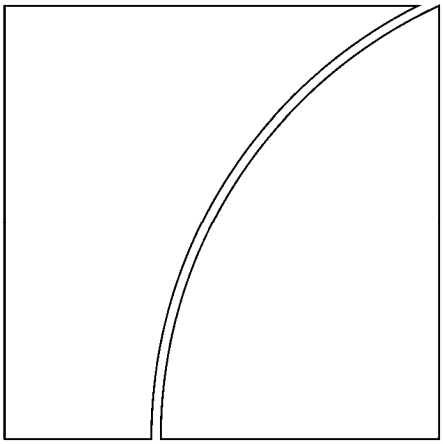
BANK FOR INTERNATIONAL SETTLEMENTS

BIS Quarterly Review

June 2010



International banking and financial market developments

BIS Quarterly Review
Monetary and Economic Department

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Special features

Notations used in this Review

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

Differences in totals are due to rounding.

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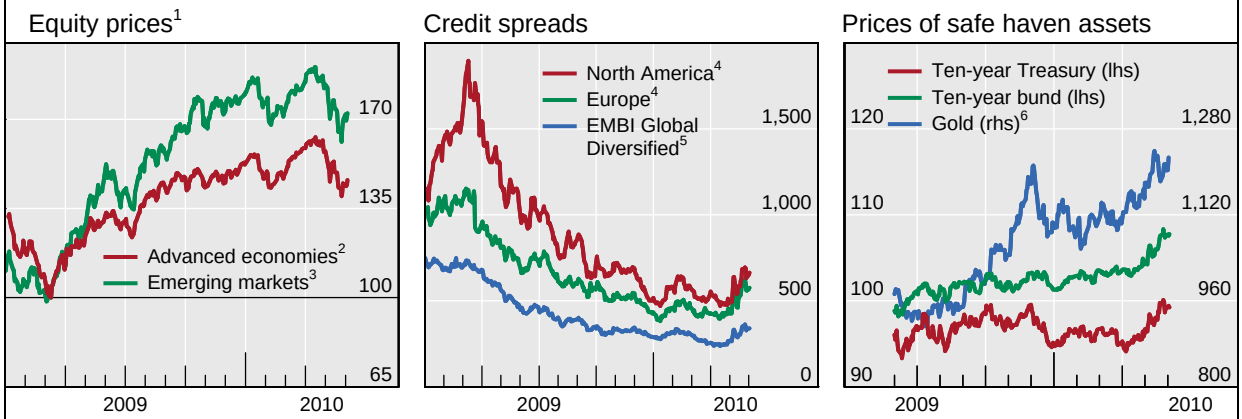
Overview: fiscal concerns shatter confidence

Global financial markets were highly volatile from mid-April to early June as fiscal concerns and the risk of weaker growth caused investor confidence to deteriorate rapidly. Investor worries about unsustainable fiscal positions crystallised around the problems of Greece and other euro area sovereigns. Faced with growing uncertainty, investors cut risk exposures and retreated to traditional safe haven assets. The announcement of a significant European rescue package bought a temporary reprieve from contagion in euro sovereign debt markets, but could not allay market concerns about the economic outlook. Instead, the flight from risky assets continued, resulting in additional increases in risk and liquidity premia.

A number of developments led investors to question the robustness of global growth. In advanced economies, investors and market commentators focused on the risk that the surge of public debt could derail the economic recovery. At the same time, rising Libor-OIS spreads reflected growing concerns that the financial system is more fragile than previously thought. Economic policy tightening in China, Brazil and India, among others, fuelled doubts that emerging economies could provide the necessary global growth momentum. Market confidence was further dented by rising geopolitical risk on

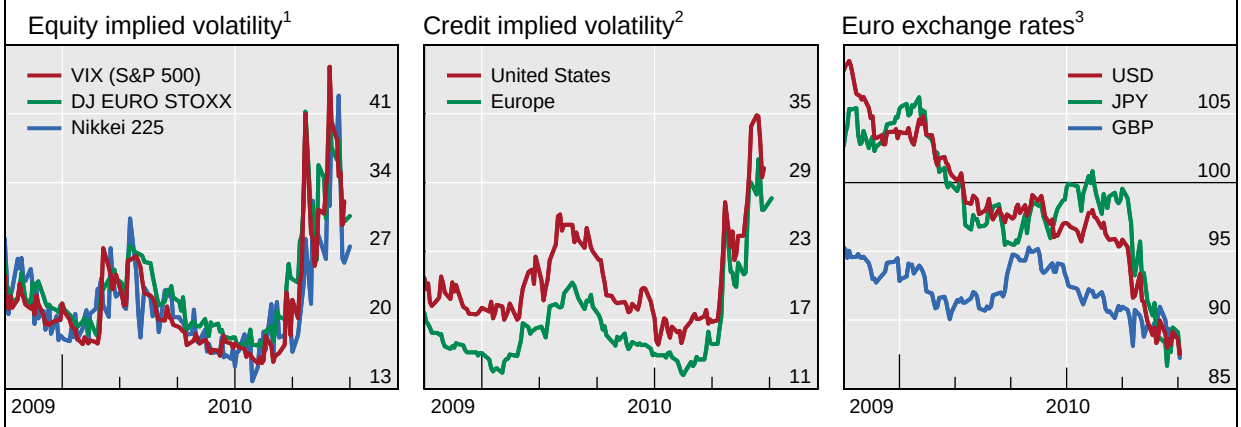
The retreat from risky assets



[1] 3 March 2009 = 100. [2] Average of S&P 500, DJ EURO STOXX, TOPIX and FTSE 100 indices. [3] Average of Asian, European and Latin American emerging market equity indices. [4] Five-year on-the-run credit default swap (CDS) mid-spreads on sub-investment grade (CDX High Yield; iTraxx Crossover) quality, in basis points. [5] Stripped spreads, in basis points. [6] Spot price per troy ounce, in US dollars.

Sources: Bloomberg; Datastream. Graph 1

Implied volatility and exchange rates



[1] Volatility implied by the price of at-the-money call option contracts on stock market indices, in per cent. [2] Volatility implied by the price of at-the-money one- to four-month option contracts on CDS indices (CDX High Yield; iTraxx Crossover), in basis points. [3] 1 January 2009 = 100.

Sources: Bloomberg; BIS calculations. Graph 2

the Korean peninsula and Spain's second downgrade, together with the difficulties of a number of Spanish savings banks, in late May.

Over the six weeks to the end of that month, prices of risky assets fell and volatility rose. Stock markets fell in advanced and emerging markets alike, bringing global equity prices below end-2009 levels (Graph 1, left-hand panel). Corporate credit spreads, which had remained broadly stable for several months, widened in late April (Graph 1, centre panel). Faced with significantly higher uncertainty, investors increased their demand for US Treasuries, German government bonds and gold (Graph 1, right-hand panel). Implied volatilities of equity prices and credit spreads rose sharply, reaching new highs for the year (Graph 2, left-hand and centre panels). The challenging fiscal situation and uncertainty about the growth outlook for the euro area also led to a significant weakening of the euro against other major currencies (Graph 2, right-hand panel). By the end of the period, investors had become increasingly concerned about the global growth outlook and, as a result, again pushed back their expected timing for the normalisation of monetary policies in the advanced economies.

Euro area sovereign risk goes global

Euro area fiscal concerns rise …

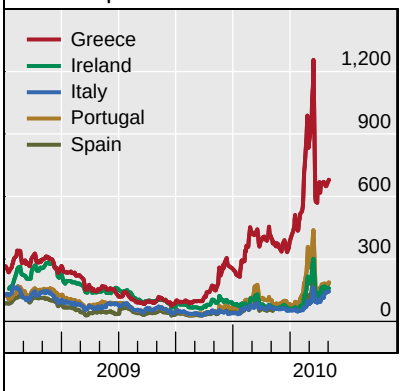
Concerns about the fiscal positions of Greece and other euro area sovereigns had been on investors' radar screen since November 2009. These worries were evident in the widening of sovereign bond spreads of those countries relative to comparable German bonds (Graph 3, left-hand panel).

Growing fears about the risk of a credit event[1] were first signalled in the inversion of Greece's credit default swap (CDS) spread curve in January (Graph 3, centre panel). Two-year CDS spreads rose above spreads on

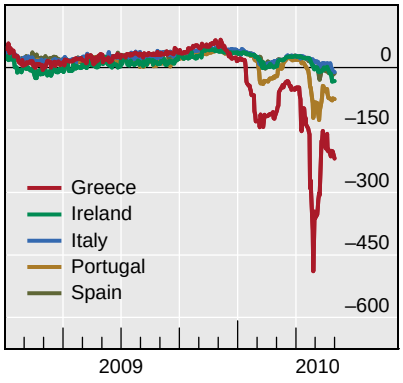
[1] This includes debt moratoriums, repudiation, restructuring and most currency redenominations as well as failures to pay.

Severe turmoil raises euro sovereign spreads

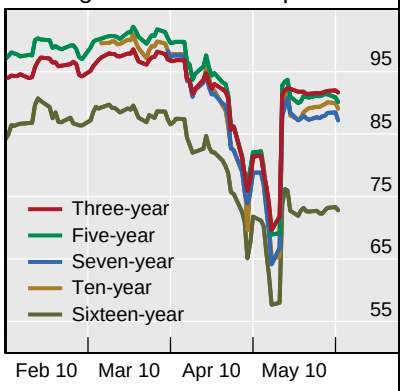
Bond spreads[1]



Credit spread curve[2]



Greek government bond prices



[1] Spread between five-year nominal yields and German five-year yields, in basis points. [2] Difference between 10-year and two-year CDS spreads, in basis points.

Sources: Bloomberg; Markit; BIS calculations. Graph 3

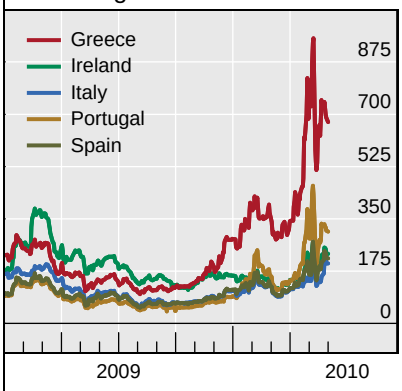
10-year CDS, consistent with the perception that the risk of a credit event was higher in the near term. At the same time, the inversion also reflected the view that, if Greece managed to meet its obligations during the next few quarters, the situation was likely to stabilise to some extent, hence resulting in lower average CDS spreads over the longer term. Consistent with this, as worries about the creditworthiness of Greece intensified in late April, the negative steepness of the Greek curve accelerated. In addition, the price of Greek government bonds fell sharply, leaving banks and other investors with large mark to market losses (Graph 3, right-hand panel).

… as Greece, Portugal and Spain are downgraded …

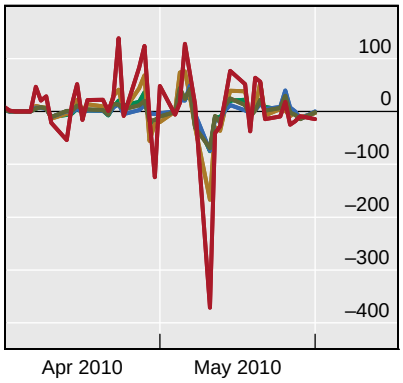
The catalyst for this sudden loss of market confidence was Standard & Poor's 27 April downgrade of Greek government debt to BB+ after Greece posted a worse than expected budget deficit. Portugal's simultaneous downgrade and Spain's subsequent one added to the negative sentiment. In the light of the Greek downgrade and escalating protests by the Greek public, the €45 billion EU-IMF support package announced on 11 April appeared

CDS market reaction to policy actions

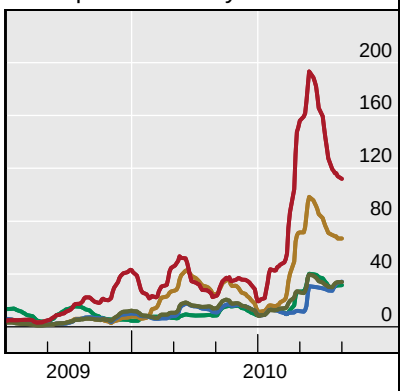
Sovereign CDS[1, 2]



Daily changes in CDS spreads[2]



CDS spread volatility[3]



[1] With old restructuring clause. [2] In basis points. [3] One-month rolling volatility, in per cent.

Sources: Bloomberg; Markit; BIS calculations. Graph 4

insufficient. Market participants questioned politicians' resolve and their ability to disburse the funds. An enlarged €110 billion package announced on 2 May also met with scepticism. Despite the ECB's decision to suspend its minimum credit rating thresholds for Greek government bonds, prices fell to distressed levels.

Euro area sovereign CDS spreads rose sharply following the 27 April downgrade. CDS spreads on five-year Greek debt rose to more than 900 basis points, similar to those of Argentina, Pakistan and Ukraine (Graph 4, left-hand panel). Portugal's sovereign CDS spreads also rose sharply, albeit to much lower levels, as investors expressed their concerns about its fiscal position. By contrast, the daily movements in sovereign CDS spreads for Ireland, Italy and Spain were more muted, consistent with differences in terms of fiscal challenges (Graph 4, centre panel). This decoupling of Greece and Portugal from Ireland, Italy and Spain was also evident in the one-month realised volatility of their CDS spreads (Graph 4, right-hand panel).

… and sovereign CDS spreads rise dramatically

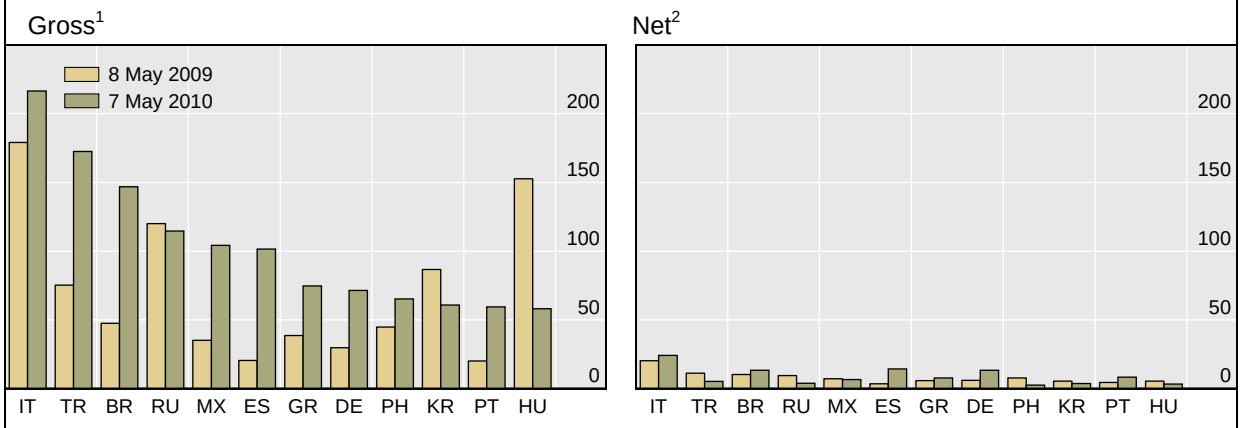
Despite the dramatic movement in euro sovereign CDS spreads, relatively little sovereign credit risk was actually reallocated via CDS markets. Even though outstanding gross volumes of sovereign CDS contracts are significant and have risen over the past year (Graph 5, left-hand panel), the net amount of CDS contracts is only about one tenth of the gross volumes (Graph 5, right-hand panel). The net amount takes into account that many CDS contracts offset one another and therefore do not result in actual transfer of credit risk.

Clear signs of contagion …

During the first week of May, the contagion from the Greek crisis quickly spread across Europe, inducing a widening of euro area sovereign CDS and bond yield spreads relative to German bunds. European equity markets fell, euro-dollar basis swaps widened, and the euro depreciated against major currencies. Market reports indicated that Portuguese, Spanish and Irish bond repo markets were becoming less liquid. With the rise of sovereign risk, market participants focused on the exposure of different banks to Greek, Portuguese

Top sovereign CDS volumes

Notional values, in billions of US dollars

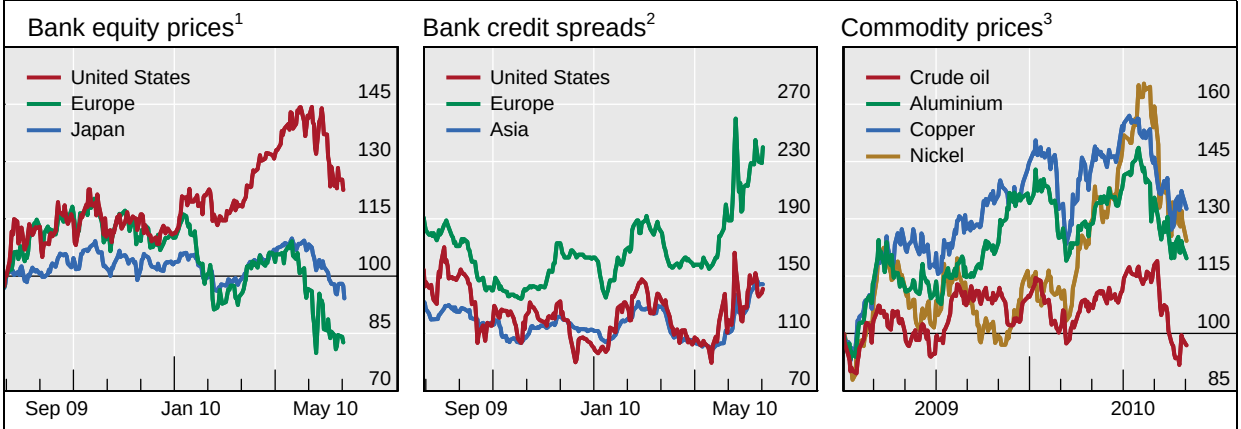


BR = Brazil; DE = Germany; ES = Spain; GR = Greece; HU = Hungary; IT = Italy; KR = Korea; MX = Mexico; PH = Philippines; PT = Portugal; RU = Russia; TR = Turkey.

[1] Sum of CDS contracts bought or sold for all warehouse contracts in aggregate. [2] Sum of net protection bought by net buyers.

Source: Depository Trust & Clearing Corporation. Graph 5

Sovereign risk goes global



[1] S&P 500, DJ EURO STOXX and TOPIX; in local currency; 31 July 2009 = 100. [2] Equally weighted average senior five-year CDS spreads for the banking sector. [3] 1 July 2009 = 100.

Sources: Bloomberg; Datastream; I/B/E/S; JPMorgan Chase; Markit. Graph 6

or Spanish sovereign debt (see pages 18–21 in this issue).

... from euro area to global markets

By the end of that week, the impact had spread beyond Europe, causing a sell-off in global equity and commodities markets. US stock markets fell 6.4% over a five-day period that included an intraday fall of 8.5%, possibly caused by a technical glitch in computer-driven trading. Equity markets in Europe and Asia dropped by similar amounts. Bank stock prices tumbled and CDS spreads widened sharply in the United States, Europe and Asia (Graph 6, left-hand and centre panels). The S&P GSCI Spot Index for commodities was down 8.5% on the week, led by falls in oil and copper (Graph 6, right-hand panel).

Continued policy tightening in China added to investor concerns about the downside risks to global growth. The Shanghai Composite Index slumped further in mid-April after the Chinese government announced new measures to cool the property market. Chinese equities dropped by almost 5% on 19 April, the first trading day after the announcement, while the property sub-index tumbled by almost 7%. On 2 May, the People's Bank of China increased its reserve requirement ratio by 50 basis points, the third such move this year. Such tightening steps, in combination with worries about developments in Europe, China's biggest export market, contributed to the 17% fall in the Shanghai Composite Index between mid-April and mid-May.

Investors cut risk exposures ...

In response to greater global uncertainty, investors cut risk exposures and moved into safe haven assets. Gold soared above $1,200 per ounce, while bond investors moved out of most euro sovereign bonds into the relative safety of German and US government bonds. Despite the uncertainty surrounding the UK election on 6 May, gilt yields were relatively stable. The Swiss franc rose sharply while the euro fell to an eight-year low against the yen and a four-year low against the US dollar.

... and stresses re-emerge in US dollar money markets

Contagion from euro area sovereign debt markets also spilled over into interbank money markets, reviving concerns about rising counterparty risk and US dollar funding shortages. Three-month Libor-OIS spreads in the United States and euro area rose sharply, with implied forward spreads forecasting

Box 1: Back to the future? Comparing recent events with the 2007–09 financial crisis

Jacob Gyntelberg and Michael R King

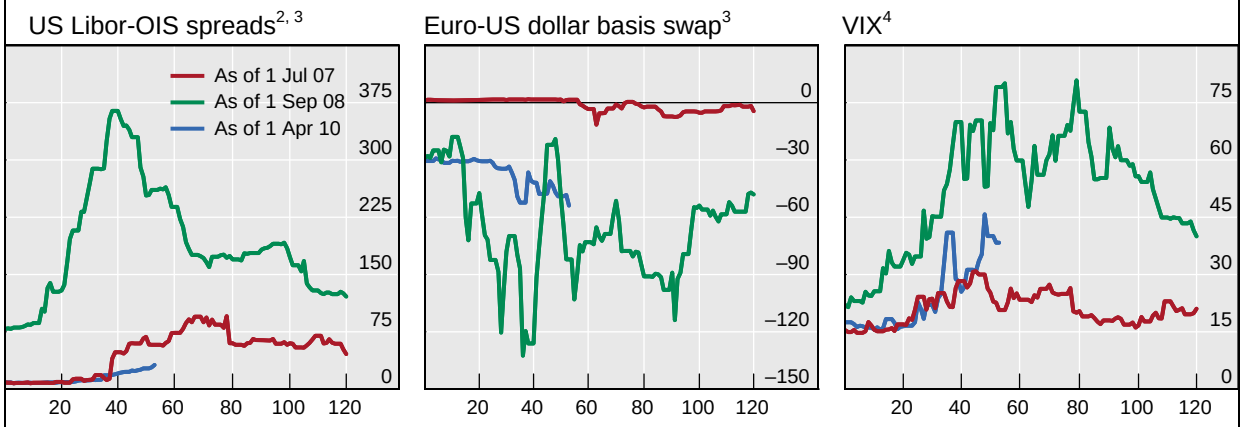
The swift reversal in market confidence evokes painful memories of autumn 2008, when the collapse of Lehman Brothers brought money and capital markets to a virtual standstill. In both cases market sentiment deteriorated rapidly around a trigger event, with problems in one region spreading globally through the network of interbank funding markets and counterparty credit exposures. Volatility jumped, and the prices of risky assets fell sharply as investors moved into perceived safe havens. In both episodes, central banks provided exceptional funding liquidity, and government rescue packages were subsequently announced with a view to restoring market confidence and stabilising the financial system.

While the broad outlines are similar, the Greek downgrade on 27 April and the subsequent market reaction may have more in common with the start of the subprime crisis in July 2007 than the collapse of Lehman Brothers in September 2008. That crisis began slowly with the disclosure of mounting losses on subprime mortgages and the downgrade by rating agencies of a large number of mortgage-backed CDOs. Similarly, emerging losses at several European banks were followed by a widening of Libor-OIS spreads (Graph A, left-hand panel). Over the next few months, European banks faced difficulties in funding their US dollar portfolios, as seen in the dislocation in cross-currency swap markets from September 2007 onwards (Graph A, centre panel). While equity prices continued to rise up to mid-October, implied equity market volatility increased from July onwards, as reflected in the upward trend of the VIX (Graph A, right-hand panel).

