders and management.[4] The experience of UniCredit, whose deeply discounted €7.5 billion rights issue led to a 45% (albeit transient) plunge in its share price, deterred other banks from following suit. Capital can also be built through retained earnings, debt-to-equity conversion or redemption below par. Some banks opted to convert outstanding bonds, notably Santander for €6.83 billion. Overall, banks plan to rely substantially on additions to capital and retained earnings to reach the 9% target ratio. The actions and plans of EBA banks thus helped to ease market fears over potential shedding of assets among banks with capital shortfalls (see box).

... although many banks plan to shed assets over the next few years

The extent of asset-shedding observed in markets reflects a broader trend among European banks towards deleveraging over the medium term. French and Spanish banks, for instance, sold dollar-funded assets and divested foreign operations partly to focus their business models on core activities. Major UK banks, similarly, continued to shrink their balance sheets, although none had to meet any EBA capital shortfall. In view of recurring funding pressures and changing business models, many banks, with or without EBA

[4] The feature on p 45 in this issue examines bank equity returns and the cost of capital.

Limited asset-shedding among banks under the European recapitalisation plan

The European Banking Authority (EBA) published its recommendation relating to the European bank recapitalisation plan on 8 December 2011. This forms part of a broader set of EU measures agreed in October 2011 to restore confidence in the banking sector. By the end of June 2012, 65 banks must reach a 9% ratio of core Tier 1 capital to risk-weighted assets (RWA). Capital will be assessed net of valuation losses on EEA sovereign exposures incurred by end-September 2011 ("sovereign buffer"). The 31 banks located in the shaded area below the regulatory line (capital = 0.09 RWA) in Graph A (left-hand panel) were below the 9% target ratio, as of end-September 2011, by an aggregate shortfall of €84.7 billion. The aggregate shortfall among all 71 banks in the EBA sample reaches €114.7 billion when six Greek banks are included with an estimated shortfall of €30 billion against the (stricter) capital targets under the EU/IMF financial assistance programme.

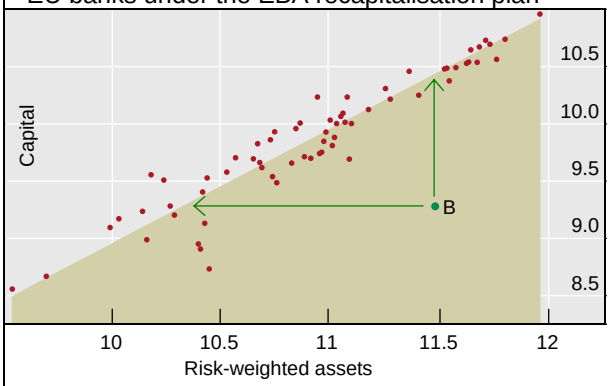
The plans banks submitted to regulators in January 2012 suggest that the shedding of bank assets will play a small part in reaching the target ratio. As the example of bank B in the left-hand panel illustrates, banks can deleverage either by recapitalising (moving upward) or by reducing RWA (moving leftward). The EBA's first assessment shows that banks intend to cover 96% of their original shortfalls by direct capital measures, although the proposed measures also surpass the original capital shortfall by 26%. Planned capital measures thus account for 77% of the overall effort, and comprise new capital and reserves (26%), conversion of hybrids and issuance of convertible bonds (28%), and retained earnings (16%), while the remaining 23% rely on RWA reductions, notably on internal model changes pre-agreed with regulators (9%) and on the shedding of assets (10%), comprising planned RWA cuts of €39 billion in loan portfolios and some €73 billion through asset sales.

In this regard, the European bank recapitalisation plan reduced, but did not eliminate, the need for banks with capital shortfalls to shed assets (Graph A, right-hand panel). The likely scale of asset-shedding cannot be inferred reliably from RWA reductions. However, assuming a 75% average risk weight on loans and that the average risk weight on disposed assets equals that on holdings (43%, from average RWA as a share of total assets, using Bloomberg data), the planned RWA cuts of €112 billion relating to lending cuts and asset sales (= €39 + €73 billion) translate into an estimated €221 billion reduction in total assets. Some of the lending cuts are an inevitable part of restructuring under state aid rules. While these amounts are sizeable, they are an order of magnitude smaller than if banks had sought to reach the target ratio without significant additions to their capital.

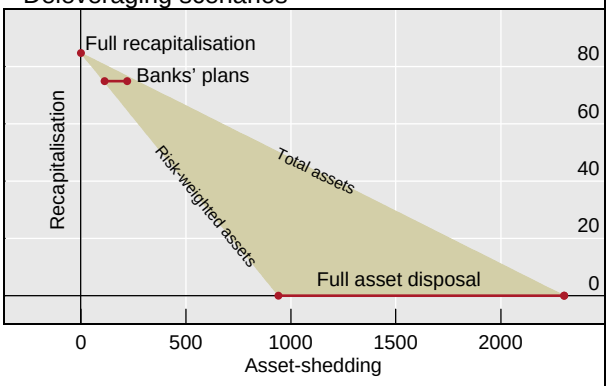
Capital-raising versus asset-shedding to close banks' capital shortfalls

In billions of euros

EU banks under the EBA recapitalisation plan[1]



Deleveraging scenarios[2]



[1] Balance sheet data as of end-September 2011 for the EBA sample (excluding Greek banks) on logarithmic scales (base 10). Reported risk-weighted assets (RWA) appear on the x-axis, while the y-axis shows banks' core Tier 1 capital net of the required sovereign capital buffer. [2] Combinations of capital-raising (y-axis) and asset-shedding (x-axis) for various assumptions on how banks could meet the 9% target ratio by June 2012. The shaded area defines a range for the potential shedding of RWA (left border) and the estimated shedding of total assets (right border). The latter is estimated by dividing the necessary reductions in RWA by the average risk weight of each bank before aggregation. This mapping assumes that the average risk weight on disposed assets equals that on total holdings, as when banks sell risky assets in equal proportions. "Banks' plans" shows the shedding of risk-weighted (left dot) and total assets (right dot) estimated on the basis of the EBA's first aggregate assessment.

Sources: EBA; Bloomberg; authors' calculations. Graph A

capital shortfalls plan to extend the ongoing trend of shedding assets. Industry estimates of overall asset disposals by European banks over the coming years thus range from €0.5 trillion to as much as €3 trillion.[5]

The central bank actions also helped to ease the pace of the deleveraging process

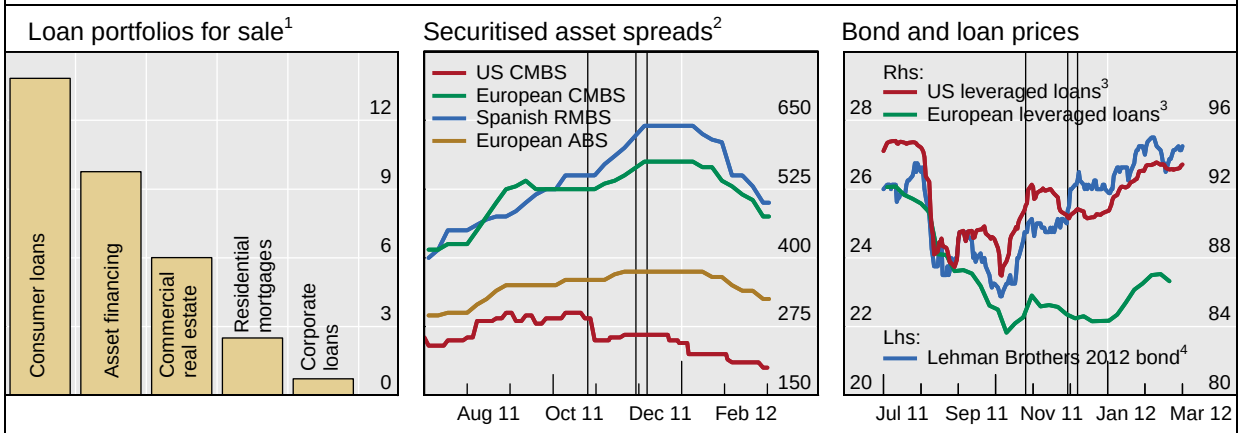
The extension of central bank liquidity eased the pace of asset-shedding observed in late 2011, but did not turn the underlying trend. If the banks in the EBA sample, for instance, failed to roll over their senior unsecured debt maturing over a two-year horizon, which amounts to more than €1,100 billion (€600 billion among banks with a capital shortfall), they would have to shed funded assets in equal measure. By covering these funding needs, the LTROs and dollar swap lines helped avert an accelerated deleveraging process. But many banks continued to divest assets in anticipation of the eventual expiration of these facilities. Banks are also mindful that a sustained increase in their capitalisation would facilitate both regulatory compliance and future access to the senior unsecured debt market.

Evidence of asset sales and price falls

Asset sales increased …

As deleveraging pressures grew towards the end of 2011, European banks offered for sale a significant volume of assets, notably those with high risk weights or market prices close to holding values (Graph 5, left-hand panel). Offerings with high risk weights included low-rated securitised assets, distressed bonds and commercial property and other risky loans. Although some such transactions were completed, others did not go through because the offered prices were below banks' holding values. Selling at these prices

Asset sales and pricing under European bank deleveraging pressures



The vertical lines on 26 October 2011, 29 November 2011 and 7 December 2011 highlight the last end-of-day prices before, respectively, announcements of the EBA capitalisation target, the reduction in the price of dollar funding from central banks and the ECB's three-year funding operations.

[1] Face value of portfolios reported for sale in 2011; in billions of euros. J Daniel, "Deleveraging in the European financial sector", Deloitte, December 2011. [2] Spreads to Libor/Euribor of five-year AAA-rated securities, in basis points. RMBS = residential mortgage-backed securities; CMBS = commercial mortgage-backed securities; ABS = asset-backed securities. [3] S&P leveraged loan price indices. [4] Price as a percentage of face value.

Sources: Bloomberg; Datastream; Deloitte; JPMorgan. Graph 5

[5] For an analysis in the upper part of this range, see "European banks", Morgan Stanley Research, 6 December 2011.

would have generated losses, thus reducing capital and preventing the banks from achieving the intended deleveraging. In contrast, other offerings included aircraft and shipping leases and other assets with steady cash flows and collateral backing, since these often fetched face values and thus avoided losses. Moreover, as dollar funding remained more expensive than home-currency funding for many European banks, dollar-denominated assets were in especially strong supply.

… but did not clearly drive prices down

Despite this, there is little evidence that actual or expected future sales significantly affected asset prices. Graph 5 (centre and right-hand panels) shows time series of price quotes for selected high-spread securitised assets, distressed bonds and leveraged loans. True, the price of US leveraged loans fell and spreads on some securitised assets rose after the EBA capital target announcement, consistent with the deleveraging implications of this news. And the price of distressed Lehman Brothers bonds increased after the reduction in the cost of dollar financing from central banks. But these changes were not unusually large compared with past price movements. Furthermore, some of the other price reactions shown in the graph were in directions opposite to those implied by the deleveraging news. That said, banks also offered for sale some assets that do not have regular price quotes, including parts of their loan portfolios. Market participants reported gaps between the best bid and offered prices for some of these assets, with low bid prices sometimes attributed to prospective supplies of similar assets from other banks.

Evidence of credit constraints

At the same time, bank credit declined in some areas …

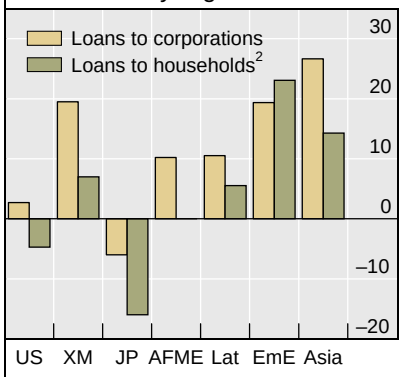
Strong deleveraging pressures during the final quarter of 2011 were also associated with weak or negative growth in the volume of credit extended by many European banks. Credit extended by financial institutions in the euro area, for example, turned down during this period, with credit to non-bank private sector borrowers in the area falling by around 0.5%, while assets vis-à-vis non-euro area residents declined by almost 4%. Outstanding loans to euro area non-financial corporations grew by just over 1% and loans to households for house purchases by around 2%, while consumer credit declined by just over 2%.

… mainly due to supply, rather than demand

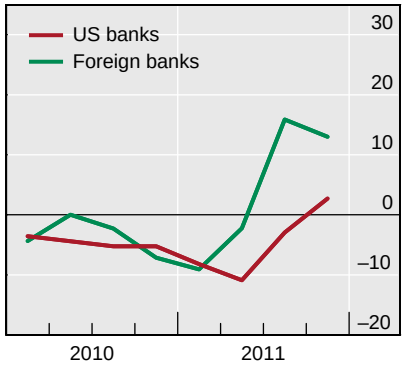
Lending surveys and changes in loan interest rates both suggested that changes in supply were important drivers of weak credit volumes. For example, many more euro area lenders tightened terms on corporate loans than loosened them in the final quarter of 2011 and a significant balance also tightened standards on loans to households (Graph 6, left-hand panel). In contrast, the balance between lenders reporting either increased or reduced demand for corporate loans was much more even. Also, more non-US (mainly European) banks operating in the United States tightened approval standards on loans to US corporations than loosened them in the third and fourth quarters of 2011 (Graph 6, centre panel). This contrasted with domestic US banks making loans to the same borrowers, who in aggregate reported no significant tightening. In addition, average interest rate margins on new syndicated and large bilateral loans to borrowers with common credit ratings increased in the final quarter of 2011 in regions that rely relatively heavily on funds from EU

Survey-based indicators of changes in loan supply and demand[1]

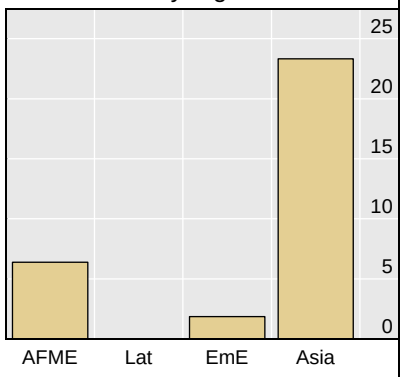
Q4 2011 changes in lending standards by region of lender



Changes in US corporate lending standards by type of lender



Q4 2011 changes in demand for trade finance by region of lender



AFME = Africa and Middle East; EmE = Emerging Europe; JP = Japan; Lat = Latin America; US = United States; XM = Euro area.

[1] Diffusion indices equal to the difference between the percentage of lenders reporting considerably tighter lending standards / increased demand during the quarter and the percentage reporting considerable loosening / reductions plus half of the difference between the percentage of lenders reporting moderately tighter lending standards / increased demand during the quarter and the percentage reporting moderate loosening / reductions. [2] Unsecured loans.

Sources: ECB; Federal Reserve; Institute of International Finance; BIS calculations. Graph 6

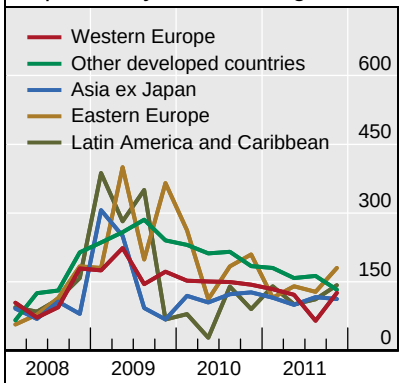
banking groups, while they fell in regions that rely less heavily on the same banks for funds (Graph 7, left-hand panel).

Dollar-denominated and risky lending by EU banks fell sharply ...

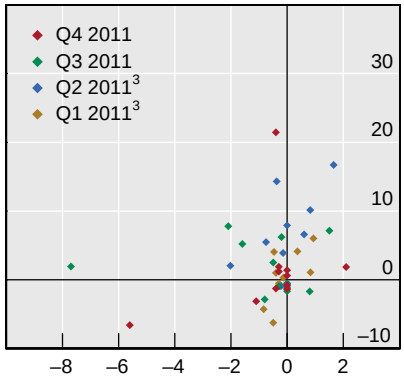
Lending cuts by European banks focused primarily on risky and dollar-denominated loans. For example, EU banks reduced their funding contributions to new syndicated and large bilateral leveraged and project finance loans between the third and fourth quarters of 2011 by more than for other, less risky types of lending (Table 1). Funds from weaker banking groups (defined as those with EBA capital shortfalls plus all Greek banks) for project financing declined more than proportionately. The same was true of dollar-denominated

New syndicated and large bilateral loans

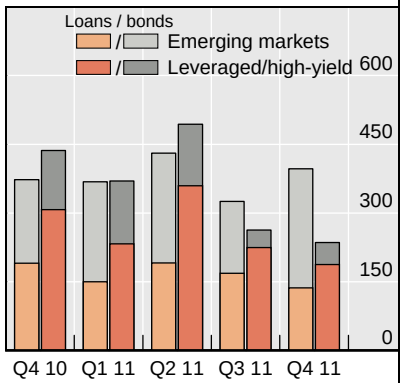
Spreads by borrower region[1]



Dollar loans versus MMF funding[2]



Loan and bond issuance[4]



[1] Simple average of spreads to benchmark funding rates of all new loans rated BBB+, BBB or BBB–, in basis points. [2] On y-axis, dollar-denominated lending of Belgian, French, German, Irish, Italian, Dutch, Nordic, Portuguese, Spanish, Swiss or UK banks relative to 2007–10 quarterly averages; in billions of dollars. On x-axis, change in 10 largest US prime money market funds' (MMFs) exposures to the same European banks; in percentage points of total assets under management. At end-2011, these 10 funds held $644 billion of assets and all US prime money market funds held $1.44 trillion of assets. [3] Interpolated as available data on money market fund exposures was for end-February 2011 rather than end-March 2011. [4] Loans of European banking groups and total bond issuance; in billions of US dollars.

