BANK FOR INTERNATIONAL SETTLEMENTS

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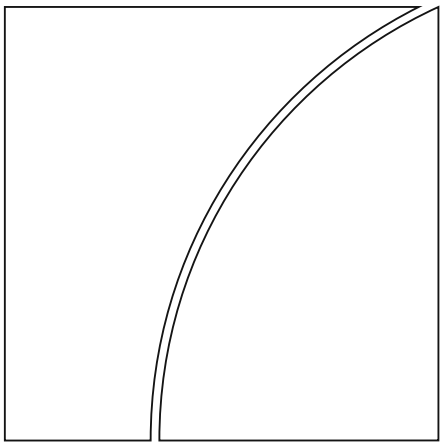

International banking and financial market developments

BIS Quarterly Review
Monetary and Economic Department

General queries concerning this commentary should be addressed to Benjamin Cohen (tel +41 61 280 8421, e-mail: ben.cohen@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).

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Statistical Features

Notations used in this Review

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

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.

Uneasy calm awaiting lift-off

The interplay between the shifting prospects for policy normalisation in the United States, emerging market (EM) weaknesses and accommodation in other major advanced economies (AEs), drove market developments in the fourth quarter of 2015.

Markets stabilised in October, following the August rout. Fears of a crisis centring on EMs faded as Chinese equity and currency markets – the rout's epicentre – entered calmer waters. Sentiment improved after policy interventions in EMEs and on expectations of continuing monetary accommodation in AEs, including the United States. Asset markets across the world staged a strong rebound and volatilities fell.

Market sentiment changed following the Federal Open Market Committee's (FOMC) October meeting and the strong US labour market report in early November. Both events raised the odds of a December rate hike in the United States. US bond yields rose and the dollar re-asserted its strength, reflecting expectations that monetary policies will diverge across the major AEs.

Although EME markets suffered a particularly sharp re-pricing, market reactions were short-lived. In the first five days following the US payroll data, equity, bond and foreign exchange markets seemed to replay the mid-2013 "taper tantrum". But in contrast to the continued deterioration that took place then, markets across the different EM asset classes largely recouped their initial losses by mid-November.

The short-lived market response might suggest that EMEs could ride out the prospect of US monetary tightening. However, less favourable financial market conditions, combined with a weaker macroeconomic outlook and increased sensitivity to US interest rates, heighten the risk of negative spillovers to EMEs once US rates do start to rise in the United States. Tighter financial conditions could also accentuate rising financial stability risks in a number of EMEs.

October rebound

Markets bounced back in October after two turbulent months. In August and September, global financial markets saw sharp corrections in response to

disappointing news from EMEs and high financial market volatility in China.[1] As a result, global equity markets posted their heaviest quarterly losses since 2012 (Graph 1, left-hand panel), while implied volatilities across markets (Graph 1, centre panel) and corporate credit spreads surged.

EMs were hit hard. Equity markets plummeted, and EM currencies took another dive after months of weakness (Graph 1, right-hand panel). Market volatility and currency weakness coincided with an exodus of capital from EMEs (Graph 2, left-hand panel). EPFR reported combined portfolio outflows of more than $45 billion from EM mutual funds in August and September, much larger than during the mid-2013 taper tantrum.

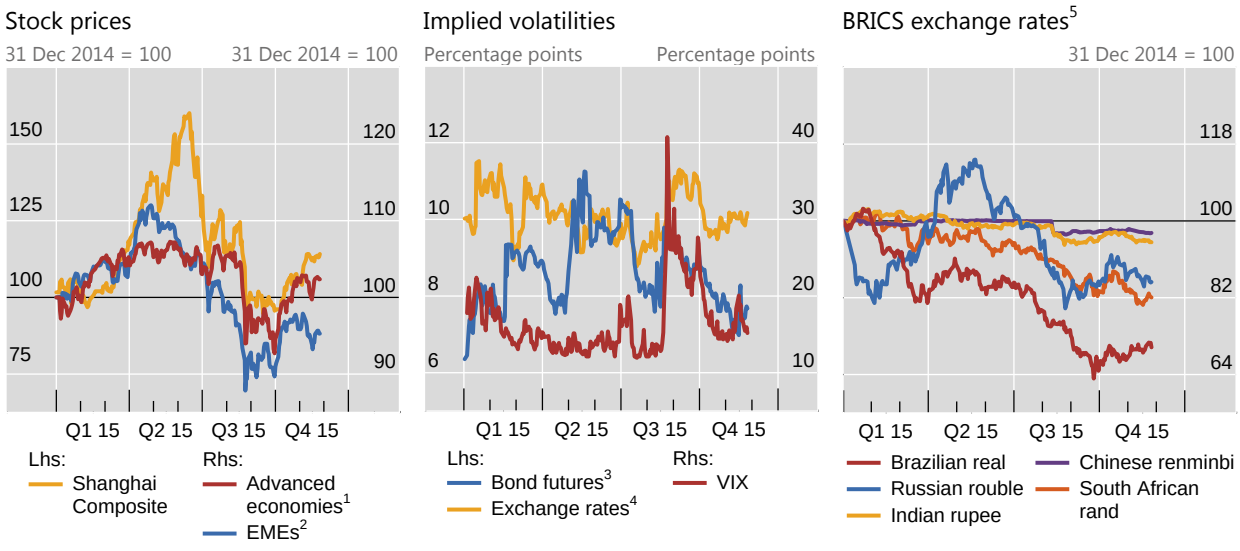
In October, equity markets staged a remarkable recovery, recording their strongest one-month gain in recent years. Market nerves were partly calmed by receding fears over tail risk in China. The improvement was broad-based. European and American stocks recouped nearly all losses experienced in the third quarter, while China's stocks also made up some lost ground. In tandem, equity market volatility eased.

Other markets also recovered, although not as strongly. Spreads tightened in credit markets, but remained wider than last year. Similarly, exchange rates began to stabilise while bond and exchange rate volatilities fell. In addition, capital returned to EMEs, albeit on a modest scale.

The market rebound occurred despite few signs of improvement in the macroeconomic backdrop. Except in India, the purchasing managers' index (PMI) – a leading indicator for economic activity – remained in contractionary territory

Markets recover

Graph 1



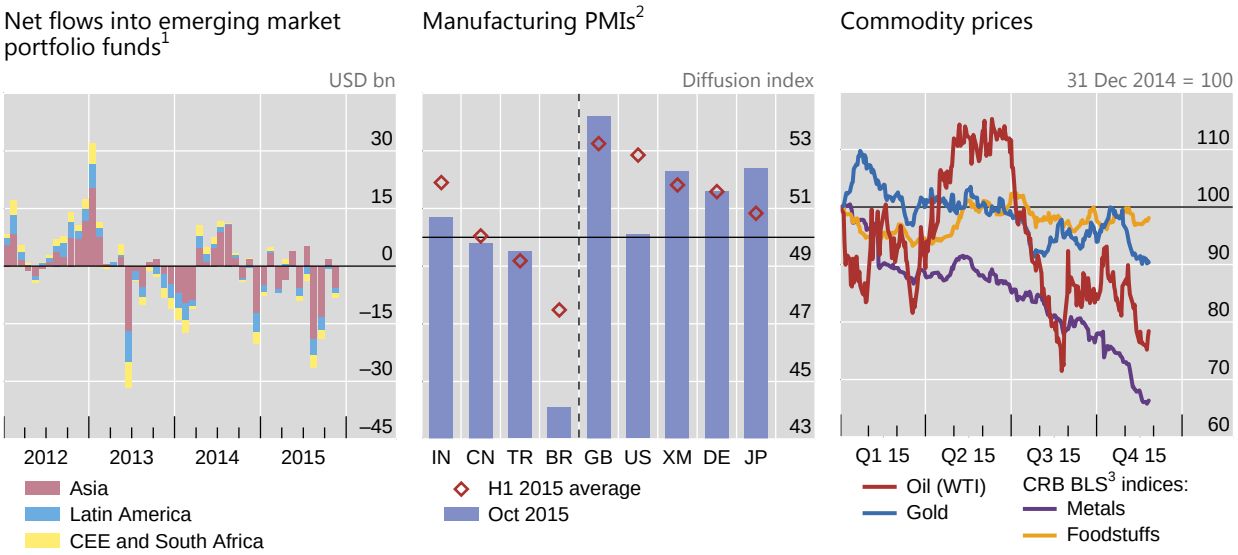
[1] MSCI World Index. [2] MSCI Emerging Markets Index. [3] Implied volatility of at-the-money options on long-term bond futures of Germany, Japan, the United Kingdom and the United States; weighted average based on GDP and PPP exchange rates. [4] JPMorgan VXY Global index. [5] US dollars per unit of local currency. A decline indicates a depreciation (appreciation) of the local currency (US dollar).

Sources: Bloomberg; Datastream; national data.

[1] See "EME vulnerabilities take centre stage", *BIS Quarterly Review*, September 2015.

EMEs continue to face headwinds

Graph 2



BR = Brazil; CN = China; DE = Germany; GB = United Kingdom; IN = India; JP = Japan; TR = Turkey; US = United States; XM = euro area.

[1] Monthly sums of weekly data across major economies in each region up to 18 November 2015. Data cover net bond and equity portfolio flows (adjusted for exchange rate changes) to dedicated funds for individual EMEs and to EME funds with country/regional decomposition. [2] Purchasing managers' indices (PMIs) derived from monthly surveys of private sector companies. A value above (below) 50 indicates expansion (contraction). [3] Commodity Research Bureau – Bureau of Labor Statistics.

Sources: Bloomberg; Datastream; EPFR; HSBC.

in October in the major EMEs (Graph 2, centre panel). China recorded its lowest GDP growth rate in the third quarter (6.9% annualised) since the first half of 2009, and industrial production and fixed investment stayed sluggish in October. Brazil and Russia remained deep in recession as political factors added to economic woes. These developments weighed on the outlook in the major AEs, although their PMIs signalled continued expansion.

Sub-par growth expectations in EMEs also put further downward pressure on commodity prices. Oil prices staged a brief rebound in early October, but have since sunk below $50 per barrel (Graph 2, right-hand panel). Base metal prices continued to dip.

The market rebound was supported by policy interventions in major EMEs and AEs.

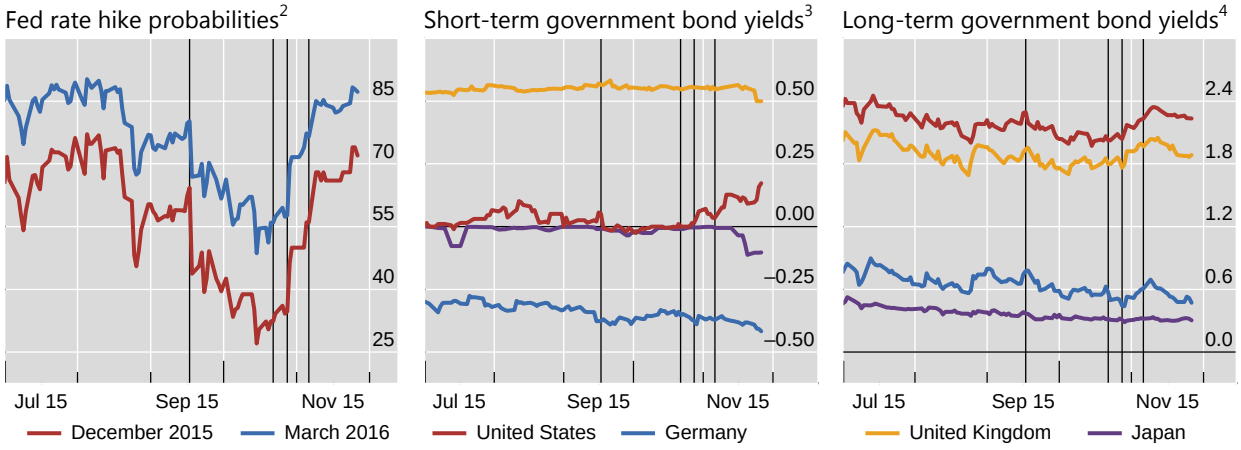
Several EMEs stepped up monetary accommodation to stimulate growth, while others had less room to do so for fear of sparking further currency weakness and inflation. The Reserve Bank of India cut its policy rate to a four-year low of 6.75% in late September. At the end of October, the People's Bank of China lowered the one-year benchmark lending and deposit rates by 25 basis points, the sixth rate cut during this easing cycle, and reduced the reserve requirement ratio by 50 basis points. By contrast, the policy rate in Brazil remained at 14.25% following an increase in July.

Some authorities also intervened in currency markets. By the end of October, China's foreign exchange reserves had fallen by over $450 billion from their peak in June 2014. And over one quarter of the reduction occurred in August

Policy announcements move markets[1]

In per cent

Graph 3



[1] Vertical lines represent the US Federal Reserve Federal Open Market Committee meetings on 17 September and 28 October 2015, the European Central Bank Governing Council meeting on 22 October 2015 and the release of US nonfarm payrolls report on 6 November 2015. [2] Based on Bloomberg implied probabilities from fed funds futures. [3] Three-month government bond yields. [4] Ten-year government bond yields.

Source: Bloomberg.

and September 2015. Brazil undertook forward-like swap and US dollar repo operations on a large scale to provide dollar liquidity and currency risk protection for the private sector.

The FOMC refrained from raising its policy rate at its September meeting, significantly boosting market sentiment. The probability of a rate hike in 2015, as implied by fed funds futures, fell abruptly to 30% (Graph 3, left-hand panel) and the three-month Treasury yield declined below zero. Across the maturity spectrum, US Treasury yields remained very low in the ensuing weeks, despite the threat of a potential default as a result of political delays in lifting the government's debt ceiling (since then resolved) (Graph 3, centre and right-hand panels).

The market mood further improved after the ECB Governing Council signalled its willingness to consider further monetary stimulus following its 22 October meeting. In Europe, government bond yields fell sharply (Graph 3, centre and right-hand panels) and yields on three-month Italian bonds turned negative for the first time. As a subsequent series of speeches by ECB officials were interpreted as signals for an expansion in monetary accommodation in early December, yields continued to fall and term premia dipped further into negative territory (Graph 4, left-hand panel). By the end of November, the stock of euro area government bonds that carried negative yields had risen to more than €1.9 trillion, or approximately one third of the total market (Graph 4, centre panel).

Other major government bond markets moved less (Graph 3, centre and right-hand panels). Japanese government bonds reacted little to the anticipated continuation of quantitative easing. The Bank of Japan kept monetary stimulus unchanged despite data showing the economy slipping back into a recession in the third quarter. UK gilt yields also changed little, as markets continued to expect a rate rise in 2016.

Markets anticipate divergence

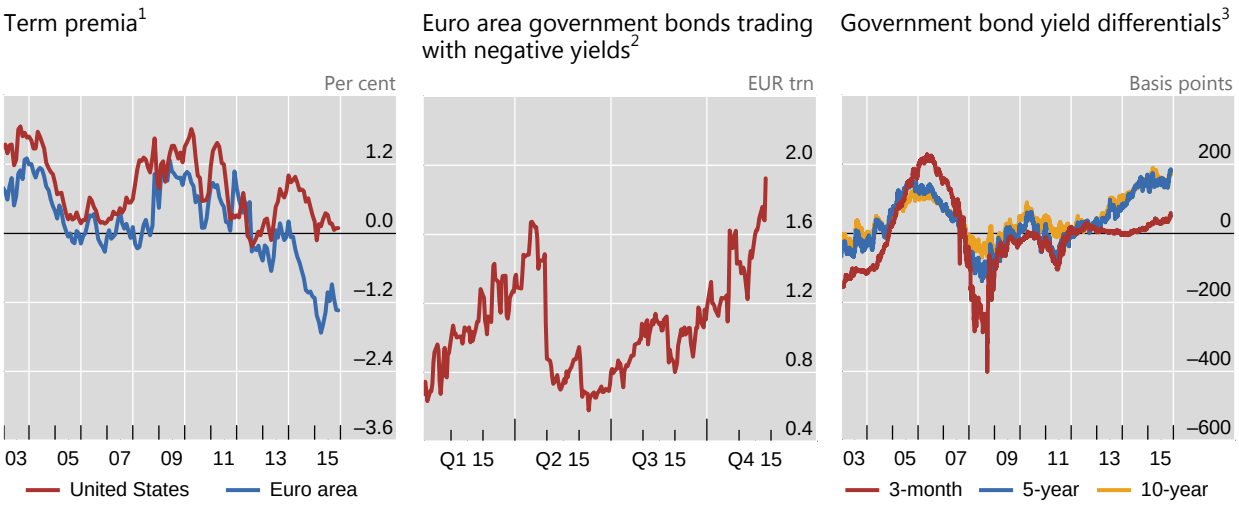
Markets changed course in late October, when the implied odds of a Fed tightening increased substantially. The first turnaround came after the FOMC's post-meeting statement, released on 28 October, was perceived as having a more hawkish tone. When the United States reported much stronger-than-expected payroll data on 6 November, the expectations of a December lift-off were further reinforced: the market-implied likelihood of a rate rise jumped to 50% immediately after the October FOMC meeting, and moved on up to almost 70% upon the release of the payroll data (Graph 3, left-hand panel).

Money and bond markets reacted to heightened rate expectations. US Treasury yields increased (Graph 3, centre and right-hand panels); on 6 November the three-month Treasury yield saw its biggest one-day leap since the taper tantrum in 2013. Yields at the long end rose too, but not as much, flattening the yield curve.

Since then, market attention has begun to shift from the timing of a lift-off to the subsequent path of the policy rate. So far, the market is pricing in a very gradual tightening with short-term rates expected to remain below 2% until the end of 2018. But the uncertainty is large. The implied volatility of two-year swaptions jumped on 6 November from already high levels that surpassed those during the taper tantrum.

Pricing adjustment was also significant in currency markets. The US dollar rose to a seven-month high against AE currencies in early November. The euro in particular lost further ground vis-à-vis the dollar as markets priced in the divergence between prospective US tightening and further accommodation in the euro area. Overall, the euro depreciated by over 10% in the first 11 months of this year. And markets have seemingly started to position themselves for a more persistently

Policy divergence increases yield differentials — Graph 4



[1] Decomposition of the 10-year nominal yield according to an estimated joint macroeconomic and term structure model; see P Hördahl and O Tristani, "Inflation risk premia in the euro area and the United States", *International Journal of Central Banking*, September 2014, pp 1–47. Yields are expressed in zero coupon terms; for the euro area, French government bond data are used. [2] Analysis based on the constituents of the Bank of America Merrill Lynch All Euro Government Broad Market Index. [3] US Treasury yields minus German bund yields.

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

strong dollar. Having shrunk during the third quarter from their March peak, when the ECB adopted quantitative easing, net short euro positions versus the dollar started to increase again at the end of October.

