

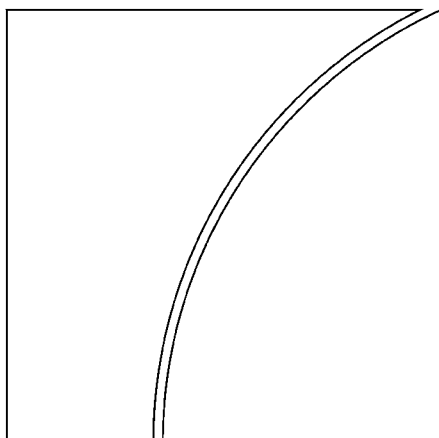


BANK FOR INTERNATIONAL SETTLEMENTS

# BIS Quarterly Review

September 2012

International banking  
and financial market  
developments



BIS Quarterly Review  
Monetary and Economic Department

Editorial Committee:

Claudio Borio  
Stephen Cecchetti

Dietrich Domanski  
Philip Turner

Christian Upper

General queries concerning this commentary should be addressed to Christian Upper (tel +41 61 280 8416, e-mail: [Christian.upper@bis.org](mailto:Christian.upper@bis.org)), queries concerning specific parts to the authors, whose details appear at the head of each section, and queries concerning the statistics to Philip Wooldridge (tel +41 61 280 8006, e-mail: [philip.wooldridge@bis.org](mailto:philip.wooldridge@bis.org)).

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## Sir Andrew Crockett 1943–2012

It was with deep regret that the BIS learned of the recent death of Sir Andrew Crockett after a long illness.

As General Manager from 1994 to 2003, he made an exceptional contribution to our institution, leading the Bank through a period of considerable change. Today's BIS is in large part a product of Sir Andrew's vision of a global cooperative institution serving central banks around the world and a forum for promoting international financial stability.

Even after stepping down as General Manager, he stayed in close touch with the BIS, maintaining a keen interest in the organisation's financial stability mission.

Those of us who worked with Sir Andrew remember him as an inspiring man of great intellectual distinction with a wonderful sense of humour. He was a good friend, whom we will miss very much. Our thoughts are with his family.

Jaime Caruana,  
General Manager



# BIS Quarterly Review

September 2012

## International banking and financial market developments

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## Notations used in this Review

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

Differences in totals are due to rounding

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

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## Search for yield as rates drop further<sup>1</sup>

During the period from mid-June to mid-September, the trajectory of global growth shifted downwards and concerns about the sustainability of euro area government debt and the future of the monetary union gained new traction. Against the backdrop of lower growth, many central banks loosened monetary policy, cutting interest rates or expanding unconventional policies. Some of the policy measures and announcements triggered large asset price reactions.

Together with central bank actions, the combination of weak growth and portfolio reallocations driven by concerns about sovereign risk in the euro area pushed yields on the debt of a number of highly rated sovereigns to unprecedented lows. In a range of European countries, nominal yields on short-term government bonds were even deep in negative territory. Such low yields on advanced economy government bonds spurred investors to search for investment opportunities that offered some extra return. The result was a rally in equities and corporate bonds. Search for yield may also partly explain the extraordinarily low volatility in credit, foreign exchange and equity markets over the past several months.

### Global growth outlook deteriorates further

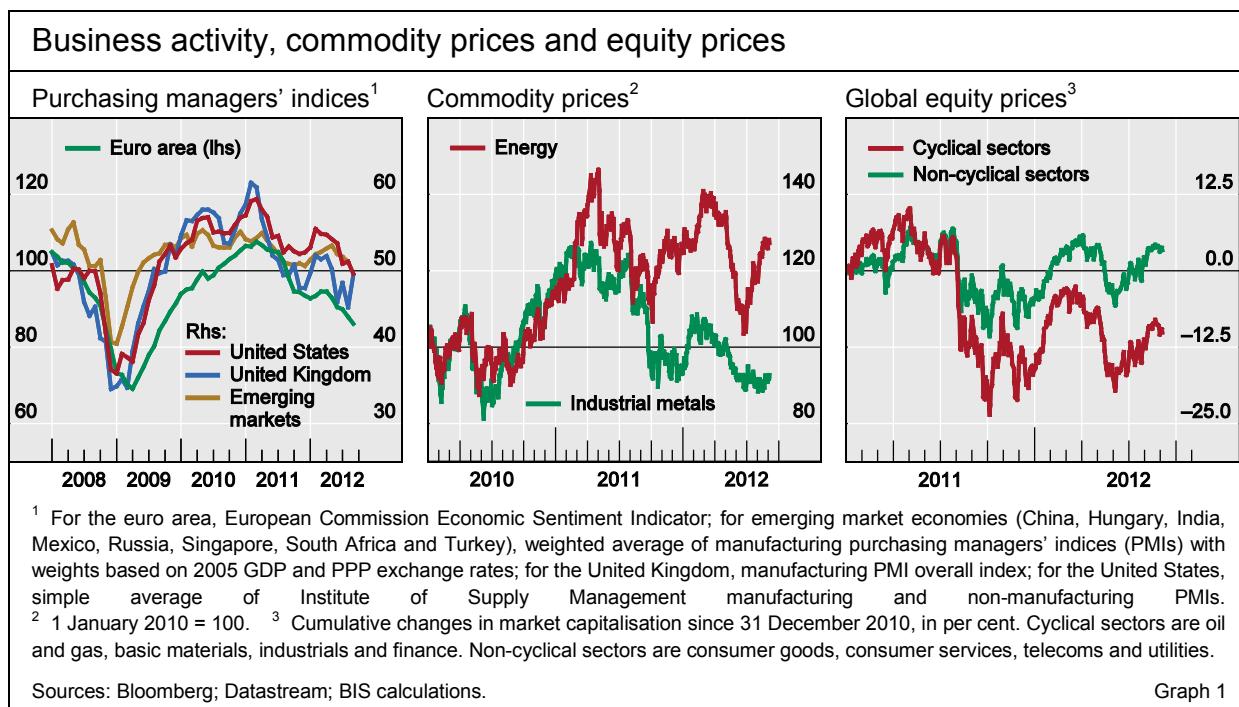
Growth weakness  
spreads ...

With macroeconomic data releases surprising mostly on the downside, it became increasingly clear that global economic growth had faltered. Provisional estimates suggested that growth in the second quarter had slowed moderately to 0.4% in the United States and to 0.3% in Japan. The euro area economy contracted by 0.2% and that of the United Kingdom by 0.7%. Surveys of purchasing managers pointed to a further deceleration of economic activity in the third quarter (Graph 1, left-hand panel). The weakness also spread to Germany and several emerging market economies with previously more robust growth.

For the United States, some business cycle indicators such as non-farm payrolls turned out slightly better than expected in July. Nevertheless, the

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<sup>1</sup> This article was prepared by the Monetary and Economic Department of the BIS. Questions about the article can be addressed to Andreas Schrimpf ([andreas.schrimpf@bis.org](mailto:andreas.schrimpf@bis.org)), Vladyslav Sushko ([vlad.sushko@bis.org](mailto:vlad.sushko@bis.org)) and Nicholas Vause ([nick.vause@bis.org](mailto:nick.vause@bis.org)). Questions about data and graphs should be addressed to Jhuvesh Sobrun ([jhuvesh.sobrun@bis.org](mailto:jhuvesh.sobrun@bis.org)) and Agne Subelyte ([agne.subelyte@bis.org](mailto:agne.subelyte@bis.org)).



economic situation remained fragile, with uncertainty about major fiscal tightening scheduled for the start of 2013 weighing on the growth outlook. Chinese growth fell in the second quarter to its lowest level in three years, and weaker than expected purchasing manager figures pointed to a further slowdown of economic activity.

This negative news had surprisingly little effect on the prices of growth-sensitive assets. Prices of industrial metals such as copper did fall (Graph 1, centre panel). Energy prices, however, picked up as a consequence of tight oil supply conditions and rising international political tensions with Iran. Global equity prices also rose, including in cyclical sectors (Graph 1, right-hand panel). The rise in equity prices was supported by corporate earnings exceeding expectations. During the recent earnings season in the United States and Germany, for example, profits of S&P 500 and DAX companies exceeded analysts' forecasts by about 5% and 16%, respectively. Equity prices also reacted strongly to announcements of additional central bank measures to support the economy (see below) and were affected by expectations about further stimulus should the economic outlook deteriorate further. This points to expected lower discount rates as another driver of recent equity price increases.

... but equity markets rally

### Euro area debt crisis continues to weigh on markets

The euro area debt crisis continued to be a key concern for global investors. Mid-June elections in Greece led to the formation of a pro-euro coalition government, easing fears of an imminent exit from the single currency. Greek government bond yields subsequently fell from their post-debt restructuring peaks. Nevertheless, investors anxiously awaited the outcome of an



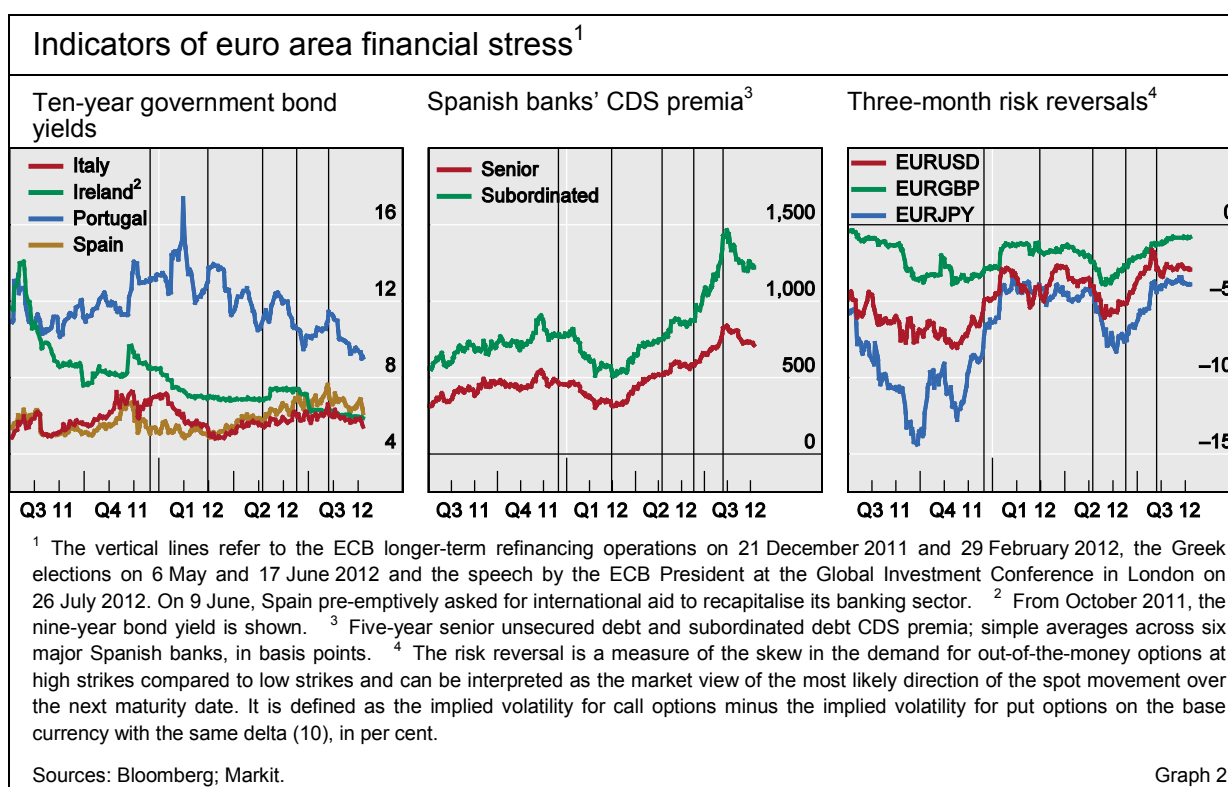
assessment by the “troika” of Greek compliance with the terms of its support later in the year.

Spanish borrowing costs soar

Meanwhile, Spain’s borrowing costs rose significantly when the government asked for international financing to help recapitalise the country’s banks in early June. As investors feared that their claims would become further subordinated to the new loans, the request for international credit led to a surge in Spanish government bond yields over much of June and July (Graph 2, left-hand panel). While EU finance ministers confirmed in late July that the new loans will not become senior to existing debt, the terms of the recapitalisation did require some writedowns on subordinated bank debt. Credit default swap (CDS) premia on subordinated debt issued by several Spanish banks rose following an early trickle of this news on 11 July. Premia on senior debt also rose as investors acknowledged the risk that it could be similarly affected in the future (Graph 2, centre panel). Spanish bank covered bond spreads increased as well, partly reflecting the effects of the weak economy on the quality of collateral pools, composed largely of property-related loans.

Uncertainty about the effect of the international credit on the sovereign debt burden was another key driver of Spain’s surging borrowing costs. This was further reinforced by the deepening of the country’s recession and by new requests by some Spanish regions for emergency credit lines from the central government. All this led Spanish 10-year sovereign yields to increase by about 70 basis points to reach a peak of 7.6% on 24 July. The distress was even more pronounced in the case of shorter-term bonds, with two-year yields climbing more than 170 basis points to 6.8% by the end of July.

Other euro area sovereign bond markets also faced selling pressure over this period. Notably, 10-year yields on Italian government debt tracked higher



for much of July, reaching a peak of 6.6% on 24 July. Contagion from Spain may have accounted for part of this rise, but domestic factors also played a role as the Italian central government provided financial assistance to Sicily and Moody's downgraded Italy's sovereign rating by two notches on 13 July. In currency markets, the trade-weighted external value of the euro declined up to the end of July as capital flowed out of the euro area.

Following the ECB President's statement in a speech on 26 July that "within our mandate, the ECB is ready to do whatever it takes to preserve the euro", yields on Italian and Spanish bonds fell significantly. Yields on shorter-term paper dropped the most. Market expectations that any prospective ECB policy action would focus on purchasing shorter-term bonds may have accounted for part of this decline. Details of the ECB's new programme of outright monetary transactions (OMTs) were finally unveiled on 6 September. The programme involves discretionary sterilised purchases of short-term sovereign bonds under certain conditions and is subject to a prior request by the respective country's government for international assistance via the European Financial Stability Facility / European Stability Mechanism (EFSF/ESM).

Sentiment turns ...

The news of a more active stance of the ECB had a broad impact on market sentiment. Global equity prices surged over much of August. Yields on German bunds and other higher-rated euro area government bonds rose. Also around this time, the Irish government regained access to international capital markets by issuing longer-term bonds with yields below those of Spain. The value of the euro against other major currencies recovered during most of August. Nevertheless, exchange rate risk reversals suggested that investors continued to pay a premium to hedge against future sharp decreases in the value of the currency (Graph 2, right-hand panel).

... on news about policy action

## Weak growth outlook prompts central bank support

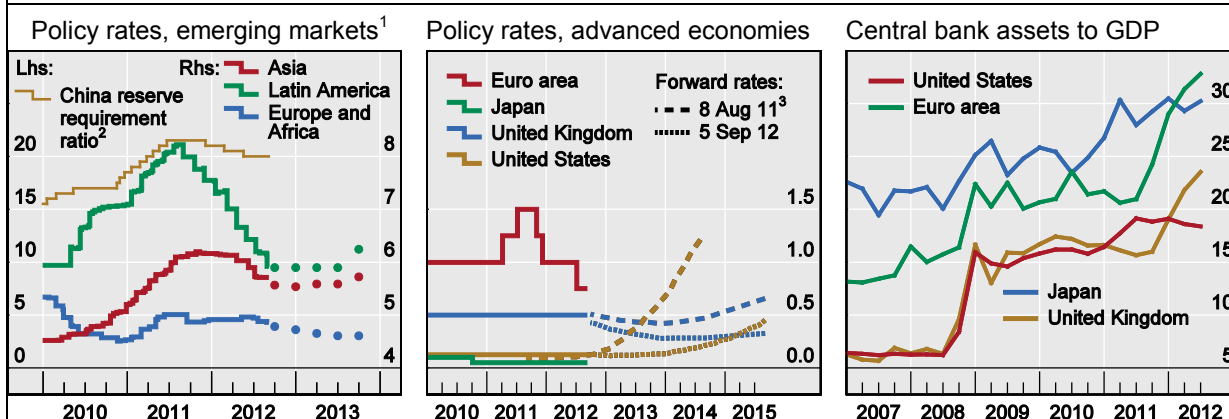
Against the background of the weaker growth outlook, central banks in both emerging market and advanced economies took further steps to ease monetary policy. The central banks of Brazil, China, Colombia, the Czech Republic, Israel, Korea, the Philippines and South Africa lowered policy rates (Graph 3, left-hand panel). The rate cuts in China followed reductions in bank reserve requirement ratios earlier in the year. Forecasts of future policy rates in emerging market economies (dots in Graph 3, left-hand panel) imply few further cuts, however.

Some central banks cut rates further ...

Central banks in advanced economies also eased monetary policy further. In early July, the ECB lowered its main refinancing rate by 25 basis points to 75 basis points and cut the interest rate on its deposit facility to zero (Graph 3, centre panel). This brought the remuneration of balances in the deposit facility into line with that on banks' current accounts, reducing the incentive to transfer excess reserves into the deposit facility at the end of each business day. That said, banks kept the total amount of reserves unchanged. Also, some money market funds stopped accepting new investments, as negative nominal interest rates made it difficult for them to offer positive returns to their investors.

## Monetary policy indicators

In per cent



<sup>1</sup> Asia: China, Chinese Taipei, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines and Thailand. Europe and Africa: the Czech Republic, Hungary, Poland, Russia and South Africa. Latin America: Brazil, Chile, Colombia and Mexico. Weighted averages based on 2010 GDP and PPP exchange rates. The dots show JPMorgan Chase forecasts as of 31 August 2012 for policy rates at the end of September 2012, December 2012, March 2013, June 2013 and September 2013. <sup>2</sup> For major banks. <sup>3</sup> Last trading day before the Federal Reserve first announced its intention to keep the federal funds rate exceptionally low over a specified horizon.

Sources: Bloomberg; Datastream; JPMorgan Chase; national data.

Graph 3

... while others expand unconventional policies

With policy rates already close to zero and expected to remain around this level for quite some time, central banks in large advanced economies extended or renewed unconventional monetary policies targeting long-term high-quality assets (Graph 3, centre and right-hand panels). On 5 July, the Bank of England announced an increase in the size of its Asset Purchase Facility by £50 billion to a total of £375 billion, financed by an expansion of central bank reserves. Likewise, on 20 June, the Federal Reserve announced a second programme to extend the maturity of its Treasury holdings. The programme involves buying \$267 billion of Treasury securities with remaining maturities of six to 30 years financed by the sale or redemption of an equal amount of Treasuries with maturities of three years or less. The Bank of Japan continued its regular purchases as a part of its Asset Purchase Program.

Discussions about central bank asset purchases featured prominently in financial commentary during the period. But, as it turned out, the actual announcements had surprisingly little impact on asset prices (see box). By contrast, government bond yields reacted strongly to news about the future path of short-term interest rates. For example, yields on two-year US Treasury notes fell by 10 basis points on 22 August after the publication of the minutes of the latest meeting of the Federal Open Market Committee. Observers interpreted the minutes as indicating that the federal funds rate target could remain low for even longer than previously expected. Yields also dropped significantly on 31 August when Chairman Bernanke expressed concern over the US labour market situation and alluded to costs and benefits of further unconventional policies in his address at the Jackson Hole conference (Graph A). This indicated that market participants remained highly sensitive to news of future policy direction.

## Unconventional policies: market impact and countervailing factors

*Torsten Ehlert and Vladyslav Sushko*

Central bank asset purchases can affect credit growth and real activity through a variety of channels.<sup>9</sup> Policy transmission begins with market reactions to official statements or anticipations thereof. The mere announcement of asset purchases can signal commitment to monetary stimulus, thereby lowering the expected path of future short-term rates (signalling channel). In addition, central banks can remove duration from the market through purchases of longer-term securities. This will lower longer-term yields, inducing investors to rebalance their portfolios towards assets with greater risk (portfolio rebalancing channel). While such portfolio rebalancing takes time, in forward-looking markets the central bank's commitment to purchases alone can trigger portfolio adjustments. Further, if asset purchase programmes are anticipated, investors will price them in even before the specifics are announced. As a result, policy announcements will affect yields only if they deliver an additional element of "surprise" to the market.

Unconventional asset purchase measures were typically first introduced during the crisis management stage, when the solvency and liquidity of major financial institutions hung in the balance.<sup>9</sup> Yet, as the focus shifts to economic recovery, at least outside the euro area, this has raised questions about diminishing market reactions to further extensions of such purchases.

A comparison of yield changes on key assets at the time of past programme announcements with more recent ones suggests that the announcement effects of asset purchase programmes have waned. Yields on Treasury securities, mortgage-backed securities (MBS) and corporate bonds hardly moved on 20 June 2012, when the Federal Reserve announced the extension of the maturity of its Treasury portfolio (Graph A). In contrast, the September 2011 announcement of the initial Maturity Extension Program (MEP1), along with further purchases of MBS, coincided with immediate declines in long-term yields of Treasuries and MBS. Furthermore, the announcement of the first round of Large-Scale Asset Purchases (LSAP1) back in 2009 was associated with significantly larger declines in Treasury yields across all maturities, ranging from 26 to 51 basis points. Similarly, the response of gilt yields to the Bank of England's expansion of its Asset Purchase Facility (APF2), while still significant for five- and 10-year maturities, has been muted compared to the introduction of the programme back in March 2009.

A variety of factors may explain these patterns. First, the novelty and surprise element of asset purchase measures may have waned. In this case, changes in asset prices on announcement days may understate the overall market impact since investors may have learned to anticipate them. As a result, greater announcement impact may now come from less anticipated statements and policy innovations, such as when the Bank of England announced the Funding for Lending Scheme.

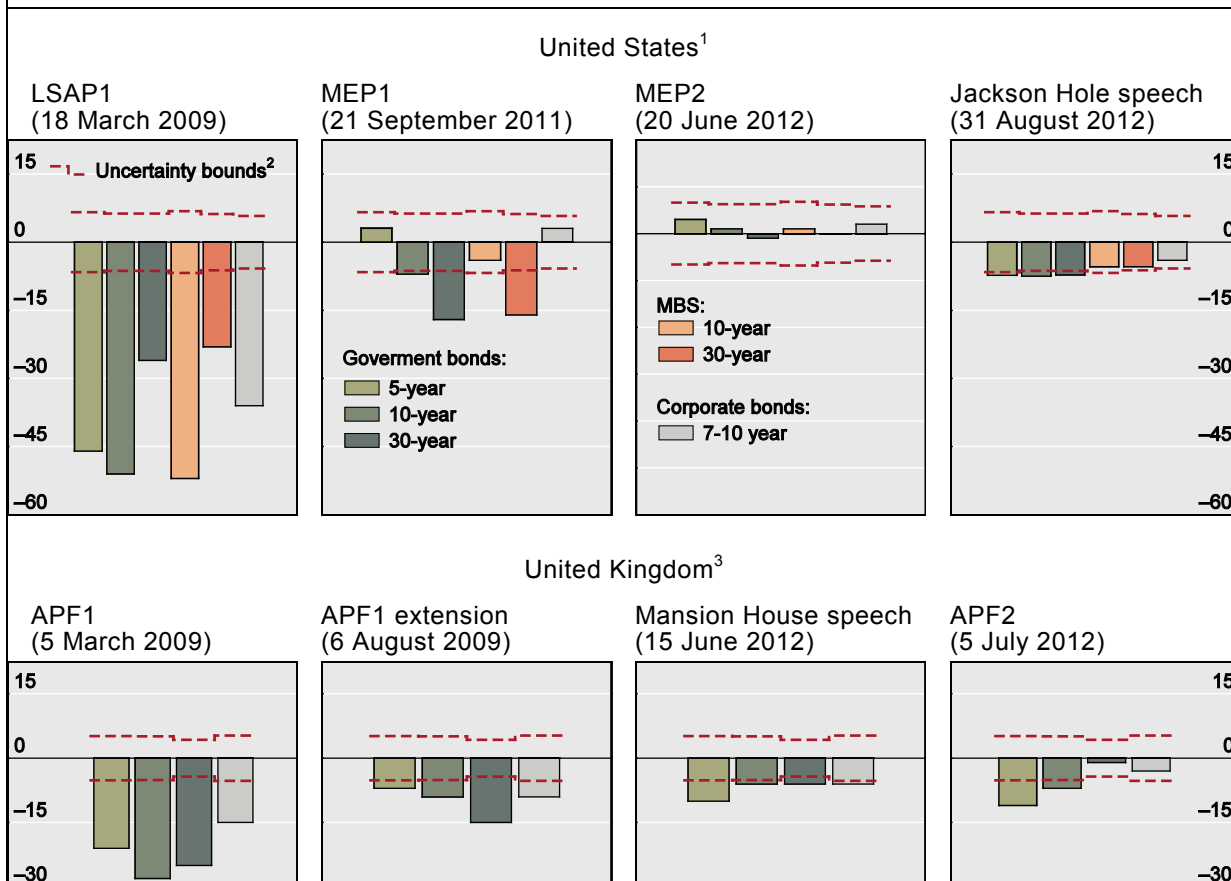
Second, with policy rates close to zero, it is unlikely that asset purchase measures would lower expectations of future interest rates any further by signalling the future policy stance. This is especially true in countries where central banks have been complementing asset purchase policies with explicit signals that future short-term risk-free rates would remain low. For example, the Federal Reserve's forward guidance on keeping interest rates low for an extended period may have firmly anchored expectations of future short-term rates.

Third, despite central bank purchases, the maturity of outstanding public debt has continued to increase. For example, despite the Federal Reserve's purchases, the cumulative public holdings (ie excluding the Federal Reserve) of Treasury debt with a maturity of one year or more have risen by approximately \$3 trillion since the beginning of 2009 and their average maturity has risen from about 50 to 60 months. Hence, in order to have the same duration impact, central banks may have to increase the maturity of their Treasury holdings at an even higher rate. Such diminishing duration impact per dollar of purchases going forward may also be reflected in a lower market impact on announcement.

Finally, negative term premia imply that the margin of adjustment for long-term yields has diminished further (Graph 4). This would impede the portfolio rebalancing channel because when the central bank removes duration from the Treasury market, the reduction in yields on other assets comes primarily through a narrowing in their risk premia. For long-term assets, the main component would have been the term premium. In addition, when the solvency and liquidity of major financial institutions hung in the balance in 2009, credit and liquidity risk premia would have been affected as

## Yield changes associated with policy measures and central bank statements

One-day change since previous day's closing yield, in basis points



<sup>1</sup> Announcement dates for Federal Reserve purchases are: increase in total Treasury debt and MBS purchases to \$1.25 trillion (18 March 2009), the Maturity Extension Program and reinvestment of agency MBS and agency debt principals into MBS (21 September 2011), the announcement of further maturity extension via the \$267 billion purchase (sale) of long-term (short-term) Treasuries (20 June 2012) and the Jackson Hole speech by Chairman Bernanke in which he expressed concern over the US labour market and alluded to costs and benefits of monetary easing (31 August 2012). <sup>2</sup> Uncertainty bounds based on a 97.5% confidence interval calculated using the historical standard deviation of yield changes for each asset class. <sup>3</sup> Announcement dates for Bank of England purchases are: the announcement of the £75 billion Asset Purchase Facility and bank rate cut from 1% to 0.5% (5 March 2009), the extension of the Asset Purchase Facility to £175 billion (6 August 2009), the Mansion House speech introducing the Funding for Lending Scheme (15 June 2012) and the announcement of a further £50 billion of asset purchases (5 July 2012).