The current market stress has been associated with the same increase in equity volatility as in the second half of 2007, but Libor-OIS spreads have moved up more slowly. Despite the recent rise to around 30 basis points, three-month US dollar Libor-OIS spreads remain well below their levels from August 2007 onwards. The current rise in the VIX initially followed the July 2007 trajectory, but then jumped sharply, as it did in September 2008. While cross-currency basis swaps are signalling difficulties for banks seeking to raise US dollars, the limited participation at US dollar auctions held by the ECB, the Bank of England and the Swiss National Bank suggests that the problem is more about counterparty credit risk than access to foreign currency funding. In contrast to July 2007, the euro-US dollar basis swap began the recent period at a level suggesting that stress was already present in cross-currency funding markets. The current departure point was similar to that of early September 2008, but the spread has widened by much less this time in response to worsening market conditions.

Stress indicators across three episodes[1]

US Libor-OIS spreads[2, 3] | Euro-US dollar basis swap[3] | VIX[4]



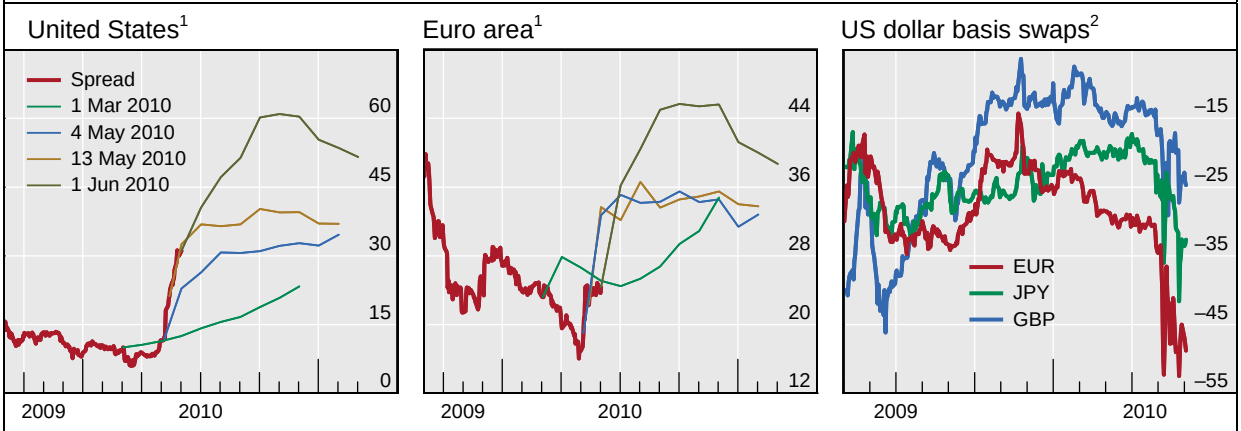
[1] The horizontal axis denotes number of calendar days. [2] Three-month Libor rate minus corresponding overnight index swap (OIS) rate. [3] In basis points. [4] VIX (S&P 500); volatility implied by the price of at-the-money call option contracts on stock market indices, in per cent.

Sources: Bloomberg; BIS calculations. Graph A

even greater increases (Graph 7, left-hand and centre panels). Spreads on USD basis swaps widened in the yen and the sterling markets, but much less

Three-month Libor-OIS spreads, implied forward spreads and basis swaps

In basis points



[1] Three-month Libor rates minus corresponding overnight index swap (OIS) rates (for the euro area, EONIA swap). Thin lines show forward spreads, calculated as the difference between three-month forward rate agreement (FRA) rates and corresponding implied OIS rates, as at the dates indicated. [2] One-year basis swap against Libor.

Sources: Bloomberg; BIS calculations. Graph 7

than against the euro (Graph 7, right-hand panel). These price movements suggested that banks were facing difficulties in raising US dollar funding.

Anecdotal reports suggested that US money market funds were reluctant to lend to European banks. Rising Libor-OIS spreads and the dislocations in US dollar funding markets recalled events in July–August 2007, when global interbank and money markets began showing clear signs of stress (see Box 1).

Contagion temporarily halted by policy actions

EU-IMF rescue package …

Having lived through the turmoil of 2008, policymakers anticipated the end-game and took action to prevent a global confidence crisis. Their response took the form of a €750 billion rescue package announced in the early hours of Monday 10 May (see Box 2). The ECB supported this move by taking the decision to purchase euro area public and private debt securities in the secondary markets to help restore market liquidity. By early June, the ECB had reportedly purchased €40 billion of euro area government bonds, sterilised through the auction of one-week fixed-term deposits. Moreover, the ECB expanded its longer-term refinancing operations.

The Federal Reserve also took steps to relieve some of the US dollar interbank funding pressures by agreeing to reintroduce US dollar swap lines with key central banks. The US dollar swap lines were identical in size to those announced previously – $30 billion for the Bank of Canada and unlimited for the other four central banks involved – and were authorised up to the end of January 2011.

… halts contagion in the euro area …

Asset price movements immediately following these announcements initially suggested that the contagion from the Greek crisis had been halted. Euro sovereign credit spreads narrowed sharply, the euro appreciated, and global equity markets rose. Conditions in European money markets improved

Box 2: Policy actions to avoid a global confidence crisis

Michael Davies and Jacob Gyntelberg

During the past few months, there have been growing concerns about the sustainability of the fiscal positions of several euro area governments. In April, the Greek government found it increasingly difficult and costly to issue debt. The European Union and IMF announced a joint €110 billion support package for Greece on 2 May. However, during early May, market concerns about Greece and several other euro area countries intensified. This led to a sharp deterioration in financial market conditions in Europe and visible spillover to global financial markets. On 9–10 May, the European Union, IMF, ECB and other major central banks announced a series of policy actions to help restore financial market confidence.

European Union

The European Stabilisation Mechanism announced by the EU has two components. One is an additional facility which supplements the existing €50 billion EU Balance-of-Payments Facility for non-euro area members; the other is the creation of a new European Financial Stabilisation Facility (EFSF) structured as a limited liability company. Both facilities will provide funding to eligible countries that are facing external financing difficulties, usually in conjunction with international organisations such as the IMF and accompanied by economic and fiscal adjustment programmes. The €60 billion European Stabilisation Mechanism facility is available to all 27 EU member states. It will be financed by the issuance of European Commission debt, which is implicitly guaranteed by the EU budget. The expansion of this facility does not require approval by national parliaments. The €440 billion EFSF can provide loans to any of the 16 euro area countries. Indications suggest that the funding for the EFSF will be guaranteed by euro area countries on a pro rata basis, in line with their share of paid-up capital in the ECB. The guarantees must be approved by national parliaments, and will come into force when they have been approved by countries representing at least 90% of shares in the EFSF. The EFSF debt is expected to receive a AAA rating.

International Monetary Fund

The IMF has stated that it is ready to cooperate with the European Union to support the affected European countries. If requested by individual countries, the IMF will provide financial assistance on a case by case basis and in accordance with its established lending procedures, in conjunction with the new European Stabilisation Mechanism. The IMF has indicated that its financial contribution will be broadly in proportion to its recent European arrangements (about one third of total funding) and will be accompanied by economic and fiscal adjustment programmes.

Main features of the European stabilisation mechanism

	European Stabilisation Mechanism	European Financial Stabilisation Facility
Facility characteristics		
Size	€60 billion	€440 billion
Guarantee structure for debt	EU budget	Cash buffer plus 120% guarantee of each euro area countries' pro rata share of issued bonds
Approval required from national parliaments	No	Yes
Loan characteristics		
Eligibility for loans	EU countries	Euro area countries
Conditionality for borrower	Economic and fiscal adjustment programme required	Economic and fiscal adjustment programme required
Loans provided jointly with international agencies	Yes	Yes

Sources: European Commission; Council of the European Union; press reports; BIS. Table A

European Central Bank

The ECB has announced that it will purchase euro area public and private debt securities in the secondary markets to restore depth and liquidity in those markets. These purchases will be sterilised, to prevent an increase in bank reserves. As at 4 June 2010, the ECB had bought euro area government bonds worth €40 billion.

The ECB has also expanded its longer-term refinancing operations to give banks better access to longer-term funding. The regular three-month tenders (26 May and 30 June) will re-adopt the fixed rate procedure with full allotment. This means that, in each tender, the ECB will provide financial institutions with unlimited liquidity at a fixed interest rate. A six-month tender was also announced for 12 May, again at a fixed rate with full allotment.

Central bank swap lines

The Federal Reserve has reinstated temporary US dollar swap lines with the ECB, the Bank of England, the Bank of Canada, the Swiss National Bank and the Bank of Japan to help counter tightening liquidity conditions in US dollar funding markets and to prevent the spread of funding strains to other markets and financial centres. Central bank swap lines substantially lessened dislocations in cross-border funding markets in late 2008 and early 2009. The swap lines are of the same size as those announced previously – $30 billion for the Bank of Canada and unlimited for the other four central banks – and have been authorised up to January 2011. As of 2 June 2010, the ECB and the Bank of Japan had $6.4 billion (down from a high of $9 billion) and $0.2 billion of funds outstanding respectively. The Swiss National Bank and the Bank of England have held US dollar auctions but have not disbursed any funds, and the Bank of Canada has not yet held any auctions.

with the spread between EONIA and Eurepo rates narrowing, particularly for Italian government bonds. US dollar liquidity conditions eased, the euro-dollar basis swap spread narrowing by 10 basis points. Broader credit spreads also improved, with a sharp fall in European corporate CDS indices. The safe haven flows of the previous week reversed, lifting German bund and US Treasury bond yields while weakening gold and the Swiss franc.

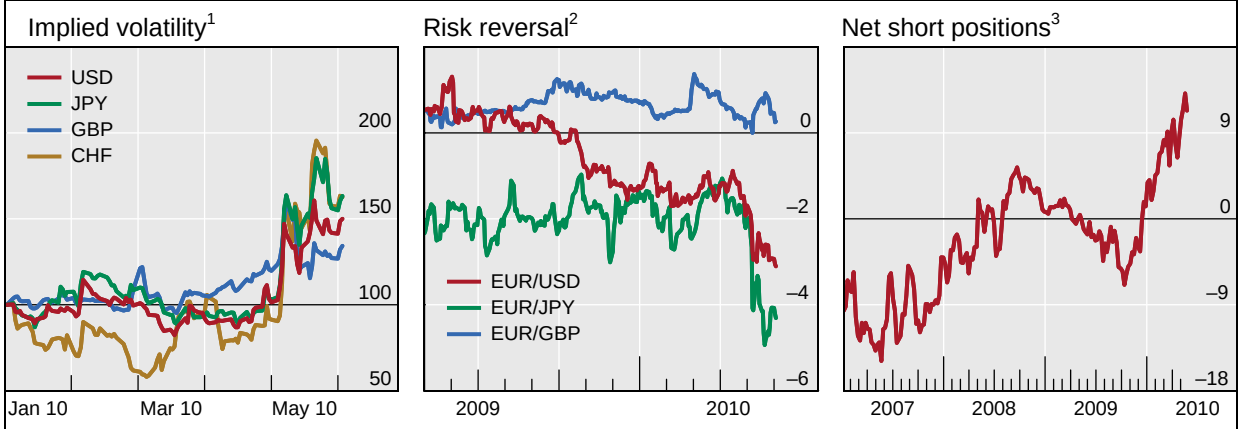
… but relief is temporary

The relief in markets turned out to be temporary, however, as investor confidence soon deteriorated on worries about the possible interactions between public debt and growth. Peripheral euro area sovereign bond spreads widened, despite bond purchases by national central banks. The euro also weakened, with volatility jumping sharply against other major currencies (Graph 8, left-hand panel). Investor concerns about a continued depreciation of the euro were reflected in the increased cost of hedging against a decline (Graph 8, centre panel) and the rapid rise in net short positions of non-commercial contracts on the euro (Graph 8, right-hand panel).

As confidence dropped, investors also scaled back their appetite for risky assets, including carry trade positions targeting currencies of commodity-exporting economies, such as the Australian dollar, the Norwegian krone and the Brazilian real. These had appreciated over the previous months on expectations that their economies would particularly benefit from a global economic recovery. In addition, these countries had begun to raise policy rates. This had led to widening interest rate differentials relative to the US dollar, the Japanese yen and the Swiss franc among others.

Despite the overall negative tone, government bond auctions by Italy, Portugal, Ireland and Spain met with strong demand in the second half of May. Also, notwithstanding apparent strains in US dollar funding markets, participation at European central bank auctions of US dollars was limited with the ECB auctioning only €1 billion in 84-day dollar loans to six counterparties.

Euro doubts escalate



[1] 1 January 2010 = 100; one-month option-implied volatility. [2] One-month, 25 delta risk reversal. [3] Difference between short and long positions, in billions of US dollars. Non-commercial contracts on the euro-dollar futures.

Source: Bloomberg. Graph 8

Seven-day auctions by the Bank of England and the Swiss National Bank received no bids, and there was little interest in longer-term US dollar auctions held by the Swiss National Bank and the Bank of Japan. The modest participation suggests that banks were more concerned about counterparty credit risk than access to US dollar funding.

Regulatory announcements add to complexity

While investors sought to understand the rapidly changing situation in the euro area, a number of financial regulatory initiatives added to an already complex situation. On 18 May EU finance ministers agreed to impose tighter restrictions on hedge funds and private equity firms operating in Europe. Later the same day, the German financial regulator BaFin surprised markets by unilaterally announcing immediate restrictions in Germany on "naked" short selling by non-market-makers, ie short selling without holding the security.[2] The motivation for this measure was the "extraordinary volatility of debt securities of countries from the euro zone" and the significant widening of euro sovereign CDS spreads. Despite its limited reach, the ban briefly increased short selling pressure in other markets, with French, Spanish and German banks' shares falling. Then, on 20 May, the US Senate passed its financial reform bill, containing a number of measures designed to limit risk-taking by large banks.

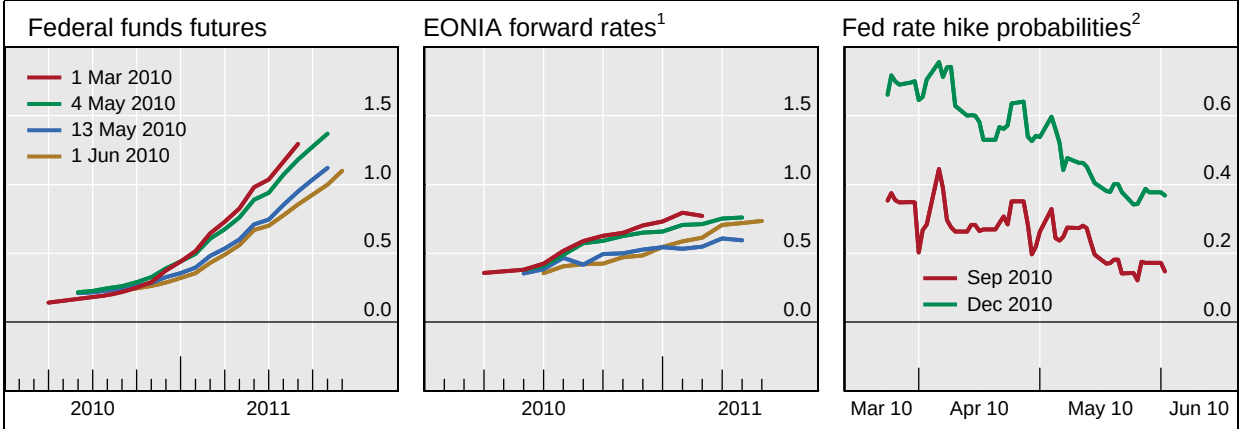
US and euro area monetary tightening expected to be postponed

Expected time of policy tightening postponed again …

As doubts mounted about the prospects for global economic growth, market participants pushed out the expected timing of monetary tightening in the major advanced economies. In the United States, federal funds futures and options suggested that the first rate hike was not expected to occur until late in the first quarter of 2011 (Graph 9, left-hand panel), with the probability of a hike in September and December 2010 declining (Graph 9, right-hand panel). Forward

[2] The ban covered euro area government bonds, CDS and the shares of several German financial companies.

Monetary policy expectations



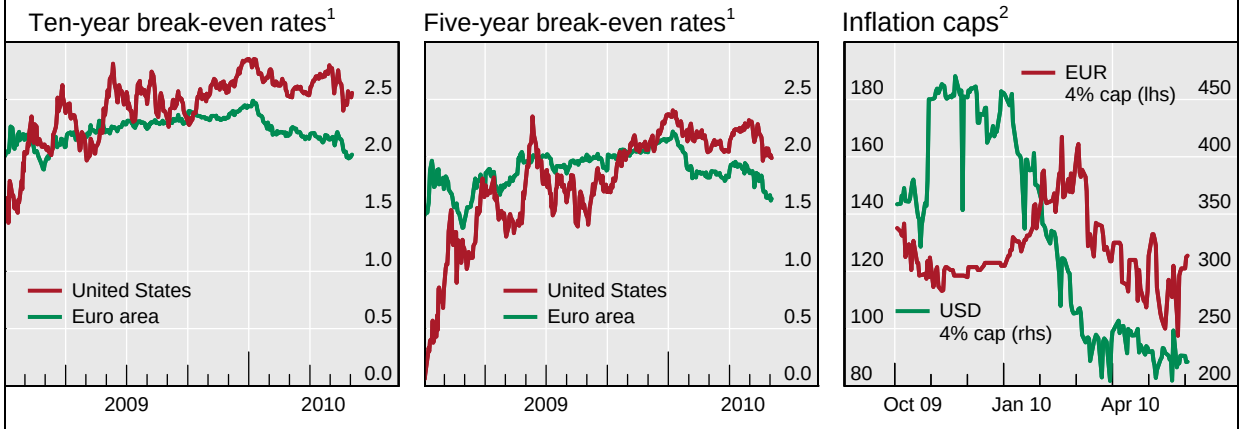
[1] One-month rates implied by overnight index swaps. [2] Option-implied probabilities that the Federal Reserve will raise the federal funds target above the 0–0.25% range following the FOMC meeting in the indicated month.

Sources: Bloomberg; BIS calculations. Graph 9

rates in Europe signalled a similar postponing of the expected first rate hike by the ECB beyond 2011 (Graph 9, centre panel). Such revisions in policy expectations in part reflected communication by these central banks that rate hikes were not anticipated in the near term, as well as investors' concerns that volatile market conditions could derail the nascent economic recovery. A further reason for the change in market expectations about monetary policy was expected fiscal consolidation in a number of countries and its possible contractionary effects.

Against this background of heightened uncertainty, market participants focused on the deteriorating financial market conditions while often ignoring positive macroeconomic news. The United States, in particular, saw upbeat news related to the employment outlook and consumer spending. The April jobs report, for example, saw US non-farm payrolls increase by 100,000 more jobs than expected to 290,000, but the S&P500 Index fell by 1.5% on the day. Similar positive news in the United States and elsewhere was often discounted or ignored by markets.

The inflation outlook



[1] From inflation swaps, in per cent. [2] Five-year caps with inflation strike level 4%, in basis points.

Sources: ECB; Federal Reserve Bank of Philadelphia; Bloomberg; BIS calculations. Graph 10

Box 3: Higher public sector holdings of US public debt

Robert N McCauley

The Federal Reserve smoothly ended its huge programme of bond purchases when it bought its last agency mortgage-backed bonds at the end of March 2010. Ending purchases does not imply, though, that holdings no longer help keep bond yields low. Gagnon et al (2010)[Ⓓ] argue that the impact depends on the stock of Federal Reserve holdings of US Treasury and agency ("public") debt, rather than on the flow of purchases. In that spirit, public debt holdings by sovereign asset managers outside the United States could have a similar impact on yields. Taken together, US government bodies and foreign official portfolios hold more than 40% of Treasury and agency securities, and they have probably absorbed over half of the net supply since mid-2008. On a duration-weighted basis, the increase has been even larger, which would amplify any impact on long-term yields.

To be sure, the motivations for the stepped-up official holdings have differed. For its part, the Federal Reserve, in conjunction with the US Treasury, has bought bonds in order to lower mortgage and other long-term yields to private borrowers. This policy interest is expected in time to abate and to reverse. Indeed, the minutes of the 27–28 April 2010 Federal Open Market Committee meeting reported majorities for a five-year bond sale programme and for timing sales after an eventual hike in the short-term policy rate. Foreign official holders have different motivations in holding US public debt and tend to behave differently over the interest rate cycle. They build up and run down their holdings of US public debt for a variety of reasons, including as a by-product of resisting currency appreciation and depreciation and as insurance against sudden calls for foreign exchange. While many central banks used their foreign exchange reserves during the crisis to support their currencies and to provide dollar liquidity to the private sector, foreign official holdings of US public debt securities reportedly rose in the years covered by the surveys of June 2008 and June 2009.

Public holdings of US public bonds

In billions of US dollars and per cent

	June 2007	June 2008	June 2009	Dec 2009	March 2010
Treasuries, outstanding	4,705	5,056	6,950	7,591	8,000
Foreign official holdings	1,611	1,910	2,624	2,705	2,707
Fed holdings	791	479	657	777	777
Agencies, outstanding	7,102	7,885	8,144	8,113	8,113
Foreign official holdings	830	1,097	829	746	719
Fed holdings	0	0	559	1,068	1,238
Agency holdings	688	854	949	925	925
Treasury holdings[1]	0	0	165	226	226
Total public debt	11,807	11,506	15,093	15,703	16,113
Foreign official holdings	2,441	3,007	3,453	3,450	3,426
Fed, agency, Treasury holdings	1,479	1,333	2,329	2,995	3,165
Total public holdings	3,920	4,340	5,782	6,446	6,592
Memo: Bank reserves at Fed	*17*	*34*	*661*	*977*	*1,051*
Memo:					
Foreign official holdings	*20.7%*	*26.1%*	*22.9%*	*22.0%*	*21.3%*
Fed, agency, Treasury	*12.5%*	*11.6%*	*15.4%*	*19.1%*	*19.6%*
Total public holdings	*33.2%*	*37.7%*	*38.3%*	*41.0%*	*40.9%*

[1] Does not include $126 billion of Treasury holdings of senior preferred stock of Fannie Mae and Freddie Mac as of end-March 2010.

Sources: Federal Reserve Flow of Funds and Department of Treasury, Federal Reserve Bank of New York, Board of Governors of the Federal Reserve System, *Surveys of foreign portfolio holdings as of June 30, 2007, 2008* and *2009* (April 2008, 2009, 2010) updated with Federal Reserve H4.1 release, monthly Treasury International Capital data and Federal Housing Finance Agency data on Treasury holdings of agency MBS. Table A

Overall, the share of US public debt held by officials has risen. Before the onset of the crisis, foreign officials and the Federal Reserve held between them about one third of US public debt securities, mostly Treasury securities. Since then, such public holdings have increased to more than 40%. The most striking development has been the increase in the share of US public debt held by the US public sector, which went up by 7 percentage points, to roughly 20%. The Federal Reserve's purchase of over $1.4 trillion in agency debt – mostly mortgage-backed securities – accounted for the bulk of this increase. By contrast, Federal Reserve holdings of Treasuries contributed little on balance over this period. The percentage share of foreign official institutions was roughly stable in the low 20% range, as a decline in holdings of agency securities appears to have been more than offset by larger holdings of US Treasury securities.[②]

The rise in the share of publicly owned US public debt understates the shift in terms of duration. The most recent survey of foreign official holdings of Treasuries shows that half mature in three years or less, with an average maturity of 48 months, slightly less than that of Treasury securities overall. Whereas traditionally the Federal Reserve had aimed for market neutrality in its Treasury holdings, in the recent bond buying, "the composition of purchases was tilted towards longer-maturity or longer-duration securities in order to enhance the portfolio balance effect and reduce longer-term interest rates" (Gagnon et al (2010, p 10)). In particular, Federal Reserve purchases of mortgage-backed securities focused on recent 4% and 4.5% paper of particularly long duration.