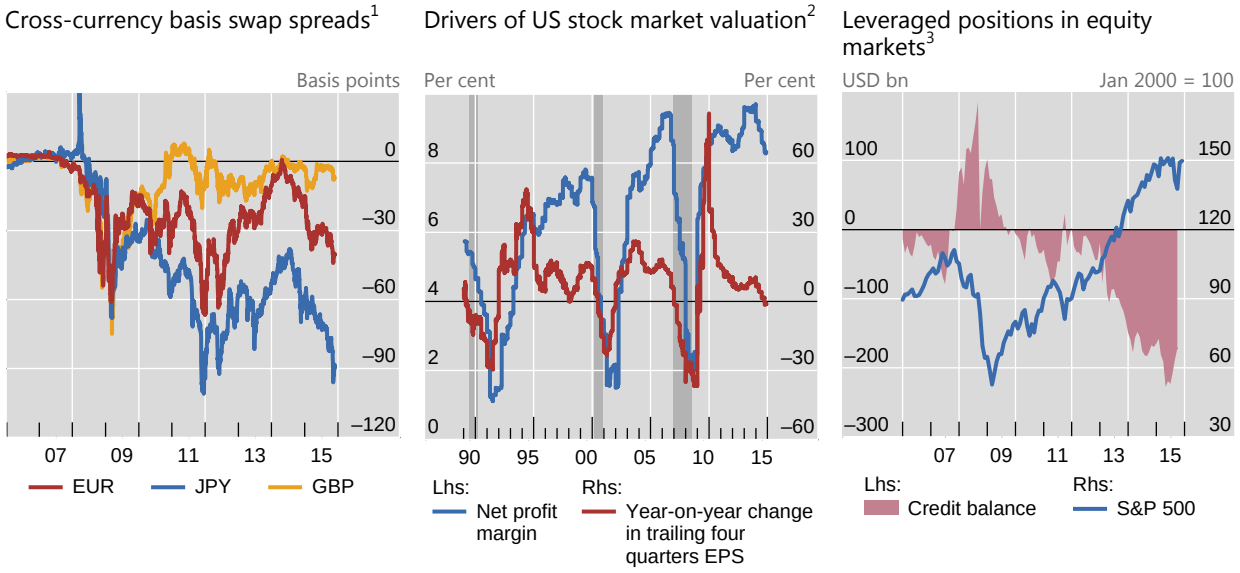
The anticipated policy divergence between the United States and the euro area led to a widening of bond differentials (Graph 4, right-hand panel). The difference between three-month government bond yields in the United States and Germany edged up, although it remained much less pronounced than during the last US tightening cycle, from 2003 until mid-2006. In contrast, the yield difference between 10-year US Treasuries and German bunds has been much wider.

The increased likelihood of policy divergence between the US, the euro area and other major currency areas also rippled through global US dollar funding markets. Historically, cross-currency basis swap spreads – a measure of tensions in global funding markets – were virtually zero, consistent with the absence of arbitrage opportunities. Since 2008, the basis has widened repeatedly in favour of the US dollar lender, ie there is a higher cost for borrowing in dollars than in other currencies even after hedging the corresponding foreign exchange risk – conventionally recorded on a negative basis (Graph 5, left-hand panel). As such, negative basis swap spreads indicate the absence of arbitrageurs to meet heightened demand for US dollar liquidity.[2]

The US dollar premium in FX swap markets widened substantially – in particular vis-à-vis the Japanese yen – after the odds of Fed tightening reached 70%. At the end of November, the basis swap spread of the Japanese yen versus the US dollar was minus 90 basis points, possibly reflecting in part the more than $300 billion US dollar funding gap at Japanese banks.

Vulnerabilities of global funding conditions and stock markets

Graph 5



[1] Five-year basis swap spreads versus the US dollar. [2] Based on S&P 500; shaded lines represent NBER recession dates. [3] Credit balance is calculated as the sum of free credit cash accounts and credit balances in margin accounts minus margin debt. Credit balance data up to September 2015.

Sources: Bloomberg; Datastream; NYSE; national data.

[2] See also the box on "Dislocated markets" in the September 2015 issue of the *BIS Quarterly Review*, pp 14–5.

While funding continued to be available, such a large negative basis indicates potential market dislocations. And this may call into question how smoothly US dollar funding conditions will adjust in the event of an increase in US onshore interest rates. Similar pricing anomalies have also emerged in interest rate swap markets recently, raising related concerns (see box).

In contrast, the stock market's response to the increased odds of tightening was more muted. In the days following the labour data announcement, US stocks weakened, but subsequently turned despite the release of the October FOMC minutes and a stream of speeches by Fed officials which markets viewed as preparing the ground for a December rate hike. The Paris terrorist attack on 13 November and heightened tensions in Syria led to increased concerns over geopolitical risks, but had little impact on the market.

The moderate response suggests that the positive and negative effects of a rate hike are perceived as broadly balanced for equities. On the one hand, higher rates would be positive as they would confirm the strength of the US recovery. But higher rates would inter alia increase interest expenses for corporates. Low rates have helped to bolster high profit margins despite low earnings growth for US corporates in recent years (Graph 5, centre panel). Earnings in fact fell in the third quarter, by 0.6%. Historically, earnings shrinkage has signalled recessions, although few analysts now forecast such a development.

Markets also continued to be propped up by leveraged positions, which may be vulnerable to higher interest rates (Graph 5, right-hand panel). Although down from its August peak, margin debt in the US equity market remained within reach of previous record highs seen in the run-up to the dotcom bust more than 10 years ago.

Uneasy calm?

Recalling the early stages of the taper tantrum, EMEs reacted strongly to the release of the US employment data. Across markets, the reaction in the first few days after 6 November was comparable to, if not stronger than, the "taper tantrum" episode beginning in May 2013 (Graph 6), when a speech by the Federal Reserve Chairman was taken to signal an imminent shift to a less accommodative policy stance. This time, the effects on foreign exchange markets were especially pronounced.

However, market reactions were short-lived this November, in contrast to the prolonged weakness seen in 2013. In less than two weeks, EM government and corporate bond markets returned to their early-November levels. Equity and foreign exchange markets recovered most of their losses. And even during the first few days, currency risk reversals over the next three months – an option-implied measure capturing the risks of large appreciations versus depreciations – hardly moved, indicating little shift in exchange rate pressures (Graph 7, left-hand panel). Overall, the short-lived market response points to resilience among EMEs to prospects of a tighter monetary policy stance in the United States.

Even though calm returned quickly to markets, compared with the initial reactions,, the recent episode took place against a less buoyant and, in some cases, weaker market backdrop than in 2013 (Graph 6, bottom centre-right and right-hand

Recent dislocations in fixed income derivatives markets

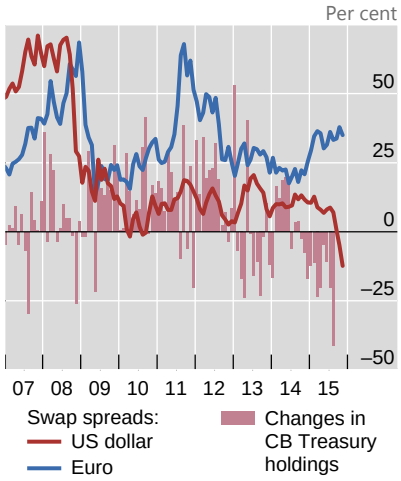
Suresh Sundaresan and Vladyslav Sushko

Recent quarters have witnessed unusual price relationships in fixed income markets. US dollar swap spreads (ie the difference between the rate on the fixed leg of a swap and the corresponding Treasury yield) have turned negative, moving in the opposite direction from euro swap spreads (Graph A, left-hand panel). Given that counterparties in derivatives markets, typically banks, are less creditworthy than the government, swap rates are normally higher than Treasury yields because of the additional risk premium. Hence, the negative spreads point to a possible dislocation. One set of factors relates to supply and demand conditions in interest rate swap and Treasury bond markets. In the swap markets, forces that can compress swap rates include credit enhancements in swaps, hedging demand from corporate bond issuers, and investors seeking to lock in longer durations (eg insurers and pension funds) by securing fixed rates via swaps. In cash markets, in turn, upward pressures on yields stemmed from the recent sales of US Treasury securities by EME reserve managers. The market impact of these Treasury bond sales may have been amplified by a second set of factors that curb arbitrage and impede smooth market functioning. First, the capacity of dealers' balance sheets to absorb rising inventory may have been overwhelmed by the amount of US Treasury bonds reaching the secondary market in the third quarter (Graph A, centre panel), causing dealers to bid market yields above the corresponding swap rates. Second, balance sheet constraints may have made it more costly for intermediaries to engage in the speculative arbitrage needed to restore a positive swap spread. Such arbitrage is sensitive to balance sheet costs because it requires leverage, with a long Treasury position funded in the repo market.①

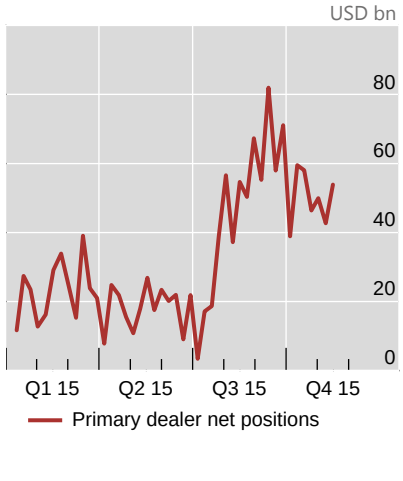
In the euro area, market tensions have been of a different nature. Ten-year swap spreads started to widen in early 2015, around the time when the Swiss National Bank abandoned its currency peg, then increased further over subsequent months (Graph A, left-hand panel). While past episodes of widening swap spreads can be attributed to credit risk in the banking sector, the most recent developments may have more to do with hedging by institutional investors. While swap rates also fell (Graph A, right-hand panel), the swap spread widened, indicating that cash market yields fell by even more. One possible explanation is that, as yields fall amid expectations of ECB asset purchases, institutional investors with long-duration liabilities, such as insurers and pension funds, would have been under pressure to extend their asset portfolio duration by purchasing additional longer-dated bonds, possibly compressing market yields below the swap rates.②

Swap spreads, Treasury bond flows and interest rate hedging costs — Graph A

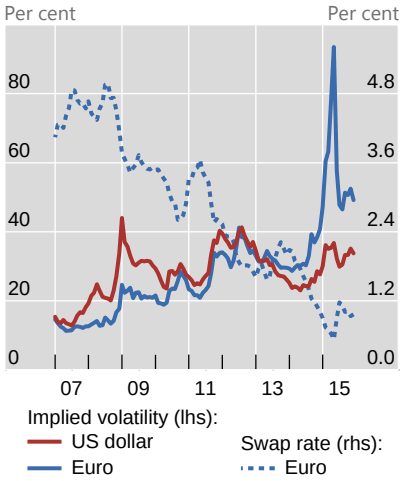
Foreign Treasury holdings and 10-year interest rate swap spreads[1]



Dealer inventories of US Treasury bonds[2]



Swaption-implied volatility and 10-year euro swap rate[1, 3]

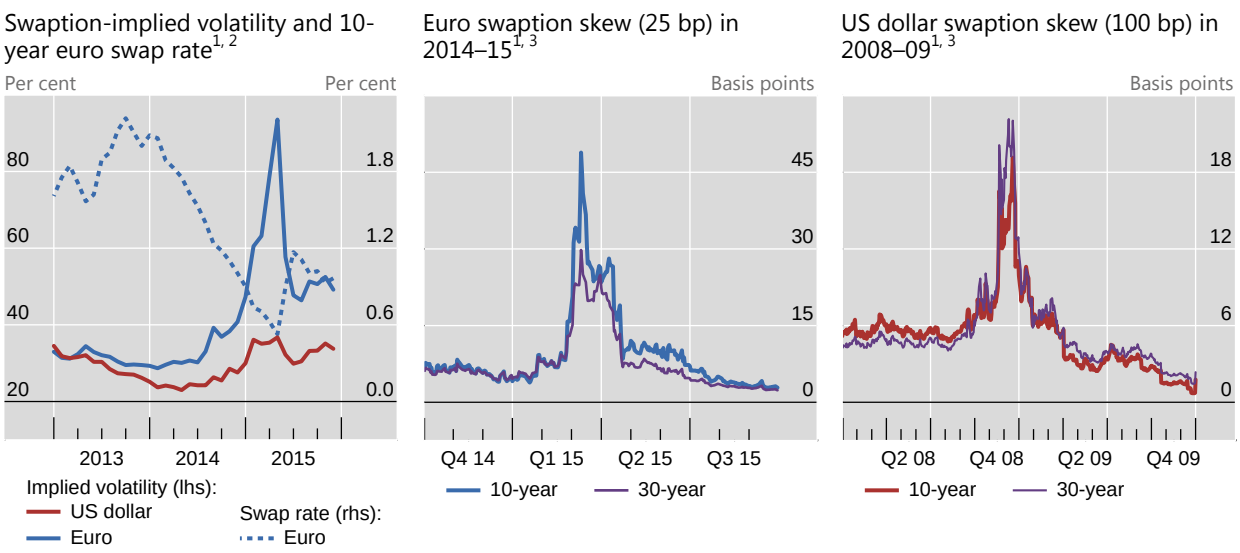


[1] Monthly average of daily observations. [2] Net positions of primary dealers in US Treasury bills and notes (excluding TIPS). [3] US dollar and euro two-year into 10-year European swaption-implied Black Vol ATM.

Sources: Federal Reserve Bank of New York; Treasury International Capital (TIC) System; Bloomberg; BIS calculations.

Interest rate hedging costs and indicator of asymmetric hedging demand

Graph B



[1] Monthly average of daily observations. [2] Two-year into 10-year European swaption-implied Black Vol ATM. [3] Difference between implied volatilities for strikes above at-the-money (payer) and below at-the-money (receiver), two-year maturities.

Sources: Barclays; Bloomberg; BIS calculations.

In addition to extending portfolio duration by purchasing longer-dated bonds or entering a long-term interest rate swap as a fixed rate receiver, investors may also hedge the risk of steeply falling yields by purchasing options to enter a swap contract at a future date (swaptions). Hence, swaptions tend to become more expensive in times of stress and when investors rush to hedge duration risk.③

As 10-year swap rates were compressed in early 2015, the cost of such options written on euro swap rates rose by a factor of three by 20 April 2015 (Graph B, left-hand panel). Steeply rising euro rate hedging costs preceded the actual correction in yields, which started rebounding around the weekend of 18 April culminating in the so-called bund tantrum. This suggests that this year's turbulence in fixed income markets may have had its origins in derivatives and hedging activity, with reduced market depth in cash markets exacerbating the spillovers.④

Such volatile movements in euro area interest rate derivatives markets raise questions about smooth pricing responses in the face of possibly transient order imbalances. Of question is liquidity in hedging markets and the capacity of traditional options writers, such as banks, to provide adequate counterparty services to institutional hedgers. Looking back at the events of late April, the rise in demand to receive fixed rate payments via swaps by institutional hedgers may have run into a lack of counterparties willing to receive floating (pay fixed) rates amid sharply falling market yields. The emergence of one-sided hedging demand pressures can be gleaned from the skew in swaption pricing (Graph B, centre and right-hand panels). The skew observed for euro rates approaching the bund tantrum resembled the developments in US dollar rates in December 2008, when US pension funds rushed to hedge interest rate risk via swaptions as market yields tumbled.

① There are some elements in common with the widening of cross-currency basis swap spreads (see Graph 6 and the discussion in the text), whereby supply and demand imbalances for US dollar funding interact with factors preventing arbitrage between onshore money market rates and the swap-implied US dollar rates. ② See D Domanski, H S Shin and V Sushko, "Hunt for duration: not waving but drowning?", *BIS Working Papers*, no 519, 2015. ③ See R Perli and B Sack, "Does mortgage hedging amplify movements in long-term interest rates?", *Journal of Fixed Income*, vol 13, no 3, 2003, pp 7–17. ④ See the box by A Schrimpf and R Riordan on "Volatility and evaporating liquidity during the bund tantrum", *BIS Quarterly Review*, September 2015, pp 10–1.

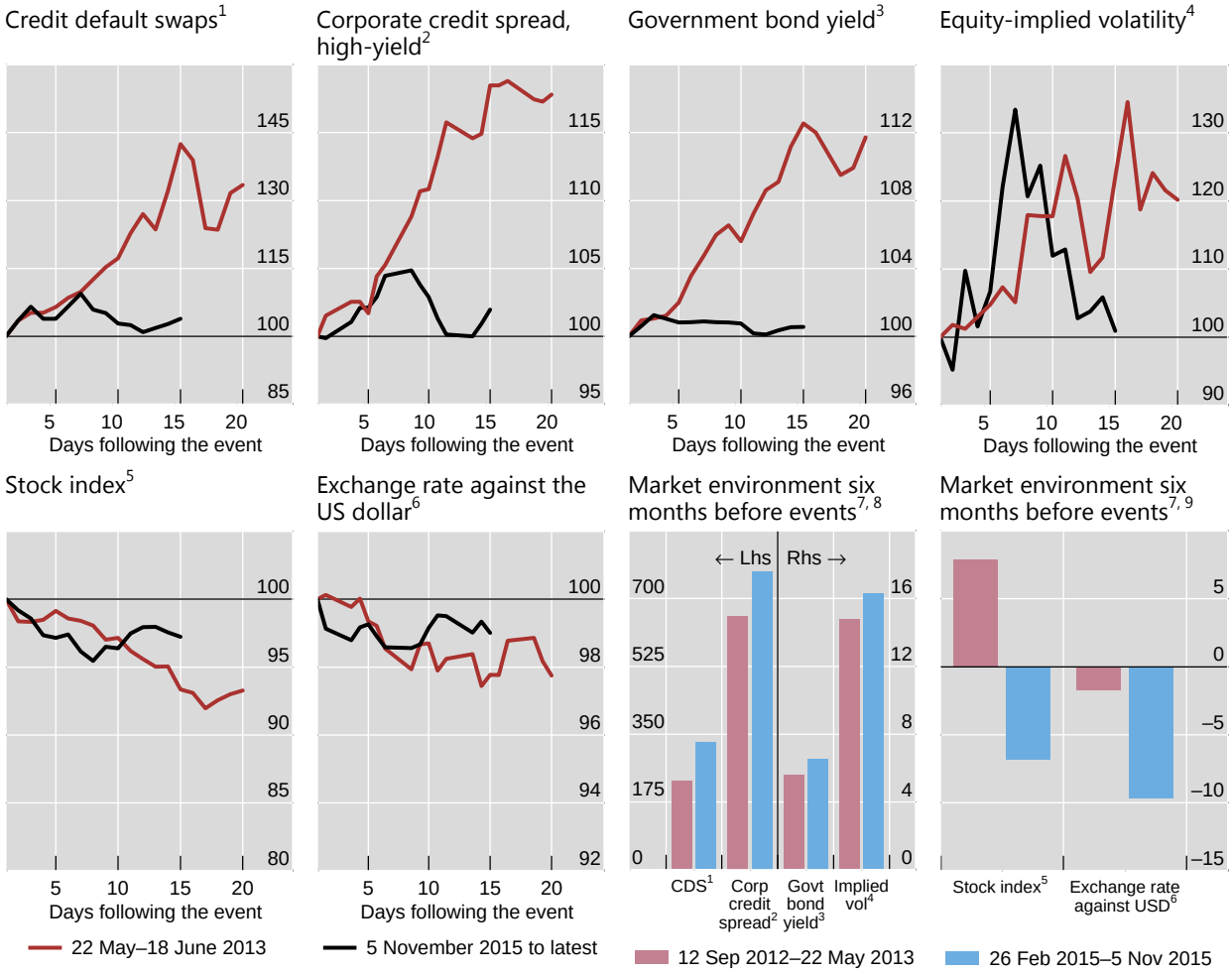
panels). In the six months leading up to the taper tantrum, equity markets gained and exchange rates were broadly stable. In contrast, in the same window before the payroll data, equity markets had sustained considerable losses and EM currencies had already depreciated by nearly 10% on average against the dollar. Funding

conditions in government and corporate credit markets were also much tighter ahead of the current episode. For instance, average high-yield corporate credit spreads were 30% higher during the six months ahead of 6 November 2015 than during the run-up to the Bernanke speech. Perhaps most importantly, the taper tantrum was not preceded by a bout of market turbulence. In contrast, in August 2015 the VIX had reached levels not seen since the onset of the European debt crisis in 2011 and CDS spreads on EME sovereigns had exceeded levels experienced during the worst of the taper tantrum.

There have also been signs that EM local currency yields are increasingly sensitive to developments in the United States. The post-crisis era has been characterised by

Another taper tantrum?

