

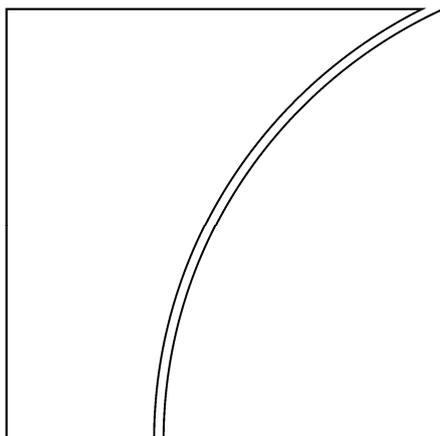


BANK FOR INTERNATIONAL SETTLEMENTS

# **BIS Quarterly Review**

December 2011

International banking  
and financial market  
developments



BIS Quarterly Review  
Monetary and Economic Department

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# BIS Quarterly Review

December 2011

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## Notations used in this Review

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

Differences in totals are due to rounding.

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.

## Euro area sovereign crisis drives global financial markets<sup>1</sup>

News on the euro area sovereign debt crisis drove most developments in global financial markets between early September and the beginning of December. Amid ratings downgrades and political uncertainty, market participants demanded higher yields on Italian and Spanish government debt. Meanwhile, difficulties in meeting fiscal targets in a recessionary environment weighed on prices of Greek and Portuguese sovereign bonds.

Conditions stabilised somewhat in October on growing optimism that the end-month EU summit would propose comprehensive measures to tackle the crisis. But by November, investors were growing sceptical about the adequacy of some of these measures. Sovereign bond yields then rose across the euro area, including for higher-rated issuers.

In the meantime, financial institutions with direct exposure to euro area sovereigns saw their costs and access to funding deteriorate. Affected banks took measures to further reduce leverage, selling assets and tightening credit terms. Financial institutions also sold certain types of assets to counter increases in the volatility of their portfolios. This included emerging market securities, whose prices plunged in September and fell again in November, while those of safe haven assets rose in a corresponding flight to quality.

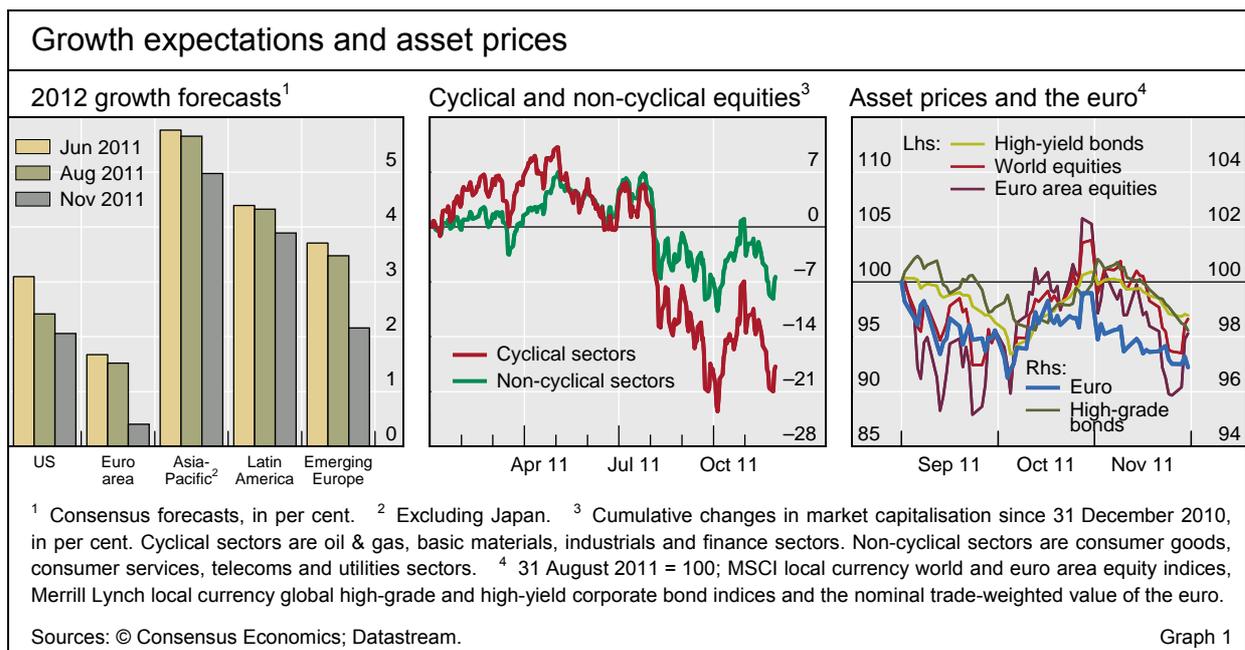
### Global growth expectations continued to deteriorate

Alongside developments in euro area sovereign bond markets, declining expectations of global economic growth pulled down growth-sensitive asset prices in September. These revisions were driven by a weakening outlook for the euro area and, to a lesser extent, emerging markets (Graph 1, left-hand panel). They followed previous growth downgrades in August, which had been led by a deteriorating outlook for the United States. By October, many forecasters were expecting the euro area economy to contract in the final quarter of this year and the first months of next year, but still to grow modestly through 2012 as a whole. Among emerging markets, analysts revised down

Growth-sensitive  
asset prices fall in  
September ...

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<sup>1</sup> The analysis covers the period to 1 December 2011. Questions about the article can be addressed to [nick.vause@bis.org](mailto:nick.vause@bis.org) or [goetz.vonpeter@bis.org](mailto:goetz.vonpeter@bis.org); questions about data and graphs should be addressed to [magdalena.erdem@bis.org](mailto:magdalena.erdem@bis.org) and [garry.tang@bis.org](mailto:garry.tang@bis.org).



forecasts for growth in the emerging Europe region most sharply, anticipating a swift deceleration in credit growth. They also cut growth forecasts for emerging markets in the Asia-Pacific region, reflecting some sharp slowdowns in export growth, notably in China, and the devastating flooding in Thailand. Growth-sensitive asset prices consequently fell in September. This included prices of industrial metals and energy as well as equity prices, especially in cyclical sectors (Graph 1, centre panel).

Monetary authorities responded to this further weakening of the global growth outlook with extra stimulus, which provided some support for growth-sensitive asset prices from late September. On 21 September, the Federal Reserve announced plans to buy an additional \$400 billion of US Treasury securities with residual maturities over six years and to sell an equal value of Treasuries with residual maturities of less than three years (see also pages 73–83 of this issue). The difference between 10-year and two-year US Treasury yields fell by 10 basis points on the day of the announcement, mainly due to a decline in the longer-term yield. On 6 October, the Bank of England expanded its Asset Purchase Programme, which invests mainly in gilts, by £75 billion. This was a little earlier and for a larger amount than many had expected. Sterling depreciated by 0.7% in trade-weighted terms on the day of the announcement, while gilt yields were essentially unchanged. The Bank of Japan also added ¥5 trillion of Japanese government bonds to its asset buying plans on 27 October. On 1 November, the Reserve Bank of Australia announced a 25 basis point cut to its main policy rate, as did the ECB two days later. A further ECB rate cut before the year-end of at least 25 basis points was priced into forward contracts. The Brazilian, Indonesian and Israeli central banks also cut policy rates.

... but then gain some support from monetary stimulus

Later in November, a US Congressional committee negotiating budget cuts for the next 10 years failed to reach agreement, adding to near-term growth fears. The lack of agreement set \$1.2 trillion of backstop spending cuts to trigger from 2013. It also left the fiscal stance for 2012 uncertain by failing to

resolve whether temporary payroll tax cuts and enhanced unemployment benefits would be extended beyond the end of this year. According to current plans, the US government would remove more than 2% of GDP of fiscal stimulus in both 2012 and 2013. The S&P 500 equity index fell by almost 2% on 21 November, the day that the committee's negotiating deadline expired.

## The euro area sovereign debt crisis reaches a decisive stage

From September, growing concerns about euro area debt sustainability overshadowed market participants' preoccupations with a weakening outlook for growth as the main driver of asset prices. Indeed, market prices closely tracked the value of the euro, reflecting the central role of euro area developments throughout this period (Graph 1, right-hand panel).

Markets went through three distinct phases in as many months. In September, European equity markets underperformed other developed market equities on fears of another recession and the possibility of a disorderly default. In October, equity markets recovered on growing optimism that politicians would finally rally behind a comprehensive plan to tackle the crisis. All markets staged a relief rally the day after the euro area summit of 26 October. The third phase, starting 1 November, was a rollercoaster ride on intense political news flow over a proposed Greek referendum and leadership crises in Greece and Italy. Markets failed to recover even as reform-minded governments came to power in both countries. Indeed, bond markets witnessed bouts of intense selling pressure drawing ever wider circles. As a result, measures of volatility in bond and equity markets remained at elevated levels. Towards the end of November, equity and bond markets began to recover some of the earlier losses.

Mounting market  
pressure ...

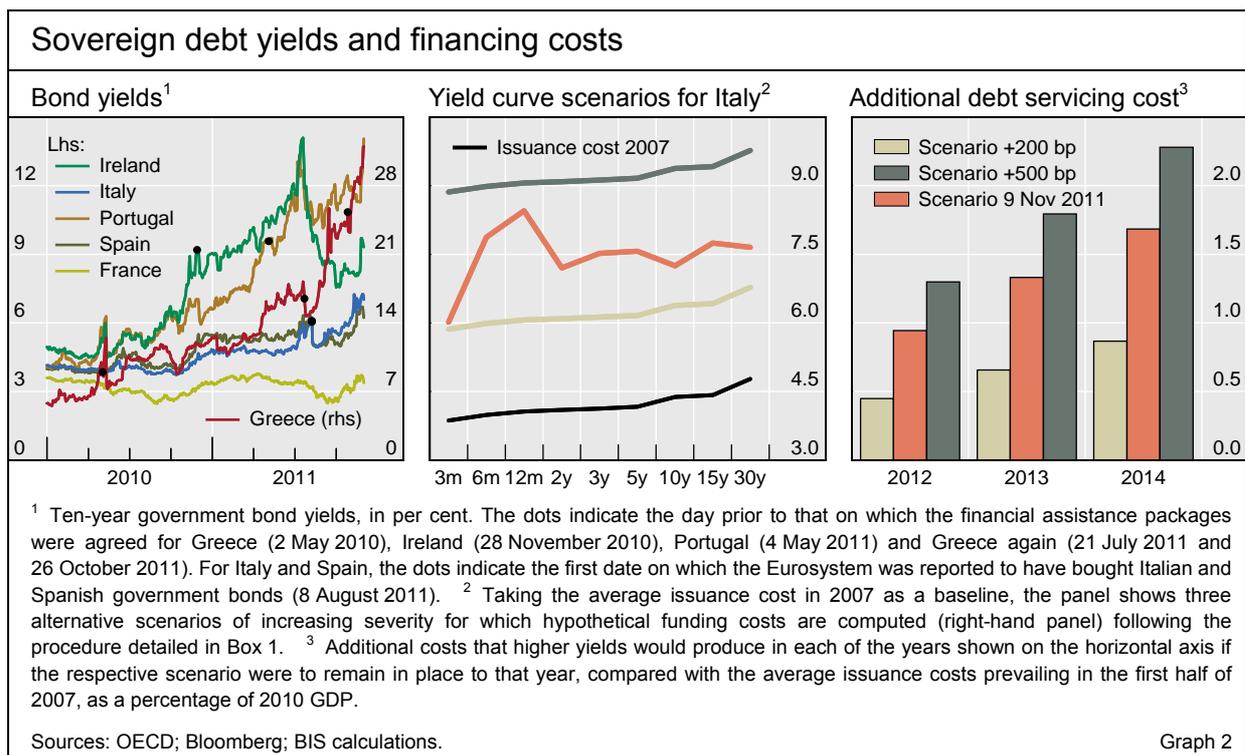
Throughout these months, a run of poor economic data and policy uncertainty put pressure on bonds issued by euro area sovereigns with high debt burdens. Greek and Portuguese bond yields rose further, reflecting difficulties in meeting fiscal targets with their economies mired in recession. Export growth in Ireland, by contrast, brought yields and credit default swap (CDS) premia down to levels prevailing before the country had resorted to multilateral funding in November 2010 (Graph 2, left-hand panel). Amid ratings downgrades and political uncertainty, market participants demanded higher yields on Spanish and Italian debt. Even highly rated sovereigns, notably France, saw their yields increase. Growing concerns over the creditworthiness of Italy eventually led two-year CDS premia to rise above 10-year premia as traders bet on a nearer-term credit event.<sup>2</sup>

... results in policy  
action

The build-up of tensions in bond markets and the associated bank funding problems forced policymakers to seek comprehensive measures for restoring confidence. On 26 October 2011, euro area heads of state agreed to a three-

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<sup>2</sup> Credit events with respect to sovereign debt obligations include the failure to pay, repudiation or moratoriums, or restructuring (ie a reduction in interest or principal payments, their deferral, subordination or re-denomination into another currency).



pronged approach combining debt relief for Greece, leveraging of the European Financial Stability Facility (EFSF) and the recapitalisation of banks (Table 1).<sup>3</sup> The summit announcement triggered a sizeable rally in global financial markets on the belief that certain downside risks had been eliminated. While equity and credit markets rallied, the response was more muted in the bond market, as analysts reckoned that the funds to leverage the EFSF would have to come from this same market. Global bank equity and Greek bond prices first strengthened, as the envisaged 50% writedown was smaller than

Measures agreed at the euro area summit on 26 October	
Objective	Measures
Reduce the Greek debt burden	A voluntary bond exchange with a nominal discount of 50% on notional Greek debt held by private investors, with the aim of bringing the debt-to-GDP ratio down to 120% by 2020. To this private sector involvement, euro area member states contribute up to €30 billion, and stand ready to provide additional financing of up to €100 billion.
Secure funding to sovereign issuers	Plans for the EFSF to attach partial risk protection to newly issued government debt covering 20–30% of losses, and leverage up the Fund's capacity to purchase debt beyond €440 billion through co-investment funds raising money from private and public sources.
Restore confidence in the banking sector	Plans to set up a public bank debt guarantee scheme and to require 70 EU banks to: (i) meet a temporary capital buffer against their sovereign exposures being marked to market; and (ii) attain a core Tier 1 capital ratio of 9% by June 2012. Preliminary estimates revealed an aggregate capital shortfall of €106 billion.

Sources: European Union; European Banking Authority. Table 1

<sup>3</sup> A follow-up European summit took place on 8–9 December, after this article went to press.

what bond prices and circulating proposals had indicated. CDS premia initially dropped on the understanding that CDS contracts would not trigger under a voluntary debt restructuring.

The rally proved short-lived, however. Even before the surprise announcement of a Greek referendum plunged markets into pondering endgame scenarios on 1 November, market participants were harbouring doubts about how these measures would be implemented. Although the referendum was cancelled three days later, political uncertainty continued to unsettle markets. On 9 November, dramatic intraday movements in Italian bond yields took market participants by surprise. Following the decision by a UK-based clearing house to raise margin requirements, Italian 10-year bonds lost 5% in value as yields soared to 576 basis points above the German bund.

This episode sparked concerns that a prolonged period of bond market turbulence could end in a self-fulfilling funding crisis in the third largest bond market in the world.<sup>4</sup> Yet simple simulations (see Box 1) of the debt service costs to the Italian Treasury in different yield curve scenarios (Graph 2, centre panel) suggest that Italy should be able to withstand elevated yields for some time, provided it retains access to the market. Given the relatively high average residual maturity of the Italian public debt (seven years), it would take a long time for elevated yields to translate into significant additional debt service costs. If the yield curve observed on 9 November persisted throughout the year 2012,

### Box 1: Simulation of Italian debt service costs

This box describes the estimation of Italian government debt service costs in various yield curve scenarios. The baseline yield curve uses the average issuance cost prevailing in the first half of 2007, before the global financial crisis erupted. Two scenarios shift the entire baseline yield curve up by 200 and 500 basis points, respectively, while an additional scenario uses the Italian yield curve observed on 9 November 2011 (Graph 2, centre panel).

The next step consists in constructing a database of all debt securities outstanding at each point in time. To do so, we first calculate a time path of future interest payments on and redemptions of existing debt, and subtract the government's forecast of future primary surpluses to obtain gross issuance needs. In meeting those needs, we assume that the Italian Treasury maintains the issuance policy followed in the years 2010–11, namely rolling over the same share of total issuance in 2010–11 for every maturity. This presumes that the Treasury does not dynamically adapt its issuance policy by altering maturities in response to changes in the yield curve. Our estimates are thus likely to overestimate debt service costs somewhat.

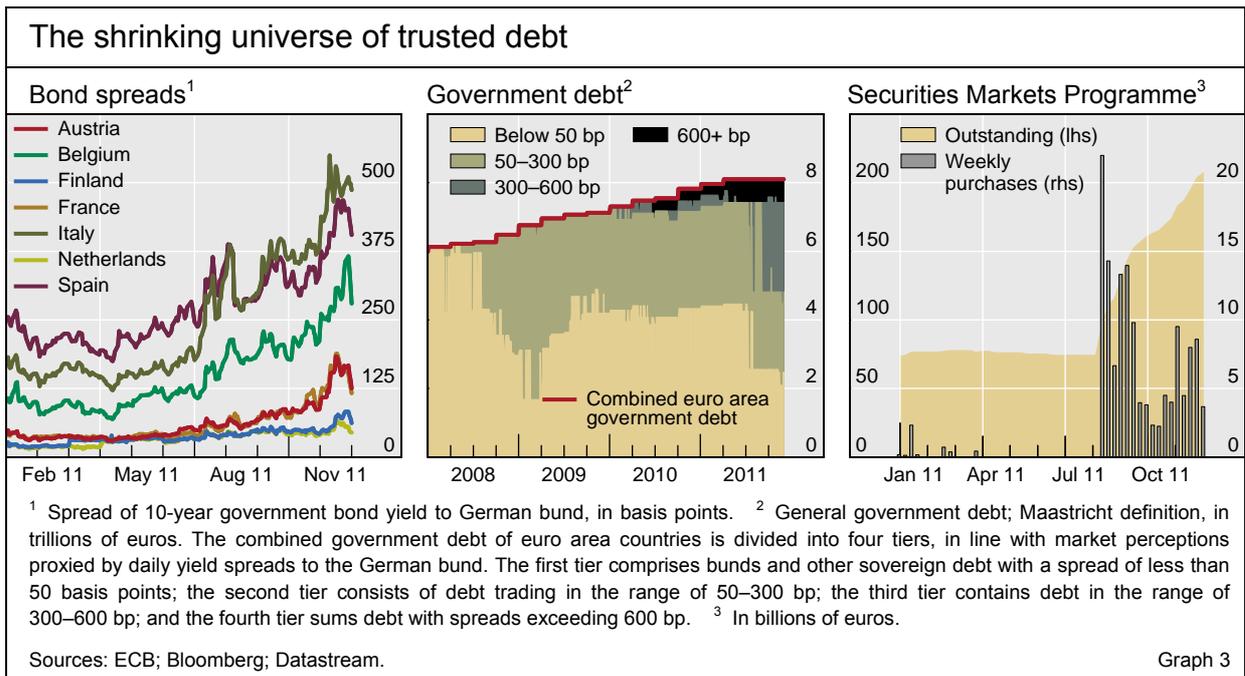
The yield curves of the different scenarios are then applied to the relevant debt securities over a three-year horizon. Whereas higher yields raise the debt service costs of *newly issued* fixed rate bonds, they affect both existing and newly issued floating rate notes.<sup>Ⓞ</sup> The overall debt service costs for each scenario, aggregated by year, are then expressed relative to the baseline costs, resulting in the *additional* debt service costs shown in Graph 2 (right-hand panel). The simulation is based on the assumption that Italy retains continued market access.

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<sup>Ⓞ</sup> Regarding inflation-linked securities, inflation expectations are held constant at current levels, with real yields running parallel to nominal yields in every scenario.

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<sup>4</sup> With €1.9 trillion in outstanding debt and €1.6 trillion in marketable securities, the Italian government bond market is third in size behind those of Japan and the United States.



the additional yearly cost would amount to 0.95% of 2010 GDP (Graph 2, right-hand panel). Even the worst scenario shown here would have to persist for three years until yearly additional costs exceeded 2% of GDP.

Bond market tensions increased further even after new governments took office in Greece and Italy to implement reforms. The rise in spreads accelerated across the board (Graph 3, left-hand panel). This run-up brought some sovereigns' financing costs up to pre-euro levels. Spain issued 10-year bonds at a shade below 7% on 17 November; 12 days later, Italy did so at 7.56%. The Eurosystem continued to purchase limited quantities of government bonds, bringing its bond holdings under the Securities Markets Programme to €207 billion by 1 December (Graph 3, right-hand panel). During some of the more volatile days in November, the run-up in yields was reportedly halted only by official purchases. However, the Eurosystem resisted mounting international pressure to embark on large-scale purchases.

... but later move to core sovereigns

In repeated rounds of selling, investors tried to offload sovereign bonds previously considered safe. Yield spreads of Austrian and French bonds approached 200 basis points, and even Dutch and Finnish yields broke away from those of German bunds (Graph 3, left-hand panel). The bond market selling pressure thus permeated ever deeper into the core, leaving the bund as virtually the only trusted AAA paper in the euro area (Graph 3, centre panel). The universe of trusted paper thus seemed to shrink just as the demand for safe assets was rising, prompting a flight to safety to assets outside the euro area (Graph 8 on page 14). Even the German bund auction on 23 November was poorly subscribed, raising just 65% of the target amount. Although markets calmed down at end-November, these dislocations in some of the largest euro area bond markets unsettled market participants; they may have inflicted damage to the investor base, given that long-term investors such as insurance companies and pension funds rely on sovereign debt markets for the preservation of capital.

## Bank funding and solvency move into focus

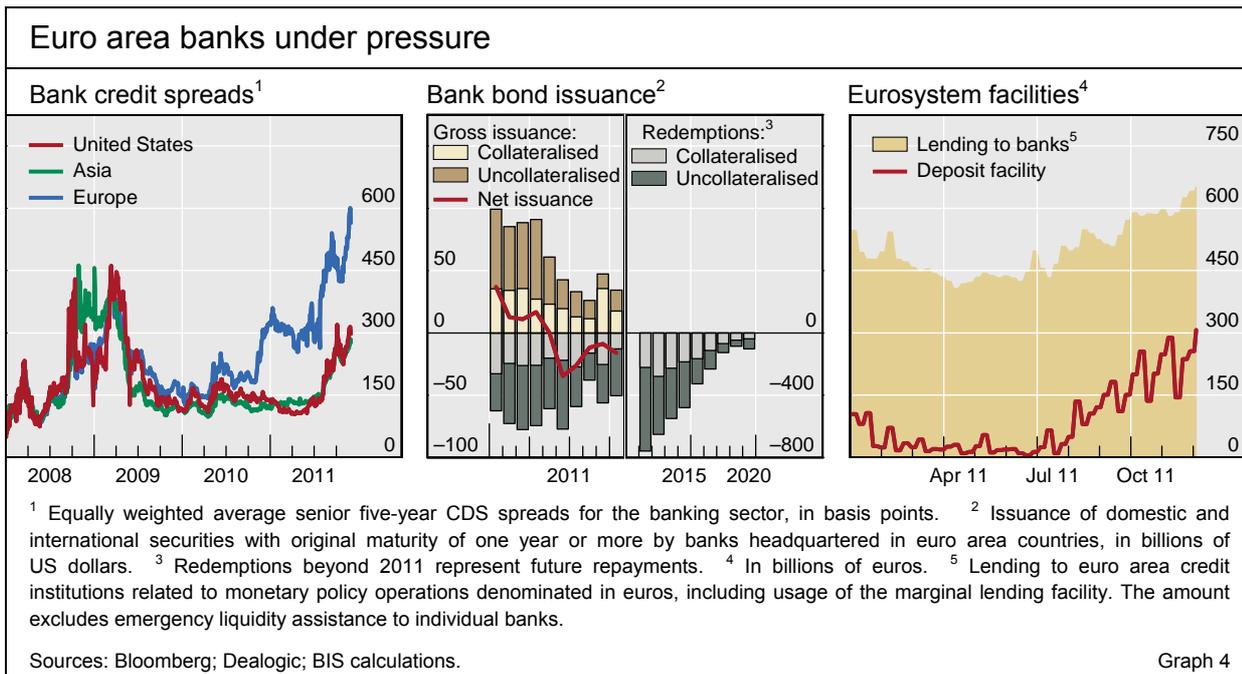
The intensification of the euro area sovereign debt crisis went hand in hand with banking sector weakness. While bank funding problems had manifested themselves throughout the year, policymakers and market participants increasingly turned their attention to issues of bank solvency. This was brought into focus by the rescue of Dexia, a Franco-Belgian bank active in public financing, and the failure of MF Global, a US broker-dealer. Both institutions lost access to funding markets as lenders grew concerned about their prospective solvency due to significant exposures to euro area sovereign debt.

Credit rating agencies downgraded scores of European banks. Some rating actions were motivated by increased sovereign risk, others by an erosion of perceived government support (see Box 2). Several French banks were also downgraded because of their continued reliance on fickle wholesale funding markets. Average credit spreads on European banks thus diverged further from those of their Asian and US counterparts (Graph 4, left-hand panel), surging beyond levels observed following the bankruptcy of Lehman Brothers in 2008.

The downgrades in a volatile market environment exacerbated European banks' funding problems. Banks from southern Europe, with the exception of a few global players, had lost market access early on, and some French banks faced unprecedented scrutiny. Net bond issuance by euro area banks continued to run negative since the middle of the year (Graph 4, centre panel; see also page 20 of this issue). Banks issued collateralised bonds, but the unsecured medium-term segment remained effectively closed. At the same time, US money market mutual funds continued to retreat from funding European banks (–42% since end-May) to avoid indirect exposure to sovereign risk. In November, the cost of swapping euros into dollars reached the highest level since December 2008. Refinancing difficulties may well persist, as

Waves of bank downgrades ...

... compound banks' funding challenges ...



## Box 2: Different causes for recent bank downgrades

*Nikola Tarashev*

Rating agencies have downgraded a large number of banks since the spring of 2011. In explaining these actions, agency reports and market commentary have referred to the link between financial institutions and sovereigns as an important driver of banks' creditworthiness. The purpose of this box is to illustrate that agencies have perceived this link as evolving differently across countries. In certain cases, recent bank downgrades have accompanied sovereign downgrades, which is consistent with an increased interdependence between the financial health of financial institutions and that of their sovereign. By contrast, bank downgrades in other countries reflect policy initiatives to wean banks off government support.

In principle, a sovereign could affect both the *financial-strength* rating of a bank, which captures its intrinsic capacity to remain solvent, and the *all-in* rating, which incorporates also the strength and likelihood of external support.<sup>①</sup> A troubled sovereign can put downward pressure on the financial-strength rating of its lenders by increasing their probability of default and impairing their access to funding markets. And the weakened finances of such a sovereign reduce its *capacity* to provide support, pushing banks' all-in ratings down towards the underlying financial-strength ratings. In turn, a reduced *willingness* to put taxpayer money at risk would also reduce rating enhancements due to sovereign support, and thus banks' all-in ratings, even if financial-strength ratings remained the same.

In a sample of some 50 banks, most of the all-in downgrades that the three major rating agencies (Fitch, Moody's and Standard & Poor's) have announced over the last half-year have been for European institutions (Table A). By contrast, there have been no all-in upgrades. Two parallel developments are likely to have contributed to these rating actions. In some European countries, the sovereigns have experienced severe financial difficulties. In others, authorities have made explicit commitments to reduce their support to banks and have backed these commitments with bank resolution schemes.

### Downgrades of bank all-in ratings<sup>1</sup>

	DE	FR	ES	IT	IE	PT	GR	CH	GB	US
Fitch	0 (8)	0 (3)	4 (4)	7 (8)	0 (3)	3 (3)	3 (3)	1 (2)	2 (6)	0 (6)
Moody's	3 (6)	1 (5)	2 (6)	7 (7)	2 (3)	4 (4)	3 (3)	0 (2)	3 (6)	2 (7)
Standard & Poor's	0 (9)	2 (5)	4 (6)	7 (8)	0 (3)	0 (4)	3 (3)	0 (2)	0 (5)	0 (6)

CH = Swiss banks; DE = German banks; ES = Spanish banks; FR = French banks; GB = UK banks; GR = Greek banks; IE = Irish banks; IT = Italian banks; PT = Portuguese banks; US = US banks.

<sup>1</sup> Sample period: 1 April to 29 November 2011 for ratings by Fitch and Moody's and 1 April to 28 November 2011 for ratings by Standard and Poor's. In parentheses, the total number of banks in the sample for the particular country-agency pair.

Source: Bloomberg.

Table A

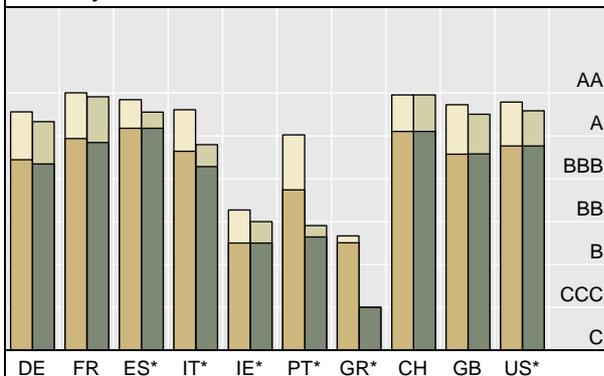
In order to delve deeper into the potential reasons for the recent all-in downgrades, it is necessary to also examine banks' financial-strength ratings and the corresponding sovereign ratings. A consistent set of such ratings is available from Fitch and Moody's only. Taken together, they suggest that the two agencies distinguish three groups of countries according to the evolution of the link between sovereign and bank finances (Graph A).

For countries in the first group, this link has changed little. Over the last half-year, the sovereigns in these countries have maintained their top ratings and, in most cases, stable rating outlooks. Likewise, the all-in ratings of banks from these countries or the rating enhancements due to official support have not changed. France belongs to this group according to both agencies and is joined by Switzerland according to Moody's or Germany and the United States according to Fitch.

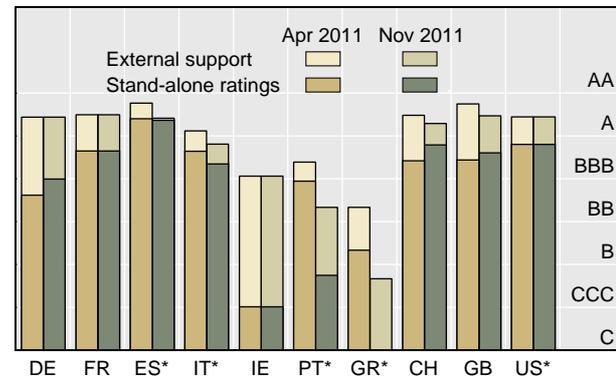
## Stand-alone ratings and the importance of external support<sup>1</sup>

Asset-weighted averages

Moody's



Fitch



Asterisks flag countries that have been downgraded, or put on a negative watch, by the respective agency over the sample period.

<sup>1</sup> A stand-alone rating plus the enhancement due to external support equals an all-in rating. For comparability, the all-in ratings by Moody's are converted on the Fitch rating scale. For the exact sample period, the number of banks in the sample and the meaning of country codes, see Table A above.

Sources: Bloomberg; The Banker Database.

Graph A

The second group comprises sovereigns that the rating agencies perceive as having financial difficulties, and hence a reduced capacity to provide support to banks. For the countries in this group, rating actions over the last half-year suggest that the prolonged crisis has strengthened the interdependence between sovereign and bank health. At least one agency has downgraded the sovereigns in the group or has assigned a negative outlook to their ratings, which has depressed the perceived official support to banks and thus their all-in ratings.<sup>2</sup> And in certain cases, exposures to troubled sovereigns have contributed to the downgrade of banks' financial-strength ratings as well. According to both agencies, Greece, Italy, Portugal and Spain belong to this group. They are joined by Ireland and the United States according to Moody's.<sup>3</sup>

Finally, the two agencies view the countries in the third group as financially stable but with a reduced willingness to provide public support to banks, which suggests a decoupling of sovereign and bank health. These countries have maintained their top sovereign ratings with a stable outlook. At the same time, banks headquartered there have seen their all-in ratings deteriorate, even though their financial-strength ratings have remained stable or improved. The United Kingdom belongs to this group according to both agencies and is joined by Switzerland according to Fitch or Germany according to Moody's.

<sup>1</sup> See F Packer and N Tarashev (2011), "Rating methodologies for banks", *BIS Quarterly Review*, June; and Committee on the Global Financial System (2011), "The impact of sovereign credit risk on bank funding conditions", *CGFS Papers*, no 43, July. <sup>2</sup> The only exception stems from the Fitch ratings for Greek banks. Currently at the lowest possible level on a financial-strength basis, these ratings are boosted significantly on an all-in basis by perceived sovereign support. <sup>3</sup> Fitch had downgraded the Irish sovereign and banks *before* the start of the sample period, April 2011.

nearly \$2 trillion of bank debt will come due by end-2014. Some 13% of this amount is government-guaranteed debt, which had been issued mostly in 2009 at maturities that may be difficult to renew on reasonable terms.