Sources: Bank of America Merrill Lynch; Bloomberg; national data; BIS calculations.

Graph A

well. By now, however, the scope for affecting these components of the risk premium, and hence for lowering yields across asset classes, has diminished.

<sup>①</sup> For announcement effects, see eg J Meaning and F Zhu, "The impact of Federal Reserve asset purchase programmes: another twist", *BIS Quarterly Review*, March 2012, pp 23–32; and M Bauer and G Rudebusch, "The signaling channel for Federal Reserve bond purchases", *FRBSF Working Paper Series*, no 2011–21, December 2011. For the portfolio balance channel, see J Gagnon, M Raskin, J Remache and B Sack, "The financial market effects of the Federal Reserve's large-scale asset purchases", *International Journal of Central Banking*, vol 7(1), March 2011, pp 3–43. Irrespective of the transmission channel, there is strong evidence of the effectiveness of asset purchases since 2009; see eg S D'Amico and T King, "Flow and stock effects of large-scale Treasury purchases: evidence on the importance of local supply", *Federal Reserve Board Finance and Economics Discussion Series*, working paper no 2012–44, February 2012. <sup>②</sup> Further, central bank balance sheet measures adopted in the wake of the global financial crisis provided temporary support to economic activity and consumer prices. See L Gambacorta, B Hofmann and G Peersman, "The effectiveness of unconventional monetary policy at the zero lower bound: a cross-country analysis", *BIS Working Papers*, no 384, August 2012.

In addition to extending or renewing earlier programmes, some central banks took measures targeted more specifically at restoring the flow of credit to

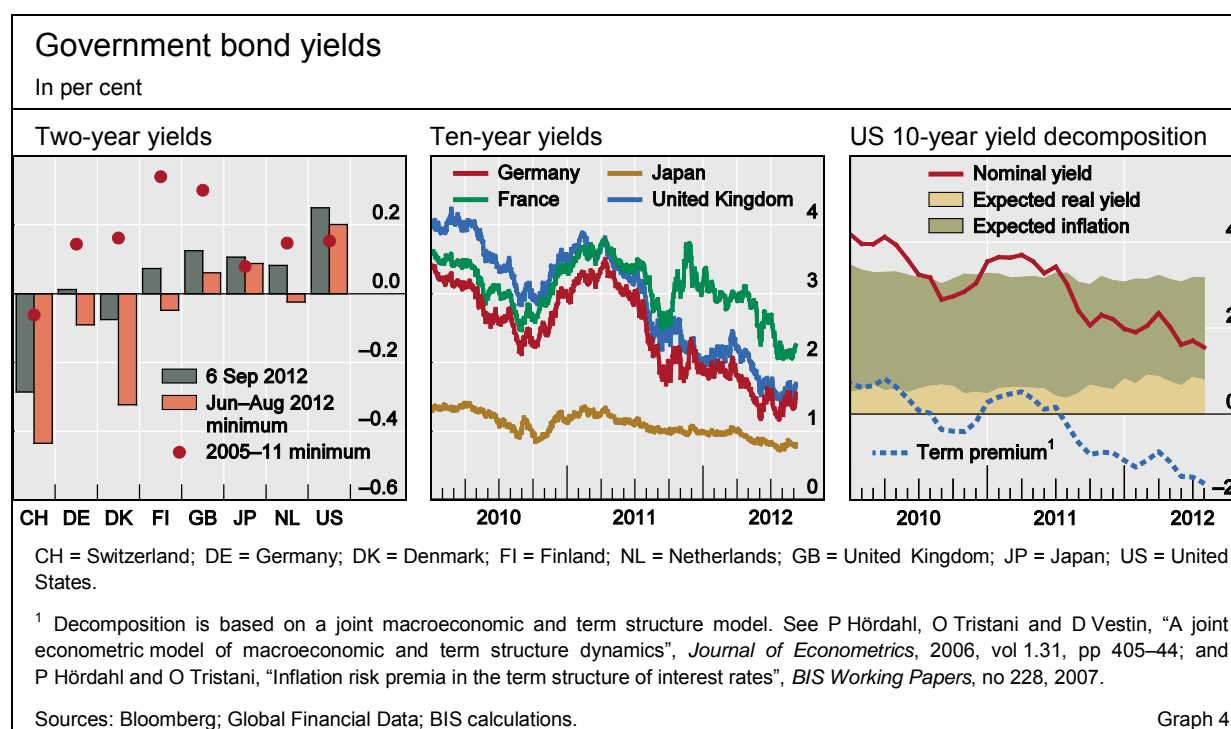
the economy. In his Mansion House speech in London on 14 June, the Governor of the Bank of England announced a new Funding for Lending Scheme (FLS); the technical details were unveiled on 13 July. The FLS provides funding to banks on terms that are conditional upon the performance of banks in sustaining or expanding their lending to UK households and non-financial companies. Corporate bond yields dropped by 6 basis points on the following trading day, and yields on gilts fell 5–10 basis points. The latter decline possibly reflected market participants' expectation that growth would remain weak and monetary policy expansionary for longer than previously thought. Meanwhile, the Bank of Japan made public plans to provide US dollar-denominated loans as part of a similar programme. Since its inception in 2010, the programme has been providing discounted long-term funds to financial institutions based on their actual lending activity.

### Ultra-low yields

A combination of weak growth, central bank policy actions and portfolio reallocations driven by concerns about sovereign risk in the euro area pushed yields to unprecedented lows. Yields on the short-term paper of a few highly rated sovereigns, most notably Switzerland and Germany, had already been close to zero (or negative) during earlier euro area distress episodes. These dynamics gained additional force after the ECB cut the interest paid on its deposit facility to zero on 5 July.

In the days after the announcement, yields on higher-rated European short-term government bonds plunged to lows not previously recorded (Graph 4, left-hand panel). Short-term yields of the Netherlands, Finland and Austria, for instance, decreased sharply and temporarily turned negative. Their spreads over German bunds tightened considerably. At the most extreme,

Yields at historical lows ...



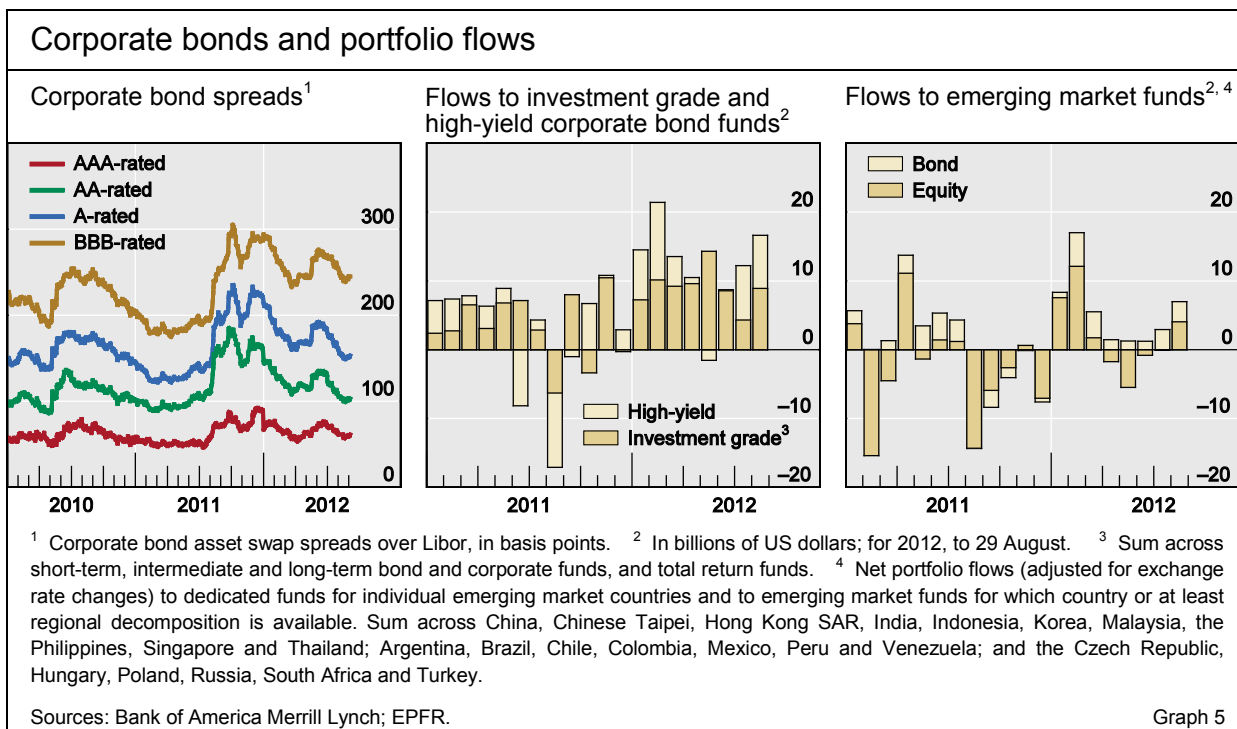
yields on Swiss and Danish two-year government bonds fell below –40 basis points and –30 basis points, respectively. Both countries (effectively) link their currency to the euro. In an effort to reduce pressure on the krone, the Danish central bank entered uncharted waters by lowering the rate on its deposit facility to –20 basis points. In primary markets, Germany sold over €4 billion of two-year Treasury notes at an average yield of –6 basis points in mid-July. France, Belgium and the Netherlands also held auctions in which short-term government paper was sold to investors at negative yields.

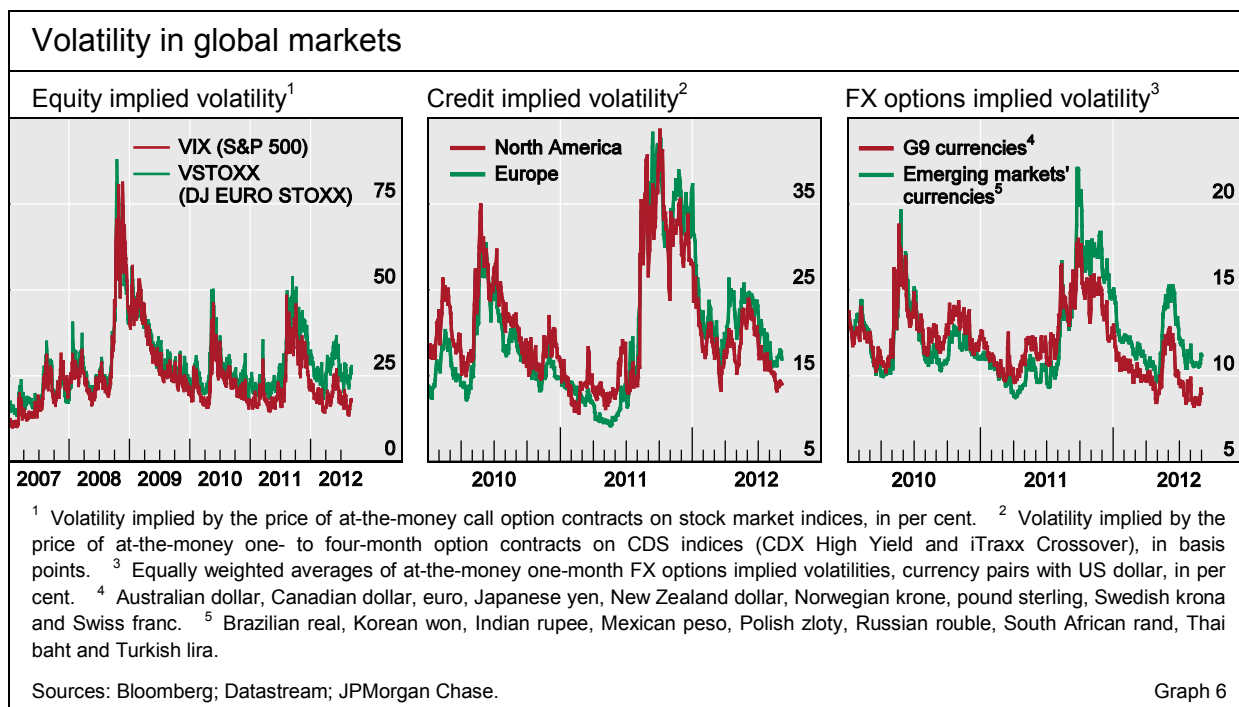
Long-term government bond yields in several countries also fell to record lows (Graph 4, centre panel). In July, 10-year US government bond yields reached their lowest for more than 200 years. Graph 4 (right-hand panel) shows an estimate of the decomposition of these yields into compensation for future inflation, real (after expected inflation) short-term interest rates available over the life of the bonds and the term premium. The term premium is usually positive since it compensates investors for the interest rate risk of holding long-duration assets. However, the estimated term premium has fallen to about –150 basis points most recently, reflecting the combined effects of central bank bond purchases and safe haven demand for long-term US Treasuries.

### Search for yield in an ultra-low rate environment

... support asset prices

With sovereign yields at historical lows, investors increasingly looked beyond benchmark government bonds in search of reasonably safe investments offering some extra yield. Such portfolio rebalancing is one of the key objectives of unconventional policies (as discussed in the box), intended to stimulate investor risk-taking by reducing the attractiveness of government securities relative to risky assets.





Corporate bond spreads fell as investors raised their credit risk exposure to the corporate sector and the asset class saw large inflows from investors (Graph 5, left-hand and centre panels). From mid-June to end-August, bond spreads moved down by 17 basis points for AAA-rated corporates and more than 30 basis points for other investment grade corporate bonds (Graph 5, left-hand panel). Consistent with search for yield behaviour and increased risk-taking induced by the low rate environment, issuance of high-yield bonds in primary markets picked up strongly. Lower-rated corporate issuers took advantage of benign market conditions to place large amounts of high-yield bonds with investors. High-yield bond funds also attracted large inflows (Graph 5, centre panel). Likewise, emerging market bond funds saw inflows from investors willing to take on credit risk to earn some extra yield (Graph 5, right-hand panel). This was also reflected in the tightening of spreads on emerging market debt securities.

The volatility of risky assets remained extraordinarily subdued given the concerns about the euro area debt crisis and the poor outlook for growth (Graph 6). Volatility was low compared to recent history in credit, foreign exchange and equity markets. On 13 August, the implied volatility index (VIX) computed from the prices of US equity market options fell to its lowest value since June 2007. With real government bond yields in negative territory in many countries, this means that equity valuations have become more attractive relative to bonds, which in turn may have pushed some investors to increase the equity share of their portfolios. As a consequence, assets traditionally perceived as risky may have been less affected by the deterioration of the growth outlook and the euro area strains compared to previous episodes.

Volatility very low despite uncertainty



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## Highlights of the BIS international statistics<sup>1</sup>

*The BIS, in cooperation with central banks and monetary authorities worldwide, compiles and disseminates several data sets on activity in international financial markets. This chapter summarises the latest data for the international banking market, available up to the first quarter of 2012. A box discusses developments in international debt securities markets in the second quarter of 2012.*

During the first quarter of 2012, the cross-border claims of BIS reporting banks expanded slightly, after a sharp fall in the previous quarter. Despite this increase, cross-border lending remained significantly below the levels recorded before the global financial crisis intensified in 2008. The latest expansion of cross-border claims was mainly driven by growth in lending to non-banks, which recorded the largest amount since early 2011. Cross-border interbank lending stabilised after the severe contraction in the previous quarter. Lending to banks in the euro area rose by the largest amount in four years, albeit with considerable differences across countries.

Cross-border lending to residents of developed countries expanded slightly (\$50 billion or 0.2%). Claims on the euro area and Japan increased by \$104 billion (1.2%) and \$84 billion (9.3%), respectively, driven almost completely by growth in interbank lending. In contrast, claims on residents of the United States and Switzerland contracted by \$101 billion (1.9%) and \$51 billion (7.8%), respectively, again largely reflecting changes in cross-border interbank activity.

BIS reporting banks' cross-border claims on most emerging market borrowers increased. The overall growth of \$86 billion (2.8%) in lending to residents of emerging markets was split roughly evenly between rises in claims on banks (\$41 billion or 2.5%) and non-banks (\$45 billion or 3.1%). Credit to Asia-Pacific in general and China in particular drove the expansion. Latin America and the Caribbean and Africa and the Middle East registered smaller increases. Only cross-border credit to emerging Europe continued to fall.

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<sup>1</sup> This article was prepared by Adrian van Rixtel (adrian.vanrixtel@bis.org) for banking statistics and Masazumi Hattori (masazumi.hattori@bis.org) for international debt securities. Statistical support was provided by Stephan Binder, Pablo García-Luna, Branimir Gruić, Carlos Mallo and Denis Pêtre.

## The international banking market in the first quarter of 2012<sup>2</sup>

BIS reporting banks' aggregate cross-border claims increased during the first quarter of 2012, after falling sharply in the previous quarter. Notwithstanding this rise, cross-border bank lending remained subdued from a longer-term perspective, in line with the moderate activity observed during the past few years. This followed a phase marked by strong growth in cross-border lending during 2004–07 and a phase of severe contraction in 2008–09.

Aggregate cross-border claims increase

The growth in cross-border lending of \$126 billion (0.4%) was driven by larger claims on non-banks of \$154 billion (1.4%; Graph 1, top left-hand panel). By contrast, cross-border interbank claims declined by \$28 billion (0.1%).

Claims denominated in euros increased by \$175 billion (1.7%), while those in US dollars fell by \$111 billion (0.9%; Graph 1, top right-hand panel). In relative terms, claims denominated in Swiss francs declined the most (\$64 billion or 13%).

### *Claims on non-banks increase<sup>3</sup>*

Cross-border claims on non-banks expanded relatively evenly vis-à-vis residents in the main regions (Graph 1, bottom left-hand panel). Claims on non-banks in offshore centres, especially those located in the Caribbean, grew by \$60 billion (4.1%). Claims on non-banks in developed countries also increased (\$46 billion or 0.6%), driven largely by a rise in claims on non-banks in the United States (\$55 billion or 2.2%). Lending to non-banks in the euro area increased slightly (\$9 billion or 0.3%), as greater claims on Luxembourg and France (\$39 billion or 10.4% and \$30 billion or 6.1%, respectively) offset falling claims on Germany and Greece (\$32 billion or 5.2% and \$24 billion or 33%, respectively). Cross-border claims on non-banks in emerging market economies picked up markedly (\$45 billion or 3.1%), driven by the Asia-Pacific region and Latin America (which in the BIS international banking statistics includes the Caribbean). For the latter region, it was the largest absolute increase since the start of the BIS international banking statistics.

### *Cross-border interbank lending stabilises*

Cross-border interbank lending worldwide stabilised in the first quarter of 2012, following the severe contraction in the previous quarter.

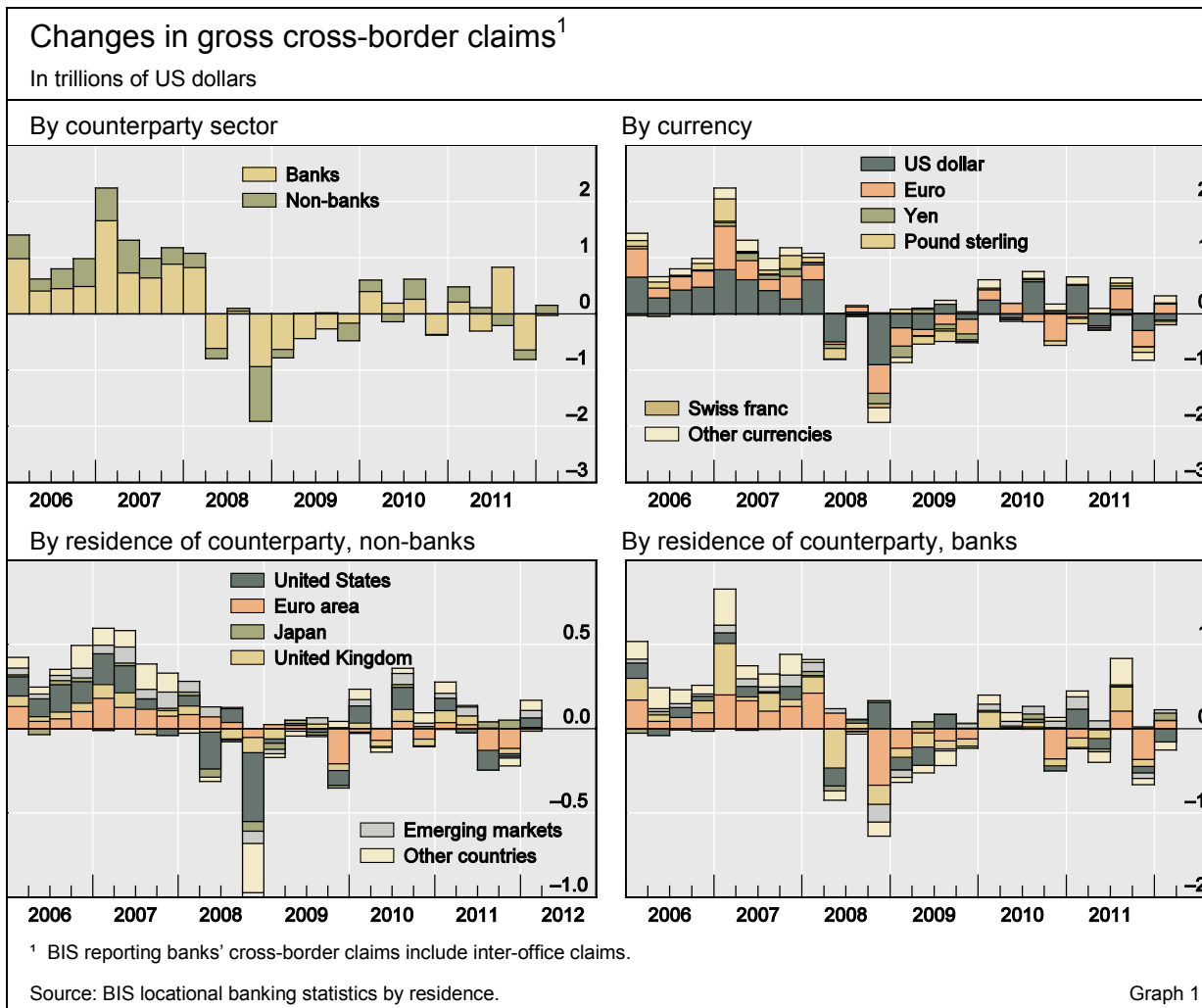
Cross-border interbank lending stabilises

The key developments in interbank markets can be summarised as follows. Internationally active banks expanded their cross-border lending to banks in the euro area, after a large decline one quarter earlier. More specifically, claims on banks in the north of the euro area rose while those on

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

<sup>3</sup> Non-banks are defined in the BIS international banking statistics as all entities (including individuals but excluding official monetary authorities) other than those defined as "banks". General government and public corporations are part of the non-bank sector. See [www.bis.org/statistics/locbankstatsguide.pdf#page=31](http://www.bis.org/statistics/locbankstatsguide.pdf#page=31).



banks in the south fell. Banks in the euro area also increased their cross-border interbank lending, which followed a similar regional pattern. Outside the euro area, cross-border claims on banks in Japan expanded, while those on banks in the United States and Switzerland contracted.

Cross-border interbank lending to banks in the euro area grows ...

Cross-border interbank lending *to* banks in the euro area picked up by \$95 billion during the period (1.7%). This may be attributed partly to returning market confidence in euro area banks following the ECB's three-year longer-term refinancing operations (LTROs), which helped to reopen wholesale bank funding markets. At the same time, there was a distinct north-south divergence in cross-border lending to euro area banks. On the one hand, cross-border claims on banks in Germany surged by \$271 billion (26%), the highest quarterly growth rate in more than 20 years. Claims on banks in the Netherlands, Finland, Belgium and Austria also rose, albeit by lesser amounts. On the other hand, cross-border interbank lending to banks in Ireland, Italy, Spain, Portugal and Greece decreased.

... as does cross-border interbank lending by banks in the euro area

Cross-border interbank lending *by* banks located in the euro area increased by \$35 billion (0.5%). This was driven mainly by banks in the Netherlands (\$32 billion or 4.6%) and Spain (\$32 billion or 11%). Banks in the United Kingdom were the main recipient of interbank financing provided by banks in the euro area, recording inflows of \$100 billion (6.0%).

Interbank lending within the euro area also exhibited a north-south divide. Higher cross-border interbank claims on banks in Germany and the other four northern euro area countries (the Netherlands, Finland, Belgium and Austria) contrasted with lower claims on banks in the four southern euro area countries (Greece, Italy, Portugal and Spain) and Ireland.

The stabilisation of cross-border interbank lending in the period was concentrated in *interbank loans and deposits*.<sup>4</sup> These declined by a modest \$40 billion (0.3%), compared with a very sharp fall of \$536 billion (3.3%) in the previous quarter. Following a slight decline in the fourth quarter of 2011, internationally active banks' purchases of *debt securities* issued by other banks increased by \$18 billion (1.0%), of which \$12 billion was issued by euro area banks. The latter issuers were dominated by banks in the Netherlands, Germany, Belgium, France and Finland. By contrast, BIS reporting banks' cross-border holdings of debt securities issued by banks in Spain, Italy, Ireland and Portugal fell. *Other assets* registered a modest decline of \$5 billion (0.3%).

#### *Foreign bank exposures to southern Europe and Ireland contract further*<sup>5</sup>

During the first quarter of 2012, internationally active banks continued to report substantial declines in their foreign exposures to Greece, Ireland, Italy, Portugal and Spain (Graph 2). Adjusted for foreign exchange effects, foreign claims on residents of these countries contracted by \$92 billion (4.7%).<sup>6</sup> Foreign claims on banks fell by \$42 billion (11%) and those on the public sector by \$17 billion (5.4%); in the previous quarter, those claims had fallen by \$52 billion and \$62 billion, respectively. Foreign exposures to the non-bank private sector declined by \$33 billion (2.6%), a much larger drop than in the previous quarter. Overall, the figures suggest that the two three-year LTROs conducted by the ECB in 2011 and 2012 did not unlock new foreign financing to these countries.