22 May 2013 = 100 (start of taper tantrum) and 5 November 2015 = 100 (day before US data release) Graph 6

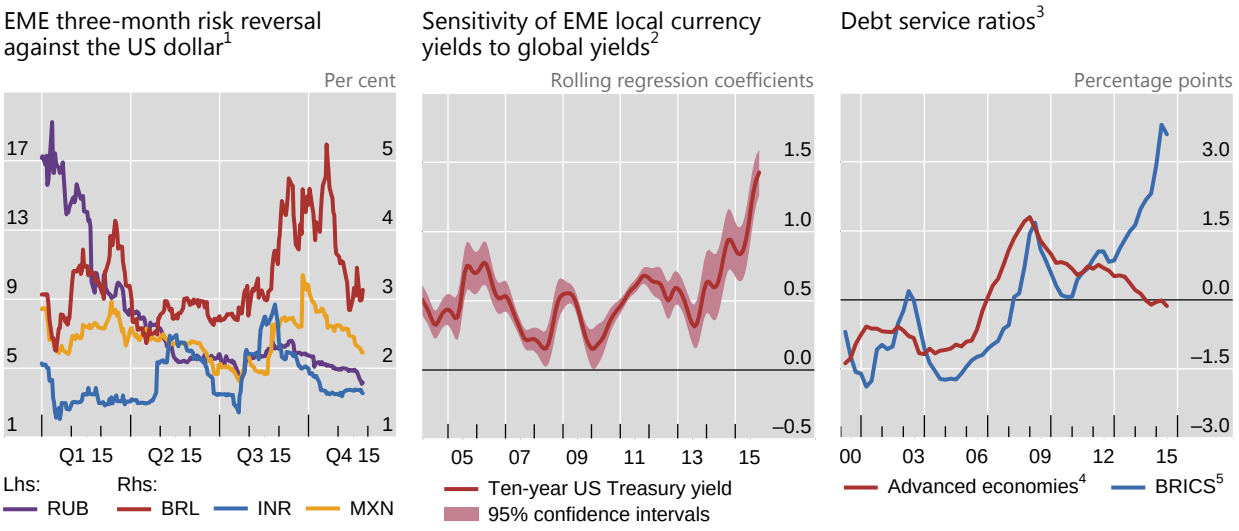


[1] JPMorgan CDX.EM sovereign index; five-year on-the-run credit default swap (CDS) spreads in US dollars. [2] Emerging market corporate plus high-yield option-adjusted spreads over US Treasury notes. [3] JPMorgan GBI-EM Broad Diversified Index (7–10 years), yield to maturity in local currency. [4] VIX. [5] MSCI Emerging Markets Index. [6] JPMorgan Emerging Markets Currency Index (EMCI), spot; a decline indicates a depreciation (appreciation) of the emerging market currencies (US dollar). [7] 150 working days before the events; the first episode is from 12 September 2012 to 22 May 2013 and the second episode from 26 February 2015 to 5 November 2015. [8] Simple average throughout the episodes; CDS and emerging market high-yield corporate credit spread in basis points, emerging market government bond yield in per cent and VIX in percentage points. [9] Percentage change between the start and the end of the episodes.

Sources: Bank of America Merill Lynch; Bloomberg; Datastream; JPMorgan; BIS calculations.

Tightening in the United States may challenge EMEs

Graph 7



BRL = Brazilian real; INR = Indian rupee; MXN = Mexican peso; RUB = Russian rouble.

[1] The risk reversal is defined as the implied volatility for call options minus the implied volatility for put options on the base currency with the same delta (25). [2] JPMorgan GBI-EM Broad Diversified Index (7–10 years) bond yield regressed over one month lagged GBI-EM bond yield index and current and one month lagged values of the US 10-year Treasury yield, JPMorgan Emerging Markets Currency Index (EMCI) and average EME policy rate. Model estimated in first differences. Time-varying estimates obtained by weighting sample observations using a normal distribution centred on each date and with a dispersion such that the two year window around each estimation date accounts for more than 99% of the weights. [3] For the private non-financial sector. For the methodology, see www.bis.org/statistics/dsr.htm?m=6%7C341; difference of DSRs from country-specific long-run averages since 2000; data up to Q2 2015. [4] Simple average across Australia, Canada, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. [5] Simple average across Brazil, China, India, Russia and South Africa.

Sources: Bloomberg; JPMorgan Chase; national data; BIS; BIS calculations.

strong international spillovers from US bond yields to emerging markets, even when those countries were at different stages of the business cycle.[3] And this effect seems to have strengthened over time. A simple rolling regression of an EME bond index on US 10-year Treasury yields suggests that the potential for spillovers is larger now than it was during the taper tantrum (Graph 7, centre panel).

Weaker financial market conditions combined with an increased sensitivity to US rates may heighten the risk of negative spillovers to EMEs when US policy is normalised. On the one hand, a solid US recovery, the basis for an interest rate hike, is likely to benefit EMEs through trade channels. On the other hand, further dollar appreciation and increasing yields may pose additional risks to growth and inflation in some countries.

Tighter financial conditions may also increase financial stability risks in EMEs. Credit growth in EMEs has been strong over recent years, owing to favourable growth prospects and very easy global financial conditions. For example, the average credit-to-GDP ratio in the BRICS has risen by close to 25% since 2010. Despite low interest rates, rising debt levels have pushed debt service ratios for households and firms above their long-run averages, particularly since 2013, signalling increased risks

[3] See B Hofmann and E Takáts, "International monetary spillovers", *BIS Quarterly Review*, September 2015, pp 105–18.

of financial crises in EMEs (Graph 7, right-hand panel).[4] Debt service ratios will inevitably increase even further when lending rates start to rise. Any further appreciation of the dollar would additionally test the debt servicing capacity of EME corporates, many of which have borrowed heavily in US dollars in recent years.[5]

[4] For a recent discussion of early warning indicators for EMEs see Table 1 (p 33) in the "Highlights of global financing flows" in the September 2015 issue of the *BIS Quarterly Review*.

[5] Dollar borrowing of EME corporates is further discussed in McCauley, B, P McGuire and V Sushko (2015), "Dollar credit to emerging market economies", this issue.

Highlights of the BIS international statistics[1]

The BIS, in cooperation with central banks and monetary authorities worldwide, compiles and disseminates data on activity in international financial markets. This chapter summarises the latest data for the international banking and international debt securities indicators. Banking data are available through the second quarter of 2015 while debt securities figures are available through the third quarter. Two boxes look at foreign bank lending to China and OTC derivatives in the first half of 2015.

Takeaways

- Cross-border bank lending contracted between end-March and end-June 2015. The decline was mainly driven by a fall in lending to advanced economies (AEs). By contrast, claims on emerging market economies (EMEs) increased modestly during the same period.
- According to the BIS locational banking statistics (LBS), cross-border claims on AEs fell by $916 billion between end-March and end-June 2015, reversing the first quarter's $761 billion expansion.
- The BIS consolidated banking statistics (CBS) suggest that the drop in lending to AEs during Q2 2015 was only $305 billion. The size of the decline in the CBS was much smaller than the one in LBS primarily because of derivatives positions and inter-office loans, both of which are included in the LBS, but not in the CBS.
- Cross-border claims on China rose by $38 billion during the second quarter of 2015. Despite this moderate quarterly increase, international bank lending to China has lost significant momentum and contracted by 3% in the year to end-June 2015.
- International debt security issuance contracted in the third quarter of 2015, with net issuance of $50 billion, down from $233 billion in the second.
- The third-quarter slide in the issuance of international debt securities was particularly severe in EMEs, where net issuance fell to $1.5 billion, the largest downturn since the end of the financial crisis.

[1] This article was prepared by Cathérine Koch (catherine.koch@bis.org), Gianpaolo Parise (gianpaolo.parise@bis.org) and Andreas Schrimpf (andreas.schrimpf@bis.org). Statistical support was provided by Jeff Slee, Stephan Binder, Branimir Gruić and Denis Pêtre.

- Outstanding OTC derivatives positions dwindled in the first half of 2015, falling by 12% from $629 trillion to $553 trillion. Trade compression – a process of tearing up trades to eliminate economically redundant derivatives positions – accounts for much of this decline. Picking up significantly in 2014 and continuing to grow in the first half of 2015, compression has allowed dealers to trim the size of their derivatives books.

Recent developments in the international banking market

Cross-border banking activity contracted significantly between end-March and end-June 2015, more than reversing the large expansion in the first quarter. The LBS[2] reveal that cross-border claims fell by $902 billion in exchange rate-adjusted terms[3] during Q2 2015, slowing the annual growth rate[4] of cross-border lending to 1% at end-June 2015, down from 6% at end-March 2015 (Graph 1). That said, the decline in Q2 2015 largely represented a reversal of the $780 billion increase observed in the first quarter of 2015. As a consequence, the overall decrease in cross-border bank claims during the first half of 2015 was only $122 billion.

Bank credit to AEs and EMEs diverged during Q2 2015. Cross-border claims on AEs fell by $916 billion. This quarterly decline more than offset the $761 billion increase in Q1 2015, bringing down year-on-year growth to less than 1%. By contrast, cross-border claims on EMEs grew by $46 billion in the course of Q2 2015, almost fully reversing the $57 billion contraction during the previous quarter. Despite the latest quarterly increase, the annual growth rate of cross-border lending to EMEs turned negative (–1%) for the first time since end-September 2012.[5]

Cross-border claims on advanced economies contracted during Q2 2015

The sharp contraction in cross-border lending to AEs between end-March and end-June 2015 reversed the developments seen during the previous quarter. Cross-border claims on AEs fell by $916 billion during the second quarter of 2015 (after adjustment for exchange rate fluctuations and breaks in series) after the $761 billion increase during the first. This took their outstanding stock to $19.6 trillion at end-June 2015.

[2] The LBS are based on the location of banking offices and capture the activity of all internationally active banking offices in the reporting country regardless of the parent bank's nationality. Banks record their positions on an unconsolidated basis, including those vis-à-vis their own offices in other countries.

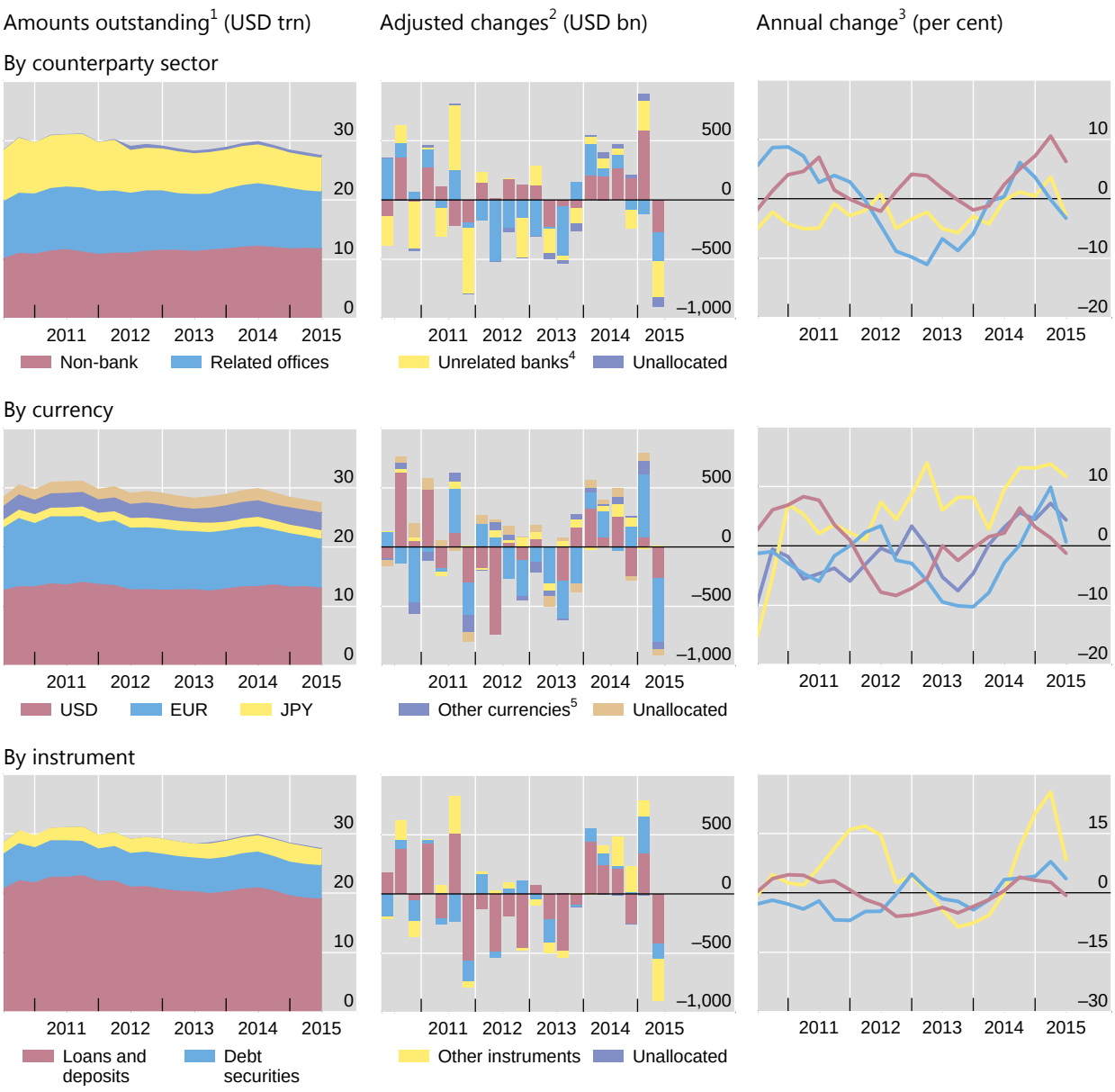
[3] Quarterly changes in outstanding amounts are adjusted for the impact of exchange rate movements between the respective quarter-ends and for methodological breaks in the data series.

[4] Annual percentage changes are calculated as the sum of exchange rate- and break-adjusted changes over the preceding four quarters divided by the amount outstanding one year earlier.

[5] The remainder of the quarterly shift in claims is accounted for by offshore centres and an unallocated portion.

Cross-border claims, by sector, currency and instrument

Graph 1



[1] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Quarterly changes in amounts outstanding, adjusted for the impact of exchange rate movements between quarter-ends and methodological breaks in the data. [3] Geometric mean of quarterly percentage adjusted changes. [4] Includes central banks and banks unallocated by subsector between intragroup and unrelated banks. [5] Other reported currencies, calculated as all currencies minus USD, EUR, JPY and unallocated currencies. The currency is known but reporting is incomplete.

Source: BIS locational banking statistics.

The above reversal pattern was present for cross-border bank lending to both bank and non-bank borrowers in AEs. Cross-border claims on banks contracted by $499 billion between end-March and end-June 2015, after increasing by $255 billion during Q1 2015. This took their outstanding stock to $11.3 trillion and pulled their annual growth rate into negative territory (–2%). Cross-border claims on non-banks, which had increased by $456 billion in Q1 2015, fell by $342 billion in Q2 2015. This slowed their year-on-year growth rate to 5% at end-June 2015, down from 10% at end-March 2015.

The currency breakdown in the LBS reveals that sharp drops in euro- and US dollar-denominated claims led the contraction in cross-border bank lending to AEs during the second quarter of 2015. Euro-denominated claims, which constituted more than one third of the overall stock of cross-border claims on AEs, accounted for more than half of the latest quarterly contraction. They fell by $527 billion, which slowed their year-on-year growth rate to 1% at end-June 2015, down from 9% at end-March 2015. US dollar-denominated claims on AEs saw a $255 billion decline, which pushed their annual growth rate down to –2%, the first year-on-year contraction since the second quarter of 2014. Cross-border claims denominated in Swiss francs and Japanese yen also contracted during Q2 2015, by a respective $51 billion and $9 billion. By contrast, lending in sterling expanded (by $14 billion), albeit more weakly than in the first quarter of 2015.

The CBS on an immediate counterparty basis[6] suggest that the Q2 2015 contraction in cross-border lending to AEs was much milder than the one recorded by the LBS. The former data set reveals that the outstanding stock of cross-border claims on AEs declined by $305 billion between end-March 2015 ($10,075 billion) and end-June 2015 ($9,770 billion).[7]

The declines in cross-border claims on AEs recorded by the LBS and the CBS data differ in size for two main reasons. First, the instrument breakdown in the LBS reveals that $342 billion of the contraction was accounted for by "Other instruments", which primarily includes the positive market values of reporting banks' derivatives positions. Such derivatives positions are not included in cross-border claims in the CBS. Second, $112 billion of the Q2 2015 overall decline in the LBS was due to inter-office loans, which are not included in the CBS.

Modest increase in credit to emerging Asia

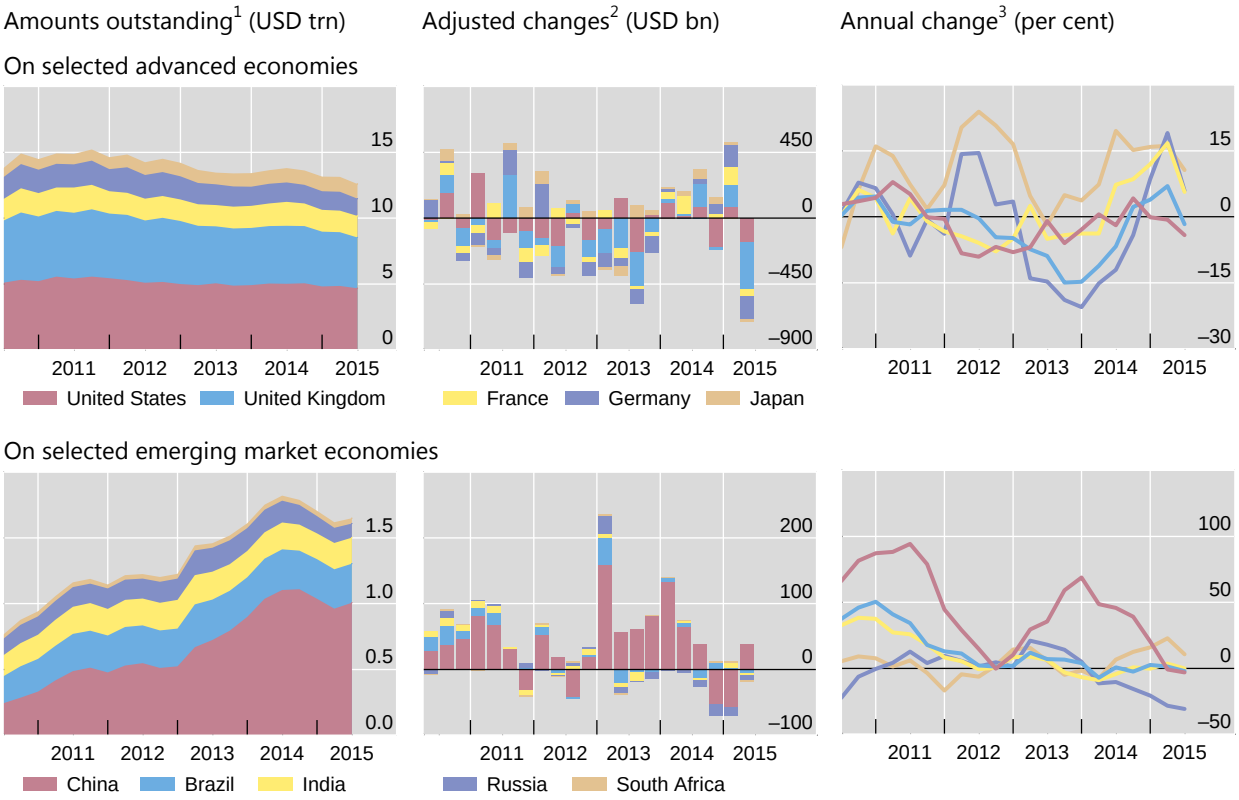
After two consecutive periods of contraction, cross-border lending to EMEs expanded moderately in Q2 2015. The $46 billion rise in such lending (after adjustment for exchange rate fluctuations and breaks in series) was not enough to offset earlier contractions, and consequently the year-on-year change declined to –1%, down from its most recent peak of 14% in Q4 2013.