... prompting further liquidity support from the Eurosystem

Continued bank funding problems on the back of stress in sovereign debt markets put the Eurosystem into the limelight. The euro area central banks continued to provide ample liquidity to the financial system. With banks increasingly reluctant to lend to each other, part of the interbank market effectively moved onto the Eurosystem's balance sheet. Utilisation of its

deposit facility reached nearly €300 billion on 7 November while lending to banks amounted to twice that level (Graph 4, right-hand panel). Banks headquartered in France, Ireland and Italy accounted for over half of the Eurosystem's lending to banks. French banks borrowed €141 billion, making up for some of the lost wholesale market funding. Italian banks' uptake jumped to €111 billion by end-October, raising the dependence on ECB funding to 2.8% of their combined balance sheet. Further measures to alleviate funding strains included emergency liquidity assistance, the reintroduction of one-year refinancing operations, and a second covered bond purchase programme of €40 billion.

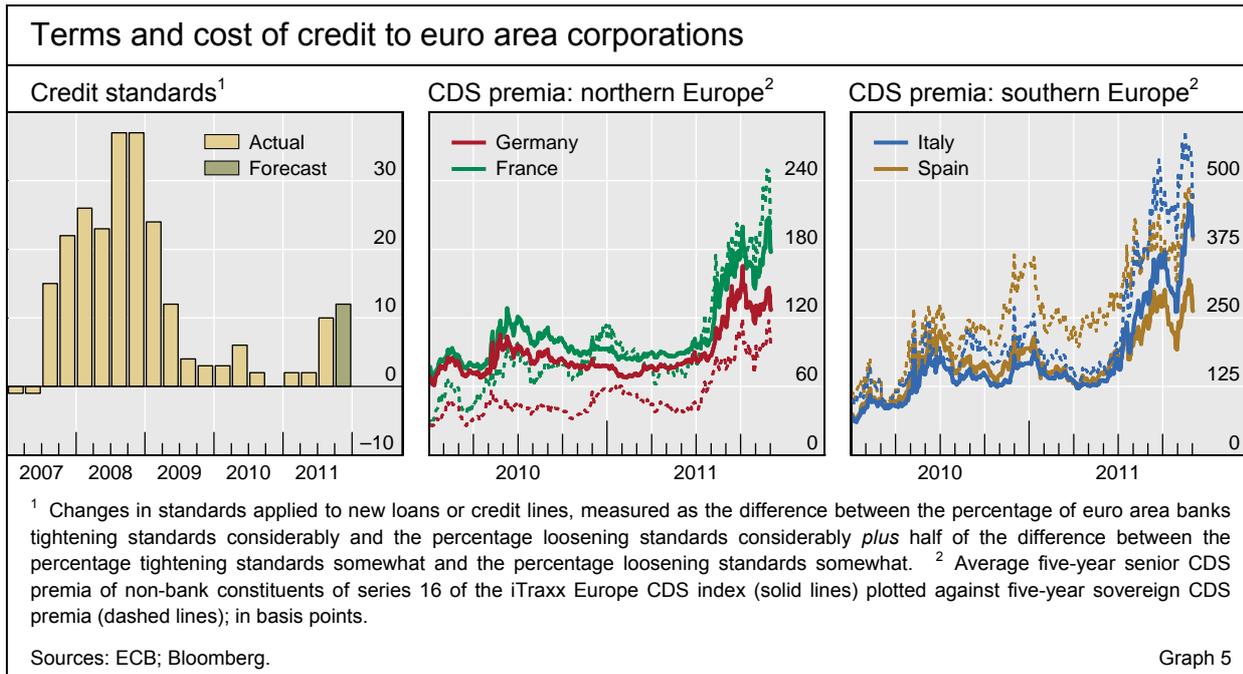
Coordinated central bank action to provide international liquidity triggered a market rally on 30 November. The Federal Reserve and the ECB, together with the central banks of Canada, Japan, Switzerland and the United Kingdom, agreed to halve the cost of US dollar swap lines to 50 basis points over overnight index swaps (OIS), and to establish contingent swap lines in each other's currencies. Market participants cheered at this display of concerted action. The major equity indices gained 3–4% on the same day, and euro area bonds yields and sovereign CDS premia tightened considerably. FX swap spreads above 50 basis points came down immediately. In particular, the premium paid by financial institutions for swapping euros into dollars dropped from 151 to 119 basis points.

The wide range of liquidity measures bought time but did not alleviate banks' medium-term funding challenges, underscoring the current focus on plans to strengthen the banking sector. While guarantee schemes for newly issued bank debt may remain national in scope, the European Banking Authority (EBA) published capitalisation targets for 70 European banks with the aim of promoting recapitalisations worth €106 billion (Table 1). As capital ratios can also be met by shedding risky assets, market participants grew concerned that times of funding strains and elevated value-at-risk would favour the shrinking of bank balance sheets, with possible macroeconomic implications inside and outside Europe.

Pressures lead banks to shed assets

Euro area banks already tightened terms and raised interest rates on loans to corporations and households throughout the review period. Recent releases of the Eurosystem's bank lending survey indicate that many euro area banks tightened credit standards in the third quarter of the year and planned to continue to do so in the fourth quarter (Graph 5, left-hand panel). The prevalence of tightening, however, was not as widespread as at the peak of the 2008 financial crisis, and the volume of euro area bank loans to the private sector did not contract in October. The surveys indicated that a key factor behind the tightening was the deterioration in banks' own funding conditions. In syndicated lending, for example, the share of euro area banks in global new loans fell to 18% in October, from 26% a year earlier. Moreover, the average interest rate on all new loans from euro area banks to corporations increased fairly steadily, by 1 percentage point in the year to end-September. Banks in Greece and Portugal raised interest rates by around 2 percentage points. The average interest rate on new unsecured loans to households also increased by about 1 percentage point. Increases in corporate CDS premia, which have

The cost and terms of credit deteriorate



risen in parallel with sovereign CDS in recent months, suggest that corporate borrowing costs have increased further since the end of September (Graph 5, centre and right-hand panels).

### Global spillovers

Securities dealers' funding costs rise ...

As the market values of euro area sovereign and bank debts fell and became more volatile, funding costs rose for financial institutions with exposures to these assets. This was especially the case for securities dealers, who tend to be highly leveraged and reliant on wholesale funding. Furthermore, some securities dealers may have had significant derivatives exposures to sovereigns. Traditionally, these have not been collateralised. Short-dated CDS premia increased sharply for US and European dealers in September and November (Graph 6, left-hand panel). The November increase came after the failure of MF Global highlighted the importance of sovereign risks.

... which affects terms for securities financing and trading

As their own funding conditions deteriorated, securities dealers tightened terms on securities financing and reduced their market-making activities. A Federal Reserve survey of 20 large securities dealers, published in October, already showed that financing asset-backed securities, corporate bonds and equities had recently become more expensive and required more collateral (Graph 6, centre panel). It also showed that liquidity had deteriorated in these markets (Graph 6, right-hand panel). Market contacts reported that liquidity declined as market-makers sought to reduce inventories, the values of which had become significantly more volatile. But this reinforced volatility, as trades moved prices by more than previously.

Risky asset prices consequently move in step with the euro crisis

As funding and market liquidity fluctuated with the state of the euro area sovereign debt crisis, risky asset prices moved in step. Both equity and bond prices fell in September, increased in October and declined again in November, as did the trade-weighted value of the euro (Graph 1, right-hand panel).

Emerging markets were adversely affected by the euro area crisis, with investors withdrawing over \$25 billion from emerging market funds in August and September, notably from equity funds. Emerging market equity prices fell sharply in September, even more sharply than developed market equity prices, after the volatility of investor portfolios escalated (Graph 7, left-hand panel). This suggests that risky assets may have been sold to reduce portfolio volatilities, with relatively little regard for their fundamental prospects. Indeed, economic forecasts for emerging markets in Latin America and the Asia-Pacific region were little changed in September, but prices still fell sharply.

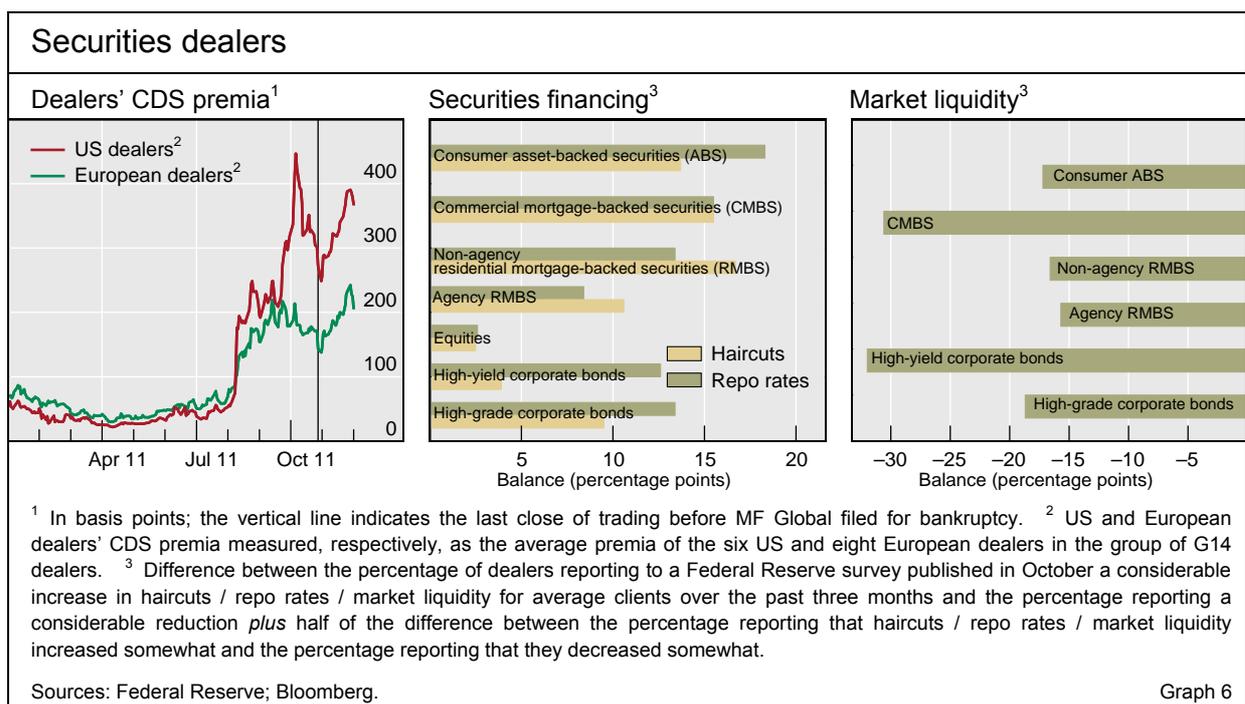
Emerging market asset prices fall as international investors withdraw ...

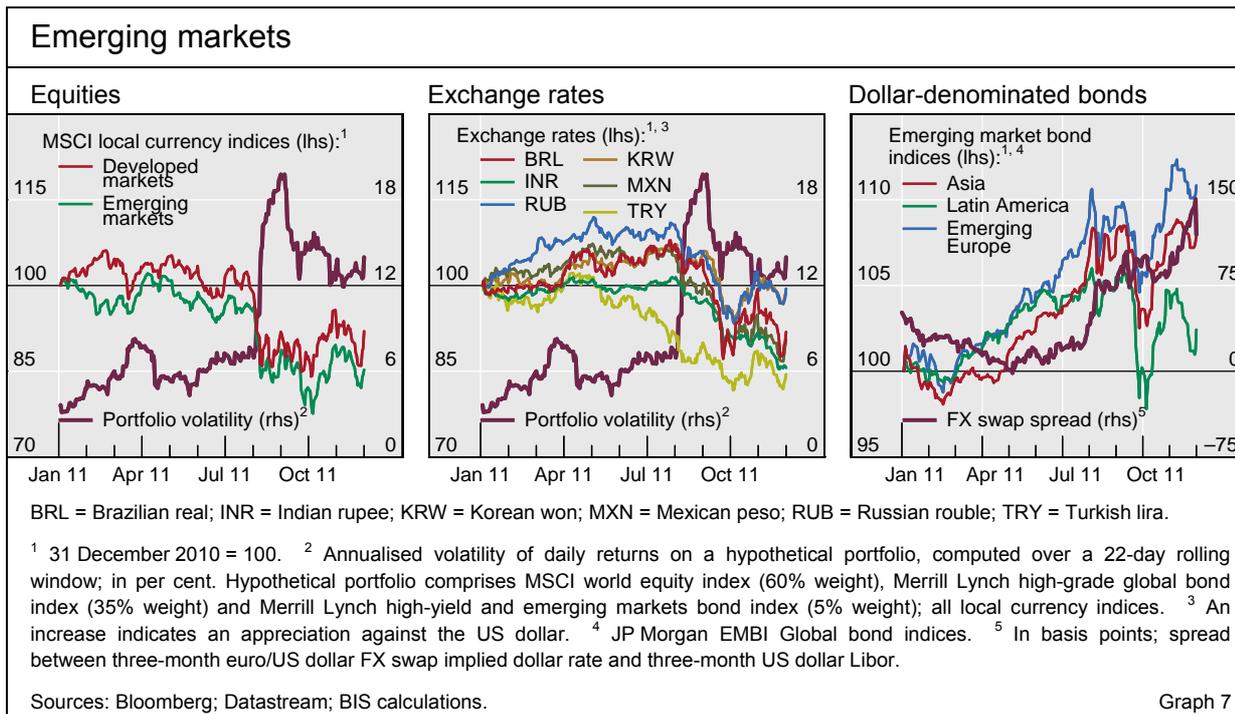
Withdrawals from emerging market funds appeared to reflect asset repatriation by euro area investors. The \$25 billion withdrawal from emerging market funds coincided with over €85 billion of portfolio inflows to the euro area from a reduction of overseas assets. Balance of payments statistics show that a large share of these went to France. Repatriation is also suggested by some of the sharpest falls in local currency bond indices occurring in emerging markets where international investors are well represented, such as Indonesia, Mexico and South Africa. Conversion of emerging market assets into euros would have put downward pressure on emerging market exchange rates, which fell sharply in September (Graph 7, centre panel). Several central banks, including those of Brazil, Hungary, Indonesia, Korea, Russia and Turkey, reportedly intervened in the currency markets to support their exchange rates.

... and repatriate funds to the euro area

Dollar funding concerns may also have motivated some investors to sell emerging market assets. As the cost of dollar funds via the currency swaps market increased, prices of dollar-denominated emerging market bonds fell (Graph 7, right-hand panel). They fell sharply in September and to a lesser extent in November. Market analysts also reported a decline in the supply of trade finance and export credit guarantees from euro area banks to emerging markets, much of which are denominated in dollars. Some of this business,

Dollar funding concerns exacerbate sales of emerging market assets





however, has been taken on by local lenders and the large international commercial banks.

Some analysts have further concerns about credit withdrawal from emerging Europe

In addition, analysts were concerned that any reduction in euro area bank lending to firms and households in emerging markets could exacerbate slowdowns in economic growth. They perceived emerging European economies as most vulnerable, with around 80% of foreign bank claims belonging to Austrian, French, Greek, Italian and other euro area banks (see also box on pages 16–17). For some countries in the region, these claims amount to over 100% of GDP. Some euro area banks, including Commerzbank and Unicredit, have already announced that they plan to scale back new loans to much of the region. Furthermore, the Austrian bank regulator has stipulated that any new loans to the region from local subsidiaries of Austrian banks must be matched by increases in local deposits. Analysts noted that this could restrict credit supply and exacerbate any downturn in emerging Europe. Croatia, the Czech Republic, Hungary and Romania have the greatest volumes of outstanding credit from Austrian banks.

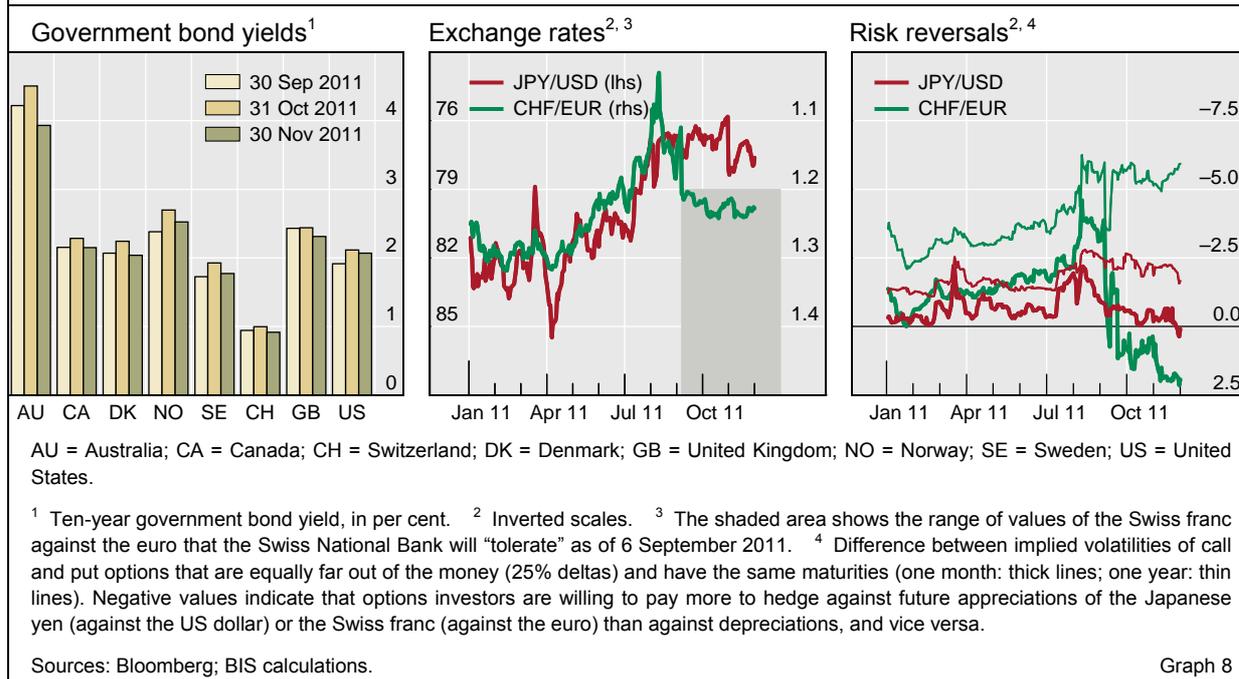
Prices of safe haven assets vary inversely with the euro crisis ...

As demand for risky assets ebbed, flowed and again ebbed in September, October and November respectively, the demand for safe haven assets followed the opposite pattern. Safe havens included North American, Australian and some northern European government bonds. Yields on these securities declined in September, rose in October and declined again in November (Graph 8, left-hand panel). Yields on three-month US and German government bonds and two-year Swiss government bonds fell below zero in November, as did yields on 10-year US and UK inflation-linked government bonds.

... and some safe haven currencies appreciate further, prompting intervention

Safe haven flows also continued into Japanese assets, putting further upward pressure on the yen (Graph 8, centre panel). In response, the Japanese authorities intervened in the currency markets in a reported record amount for one day on 31 October. Since a recent series of interventions

## Flight to quality and exchange rate intervention



began in August, the balance of risks to the near-term future value of the yen suggested by the difference between premia on options offering protection against either appreciation or depreciation of the yen over a one-month horizon has neutralised from a skew towards appreciation. The corresponding difference between premia on Swiss franc options collapsed after the Swiss National Bank announced in early September that it intended to prevent its currency from appreciating beyond a certain level against the euro. The balance of risks to both the yen and the Swiss franc over 12 months, however, remained skewed towards appreciation (Graph 8, right-hand panel).

## 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 second quarter of 2011. The discussion of international debt securities and exchange-traded derivatives draws on data for the third quarter of 2011. OTC derivatives market statistics are available up to mid-2011. There are two boxes in this chapter. The first provides measures of the vulnerability of emerging market economies to sudden capital withdrawals through the banking system, and the second examines how deleveraging by euro area banks could potentially affect emerging market economies.*

### The international banking market in the second quarter of 2011<sup>1</sup>

The aggregate cross-border claims of internationally active banks declined during the *second quarter of 2011*, mainly as a result of a decrease in lending to developed economies. By contrast, cross-border claims on residents of emerging markets rose for the ninth quarter in a row.

High shares of cross-border claims and short-term international claims could make Asia-Pacific the emerging market region most vulnerable to sudden capital withdrawals through the banking system (Box 1). Meanwhile, the risk of a credit crunch triggered by a potential deleveraging by euro area banks is highest in emerging Europe (Box 2).

#### *Aggregate cross-border claims record a slight decline<sup>2</sup>*

The aggregate cross-border claims of BIS reporting banks contracted slightly during the second quarter of 2011 (Graph 1, left-hand panel). The \$192 billion (0.6%) fall was caused by a decrease in interbank claims (\$293 billion or 1.5%). By contrast, lending to non-banks rose by \$101 billion (0.9%).

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<sup>1</sup> Queries concerning the banking statistics should be addressed to Stefan Avdjiev.

<sup>2</sup> The analysis in this and the following subsections 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 fluctuation and breaks in series.

## Box 1: Measuring the vulnerability of emerging market economies to sudden capital withdrawals through the banking system

Stefan Avdjiev

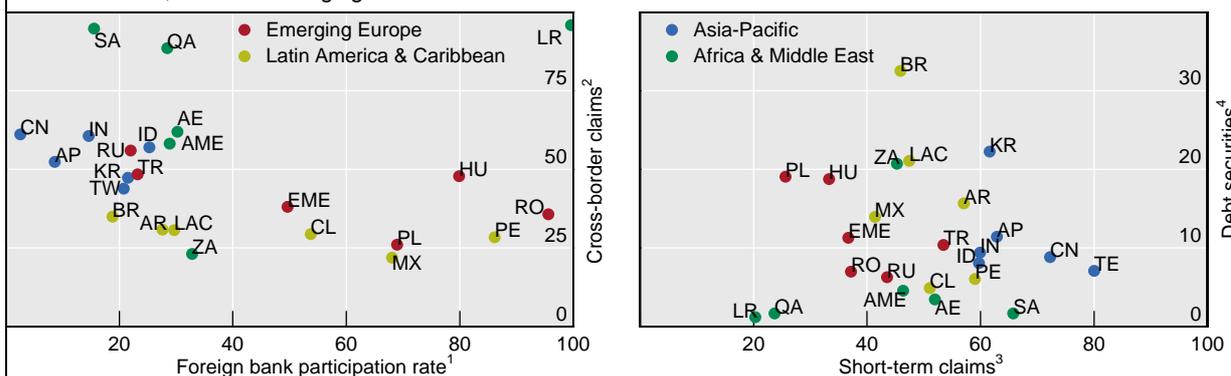
The steady growth of foreign credit to emerging market economies has been one of the most significant regularities in international banking over the past couple of years. Nevertheless, some commentators have expressed concerns that the flow of capital to these economies may be adversely affected by the sharp rise in global financial volatility which began in the third quarter of 2011. How vulnerable were emerging markets on the eve of the turmoil?

The BIS international banking statistics can be used to construct four measures of the degree to which a country is vulnerable to sudden capital withdrawals through the banking system. First, the fraction of short-term international claims relative to total international lending measures the degree to which an economy is exposed to a non-renewal of short-term foreign bank credit to its residents. Second, the share of cross-border lending in total foreign lending sends a signal about the stability of funding from foreign banks since cross-border claims tend to be much more volatile than their locally booked counterparts.<sup>1</sup> Third, the proportion of cross-border claims held in the form of tradable debt securities (as opposed to non-tradable loans) quantifies the ease with which foreign creditors could dispose of the claims they have on the residents of a given country. Finally, the foreign bank participation rate gives an indication of the fraction of total credit to non-banks in a given economy that is provided by foreign-owned banks.<sup>2</sup> While none of these four indicators is perfect on its own, taken as a group they can paint a fairly informative picture of the vulnerability of various emerging market economies to sudden capital withdrawals.

Based on the first two indicators, Asia-Pacific appears to be the region most exposed to sudden capital withdrawals. As of the end of June 2011, close to two thirds (63%) of all international claims on residents of that region had a remaining maturity of less than one year (Graph A, right-hand panel). In addition, cross-border claims represented more than half (52%) of all foreign lending to the area (Graph A, left-hand panel). Nevertheless, the signals sent by the other two indicators for Asia-Pacific were less worrying. First, foreign bank participation rates in the area were relatively low compared to those in the other three emerging market regions. In addition, debt securities represented only about a tenth of all cross-border claims on the region.

### Measures of vulnerability to sudden capital withdrawals through the banking system

End-Q2 2011, selected emerging market economies



AE = United Arab Emirates; AME = emerging Africa & Middle East; AP = emerging Asia-Pacific; AR = Argentina; BR = Brazil; CL = Chile; CN = China; EME = emerging Europe; HU = Hungary; ID = Indonesia; IN = India; KR = Korea; LAC = emerging Latin America & Caribbean; LR = Liberia; MX = Mexico; PE = Peru; PL = Poland; QA = Qatar; RO = Romania; RU = Russia; SA = Saudi Arabia; TR = Turkey; TW = Chinese Taipei; ZA = South Africa.

<sup>1</sup> BIS reporting banks' foreign claims on non-banks as a percentage of total credit to non-banks. <sup>2</sup> BIS reporting banks' cross-border claims as a percentage of their total foreign claims. <sup>3</sup> BIS reporting banks' international claims with remaining maturity of up to one year as a percentage of their total international claims. <sup>4</sup> BIS reporting banks' debt securities as a percentage of their total cross-border claims.

Sources: IMF; BIS consolidated banking statistics (immediate borrower basis and ultimate risk basis); BIS locational banking statistics by residence.

Graph A

Emerging Europe and Latin America and the Caribbean were mirror images of Asia-Pacific along three of the four dimensions of vulnerability examined in this box. Namely, they had substantially lower shares of cross-border claims (38% and 31%, respectively) and short-term claims (37% and 47%, respectively) than Asia-Pacific. By contrast, foreign bank participation rates were significantly higher across emerging Europe and Latin America and the Caribbean than in Asia-Pacific (Graph A, left-hand panel). The only dimension along which the three regions looked similar was the share of debt securities, which was relatively small in all of them. It was slightly over a fifth (21%) in Latin America and the Caribbean and barely over a tenth in emerging Europe (11%).

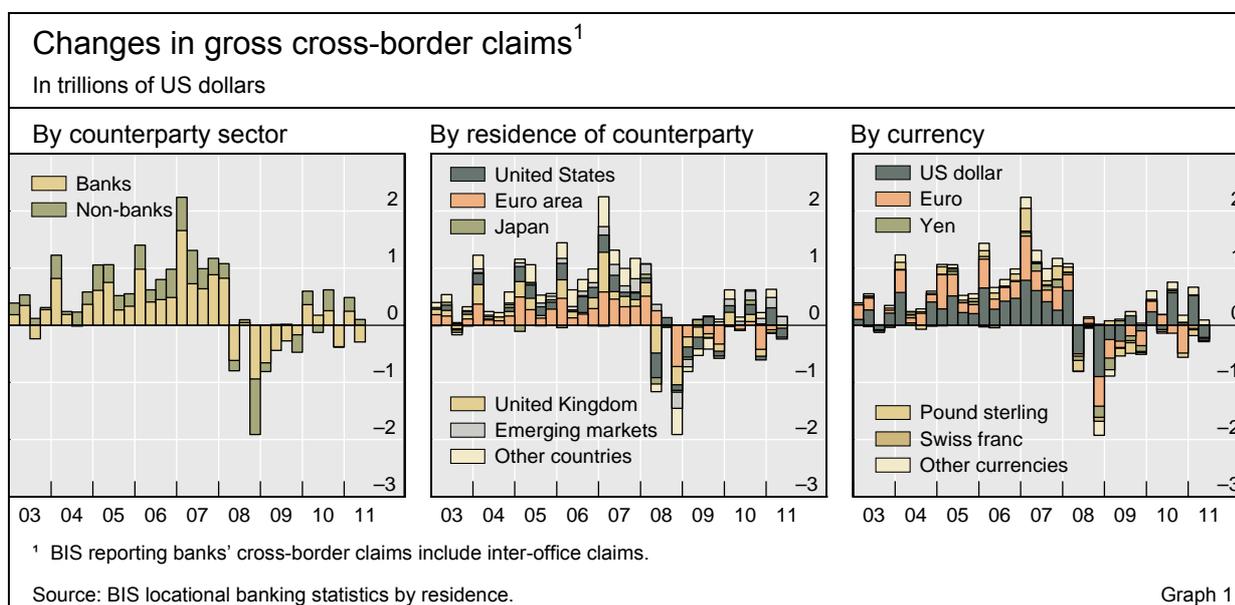
The picture in Africa and the Middle East was mixed. On the one hand, it was the only emerging market region other than Asia-Pacific for which the share of cross-border claims exceeded one half. On the other hand, the share of debt securities in the region was very small (5%). Furthermore, foreign bank participation rates were much lower than in emerging Europe, and the share of short-term claims in international claims (46%) was substantially smaller than in Asia-Pacific.

<sup>Ⓢ</sup> See R McCauley, P McGuire and G von Peter, "The architecture of global banking: from international to multinational?", *BIS Quarterly Review*, March 2010, pp 25–37. <sup>Ⓢ</sup> This variable is constructed by combining BIS data on cross-border credit and foreign credit with IMF data on domestic credit. See P McGuire and N Tarashev, "Bank health and lending to emerging markets", *BIS Quarterly Review*, December 2008, pp 67–80, for a more detailed description of the construction of the measure.

Cross-border claims on developed economies fall ...

Internationally active banks reduced their cross-border lending to developed economies (Graph 1, centre panel). In absolute terms, lending to residents of the United States decreased the most (by \$155 billion or 2.8%). Claims on the United Kingdom and Japan also fell (by \$52 billion or 1.1% and by \$32 billion or 4.1%, respectively), whereas claims on residents of the euro area inched up by \$7.5 billion (0.1%).

Cross-border claims denominated in most major currencies fell during the quarter (Graph 1, right-hand panel). US dollar-denominated claims recorded the largest absolute decline (\$212 billion or 1.6%). Internationally active banks also reported decreases in claims denominated in yen (\$26 billion or 2.2%), Swiss francs (\$19 billion or 3.8%) and euros (\$28 billion or 0.3%). By contrast, claims in sterling rose slightly (by \$7.4 billion or 0.5%).



*Cross-border claims on emerging market economies continue to grow*

Between the start of April and the end of June 2011, BIS reporting banks increased their cross-border claims on residents of emerging market economies for the ninth consecutive quarter. The \$145 billion (4.7%) expansion was led by a \$92 billion (5.6%) rise in interbank claims. Claims on non-banks also grew (by \$53 billion or 3.7%). Note that these developments preceded the sharp capital outflows from emerging markets that took place in the subsequent months (see pages 11–14 for further discussion of this issue).

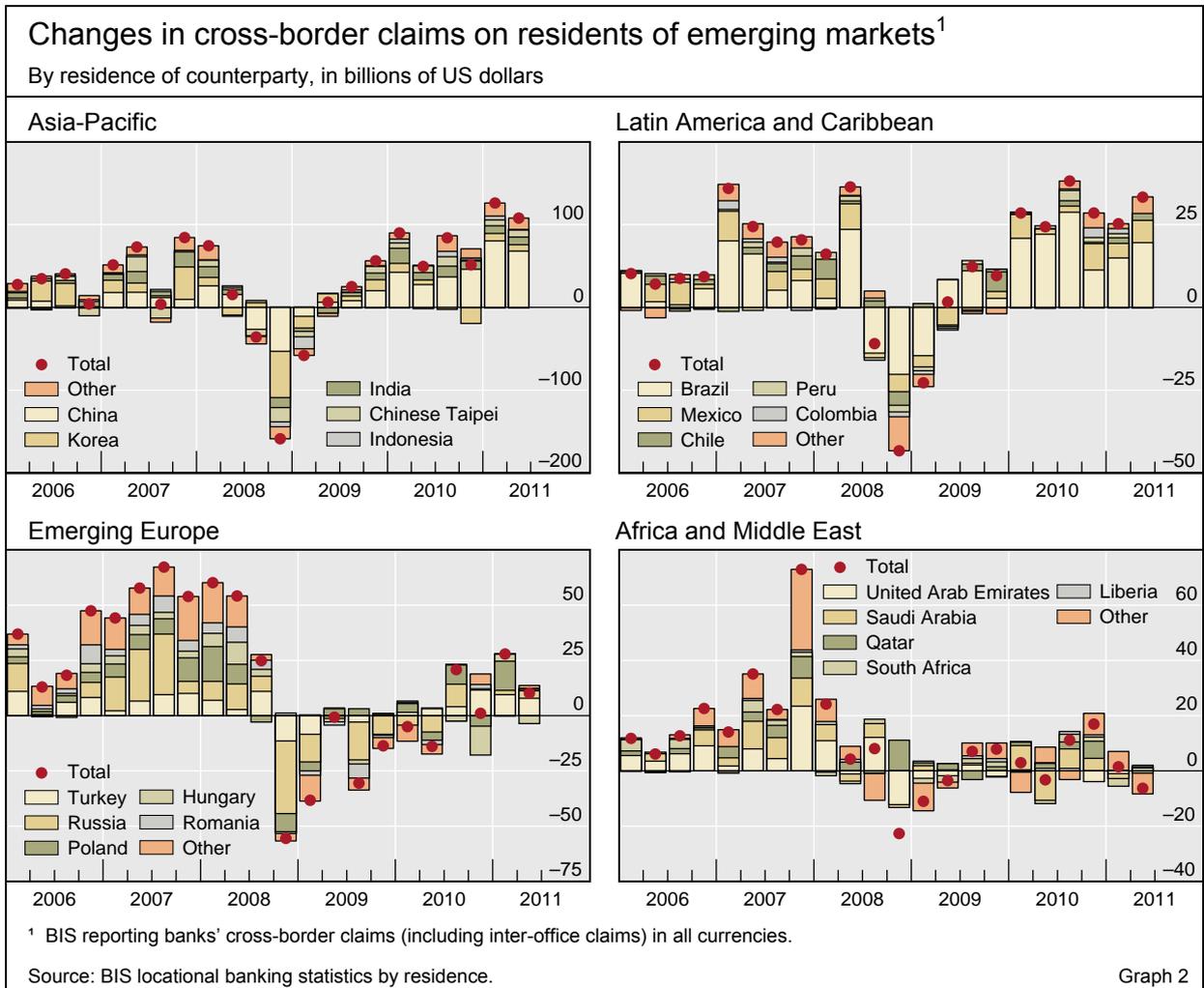
... while those on emerging markets continue to expand

Cross-border claims on Asia-Pacific continued to expand at a fast pace (Graph 2, top left-hand panel). Almost two thirds of the \$108 billion (9.0%) increase in lending to the region was due to a surge in claims on China (\$68 billion or 16%). Internationally active banks also reported significant increases in their claims on India (\$9.3 billion or 4.7%), Chinese Taipei (\$8.1 billion or 9.0%) and Korea (\$7.7 billion or 3.7%).