Foreign claims on the euro area periphery continue to fall

The sectoral composition of the contraction in foreign claims varied considerably across countries. The decline in foreign exposures to Spain and Ireland (\$33 billion or 5.6% and \$11 billion or 2.8%, respectively) affected mainly their non-bank private sectors (\$18 billion or 5.1% and \$6.2 billion

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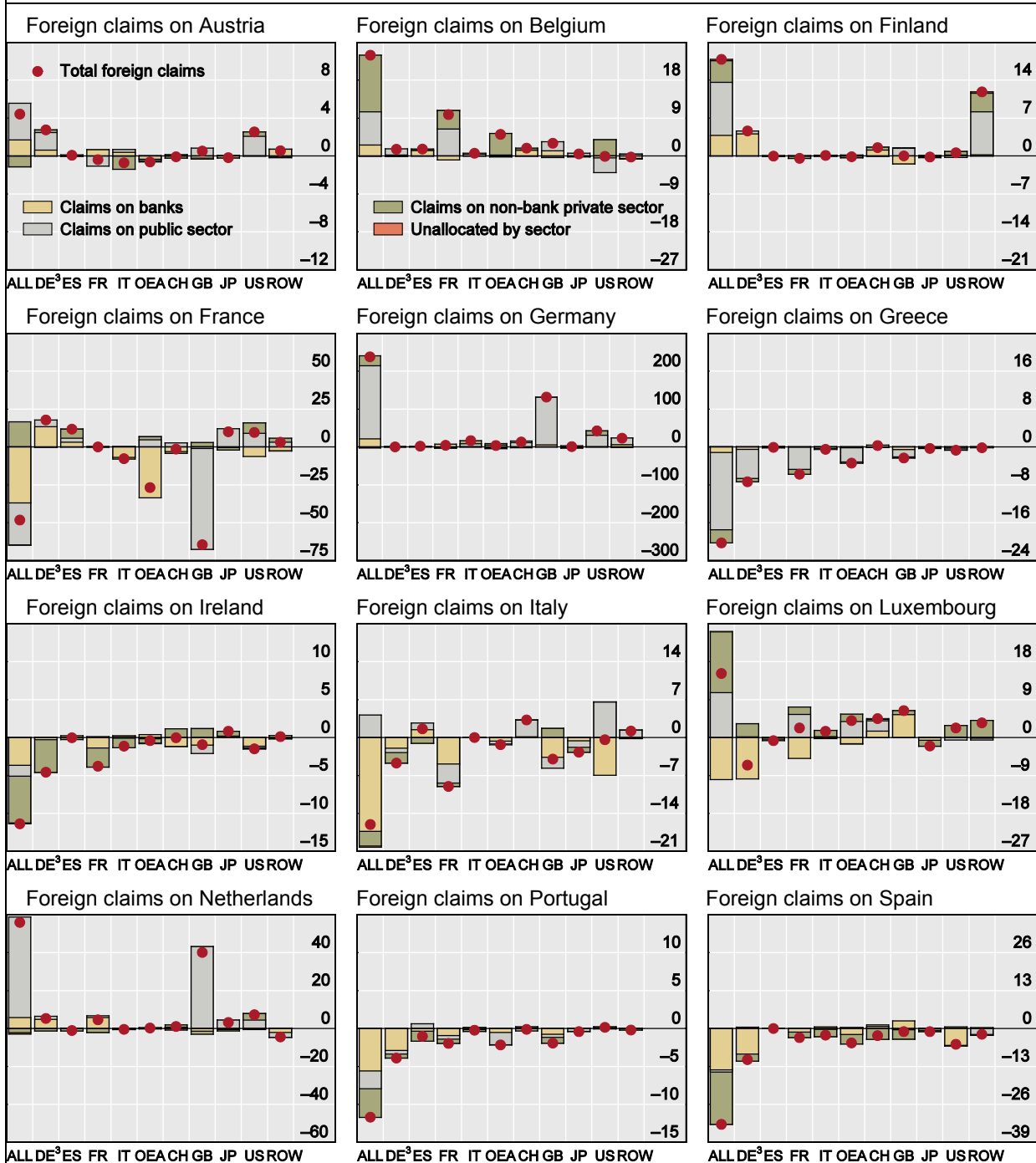
<sup>4</sup> BIS locational banking statistics by residence divide the cross-border claims of reporting banks into three instrument categories: *loans and deposits*, *debt securities* and *other assets*. The last category includes equity, participations, derivative instruments, working capital supplied by head offices to branches and residual on-balance sheet claims. For further details, see *Guidelines to the international locational banking statistics*, [www.bis.org/statistics/locbankstatsguide.pdf](http://www.bis.org/statistics/locbankstatsguide.pdf).

<sup>5</sup> The analysis in this section is based on the BIS consolidated international banking statistics on an ultimate risk basis, which break down exposures according to where the ultimate debtor is headquartered. These exposures are classified according to the nationality of banks (ie according to the location of banks' headquarters), not according to the location of the office in which they are booked. In addition, the classification of counterparties takes into account risk transfers between countries and sectors (for a more detailed discussion and examples of risk transfers, see the box on pp 16–7 of the March 2011 *BIS Quarterly Review*).

<sup>6</sup> To adjust for the period's currency fluctuations, we assume that all foreign claims on residents of the euro area are denominated in euros.

# Estimated changes in foreign claims<sup>1</sup> on selected countries, Q1 2012

By bank nationality at constant end-March 2012 exchange rates,<sup>2</sup> in billions of US dollars



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

<sup>1</sup> Foreign claims consist of cross-border claims and of local claims of foreign affiliates; claims of locally headquartered banks are not included, as these are not foreign claims. <sup>2</sup> All claims are assumed to be denominated in euros. <sup>3</sup> Claims of German banks are on an immediate borrower basis, except for their claims on the Greek public sector, which are on an ultimate risk basis.

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

Graph 2

or 1.9%, respectively). In contrast, the overall drop in foreign claims on Italy and Portugal (\$16 billion or 2.3% and \$12 billion or 6.9%, respectively) involved significant reductions in exposures to their banking systems (\$17 billion or 16%

and \$5.6 billion or 20%). Lower foreign claims on Greece (\$20 billion or 21%) were driven by a large reduction in foreign exposures to its public sector (\$16 billion or 72%). This may be related to the restructuring of Greek sovereign debt that was concluded in March 2012.

The only sector in the above countries that registered an expansion of foreign exposures in the first quarter of 2012 was Italy's public sector, of \$4.1 billion (2.4%). The increase was supported mainly by US, Swiss and Spanish banks, while French, UK and Japanese banks reduced their exposures.

Foreign exposures increase only towards Italy's public sector

Euro area banks accounted for the bulk of the reduction in foreign claims on Greece, Ireland, Italy, Portugal and Spain (\$71 billion or 5.1%; Graph 2). This was largely driven by German and French banks (\$31 billion or 7.4% and \$24 billion or 4.4%, respectively). In contrast, foreign claims of Swiss banks on these countries rose through larger public sector exposures (\$3.7 billion or 73%) predominantly to Italy, with minor increases to Spain and Portugal.

#### *Cross-border claims on emerging market economies increase<sup>7</sup>*

BIS reporting banks' cross-border claims on the residents of emerging market economies increased by \$86 billion (2.8%), after a decline of \$77 billion (2.4%) in the previous quarter. It was the first expansion in three quarters, a possible indication of how these economies benefited from improving market conditions in the first quarter of 2012. Cross-border claims increased both on banks (\$41 billion or 2.5%) and on non-banks (\$45 billion or 3.1%). The overall growth in cross-border credit to emerging market economies was driven by banks in Asian offshore centres and in the United Kingdom. Banks in the euro area held their cross-border credit fairly constant, following a sharp contraction in the previous quarter.

Cross-border credit to the Asia-Pacific region grew the most, accounting for 79% of the total rise in lending to emerging market economies (Graph 3, top left-hand panel). The \$68 billion (5.4%) overall increase was due to a \$40 billion (4.9%) expansion in interbank claims and a \$28 billion (6.1%) rise in lending to non-banks. Banks in Asian offshore centres, eg in Hong Kong SAR and Singapore, accounted for more than half of the growth in cross-border claims on the region. Banks in the euro area expanded their cross-border claims on Asia-Pacific by \$10 billion (6.8%), after a decline of \$18 billion (10%) in the previous quarter.

Cross-border lending to Asia-Pacific increases ...

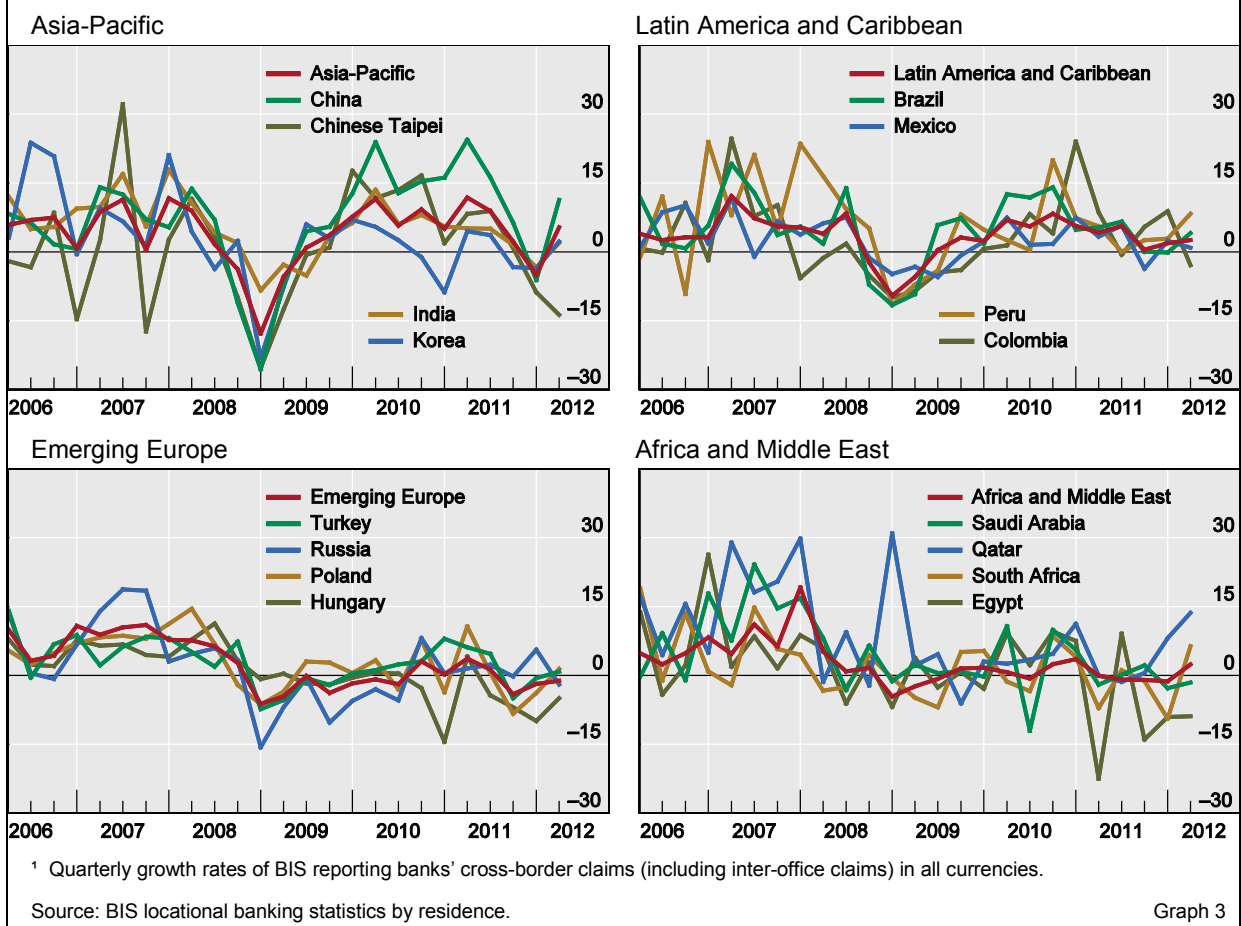
The main factor behind the growth in cross-border claims on the Asia-Pacific region was larger claims on China (\$54 billion or 11%). The rise in claims on China was primarily driven by an expansion in cross-border interbank loans of \$36 billion (14%); lending to non-banks in the country increased by \$15 billion (11%). Cross-border credit also rose significantly in Thailand and Korea, where the changes were mainly driven by interbank lending and credit to the non-bank sector, respectively.

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<sup>7</sup> The analysis in this section is based on the BIS locational banking statistics by residence. See footnote 2 for a description of this data set.

## Growth rates of cross-border claims on residents of emerging markets<sup>1</sup>

By residence of counterparty, in per cent



... and also to Latin America and the Caribbean, and Africa and the Middle East ...

Cross-border lending to Latin America and the Caribbean and to Africa and the Middle East increased as well (Graph 3, right-hand panels). Claims on the former picked up by \$16 billion (2.6%), due to large increases in cross-border lending to non-banks (\$19 billion or 5.3%). The latter expansion – unprecedented in absolute terms – was driven by the high growth of credit to Brazil's and Mexico's non-bank sectors. Much of the rise in cross-border lending to both countries came from banks in the United Kingdom. Cross-border claims on Africa and the Middle East rose by \$11 billion (2.4%), driven mainly by increased cross-border interbank lending to Qatar (\$9.2 billion or 36%).

... while cross-border credit to emerging Europe contracts

Cross-border claims on emerging Europe contracted by \$8.7 billion (1.2%) (Graph 3, bottom left-hand panel), with the largest declines in claims on residents of Russia (\$3.1 billion or 2.0%) and Hungary (\$3.0 billion or 5.0%). In the case of Russia, a large fall in cross-border credit to the non-bank sector was partly offset by higher cross-border interbank lending. Lower claims mainly by banks in France and the Netherlands led the decline in cross-border credit to Russia, while banks in the United Kingdom, Germany and Belgium drove lower lending to Hungary.

## International debt securities issuance in the second quarter of 2012

Issuance of international debt securities dropped in the second quarter of 2012. This was attributable mainly to a plunge in issuance by financial institutions, especially those headquartered in the euro area. The decline might reflect a front-loading of issuance to the first quarter as banks sought to exploit the improvement in funding conditions brought about by the ECB's three-year longer-term refinancing operations (LTROs). Moreover, funding conditions in global debt markets deteriorated in the second quarter on revived market tensions in the euro area, weaker than expected economic data in the United States, and worries about the growth outlook in emerging markets, especially China. Meanwhile, investors' appetite for yield in a generally low interest rate environment supported issuance by a few issuer categories, most notably US corporate issuers and, to a lesser extent, emerging market ones.

Global gross issuance of international debt securities amounted to \$1,828 billion between April and June, a 30% decrease relative to the previous quarter (Graph A, left-hand panel). With repayments down by only 6%, to \$1,765 billion, net issuance dropped by 92% quarter on quarter to \$63 billion, the smallest amount since the second quarter of 1995.

Net issuance declined across the globe. Issuers headquartered in Europe made net repayments of \$92 billion during the period. Net issuance by US nationals halved to \$50 billion and that by emerging market borrowers fell by 40% to \$75 billion. International institutions (mostly multilateral development banks) raised \$28 billion net.

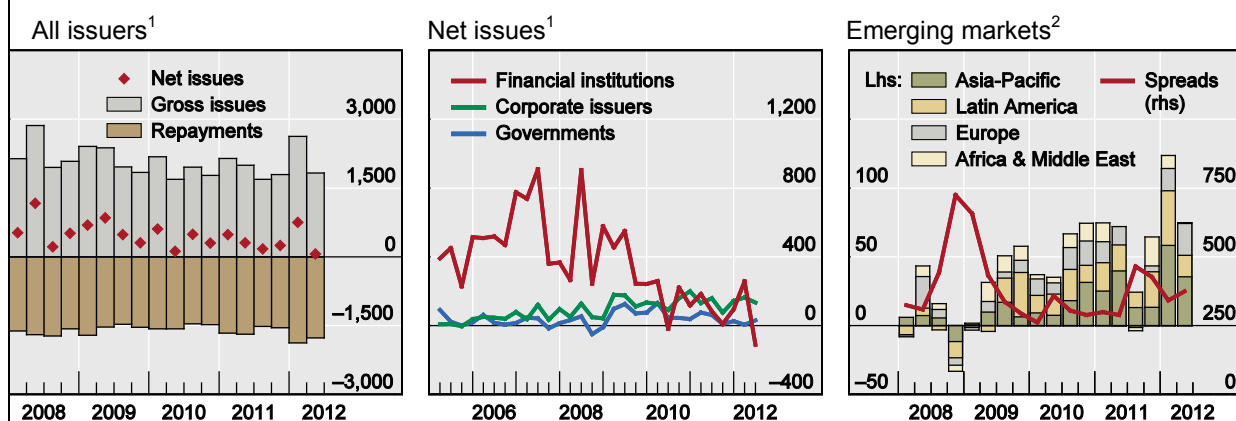
Financial institutions worldwide reduced their debt in the international market by \$137 billion (Graph A, centre panel). This reflected net repayments of \$110 billion by institutions in the euro area. Net repayments by US-headquartered institutions were relatively modest, at \$38 billion.

Corporate issuers as a whole also reduced net issuance, by 10% quarter on quarter to \$144 billion, but there was a contrast between entities headquartered in the United States and others. Notably, European issuers decreased issuance by 35% to \$37 billion while US issuers increased it by 17% to \$88 billion, taking advantage of low interest rates and investors' appetite for investment grade corporate bonds.

Net issuance by emerging market borrowers dropped significantly from the previous quarter's record (Graph A, right-hand panel), but it remained above the amounts raised in the same quarter of the previous year despite some widening in credit spreads. Borrowers from Asia and the Pacific tapped international debt markets to raise \$35 billion. Issuers in emerging Europe increased their funding to \$23 billion. Borrowing from issuers headquartered in Latin America amounted to \$16 billion. Entities headquartered in China, Russia and Brazil comprised 66% of net issuance and 53% of completed issuance by emerging market borrowers.

Issuance activity in the high-yield bond market segment lost some of the momentum gained in the first quarter, when investors' risk appetite in global debt markets increased after the ECB's first three-year LTRO (Graph B, left-hand panel). Funding conditions for high-yield bond issuers became

### International debt securities issuance



<sup>1</sup> In billions of US dollars. <sup>2</sup> Net issues, in billions of US dollars. Spreads are based on the Quarterly JPMorgan EMBI Global Composite index, in basis points.

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

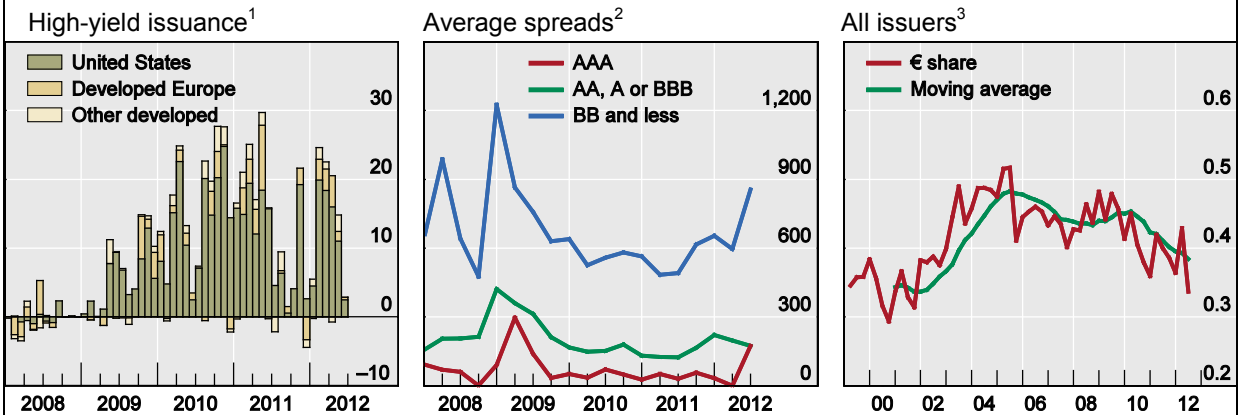
Graph A



unfavourable and spreads widened as optimism evaporated and high-yield exchange-traded funds in the United States saw substantial outflows (Graph B, centre panel).

The euro lost some ground as a funding currency in international debt securities markets (Graph B, right-hand panel). Only 34% of total completed issuance was denominated in the currency, the lowest amount since the third quarter of 2001. And net issuance of \$181 billion in dollar-denominated debt contrasted with net repayments of \$111 billion of debt in euros. As a consequence, the share of euro-denominated international debt securities in the total amount outstanding declined from nearly half in 2008 to 41% in the second quarter.

### International debt securities issuance



<sup>1</sup> Net issues by non-financial corporations headquartered in developed countries, in billions of US dollars. <sup>2</sup> Weighted average, rating at issue, in basis points. <sup>3</sup> Share of euro-denominated international debt securities in new issuance (quarterly and eight-quarter moving average).

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

Graph B



## Do debt service costs affect macroeconomic and financial stability?<sup>1</sup>

*Excessive private sector debt can undermine economic stability. In this special feature, we propose the debt service ratio (DSR) as a measure of the financial constraints imposed by private sector indebtedness, and investigate its association with recessions and financial crises. We find that the DSR prior to economic slumps is related to the size of the subsequent output losses. Moreover, the DSR provides a very accurate early warning signal of impending systemic banking crises at horizons of up to one to two years in advance. We conclude that the DSR can serve as a useful supplementary indicator for the build-up of vulnerabilities in the real economy and financial sector.*

*JEL classification: E37, E44, G01, G21.*

The global financial crisis has underlined the destabilising effects of excessive debt build-ups in the private sector. When households and firms are overextended, even small income shortfalls prevent them from smoothing consumption and making new investments. Larger shortfalls trigger a rise in defaults and bankruptcies. As a consequence, output volatility increases, thereby aggravating the repayment problems and increasing banks' losses.<sup>2</sup> When a large part of the private sector is overindebted, a full-scale banking crisis may result. In this special feature, we propose the debt service ratio (DSR) as a measure of the economic constraints imposed by private sector indebtedness.

Defined as interest payments and debt repayments divided by income, the DSR captures the burden imposed by debt more accurately than established leverage measures, such as the debt-to-GDP ratio. That is because the DSR explicitly accounts for factors such as changes in interest rates or maturities that affect borrowers' repayment capacity. This can easily be seen by

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<sup>1</sup> We thank Claudio Borio, Stephen Cecchetti, Kostas Tsatsaronis and Christian Upper for useful comments and Anamaria Illes for excellent research assistance. We are also grateful for invaluable assistance in constructing debt service ratios from Christian Dembiermont, Denis Marionnet and Siriporn Muksakunratana as well as representatives from national central banks, specifically David Aikman, Luci Ellis, Jannick Damgaard, Robert Johnson, Esa Jokivuolle, Alexander Schulz, Tatevik Sekhposyan, Haakon Solheim and Chris Steward. The views expressed are those of the authors and do not necessarily reflect those of the BIS.

<sup>2</sup> This is consistent with Juselius and Kim (2011), who show that US banking sector credit losses start to increase rapidly if private sector financial obligation ratios – a broader DSR measure – are high and the business cycle deteriorates.

considering a borrower with monthly disposable income of CHF 2,500 who takes out a 20-year mortgage of CHF 150,000 at a 2% variable annual interest rate. Assuming that the loan is paid off in equal shares per month, the borrower's debt servicing costs are approximately CHF 760 at the initial interest rate (see box) and his DSR is 30%. If the interest rate moves to 5%, the debt servicing costs rise to CHF 990 with a DSR of 40%. This clearly reduces the borrower's ability to consume and exposes him to possible future income shortfalls. Yet these effects cannot be deduced from the borrower's (annualised) debt-to-income ratio, which is 500% regardless of the interest rate. In fact, the DSR and the debt-to-income ratio will only provide identical information if interest rates and maturities remain constant.

To explore the DSR's properties, we construct it for the non-financial private sector in several advanced and selected emerging market economies. We find that the ratio's level prior to economic downturns explains a significant fraction of subsequent output losses. This finding is consistent with feedback between debt servicing problems and reductions in aggregate income, suggesting that economic policymakers should be mindful about rising DSRs.

We also find that the DSR produces a very reliable early warning signal ahead of systemic banking crises. DSRs tend to peak just before these materialise, reaching levels that are surprisingly similar across countries. At horizons of around one year before crises, the quality of the early warning signal issued by the DSR is even more accurate than that provided by the credit-to-GDP gap. The latter has been previously identified as the single best performing early warning indicator, which remains the case for horizons longer than two years. As such, the DSR can prove useful to policymakers as a supplementary tool for monitoring the build-up of financial vulnerabilities.

The DSR's explicit dependence on the interest rate establishes a direct link between monetary policy and financial stability. We explore this link by decomposing changes in the DSR around crisis dates into the interest rate-related component and the one related to debt-to-income. We find that the more volatile shifts in the DSR are driven primarily by changes in the short-term money market rate. Hence, this monetary transmission channel may represent an effective way of counteracting private sector debt problems, provided that these are recognised at an early stage.

We also construct separate DSRs for the household and for the business sectors, and find that vulnerabilities do not always build up simultaneously in both. If anything, the business sector has a slight tendency to become overindebted more regularly and more often than the household sector. This suggests that business sector debt problems have a closer link to the business cycle, whereas household indebtedness rises and falls over a longer cycle that is more closely aligned with infrequently occurring banking crises.

This special feature consists of six sections. First, we discuss the construction of DSRs and present the estimated series. In the following two sections, we formally test their association with impending recessions and systemic banking crises respectively. In the fourth section, we discuss the main drivers for DSRs around crisis dates. In the fifth section, we present sector-specific DSR estimates. The final section concludes.

## Estimating the aggregate debt service ratio

Constructing DSRs at the aggregate level involves both estimation and calibration, as detailed loan-level data are generally not available. This box discusses the necessary steps.

We make the basic assumption that the debt service costs – interest payments and amortisations – on an aggregate debt stock are, for a given interest rate, repaid in equal portions over the maturity of the loan (instalment loans).<sup>⑥</sup> The justification is that the differences between the repayment structures of individual loans will tend to cancel out in the aggregate. For example, consider 10 loans of equal size for which the entire principal is due at maturity (bullet loans), each with 10 repayment periods and taken out in successive years over a decade. After 10 periods, when the first loan falls due, the flow of repayments on these 10 loans will jointly be indistinguishable from the repayment of a single instalment loan. Typically, a large share of private sector loans in most countries will in any case be instalment loans, eg household sector mortgage credit.

By using the standard formula for calculating the fixed debt service costs (*DSC*) of an instalment loan and dividing it by income – and interpreting terms as referring to aggregate quantities – we can calculate the DSR (*DSR*) at time *t* as

$$DSR_t = \frac{DSC_t}{Y_t} = \frac{i_t D_t}{(1 - (1 + i_t)^{-s_t}) Y_t} \quad (1)$$

where  $D_t$  denotes an aggregate credit stock,  $i_t$  denotes the average interest rate per quarter on the stock,  $s_t$  denotes the average remaining maturity in quarters in the stock (ie for a five-year average maturity with quarterly down payments,  $s_t = 20$ ) and  $Y_t$  denotes quarterly aggregate income.