Sources: Dealogic; Fitch Ratings; BIS calculations. Graph 7

Changes in new lending by type of lender and loan[1]

Loan type	Change in new lending between Q3 2011 and Q4 2011, by type of lender; in per cent			2011 lending volume	
	Weaker EU banks[2]	Other EU lenders	All lenders worldwide	In billions of dollars	Denominated in dollars (%)
All loans	–14.6	–6.0	0.4	4,181	62
Dollar-denominated	–16.2	2.4	4.4	2,503	100
Leveraged[3]	–43.0	–43.4	–18.3	1,085	80
Project finance	–39.0	–21.4	–7.0	319	40
Trade finance	–23.5	–9.8	-4.6	65	88
Aircraft/ship leasing	–40.5	–12.9	7.3	49	85

Colour coding:	[< –30]	[–30 to –15]	[–15 to 0]

[1] Lending measured as newly signed syndicated and large bilateral loans by consolidated organisational groups, excluding any loans subsequently cancelled or withdrawn. Where the relative contributions to syndicated loans were not reported, these were assumed to be distributed evenly between participants. [2] The 31 banking groups with EBA capital shortfalls, plus all Greek banking groups. [3] Loans rated below investment grade, plus some non-rated loans depending on pricing and characteristics. All loans for leveraged buyouts included. All loans for asset financing excluded.

Sources: Dealogic; BIS calculations. Table 1

lending and financing of trade, aircraft and ships, which are largely denominated in dollars. As Graph 7 (centre panel) suggests, this may have reflected withdrawals of dollar funding.

… as did lending to emerging markets

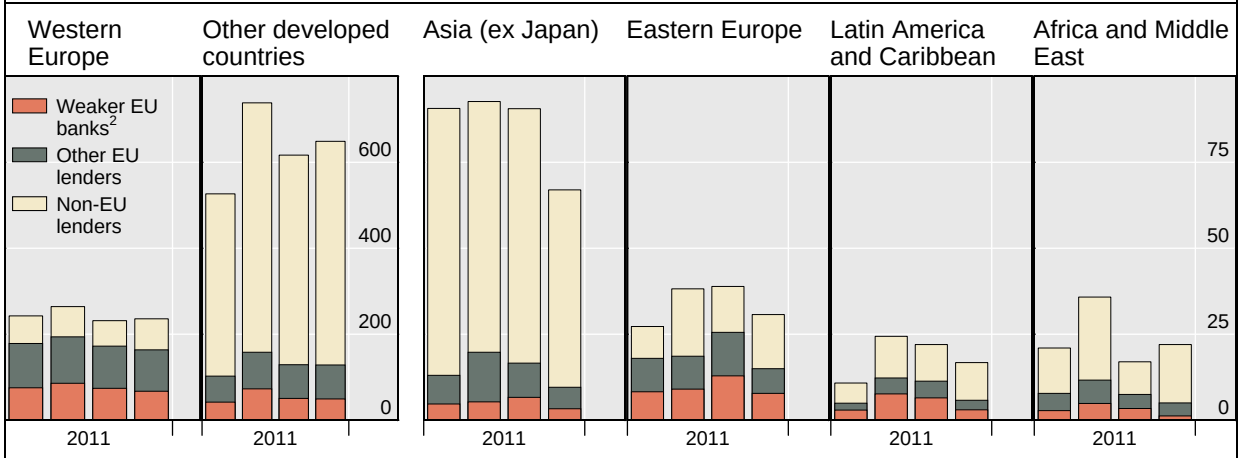
European banks also cut lending to emerging markets. Their consolidated foreign claims on emerging Europe, Latin America and Asia had already started to fall in the third quarter of 2011 (see pages 18–20 of the Highlights). New syndicated and large bilateral loans from EU banking groups to emerging market borrowers then fell in the final quarter of the year. This was in contrast to lending to western Europe and other developed countries, which was essentially unchanged (Graph 8). At the same time, banks tightened terms on new loans to corporations and households in emerging markets (Graph 6, left-hand panel). The more pervasive tightening in emerging Europe than elsewhere may have reflected the widespread ownership of banks in the region by EU banking groups. Reduced lending to emerging Europe may also reflect lower demand, however, as the region's economic growth forecasts fell by more than those for any other during the final quarter of 2011.

Other forms of financing largely filled the gaps …

Increased financing from other banks and bond market investors largely compensated for the cuts made by European banks in the final quarter of 2011. As a result, the overall volume of new syndicated and large bilateral loans was essentially the same as in the third quarter. In trade finance, for example, a strong balance of Asia-based lenders reported increased demand (Graph 6, right-hand panel) and these and other non-European lenders ensured that financing of trade did not fall overall. More generally, types of lending mostly denominated in dollars were quite steady in aggregate, even though contributions from European banks declined. Elsewhere, higher bond market

New syndicated and large bilateral loans by type of lender and region of borrower[1]

In billions of US dollars



[1] New loans of consolidated groups, grouped by signing date, excluding any loans subsequently cancelled or withdrawn. Where the relative contributions to syndicated loans were not reported, these were assumed to be distributed evenly between participants. [2] The 31 banking groups with EBA capital shortfalls plus all Greek banking groups.

Sources: EBA; Dealogic; BIS calculations. Graph 8

issuance offset reductions in the supply of bank credit. In particular, increased emerging market bond issuance more than offset the corresponding decline in bank lending, while a modest rise in high-yield bond issuance only partially offset the decline in leveraged lending (Graph 7, right-hand panel).

Conclusion

Pressures on European banks to deleverage increased towards the end of 2011 as funding strains intensified and regulators imposed new capitalisation targets. Many of these banks shed assets, both through sales and by cutting lending. However, this did not appear to weigh heavily on asset prices, nor did overall financing fall for most types of credit. This was because other banks, asset managers and bond market investors took over the business of European banks. An open question is whether other financial institutions will be able to substitute for European banks as the latter continue to deleverage. The reduction in deleveraging pressures in late 2011 and early 2012, after measures by central banks mitigated bank funding strains, means at least that this process may run more gradually. This should reduce any impact on financial markets and economic activity.

Highlights of the BIS international statistics

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 third quarter of 2011. The discussion of international debt securities draws on data for the fourth quarter of 2011.[1]

The international banking market in the third quarter of 2011

The aggregate cross-border claims of BIS reporting banks expanded slightly during the *third quarter of 2011*. The overall rise was exclusively caused by an increase in interbank claims. By contrast, claims on non-banks recorded their largest decline since the fourth quarter of 2009.

Despite the overall increase in cross-border claims during the period, there were several notable signs of a slowdown in international banking activity. First, cross-border lending to non-banks in all major developed economies with the exception of Japan contracted or remained virtually unchanged. Second, internationally active banks reported sharp reductions in their foreign claims on residents of the euro area economies experiencing fiscal difficulties. And last but not least, cross-border claims on emerging market economies declined for the first time in 10 quarters. Internationally active banks reduced lending to the residents of emerging Europe and Africa and the Middle East. The growth rates of cross-border claims on Asia-Pacific and Latin America and the Caribbean did remain positive; nevertheless, they fell considerably relative to those observed during the preceding two years.

[1] This article was prepared by Stefan Avdjiev (banking statistics; stefan.avdjiev@bis.org) and Andreas Schrimpf (international debt securities; andreas.schrimpf@bis.org). From this issue onwards, there will be no commentary on turnover and open interest on the international derivatives exchanges. The data will still be published in the Annex tables to the *BIS Quarterly Review* and at http://www.bis.org/statistics/extderiv.htm. The June and December issues will continue to report the highlights from the semiannual over-the-counter derivatives statistics.

Aggregate cross-border claims record a slight increase[2]

Aggregate cross-border claims increase ...

The aggregate cross-border claims of BIS reporting banks rose slightly during the third quarter of 2011. The $610 billion (1.9%) overall increase reflected an $826 billion (4.2%) rise in interbank lending (Graph 1, top left-hand panel). By contrast, claims on non-banks declined by $216 billion (1.8%).

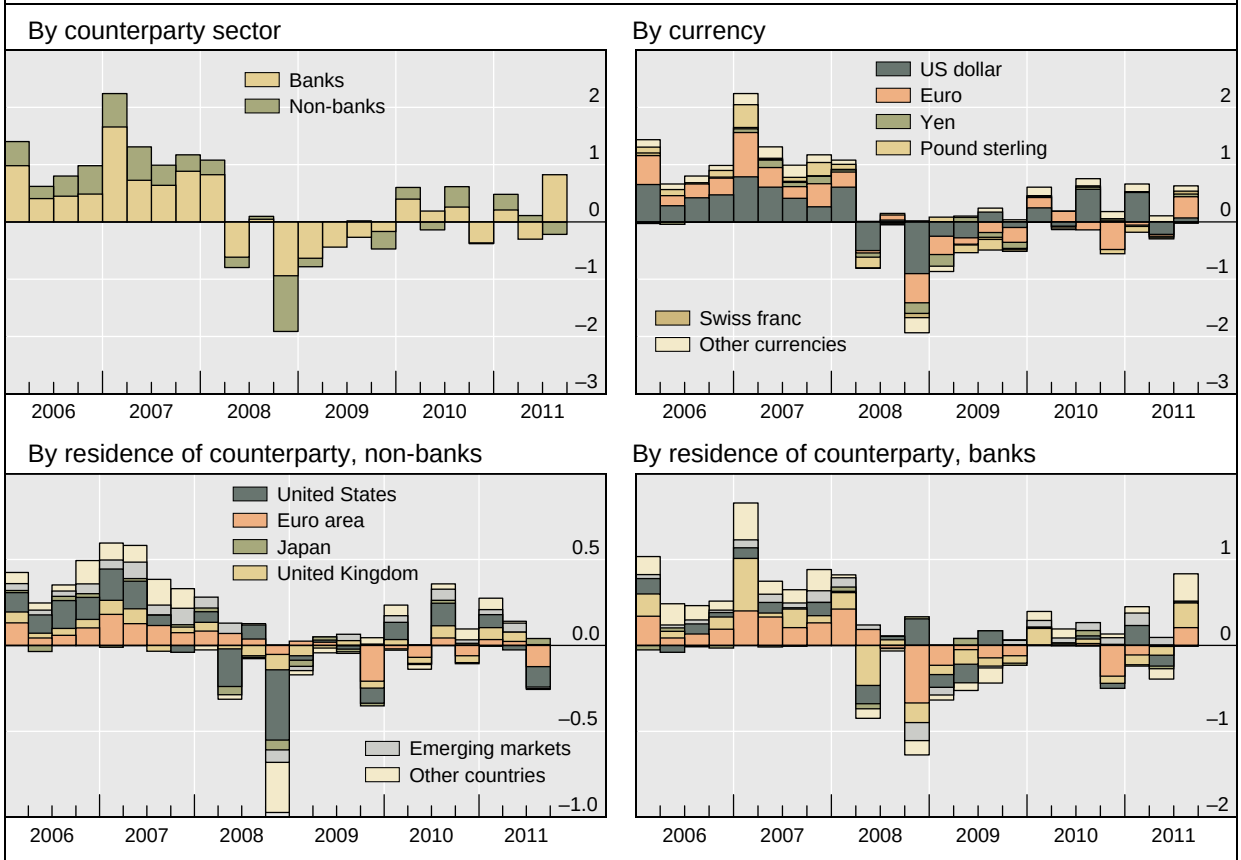
The aggregate growth in cross-border lending went hand in hand with increases in claims denominated in most major currencies (Graph 1, top right-hand panel). In relative terms, claims denominated in Swiss francs grew the most ($52 billion or 10%). Those denominated in yen ($46 billion or 3.8%), euros ($369 billion or 3.2%) and US dollars ($71 billion or 0.6%) all rose as well. Conversely, claims in sterling contracted by $21 billion (1.4%).

... but cross-border lending to non-banks contracts

Cross-border lending to non-banks in most major advanced economies shrank (Graph 1, bottom left-hand panel). Claims on non-banks in the euro area declined the most (–$124 billion or –3.1%). More than 40% of the overall drop was accounted for by a $53 billion (16%) fall in lending to non-bank

Changes in gross cross-border claims[1]

In trillions of US dollars



[1] BIS reporting banks' cross-border claims include inter-office claims.

Source: BIS locational banking statistics by residence. Graph 1

[2] The analysis in this subsection is based on the BIS locational banking statistics by residence. In this dataset, creditors and debtors are classified according to their residence (as in the balance of payments statistics), not according to their nationality. All reported flows in cross-border claims have been adjusted for exchange rate fluctuations and breaks in series.

borrowers in Italy. BIS reporting banks also considerably reduced their claims on non-banks in the United States (–$119 billion or –4.5%). Cross-border lending to non-banks in Switzerland and Australia contracted as well (–$12 billion or –6.0% and –$6.2 billion or –3.9%, respectively). The only major economy that saw a significant expansion in cross-border claims on its non-bank residents was Japan ($35 billion or 18%).

What drove the growth in cross-border interbank lending during the period?

Rising derivatives values and inter-office lending growth drive the expansion in interbank claims

There were two main drivers of the aggregate increase in cross-border interbank claims. First, a $376 billion (22%) surge in the category *other assets*[3] was responsible for almost half (46%) of the overall rise. Even though the BIS locational banking statistics do not contain a finer breakdown of that category, there is anecdotal evidence that a large part of the expansion reflected increases in the market value of (mostly interest rate-related) derivatives positions. Second, reporting banks' claims on related offices abroad rose by $208 billion (2.0%). This accounted for more than one quarter of the aggregate expansion in interbank claims.

While the increases in both of the above categories contributed significantly to the expansion in cross-border interbank claims during the quarter, none of them could really be interpreted as a sign of increased international lending activity. What is more, to the extent that the growth in intrabank transactions was driven by banks cutting credit to the real economy and "parking" funds at affiliated offices, it may even be indicative of a slowdown in foreign bank lending around the world. Nevertheless, the lack of finer breakdowns in the data prevents us from making more definitive statements about the exact causes of those increases.

Cross-border claims on banks in the UK, Germany ...

The cross-border interbank market channelled new funds mainly to banks located in the United Kingdom and Germany (Graph 1, bottom right-hand panel). Claims on the former expanded by $287 billion (7.5%) while those on the latter rose by $196 billion (18%). A $172 billion (42%) surge in *other assets* accounted for the majority of the increase in claims on banks in the United Kingdom. By contrast, a $156 billion (20%) expansion in interbank loans was the main driver of the growth in lending to banks in Germany.

... and Switzerland expand

Cross-border claims on banks located in Switzerland also rose sharply. They surged by $103 billion (26%) in the third quarter of 2011, during which a sharp rise in global risk aversion caused the rapid appreciation of the Swiss franc. This ultimately prompted the Swiss National Bank (SNB) to set a floor on the euro/Swiss franc exchange rate on 6 September 2011.[4] As in the case of

[3] In the instrument breakdown of the BIS locational banking statistics by residence, the international claims of reporting banks are divided into three categories: *loans and deposits*, *debt securities* and *other assets*. The last category includes equity, participations, derivative instruments, working capital supplied by head offices to branches and residual on-balance sheet claims. See Guidelines to the international locational banking statistics for more details.

[4] The quarterly frequency of the BIS international banking statistics does not allow us to establish how much of the surge in claims on banks located in Switzerland took place before the SNB announcement on 6 September 2011 and how much afterwards.

Germany, interbank loans accounted for almost all of the increase ($102 billion or 31%).

In contrast to the above developments, cross-border lending to banks located in the GIIPS countries (Greece, Ireland, Italy, Portugal and Spain) declined sharply during the quarter. Claims on banks located in Italy and Spain shrank by $60 billion (9.0%) and $45 billion (7.5%), respectively. Lending to banks located in Portugal and Greece also contracted considerably (–$13 billion or –7.7% and –$6.5 billion or –8.4%, respectively).

Foreign bank lending to the GIIPS countries contracts[5]

During the third quarter of 2011, internationally active banks reported substantial declines in their foreign exposures to the GIIPS economies (Graph 2). According to our estimates, at constant exchange rates,[6] the consolidated foreign claims of BIS reporting banks on the residents of that set of countries contracted by $110 billion (4.5%). Foreign claims on the public sector shrank the most (–$63 billion or –13%). Interbank claims also fell considerably (–$43 billion or –8.5%). By contrast, foreign lending to the non-bank private sector remained relatively stable, ticking down by $4.6 billion (0.3%).

There are three possible drivers of the above declines. First, reporting banks may have marked some of the foreign claims on their trading books down to their market values or provisioned against future losses on loans in their banking books. Second, banks may have let a portion of their foreign claims mature without replenishing them. Third, banks may have sold some of their tradable foreign claims. Potential buyers of such claims, whose holdings would not be captured in the BIS international banking statistics, include banks headquartered in the same jurisdiction as the borrower and the ECB (in the case of sovereign debt). Unfortunately, it is impossible to quantify the exact contribution of each of the above factors using the breakdowns currently available in the BIS consolidated banking statistics.