Cross-border lending to emerging Asia in general, and China in particular, continued to lose momentum. Claims on emerging Asia went up by $42 billion during Q2 2015. Nevertheless, despite the latest quarterly increase, the year-on-year growth rate has turned negative (–2%). Regional developments were once again dominated by China, which remains the largest EME borrower country, with an outstanding volume of cross-border claims equivalent to $1 trillion. Even though cross-border claims on China increased by $38 billion during the second quarter of 2015, the annual growth rate fell to –3% (Graph 2, bottom panels). Box 1 sheds light on foreign lending to China from a consolidated perspective.

[6] The CBS are based on the nationality of reporting banks and are reported on a worldwide consolidated basis, ie excluding positions between affiliates of the same banking group. Banks consolidate their inter-office positions and report only their claims on unrelated borrowers without providing a currency breakdown. As a consequence, exchange rate-adjusted changes are not available in the CBS.

[7] Changes in outstanding stocks in the CBS should always be interpreted with caution because, unlike the adjusted flows in the LBS, they are not adjusted for exchange rate fluctuations and breaks in series.

Cross-border claims, by borrowing country Graph 2



[1] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Quarterly changes in amounts outstanding, adjusted for the impact of exchange rate movements between quarter-ends and methodological breaks in the data. [3] Geometric mean of quarterly percentage adjusted changes.

Source: BIS locational banking statistics.

The picture for international bank lending to other countries in emerging Asia was mixed. Korea saw cross-border claims on its residents increase by $2.6 billion. By contrast, lending to India and Indonesia contracted, by a respective $3.5 billion and $1.4 billion.

Mixed growth in credit to non-Asian emerging market economies

Cross-border lending to Latin America and the Caribbean remained virtually unchanged (after adjustment for exchange rate fluctuations and breaks in series) between end-March and end-June 2015. However, this regional aggregate conceals considerable differences at the country level. Brazil, the second largest borrower among EMEs, saw its cross-border borrowing drop by $5.1 billion during Q2 2015, which reduced its outstanding total to $296 billion (Graph 2, bottom panels). Mexico, the second largest borrower in the region, also experienced a decline (of $3 billion), which took its outstanding stock of cross-border borrowing to $123 billion. By contrast, cross-border claims on Venezuela grew by $2 billion. The increase was almost entirely driven by a jump in cross-border claims on banks, and lifted the annual growth rate of cross-border claims on the country to 11%. Cross-border claims on Argentina, Ecuador, Guyana and Uruguay all rose as well (with increases of about $1 billion each).

Foreign bank lending to China

Cathérine Koch

The BIS consolidated banking statistics (CBS) on an immediate counterparty basis indicate that foreign claims① on Chinese residents, including local claims booked by foreign banks' offices in China, amounted to $1.2 trillion at end-June 2015. This was down from an all-time high of $1.3 trillion at end-September 2014. As of mid-2015, almost two thirds of these foreign claims were booked by banks headquartered in BIS reporting countries (Graph A, left-hand panel). Banks headquartered outside BIS reporting countries but with offices located in BIS reporting countries – for instance, Chinese banks located in Hong Kong SAR – accounted for more than a third of the foreign claims on China at end-June 2015.② The claims of this group of so-called "outside area banks" contracted from $512 billion at end-September 2014 to $460 billion at end-June 2015. Unlike the claims of banks headquartered in BIS reporting countries, those of outside area banks are reported on an unconsolidated basis and thus include intragroup positions.

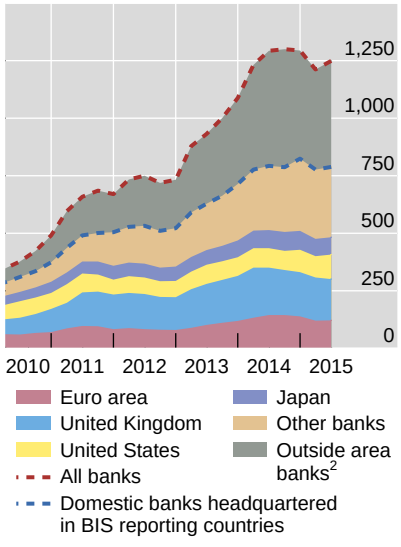
A large share of the growth in foreign claims on China over the past several years has taken the form of credit to banks (Graph A, centre and right-hand panels). The outstanding stock of these interbank claims accounted for more than half of international claims③ on China at the end of Q2 2015. However, these claims declined from $660 billion at mid-2014 to $532 billion at mid-2015 (Graph A, centre panel).④ Interbank positions include renminbi-denominated claims that are the counterpart to offshore deposit liabilities.⑤ By contrast, international claims on the Chinese non-bank private sector continued to grow at the steady pace seen in the past few years, lifting their outstanding stock from $91 billion at mid-2010 to $395 billion at mid-2015.

Short-term claims have mirrored the recent declines in interbank lending to China (Graph A, right-hand panel). Claims with remaining maturities of up to one year, which accounted for 75% of the total stock of international

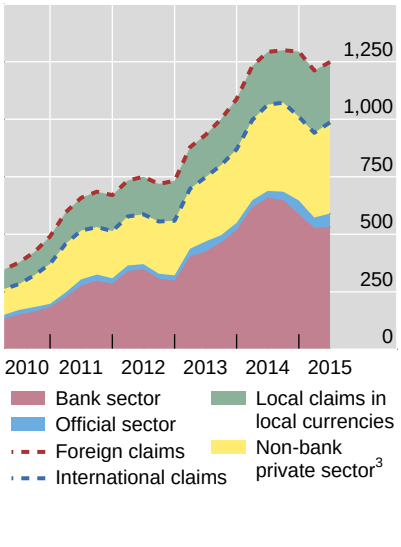
Foreign bank claims on China

In billions of US dollars — Graph A

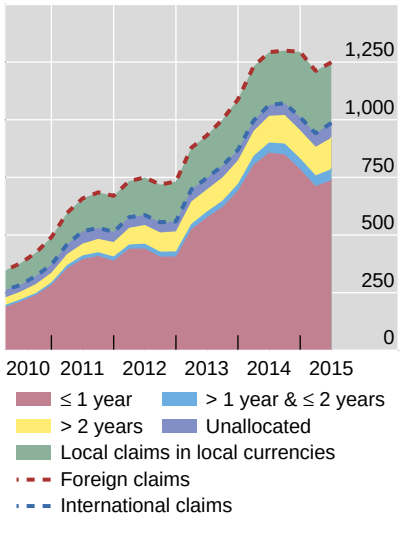
By bank nationality



By borrowing sector and local claims in local currency[1]



By remaining maturity and local claims in local currency[1]



[1] Breakdowns by borrowing sector and maturity not available for local claims in local currency. [2] Includes branches or subsidiaries located in the reporting country whose activities are not consolidated by a controlling parent institution in another reporting country. This mainly comprises banking offices with a non-bank controlling parent institution (eg the banking subsidiary of an insurance group). Over the period, this accounted for on average just over $960 million. [3] Includes international claims unallocated by sector.

Source: BIS consolidated banking statistics, immediate counterparty basis.

claims on China as of end-Q2 2015, have contracted from $858 billion at mid-2014 to $737 billion at mid-2015. Thus, they constituted most of this period's overall decline in international bank lending to China.

① Foreign claims comprise local claims of the bank's offices abroad as well as cross-border claims of the bank's offices worldwide. ② A list of countries in the BIS reporting area is available on the BIS website: www.bis.org/statistics/rep_countries.htm. China does not report international banking statistics to the BIS. However, the locational statistics and consolidated statistics on an immediate counterparty basis capture the positions of Chinese and other banks headquartered outside the BIS reporting area to the extent that these positions are booked through offices in a BIS reporting country. ③ International claims are defined as the sum of cross-border claims denominated in all currencies and foreign offices' local claims denominated in foreign currencies. ④ Changes in the consolidated banking statistics are not adjusted for exchange rate movements. To the extent that claims are denominated in currencies other than the US dollar, an appreciation of the US dollar will result in a decline in the reported US dollar value of outstanding claims in those currencies. ⑤ See R McCauley, "Capital flowed out of China through BIS reporting banks in Q1 2015", *BIS Quarterly Review*, September 2015, pp 28–9.

Between end-March and end-June 2015, cross-border lending to emerging Europe contracted by $3.5 billion; and, as in other regions, the picture varied markedly across countries. Cross-border claims on Russia and Ukraine continued to decline. The $8 billion quarterly drop on Russia accelerated the year-on-year decline to 30% and reduced the outstanding stock to $108 billion. Cross-border claims on Ukraine fell by $473 million during the second quarter of 2015, which took their annual rate of contraction to 44%. Those on Bulgaria and Turkey also declined (by $1.1 billion and $3.5 billion, respectively). By contrast, claims on the Czech Republic and Poland rose significantly (by $1.9 billion and $5.2 billion, respectively), with the quarterly expansion registered by Poland almost entirely driven by interbank cross-border claims.

During the second quarter of 2015, cross-border lending to Africa and the Middle East went up by $6 billion. The latest quarterly expansion kept the annual growth rate at a robust 11% – in line with the steady expansion observed since the beginning of 2014 – and took the outstanding total to $523 billion. The strongest underlying components of the overall increase were rises in cross-border claims on the United Arab Emirates ($11 billion), Qatar ($2 billion) and Egypt ($1.5 billion). By contrast, cross-border lending to Nigeria, Saudi Arabia and South Africa fell (by $1.2 billion, $1.8 billion and $2.3 billion, respectively).

The euro as a global funding currency

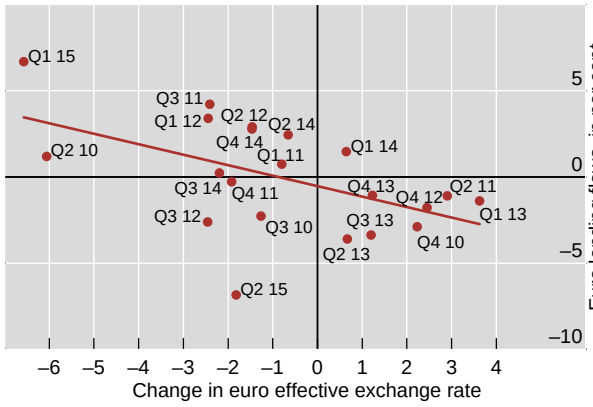
The latest developments in euro-denominated cross-border claims (discussed above) appear to be part of a broader pattern that links exchange rate movements in a given funding currency with global cross-border bank lending denominated in that currency. Specifically, there is growing empirical evidence that the depreciation of a global funding currency (typically, the US dollar) is associated with a rise in the net worth of borrowers from countries with other home currencies and, ultimately, with an increase in cross-border lending denominated in the global funding currency.[8]

[8] See V Bruno and H S Shin, "Capital flows and the risk-taking channel of monetary policy", *Journal of Monetary Economics*, no 71, 2015, pp 119–32; and B Hofmann, I Shim and H S Shin, "The risk-taking channel of currency appreciation", *BIS Working Papers*, forthcoming.

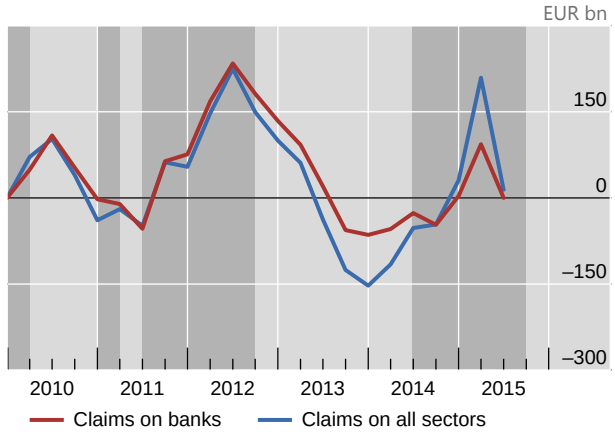
Cross-border bank claims in euros on borrowers outside the euro area

Graph 3

Percentage changes in cross-border claims in euros vs changes in euro effective exchange rate[1]



Cumulative flows[2]



[1] The line is a fitted regression line. Positive changes in FX rate denote euro appreciation; percentage changes are break-adjusted and refer to cross-border claims on all sectors. [2] Shaded areas indicate depreciation of the effective euro exchange rate; flows break-adjusted.

Sources: BIS effective exchange rate statistics; BIS locational banking statistics by residence.

Even though the global funding currency in the above story has typically been the US dollar, the LBS suggest that a similar pattern is starting to emerge for the euro. The left-hand panel of Graph 3 plots quarterly growth rates of euro-denominated cross-border bank claims on borrowers outside the euro area against quarterly changes in the effective euro exchange rate. It suggests that, on average, a euro depreciation is associated with faster growth of euro-denominated cross-border claims on borrowers outside the euro area.

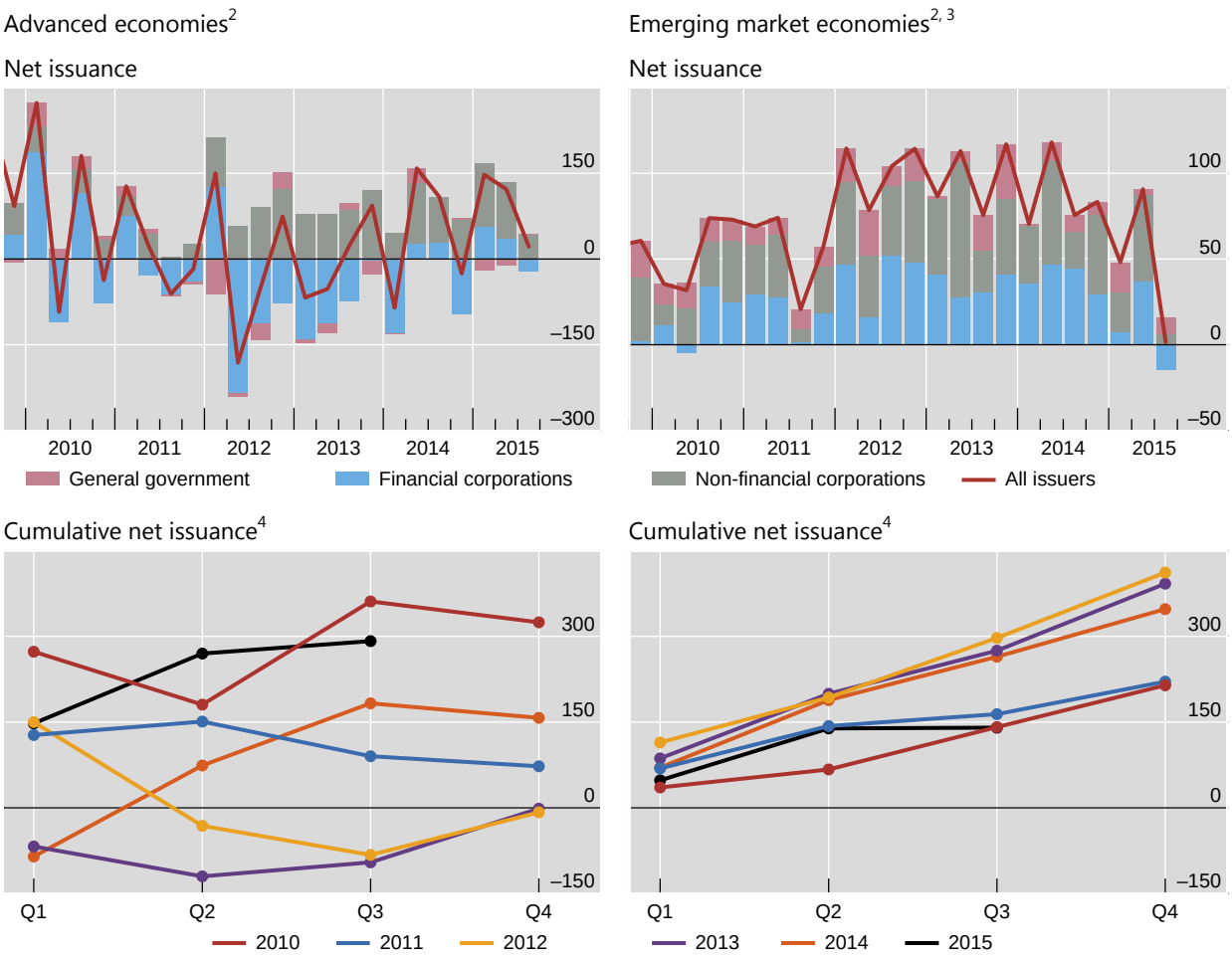
The right-hand panel of Graph 3 takes a time series perspective. It shows the evolution of the cumulative adjusted quarterly flows in euro-denominated cross-border claims on borrowers outside the euro area, while distinguishing between the episodes during which the euro was appreciating and those in which it was depreciating (shaded areas). A similar pattern emerges. Namely, periods of euro depreciation tend to be associated with a pickup in euro-denominated cross-border bank lending (blue line). By contrast, episodes during which the value of the euro increases tend to coincide with contractions in cross-border bank lending in euros. The relationship appears to be driven primarily by cross-border interbank lending (red line).

Recent developments in international debt securities

While cross-border lending contracted in the second quarter of 2015, international debt securities issuance was generally strong throughout the first half of the year (see "Highlights of global financing flows", *BIS Quarterly Review,* September 2015). This pattern reversed in the third quarter (not covered by the previous section on cross-border claims), when net issuance fell to $50 billion (Graph 4), the largest contraction since the first quarter of 2013. This represents declines of 79% and 78% compared with the previous quarter and the third quarter of 2014, respectively. Issuance contracted both in AE borrowers and EMEs. Borrowers based in AEs issued

International debt securities[1]

In billions of US dollars — Graph 4



[1] All issuers, all maturities, by nationality of issuer. [2] See *BIS Statistical Bulletin* for a list of countries. Sectors refer to issuer's parents. [3] Includes Hong Kong SAR and Singapore. [4] Net cumulative quarterly issuance.

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

$22 billion net of repayments, $100 billion less than in the preceding quarter. EME borrowers issued only $1.5 billion on net, about $89 billion less.[9] Offshore centres and international organisations accounted for the remainder.

The contraction in debt issuance was especially severe in EMEs. Despite the third quarter slowdown, cumulative net issuance in AEs in the first three quarters of 2015, at $291 billion, exceeded the pace in each of the previous four years (Graph 4, bottom left-hand panel). Emerging market borrowers, by contrast, issued$141 billion in the first three quarters of 2015, a significantly slower pace than in the past several years (Graph 4, bottom right-hand panel).

Weak debt securities issuance in the third quarter can only be partially explained by seasonality. For the largest part, it appears to have reflected the turbulence that affected global financial markets, particularly EMEs (see "EME vulnerabilities take centre stage", *BIS Quarterly Review,* September 2015).

[9] Includes Hong Kong SAR and Singapore.

Preliminary estimates from the Institute of International Finance suggest that the third quarter of 2015 was the worst for EME portfolio flows since the Great Financial Crisis. Growing concerns over emerging market fundamentals, falling commodity prices and rising debt burdens probably played a role. Additionally, an increasing focus on local markets may also have been a factor, in particular for China. Recent data from the People's Bank of China indicate that total bond issuance by Chinese non-financial corporations including domestic issuance was on the increase.