While quarterly time series on aggregate income and credit are available for a wide range of countries, we have to estimate the average interest rate and remaining maturity in many countries. National central banks in a number of advanced economies have calculated the average interest rate on the stock of loans of monetary and financial institutions (MFIs) for the past decade or so. We extend these series backwards to the beginning of 1980 using an estimated relationship of the form

$$\dot{i}_t = \mu + \alpha \dot{i}_{t-1} + \beta_0 i_t^m + \beta_1 i_{t-1}^m + \beta_2 i_{t-3}^m + \beta_3 i_{t-12}^m + \varepsilon_t \quad (2)$$

where  $i_t^m$  denotes the short-term interest rate and  $\varepsilon_t$  is an error term. This procedure yields fairly accurate estimates to the extent that the proportions of various loan types, eg fixed or variable rate loans, have remained approximately constant. For the remaining countries, we construct the average lending rate as

$$\dot{i}_t = \alpha \dot{i}_{t-1} + (1 - \alpha)(i_t^m + \mu) \quad (3)$$

starting from the initial value  $\dot{i}_0 = i_0^m + \mu$ . We set  $\alpha = 0.9$  and  $\alpha = 0.8$  for advanced and emerging economies respectively.

Obtaining accurate estimates of the average remaining maturity, in particular over time, is more difficult due to data limitations. For this reason, we make the simplifying assumption that the maturity structure is constant,<sup>⑦</sup> ie we set  $s_t = s$  in (1), even though we allow  $s$  to differ across countries. While this is the only practicable solution, this assumption is likely to be violated in our sample. For instance, factors such as rising life expectancy and declining inflation rates would all tend to raise the average remaining maturity. Hence, actual remaining maturities may have been lower at the start of our sample, and therefore DSRs would have been higher, than our estimates reveal. However, the effect of changes in the maturity parameter on the estimated DSRs is rather small, suggesting that this problem is more acute for countries that have experienced rapid economic development or hyperinflation in recent decades.<sup>⑧</sup> Furthermore, by demeaning DSRs with a 15-year rolling average, such slow changes should not affect our statistical results.

Our primary source for estimates of the maturity parameter is euro area data on MFI loans classified into three maturity tranches.<sup>⑨</sup> We supplement these data with similar OECD household sector data, as well as national data. The estimated maturities are reported in Table A. We note that estimates of household sector debt maturities tend to be higher and vary less across countries than

| Estimated average maturity of the credit stock |                         |                  |                       |                 |
|--|-------------------------|------------------|-----------------------|-----------------|
| In years                                       |                         |                  |                       |                 |
|  | Total private sector(s) | Household sector | Household real estate | Business sector |
| Australia                                      | ...                     | 13.50            | ...                   | ...             |
| Austria  | 10.50                   | 12.25            | 13.75                 | 9.25            |
| Belgium  | ...                     | 13.75            | ...                   | ...             |
| Canada   | ...                     | 10.75            | ...                   | ...             |
| Denmark  | 13.00                   | 14.00            | 14.75                 | 11.00           |
| Finland  | 12.25                   | 13.25            | 14.50                 | 10.50           |
| France   | ...                     | 13.00            | ...                   | ...             |
| Germany  | 12.25                   | 13.25            | 14.50                 | 10.25           |
| Greece   | 8.50                    | 11.50            | 14.75                 | 5.50            |
| Ireland  | ...                     | 13.00            | ...                   | ...             |
| Italy  | 7.75                    | 10.50            | 14.75                 | 6.00            |
| Netherlands                                    | 11.00                   | 14.00            | 15.00                 | 9.25            |
| Norway   | 9.00                    | 14.00            | ...                   | ...             |
| Portugal                                       | 9.75                    | 13.75            | 14.75                 | 5.25            |
| Spain  | 10.75                   | 13.50            | 14.75                 | 8.25            |
| United Kingdom                                 | ...                     | 12.00            | ...                   | ...             |
| United States                                  | ...                     | 10.75            | 19.00                 | ...             |
| Mean   | 10.50                   | 12.75            | 15.00                 | 8.50            |
| Std  | 1.73                    | 1.24             | 1.43                  | 2.24            |

Table A

their business sector counterparts. This implies that the relative shares of credit held by these two sectors will affect the average maturity in the total private sector credit stock. Hence, DSRs will generally not be directly comparable in absolute terms across countries. For the countries with missing entries in the first column, we used calibrated numbers from the household sector estimates. For other advanced or emerging market economies countries, we set  $m = 40$  (10 years) and  $m = 30$  (7.5 years) respectively.

① In an instalment loan, debt servicing costs are regularly paid in a series of equal instalments over the lifetime of the loan. The Fed uses a similar approach to calculate debt service costs for the household sector (Dyanan et al (2003)). ② This has the advantage that voluntary down payments on the principal will not affect the estimated ratios. ③ For this reason, we focus mainly on advanced economies or highly developed emerging market economies. We also exclude from the sample countries that have experienced hyperinflation. ④ The tranches are loans with a remaining maturity of less than one, between one and five, and above five years. We assume that the average maturity within the tranches is 0.5, 3 and 15 years respectively, and take a weighted average.

## Constructing the aggregate debt service ratio

Ideally, the build-up of potential financial vulnerabilities in the private sector would be assessed by looking at the DSRs of households and firms that are highly indebted relative to their disposable income. As such data are unfortunately not publicly available, we have to rely on aggregated measures. Aggregation always entails the loss of some information: for example, not all households are indebted. However, as this article shows, even aggregated DSRs can provide very useful information about impending downturns and financial crises.

As discussed in detail in the box, the measurement of aggregated DSRs requires a credit aggregate, together with an appropriate measure of income and an associated average lending rate. In addition, we need at least some information on the average repricing and maturity structure of the credit aggregate.<sup>3</sup>

To capture financial constraints imposed by private non-financial sector debt, we construct DSRs ...

We construct a quarterly time series of non-financial private sector DSRs for 27 countries, starting from the early 1980s where possible. These cover mainly advanced economies but also some emerging markets. We use total credit to households and firms as the relevant credit aggregate and GDP as a proxy of the combined income of these two groups. Average lending rate data for the non-financial private sector are available only for 12 advanced countries and relate only to the most recent decade.<sup>4</sup> We construct estimates of these series for the earlier years in our sample and for the remaining countries based on the association between lending rates and the short-term money market rate (see box).

To highlight general patterns in the DSRs in our sample, Graph 1 depicts the estimated DSRs for six representative countries. The vertical dark grey bars indicate the period between peaks and troughs in real GDP, whereas the red lines mark the initial dates of banking crises.<sup>5</sup> Three important properties stand out.

First, the DSRs have a tendency to rise prior to slumps and decline in their aftermath. However, as several factors, such as foreign demand or government spending, are relevant in shaping the business cycle, this relationship is clearly less than perfect.

Second, a more definite pattern is that most major peaks in the DSRs are associated with a crisis, suggesting that the ratio might serve as a reliable early warning indicator. One exception is Australia, but this has more to do with the rather stringent definition of systemic crises that we employ than the DSR's performance. In 1989, two banks experienced stress and received capital injections from the government (Reinhart and Rogoff (2008)). And in late 2008, the Australian authorities took action on several fronts to stabilise the banking system.<sup>6</sup>

Third, the DSRs' peak levels are surprisingly similar across countries and time despite different levels of financial development. As a broad rule of thumb,

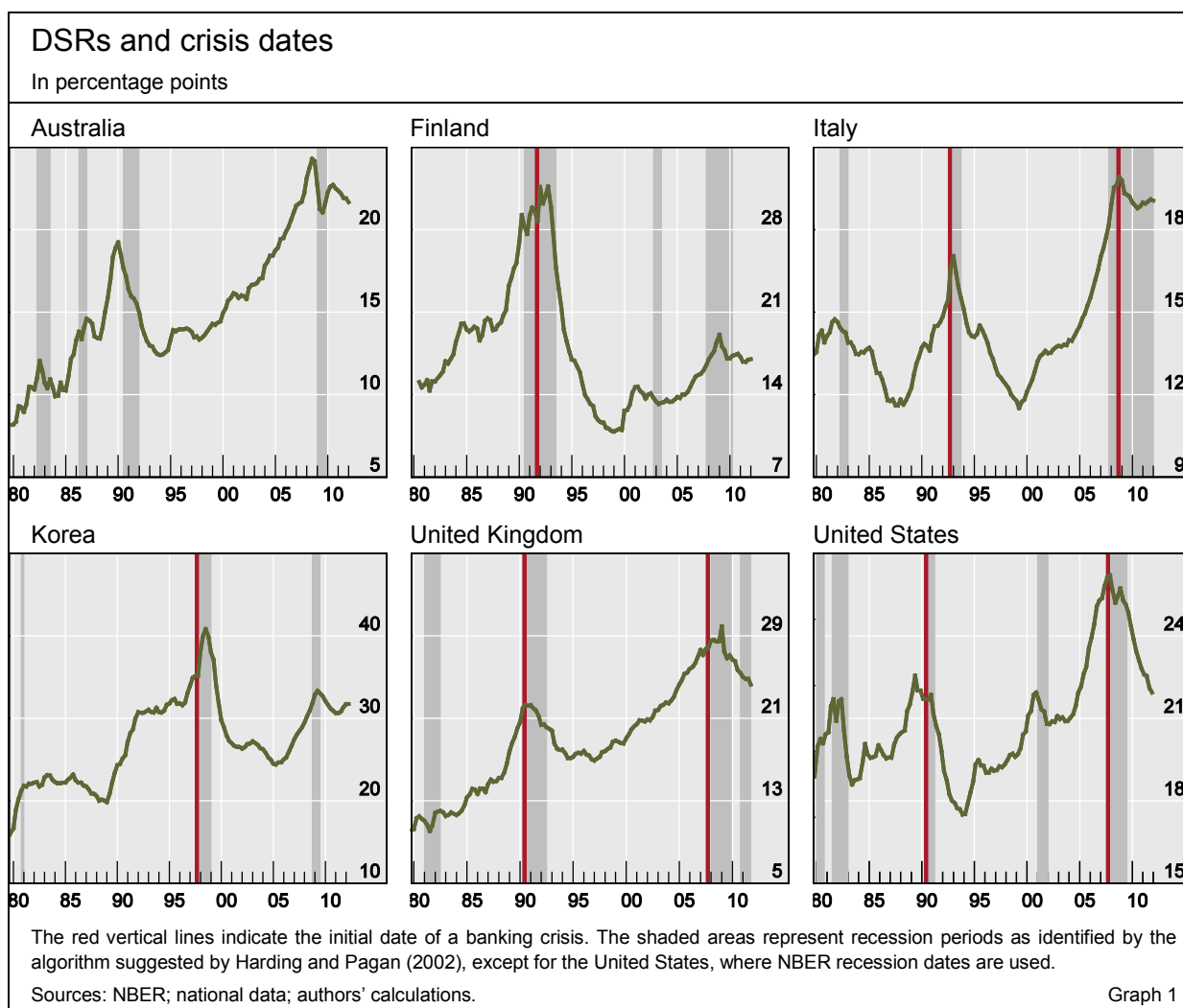
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<sup>3</sup> In the final section, we show that our method of constructing DSRs with relatively little information provides approximations that appear consistent when compared with IMF and Fed estimates.

<sup>4</sup> The 12 countries for which average lending rates are available are Australia, Denmark, Finland, Germany, Greece, Italy, Japan, Norway, Portugal, Spain, the United Kingdom and the United States. The remaining countries are Belgium, Canada, the Czech Republic, France, Hungary, Ireland, Korea, Malaysia, the Netherlands, New Zealand, Poland, South Africa, Sweden, Switzerland and Thailand.

<sup>5</sup> Throughout the paper, crisis dates are based on Laeven and Valencia (2012). In addition, we have used judgment and drawn on correspondence with central banks to determine some of the crisis dates.

<sup>6</sup> In particular, the Australian authorities enhanced the deposit insurance scheme, introduced debt guarantees and intervened in the capital markets to buy residential mortgage-backed securities. These measures were framed as a response to international funding pressures.



the graph panels suggest that a DSR above 20–25% reliably signals the risk of a banking crisis. However, for some countries, such as Korea, the DSR typically exceeds this level without any crisis occurring. Equally, some countries, like Germany or Greece (not shown), have much lower values. This is likely to be driven by country-specific factors, such as the age distribution, the rate of home ownership, industrial structure and income inequality. An additional factor could be the assumptions that we have made in order to deal with countries where data are partly missing. To take such country-specific effects into account, we subtract 15-year rolling averages from the DSRs in what follows.

### The debt service ratio and the severity of recessions

The discussion in the introduction suggests that the effects of negative shocks to income and rising interest rates are substantially amplified when the private sector is overindebted relative to its income. High DSRs prevent borrowers from smoothing consumption or undertaking profitable investments. If shocks are significant, large-scale defaults may result. Both effects increase output volatility.

... which worsen economic downturns when they increase ...



To explore this question, we conduct simple regressions to evaluate how DSRs could affect the severity of recessions. A more complete assessment would account for potential non-linear interactions between DSRs and output volatility, but our analysis is intended as a first step towards illuminating the link between overindebtedness and output losses. We implement a two-stage procedure.

First, we identify the peaks and troughs of the real business cycle. Except for the United States, consensus dates are not available. We therefore use the computerised algorithm suggested by Harding and Pagan (2002). The algorithm involves (i) the identification of local maxima and minima in real GDP<sup>7</sup> and (ii) the imposition of censoring rules to ensure that each cycle has a minimum length of five quarters and that each phase (expansion or contraction) is at least two quarters long. Once the peaks and troughs are identified, we measure the severity of a recession by the relative fall in output from the peak to the following trough.

Second, we try to explain the severity of recessions by reference to the DSR and also to the credit-to-GDP gap, a more established measure for overindebtedness. The credit-to-GDP gap is the deviation of the (private sector) credit-to-GDP ratio from its long-term trend and can be interpreted as a rough measure of excessive private sector leverage (Borio and Lowe (2002)). In contrast to earlier work, we use a measure of total credit from all sources instead of bank credit when calculating the gaps, drawing on a new BIS database.

This step of the analysis follows Cecchetti et al (2009), who explored a broad range of explanatory variables, but found that only GDP growth preceding the peak and crisis indicators can robustly explain the severity of recessions. We therefore include these variables as controls.

Table 1 shows that higher DSRs significantly increase the severity of recessions. This is also the case for the credit-to-GDP gap, even though these effects disappear if the DSR is also included and they are economically much less important. In contrast, the effects of the DSR on the subsequent recession are economically important: if the DSR is 5 percentage points higher, the

... thereby helping to explain losses in recessions

| Impact of indebtedness on the severity of recessions |          |          |          |          |          |
|--|----------|----------|----------|----------|----------|
|  | Reg 1    | Reg 2    | Reg 3    | Reg 4    | Reg 5    |
| GDP growth   | -0.22**  | -0.20    | -0.25**  | -0.24*   | -0.22*   |
| DSR  | -0.29*** |          | -0.22*** |          | -0.17*   |
| Credit-to-GDP gap                                    |          | -0.07*** |          | -0.05**  | -0.02    |
| Banking crises                                       |          |          | -1.29    | -2.22*** | -1.57*   |
| Constant   | -2.26*** | -2.45*** | -2.04*** | -1.88*** | -1.88*** |
| R <sup>2</sup>                                       | 0.19     | 0.16     | 0.22     | 0.26     | 0.28     |

Results are based on a panel regression using random effects. \*\*\*/\*\* indicates significance at the 10/5/1% confidence level.  
Sources: National data; authors' calculations.

Table 1

<sup>7</sup> A local maximum (minimum) is defined at time  $t$  if the value of real GDP is the highest (lowest) within the five-quarter window centred at  $t$ .

recession is about 25% more severe, as real output would on average drop by 5% rather than 4%. And, as seen from Graph 1, a 5 percentage point increase in the DSR is not uncommon.

## The debt service ratio as an early warning indicator for crises

In this section, we formally test our initial impression, derived from Graph 1, that the DSR captures financial fragilities in the run-up to crises. We benchmark its performance against the credit-to-GDP gap, which has been identified from a wide range of alternatives as the best single early warning indicator for systemic banking crises (Borio and Lowe (2002) or Drehmann et al (2011)).<sup>8</sup>

As a first step, we look at the time profile for both indicator variables around systemic banking crises. Graph 2 summarises the behaviour of the variables during a window of 16 quarters before and after the onset of a crisis (time 0 in the graphs). For each variable, we show the median (solid line) as well as the 25th and 75th percentiles (dashed lines) of the distribution across episodes. In both cases, a value of zero corresponds to the average conditions outside the 33-quarter window.<sup>9</sup>

DSRs tend to rise sharply before crises and decline rapidly in their aftermath ...

The graph shows that both the DSR and the credit-to-GDP gap are very high in the run-up to crises, albeit with different time profiles. The median DSR starts from a relatively low base and triples during the four years before a crisis, at which point it peaks. The credit-to-GDP gap, on the other hand, is already very high three to four years ahead of a crisis but rises much more slowly. These developments can be interpreted in terms of the slow and continuous build-up of leverage before the crisis. Ultimately, though, crises erupt when the incipient liquidity constraint captured by the DSR starts to bind. For early warning purposes, Graph 2 suggests that both indicators should be useful, but that the DSR may perform better over shorter horizons and the credit-to-GDP gap over longer ones.

To assess the early warning performance of each indicator, we use a signal extraction method as first proposed in this type of context by Kaminsky and Reinhart (1999). The underlying idea is simple: a particular indicator will give a signal if it breaches a predefined threshold. We consider a signal correct if a crisis occurs at any point within the following three years. Otherwise, we consider it incorrect (a false positive). The noise-to-signal ratio is the fraction of false positives relative to the fraction of correct signals. The lower this ratio, the better the signalling quality of the indicator. As the costs of false positives are much lower than those of failing to predict a crisis, we search across a wide range of thresholds to select the one that keeps the noise-to-signal ratio to a minimum while predicting at least two thirds of the crises.<sup>10</sup>

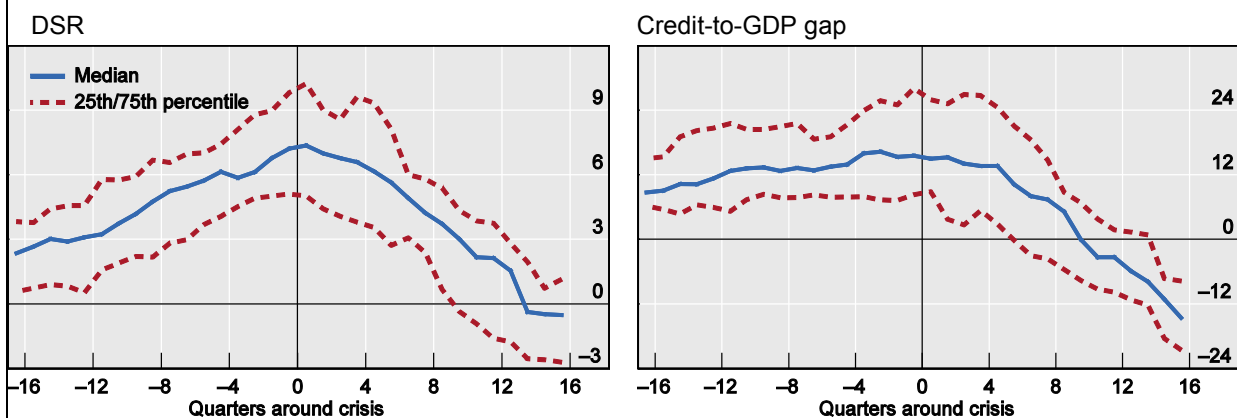
<sup>8</sup> Combining the credit-to-GDP gap with indicators that capture accelerating asset price growth such as the property price and equity price gaps can provide better early warning indicators (Borio and Drehmann (2009)).

<sup>9</sup> Outside the 33-quarter window, the DSR has a mean of -0.1 and the credit-to-GDP gap one of 1.2.

<sup>10</sup> See Borio and Drehmann (2009) for a more detailed discussion of this issue.

## Debt servicing and credit behaviour around banking crises<sup>1</sup>

In percentage points



<sup>1</sup> The horizontal axis depicts plus/minus 16 quarters around a crisis, which is indicated by the vertical line. The historical dispersion of the relevant variable is taken at the specific quarter across crisis episodes in the sample.

Sources: National data; authors' calculations.

Graph 2

... and hence can be used as a reliable early warning indicator

The upper panel of Table 2 shows that the DSR outperforms the credit-to-GDP gap as an early warning indicator when the full three-year horizon is used.<sup>11</sup> Shaded cells highlight the minimum noise-to-signal ratio for each indicator, always provided that two thirds or more of the crises are predicted. In the DSR's case, this noise-to-signal ratio is 5% compared with 17% for the credit-to-GDP gap. These noise-to-signal ratios are extremely low. In the large scale study by Drehmann et al (2011), the runners-up to the credit-to-GDP gap in terms of predictive performance had corresponding noise-to-signal ratios of about 30–40%.

The statistical tests also confirm the intuition that leverage builds up slowly before a crisis, but that the crisis itself is often precipitated by tightening liquidity constraints (Table 2, lower panels). To examine this proposition, we also consider the performance of both indicators in providing a warning only one, two or three years in advance of a crisis.<sup>12</sup> Thus, rather than assuming that a signal is correct if a crisis erupts in *any* of the three years after it is issued, we make the assumption that it is correct if a crisis breaks in a *specific* year (the first, second or third).

... in particular one to two years before crises, whereas measures of excessive leverage tend to pick up vulnerabilities as early as three years before crises

The DSR owes most of its predictive ability to the developments in the year immediately before a crisis. The performance here is exactly the same as for the full three-year horizon. When only year 2 or year 3 is considered, the minimum noise-to-signal ratio increases to 15% and 33% respectively, as we must lower the optimal thresholds in order to predict two thirds of the crises. In contrast, the credit-to-GDP gap performs consistently well during each of the three years leading up to a crisis. For example, for year 3, a credit-to-GDP gap

<sup>11</sup> The results discussed in this paper are robust to the use of data drawn solely from countries for which high-quality DSRs are available.

<sup>12</sup> Technically, when analysing a particular horizon (eg year 2), we take account only of signals emitted for that year and ignore signals emitted for the other two years in the three-year forecast horizon (eg in years 1 and 3).

| Predictive performance of the DSR and the credit-to-GDP gap   |                 |                   |                 |                   |                   |                 |
|---|-----------------|-------------------|-----------------|-------------------|-------------------|-----------------|
|   | DSR             |                   |                 | Credit-to-GDP gap |                   |                 |
| Horizon <sup>4</sup>  | TH <sup>1</sup> | Pred <sup>2</sup> | NS <sup>3</sup> | TH <sup>1</sup>   | Pred <sup>2</sup> | NS <sup>3</sup> |
| <i>All years</i>  |                 |                   |                 |                   |                   |                 |
| All three years   | 2.5             | 84                | 27              | 8.5               | 92                | 23              |
|   | 4               | 80                | 13              | 9.5               | 84                | 22              |
|   | 5               | 80                | 8               | 11                | 76                | 21              |
|   | 6               | 68                | 5               | 14                | 72                | 17              |
| <i>Individual years</i>   |                 |                   |                 |                   |                   |                 |
| Year 1  | 2.5             | 84                | 27              | 8.5               | 80                | 27              |
|   | 4               | 80                | 13              | 9.5               | 68                | 28              |
|   | 5               | 80                | 8               | 11                | 64                | 25              |
|   | 6               | 68                | 5               | 14                | 60                | 20              |
| Year 2  | 2.5             | 84                | 27              | 8.5               | 80                | 27              |
|   | 4               | 68                | 15              | 9.5               | 80                | 24              |
|   | 5               | 60                | 10              | 11                | 72                | 22              |
|   | 6               | 52                | 6               | 14                | 48                | 25              |
| Year 3  | 2.5             | 68                | 33              | 8.5               | 72                | 30              |
|   | 4               | 56                | 18              | 9.5               | 72                | 26              |
|   | 5               | 48                | 13              | 11                | 64                | 25              |
|   | 6               | 28                | 11              | 14                | 52                | 23              |
| <p>■ Threshold with minimum noise-to-signal ratio given that more than two thirds of crises are predicted.</p> <p><sup>1</sup> Threshold. <sup>2</sup> Predicted. <sup>3</sup> Noise-to-signal ratio. <sup>4</sup> Indicates the horizon within which a crisis has to occur for the signal to be classified as correct. All three years: a signal is correct if a crisis erupts at any time within the next three years. Year 1 (2/3): a signal is correct if a crisis erupts in the first year after the prediction was made (or in the second/third year).</p> <p>Sources: National data; authors' calculations. <span style="float: right;">Table 2</span></p> |                 |                   |                 |                   |                   |                 |

greater than 12 percentage points predicts 72% of crises with a noise-to-signal ratio of 26%. And this optimal threshold does not change much when only year 1 or year 2 is considered.

Overall, the analysis indicates that the DSR and the credit-to-GDP gap provide complementary information. While the credit-to-GDP gap starts to signal impending vulnerabilities well in advance of a crisis, a rapid rise in the DSR above 6% (relative to a 15-year average) is a very strong indication that a crisis may be imminent.

### Decomposing changes in the debt service ratio

The foregoing analysis has shown that the DSR has a clear tendency to increase rapidly a few years prior to financial crises and to fall off in their wake. What explains this dynamic? Two major factors can contribute to changes in the DSR: changes in the average lending rate and changes in the credit-to-GDP ratio.<sup>13</sup> In this section, we investigate the behaviour of these factors

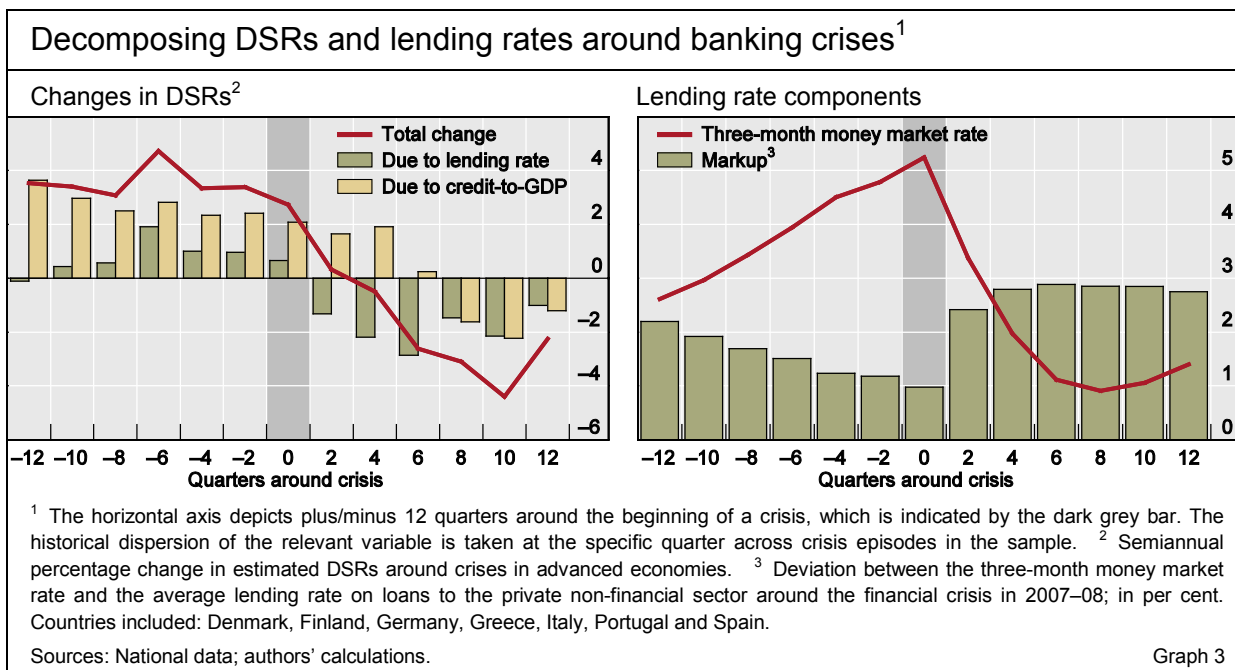
<sup>13</sup> We do not consider changes in the average remaining maturity as a cause for short-term changes in the DSR. For example, banks may at times have incentives to temporarily extend

before and after crises, and discuss their implications for the monetary transmission channel.