Lending to China keeps surging

Cross-border claims on residents of Latin America and the Caribbean also grew rapidly (Graph 2, top right-hand panel). More than half of the \$33 billion (5.9%) rise in lending to the region was explained by the ninth consecutive increase in claims on Brazil (\$20 billion or 7.4%). Claims on Mexico and Chile also rose significantly (by \$6.7 billion or 5.6% and by \$2.0 billion or 4.0%, respectively).

Cross-border claims on Brazil rise further



Lending to emerging Europe expanded for a fourth consecutive quarter (Graph 2, bottom left-hand panel). The \$10.2 billion (1.3%) quarterly increase brought the aggregate stock of cross-border claims on the region to \$822 billion, approximately 10% below the peak of \$916 billion reached at the end of June 2008. The overall growth during the second quarter of 2011 reflected a \$6.8 billion (1.9%) rise in lending to non-banks and a \$3.4 billion (0.8%) advance in interbank claims. Claims on residents of Turkey continued to surge, increasing by \$7.9 billion (4.7%). By contrast, lending to Hungary and the Czech Republic contracted (by \$3.5 billion or 4.4% and by \$1.1 billion or 2.2%, respectively).

The only emerging market region that saw a decrease in cross-border claims on its residents in the second quarter of 2011 was Africa and the Middle East (Graph 2, bottom right-hand panel). The \$6.3 billion (1.2%) decline was caused by a \$7.6 billion (3.6%) fall in interbank claims. By contrast, claims on non-banks rose by \$1.3 billion (0.4%). Lending to residents of Kuwait and Iran shrank by \$3.9 billion (17%) and \$2.5 billion (15%), respectively. Internationally active banks reported modest declines in their claims on Egypt (\$0.2 billion or 1.0%) and Tunisia (\$0.2 billion or 4.8%) in the aftermath of the sociopolitical turmoil that rocked the two countries in the first quarter of 2011. Meanwhile, claims on Libya, which was still mired in a civil war, remained virtually unchanged.

### International debt securities issuance in the third quarter of 2011<sup>3</sup>

Drop in issuance of international debt securities ...

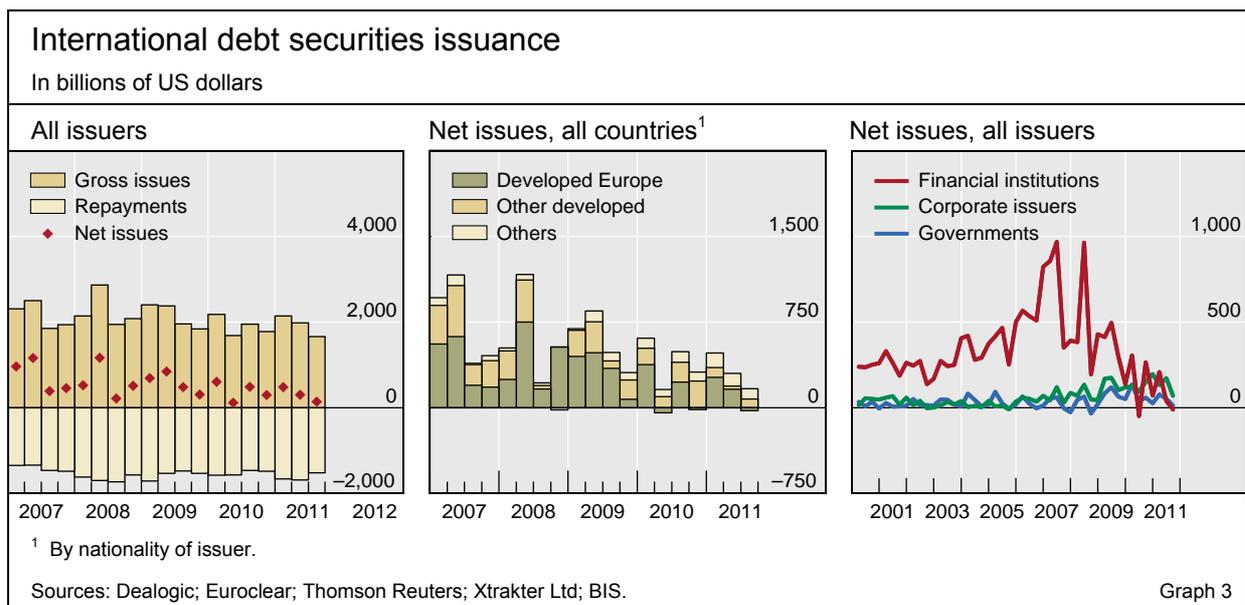
Issuance of international debt securities dropped in the *third quarter of 2011* (Graph 3, left-hand panel). Deteriorating market conditions compounded the usual summer slowdown in the northern hemisphere. This resulted in a 16% decline in completed global gross issuance. At \$1,663 billion, this was the lowest since the end of 2005. Net issuance of international debt securities slid to \$142 billion, the second lowest since the end of 1998.<sup>4</sup>

... mainly due to lower issuance by European borrowers

The main driver of these developments was a drop in net issuance by European borrowers, who (on net) repaid funds worth \$25 billion (Graph 3, centre panel). Borrowers from this region found it difficult to tap the market at favourable terms, even before the recent worsening of the European sovereign debt crisis (see pages 1–14). At \$18 billion of net issuance, emerging market borrowing also weakened compared to recent quarters. This was to some extent compensated for by record issuance by international institutions. Borrowers from this sector, which includes institutions such as the International Bank for Reconstruction and Development (IBRD) and the European Investment Bank (EIB), issued an all-time record \$71 billion of international debt securities net of repayments. After a weak second quarter, net issuance by US borrowers picked up to \$68 billion in the third quarter of 2011.

<sup>3</sup> Queries concerning international debt securities should be directed to Andreas Schrimpf.

<sup>4</sup> Net issuance is defined as completed gross issuance of debt securities minus repayments.



Financial borrowers were most affected by the market tensions in the context of the European sovereign debt crisis. They repaid a net \$11 billion, the second lowest quarterly value since 2000 (Graph 3, right-hand panel). Financial institutions headquartered in Europe in particular had difficulties placing new debt as investors demanded higher credit risk compensation.<sup>5</sup> Their net redemptions of \$36 billion stand in stark contrast to strong issuance during the first half of the year, when they had taken advantage of the benign market conditions and raised a total of \$266 billion through the sales of international debt securities. These aggregates, however, mask a wide dispersion across European countries (Graph 4, left-hand panel). Financial institutions headquartered in the United Kingdom, France and Italy saw the highest net repayments, with net redemptions of \$24 billion, \$18 billion and \$17 billion, respectively, in the period from July to September. By contrast, financial institutions of German, Dutch and Austrian nationality raised \$47 billion, \$3 billion and \$3 billion, respectively.

Issuance by financials affected by difficult market conditions

Issuance by financial institutions of non-European nationality was also fairly weak over the third quarter of 2011. Financial borrowers from Asia-Pacific repaid a net \$5 billion. Net issuance of \$18 billion by US financials represented a pickup compared to the last two quarters, but fell well short of the levels seen in the past.

<sup>5</sup> Benchmark credit risk indices for debt issued by European financials reflected the difficult market conditions. The Markit iTraxx index for CDS spreads of European financials, for instance, reached 280 basis points at the end of September, a 125 basis point increase from the end of June.

## Box 2: Evaluating the potential impact of deleveraging by euro area banks on emerging market economies

*Stefan Avdjiev*

The latest financial developments in the euro area have given rise to concerns that, rather than raise new capital, euro area banks could deleverage by reducing their lending to emerging market economies. In this box, we use data from the BIS international banking statistics to quantify the degree to which various emerging market economies depend on banks headquartered in the euro area for foreign financing. In addition, we re-estimate the foreign bank credit withdrawal vulnerability measures discussed in Box 1 on pages 16–17 for a dataset encompassing exclusively euro area banks.

Not surprisingly, as of the end of June 2011, the fraction of total lending to non-banks attributable to euro area banking systems was highest in the neighbouring region of emerging Europe (Table A, first column). These banks accounted for approximately 42% of all credit to non-banks in the region. In addition, their claims on banks in that part of the world amounted to 5% of total credit to non-banks in the region. Euro area banks were also responsible for a significant share of total lending to non-banks in Latin America and the Caribbean (16%) and Africa and the Middle East (11%). By contrast, these banks were not nearly as important in Asia-Pacific, accounting for only 1% of all lending to non-banks in the region.

Estimates of the recapitalisation needs of various euro area banking systems released recently by the European Banking Authority indicate that the extent of the potential deleveraging is likely to vary significantly across banking systems. In order to account for that, we construct an index which measures emerging market economies' dependence on foreign bank lending that originates in euro area banking systems which will have to increase their capital ratios in the coming months (Table A, second column). For every emerging market economy, we calculate the index by weighting the lending share of each euro area banking system by its estimated capital shortfall scaled by its risk-weighted assets.

Once the near-term recapitalisation needs of euro area banking systems are taken into account, the contrast between developing Europe and the other three emerging market regions becomes even starker. More precisely, the index, which has a value of 41.8 for emerging Europe, suggests that the credit dependence of that part of the world on euro area banking systems that are currently experiencing capital shortfalls is more than four times greater than that of Latin America and the Caribbean, which is the second most dependent region according to the index (9.6). The values of the index for Africa and the Middle East and Asia-Pacific are much lower (4.8 and 0.5, respectively).

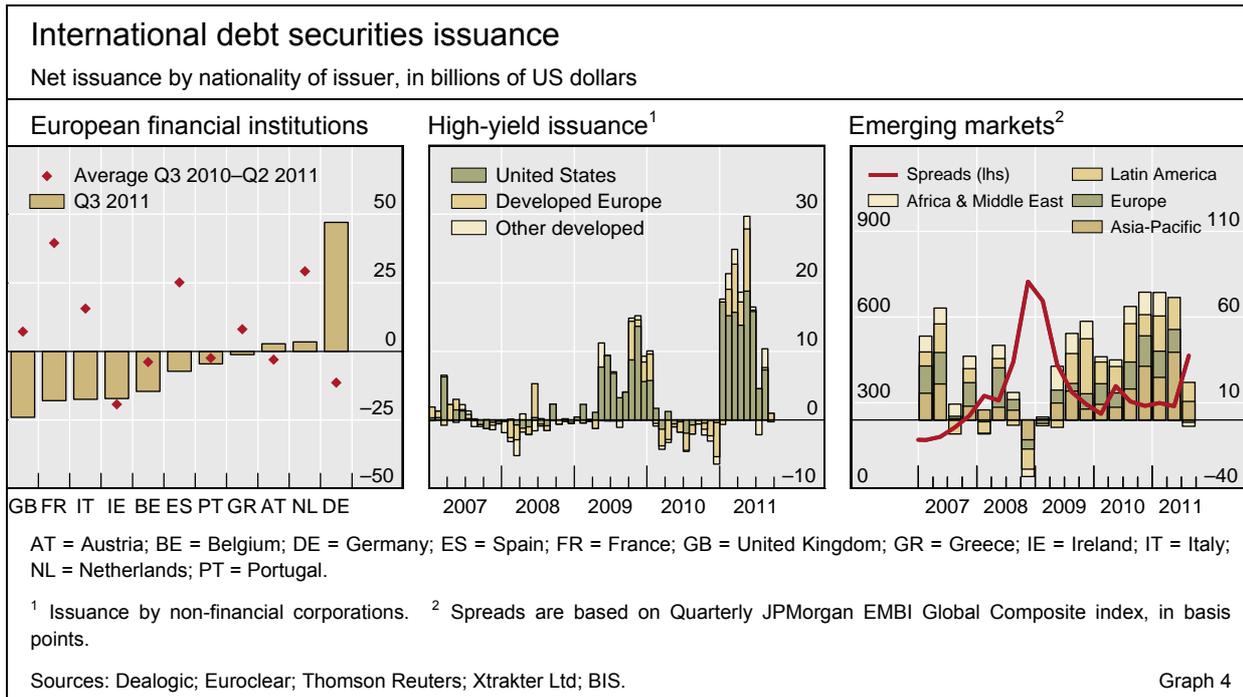
There are several factors that may mitigate the potential impact of euro area banks' deleveraging on emerging Europe. First, only a third of all euro area banks' lending to the region is accounted for by cross-border claims (third column of Table A). The rest is in the form of locally booked claims, which, as discussed in Box 1, tend to be much more stable. Second, the share of euro area banks' claims on emerging Europe with a maturity of less than one year (33%) is significantly lower than the respective shares in the other three emerging market regions (fourth column). Finally, banks located in the euro area hold only about a tenth of their total international claims on emerging Europe in the form of tradable debt instruments (fifth column). As a result, it would be relatively difficult for them to quickly and costlessly dispose of most of their claims on the region.

Euro area banks and emerging market economies					
End-Q2 2011					
	Euro area banks' share of total credit <sup>1</sup>	Euro area banks' RN-weighted share of total credit <sup>2</sup>	Euro area banks' cross-border claims share <sup>3</sup>	Euro area banks' short-term claims share <sup>4</sup>	Euro area banks' debt securities share <sup>5</sup>
<b>Emerging Europe</b>	<b>47.3 (5.2)</b>	<b>41.8</b>	<b>33.5</b>	<b>33.1</b>	<b>10.3</b>
Poland	63.2 (5.3)	41.1	23.1	21.6	17.5
Russia	18.9 (3.4)	7.4	48.8	35.2	2.6
Turkey	20.6 (3.5)	36.1	37.0	46.3	5.7
Hungary	82.4 (9.0)	41.6	45.0	29.5	19.3
Romania	99.4 (8.2)	162.2	35.7	36.8	7.2
<b>Latin America &amp; Caribbean</b>	<b>17.1 (1.5)</b>	<b>9.6</b>	<b>21.8</b>	<b>39.2</b>	<b>14.3</b>
Brazil	10.9 (1.1)	6.1	24.1	30.7	28.5
Mexico	35.9 (3.3)	20.4	17.4	30.9	7.0
Chile	43.5 (3.1)	25.6	18.7	50.4	1.8
Peru	44.4 (1.9)	27.0	16.3	64.3	5.0
Argentina	18.0 (0.7)	9.8	27.2	55.4	8.6
<b>Emerging Asia-Pacific</b>	<b>2.3 (0.9)</b>	<b>0.5</b>	<b>67.6</b>	<b>51.8</b>	<b>7.8</b>
China	0.9 (0.5)	0.2	67.1	61.7	1.2
Korea	5.7 (2.6)	1.2	71.6	53.1	24.7
India	4.1 (1.2)	0.8	60.7	55.8	4.7
Chinese Taipei	4.1 (0.9)	0.8	55.0	74.5	9.0
Indonesia	4.6 (0.9)	0.9	77.6	49.0	2.6
<b>Africa &amp; Middle East</b>	<b>13.7 (2.8)</b>	<b>4.8</b>	<b>73.7</b>	<b>40.5</b>	<b>2.7</b>
United Arab Emirates	8.5 (1.9)	2.5	91.9	47.5	2.9
Saudi Arabia	15.9 (5.6)	3.4	93.8	68.2	–
Qatar	12.3 (1.8)	3.9	98.3	16.4	3.5
Liberia	55.7 (–)	80.2	99.9	14.3	2.2
South Africa	4.2 (1.9)	1.9	75.3	35.5	15.1
Colour coding:	[0–25]	[25–50]	[50–75]	[>75]	
<p><sup>1</sup> Euro area banks' foreign claims on all sectors as a share of total credit to non-banks, in per cent. The numbers in parentheses indicate euro area banks' foreign claims on banks as a percentage of total credit to non-banks. <sup>2</sup> Euro area banks' foreign claims on all sectors as a share of total credit to non-banks, weighted by the ratio of the recapitalisation needs (RN) of each BIS reporting euro area banking system to its risk-weighted assets, as identified by the EBA in October 2011. For each country, the index is normalised so that it would be equal to the unweighted percentage reported in column 1 if all BIS reporting euro area banking systems had equal amounts of foreign claims on the respective country. <sup>3</sup> Euro area banks' cross-border claims as a share of their foreign claims, in per cent. <sup>4</sup> Euro area banks' international claims with a remaining maturity of up to one year as a share of their international claims, in per cent. <sup>5</sup> Euro area-located banks' debt securities as a share of their cross-border claims, in per cent.</p> <p>Sources: European Banking Authority (EBA); IMF; BIS consolidated banking statistics (immediate borrower and ultimate risk basis); BIS locational banking statistics by residence.</p>					

Table A

Net issuance by the non-financial corporate sector was also much weaker than in previous quarters (Graph 3, right-hand panel). At \$70 billion, it was the lowest in three years. High volatility and increased overall risk aversion in financial markets squelched issuance of junk bonds in particular. Issuance in

Lower issuance by corporates, especially in the high-yield segment



the high-yield segment had reached record highs in the first half of the year, but activity slumped over the summer and ground to a halt in September (Graph 4, centre panel).

Weaker emerging market borrowing

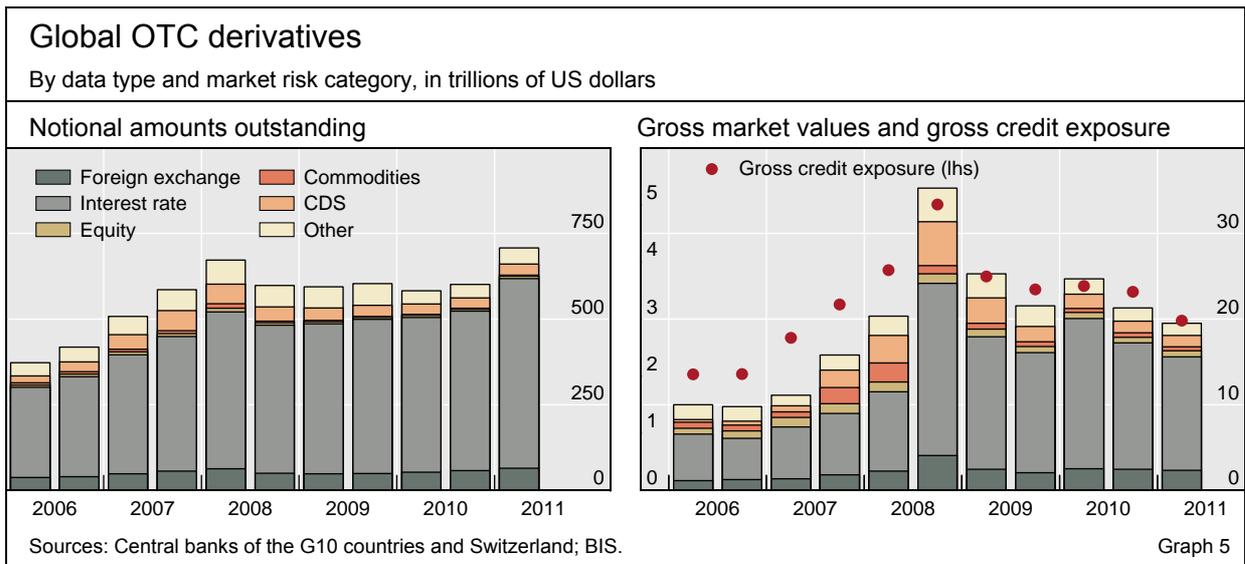
Emerging market borrowing, which had been robust over the past two years, showed a marked decline in the third quarter of 2011 in the face of wider spreads (Graph 4, right-hand panel). The decline in issuance was mostly due to lower activity by borrowers from Asia-Pacific, whose net issues (\$11 billion) were just about half of the average quarterly amount raised during the past year. Chinese borrowers raised a mere \$6 billion compared to \$25 billion in the second quarter. Borrowers from emerging European economies also curtailed their funding via international debt securities, repaying \$1 billion in net terms. This contrasts with an average of \$14 billion of net issues per quarter over the past year. In particular, Russian borrowers redeemed a net \$3 billion in the third quarter. Borrowers from Latin American and Caribbean economies were still net raisers of funds via international debt securities, to the tune of \$11 billion. Mexican borrowers sold international debt securities worth \$6 billion net of repayments, whereas Brazilian net borrowing declined from \$13 billion in the second quarter to \$2 billion in the third quarter.

### Over-the-counter derivatives in the first half of 2011<sup>6</sup>

Rebound in notional amounts outstanding ...

For the first time since the financial crisis, positions in over-the-counter (OTC) derivatives went up significantly in the *first half of 2011*. Notional amounts outstanding of contracts in all risk categories rose by 18% to \$708 trillion at the end of June, well above the \$673 trillion peak in mid-2008 (Graph 5, left-hand

<sup>6</sup> Queries concerning the over-the-counter derivatives statistics should be addressed to Christian Upper.



panel). By contrast, gross market values of these contracts fell by 8%, owing mainly to a 10% reduction in the market value of interest rate contracts (Graph 5, right-hand panel). Since interest rates remained roughly unchanged over the period since the previous survey, this suggests that a significant number of contracts with large mark to market values have either expired or been terminated. Gross credit exposure dropped by 15% to \$3.0 trillion, the lowest since the end of 2007.

Most of the increase in the total amounts outstanding is due to larger (gross) positions on interest rate risk. Notional amounts outstanding of interest rate contracts increased by 19% to \$554 trillion. The expansion was evenly split across currencies.<sup>7</sup> Maturities shortened: the amounts outstanding of contracts with remaining maturities of more than five years fell by 6% to \$130 trillion, whereas those with maturities of one year or less went up by more than 30% to \$247 trillion.

... reflecting higher volumes of interest rate derivatives

Higher volumes of shorter-maturity contracts also lifted outstanding notional amounts outstanding in FX derivatives. Positions in contracts with maturities of one year or less rose by a quarter, while those with maturities of over five years halved. As a consequence, total amounts outstanding increased by 12% to \$65 trillion.

Increased volumes of short-term FX contracts

Notional amounts outstanding in the credit default swap (CDS) market increased moderately, reversing the post-crisis downward trend. That said, at \$32 trillion at the end of June 2011, notional amounts outstanding of CDS remained well below the peak of \$58 trillion at the end of 2007. Multi-name contracts drove the increase, with positions going up by 22% to \$14 trillion. Amounts outstanding of single-name CDS remained stable at \$18 trillion.

CDS positions increase for the first time since the financial crisis

The share of centrally cleared CDS contracts increased slightly. 17% of all CDS by reporting dealers involved a central counterparty (CCP), up from 15% six months before. This means that approximately 9% of all trades were

<sup>7</sup> The 63% increase in interest rate derivatives denominated in Canadian dollars was partly due to an expansion in the reporting population. The impact of this increase in coverage on total notional amounts outstanding across currencies and risk categories is well below 1%.

cleared centrally, since a single contract between two CCP members is replaced by separate contracts between the CCP and each of the counterparties.<sup>8</sup> Positions of reporting dealers with non-financial customers shrank by 23% to only \$238 billion, following a 63% decline in the second half of 2010. Non-financial customers now hold less than 1% of all CDS, compared with a peak of 5% at the end of December 2009. The amount of risk transfer between reporting dealers and the different types of counterparties is discussed in greater detail in the special feature on pages 85–89 of this issue.

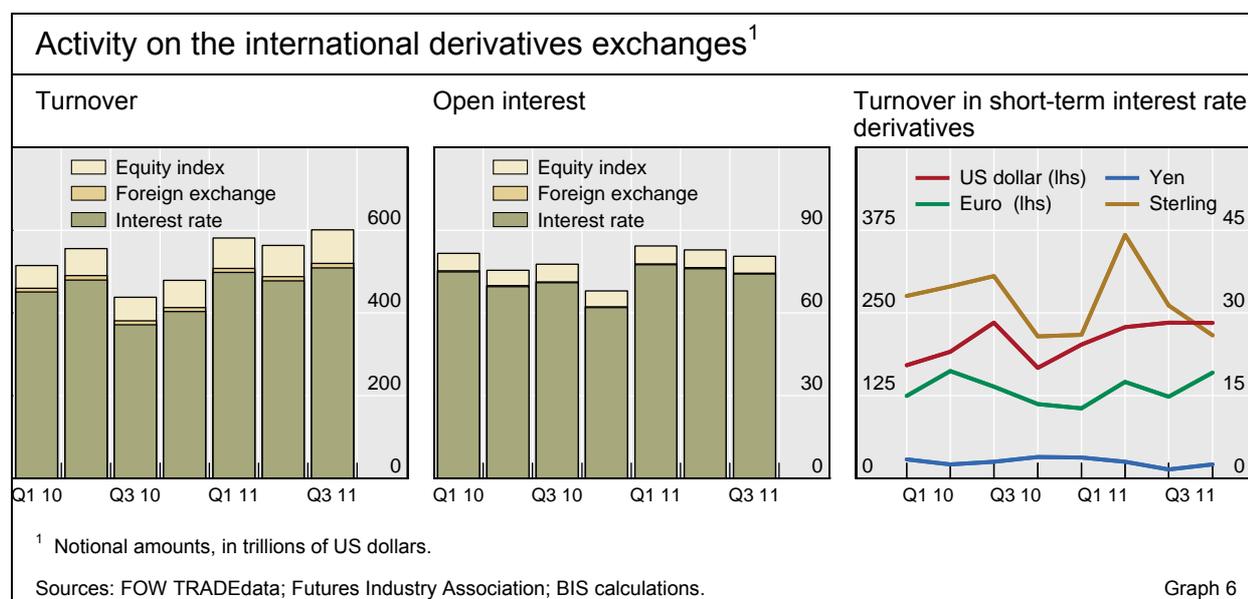
Larger OTC positions in equity and commodity derivatives

Positions in equity and commodity derivatives also increased significantly. Notional amounts outstanding of equity-linked contracts increased by 21%. Positions in equity-linked options were up by 26%, while those in forwards and swaps increased by 11%. Amounts outstanding of commodity contracts grew by 9%, with contracts on gold up 18% and options on precious metals and other commodities up 19%.

### Exchange-traded derivatives in the third quarter of 2011<sup>9</sup>

Higher turnover but lower open interest in listed futures and options

Activity on the international derivatives exchanges rebounded in the third quarter of 2011. Turnover measured by notional amounts increased by 7% to \$603 trillion between July and September, with very little difference across the types of underlying risk (Graph 6, left-hand panel). The increase in turnover more than offset the 3% decline recorded in the second quarter. Open positions continued to contract, falling by 3% to \$81 trillion at the end of September, with a particularly large decline in foreign exchange (Graph 6, centre panel).



<sup>8</sup> See N Vause, “Central clearing and OTC derivatives statistics”, *BIS Quarterly Review*, June 2011, p 26.

<sup>9</sup> Queries concerning the exchange-traded derivatives statistics should be directed to Christian Upper.

Investors taking positions on changes in the medium-term outlook for monetary policy in the euro area and Japan lifted activity in the interest rate segment of the international derivatives exchanges. Turnover in futures and options on interest rates in all currencies increased by 7% to \$510 trillion. A sizeable part of the increase was driven by higher turnover in contracts on short-term euro (+30%) and yen (+60%) money market rates (Graph 6, right-hand panel). While the near-term outlook for policy rates in these two currencies remained stable during the period under review, investors began to price in significantly lower rates than before over a one-year horizon. In the euro area, traders mainly demanded options on short-term euro money market rates (70%), whereas trading activity in the corresponding futures contract rose roughly in line with the entire market (+7%). By contrast, with little option trading in short-term yen rates, the entire increase in activity was concentrated in the futures contract.

Revised monetary policy expectations lift activity in euro and yen interest rate contracts

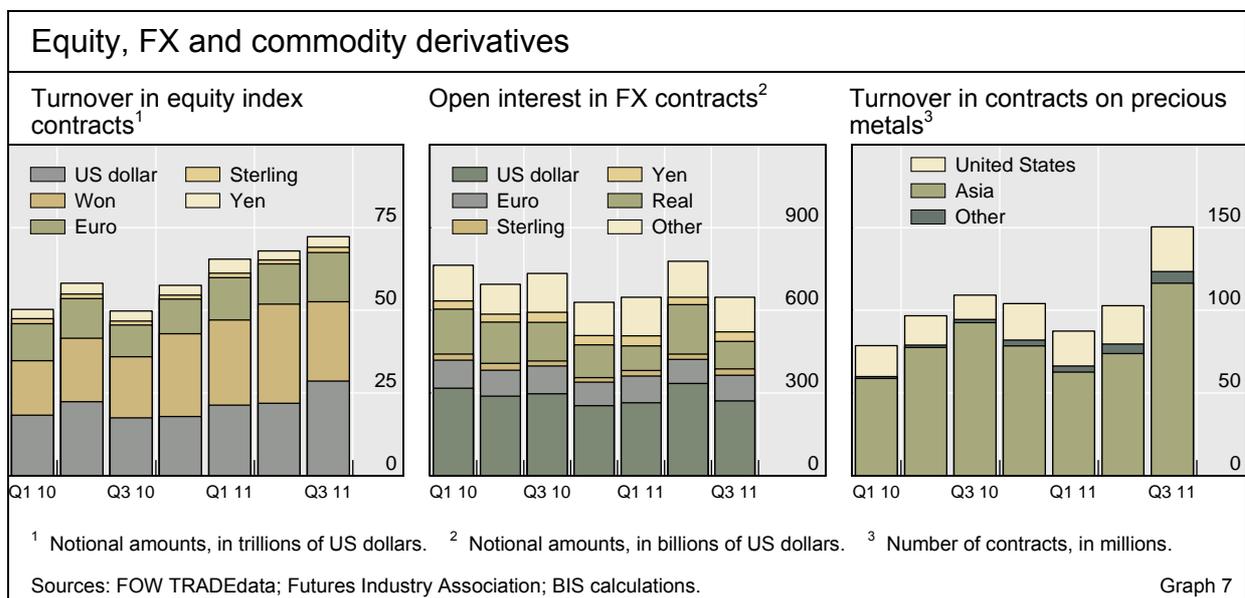
Activity in futures and options on stock indices rose as equity prices fell in most markets in the third quarter of 2011. Turnover increased by 7% to \$81 trillion between July and September, the highest on record (Graph 7, left-hand panel). The number of contracts traded, which is independent of valuation effects, went up by 12% over the same period. Trading volumes increased in all major markets apart from Korea, where turnover in won-denominated equity index contracts fell by 20% in dollar terms and 12% in terms of the number of contracts.

Higher activity in stock index contracts as equity prices tumble

Heavier trading in currency futures lifted turnover in exchange-traded FX derivatives. Turnover in FX futures increased by 9% to \$10.6 trillion, whereas options turnover remained stable at \$0.7 trillion.

Open interest in FX contracts plummeted after the Brazilian government introduced a 1% transaction tax on certain FX derivatives. Open positions in contracts traded on Brazilian exchanges fell by 44% (turnover: -6%). The market for futures and options on the Brazilian real is unusually large relative to the OTC market. This makes the real the second most important currency on the international derivatives exchanges in terms of open interest, behind the

Brazilian transaction tax depresses positions in FX contracts



US dollar but before the euro (Graph 7, centre panel). As a consequence, the drop in open interest on the Brazilian exchanges fed into a global reduction in open interest in FX products of 17%, despite a 6% increase in positions on all other exchanges.