In sum, on the available evidence, large-scale US official purchases of agencies have raised the share of the rapidly growing US public debt in relatively concentrated public hands to more than two fifths.[③] Much of the large increase in US public debt since 2008 has found its way into official hands.

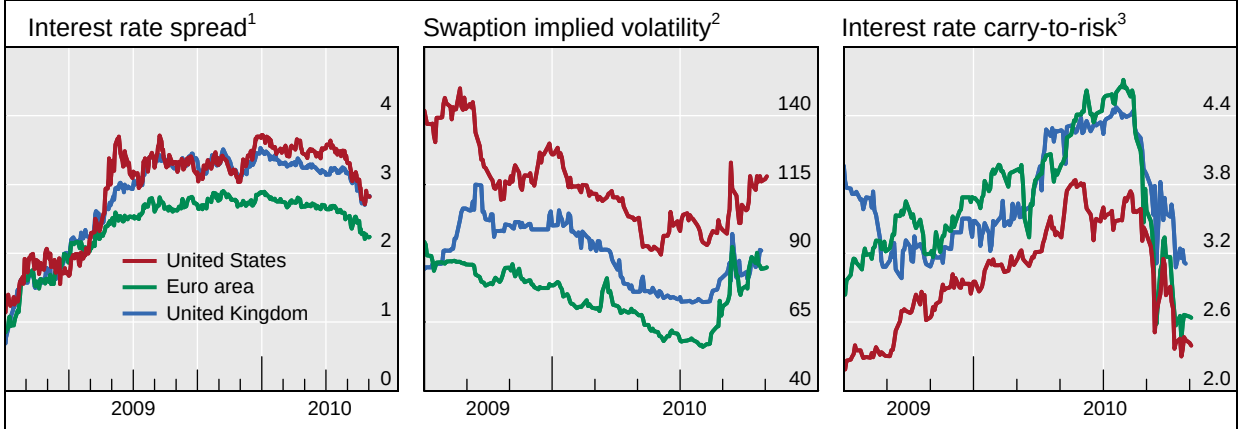
[①] J Gagnon, M Raskin, J Remaché and B Sack, "Large-scale asset purchases by the Federal Reserve: did they work?", Federal Reserve Bank of New York, *Staff Reports* 441, March 2010. [②] The table mostly relies on annual surveys of stocks, which drill down with custodians to identify foreign official holdings that monthly transactions data miss. In particular, the last surveys of June 2007, 2008 and 2009 raised the estimate of foreign official holdings by 13%, 5% and 17%, respectively. Thus the December 2009 and March 2010 estimates are likely to be understated. [③] One could view the US official purchases as entirely asset swaps, as were the Treasury purchases of agencies with the proceeds of sales of Treasury securities. Accordingly, one could include Federal Reserve liabilities to banks in the public debt (treating banks' claims on the Federal Reserve as close substitutes for their holdings of Treasury bills). In terms of the table, this would mean adding the memo item "Bank reserves at Fed" to the public debt. On this view, the increase in the US public debt would be larger since mid-2008 and the rise in the share in public hands somewhat smaller. Still, much of the large increase in US public debt would have found its way into official hands.

… as doubts about global recovery increase

Inflation expectations over this period remained well anchored in major advanced economies. In many cases, realised inflation data surprised on the downside – the United Kingdom being an exception – with US consumer prices dropping unexpectedly in April. Break-even inflation rates were broadly stable in the United States and the euro area, as indicated by the pricing of inflation swaps (Graph 10, left and centre panels). Moreover, inflation derivatives prices showed no sign of increased concern about high inflation outcomes; prices of euro area and US five-year out-of-the-money inflation caps have been stable or declining since the start of the year (Graph 10, right-hand panel). These indicators contrasted with market commentary that the ECB's decision to purchase euro area sovereign bonds might damage its inflation-fighting credibility.

With the expected timing of policy rate increases pushed further out in major developed economies, yield curves remained extraordinarily steep even as long-term benchmark yields declined on flight to safety trades (Graph 11, left-hand panel). The recent turbulence in financial markets did, however, result in greater uncertainty about future interest rates, as indicated by higher implied

Yield curve carry trade attractiveness dwindles



[1] Ten-year swap rates minus three-month money market rates, in per cent. [2] Volatility implied by three-month swaptions on 10-year swap contracts, in basis points. [3] Defined as the differential between 10-year swap rates and three-month money market rates divided by the three-month/10-year swaption implied volatility.

Sources: Bloomberg; BIS calculations. Graph 11

swaption volatilities (Graph 11, centre panel). Yield curve carry trades therefore became much less attractive from a risk-return perspective (Graph 11, right-hand panel).

US phases out exceptional policy measures

While European policymakers introduced new support initiatives, a number of other monetary authorities continued to withdraw exceptional support measures. As planned, the US Federal Reserve completed its purchases of agency mortgage-backed bonds at the end of March. Although the Fed is no longer buying bonds, there are signs that its significant holdings of public sector bonds continue to help keep bond yields low (see Box 3). With uncertainty remaining about the strength of the economic recovery, market participants were anxious about the timing and speed of possible Federal Reserve asset sales. But minutes from the April FOMC meeting indicated that asset sales would probably be gradual, starting only after the first policy rate increase.

EMEs continue tightening

While the decline in confidence further postponed the normalisation of monetary policies in most advanced economies, other countries took steps to tighten policy from April onwards. The Bank of Canada raised interest rates by 25 basis points on 1 June. Moreover, as discussed above, China raised its bank reserve requirements and took steps to cool its housing markets. The Central Bank of Brazil raised its target short-term interest rate by 75 basis points to 9.50% towards the end of April, citing upside risks to inflation. The Reserve Bank of India increased both its cash reserve ratio and its repo rate by a further 25 basis points on 20 April. Market participants expected more policy tightening across a range of emerging market economies, although uncertainty about the pace of tightening increased. On the one hand, many of these economies are facing rapid economic growth, currency appreciation and the risk of overheating in asset and property markets. On the other hand, the growth and inflation outlook has been complicated by the high volatility in commodity prices and the unpredictable effects on economic activity of the euro sovereign debt crisis.

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Highlights of international banking and financial market activity

The BIS, in cooperation with central banks and monetary authorities worldwide, compiles and disseminates several datasets on activity in international banking and financial markets. The latest available data on the international banking market refer to the fourth quarter of 2009. The discussion on international debt securities and exchange-traded derivatives draws on data for the first quarter of 2010. Data on the over-the-counter (OTC) derivatives market are available up to the end of 2009. This chapter contains two boxes. The first, on page 20, discusses how BIS banking statistics shed light on the exposures of reporting banking systems to particular countries. The second, on page 26, compares the BIS data on OTC derivatives with the Interest Rate Trade Reporting Repository reports published by TriOptima.

The international banking market[1]

BIS reporting banks' international balance sheets contracted for the fifth consecutive quarter in the last three months of 2009.[2] The $337 billion reduction in international claims was smaller than any of the previous four. Nevertheless, it brought the net cumulative decline for the past seven quarters to $5,024 billion, a fall of 12% from the record level ($40,393 billion) reached at the end of March 2008. Most of the crisis-related contraction had reflected a decline in interbank claims rather than in claims on non-banks. This pattern reversed in the final quarter of 2009, when exposures to non-banks dropped more (–$219 billion) than interbank claims (–$118 billion) for the first time since the fourth quarter of 2008 (Graph 1, left-hand panel).

Euro-denominated claims contract

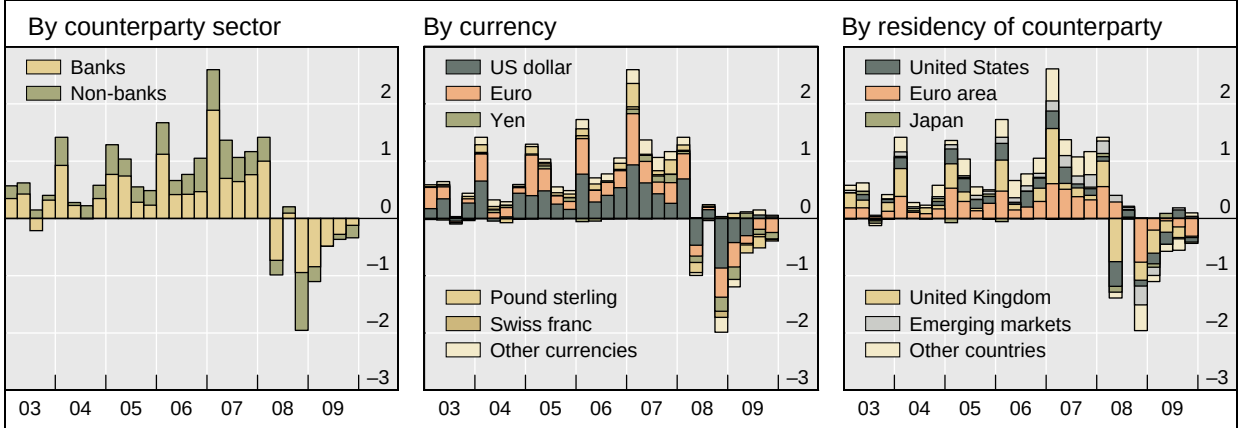
Claims denominated in euros fell for the fifth consecutive quarter. The $245 billion drop was the largest since the first quarter of 2009 (Graph 1, centre panel). A sizeable portion of the decline was due to a $51 billion fall in euro-denominated cross-border interbank claims within the euro area. This

[1] All queries concerning the international banking statistics should be directed to Stefan Avdjiev.

[2] BIS locational banking statistics by residence. Note that international claims contain inter-office claims.

Changes in gross international claims[1]

In trillions of US dollars



[1] BIS reporting banks' cross-border claims (including inter-office claims) in all currencies plus locally booked foreign currency claims on residents of BIS reporting countries.

Source: BIS locational banking statistics by residence. Graph 1

drop, the fourth in the last five quarters, brought the overall exchange rate adjusted shrinkage in that category since the third quarter of 2008 to $461 billion. These observations are in line with the evidence presented recently by a group of ECB economists, who show that the share of cross-border transactions in euro area money markets has declined substantially since the start of the financial crisis.[3]

Growth in claims mirrors economic growth across regions

Banks steered funds towards the faster-growing regions of the world, and away from those where the pace of economic recovery was sluggish. International claims on residents of emerging markets grew by $37 billion during the last quarter of 2009 (Graph 1, right-hand panel). Once again, the increase was mainly driven by a rise in claims on borrowers in the Asia-Pacific region, while claims on emerging Europe continued to decline. At the same time, reporting banks reduced their exposures to residents of all developed regions, with claims on euro area residents contracting the most (–$311 billion).

Cross-border claims on emerging markets continue to expand

Claims on emerging market economies expand …

Cross-border claims on borrowers in emerging market economies registered their largest advance ($70 billion) in six quarters. Despite that increase, however, their aggregate stock was still 12% below the peak ($2,834 billion) attained at the end of the second quarter of 2008. By contrast, local claims in local currencies on residents of emerging market economies reached a new

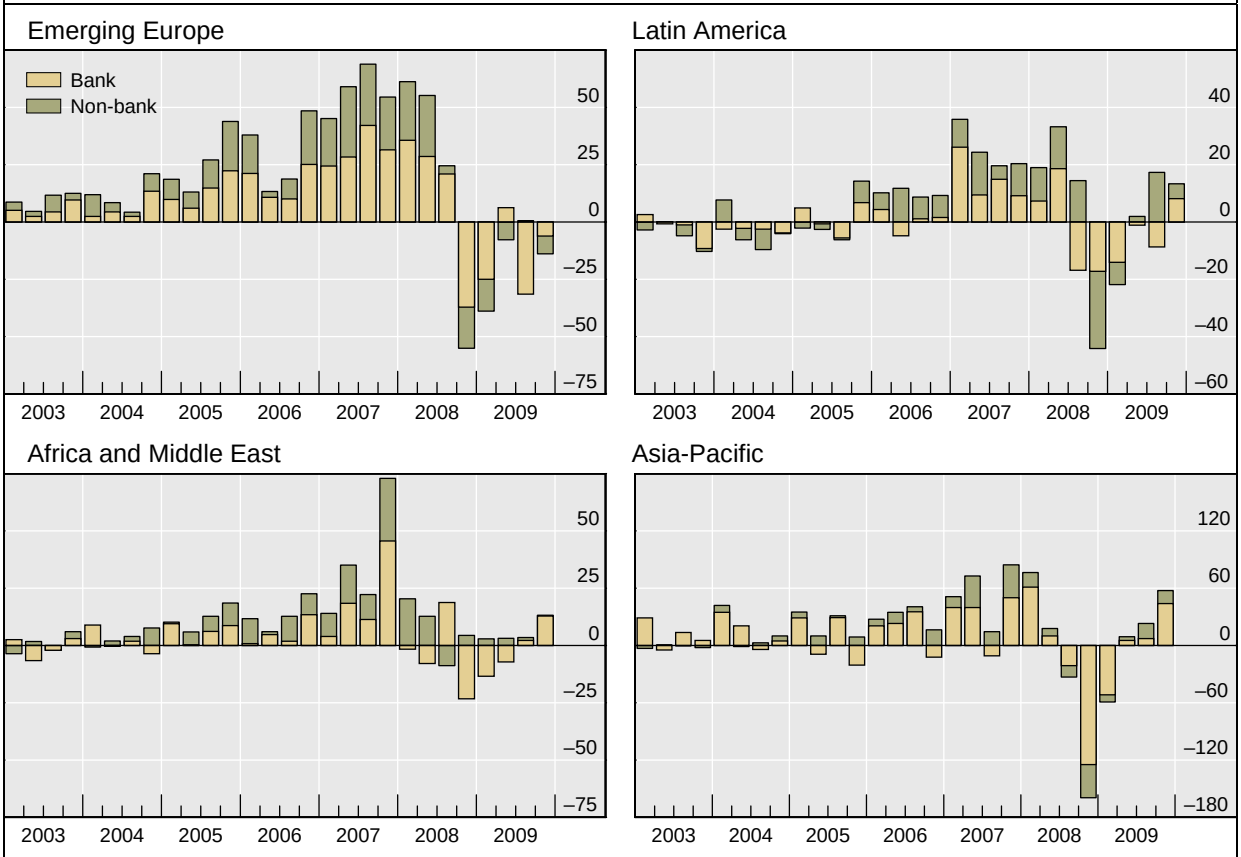
[3] N Cassola, C Holthausen and M Lo Duca, "The 2007/2009 turmoil: a challenge for the integration of the euro area money market?", paper presented at the ECB-European Commission conference on *Financial integration and stability: the legacy of the crisis*, Frankfurt, 12 April 2010.

high at the end of 2009, boosted by a $31 billion increase in the last quarter of the year.[4]

Just as in the previous three months, there was significant variation across regions (Graph 2). Once again, the main driver of the overall expansion in cross-border claims on emerging markets was a rise in claims on residents of Asia-Pacific ($57 billion or 8%). Furthermore, local claims in local currencies in the area registered the largest increase of all emerging market regions for the quarter in both absolute ($13 billion) and relative (3%) terms. BIS reporting banks also increased their cross-border claims and local claims in local currencies on residents of Latin America and the Caribbean (by $13 billion and $10 billion, respectively) and of Africa and the Middle East (by $13 billion and $3 billion, respectively). By contrast, they reduced their cross-border claims on residents of emerging Europe (by $14 billion or 2%) for the fifth quarter in a row. Nevertheless, local claims in local currencies on residents of this region increased slightly (by $4 billion or 1%).

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

By counterparty sector, in billions of US dollars



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

Source: BIS locational banking statistics by residence. Graph 2

[4] Cross-border claims are obtained from the BIS *locational* international banking statistics by residence. Local claims in local currencies are obtained from the BIS *consolidated* international banking statistics on an immediate borrower basis.

Not surprisingly, the countries that saw the largest increases in cross-border claims on their residents were in the Asia-Pacific region. Strong economic growth in this area led to significant expansions in claims on borrowers in China ($20 billion or 13%), Korea ($14 billion or 7%), Chinese Taipei ($8 billion or 18%) and India ($8 billion or 6%). Local claims in local currencies also increased considerably in China (by $7 billion or 9%), Thailand (by $3 billion or 7%) and Malaysia (by $1 billion or 2%).

… particularly in Asia-Pacific …

BIS reporting banks significantly expanded their cross-border claims on several emerging market economies in Latin America. Boosted by rising commodity prices and steadily falling unemployment, Chile experienced a larger increase in cross-border claims ($6.3 billion or 16%) than any other emerging market economy outside the Asia-Pacific region.[5] Cross-border claims on Brazil continued to rise during the fourth quarter of 2009, despite the October 2009 imposition of a 2% financial transactions tax on foreign investments in Brazilian stocks and fixed income securities. While the growth rate of BIS reporting banks' holdings of Brazilian debt securities fell from 21% in the third quarter of 2009 to 12% in the fourth quarter, the $6.5 billion surge in that category was still the second largest on record. Meanwhile, claims on residents of Mexico increased (by $3.1 billion or 3%) for the first time in five quarters, mainly due to the better outlook for the country's export sector.

… and Latin America

The overall shrinkage in cross-border claims on emerging Europe was led by considerable declines in claims on residents of Russia (–$8.5 billion or 6%) and Ukraine (–$2.3 billion or 8%). Weak domestic demand was probably the main reason for these sharp contractions. In Ukraine, this factor was coupled with uncertainty surrounding the outcome of the upcoming presidential election. Reporting banks continued to cut their exposures to residents of the Baltic countries. Cross-border claims on banks located in Lithuania shrank by no less than 10% ($1.5 billion), and those on banks in Latvia contracted by 6% ($0.9 billion). A slight increase in claims (1%) on banks in Estonia was more than offset by a 7% decline in claims on non-banks.

Cross-border claims on emerging Europe continue to decline

BIS reporting banks' exposures to the euro area countries facing market pressures

The integration of European bond markets after the advent of the euro has resulted in a much greater diversification of risk in the euro area. As of 31 December 2009, banks headquartered in the euro zone accounted for almost two thirds (62%) of all internationally active banks' exposures to the residents of the euro area countries facing market pressures (Greece, Ireland, Portugal and Spain).[6] Together, they had $727 billion of exposures to Spain,

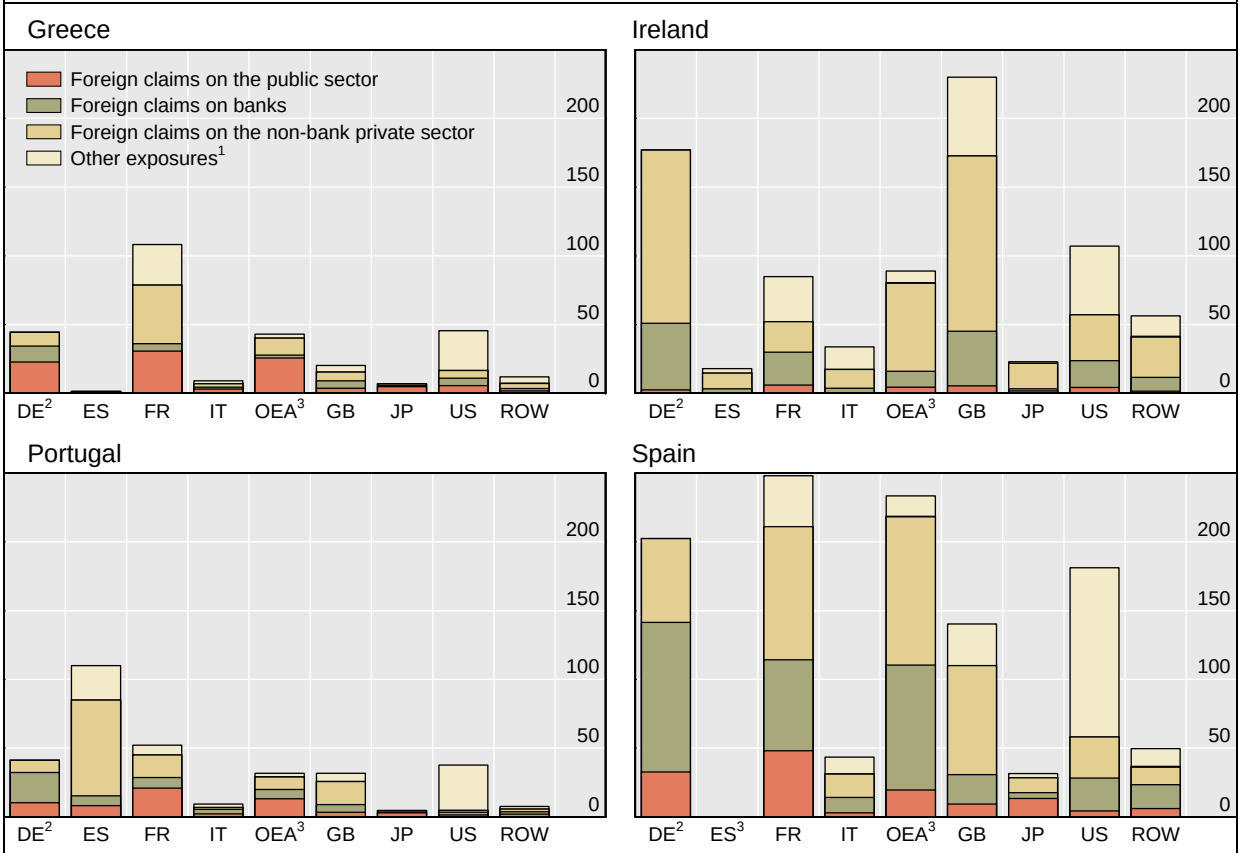
Euro area banks are most exposed to Greece, Ireland, Portugal and Spain …

[5] These developments occurred in the fourth quarter of 2009, before an earthquake struck Chile in February 2010.

[6] The discussion in this subsection is based on figures for international claims from the BIS consolidated banking statistics on an *immediate borrower* basis for German banks and on figures for foreign claims and other exposures from the BIS consolidated banking statistics on an *ultimate risk* basis for all other banks. Note that these figures do not include the exposures of banks on the residents of the country they are headquartered in. For example, the

Exposures to Greece, Ireland, Portugal and Spain, by nationality of banks

End-Q4 2009; in billions of US dollars



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

[1] Derivative contracts, guarantees and credit commitments. [2] International claims obtained from the BIS consolidated banking statistics (immediate borrower basis). Other exposures are not available for banks headquartered in Germany. [3] Claims of other euro area banks on the residents of each vis-à-vis country do not include the claims of banks headquartered in the respective country, as these are not foreign claims. Similarly, the claims of Spanish banks on residents of Spain are not reported, since they are not foreign claims.