Sharp changes in DSRs around crises are mainly driven by changing short-term policy rates

While increases in the credit-to-GDP ratio induce steady and large increases in the DSR prior to a crisis, it is rising or falling lending rates that cause the sharpest changes. This can be seen from Graph 3 (left-hand panel), which decomposes the average changes in the DSR three years before and after a crisis into those due to changes in the lending rate and those arising from changes in the credit-to-GDP ratio. The contribution of the credit-to-GDP ratio is positive and quite steady (approximately 3% per half-year) ahead of a crisis. In contrast, the impact of the lending rate is more volatile. Three years ahead of a crisis, changes in lending rates contribute virtually nothing to rising DSRs. Their contributions then increase rapidly one or two years before a crisis, peaking at a semiannual rate of almost 2%. After a crisis, the DSR's decline over the first one and a half years is almost entirely due to falling lending rates, as the credit-to-GDP ratio adjusts only slowly.

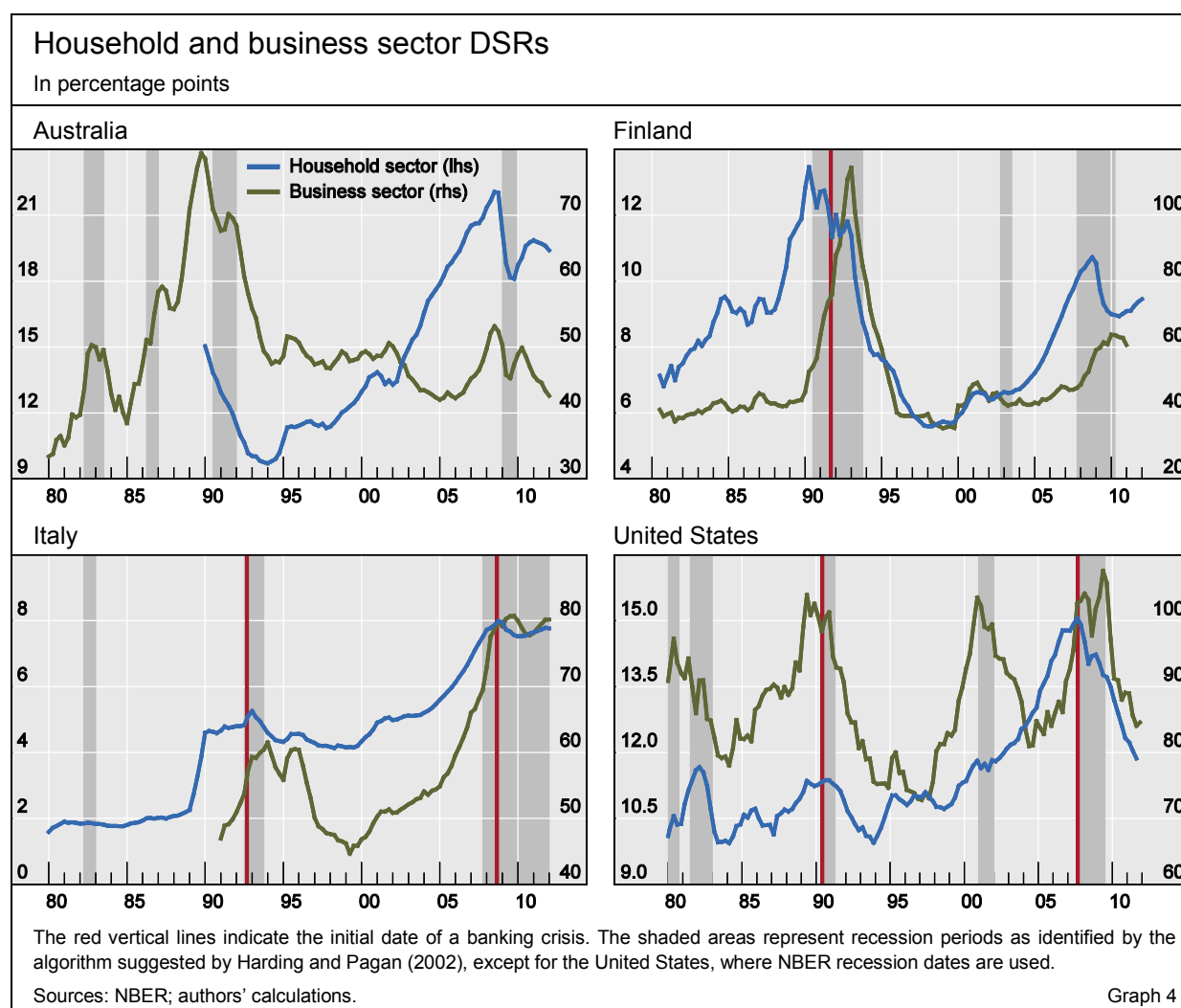
The rapid increase and decline in the lending rate around crisis dates is almost exclusively due to changes in the short-term policy rate rather than in lending spreads. This is evident from the right-hand panel of Graph 3, which compares the average markup in the lending rate with the average short-term money market rate.<sup>14</sup> Money market rates start to increase strongly about 12 quarters before a crisis but decline rapidly thereafter. In sharp contrast, the average markup in the lending rate falls in the run-up to a crisis but rises rapidly after the crisis erupts. Interestingly, this pattern is at odds with forward-looking behaviour, which would suggest that risk premia should increase before a crisis.



maturities for financially distressed borrowers. While it is conceivable that such changes occur, their net effect is nevertheless likely to be small.

<sup>14</sup> This decomposition can only be done around the recent crisis dates when high-quality data are available, as it requires more detailed information about lending rates.

These patterns suggest that the impact of interest rate changes on the DSR constitute an important additional way in which monetary policy is transmitted to the real economy. An increase (reduction) in nominal interest rates leads to higher (lower) lending rates that raise (lower) DSRs. As we have shown in the previous sections, high DSRs increase output volatility and can lead to a financial crisis. Of course, changing the policy stance may also influence both credit and income via other channels.<sup>15</sup> This will affect the DSR to the extent that the credit-to-income ratio changes. Because an interest rate change is only gradually transmitted to credit and income and tends to move them in the same direction, however, it may take considerable time before there is a notable impact on their ratio. This seems to be the case in Graph 3. The left-hand panel shows that the change in the credit-to-GDP ratio remains approximately constant until a crisis occurs (and a few quarters beyond) even though money market rates are steadily increasing over the same period (right-hand panel).



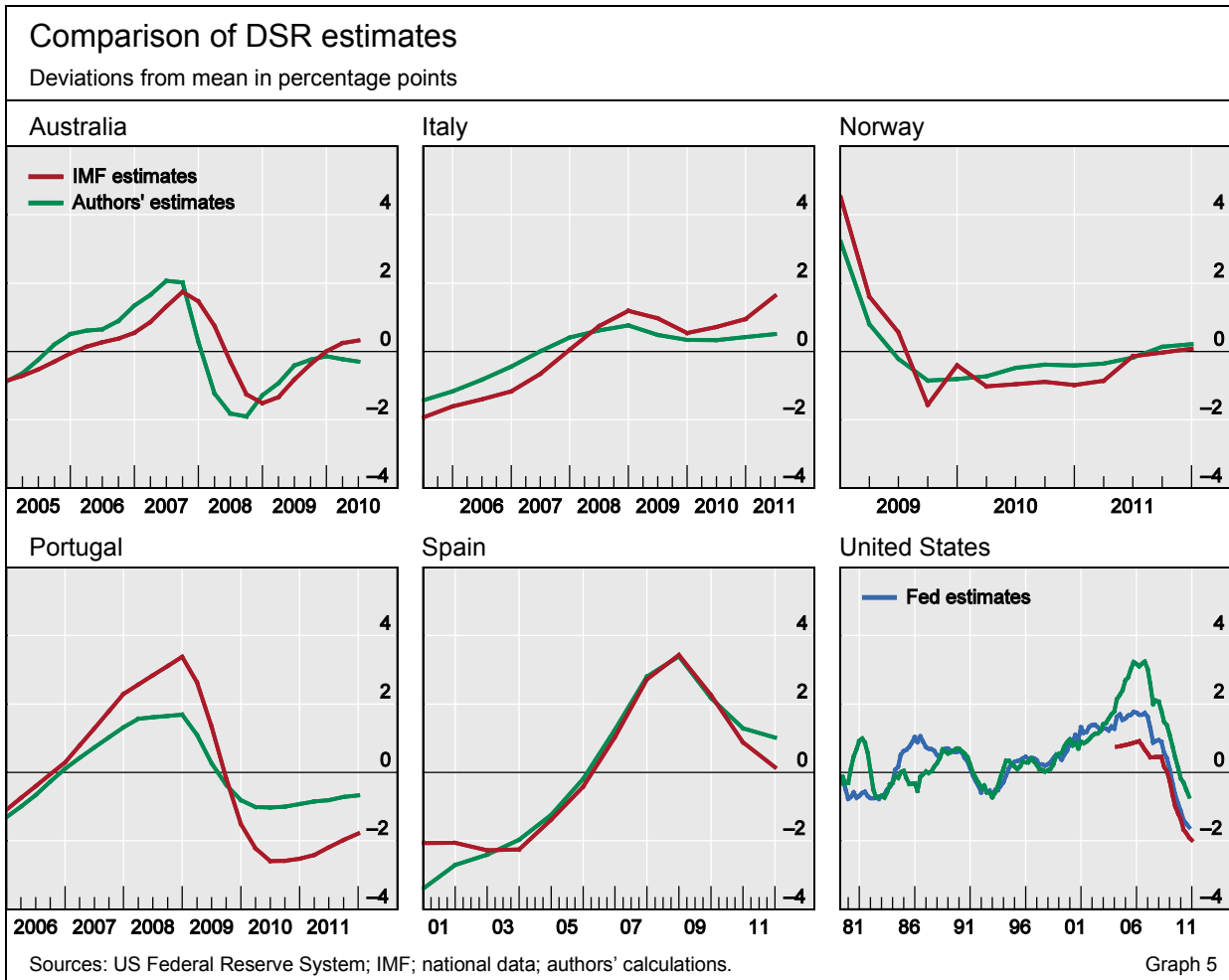
<sup>15</sup> Mishkin (1996) provides an overview of the various channels of monetary transmission. In terms of Mishkin's terminology, the "debt cost" channel that we discuss here seems to belong under the more general "credit channel".

## DSRs for the household and the business sector

Sectoral DSRs are consistent with existing estimates and can reveal different vulnerabilities for the household and the business sector

To assess whether increases in aggregate DSRs are driven by the debt situation of households or businesses, this section derives separate DSRs for each sector. The data required to do so, however, are only available for a subset of countries.<sup>16</sup> An additional complication arises from the question of how to divide GDP between the two sectors. We sidestep this problem by using disposable income for the household sector and the corporate operating surplus for the business sector.

The sector-specific DSRs reveal that sectoral vulnerabilities may not always build up at the same time. As examples, Graph 4 depicts these ratios for Australia, Finland, Japan and the United States. The graph shows that the DSRs in the two sectors can, at times, display significantly different patterns. For instance, in the United States, the business sector DSR seems to be more closely linked to the standard business cycle, whereas household sector DSRs only peak ahead of a crisis. Also, the Australian business sector's DSR did not peak after the recent global crisis, in sharp contrast to the corresponding household sector pattern.



<sup>16</sup> Sectoral DSRs can be constructed for Australia, Denmark, Finland, Italy, Japan, Norway, Portugal, Spain, the United Kingdom and the United States.

The household sector DSRs confirm that our method of constructing DSRs with relatively little information results in approximations that appear remarkably consistent when compared with estimates by the IMF and the Fed. In particular, the latter uses much more granular data (Dyhan et al (2003)). The average difference between our US estimates and those of the Fed and the IMF are  $-0.41\%$  and  $0.84\%$  respectively. For the remaining countries, the levels of DSR estimates provided by the IMF differ from ours. One likely explanation is that the IMF approximates credit by different series. The *cyclical* patterns, though, are exceptionally well aligned. This is clear from Graph 5, which shows the deviations of different household sector DSR estimates from their respective means in countries where such a comparison is possible.

## Concluding remarks

In this special feature, we have discussed the DSR's capabilities as an indicator for private sector indebtedness. We have found that its level is associated with the loss of output in subsequent economic downturns and that it provides a fairly accurate signal for an impending financial crisis, albeit at shorter horizons than alternative measures.

This suggests the benefits of monitoring the debt service costs in the economy. It also indicates that policymakers should act early when choosing to lean against credit booms, before the DSR reaches critical levels.

Despite these promising results, several data-related issues need to be resolved before more accurate DSR estimates can be produced. Data for the average interest rate and remaining maturity of the outstanding credit stock would be particularly useful. Currently, this type of data exists only for the most recent decade and for a small set of industrialised countries. A broader coverage would permit a deeper characterisation of the linkages between short-run policy rates and the DSR. Such an analysis would potentially be useful for policy.



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## Taylor rules and monetary policy: a global “Great Deviation”?<sup>1</sup>

*Policy rates have on aggregate been below the levels implied by the Taylor rule for most of the period since the early 2000s in both advanced and emerging market economies. This finding suggests that monetary policy has probably been systematically accommodative for most of the past decade. The deviation may, however, in part also reflect lower levels of equilibrium real interest rates that might introduce an upward bias in the traditional Taylor rule.*

*JEL classification: E43, E52, E58.*

The Taylor (1993) rule is a simple monetary policy rule linking mechanically the level of the policy rate to deviations of inflation from its target and of output from its potential (the output gap). Initially proposed as a simple illustration for the United States of desirable policy rules that had emerged from the academic literature at that time, it has become a popular gauge for assessments of the monetary policy stance in both advanced economies and emerging market economies (EMEs).

From a historical perspective, the Taylor rule has been a useful yardstick for assessing monetary policy performance. Specifically, in some major advanced economies, policy rates were below the level implied by the Taylor rule, and monetary policy therefore systematically too accommodative from the perspective of this benchmark, during the “Great Inflation” of the 1970s. In contrast, policy rates were broadly consistent with the Taylor rule during the “Great Moderation” between the mid-1980s and early 2000s, a period characterised by low inflation and low macroeconomic volatility.<sup>2</sup>

Between the early 2000s and the outbreak of the global financial crisis, policy rates were again systematically below Taylor rule-implied rates in a number of advanced economies (eg Taylor (2007), Ahrend et al (2008)). The

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<sup>1</sup> The authors thank Claudio Borio, Steve Cecchetti, Andrew Filardo, Mikael Juselius, Carlos Montoro, Előd Takáts and Christian Upper for useful comments and discussions. The views expressed are those of the authors and do not necessarily reflect those of the BIS.

<sup>2</sup> For Taylor rule-based analyses of historical monetary policy performance, see, for instance, Taylor (1999) for the United States, and Nelson and Nikolov (2003) for the United Kingdom. Orphanides (2003) demonstrates that the deviation of policy rates from the Taylor rule during the 1970s can be largely explained by real-time mismeasurement of the output gap, while Nelson and Nikolov (2003) show that this factor played a less important role in the United Kingdom.

prolonged monetary accommodation suggested by this deviation has been identified as a potential causal factor in the build-up of financial imbalances before the global financial crisis, but the literature has not reached a consensus on this issue.<sup>3</sup> Taylor (2010, 2012) even argues that the deviation reflects another change in the policy regime, to a regime which he dubs the “Great Deviation”, a conjecture that is, however, rejected by Bernanke (2010).<sup>4</sup>

This special feature takes up this question from a global perspective by assessing the level of policy rates prevailing since the mid-1990s through the lens of the Taylor rule. The results of the analysis show that, in advanced economies and in particular also in EMEs, policy rates were on aggregate well below the levels implied by the Taylor rule over the past decade. While lower equilibrium real interest rates may explain part of the deviation and the simplistic setup of the Taylor rule generally cautions against taking its indications too literally, this finding suggests that monetary policy has probably been systematically accommodative for most of the past decade.<sup>5</sup>

The remainder of this special feature is organised as follows. The first section compares the level of policy rates that prevailed in advanced economies and EMEs with the levels that result from the Taylor rule. The second section estimates policy rules empirically. In the third section we discuss possible explanations of our findings. The fourth section concludes.

## The Taylor rule and global monetary policy

The Taylor (1993) rule takes the following form:

$$i = r^* + \pi^* + 1.5(\pi - \pi^*) + 0.5y \quad (1)$$

where  $i$  is the nominal policy rate,  $r^*$  is the long-run or equilibrium real rate of interest,  $\pi^*$  is the central bank’s inflation objective,  $\pi$  is the current period inflation rate, and  $y$  is the current period output gap.

The Taylor rule implies that central banks aim at stabilising inflation around its target level and output around its potential. Positive (negative) deviations of the two variables from their target or potential level would be associated with a tightening (loosening) of monetary policy. While the

The Taylor rule links policy rates mechanically to the deviation of inflation from target and the output gap

<sup>3</sup> Evidence presented by Taylor (2007) and Ahrend et al (2008) suggests that monetary policy was probably an important driver in the build-up of pre-crisis imbalances. Other studies, however, suggest rather that regulatory and supervisory failure and global imbalances were the main drivers (eg Merrouche and Nier (2010)).

<sup>4</sup> Specifically, Bernanke (2010) argues that the systematic deviation largely disappears when real-time output gap estimates and inflation forecasts are used in the construction of the Taylor rule benchmark. The deviation that has been identified ex post would therefore reflect real-time measurement problems with the Taylor rule’s input variables rather than a change in the monetary policy regime.

<sup>5</sup> This assessment appears to be at odds with the observation that inflation rates have been broadly consistent with central banks’ inflation targets over this period. Svensson (2012) argues that monetary policy in Sweden was probably even too tight over the past 15 years since average inflation was lower than the Riksbank’s inflation target. A potential explanation for this apparent inconsistency between inflation performance and the indications of Taylor rules is that, as a consequence of credible monetary policy frameworks, globalisation and financial liberalisation, loose monetary conditions manifest themselves in a build-up of financial imbalances rather than in rising inflation (Borio and Lowe (2002), White (2006)).

calibration of the reaction coefficients by Taylor is not normative, it incorporates important properties of desirable rules from the perspective of modern macroeconomic models of the New Keynesian type.<sup>6</sup> In particular, an inflation reaction coefficient larger than one ensures that real interest rates respond in a stabilising way to inflationary pressures.<sup>7</sup>

We compute Taylor rule benchmarks for the global aggregate as well as the aggregates of advanced and emerging market economies based on quarterly data for 11 advanced economies and 17 EMEs over the period from the first quarter of 1995 to the first quarter of 2012.<sup>8</sup> In order to take account of the uncertainty around the measurement of the input variables, ie the inflation rate and the output gap, we pursue a “thick modelling approach” by considering all possible combinations of different measures of inflation and the output gap to obtain a range of possible Taylor rule-implied rates.

Specifically, we consider four different inflation measures: the current headline CPI inflation rate, the current GDP deflator inflation rate, the current core CPI inflation rate and the consensus forecast of CPI inflation for the next four quarters as a forward-looking inflation measure.<sup>9</sup> In each case, inflation is measured as the year-on-year percentage change in the respective price index. For the output gap, we consider three different statistical estimators of potential real GDP: a segmented linear trend that allows for a break in the trend in 2001,<sup>10</sup> a Hodrick-Prescott (HP) filter trend and an unobserved components (UC) estimator.<sup>11</sup> For the aggregate of advanced economies, we also use the structural output gap estimate published in the IMF *World Economic Outlook* (WEO), which is not available for the aggregate of EMEs. The output gap is measured as the percentage difference between real GDP and potential GDP. Overall, we therefore have 12 possible combinations of inflation and output gap measures for the aggregate of EMEs and 16 possible combinations for the aggregate of advanced economies.

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<sup>6</sup> The Taylor rule generally performs well in terms of delivering macroeconomic stability across a variety of models and is therefore more robust than model-specific optimal and more complex policy rules. See Taylor and Williams (2011) for a detailed discussion. However, it needs to be borne in mind that this robustness has emerged over a class of models where price rigidities are the only friction in the economy.

<sup>7</sup> In the standard New Keynesian model, this feature, which is referred to as the Taylor principle, is a sufficient but not a necessary condition for equilibrium determinacy (Woodford (2001)). This result, however, does not necessarily hold under richer model specifications, where a large inflation reaction parameter can even be destabilising (see eg Christiano et al (2011)).

<sup>8</sup> The aggregates are constructed based on 2005 PPP weights.

<sup>9</sup> This measure is constructed as a weighted average of the consensus forecast for the current year and the consensus forecast for the next year as in Gerlach et al (2011).

<sup>10</sup> A segmented linear trend instead of a standard linear trend was chosen since the trend governing real GDP in advanced and emerging market economies changed after 2001, so that a linear trend yielded very implausible output gap estimates.

<sup>11</sup> In order to mitigate the endpoint problem of trend estimation we extended the output series to the fourth quarter of 2013 using forecasts from the OECD *Economic Outlook* and JPMorgan.

Following Taylor (1993), we link the calibration of the equilibrium real interest rate to the estimates of trend output growth, which can be motivated by standard consumption theory.<sup>12</sup> Specifically, we set in each inflation-output gap combination the long-run level of the real interest rate equal to the respective estimate of the trend growth rate of real GDP. This means that  $r^*$  varies over time in those specifications where the HP gap, the UC gap or the IMF WEO output gap are used. For the construction of the global and regional aggregates of the central banks' inflation objective  $\pi^*$ , we use official inflation target or goal levels when available.<sup>13</sup> For countries that do not have an official inflation target, we use the sample average of the respective inflation measure in the case of advanced economies, and the HP filter trend in the case of EMEs.

Long-run real interest rates are assumed to be linked to trend output growth

The results reveal that the systematic deviation of policy rates from the Taylor rule since the early 2000s that has been identified by previous studies for some advanced economies is a global phenomenon. While policy rates were consistent with the levels implied by the Taylor rule up until the early years of the new millennium, a systematic deviation emerged thereafter. Since 2003, global policy rates have almost always been below the levels indicated by Taylor rules (Graph 1, left-hand panel). Only during the Great Recession of 2009 were policy rates briefly inside the Taylor rule range. After 2009, as policy rates remained low while the global economy recovered, the gap opened up again. Reflecting the recent weakening of the global economy in the wake of the European sovereign debt crisis, however, the deviation narrowed somewhat in the first quarter of 2012.

Global policy rates have on aggregate been below Taylor rule benchmarks since the early 2000s

A look at global regions reveals that the result is mainly driven by the EMEs (Graph 1, right-hand panel). There, the deviation has averaged about 4.5 percentage points since 2003. At the end of the sample period, ie the beginning of 2012, the difference was around 3.5 percentage points. In the advanced economies, policy rates have been below the range of Taylor rule rates since around 2001, but the deviation is smaller, on average less than 2 percentage points (Graph 1, centre panel). In the Great Recession, the Taylor rule would on average have suggested negative policy rates for a short period of time, but actual policy rates were still well inside the range. In 2011, the spectrum of Taylor rates shifted back to positive levels and policy rates have been at the lower bound of the range since then.

The deviation is particularly pronounced in EMEs

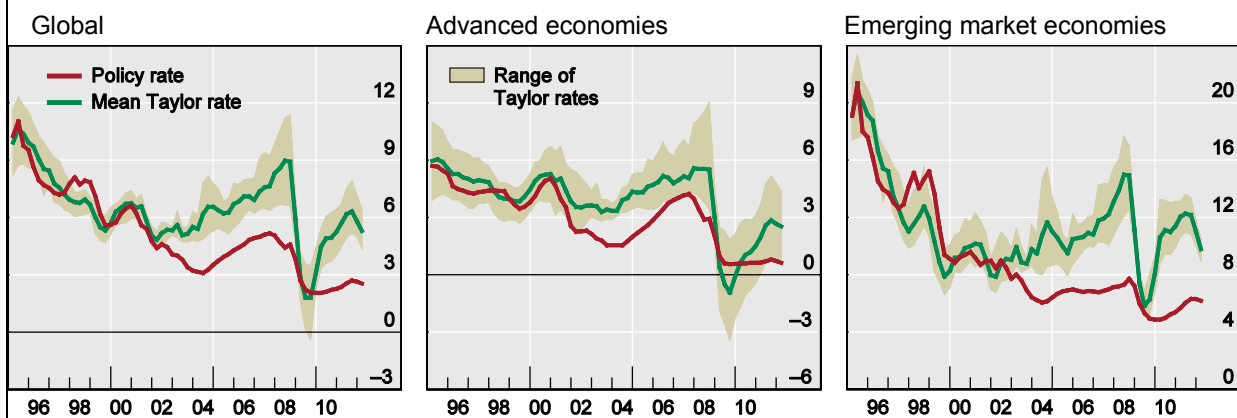
The finding that policy rates in advanced economies might currently be slightly too low compared to the levels implied by the Taylor rule may appear

<sup>12</sup> See Laubach and Williams (2003), who also present evidence that the natural real interest rate in the United States is indeed closely linked to trend output growth. However, they also find that estimates of the natural rate level are surrounded by a very high degree of uncertainty.

<sup>13</sup> We construct implicit target levels for all inflation measures by adding to the inflation target the average difference between the respective inflation measure and the targeted inflation measure over the sample period. For instance, when the inflation target refers to the CPI, we construct the implicit target for GDP deflator inflation by adding the average difference over the sample between the GDP deflator inflation rate and the headline CPI inflation rate to the inflation target level.