The introduction of the Brazilian transaction tax triggered a surge in turnover in the real contract listed on the Chicago Mercantile Exchange (68%). That said, at \$5.5 *billion* between July and September 2011, turnover in the Chicago-traded real contracts remains a fraction of that taking place onshore in Brazil (\$1.5 *trillion*) over the same period. Moreover, open interest in the CME's real contract fell by 16% in the third quarter, which suggests that the transaction tax did not result in any significant push of positions offshore.

Asian trading  
boosts turnover  
in contracts on  
precious metals

High demand for precious metals in Asia drove up turnover in the corresponding derivatives during the emerging market sell-off in August and September. Over the quarter as a whole, turnover measured by the number of contracts traded (notional amounts are not available) increased by 46% (Graph 7, right-hand panel). In Asia, where contract size tends to be smaller (ie involving less of the underlying commodity), trading increased by 58%.

Turnover in other commodities also increased, despite falling commodity prices. Trading in contracts on non-precious metals, agricultural commodities and energy increased by 11%, 5% and 2%, respectively.



## FX strategies in periods of distress<sup>1</sup>

*This article presents an overview of widely practised short-term multicurrency investment strategies such as carry trade, momentum and term spread strategies. We provide evidence on their downside risk properties and illustrate their performance over historical episodes of financial market turmoil. We show that the strategies exhibit substantial tail risks and that they do not perform uniformly during distress periods in global markets. Interestingly, equity market investments feature even greater downside risk.*

*JEL classification: F31, G11, G15.*

Nowadays, market participants and researchers view foreign exchange (FX) as a distinct asset class. Trading activity in many currencies has surged with the rise of electronic trading networks and the emergence of dedicated FX investors and hedge funds.<sup>2</sup> Over the last decade, there has also been a growing interest in trading strategies that rely on the continued presence of attractive short-term investment opportunities in FX markets. The widespread availability of financial products based on FX carry and momentum strategies suggests fund managers and other investors use them widely.<sup>3</sup> The most prominent example is the carry trade, which is a bet that higher-yielding currencies will not depreciate enough against lower-yielding currencies to outweigh the interest differential (or carry). A second example is FX momentum strategies. These are bets that currencies that appreciated the most in the recent past (so-called “winners”) will continue to do so for a few months, and that currencies that depreciated the most in the recent past (so-called “losers”) will continue to do so for a short time period.

Given these features of today’s FX markets, a better and more detailed understanding of the properties and risks associated with widely followed

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<sup>1</sup> The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. We are especially grateful to Tim Kroencke for useful comments and assistance with the data construction, to Claudio Borio, Stephen G Cecchetti, Peter Hördahl, Lukas Menkhoff, Maik Schmeling and Christian Upper for useful comments on earlier drafts of this article, and to Gary Tang for excellent research assistance.

<sup>2</sup> See King et al (2011) for a discussion of these developments.

<sup>3</sup> See Deutsche Bank (2007). Pojarliev and Levich (2010) provide empirical evidence that these investment strategies are widely followed by currency fund managers.

investment strategies is paramount for gauging effects on price dynamics and for assessing potential financial vulnerabilities.

In this feature, we provide an overview of typical FX investment strategies and illustrate how they work. The strategies we consider are standard carry trade, momentum and term spread strategies. The last of these are refined carry trades that, in addition to interest rate differentials, also take into account expected macroeconomic conditions as reflected by the steepness of the yield curve (Ang and Chen (2010)). Our main focus is on illustrating the risk-return profiles of the different strategies. Besides analysing their behaviour under normal market conditions, we take a closer look at the downside risks involved, especially tail risks. We find that even though FX investment strategies have fared rather well, short-term downside risks to investors can still be quite substantial. This is an important aspect given the short-term nature of the typical strategies deployed in these markets. One bad month can be sufficient to wipe out one to two years of average returns. We also show, however, that investments in equities expose investors to even larger downside risks.

The article proceeds as follows. We first provide an overview of some of the most popular FX investment strategies before discussing their risk-return profile. We then take a specific look at some extreme events in the lower tail of the return distribution, illustrate the strategies' performance during both recent and historical episodes of severe market stress (such as the Asian crisis and the recent financial crisis) and provide a comparison with other risky assets over the same period. In a separate box, we discuss possible economic drivers of the returns generated by these investment strategies and emerging themes in the literature. The final section concludes.

## FX investment strategies

### *Carry trade*

A carry trade involves borrowing in currencies with low interest rates (called funding currencies) and investing in those with high interest rates (the target currencies). Examples of recently attractive target currencies are the Brazilian real, the South African rand and the Australian dollar. Popular funding currencies included most recently the US dollar and historically also the Japanese yen or the Swiss franc. If the target currency does not depreciate vis-à-vis the funding currency during the life of the investment, then the investor earns at least the interest differential. This strategy does not work if uncovered interest parity (UIP) holds. The UIP condition states that higher-yielding currencies will tend to depreciate against lower-yielding ones at a rate equal to the interest differential so that expected returns are equalised in a given currency. Under UIP, any interest differential is expected to be fully offset by currency movements.

A large body of empirical literature documents that UIP fails almost universally at short- and medium-term horizons (Froot and Thaler (1990), Sarno (2005)). Indeed, in many cases the relationship is precisely the opposite of that predicted by UIP: currencies with high interest rates tend to appreciate

We focus on risk-return profiles of FX strategies ...

... such as carry trade and momentum

while those with low interest rates depreciate. This failure of UIP is so well established that the phenomenon is called the “forward premium puzzle”. The failure of UIP is no secret to investors, hence the popularity of carry trades. This strategy has become so commonplace that the market has created tradable benchmarks for it and has introduced structured FX instruments referencing these benchmarks. In our analysis below, we mimic a typical carry trade strategy readily available to investors.<sup>4</sup> The carry trade puts upward pricing pressure on target currencies and downward pressure on funding currencies. This could result in amplification of underlying exchange rate moves. In addition, it may also result in more rapid exchange rate moves when carry trade investors unwind their positions.

### *Momentum strategies*

Momentum strategies rely on short-term trends ...

Momentum strategies are also known as “trend-following” strategies. They have been quite profitable across several asset classes (Asness et al (2009)), including equity markets worldwide, commodities and corporate bonds.

... are long past “winners” and short past “losers” ...

We consider portfolios of currencies where an investor buys (takes a long forward position) in currencies with high past excess returns (“winners”) and sells (takes a short forward position) in currencies with low past excess returns (“losers”). By design, momentum strategies may potentially perpetuate past directional moves in exchange rates. This could result in amplification as well as delayed but more abrupt exchange rate moves.

... and are multicurrency

In our implementation, which mimics typical currency momentum strategies as performed by practitioners, we rely on past performance as measured over short-term horizons of one and three months.<sup>5</sup> This family of FX momentum strategies draws on information from the entire cross section of tradable currencies.<sup>6</sup> The idea is to go long in a portfolio of winner currencies and go short in a portfolio of loser currencies. Currency momentum therefore has a distinct cross-sectional focus, which distinguishes it from other trading strategies that also exploit short-term trends but focus on individual exchange rates (eg Neely et al (2009)).<sup>7</sup>

The momentum strategy is somewhat of a chameleon when compared to the carry trade. The portfolio of winner currencies might at the same time contain both high interest rate currencies, such as the New Zealand dollar, and

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<sup>4</sup> There is also an expanding literature exploring the economic drivers of the returns generated by this strategy (for recent contributions, see eg Brunnermeier et al (2009), Burnside et al (2011a), Lustig et al (2011) and Menkhoff et al (2011a)).

<sup>5</sup> Menkhoff et al (2011b) show that FX momentum strategies with relatively short formation periods (up to six months) and monthly rebalancing of FX momentum portfolios tend to be the most profitable. They also dissect the differences between carry trade and momentum strategies in close detail and show that the strategies and their properties are indeed very different. This implies that the two phenomena require different explanations.

<sup>6</sup> Similar strategies have also been considered by Okunev and White (2002), Burnside et al (2011b) and Menkhoff et al (2011b).

<sup>7</sup> See Menkhoff and Taylor (2007) and Neely and Weller (2011) for comprehensive surveys of the literature on so-called “technical trading rules” in foreign exchange markets.

low interest rate ones, such as the Japanese yen or the Swiss franc: It all depends on their short-term behaviour in the immediate past. More recently, currencies in the short portfolio have included the Hungarian forint, the Polish zloty and the euro. One distinguishing feature of the momentum strategy is that the long-short combination requires more frequent rebalancing than the carry trade and thus results in a less stable currency composition over time. As a result, transaction costs are potentially large (Menkhoff et al (2011b)). Hence we report all our performance measures and results with transaction cost adjustments based on quoted bid-ask spreads.

#### *Yield curve slope or term spread strategies*

Term spread strategies are also long-short investment strategies guided by relative yield curve steepness. They represent a class of FX investment strategies where predictive signals for exchange rates are based on the entire yield curve (Ang and Chen (2010)) and can be best thought of as a refined version of the carry trade. Differentials in yield curve slopes across countries convey information about differences in term premia. This additional forward-looking information is neglected by standard carry trade investors, who only consider the short end of the yield curve when deciding which currencies to buy and sell. The simple form of term spread strategy involves going long in currencies with low term spreads (the Australian dollar and the Swedish krona are recent examples) and short currencies with high term spreads (recently sterling and the Mexican peso).

Term spread strategies are refined carry trades ...

... based on both interest differentials and relative yield curve slopes

### Risk-return profiles for different strategies

To explore the nature of the risk faced by investors, we follow recent work by Kroencke et al (2011) and draw on a broad cross section of currencies. The cross section includes most of the major currencies for the developed and emerging economies. We cover the period January 1985–September 2011 for a total of 25 currencies, all measured against the US dollar (USD).<sup>8</sup> This set of currencies broadly corresponds to the investment universe deployed in typical FX investment vehicles available to investors and covers over 95% of global FX turnover (King and Rime (2010)).<sup>9</sup>

We build portfolios of currencies to implement these strategies in line with current practice in industry and research (Lustig and Verdelhan (2007)). In each month, we sort currencies according to either (a) forward discount / lagged interest rate differential vis-à-vis the United States (Carry trade); (b) lagged past performance over one or three months (Momentum 1 and Momentum 3); or (c) the term spread differential (Term spread strategy). The

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<sup>8</sup> Quantitatively similar results hold when considering alternative base currencies such as the euro, sterling and the Swiss franc (Kroencke et al (2011) or Menkhoff et al (2011b)).

<sup>9</sup> The sample covers the currencies of Australia, Brazil, Canada, Chinese Taipei, Denmark, the euro area, France, Germany, Hungary, India, Indonesia, Italy, Japan, Korea, Mexico, the Netherlands, New Zealand, Norway, Poland, Russia, Singapore, South Africa, Sweden, Switzerland and the United Kingdom against the USD.

strategies are then implemented through long forward positions in the 25% of currencies with the highest value of the specific signal defined by each strategy and short forward positions in the 25% of currencies with the lowest value of this signal. The portfolios are rebalanced monthly and we compute excess returns for equally weighted portfolios.

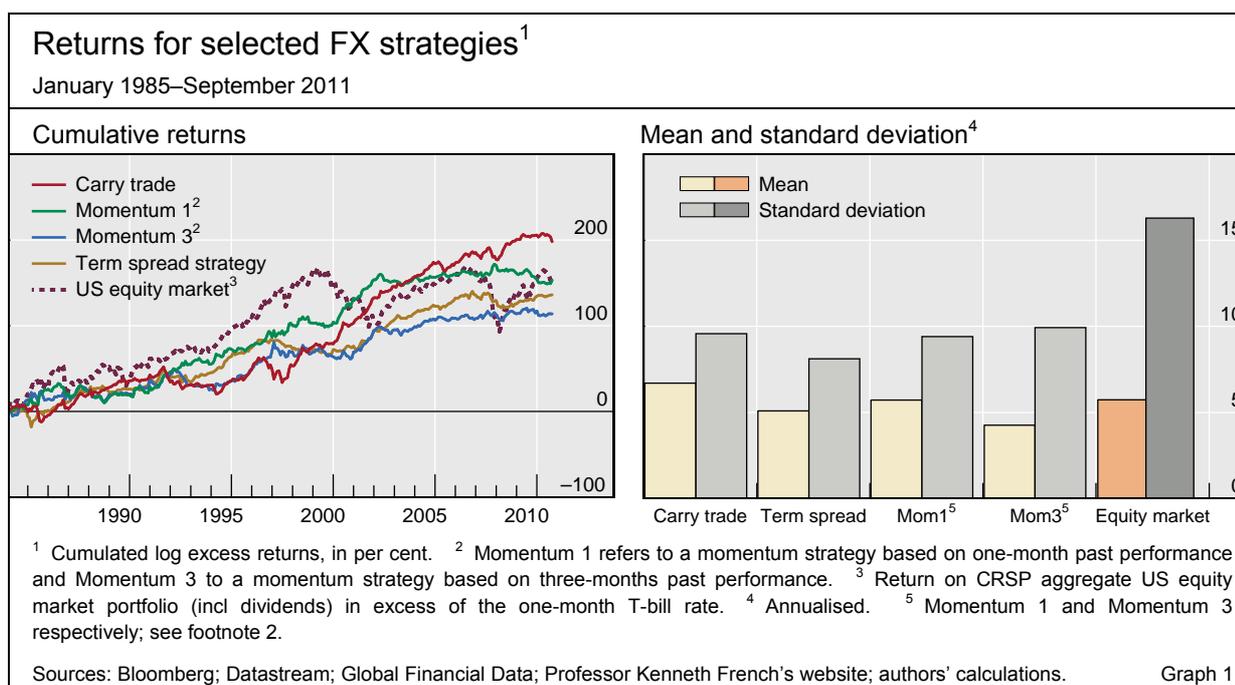
Here the *excess return* is what is left after borrowing in USD at the US interest rate, converting into foreign currency, investing in the foreign money market and finally converting back to USD at the end of the investment period. Specifically, the excess return to a long FX forward position at time  $t$  is given by  $f(t) - s(t+1)$ , where  $s(t)$  is the logarithm of the spot rate (defined as units of foreign currency per USD), and  $f(t)$  denotes the log forward rate. Put differently, the excess return is the return to selling the USD forward and buying it back at the future spot rate.

### Returns

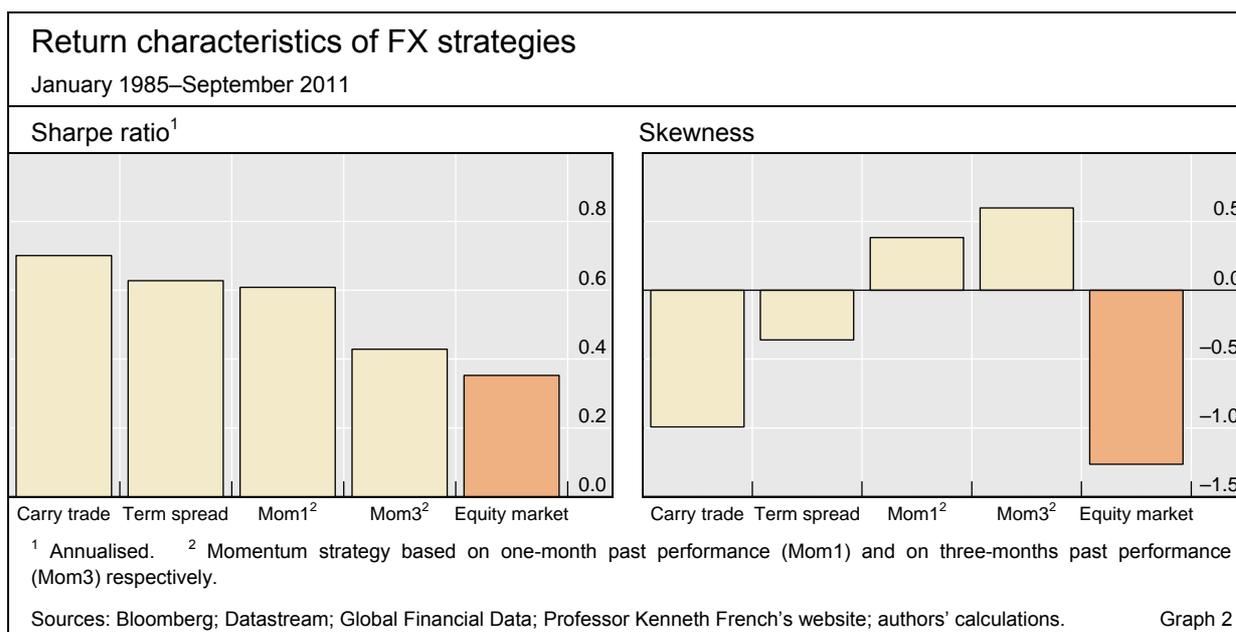
FX strategies have generated high returns ...

Returns for the FX strategies considered here have been larger than or on a par with those for equities during the examined period (Graph 1). For benchmark purposes, we compare the FX strategies with the return to the aggregate US equity market in excess of the US one-month T-bill rate.<sup>10</sup> The annualised average monthly return on a carry trade portfolio was 7.4% during the period, while the momentum strategy yielded an average of 5.7% per year compared to 5.9% for US equities. Moreover, the return volatility for the FX strategies is fairly low compared to that for the equity market.

Returns from FX strategies are not normally distributed. As is typical for financial returns, the return distributions have heavier tails than a normal distribution. The return distribution for both the carry trade and the term spread



<sup>10</sup> We use the broad equity index by the Center for Research in Security Prices (CRSP).



strategy are negatively skewed (Graph 2, right-hand panel), ie large losses are more likely than large gains. The negative skew reflects the presence of occasionally large negative monthly returns in the range of about 8–12%. This squares well with the evidence presented elsewhere (Gyntelberg and Remolona (2007), Brunnermeier et al (2009)). This skew can be considered as a proxy for what we call downside risk, but we consider some more refined measures below. In contrast, both of the momentum strategies have positive skew, and hence feature a slightly higher frequency of positive returns.

#### Risks

We consider three standard measures of risk: (1) volatility; (2) value-at-risk (VaR); and (3) expected shortfall (Table 1). Volatility of returns is the most common measure of risk in financial markets and would be most appropriate for symmetric and normal return distributions. VaR is defined as the capital needed to cover a certain level of losses over a given holding period and at a

Strategy type	Mean excess return (per annum)	Volatility <sup>1</sup> (per annum)	1% VaR <sup>2</sup> (monthly)	1% expected shortfall <sup>3</sup> (monthly)
Carry trade	7.4	9.9	6.7	8.1
Momentum – 1 month <sup>4</sup>	5.7	9.4	7.9	9.9
Momentum – 3 months <sup>4</sup>	4.3	9.9	8.6	10.7
Term spread	5.1	8.1	6.4	7.6
US equity market <sup>4</sup>	5.9	16.3	9.1	10.3

<sup>1</sup> Standard deviation of returns (annualised, in per cent). <sup>2</sup> The 1% VaR for a random variable  $x$  is defined as the 1% percentile of the distribution. <sup>3</sup> The 1% expected shortfall is the expected loss given the loss exceeds the 1% VaR. Both VaR and expected shortfall are estimated using an extreme value theory approach following the method suggested by Gilli and K llezi (2006). <sup>4</sup> Momentum strategy based on one-month past performance and three-months past performance respectively. <sup>5</sup> Return on CRSP aggregate US equity market portfolio (incl dividends) in excess of the one-month T-bill rate.

Sources: Datastream; Global Financial Data; Professor Kenneth French's website; BIS calculations. Table 1

given confidence level. It is a standard measure of risk when return distributions feature small probabilities of large losses. Expected shortfall is the (estimated) expected loss in situations where losses exceed a 1% VaR level. Both VaR and expected shortfall are measures that focus on downside risk.

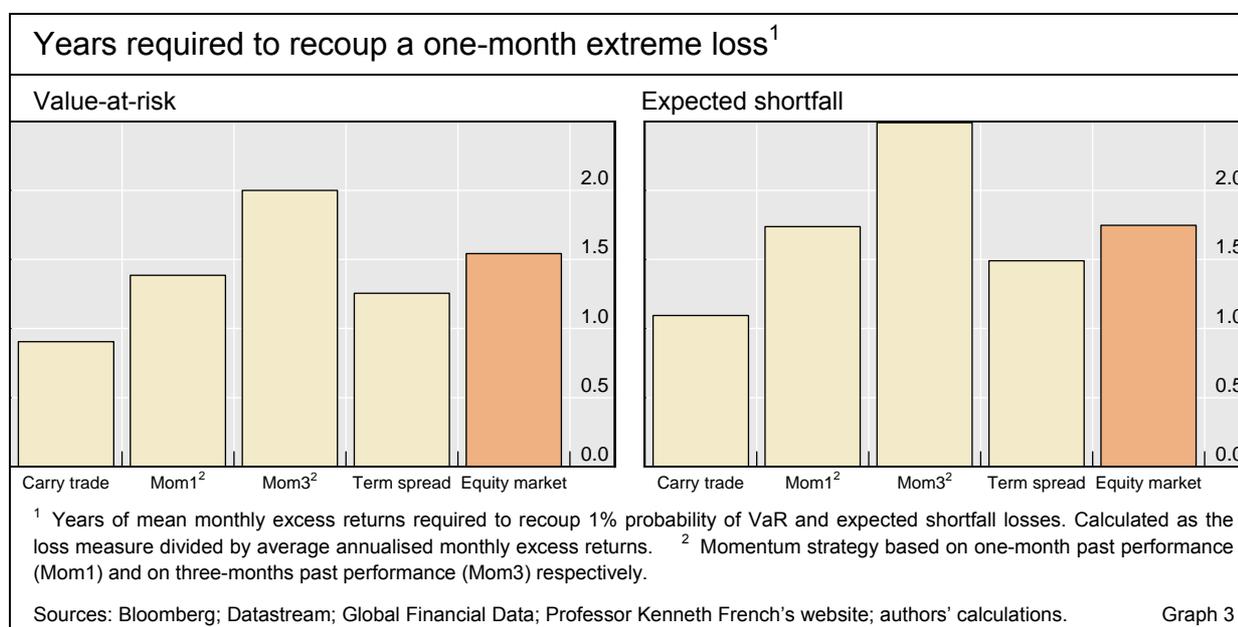
### Returns versus risk

The most prominent measure of return per unit of risk is the Sharpe ratio, which is the ratio of average excess return per unit of volatility. It is also often termed the reward-to-risk ratio. The Sharpe ratios for the FX strategies are clearly higher than those for equities (Graph 2, left-hand panel).<sup>11</sup> The reason is that although the mean excess returns for the FX strategies and equities are roughly the same, the FX strategies have much lower return volatility (Table 1 and Graph 1).

While the Sharpe ratios suggest that the FX strategies have very attractive risk-return profiles, they do not account for downside risks, which can be substantial. That said, the FX strategies are less risky on the downside relative to the equity market (Table 1). This is illustrated in Graph 3, which compares the VaR and expected shortfall estimates. Interestingly, the carry trade strategy has the lowest monthly downside risk measures among the strategies considered here. Nevertheless, although the downside risks are smaller for the carry trade and the term spread strategies, a single bad month can still be sufficient to wipe out the return obtained over a whole year. For momentum strategies, the situation is even more extreme, with losses over a single month potentially wiping out about two years of returns.

... but also feature substantial downside risks

For FX strategies, one bad month can cost as much as one to two years' worth of returns



<sup>11</sup> Sharpe ratios for equities are sensitive to the sample period due to the high variability of equity returns. This makes it difficult to pin down the value of the historical equity premium precisely. Computing the Sharpe ratio for the US equity market for a longer period over the post-WWII sample (January 1947–August 2011) gives a value of 0.47. This value has been the subject of a large literature on the “equity premium puzzle”. Returns to FX investment strategies present a challenge to researchers of even greater magnitude.

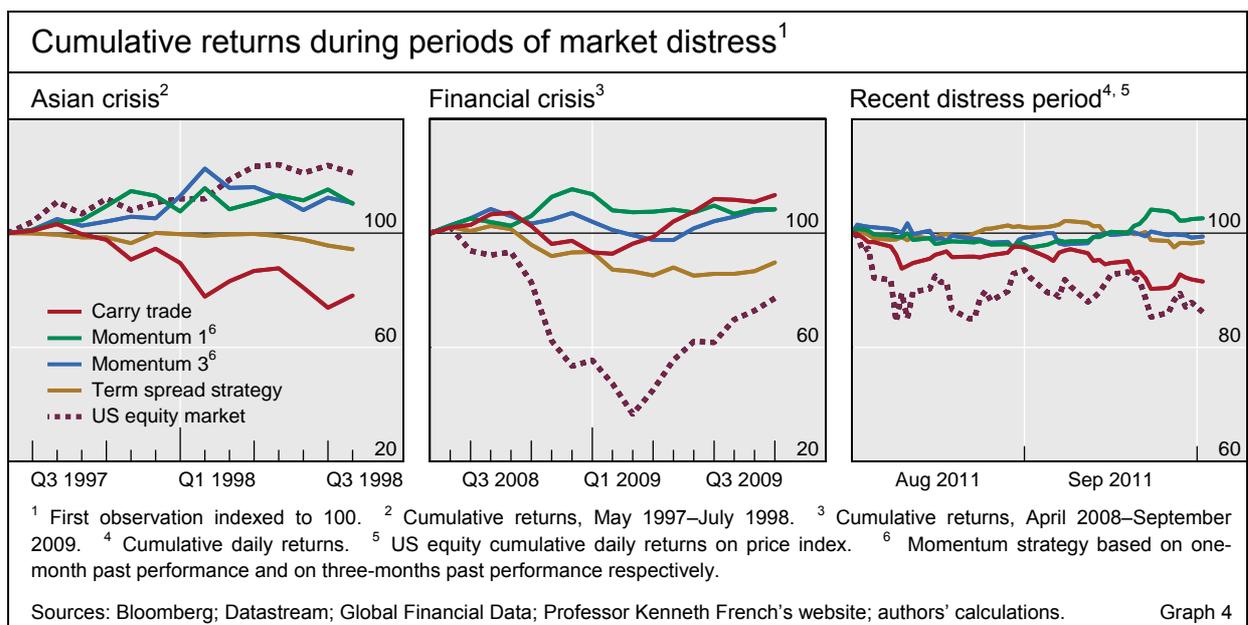
## Performance during actual periods of market distress

We now turn to the selected periods of market distress and discuss the returns in the bad tail of the distribution. This exercise is particularly interesting since the recent literature on carry trades emphasises the importance of market-wide distress. The focus is on measures of funding or market illiquidity and systematic volatility risk.<sup>12</sup> We consider the Asian crisis (1997–98) and the latest financial crisis (2008–09). In addition, we take a closer look at the two recent months of August and September 2011.

The Asian crisis was bad for carry trade investors

The Asian crisis was clearly not a good period for carry trade investors, as depicted by Graph 4 (left-hand panel). The largest monthly loss for our simulated carry trade strategy was about –12% in January 1998. During this period, the Deutsche mark, Japanese yen, Dutch guilder and Swiss franc were all attractive as funding currencies while the South African rand, Indonesian rupiah and Mexican peso were targets. While carry trades suffered severe losses, other FX investment strategies either did not exhibit such a poor performance (as in the case of the term spread strategy) or actually yielded positive returns (as in the case of the two momentum strategies). It is also worth noting that, in contrast to Asian equity markets, US equities actually performed rather well during the Asian crisis.

The 2008–09 financial crisis is a telling example of a severe period of market stress or tail event. In the run-up to the crisis, currencies such as the South African rand, Brazilian real and New Zealand dollar featured prominently as attractive target currencies.<sup>13</sup> Primary funding currencies were the Swiss franc and Japanese yen. As shown by Graph 4 (centre panel), the carry trade suffered severe losses during the crisis. The most negative return to our



<sup>12</sup> See eg Brunnermeier et al (2009), Christiansen et al (2011), Lustig et al (2011) and Menkhoff et al (2011a).

<sup>13</sup> See Galati et al (2007), Gyntelberg and Remolona (2007) and McGuire and McCauley (2009).

## Drivers of carry and currency momentum

Research on the economic drivers of carry trade returns has seen significant advances over the past several years. It has been established that it is difficult to explain carry trade returns purely as compensation for risk exposure with standard risk factors – that is, conventional asset pricing models based on covariance risk with, for instance, the broader market or business cycle factors (Burnside et al (2011a)). This has led researchers to emphasise aspects such as funding market constraints and crash risk (Brunnermeier et al (2009)), and to argue that currencies share a common risk factor (Lustig et al (2011) and that carry trade premia are compensation for systematic volatility and liquidity risks (Menkhoff et al (2011a)).<sup>①</sup>

In addition to work based on observable risks, an alternative explanation is that carry trade returns might be a compensation for the risk of rare disasters with significant losses which do not occur in-sample (Burnside et al (2011a)).<sup>②</sup>

Whereas the literature on carry trades is meanwhile quite extensive, much less is known about the potential drivers of currency momentum.<sup>③</sup> This is especially so for FX momentum strategies relying on a broad cross section of currencies that have been introduced more recently. Recent empirical studies suggest that currency momentum returns cannot be successfully explained by the risk types that seem plausible for carry trades (Burnside et al (2011b), Menkhoff et al (2011b)). This research also documents that the anatomy of carry trade returns is very different from that of currency momentum returns.

There is evidence that momentum returns in part reflect the gradual incorporation of news into prices and a resulting return drift, as shown in Menkhoff et al (2011b).<sup>④</sup> In addition, this research also points to country-specific risks, transaction costs and other forms of limits to arbitrage as likely explanations for the continued presence of momentum returns. Our finding of substantial downside risks for the currency momentum strategies presented in the main text squares well with this explanation. Following momentum strategies can expose investors to potentially painful short-term losses, as illustrated in the main text. This may discourage market participants from taking aggressive positions to trade momentum profits away (Shleifer and Vishny (1997)). Arbitrage capital might therefore move slowly, which could possibly explain why an apparent market anomaly like FX momentum continues to exist (Duffie (2010)).

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<sup>①</sup> There is also empirical evidence that carry returns co-vary more strongly with the equity market in volatile periods (Christiansen et al (2011)). <sup>②</sup> This explanation is often referred to as the peso problem (Krasker (1980)). <sup>③</sup> Okunev and White (2002) were to our knowledge the first academic researchers to document the profitability of momentum strategies relying on a broad cross section of currencies. Most other earlier research on trading strategies which exploit short-term trends focused on individual exchange rates. Menkhoff and Taylor (2007) and Neely and Weller (2011) comprehensively review this literature on so-called technical trading rules. A major aim in much of this work has been to determine which rules work best and how stable they are over time (Neely et al (2009)). <sup>④</sup> This finding – which was first established for equities by Jegadeesh and Titman (2001) – suggests that momentum profits across asset classes may share a common root.

diversified portfolio mimicking a typical carry trade investment strategy was –6% in October 2008, which coincided with a major jump in the VIX and other measures of volatility over this period.

Carry trades rebounded quickly after the 2008–09 crisis ...

During the latest crisis, the carry trade first saw a sharp drop followed by a quick rebound as volatility and uncertainty receded over the months. By April 2009, the initial losses were recouped. By contrast, it took the US equity market several years (up to January 2011) to recover from the losses that occurred during the height of the financial crisis.

... while momentum returns were surprisingly robust

In contrast to the carry trade, momentum strategies were surprisingly successful over the crisis period (Burnside et al (2011b)). Thus, during this

period of extreme stress, FX strategies clearly provided diversification.<sup>14</sup> The term spread strategy, however, performed poorly over the entire period. This may in part reflect the effect of unconventional monetary policy measures on the correlation between term premia differentials and exchange rate movements.

In line with previous distress episodes, carry trades also suffered some severe losses in August and September 2011. The largest loss for a carry trade portfolio funded by US dollars over these two months amounted to about 3% on a single day. This reflects the fact that carry trade target currencies such as the Australian dollar, Brazilian real and South African rand depreciated strongly whereas the US dollar (the most attractive funding currency) appreciated against the vast majority of currencies. This illustrates that downside risks can be substantial and suggests that carry trades are exposed to systematic volatility risk (Menkhoff et al (2011a)). At the same time, the performance of the other strategies was much less affected by the market stress, while equity markets suffered even larger losses (Graph 4, right-hand panel).

## Conclusion

In this feature, we have provided an overview of common FX investment strategies. We have focused on their risk-return properties, especially during periods of market stress.

Our analysis suggests that carry trade and momentum investment strategies have continued to generate attractive returns for extended periods – but that they also involve significant downside risks.<sup>15</sup> Interestingly, we document that the downside risks to momentum strategies are of a similar magnitude to those for carry trades. The strategies, however, have quite different risk-return profiles. The carry trade is a typical “nickel” strategy yielding small gains most of the time but exposing an investor to large losses. In contrast, momentum strategies, in addition to downside risk, also have substantial upside. To put the downside risk of FX investment strategies into perspective, though, standard equity investments expose investors to even greater downside risks.

Our analysis also shows that, historically, the different strategies did not perform uniformly during episodes of market stress. This suggests that it is necessary to have a good understanding of the properties and risks associated with widely practised short-term investment strategies when trying to gauge their implications for price dynamics. From a financial stability perspective, the size of possible losses points to a potential for significant counterparty risks in FX markets. In addition, all the strategies considered have the potential to perpetuate and perhaps to amplify trends as well as short-term misalignments.