Source: BIS consolidated banking statistics (ultimate risk basis). Graph 3

$402 billion to Ireland, $244 billion to Portugal and $206 billion to Greece (Graph 3).[7]

French and German banks were particularly exposed to the residents of Greece, Ireland, Portugal and Spain. At the end of 2009, they had $958 billion of combined exposures ($493 billion and $465 billion, respectively) to the residents of these countries. This amounted to 61% of all reported euro area banks' exposures to those economies. French and German banks were most exposed to residents of Spain ($248 billion and $202 billion, respectively), although the sectoral compositions of their claims differed substantially. French banks were particularly exposed to the Spanish non-bank private sector

exposures of Greek banks on residents of Greece are not included, as they are not considered *foreign* exposures.

[7] See Box 1 for a description of how the BIS banking statistics may be used to measure banking systems' exposures to particular countries.

Box 1: Measuring banking systems' exposures to particular countries

Stefan Avdjiev

The BIS consolidated international banking statistics provide a unique perspective on the exposures of national banking systems to residents of a given country. The statistics provide information on the aggregate foreign claims[①] of banks headquartered in a particular location on a worldwide consolidated basis. The BIS *consolidated* statistics offer a more useful measure of the total risk exposure of a reporting banking system than do the BIS *locational* statistics, which are based on the residence principle.

The BIS consolidated international banking statistics on an *ultimate risk* basis are the most appropriate source for measuring the aggregate exposures of a banking system to a given country. Unlike the BIS consolidated international banking statistics on an *immediate borrower* basis, they are adjusted for net risk transfers. For example, suppose that a Swedish bank extends a loan to a company based in Mexico and the loan is guaranteed by a US bank. On an *immediate borrower* basis, the loan would be considered a claim of a Swedish bank on Mexico, as the *immediate borrower* resides in Mexico. On an *ultimate risk basis*, however, the loan would be regarded as a claim of a Swedish bank on the United States since that is where the *ultimate risk* resides.

To take a concrete example, one can use the BIS consolidated statistics on an *ultimate risk* basis to find out the size of exposures of *Canadian* banks to residents of *Denmark* at the end of the most recent quarter for which data are available. The intersection of reporting country *Canada* (in the column headings) and vis-à-vis country *Denmark* (in the row headings) in BIS Table 9D[②] indicates that the consolidated foreign claims of Canadian banks on *Denmark* at the end of the fourth quarter of 2009 were $2,068 million. This number represents the aggregate claims of all *Canadian-owned* bank branches and subsidiaries around the world on residents of Denmark. Therefore, it would include a loan extended by the London branch of a *Canadian* bank to a company based in Copenhagen (assuming that the loan is not guaranteed by another entity based outside Denmark). Conversely, it would not include a loan extended by the Toronto branch of a *US* bank to the same Copenhagen-based company, as this loan would represent a claim of a US bank, not a Canadian bank.

Developments in the banking world, such as mergers, acquisitions and restructurings, often lead to changes in the reporting populations of the BIS consolidated banking statistics. That is why, when tracking period to period changes in exposures, it is important to take into account all breaks in series that have occurred during the respective time span before making any inferences or conclusions.[③] For example, as a result of a restructuring that took place during the fourth quarter of 2009, a Swiss bank was reclassified as a Greek bank. As a consequence, its claims on Greece were no longer included in the consolidated figures for Swiss banks. This change in the reporting population of Swiss banks caused most of the $74.9 billion decline (from $78.6 billion to $3.7 billion) in the claims of Swiss banks on residents of Greece between the third and the fourth quarter of 2009. If one compared the numbers for these two quarters in BIS Table 9D disregarding the break in series in the fourth quarter, one would wrongly conclude that there was a precipitous decline in the foreign claims of Swiss banks on Greece when, in fact, there was no sizeable change in the stock of claims held by the bank in question.

Care is also necessary when using the BIS consolidated international banking statistics to make inferences about how exposed banking system X is to a potential sovereign debt restructuring in country Y. The numbers reported in BIS Table 9D represent the consolidated *foreign claims* of a given banking system on all residents (ie public sector, banks and non-bank private sector) of a country. Therefore, the fact that banking system X has a large amount of foreign claims on the residents of country Y does not necessarily imply that the exposures of banking system X to the *public sector* of country Y are large.

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① Foreign claims comprise loans, deposits placed, holdings of debt securities, equities and other on-balance sheet items. Note that foreign claims do not include *other exposures*, such as derivative contracts, guarantees and credit commitments. ② Consolidated foreign claims of reporting banks, ultimate risk basis, www.bis.org/statistics/consstats.htm. ③ The BIS communicates all important breaks in the press release that accompanies the publication of the data. In addition, a separate document, which is updated every quarter and is available on the BIS website (www.bis.org/statistics/breakstablescons.pdf), provides details on the period of the change, the reporting country, the reason for the break and the net changes in aggregate assets and liabilities that resulted from it.

($97 billion), while more than half of German banks' foreign claims on the country were on Spanish banks ($109 billion). German banks also had large exposures to residents of Ireland ($177 billion), more than two thirds ($126 billion) of which were to the non-bank private sector.

… in absolute terms …

French and German banks were not the only ones with large exposures to residents of euro area countries facing market pressures. Banks headquartered in the United Kingdom had larger exposures to Ireland ($230 billion) than did banks based in any other country. More than half of those ($128 billion) were to the non-bank private sector. UK banks also had sizeable exposures to residents of Spain ($140 billion), mostly to the non-bank private sector ($79 billion). Meanwhile, Spanish banks were the ones with the highest level of exposure to residents of Portugal ($110 billion). Almost two thirds of that exposure ($70 billion) was to the non-bank private sector.

Government debt accounted for a smaller part of euro area banks' exposures to the countries facing market pressures than claims on the private sector. The joint foreign claims of banks headquartered in the euro zone on the public sectors of Greece, Ireland, Portugal and Spain ($254 billion) amounted to approximately 16% of their combined overall exposures to these countries. Once again, most of those claims belonged to French ($106 billion) and German ($68 billion) banks. These two banking systems had sizeable exposures to the public sectors of Spain ($48 billion and $33 billion, respectively), Greece ($31 billion and $23 billion, respectively) and Portugal ($21 billion and $10 billion, respectively). The largest non-euro area holders of claims on the above four public sectors were Japanese and UK banks ($23 billion and $22 billion, respectively). The greatest exposures of both these banking systems were to the Spanish public sector ($13 billion and $9 billion, respectively).

… and relative to their Tier 1 capital

The exposures of BIS reporting banks to the public sectors of the euro area countries facing market pressures can be put into perspective by comparing them with these banks' capital. The combined exposures of German, French and Belgian banks to the public sectors of Spain, Greece and Portugal amounted to 12.1%, 8.3% and 5.0%, respectively, of their joint Tier 1 capital.[8] By comparison, the combined exposures of Italian, Dutch and Swiss banks to the same public sectors were equal to 2.8%, 2.7% and 2.0%, respectively, of their Tier 1 capital. Those ratios stood at 3.4%, 1.2% and 0.7%, respectively, for Japanese banks and 2.0%, 0.8%, and 0.7%, respectively, for UK banks. The exposures of US banks to each of the above public sectors amounted to less than 1% of their Tier 1 capital.

[8] Tier I capital data submitted to the BIS by selected central banks and supervisory authorities.

The international debt securities market[9]

Issuance rebounds ...

Activity in the primary market for international debt securities recovered in the first quarter of 2010.[10] Announced gross issuance rose by 27% quarter on quarter to $2,249 billion. With stable repayments, net issuance almost doubled to $595 billion, thus partly reversing the decline in the second half of last year (Graph 4, left-hand panel).

... due to higher borrowing by residents in developed economies

The recovery in issuance was primarily due to higher borrowing by residents in the developed economies (up 94% to $524 billion). International financial institutions (IFIs) also placed larger volumes ($43 billion, after net redemptions of $1 billion in the previous quarter). This contrasted with a sharp drop in issuance by borrowers resident in developing economies (–43%, to $24 billion).

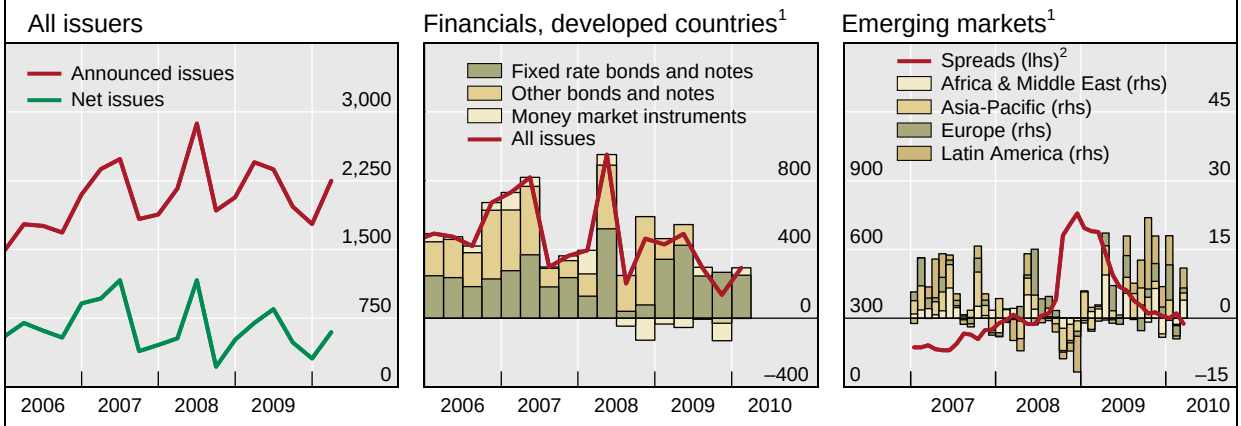
Financial institutions issue more debt

International issuance by financial institutions resident in the developed economies recovered to $292 billion (Graph 4, centre panel) after a very weak fourth quarter of 2009 ($135 billion). Banks sold money market paper to the tune of $51 billion, after net redemptions of $67 billion in the previous quarter. Issuance of straight fixed rate bonds was stable at $250 billion.

Although higher than in late 2009, issuance by financial institutions remained well below the levels seen before the crisis as banks continued to shrink their balance sheets. The share of government-guaranteed securities placed in domestic and international markets declined to 4% of announced gross issuance in the first quarter of 2010, from 7% in late 2009 and 25% in the first quarter of 2009. Financial institutions appear to be able to borrow on the strength of their own financial soundness once more, but they are doing so in

International debt securities issuance

Net issuance, in billions of US dollars



[1] By residence of issuer. [2] Quarterly JPMorgan EMBI Global Composite index, in basis points.

Sources: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS. Graph 4

[9] All queries concerning the international debt securities statistics should be directed to Christian Upper.

[10] International debt securities are defined as securities denominated in foreign currencies or marketed to foreign investors, as indicated, for example, by the participation of foreign banks in the placement syndicate.

moderation. The composition of their securities issuance has also changed. Before the crisis, money market paper accounted for a much larger fraction of total issuance than after the crisis, despite the rebound in the first quarter.

Budget deficits lead to record issuance by developed country sovereigns

Governments from the developed economies placed $117 billion of debt in the international market, the highest amount on record. Although high budget deficits are the main reason for this increase, technical factors also play a role. For example, more and more governments, European ones in particular, place bonds in the international markets through syndicates rather than through taps[11] or primary dealers (which do not show up in the BIS international debt securities statistics). In the past, syndication was used mainly by smaller economies.[12] The largest borrowers in the international market were Spain ($24 billion), Greece ($16 billion), Belgium ($12 billion), the United Kingdom ($11 billion) and France ($10 billion). Bonds from regional governments accounted for about one third of Spanish issuance; in the other countries, it was mainly the central government that issued in the international market. Not all countries have moved to syndicated issuance. For example, Germany and the United States auction securities to a group of primary dealers, although Germany uses syndication to place inflation-indexed and foreign currency securities.

Weaker issuance in Latin America and emerging Europe

The decline in issuance by residents of developing economies was the result of a sharp drop in issuance by residents of Latin America and the Caribbean, which fell by 61% to $10 billion. Residents of developing Europe also placed fewer securities in the international market (–19% to $6 billion). Issuance by residents of Asia-Pacific and of Africa and the Middle East remained stable at $5 billion and $2 billion, respectively.

IFIs tap the international market

IFIs raised $43 billion through the issuance of debt securities in the international market, the second highest amount on record. Accounting for more than 80% of the borrowing was the European Investment Bank, which increased its funding programme in anticipation of a higher demand for loans. Just over half of total IFI issuance was denominated in euros, followed by sterling and the Australian dollar (16% each). The share of the US dollar stood at 3%.

Derivatives

Exchange-traded derivatives

Higher turnover …

Activity on the derivatives exchanges accelerated during the first quarter of 2010. Turnover measured by notional amounts of futures and options on interest rates, stock price indices and foreign exchange increased by 16% quarter on quarter to $514 trillion between January and March. Open interest, expressed in notional amounts outstanding, rose by 12% to $82 trillion.

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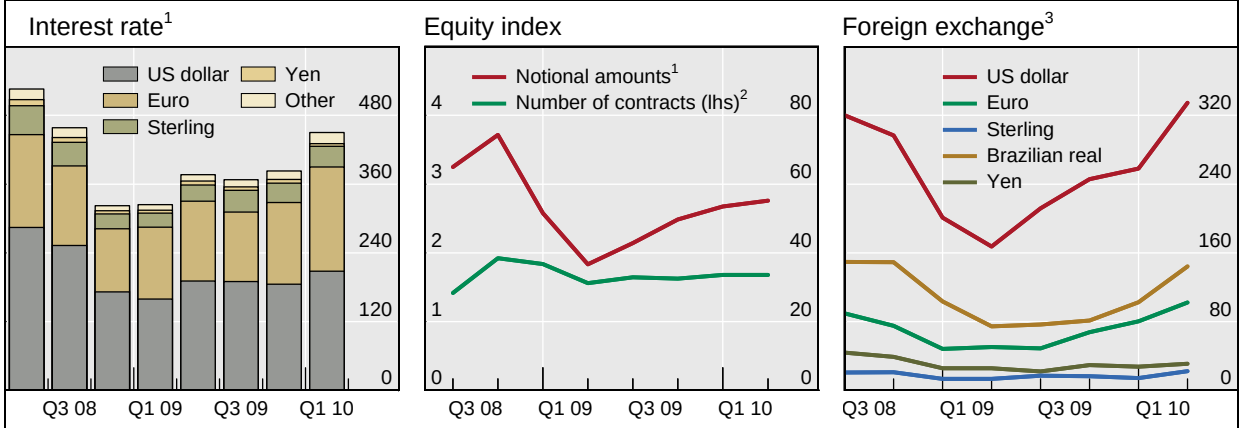
[11] Tap issuance refers to the practice of selling securities directly to investors at the prevailing market price rather than through auctions.

[12] See H Blommestein, "Responding to the crisis: changes in OECD primary market procedures and portfolio risk management", OECD, *Financial Market Trends*, no 97, vol 2009/2.

Exchange-traded derivatives

Futures and options contracts



[1] Turnover, notional amounts in trillions of US dollars. [2] Turnover, number of contracts in billions of contracts. [3] Open interest, in billions of US dollars. Contracts with at least one leg referenced to the respective currency.

Source: BIS. Graph 5

... as market participants reposition themselves on rate hikes

Volumes in the market for derivatives on short-term interest rates surged as market participants revised their expectations about the future path of monetary policy (Graph 5, left-hand panel). Turnover in money market contracts went up by 18% to $408 trillion, thus outpacing turnover growth in derivatives on government bonds (up 11% to $11 trillion). Particularly rapid increases in activity were seen in contracts on short-term Brazilian rates, where turnover in futures and options almost doubled to $5.4 trillion, as market participants began to price in higher interest rates. Turnover in contracts on short-term euro interest rates went up by 30% to $162 trillion. In the United States, turnover in futures and options on the overnight federal funds rate – which is closely related to monetary policy – increased by 25% to $28 trillion, whereas turnover in contracts on three-month eurodollar rates rose by 10% to $163 trillion. The main exception to the increase in activity in money market contracts was in the yen segment. Turnover in yen-denominated futures and options fell by 27%, to $2.5 trillion, as investors continued to expect that short-term interest rates would remain low.

Stable activity in stock index derivatives

Activity in the market for derivatives on stock price indices remained stable in the first three months of 2010, despite some notable fluctuations in equity prices. Turnover measured in terms of notional amounts increased by 3% to $55 trillion, although this mainly reflected a valuation effect (Graph 5, centre panel). The number of stock index contracts traded on the international derivatives exchanges barely changed over the period.

Open interest in FX contracts rises

Investors increased their positions in FX futures and options. Open interest of such contracts increased by 29% to $0.4 trillion (Graph 5, right-hand panel), far outpacing growth in turnover (up 11% to $9 trillion). Open interest in contracts with one leg in sterling increased by 57% to $0.02 trillion.[13] Open interest in contracts on the Brazilian real rose by 41% to $0.14 trillion. This

[13] As each contract has two legs, open interest and turnover in the various currencies add up to 200% of the total.

makes it the second most important currency on the international derivatives exchanges in terms of open positions, behind the US dollar ($0.33 trillion) but ahead of the euro ($0.10 trillion). The importance of the real in the currency segment of the futures and options market is due to the fact that there is comparatively little trading over the counter.

Lower trading in non-precious metals dampens activity on commodities exchanges

Turnover on the international commodities exchanges fell slightly on the back of a sharp drop in activity in contracts on non-precious metals. Total turnover of commodity derivatives (measured in terms of the number of contracts traded, as notional amounts are not available) fell by 4%, following a 7% increase in the last quarter of 2009. This drop was driven by lower activity in contracts on non-precious metals, which fell by 30%. This contrasted with a 22% surge in derivatives on precious metals, and slight increases in contracts on agricultural commodities (2%) and energy products (3%).

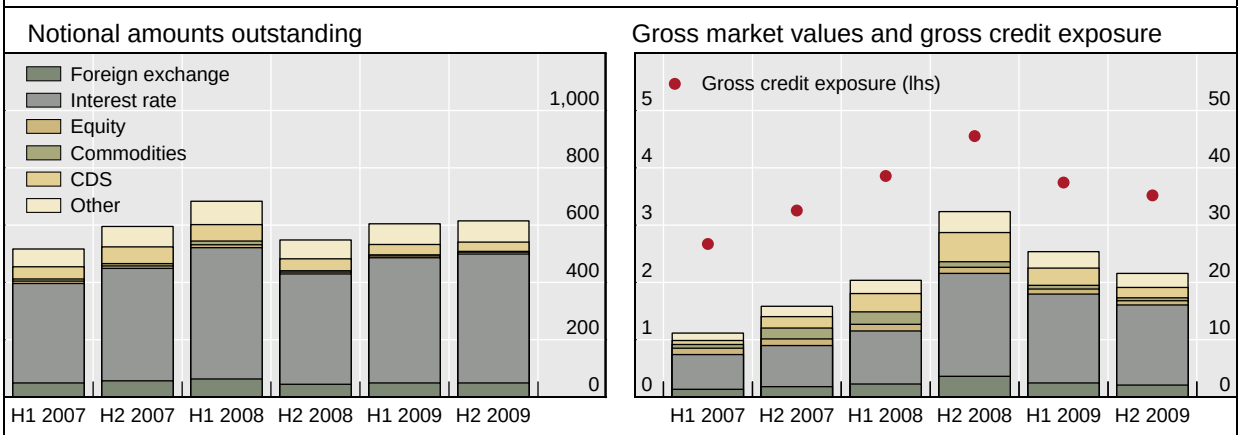
OTC derivatives[14]

Modest increase in notional volumes, decline in market values

Notional amounts of all over-the-counter (OTC) derivatives increased modestly (2%) in the second half of 2009, reaching $615 trillion by the end of December (Graph 6, left-hand panel). The increase was evenly spread among risk categories, with the exception of commodity derivatives and credit default swaps (CDS), where amounts outstanding fell by 21% and 9%, respectively. The decline in reporting banks' gross credit exposures, which provide a measure of counterparty risk, slowed to 6%, after an 18% fall in the first half of 2009.[15] Gross market values also decreased, by 15% to $22 trillion (Graph 6, right-hand panel).

Global OTC derivatives

By data type and market risk category, in trillions of US dollars



Source: BIS.

Graph 6

[14] Queries concerning the OTC derivatives statistics should be addressed to Karsten von Kleist.

[15] Gross credit exposure is defined as gross market values after taking into account legally enforceable bilateral netting agreements, but before collateral. Credit default swap (CDS) contracts are excluded from this measure for all countries except the United States.

Box 2: A new trade repository for OTC interest rate derivatives

Jacob Gyntelberg and Karsten von Kleist

The OTC Derivatives Interest Rate Trade Reporting Repository (IR TRR) launched by TriOptima in early 2010 is an important step towards improving transparency in the global OTC derivatives markets. The IR TRR collects data on all transactions in OTC interest rate derivatives from a group of 14 major dealers. It complements the trade repository for credit default swaps (CDS) run by the Depository Trust & Clearing Corporation (see *BIS Quarterly Review*, December 2009, pp 24–25).

In April 2010, the IR TRR published its first monthly report summarising outstanding notional volumes at end-March 2010. The report provides a detailed breakdown of outstanding volumes by currency, maturity and type of contract. In contrast to the BIS data, the IR TRR does not publish information on market values or counterparty exposures.

The total amount outstanding of interest rate derivatives of the 14 participants in the new trade repository (13 of which are included in the sample of 57 dealers reporting to the BIS OTC derivatives statistics) at the end of March 2010 is very close to the market totals reported by the BIS statistics (Table A).[①] This suggests that market concentration is high and that the coverage of the IR TRR data is near comprehensive.

OTC interest rate derivatives data comparison

IR TRR			**BIS**		
	End-March 2010			End-Dec 2009	
Counterparty type	Notional amounts outstanding (USD billions)	% of total	Counterparty type	Notional amounts outstanding (USD billions)	% of total
Dealers	94,200	21	Dealers	138,537	31
CCPs	198,714	45	Other financial	275,649	61
Other counterparties	145,935	33	Non-financial	35,607	8
Total	438,848	100	Total	449,793	100

The trade repository data include $9,836 billion of cross-currency swaps, which are classified as FX instruments in the BIS data. They are thus excluded from the IR TRR data column in this table.

Source: The detailed data are available on http://www.trioptima.com/services/interest_rate_trade_reporting_repository. Table A

A detailed comparison of the IR TRR and BIS data is complicated by the different counterparty classifications used in the two datasets. The IR TRR provides separate information on the use of central clearing counterparties (CCPs). By contrast, contracts with CCPs are currently reported as part of deals with other financial institutions in the BIS data.