## The Taylor rule and policy rates<sup>1</sup>

In per cent



The Taylor rates are calculated as  $i = r^* + \pi^* + 1.5(\pi - \pi^*) + 0.5y$ , where  $\pi$  is a measure of inflation,  $y$  is a measure of the output gap,  $\pi^*$  is the inflation target and  $r^*$  is the long-run level of the real interest rate. We compute Taylor rates for all combinations of four measures of inflation (headline, core, GDP deflator and consensus headline forecasts) and measures of the output gap obtained from three different statistical ways to compute potential output (HP filter, segmented linear trend and unobserved components). For the advanced economies, we also use the structural output gap estimate from the IMF WEO. In each case, the long-run real interest rate is set equal to the trend output growth rate as estimated by the trend filter used to construct the respective output gap measure.  $\pi^*$  is set equal to the official inflation target or goal levels when available. Implicit target levels for the inflation measures to which the official inflation target does not refer are constructed by adding the average difference over the sample period between the respective inflation measure and the targeted inflation measure to the official inflation target. For countries that do not have an official inflation target, we use the sample average of the respective inflation measure in the case of advanced economies, and the inflation trend obtained from an HP filter in the case of emerging market economies. For the consensus CPI inflation forecast we use the same target level as for the actual CPI inflation rate. The graph shows the range and the mean of the Taylor rate of all inflation-output gap combinations.

<sup>1</sup> Weighted average based on 2005 PPP weights. "Global" comprises the economies listed here. Advanced economies: Australia, Canada, Denmark, the euro area, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom and the United States. Emerging market economies: Argentina, Brazil, China, Chinese Taipei, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Poland, Singapore, South Africa and Thailand.

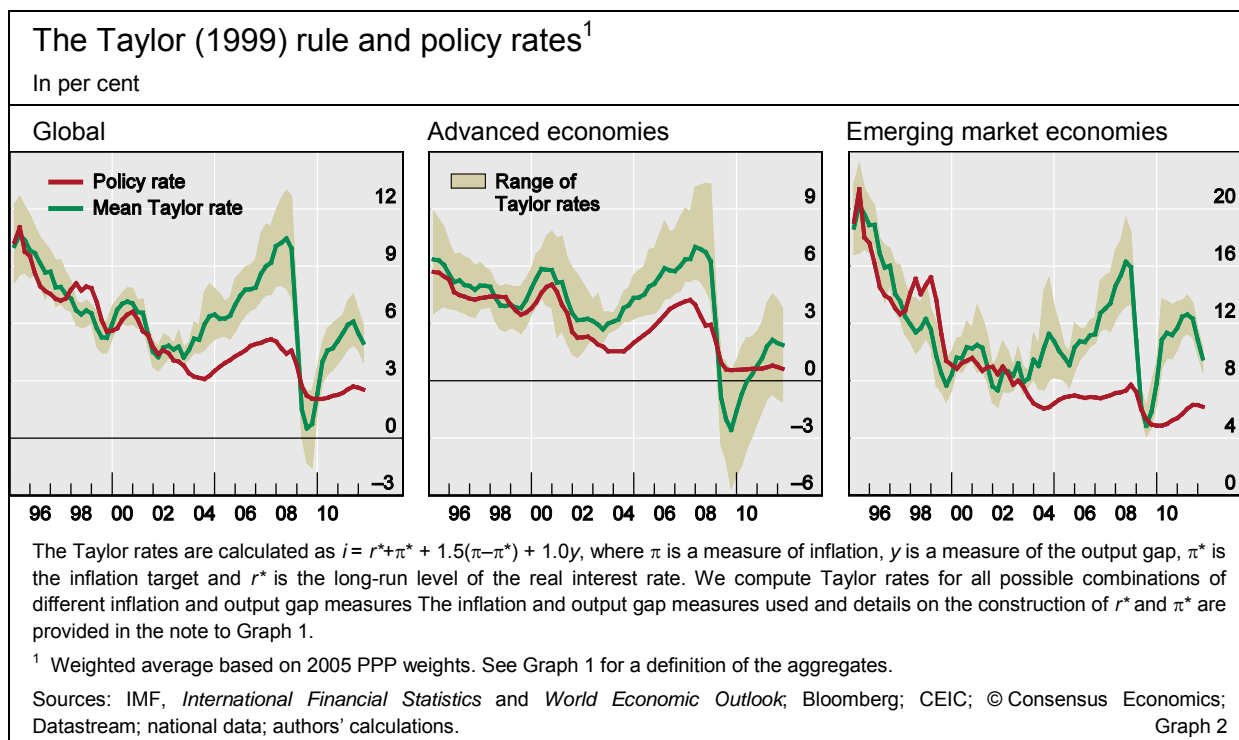
Sources: IMF, *International Financial Statistics* and *World Economic Outlook*; Bloomberg; CEIC; © Consensus Economics; Datastream; national data; authors' calculations. Graph 1

implausible given the perceived large degree of economic slack in these economies. This finding does indeed depend somewhat on the calibration of the Taylor rule parameters, specifically on the choice of the weight of the output reaction. In order to illustrate this point, we replicate the analysis with an alternative calibration of the Taylor rule considered by Taylor (1999). The only difference from the original calibration is a larger output reaction coefficient, which is twice as large as in the original calibration (ie equal to 1.0). This larger output weight, however, does not fundamentally alter the Taylor rule's assessment of the evolution of the global monetary policy stance over the past decade (Graph 2). The main difference is that, for the aggregate of advanced economies, the range shifts down for the period since the Great Recession, indicating negative policy rates for a longer period and putting policy rates well inside the Taylor rule range at the end of the sample period.

Estimated policy rules show that the deviation of policy rates from the Taylor rule reflects ...

### Estimated policy rules

To understand in what way policy rate setting has deviated from the Taylor rule since the early 2000s, we estimate empirically the parameters of simple policy rules for the aggregates of the group of advanced economies and the group of



EMEs. The specification of the empirical policy rule is given by:

$$i = \rho i_{-1} + (1 - \rho) \{ \alpha + \beta_{\pi} (\pi - \pi^*) + \beta_y y \} + \varepsilon \quad (2)$$

The specification includes a lagged interest rate term, thus allowing for interest rate smoothing. This implies a gradual adjustment of policy rates to their benchmark level, which includes the same arguments as the original Taylor rule. The constant in the empirical policy rule corresponds to the sum of the long-run real interest rate and the inflation objective in equation (1), ie  $\alpha = r^* + \pi^*$ . We can therefore back out the implicit estimated long-run real interest rate by subtracting the target inflation rate from the estimated constant.<sup>14</sup> Finally,  $\varepsilon$  is the error term.

A thick modelling approach is also applied in the estimation of the policy rules. Specifically, we estimate equation (2) by non-linear least squares (NLLS) for all possible inflation-output gap combinations.<sup>15</sup> The sample period for the EMEs is the first quarter of 2001 to the first quarter of 2012. For the advanced economy aggregate, the sample period ends in the fourth quarter of 2008 due to the binding of the effective lower bound of interest rates in the core advanced economies since early 2009.

The results reveal that empirical policy rules deviate from the Taylor rule primarily in the level of the implicit long-run real interest rate. The range of estimated implicit long-run real rates is well below the trend rate of real GDP growth (Graph 3), consistent with the average levels of ex post real interest

... average real interest rates that were well below average output growth ...

<sup>14</sup> Since  $\pi^*$  varies over time,  $r^*$  also varies over time. For ease of exposition, we report the range of the sample averages of the time-varying  $r^*$ .

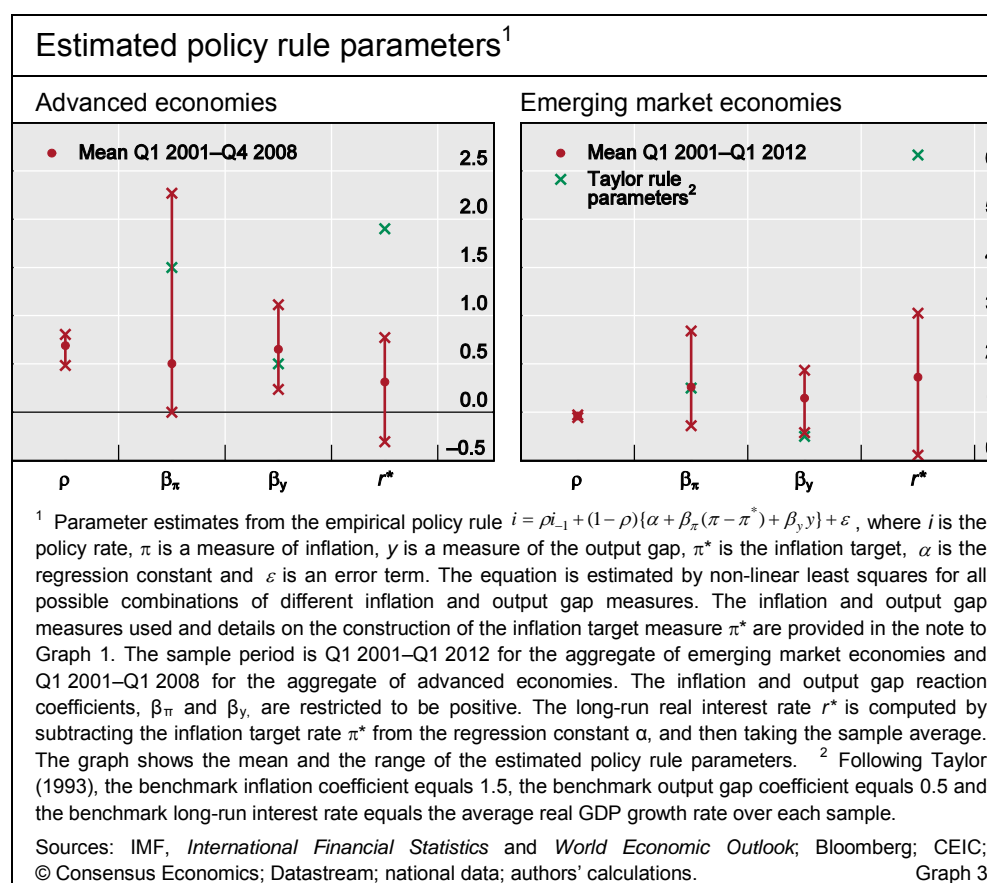
<sup>15</sup> Inflation and output gap reaction coefficients are restricted to be positive in order to rule out implausible coefficient values.



rates that prevailed over the sample period. This finding does not, however, constitute evidence that equilibrium real interest rates are in fact lower. It is rather a mechanical reflection of the systematic negative deviation of policy rates from Taylor rule-implied rates documented in the previous section. A lower constant term, and hence a lower estimated long-run real interest rate level, than assumed in the Taylor rule is needed in order to obtain a policy rule that is consistent with the actual path of policy rates.

The estimated inflation reaction parameter is on average fully consistent with the value of 1.5 in the Taylor rule in the EMEs but, with a mean estimate of 0.5, is well below that value in the advanced economies. However, the range of the estimated inflation response parameters in the latter group of countries is rather wide and includes the value of the Taylor rule. Therefore, rather than indicating a genuine violation of the Taylor principle, this finding may just be a reflection of central banks' success in keeping inflation low and stable over the sample period. In the absence of major movements in inflation, the reaction of policy rates to this variable might simply have become more difficult to pin down with any great precision.<sup>16</sup>

The estimated response of policy rates to the output gap is very close to the Taylor rule parameter value of 0.5 for the aggregate of advanced economies. For the EME aggregate, the estimated reaction parameter is



<sup>16</sup> This explanation is similar to the one that has been put forward for the disappearance of the money growth inflation link implied by the quantity theory (see eg De Grauwe and Polan (2005)).

higher, with a mean value of 1.3. However, this finding does not necessarily imply a higher preference for output stabilisation in this group of countries, since the policy rule parameters reflect, from a conceptual point of view, not only the central bank's preferences but also the structural determinants of the transmission mechanism.<sup>17</sup>

Finally, in line with the previous literature, we find that interest rate smoothing plays an important role in policy rate setting. The smoothing parameter  $\rho$  is very tightly estimated with a mean value of around 0.7 in the advanced economies and around 0.9 in the EMEs. This implies that policy rates adjust very slowly to their benchmark level. The persistent deviation of policy rates from the Taylor rule documented in the previous section might therefore in part reflect the effect of interest rate smoothing. This cannot, however, explain why policy rates on various occasions over the sample did not display any adjustment towards the Taylor rule benchmark or even moved in the opposite direction.

... and a high degree of interest rate smoothing

### The global deviation from the Taylor rule: potential explanations

What explains the global deviation of policy rates from the Taylor rule? A possible explanation is the systematic influence of factors other than the dynamics of inflation and output in policy rate setting, specifically of concerns about financial instability and about destabilising capital flow and exchange rate movements.<sup>18</sup>

The global deviation from the Taylor rule could be driven by ...

Concerns about the macroeconomic tail risks associated with financial instability offer a potential explanation for the deviation of policy rates from Taylor rates in the group of advanced economies. The view that prevailed in some core advanced economy central banks over the past decade was that monetary policy should mitigate the fallout of financial busts, but should respond to financial booms only if they are associated with perceived risks to the inflation objective. Advanced economy policy rates did indeed fall strongly and rapidly in the wake of the two financial busts since 2000 and rose only slowly or not at all during the following recovery (Graph 1, centre panel). This suggests that an asymmetric response pattern over the financial cycle might have been present, a notion that is also supported by formal empirical evidence (Borio and Lowe (2004) and Ravn (2011)).<sup>19</sup> With inflation rates firmly anchored to central banks' inflation goals over this period, this could have driven down nominal and real interest rates and thereby opened a wedge between policy rates and Taylor rule-implied rates.

... an asymmetric monetary policy response over the financial cycle in some countries ...

<sup>17</sup> See Hayo and Hofmann (2006) for an applied discussion of this issue in the context of a comparison of output reaction coefficients in estimated Bundesbank and ECB policy rules.

<sup>18</sup> Hannoun (2012) refers to these two factors as "financial dominance" and "exchange rate dominance".

<sup>19</sup> Conceptually, a systematic, though symmetric, response of policy rates to financial factors can be rationalised based on models with financial frictions. For instance, in the model of Cúrdia and Woodford (2009) a credit spread measure enters the optimal policy rule as an additional argument. Policy rates would therefore be higher than implied by the classical Taylor rule during financial booms when credit spreads are below normal, and lower during financial busts when credit spreads are above normal.

... combined with global behavioural monetary policy spillover effects

Concerns about unwelcome capital flows and exchange rate movements may in turn have transmitted low interest rates in core advanced economies to EMEs and other advanced economies. Out of such concerns, central banks may aim to avoid large and volatile interest rate differentials so that their policy rates become implicitly tied to those prevailing in core advanced economies.<sup>20</sup> The empirical relevance of this point is underpinned eg by Gray (2012) and Goldman Sachs (2012), who find that US interest rates are an important argument in estimated policy rules of both advanced economies and EMEs. Through this channel, the downward trend in core advanced economies' policy rates might have exerted downward pressure on policy rates around the globe, driving down real interest rates and alienating policy rates from the levels suggested by domestic inflation and output developments through the Taylor rule.

The deviation may in part also reflect lower equilibrium real interest rates

The indication that monetary policy has been systematically too accommodative over the past decade from the perspective of the Taylor rule would, however, be partly qualified if equilibrium real interest rates were indeed lower than trend real output growth. While the low average level of ex post real interest rates since early 2000 might merely be a reflection of systematically accommodative monetary policy, there are also a number of factors that might have pushed down equilibrium real rates over this period. Low long-run real rates may in part reflect secular demographic trends, specifically the influence of the baby boomer generation on asset markets (Takáts (2010)). Also, high saving rates and underdeveloped financial markets in EMEs may have given rise to a global asset shortage that has lowered equilibrium real interest rates worldwide (Caballero et al (2008)). Another potential factor is a possible increase in the perceived riskiness of capital assets in the wake of the recurrent asset price booms and busts since the late 1990s. Such higher "capital price risk" could drive long-run risk-free real interest rate levels well below trend output growth (Abel et al (1989)). However, while all these factors may have lowered equilibrium real interest rates, there is no evidence at hand to assess their quantitative impact.

Finally, there are a number of specific considerations that might explain in part the deviation of policy rates from the Taylor rule over the more recent period. The negative shocks that have buffeted the global economy over the past four years may have temporarily lowered equilibrium or "natural" real interest rates below their low-frequency component that is linked to trend output growth.<sup>21</sup> Moreover, the binding of the zero lower bound during the Great Recession in some economies might have created a cumulative shortfall of monetary accommodation over this period. This would make the case for

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<sup>20</sup> Gray (2012) explores the mechanics of such behavioural monetary policy spillover effects across borders in a simple open economy rational expectations model. From a conceptual point of view, a systematic reaction to exchange rate misalignments and foreign demand conditions would be part of an optimal monetary policy rule in open economy models with incomplete exchange rate pass-through and incomplete asset markets (Corsetti et al (2010)).

<sup>21</sup> From the perspective of New Keynesian macro models, the equilibrium or "natural" real interest rate in the Taylor rule should also include a high-frequency component reflecting the real economic shocks hitting the economy (Woodford (2001)).

keeping policy rates below the levels implied by conventional monetary policy rules until the shortfall is made up for (Reifschneider and Williams (2000)).

## Conclusions

The analysis in this special feature suggests that, from the perspective of the Taylor rule, monetary policy has on aggregate been systematically accommodative globally since the early 2000s. A candidate explanation for the potential global accommodative bias in monetary policy is the combination of two factors: an asymmetric reaction of monetary policy to the different stages of the financial cycle in core advanced economies, and global behavioural monetary policy spillovers through resistance to undesired capital flows and exchange rate movements in other countries, especially in EMEs. This would suggest that central banks need to reconsider their monetary policy frameworks with a view to ensuring symmetry in the conduct of monetary policy over the financial cycle and to better internalise the externalities associated with global monetary policy spillovers (Borio (2011)).

At the same time, it is important to bear in mind the limitations and pitfalls of Taylor rule-based analysis. First, the indications of Taylor rules should be taken with caution as they involve assumptions about unobservable concepts which might be wrong and hence misleading. Specifically, the indication that monetary policy has been systematically too accommodative might in part reflect a drop in equilibrium real interest rates. Second, the traditional Taylor rule might not adequately capture the factors that are relevant for macroeconomic stability and hence for monetary policy. In particular, financial stability risks and their macroeconomic implications are not appropriately captured. As a consequence, the Taylor rule is likely to have a downward bias during financial booms and an upward bias during financial busts.<sup>22</sup> Finally, Taylor rules do not capture the role of other monetary policy instruments. Specifically, changes in reserve requirements, which play an important role in some EMEs, and central banks' balance sheet policies are not taken into account. Total assets held by central banks have roughly quadrupled over the past decade and stood at approximately \$18 trillion at the beginning of 2012, or roughly 30% of global GDP. This is likely to have further eased monetary policy, eg by lowering long-term interest rates and mitigating exchange rate appreciation,<sup>23</sup> so that the global monetary policy stance over the sample period was probably more accommodative than indicated by the level of policy rates.

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<sup>22</sup> The Taylor rule might also have a downward bias in the bust emanating from potential adverse side effects of prolonged low levels of interest rates. See BIS (2012) for a more detailed discussion of these side effects.

<sup>23</sup> For an overview and new evidence of the effect of central bank bond purchase programmes on long-term government bond yields, see Meaning and Zhu (2011). Gambacorta et al (2012) present evidence that the expansionary balance sheet policies adopted by advanced economy central banks in response to the global financial crisis had significant macroeconomic effects.

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## Credit in times of stress: lessons from Latin America<sup>1</sup>

*The 2007–09 global financial crisis disrupted the provision of credit in Latin America less than previous crises. We identify key initial macroeconomic conditions that contributed to the higher resilience of real credit in Latin America during this episode. These relate to economies' capacity to withstand an external financial shock and the scope for countercyclical macroeconomic policies. We also show that in most cases current macroeconomic fundamentals have deteriorated relative to those in 2007.*

*JEL classification: E65, G2.*

Credit growth in Latin American economies during the 2007–09 global financial crisis was more resilient than in previous crisis episodes, when financial stress elsewhere ushered in banking crises and credit crunches in the region.

In this special feature we identify macroeconomic conditions that contributed to this higher resilience of real credit growth.<sup>2</sup> To do so, we compare the development of real credit in selected Latin American countries during the most recent stress episode to that in the aftermath of the Asian and Russian financial crises in 1997–98. While real credit growth fell by about 25 percentage points after both episodes, it recovered much more quickly after the most recent crisis than it did in the late 1990s (Table 1). It took Latin American economies only four to six quarters on average to recover half of the 2007–09 drop in credit growth, compared to well over three years in most countries after 1997–98. Furthermore, no major banking crisis occurred in the region after 2007–09, compared with major domestic financial crises in Brazil and Argentina in 1999 and 2001, respectively.

Credit growth during the global financial crisis also fared better in Latin America than in other emerging market regions. Based on a sample of emerging

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<sup>1</sup> The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS or the Center for Global Development. We would like to thank Claudio Borio, Stephen Cecchetti, Ramon Moreno and Christian Upper for helpful comments. Alan Villegas provided excellent research assistance. Most of the analysis of this article is based on Montoro and Rojas-Suarez (2012).

<sup>2</sup> Cecchetti et al (2011) analyse the factors behind the macroeconomic performance during the 2007–09 global financial crisis for a sample of advanced and emerging economies.

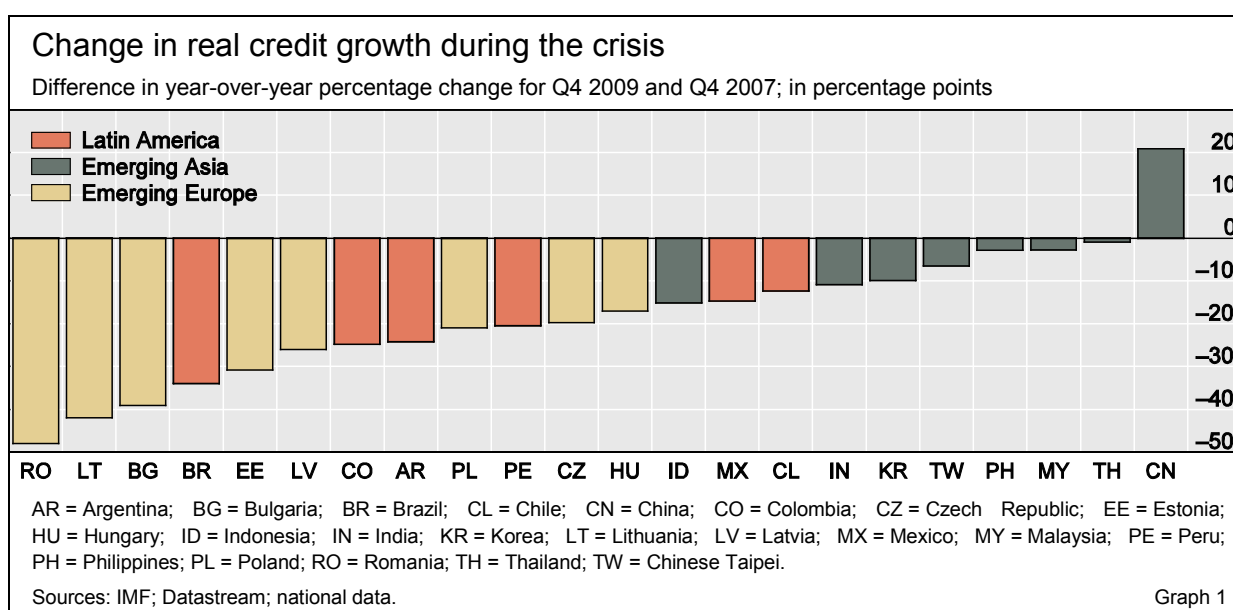
| Credit behaviour in Latin America during recent crisis episodes |           |        |       |          |        |      |                            |
|---|-----------|--------|-------|----------|--------|------|----------------------------|
|   | Argentina | Brazil | Chile | Colombia | Mexico | Peru | Latin America <sup>1</sup> |
| 1998 crisis   |           |        |       |          |        |      |                            |
| Drop in credit growth <sup>2</sup>                              | -17       | -17    | -5    | -19      | -41    | -18  | -25                        |
| No of quarters to recover half of drop <sup>3</sup>             | >12       | >12    | 2     | 11       | >12    | >12  |                            |
| 2007–09 crisis  |           |        |       |          |        |      |                            |
| Drop in credit growth <sup>2</sup>                              | -24       | -34    | -12   | -25      | -15    | -20  | -24                        |
| No of quarters to recover half of drop <sup>3</sup>             | 4         | 4      | 6     | 5        | 5      | 4    |                            |

<sup>1</sup> Weighted average of the economies shown, based on 2005 GDP and PPP exchange rates. <sup>2</sup> Q4 1999 (Q4 2009) minus Q4 1997 (Q4 2007); in percentage points. <sup>3</sup> Number of quarters after Q4 1999 (Q4 2009) that it took for credit growth to recover half of its drop.

Sources: IMF; Bloomberg; Datastream; national data. Table 1

market economies, Latin America ranked between emerging Asia and emerging Europe in terms of the size of the reduction in credit growth (Graph 1).

In the remainder of the chapter we present macroeconomic indicators that could help explain the relatively good performance of Latin American economies after the 2007–09 financial crisis. However, there are two caveats to our analysis. First, we study only two crisis episodes and do not have the full set of indicators available for all countries over the entire sample. This means that we cannot perform clean statistical tests of how the vulnerability measures we consider affected the drop in credit growth. Our findings are therefore more indicative than conclusive. Second, the resilience of credit growth to an external shock depends on a variety of factors, including real and financial exposures<sup>3</sup> to particular regions and the strength of the financial sector.<sup>4</sup>



<sup>3</sup> For example, Avdjiev (2011) presents some indicators using data from the BIS international banking statistics to evaluate the potential impact of deleveraging by euro area banks on emerging market economies.

<sup>4</sup> An analysis of other variables for the global financial crisis period can be found in Montoro and Rojas-Suarez (2012).

## A set of indicators of macroeconomic strength

Resilience depends on macroeconomic strength ...

We select a set of macroeconomic variables that are key for explaining the resilience of credit in emerging market economies to external financial shocks. A first dimension of macroeconomic strength is an economy's capacity to withstand a shock. At the macro level, this will depend, inter alia, on a country's current net external financing needs, its external indebtedness, its external liquidity position and its aggregate exposure to exchange rate risk. We assess these characteristics by looking at: (i) the current account balance as a ratio of GDP; (ii) the ratio of total external debt to GDP; (iii) the ratio of short-term external debt to gross international reserves; and (iv) the currency mismatch ratio, given by the foreign currency share of total debt divided by the ratio of exports to GDP.<sup>5</sup>

... and ability to implement offsetting policies

A second dimension of macroeconomic strength is the scope for countercyclical policy that could offset the effects of an external shock. From a macroeconomic perspective, this corresponds to the capacity to implement countercyclical fiscal and monetary policies. We measure this as: (v) the ratio of general government fiscal balance to GDP and (vi) the financial pressures-adjusted monetary policy stance that takes into account both price stability conditions and the degree of financial stability pressures (see box).<sup>6</sup> This indicator captures both the extent to which inflation is not under control and the size of financial imbalances, which in turn reflects the fact that monetary policy tends to be less effective during a financial bust. We do not explicitly consider another constraint for monetary policy, the proximity of nominal rates to the zero lower bound, because we believe that inflationary constraints are more important in countries where policy rates are typically fairly high and well above the lower bound.