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<sup>14</sup> Kroencke et al (2011) show empirically that FX investment strategies provide diversification even for broadly diversified international equity and bond portfolios.

<sup>15</sup> For the carry trade, this is consistent with the findings in Gyntelberg and Remolona (2007) and Brunnermeier et al (2009).

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## Renminbi internationalisation and China's financial development<sup>1</sup>

*For now, effective capital controls allow the Chinese authorities to retain regulated deposit and lending rates, quantitative credit guidance and bond market rationing. Relaxation of the capital controls would put these policies at risk. Reserve requirements can be extended to bank inflows from the offshore market, but only at a price.*

*JEL classification: E4, E5, F3, G1, O16, P2.*

A currency is internationalised when market participants – residents and non-residents alike – conveniently use it to trade, to invest, to borrow and to invoice in it outside the currency's home country ("offshore"). The Chinese renminbi has just begun the process of becoming an international currency.

Economists have long considered the international use of a currency as a market outcome that is subject to inertia as a result of network externalities ("I use it because others use it"). Against this, Eichengreen and Flandreau (2010) find that it took the dollar just 15 years to overtake sterling in official reserves after the Federal Reserve Act promoted the US dollar's challenge to sterling in global trade and finance. Frankel (2011) argues that a "tiny elite" promoted the dollar at the Federal Reserve's founding and that German and Japanese industrialists resisted international use of the Deutsche mark and yen in the 1970s and 1980s.<sup>2</sup>

However one interprets the dollar's ascent, there is no precedent for the managed availability of the renminbi offshore. In the late 1950s, US officials were taken unawares by the spontaneous rise of London's eurodollar market as UK banks sought to avoid sterling exchange controls, US banks sought to avoid US regulation and central banks sought to invest at higher yields (Schenk (1998), McCauley (2005)).

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<sup>1</sup> The views expressed are those of the author and not necessarily those of the BIS. The author thanks Woon Khien Chia, Tim Condon, Dong He, Daniel Hui, Thomas Liu, Andy Lui, Guonan Ma, Sebastian Mallaby, Miranda Tam, Olin Wethington and Haibin Zhu for helpful discussions and Agne Subelyte and Emese Kuruc for research assistance. A longer version is at <http://www.cfr.org/thinktank/cgs/beijingpapers.html>.

<sup>2</sup> See Funke (1999, pp 246–8), Ito (2011) and Takagi (2011).

The Chinese authorities have begun to internationalise the renminbi *before* fully liberalising China's capital account. More broadly, the renminbi is crossing borders at a transitional stage in China's financial development. In the country's banking system, the net interest margin is still regulated, lending is still subject to quantitative guidance and foreign banks are still limited to playing a small role. Similarly, in the corporate bond market, issuance is still rationed. Backed by capital controls, these reinforcing restrictions provide the authorities with direct leverage over credit growth and its allocation.

How does the managed internationalisation of the renminbi square with this transitional stage of financial development? Can the Chinese authorities continue to manage the internationalisation of the renminbi within the regime of capital controls, and this without depriving themselves of direct levers on credit? Or is internationalisation likely to take the levers out of their hands?

As long as capital controls remain effective, renminbi internationalisation leaves the levers intact. Relaxed capital controls would put at risk bond market rationing, regulated deposit and lending rates, and quantitative credit guidance. Reserve requirements can be extended to inflows from offshore, but at a price.

This special feature first sketches the role of offshore markets in the multi-track strategy for China's financial development. The next section shows that offshore markets in renminbi are growing within a regime of capital controls. The following section traces the flow of funds from onshore to offshore and vice versa. The penultimate section contrasts the existing renminbi offshore markets with offshore markets in major currencies in order to highlight future challenges facing Chinese policymakers. The last section concludes.

## The three-track strategy of financial development

A generation ago, China gradually shifted from central planning to a socialist market economy. But instead of a big bang, as in Poland, price controls remained in place over the medium term for certain quantities of goods, and flexible market pricing applied to output beyond those quantities. In the transition, market prices served as shadow prices for the set quantities.

By analogy, the authorities have continued to set maximum deposit rates in the Chinese banking system, to exercise window guidance on loan growth and to ration access to bond markets. This is the first track. At the same time, the authorities have allowed market-set money and bond yields to signal the scarcity of funds. This is the second track. Banks heed these signals when they negotiate liberalised loan spreads with customers. Thus, over time, the two tracks can converge (He and Wang (2011)).

The offshore markets can serve as a third track. Renminbi accumulate offshore when Hong Kong SAR residents buy limited amounts of renminbi against dollars or when renminbi payments for China's imports exceed renminbi receipts for China's exports. Using these offshore renminbi, banks and underwriters build offshore foreign exchange, money and bond markets. So far, the authorities have permitted relatively narrow channels from (third-track) offshore markets to the (second-track) currency, money and bond markets in China. As a result, offshore price signals differ from those onshore.

Offshore market prices can help guide pricing by Chinese banks

That said, the Chinese authorities do not delude themselves that the third track can be permanently isolated from the second and first tracks. Instead, offshore prices can complement the domestic market-determined yields in sending signals to the still regulated banking system. The third track thus helps to expand the ambit of flexible prices. If the offshore markets put pressure on the pace of development of the domestic money and bond markets, within limits this would be welcome.

## Internationalisation within capital controls

Offshore prices differ from onshore prices in ...

Renminbi are accumulating outside the mainland via carefully drilled holes in China's capital controls. However, currency, bond and equity markets show that these controls nonetheless continue to bind.<sup>3</sup>

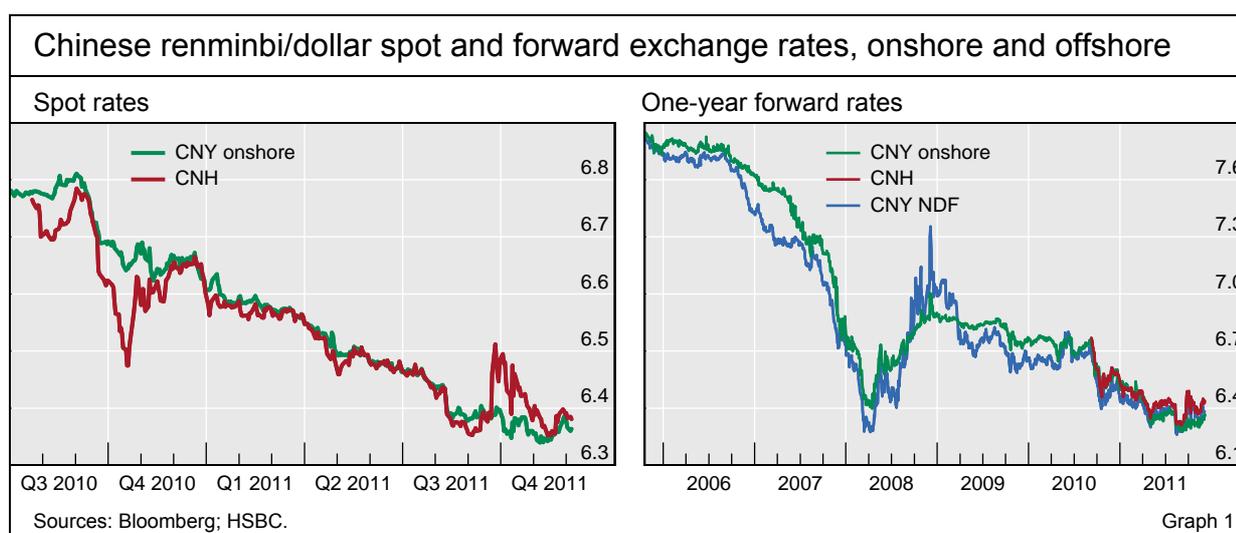
### Exchange rates

... spot foreign exchange ...

The renminbi's internationalisation has produced a second spot exchange rate for the renminbi, dubbed the CNH, for delivery of renminbi against dollars outside the mainland, largely in Hong Kong. And this spot renminbi exchange rate in Hong Kong differs from that in Shanghai (CNY), a clear sign of segmentation. From its inception on 11 July 2010 to November 2011, the premium on the Hong Kong CNH relative to the Shanghai fixing ranged between -1.9% and 2.6% and averaged 0.2% in absolute value (Graph 1, left-hand panel). In September and October 2011, with heightened risk in global equity markets ("risk off") and associated weakness in Asian currencies against the dollar, the renminbi traded substantially more cheaply in Hong Kong than in Shanghai. Global financial strains exposed the limits of arbitrage.

... forward foreign exchange...

With the introduction of a CNH forward in late 2010, three different markets trade forward rates for the renminbi (see box). For more than 10 years, a forward contract for difference, a so-called non-deliverable forward (NDF),

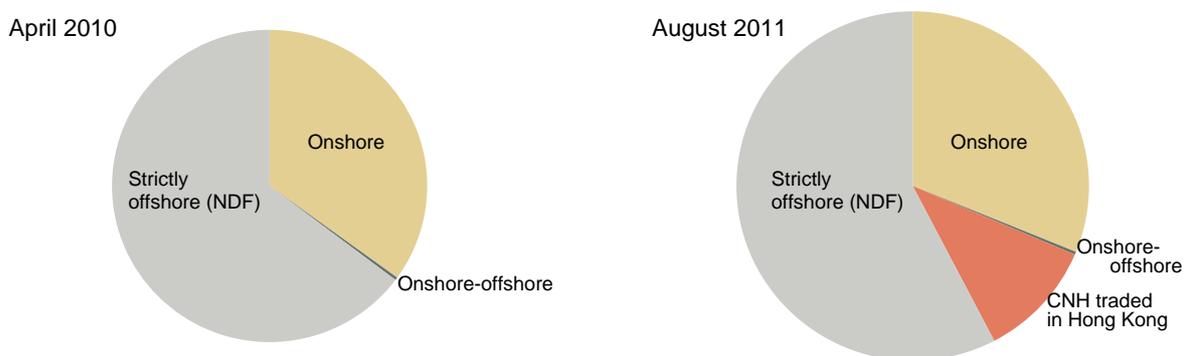


<sup>3</sup> For money markets, see Ma et al (2004), Ho et al (2005), Ma and McCauley (2008a,b) and McCauley (2011).

## The trifurcated renminbi foreign exchange markets: a transactions perspective

To complement the point made in the main text – that, in terms of pricing, the renminbi trades in a trifurcated market – this box gives a transactions perspective. According to the triennial central bank survey of April 2010, the largest share of trading in the renminbi was the \$23 billion per day virtual trading of the NDF outside China (Graph A, left-hand pie chart). The onshore deliverable market in April 2010 reported only \$10 billion (though this may have been an undercount). By centres, trading volume was about \$10 billion per day on the mainland and in Hong Kong SAR, with another \$7 billion per day in Singapore and London and \$3 billion per day in New York. Market estimates for August 2011 put trading offshore in the deliverable renminbi, CNH, at \$4 billion per day. If turnover on the mainland and that in non-deliverable forwards outside China are assumed to have continued at the April 2010 rate, then the trifurcation of activity would be as portrayed in the right-hand pie chart in Graph A.

### Geography of currency trading: estimated distribution of renminbi turnover



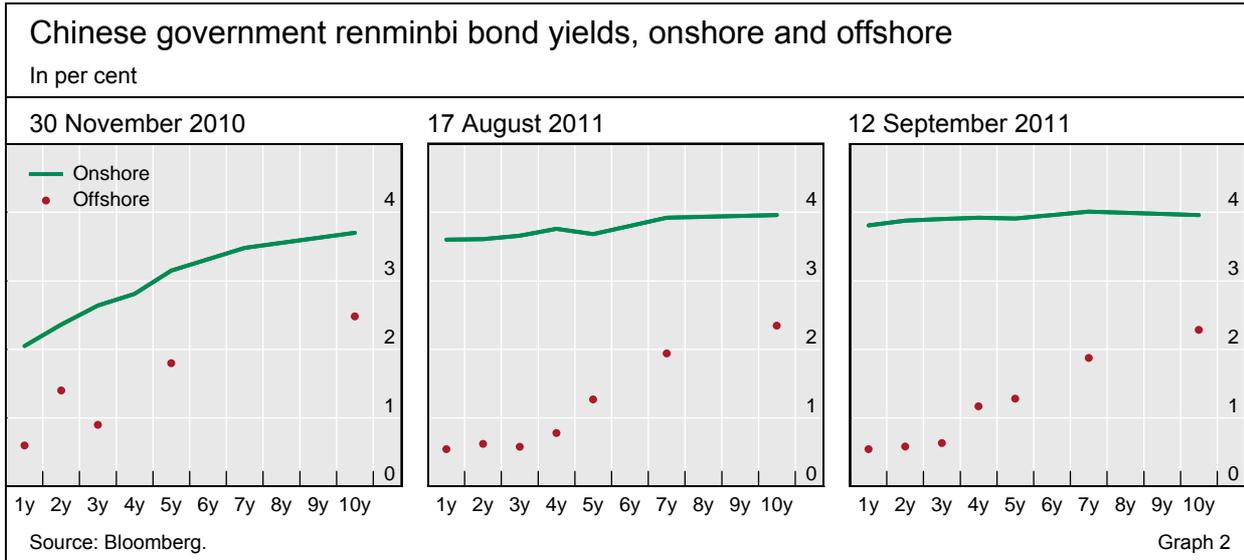
Sources: Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity; HSBC; author's estimates. Graph A

has traded offshore. In this market, counterparties take a position on the domestic renminbi exchange rate fixing at some date in the future, but settlement involves dollars only. Then, in October 2005, after the unpegging of the renminbi from the dollar in July 2005, a deliverable forward began to trade onshore. From then until late 2010, the offshore NDF and the onshore forward traded at strikingly different rates (Graph 1, right-hand panel). In particular, the gap between the onshore forward and the offshore NDF rate ranged between  $-5\%$  and  $4\%$ , and averaged  $1\%$  in absolute value. During this period, multinational firms arbitrated these two markets within the limits set by China's capital controls. From the start of forward CNH trading to August 2011, its price differed from its onshore counterpart and the NDF by no more than  $\pm 2\%$ . In this period, the gap between the onshore forward and the NDF narrowed from an average absolute value of  $1\%$  to  $0.6\%$ . Again, in September and October 2011, the forwards in Hong Kong depreciated relative to their Shanghai counterpart, resembling in sign if not extent the pattern observed after Lehman's failure in 2008.

### Government bond yields

The natural experiment of the sale in Hong Kong of Chinese government bonds has produced fresh and strong evidence for the effective segmentation of the domestic and offshore markets. When the Chinese government first issued renminbi bonds in Hong Kong in 2007, it paid a higher yield than that demanded in domestic markets. However, with the subsequent build-up of

... Chinese government bonds ...



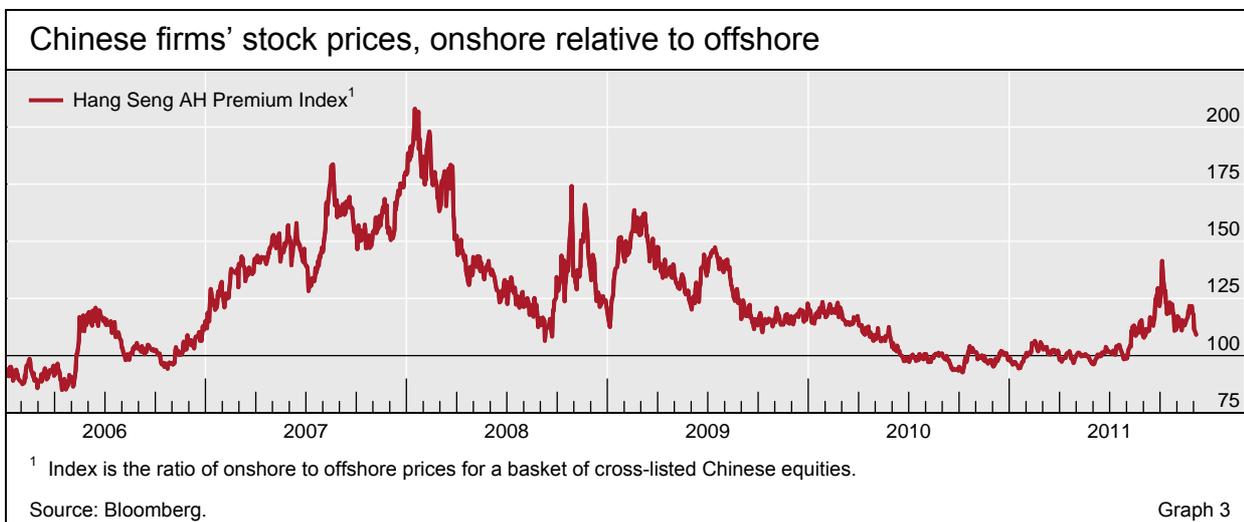
renminbi in Hong Kong, the Chinese government issued in November 2010 and August 2011 at yields below those offered onshore.

On 30 November 2010, the auction yield on all four maturities came in well below the domestic yield curve, saving the Chinese government an average of 144 basis points (Graph 2, left-hand panel). On 17 August 2011, the experiment provided similar results: the yields on all four maturities came in well below domestic yields, saving the government 258 basis points (Graph 2, centre panel). Such pricing continues in the secondary market (Graph 2, right-hand panel). Reflecting (and demonstrating) their lack of access to the mainland bond market, investors in Hong Kong pay a premium over what investors on the mainland pay for given renminbi obligations of the Chinese government.

#### Stock prices

... and Chinese equity prices

The differential in the prices of Chinese shares between the mainland and Hong Kong also points to the effectiveness of capital controls (Graph 3). The Chinese authorities have allowed many firms to list shares both on the



mainland (so-called A shares) and in Hong Kong (so-called H shares).<sup>4</sup> The price of mainland-listed shares rose to twice the level of their Hong Kong-listed counterparts at the end of 2007. In the latter half of 2010 and the first half of 2011, shares in Hong Kong and the mainland traded at near parity. Recently, global risk aversion drove domestically traded shares to a premium.

### The flow of funds between offshore and onshore

Although capital controls remain in place, measures that allow a degree of renminbi internationalisation have punched holes in them. Since 2003, Hong Kong residents have been permitted to buy renminbi up to a daily limit to obtain offshore renminbi deposits. The counterpart to offshore renminbi deposits was an increase in the net foreign currency assets of the Chinese banking system – in this case, higher official foreign reserves (Table 1, red arrows).

From 2007, the offshore sale of renminbi bonds has been permitted, providing an investment alternative to renminbi bank accounts. These bonds offered yields above those on bank deposits but below those on equivalent bonds sold on the mainland. If the renminbi proceeds are to be remitted to the mainland to finance assets there, the transaction must be approved by the State Administration of Foreign Exchange (SAFE), just as in the case of dollars that are to be exchanged for renminbi.

Since 2009, it has been possible to invoice and settle imports and exports in renminbi, and the growth of Hong Kong holdings of renminbi has come to depend on the response of such trade to the gap between the CNH and CNY rates (Garber (2011), He (2011)). Offshore investment demand for renminbi makes the currency relatively expensive in Hong Kong, providing incentives for Chinese imports to be invoiced and settled in renminbi and Chinese exports to be invoiced in dollars. The resulting excess of renminbi-denominated imports over renminbi-denominated exports leads to a net *flow* of renminbi into Hong Kong, thereby increasing the *stock* of renminbi deposits there. By contrast, in late September and October 2011, offshore investment demand for renminbi fell as investors deleveraged amid rising risk aversion, and the renminbi became relatively cheap in Hong Kong. As a result, the stock of renminbi

Investment demand for renminbi offshore leads to outflows of renminbi through the trade channel

Renminbi consolidated banking balance sheet		
	Assets	Liabilities
Onshore	Net foreign currency assets (including official foreign reserves) ↑ CNY credit by onshore banks	Onshore CNY M2
Offshore	CNY credit by offshore banks ↑	Bank bonds held by non-banks Offshore CNY deposits ↑ ↑
Sources: He (2011); author's adaptation.		Table 1

<sup>4</sup> See Peng et al (2007) and McCauley and Ma (2009) for evidence on the speed of convergence of the prices of cross-listed shares.

deposits in Hong Kong barely increased in September and actually shrank in October.

There is a debate over whether the stock of renminbi deposits and bonds in Hong Kong accurately measures the addition to the foreign exchange reserves of the People's Bank of China associated with accommodating offshore demand for renminbi (with a given exchange rate policy), or whether the addition is smaller than that. In either case, renminbi internationalisation has led to a rise in official foreign exchange reserves, increasing the government's long foreign exchange position and its associated valuation risks. Moreover, any reflux of renminbi to the mainland adds to the need for sterilisation by the central bank. In pursuing the managed internationalisation of the renminbi, the Chinese authorities must see medium-term benefits, because the short-term effects only add to current policy challenges.

A different and more balanced evolution of offshore renminbi banking could generate assets and liabilities offshore without adding to official foreign exchange reserves (Table 1, green arrows). Loans could be extended offshore to non-Chinese borrowers, and non-Chinese investors would be happy to hold corresponding offshore renminbi deposits. To some, this would be the ideal development, internationalising the renminbi without involving money and credit in China. However, reality is not likely to follow this path (Aliber (1980)). The next section examines existing offshore markets to sketch the challenges that the Chinese authorities will eventually face.

## Prospective challenges of renminbi internationalisation

Looking forward, the development of the renminbi's offshore market can be expected to pose challenges to China's financial development. One of the consequences of this model is that hardly any credit is extended to Chinese borrowers across the mainland border (Borio, et al (2011)).<sup>5</sup>

Already, as noted, Chinese firms are selling renminbi bonds offshore and ready access to such funding could undermine the domestic rationing of bond market access and accelerate large Chinese firms' exit from the banking system. Eventually, banks will forge strong links between the offshore renminbi interbank market and its domestic counterpart, challenging monetary and credit control. In the longer term, firms in China will borrow from non-Chinese banks located outside the mainland, challenging not only monetary and credit control but also the predominance of Chinese-owned banks.

In what follows, I take up the issue of non-Chinese and Chinese obligors selling renminbi bonds offshore, the forging of strong interbank links between the renminbi market on the mainland and offshore, and direct borrowing by Chinese firms from banks located outside the mainland. In each case, I draw

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<sup>5</sup> As noted in Borio et al (2011), foreign currency credit to Chinese borrowers is larger than cross-border credit owing to foreign currency loans extended by banks in China. According to the People's Bank of China's Financial Statistics for October 2011, foreign currency loans reached \$530 billion, a year-on-year increase of 24.4%.

on the evidence of existing offshore markets to infer the possible trajectories and implications of renminbi internationalisation.

### *Offshore bond market development*

If it follows the precedent of offshore markets in other major currencies, the renminbi offshore bond market will diversify away from Chinese nationals as issuers. So far, the overwhelming majority of issuers of renminbi bonds in Hong Kong have plans to use the proceeds on the mainland. Since offshore bonds yield less than onshore bonds, which themselves are generally cheaper than bank loans, there is much latent supply of offshore bonds. The constraint is not the bond issuance in Hong Kong per se, but rather the remittance of the renminbi proceeds to the mainland – for which SAFE approval is required, just as it is for the inward remittance of dollars.

The offshore renminbi bond market ...

This dominance of the offshore market by borrowers of domestic origin (mainland banks and firms or their offshore subsidiaries) is a very unusual trait (Graph 4). Whereas 80% of renminbi issuers are of Chinese nationality,<sup>6</sup> only 30–60% of issuers in other offshore markets are nationals of the currency's country of issue. For non-financial issuers, however, the offshore renminbi bond market is less out of line with the international experience.

... is currently dominated by issuers of Chinese nationality ...

The dearth of non-Chinese renminbi bond issuers allows unusually weak credits to issue offshore bonds. While the median rating of renminbi bonds sold in Hong Kong is A, some 7% by number and 17% by value carried sub-investment grade ratings at the time of issue. In contrast to the high quality of issuers in other offshore markets (McCauley (2010)), the unsatisfied demand for offshore renminbi bonds lets weak credits issue bonds.

A major deterrent to the borrowing of renminbi by firms and governments outside China, even at low interest rates, is the potential exposure to a currency that is widely anticipated to appreciate. If they perceived a two-way risk in the exchange rate, obligors outside China might be more willing to take on renminbi liabilities and to hold them without hedging them. And, indeed, the recent weakness of the CNH suggests that this perception of a one-way risk could change quickly.

... but will eventually attract obligors from outside China to share China's foreign exchange risk ...

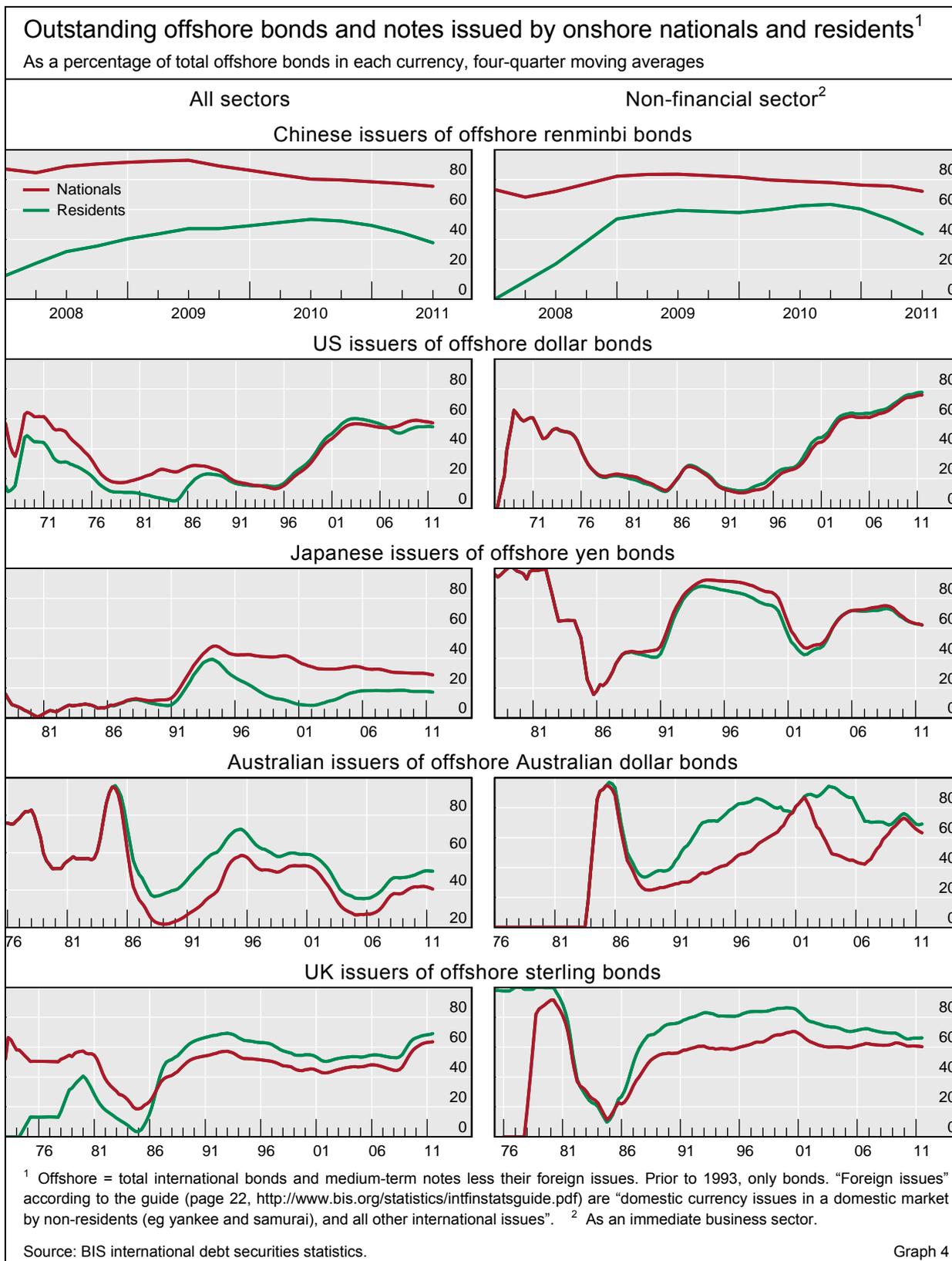
One of the payoffs to China of renminbi internationalisation would be the sharing of exchange risk – the short renminbi, long foreign currency risk – that is currently held by Chinese investors in general, and the government in particular (Cheung et al (2011)). This ultimately requires that firms and governments in the rest of the world take on renminbi obligations and leave them unhedged (except through trade flows). For the international use of the renminbi to succeed as a tool for international risk diversification, offshore issuance of renminbi bonds needs more non-Chinese issuers.

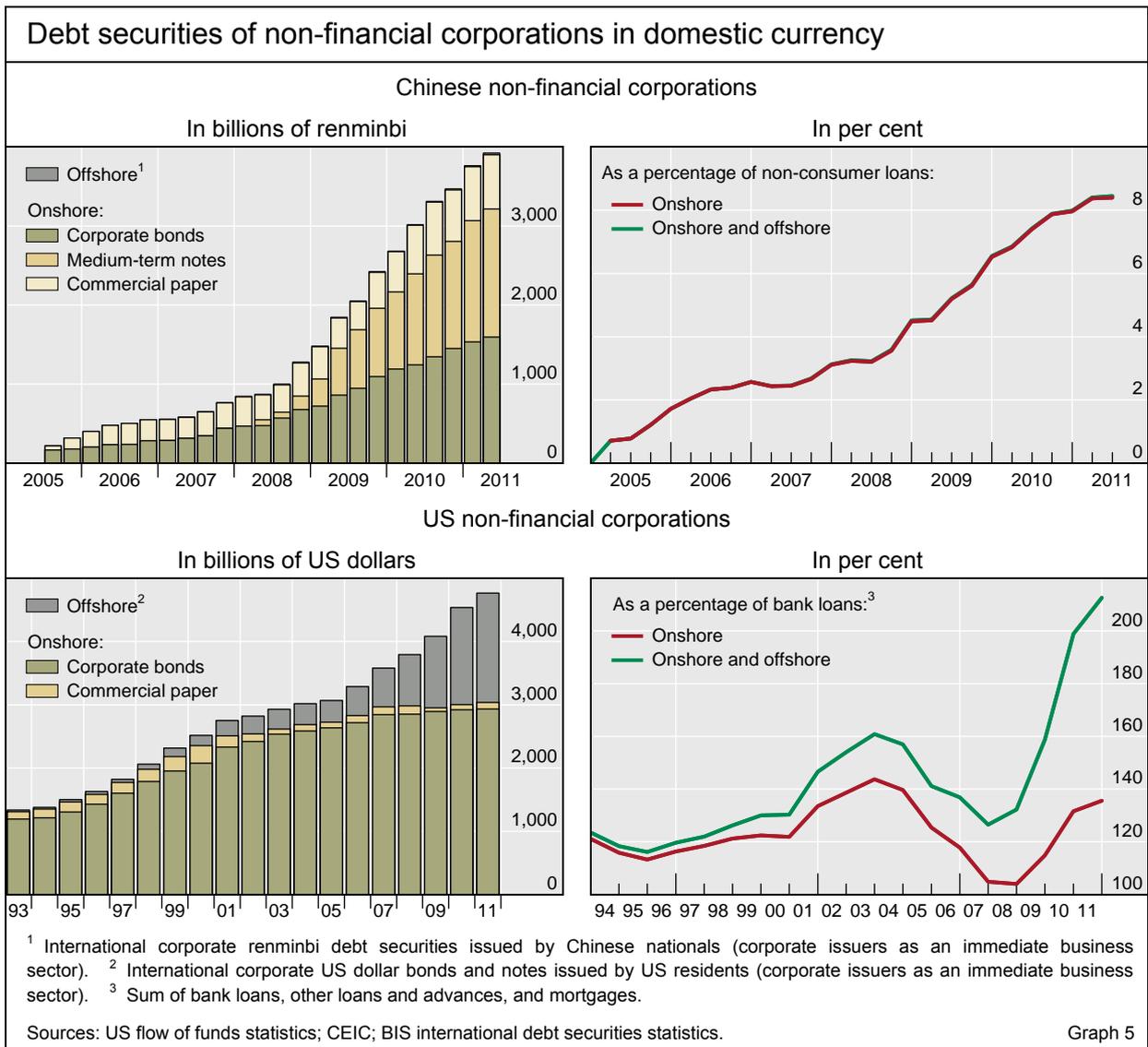
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<sup>6</sup> Hitherto, firms in China have been able to sell offshore bonds in renminbi only through their offshore affiliates. Once non-financial firms are permitted to sell offshore bonds directly, the share of Chinese residents can be expected to rise towards that of Chinese nationals, much as the share of US residents rose after the repeal of the US withholding tax on bond interest (which had led to US firms selling eurodollar bonds through Netherlands Antilles financing subsidiaries).

... and, with eased capital controls, will compete with the onshore bond market ...

Returning to Chinese issuance of offshore renminbi bonds, a future regime allowing easy repatriation of renminbi to China would pose a challenge to domestic credit control. Required approval for the repatriation of the proceeds of renminbi offshore bonds keeps offshore issuance small in relation to the domestic bond market in China, which itself is small in relation to bank





debt (Graph 5). By contrast, not only is the international dollar bond market important to US firms, but also their bond debt greatly exceeds their outstanding bank and other loans.