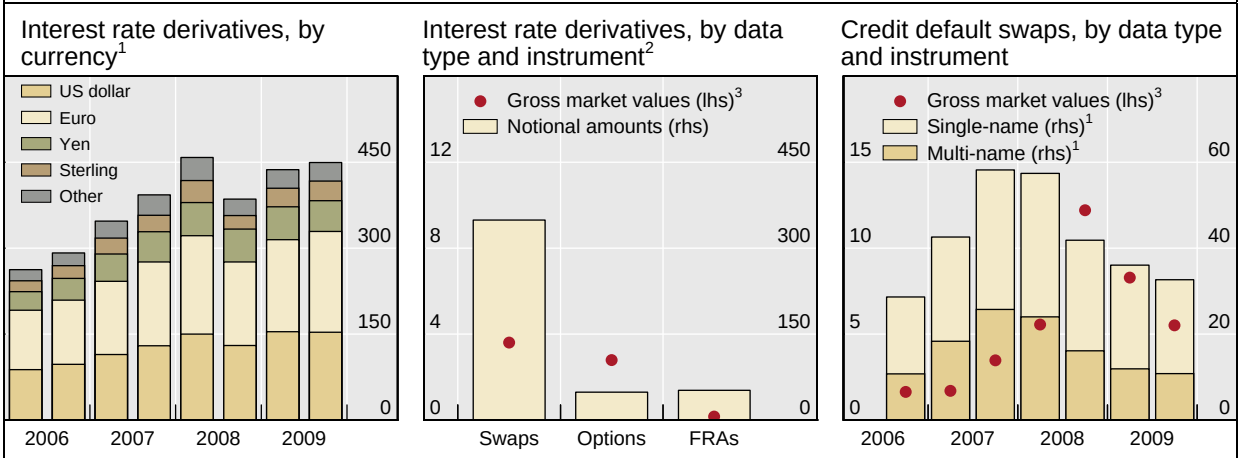
The new IR TRR data show that at end-March 2010 CCPs (essentially SwapClear) covered around 45% of the total market in terms of amounts outstanding. This included business with all 30 SwapClear members and not just with the 14 dealers participating in the IR TRR. Currently, 99% of instruments covered by the CCP are standard interest rate swaps, while more exotic swaps and interest rate options continue to be traded without the use of a CCP.

[①] The figures adjust inter-dealer positions to account for double-reporting and exclude cross-currency swaps.

Notional amounts outstanding of interest rate derivatives rose by 3%, with limited variation between currencies (Graph 7, left-hand and centre panels). Increased netting of contracts interacted with a decline in the value of the US dollar during the reporting period to produce the smallest increase since end-2005 (other than the exceptional 16% fall in the second half of 2008, which was partly due to a major correction in sterling and the euro in that period). Market

Global OTC interest rate derivatives and credit default swaps

In trillions of US dollars and per cent



[1] Notional amounts outstanding. [2] At end-2009. [3] As a percentage of the notional amount outstanding.

Source: BIS. Graph 7

values of interest rate derivatives declined by 9% overall, with notable reductions in US dollar and Canadian dollar contracts (–17% and –28% respectively).

More existing and new interest rate contracts between dealers are now being cleared via central counterparties (CCPs). As more interest rate deals migrate to CCPs, reported contracts between dealers and other financial institutions will increase in the BIS data, given that one contract between two dealers is replaced with two contracts with the CCP (see also Box 2).

CDS volumes contract again …

CDS amounts outstanding contracted again, by almost 10% (Graph 7, right-hand panel), due to a combination of factors. A reduction in overall activity and reduced spreads depressed new business, while ongoing netting continued to reduce the volume of outstanding contracts. Market values fell by another 36% for single-name CDS, and by almost 50% for multi-name contracts. The decline in activity was most pronounced for multi-name contracts between reporting dealers (15%), while notional volume between dealers and non-reporters decreased by only 5% (Graph 8). This is consistent with increasing use being made of CCPs, as these contracts are classified as contracts with non-reporting counterparties in BIS reporting.[16]

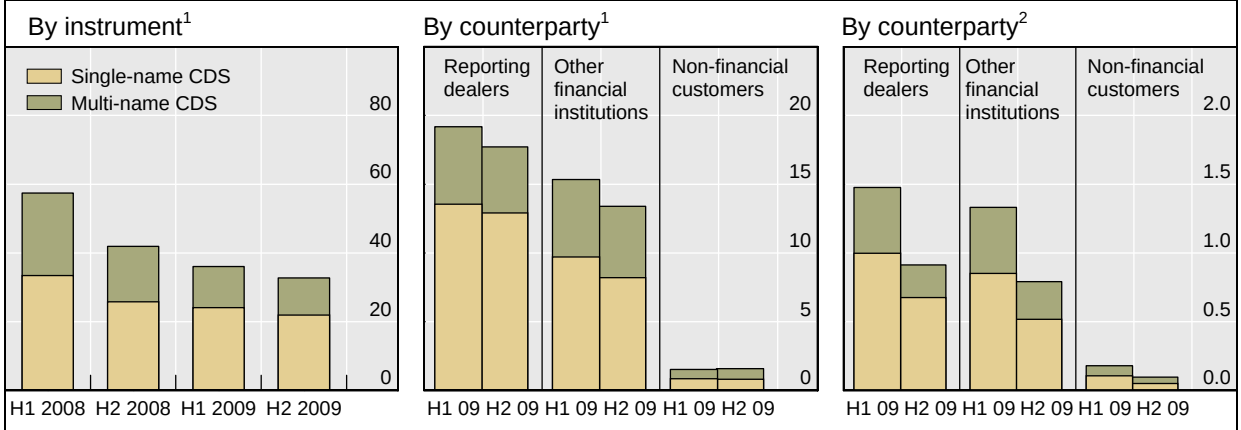
… but CDS positions on sovereigns increase

The amounts outstanding of single-name CDS on sovereigns increased by 10% in the second half of the year, as market attention was drawn to the implications of large fiscal deficits in late 2009 and sovereign CDS spreads rose. This increase was driven by inter-dealer positions, which rose by 20%. Data from the Depository Trust & Clearing Corporation (DTCC) suggest that exposures on some sovereign names increased by up to 50% during the period under review. Nevertheless, at end-2009, total notional amounts outstanding of sovereign CDS in the BIS data remained below their June 2008 peak. In contrast, positions on non-sovereigns (financial and non-financial firms) were

[16] The BIS will introduce separate reporting of CCPs in the CDS data as of June 2010.

Credit default swaps

In trillions of US dollars



[1] Notional amounts outstanding. [2] Gross market values.

Source: BIS. Graph 8

down 11%. This was mainly due to reporters' business with non-reporting financial institutions, whose outstanding CDS contracts declined by 17%.

Sizeable increases in the notional amounts outstanding of equity derivatives contrasted with declining replacement values. Rising equity valuations resulted in an increase in notional amounts of contracts on Japanese and other Asian equities by 50–80%, depending on the instrument. At the same time, market values dropped by 10–50% for various instruments. The US equity-linked derivatives segment saw a 17% increase in volume, but in terms of market value positions declined by 5%. Notional amounts and market values for European equities fell by around 20%. Notional amounts of Latin American equity-linked instruments decreased by 69% in the second half of 2009, but market values fell only 34%.

Commodity derivatives declined another 21% in both notional amounts and mark to market terms. The contraction was more than accounted for by options. Forwards and swaps, which had declined by 25% in the first half-year, held mostly steady in notional amount terms. Outstanding positions on gold were unchanged, but their market value increased by 11%.

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Policy responses to dislocations in the FX swap market: the experience of Korea[1]

During the financial crisis, Korea responded to dislocations in the FX swap market by both drawing on its swap line with the Federal Reserve and using its own international reserves to provide dollars to domestic banks. We show that the Bank of Korea's use of the Fed swap line was very effective in alleviating dislocations in the won/dollar FX swap market, whereas the provision of funds using its own foreign reserves was not.

JEL classification: G12, G13, G18.

Like many other emerging market economies, Korea relies heavily on US dollar funding through foreign banks and investors but does not have a deep foreign exchange (FX) swap market.[2] This turned out to be a major vulnerability during the financial crisis, when Korea experienced the most severe dislocations in the FX swap market of any emerging market economy. In response, the Korean authorities took several measures to stabilise the foreign currency funding market. In particular, they both drew on Korea's swap line with the Federal Reserve and used the country's own foreign reserves to provide foreign currency liquidity to the private sector. The experience of Korea thus provides useful lessons on the effectiveness of these two different policies in mitigating foreign currency funding problems.

In this feature, we examine which of these two policies was more effective in alleviating deviations from covered interest parity (CIP deviations). We find that the Bank of Korea's US dollar loans of the proceeds of swaps with the Fed were effective, whereas the use of its own foreign reserves were not. Our model does not tell us why exactly this was so. However, we believe that a major reason was that the Bank of Korea's loan auctions funded by the Fed swap line effectively added to Korea's foreign reserves. When the auctions were conducted, Korea's foreign reserves were just enough to cover the short-

[1] The authors are grateful for useful discussions with and comments by Claudio Borio, Myunghee Lee, Robert McCauley, Frank Packer, Eli Remolona and Christian Upper. We thank Eric Chan for excellent research assistance. The views expressed in this article are those of the authors and do not necessarily reflect those of the Bank of Japan or the BIS.

[2] In an FX swap, two parties exchange a set amount in two currencies for the tenor of the contract (which is mostly short-term). This is equivalent to a combination of an FX spot transaction and an FX forward transaction in the reverse direction, or to a collateralised loan.

term foreign currency debt. Providing dollar liquidity from the official reserves would have reduced this coverage. Auctioning off the proceeds from the swap line with the Federal Reserve, by contrast, did not result in a reduction in the reserve coverage, which should have enhanced market confidence. That said, we do not know whether the estimation results would have been different had Korea had a higher level of reserves.

In the next section, we briefly review FX swap market dislocations in selected countries during the crisis. We then describe the dislocations in the Korean FX swap market and the policy responses, and go on to analyse the effectiveness of the two main policy measures adopted. The last section concludes.

Global deleveraging and FX swap markets

Many countries experienced dislocations in the FX swap market

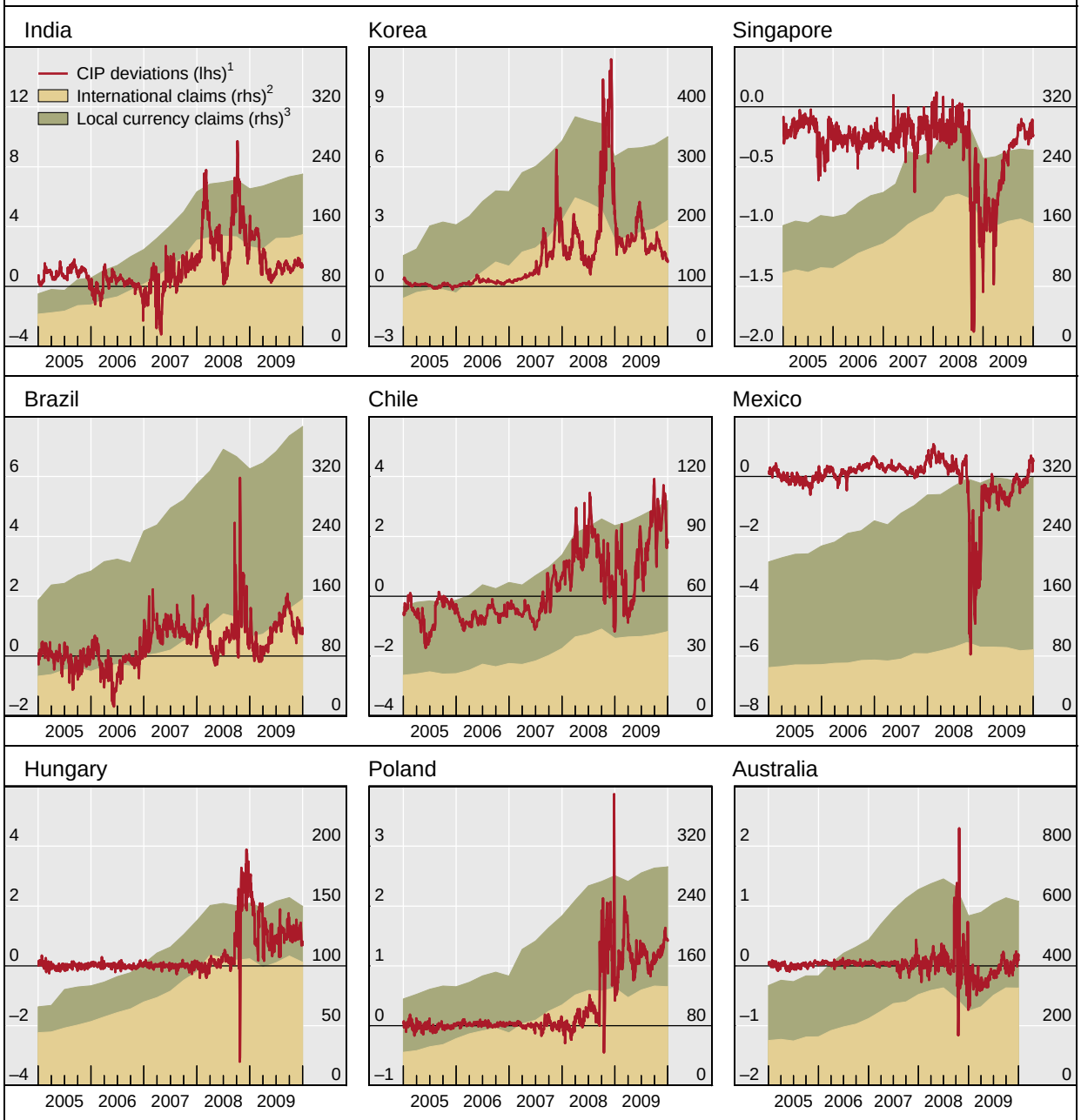
We compare the FX swap market dislocations in selected countries which either used their own foreign reserves or established swap lines with the Fed or other central banks. Specifically, we look at India, Korea and Singapore from Asia; Brazil, Chile and Mexico from Latin America; Hungary and Poland from central Europe; and Australia from the Pacific.

When foreign banks' lending to these countries contracted sharply around the fourth quarter of 2008, domestic banks faced difficulties in borrowing in the interbank market and much higher costs of obtaining short-term dollar (or euro or Swiss franc in central Europe) financing through FX swaps (Graph 1). In particular, there was an abrupt drop in gross international claims (the sum of cross-border claims in all currencies and local claims in foreign currencies of international banks) on many of these countries. Korea experienced a severe retreat of global banks' lending, which led to the most significant dislocations in the FX swap market during the financial crisis in terms of CIP deviations.[3]

By contrast, fewer countries exhibited a sharp reduction in local claims in local currency extended by foreign banks' offices, after adjusting for exchange rate movements (McCauley et al (2010)). In particular, most of foreign banks' lending to Latin American countries was conducted by their local subsidiaries in local currency funded by the domestic deposit base. This partly explains why the FX swap markets of these countries were relatively less affected by the deleveraging of global banks.

[3] We denote by S_t the FX spot rate (US dollar/Korean won) at time *t*, and by $F_{t,t+s}$ the FX forward rate contracted at time *t* for exchange at time *t*+*s*. Covered interest parity in the won/dollar FX swap market states that the interest rate differential ($r_{t,t+s}^{USD} - r_{t,t+s}^{KRW}$) should be perfectly reflected in the forward discount rate ($\ln F_{t,t+s} - \ln S_t$). This condition is equivalent to the equality of the FX swap-implied dollar rate from Korean won and the dollar cash rate, ie $\frac{F_{t,t+s}}{S_t}\left(1 + r_{t,t+s}^{KRW}\right) = 1 + r_{t,t+s}^{USD}$. The difference between these two rates defines the CIP deviations.

CIP deviations and foreign claims for selected economies



[1] Calculated as the difference between the three-month FX swap-implied US dollar interest rate and three-month US dollar Libor, in per cent. The former is derived from the covered interest parity condition based on the following domestic three-month interest rates: India, Mumbai interbank rate; Korea, 91-day certificate of deposit rate; Singapore, interbank rate; Chile, 90-day DISCTB promissory note rate; Mexico, TIIE interbank rate; Hungary, interbank rate; Poland, Warsaw interbank rate; Australia, bank bill rate. For Brazil, the "cupom cambial" is used as the three-month FX swap-implied US dollar interest rate. [2] Consolidated cross-border claims in all currencies and local claims in foreign currencies, in billions of US dollars. [3] Local currency claims of reporting banks' foreign offices on local residents, calculated at constant end-Q4 2009 exchange rates, in billions of US dollars.

Sources: Bloomberg; Datastream; BIS; authors' calculations. Graph 1

FX swap market dislocations in Korea and policy responses

After examining why there were persistent CIP deviations in the FX swap market in Korea even before August 2007, we describe the problems faced by Korean banks in obtaining foreign currency funding during the crisis and how they showed up in the FX swap market. Finally, we review various policy

measures Korea took to stabilise the foreign currency funding market, focusing on two types of dollar-supplying operations.

Dislocations in the Korean FX swap market

Structural excess demand for US dollars …

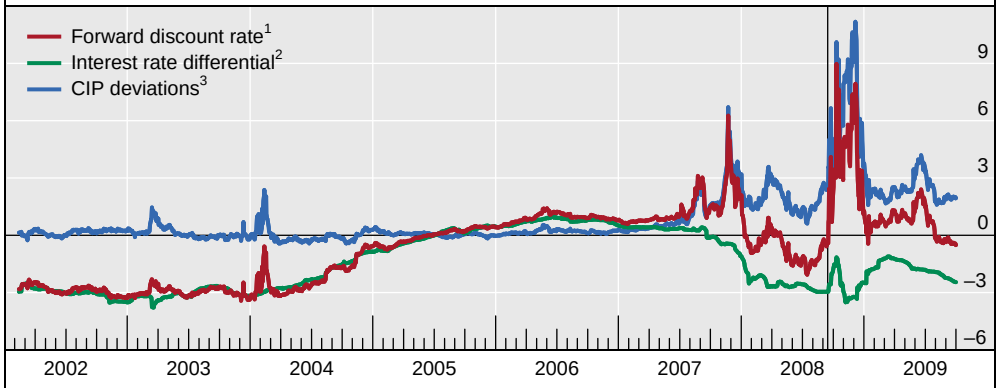
From 2006 to 2007, exporting firms such as Korean shipbuilders as well as Korean investors in foreign stocks sold a large amount of US dollar forwards to domestic banks to hedge their currency exposures (McCauley and Zukunft (2008)). Korean banks sold these US dollar forwards to, and at the same time borrowed US dollars from, Korean branches of foreign banks, in order to hedge currency risk. The latter, in turn, invested the won they had acquired from these FX swap transactions in short-maturity Korean government and Bank of Korea (BoK) paper. The absence of natural buyers of FX forward exposures pushed up the FX forward rate, which drove the forward discount rate (red line in Graph 2) above the interest rate differential (green line) between the United States and Korea. In effect, US dollars traded at a premium yield in the won/dollar FX swap market, given strong borrowing demand.

… and a global dollar shortage …

Deviations from CIP (blue line) widened sharply after the middle of 2007. The interest rate differential turned negative as the Fed cut policy rates by a total of 325 basis points between September 2007 and April 2008 while the BoK held its policy rate at 5%. At the same time, the structurally strong demand for US dollars in the Korean FX forward market and an increasing challenge for global banks to supply dollar funding to Korea for more than the shortest periods increased the FX forward rate, and in turn the forward discount rate. The Korean branches of foreign banks did not take advantage of the enlarged arbitrage opportunities, but began to decrease their investments in Korean bonds as funding from their headquarters dried up. Other foreign investors such as hedge funds only partly took their place (Yang and Lee (2008)).

CIP deviations in the Korean three-month FX swap market

In percentage points



The vertical line marks 15 September 2008, the date on which Lehman Brothers filed for Chapter 11 bankruptcy protection.

[1] Defined as *ln*(US dollar/Korean won forward rate) minus *ln*(US dollar/Korean won spot rate). [2] Defined as three-month US dollar Libor minus the 91-day Korean won certificate of deposit rate. [3] Defined as the forward discount rate minus the interest rate differential.

Sources: Datastream; authors' calculations. Graph 2

… caused severe dislocations in the Korean FX swap market

Following the Lehman failure, the cost of borrowing dollars by swapping Korean won skyrocketed. Korean banks were now completely shut off from the international market for US dollar funding, and the already strained FX swap market took the whole burden of supplying US dollars. International banks, deleveraging on a worldwide scale, sharply reduced their exposures to Korea (Graph 1). UK and euro area banks in particular repatriated their large dollar positions. This prompted drastic policy responses by the Korean authorities.

Policy responses

Korean authorities took various policy measures …

From 2006 onwards, the Korean authorities became worried about the appreciation of the won, which was partly driven by the rapid increase in short-term foreign currency borrowing by foreign banks. They therefore announced a set of policy measures to promote domestic banks' investment in foreign securities and reduce short-term borrowing in foreign currency (Table 1). These measures seem to have contributed to a modest widening of CIP deviations in early 2007.

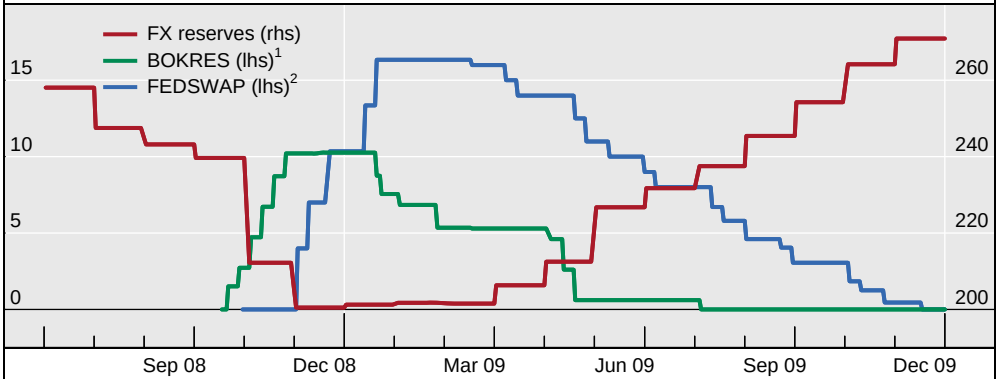
From the second half of 2007, however, the won/dollar FX swap market started to show signs of greater tension. In September 2007, the BoK intervened in the FX swap market for the first time by swapping dollars for won with selected banks. After this intervention, the FX swap market stabilised temporarily, but stress flared up again towards the end of the year. In early 2008, the BoK reacted by partially loosening restrictions on the use of foreign currency loans.

… to stabilise the foreign currency funding market

Immediately after the bankruptcy of Lehman Brothers, the Korean Ministry of Strategy and Finance (MoSF) used its foreign reserves to provide dollar liquidity to exporting small and medium-sized enterprises and banks. It also guaranteed the external debt issued by Korean banks to enable them to raise funding abroad. The BoK set up a swap auction facility in October 2008 and conducted competitive auctions swapping its own foreign reserves for won to provide up to $10.27 billion of dollar funding to Korean banks. It also entered into a $30 billion swap arrangement with the Fed on 30 October 2008 and

Korea's foreign reserves and dollar-supplying operations

In billions of US dollars



[1] The Bank of Korea's swap auctions using its own foreign reserves. [2] The Bank of Korea's loan auctions using the proceeds of swaps with the Federal Reserve.