## Macroeconomic strength prior the 2007–09 crisis

Macro factors explain resilience ...

The six variables discussed above can explain a significant part of the variation across countries in the change in real credit growth after the crisis. Graph 2 shows the cross-country correlations between the macroeconomic variables and the change in real credit growth. The highest correlation coefficients were found for current account / GDP (0.77) and the currency mismatch ratio (–0.67).<sup>7</sup> The correlation coefficients of financial pressures-adjusted monetary policy stance (0.50) and total external debt / GDP (–0.48) were also relatively significant.

... and variation across regions

The macroeconomic vulnerabilities also varied considerably across regions. For example, debt ratios (both total and short-term external debt) were

<sup>5</sup> See Goldstein and Turner (2004). The time series of this and other measures of currency mismatches for 27 countries are available on request from bilyana.bogdanova@bis.org.

<sup>6</sup> This indicator also captures that credit was growing too rapidly in some economies before the global financial crisis and some slowdown may have been desirable.

<sup>7</sup> These two variables explain 73% of the cross-country variation in the change in real credit growth after the crisis.

## A financial pressures-adjusted monetary policy stance

Financial imbalances can also develop when inflation is under control and output is close to potential, as these imbalances are accumulated over longer horizons than those taken into account by traditional monetary policy frameworks. To capture this, we assess monetary policy conditions along two dimensions: the “pure” monetary policy stance and the degree of financial stability pressures. We measure the former by the deviation of the policy rate from a benchmark rate designed to maintain price stability. For the latter we use the credit-to-GDP gap as an indicator of financial imbalances that signal the risk of subsequent financial distress.<sup>Ⓞ</sup> We multiply these two factors to obtain a financial pressures-adjusted monetary policy stance. The indicator is asymmetric and non-linear to capture the greater risk from a combination of expansionary monetary policy and growing financial imbalances. More formally, our indicator is

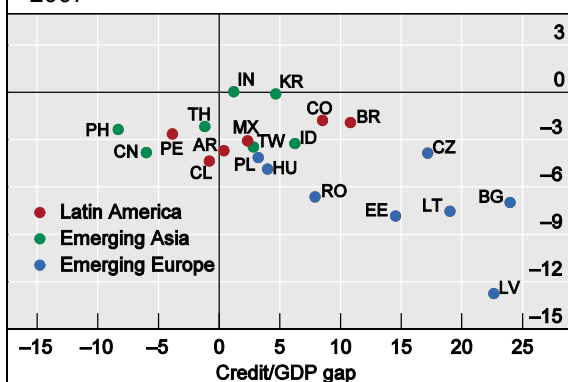
$$e^{\left(\frac{CR}{GDP}_t^{gap} \times IND\right)} \times \left(R_t - R_t^{TR}\right)$$

where  $CR / GDP_t^{gap}$  is the credit-to-GDP gap,<sup>Ⓢ</sup>  $R_t - R_t^{TR}$  is the interest rate gap (deviations from a reference Taylor rule)<sup>Ⓢ</sup> and  $IND$  equals 1 if the real credit gap is positive and the interest rate gap is negative, and equals 0 otherwise.

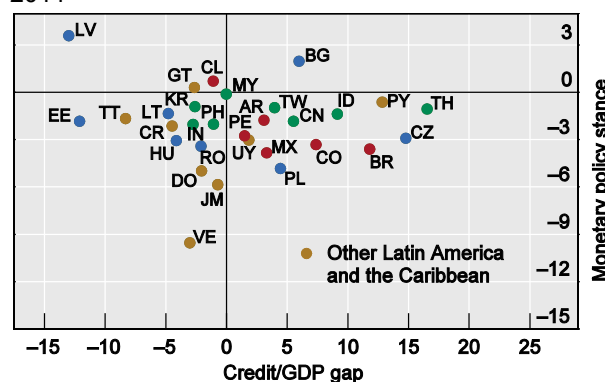
## Financial pressures-adjusted monetary policy stance

Annual average of quarterly data, in per cent

2007



2011



AR = Argentina; BG = Bulgaria; BR = Brazil; CL = Chile; CN = China; CO = Colombia; CR = Costa Rica; CZ = Czech Republic; DO = Dominican Republic; EE = Estonia; GT = Guatemala; HU = Hungary; ID = Indonesia; IN = India; JM = Jamaica; KR = Korea; LT = Lithuania; LV = Latvia; MX = Mexico; MY = Malaysia; PE = Peru; PH = Philippines; PL = Poland; PY = Paraguay; RO = Romania; TH = Thailand; TT = Trinidad and Tobago; TW = Chinese Taipei; UY = Uruguay; VE = Venezuela.

Sources: IMF; Datastream; national data.

Graph A

Graph A shows the two components of the financial pressures-adjusted monetary policy stance indicator for 2007 and 2011. In 2007, most of the emerging market economies in our sample were in the southeast quadrant of the panel, implying a dangerous combination of accommodative monetary policy and the build-up of financial imbalances. By 2011 this situation had partly reverted, with fewer economies in the southeast quadrant and smaller credit-to-GDP and interest rate gaps.

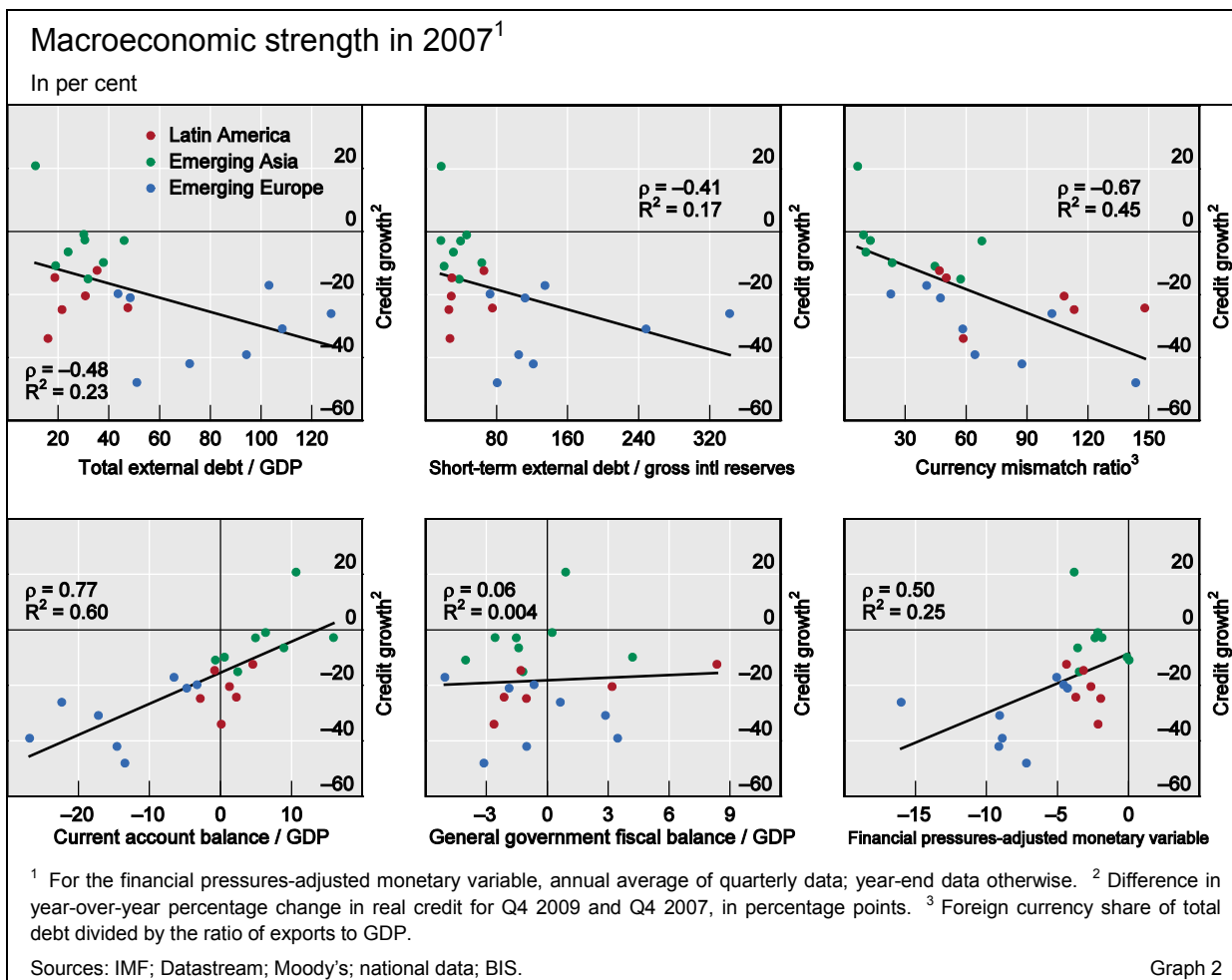
<sup>Ⓞ</sup> Borio and Lowe (2002a,b) discuss leading indicators of banking system distress. Drehmann et al (2011) analyse the performance of the credit-to-GDP gap as an indicator of the build-up of system-wide vulnerabilities that typically lead to a banking crisis. <sup>Ⓢ</sup> The credit-to-GDP gap is calculated using the Hodrick-Prescott (HP) filter with a smoothing parameter  $\lambda$  of 400,000, as in Drehmann et al (2011). We use a broad definition of credit that captures all sources of funds for the private sector as in Basel Committee on Banking Supervision (2010). <sup>Ⓢ</sup> The Taylor rule estimated has the following form:  $R_t^{TR} = \rho R_{t-1}^{TR} + (1-\rho) [(R_t^N + \bar{\pi}) + \gamma_{\pi} (\pi_{t+4} - \bar{\pi}) + \gamma_y (y_t - \bar{y}_t)]$ , where  $R_t^{TR}$  is the nominal benchmark rate at quarter  $t$ ,  $R_t^N$  is the natural interest rate,  $\bar{\pi}$  is the inflation target level,  $\pi_{t+4}$  is the inflation rate one year ahead and  $y_t - \bar{y}_t$  is the output gap calculated as the deviation of output with respect to its potential level. The coefficients used are:  $\rho = 0.75$ ,  $\gamma_{\pi} = 1.5$  and  $\gamma_y = 0.5$ . The natural interest rate is estimated as the average real ex post interest rate for each country over the longest available period (which varies across countries). When no inflation target is available, we use the average inflation level (over the same period used for estimating the long-term interest rate). We calculate the potential output using the HP filter.

much lower in emerging Asia (green dots in Graph 2) and Latin America (red dots) than in emerging Europe. Moreover, while all European countries in the sample displayed current account deficits, the large majority of Asian and Latin American countries experienced current account surpluses. Similarly, most of the Asian and Latin American countries held large foreign exchange reserves (as a ratio of short-term external liabilities) and had limited external financing needs.

As a result of the solid external position in Latin American countries, the external shock did not raise significant concerns about their capacity to meet their external obligations. Authorities in the region were also able to pursue countercyclical policies. Chile, followed by Peru, was the best positioned in terms of its fiscal and monetary stance. Indeed, authorities in these two countries were able not only to undertake countercyclical fiscal and monetary expansions relatively fast after the shock but also to quickly reverse the expansion once the worst of the crisis was over.

It is interesting to note the role of trade openness in determining the relative resilience of Latin American economies. By construction, the mismatch ratio is high if the ratio of exports to GDP is low, since low exports reduce the availability of foreign exchange. The limited trade openness of Latin American countries partly explains the relatively high mismatch ratios in a number of those countries. In other words, efforts to increase the region's degree of trade

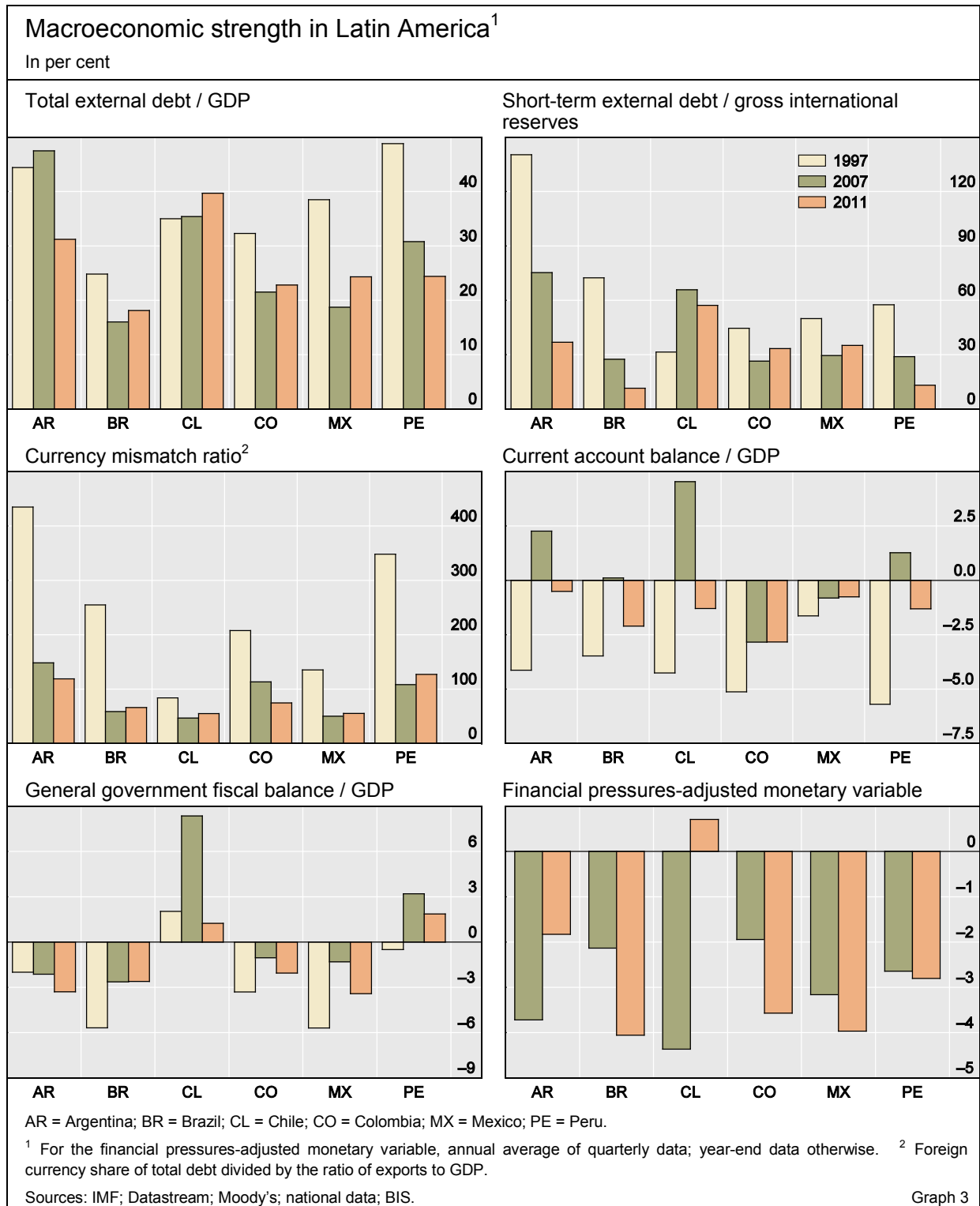
Room for manoeuvre mattered



openness and local currency funding could improve Latin American economies' resilience to external financial shocks.

### How macroeconomic strength has evolved in Latin America

Countries in Latin America consolidated their macroeconomic strength in the years prior to the global financial crisis. Graph 3 shows the set of



macroeconomic variables for the Latin American countries in our sample for 1997 (the year the Asian financial crisis started and prior to the Russian financial crisis), 2007 and 2011.<sup>8</sup>

Latin American economies were vulnerable in 1997 ...

The most important improvements from 1997 to 2007 were reductions in currency mismatches and short-term external funding. The latter halved as a fraction of gross international reserves in most countries. Also, current account balances moved from deficits to surpluses (or, in Colombia and Mexico, much smaller deficits). Thus, while high external financing needs made Latin American countries very vulnerable at the time of the Asian shock, improved current accounts seem to have contributed to these countries' credit resilience at the time of the global financial crisis. In addition, external debt ratios improved significantly in most countries in the region, with Brazil, Colombia, Mexico and Peru showing a drastic reduction.<sup>9</sup> With the exception of Argentina, fiscal positions were significantly stronger at the beginning of the 2007–09 crisis than before the Asian and Russian crises, and consequently governments were able to provide larger fiscal stimulus during the more recent episode.<sup>10</sup> Overall, these improvements in macroeconomic fundamentals supported the stronger resilience of credit growth during the 2007–09 global financial crisis in comparison to that during the Asian and Russian crises.

... and may be becoming more so today

Unfortunately, the improvement in the vulnerability indicators that took place between 1997 and 2007 did not continue in subsequent years. Our indicators suggest that the Latin American countries in our sample may have

| Monetary policy rates and inflation since the Lehman Brothers bankruptcy <sup>1</sup> |                                    |                      |                        |           |
|---|------------------------------------|----------------------|------------------------|-----------|
| In per cent   |                                    |                      |                        |           |
|   | Monetary policy rates <sup>2</sup> |                      | Inflation <sup>3</sup> |           |
|   | Prior to 15 September 2008         | As of 15 August 2012 | August 2008            | July 2012 |
| Brazil  | 13.75                              | 8.00                 | 6.17                   | 5.20      |
| Chile   | 8.25                               | 5.00                 | 9.30                   | 2.51      |
| Colombia  | 10.00                              | 5.00                 | 7.87                   | 3.03      |
| Mexico  | 8.25                               | 4.50                 | 5.57                   | 4.42      |
| Peru  | 6.25                               | 4.25                 | 6.27                   | 3.28      |

<sup>1</sup> 15 September 2008. <sup>2</sup> For Brazil, SELIC target rate; for Chile, official monetary policy rate; for Colombia, minimum rate for one-day expansion auctions; for Mexico, rate target for overnight interbank funding operations; for Peru, reference rate. <sup>3</sup> Annual changes in CPI.

Sources: National data. Table 2

<sup>8</sup> The financial pressures-adjusted monetary policy stance is not calculated for 1997 due to data limitations.

<sup>9</sup> While the external debt ratio remained practically unchanged in Chile from 1997 to 2007, this country showed the largest improvement in current account balance among the countries in the sample over the same period. Argentina is the exception in the sample, since its external debt ratio was larger in 2007 than in 1997.

<sup>10</sup> In 1999 the fiscal stimulus, measured by the change in the fiscal balance, in these Latin American countries was no larger than 2% of GDP (and even negative for Brazil and Mexico). In contrast, in 2009 it was between 2 and 8% of GDP for these countries.

| Macroeconomic strength in other Latin American and Caribbean countries <sup>1</sup> |                           |   |                                      |                               |   |  |
|---|---------------------------|---|--------------------------------------|-------------------------------|---|--|
| 2011, in per cent   |                           |   |                                      |                               |   |  |
|   | Total external debt / GDP | Short-term external debt / gross international reserves | Currency mismatch ratio <sup>2</sup> | Current account balance / GDP | General government fiscal balance / GDP | Financial pressures-adjusted monetary variable |
| Costa Rica  | 25.5                      | 50.9  | 84.2                                 | -5.2                          | -4.3                                    | -2.1   |
| Dominican Republic  | 22.8                      | 26.0  | 103.0                                | -7.9                          | -2.5                                    | -5.0   |
| Guatemala   | 25.8                      | 28.3  | 108.1                                | -2.8                          | -2.8                                    | 0.3  |
| Jamaica   | 64.7                      | 29.7  | 156.0                                | -9.9                          | -6.5                                    | -5.9   |
| Paraguay  | 20.5                      | 38.4  | 31.8                                 | -1.2                          | 1.2                                     | -0.7   |
| Trinidad and Tobago   | 34.3                      | ...   | 62.1 <sup>3</sup>                    | 20.7                          | 0.3                                     | -1.7   |
| Uruguay   | 31.8                      | 5.3   | 149.0                                | -2.2                          | -0.8                                    | -3.1   |
| Venezuela   | 34.0                      | 167.7   | 101.9                                | 8.6                           | -5.3                                    | -9.5   |

<sup>1</sup> For financial pressures-adjusted monetary variable, annual average of quarterly data; year-end data otherwise. <sup>2</sup> Foreign currency share of total debt divided by the ratio of exports to GDP. <sup>3</sup> Q4 2010 data.

Sources: IMF; Datastream; Moody's; national data; BIS.

Table 3

less capacity to withstand an external shock now than in 2007. External debt and currency mismatch ratios have increased. Current account balances have deteriorated relative to 2007. Only the external liquidity position, measured by short-term external debt as a fraction of gross international reserves, has improved as the economies have accumulated foreign reserves.

The findings concerning the ability to implement countercyclical macroeconomic policies are more mixed. Larger fiscal deficits indicate a lower capacity to implement countercyclical fiscal policy, but monetary policy may face fewer restrictions today than in 2007 as inflationary pressures have abated. On the other hand, policy rates currently lower than those in September 2008 indicate less room for monetary easing (Table 2).

Smaller countries in Latin America and the Caribbean are generally in a weaker position than the economies in our sample (Table 3). Debt ratios tend to be higher and, more importantly, some countries display sizeable currency mismatches, often exceeding 100%. Large fiscal deficits and expansionary monetary policy, even with moderate credit growth rates, suggest that there is little room for countercyclical macroeconomic policy.

## Conclusion

A central lesson from the 2007–09 crisis is that the resilience of real credit growth to a severe external shock depends on the strength of key macroeconomic factors in the pre-crisis period. Countries that entered the crisis with lower external financing needs, lower currency mismatches in both private and public balance sheets, and enough room to implement countercyclical fiscal and monetary policies without generating macroeconomic instability were able to withstand the shock posed by the global financial crisis better than others. Improvements in these indicators could also explain why



credit growth in Latin America held up better in 2007–09 than after the Asian/Russian crisis period a decade earlier.

But there are indications that the vulnerability of Latin American economies to foreign financial shocks has increased more recently. This is important because international capital markets have, once again, been showing signs of increased stress, this time mostly from events in the euro zone. Current data indicate that macroeconomic fundamentals in Latin America, although still strong, have weakened since 2007. Particularly worrisome is the deterioration in the fiscal stance and the current account balance. While the global slowdown in economic growth partly accounts for these outcomes, Latin American policymakers could help reduce vulnerabilities by strengthening fiscal balances and implementing reforms that improve the competitiveness of their non-commodity sectors. These efforts would yield a large return in terms of economic and financial stability if another severe external shock were to materialise in the near to medium-term future.

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## Have public bailouts made banks' loan books safer?<sup>1</sup>

*In response to the financial crisis, the authorities in a number of countries used public funds to recapitalise their banks. Did a reduction of risk in banks' lending follow these rescue operations? To help answer this question, we analyse the balance sheets and syndicated loan signings of 87 large internationally active banks. As loan signing volumes started diminishing across the board in 2009, our evidence shows that rescued banks did not reduce the risk of their new lending significantly more than non-rescued banks. Our results are relevant for the ongoing assessment of public bank rescue programmes.*

*JEL classification: G15, G21, G32, E51.*

As the bankruptcy of Lehman Brothers dramatically shook financial markets and investor confidence in September 2008, authorities around the globe announced bank rescue packages. The aim of these measures was to ensure the solvency of systemically important financial institutions and to restore confidence in the financial system. Bank recapitalisations using public funds in the G10 countries totalled close to \$500 billion during the period 2007–10 (Brei et al (2011)). The appropriateness and effects of these programmes are still under assessment.<sup>2</sup> In this special feature we examine whether the rescue operations were followed by a greater reduction of risk in new loans made by rescued banks compared to those that were not rescued. Have bank rescues helped make institutions with risky lending activities safer, as one might expect?

To address these questions, we focus on the market for syndicated loans, where a group of banks jointly extends credit to a single borrower. In particular, we examine the balance sheets and syndicated loan signings of 87 large internationally active banks from industrial economies, approximately half of which received public financial support during the crisis. With close to \$7 trillion

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<sup>1</sup> The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. We would like to thank Claudio Borio, Stephen Cecchetti, Peter Hördahl and Kostas Tsatsaronis for valuable comments and suggestions, as well as Serge Grouchko, Gabriele Gasperini and Bat-el Berger for able research assistance. We gratefully acknowledge the information-gathering exercise on bank rescue operations, carried out using publicly available sources by Corrinne Ho, Arsim Arslani, Giulia Felber, Elias Hafner, Nicole Hasler and Reto Hausmann.

<sup>2</sup> See, for instance, Black and Hazelwood (2012) or Diamond and Rajan (2011).

of new facilities signed in 2007, syndicated lending has been one of the largest sources of corporate funding. Syndicated loans also form a significant component of banks' total portfolio of commercial and industrial loans.<sup>3</sup> Importantly, the available information on individual borrowers (like sector or nationality) and loan transaction terms (such as spreads, maturities or guarantees) makes the syndicated loan market a good laboratory for analysing bank risk.

We find no evidence that rescued banks reduced the riskiness of their new lending more than non-rescued banks in response to the crisis and the public rescues. Even as lending volumes decreased across the board in 2009, rescued banks continued to write riskier syndicated loans, as reflected by their involvement in the leveraged loan segment and in the spreads charged on the facilities that they originated. We also find, unsurprisingly, that the syndicated lending of banks that later received a bailout was riskier before the crisis than that of non-rescued institutions.

In the remainder of this article, we first outline the main questions, referring to some of the relevant literature. Thereafter we explain the data sample and methodology. In the analysis that follows we first look at whether the riskiness of banks' syndicated loan signings carries information content for the subsequent bailouts. We then move on to the key question of this research and explore whether and to what extent rescued banks cut the riskiness of their new loans in response to the crisis and the bailouts. The final section concludes.

## Public support, incentives and risk: the main questions

Between early 2007 and early 2009, the banking sectors of a number of major industrial countries moved from being highly profitable into deep crisis. Many banks lost up to two thirds of their stock market values. Authorities responded by conducting outsize rescue operations in the form of extended deposit insurance, guarantees of newly issued bank debt, capital injections, asset insurance and asset purchases.<sup>4</sup> In this article we focus on bailouts in the form of recapitalisations<sup>5</sup> using public funds and directed at individual banks by their home authorities.

The expectation of state support may give rise to moral hazard and lead banks to engage in higher risk-taking. Distortions often accompany bank rescues (Diamond and Rajan (2009, 2011), Farhi and Tirole (2012)). However, some might argue that in times of crisis, the objective of recapitalisations and other forms of public support is at least partly to prevent banks from cutting

Expected public support can distort banks' risk-taking incentives ...

<sup>3</sup> The market is representative in the sense that during 2000–10, the syndicated loan exposure of the banks that we analyse represented up to 18% of their total loans outstanding. For an overall description of the structure and behaviour of the international syndicated loan market, see Gadanecz (2004). For an analysis of its collapse during the crisis, see Chui et al (2010).