Foreign claims on all GIIPS countries decline

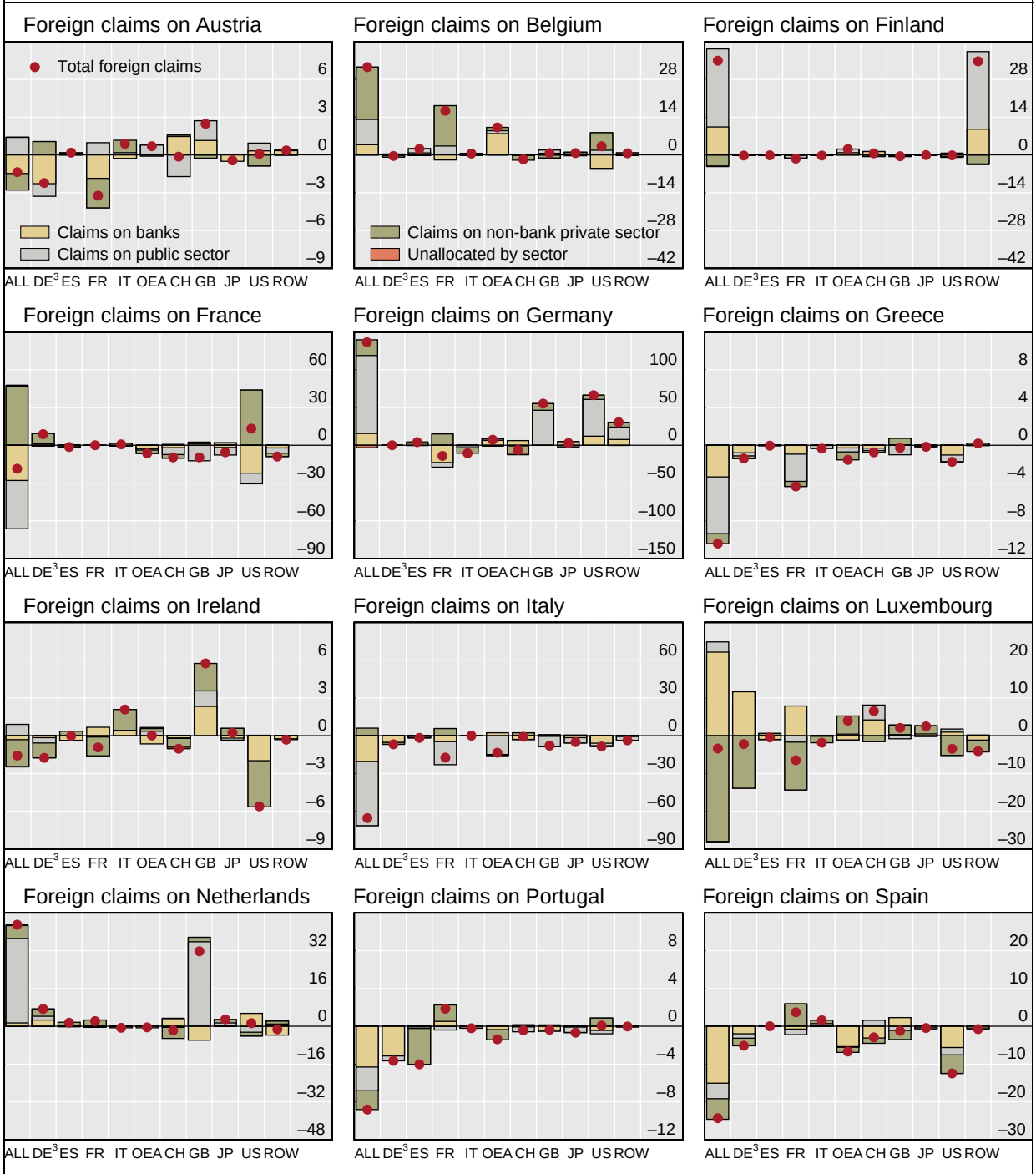
The composition of the contraction in foreign claims varied considerably across the GIIPS economies. The overall declines in foreign lending to Italy and Greece (–$65 billion or –7.0% and –$10 billion or –7.9%, respectively) involved primarily the public sectors of the two countries (–$51 billion or –18% and –$6.0 billion or –15%, respectively). By contrast, the drops in foreign lending to Spain (–$24 billion or –3.3%) and Portugal (–$8.8 billion or –4.3%)

[5] The analysis in this subsection is based on the BIS consolidated international banking statistics on an ultimate risk basis. In this dataset, the exposures of reporting banks are classified according to the nationality of banks (ie according to the location of banks' headquarters), not according to the location of the office in which they are booked. In addition, the classification of counterparties takes into account risk transfers between countries and sectors (see box on pages 16–17 of the March 2011 *BIS Quarterly Review* for a more detailed discussion and examples of risk transfers).

[6] In order to adjust for the currency fluctuations that took place during the period, we make the (admittedly imperfect) assumption that all foreign claims on residents of the euro area are denominated in euros.

Estimated changes in foreign claims[1] on selected countries, Q3 2011

By bank nationality at constant end-Q3 2011 exchange rates,[2] in billions of US dollars



ALL = all BIS reporting banks; CH = Switzerland; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; IT = Italy; JP = Japan; OEA = other euro area; ROW = rest of the world; US = United States.

[1] Foreign claims consist of cross-border claims and local claims of foreign affiliates. Claims of banks headquartered in the respective country are not included, as these are not foreign claims. [2] All claims are assumed to be denominated in euros. [3] Claims of German banks are on an immediate borrower basis, except claims on the Greek public sector, which are on an ultimate risk basis.

Source: BIS consolidated banking statistics (ultimate risk basis). Graph 2

affected mainly recipient banks (–$15 billion or –6.7% and –$4.3 billion or –12%, respectively). Meanwhile, a decrease in claims on the non-bank private

sector in Ireland (–$2.1 billion or –0.6%) was the primary reason for the overall reduction in foreign lending to that country (–$1.6 billion or –0.3%).

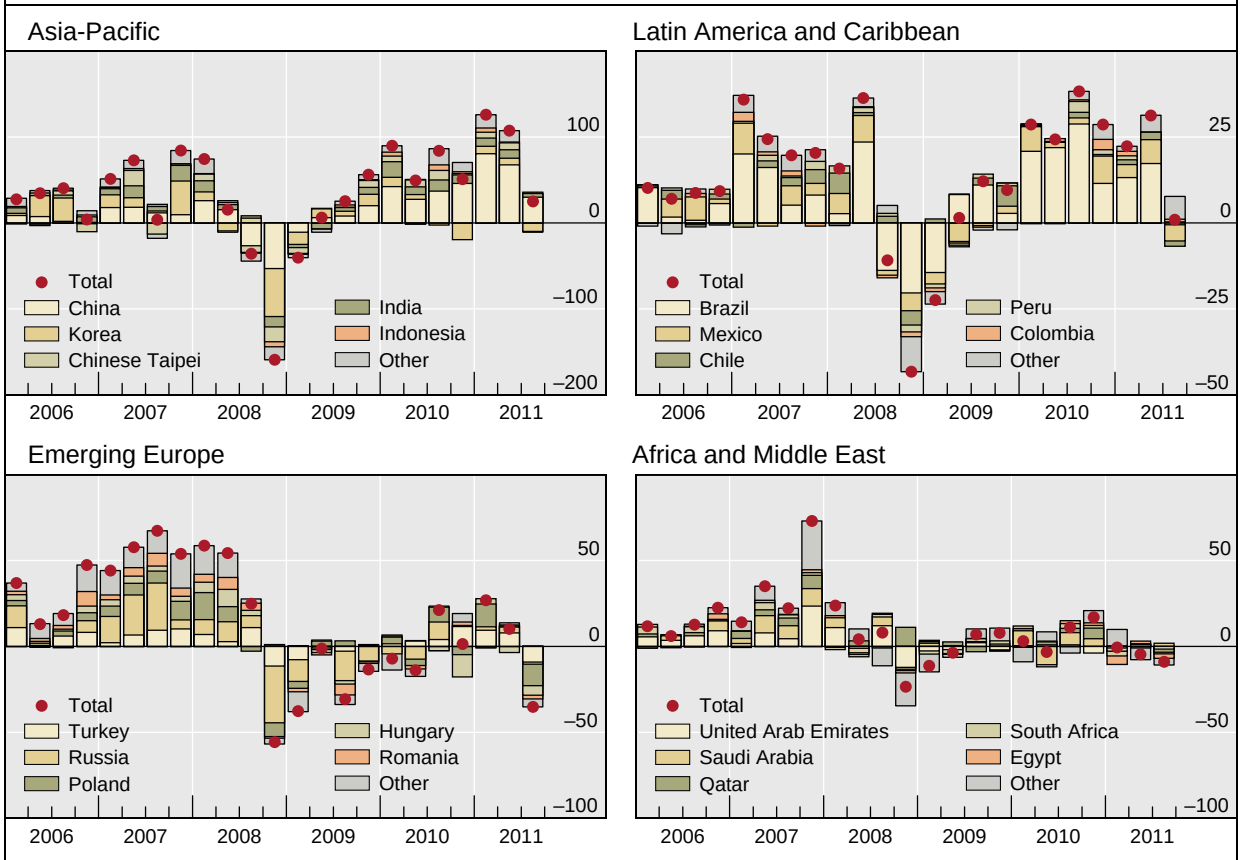
On the lender side, euro area banks and US banks contributed the most to the overall contraction in foreign claims on the GIIPS countries. Euro area banks' foreign claims on that group of economies decreased by $61 billion (or 3.5%). US banks also reported a substantial fall (–$28 billion or –16%). The bulk of the reduction reported by euro area banks was on the GIIPS public sectors (–$41 billion or –11%). By contrast, in the case of US banks, more than half of the reported decline affected banks in the GIIPS countries (–$15 billion or –26%).

Cross-border claims on emerging market economies decline[7]

After nine consecutive quarters of steady growth, cross-border lending to emerging market economies contracted during the third quarter of 2011. The $18 billion (0.6%) reduction reflected decreases in both interbank claims (–$9.4 billion or –0.5%) and claims on non-banks (–$8.6 billion or –0.6%). Claims on emerging Europe and Africa and the Middle East fell. Those on Asia-

Changes in cross-border claims on residents of emerging markets[1]

By residence of counterparty, in billions of US dollars



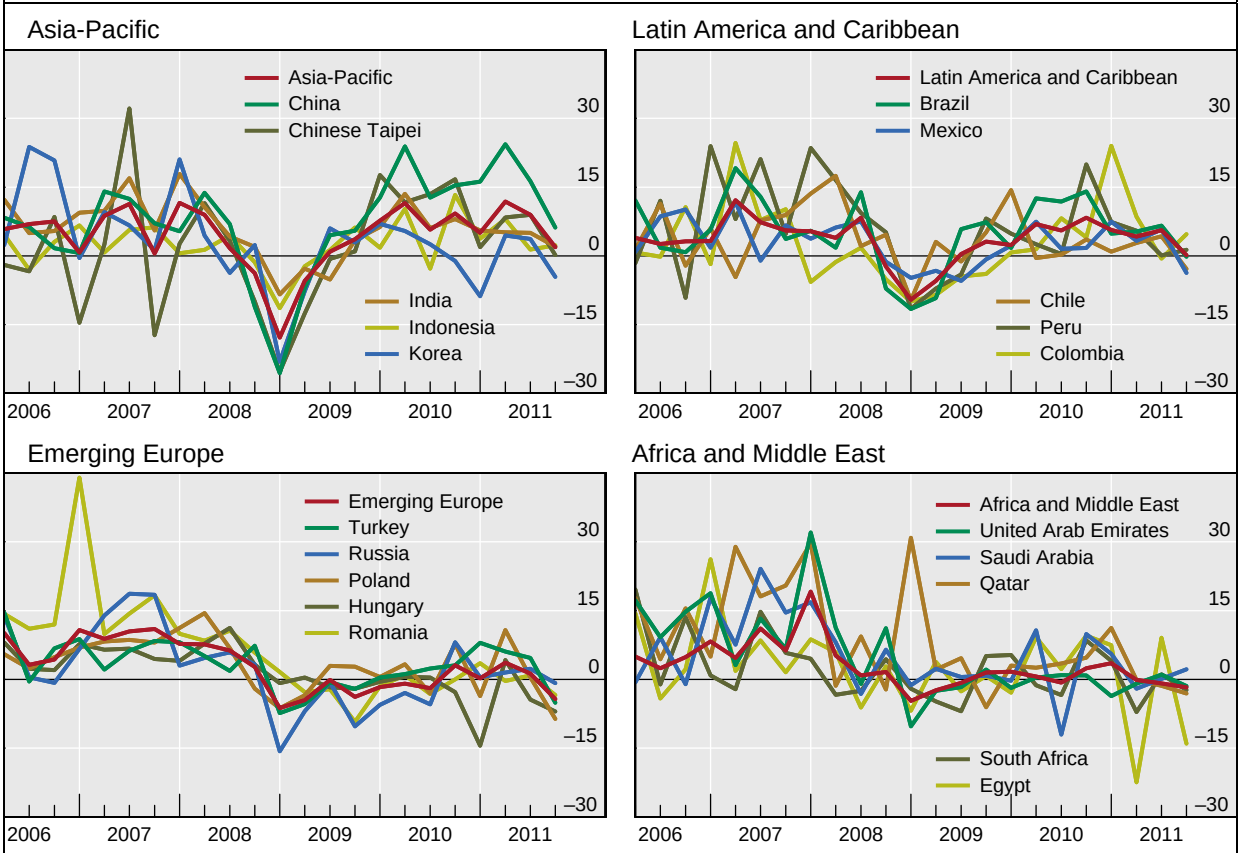
[1] BIS reporting banks' cross-border claims (including inter-office claims) in all currencies.

Source: BIS locational banking statistics by residence. Graph 3

[7] The analysis in this subsection is based on the BIS locational banking statistics by residence. See footnote 2 for a description of this dataset.

Growth rates of cross-border claims on residents of emerging markets[1]

By residence of counterparty, in per cent



[1] Quarterly growth rates of BIS reporting banks' cross-border claims (including inter-office claims) in all currencies.

Source: BIS locational banking statistics by residence. Graph 4

Pacific and Latin America and the Caribbean did increase, but at a much lower rate than in the preceding quarters.[8]

Cross-border lending to emerging Europe shrinks

Emerging Europe, the region most dependent on euro area banks for foreign credit,[9] saw the largest drop (Graph 3, bottom left-hand panel). The $35 billion (4.3%) overall decline was led by a $21 billion (4.6%) fall in interbank claims. Lending to non-banks also shrank (–$15 billion or –3.9%). The countries most affected were Poland (–$13 billion or –8.6%), Hungary (–$5.5 billion or –7.0%) and Turkey (–$9.1 billion or –5.1%). Euro area banks account for more than 80% of all foreign credit to the first two of these countries. They are also responsible for approximately two thirds of all foreign claims on Turkey, whose susceptibility to sudden capital withdrawals is further increased by the fact that more than half of all international claims on its residents have a maturity of less than one year.

[8] It is interesting to note that net issuance of international debt securities by residents of emerging market economies, which had slowed considerably during the third quarter of 2011, recovered in the last three months of the year. See the box on page 21 for more details. Provisional data on international bank lending to emerging market economies during the last quarter of 2011 will be released in April 2012.

[9] See Box 2 on pages 21–2 in the December 2011 *BIS Quarterly Review* for estimates of the share of total bank credit in major emerging market economies provided by euro area banks.

Growth in cross-border claims on Asia-Pacific and Latin America and the Caribbean falls

The growth rate of cross-border claims on Asia-Pacific and Latin America and the Caribbean fell significantly (Graph 4, top panels). In the former region, it declined to 1.9% from an average of 7.9% in the preceding eight quarters. In the latter region, it dropped to 0.2% from an average of 5.2% during the previous two years. Moreover, cross-border lending actually contracted in some of the largest countries in the two regions.

Each of the major economies in Asia-Pacific and Latin America and the Caribbean that saw a fall in cross-border claims had a high score on one or more of the vulnerability indicators presented in the December 2011 *BIS Quarterly Review*.[10] Korea and Chile, where cross-border lending shrank by $10 billion (4.6%) and $1.5 billion (2.8%), respectively, both had a share of short-term claims in international claims that exceeded one half (63% and 54%, respectively). In addition, cross-border claims represented nearly 50% of all foreign claims on Korea. Meanwhile, euro area banks accounted for almost a half (48%) of all foreign credit to Mexico, where cross-border lending declined by $4.7 billion (3.7%). Finally, claims on Brazil, the emerging market economy with the highest ratio (30%) of cross-border claims held in the form of tradable debt securities, dropped by $0.5 billion (0.2%). This reduction contrasted sharply with developments in the preceding eight quarters, when cross-border lending increased by an average of 8.0%.

[10] The four vulnerability indicators are: *foreign bank participation rate*, *share of cross-border claims in foreign claims*, *share of short-term claims in international claims* and *share of tradable debt securities in cross-border claims*. See Box 1 on pages 16–17 of the December 2011 *BIS Quarterly Review* for a detailed description of each indicator.

International debt security issuance in the fourth quarter of 2011

Issuance of international debt securities stabilised in the fourth quarter of 2011, recovering slightly from the third quarter's market turmoil in the wake of European sovereign debt woes. Gross issuance reached $1,806 billion, some 7% more than in the previous quarter (Graph A, left-hand panel). With repayments almost unchanged at $1,541 billion, net issuance climbed to $265 billion, a notable recovery after the rather low $181 billion in the previous quarter. Net issuance of bonds and notes rose to $299 billion (Graph A, centre panel), whereas the money market segment saw net repayments of $33 billion (Graph A, right-hand panel).

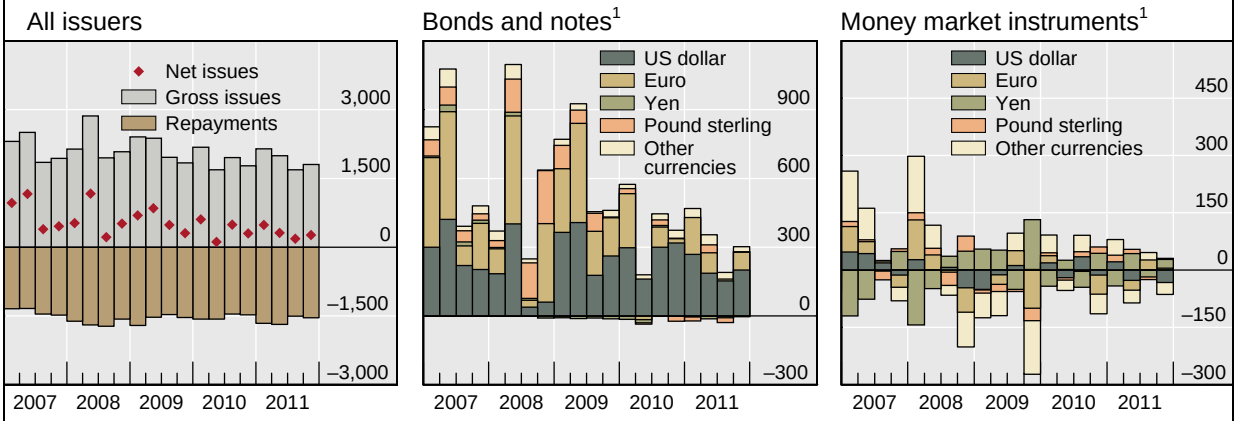
Borrowers of European nationality accounted for the largest share of the increase in net issuance. They raised $105 billion in the fourth quarter, compared with just $6 billion in the third. Emerging market borrowers also made a strong showing in the primary market for international debt securities, with net issues of $65 billion, up from only $21 billion in the third. US borrowing declined slightly, to $59 billion.

The breakdown by currency shows that euro-denominated borrowing posted the strongest increase, to $82 billion net. Borrowing via dollar-denominated international debt securities took the largest share in overall issuance, edging up to $168 billion. The sterling and yen segments of international debt markets stagnated.

In line with recent trends, corporate borrowing continued to outstrip borrowing by financials. Net issues by non-financial corporations amounted to $148 billion, more than twice the net issuance of financial institutions ($71 billion). In particular, US corporations tapped the market for international debt securities, raising $80 billion net. US financials, by contrast, repaid international debt securities to the tune of $22 billion.

International debt securities issuance

In billions of US dollars



[1] Net issues.