Source: Bank of Korea. Graph 3

Major policy measures to stabilise the foreign currency funding market in Korea		
Announcement date	Description	Anticipated impact on CIP deviation
15 Dec 2006	From 1 January 2007, the BoK can provide foreign currency loans to domestic banks through currency swap arrangements.	(–)
19 Apr 2007	The Financial Supervisory Service requests 36 foreign banks operating in Korea to slow down short-term foreign currency borrowing.	(+)
12 Jul 2007	The MoSF announces a plan to regulate short-term foreign currency borrowing by lowering the ceiling for tax deductibility of interest expenditure resulting from foreign bank branches' borrowing from their headquarters, from six times their capital to three times, starting 1 January 2008.	(+)
10 Aug 2007	The BoK limits foreign currency lending to actual uses overseas by end users and domestic facilities investment funds for manufacturers.	(+)
11 Sep 2007	The BoK intervenes in the FX swap market for the first time to provide dollars.	(–)
28 Jan 2008	The BoK allows foreign currency lending for domestic facilities investment funds for non-manufacturers.	(–)
14 Jul 2008	The MoSF announces that the tax deductibility ceiling for foreign bank branches will be raised back to the previous level, effective the 2008 business year.	(–)
26 Sep 2008	The MoSF announces a plan to provide the private sector with at least $10 billion by early October.	(–)
17 Oct 2008	The BoK announces a plan to introduce a competitive swap auction facility and to provide banks with $10 billion using the official foreign reserves.	(–)
19 Oct 2008	The MoSF announces a plan to provide a foreign currency debt issuance guarantee, and an additional $20 billion using the official foreign reserves.	(–)
27 Oct 2008	The BoK allows foreign currency borrowing by domestic exporters for payment of knock-in/knock-out and other currency option transactions.	(–)
30 Oct 2008	The BoK and MoSF announce the opening of swap lines with the Fed.	(–)
13 Nov 2008	The BoK announces a plan to introduce foreign currency loans secured by export bills purchased.	(–)
27 Nov 2008	The BoK announces a plan to conduct competitive US dollar loan facility auctions using the proceeds of swap transactions with the Fed.	(–)
1 Dec 2008	The BoK abolishes restrictions on the rollover of foreign currency lending for use as working capital procured before 10 August 2007.	(–)
12 Dec 2008	The BoK announces the opening of swap lines with the People's Bank of China and expansion of the current bilateral swap lines with the Bank of Japan.	(–)
26 Feb 2009	The MoSF announces the removal of withholding tax on bond interest income of non-residents, other tax benefits and relaxation of restrictions on foreign currency deposits by non-residents and foreign currency borrowing by residents.	(–)
Sources: Bank of Korea (BoK); Ministry of Strategy and Finance (MoSF); Financial Supervisory Service.		Table 1

conducted competitive US dollar loan auctions using the dollar proceeds of swap transactions with the Fed to provide up to $16.35 billion over the course of a year starting from December 2008. Graph 3 shows the total amount of Korea's foreign reserves as well as the outstanding amount of US dollar funds auctioned out by the BoK around the peak of the crisis.

Effectiveness of policy responses

Among the policy measures ...

We investigate the effectiveness of different policy actions in reducing CIP deviations in the three-month won/dollar swap market using regression analysis (see box). Most recent work on dislocations in FX swap markets has focused on major currency pairs, with relatively little on emerging market currencies (Baba and McCauley (2009)).

To gauge the policy impact correctly, we control for variables representing global market uncertainty, counterparty risk of banks and tensions in interbank markets. We find that the CDS spreads of Korean banks play a significant role in explaining the movement of CIP deviations during the pre-crisis period. Also, over the crisis period, we find a significant role of the VIX[4] in explaining changes in CIP deviations across various specifications (Table 2).

The most interesting result concerns the effectiveness of policy variables. We call BoK loan auctions funded by the Fed swap line FEDSWAP, and BoK swap auctions using its own foreign reserves BOKRES. In the regression, the key variables of interest are the following: FEDSWAP1 (BOKRES1) equals 1 on the date of each FEDSWAP (BOKRES) auction; FEDSWAP2 (BOKRES2) denotes the changes in US dollar balance outstanding from FEDSWAP (BOKRES).

... the supply of funds from the Fed swap line was very effective ...

The coefficients on both FEDSWAP1 and FEDSWAP2 are statistically significant, but those on BOKRES1 and BOKRES2 are not. The FEDSWAP auctions were not only statistically but also economically significant. CIP deviations fell by 13.2 basis points on average after each FEDSWAP auction, and every $1 billion auctioned out decreased the deviation by a further 9.2 basis points. The cumulative effects of all FEDSWAP auctions are 2.83 percentage points, which is 30% of the total reduction in the CIP deviation of 9.32 percentage points from the peak in early December 2008 when the first auction was conducted to late September 2009 when the last auction was conducted. By contrast, CIP deviations decreased by 3.4 basis points on average after each BOKRES auction, and every $1 billion auctioned out further reduced the deviation merely by 0.1 basis points.

... whereas the use of own foreign reserves was not

There are several possible explanations for the much greater effectiveness of the FEDSWAP auctions. The two facilities were similar in terms of counterparties, maturities, minimum bid amount and auction type. One source of difference was that the average amount of auctioned funds was larger for FEDSWAP than for BOKRES. The coefficients for FEDSWAP2 and BOKRES2 already capture this aspect. Another source of difference explaining the greater popularity of FEDSWAP was that the BoK announced the minimum bid rate before each FEDSWAP auction, while using an internal maximum

[4] The Chicago Mercantile Exchange Volatility Index (VIX) is a 30-day implied volatility index based on S&P 500 index options. A high value of the VIX means investors anticipate the US equity market will move sharply. The VIX can be a proxy for uncertainty in the global market because (1) it is highly correlated with similar volatility indices in other countries (Lustig et al (2009)), and (2) it tends to jump up immediately after the onset of crises and to stay at a very high level for a prolonged period.

Regression analysis and data

This box presents the econometric model that analyses the drivers of CIP deviations in the three-month won/dollar FX swap market and the effectiveness of the various policy measures. Following Baba and Packer (2009a,b), we use an EGARCH(1,1) model, but also consider an EGARCH(1,1)-in-mean model to test whether volatility risk is priced in the won/dollar FX swap market (see Engel et al (1987) and Nelson (1991) for details on this model).

Our choice of variables is similar to Baba and Packer (2009a,b) and Baba (2009). Policy variables are also included in the variance equation to test whether they had stabilising effects in the won/dollar FX swap market in the crisis period.

CIP deviations and their squared values tend to be highly autocorrelated, suggesting the need to control for AR1 effects in the mean equation and for GARCH effects in the variance equation. All the variables have large excess kurtosis in both the pre-crisis and crisis periods, suggesting that it is appropriate to use fat-tailed distributions as well as larger standard deviations in the crisis period than in the pre-crisis period.

The standard unit root tests suggest that three-month CIP deviations are highly likely to be I(1). The results for other variables are mixed, particularly in the pre-crisis period, but we use first-differenced form for all the variables throughout the analysis to be on the conservative side except for the policy dummy (auction date dummy) and the lagged level of the dependent variable.

The mean equation and the variance equation are specified as follows:

$$dY_t = a_0 + a_1 dX_{t-1} + \lambda\sigma_t + \varepsilon_t ,$$

$$\log\left(\sigma_t^2\right) = \omega + \beta\log\left(\sigma_{t-1}^2\right) + \gamma\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \eta\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}} - \mathrm{E}\left(\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right)\right| + b_1 dX_{t-1},$$

where

dY_t three-month CIP deviations (FX swap-implied US dollar rate from Korean won CD rate – US dollar Libor),

dX_{t-1} *Own dynamics:*

(1) Lagged "level" of the dependent variable (Y_{t-1}) to control for the level effect following McAndrews et al (2008),

(2) Lagged dependent variable (dY_{t-1}) to control for momentum and AR1 effects,

Global market uncertainty:

(3) VIX (CME),

Counterparty risk:

(4) five-year CDS spread of US banks (JPMorgan),[①]

(5) five-year CDS spread of Korean banks (Markit),[②]

Tensions in the interbank market:

(6) US dollar TED spread defined as Libor –Treasury bill rate (three-month),

(7) Korean won TED spread defined as Koribor – Monetary Stabilisation Bond rate (one-year),

Bank of Korea policy:

(8) FEDSWAP1 = 1 on the dates of competitive US dollar loan facility auctions using US dollar proceeds through swap lines with the Fed,

(9) FEDSWAP2 = changes in US dollar balance outstanding of US dollar loan auctions,

(10) BOKRES1 = 1 on the dates of competitive swap facility auctions using the Bank of Korea's foreign reserves, and

(11) BOKRES2 = changes in US dollar balance outstanding of US dollar swap auctions.

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① JPMorgan Bank CDS index is an equally weighted average of five-year CDS spreads of seven banks: Bank of America, Capital One Bank, Citigroup, JPMorgan Chase, Wachovia Corp, Washington Mutual and Wells Fargo & Co. ② We use an equally weighted average of five-year CDS spreads of six commercial banks: Kookmin Bank, Woori Bank, Hana Bank, Korea Exchange Bank, National Association of Agricultural Cooperatives and Shinhan Bank.

Estimation results[1]

	Pre-crisis period (1 Apr 2005 – 8 Aug 2007)				Crisis period (9 Aug 2007 – 30 Sep 2009)			
Constant	–0.001 (0.003)	0.002 (0.001)	–0.000 (0.003)	0.001 (0.001)	0.084*** (0.018)	0.082*** (0.018)	0.025** (0.011)	0.007 (0.006)
GARCH–M[2]	0.012 (0.115)		0.033 (0.111)		0.034 (0.081)		–0.122** (0.062)	
Deviation level (–1)	–0.008 (0.007)	–0.005 (0.005)			–0.042*** (0.011)	–0.038*** (0.009)		
d (deviation) (–1)	0.038 (0.038)	0.040 (0.039)			0.124*** (0.042)	0.123*** (0.041)		
d (VIX) (–1)	–0.001 (0.001)	–0.000 (0.001)	–0.000 (0.001)	–0.000 (0.001)	0.010*** (0.003)	0.010*** (0.003)	0.011*** (0.003)	0.011*** (0.003)
d (US bank CDS) (–1)	0.056 (0.132)	0.063 (0.130)	0.049 (0.128)	0.053 (0.127)	0.004 (0.031)	0.004 (0.031)	0.003 (0.031)	0.004 (0.032)
d (KR bank CDS) (–1)	0.243** (0.114)	0.246** (0.114)	0.248** (0.113)	0.248** (0.113)	–0.146** (0.069)	–0.144** (0.068)	–0.097 (0.069)	–0.097 (0.069)
d (3M USD TED) (–1)	–0.011 (0.028)	–0.013 (0.028)	–0.018 (0.028)	–0.017 (0.028)	0.061 (0.077)	0.065 (0.077)	0.077 (0.078)	0.071 (0.078)
d (1Y KRW TED) (–1)	0.050 (0.044)	0.049 (0.044)	0.051 (0.045)	0.051 (0.045)	0.030 (0.116)	0.041 (0.116)	0.024 (0.118)	0.034 (0.119)
FEDSWAP1					–0.132** (0.052)	–0.132*** (0.051)	–0.136*** (0.050)	–0.138*** (0.052)
FEDSWAP2					–0.092** (0.046)	–0.091** (0.046)	–0.092** (0.045)	–0.098** (0.047)
BOKRES1					–0.034 (0.053)	–0.038 (0.053)	–0.056 (0.050)	–0.051 (0.052)
BOKRES2					–0.001 (0.021)	–0.001 (0.022)	0.010 (0.029)	0.008 (0.025)

[1] Only the coefficients for the mean equation are reported. The numbers in parentheses are standard errors. ***, ** and * indicate that each parameter estimate is significantly different from zero at the 1%, 5% and 10% level, respectively. [2] For the GARCH–M term, we use the standard deviation.

Source: Authors' calculations. Table 2

swap rate for each BOKRES auction. This difference could also be reflected in the difference in the coefficients for FEDSWAP and BOKRES. Moreover, the fact that the BOKRES auctions were conducted earlier than the FEDSWAP auctions does not seem to be a crucial source of difference in their effectiveness because we control for global factors such as VIX, US banks' credit and TED spreads as well as Korean banks' credit and TED spreads in our regression analysis. We believe that the most important driver of the different policy impact in this regression is that funds from FEDSWAP enhanced market confidence more effectively because they were adding to Korea's foreign reserves when the total size of Korea's short-term foreign currency debt almost reached the level of its official foreign reserves, while the provision of funds by BOKRES was not.

Conclusion

In this feature, we showed that BoK loans funded by the swap line with the Fed were more effective than BoK swaps using its own foreign reserves. As discussed in CGFS (2010), this result suggests far from perfect substitutability of a country's own foreign reserves and inter-central bank swap arrangements.

This result has an important implication for the current discussion in the G20 on the strengthening global financial safety net. Even though building up a large amount of foreign reserves has certain merits as self-insurance, once a country faces a foreign liquidity run, swap lines with other central banks can have a powerful effect of complementing the use of foreign reserves and thus stopping the run.

The Korean case also points to the dangers of relying on foreign currency borrowing as well as of maturity mismatch in foreign currency. In response to the crisis, the Korean authorities tightened the foreign currency liquidity regulation for domestic banks in 2010, by fine-tuning the regulation on the foreign currency liquidity ratio, introducing mandatory minimum holdings of safe foreign currency assets and raising the ratio of mid- to long-term borrowing to mid- to long-term lending. However, foreign bank branches in Korea are not subject to these liquidity ratios. Also, foreign currency liquidity risk turned out to be a systemic risk in Korea: all banks tended to face the same liquidity problem at the same time because they all relied on foreign bank branches for US dollar funding. It is crucial that foreign currency liquidity regulation and stress testing exercises take this systemic dimension of liquidity risk into account.

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Currency collapses and output dynamics: a long-run perspective[1]

Currency collapses, defined as large nominal depreciations or devaluations, are associated with permanent output losses on the order of 6% of GDP on average. In this feature, we argue that the fact that these losses tend to materialise before a drop in the value of the currency indicates that it is not the large depreciation as such that is costly but the factors leading to the currency collapse. Taken on its own, the drop in the exchange rate actually has a positive effect on output.

JEL classification: E32, F31, F41, F43.

Public authorities tend to resist sharp depreciations in their economy's exchange rate, presumably because they fear that they would be very costly in terms of foregone output.[2] This article presents new evidence on the relationship between currency collapses, defined as large nominal depreciations or devaluations, and real GDP. The analysis is based on nearly 50 years of data covering 108 emerging and developing economies.[3] We find that output growth slows several years before a currency collapse, resulting in sizeable permanent losses in the level of output. On average, real GDP is around 6% lower three years after the event than it would have been otherwise. However, these losses tend to materialise *before* the currency collapse. This means that the economic costs do not arise from the depreciation per se but

[1] This article is based on the paper "Chronicle of currency collapses: re-examining the effects on output" co-authored with Matthieu Bussière (Bank of France) and Sweta Saxena (International Monetary Fund). The views expressed are those of the authors and do not necessarily reflect those of the BIS, the IMF, the Bank of France or the Eurosystem. The author thanks Claudio Borio, Stephen Cecchetti, Robert McCauley and Christian Upper for their useful comments, as well as Sergio Vargas for his assistance.

[2] The empirical macroeconomic literature has grappled with the question of how currency collapses affect output. Different transmission mechanisms can operate in opposite directions (eg expansionary expenditure switching effect versus contractionary balance sheet effects), so assessing the overall impact is mainly an empirical exercise. Unfortunately, existing research has failed so far to provide conclusive evidence. For a general survey, see Agénor and Montiel (1999, 2008) and Bussière et al (2010).

[3] The period under analysis is 1960–2006 and relies on World Bank GDP and bilateral IMF nominal exchange rate data.

rather reflect other factors. Quite on the contrary, depreciation itself actually has a positive effect on output.

Defining currency collapses

We define currency collapses as episodes in which the annual change in the bilateral nominal exchange rate in any given month during the calendar year falls in the top quartile of all depreciation episodes in the sample. To ensure that the events are well identified, no other episode must occur within a three-year window before and after the depreciation.[4]

Currency collapses occur when the annual exchange rate drops by around 22%

Using this definition, we identify a total of 79 episodes (Table 1). The threshold for a depreciation to qualify as a currency collapse is around 22%, which is in line with alternative definitions used in the literature. Currency collapses were most frequent during the 1980s and 1990s, and more common in Africa than in Asia or Latin America.[5] They also occurred under all types of

Descriptive statistics of currency collapses

		Number of episodes
Decade	1960s	6
	1970s	12
	1980s	24
	1990s	32
	2000s	5
Region	Africa	40
	Asia	21
	Latin America	12
	Other	6
Exchange rate regime[1]	Peg	33
	Crawling	14
	Managed float	15
	Flexible	1
	Freely falling	5
	Unclassified	2

[1] Due to sample coverage, fewer episodes are reported in this category.

Source: Bussière et al (2010). Table 1

[4] Bussière et al (2010) also consider alternative definitions of currency collapses, including some that take into account the acceleration of the exchange rate change or the initial level. Results appear to be robust independently of the definition employed. However, they are somewhat sensitive to the persistence of the event over time.

[5] More episodes are identified in Asia than in Latin America because we are examining one-off drops in the exchange rate rather than persistent depreciations. See Bussière et al (2010) for the implications of such differentiation.

currency regimes,[6] except possibly floating exchange rate regimes, where there are simply too few observations to obtain meaningful estimates.

Output dynamics around the time of currency collapses

Output growth slows in the years prior to the collapse, picks up afterwards

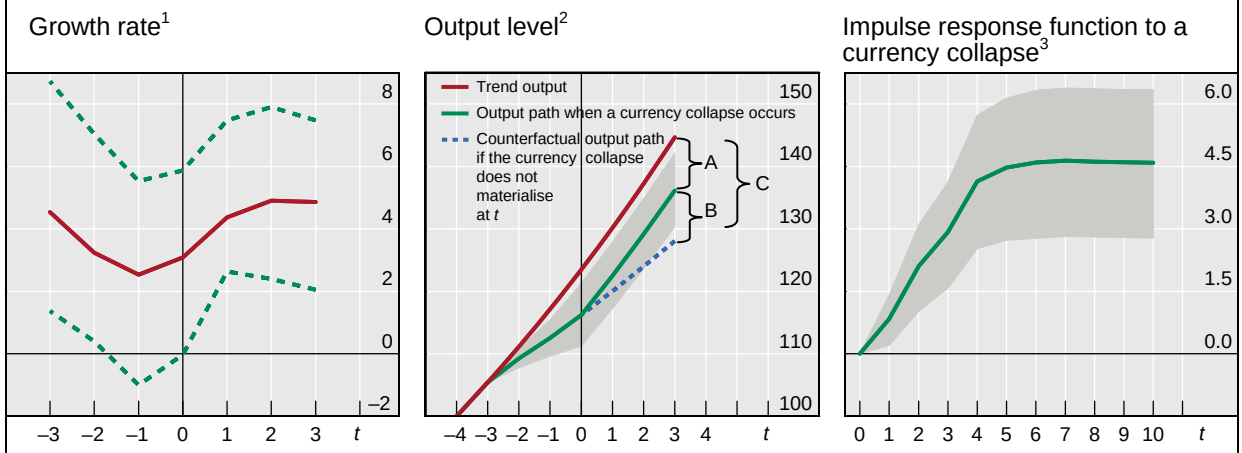
We look at the relationship between currency collapses and output by first examining the dynamics of average output growth in the countries where a currency collapse occurred (ie event study) and then using econometric methods that take advantage of the full sample (see box).

Our results based on event analysis show that output growth on average tends to slow down in the years before the currency collapse (Graph 1, left-hand panel), although outright contractions are not that common. In fact, only 22 of the 79 episodes in the sample were preceded by a drop in GDP.[7] Growth tends to pick up in the year of the collapse and accelerate afterwards. Growth rates a year to three years after the episode are on average well above those one or two years prior to the event.

Currency collapses are associated with permanent losses in the level of output …

Econometric estimates confirm the results of the event study (see box). They also show that the higher growth rates after the currency collapse are not sufficient to compensate for the losses in output (relative to trend) incurred before the event. The centre panel of Graph 1 shows that actual output (green line) begins to deviate from trend (red line) three years before the collapse, the distance between the two representing the net output costs. Three years

Output dynamics around the time of a currency collapse



The currency collapse occurs at year $t = 0$, and no collapse occurs within a three-year window before and after the event. The shaded area displays the 95% confidence interval.

A: net permanent output loss = 6.3%; B: currency collapse gain = 6.3%; C: maximum output loss = 12.9%.

Event case study results. The continuous line displays the sample average. The dashed lines display the 25th and 75th percentiles, respectively. [2] Estimates based on two-way fixed effects panel regressions; displayed as an index. [3] Estimates based on dynamic panel regressions; in per cent.

Source: Bussière (2010). Graph 1

[6] We follow the classification by Reinhart and Rogoff (2004). An update is available at terpconnect.umd.edu/~creinhar/Papers.html.

[7] The median GDP decline in such cases was 2.8%.

Econometric methodology

The results we report in the article are derived from two econometric exercises.[①] The first examines the impact of currency collapses on output growth rates using two-way fixed effects panel regressions (see Forbes (2002)). The benchmark equation that we estimate is:

$$g_{i,t} = \sum_{j=-3}^{3} \beta_j D_{i,t-j} + \delta_1 Infla_{i,t} + \nu_i + \omega_t + \varepsilon_{i,t}$$

where $g_{i,t}$ is real GDP growth rate in country *i* in year *t*, $Infla_{i,t}$ is the inflation rate[②] and $D_{i,t-j}$ is a dummy variable that is equal to one if country *i* had a currency collapse in period *t* = 0. ν_i is an idiosyncratic time-constant but cross-sectional varying component, ω_t is the time-varying but cross-sectional constant factor, and $\varepsilon_{i,t}$ is the error term. To avoid selection bias we use the full country sample. This allows us to compare the performance of countries affected by a currency collapse with that of countries that are not. We then use the econometric results to evaluate the impact on output levels. We set the level of output at *t*–4 to 100 and then project it forward using the statistically significant parameter estimates, which we can compare to the path of output in the absence of a currency collapse.

The drawback of this approach is that it may suffer from endogeneity problems. To deal with this, we estimate a forecasting equation in which the currency collapse can only have a lagged effect on output. This means that we do not capture the costs incurred before the depreciation, but we can isolate the impact of the change in the exchange rate itself. Specifically, we estimate a univariate autoregressive model in output growth rates using panel data with fixed effects (see Cerra and Saxena (2008) and Romer and Romer (1989)). We report the results using the group averages of impulse responses of output to the currency shock. The specific model that is estimated is given by:

$$g_{i,t} = \alpha_i + \sum_{j=1}^{4} \gamma_j g_{i,t-j} + \sum_{s=1}^{4} \delta_s D_{i,t-s} + \varepsilon_{i,t}$$

The impulse response function (IRF) of this forecasting equation provides a ceteris paribus estimate of the total effect of a large currency collapse over time. It thus provides a natural way to summarise the output response to currency collapses as it traces the effect of a unit shock to the currency collapse variable D, including the feedback effect through lagged output. IRFs are calculated relative to the estimated trend output and cumulated over time to reflect movements in levels.

[①] See Bussière et al (2010) for further details. [②] Controlling for inflation is important for at least two reasons: first, to take into account the possible impact of prices changes on output growth, and second, to ensure that results are not driven by hyperinflationary episodes.

Output dynamics following a currency collapse[1]

	Coefficient	Standard error
Collapse *t*+3	–0.46	0.73
Collapse *t*+2	–1.77**	0.73
Collapse *t*+1	–2.44***	0.63
Collapse *t*	–2.12**	0.92
Collapse *t*–1	0.43	0.59
Collapse *t*–2	0.39	0.69
Collapse *t*–3	0.37	1.26
Inflation	–0.00**	0.00
Constant	5.42***	0.67

[1] The currency collapse occurs at *t* = 0. Based on 3,138 observations from 97 countries. Two-way panel fixed effects. Robust standard errors in brackets. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Source: Bussière et al (2010). Table A

after the collapse, these costs are estimated to be around 6% of GDP.[8] The estimates also show what would have happened if the currency for some reason had not collapsed. In this case, output would have continued on the low-growth trajectory (blue line), and the output cost would have increased even further.