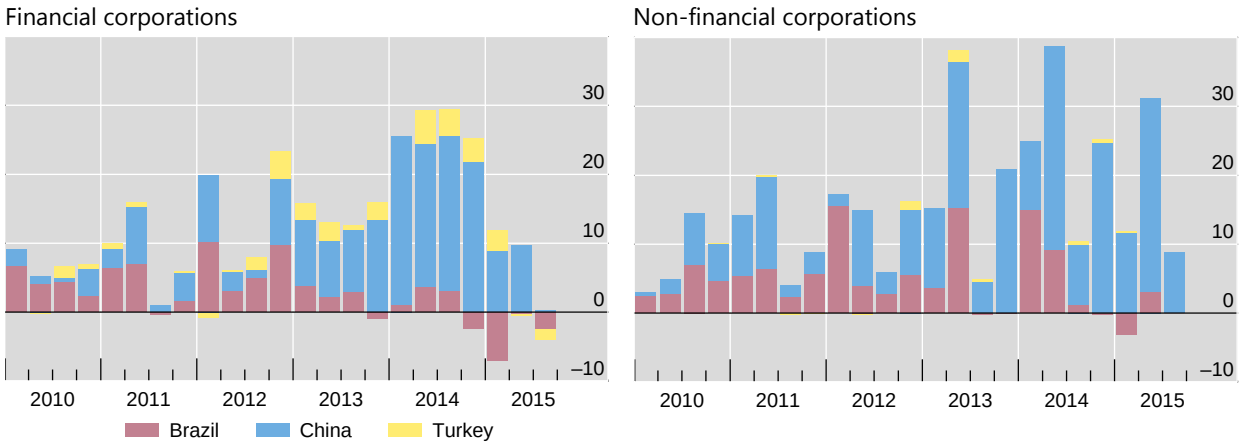
Net issuance by EMEs posted its largest negative figure since the end of the crisis (Graph 4, top right-hand panel). Net repayments by financial corporations totalled $15 billion, compared with $37 billion in net issuance in the previous quarter, while net issuance by non-financial corporations in EMEs was $6 billion. Both values were the lowest since the beginning of 2009. Net issuance by Brazilian financial corporations was negative, at –$2 billion, compared with –$200 million in the previous quarter, the value for Chinese financial corporations fell to $300 million, down from $10 billion in the previous quarter, while net issuance for Turkish financial firms was negative, at –$1.6 billion, the lowest in the last six years (Graph 5, left-hand panel). Net issuance from Chinese non-financial corporations fell to $9 billion, down from $28 billion, and to –$8 million for Brazilian firms, down from $3 billion in the preceding quarter (Graph 5, right-hand panel). Similarly, net issuance eased by $4.3 billion in India and $5.5 billion in Korea.

The quarterly decline in international debt issuance was also significant in developed economies. The financial industry reduced its net issuance of debt securities to a negative $22 billion, compared with positive net issuance of $35 billion in the previous quarter (Graph 4, top left-hand panel). Net issuance by non-financial corporations amounted to $43 billion, the lowest value since the fourth quarter of 2011.

Euro-denominated securities increased their importance vis-à-vis dollar-denominated instruments in the third quarter of 2015. Net issuance in euros by non-financial firms was $23 billion in total, while net issuance in dollars was only $22 billion. The corresponding figures for the previous quarter were $50 billion and

International debt securities[1]

Quarterly net issuance, in billions of US dollars — Graph 5

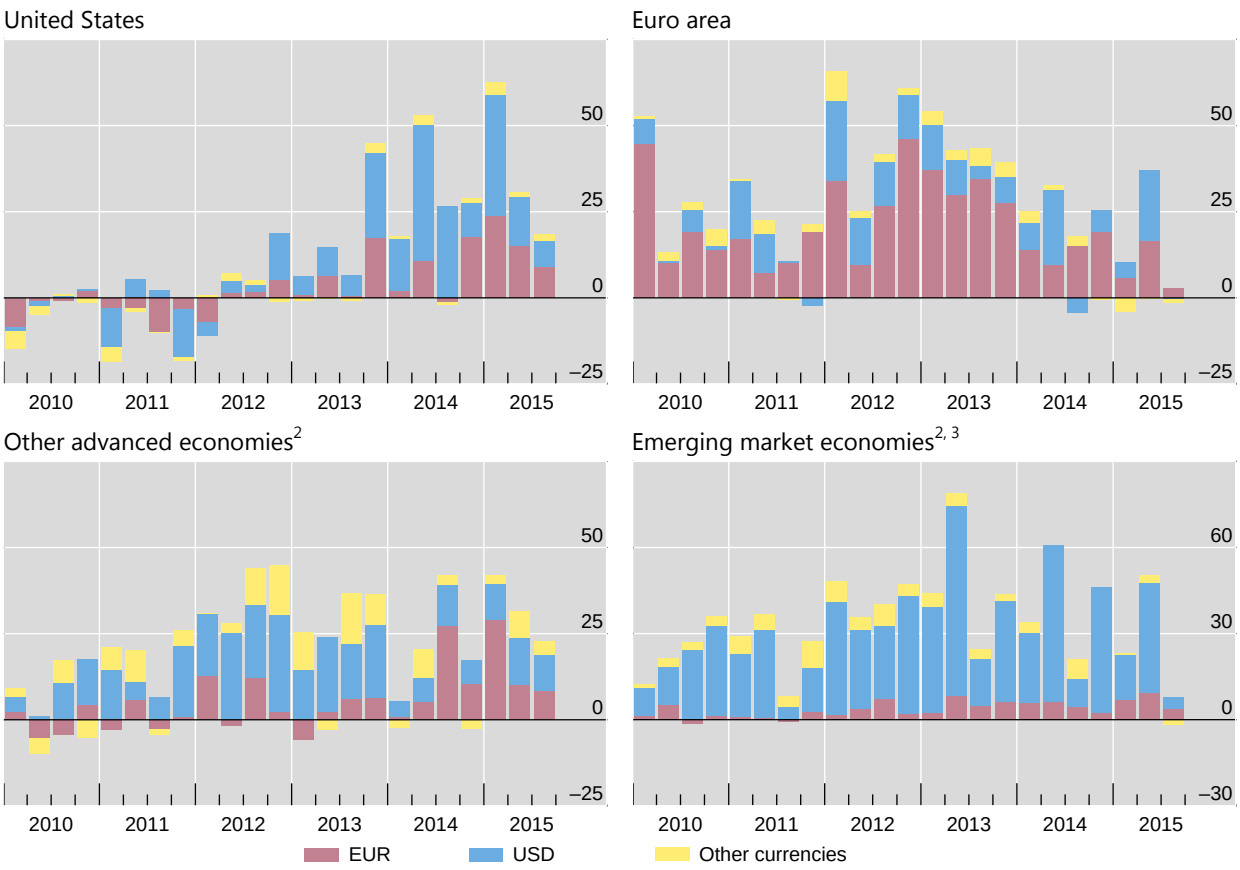


[1] By nationality of issuer and sector of issuer's parents.

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

International debt securities[1]

Quarterly net issuance, in billions of US dollars — Graph 6



[1] Non-financial headquarters, by nationality of issuer. [2] See *BIS Statistical Bulletin* for a list of countries. [3] Includes Hong Kong SAR and Singapore.

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

$87 billion, respectively. Among US non-financial borrowers, euro-denominated net issuance, at $15 billion, surpassed the dollar-denominated value in the second quarter of 2015, at $14 billion, and continued to be more prominent in the third quarter, at $9 billion versus $8 billion (Graph 6, top left-hand panel). Among European issuers, dollar-denominated net issuance by non-financial corporations was negative at –$200 million, down from $21 billion in the previous quarter (Graph 6, top right-hand panel). In other AEs, the euro's share of total net debt issuance edged upwards, from 32% to 36% (Graph 6, bottom left-hand panel). Both euro- and dollar-denominated issuance declined in EMEs compared to the previous quarter. However, the euro increased its presence in total EME net debt issuance, going from 18% in the second quarter of 2015 to 62% in the third quarter, its highest share in the last six years (Graph 6, lower right-hand panel).

Outstanding OTC derivatives positions dwindle as compression gains further traction

Andreas Schrimpf

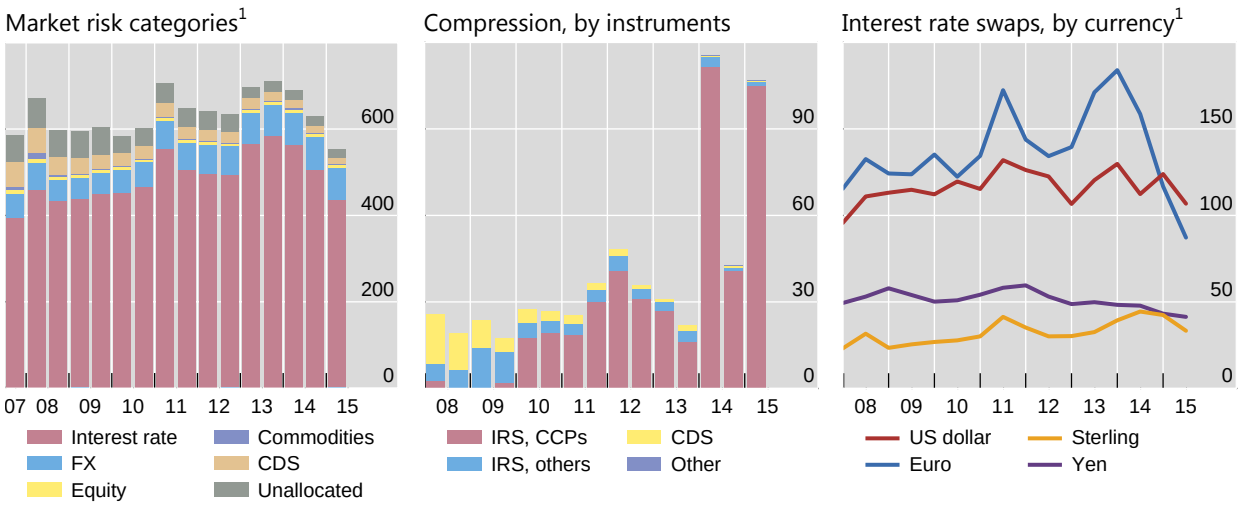
Outstanding positions in global over-the-counter (OTC) derivatives markets shrank significantly in the first half of 2015. Notional amounts of outstanding contracts fell by 12% between end-December 2014 and end-June 2015, from $629 trillion to $553 trillion (Graph B, left-hand panel).① Changes in outstanding notionals, however, do not necessarily reflect changes in market activity or in the risk that is actually held. Dealers often enter into derivatives contracts to offset existing exposures. The move towards central clearing tends to further inflate outstanding notionals; after novation to the central counterparty (CCP), a single trade between two dealers becomes two outstanding contracts of each dealer with the CCP. Trade compression – a process of tearing up trades to eliminate economically redundant derivatives positions – has reversed this trend, helping to sharply undercut the value of outstanding notional OTC derivatives positions in recent years. The overall volume of compressions increased strongly in 2014 but continued to grow in the first half of 2015 (Graph B, centre panel).

The decline in outstanding OTC derivatives contracts largely stems from a sharp contraction in notional amounts in the euro-denominated interest rate segment. The notional value of such contracts fell from $167 trillion to $126 trillion between end-December 2014 and end-June 2015 (or equivalently from €138 trillion to €113 trillion). Since late 2013, the outstanding volume of EUR interest rate swap notionals has dropped by about 50% (Graph B, right-hand panel), thanks to a strong increase in compression.②

Basic compression technology has been available for several years, but has gained particular traction in the interest rate swap (IRS) segment in the past two years (Graph B, centre panel). Growing demand by global bank dealers for more efficient balance sheet usage (partly driven by regulatory changes) has been a key catalyst for technological innovation that facilitates the compression of derivatives trades. The most popular compression services are offered by third-party providers, drawing on submissions of the portfolio positions of each of their subscribers. An algorithm seeks to identify redundant contracts that can be terminated without changing each participant's net position. The shrinkage of a dealer's derivatives book via compression techniques helps reduce operational risks, counterparty risks and associated costs.

Global OTC derivatives markets shrink due to trade compression

Notional principal, in trillions of US dollars — Graph B



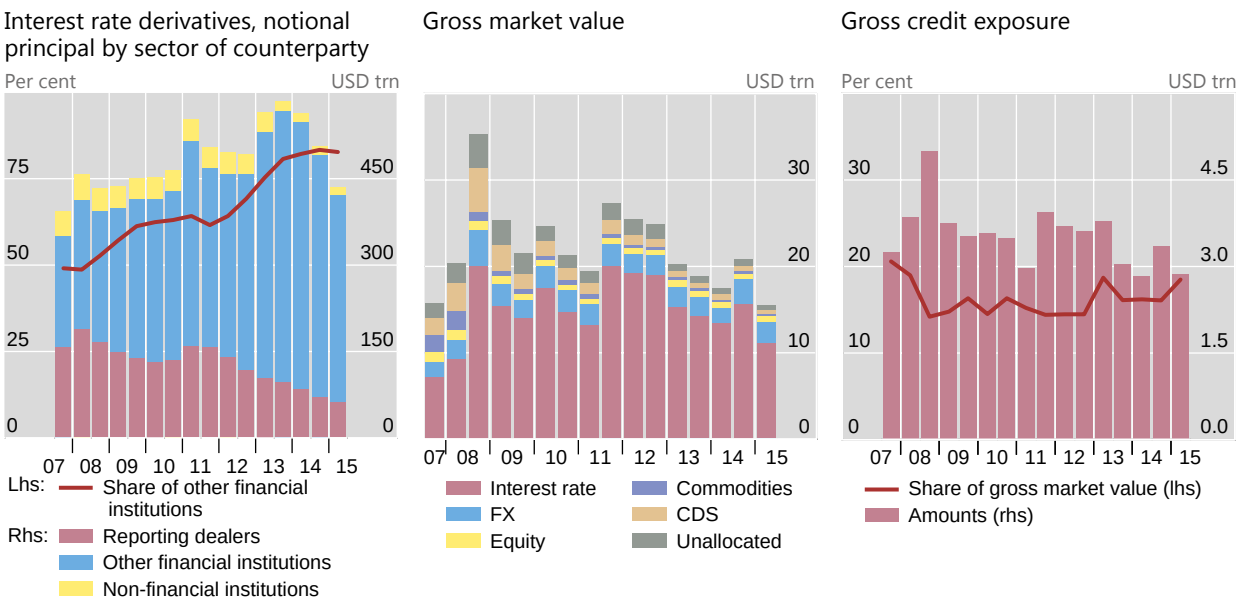
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Sources: TriOptima triReduce; BIS derivatives statistics.

Global OTC derivatives markets[1]

Graph C



Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

Compression had already contributed to a significant decline in outstanding notional amounts of credit default swap contracts in the years following the Great Financial Crisis. More recently, the pickup in clearing of IRS through CCPs (see Domanski et al, "Central clearing: trends and current issues", in this issue) may have led to an acceleration of this trend, since central clearing has further enabled the use of sophisticated compression techniques. The distribution of interest rate derivatives by counterparty points to a continued shift in activity towards financial institutions other than dealers, including CCPs (Graph C, left-hand panel). Contracts between dealers and other financial institutions, including CCPs, stood at $360 trillion at end-June 2015, down from $421 trillion at end-December 2014. More recently, compression methods have emerged that do not require third-party involvement. This has led to a further pickup in compression volumes. And some newly available electronic trading platforms for OTC derivatives – such as swap execution facilities (SEFs) – have also started to offer efficient mechanisms for cancelling offsetting positions between counterparties.

The gross market value of outstanding contracts – that is, the cost of replacing all outstanding contracts at market prices prevailing on the reporting date – also decreased in the first half of 2015 (Graph C, centre panel). Gross market values have continued their downward trend of recent years despite a brief spurt in late 2014. Market values stood at $15.5 trillion at end-June 2015, their lowest level since 2007. Along with compression, a narrowing gap between rates on the reporting date and rates at contract inception may have contributed to the decline. Gross credit exposures, which take into account the reduction of counterparty credit risk through netting agreements but not collateral, also declined, to $2.9 trillion at end-June 2015, close to pre-crisis levels (Graph C, right-hand panel).

① Over this period, currency movements overstated the contraction of positions in non-US dollar currencies. For example, the euro's depreciation against the dollar between end-December 2014 and end-June 2015 led to a decline in the dollar value of euro-denominated positions. Yet, even after adjusting for this effect, notionals at end-June 2015 were still about 10% lower than at end-December 2014. ② There is a variety of reasons why the impact of compression has been strongest in the EUR IRS segment. EUR derivatives books tend to be very large from the outset, compared to those in other currencies. EUR IRS also tend to be more standardised and the set of broker-dealers active in these markets is less diverse. All this means that the scope for compression may have been larger in EUR IRS.

Robert N McCauley
robert.mccauley@bis.org

Patrick McGuire
patrick.mcguire@bis.org

Vladyslav Sushko
vlad.sushko@bis.org

Dollar credit to emerging market economies[1]

We profile the US dollar debt incurred by borrowers in a dozen prominent emerging market economies (EMEs). These countries account for the bulk of total US dollar debt owed by EMEs. We measure the dollar borrowing of non-banks resident in these economies as well as that of their affiliates offshore, and relate these items to commonly used debt measures. We also discuss the limitations of our data. These data fail to assign bank debt to the right home country if firms have obtained dollar bank loans through offshore affiliates. And they understate dollar debt when firms borrow dollars indirectly through foreign exchange forwards.

JEL classification: E43, E51, F34, G21, G23.

Since 2008, dollar credit has grown more rapidly outside the United States than inside. Although there is only one dollar yield curve, the two stocks of dollar credit behave differently. Dollar credit to non-US residents grew faster owing not only to more rapid growth in emerging market economies (EMEs) over the last six years. Dollar credit also expanded owing to its substitution for local currency credit given favourable dollar interest rates and exchange rate expectations (Bruno and Shin (2015a,b)) as EME firms leveraged up (IMF (2015)).

Dollar credit to non-banks outside the United States reached $9.8 trillion at end-Q2 2015. Borrowers resident in EMEs accounted for $3.3 trillion of this amount, or over a third. EME nationals resident outside their home countries (for instance, financing subsidiaries incorporated in offshore centres) owed a further $558 billion.[2]

Dollar bonds issued by EME non-banks' offshore affiliates have surged over the past six years, as have dollar bank loans obtained by non-banks *within* the home country. Since high overall dollar debt can leave borrowers vulnerable to rising dollar yields and dollar appreciation, dollar debt aggregates bear watching. Standard measures of residents' external debt do not include bonds issued by affiliates outside the home country or dollar bank debt incurred in the home country. Multinational firms' balance sheets are not neatly confined within national borders, and the domestic currency may not account for all domestic intermediation (Avdjiev et al (2015)), so a dollar debt measure that looks beyond

[1] This article expresses the views of the authors and not necessarily those of the BIS. Emerging market economies refer to "developing economies" in the BIS statistical tables. The authors thank Pablo García-Luna and Jeff Slee for research assistance and Claudio Borio, Ben Cohen and Hyun Song Shin for comments.

[2] This includes $66 billion of bonds sold through affiliates located in the United States, which is excluded from the $9.8 trillion. There is (very minor) double-counting of debt issued by EME nationals as residents of another EME. Since the perspective here is on dollar credit to particular EMEs, these bonds are included in the measures discussed throughout this feature.

and within national borders can indicate vulnerabilities missed by external debt measures.

Which EMEs borrow dollars? In what form do they borrow them? To what extent do they borrow dollars from banks at home or sell bonds through offshore affiliates? How big is dollar debt relative to all debt?

This special feature first describes the construction of measures of dollar credit to emerging economies, drawing attention to their relationship to external debt and to domestic debt aggregates, and to the limitations of the underlying data. It then expands on Borio et al (2011) and McCauley et al (2015) by profiling recent dollar credit growth for a dozen EMEs that accounted for almost three quarters of the US dollar credit to all EME non-bank borrowers.[3]

For this dozen, we find that underneath the rapid growth of dollar credit lies a variety of forms and channels of dollar borrowing that can make for different vulnerabilities. Some countries rely on bank loans, others more on bonds. Some rely on bank loans booked by banks at home, others not. Some issue dollar bonds not out of headquarters at home, but from their offshore affiliates. Some of these differences bear the footprint of policy.