Sources: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS. Graph A

European financials returned to the primary market for international debt securities in the fourth quarter of 2011 after being almost absent during the third. Gross issuance by financial institutions of European nationality picked up 11% compared with the previous quarter, reaching $971 billion. After accounting for a 4% increase in repayments, net issuance recovered to $58 billion, after $6 billion of net repayments in the third quarter. Dutch financials borrowed the most with $51 billion of net issues, followed by German financial institutions with net issues of $20 billion (Graph B, left-hand panel). Spanish, Greek and French financials also expanded their borrowing relative to the third quarter, raising $11 billion, $8 billion and $7 billion, respectively, after repayments. UK and Belgian financials, however, continued to repay funds worth $25 billion and $14 billion, respectively, on a net basis.

The recovery in issuance by European financials can be largely attributed to a significant increase in borrowing by the subcategory of other financial institutions, which includes quasi-sovereign borrowers, asset-backed security issuers and insurance companies. By contrast, issuance by European banks slumped. Gross issuance by the group of other financial institutions

picked up to $487 billion, 55% above the amount raised in the same quarter of the previous year. After accounting for repayments, net issuance by borrowers from this subcategory reached $198 billion.

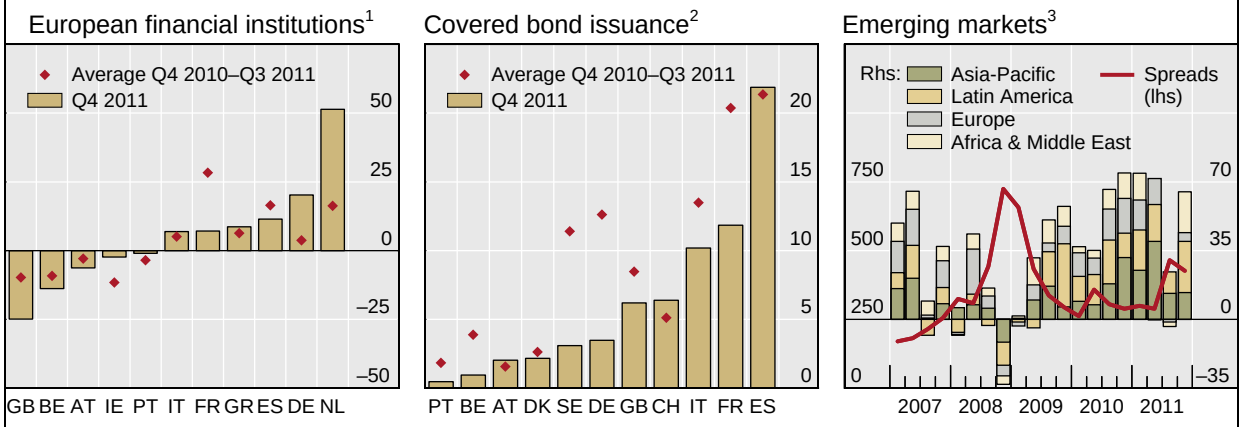
Market conditions remained generally difficult for many European private banks in the fourth quarter of 2011 (see pages 2–5 for a detailed discussion of the current funding situation of European banks). European private banks repaid another $151 billion, following net repayments of $79 billion in the third quarter. Gross issuance of international debt securities by private banks of European nationality stood at $445 billion, 23% less than in the same quarter of the previous year, suggesting that funding difficulties persist.

Attention shifted to the covered bond market segment over the second half of 2011, as unsecured term funding had become increasingly difficult to obtain for banks from several European countries (see page 2 for a discussion). Continuing the trend of the entire past year, issuance of covered bonds was particularly strong in the case of Spanish, French and Italian financial institutions, with gross issues of $22 billion, $12 billion and $11 billion, respectively (Graph B, centre panel).

Emerging market borrowing saw a strong comeback in the fourth quarter of 2011, as credit spreads eased somewhat (Graph B, right-hand panel). While issuance by borrowers from Asia and the Pacific remained constant at $14 billion of net issues, net issues by borrowers from Latin America expanded strongly ($26 billion). Borrowing from Africa and the Middle East via international debt securities reached $21 billion, the highest amount ever raised by borrowers from that region.

Debt securities issuance

Issuance by nationality of issuer, in billions of US dollars



AT = Austria; BE = Belgium; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; GR = Greece; IE = Ireland; IT = Italy; NL = Netherlands; PT = Portugal.

[1] Net issues, international debt securities. [2] Gross issues. [3] Net issues, international debt securities. Spreads are based on the JPMorgan EMBI Global Composite index, in basis points.

Sources: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS. Graph B

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The impact of Federal Reserve asset purchase programmes: another twist[1]

This article examines the effectiveness of recent Federal Reserve asset purchase programmes. We estimate that once we control for factors such as the size and the maturity profile of Treasury issuance, the new Maturity Extension Program (MEP) could have an impact comparable to the one we estimate for the Large-Scale Asset Purchase (LSAP) programme. The effectiveness of such programmes is limited by Treasury debt management policy. Indeed, the Treasury's extension of the average maturity of outstanding debt during LSAP is likely to have pushed up the 10-year bond yield significantly.

JEL classification: E52, E63.

Just before making its most recent policy rate cut in December 2008, the Federal Reserve started a series of asset purchase programmes that focus on longer-term securities including government bonds (Graph 1). How effective will the recent programmes, especially the Maturity Extension Program (MEP), be in lowering interest rates?

We seek to answer this question using estimates from a simple model of US Treasury bond yield dynamics. We find, first, that the likely impact of the MEP on the 10-year government bond yield is sizeable. Second, the estimated impact on yields is comparable to that of the previous asset purchase programmes. And the effectiveness of Federal Reserve asset purchases is limited by the Treasury's debt management policy. Indeed, we estimate that the Treasury's extension of the average maturity of outstanding debt during the Large-Scale Asset Purchase (LSAP) programme pushed the 10-year bond yield up by 27 basis points during the first stage of the programme (LSAP1) and by 14 basis points during the second stage (LSAP2).

[1] The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. We are grateful to Claudio Borio, Jagjit Chadha, Stephen Cecchetti, Bob McCauley, Bill Nelson and Christian Upper for useful comments on earlier drafts of this article, and to Jakub Demski for expert assistance with data and graphs.

Federal Reserve asset purchase programmes

A new Operation Twist focuses on the composition of Fed asset holdings

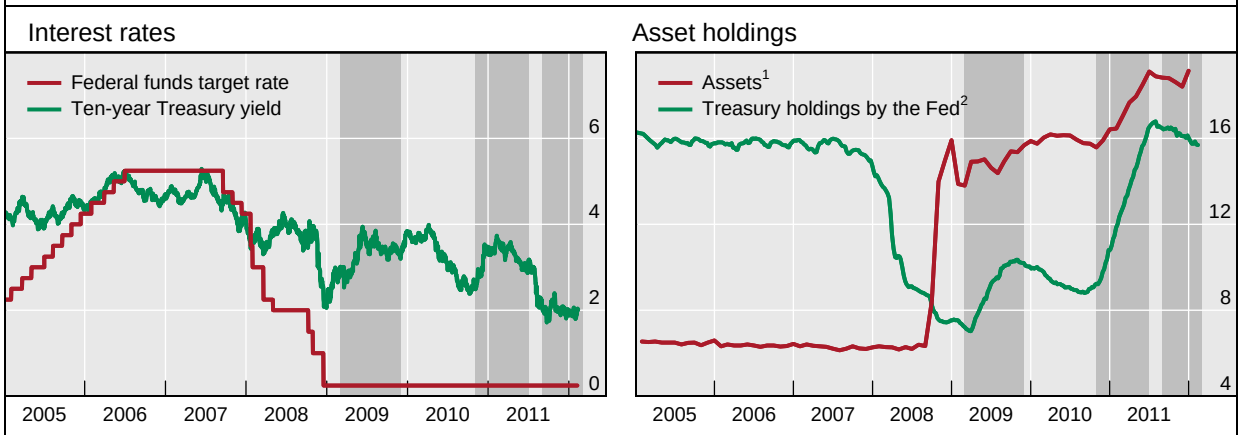
On 21 September 2011, the Federal Open Market Committee (FOMC) announced the new MEP, which seeks to increase the average maturity of the Federal Reserve portfolio of Treasury securities by 25 months to about 100 months by the end of 2012. To do so, the FOMC planned to buy $400 billion in Treasury securities with remaining maturities of 72 to 360 months and to sell an equal amount of Treasuries with remaining maturities of three to 36 months. About 64% of the purchases were allocated to the six- to 10-year segment, and another 29% to the 20- to 30-year segment.

The MEP differs from the previous LSAP programme. When LSAP was established in November 2008, the FOMC intended to acquire up to $600 billion in agency mortgage-backed securities and agency debt. From March 2009 to March 2010, it committed an additional $850 billion to purchases of agency securities, and a further $300 billion to acquiring longer-term Treasury securities (LSAP1). As the recovery faltered, in November 2010 the FOMC put in place LSAP2, which consisted of further purchases of $600 billion in longer-term Treasury securities until mid-2011. The Federal Reserve's asset holdings expanded rapidly as a consequence of these purchases, reaching about 17% of Treasury securities outstanding by mid-2011 (Graph 1).

Unlike the LSAP programme, the MEP explicitly aims at extending the average maturity of the Fed's Treasury holdings without changing the overall size of the central bank's balance sheet. In this regard it is essentially a new version of Operation Twist, implemented in the early 1960s, which sought to "twist" the yield curve by nudging the longer-term yields lower while keeping the short rates at existing levels. Under that programme, the Fed bought about $8.8 billion of longer-term Treasury securities and reduced its holdings of short-term Treasury bills by $7.4 billion. The size of purchases was comparable

Federal Reserve monetary policy measures

In per cent



The shaded areas represent LSAP1: March 2009–November 2009; LSAP2: November 2010–June 2011; and MEP: September 2011–June 2012.

[1] Federal Reserve total assets as a share of GDP. [2] Federal Reserve Treasury securities holdings as a share of Treasury securities outstanding, excluding intragovernmental holdings.

Sources: Federal Reserve Board; US Department of the Treasury; Bloomberg; national data. Graph 1

to the LSAP programmes, relative to GDP and to Treasury debt outstanding.

Early studies, such as Modigliani and Sutch (1966, 1967), find that Operation Twist had little impact on long-term bond yields. However, based on event studies with high-frequency data, Swanson (2011) estimates that it could have lowered the US 10-year Treasury bond yield by about 15 basis points.

The likely impact of the MEP

How effective will the MEP be? Will it have a greater impact on Treasury bond yields than outright asset purchases under the LSAP programme? We evaluate the likely effects of the programme by estimating the impact on 10-year Treasury bond yields of the targeted 25-month maturity extension of the Fed portfolio of Treasury securities.

The effectiveness of the MEP

Central banks can affect government bond yields by changing either the size or the composition of their bond holdings, or both. The maturity structure of the Federal Reserve's Treasury holdings is a good indicator of the portfolio's composition. We estimate a dynamic model of yield determination to gauge the impact on the 10-year Treasury bond yield of changes in the average maturities of the Fed holdings of Treasury securities and of Treasury securities outstanding (see box). We control for the size of the Fed Treasury holdings relative to Treasury debt outstanding, the effective federal funds rate and a number of other factors reflecting macroeconomic and market conditions.

Fed maturity extension reduces bond yields …

Our estimates indicate, first, that the maturity structure of Fed Treasury holdings matters for Treasury bond yields.[2] Lengthening the average maturity of the Fed holdings by one month lowers the 10-year bond yield by 3.4 basis points, all other things being equal (Table 1). Assuming that the relationship is linear and ceteris paribus, the planned 25-month extension of the average

Estimated long-run coefficients from error correction model[1]

Impact on 10-year Treasury bond yield

Sample period	Average maturity of Fed Treasury holdings	Average maturity of Treasuries outstanding	Fed holdings relative to Treasuries outstanding	Fed funds rate
Jan 1990–Jun 2011	–0.034	0.070	–0.202	0.220
	(0.004)	(0.007)	(0.012)	(0.024)
Jan 1990–Jun 2007	–0.080	0.093	–0.126	0.262
	(0.018)	(0.013)	(0.035)	(0.027)

[1] Standard errors are reported in parentheses.

Source: Meaning and Zhu (2012). Table 1

[2] Kuttner (2006) finds that Fed purchases of long-term bonds have a significant impact on the term premia, but the effects of changes in the outstanding publicly held Treasury debt are insignificant.

Estimating the yield impact of Fed bond purchases

Using monthly US data from January 1990 to June 2011, we apply the Engle-Granger (1987) two-step procedure to estimate an error correction model of the dynamics of the 10-year Treasury bond yield. In the first step, we estimate a co-integrating vector, interpreted as the "long-run" equilibrium relationship, of the following form:

$$y_t^{10Y} = \alpha + \beta^F M_t^F + \beta^T M_t^T + \delta F_t + \kappa i_t + \gamma C_t + \varepsilon_t \qquad (1)$$

where y_t^{10Y} is the yield for a bond of 10 years remaining maturity at time t, M^F is the average maturity of the Fed holdings of Treasury securities, M^T is the average maturity of outstanding Treasury securities, F is the size of the Fed Treasury holdings relative to total Treasury debt outstanding, and i is the effective federal funds rate. The coefficients on these variables capture the individual impact on yields of Fed maturity transformation, Treasury debt maturity transformation, the relative size of Fed holdings of Treasury securities, and conventional interest rate policy.

Model (1) is similar to those of Kuttner (2006) and Greenwood and Vayanos (2008), and shares their limitations. First, changes in the maturity structure and size of Fed asset holdings and Treasury debt outstanding are not independent from each other. The overall effect of MEP will be smaller than the partial effect indicated by the coefficient β^F if the Treasury extends the maturity or increases the size of its outstanding debt. Unlike Kuttner (2006), we include F to control for effects arising from changes in the size of Fed holdings relative to the amount outstanding of Treasuries. It is important to bear in mind that F depends on both Fed and Treasury actions.[1]

In addition, M^F, M^T and F may be correlated with some omitted variables. We consider a set of control variables C which include the consensus forecasts of one-year-ahead inflation and real GDP growth rates, the VIX (an index of implied volatility), and the Cochrane-Piazzesi (2005) forward rate factor. First, a rise in expected inflation can increase long yields by raising the expected level of future short interest rates. Second, higher growth expectations could be associated with a rise in expected inflation, tighter monetary policy and higher interest rates. There is also evidence that expected real output growth plays a significant role in explaining time variation in bond risk premia. Third, implied volatility captures a "flight to safety" factor, as rising market strains may drive investors to shift to safe haven assets such as Treasury securities, depressing their yields. Fourth, Fama and Bliss (1987) and Cochrane and Piazzesi (2005) show that forward rates implied from the yield curve have significant predictive power for bond term or risk premia. Implied forward rates, along with lagged 10-year yields and lagged federal funds rates, convey information on the future path of the policy rate. We find that these variables are statistically significant and have signs in line with our priors, but they do not significantly affect the coefficient estimates on M^F, M^T and F.

Most of the included variables are tested to be non-stationary. In the second step, we formulate an error correction model that captures the dynamics of their interactions:

$$\Delta y_t^{10Y} = \sigma + \sum_{i=1}^{I} \rho_i \Delta y_{t-i}^{10Y} + \sum_{j=0}^{J} \beta_j^F \Delta M_{t-j}^F + \sum_{k=0}^{K} \beta_k^T \Delta M_{t-k}^T + \sum_{l=0}^{L} \delta_l \Delta F_{t-l} + \sum_{m=0}^{M} \kappa_m \Delta i_{t-m} + \sum_{f=0}^{F} \theta_f \Delta C_{t-f} + \phi_g \hat{\varepsilon}_{t-1} + \xi_t \qquad (2)$$

where $\hat{\varepsilon}_t$ s are the regression residuals from (1) and represent the estimated error correction term, ie deviations of actual yields from their estimated implied equilibrium level. We use information criteria to select the "optimal" lag structure, which typically includes one or two lags for each variable. We focus our discussion based on estimates from the equilibrium co-integrating relationships.

One concern is that the model estimates may not be stable over time. We estimate the model with data from January 1990 to June 2007, before the large jump in the average maturity of Fed Treasury holdings. There is evidence that changes in the maturity structure of Fed holdings and

Treasury debt outstanding actually had more of an effect in this earlier period when Fed maturity extension or asset purchases were not used as policy tools (Table 1).

[①] We interpret the coefficient on F as representing the quantity effect on yields of the proportional reduction in Treasury debt supply resulting from Fed outright asset purchases. Whether this correctly measures the impact of the LSAP is debatable, as the ratio depends on both Fed and Treasury actions. But the Fed purchases take Treasury actions as given, and the size of intervention relative to total supply is a key determinant for yields. We conduct a number of robustness checks. First, we run regressions with the Fed holdings and Treasury debt outstanding, in logarithms, as two separate variables. The coefficient estimates on the two variables are significant and have the right signs, and those on the maturity variables are in line with the presented results. Second, we normalise the average maturity of Fed holdings by the Fed's market share, and the new variables are again significant with the right sign. More details are provided in Meaning and Zhu (2012).

maturity under the MEP could reduce the 10-year bond yield by 85 basis points, assuming that the stock and maturity of the outstanding Treasury debt remain unchanged.[3]

... as do changes in the size of Fed Treasury holdings

This caveat is important because our estimates, second, show that changes in the size of the Fed Treasury holdings relative to total Treasury debt outstanding can have a significant effect on yields. An increase of 1% in the ratio of Fed holdings to Treasuries outstanding reduces yields by 20 basis points for bonds of 10-year residual maturity. This effect was significantly smaller in the pre-crisis period, probably because bond purchases were not considered a policy tool at that time.[4] Indeed, as shown in Meaning and Zhu (2011), mere announcements of Fed asset purchases following the global crisis had sizeable effects on yields, on top of the impact of actual purchases.

Admittedly, the estimated model is quite simple, and may fail to control for other drivers of yields. That said, the results suggest that Fed asset purchase programmes have been effective. We estimate that in the absence of any Fed purchases, the 10-year Treasury yield would have been 180 basis points higher by mid-2011 (Graph 2). During LSAP1 and LSAP2, the proportion of outstanding Treasury debt held by the Federal Reserve increased by 3.0 and 7.7 percentage points (Graph 1), respectively, implying reductions of 60 and 156 basis points in the 10-yield Treasury yield (Graph 2). On the other hand, Fed outright asset purchases had little effect on the maturity structure of Fed Treasury holdings. The average maturity of these holdings increased by only two months during LSAP1 and actually declined by over six months during LSAP2 (Graph 3), so the yield effects of maturity transformation were small.