Moreover, assuming more cross-border capital mobility in the future, offshore bond issuance could spur an accelerated liberalisation of the domestic bond market that could cost banks their best corporate borrowers in a few short years. In Japan, the liberalisation of the foreign exchange market in 1980 and 1984 and of the euroyen market in 1984 prompted heavy use of the offshore market from the mid-1980s (Hoshi and Kashyap (2001, pp 232–6)). This, in turn, spurred domestic bond market liberalisation. Losing their big corporate borrowers, the big Japanese banks reinvented themselves as lenders to small and medium-sized firms that had real estate collateral, with disastrous results.

... helping the best firms to repay bank loans

All this highlights how the development of the offshore renminbi market leaves the domestic rationing of bond market access vulnerable to easier cross-border flows of renminbi. Of course, a similar statement can be made about cross-border flows of dollars into China. Easy cross-border flows of dollars would lead to an explosion of dollar bond issuance. The development of

the offshore renminbi bond market implies that an easing of cross-border flows would give Chinese firms a choice between dollar and renminbi borrowing.

### Interbank inflows

Currently, the offshore renminbi interbank market is segregated from its onshore counterpart ...

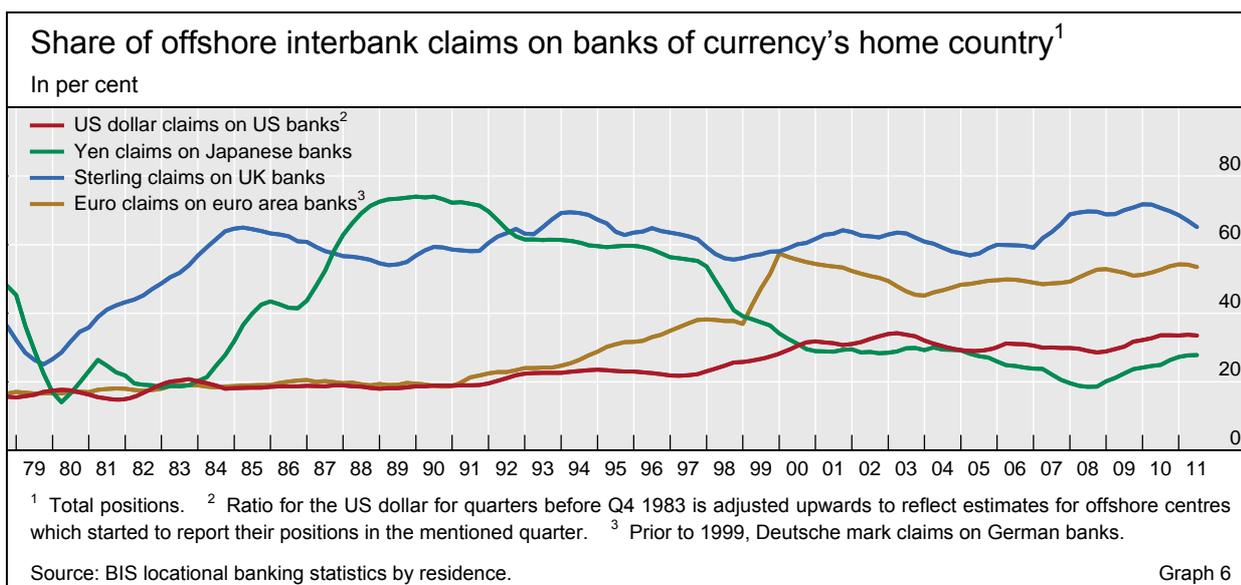
Offshore banking in the renminbi can be expected ultimately to be less isolated from banking markets on the mainland, and the eventual interactions may pose policy challenges. At present, renminbi in Hong Kong banks can flow back to the mainland only via limited channels. They can flow back through trade (as payment for exports from the mainland) or through capital account channels (as an authorised remittance by an issuer of a dim sum bond or as an authorised investment in the interbank market for Chinese government bonds). The existing, relatively small claims of offshore banks on Chinese banks and non-banks are denominated in dollars and other foreign currencies.

At some stage, one would expect cross-border markets to link banks outside the mainland to mainland banks and firms. The records of the global banking markets in dollar, euro, yen and sterling all make clear that offshore banks end up holding substantial exposures to the banks and non-banks of the currency's home country. And the growth and fluctuations of these stakes have posed policy challenges elsewhere to authorities used to working with regulated deposit rates, reserve requirements and domestic banks.

... but international experience suggests that offshore banks will eventually hold substantial claims on onshore banks ...

Experience elsewhere suggests that eventually banks outside the mainland will lend in renminbi directly to banks in China.<sup>7</sup> For example, dollar claims on banks in the United States booked by banks located outside the United States have risen from less than a fifth to more than a third of overall dollar interbank claims booked outside the United States (Graph 6, red line).

Eurodollar inflows into the United States in 1969 are instructive. With inflation rising towards 5–6%, the Federal Reserve was in the process of



<sup>7</sup> This section analyses the policy challenges arising in situations when money market yields are such that there are incentives for inward flows. Policy challenges can also arise when higher rates offshore lead to outflows. In that case, as noted in He and McCauley (2010), the authorities have been known to conduct operations in the offshore markets.

raising interest rates to 10%. As Treasury bill and other money market yields approached the (Regulation Q) ceilings on deposit rates, banks suffered a run-off of interest-sensitive certificates of deposit – so-called disintermediation. Previously, banks would have been forced to cut back on their lending. But the eurodollar market had advanced so much in a dozen years that big US banks could attract deposits there and thereby replace the lost funding at home.

At the time, Federal Open Market Committee (FOMC) members were surprised at how elastic a source of funds the offshore dollar market had become. President Hayes of the Federal Reserve Bank of New York worried in February about the consequences of a “drying up of the supply of Euro-dollars” (FOMC, 4 February 1969, p 44). However, at the 9 September meeting, FOMC members learned that New York banks had drawn on the eurodollar market since December for an amount equivalent to 6–7% of their assets.<sup>8</sup> An inflow in eight months of a like share of the assets of the large Chinese commercial banks would be quite a sum.

As argued in He and McCauley (2010), policymakers can (and did) resort to reserve requirements on funding from the eurodollar market. These, however, could sharpen the incentives for direct cross-border lending to non-banks in renminbi.

#### *Direct borrowing by Chinese firms from banks abroad*

Eventually, banks offshore will extend renminbi credit directly to firms in China, bypassing domestic banks altogether and putting at risk some of the policy levers of the authorities. In particular, the offshore markets in dollar, euro, yen and sterling direct 20–40% of their credit to borrowers in the currency’s home country. Dollar claims on US residents that are booked by banks outside the United States started out as a small proportion of overall dollar claims booked offshore but rose over a generation to approach a half (Graph 7, red line). Precisely when the Bank of Japan sought to restrict domestic yen lending (Fukumoto et al (2010)), the proportion of offshore yen claims on Japanese residents jumped in the late 1980s from around 20% to 60% (Graph 7, green line). Eventually, a good part of the renminbi offshore assets can be expected to be claims on Chinese residents.

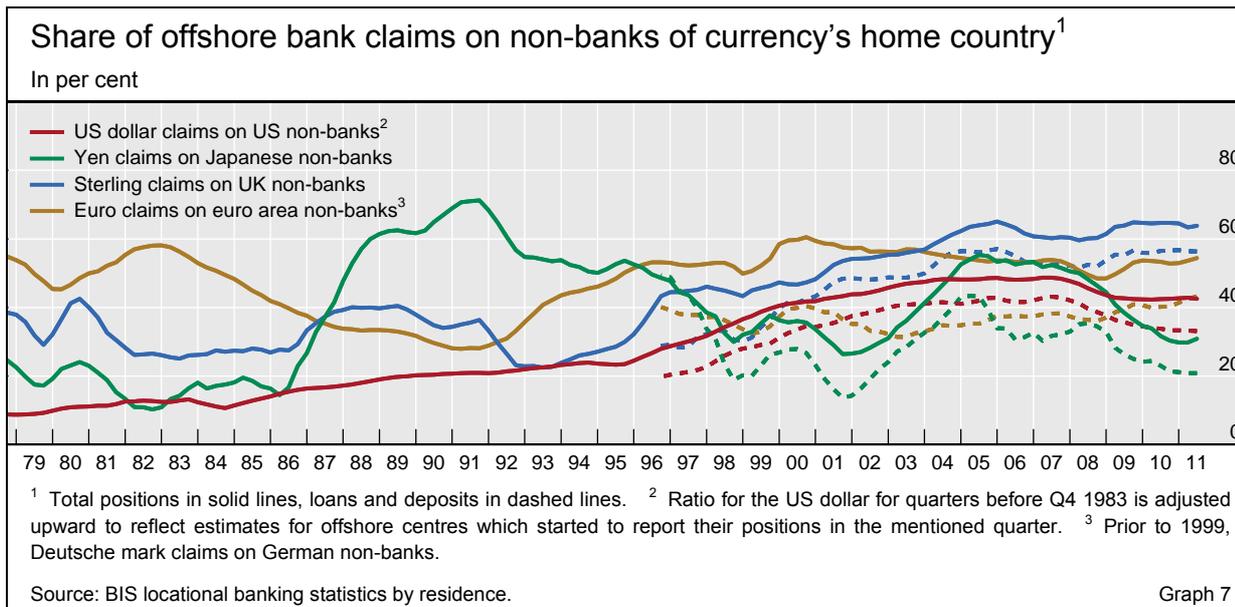
Such renminbi credit would pose manifold policy challenges. Offshore loans can be priced below minimum regulated loan rates, especially if they are funded with deposits that are not subject to reserve requirements. The authorities may encounter difficulties in measuring such credit, even with authorisation or registration requirements. If, as can be expected, non-Chinese banks do most of this direct cross-border lending, especially if they can evade reserve requirements or other regulation, the foreign bank share of bank credit

... at times posing challenges to monetary control

Offshore bank lending can pose policy challenges

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<sup>8</sup> Stephen Axelrod, Staff Director for the Division of Monetary Affairs, reported (FOMC, 9 September 1969, p 26): “In early December 1968, when outstanding CD’s of New York banks, for example, were at their peak of \$7½ billion, they represented 10 per cent of total assets of these banks. At present, these banks have only about \$2 billion of CD’s left; and these finance only about 2¼ per cent of total assets. It is interesting to note that the corresponding build-up in Euro-dollar borrowings has brought such liabilities of New York banks to a total now of over 10½ billion, representing a little more than 13½ percent of the total assets – a doubling since December.”



to Chinese residents (currently 2%) can be expected to rise. By allowing foreign banks to raise their market share in China, direct cross-border lending will also weaken window guidance as a tool for influencing credit growth.

## Conclusions

The growing use of the renminbi beyond the Chinese mainland has a complex relationship with the country's capital controls. Cross-border flows themselves represent an exception to capital controls, and the build-up of renminbi deposits has further raised China's official foreign exchange reserves. Yet capital controls remain effective, and this allows the Chinese authorities to enforce ceilings on deposit rates and to guide bank lending quantities as well as to ration access to the bond market.

This feature argues that established offshore markets provide significant credit to borrowers in the currency's home country. This is already the direction in which the offshore renminbi bond market is moving. (Indeed, its more balanced development requires greater numbers of non-Chinese borrowers.) At this stage, border controls on renminbi inflows limit the impact of the offshore renminbi bond market on domestic bond market rationing and, more generally, on the balance between bank credit and securities market credit.

For its part, offshore renminbi banking can be expected to evolve beyond the use of deposits outside the mainland to fund non-Chinese borrowers. Renminbi credit will at some stage flow into China through the interbank and direct cross-border lending channels, complicating monetary and credit control. Reserve requirements may well be extended to renminbi interbank inflows, but these may give an edge to foreign banks in lending directly to Chinese firms from offshore.

All in all, the internationalisation of the renminbi can provide a third track of pricing for currency, money and bond markets. This track will help to diminish the importance of regulated financial prices and, alongside its domestic counterpart, to inform their setting where flexibility is permitted. The

more that offshore renminbi are given a passport to enter the mainland freely, the more prices in the offshore market will matter. In the process of easing capital controls, a preferential passport for renminbi to enter the domestic economy could usefully lessen the risk of foreign currency borrowing.

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## Assessing global liquidity<sup>1</sup>

*Global liquidity has become a key focus of international policy debates, yet the term continues to be used in a variety of ways. This lack of precision can lead to potentially undesirable policy responses. In this feature, we attempt to clarify the concept of global liquidity, its measurement and policy implications. We argue that policy responses to global liquidity call for a consistent framework that takes into account all phases of global liquidity cycles, countering both surges and shortages.*

*JEL classification: E 50, F30, G15.*

### Introduction

Global liquidity has become a buzzword in discussions about the international monetary system. This reflects a broad, though often vague, perception that it is an important driver of capital flows, global asset price dynamics and inflation, and that international monetary arrangements – including exchange rate regimes, capital account policies and financial safety nets – have a major bearing on global liquidity.

The term “global liquidity” is used in a variety of ways.<sup>2</sup> Sometimes it has been used to refer to the stance of monetary policy in major currency areas. In this view, global liquidity is a major determinant of goods price inflation. More recently, policymakers and academics alike have put greater emphasis on the financial stability implications of global liquidity.<sup>3</sup> This view of global liquidity typically reflects the recognition that the availability of ample and low-cost funding in global financial markets can contribute to the build-up of financial system vulnerabilities in the form of leverage and large mismatches across currencies, maturities and countries.

The lack of a coherent conceptual framework hinders diagnosis of global liquidity conditions and the development and implementation of effective policy

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<sup>1</sup> 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 G Cecchetti and Christian Upper for useful comments on earlier drafts of this article, and to Jhuvesh Sobrun for research assistance.

<sup>2</sup> See Williamson (1973) for an early example.

<sup>3</sup> See, for example, Caruana (2011) and Shin (2011).

responses. For instance, a focus on the collapse of interbank markets during the recent crisis may lead to calls for an expansion of safety nets, but may miss the importance of appropriate measures to prevent the build-up of vulnerabilities because of ample liquidity. Similarly, an exclusive focus on monetary policy as a driver of global liquidity may miss the role of risk-taking incentives in the private sector and how these relate to economic policies.

This special feature, drawing on recent work by the Committee on the Global Financial System (CGFS),<sup>4</sup> discusses elements of a conceptual framework for global liquidity, and highlights the analytical challenges involved in assessing the implications for financial stability.<sup>5</sup> The first section of this article discusses terms and concepts, and illustrates the elusive nature of global liquidity. The second section investigates what the available data have to say about aspects of global liquidity, focusing on current conditions. The final section discusses policy implications for central banks.

## Terms and concepts

In general terms, liquidity is the ease with which an asset can be converted into a means of payment. One way in which conversion may occur is through the selling of the asset. The less such a sale moves the price of the asset, the greater is market liquidity. Borrowing, in turn, can be seen as an alternative way of converting assets into cash, either by pledging assets as collateral or by issuing unsecured claims against those assets. The less borrowing moves the price of funding, the greater is funding liquidity.

These basic considerations have two important implications for the concept of global liquidity. First, at the aggregate level, liquidity depends on the interaction of funding and market liquidity. For instance, in the run-up to the financial crisis, securitisations such as mortgage-backed securities were perceived as highly liquid. This, in turn, allowed banks and other financial institutions to use these securities as collateral in repo transactions or similar activities, which increased funding liquidity. Hence, global liquidity should be understood as the overall “ease of financing” in the international financial system.

Second, this overall “ease of financing” (or perceptions thereof) depends on the actions of both private investors and financial institutions as well as the public sector. The securitisation example illustrates how liquidity is being created through interactions among private market participants. In addition, central banks supply the means of payment in the form of base money. The terms and conditions on which they do so, in turn, affect funding and market liquidity in private markets. The distinction between liquidity created by private

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<sup>4</sup> The CGFS is a central bank forum that monitors broad issues relating to financial markets and systems and develops appropriate policy recommendations. The CGFS places particular emphasis on assisting central bank Governors in recognising, analysing and responding to threats to the stability of financial markets and the global financial system.

<sup>5</sup> For reference, see the recent CGFS (2011) report on *Global liquidity – concept, measurement and policy implications*, which was prepared by a group chaired by Jean-Pierre Landau (Bank of France).

and public sector market participants, for its part, is key to understanding the sources of global liquidity and its dynamics.<sup>6</sup>

### *Private liquidity*

Private liquidity is created by market participants ...

Private liquidity is created by private sector market participants, including international banks, institutional investors, non-bank financial institutions (including shadow banks) and so on. For instance, financial institutions provide funding liquidity by lending in the interbank market. Or money market mutual funds provide liquidity to corporations by buying commercial paper.

... is transmitted through cross-border operations ...

The availability of private liquidity is a key factor behind the build-up of exposures in the global financial system. Movements in private liquidity are transmitted internationally through the cross-border and/or cross-currency operations of bank and non-bank financial institutions. These effects can go both ways: domestic liquidity conditions can spill over to global markets and, conversely, global developments can amplify movements in domestic financial conditions and intensify domestic imbalances.

... and is endogenous

Private liquidity is *endogenous* to the conditions in the global financial system. It depends on the willingness of market participants to supply funding or trade in securities markets. For instance, the conditions under which banks can fund their own balance sheets depend, in turn, on the willingness of other private sector participants – such as money market funds or institutional investors – to provide funding or market liquidity. These funding conditions, in turn, determine the ability of banks to provide liquidity. This example illustrates that perceptions of counterparty risk or, more generally, the degree of confidence in the financial system are an important determinant of global private liquidity.

### *Official liquidity*

Official liquidity is exogenous ...

Official liquidity is funding provided by the public sector. The central bank supplies official liquidity in domestic currency in the form of reserve balances or central bank money, on terms and conditions that do not depend on the availability of funding in financial markets. Official liquidity is therefore *exogenous*.<sup>7</sup>

... and ultimately created by central banks

Central banks create official liquidity in their domestic currency through regular monetary operations and, in periods of stress, through emergency liquidity assistance (ELA). Other public entities, including treasuries or state-owned commercial banks, can also provide liquidity. But their ability to do so depends in principle on the conditions under which they can fund themselves in private markets – unless they have access to central bank liquidity. Ultimately, official liquidity is therefore the funding that central banks provide.

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<sup>6</sup> Conceptually, private and public liquidity are closely related to inside and outside money.

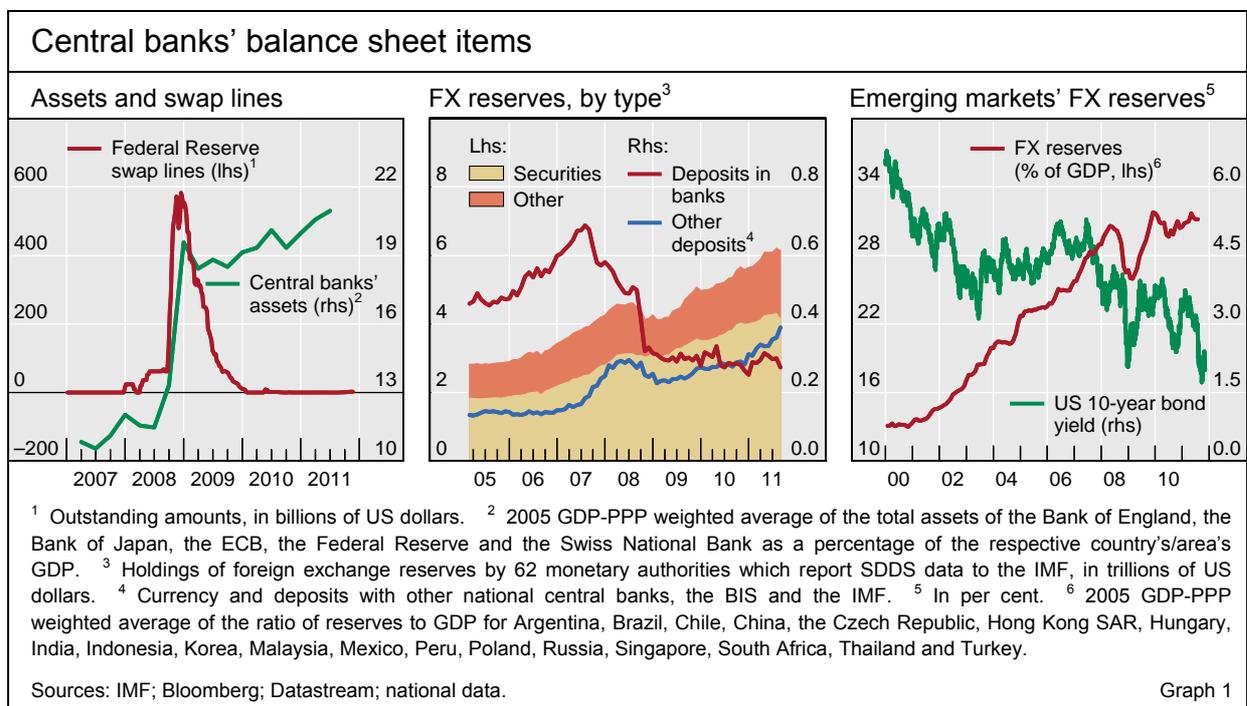
<sup>7</sup> In addition, central banks can support market liquidity by swapping liquid assets against illiquid ones, as the Federal Reserve and the Bank of England did during the financial crisis with their securities lending programmes.

The capacity of monetary authorities to supply official liquidity depends on domestic monetary policy frameworks and the international monetary system. The exchange rate regime or currency backing requirements may constrain the ability of national authorities to issue their domestic currency. At the international level, an external anchor – such as the quantity of official gold holdings under the gold standard – could impose an absolute limit on official liquidity supply. In a pure fiat money system, by contrast, central banks can technically create any amount of official liquidity.<sup>8</sup>

Various instruments and mechanisms can provide domestic authorities and financial institutions with access to official liquidity in foreign currency. The first is by selling foreign exchange reserves. Second, swap lines between central banks and similar facilities provide direct access to central bank money. Such swap lines between the US and European monetary authorities were critically important during the recent financial crisis, particularly in the months following the collapse of Lehman Brothers (Graph 1, left-hand panel). A third possibility are facilities offered by international financial institutions or regional financing arrangements, including IMF programmes or Special Drawing Rights (SDR). Ultimately, all these instruments give the domestic financial system access to official liquidity created by a foreign central bank, though subject to different costs and conditions (“conversion costs”).<sup>9</sup>

Various mechanisms can provide access to global liquidity ...

Since 2008, central banks in major advanced economies have massively expanded the provision of official liquidity. Their balance sheets have swollen



<sup>8</sup> Ultimately, however, their ability to do so will depend on the level of confidence in the value of their currencies.

<sup>9</sup> This suggests that any measure of official liquidity would have to weigh different components of the liquidity concept in ways that reflect the different degrees to which they allow access to central bank liquidity in foreign currency (“conversion costs”), similar to the so-called Divisia monetary aggregates. See Barnett (1980).

as central banks have created liquidity in domestic currency on a large scale. As the left-hand panel of Graph 1 shows, central bank balance sheets in major advanced economies as a percentage of GDP have doubled since 2007. At the same time, nominal policy rates have fallen to near-zero levels.

*Conversion costs: the case of foreign exchange reserves*

... being subject to different forms of conversion cost

Foreign exchange reserves are the traditional means for accessing official liquidity in foreign currency and are typically viewed as a core component of official liquidity. Indeed, foreign exchange reserves have been used to alleviate foreign currency funding pressures in domestic financial systems, for example in Korea and Brazil during the recent financial crisis. However, the degree of self-insurance afforded by such stocks of reserves depends on the size and source of the shock hitting the domestic financial system as well as the instruments and currencies the reserves are invested in. Hence, the use of foreign exchange reserves is subject to various forms of conversion cost.

First, there are costs at the level of the individual reserve holder. Only a small fraction of foreign exchange reserves is held in the form of deposits with central banks or as (term) deposits with private banks (about 5% in each case), whereas the bulk is invested in securities, mostly US Treasuries and government bonds of euro area sovereigns (Graph 1, centre panel). Converting these foreign assets into funds that can be used to settle foreign currency claims involves costs that depend on market conditions. Such costs may be low in the case of a country-specific shock, when global interbank and securities markets remain liquid. But it may not be so easy to deploy reserves quickly in the event of a global liquidity shock, as drawdowns of such reserves by multiple countries at the same time could depress the prices of foreign reserve assets.

Second, deploying foreign exchange reserves may also involve more indirect costs in the form of higher country risk premia in financial markets and depreciation pressure on the domestic currency (which could result from lower reserve levels). This can aggravate the very foreign currency funding pressures that the use of foreign exchange reserves is supposed to alleviate. Indeed, concerns that only a fraction of the stock of foreign exchange reserves can be used without triggering adverse confidence effects have reinforced calls for alternative mechanisms for insuring against liquidity shortages.<sup>10</sup>

Third, mobilising foreign exchange reserves may also impose costs on international financial markets and institutions by adversely affecting liquidity conditions at the global level. For instance, drawing down reserves that are deposited with commercial banks would reduce funding liquidity. This can have knock-on effects on the financial system more broadly – for instance, if the affected banks struggle to replace their corresponding foreign currency funding, as experienced during the Lehman crisis (Graph 1, left-hand panel). Only foreign reserves held in the form of central bank money will tend to avoid such effects.

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<sup>10</sup> See Baba and Shin (2010).

### *The interaction between private and official liquidity*

In a world with high international capital mobility and a well developed financial system, private sources of liquidity quantitatively dominate public ones. But the two can, and do, behave quite differently over time. Private liquidity is procyclical, driven by changes in a variety of factors, including growth rates, growth differentials, monetary policies, regulatory frameworks and, above all, investors' attitude towards risk. Furthermore, structural developments that help shape the way international banks operate, such as financial innovation and integration, also play a role. This multitude of factors and their interdependence underline the endogenous character of private liquidity.<sup>11</sup>

Official and private liquidity interact in various ways. One way to think about this interaction is the traditional money multiplier concept: by determining the risk-free short-term interest rate and the amount of funds available to settle payments through the central bank, official liquidity is the basis for private liquidity creation. In times of crisis, however, private liquidity tends to evaporate and global liquidity collapses into its official component – or, to use the money multiplier analogy, the multiplier falls to zero. In those circumstances, global liquidity will crucially depend on individual banks' access to official sector funding. This is particularly relevant when banks' funding needs are in a foreign currency, constraining the ability of the domestic central bank to address liquidity shortages, as observed in late 2008.

But the interactions between private and public liquidity are arguably more complex than this conventional view suggests. For instance, private capital flows may lead to foreign exchange reserve accumulation (increasing official liquidity), and the reinvestment of these reserves in the liquid assets of other countries may help to further ease financial conditions (increasing private liquidity). There are signs, for example, that the channelling of large reserve holdings into government securities can contribute to global liquidity conditions through its effect on yield levels (Graph 1, right-hand panel).<sup>12</sup>

Official and private liquidity interact in various ways ...

... including through the reinvestment of foreign exchange reserves

### Indicators and measures

The conceptual considerations above suggest that measures of global liquidity should capture the evolution of both private and official liquidity as well as the ease of financing in the global financial system. The former would call for indicators that track the quantity of liquidity in the system, while the latter would tend to emphasise measures of the availability of market and funding liquidity. Ideally, such measures should also provide early indications of financial system vulnerabilities.

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<sup>11</sup> For more details, see CGFS (2011) and Bruno and Shin (2011).

<sup>12</sup> Warnock and Warnock (2009) estimate that foreign purchases lowered US Treasury yields by some 90 basis points in 2005.

### *Credit aggregates and the evolution of global liquidity*<sup>13</sup>

Global credit aggregates allow an analysis of global liquidity ...

Several arguments speak in favour of using credit aggregates as a proxy for global liquidity.<sup>14</sup> First, private sector credit stands at the end of the financial intermediation chain and captures the interaction of market and funding liquidity. Credit measures also provide broad coverage of private liquidity sources, including banks and securities markets. Moreover, credit aggregates have been shown to behave as early warning indicators, especially when combined with measures such as asset prices.<sup>15</sup> Cross-border positions, particularly those in interbank markets, will be important when the focus is on how changes in liquidity conditions are transmitted internationally and affect domestic financial stability in the target economies.<sup>16</sup> This places a premium on measures that capture such interlinkages.

Second, international credit aggregates facilitate the analysis of global liquidity conditions from various vantage points. One such perspective suggests that, worldwide, bank credit continued to expand throughout the recent crisis (Graph 2). Cross-border credit and, hence, internationally intermediated lending did contract (green line), but the growth rate of total bank credit remained positive.

... from the perspective of: the recipient country ...

A complementary, “*recipient economy*” perspective focuses on the evolution of borrowing by non-banks in individual economies. This perspective can, for instance, inform assessments of whether cross-border credit flows are associated with a build-up of vulnerabilities in the recipient country’s financial system. Differences in credit growth across countries and regions are considerable (Graph 2). While total bank credit to non-banks in the United States and the euro area has levelled off since the start of the crisis, Asia-Pacific has seen a particularly strong rebound in cross-border credit. This is in line with the observation that cross-border and foreign currency credit tend to grow especially strongly within countries that are experiencing a domestic credit boom – such as China.<sup>17</sup>

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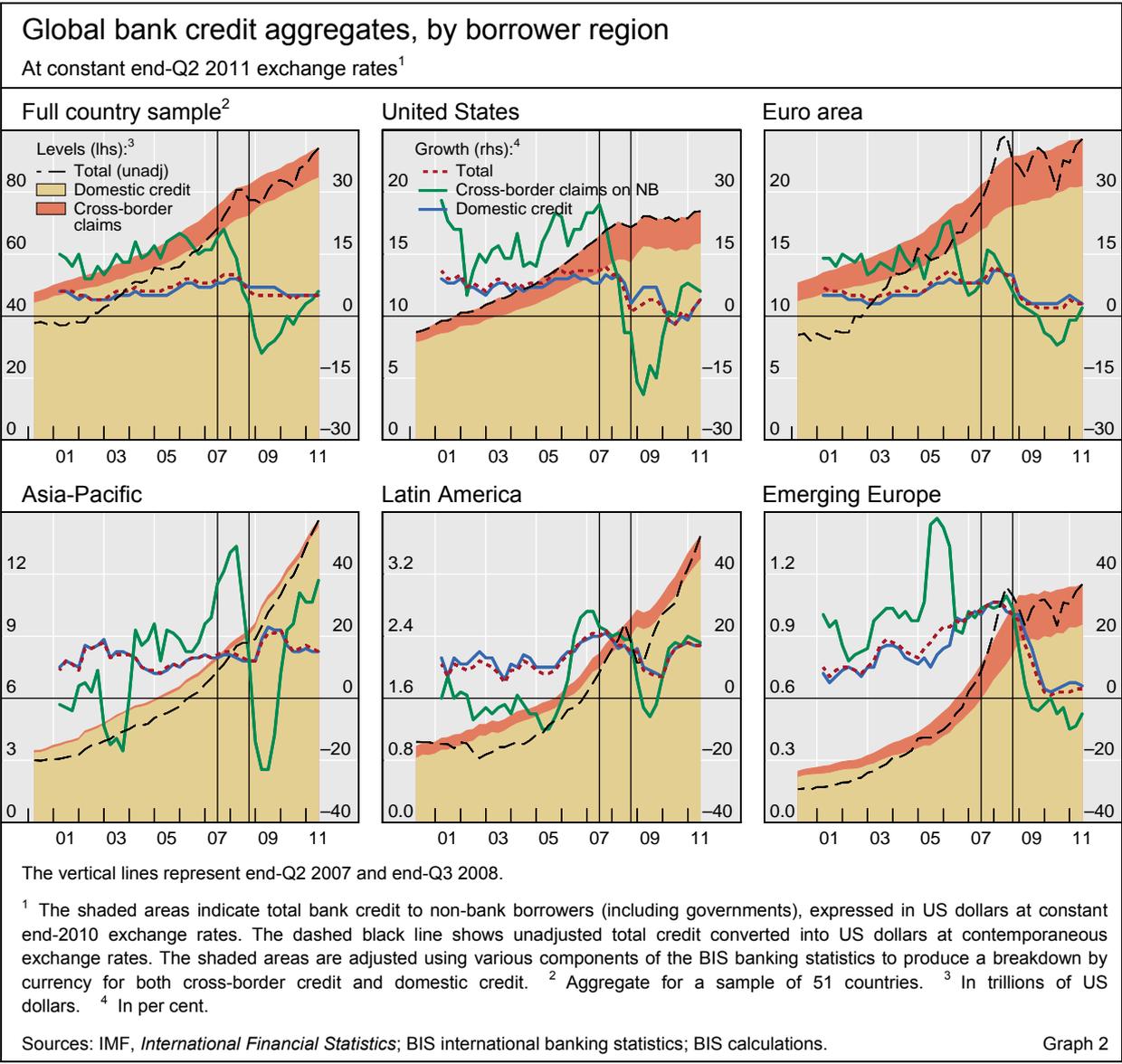
<sup>13</sup> The calculation of these measures relies heavily on the BIS international banking and securities statistics. These data allow the construction of consistent credit aggregates and maturity mismatch measures that include cross-border bank lending and – to some extent – securities issuance. For details, see Borio et al (2011).