The feature first takes up measurement issues and then makes comparisons with other debt aggregates. Then it draws out the themes of similarity and differences across the 12 cases for dollar bank loans and dollar bonds. The last section concludes. A box addresses the frequent question of why firms borrow dollars.

What we measure: dollar credit aggregates

Viewed from the debtor perspective, dollar credit to non-banks outside the United States represents about 17% of non-US GDP. Viewed from the creditor side, non-US borrowers owe remarkably little of their dollar debt to banks or investors that reside in the United States.[4] It is thus understandable that dollar credit to non-US residents has not, until recently, appeared on US radar screens.

The ideal versus the practical

The baseline aggregate of dollar credit to non-banks resident in a particular country comprises outstanding bank loans and bonds. Non-banks include non-financial corporations, non-bank financial institutions, households and governments.[5] For bank loans, we sum dollar loans to non-banks (including non-bank financials)

[3] Data for these EME borrowers are available on the BIS website.

[4] These US-based creditors extended only about a quarter of dollar credit to non-US non-bank borrowers. See Figure 3 in McCauley et al (2015).

[5] In classifying bonds by sector, we look through the immediate borrower (eg Petrobras International Finance Company) to the ultimate borrower (in this case, Petrobras, an energy company). Thus, Petrobras issues are included in column 7 of Table 2 (non-financial corporates) and a non-financial aggregate can be constructed by excluding column 6 (non-bank financials). We exclude bonds issued by a bank, either as an ultimate issuer or as an immediate issuer (even a bank with a non-bank parent).

booked both locally (within the respective economy) and cross-border.[6] For bonds, we sum outstanding dollar obligations of non-bank borrowers resident inside the country. Combined, these elements provide an estimate of the total dollar credit to non-banks resident in the country.

Ideally, we would complement this residence-based measure with a corresponding *consolidated* one that respects the cross-border span of corporate balance sheets. That is, we would like a measure that includes dollar credit to offshore affiliates of non-banks headquartered in the country while excluding dollar credit to foreign-owned entities inside the country. For instance, Brazilian firms have sold many dollar bonds out of their financing subsidiaries in the Netherlands Antilles. Similarly, Chinese firms have borrowed significant dollar amounts from banks in Hong Kong SAR, using affiliates incorporated outside China. None of this debt shows up in residence-based credit measures for the countries concerned, but all would be included in an ideal consolidated measure based on corporate balance sheets rather than national borders.

Uses of US dollar funding

A frequently asked question is: why do firms (and some households) outside the United States borrow in US dollars? Some of the answers to this question simply invoke the dollar's broad international role in trade and investment, and the need to hedge the currency exposures that arise from these activities. Other motivations are better explained as an attempt to profit from interest rate differentials or currency movements, potentially leading to liabilities that can leave firms' financial soundness vulnerable to dollar appreciation.

Firms engaged in international trade borrow dollars to finance dollar-invoiced transactions. However, a back-of-the-envelope calculation shows that trade finance can explain only a small portion of offshore US dollar credit. About half of the $23.4 trillion per year in international trade is dollar-invoiced (Ito and Chinn (2015)). Assuming three-month financing terms, dollar credit of roughly $3 trillion (= $23.4 trillion x 0.5 x 0.25) finances dollar-invoiced trade. Subtracting the one ninth US share in world trade leaves about $2.7 trillion of US dollar trade credit to non-US residents, decidedly less than $9.7 trillion.

Firms can also use dollar credit to fund holdings of inventory and fixed assets at home. To the extent that these are in the traded goods sector, currency mismatches need not arise. Such risks do arise when firms in the non-traded goods sector at home borrow dollars, especially in leveraged real estate. This type of dollar borrowing is often motivated not only by lower interest rates but also by the ability to borrow at longer maturities.

Firms can borrow dollars to fund productive assets held by affiliates outside the home country, ie foreign direct investment. EME firms accounted for a record 35% of all foreign direct investment in 2014 (UNCTAD (2015)). In some EMEs, the largest dollar borrowers are also some of the largest direct investors abroad. Firms hedge some of the dollars borrowed for these purposes, but in general it is not possible to say how much. Inferences drawn from stock price responses to currency movements (see eg Acharya et al (2015) on India) require that investors know about these hedging strategies on the basis of scant disclosures by firms.

Finally, firms may also borrow dollars to accumulate financial assets, including those in the domestic currency. The combination of debt in the US dollar and a long position in domestic currency (a form of "carry trade") is difficult to document, given the opacity of corporate reporting. Bruno and Shin (2015c) find that dollar bonds are issued when carry trade incentives are attractive, and are associated with increases in corporate cash holdings. While such accumulated cash may reflect opportunistic front-loading of funding on the back of low US dollar yields, it may also fund corporate holdings of higher-yielding domestic assets, such as wealth management products or investment fund shares (Chui et al (2014)).

[6] Most of the data are from the more than 40 jurisdictions that report to the BIS international banking statistics. For non-reporting countries (other than China, the Philippines and Russia), we proxy locally booked dollar loans to non-banks in these countries with cross-border loans to banks in these countries. For China, the Philippines and Russia, proxies are based on national data.

A further desideratum would be to measure dollar debt net of off-balance sheet hedges, including dollar credit obtained indirectly through forward dollar sales. For instance, Korean manufacturers effectively borrow dollars by selling forward dollars in exchange for won (see below). Such dollar debt is not at all captured by our measure.

Data limitations preclude the ideal measure, and allow only a partial shift from a strictly residence-based measure to a consolidated one that takes into account off-balance sheet positions. The dollar bond data *do* include information about both the nationality and the location of the issuer, so that we can use them, for example, to measure Brazilian firms' overall dollar debt rather than the dollar debt of firms in Brazil.[7] Economy-level aggregates discussed below thus include these offshore dollar bonds, although they are identified separately in each graph and table to preserve the residence-based measure.

Otherwise, the possible falls short of the ideal. First, the dollar loan data reveal the borrower's location but not its nationality. Thus, neither loans to offshore national affiliates nor those to foreign entities inside the country can be identified. Second, data about off-balance sheet positions in general or indirect dollar credit via forward dollar sales in particular are unavailable for any country. Below, we discuss partial data from Hong Kong and Korea that bear on these lacunae.

Dollar debt versus other debt aggregates

Table 1 juxtaposes, for 12 EMEs, dollar credit and other credit aggregates at end-Q2 2015. Column 1 reports the broadest aggregate, namely the hybrid that includes dollar credit to non-bank residents in each country and the dollar bonds issued by domestically headquartered non-banks' offshore affiliates (the time series are presented below). Across all EMEs, total dollar credit exceeded $3.8 trillion (last row), with the 12 EMEs detailed in the table accounting for $2.8 trillion, or 70%. Column 2, in turn, reports only the dollar debt of non-bank borrowers *resident* in each country (ie excluding offshore dollar bonds), which can be compared with other credit aggregates in the rest of the table.

Data limitations again hamper the assessment of how dollar credit from banks and bond investors contributes to non-banks' external debt in all currencies (column 4). In this case, the problem is the lack of data on domestic holdings of international dollar bonds issued by home firms and governments. However, on the extreme assumption that all dollar bonds issued by non-bank residents sit in the portfolios of non-resident investors, then column 3 provides an upper-bound estimate of the total *cross-border* portion of dollar credit in column 1 to non-bank borrowers in each country. On this assumption, such cross-border dollar credit accounted for much of total external debt in most of the 12 (column 5).

Columns 6 and 7 take the further step of juxtaposing the resident dollar credit aggregates to credit aggregates that include both cross-border and locally extended credit in all currencies. Here, we use the total credit figures (column 6) for non-financial firms only (see BIS website). Given granular bond data, we exclude from the numerator dollar bonds issued by governments and non-bank financial

[7] As discussed below, bonds issued by foreign entities resident in these economies contribute little, ie generally less than 5% of total bonds outstanding; see Table 2.

Emerging market economies' dollar debt outstanding

At end-Q2 2015; debt of non-bank borrowers[1] Table 1

Country	US dollar debt (USD billions)			External debt		Non-financial corporate debt	
		Of which: of residents					
	Total[2]	Total[3]	Cross-border (maximum)[4]	Total[5] (USD bn)	Maximum dollar share (per cent)	Total[6] (USD bn)	Dollar share[7] (per cent)
	(1)	(2)	(3)	(4)	(5) = (3)/(4)	(6)	(7)
Brazil	322	219	193	558	35	897	18
Chile	88	86	62	120	51		
China	1,178	935	198	1,042	19	17,273	5
India	118	98	81	339	24	1,009	10
Indonesia	160	149	104	267	39	190	52
Korea	128	123	69	191	36	1,423	8
Malaysia	41	36	36	126	29	199	10
Mexico	237	222	193	385	50	259	66
Philippines	59	57	47	58	80		
Russia	297	247	99	401	25	742	29
South Africa	34	27	24	112	21	111	14
Turkey	183	182	89	224	40	398	33
Total[8]	2,846	2,381	1,195	3,823	31	22,500	9
Memo: All EMEs[8]	*3,824*	*3,267*	*2,053*	*6,902*	*30*	*23,485*	*10*

[1] Non-banks comprise non-bank financial entities, non-financial corporations, governments, households and international organisations. [2] Cross-border and locally extended loans plus total outstanding bonds issued by non-banks (of all nationalities) located in the country plus bonds issued offshore by the foreign affiliates of non-banks with a parent headquartered in the country. [3] Column 2 less dollar bonds issued by offshore affiliates of non-banks with a parent headquartered in the country. [4] Estimated as total dollar credit (column 2) excluding locally extended dollar loans and bonds issued offshore. The estimate assumes that all dollar bonds issued by resident non-banks are held by non-residents. [5] Total external debt (all currencies) of the non-bank and government sectors. For China, SAFE total less BIS cross-border claims on banks [6] Total debt of the non-financial corporate sector. [7] Estimated as the ratio of dollar loans to non-banks (both cross-border and locally extended) plus resident non-financial corporate dollar bonds to total credit to non-financial corporate borrowers. This estimate assumes that dollar loans to governments, non-bank financials and households, which cannot be separated from loans to non-banks, are negligible. [8] Bonds issued by non-banks' offshore affiliates located in other EMEs totalled $1.46 billion for the 12 economies listed in the table, and $4.01 billion for all EME non-banks. Such bonds are double-counted in column 1.

Sources: State Administration of Foreign Exchange (SAFE); World Bank; national data; BIS international banking statistics; BIS international debt securities statistics; BIS long-term credit data; authors' calculations.

firms (included in column 2). Ideally, we would exclude dollar *loans* to these two sectors and to households. In practice we cannot, but if dollar loans to governments and non-bank financial firms are not large, then the most upwardly biased ratio would be for an economy with substantial dollar household mortgages. The admittedly imperfect ratios suggest that dollar-denominated borrowing accounts for double-digit shares in total corporate debt for eight economies considered here, with Mexico, Indonesia and Turkey registering the highest shares.

Dollar bank loans

In aggregate, dollar bank loans remained larger than dollar bonds even as rapid bond issuance drove the doubling of the stock of dollar debt of non-bank

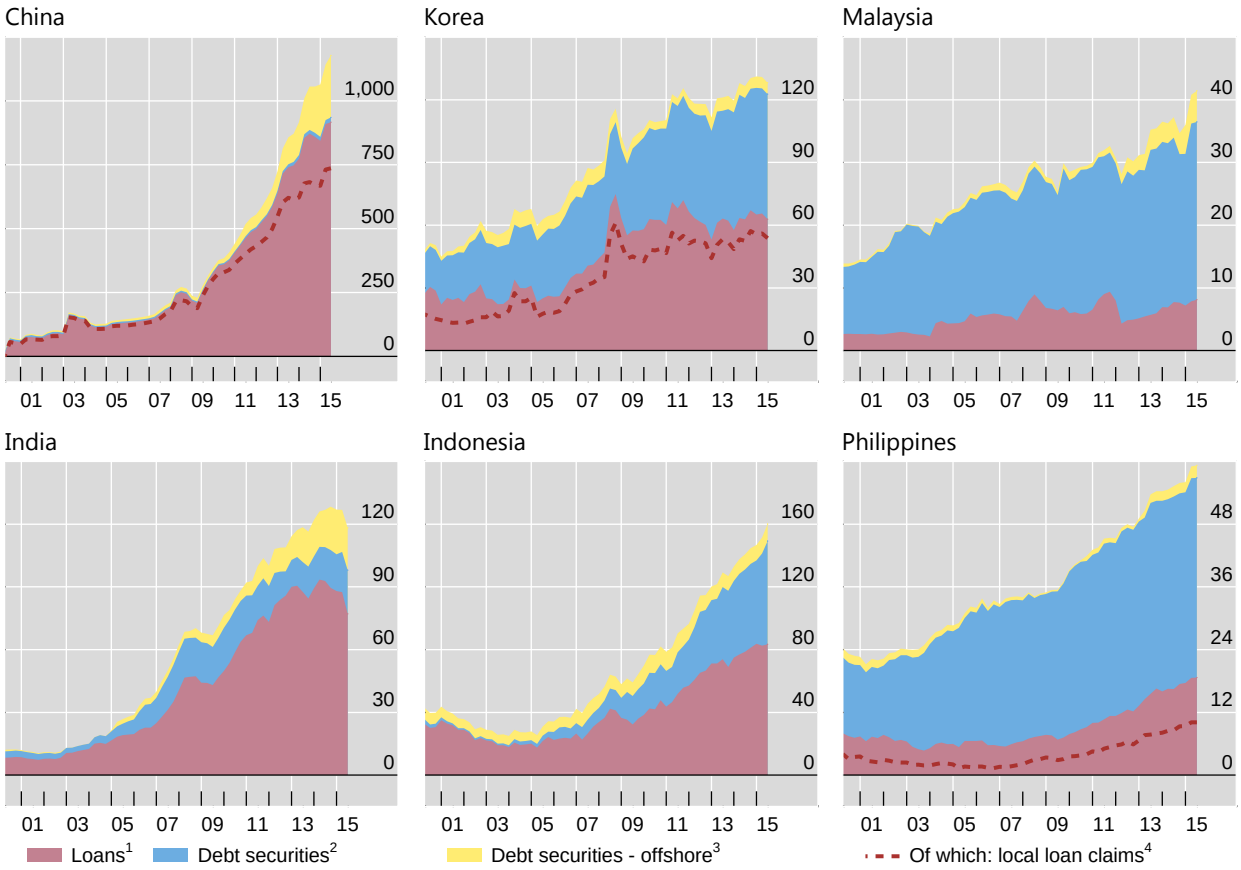
borrowers in selected major EMEs between Q1 2009 and Q2 2015. Yet the composition of the dollar credit varies widely across the 12 cases, with dollar bank loans substantially larger than bonds only in China, India, Russia and Turkey (the different categories of dollar debt are illustrated in Graph 1, for the six Asian economies, and Graph 2 for the others).

In China, Russia and Turkey, the bulk of the dollar bank loans are booked at resident banks. Only in India's case do cross-border bank loans constitute most of the dollar loans.

Recall that the split between dollar funding through bank loans and bonds is imprecise because data on bank loans are only available by residence. According to data published by the Hong Kong Monetary Authority (HKMA) on mainland-related lending in the territory to entities incorporated outside the mainland (Graph 3, left-hand panel), China's reliance on bank funding is even more disproportionate than that shown in the top left-hand panel of Graph 1 (Yuen (2014)).[8]

US dollar credit to selected non-bank borrowers

In billions of US dollars — Graph 1



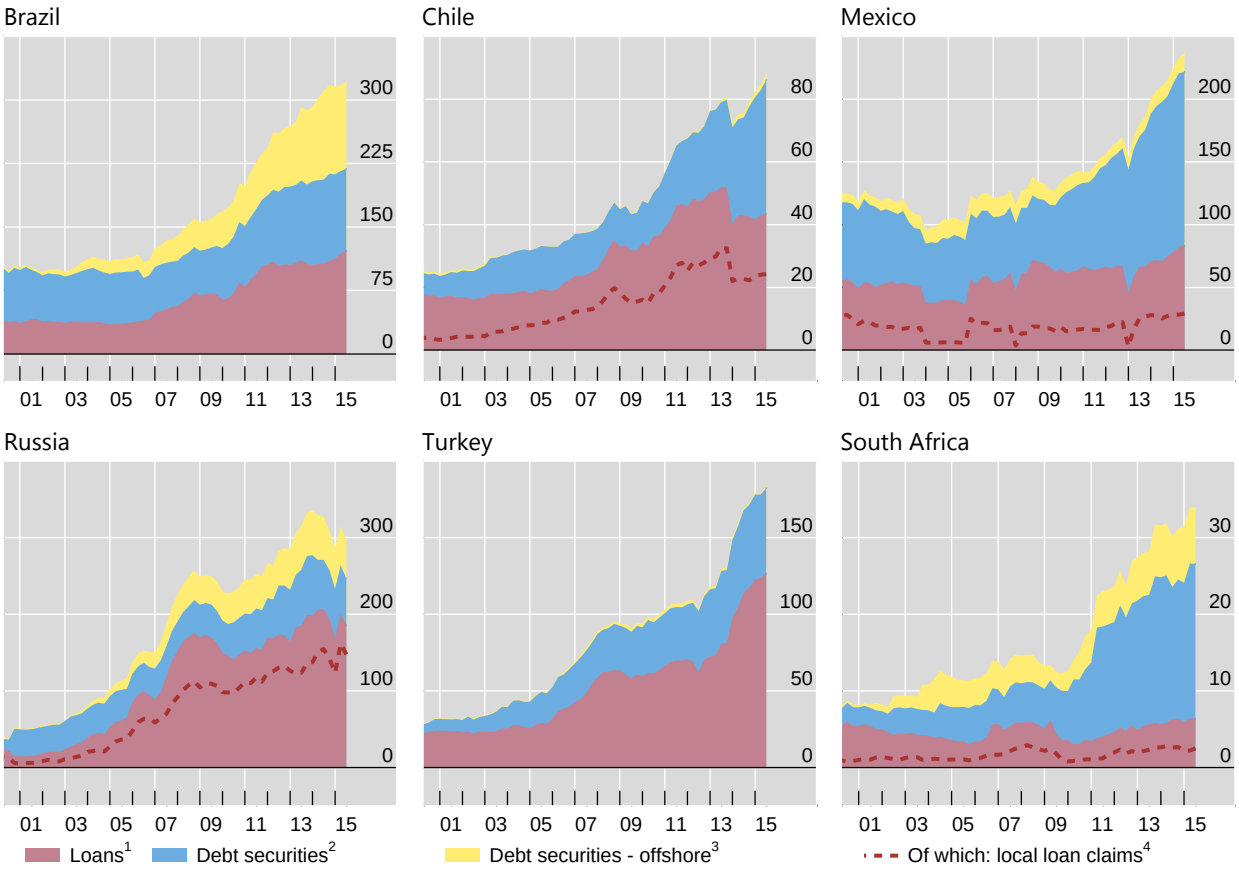
[1] US dollar loans to non-bank residents of the country listed in the panel title. [2] Outstanding US dollar international bonds issued by non-bank residents of the country listed in the panel title. [3] Outstanding US dollar international bonds issued by offshore affiliates of non-banks with a parent entity headquartered in the country listed in the panel title. [4] US dollar loans booked by banks located in the country in the panel title to non-bank borrowers in that country. For China and the Philippines, figures are estimates based on national data.

Sources: National data; BIS international debt securities statistics; BIS locational banking statistics by residence; authors' calculations.