Taking account of the sizes of outright asset purchases during LSAP1 and LSAP2, and the planned size of the MEP asset trade to support the maturity transformation of Fed Treasury holdings, the programmes' effects on the 10-year Treasury yield are of similar magnitude.

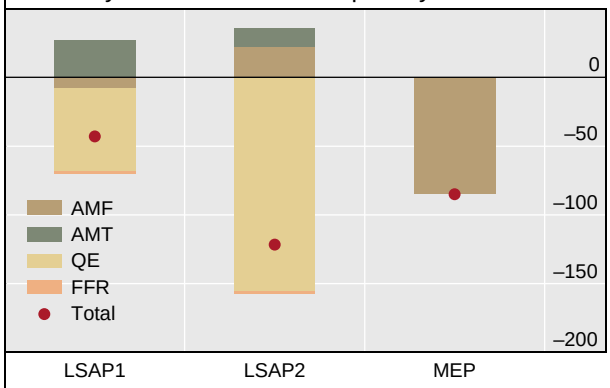
[3] See Meaning and Zhu (2012) for more details. Applying the same model to different maturities, they find that the MEP could have a significant impact on the entire Treasury yield curve.

[4] Interest rate policy appears to have been slightly more effective before the crisis. We estimate that lowering the federal funds rate by 100 basis points leads to a 22 basis point reduction in the 10-year bond yield. This compares to the pre-crisis sample estimate of 26 basis points.

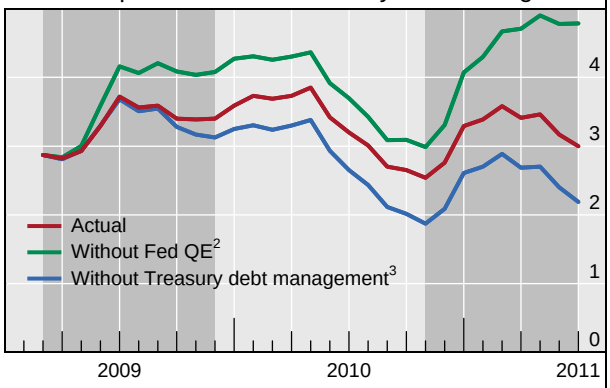
The impact of Federal Reserve asset purchase programmes

Ten-year Treasury bond yield

Maturity transformation and quantity effects[1]



Fed asset purchases and Treasury debt management



The shaded areas represent LSAP1: March 2009–November 2009; and LSAP2: November 2010–June 2011.

[1] AMF is the impact of changes in the average maturity of the Federal Reserve's Treasury securities portfolio; AMT is the impact of changes in the average maturity of Treasury debt outstanding; QE is the impact of changes in the size of the Federal Reserve's Treasuries portfolio relative to total Treasury debt outstanding; FFR measures the impact of changes in the federal funds rate. The projected impact of the MEP is based on the Federal Reserve decision to extend the average maturity of its Treasury debt portfolio by 25 months assuming the Treasury does not change the size and maturity profile of the debt outstanding. [2] Counterfactual 10-year Treasury bond yield keeping the average maturity of Fed holdings of Treasuries and the size of the Fed bond holdings relative to total Treasury debt outstanding constant at the February 2009 levels. [3] Counterfactual 10-year Treasury bond yields keeping the average maturity of Treasury debt outstanding constant at the February 2009 level.

Source: Authors' calculations. Graph 2

Asset purchases and Treasury debt management policy

Our estimates suggest that the effectiveness of the Federal Reserve's asset purchase programmes is constrained by the Treasury's debt management policy. A one-month maturity extension of Treasury debt outstanding raises the 10-year bond yield by 7 basis points, twice the yield reduction effect of a one-month maturity lengthening of the Fed holdings. This is unsurprising as the Fed portfolio makes up between 7 and 18% of the overall Treasuries market over our sample period.[5]

The impact of bond purchases on the 10-year bond yield would have been greater had the Treasury not expanded the supply of Treasuries – especially the longer-term securities – thereby increasing the maturity of Treasury debt outstanding during LSAP1 and LSAP2 (Graph 2). The net effects on 10-year bond yields of −43 basis points during LSAP1 and −121 basis points during LSAP2 are consistent with the estimates of D'Amico and King (2010) and Meaning and Zhu (2011, 2012).

Sovereign debt managers and monetary policymakers do not share the same goals.[6] Seeking to minimise borrowing costs and maximise returns, Treasury debt managers could be tempted to take advantage of the lower long

[5] That said, maturity transformation of Fed Treasury holdings via bond purchases seems to have a greater impact on yields per dollar spent than that of Treasury debt outstanding.

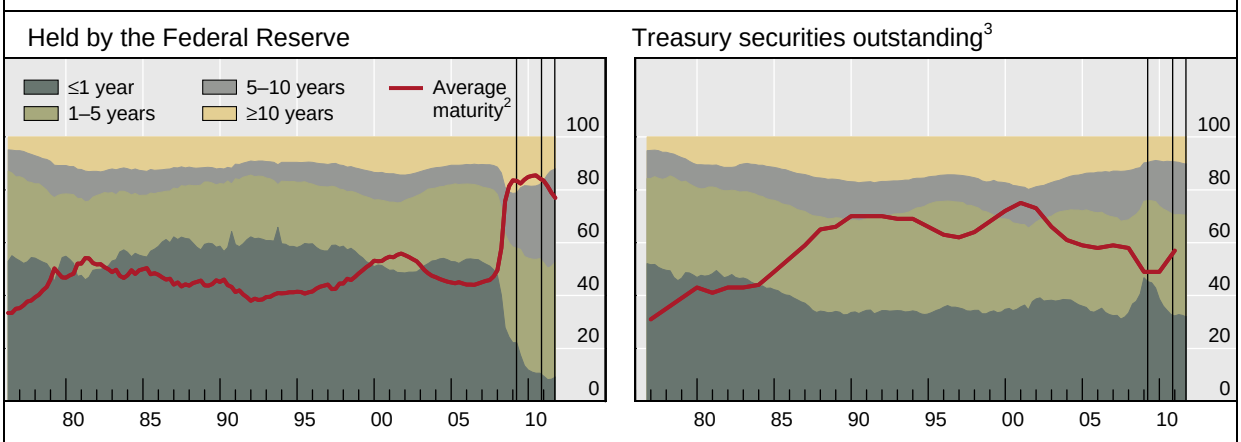
[6] Fisher (2002) argues that "the Treasury's debt management serves a single, overriding objective", which is "to meet the financing needs of the federal government at the lowest cost over time".

Treasury debt management limits the impact of Fed asset purchases

rates afforded by Fed bond purchase programmes by issuing more longer-term debt.[7] As a matter of fact, the Treasury increased the average maturity of outstanding debt during LSAP1 and LSAP2 from 47 months in March 2009 to almost 59 months in June 2011 (Graph 3). We estimate that, all other things being equal, this would have pushed the 10-year bond yield up by 27 basis points during LSAP1 and 14 basis points during LSAP2 (Graph 2, left-hand panel). Were it not for the Treasury's debt maturity extension, the 10-year yield would have been 80 basis points lower by mid-2011 (Graph 2, right-hand panel). The same lesson can be learned from the implementation of the original Operation Twist: its apparent lack of success can be partly attributed to the Treasury raising the average maturity of marketable debt from 41 months in 1960 to 55 months in 1963.[8]

The average maturity of Treasury debt outstanding remains well below the average level over the two decades preceding the crisis (Graph 3). Looking ahead, the Treasury may continue to favour issuance of longer-dated debt, and the average maturity of Treasury debt outstanding may rise further. The Treasury issued $310 billion in net marketable debt in the fourth quarter of 2011. It expects to issue an additional $444 billion in debt in the first quarter of 2012 and $200 billion in the second quarter, with plans for sales of more longer-term notes and bonds. The planned issuance of $644 billion in new debt in the first half of 2012 is larger than the $400 billion MEP. Expanding the size of Treasury debt outstanding would reduce the ratio of Fed Treasury holdings relative to debt outstanding, further diluting the stimulative effects of Fed asset purchases.

Maturity distribution of US Treasury debt securities[1]



[1] Breakdown of securities held outright refers to remaining maturity as a percentage of total; vertical lines mark the first days of the LSAP and MEP programmes: March 2009, November 2010 and September 2011. [2] In months. [3] Excluding intragovernmental holdings.

Sources: Federal Reserve Board; US Department of the Treasury; Datastream. Graph 3

[7] See Borio and Disyatat (2010), Chadha (2011), McCauley and Ueda (2009), Meaning and Zhu (2012) and Turner and Mohanty (2011).

[8] See United States Department of the Treasury (1968).

Conclusion

The Federal Reserve's new Operation Twist, the MEP, may have a significant impact on the 10-year Treasury bond yield, comparable to that of outright asset purchases under the LSAP programme. The MEP does not involve any size changes in the Fed balance sheet, but it is limited by the existing amount of short-maturity assets in the Fed asset portfolio. That said, the effectiveness of the Federal Reserve asset purchase programmes depends on Treasury debt management policy. When the Federal Reserve acts to lower yields for longer-dated bonds and the Treasury has large longer-term borrowing needs, a conflict of interests may emerge.

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FX volume during the financial crisis and now[1]

This special feature looks at trading activity in the foreign exchange (FX) market. By using information from surveys conducted by FX committees around the world as well as settlement data from CLS Bank, I analyse how global FX market activity was affected by the recent financial crisis. I show that FX activity continued to grow during the first year of the crisis but experienced a sharp drop after the Lehman bankruptcy, from which it recovered only slowly. I estimate that global FX activity was around $4.7 trillion a day on average in October 2011, compared with $4.0 trillion reported by the latest triennial central bank survey of foreign exchange activity conducted in April 2010.

JEL classification: C82, F31, G15.

FX trading activity stood at $4.0 trillion per day in April 2010

The authoritative source on global FX market activity is the Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity published by the BIS ("the Triennial").[2] By the latest account, FX trading activity averaged $4.0 trillion a day in April 2010. However, as the survey is conducted only every three years, it provides little information on market trends that occur at a higher frequency. Moreover, due to the timing of the Triennial, the FX market was not surveyed during the height of the recent financial crisis. The last two surveys, in April 2007 and April 2010, bracketed most of the turmoil. The next survey is scheduled for April 2013, with expected publication of preliminary results about four months later.

Fortunately, the Triennial is not the only source of information on FX activity. A number of central bank-sponsored industry groups, known as foreign exchange committees, have for the last half-decade or so conducted semiannual surveys on FX activity in their respective markets. In addition, electronic trading platforms and settlement systems provide alternative gauges of FX activity at even higher frequencies.

[1] The views expressed in this article are those of the author and do not necessarily reflect those of the BIS. I am grateful to Claudio Borio, Stephen Cecchetti, Corrinne Ho, Bob McCauley, Andreas Schrimpf and Christian Upper for useful comments and to Sha Lu at the Federal Reserve Bank of New York and Jhuvesh Sobrun for excellent research assistance.

[2] For details on the methodology and changes over time, see King and Mallo (2010). See King and Rime (2010) and McCauley and Scatigna (2011) for discussions of the drivers of FX trading. See, for example, Baba et al (2008), Melvin and Taylor (2009) and Goldberg et al (2011) for discussions of the FX market and the recent financial crisis.

In this special feature, I seek to take stock of the activity in the FX market at the midpoint between two Triennials and describe how market turnover was affected by the recent financial crisis. By applying a technique known as benchmarking to the different sources on FX activity, I produce a monthly time series that is comparable to the headline numbers from the Triennial going back to 2004.

Taking stock of FX activity during the financial crisis and now

I estimate that in October 2011 daily average turnover was roughly $4.7 trillion based on the latest round of FX committee surveys. Moreover, I find that FX activity may have reached $5 trillion per day prior to that month but is likely to have fallen considerably into early 2012. Furthermore, I show that FX activity continued to grow during the first year of the financial crisis that erupted in mid-2007, reaching a peak of just below $4.5 trillion a day in September 2008. However, in the aftermath of the Lehman Brothers bankruptcy, activity fell substantially, to almost as low as $3 trillion a day in April 2009, and it did not return to its previous peak until the beginning of 2011. Thus, the drop coincided with the precipitous fall worldwide in financial and economic activity in late 2008 and early 2009.

FX activity was just above $3 trillion per day in April 2009 …

… and roughly $4.7 trillion per day in October 2011

The article is organised as follows. In the first part, I discuss the different gauges of FX activity available, highlighting differences in methodology, coverage and scope. I start with surveys of financial institutions before turning to information obtained from trading platforms or settlement systems. In the second part, I review the concept of benchmarking and then apply the methodology to available data on FX activity.

Gauges of foreign exchange activity

In general, there are two types of data sources on FX market activity: surveys of financial institutions, and turnover data obtained from either trading platforms or settlement systems. The different sources cover a variety of FX instruments. These include spot transactions, outright forwards, foreign exchange swaps, currency swaps and currency options (see the box for a description of FX instruments). The surveys tend to cover the full set of instruments and provide detailed breakdowns in terms of, for example, currency pairs, types of counterparties and execution methods. In contrast, trading platforms and settlement systems are tailored to specific instruments and often provide only aggregate turnover, but the information is available at higher frequencies.

Surveys of financial institutions

I focus here on the Triennial Survey published by the BIS and on the more frequent FX committee surveys of the markets in the United Kingdom, North America, Canada, Singapore, Japan and Australia.[3] The surveys measure

The Triennial Survey and FX committee surveys …

[3] In addition, a number of central banks, including the Reserve Bank of New Zealand, the Central Bank of Norway, the South African Reserve Bank and Sveriges Riksbank, publish volume statistics for their respective currencies.

Foreign exchange instruments

FX volume surveys report turnover by instrument. Instrument types include the following:

Spot transactions are single outright transactions that involve the exchange of two currencies at a rate agreed to on the date of the contract for value or delivery within typically two business days.

Outright forwards involve the exchange of two currencies at a rate agreed to on the date of the contract for value or delivery at some time in the future. This category also includes forward foreign exchange agreement (FXA) transactions, non-deliverable forwards (NDFs) and other forward contracts for differences.

Foreign exchange swaps involve the exchange of two currencies on a specific date at a rate agreed to at the time of the conclusion of the contract, and a reverse exchange of the same two currencies on a future date at a rate agreed to at the time of the contract. For measurement purposes, only the long leg of the swap is reported, so that each transaction is recorded only once.

Currency swaps involve the exchange of fixed or floating interest payments in two different currencies over the lifetime of the contract. Equal principal based on the initial spot rate is typically exchanged at the beginning and close of the contract.

Currency or foreign exchange options are contracts that give the right to buy or sell a currency with another currency at a specified exchange rate during or at the end of a specified time period.

activity in terms of the notional or nominal amount of the contracts. Turnover is reported in US dollar equivalents.

… are not directly comparable

The surveys differ in three important aspects: market definition, reporting basis and double-counting adjustments. Only the Triennial attempts to capture the global market in its totality. In contrast, the FX committee surveys confine themselves to a specific geographical location. There are two ways to classify where a given trade took place. The reporting basis is either the location of the sales desk of the trade or the location of the price-setting dealer of the transaction, also referred to as the "trade desk". Double-counting arises because transactions between two reporting entities are recorded by both of them. The FX committee surveys adjust for local, ie within-country, double-counting while the Triennial adjusts for both local and cross-border double-counting. In addition, there are minor differences in the instruments covered and the history available.

Consequently, while similar in nature, the aggregate volume of the FX committee surveys is not directly comparable to that of the Triennial. Table 1 provides an overview of the characteristics of the individual surveys.

The objective of the Triennial is to obtain comprehensive and internationally consistent information on the size and structure of the FX market with a view to increasing market transparency and monitoring activity in the global financial system. The survey was first conducted in April 1989 and has been repeated every three years since.

Triennial FX activity went up 20% in 2007–10

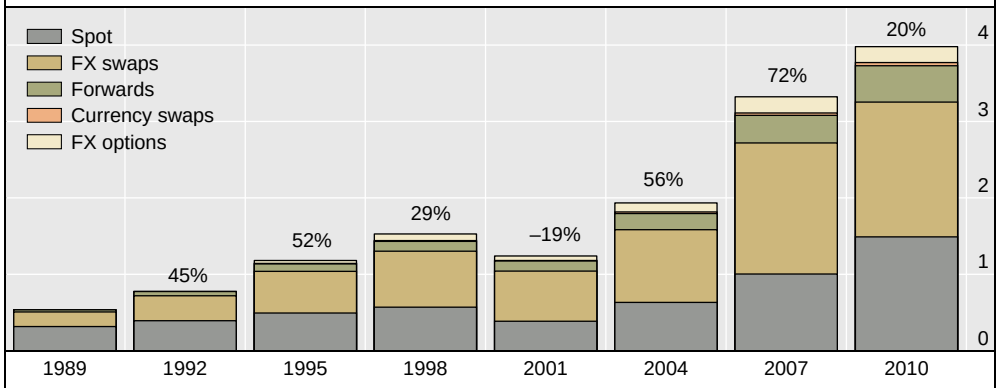
According to the Triennial, FX activity has grown continuously over the last two decades, with the exception of the 2001 survey following the introduction of the euro in 1999 (Graph 1). Reported FX activity increased eightfold from $500 billion in April 1989 to $4.0 trillion in April 2010. FX activity grew 20% between the last two surveys in April 2007 and April 2010.

FX committees in all major markets …

Several central banks in the major FX centres around the world are sponsoring industry groups, called FX committees, which provide a forum for

Foreign exchange and derivatives market turnover

In trillions of US dollar equivalents



[1] Percentages denote growth since previous survey.