… but these losses materialise prior to the collapse itself, which actually has positive effects

Dynamic panel data estimates confirm that currency collapses in the absence of other events, ie ceteris paribus, induce a positive adjustment in the level of output. In particular, these estimates indicate that such output gains exceed 4% and fully materialise within five years after the shock (Graph 1, left-hand panel). This is qualitatively and quantitatively similar to the results reported above suggesting that output picks up after a currency collapse.[9] Interestingly, this is also consistent with dynamic stochastic general equilibrium models that have examined the role of devaluations on output while carefully controlling for the transmission mechanisms involved and the source of the shock triggering the currency collapse (eg Tovar (2005, 2006)). In this literature, contractionary transmission mechanisms such as balance sheet effects, which arise when firms' debts are denominated in dollars and revenues are denominated in local currency, are outweighed by expansionary expenditure-switching effects – ie domestically produced goods become cheaper in relative terms than foreign produced goods. As a result, following a devaluation output ends up expanding.

The evidence reported so far summarises the average behaviour of output around the time of currency collapses. We now complement this statistical analysis by looking at three particular episodes: Mexico in 1994–95, Korea in 1980 and Korea in 1997. The domestic currency depreciated by 89% in the case of Mexico, and by 25% and 51% in the case of Korea in 1980 and 1998, respectively. The evolution of output around these three currency collapses matches the average pattern surprisingly well (Graph 2, left-hand panel). In particular, output losses materialised prior to the currency collapse, and the episodes were associated with permanent output losses relative to trend in the medium run.

Twin crises induce a permanent loss in output double the size associated with a currency collapse

We also examine the robustness of our results to banking crises. The costs of a currency collapse are magnified if it coincides with a banking crisis.[10] On average, GDP after twin crises (brown line in the right-hand panel of Graph 2) drops 11.9% below trend (red line) three years after the second event. This is almost double the output loss associated with a currency

[8] The confidence interval around the point estimate can be affected by the window size around the currency collapse; it therefore may be relevant to check the sensitivity of results to alternative window sizes. See Bussière et al (2010) for a discussion.

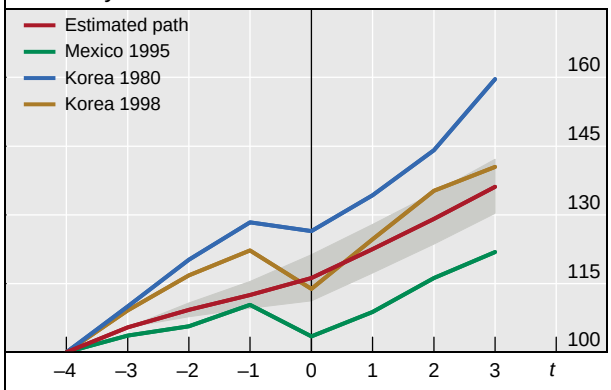
[9] The dynamic panel estimates only fit the dynamics from $t = 0$ onwards and do not allow us to examine the dynamics of output prior to the event as in the previous methodology, which incorporates both leads and lags.

[10] The data employed for banking crisis episodes are from Laeven and Valencia (2008), available at www.luclaeven.com/Data.htm. See Cecchetti et al (2009) for a recent literature review.

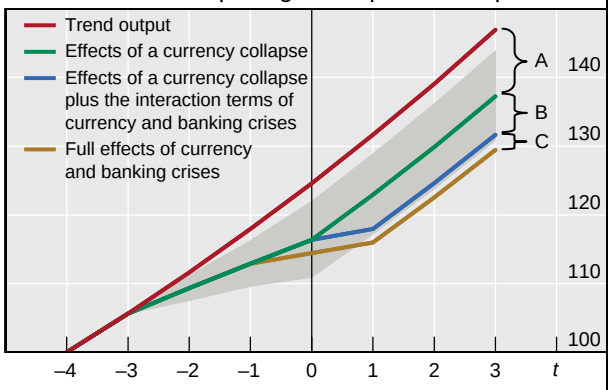
Case studies and twin crises

Effects of currency collapses on output

Country case fit



Twin crises: decomposing the impact on output



The currency collapse occurs at year $t = 0$, and no collapse occurs within a three-year window before and after the event. The shaded area displays the 95% confidence interval.

A: currency collapse = 6.6%; B: interaction effects = 3.8%; C: banking crises = 1.5%.; A + B + C: total cost of twin crises = 11.9%.

[1] Estimates based on two-way fixed effects panel regressions. The shaded area displays the 95% confidence interval.

Source: Author's calculations based on Bussière et al (2010). Graph 2

collapse alone (green line). The estimates for the costs of twin crises are in line with those reported in the recent literature. For instance, IMF (2009) estimates that twin crises induce output losses of a magnitude of 10% over a similar horizon. The results also confirm that losses due to currency crises materialise prior to the event, while those associated with banking crises tend to materialise afterwards. Therefore, it appears that the isolated effects of currency collapses identified earlier are robust.

Concluding remarks

Currency collapses are associated with permanent output losses of a magnitude of 6% of GDP on average. Such costs, however, tend to materialise *before* the currency collapse itself, which has a positive effect on output. This suggests that it may not be the currency collapse that reduces output, but rather the factors that led to the depreciation.

Before drawing policy conclusions we should emphasise that these results are subject to a number of caveats. Our estimations are based on the evolution of output and the exchange rate, but ignore many other factors that determine the welfare costs of a currency collapse. Most importantly, the analysis does not address the reasons why currency collapses occur in the first place. A vast theoretical and empirical literature examines the factors and shocks behind currency collapses.[11] Our analysis also has little to say about the mechanisms involved after the currency collapse takes place. While we cannot disentangle the various factors, our results do suggest that expansionary mechanisms tend to dominate. That said, even if currency collapses can have a positive

[11] See Bussière et al (2010) for references.

correcting effect on output, they may also have undesirable side effects; for instance, inflation may increase or the financial system may become unstable.

From a policy perspective, our analysis raises several additional questions. For instance, why does output remain below trend for so long? And what can policies do to close the output gap faster? Unfortunately, we do not have a straightforward or general answer to these.

In summary, to gain a full understanding of the implications of currency collapses on economic activity it is important to carefully examine the full circle of events surrounding the episode, ie before and after the event. In this sense, the patterns identified here are an invitation to marry the literature explaining the factors that preceded and triggered the currency collapse with that examining economies' adjustment before and after these episodes.

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Was it credit supply? Cross-border bank lending to emerging market economies during the financial crisis[1]

Cross-border bank lending dropped sharply during the financial crisis. This feature uses a panel regression framework to analyse the key drivers of cross-border bank lending to 21 emerging market economies between 1995 and 2009. The analysis suggests that both demand and supply factors contributed to the fall, but the impact of supply was stronger. The two factors seem to have had more balanced effects before the crisis.

JEL classification: F34, G15, G21.

The global financial crisis shook the foundations of international banking and finance. Many markets became dysfunctional, and many international banks needed to be rescued from bankruptcy. Economic growth halted and reversed in most countries. Cross-border bank lending to emerging markets also dropped sharply, raising serious policy questions: did declines in cross-border bank lending transmit advanced country financial shocks to emerging markets? Or did they simply reflect the lower need for financing? In other words, did supply or demand drive cross-border bank lending during the financial crisis?

Understanding the drivers of cross-border bank lending to emerging markets is the key to thinking about financial vulnerabilities. Cross-border bank lending in the BIS banking statistics measures foreign bank lending relevant for balance of payment financing. This is a fundamental variable for emerging markets, which have experienced balance of payment crises in recent decades. Policymakers are concerned about possible balance of payments stress, as perhaps evidenced by soaring foreign exchange reserves.

This feature finds that supply factors drove the fall in cross-border bank lending to emerging markets during the crisis. The demand for cross-border bank lending also declined, but it played a much smaller role. This contrasts with a much more balanced impact before the crisis.

[1] The author thanks Leonardo Gambacorta, Robert McCauley, Ramon Moreno and Christian Upper for useful comments and discussions. Pablo García-Luna provided excellent research assistance. The views expressed are those of the author and do not necessarily reflect those of the BIS.

To put these results in the proper context, one needs to examine a larger lending picture. There are other channels through which international banks provide loans to emerging market economies. The Committee on the Global Financial System (CGFS (2009)) documents the steady increase in local currency lending of subsidiaries; as McCauley et al (2010) show, this local currency lending held up much better than international lending during the financial crisis. Furthermore, as Takáts (2010) documents, there is substantial heterogeneity across emerging market experiences. Hence, policy conclusions on the role of internationally active banks are likely to be nuanced.

Empirical strategy

The analysis uses a panel regression framework that incorporates a global supply factor and country-specific demand factors. The dataset covers quarterly data from 21 emerging market economies[2] between early 1995 and the third quarter of 2009. Currency-adjusted locational claims are used as the dependent variable. This section explains the choice between the two available sets of BIS statistics – locational and consolidated data – and the identification strategy.

Locational data: advantages …

The BIS locational statistics have the advantage of measuring cross-border lending exactly, ie consistently with the principles underlying national accounts and balance of payment statistics. By contrast, the consolidated statistics measure international claims, which also include local claims in foreign currency besides cross-border lending. These local claims in foreign currency are not directly relevant for balance of payment financing, and might bias the results. They are also substantial in many emerging economies, so any bias might be non-trivial. Furthermore, changes in locational claims are also available in currency-adjusted form, which is not the case for the consolidated statistics.

… and disadvantages

However, using locational data also involves trade-offs. Most importantly, it only allows us to identify global supply factors. In contrast to consolidated data, the locational statistics do not permit researchers to exploit information on the variation across lender countries due to the presence of financial centres (eg London), which intermediate bank lending. These intermediated claims show up twice in the locational data: first, between the original lender's country and the financial centre, and second, between the financial centre and the end destination. Since it is not possible to track flows from their origin to their destination, bilateral flows cannot be explained by demand and supply factors of the two countries involved.[3]

Supply factor: volatility

This analysis uses the normalised quarterly volatility of the S&P 500 financial index as the global supply factor. Volatility tends to be high in periods

[2] Argentina, Brazil, Chile, China, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey.

[3] By contrast, McGuire and Tarashev (2008) show that it is possible to use country pair analysis with consolidated data.

of stress, which is in turn negatively related to credit supply. Higher volatility also implies that it is more difficult for banks to raise additional capital, which also limits credit supply. A further advantage is that volatility is computed from stock prices, which are based on large trading volumes and have a long track record. That said, the results are robust to alternative measures of supply, as discussed in the section on robustness below.

Demand factor: output

The most important demand factor in the analysis is GDP. This follows straightforwardly from the standard credit equation: higher levels of output require more credit, including more cross-border lending. Further demand factors are also considered below.

Analysis

The impact of country-specific demand factors and a global supply factor on cross-border lending is estimated in a panel regression (Table 1). The benchmark model estimates demand and supply factors jointly. All coefficients have the right sign and are statistically significant. The size of coefficients also seems plausible: a 1% increase in output is associated with around 0.2% higher cross-border bank lending. However, the demand and supply factors are correlated, which calls for standalone "demand only" and "supply only" estimates. By omitting the other variable, these models force their respective coefficients to assume the full effect of correlation between the two variables. They therefore provide upper bounds for the demand and supply effects, respectively. The relative proximity of the standalone and the respective benchmark coefficients suggests that the correlation does not substantially affect the magnitude of the estimates.

Supply was dominant during the crisis …

Supply dominated during the financial crisis, though demand factors also contributed to the decline in cross-border lending (Graph 1). At the height of the crisis in Q4 2008, cross-border lending to an average emerging market dropped 12.4%; supply factors contributed 8.4% and demand factors 2.5% to the decrease (leaving the remainder unexplained).

Demand and supply factors in cross-border lending[1]

Q1 1995–Q3 2009

Model	Observations	R-squared	Constant	Supply[2]	Demand[3]
Benchmark	1,197	0.18	0.0370***	–0.1009***	0.2032***
Demand only	1,197	0.12	0.0097**	…	0.2886***
Supply only	1,218	0.15	0.0463***	–0.1221***	…

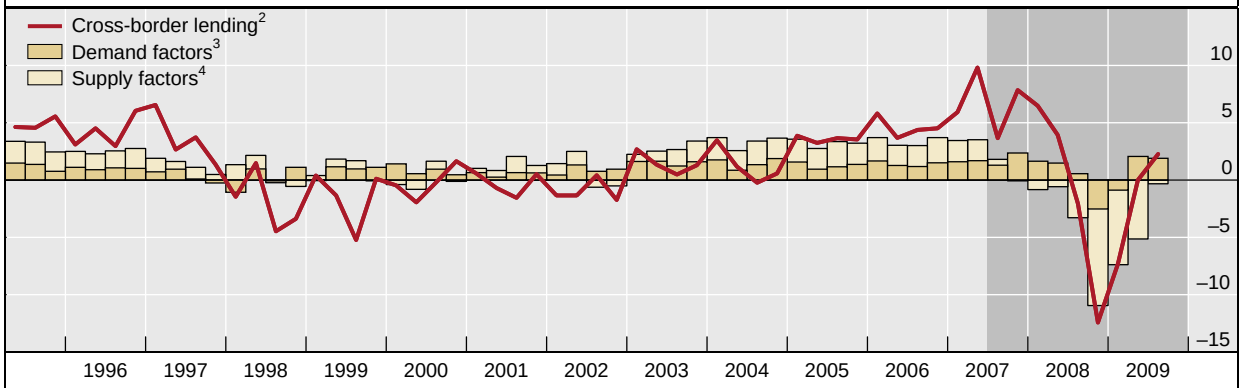
*, ** and *** denote coefficients significantly different from zero at the 10%, 5% and 1% level, respectively.

[1] The dependent variable is the quarter-on-quarter growth rate (logarithmic) in BIS reporting banks' currency-adjusted cross-border gross claims vis-à-vis each country in the sample. The series is built by taking end-1994 cross-border claims and adding consecutive currency-adjusted changes. The model is estimated through panel regression allowing for heteroscedasticity across countries and using country-specific fixed effects. [2] Volatility of US S&P 500 financial index, average for the period, normalised. [3] GDP of each country and at current prices, expressed in US dollars at average exchange rates, in logarithms, seasonally adjusted.

Sources: Datastream; national data; BIS locational banking statistics; BIS estimates. Table 1

Demand and supply factors in cross-border bank lending to emerging markets[1]

Average quarter-on-quarter changes, in per cent



[1] Demand and supply model reported in Table 1; for each quarter, the graph shows the average estimated forecasts across countries in the sample. [2] Quarter-on-quarter growth rate (logarithmic) in BIS reporting banks' cross-border gross claims vis-à-vis each country; actual data, in per cent. [3] Quarter-on-quarter growth rate (logarithmic) in seasonally adjusted nominal GDP in US dollar terms times its panel coefficient estimate plus a share of constant and country fixed effects. [4] Volatility of the S&P financials index times the panel coefficient plus a share of constant and country fixed effects. The constant and fixed effects are divided between demand and supply factors in the ratio of the appropriate standalone estimate constants and fixed effects.

Sources: Datastream; BIS estimates. Graph 1

… but demand and supply were more balanced beforehand

However, demand and supply factors tend to be more balanced during non-crisis periods. For example, between 2003 and 2007, demand and supply factors each contributed to around one third of cross-border lending (leaving the remaining third unexplained), suggesting that the credit boom of advanced countries also spilled over to emerging markets.

Of course, all these results apply only to an "average emerging market economy", and there is substantial heterogeneity among them. It is possible that the 1997–98 and 2002 crises meant very strong supply constraints for some economies. In the current crisis, international banks seem to have supported operations in some countries – even though they retrenched their activities in general. Takáts (2010) provides more details on these heterogeneous experiences.

It is important to emphasise that identifying demand and supply factors amid such heterogeneity is difficult. Hence, some caution is warranted, and there is ample room for further research. The next section aims to answer questions regarding the robustness of the results obtained from this analysis.

Robustness

The model is robust for out-of-sample estimation …

The model is fairly robust to straightforward modifications (Table 2). First, the model performs well out of sample (Model 1). Using observations up until end-2006, the model produces statistically significant coefficients of the right sign and approximately the right magnitude. Interestingly, this result is similar to McGuire and Tarashev's (2008) finding that out-of-sample estimates are somewhat lower than actual lending during the crisis. Cross-border lending held up better than one would have expected based on pre-crisis data. Second, the results are very robust to the exclusion of financial centres (Model 2).

… exclusion of financial centres …

Robustness of estimates[1]

Model	Observations	R-squared	Supply	Demand
Benchmark	1,197	0.18	–0.1009***	0.2032***
1 (out-of-sample)[2]	966	0.14	–0.1879***	0.1307***
2 (no financial centre)[3]	1,081	0.18	–0.1067***	0.1954***
3 (extended time frame)[4]	1,755	0.06	–0.1219***	0.0227**

*, ** and *** denote coefficients significantly different from zero at the 10%, 5% and 1% level, respectively.

[1] As defined in Table 1. [2] Using data up until end-2006. [3] Excluding Hong Kong SAR and Singapore. [4] Extended time frame from Q2 1978 to Q3 2009. Supply effect is Datastream US financial sector volatility.

Sources: Datastream; national data; BIS locational banking statistics; BIS estimates. Table 2

… and extending the time horizon

Financial centres might especially affect the demand factor estimate, as parts of cross-border lending to financial centres are not used locally. However, the exclusion of Hong Kong SAR and Singapore does not substantially change the demand or supply coefficients. Finally, extending the model to include the 1978–2009 period also shows the setup to be robust (Model 3). Data availability is an issue for some countries; hence the results might be less representative than the benchmark model. Nevertheless, the estimated supply impact is almost the same as in the main model.[4] he demand effect, however, seems to be substantially weaker.

The model is robust to various other supply …

The model's supply specification also seems to be robust to alternative measures of supply (Table 3). Replacing the volatility of the S&P 500 financial index with the implied volatility of a broader stock index paints a very similar picture. Lending surveys provide an alternative and very direct measure for

Robustness of supply estimates[1]

Model	Observa-tions	R-squared	Demand	Index volatility	Survey	TED (US)	TED (DE)	Index level
Benchmark	1,197	0.18	0.2032***	–0.1009***				
4	1,197	0.16	0.2340***		–0.0006***			
5	1,197	0.18	0.2019***	–0.0836***	–0.0002			
6	1,197	0.13	0.2639***			–0.0176		
7	1,197	0.13	0.2670***				–0.0227	
8	1,197	0.13	0.2548***					0.0703
9	1,197	0.18	0.1992***	–0.0967***				0.0156

*, ** and *** denote coefficients significantly different from zero at the 10%, 5% and 1% level, respectively. In parenthesis, t-statistics.

[1] As defined in Table 1. The definition of the independent variables is as follows: (i) demand: GDP, at current prices expressed in US dollars at average exchange rates, in logarithms, seasonally adjusted; (ii) index volatility: S&P 500 financial sub-index volatility is the quarterly average, normalised to 1995–2005 = 1; (iii) survey: US lending survey on credit tightening for medium and large firms; (iv) TED (US): US TED spreads; (v) Ted (DE): German TED spreads; (vi) index level: S&P 500 financial sub-index end-of-quarter levels, logarithmic change.

Sources: Datastream; national data; BIS locational banking statistics by residence; BIS estimates. Table 3

[4] The extended setup uses the volatility of the Datastream US financial sector index due to data availability. However, this should not affect results as the volatility measures are very similar.

supply effects. Using credit tightening measures from the US lending survey yields similar results to the benchmark model (Model 4). However, this survey coefficient is not significant after controlling for volatility (Model 5). The TED spread, the difference between the interest rates on interbank loans and short-term government debt, is also a natural measure of bank stress. The larger the spread, the riskier banks are perceived as being – and the less likely they are to be able to provide credit. However, the coefficient is not significant, though it has the right sign (Models 6 and 7). The inclusion of banks' stock market valuations as a measure of supply effects also does not change the results (Models 8 and 9). Valuation could be a proxy for the cost of capital, and thus for credit supply, as McCauley and Zimmer (1991) discuss. The higher the stock valuation, the lower the cost of capital, and the stronger credit supply is. Here the value of the S&P 500 financial index is considered as a supply measure: the coefficient has the right sign and its size seems to be economically significant. The economic message is similar to the benchmark model: before the crisis the two impacts are balanced, and during the crisis supply is somewhat stronger (though not to the same degree as in the benchmark model). Unfortunately, this supply coefficient is insignificant (Model 8). Furthermore, the impact disappears after controlling for stock market volatility (Model 9).

… and demand factors

The model is also robust to various changes to the demand specification (Table 4). The need to finance current account deficits could create additional demand for cross-border lending. Similarly, large interest rate differentials might induce foreign currency borrowing – perhaps through cross-border lending. Though coefficients for current account deficits and interest rate differentials are statistically significant and have the right sign, they are not economically relevant in explaining cross-border lending (Models 10, 11 and 12). Furthermore, in many emerging markets cross-border lending is connected to specific economic activities, such as export financing, certain

Robustness of demand estimates[1]

Model	Observations	R-squared	Supply	Demand	Current account	Interest rate diff	Exports	Investment	Consumption
Benchmark	1,197	0.18	–0.1009***	0.2032***					
10	1,117	0.18	–0.1007***	0.2028***	–0.4395***				
11	1,160	0.19	–0.1026***	0.1776***		–0.0006***			
12	1,080	0.19	–0.1017***	0.1810***	–0.3790**	–0.0005***			
13	1,197	0.18	–0.0992***	0.1982***			0.0123		
14	1,189	0.18	–0.0975***	0.1869***				–0.0593*	
15	1,073	0.18	–0.0620***	0.1852***					0.0319

*, ** and *** denote coefficients significantly different from zero at the 10%, 5% and 1% level, respectively. In parenthesis, t-statistics.

[1] As defined in Table 1. The definition of the independent variables is as follows: (i) supply: S&P 500 financial sub-index quarterly average volatility, normalised to 1995–2005 = 1; (ii) demand: GDP, at current prices expressed in US dollars at average exchange rates, in logarithms, seasonally adjusted; (iii) current account: quarterly current account deficit as a percentage of previous four-quarter average GDP; (iv) interest rate differential: vis-à-vis the USD interest rate; (v) exports: in US dollars, in logarithms; (vi) investments: gross fixed capital formation at current prices expressed in US dollars at average exchange rates, in logarithms; (vii) consumption: at current prices expressed in US dollars at average exchange rates, in logarithms.

Sources: Datastream; national data; BIS locational banking statistics by residence; BIS estimates. Table 4

investments or even consumer lending. Developments in some of these fields might better correspond to actual credit demand. However, measures of exports, investment and consumption are not only economically, but also mostly statistically insignificant after controlling for output (Models 13, 14 and 15). In sum, output seems to explain credit demand well on average.

Conclusion

The financial crisis posed many questions for policymakers. This feature aims to answer one such question: did supply or demand drive cross-border bank lending to emerging markets during the financial crisis?

The feature finds that supply mainly drove cross-border bank lending during the financial crisis. In other words, the stress experienced by major, internationally active banks appears to have limited the supply of cross-border lending. This finding is consistent with the general understanding that this time the financial crisis originated outside emerging markets. Cross-border bank lending was one of the channels through which the crisis propagated to emerging markets.