[8] The HKMA survey was not intended to complement the residence-based bank loan data. As a result, some loans included in Graph 3 double-count cross-border claims on mainland residents.

US dollar credit to selected non-bank borrowers

In billions of US dollars — Graph 2



[1] US dollar loans to non-bank residents of the country listed in the panel title. [2] Outstanding US dollar international bonds issued by non-bank residents of the country listed in the panel title. [3] Outstanding US dollar international bonds issued by offshore affiliates of non-banks with a parent entity headquartered in the country listed in the panel title. [4] US dollar loans booked by banks located in the country in the panel title to non-bank borrowers in that country. For Russia, figures are estimates based on national data.

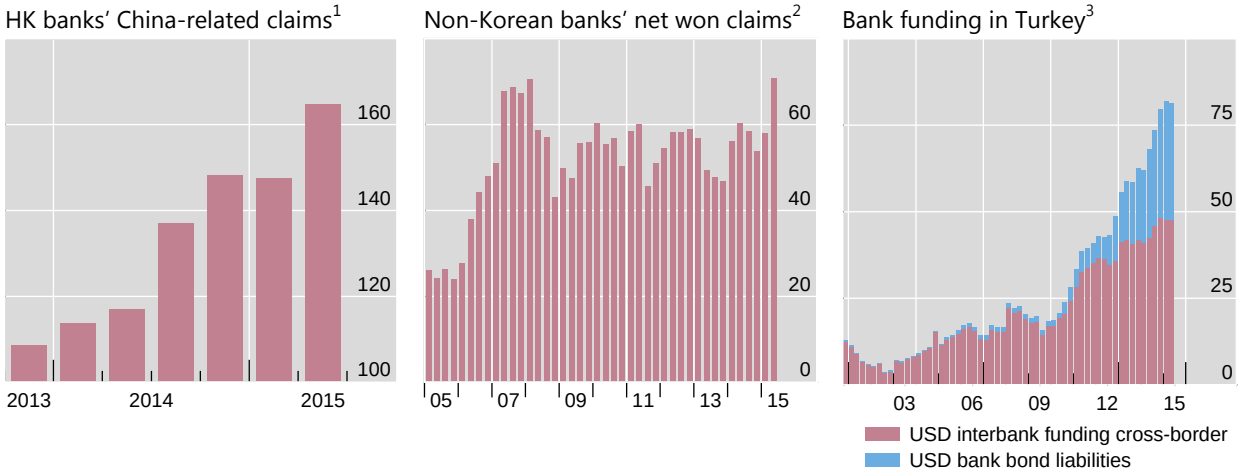
Sources: National data; BIS international debt securities statistics; BIS locational banking statistics by residence; authors' calculations.

Chinese and Hong Kong data suggest that the third quarter of 2015 may have marked an inflection point in the growth of mainland-related dollar credit. Chinese domestic banking data show a $70 billion decline in foreign currency lending in the August–October 2015 period. Similarly, foreign currency loans fell in Hong Kong in September 2015.

Our measure of dollar debt in general, and the share accounted for by banks in particular, may be biased downwards. This is because of our inability to take account of forward sales of dollars that are in effect dollar bank loans. Taking into account forward positions would represent a net addition to our measure of dollar debt. For Korea, He and McCauley (2013) treat virtual dollar credit through dollar/won forwards as dollar credit and estimate its volume based on BIS data (Graph 3, centre panel). This would suggest another $60 billion in dollar bank debt in Korea, about half of which is owed by exporters (non-financial) and half by mutual funds (financial) (Chung et al (2015)). Looking at the same data for 23 EMEs in Q2 2015, $585 billion in additional virtual dollar debt (including Korea's

Dollar bank debt: measurement and funding

Quarterly changes, in billions of US dollars — Graph 3



[1] Including mostly entities incorporated outside mainland China where the credit is granted for use in mainland China. [2] Net local currency (Korean won) positions of foreign banks' offices in Korea. [3] BIS reporting banks' cross-border loan claims on banks in Turkey (red shaded area) and the stock of dollar bond debt issued by public and private banks in Turkey (blue shaded area).

Sources: Hong Kong Monetary Authority; BIS consolidated banking statistics; BIS international debt securities statistics; BIS locational banking statistics; authors' calculations.

$60 billion) might be inferred, some of which is owed by non-bank financials and some by non-financial firms. On this view, non-bank EME dollar debt could easily be some 10% larger than our estimated $3.8 trillion.

The economies most dependent on dollar bank loans differ in the sourcing of the dollars. In particular, banks in China and Russia, according to national sources, rely to a considerable extent on domestic dollar deposits to fund dollar loans at home. (Similarly, banks in Indonesia and the Philippines (another country where we rely on national data) draw on domestic dollar deposits to a considerable extent.) These economies may be said to have partially dollarised banking systems, with the result that external debt statistics can understate vulnerability to dollar interest rate rises or dollar appreciation. In contrast, banks in Turkey issue dollar bonds and raise dollar funding from banks abroad to fund domestically booked dollar loans (Graph 3, right-hand panel),[9] although they also have domestic dollar deposits.

Dollar bonds

As noted in Shin (2013) and McCauley et al (2015), dollar bonds outstanding have grown faster than dollar loans since 2009. In part, this reflects the retrenchment of global banks, which suffered losses on their cross-border credits during the Great Financial Crisis of 2008–09 and which have since come under pressure from shareholders and supervisors. But it also reflects the very favourable yields for global borrowers that resulted from the Federal Reserve's large-scale bond buying.

[9] Central Bank of the Republic of Turkey (2015) reports a sharp rise in net foreign currency liabilities of non-financial firms (from $63 billion to $150 billion) between 2009 and 2014.

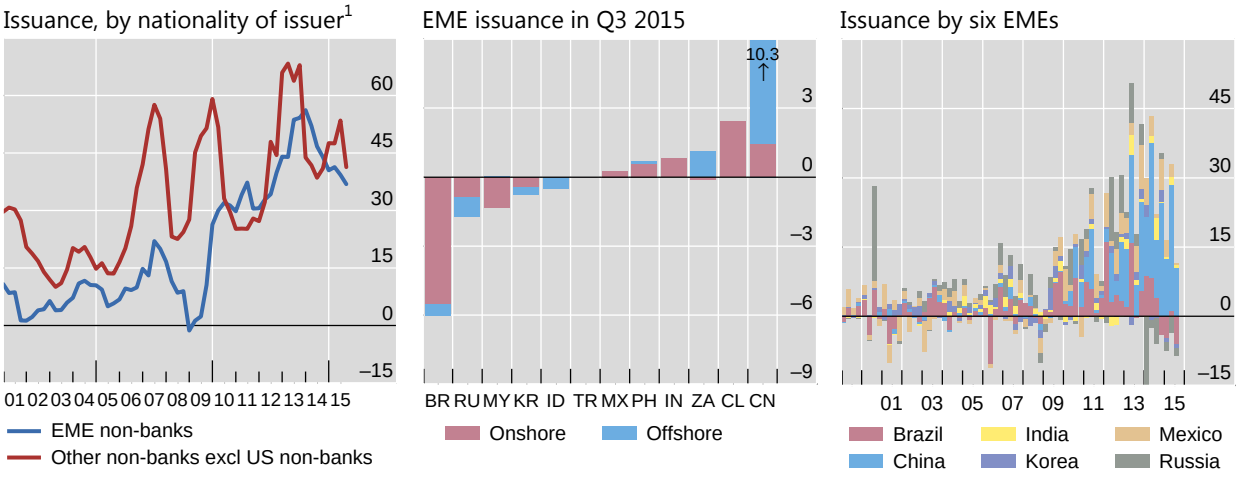
These developments drove a surge in issuance by both long-standing issuers and new ones (Mizen et al (2012)).[10] Petrobras, among the largest issuers, exemplifies the former. To pay the development costs for offshore oil in the face of cash flows weakened by low domestic administered energy prices, this partially state-owned Brazilian oil company ramped up its dollar debt in 2009–14, with multi-tranche offerings of no less than $8 billion and $6 billion highlighting the ready supply of institutional funds.[11] Many African sovereigns exemplify the new issuers. Would-be underwriters courted them, mindful that pension funds and mutual funds sought to diversify away from the sovereign debt of the major economies in their portfolios. Ghana, Kenya, Rwanda and Zambia all found ready markets.

At the time of writing, deals are still going through even for non-investment grade sovereign issuers. Ghana, Pakistan, Sri Lanka and Zambia all issued in 2015, albeit in smaller amounts or at higher spreads than they desired or had previously achieved. Ethiopia debuted at end-2014, while Angola did so in November 2015.

Nevertheless, dollar bonds outstanding have grown more slowly in 2015 than in 2013 and 2014. The largest Brazilian borrower and the main Russian borrowers have not been issuing owing to governance issues and international sanctions, respectively. Indeed, Q3 2015 data signal a steep decline in net issuance by the 12 (from $41 billion in Q2 to $5 billion in Q3), following the market turbulence in August in many EMEs (Graph 4; see also BIS (2015)). China's net issuance fell to $10.3 billion in Q3 but remained well above that of its peers (centre panel). But for

Net issuance of US dollar bonds by EME non-banks

In billions of US dollars — Graph 4



BR = Brazil; CL = Chile; CN = China; ID = Indonesia; IN = India; KR = Korea; MX = Mexico; MY = Malaysia; PH = Philippines; RU = Russia; TR = Turkey; ZA = South Africa.

[1] Four-quarter moving averages. The blue line tracks net issuance of dollar bonds by non-banks headquartered in emerging economies. The red line tracks net issuance by non-banks of other nationalities, excluding those headquartered in the United States.

Sources: BIS international debt securities statistics; authors' calculations.

[10] Large established firms issuing global bonds are subject to full US Securities and Exchange Commission (SEC) disclosure rules, but Fuertas and Serena (2015) find that EME firms often opt for the lighter disclosure for bonds marketed to US institutional investors (under SEC rule 144A) or in eurobond markets. Lighter regulation attracts firms with poorer credit quality.

[11] Figures from Bloomberg.

five of the 12 EMEs that we study here, net dollar bond issuance by non-banks turned negative in Q3 2015.

A closer look at bond issuance

Table 2 summarises the outstanding dollar bonds issued by non-banks in the 12 countries discussed above. They totalled $1.1 trillion at end-Q2 2015 (column 4), or two thirds of the $1.7 trillion issued by non-banks in all EMEs (last row).[12]

Non-banks in most of these EMEs tended to issue dollar bonds as residents (column 2) rather than through offshore affiliates (column 3). We discuss the exceptions below. In principle, resident issuers of dollar bonds could include local affiliates of multinationals headquartered elsewhere. Column 2 demonstrates that there is very little such issuance. Thus, the sum of columns 2 and 3 yields a *consolidated* dollar bond aggregate that respects the cross-border span of domestic firms' balance sheets, as opposed to the residence-based aggregate in column 1 that is confined by national borders. (As noted, this shift in perspective is not possible for dollar loans.) Ignoring the offshore components of dollar credit raises the risk of missing potential threats to the ability to service this debt.

Corporate bonds bulk large (column 7). Government issues predominated only in Turkey and the Philippines (column 5). And only in four of the 12 economies – China, Indonesia, Korea and Malaysia – did non-bank financial institutions' dollar bonds contribute significantly. For the remaining eight economies, such issues accounted for single-digit shares of total dollar bonds issued by all non-banks.

Columns 8–12 in Table 2 demonstrate the prominence of non-banks' dollar bonds in various bond aggregates for these countries. For most countries, dollar bonds predominated in non-banks' total outstanding *international* bonds in all currencies (column 8). Moreover, non-banks' dollar bonds accounted for the bulk of total international dollar bonds, including those issued by banks (column 9). Only in Korea did banks issue a significant amount of dollar bonds. Non-banks' dollar bonds even accounted for a large share of total bond issuance, including domestic bonds, in some countries, notably Chile, Indonesia, and Russia (column 12).

Dollar bond issuance from the home country vs offshore affiliates

Chinese, Indian, Brazilian, Russian and South African firms use offshore subsidiaries to issue dollar bonds (Table 2, column 3). For this reason, external debt statistics can understate vulnerability to dollar yields or appreciation. The largest stock of such bonds, at $243 billion as of Q2 2015, is issued by affiliates of China's non-banks.

The repatriation of bond proceeds from offshore affiliates leaves a trail in the intercompany cross-border direct investment flows in the balance of payments (Avdjiev et al (2014)). According to Brazilian data, for example, intercompany loans tripled, from $67 billion to $206 billion between Q1 2009 and Q1 2015 (Graph 5, left-hand panel). Brazilian offshore dollar bonds outstanding also tripled then, from $34 billion to $107 billion, accounting for approximately half of the intercompany

[12] Dollar bond issuance tends to be concentrated among a few issuers in each country; the top five issuers account for over half of outstanding bonds in all but the larger economies. Non-banks' dollar bonds are overwhelmingly long-term.

Emerging market dollar bonds outstanding[1]

At end-Q2 2015; non-bank issuers Table 2

Country	Amounts (USD billions)				Dollar bond shares (in per cent)						
	Onshore issuers[2]		Offshore national issuers[4]	Total[5]	By issuer type[6]			In international bonds[7]			In all bonds[11] (all curr & iss)
	All issuers	*of which:* nationals[3]			Gov't	Non-bank financial	Non-financial corporate	In non-bank total[8] (all curr)	In USD total[9] (all iss)	In overall total[10] (all curr & iss)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(11)	(12)
Brazil	97	95	103	200	24	7	68	88	71	64	14
Chile	43	36	2	44	10	4	86	91	85	72	42
China	18	18	243	261	0	16	84	78	74	53	7
India	21	21	20	41	0	6	94	82	53	45	
Indonesia	66	65	11	77	49	19	33	95	97	92	46
Korea	60	59	5	65	7	12	81	77	46	34	6
Malaysia	28	28	5	33	13	36	51	71	77	54	12
Mexico	139	132	15	153	30	3	66	72	91	67	25
Philippines	38	37	2	41	61	1	38	88	92	82	30
Russia	61	57	50	111	26	3	71	82	56	47	48
South Africa	20	20	7	27	38	3	59	54	83	46	15
Turkey	56	54	1	57	87	2	11	79	58	49	24
Total[12]	647	624	465	1,112	23	9	67	80	71	56	13
Memo: All EMEs[12]	1,128	*1,087*	*558*	*1,686*	*33*	*10*	*57*	*77*	*74*	*57*	

[1] Non-banks comprise non-bank financial entities, non-financial corporations, governments and international organisations. [2] Issuers (all nationalities) resident in the country in the left-hand column. [3] Issuers with a parent company headquartered in the country in the left-hand column [4] Issuers resident outside the country in the left-hand column and with a parent inside that country. [5] Sum of columns 2 and 3. [6] Share of non-banks' dollar bonds (column 4) issued by each type of borrower. [7] The BIS classifies a bond as international if any one of the following characteristics is different from the country of residence of the issuer: country where the security is registered, law governing the issue, or market where the issue is listed. All other bonds are classified as domestic bonds. [8] Share of non-banks' dollar bonds (column 4) in non-banks' total outstanding international bonds in all currencies. [9] Share of non-banks' dollar bonds (column 4) in total outstanding international dollar bonds issued by borrowers in all sectors. [10] Share of non-banks' dollar bonds (column 4) in total outstanding international bonds in all currencies issued by borrowers in all sectors. [11] Share of non-banks' dollar bonds (column 4) in their total outstanding *international* and *domestic* bonds in all currencies. [12] Issues by non-banks' offshore affiliates located in other EMEs totalled $1.46 billion for the 12 economies listed in the table, and $4.01 billion for all EME non-banks. Such bonds appear in both columns 1 and 3 and thus are double-counted in column 4.

Sources: BIS international debt securities statistics; authors' calculations.

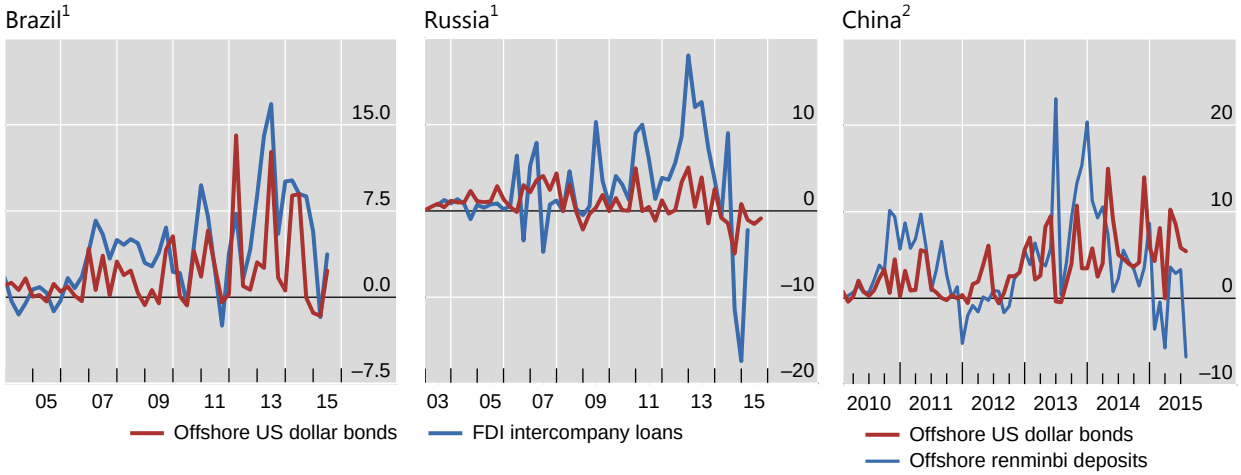
loans in Brazilian gross foreign direct investment. Hence, up to half of intercompany direct investment inflows into Brazil may represent the substitution of low-yielding dollar debt for higher-yielding domestic currency debt.

In China's case, there is a positive relationship between dollar issues by the offshore affiliates of Chinese non-banks and changes in offshore renminbi deposits in jurisdictions such as Hong Kong, Chinese Taipei and Singapore (Graph 5, right-hand panel). To some extent, Chinese firms may have used the proceeds of dollar bonds to accumulate offshore renminbi (which might show up in China's balance of payments as a renminbi deposit held by a non-resident bank). This would be

Moving offshore dollar funding onshore

In billions US dollars

Graph 5



[1] Intercompany lending (quarterly changes) to the country in the panel heading (blue lines) plotted against quarterly net issuance of dollar bonds by offshore affiliates of non-banks with a parent entity in the country in the panel heading (red lines). [2] Deposits of renminbi (expressed in US dollars) in banks in Chinese Taipei, Hong Kong SAR, Korea and Singapore (blue line) plotted against net issuance of dollar bonds by offshore affiliates of Chinese non-banks (red line).

Sources: Central Bank of the Republic of China (Taiwan); Hong Kong Monetary Authority; Bank of Korea; Monetary Authority of Macao; Monetary Authority of Singapore; CEIC; Datastream; BIS international debt securities statistics; authors' calculations.

consistent with the observation of Bruno and Shin (2015c), who uncovered evidence that dollar bond issuance responds to the same interest rate and exchange rate incentives that motivate the accumulation of offshore renminbi deposits.

Similarly to Brazil, intercompany lending by Russian firms tends to co-move with offshore US dollar issuance (Graph 5, centre panel), but the net issuance amounts to a much smaller fraction of intercompany lending flows. For example, only about half of the rise in intercompany flows is explained by offshore bond issuance in Q4 2010 and less than a third in Q4 2012. One reason for the difference with Brazil is that, while Brazilian firms issue bonds out of their own offshore subsidiaries, Russian firms have also relied on the services of banks elsewhere in Europe (at least prior to the sanctions). German and other banks were used to issue debt securities in Ireland or Luxembourg, backed by a loan participation note from a Russian firm's offshore affiliate, which then channelled the funds onshore. Hence, offshore US dollar funding raised indirectly via foreign banks supplemented US dollar bonds issued directly offshore by Russian firms.