Source: BIS Triennial Surveys, 1989–2010. Graph 1

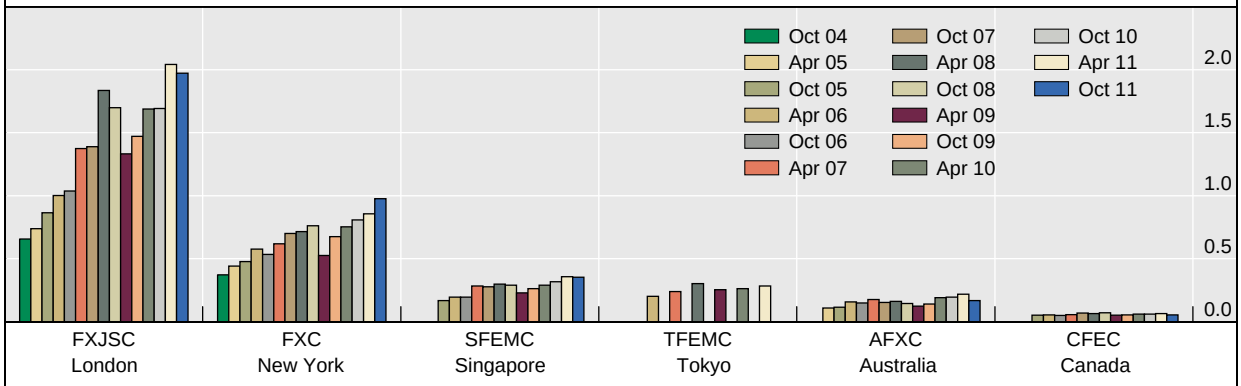
market participants to discuss issues of common interest. For example, the committees serve as vehicles to develop standards and best practices related to FX trading and operations. The current slate of committees includes: the Foreign Exchange Joint Standing Committee (FXJSC) in London, the Foreign Exchange Committee (FXC) in New York, the Singapore Foreign Exchange Market Committee (SFEMC), the Tokyo Foreign Exchange Market Committee (TFEMC), the Australian Foreign Exchange Committee (AFXC) and the Canadian Foreign Exchange Committee (CFEC).[4]

… conduct semiannual surveys …

In order to provide more frequent information on the size and structure of FX activity, the committees conduct semiannual volume surveys of their respective markets.[5] The surveys are carried out in April and October and

FX committee survey volumes

In trillions of US dollar equivalents



Source: FX committee surveys. Graph 2

[4] The FXC covers transactions that are priced or facilitated by traders in the United States, Canada and Mexico. The group of reporting dealers includes three Canadian banks. Eight Canadian banks participate in the CFEC survey. In addition, the ECB sponsors the Foreign Exchange Contact Group (FECG), and in Hong Kong SAR the Treasury Market Association (TMA) also covers foreign exchange-related issues. At present, the committees in Frankfurt and Hong Kong do not publish FX volume data.

[5] In the case of the TFEMC, the survey is conducted annually during the month of April.

Comparison of FX trading activity surveys

	BIS	FX committee surveys					
		London	New York	Singapore	Tokyo	Australia	Canada
Frequency	Triennial	Semiannual	Semiannual	Semiannual	Annual	Semiannual	Semiannual
Survey start	Apr 1989	Oct 2004	Oct 2004	Oct 2005	Apr 2006	Apr 2005	Oct 2005
Double-counting corrections	Local and cross-border	Local	Local	Local	Local	Local	Local
Instruments	All instruments	All instruments	No currency swaps	All instruments	No currency swaps	All instruments	All instruments
Reporting basis	Sales desk	Trade desk	Trade desk	Trade desk	Trade/Sales desk	Sales desk	Trade desk
Market	World	UK	N America	Singapore	Japan	Australia	Canada

London = Foreign Exchange Joint Standing Committee; New York = Foreign Exchange Committee; Singapore = Singapore Foreign Exchange Market Committee; Tokyo = Tokyo Foreign Exchange Market Committee (TFEMC); Australia = Australian Foreign Exchange Committee; Canada = Canadian Foreign Exchange Committee; All = spot FX, outright forwards, FX swaps, currency swaps and FX options. In 2010, the TFEMC changed the reporting basis from a trade desk basis to a sales desk basis.

Sources: 2010 Triennial Central Bank Survey; FX committee surveys. Table 1

hence coincide with the Triennial every three years. The results of the surveys are released in a coordinated fashion roughly three months after the survey month. The latest set of results covering October 2011 was released on 6 February 2012. Graph 2 shows the level of activity across the different markets and time.

… showing, for 2007–10, growth in line with the Triennial

The FX committee surveys – like the Triennial – show that most trading takes place in London and New York. In particular, the turnover in the United Kingdom dwarfs that of any other market centre. At slightly over $2 trillion per day in April 2011, its reported volume was larger than the other surveyed markets put together. According to FX committee surveys, trading activity grew some 18%, on a weighted average basis, between April 2007 and April 2010 – broadly in line with the growth suggested by the Triennial.

Data from trading platforms and settlement systems

Higher-frequency data available from …

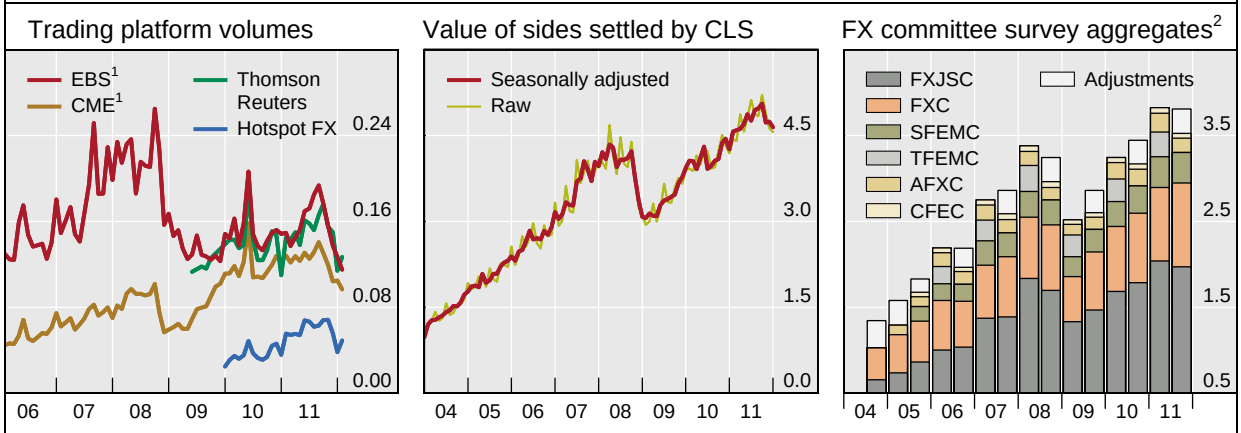
FX activity information gleaned from trading platforms and settlement systems is a by-product of their respective business operations. As with the surveys, activity is reported in US dollar equivalents. A potential issue in using this type of data to assess FX activity is that it can be hard to distinguish overall market trends from market share trends for the specific platform or system. Moreover, as the data are of higher frequency, seasonal patterns and/or calendar effects are likely to be more pronounced.

… trading platforms …

FX instruments are traded in a multitude of ways, ranging from voice brokers to electronic platforms (King and Rime (2010), King et al (2011)). Increasingly, the electronic platforms are making data on turnover readily available, yielding another source on FX activity. Here, I use as illustrative examples the inter-dealer broking systems offered by EBS and Thomson Reuters, the multi-bank trading system Hotspot FX and the Chicago Mercantile Exchange (CME), which offers trading and clearing for FX futures and FX

Daily average turnover

In trillions of US dollar equivalents



[1] Seasonally adjusted. [2] Semiannual data refer to April and October observations.

Sources: CLS Group; CME; EBS; FX committee surveys; Hotspot FX; Thomson Reuters; BIS calculations due to adjustments. Graph 3

options (Graph 3, left-hand panel). Daily average activity reported by EBS, Thomson Reuters and the CME for the last couple of years has been in the range of $100–200 billion a day, whereas activity on Hotspot FX has been around $50 billion a day. While the platforms cover different FX instruments and by themselves only represent a small share of the market, together they can give an indication of wider market trends. For example, EBS and the CME both experienced a steep drop in activity after the Lehman bankruptcy in September 2008. Moreover, all platforms saw a significant spike in May 2010 and experienced a considerable drop in activity in late 2011 and into 2012.

… and CLS Bank

As with trading, FX instruments can be settled in different ways.[6] CLS Bank International (CLS) is the principal settlement institution for FX transactions. CLS was founded in response to concerns raised by the G10 central banks about settlement risk in FX transactions (BIS (1996)). CLS eliminates settlement risk by ensuring that settlement of both legs of a FX transaction occurs simultaneously – a process known as payment versus payment (PVP) (Galati (2002)). CLS began operating in September 2002. Settlements have grown sharply since its start, reflecting a combination of market growth and increasing market share.[7]

CLS settlements dropped 30% after Lehman

Settlement activity is measured in terms of the value (and number) of "sides". A side reflects a payment from one party to another. For example, a spot transaction gives rise to two sides being settled, whereas an FX swap gives rise to four sides in its lifespan – two at its inception and two at maturity. CLS settlements have more than doubled over the past six years. In early 2005, CLS settled sides worth around $2 trillion on average per day, whereas settlements averaged more than $4.5 trillion a day in 2011 (Graph 3, centre

[6] Settlement methods include traditional correspondent banking, bilateral netting and settlement systems.

[7] According to a 2008 Committee on Payment and Settlement Systems study, CLS settled 55% of FX obligations of surveyed institutions (BIS (2008)).

panel). From April 2007 to April 2010, settlements via CLS rose 27%, somewhat higher than the growth implied by the Triennial.[8] After the Lehman bankruptcy in September 2008, the value of settlements dropped by almost 30% by the end of the year, before slowly rebounding to pre-Lehman levels by April 2010.[9]

Benchmarking FX activity

Creating a measure comparable to that of the Triennial ...

As documented above, the FX committee surveys, the trading platform data and CLS settlements paint a broadly similar picture of rapid growth in FX market activity from the mid-2000s up to September 2008. This expansion of activity was followed by a precipitous fall in the wake of the Lehman bankruptcy well into the first half of 2009. Since then, most sources suggest that FX market activity has recovered and has exceeded the peak reached during the financial crisis. The question is how these trends can be translated into a measure of global activity comparable to that of the Triennial Survey.

... by using benchmarking ...

The concept of benchmarking helps here. It deals with the problem of combining a time series of higher-frequency with a series of less frequent data for a certain variable into a consistent time series (Bloem et al (2001)). The lower-frequency series provides the most reliable information on the overall level and longer-term movements of the variable. However, the higher-frequency or indicator series provides the only information available on the short-term movement of the variable.

... to match the movement of high-frequency data

A number of different benchmarking techniques are available.[10] Here, I rely on the proportional Denton technique. This technique is based on the principle of movement preservation. It seeks to match the growth in the indicator series as closely as possible by minimising the sum of squared deviations, while ensuring that the resulting series matches the reliable series (Bloem et al (2001)). In mathematical terms, the technique can be written as:

$$\min_{\{X_t\}_{t=1}^{T}} \sum_{t=2}^{T} \left[\frac{X_t}{X_{t-1}} - \frac{I_t}{I_{t-1}}\right]^2 \quad \text{s.t.} \quad X_s = A_s \text{ for } s \in \Omega \subset \{1,\ldots T\} \tag{1}$$

[8] During the financial crisis, the value of daily settlements peaked on 19 March 2008, when CLS settled sides worth $10.3 trillion (CLS (2008a)). In contrast, the number of sides settled peaked on 17 September 2008, when over 1.5 million sides (worth $8.6 trillion) were processed for the first time (CLS (2008b)). The record in terms of the number of sides settled has been broken a couple times since then, and is currently above 1.9 million sides (CLS (2011)).

[9] A greater focus on settlement risk during the financial crisis resulted in more trades being settled on CLS and in more participants in the FX market seeking to join CLS (Melvin and Taylor (2009)). Moreover, while settlements are related to trading activity, they represent an imperfect measure. For example, a decrease in settlement activity can reflect either a decrease in trading, or a decrease in FX swaps relative to spot and forward transactions. Moreover, settlements within say a month include sides that were the result of trading in prior months.

[10] Different benchmarking techniques are used, for instance, by statistical agencies around the world to produce quarterly national accounts.

where $\{X_t\}_{t=1}^{T}$ is the benchmarked series, ie the outcome of the procedure, $\{I_t\}_{t=1}^{T}$ is the related high-frequency (or indicator) series, $\{A_s\}_{s\in\Omega}$ is the low-frequency series, and Ω is the set of dates on which the low-frequency series is observed (see Appendix for details on how to solve this problem).

From triennial to semiannual ...

To arrive at a higher-frequency series for global FX market activity, I apply a three-step approach. First, I construct an aggregate volume series for the FX committee surveys. I do this by simply adding up the individually reported volumes while adjusting for the fact that the surveys began at different points in time and that the survey for Japan is conducted only annually (Graph 3, right-hand panel).[11] Second, I use this aggregate volume series for the FX committee surveys to convert the Triennial Survey numbers to a semiannual frequency (Graph 4, left-hand panel). Finally, I use seasonally adjusted daily average settlement values from CLS to convert the constructed semiannual series to a monthly frequency (Graph 4, right-hand panel).[12]

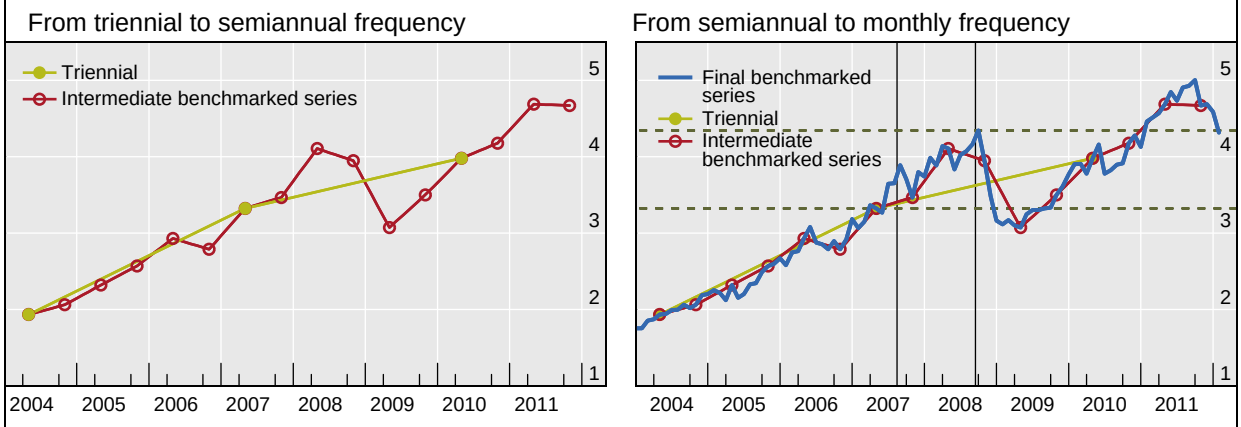
... and from semiannual to monthly time series

The analysis suggests that global FX activity grew close to linearly between the Triennials in 2004 and 2007. The only exception was an apparent lull in activity in the second half of 2006. In other words, the trend implied by simple interpolation provides a reasonable description of the development of FX activity over this three-year period.

The picture is quite different for the subsequent three-year period covering the recent financial crisis. During this period, global FX activity deviated considerably from the trend implied by the Triennial. The analysis suggests that global trading activity continued to grow both in the run-up to the onset of the

Benchmarked average daily FX trading activity

In trillions of US dollar equivalents



The vertical lines refer to 9 August 2007 and 15 September 2008. The horizontal lines indicate the 2007 Triennial Survey level and the peak reached during the financial crisis.

Source: BIS calculations. Graph 4

[11] The aggregate FX volume was adjusted up prior to the start of the AFXC, SFEMC, CFEMC and TFEMC surveys by assuming that their size relative to the FXJSC and FXC surveys was the same as reported in the initial surveys. Moreover, simple interpolation was used to fill in October values for the TFEMC survey with the exception of October 2011, where the growth rate of the other markets was applied to the TFEMC turnover.

[12] It is in principle possible to use multiple indicator series, but due to the shorter samples I did not use the additional data from the trading platforms.

crisis in August 2007 and during the first year of the crisis. FX activity reached $4 trillion per day perhaps as early as late 2007 and peaked during the tumultuous period around the Lehman bankruptcy in September 2008, at almost $4.5 trillion. Moreover, the start of the turmoil appears to have induced greater month-to-month volatility in activity. Subsequently, daily average activity fell by more than 30% – to just above $3 trillion in April 2009. That is, FX activity fell below the level of the 2007 Triennial.

Nonetheless, by mid-2009, global FX activity had started to pick up again and it rose to $4.0 trillion a day in April 2010, as reported by the last Triennial. Yet FX activity did not surpass the peak level experienced during the financial crisis until the turn of the year 2010–11. As such, the analysis paints a more nuanced picture than the Triennial, which shows FX trading activity being up 20% over the course of the financial crisis. The latest FX committee survey-based reading in October 2011 suggests a level of activity of about $4.7 trillion a day. In addition, our measure shows that FX activity may have reached $5 trillion per day in September 2011, before dropping off considerably by the end of the year and into January 2012.

Activity might have reached $5 trillion in September 2011 before dropping off considerably into 2012

Conclusion

The FX market is one of the most important financial markets in the world. It facilitates trade, investments and risk-sharing across borders. While good and timely data are available on prices of FX instruments, the same is not true for trading activity. The authoritative source on turnover (the Triennial) scores high on quality but gets lower marks for timeliness. In this article, I show how it is possible to leverage alternative sources on FX activity to obtain a timelier grasp of turnover developments. I produce a time series that, despite some caveats, is comparable to the headline number from the Triennial. The results show that FX activity continued to grow during the first year of the financial crisis but experienced a sharp drop after the Lehman bankruptcy, from which it recovered only slowly. Moreover, I find that trading activity was about $4.7 trillion per day in October 2011.

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Appendix

Following Bloem et al (2001), the first-order conditions for the proportional Denton technique can be found with the help of the following Lagrange function:

$$L_{\mathrm{Pr}op}(X_1,\ldots X_T;\boldsymbol{\theta}) = \sum_{t=2}^{T}[\frac{X_t}{X_{t-1}} - \frac{I_t}{I_{t-1}}]^2 + 2\sum_{s\in\Omega}\theta_s(X_s - A_s) \tag{2}$$

The first-order conditions, with respect to X_t, and benchmark restrictions constitute a system of linear equations that are straightforward to solve. For example, if T = 5 and $\Omega = \{1,5\}$, then the system is:

$$\begin{bmatrix} I_1^{-2} & -(I_1I_2)^{-1} & 0 & 0 & 0 & 1 & 0 \\ -(I_1I_2)^{-1} & 2I_2^{-2} & -(I_2I_3)^{-1} & 0 & 0 & 0 & 0 \\ 0 & -(I_2I_3)^{-1} & 2I_3^{-2} & -(I_3I_4)^{-1} & 0 & 0 & 0 \\ 0 & 0 & -(I_3I_4)^{-1} & 2I_4^{-2} & -(I_4I_5)^{-1} & 0 & 0 \\ 0 & 0 & 0 & -(I_4I_5)^{-1} & I_5^{-2} & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \\ X_5 \\ \theta_1 \\ \theta_5 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ A_1 \\ A_5 \end{bmatrix} \tag{3}$$

In matrix notation, we have:

$$\underset{T+S\times T+S}{\mathbf{O}} \cdot \underset{T+S\times 1}{\mathbf{X}} = \underset{T+S\times 1}{\mathbf{A}} \Rightarrow \underset{T+S\times 1}{\mathbf{X}} = \underset{T+S\times T+S}{\mathbf{O}^{-1}} \cdot \underset{T+S\times 1}{\mathbf{A}} \tag{4}$$

where the matrices are defined as suggested in the simple example.