<sup>4</sup> King (2009) gives an overview of announced packages, with further detail and analysis provided in Panetta et al (2009), Petrovic and Tutsch (2009), Borio et al (2010), Brei et al (2011) and Brei and Gadanecz (2012).

<sup>5</sup> Involving preferred shares, warrants, mandatory convertible notes, core Tier 1 capital or debt swaps.

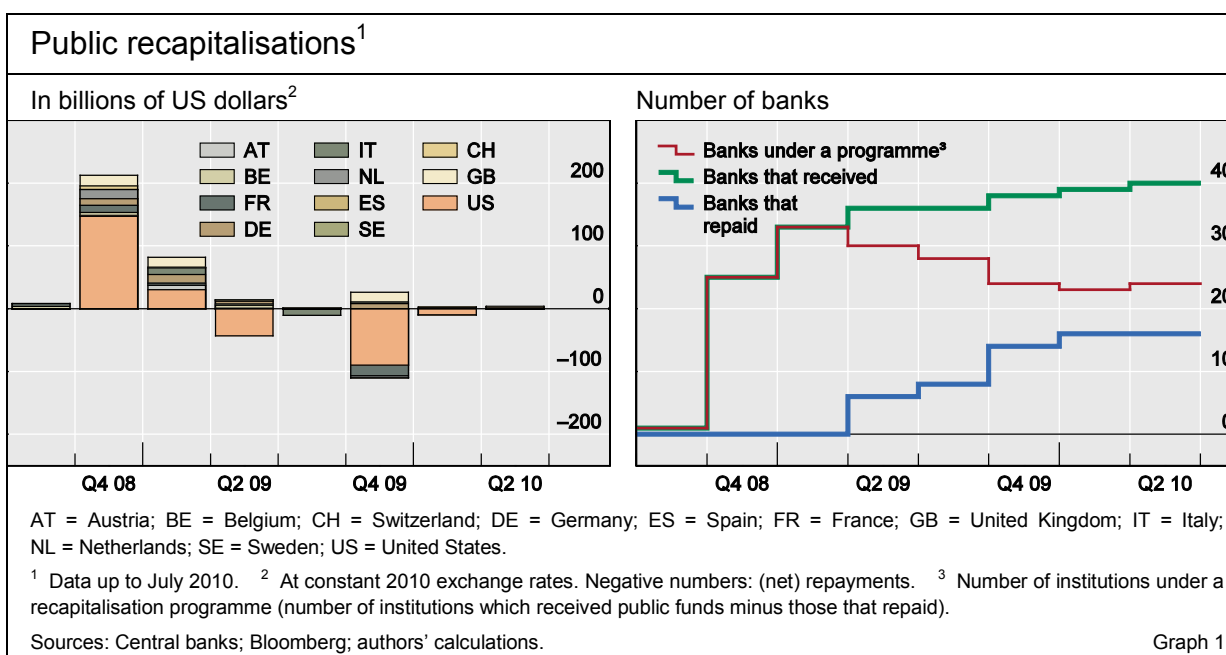
... but actual rescues can make them safer

back on risk-taking too much, so as to avoid a major credit crunch. Thus, state intervention in times of stress needs to strike a balance between, on the one hand, limiting the adverse impact on the real economy and, on the other, containing moral hazard (Borio et al (2010)).<sup>6</sup> Bearing this in mind, public recapitalisations, once they have occurred, can help make banks safer. When banks receive a bailout, the public sector's involvement in the banking sector increases, and so should its power to curb the riskiness of banking activities. Actual recapitalisations may also strengthen banks' monitoring incentives and reduce moral hazard by putting at risk more equity, from a broader array of sources (Holmstrom and Tirole (1997), Hellmann et al (2000), Mehran and Thakor (2011)). Lastly, policy interventions tend to be associated with higher regulatory supervision (Berger et al (2012)).

### Public rescue operations and sample characteristics

Large public rescues occurred in 2008 and 2009

We analyse if the public rescue measures granted to banks in 14 major economies (the G10 countries plus Austria, Australia and Spain) were associated with a decrease in the riskiness of the new syndicated loan signings by these banks. We use as a control sample a set of large systemically important institutions that did not receive public support (see box for a description of the data set). After controlling for mergers, acquisitions and missing data, our final sample comprises 87 bank holding companies. These institutions cover \$54 trillion of bank assets, which correspond to 52% of worldwide banking assets reported in *The Banker* at end-2010. Of these banks, 40 institutions (corresponding to 56% of the sample's total assets) became subject to a public recapitalisation programme between Q3 2008 and Q2 2010.



<sup>6</sup> Penalising shareholders and managers, as well as imposing strict conditions and restrictions in exchange for support, are mechanisms that can help achieve the second objective.

## The data set

Information on bank rescue measures, comprising 14 jurisdictions (the G10 countries plus Austria, Australia and Spain) was collected from publicly available sources<sup>①</sup> between October 2008 and September 2010. We augmented the set of rescued banks with a control sample of large systemically important banks which did not receive a public rescue. We combined this information with two data sets. First, we took annual consolidated bank financial statements from Bankscope and adjusted them for mergers and large acquisitions.<sup>②</sup> Second, we extracted individual syndicated loan transactions from Dealogic Loan Analytics. That database provides information on syndicated loan facilities, such as loan size, terms, leverage and type, as well as on a number of borrower characteristics including nationality, sector and credit rating. Information is also available on the identity of the banks that participated in the syndications (allowing the merging with the Bankscope data), as well as the amounts that they committed (making it possible to calculate individual “portfolios” of syndicated loan signings for each bank for each year). Roughly 84,000 loans were recorded in the database for the period 2000–10 for our sample of banks, each comprising on average eight individual participating banks.<sup>③</sup>

Matching of these information sets allows us to compute the average characteristics of the new loans written in a given year by a particular bank, for instance the average pricing of these exposures. Furthermore, the behaviour of banks with different characteristics (eg those which received a public recapitalisation versus those which did not) can be compared to detect different patterns in investment decisions.

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<sup>①</sup> Eg news reports, official websites of national authorities, banks’ media releases and investor relations materials. <sup>②</sup> Following Brei et al (2011), the decision to work with consolidated statements reflects the fact that these banks operate on a consolidated worldwide basis and, importantly, that the public recapitalisations occurred at the consolidated entity, rather than at the subsidiary, level. The statements are annual, because most banks did not report consistently at a quarterly frequency over the sample period 2000–10. To avoid discontinuities in the financial statements caused by large acquisitions, we constructed pro forma banks by aggregating the reported positions of the acquiring and acquired banks prior to the takeover. <sup>③</sup> Where banks’ exact participation shares were not available in Dealogic Loan Analytics, we assigned equal shares of any unallocated loan amounts, in line with the literature.

As shown in Graph 1, these recapitalisations totalled close to \$350 billion between 2008 and 2010. Most of the funds were injected in Q4 2008 and Q1 2009, primarily in the United States (with the TARP), as well as in France, Germany, the Netherlands and the United Kingdom. Banks had repaid about 50% of the capital injections by September 2010 (mainly in France and the US).

Syndicated lending makes up a significant part of banking activities for all banks in our sample. Although there are national differences,<sup>7</sup> on average signings of such loans accounted for 18% of banks’ total loans during 2000–10.

Banks that received a rescue differed in a number of ways from those that did not. Both before and during the crisis, rescued banks were larger as a group than non-rescued ones, as measured by their total assets (Table 1). The business models<sup>8</sup> also seem to differ. Before the crisis, rescued banks had a lower average loan-to-asset ratio than non-rescued banks (46% versus 49%,

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<sup>7</sup> Relative to total loans outstanding, syndicated loan issues have been most significant for banks headquartered in the US (38% of their total loans), France (26%), Switzerland and Canada (24% in each case). Least involved have been Austrian, Belgian, Italian, Spanish and Swedish banks (below 10% of their total loans in each case).

<sup>8</sup> Altunbaş et al (2011) feature an empirical analysis of bank risk and business models, together with a literature review.

| Rescued and non-rescued banks: overview <sup>1</sup> |                               |                 |                   |                 |
|--|-------------------------------|-----------------|-------------------|-----------------|
|  | Rescued                       |                 | Non-rescued       |                 |
| <b>Number of banks</b>                               | <b>40</b>                     | <b>40</b>       | <b>47</b>         | <b>47</b>       |
| <b>Bank characteristics<br/>(year-end, USD trn)</b>  | <b>2007</b>                   | <b>2010</b>     | <b>2007</b>       | <b>2010</b>     |
| Assets   | 31.29                         | 30.38           | 21.82             | 24.01           |
| Deposits   | 11.62                         | 11.81           | 9.54              | 11.29           |
| Loans  | 13.57                         | 13.48           | 10.00             | 11.34           |
| Syndicated loan signings                             | 4.57                          | 2.11            | 2.35              | 1.76            |
| Net income   | 0.15                          | 0.11            | 0.14              | 0.12            |
| <b>Balance sheet ratios<br/>(period averages, %)</b> | <b>Pre-crisis<sup>2</sup></b> | <b>Δ crisis</b> | <b>Pre-crisis</b> | <b>Δ crisis</b> |
| Total loans relative to total assets                 | 45.6                          | -1.8            | 48.6              | -1.3            |
| Total deposits relative to total assets              | 39.6                          | -1.9            | 46.7              | -1.8            |
| Profitability (ROE)                                  | 12.4                          | -14.6***        | 9.8               | -2.9***         |
| Impaired loans over total lending                    | 2.0                           | 2.3***          | 2.8               | -0.5*           |

<sup>1</sup> The sample period is 2000–10 and includes 87 banks and 927 observations. “Rescued” denotes banks which received a public recapitalisation during 2008–10, while “non-rescued” indicates banks which did not receive such support. <sup>2</sup> “Pre-crisis” = 2000–07. “Δ crisis” is the value during the crisis (2008–10) minus the pre-crisis value (2000–07). \*\*\*, \*\* and \* indicate that the differences are significant at the 1%, 5% and 10% levels, respectively, based on a weighted t-test.

Sources: Bankscope; Dealogic; authors' calculations. Table 1

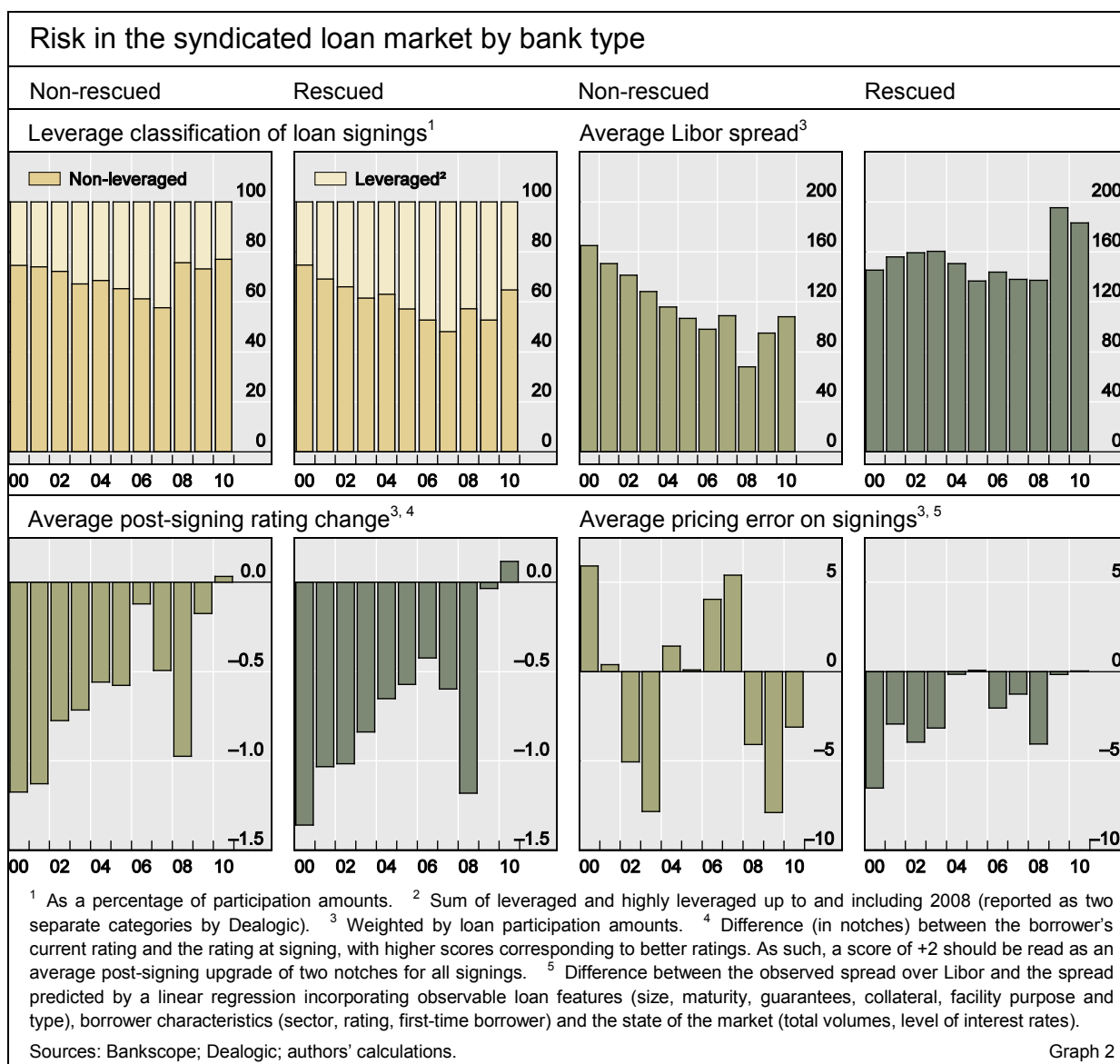
respectively). That could indicate that they may have been holding more securities or securitised more of their customer loans (Altunbaş et al (2009)). On the liability side, rescued banks relied to a greater extent on non-deposit funding (by 7% of assets pre-crisis), a possible source of vulnerability to a freeze of wholesale funding markets (Huang and Ratnovski (2011)). The crisis severely dented the profitability of both rescued and non-rescued banks. Not surprisingly, the financial crisis hit rescued banks most. Their profitability (gauged by ROE) plunged during the crisis (from 12% to -2%), while it fell less abruptly in the case of non-rescued banks (from 10% to 7%). Likewise, rescued banks' ratio of impaired to total loans jumped more sharply during the crisis (either because they were facing more impaired loans or because the rescues were associated with higher recognition of such loans).

### Have bailouts been associated with riskier loan signings before the crisis?

Rescued banks participated in riskier loans before the crisis

Several risk indicators consistently show higher risk in the flow of syndicated loans written before the crisis by banks that later received a rescue, relative to non-rescued banks. Of particular relevance are signings of leveraged loans<sup>9</sup> as a share of total syndicated lending, the Libor spreads on the loan

<sup>9</sup> We divide loans into two categories: leveraged and non-leveraged. We rely on the definition of Dealogic Loan Analytics for leveraged loans, which is based on borrower financial leverage, loan spreads, borrower ratings and loan purpose (especially leveraged buyouts). For the purposes of this special feature we also include in the leveraged category those facilities



signings and the average rating changes of borrowers after the loans were signed (see Graph 2 and the “Pre-crisis” columns of Table 2).

Before the crisis, banks that later received a rescue wrote more leveraged loans as a share of their total syndicated lending (39%) than their non-rescued peers (33%). Moreover, average Libor spreads (weighted by participation amounts) on rescued banks' new loan signings were significantly higher compared to non-rescued banks' (149 versus 127 basis points). And the average maturity of rescued banks' loans was higher than that of non-rescued banks. In addition, borrowers who had been granted syndicated loans by rescued banks were subsequently downgraded to a greater extent than borrowers who had received loans from non-rescued institutions.

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identified by Dealogic as “highly leveraged”. Dealogic ceased to distinguish between highly leveraged and leveraged for loans signed after 2008, and since then have reported only leveraged versus non-leveraged status. Every loan is classified according to the definition which was valid when it was signed. It is not possible to reclassify earlier loans when the definition changes.



| Syndicated lending of rescued versus non-rescued banks <sup>1</sup> |            |          |             |          |                           |               |          |
|---|------------|----------|-------------|----------|---------------------------|---------------|----------|
|   | Rescued    |          | Non-rescued |          | Rescued minus non-rescued |               |          |
|   | Pre-crisis | Δ crisis | Pre-crisis  | Δ crisis | Pre-crisis                | During crisis | Δ crisis |
| Syndicated loan signings relative to total assets (%)               | 12.1       | -4.9***  | 8.1         | -1.6***  | 4.0***                    | 0.7           | -3.3***  |
| Share of leveraged loans in new signings (%)                        | 38.5       | 3.3**    | 32.5        | -7.7***  | 6.0***                    | 17.0***       | 11.0*    |
| Average Libor spread on new signings (bp)                           | 148.8      | 23.1***  | 126.7       | -36.4*** | 22.1***                   | 81.6***       | 59.5***  |
| Average rating change <sup>2</sup> (notches)                        | -0.8       | 0.4***   | -0.7        | 0.3***   | -0.1**                    | 0.0           | 0.1      |
| Average maturity of new signings (years)                            | 4.5        | 1.2***   | 4.3         | -0.2     | 0.2**                     | 1.6**         | 1.4      |
| Average pricing error <sup>3</sup> on new signings (bp)             | -2.5       | 1.1      | 0.5         | -5.6**   | -3.0**                    | 3.6           | 6.7      |

<sup>1</sup> See Table 1, footnotes 1 and 2. Averages are weighted either by total assets or syndicated loan participations. "During crisis" = 2008–10. <sup>2</sup> See Graph 2, footnote 4. <sup>3</sup> See Graph 2, footnote 5.  
Sources: Bankscope; Dealogic; authors' calculations. Table 2

These results suggest that rescued banks may have had a more relaxed attitude towards risk before the crisis. As such, engaging in riskier loans is not necessarily undesirable if the corresponding price (Libor spread) is appropriate, or if the bank manages them well (better than other banks).

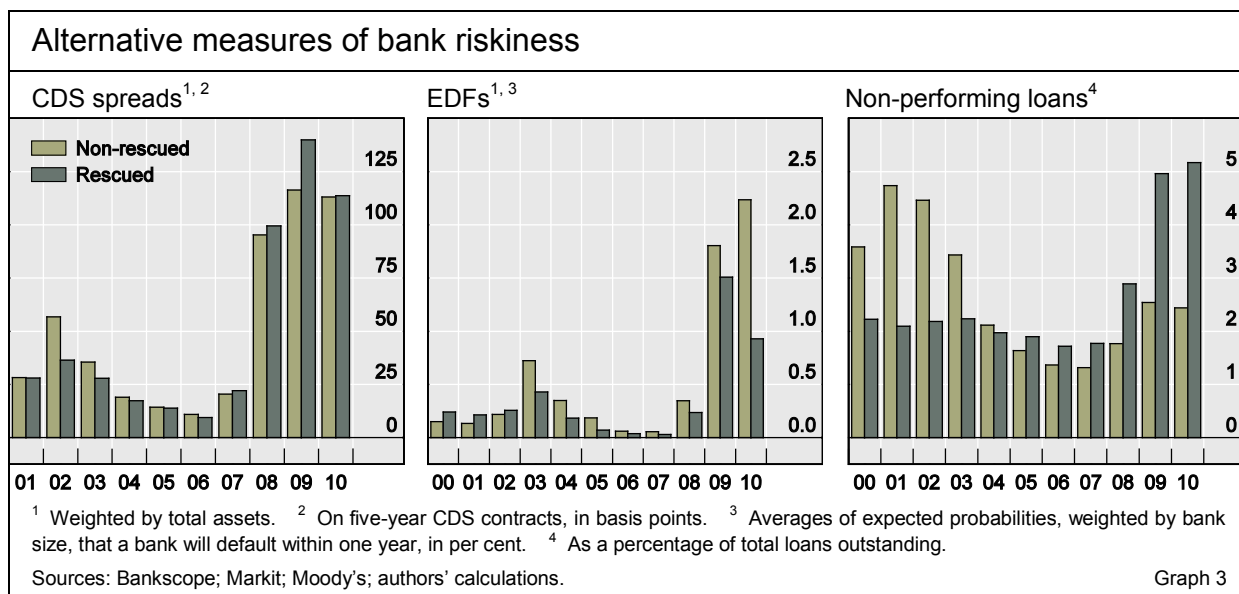
Their loans have been underpriced

To interpret the findings further, we look at the "pricing error" on the loan signings relative to a benchmark. Following Carey and Nini (2007) and Gadanecz et al (2008), we calculate these errors by taking the difference between the observed syndicated loan spread over Libor, and the spread predicted by a regression incorporating observable loan features (size, maturity, guarantees, collateral, facility purpose and type), borrower characteristics (sector, rating, first-time borrower) and the state of the market (total volumes, level of interest rates). We calculate the resulting score for every year on every bank's signings (weighted by participation amounts). Negative (positive) pricing errors suggest that banks "underprice" ("overprice") risk according to this model.

It is interesting to note that before the crisis, rescued institutions had been participating in facilities that were systematically more underpriced (in the sense of being below a benchmark predicted by observable risk factors) than those of non-rescued banks. We surmise that they may not have been properly compensated for the higher risk they took on, adding to their vulnerability when the crisis hit.

Differences in risk were not apparent in market-based measures

Market and accounting measures did not pick up the difference in riskiness. Indeed, CDS spreads and EDF measures did not appear higher for rescued banks than for non-rescued banks before the crisis (Graph 3). Given that both rescued and non-rescued banks in our sample are systemically important, it is hard to conclude that any differences in these market and accounting measures are due to differential expectations of bailouts, consistent with broader evidence that such indicators tend to act more like



contemporaneous than leading indicators of financial distress (Borio and Drehmann (2009)). And non-performing loan ratios were higher before the crisis for non-rescued banks, which may have been more diligent in recognising them than their rescued peers, although this is also influenced by accounting standards.

All in all, signs of higher risk before the crisis in rescued banks' syndicated loan signings suggest that such risk measures carry information about the subsequent incidence of public rescues.<sup>10</sup> Having established this, in the next section we use the risk measures derived from the syndicated loan market to test whether rescued banks reduced the risk of their new loans relatively more than their non-rescued peers in response to the crisis.

### Did rescued banks cut the riskiness of their loan signings more than non-rescued banks in response to the crisis?

In this section we compare changes in the riskiness of loan signings of rescued and non-rescued banks in response to the crisis. We calculate the corresponding changes in the risk proxies discussed above with respect to new loan signings. We test the statistical significance of the difference between the crisis and pre-crisis values, comparing the crisis responses across rescued and non-rescued institutions.

During the crisis, rescued banks did not reduce the riskiness of their new syndicated lending compared to their non-rescued peers. In fact, our results suggest that the relative riskiness of their lending increased. This is apparent when comparing how the two types of institutions changed their participation in leveraged facilities (relative to their total new signings), as well as the average Libor spread on those signings and the corresponding average maturities. As shown in the rightmost column of Table 2, for both loan leverage and spreads,

Measured by loan leverage, spreads and maturities ...

<sup>10</sup> In Brei and Gadancz (2012), we corroborate this finding econometrically by means of a logit regression which explains the probability of receiving public financial support. That model confirms that leveraged lending is a significant determinant of public rescues.

the differences, calculated as rescued banks' minus non-rescued banks' crisis-related changes, are positive and statistically significant (11 percentage points and 60 basis points, respectively).

The riskiness of non-rescued banks' new syndicated lending diminished with the onset of the crisis. These institutions cut their participation in leveraged loans from 33% to 25% of their total new signings (change shown in the fourth column of Table 2, together with the crisis-related changes in their other loan risk proxies, all of them statistically significant with the exception of average maturities). Moreover, the average Libor spread on non-rescued banks' new signings fell by 36 basis points. These findings are consistent with the collapse of the leveraged loan market during the crisis (Chui et al (2010)) and also with a move towards less risky lending.

... rescued banks  
remained riskier

At the same time, rescued banks increased the riskiness of their new signings. They participated to a greater extent in leveraged loans (with the share of such loans in their total new signings rising from 39% to 42%; we report this and other statistically significant different changes in the second column of Table 2). They also increased the average spread on their new signings by 23 basis points (while raising the average maturity). In response to the crisis and particularly during 2009–10, they aligned their pricing to better reflect the observed risk factors, although the increase is not statistically significant. Again, these findings point to a possibly more relaxed attitude of rescued banks towards risk.<sup>11</sup>

During the crisis, spreads on rescued banks' domestic syndicated loan signings increased more strongly than those on their foreign exposures (Brei and Gadanez (2012), Graphs 5a and 5b). That could be indicative of either higher risk, or higher margins exploiting a degree of imperfect competition or monopolistic power in home markets (Santos (2011)).

## Concluding remarks

In this special feature, we examine whether large internationally active banks which received public rescue packages during 2008–10 reduced the riskiness of their syndicated lending during the crisis relatively more than non-rescued institutions. Our analysis shows that this is not the case. Specifically, rescued banks continued to add to the share of leveraged loans in their total signings. They also kept increasing the average maturity and Libor spreads of their new loans (which, however, remained underpriced with respect to a standard benchmark). Unsurprisingly, rescued banks were riskier than non-rescued ones along all these dimensions also prior to the crisis.

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<sup>11</sup> The causal relation between risk and bailouts may be that rescued banks wrote riskier syndicated loans before the crisis than non-rescued ones, insofar as they were expecting to receive public financial support (the moral hazard argument). Conversely, riskier lending could have necessitated bailouts. The result that rescued banks did not reduce the riskiness of their syndicated loan signings in response to the crisis, at least not relatively more than non-rescued institutions, holds even when allowing for the possibility that bailouts are endogenously determined (see Brei and Gadanez (2012) for a two-stage regression analysis of bank risk, using an instrumented public bailout variable).

A limitation of the analysis is the focus on only one facet of the banking business: the international syndicated loan market. At the utmost, syndicated loan issuance accounts for 18% of the total loans of the banks in our sample and, as such, cannot characterise their overall behaviour. Furthermore, all our risk proxies pertain to new lending (a flow measure), which has an influence on, but cannot totally characterise, banks' overall risk profile (a stock measure). However, we find that indicators extracted from syndicated lending do convey interesting risk information not contained in market-based proxies like CDS spreads or EDF measures, or balance sheet indicators such as non-performing loan ratios.

It is not surprising that rescued banks' (syndicated) lending was riskier than that of non-rescued banks prior to the public recapitalisations. Indeed, it is consistent with the literature on the effect (actual or expected) of state support on bank risk. Rescued banks' incentives to monitor risks might be distorted by the implicit bailout guarantee. It could also be that during the crisis rescued banks' inefficiency in providing loans at competitive spreads was compounded by the higher funding costs that they were facing themselves. In any case, the absence of a reduction in the riskiness of rescued banks' syndicated lending relative to non-rescued institutions warrants further cost-benefit analysis of the rescue operations.

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