<sup>14</sup> A potential problem in using credit aggregates as measures of global liquidity is that they do not focus on liquidity or financing conditions as such, but rather on one of the *outcomes* of these conditions. This may complicate interpretation, because credit aggregates may change irrespective of any developments in financing conditions.

<sup>15</sup> In particular, there is a growing literature suggesting that joint cumulative increases in private sector credit and asset prices beyond historical norms tend to herald subsequent financial distress. See, for example, Alessi and Detken (2009) and Borio and Drehmann (2009).

<sup>16</sup> See Bruno and Shin (2011) for a theoretical model capturing these effects.

<sup>17</sup> This could be because banks that lend cross-border may have less information than local lenders on the quality of borrowers. Therefore, these banks may have been over-optimistic about the strength of borrowers in foreign markets in the upswing, to then change their assessment in the downswing. Another possibility is that internationally active banks may regard foreign markets as less important to their business than is the case for domestic banks, which might affect their willingness to expand or contract their international activities in a procyclical fashion. It is also possible that internationally active banks faced bigger negative



Yet another perspective is that of the credit originator. Here, it is important to distinguish the economy that issues the currency – the “*currency of denomination*” perspective – from the intermediaries that extend credit, possibly in foreign currency – the “*lender*” perspective.

... credit originator and ...

The “*currency of denomination*” perspective considers global credit provided in a particular currency, and may help to answer the question to what extent funding conditions in one particular currency contribute to global liquidity. Most international credit is denominated in US dollars, euros, yen, sterling and Swiss francs. Graph 3 (left-hand panel), illustrating the case of the US dollar, shows that the international component of global credit can be quite sizeable. In mid-2010, dollar credit to non-US residents reached 13% of dollar credit to the non-financial sector worldwide, from 10% in 2000. The right-hand panel of Graph 3 shows that, as in recent quarters, US dollar credit to the rest

... currency of origination

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shocks in their home markets and that these banks relied more on wholesale funding than domestic banks.

of the world has at times grown faster than credit to US residents. The growth of dollar credit to households and non-financial businesses outside the United States exceeded 10% at the end of 2010, while lending to US non-financial sectors stagnated.

The *lender perspective* sheds light on the evolution of the international credit and funding exposures of banks (and other intermediaries). Growth in funding exposures and the currency and/or maturity mismatches of banks are an indication of financial vulnerability and may force a contraction of global liquidity if bank balance sheets come under stress (Fender and McGuire (2010)). Current deleveraging pressures in the European banking sector should be seen in this light (Carney (2011)).

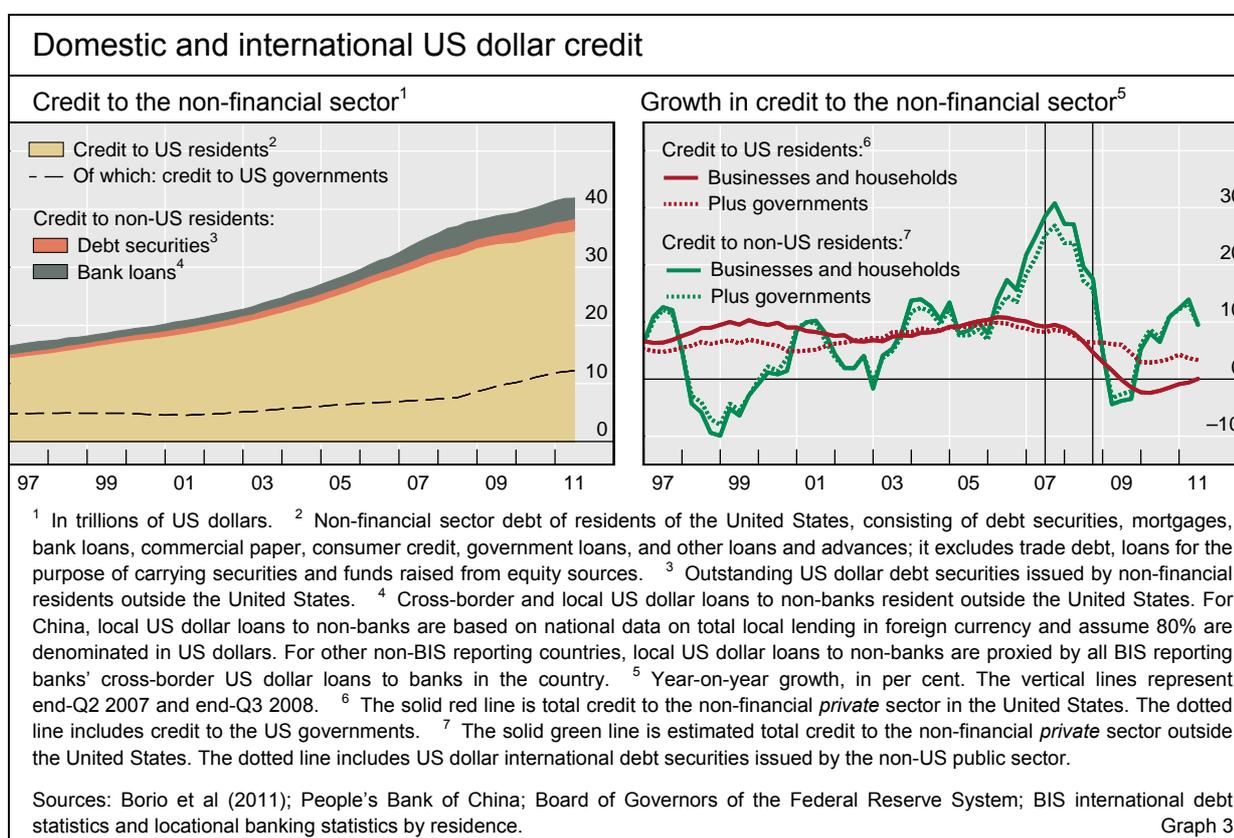
### Assessing the ease of financing by combining quantity- and price-based indicators

These aggregates can also be combined with price-based measures ...

The combination of price and quantity measures supports assessments of the ease of financing. Price-based indicators provide information about liquidity supply conditions in different markets, while quantity-based indicators capture how far such conditions translate into changes in exposures and risks. Key indicators in this regard are proxies of risk appetite, which is – as discussed above – a major driver of the willingness of private investors to provide funding and, therefore, of private liquidity (Table 1).

... such as risk appetite proxies

Graph 4 illustrates the combined use of price and quantity measures, showing indicators of cross-border credit extension by BIS reporting banks together with the VIX index as a simple proxy for risk appetite (which, in turn,



proxies financial sector leverage).<sup>18</sup> Two broad patterns emerge. First, the growth in international bank credit exhibits boom-bust cycles that appear to correspond closely to episodes of financial distress, characterised by high volatility and low risk appetite, shown as spikes in the VIX. Second, the co-movement of cross-border credit and risk appetite proxies appears consistent with the notion of a global liquidity cycle. Periods of particularly strong growth in cross-border credit are often characterised by elevated risk appetite, while episodes of credit contraction are typically associated with low risk appetite.

Against this backdrop, the recent spike in the VIX may be indicative of a reduction in the supply of global liquidity in the second half of 2011. This is consistent with anecdotal evidence that market pressures for European banks have forced a retrenchment of these institutions from activities involving foreign currency funding, such as trade and commodities financing.

*Open technical and analytical issues*

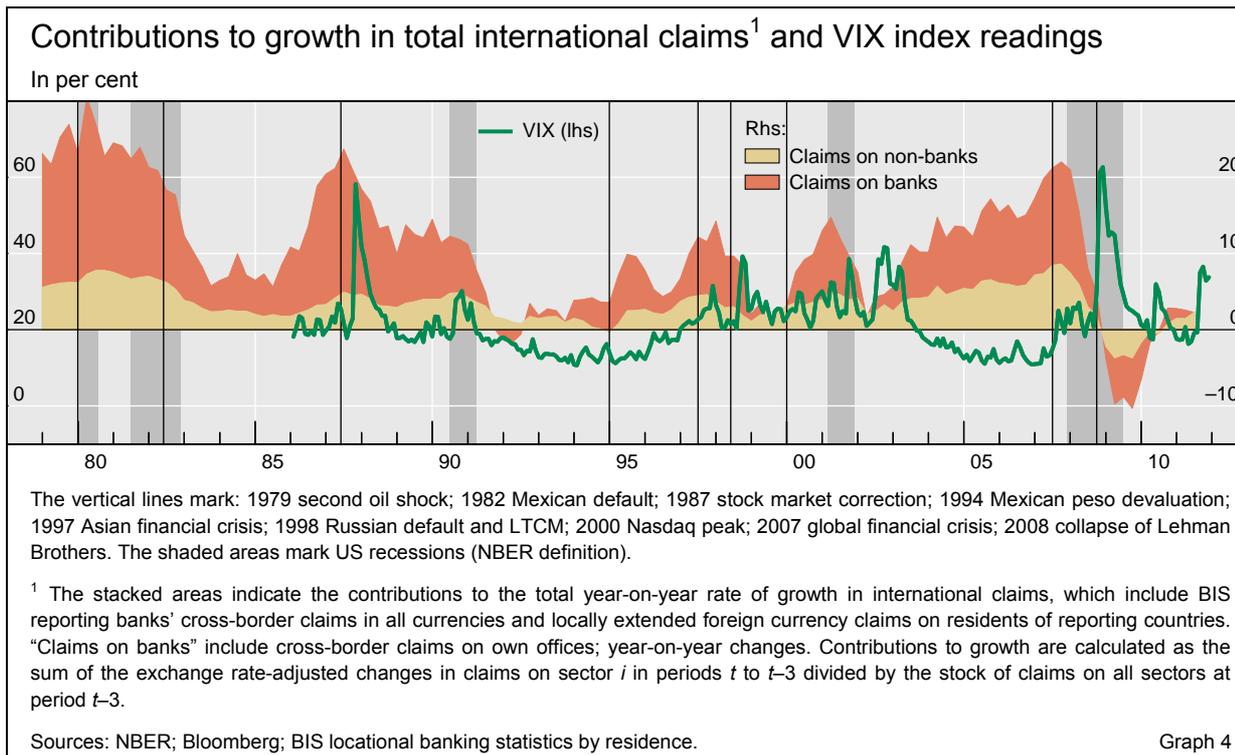
Turning the indicators discussed above into a fully fledged framework for the assessment of global liquidity faces a number of challenges. The first is aggregation. The appropriate credit aggregate may depend on the analytical question at hand. For example, when assessing financial exposures of households and corporates, information on the currency composition of credit is of particular importance.

Open issues include aggregation ...

Selected complementary indicators		
	Quantities	Prices
Monetary liquidity	Base money and broader monetary aggregates Foreign exchange reserves	Policy and money market interest rates Monetary conditions indices
Funding liquidity	Bank liquidity ratios Maturity mismatch measures CP market volumes	Libor-OIS spreads FX swap basis Bond-CDS basis Surveys of funding conditions
Market liquidity	Transaction volumes	Bid-ask spreads on selected global assets Qualitative fund manager surveys
Risk-taking and valuation	Bank leverage ratios	VIX index and other risk appetite measures Sharpe and carry-to-risk ratios Asset prices and spreads Price/earnings ratios

Table 1

<sup>18</sup> The patterns shown in Graph 4 apply in a similar fashion also for other risk appetite proxies and for indicators known or expected to correlate with risk-taking in the private sector. See, for example, Adrian and Shin (2008), who find that VIX index readings provide a good proxy for financial sector leverage.



In contrast, when assessing the role of different intermediation channels in the provision of liquidity, distinguishing between bank and non-bank providers of credit is essential. Graph 5 shows total credit to the non-bank sector in different countries together with the estimated amount which is provided by banks.<sup>19</sup> In France, Germany, the United Kingdom and the United States, for example, non-banks supply roughly half the total. In contrast, banks are the main suppliers of funds in Japan and Spain. In most emerging market economies (not shown), banks provide the bulk of credit to non-bank borrowers, although in several (eg the Czech Republic, Hungary and Poland) the share of total credit provided by non-banks is similar to that in advanced economies.

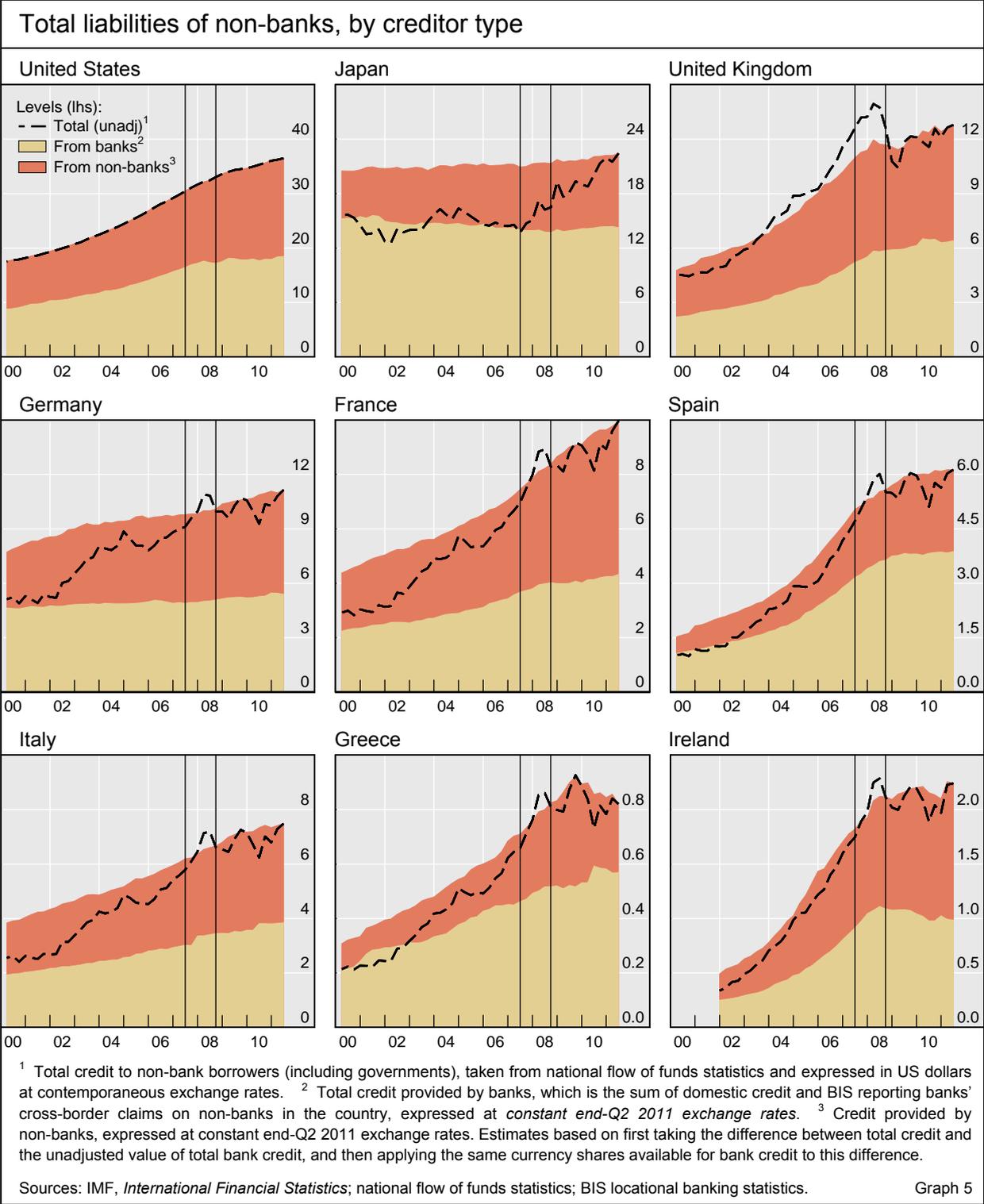
... as well as global liquidity dynamics

A second issue is data gaps. More granular information on creditor-side data in individual sectors would help improve the monitoring of global liquidity conditions. For instance, more comprehensive data on currency composition and maturity of international claims would enhance the diagnosis of the build-up of financial system risks associated with ample global liquidity. The same applies more generally for data on the shadow banking sector and derivatives market activities.

A third, related issue is the need for analytical work to better understand the dynamics of global liquidity and its impact on financial markets and institutions. For example, the interaction of private and public liquidity is not fully understood. Private sector perceptions that central banks will support liquidity in times of stress may affect risk-taking and the ease of financing. Other linkages between private and official liquidity may result from the use of

<sup>19</sup> Note that this amount provided by banks includes their loan *and* debt securities claims, and thus is not synonymous with an *instrument* breakdown of total credit (eg loans vs securities).

private financial instruments when providing or managing official liquidity. For instance, the collateral policies of central banks may influence the terms and conditions of secured funding in private markets. Another example is, as mentioned above, the impact of foreign exchange reserves on the markets of those assets where the reserves are invested.



## Policy issues

Policy responses need to address both surges and shortages, and include ...

The dominant role of the choices and decisions of financial institutions and other economic agents in determining global liquidity has important implications for the design of policy frameworks aimed at ensuring financial stability. First, policies need to take into account the full liquidity cycle – liquidity surges and their associated contributions to systemic risk as well as liquidity shortages or disruptions in the provision of private liquidity. Second, policy frameworks need to be sufficiently robust to uncertainty about the exact sources and impact of global liquidity surges and sufficiently flexible to address sudden shortages in liquidity conditions at the global level.

... microprudential as well as ...

Policy responses to surges in global liquidity are closely associated with the financial reform agenda. Microprudential measures that prevent excessive maturity transformation – such as the liquidity coverage ratio (LCR) under Basel III – and that enhance the resilience of financial institutions more generally – such as the new, higher capital ratios – will tend to reduce the size and frequency of abrupt changes in liquidity provision due to banking sector strains. And measures that help to counter the procyclicality of credit (such as leverage ratios and capital conservation buffers) will tend to dampen cyclical fluctuations in private liquidity.

... macroprudential measures ...

Macroprudential tools can also be used to address global liquidity surges. The new Basel III framework goes some way in this direction by providing a macroprudential overlay targeting both the cross-sectional dimension of systemic risk (eg capital surcharges for systemically important institutions) and its time dimension (eg the countercyclical capital buffer).<sup>20</sup>

... macroeconomic policy and ...

In addition, macroeconomic policy has an important part to play. Fiscal, monetary and exchange rate policies are ultimately and necessarily set to meet domestic policy objectives. At the same time, macroeconomic policy settings can be a key influence on global liquidity and the international transmission of liquidity cycles. Policy settings that help to avoid the build-up of domestic financial imbalances can, hence, also help to prevent unwanted surges in global liquidity. For instance, greater exchange rate flexibility may be consistent with domestic macroeconomic objectives, while helping to dampen global liquidity spillovers. In particular, such flexibility can reduce private sector incentives to establish unmatched foreign currency funding and investment positions.

The possible need to respond to liquidity shortages raises the issue of when and how the official sector should step in to fill the gap. To be sure, successful prevention of unsustainable surges in liquidity could substantially reduce the frequency and size of liquidity shortages. Even so, additional policy measures may still be needed.

... self-insurance mechanisms

Designing policies to address liquidity shortages involves questions about the effectiveness of self-insurance mechanisms, including precautionary accumulation of reserves and financial safety nets. Key considerations in this

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<sup>20</sup> See BIS-FSB-IMF (2011).

context are the nature of the shock and the degree of pre-commitment and moral hazard risk.

The appropriate policy responses will have to be calibrated to the possible size and nature of the liquidity shock. In the case of idiosyncratic and smaller-scale regional shocks, self-insurance in the form of precautionary foreign reserves holdings and supply of liquidity through mechanisms for redistributing official liquidity, such as IMF programmes, SDR allocations and regional support arrangements, will typically be sufficient.

In the case of a global liquidity shock, however, drawing on such prearranged mechanisms may not suffice. For instance, a freezing of interbank markets in major funding currencies, as during the recent crisis, may require the ability to supply official liquidity in major currencies in an elastic manner. Only the currency-issuing central banks have this ability.

Only central banks  
can address global  
liquidity shocks

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## The impact of recent central bank asset purchase programmes<sup>1</sup>

*This article analyses the effectiveness of the asset purchase programmes implemented by the Federal Reserve and the Bank of England. Both the Federal Reserve's Large-Scale Asset Purchase (LSAP) programme and the Bank of England's Asset Purchase Facility (APF) had a significant impact on financial markets when the first stages were announced, but the effects became smaller for later extensions of the programmes. Applying a methodology developed by D'Amico and King (2010), we estimate that the lasting reduction in bond supply via central bank asset purchases lowered government bond yields significantly. The effect is largely similar for the LSAP and the APF. Our estimations also suggest that the Federal Reserve's new maturity extension programme (MEP) should have an effect on longer-term Treasury bond yields comparable to that of the outright asset purchases under the LSAP.*

*JEL classification: E52, E63.*

Following the recent global financial crisis and the onset of the ensuing recession, central banks in the major advanced economies lowered policy rates rapidly to close to zero. Several central banks also implemented policy measures considered non-standard (see box), including outright purchases of large amounts of long-term bonds. This led to dramatic increases in the securities holdings of the Federal Reserve and the Bank of England (Graph 1).<sup>2</sup> In recent months, central banks have responded to the deepening European sovereign debt crisis and the faltering recovery in the major advanced economies by expanding the existing asset purchase programmes or adopting new measures, such as the Federal Reserve's maturity extension programme (MEP) in September 2011.

In this article, we estimate the impact of the recent purchases of Treasury securities by the Federal Reserve and of gilts by the Bank of England on

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<sup>1</sup> The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. We are grateful to Morten Bech, Claudio Borio, Stephen G Cecchetti, Eli Remolona, Jing Yang and Christian Upper for useful comments on earlier drafts of this article, and to Jakub Demski for assistance with data and graphs.

<sup>2</sup> For instance, the Federal Reserve's outright securities holdings tripled from about \$790 billion in mid-2007 to over \$2.6 trillion by mid-2011.

government bond yields using two different methodologies.<sup>3</sup> We first study the immediate financial market impact of both the announcements of the programmes and of the actual purchases. Our event study points to large responses to the announcements of US LSAP1 and UK APF1, and smaller responses to the announcements of later programmes. We then estimate the impact of the actual purchases using the methodology of D'Amico and King (2010). We find that yields fell significantly over the course of each programme.

Asset purchases by central banks can affect real activity through several channels.<sup>4</sup> First, through the portfolio balance channel, purchases of longer-term securities can lower the long end of the yield curve and lead investors to buy assets with greater duration or higher credit risk. This can increase prices for a range of private assets, including home and equity prices. In the second, the signalling channel, a central bank communicates, via asset purchases, its commitment to monetary stimulus. This can lower the expected future path of short-term rates and reduce longer-term yields. A credible commitment can

## US and UK asset purchase programmes

Since late 2008, a number of central banks have established asset purchase programmes in order to improve financial conditions, revive credit flows and stimulate economic activity. The purchases have been concentrated in government securities and related assets.

The US Federal Reserve announced its Large-Scale Asset Purchase (LSAP) programme on 25 November 2008, with purchases of up to \$600 billion in agency mortgage-backed securities (MBS) and agency debt. In March 2009, the Federal Open Market Committee expanded the LSAP with an additional \$850 billion in purchases of agency securities and another \$300 billion in purchases of longer-term Treasury securities. The announced total amount of \$1.75 trillion represented 14.5% of the combined outstanding Treasury and agency securities, which stood at around \$12 trillion at the beginning of the LSAP. The operations (LSAP1), which were extended to March 2010, became known as Quantitative Easing 1. As the recovery faltered, the Federal Reserve put in place LSAP2 in November 2010, which consisted of further purchases of \$600 billion in longer-term Treasury securities until mid-2011.

On 21 September 2011, the Federal Reserve announced a new maturity extension programme (MEP). Under the programme, by the end of June 2012 the Fed would buy \$400 billion in Treasury securities with remaining maturities of six to 30 years, while selling an equal amount of Treasuries with remaining maturities of three months to three years.

The Bank of England established an Asset Purchase Facility (APF) Fund in January 2009 to buy high-quality assets to improve liquidity in credit markets.<sup>Ⓞ</sup> Initially, it committed £75 billion to purchase bonds with residual maturity between five and 25 years. This was raised to £125 billion in May, £175 billion in August and £200 billion in November 2009 (APF1). By February 2010, the purchases of gilts amounted to £198 billion, which was about 29% of the free float gilt market. On 6 October 2011, the Bank decided to expand the APF by a further £75 billion to £275 billion (APF2).

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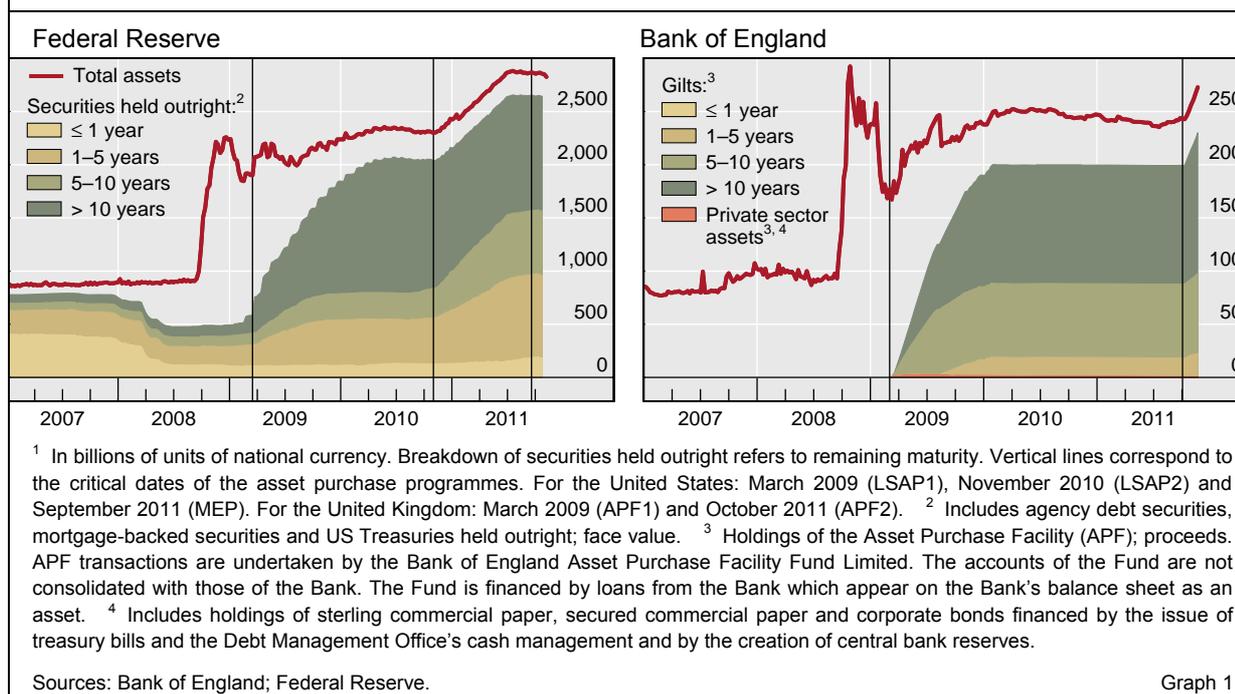
<sup>Ⓞ</sup> Benford et al (2009) and Cross et al (2010) provide detailed accounts of the APF, and Joyce et al (2010) estimate the impact of the asset purchases on financial markets.

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<sup>3</sup> See Meaning and Zhu (2011) for a comprehensive analysis.

<sup>4</sup> Chen et al (2011) discuss in detail the domestic and international channels of transmission for central bank asset purchases. Meaning and Zhu (2011) analyse the strength of the portfolio balance channel.

## Central bank balance sheets and outright asset purchases<sup>1</sup>



also reduce uncertainty, inspire confidence and drive down risk premia while supporting asset prices. Third, in the traditional interest rate channel, if nominal prices and wages are slow to adjust, reducing longer-term yields and subsequently real interest rates encourages spending by firms and households.

Here we focus on the overall impact of the purchases on asset prices, without distinguishing between the various channels. However, we do provide some evidence on the portfolio balance channel, which was considered by Gagnon et al (2011) as the main channel through which the LSAP programme affected yields.

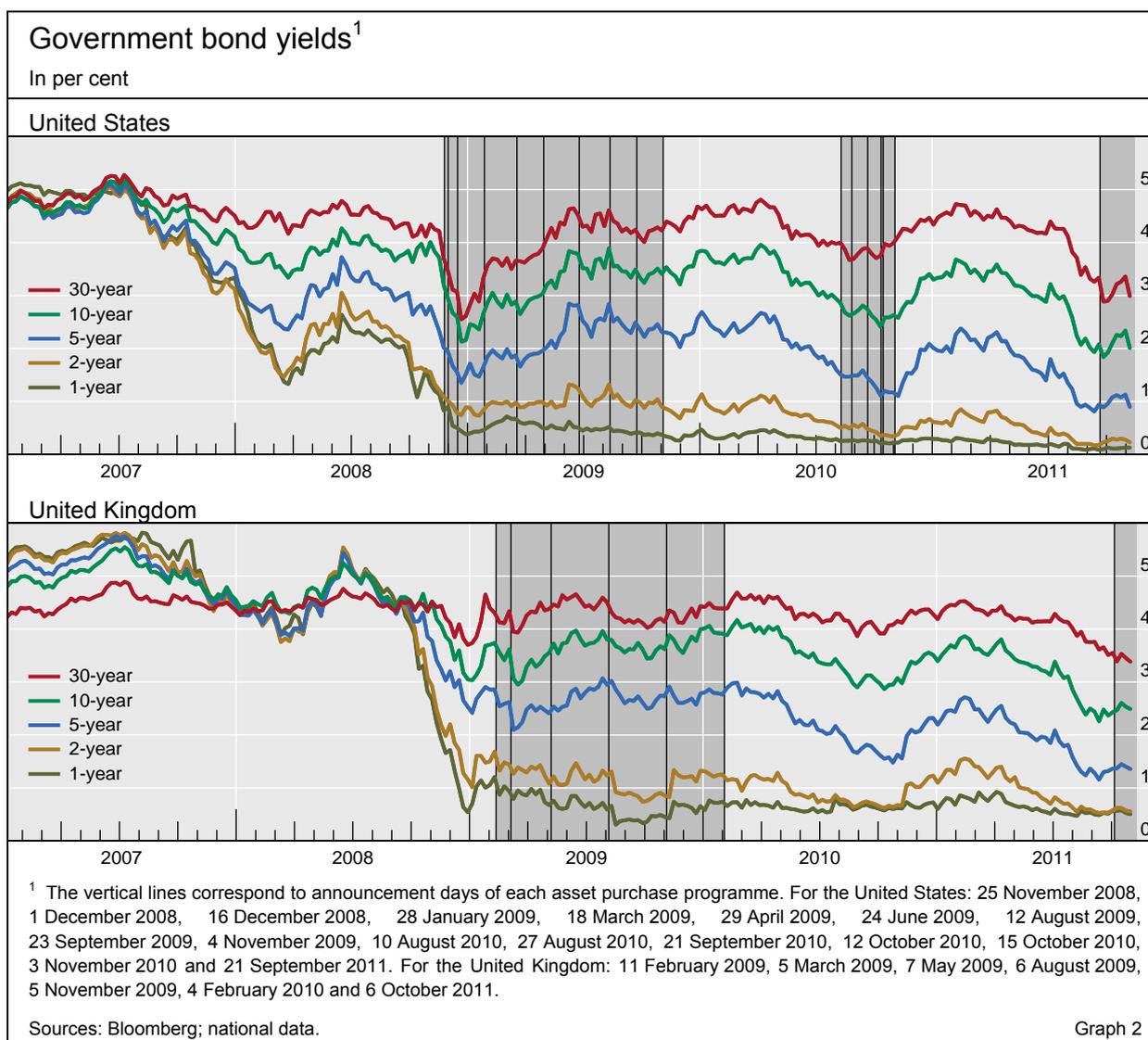
### Announcement effects of asset purchases

Bond yields reacted to asset purchase programmes

US and UK asset purchases appear to have had an immediate and non-negligible impact on sovereign bond yields across the maturity range (Graph 2). Following most of the relevant announcements related to the US and UK asset purchase programmes, bond yields declined across maturities, with the largest impact on the five- and 10-year yields. The effects were greatest after the initial announcement of each programme.

We study the financial market responses to the major announcements of US and UK asset purchase programmes using an event study methodology, as in Gagnon et al (2011). We use one- and two-day event windows to measure the cumulative changes in a number of key financial indicators.<sup>5</sup> Large-scale asset purchases are a relatively new and less well understood policy tool compared to changes in policy rates. We therefore allow the event windows to

<sup>5</sup> Chen et al (2011) find sizeable effects of announcements of central bank asset purchase programmes on the global financial market, with significant cross-country differences.



be longer than usual to allow the market reactions to the policy announcements to fully register, but short enough to exclude the likely impact of other relevant events close to the announcement dates.