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Bank stock returns, leverage and the business cycle[1]

The returns on bank stocks rise and fall with the business cycle, making bank equity financing cheaper in the boom and dearer during a recession. This provides support for prudential tools that give incentives for banks to build capital buffers at times when the cost of equity is lower. In addition, banks with higher leverage face a higher cost of equity, which suggests that higher capital ratios are associated with lower funding costs.

JEL classification: G3, G21, G28.

Capital planning plays a key role in banks' business decisions. The cost of equity financing and return targets on shareholders' funds shape banks' capital allocation and product pricing. Given the importance of equity capital in absorbing losses, prudential regulators require banks to hold sufficient equity to cover risks. Regulation that motivates banks to raise equity financing when capital is cheap would promote the interests of long-term shareholders. All these considerations call for a better understanding of what drives the cost of bank capital. One way to gauge this cost of equity is to analyse expected stock returns.

In this special feature, we examine how expected equity returns vary across a sample of globally active banks and over time in 11 countries. We estimate the determinants of the rate of return on bank stocks using a standard equity pricing framework that decomposes share price risk into a systematic and an idiosyncratic component. The systematic component cannot be diversified away, and it is priced in the market in the sense of commanding higher expected returns. The opposite holds for the idiosyncratic component, which can be diversified away in sufficiently large portfolios and hence is not priced in the market.

We show that leverage and the state of the business cycle affect the systematic (priced) component of the risk of bank stocks. Systematic risk differs across the stages of the business cycle: it is lower near the top of the

[1] The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. We are grateful to Claudio Borio, Stephen Cecchetti, Dietrich Domanski, Robert McCauley and Christian Upper for useful comments on earlier drafts. Michela Scatigna provided valuable research assistance.

cycle and higher around the trough. We also find that higher leverage is systematically associated with higher average stock returns. However, leverage also boosts the idiosyncratic (non-priced) risk component of bank stock, increasing the required size of the portfolio that can neutralise this risk. Finally, all else equal, banks regarded as highly systemically important by international regulators tend to have a lower average stock return and, hence, a lower cost of equity finance.

The rest of this article is organised in three sections. The next section outlines the empirical framework and describes the data. The following one discusses the findings concerning the effect of the business cycle and bank characteristics on the expected returns of individual bank stocks. The final section concludes.

Banks as equity investments

Bank stock variability …

Graph 1 depicts the performance of bank stocks relative to the broad market index for a number of advanced market economies. There is a common pattern across many markets. Bank stocks performed strongly between 1990 and 2007, with a brief reversal around the turn of the century, but they hugely underperformed during the past four years in the wake of the financial crisis. This pattern is very pronounced in the United States and the United Kingdom, but less so in continental Europe. The protracted period of strains in the Japanese financial system during the 1990s results in a different picture for the first half of the period shown in the graph.

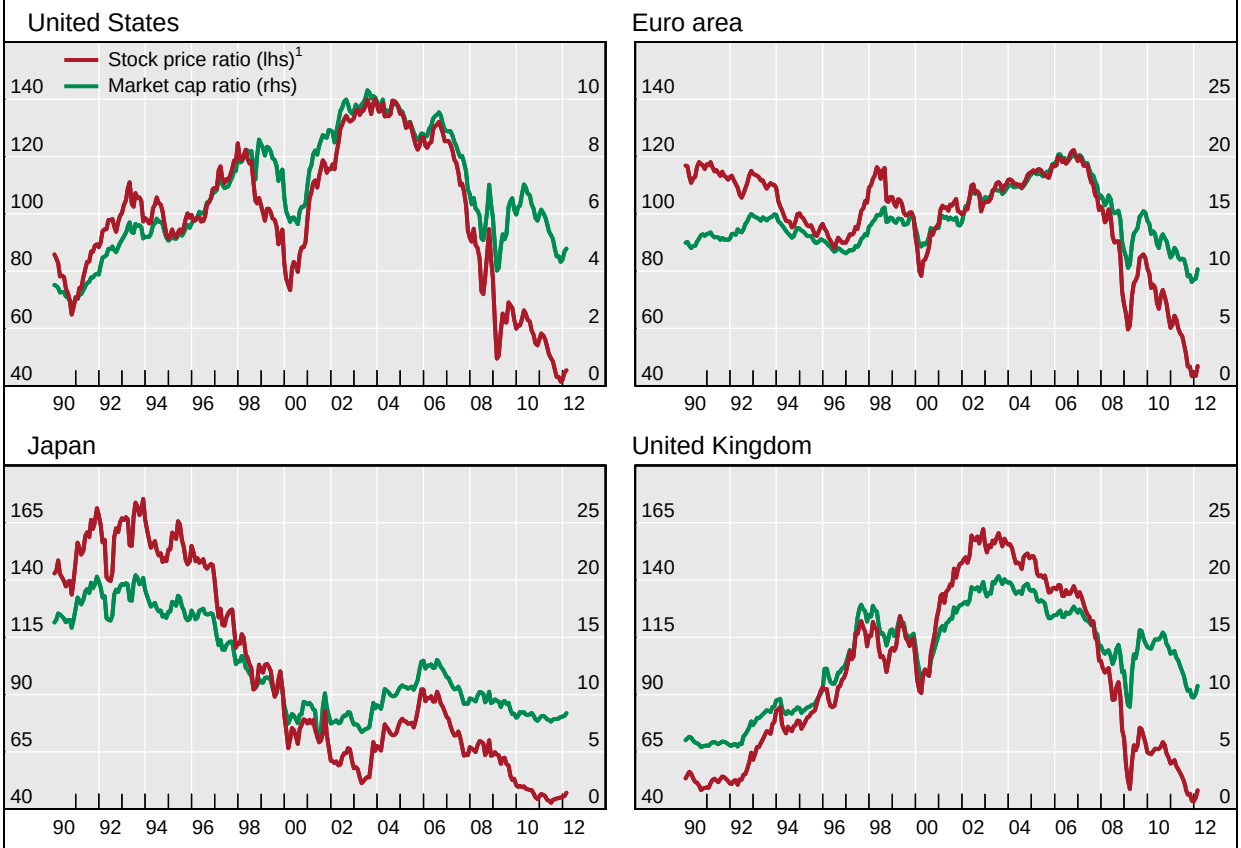
Banks represent a sizeable share of the broad market portfolio in developed equity markets. In the United States and the United Kingdom, this share grew substantially over the past two decades in line with the increase in financial activity. For example, at the end of 2011 banks made up around 5% and 10% of the overall market capitalisation, respectively, of the S&P 500 and FTSE 100 indices. This was roughly double their share at the beginning of the 1990s, albeit only half that on the eve of the crisis. The market capitalisation shares in continental Europe and Asia are currently about 8% and 10%, respectively, in both cases below their levels in 1990.

While the banking sector index depicts the general trend in bank equity prices, it is silent about the drivers of their performance. Understanding these drivers is important for equity market investors, bank managers and prudential regulators alike. For investors, a better understanding would inform portfolio decisions. For bank managers, the expected rate of return on shareholders' funds represents a key hurdle rate for business decisions. For policymakers, it would shed light on the incentives of bank shareholders and, by extension, bank managers. Furthermore, insight into the determinants of bank equity prices can also inform the calibration of policies to shape incentives for banks to build up loss-absorbing buffers in the most efficient way.

… can be explained by a three-factor model …

We use a standard asset pricing framework to examine the drivers of bank stock returns. The workhorse for our analysis is the factor pricing model that describes the cross section of equity returns and is used extensively in the empirical finance literature. The model describes the returns of an individual

Banking equity performance relative to broad indices



[1] Whole period = 100.

Sources: Datastream; BIS calculations.

Graph 1

stock in terms of its sensitivity (often referred to as "beta" or "loading") to a number of pricing factors that are themselves expressed as returns on specific stock portfolios (see box on page 48). One factor corresponds to the market portfolio (typically proxied by a broad-based index) as postulated by the Capital Asset Pricing Model (CAPM) (Sharpe (1964) and Lintner (1965)). Eugene Fama and Kenneth French identify the other two factors as *size* and *value*. The size factor is the difference in the return of a portfolio of small capitalisation stocks and another portfolio of large capitalisation stocks. It has been observed that smaller capitalisation stocks tend to have higher average returns, presumably as a result of higher growth opportunities. The value factor is defined as the difference in returns on the stocks of firms with high and low ratios of book-to-market values. Typically, firms with low book-to-market ratios tend to have consistently higher earnings and higher stock market returns than firms with high ratios.

... that distinguishes between systematic and idiosyncratic risk

The loading of individual stock returns on these three factors determines the systematic component of their risk. In other words, it represents the variability of the stock that is common with other stocks in the market and thus cannot be diversified away. As a result, this component of risk is priced in the market, in the sense that investors require a higher average return in order to hold stocks with higher systematic risk. The part of the variability of the stock that is not captured by its relationship with the three factors is the idiosyncratic

Modelling framework

The three-risk-factor pricing model is well established in the finance literature, as it has been found to explain a large fraction of the systematic movement of the equity returns of individual firms. The model combines the Capital Asset Pricing Model (CAPM) with two additional pricing factors identified by Fama and French (1992) to explain the cross-sectional and time variation of equity returns in excess of the risk-free rate. More concretely, the typical specification of the model is of the form:

$$R_t^i = \alpha + \beta_M \cdot R_{it}^{\ m} + \beta_{HML} \cdot HML_{it} + \beta_{SMB} \cdot SMB_{it} + u_{it}$$

The market factor (R_{it}^m) is the return on the broad market index corresponding to the individual bank. The *value* factor (*HML*) is the difference in the stock returns between a portfolio of firms with a high ratio of book-to-market valuation of their equity and one with a low valuation ratio. The *size* factor (*SMB*) is identified as the return differences between small and large capitalisation stocks.

We augment this framework by including the business cycle, leverage, earnings and book-to-market ratio as characteristics that influence individual banks' return sensitivities to the three pricing factors. Doing so, we assume that the Fama-French three-factor model is correctly specified and that it captures the dimensions of systematic risk, but it does not fully explain the variability of loadings across stocks. We therefore run regressions where, in turn, each of the four additional drivers are entered as interaction terms that essentially shift the loading of a stock on the three factors. For instance, in the case of leverage, we run the regression:

$$R_t^i = \alpha + \left(\beta_M + \beta_{LEV\_MKT} \cdot LEV_{it}\right) \cdot R_{it}^{\ m} + \left(\beta_{HML} + \beta_{LEV\_HML} \cdot LEV_{it}\right) \cdot HML_{it} + \left(\beta_{SMB} + \beta_{LEV\_SMB} \cdot LEV_{it}\right) \cdot SMB_{it} + \eta_{it}$$

We also estimate a parsimonious model (results reported in the last column of Table 1) with the following specification:

$$R_t^i = \alpha + \left(\beta_M + \beta_{LEV\_MKT} LEV_t^i + \beta_{Earning\_MKT} \cdot Earning_t^i\right) \cdot R_t^m + \beta_{HML} HML_t^i + \left(\beta_{SMB} + \beta_{CYL\_MKT} CYL_t^i\right) \cdot SMB_{it} + \varepsilon_t$$

where *LEV* is leverage defined as total assets over the market value of equity; *Earning* is net income over equity; and *BTM* is the book-to-market value of equity. *CYL* is the business cycle defined as the GDP growth deviation from a time trend. This variable is normalised to take discrete values of 1–4 on the basis of the quartile of its distribution over time.

The data used in this article cover the annual returns on the stocks of 50 actively traded global banks located in 11 OECD countries (Australia, Austria, Canada, France, Germany, Japan, the Netherlands, Spain, Switzerland, the United Kingdom and the United States) for the period 1990–2009. Banks are included in the sample until their stock is no longer traded. When two banks merge, only the surviving entity stays in the sample.

We complement the return data with information about banks' consolidated balance sheets and income statements, and country-specific macro data. For market indices, we take the national stock market index for each country. More specifically, we use the S&P 500 (United States), FTSE 100 (United Kingdom), TSX (Canada), CAC 40 (France), DAX (Germany) and Nikkei (Japan). The Fama-French factors are taken from Kenneth French's website. The value factor is available for each country, while the size factor is available only at the global level.

risk of the firm's equity. Since this risk can be diversified away in large portfolios, it is not priced in the market and does not command a higher return.

The general framework is used extensively in the literature to explain the movement of stock returns both over time and in the cross section. For example, Campbell et al (2001) use it to measure the level of idiosyncratic risk

over time. Fama and French (2004) provide a summary of the related literature. More recently, Da et al (2012) conclude that the framework does a good job in providing estimates of the cost of capital for non-financial firms. Fewer studies have focused on bank stocks. This is partly because bank equity prices are likely to be influenced by regulation and the safety net. That said, Schuermann and Stiroh (2006) have found that the three factors account for the lion's share of the systematic risk in individual bank stocks. Stiroh (2005) investigated whether additional factors, such as different interest rate spreads, can explain bank-level equity returns, but he did not find strong evidence supporting that fact. Demsetz and Strahan (1997) drew the conclusion that larger banks are more diversified (ie have a lower share of idiosyncratic risk) than smaller banks, but they are not less risky overall because they operate with more leveraged balance sheets.

The model is augmented with …

We augment the standard framework by including the business cycle and three bank-specific characteristics as additional drivers of the systematic risk in banks' stock prices. In particular, we consider three bank-specific variables: leverage, earnings and book-to-market valuation.

… the business cycle …

Intuitively, the state of the business cycle can influence bank equity prices through its impact on bank assets. During an economic boom, default rates for loans to households and firms decline. This, in turn, boosts bank earnings and can mitigate investors' perception of the risk in bank profits, thereby lowering their required return on bank stocks. Recessions have the opposite impact on loan values and bank earnings, thereby raising required returns. In fact, the impact is arguably asymmetric. The negative influence near the bottom of the cycle is stronger than the positive influence near the top of the cycle, given that credit losses that materialise a in a recession were typically underpriced during the preceding boom. We measure the business cycle as the deviation of GDP growth from its time trend.

… leverage …

Bank balance sheets are highly leveraged. The average ratio of total assets to shareholders' capital is about three for non-financial companies, but it is six times that figure for banking firms.[2] From the shareholders' perspective, higher bank leverage boosts the return on equity for any given level of bank profits. This, however, imposes higher risk, since leverage also increases the volatility of that return. Indeed, in most advanced economies bank equity prices have been more volatile than those of non-financial companies in the last four decades.[3] We measure leverage as the ratio of total assets to the market value of equity (ie market capitalisation).[4]

…book-to-market ratio …

Arguably, financial companies' financial statements are harder to assess than those of other firms, as they are more opaque. The difference between the book and market value of a bank is a proxy for that opaqueness, which can be traced to the predominance of information-intensive, and often complex,

[2] See BIS (2010) for details.

[3] See reference above.

[4] We also used the ratio of total assets to book value of equity as an alternative measure of leverage and obtained very similar results.

financial instruments on banks' balance sheets. Conservative valuation practices, often induced by regulatory decisions, tend to build buffers by setting higher thresholds for the recognition of gains than losses.[5] This, combined with leverage, can possibly increase the wedge between the book and market value of banking firms.

... and earnings history ...

Earnings capacity is a key element in the stock market valuation of firms. Higher sustainable profits should lead to higher dividend payments and boost firms' equity values. We use past earnings as a proxy for future cash flows and hence for payments to shareholders. To the extent that bank managers smooth earnings, they also increase the correlation between reported earnings in consecutive years and augment the salience of this driver.

... each interacting with the risk factors

We postulate that these three drivers affect bank equity performance indirectly. Rather than treating them as independent sources of systematic risk, we assume that they affect bank share prices through their influence on the sensitivity (loadings) of the stock to the three established factors. To formally assess the influence of these characteristics, we include interaction terms between them and the three market pricing factors. The idea is that the coefficients of these interaction terms act as shift parameters, capturing how the sensitivity of returns to systematic risk vary in line with the bank characteristics. The box on page 48 describes in greater detail the specification of the estimation framework and the data used.

We take this approach for empirical reasons. We interpret the large asset pricing literature as suggesting that the Fama-French factor model is a robust specification of the systematic risk in equity returns. It can explain the cross-sectional variations in stock returns quite well. Thus, we do not construe our additional drivers as additional dimensions of systematic risk.[6] Instead, we assume that they help describe the way individual bank stocks relate to these factors by affecting the risk loadings. For example, leverage amplifies risk and return to holders of the bank's equity but does not alter the nature of the risk, which is determined by the business model of the firm. It is thus expected to increase the loading on the risk factors. Similar arguments can be made for the other bank characteristics and the business cycle. This approach accords with findings that factor loadings vary both over time and across stocks. In particular, Fama and French (1997) have demonstrated this result in the US equity market, while Schuermann and Stiroh (2006) and King (2009) have done so for bank stocks. We contend that the drivers can help explain this variability in factor loadings.

Determinants of required stock returns for banks

We next discuss the impact of the different drivers on the sensitivity of bank stock returns to the systematic risk factors. Table 1 presents the results of our empirical analysis. Each of the first four columns reports regressions that, in

[5] See Borio and Tsatsaronis (2005) for a discussion of valuation conservatism.

[6] This is consistent with the findings in Schuermann and Stiroh (2006).

addition to the three risk factors, include interaction terms of the factors with a specific driver. The last column of the table reports the results of a parsimonious specification that includes only statistically significant interaction terms. At the end of the section, we consider separately the stock price returns for more systemically important banks (Table 2).

Business cycle and bank returns

Bank returns are procyclical

Bank equity returns are more sensitive to systematic risk near cyclical troughs than they are near the top of the cycle. More specifically, the first column in Table 1 shows the estimates of the interaction terms between the variable depicting the cyclical phases and the three pricing factors. Negative coefficients indicate that bank stocks are more sensitive to the market and size factors in economic downturns. The result is most pronounced in the case of the size factor. The loading on size increases by 15 basis points when GDP growth deteriorates by moving down one quartile.