The paper also finds that demand and supply factors were much more balanced before the crisis. It seems that during tranquil times international banks allocate capital according to its most efficient use. Furthermore, it seems that this more balanced pattern is returning as the crisis subsides.

Hence, a trade-off arises for economic policy. On the one hand, cross-border lending seems to be a two-way street for contagion. Crises can be transmitted from advanced countries to emerging markets, not just the other way around. In addition, cross-border lending can transmit advanced country credit booms. Policymakers might want to reduce the resulting vulnerabilities. On the other hand, cross-border lending is normally a channel for efficient international capital allocation. Emerging markets might wish to continue to benefit from this access to international lending. Given the heterogeneity of emerging markets, the policy responses might differ substantially across countries.

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European banks' US dollar funding pressures[1]

With major central banks having re-established temporary foreign exchange swap facilities to alleviate growing strains in short-term funding markets, European banks' US dollar funding patterns are back in the news. This article documents the persistence of these banks' aggregate US dollar funding needs, pointing to an ongoing, large-scale reliance on sources of wholesale funds and, in particular, on the foreign exchange swap market.

JEL Classification: F34, F55, G01 G21.

Dollar funding problems are back in the news. On 9 May 2010, as part of a comprehensive policy package to address the risk of contagion among euro area sovereigns and financial institutions, the Federal Reserve and other major central banks re-established temporary foreign exchange (FX) swap facilities to alleviate growing strains in US dollar short-term funding markets in Europe.[2] An identical set of swap lines had been the major central banks' response to similar funding pressures in the wake of the Lehman failure in September 2008.[3] Both the re-emergence of these pressures (as apparent from rising Libor-OIS and cross-currency basis spreads) and the subsequent re-establishment of FX swap lines to alleviate them indicate that maturity mismatches in European banks' cross-currency activities have remained significant. As a result, with concerns about exposures to fiscally challenged sovereigns on the rise, European banks have apparently found it difficult to roll over their short-term US dollar funding positions. This article documents European banks' aggregate US dollar funding needs in more detail and shows how some European banking systems have been more successful than others in reducing their reliance on short-term sources of US dollar funds relative to the levels seen before the recent financial crisis.

[1] The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS.

[2] In addition to the Federal Reserve, these facilities involve the Bank of Canada, the Bank of England, the European Central Bank and the Swiss National Bank. The arrangement with the Bank of Canada supports drawings of up to $30 billion, while those with the other central banks are designed to allow tenders of US dollars at fixed rates for full allotment. See Federal Reserve (2010).

[3] See Fender and Gyntelberg (2008) and BIS (2009).

Cross-currency financing and the FX swap market

In principle, a non-US bank can finance its foreign currency assets in two ways. It can borrow foreign currency outright from the interbank market or from non-bank market participants or central banks, using retail (ie deposits) as well as wholesale (eg commercial paper or repurchase arrangements) instruments. Alternatively, the bank can use FX swaps to convert liabilities in its domestic or third currencies (which will themselves be from either retail or wholesale sources) into the desired funds for the purchase of foreign currency assets. Either way, it will seek to match the level of its foreign currency investments with on- or off-balance sheet liabilities in the same currency to avoid taking open FX exposures. Yet, to the extent that these assets and liabilities have different maturities, the bank will be exposed to *embedded maturity mismatch* and, hence, face *funding* (or rollover) *risks*.

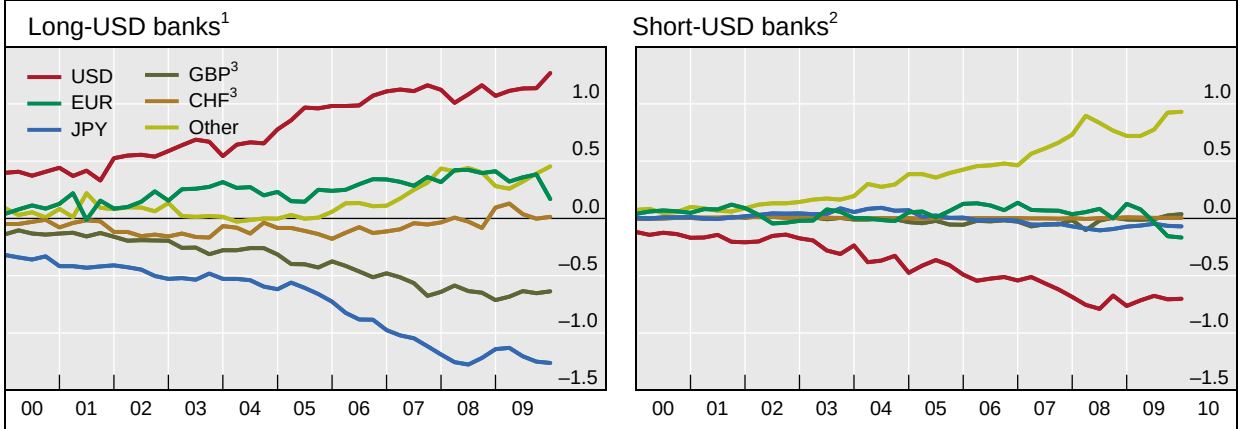
Cross-currency financing …

For many national banking systems, foreign currency assets persistently exceed the amount of outright foreign currency funding. Consolidated banking data thus point to structural cross-currency funding needs arising from banks' international activities. The underlying FX swap positions, which are off-balance sheet and notoriously hard to track with available volume data, must be inferred from reported on-balance sheet activities at the level of national banking systems. Specifically, assuming that banks have very small open FX positions, any *on-balance sheet* net (ie assets minus liabilities) long or short position in a particular currency provides an estimate of banks' offsetting net FX swaps (and futures) off-balance sheet positions in that currency.

Using the BIS international banking statistics, Graph 1 aggregates these on-balance sheet positions by currency separately for two groups of banking systems: those that had either an excess or a shortfall of on-balance sheet US dollar assets relative to US dollar liabilities at the start of the crisis. We label these banking systems as *long-USD* and *short-USD*, respectively. If banks

Long- and short-USD banks' net FX swap positions, by currency

In trillions of US dollars



[1] Banking systems with more on-balance sheet US dollar assets than US dollar liabilities at end-Q2 2007: Canadian, Dutch, German, Indian, Japanese, Swiss and UK banks. [2] Banking systems with fewer on-balance sheet US dollar assets than US dollar liabilities at end-Q2 2007: Australian, Belgian, Chinese Taipei, Danish, Finnish, French, Greek, Hong Kong, Italian, Luxembourg, Norwegian, Portuguese, Spanish, Swedish and Turkish banks. [3] Positions booked by offices located in Switzerland (for CHF) and in the United Kingdom (for GBP). CHF and GBP positions reported by offices located elsewhere are included in "Other".

Sources: BIS consolidated statistics (immediate borrower basis); BIS locational statistics by nationality. Graph 1

hedge their foreign exchange risk in the way described above, then these figures imply that, at end-2009, long-USD banks (shown in the left-hand panel) demanded an estimated aggregate of $1.27 trillion (net) in US dollars from the FX swap market. In exchange, these banks provided an equal amount of yen, euros, sterling, Swiss francs and other currencies. On the other side (shown in the right-hand panel), short-USD banks were net providers of roughly $700 million to the FX swap market. The difference of some $570 billion is accounted for by non-bank participants not captured by BIS banking data.

Measuring US dollar funding gaps[4]

Gauging the funding risk arising from these activities requires information on the amount of banks' net short-term US dollar liabilities at any point in time (ie those short-term liabilities that are not offset by assets of corresponding maturity). This, in turn, necessitates a breakdown by *residual maturity* of banks' US dollar-denominated assets and liabilities. Although maturity information is not available, the counterparty type (bank, non-bank or central bank) can serve as a proxy. Specifically, banks' US dollar-denominated claims on non-banks can be thought of as their desired dollar-denominated investment portfolio. This portfolio of non-bank assets includes banks' retail and corporate lending, lending to hedge funds, and holdings of securities ranging from US Treasury and agency bonds to structured products. These exposures are of varying maturities, but, on average, are likely to be longer-term than the funding that supports them. In contrast, interbank positions (both assets and liabilities) are typically short-term, as are any FX swap positions used to convert funds into US dollars.

… can embed sizeable maturity mismatches in bank balance sheets

Graph 2 (left-hand and centre panels) illustrates the size of these positions (in both gross and net terms) for European banks that were long US dollars at the start of the crisis (Graph 3 presents corresponding data for short-USD banking systems). Additional assumptions about banks' liabilities to non-banks then allow the construction of various estimates of maturity mismatch – what might be called *funding gaps*.

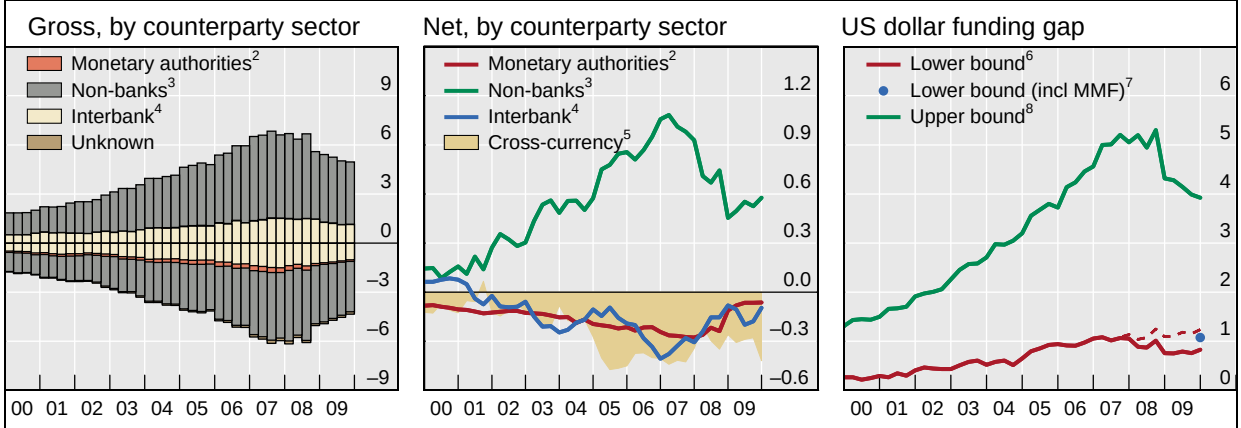
Measures of these funding gaps are presented in the right-hand panels of Graphs 2 and 3, aggregated for long- and short-USD banks, respectively.[5] If liabilities to non-banks are all assumed to be long-term, then the lower bound estimate of these banking systems' overall US dollar funding gap is net interbank borrowing (if positive) plus net borrowing from the FX swap market, which is backed out from the balance sheet identity (see Table 1 for an illustration). To this, any net US dollar borrowing from official monetary authorities (mainly via deposits of currency reserves) is added – positions with

[4] See McGuire and von Peter (2009). This article updates and extends these earlier results.

[5] Note that the overall estimate of the US dollar funding gap will critically depend on, among other things, the sample of national banking systems included in the calculation. Furthermore, for technical reasons related to the compilation of the BIS banking statistics, the quality of the funding position estimates differs across banking systems, with data for Swiss banks being particularly difficult to analyse. See McGuire and von Peter (2009) for details.

Long-USD European banks' on-balance sheet USD positions[1]

In trillions of US dollars



[1] Estimates are constructed by aggregating the worldwide on-balance sheet cross-border and local positions reported by internationally active banks headquartered in Germany, the Netherlands, Switzerland and the United Kingdom. [2] Positions vis-à-vis official monetary authorities. Excludes liabilities to Japanese monetary authorities placed in banks located in Japan. [3] International positions vis-à-vis non-banks plus local positions vis-à-vis US residents (all sectors) booked by banks' offices in the United States. No sectoral breakdown is available for these positions. [4] Estimated net interbank lending to other (unaffiliated) banks. [5] Implied cross-currency funding (ie FX swaps), which equates US dollar assets and liabilities. [6] The dashed red line is the estimate after adding back in writedowns of assets (based on Bloomberg data). [7] Lower bound estimate plus estimated US dollar liabilities to money market funds (based on JPMorgan data). [8] Same as the lower bound estimate, but all liabilities to non-banks are assumed to be short-term.

Sources: Bloomberg; JPMorgan; BIS consolidated statistics (immediate borrower basis); BIS locational statistics by nationality. Graph 2

unclear maturity, but which proved to be volatile during the recent crisis. The upper bound estimate is then set simply by adding liabilities to non-banks to the lower bound measure, under the assumption that these are short-term (and, hence, might not be replaced).[6]

Estimated funding gaps …

The range defined by both estimates implies that long-USD European banks' aggregate US dollar investments were subject to considerable funding risk at the start of the crisis. Even by the lower bound measure, the estimated US dollar funding gap for Dutch, German, Swiss and UK banks combined reached some $1 trillion by mid-2007, having built up gradually over time.

Stylised bank balance sheet

US dollar book (assets and liabilities denominated in US dollars)

Assets	Liabilities
Claims on non-banks (assumed long-term)	Liabilities vis-à-vis non-banks (short- or long-term) Net interbank borrowing (short-term) Net borrowing from monetary authorities (short-term) Net borrowing via the FX swap market (short-term)

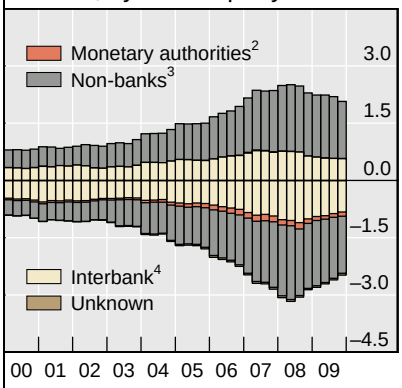
Table 1

[6] For long-USD banks with positive net interbank borrowing, the first (lower bound) measure is identically equal to banks' net US dollar claims (assets minus liabilities) on the non-bank sector. The second (upper bound) measure, in turn, is identically equal to banks' gross US dollar claims on non-banks.

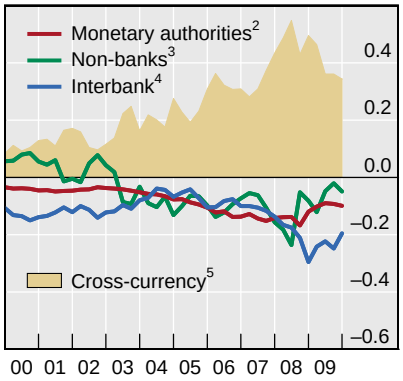
Short-USD European banks' on-balance sheet USD positions[1]

In trillions of US dollars

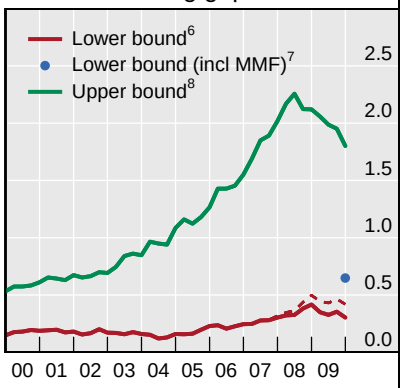
Gross, by counterparty sector



Net, by counterparty sector



US dollar funding gap



[1] Estimates are constructed by aggregating the worldwide on-balance sheet cross-border and local positions reported by internationally active banks headquartered in Belgium, Denmark, Finland, France, Greece, Italy, Luxembourg, Norway, Portugal, Spain and Sweden. [2] Positions vis-à-vis official monetary authorities. Excludes liabilities to Japanese monetary authorities placed in banks located in Japan. [3] International positions vis-à-vis non-banks plus local positions vis-à-vis US residents (all sectors) booked by banks' offices in the United States. No sectoral breakdown is available for these positions. [4] Estimated net interbank lending to other (unaffiliated) banks. [5] Implied cross-currency funding (ie FX swaps), which equates US dollar assets and liabilities. [6] The dashed red line is the estimate after adding back in writedowns of assets (based on Bloomberg data). [7] Lower bound estimate plus estimated US dollar liabilities to money market funds (based on JPMorgan data). [8] Same as the lower bound estimate, but all liabilities to non-banks are assumed to be short-term.

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

Banks obtained the funds to close this gap mainly from non-US dollar sources, and then swapped the proceeds into the US currency. If all liabilities to non-banks are treated as short-term funding, the upper bound estimate of these long-USD banks' combined US dollar funding gap would have been roughly $5 trillion as of mid-2007.

Cross-currency funding patterns for long-USD banks contrast with those for the short-USD banking systems. In the latter, asset holdings (domestic or foreign) were largely built up in the domestic currency. Banks, therefore, were able to fund part of these activities from their domestic deposit base, with the balance obtained from domestic wholesale and foreign currency sources. As a result, short-USD banks accumulated net short on-balance sheet positions in US dollars, which were then channelled through the FX swap market to fund activities in their domestic as well as other currencies. The aggregate funding gap arising from this activity reached an estimated $400 billion–$2.1 trillion in late 2008.

Dollar funding during the crisis

The estimates of the US dollar funding gaps for both groups of banks have come down over the past year. Data up to end-2009 show dollar funding gaps within a range of $820 billion–$3.9 trillion for the long-USD banks,[7] and within $300 billion–$1.8 trillion for short-USD banks. If estimates (taken from

[7] This range becomes $800 billion–$3.4 trillion if Dutch banks, which have moved since the start of the crisis and the break-up of ABN AMRO from a long on-balance sheet US dollar position to a short US dollar position, are excluded.

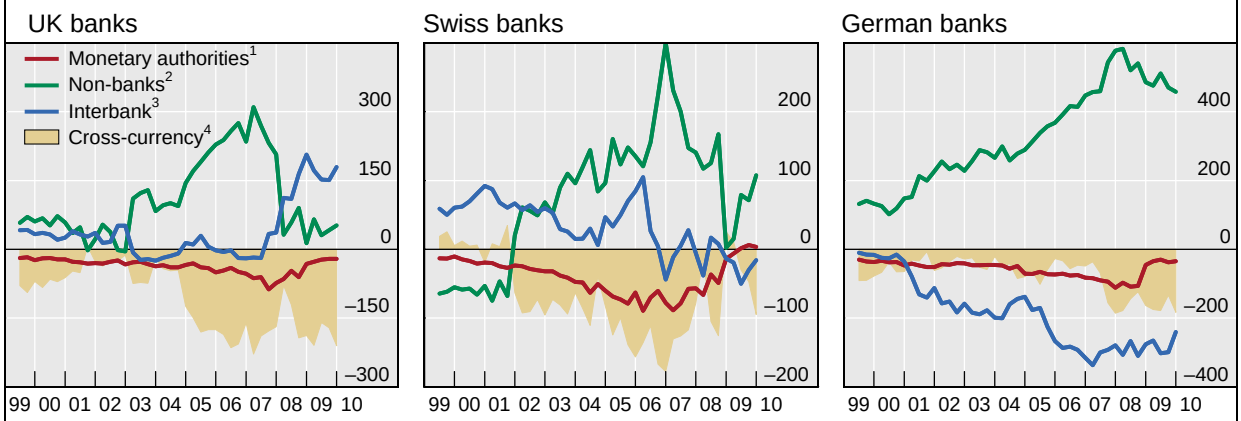
Roever (2010)) of banks' reliance on money market funds (which are treated as non-bank counterparties in the BIS banking data) are included in the analysis as short-term liabilities, then the lower bound estimates at end-2009 are considerably higher in each case (as indicated by the blue dots in the right-hand panels of Graphs 2 and 3). Overall, while lower than before the crisis, this persistence of funding gaps on European banks' balance sheets points to an ongoing, large-scale reliance on sources of wholesale funds and, for long-USD banks, on the FX swap market.

... remained large up to end-2009 ...

Moreover, there are also some aspects of bank behaviour that could make any observed declines in the measures misleading. One issue is whether banks close out funding positions as soon as assets are written down. Asset writedowns reduce the reported stock of US dollar claims and thus lead to a decline in net claims on non-banks. Since the net FX swap positions have to be backed out as a residual from the balance sheet identity, any writedown on the asset side is automatically reflected in a reduction in the implied net FX swap positions. As a result, the accuracy of the estimated US dollar funding gap depends on the extent to which banks *actually* unwound the funding positions supporting these written-down assets as they matured. If the long-USD banks closed out *all* these positions by, for example, buying US dollars in the spot market, then the original lower bound estimate of their US dollar funding gap is correct. If, on the other hand, banks have *not* closed out all their funding positions (perhaps because they do not expect writedowns to be permanent), then the observed measure would underestimate the true funding gap by the amount of the corresponding writedowns (ie the difference between the solid and dashed red lines in the right-hand panels of Graphs 2 and 3). In this latter case, assuming that banks' writedowns are related mainly to US dollar-denominated non-bank assets, the lower bound estimate of the US dollar funding gap at end-2009 could still be in the neighbourhood of its pre-crisis peak, and considerably higher than the estimated $800 billion lower bound gap

Net US dollar-denominated positions, by counterparty sector

In billions of US dollars



[1] Positions vis-à-vis official monetary authorities. Excludes liabilities to Japanese monetary authorities placed in banks located in Japan. [2] International positions vis-à-vis non-banks plus local positions vis-à-vis US residents (all sectors) booked by banks' offices in the United States. No sectoral breakdown is available for these positions. [3] Estimated net interbank lending to other (unaffiliated) banks. [4] Implied cross-currency funding (ie FX swaps), which equates US dollar assets and liabilities.

Sources: BIS consolidated statistics (immediate borrower basis); BIS locational statistics by nationality; authors' calculations. Graph 4

that results when long-USD banks' funding positions are assumed to have been closed in lockstep with asset writedowns.

... but differed by banking system

Importantly, however, banking systems differ in their reliance on short-term US dollar funds (Graph 4). Swiss banks' net non-bank US dollar positions have fallen from $300 billion before the crisis to just over $100 billion most recently, following a reduction in the size of their US dollar books (centre panel). Reflecting the same trend, UK banks' net non-bank positions have also come down significantly (left-hand panel). The change in Dutch banks' positions (not shown), in turn, appears to be largely the result of the break-up of ABN AMRO, a source of sizeable US dollar activities before the crisis. German banks, finally, stand out as maintaining the largest US dollar funding gaps among European banking systems, at least on the basis of BIS data (right-hand panel).

Possible implications

The funding patterns documented in this article point to an ongoing, large-scale reliance of European banks on sources of wholesale cross-currency funding. As a result, banks are required to roll over significant parts of their funding at relatively short maturities, which are bound to become even shorter if conditions deteriorate. Reduced access to outright funding in individual currencies could then force banks to rely even more strongly on FX swap markets for any additional foreign currency funds or require the transfer of collateral across jurisdictions (for use in repo or other transactions).

Such funding patterns put a premium on contingency funding arrangements for international banks and underline the need for further diversification in banks' funding profiles (ie a reduced reliance on short-term foreign currency funds). In particular, they point to potential benefits from improvements to FX swap market infrastructure, such as the use of central counterparties to allow multilateral netting and more efficient collateral management. In addition, broader measures to address systemic cross-border funding pressures could include mechanisms that facilitate the cross-border use of collateral in central bank refinancing operations or regional swap arrangements on the basis of reserve pooling.[8]

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[8] See CGFS (2010) for a detailed discussion of these measures; CPSS (2006) examines the mechanics of cross-border collateral arrangements.

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