Graph 3 reports our findings on the cumulative effects with a one-day event window. First, the announcements had a strong and immediate impact on government bond yields. The five- and 10-year yields fell most, reflecting the intention of the Federal Reserve and the Bank of England to target longer-maturity assets. But not all announcements lowered long yields: for instance, yields actually rose after the Bank of England's 6 October 2011 decision to extend its APF. This might have reflected the rising market unease with the ongoing tensions in Europe's sovereign debt markets. In addition, the three-month OIS rate declined by about 30 basis points during LSAP1, suggesting investors might have lowered their expectations of future effective federal funds rates in response to the policy announcements.

Second, US LSAP1 and UK APF1 had far greater impact on sovereign bonds of different maturities and on corporate bond yields than the later programmes. This suggests that the novelty or surprise factor associated with LSAP1 and APF1 might have waned over time as "more of the same" failed to

Longer-term yields were most affected ...

... but the impact was smaller for later programmes

evoke market reactions of similar magnitude. Another factor could have been the additional impact of large-scale purchases of agency debt and agency MBS under LSAP1. While one-day reactions of 15- and 30-year mortgage rates to LSAP1 and LSAP2 announcements were small, two-day responses were significant. In addition, only one announcement is included in the analysis for the US MEP and UK APF2, but the impact was rather small for an initial announcement.

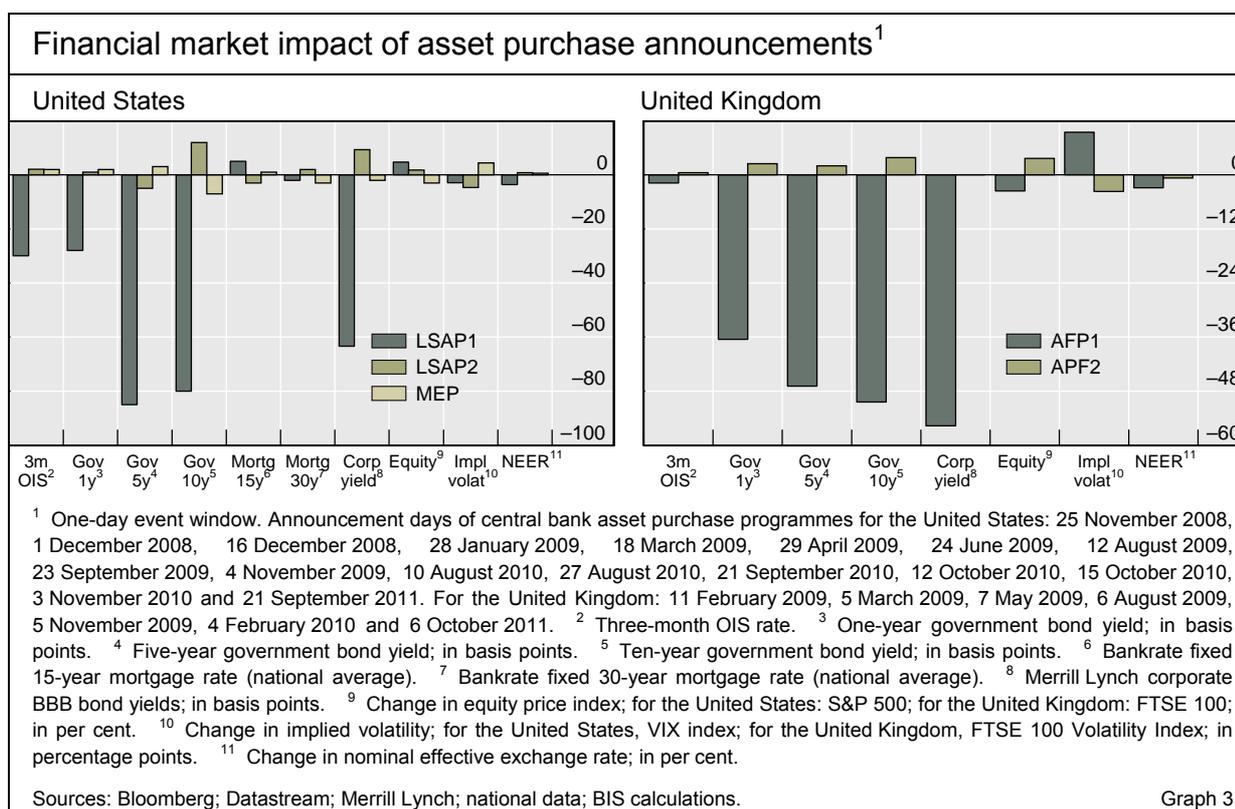
Corporate bond yields dropped ...

... as the portfolio balance channel may have been at work

Third, the impact of the programmes extended well beyond the assets purchased. The announcements led to sizeable reductions in corporate bond yields: US BBB bond yields fell by 63 basis points in one day and almost 100 in two days after the LSAP1 announcements. Similarly, APF1 announcements prompted declines in UK BBB bond yields of 56 basis points in one day and 98 in two days. This could reflect investors' portfolio rebalancing set in motion by central bank actions. The announcements preceded significant depreciations in the nominal effective exchange rates of the US dollar (7.7% in two days) during LSAP1 and sterling (3.7%) during APF1, but had little impact with later programmes. Equity prices rallied strongly during LSAP1 and APF2, but fell with MEP and APF1.

Fourth, the programmes apparently had a stabilising effect on financial markets. Implied volatility of stock prices, taken as a proxy for overall uncertainty in financial markets, fell after the announcements of LSAP1 and APF2, but not APF1.

Two caveats are in order concerning the event study estimates. First, the announcement effects of asset purchases were sometimes "contaminated" by the impact of concurrent central bank statements on the economic outlook and policy actions other than asset purchases. Second, some announcements were



noisier and had a lower degree of precision, and markets therefore faced greater uncertainty. For instance, in some cases central banks had yet to determine the size and operating procedures of such programmes.

## The impact of asset purchases

In this section, we estimate the impact on government bond yields of actual bond purchases under the various programmes. We focus on the stock effect, ie the impact on yields associated with a lasting reduction in the bond supply.<sup>6</sup> D'Amico and King (2010) find large stock effects: the Fed's \$300 billion Treasury purchases during LSAP1 lowered yields, on average, by about 30 basis points across the yield curve, and as much as 50 basis points for bonds with 10–15 years of remaining maturity. This is equivalent to a reduction of about 200 basis points in the federal funds rate.

We first replicate the D'Amico and King (2010) results for LSAP1. We then estimate the stock effects of LSAP2, ie the Fed asset purchase initiative between November 2010 and June 2011, and of the Bank of England's gilt purchases under APF1, which ran from March 2009 to January 2010. The purchase data are of daily frequency for individual government securities, each identified by a unique US CUSIP or UK ISIN code.

### *The impact of US LSAP2 and UK APF1*

Ultimately, what matters for the macroeconomic impact of the asset purchase programmes is whether they achieve a lasting reduction in yields. The price or yield impact of a reduction in bond supply may occur on the day of the policy announcement, at the time of actual purchases or after their completion, or a mixture of all three. While event studies measure the market impact of the presence of asset purchase programmes as perceived by market participants, a cross-sectional regression which covers a period starting from immediately prior to the announcement of treasury purchases to the day of final purchase allows us to capture the full impact of treasury purchase programmes on the yield curve, in particular that of the actual purchases.

Stock effects matter

Following D'Amico and King (2010), we use cross section two-stage least squares to estimate the stock effects of US LSAP2 and UK APF1. In the first stage, we instrument the level of purchases to take account of any endogeneity arising from the fact that central banks might have preferred to purchase those securities that were undervalued and were therefore likely to see a price rise

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<sup>6</sup> Meaning and Zhu (2011) estimate the flow effects (ie responses of yields to each new set of bond purchases) of UK and US asset purchases. They find that all three programmes exhibit significant flow effects: an LSAP1 operation with typical asset purchase composition lowered yields by 3.5 basis points on the day of purchase, and a typical LSAP2 operation reduced yields by 4.7 basis points. A typical APF1 operation, on the other hand, led to a yield decrease of 1.5 basis points.

even in the absence of central bank purchases.<sup>7</sup> In the second stage, we run regressions of the following form:<sup>8</sup>

$$\frac{\Delta p_i}{p_{i,0}} = \mu + \kappa \widehat{Q}_i + \kappa_s \widehat{Q}_s + \gamma_1 RM_i + \gamma_2 RM_i^2 + \zeta_i \quad (1)$$

where  $\Delta p_i$  is the price change for security  $i$  during a purchase programme,  $p_{i,0}$  is its price just before the start of the programme,  $\widehat{Q}_i$  is the instrumented value of purchases of security  $i$  and  $\widehat{Q}_s$  is that of near-substitute purchases during an asset purchase programme,<sup>9</sup> and  $RM_i$  is the remaining maturity of security  $i$ . Based on the estimates of bond price changes, we construct a set of counterfactual yields, ie those that would have prevailed in the absence of the asset purchase programmes. To do so, we first estimate bond price changes due to asset purchases, and then subtract these from the observed yields.

LSAP2 and APF1 led to sizeable declines in bond yields ...

Several key points emerge from the analysis. First, US and UK asset purchase programmes resulted in significant declines in yields as the central banks removed part of the supply of treasury securities from the market (Table 1). LSAP2 on average lowered the yield curve by 21 basis points, with a maximum impact of 108 basis points for some securities with remaining maturity of around 20 years. APF1 on average lowered yields by 27 basis points for gilts with a remaining maturity of five to 25 years. APF1 had its greatest impact on the yields for gilts of about 12 years to maturity, which were reduced by as much as 74 basis points.

When interpreting these estimates, one has to bear in mind that the different programmes varied in size. LSAP2 was approximately twice as large as LSAP1.<sup>10</sup> This means that, on average, LSAP2 was less effective per billion dollars spent than LSAP1, although the maximum impact was similar. The greater effectiveness of LSAP1 in reducing bond yields could be partly attributed to the additional impact from Fed purchases of agency debt and

<sup>7</sup> Results from the first-stage regressions suggest that the asset purchase programmes indeed successfully targeted underpriced maturity segments.

<sup>8</sup> Considering the possibility that our coefficients of interest,  $\kappa$  and  $\kappa_s$ , may vary for different maturities, for LSAP we include interaction dummies which separate securities with less than 15 years of remaining maturity from the rest. For APF1, we use interactive dummies to separate gilts which were within the APF initial purchase range from those which were not. We do not control for factors such as changes in the growth outlook or inflation expectations. These variables may have had a significant impact on yields as they changed over the course of each programme, but cross section regressions could only take account of the impact of the change in the growth outlook at the end of the programme compared to that at the beginning, and could only provide the same average estimated impact across different maturities.

<sup>9</sup> Near substitutes are defined as securities with a remaining maturity within two years of the remaining maturity of the security in question.

<sup>10</sup> The amount of \$600 billion in Treasuries may understate the true extent of supply withdrawn by the Fed as LSAP2 was supplemented by additional securities bought by the Fed reinvesting funds originated from other Fed programmes. Taking this into account, the Fed purchases made over the course of LSAP2 were just under \$750 billion.

The stock effects of US and UK asset purchases <sup>1</sup>						
	Own sector	Near substitutes	Remaining maturity	Remaining maturity squared	Adjusted R <sup>2</sup>	No observations
<b>US LSAP2</b>						
< 15 years remaining maturity	2.351 (1.049)	0.031 (0.022)				
> 15 years remaining maturity	3.215 (0.022)	-0.146 (0.231)	-0.146 (0.000)	0.0000913 (0.000)	0.63	188
<b>UK APF1</b>						
IPR <sup>2</sup>	0.1583 (0.062)	-0.02830 (0.025)				
Non-IPR	-	0.010 (0.022)	-	-	0.21	31
<sup>1</sup> Standard errors are reported in parentheses. <sup>2</sup> IPR indicates "initial purchase range" of between five and 25 years' remaining maturity, as laid out by the Bank of England for gilt purchases. The range was later extended to three–25 years. <span style="float: right;">Table 1</span>						

agency MBS. The programme sizes of LSAP1 and APF1 were similar, and their average and maximum yield effects were of roughly the same magnitude.

Our results are largely in line with those of previous work. For instance, Williams (2011) adjust the existing estimates by the size of asset purchase programmes: for a \$600 billion operation, the estimated impact on longer-term bond yields ranges from 14 basis points in Greenwood and Vayanos (2008) and 15 basis points in Krishnamurthy and Vissing-Jorgensen (2011) to 18 basis points in Gagnon et al (2011) for US asset purchases, and 40 basis points in Joyce et al (2011) for UK purchases.

Third, the effectiveness of the three asset purchase programmes also differs if we compare them in terms of their size relative to total treasuries outstanding. The Bank of England's purchases under APF1 represented about 29% of the free float of gilts. The announced purchases of LSAP1 and LSAP2, on the other hand, accounted for about 4.7% and 6.6%, respectively, of the US Treasury debt outstanding at the start of each programme. According to this metric, APF1 was less effective than the two US programmes.

... but might be subject to diminishing returns

### *The impact of Operation Twist<sup>11</sup>*

On 21 September 2011, the Federal Reserve announced a \$400 billion maturity extension program (MEP), also known as Operation Twist since it is similar to the programme of the same name implemented in the early 1960s.<sup>12</sup> Compared to the recent LSAP and APF, the new Operation Twist has

Operation Twist ...

<sup>11</sup> Meaning and Zhu (2011) distinguish the quantity effects of asset purchases from the impact of a maturity transformation of the Federal Reserve holdings of Treasuries. They find that the MEP could have a large impact on the 10-year Treasury yield, but its success will depend crucially on the Treasury's debt management policy.

<sup>12</sup> The original Operation Twist, implemented under the Kennedy Administration, aimed at lowering longer-term yields while maintaining the existing level of short-term interest rates. The Fed bought about \$8.8 billion of longer-term Treasury securities and reduced its holdings

the distinct feature of keeping the size of the Federal Reserve balance sheet unchanged, as the purchases of longer-term Treasury securities will be financed with the proceeds from selling shorter-term ones rather than through increases in reserves.

Will the MEP be as effective as the asset purchase programmes implemented so far? We evaluate the MEP based on the likely stock effects arising from the \$400 billion simultaneous purchases of longer-dated bonds and sales of short-term Treasury securities. First, we assume that these purchases follow the maturity distribution of MEP purchases published by the Federal Reserve. We then distribute the \$400 billion of sales uniformly among the Federal Reserve's existing stock of securities with a remaining maturity between three months and three years. Finally, we estimate the impact of the MEP using previous estimates from the LSAP2 stock effect regressions.

... could have a large impact on the yield curve

The simulations suggest that on average, yields may drop 22 basis points for securities with a remaining maturity over eight years, consistent with the estimated stock effects of previous programmes. However, selling securities at the short end would raise yields in the three-month to three-year sector by around 60 basis points on average. This compares to Hamilton and Wu's (2011) estimates of a 14 basis point drop in the 10-year yield and an 11 basis point increase in the six-month rate. However, the Federal Reserve expects a small impact of the sales on the yields of short-term securities. This expectation probably relies on the Federal Reserve's commitment to maintain "exceptionally low levels for the federal funds rate at least through mid-2013", which should anchor short-term yields.

## Conclusion

The asset purchase programmes implemented by the Federal Reserve and the Bank of England significantly reduced yields of longer-term bonds. Government bond yields fell significantly and the prices of some risky assets increased as the programmes were announced. The purchase programmes had a lasting and large yield impact by withdrawing bond supply from the market. The impact per billion dollars spent of the US and UK asset purchase programmes was comparable. In terms of programme size relative to the amount of outstanding debt, however, the purchases might be subject to diminishing returns as central banks hold a larger share of the sovereign debt. Looking ahead, our estimates suggest that the impact on bond yields of the new Operation Twist can be expected to be comparable to previous LSAP programmes.

Recent asset purchases seem to have been effective, but there are limitations for further actions. First, long-term government bond yields are already very low, and the scope for further reduction becomes smaller as more purchases are carried out. Second, it may be harder to achieve the same degree of effectiveness as with the initial programmes once the surprise or

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of short-term Treasury bills by \$7.4 billion. Early studies, eg Modigliani and Sutch (1966, 1967), show that the operation 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 US 10-year Treasury bond yields by about 15 basis points.

novelty element wanes. Third, central banks face some risks associated with large holdings of longer-term securities and riskier private debt. For instance, a sharp balance sheet expansion due to outright asset purchases, if it persists, may affect inflation expectations. Also, it can be difficult to unwind large asset holdings in a way that does not roil markets.

Given these caveats, central bank asset purchases are unlikely to replace conventional interest rate policy in normal times. That said, they have proven to be useful tools in these extraordinary times to tackle the unique problems arising from the global financial crisis and the ensuing recession.

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## Enhanced BIS statistics on credit risk transfer<sup>1</sup>

*From June 2011, the BIS credit derivatives statistics provide more granular information on the types of risks transferred through credit default swaps by different groups of counterparties. The new data suggest that reporting dealers have used some hard-to-value credit derivatives to transfer credit risk to shadow banks, possibly exposing these counterparty groups to valuation risks. The data also show that some financial counterparties have sold protection against defaults in the same sector on a net basis.*

*JEL classification: C82, G18.*

The BIS CDS statistics were enhanced in two phases

First, a finer breakdown of financial counterparties was introduced

Second, the types of risks exchanged with counterparties were decomposed

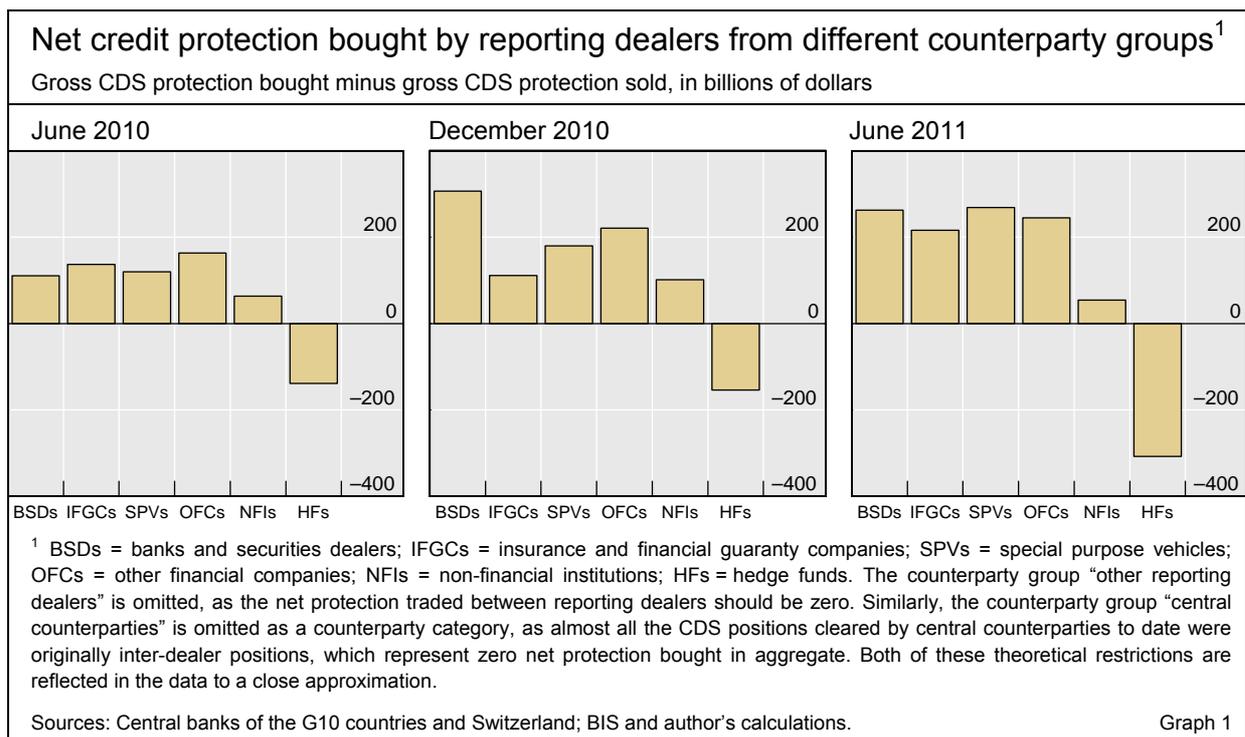
Opacity about the location of exposures to failing financial institutions exacerbated the recent financial crisis. In particular, there was a shortage of information about the web of credit risk transfers through over-the-counter (OTC) derivatives. To reduce that data gap, the Committee on the Global Financial System (CGFS) proposed two sets of enhancements to the semiannual credit default swaps (CDS) statistics compiled by the BIS (CGFS (2009)). These have been implemented in two phases.

The first set of enhancements, introduced with the June 2010 statistics, provides a finer classification of the counterparties of reporting derivatives dealers (Vause (2010)). The new data showed net credit risk transfers from hedge funds to reporting dealers and from reporting dealers to all other sectors.<sup>2</sup> This pattern persisted in December 2010 and June 2011 (Graph 1).

The second set of enhancements, first applied to the June 2011 data, makes two further improvements. It decomposes total credit risk transfers with each counterparty group according to characteristics of the underlying debt (sector, rating and maturity). It also reveals the market values of credit risk transfers with counterparties in different sectors after netting of any bilateral CDS positions with offsetting market values. This identifies counterparty groups

<sup>1</sup> 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 and Christian Upper for useful comments on earlier drafts of this article, and to Denis Pêtre for able research assistance.

<sup>2</sup> Note that transfers involving reporting dealers provide quite a comprehensive picture of all credit risk transfers, as BIS reporting dealers are (at least) one of the counterparties to the vast majority of outstanding CDS.



with net claims on dealers and vice versa.<sup>3</sup> Results are described, in turn, below.

### Characteristics of sectoral credit risk transfers

Graph 2 decomposes the net credit risk transfers by counterparty group as of June 2011 shown in the right-hand panel of Graph 1 by type of risk. In particular, it splits these totals by debtor sector, credit rating or residual maturity.

Reporting dealers transferred credit risk to insurance and financial guaranty companies (IFGCs), special purpose vehicles (SPVs) and other financial companies (OFCs)<sup>4</sup> mainly through CDS referencing debt from multiple sectors and CDS that were not rated (Graph 2, left-hand and centre panels).<sup>5</sup> These types of CDS can be difficult to value and have experienced

Risk transfers to non-bank financials occurred via hard-to-value CDS

<sup>3</sup> In addition, the second set of enhancements reveals the share of outstanding multi-name CDS positions that are CDS indices, including index tranches. This was 87% as of June 2011. CDS index tranches are generally not straightforward to value and are often less liquid than CDS indices. According to data from the Depository Trust & Clearing Corporation, index tranches represented 19% of all outstanding CDS indices as of June 2011.

<sup>4</sup> Pension funds are included in the IFGC category. Other managed funds, such as money market mutual funds, are well represented in the OFC category.

<sup>5</sup> Information is not available on positions in CDS that are both non-rated and reference multiple sectors, but supplementary BIS data do show that the majority of non-rated risk transfers to IFGCs, SPVs and OFCs occurred through multi-name CDS. Multi-name CDS that are likely to reference multiple sectors and be classified as non-rated include basket CDS, synthetic collateralised debt obligations (CDOs) and CDS index tranches. Where multi-name CDS did not have a rating, reporting dealers were asked to allocate these instruments to a rating bucket on the basis of the credit quality of the underlying debt, unless this was “not possible or very burdensome”. The products listed above would probably fit this description. Also, note that some single-name CDS, such as synthetic CDOs and CDS on asset-backed securities,

significant price jumps in the past. To the extent that such risks remain, some of them appear to have been passed on from reporting dealers to their counterparties.

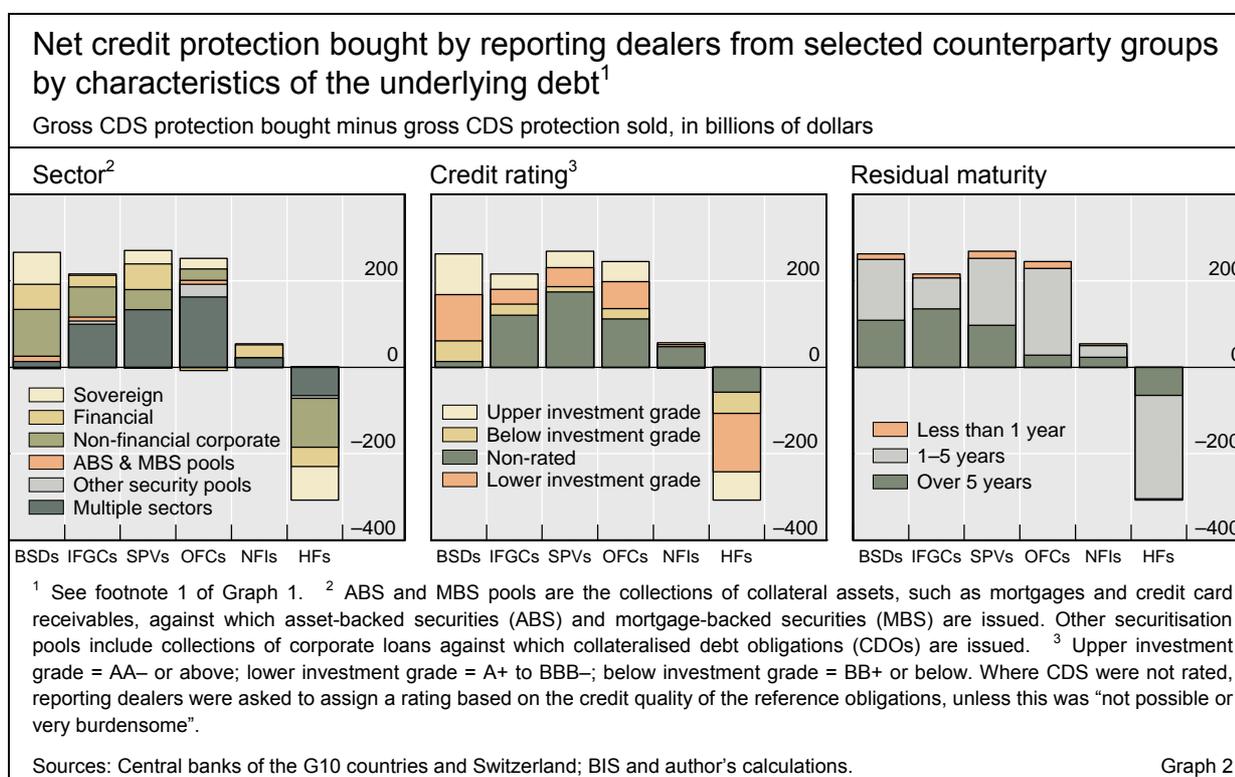
Some counterparties sold protection on their own sector

The left-hand panel of Graph 2 also shows that some counterparty sectors sold protection on a net basis against defaults in the same sector. In particular, (non-reporting) banks and securities dealers (BSDs) and SPVs sold protection against defaults of financial institutions. This is despite expectations of simultaneous defaults of counterparties and reference entities in common sectors often being higher than for counterparties and reference entities in different sectors. In contrast, much of the credit risk transfer from reporting dealers to non-financial institutions (NFIs) related to financial debt.

The distribution of rated credit risk transfers across counterparty groups was fairly uniform across ratings, as can be seen in the centre panel of Graph 2. All counterparty groups had a relatively large position in investment grade credit and a smaller position in sub-investment grade credit. This reflects the relative prevalence of the two grades in the market. Within investment grade, hedge funds had a larger position in lower-rated credit than higher-rated credit, while the balance was more even for the other counterparty groups.

Insurers took on longer-term credit risk

With the exception of IFGCs, the majority of credit risk transfers had residual maturities of one to five years (Graph 2, right-hand panel). This reflects the five-year maturity being the benchmark for trading credit protection on most reference entities. As a result, five-year CDS are often the most liquid contracts, which therefore reflect the best prices. IFGCs, by contrast, mostly



are classified as multi-name instruments in the new BIS data because they have multiple underlying credits.

offered credit protection with residual maturities in excess of five years. This may reflect the long-term horizons of some businesses in this sector, such as life insurance. Supplementary BIS data show that IFGCs took on longer-term credit risk via multi-name CDS more than through single-name CDS. This is consistent with the finding that long-term multi-name CDS are often more liquid than long-term single-name CDS.

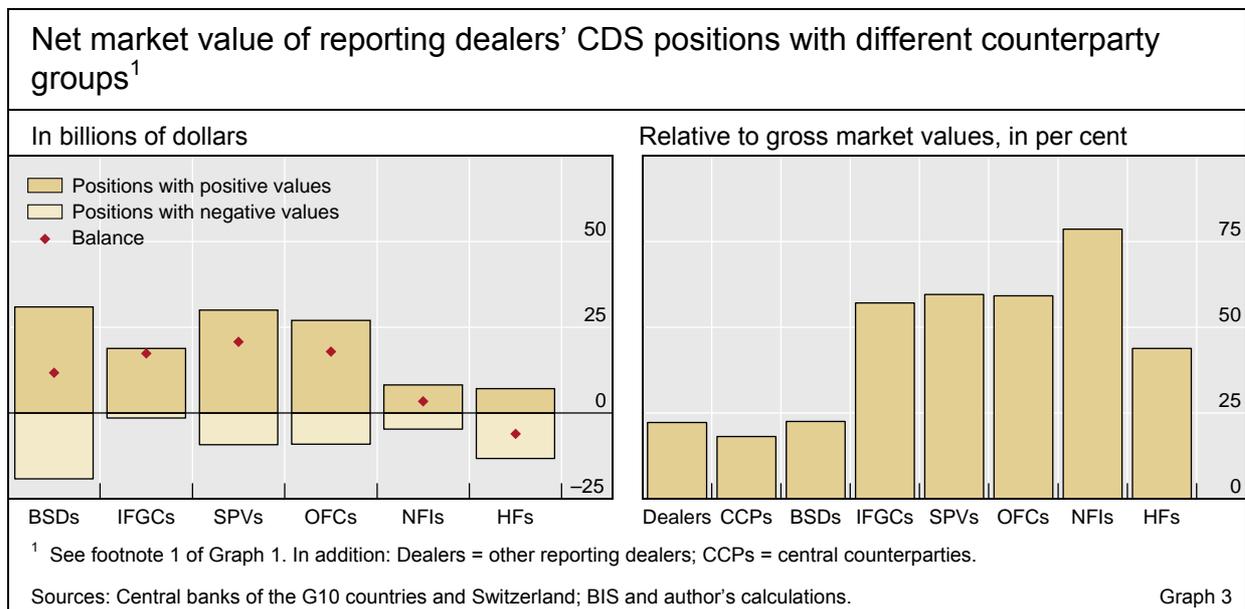
### Market values of sectoral credit risk transfers

The market values of the credit risk taken on or shed by different counterparty sectors as of June 2011 were very small relative to their overall balance sheets. The bars in the left-hand panel of Graph 3, which show the gross positive and negative market values of outstanding CDS positions of reporting dealers with counterparties in different sectors, are much larger in absolute amount than the red diamonds, which correspond to the net values. These reflect offsetting of bilateral positions with positive and negative market values wherever the two counterparties to the positions have signed a legally enforceable netting arrangement. Reporting dealers had net claims on all sectors except hedge funds. Net claims on BSDs, IFGCs, SPVs and OFCs were of the order of \$15–20 billion, while those on NFIs were somewhat smaller. Each of these claims represented less than 0.1% of dealers’ total assets. Hedge funds had a net claim on dealers, of a little over \$5 billion, which was less than 0.3% of their total assets.

Market values of sectoral risk transfers were small compared with balance sheets

Separately, comparison of net market values with gross market values by counterparty sector suggests that inter-dealer positions and positions between dealers and central counterparties (CCPs) net to a much greater extent than other positions. The right-hand panel of Graph 3 divides the net market values of reporting dealers’ outstanding CDS positions with different counterparty sectors by the gross market values of those positions. The net market value is the sum of all bilateral positions with positive (or, equivalently, negative) market value after netting, while the gross market value is constructed in the

Inter-dealer and dealer-CCP positions netted much more than other positions



same way but without netting. The ratios therefore reflect the pervasiveness of CDS netting by counterparty sector. The graph suggests significant netting benefits for inter-dealer positions, as the net market value of these positions is equal to around 25% of their gross market value. CCPs, which stand between bilateral counterparties, compress the ratio of net to gross market value to an even greater extent. Trades between dealers and other counterparty groups do not net as much, probably reflecting a much smaller number of positions.

## Conclusions

A key insight from the enhanced BIS credit derivatives data is that non-rated multi-name credit risk sourced from multiple sectors has been transferred from derivatives dealers to IFGCs, SPVs and OFCs. Such risk transfers are likely to have been generated by basket CDS, synthetic CDOs or CDS index tranches. These types of CDS can be difficult to value and have experienced significant price jumps in the past. To the extent that such risks remain, they appear to have been passed on from the banking sector to parts of the non-bank financial sector often known as shadow banks.

The new data also show that BSDs and SPVs had sold on a net basis credit protection on financial debt. The risk of simultaneous default of protection sellers and reference entities is often higher when these institutions come from a common sector, rather than different sectors. As the financial sector is broad, however, this risk could have been mitigated by careful pairing of reference entities with counterparties.

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