Another way to gauge the overall effect of the business cycle on average stock returns is to multiply the average value of the two risk factors by the difference between the coefficient on the interaction term between the top and bottom quartiles of the output gap. The average value of the market factor is about 4% and that of the size factor 2%. This implies that the sensitivity of the return on bank stocks can increase by 162 basis points when economic activity moves from peak (top quartile) to trough (bottom quartile). Put in different words, the returns that bank equity investors demand can be higher by 1.62 percentage points in recessions. This is consistent with the stylised fact that firms' equity issuance is procyclical (see Covas and Den Haan (2010) and Choe et al (1993)).

Leverage and bank returns

The regressions confirm the assertion that higher leverage leads to a higher sensitivity to systematic market risk (Table 1, second and fifth columns). If the ratio of a bank's total assets to its equity increases by 10 and the market return is 4% in excess of the risk-free rate, the bank pays 0.4% more for every unit of equity in the form of a higher expected return to investors holding its stock. This is the increase in risk that is priced in the equity market.

Leverage increases the cost of equity

In addition to increasing the required return on bank stocks, leverage also boosts the idiosyncratic risk of the stock. The volatility of the regression residuals captures this component of risk in our model. Banks that are more leveraged tend also to have residuals that have a higher variance. Given that idiosyncratic risk is not priced, the holder of the stock would need to diversify it away in larger portfolios. Given the potential impact on equity investors, it is useful to gauge the relative impact of higher leverage on the systematic and non-systematic risk components. To that effect, we perform a "back of the envelope" exercise in two stages, focusing on the regression reported in the third column of Table 1. In the first stage, we remove the direct impact of all risk factors from the bank returns and all leverage interaction terms. This is achieved by running four regressions on a constant and each of the three

Business cycle, leverage and bank returns

	Business cycle	Leverage	Earnings	BTM	Overall
Market	1.29***	0.88***	1.18***	0.90***	0.98***
	(17.25)	(18.23)	(27.62)	(13.84)	(19.85)
HML	0.23**	0.53***	0.48***	0.49***	0.40***
	(2.56)	(7.62)	(7.96)	(5.97)	(7.04)
SMB	0.48***	0.21**	0.02	0.18	0.47***
	(3.23)	(2.03)	(0.24)	(1.52)	(2.89)
CYL_Market	–0.06**				
	(–1.99)				
CYL_HML	0.05				
	(1.49)				
CYL_SMB	–0.15***				–0.14**
	(–2.62)				(–2.33)
LEV_Market		0.01***			0.01***
		(7.44)			(6.47)
LEV_HML		–0.00			
		(–0.14)			
LEV_SMB		–0.02**			
		(–2.42)			
Earning_Market			–1.08***		–0.90***
			(–5.02)		(–5.54)
Earning_HML			–0.42*		
			(–1.77)		
Earning_SMB			0.66		
			(1.53)		
BTM_Market				0.27***	
				(4.29)	
BTM_HML				–0.04	
				(–0.49)	
BTM_ SMB				0.27**	
				(–1.97)	
Constant	1.61**	2.23***	1.92**	2.25***	2.35***
	(2.17)	(2.62)	(2.38)	(2.74)	(2.96)
Number of observations	1,176	689	790	794	790
R^2	0.56	0.64	0.62	0.61	0.64

The dependent variable is the excess return on bank equity. Market, HML and SMB are the market, value and size factors, respectively. The other explanatory variables are interaction terms between the business cycle (CYL) and the three factors, between market leverage (LEV) and the three factors, between earning yields (Earning) and the three factors, and finally between the book-to-market ratio (BTM) and the three factors. The models are estimated as pooled ordinary least squares (OLS). Numbers in parentheses show *t*-statistics. *, ** and *** indicate significant level of 10%, 5% and 1%, respectively.

Source: Authors' calculations. Table 1

systematic factors. The dependent variables in these regressions are the stock returns and the three leverage interaction terms. In the second stage, we assess the effect of leverage on returns conditional on the three risk factors by regressing the residuals of the first of these regressions (the one that corresponds to the stock returns) on the residuals of the other three

regressions (the ones that correspond to the three systematic factors). The goodness-of-fit of this second-stage regression measures the proportion of the variability in stock returns explained by leverage, net of the direct influence of the three factors. This is the contribution of leverage to systematic risk. Its complement – that is, the unexplained proportion of return variability – is a measure of the impact of leverage on the risk of the stock that is not priced in the market. Our estimate for the goodness-of-fit of this second-stage regression is 12%. This suggests that only about one eighth of the overall increase in the volatility of equity returns due to higher leverage is priced. The remaining increase represents risk that is idiosyncratic, which does not command higher returns and which can only be diversified in large portfolios.

How would deleveraging affect a bank's weighted average cost of funds? Our results suggest that if leverage declines, the cost of equity will also fall. For example, if leverage of the average bank halves to 10, the market beta would fall by 10 basis points. This implies that the average equity factor for banks will fall by 0.4% to 13.0%. Assuming a 5% cost of debt, the weighted average cost of funds for the bank would be 5.8% (ie 0.10*13.0% + 0.90*5%).[7] This is only about 40 basis points higher than when leverage is equal to 20, the average value in our sample. Critically, this calculation ignores any beneficial effects on the costs of bank debt from the fact that lower leverage lowers the risk of default. Any such effect would tend to make this reduce the estimated increase in the cost of capital. These results are in line with the very small impact on the cost of funding associated with large increases in bank capital estimated by Kashyap et al (2010) for US banks and Miles et al (forthcoming) for UK banks.

Book-to-market value and banks' returns

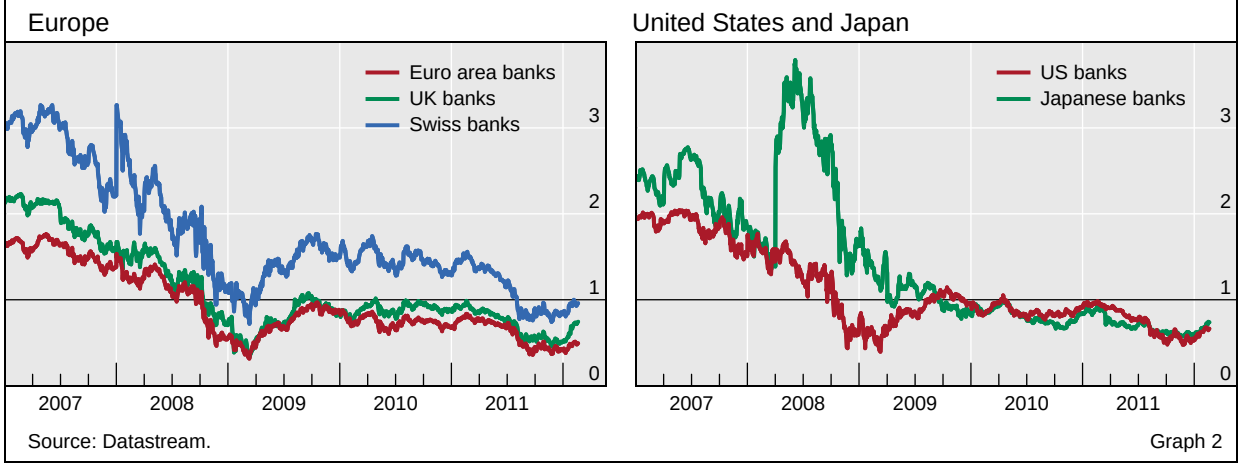
What is the role of market valuation in bank stock returns? The ratio of book value to market value of equity (BTM) is often used as an indicator for firms' future earnings capacity. Put another way, if investors have a favourable view of a firm's future earnings, they will push up the price of its stock, thus lowering its cost of equity and creating incentives for managers to undertake additional investment. By contrast, financial stress would coincide with rising BTM ratios. From 2008, the BTM ratio rose around 50% for most banks in the sample (Graph 2). The increases were particularly pronounced for German, Austrian and Dutch banks. In sharp contrast, the recent crisis has hardly affected the BTM ratios of banks in Australia, Canada and Japan.

Opacity increases risk sensitivity

We find that banks with a high BTM also have a higher loading on systematic risk and hence a higher cost of equity (Table 1, third column). Higher systematic risk means that these banks need to sell more shares in order to raise a given amount of equity, thus imposing a greater dilution on the value of holdings of existing shareholders. This will also have detrimental effects on the return on equity and management compensation that are often tied to this metric of performance. Thus, high book-to-market value could discourage bank shareholders and managers from raising fresh capital.

[7] The calculation is based on the assumption that the market, size and value factor are at their sample averages of 4%, 1.9% and 4%, respectively.

Bank price-to-book ratios



Source: Datastream.

Graph 2

Profitability and bank returns

Cost of equity declines with profitability

Empirical research has found that highly profitable firms face a lower cost of equity funding (for example, Hail and Leuz (2006)). This work has not looked at banks. In the third column of Table 1, we use earnings (defined as net income over equity) to proxy for future profitability. We find that high profitability compresses the market beta. In other words, more profitable banks tend to be less correlated with the market return, facing therefore a lower risk premium. This could reflect the extra buffer that higher profits afford to banks that would like to preserve stable cash distributions to shareholders through earnings and dividend smoothing.

Using our estimates in the parsimonious model, we calculate the cost of equity for banks. Graph 3 shows how this cost varies over time and across countries. We find that banks in the United Kingdom have the lowest estimated cost of equity (about 5.5% on average), followed by their Japanese peers. In contrast, banks in Germany are confronted with a high average cost of equity, nearly 15%. US and Canadian banks face a more moderate cost of equity, of around 7.5%.

What factors account for the cross-country differences in the cost of equity? It is tempting to attribute these differences to country-specific characteristics, but we do not find evidence to support this hypothesis. Controlling for country effects, we do not find them to be statistically significant. This suggests that differences in the factors account for most of the variations. For example, the elevated cost of equity for German banks can be mainly attributed to an average ratio of assets to equity of around 40, twice the sample average. Similarly, below-average earnings also contributed to high required returns for these banks. In the case of the United Kingdom, low costs of equity are linked to very low values of the market factor (below 1%) and the value factor.

Systemic importance of banks and the cost of equity

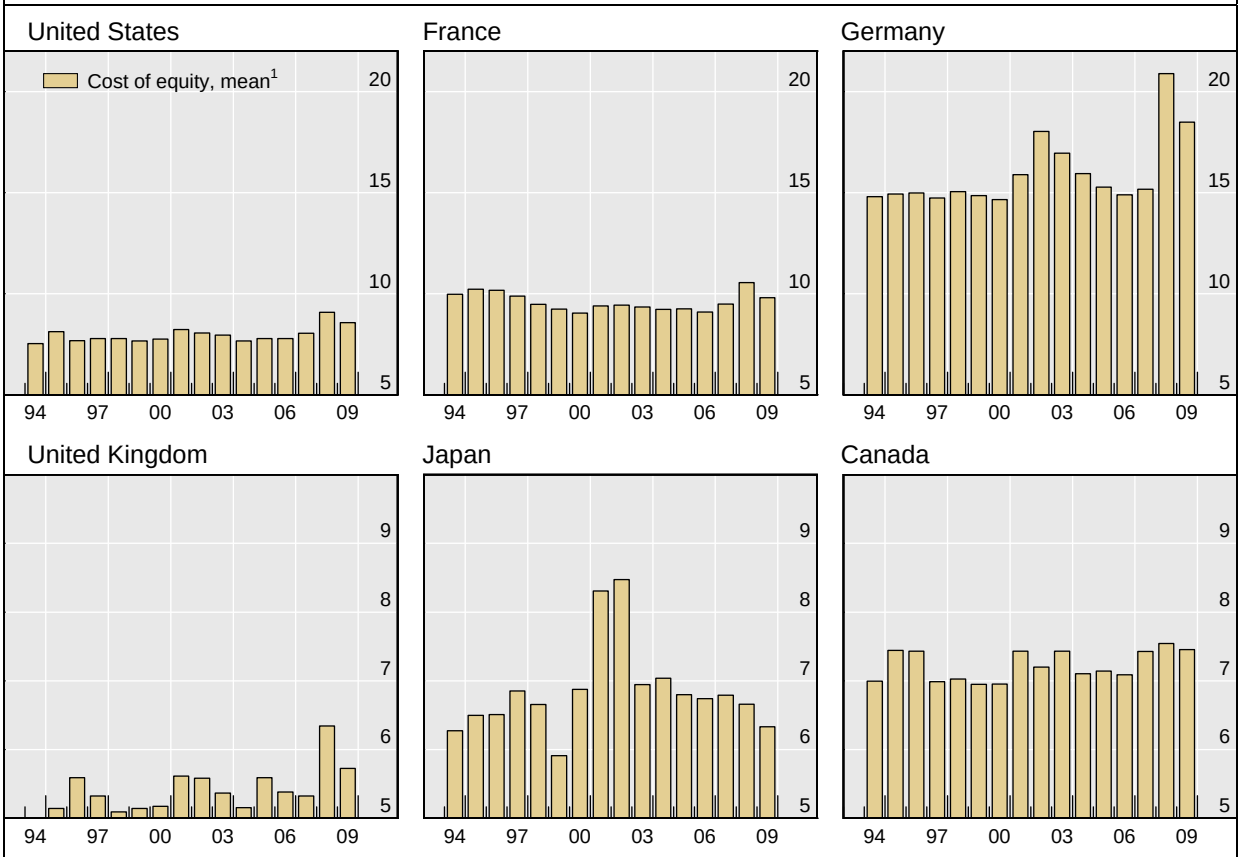
The presence of the financial safety net can affect the behaviour of bank stock prices. Explicit provisions such as deposit insurance and the access to liquidity facilities by the central bank, as well as the perceived availability of state support in times of distress, can affect market discipline by numbing creditors' sensitivity to risk-taking by banks. Besides lowering the cost of debt financing, this also means that shareholders of banks that are more likely to receive support may require a lower return on their investment, in line with the reduced risk of the bank failing.

Systemically important banks have a lower cost of equity

In order to assess the impact on the sensitivity of stock market returns for these banks, we focus explicitly on banks that were included in the list of global significantly important institutions published by the Financial Stability Board. Our dataset covers 22 banks among the 29 included in this list of global systemically important banks (G-SIBs). The average G-SIB has total assets of $986 billion, leverage of 26 and a book-to-market ratio just above unity. For comparison, the other banks in the sample are smaller, with total assets of

Required return on equity and business cycles (inflation-adjusted)

In per cent



[1] Annual estimates of the cost of equity for each country's banking sector are calculated by averaging all values for the banks headquartered in that country on an equally weighted basis. For each bank, the cost of equity figures represent the estimated required equity market return for the bank in excess of the risk-free interest rate. The bank-specific cost of equity is equal to a sum of estimated betas (market, value and size beta) multiplied by the average factor returns. The figures are expressed in real terms by subtracting inflation expectations which are taken from consensus forecasts.

Source: Authors' estimates. Graph 3

Required return on equity: G-SIBs vs other banks		
	G-SIBs	Other banks
Market	1.01***	0.99***
	(9.66)	(13.75)
HML	0.39***	0.41***
	(3.61)	(6.17)
SMB	0.54	0.29
	(1.42)	(1.64)
CYL_SMB	–0.04	–0.18***
	(–0.29)	(–2.71)
LEV_Market	0.01***	0.01**
	(6.55)	(2.46)
Earning_Market	–0.93***	–1.04***
	(–4.14)	(–4.21)
Constant	0.92	2.82***
	(0.57)	(3.09)
Number of observations	224	559
R^2	0.72	0.61

The dependent variable is the excess return on bank equity. Market, HML and SMB are the market, value and size factors, respectively. The other explanatory variables are interaction terms between the business cycle (CYL) and the three factors, between market leverage (LEV) and the three factors, between earning yields (Earning) and the three factors, and finally between the book-to-market ratio (BTM) and the three factors. The models are estimated as pooled ordinary least squares (OLS). Numbers in parentheses show *t*-statistics. *, ** and *** indicate significant level of 10%, 5% and 1%, respectively.

Source: Authors' calculations. Table 2

$250 billion on average, less leveraged, with leverage of 20, and a book price around 75% of the market price for equity.

In Table 2, we report the results of the parsimonious regression specification, splitting the sample between the G-SIBs and the rest. We find that both market and value factors are significant drivers of average stock returns for G-SIBs. We also find that leverage amplifies the impact of the market factor to a similar degree for both groups of banks. In addition, high profitability reduces the correlation between bank shares and the market factor, but this effect is slightly more pronounced for less systemically important banks. Interestingly, G-SIBs' returns do not exhibit any clear cyclical pattern. This could reflect big banks' real, or perceived, ability to smooth the effect of the cycle on earnings or to diversify away risk across business lines and countries. On the basis of these estimates, equity investors in G-SIBs require on average about a 6% return compared with about 8% for the other banks with a similar leverage or BTM ratio.

Conclusion

The results of our analysis provide support for the regulatory reform embodied in the most recent revision of the Basel prudential framework for banks. In particular, they suggest that higher capital requirements can be beneficial to

equity investors by restraining bank leverage, and provide an additional rationale for the introduction of countercyclical capital buffers.

Our analysis shows that it is cheaper for banks to raise capital during an economic expansion than in a recession. The low hurdle rate for investment in a boom can have a procyclical effect. It encourages credit growth that can further boost economic activity. From a prudential viewpoint, this evidence supports the rationale behind the introduction of countercyclical capital buffer requirements, which increase in booms and decline in busts. This would provide a concrete incentive for banks to build buffers when equity is relatively cheap, rather than having to do so after capital is depleted and the cost of balance sheet repair is higher.

One of our findings is that even though the equity market rewards leverage with higher returns, balance sheet gearing also comes with higher stock price volatility. In fact, most of the increased volatility in bank stock returns associated with higher leverage is not priced in the market. This means that stricter capital rules not only reduce leverage and lower the required return in the stock market, but also reduce non-remunerated volatility for the holders of bank equity, making diversification easier. Moreover, the fact that lower leverage goes hand in hand with lower required returns downplays industry concerns that higher capital requirements will imply a material increase in funding costs. The finding that G-SIBs enjoy a lower cost of capital compared with other banks with similar characteristics supports the motivation behind the requirement for capital surcharges decided by the international policy community.

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