The point to stress is that offshore dollar bond issues can show up in external debt statistics in a variety of ways. To the extent that dollar debt is obscured, corporate vulnerabilities can be understated.

Policy footprints

Policy measures can shape the composition of dollar credit: that is, whether loans are preferred to bonds; whether onshore loans are preferred to cross-border or offshore bank loans; and whether resident issuance is preferred to offshore bond issuance.

In Korea, policy discouraged dollar bank loans and thereby encouraged dollar bonds. A macroprudential levy was adopted in 2010 (operationalised in 2011) that, along with previous restrictive measures, raised the cost of dollar funding for banks in Korea. As a result, the growth of dollar loans in Korea slowed. Bruno and Shin (2014) find that the levy was associated with a decline in cross-border claims on Korea as compared with a control panel.[13] The shift from US dollar bank loans to US dollar bond issuance boosted bonds to approximately half of the $128 billion in the US dollar debt of Korean non-banks, including both residents and offshore (Graph 1, top centre panel). This could be considered a case of regulatory arbitrage, but it could be more appropriately seen as an intended outcome. The bonds have a longer maturity than interbank deposits, reducing the risk of sudden massive outflows such as those experienced by Korea in Q1 1998 and Q4 2008.

Working in the opposite direction have been international sanctions on Russia. These deny some Russian firms and banks access to bond markets. The effect can be seen in the decline in the blue and yellow shaded areas in Graph 2, bottom left-hand panel, and a consequent shift towards reliance on dollar bank loans.

In China, the authorities' restricted foreign banks' ability to bring dollars into China. This was followed by a rapid increase in direct cross-border loans by banks outside China to non-banks in China (a divergence between the dotted red line and the top of the red area in the top left-hand panel of Graph 1). In addition, Chinese firms' offshore affiliates borrowed dollars from banks, as discussed above.

The Reserve Bank of India has eased restrictions on Indian firms' issuance of international bonds out of their offshore subsidiaries (Acharya et al (2015)). The yellow shaded area in the bottom left-hand panel of Graph 1 has accordingly grown in recent years.

Conclusion

We find that, underlying the generally rapid growth of dollar credit, the sheer variety of forms and channels for dollar borrowing can make for different vulnerabilities. Some countries rely on bank loans, others more on bonds. Some rely on bank loans booked by banks at home, others on cross-border loans. Some issue dollar bonds as obligations of headquarters at home, others as obligations of their offshore affiliates. Some of these differences bear the footprint of policy. Until recently, currency trends and interest rate differentials vis-à-vis the US dollar rewarded EME firms for substituting dollar borrowing for domestic currency borrowing. Policy measures helped to determine where and how this substitution took place.

The most recent data on foreign exchange loans in China and Hong Kong, as well as net issuance of US dollar bonds by EMEs, raise the question of whether dollar borrowing outside the United States will continue to expand. Changing macroeconomic and financial conditions – in particular, a shift in relative funding costs that might emerge from a tightening of US monetary policy – could lead dollar borrowers to repay dollar debt, and dollar creditors to seek repayment. This in turn could lead to a re-evaluation of the policy measures that have helped to shape these flows.

[13] As in the case of on-balance sheet dollar loans, virtual dollar debt through forward dollar sales (see above) has not grown much, constrained as it is by the macroprudential levy and other measures.

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Ingo Fender
ingo.fender@bis.org

Ulf Lewrick
ulf.lewrick@bis.org

Calibrating the leverage ratio[1]

The Basel III leverage ratio (LR) is designed to restrict the build-up of leverage in the banking sector and to backstop the existing risk-weighted capital requirements (RWRs) with a simple, non-risk-weighted measure. But how should a minimum LR requirement be set? This special feature presents a conceptual framework for the calibration of the LR, focusing on the LR's cyclical and structural dimensions as well as its consistency with the RWRs. It then applies the framework to historical bank data. Subject to various caveats, it finds that there is considerable room to raise the LR requirement above its original 3% "test" level, within a range of about 4–5%. Doing so should help to constrain banks' risk-taking earlier during financial booms, providing a consistent and more effective backstop to the RWRs.

JEL classification: E44, E61, G28.

The Basel III framework is a central element of the post-crisis financial reform agenda. Developed by the Basel Committee on Banking Supervision (BCBS), the framework seeks to address the weaknesses of the international banking system as revealed by the 2007–09 Great Financial Crisis. These include insufficient loss-absorbing bank capital, unsustainable leverage and credit growth, and inadequate liquidity buffers.

The cornerstone of the Basel III framework is enhanced risk-weighted capital requirements (RWRs). Relative to pre-crisis regulations, the RWRs have been substantially tightened for all three of their components: the RWR numerator (ie the definition and quality of bank capital), the denominator (ie the computation of risk-weighted assets (RWA)), and the required capital ratio itself. Banks now have to: (i) comply with a minimum RWR of 4.5% Common Equity Tier 1 (CET1) capital to RWA; (ii) meet a 6% Tier 1 capital ratio (comprising a more broadly defined Tier 1 capital element as numerator); and (iii) maintain an additional capital conservation buffer of 2.5% (in terms of CET1 capital to RWA).[2]

[1] The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS or the BCBS. We are grateful to Mathias Drehmann and Kostas Tsatsaronis for analytical inputs and to Michael Brei and Leonardo Gambacorta for sharing their data. We also gratefully acknowledge comments by Fernando Avalos, Claudio Borio, Ben Cohen, Michela Scatigna and Hyun Song Shin as well as expert research assistance by Jörg Urban and José María Vidal Pastor.

[2] Tier 1 capital consists of CET1 capital and Additional Tier 1 (AT1) instruments such as contingent convertible bonds. For further information on the Basel III capital requirements as well as on other parts of the enhanced framework, see BCBS (2011) and BIS (2013).

Box 1

The Basel III leverage ratio: logic and design

The leverage ratio (LR) is defined as the ratio of Tier 1 capital (numerator) and an exposure measure (denominator). The latter is equal to the sum of the following items (BCBS (2014)):

- on-balance sheet exposures (eg loans);
- derivatives exposures at replacement cost (net of cash variation margin, meeting a set of strict eligibility criteria) plus an add-on for potential future exposure;
- exposures from securities financing transactions, with limited recognition of netting of cash receivables and cash payables with the same counterparty under strict criteria; and
- off-balance sheet items (eg standby letters of credit).

Given its broad scope and the fact that it does not try to account for the riskiness of assets, the LR ensures greater robustness of capital requirements against uncertainties and risks that are difficult to model within the risk-weighted framework. Its relative simplicity makes it easier for supervisors and market participants to understand and compare leverage across banks. That said, the LR does not provide information about banks' underlying risk profiles. This insensitivity to risk may incentivise banks to take on riskier positions. Risk-weighted capital requirements and the LR, therefore, are complements – and not substitutes – within the broader regulatory framework.

Several components of the Basel III framework serve to further raise the effectiveness of the RWRs. The leverage ratio (LR) requirement, in particular, is designed to restrict the build-up of leverage in the banking sector and to backstop the existing RWRs with a simple, non-risk-based measure. The LR is defined as Tier 1 capital divided by an exposure measure, which consists of the sum of all on-balance sheet exposures, derivatives positions, securities financing transactions and certain off-balance sheet items (Box 1).

In view of the instrument's novelty, the BCBS and national authorities started testing the LR at an initial minimum level of 3% from 1 January 2013 (the so-called parallel run). Banks began publicly disclosing their consolidated LRs on 1 January 2015. Final adjustments to the definition and calibration are scheduled to be carried out by 2017, with a view to establishing the LR as a Pillar 1 requirement on 1 January 2018 (BCBS (2014)).

This special feature examines a number of considerations for LR calibration. The next section presents a conceptual framework to help inform the calibration of the LR. In the second section, the framework is applied to historical bank data (from both publicly accessible and vendor sources) in order to derive a range of LR calibration benchmarks, which are then set against measures for the LR's impact on bank resilience and macroeconomic costs and benefits. The final section concludes.

A simple conceptual framework

Calibrating a minimum LR requirement involves several considerations: clarifying the LR's *objectives*; choosing a calibration *consistent* with the notion of it being a backstop to the RWRs; and assessing the *costs and benefits* of different calibrations. In what follows, each of these is discussed in turn.

Objectives

The LR's main objective is to prevent damage to the financial system and the economy by containing build-ups of leverage in the banking sector that could ultimately result in destabilising deleveraging spirals (BCBS (2014)). While the RWRs are also designed to contain leverage, the models used to generate the risk weights may understate risk. That is, measured risks tend to become artificially compressed in times when credit spreads are tight, defaults are rare and volatility is low. In addition, models may provide incentives for "gaming" (ie by making assumptions that are hard to verify and result in artificially low risk weights (see eg Behn et al (2014)).

Hence, LR calibration should consider two dimensions: (i) a *cyclical* (or time series) dimension, suggesting that a minimum LR requirement should backstop (ie provide insurance against) declines in measured RWA during financial booms; and (ii) a *cross-sectional* (or structural) dimension, based on the idea that the LR can provide additional benefits to RWRs in terms of bank resilience. Both dimensions, in turn, suggest that consistency with the RWRs should be a central building block of LR calibration.

Consistency

A helpful concept in calibrating the LR in a manner consistent with the existing RWRs (ie by taking possible interactions into account) is the "RWA density" or "density ratio" (DR), defined as the ratio of RWA to the LR exposure measure (EXP_{LR}; see Box 1). The DR denotes the average risk weight per unit of exposure for any given bank or banking system. The relationship between the LR and the DR can be obtained by expanding the LR definition as follows:

$$LR = \frac{T_1}{RWA} \times \frac{RWA}{EXP_{LR}} = \frac{T_1}{RWA} \times DR$$

The LR can thus be expressed as the product of the risk-weighted Tier 1 capital ratio (ie T_1/RWA) and the DR. The relationship can help inform the calibration of a consistent minimum LR requirement, in terms of both its cyclical and its cross-sectional dimensions.

A necessary condition for the minimum LR requirement to be a cyclical backstop to the RWRs is that banks' leverage expands more strongly during a financial boom than the corresponding increase in RWA. Indeed, empirical evidence (Brei and Gambacorta (2014)) suggests that, after controlling for other factors, EXP_{LR} co-moves with various proxies of the economic cycle. Moreover, the cyclicality in the EXP_{LR} measure is more pronounced than the one found for RWA. As a result, entering into a boom, observed DRs across banks will tend to fall and LRs will decline for any given T_1/RWA. A minimum LR, therefore, becomes more likely to constrain banks' risk-taking. This is consistent with the idea of the LR restricting the build-up of risks during cyclical upswings, safeguarding against the tendency of the RWRs to insufficiently limit such build-ups. On this basis, calibrating the LR requires the DR to be set at a level consistent with a cyclically adjusted value of RWA/EXP_{LR}, as explained in more detail in the next section.[3]

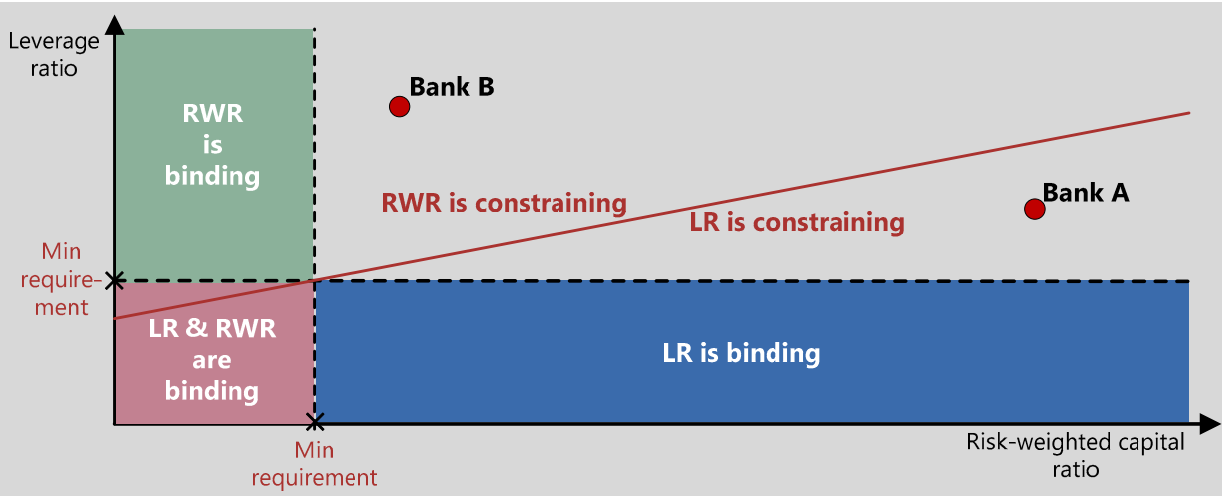
[3] An additional LR requirement could be added for global systemically important banks (G-SIBs) so as to align the total LR requirement with the RWR established by the G-SIB capital surcharge. Not

The above equation also shows how the LR and the RWRs complement each other from a cross-sectional point of view. If, all else equal, a bank's risk models underestimate its risk weights, this will bias the Tier 1 capital ratio upwards. Yet, at the same time, the DR is biased downwards, making a minimum LR requirement relatively more constraining.[4] Conversely, for a given LR requirement, a bank with a relatively low DR will have an incentive to shift its balance sheet towards riskier assets to earn more income – a type of behaviour that the RWRs would constrain. This suggests that banks' risk-weighted capital ratios and the LR provide complementary information when banks' resilience is assessed.

Selecting a consistent LR benchmark requires the relevant backstop concept to be defined. There are two main alternatives.

The first approach is to calibrate the LR so that it is the *binding* constraint on a given average share of banks at any given point in time. Accordingly, calibrating the LR involves choosing the share of banks that, on average, would have been bound by the minimum LR requirement (subject to the RWR being met), based on historical data. The area shaded in dark blue in Graph 1 illustrates combinations of the LR and RWRs for which this is the case. A target share of 50% would imply that, over a full cycle, about half the banks of a given sample are bound by the LR. The share would then rise (fall) as the economy strengthens (weakens), counteracting the corresponding increase (decrease) in banks' incentives to increase risk-taking and leverage. That is, a 50% target is the highest share that is still consistent with the concept of the LR serving as a backstop for the RWRs.

How the leverage ratio is linked to the Tier 1 risk-weighted capital requirement — Graph 1



The red diagonal line represents combinations of the LR (T1/EXPLR) and the risk-weighted capital ratio (T1/RWA) for which the banks' density ratio (DR) is exactly equal to the threshold DR (ie the minimum LR requirement divided by the minimum RWR). Bank A, for example, meets both minimum requirements (ie it is not bound by either of them). Yet Bank A is constrained by the minimum LR requirement, which means that the regulatory capital required to meet this requirement is higher than the amount due to the minimum RWR. For Bank B, by comparison, the RWR is constraining.

adding such an LR surcharge for G-SIBs would make the LR relatively less likely to bind for G-SIBs than for other banks, given the higher Tier 1 capital requirement that results from the G-SIB surcharge. See BCBS (2013).

[4] Other components, such as risk-weight floors, also guard against an underestimation of risks by internal models-based calculations.

An alternative approach is to calibrate the LR so that it is more *constraining* than the RWRs for a given target share of banks. For any target percentage, this – less stringent – criterion would result in a lower minimum requirement because the LR can be relatively more constraining even if it is not binding, capturing a larger share of banks. Whether the LR is constraining depends on how a bank's DR compares with the threshold DR (or "critical" average risk weight) implied by combining the minimum RWR and LR requirements (Bank of England (2014)). For the current "test" level, with the minimum LR requirement set at 3% and Tier 1 RWR at 8.5%, the threshold DR is equal to about 35% (3% divided by 8.5%, as per the above equation). A bank with a DR below this threshold would find itself relatively more constrained by the LR (see Bank A, which is located below the line implied by the threshold DR; Graph 1). This means that the amount of capital it needs to hold due to the minimum LR requirement is higher than the amount due to the minimum RWR. By comparison, a bank with a DR above the threshold DR would be more constrained by the RWR (see Bank B, Graph 1). Again, target shares of up to 50% would be consistent with the backstop concept underpinning the LR.

Costs and benefits

Having operationalised the backstop concept, the next step is to evaluate the costs and benefits of introducing alternative minimum LR requirements. The BCBS's long-term economic impact (LEI) assessment provides a suitable framework. This study, conducted in 2010, evaluates the macroeconomic impact of higher bank capital requirements (BCBS (2010); see Box 2 for details).

On this basis, the cost-benefit analysis comprises three main elements: an estimate of the increase in capital associated with different levels of the LR (the implied "capital shortfall"); the benefits in the form of lower (expected) crisis costs, equal to the reduction in the crisis probability times costs; and the expected output loss which might result from higher lending spreads.

Deriving benchmarks for the leverage ratio

This section starts with a brief description of the data set. Next, different LR benchmarks are presented, applying the conceptual framework discussed above. The section concludes by illustrating the costs and benefits associated with a minimum LR set within the range implied by these benchmarks.

Data

A challenge for LR calibration is the lack of consistent historical time series on RWA and the exposure measure across countries and over time. To overcome this problem, the analysis presented below draws on data compiled by Brei and Gambacorta (2014), who combine information from the Bankscope vendor database with aggregate data based on the BCBS's Quantitative Impact Study (QIS).

Specifically, the QIS data are employed to generate a set of country-level scaling factors that, combined with Bankscope data, are used to calculate proxies for the LR's exposure measure for a sample of more than 100 banks

Box 2

The long-term economic impact of stronger capital and liquidity requirements

A useful template for an analysis of the macroeconomic costs and benefits of the new leverage ratio (LR) requirement is the BCBS's 2010 long-term economic impact (LEI) report, which investigates the impact of the core Basel III capital and liquidity requirements.①

The LEI methodology separates the assessment into two steps by: (i) assessing the *expected benefits* of higher capital requirements in the new steady state, specifically the reduction in the expected output losses from systemic crises; and (ii) comparing this with the *expected costs* of higher capital requirements in terms of forgone output. In deriving these estimates, the LEI adopts an explicitly conservative approach – making assumptions that tend to raise cost estimates and downplay expected benefits, introducing a downward bias into the estimates of expected net benefits. The key finding is that even large increases in bank capital requirements from their pre-crisis levels are unlikely to result in macroeconomic costs that outweigh the associated benefits in terms of reduced crisis costs.

Expected benefits. Conceptually, the expected benefits are based on multiplying the *probability* of systemic financial crises, given different minimum capital ratios, by the expected macroeconomic *costs* of such crises should they occur. To derive a link between crisis probabilities and different capitalisation levels, the LEI uses a range of probit models as well as portfolio credit risk analyses that treat the banking system as a portfolio of banks. Averaging the results from these models, it then derives a schedule with diminishing marginal returns (ie the extra effect of additional capital declines as the capital level increases). Later studies broadly confirm these results (eg Junge and Kugler (2013)).

Crisis cost estimates, in turn, are derived from academic studies of historical crisis experiences. The LEI study found that the median cost of systemic banking crises in these studies is 63% of GDP in net present value terms. But the variation in these cost estimates is large, and later studies have generated both higher and lower estimates (see Romer and Romer (2015) for an example at the lower end). A shortcoming of these studies of the cost of financial crises is that they rely only on pre-2007 data, missing the impact of the most recent crisis episode. An exception is Haldane (2010), who estimates the present value of output losses from the recent crisis to be between 90 and 350% of world GDP, depending on the strength of permanent effects. More recently, Ball (2014) confirms these results, with estimates implying that the weighted average cumulative loss across all OECD countries amounts to about 180% of pre-crisis GDP. Ball also finds that the growth rate in potential output has declined by 0.7 percentage points per year since the crisis and that, so far, there has been no reversal. If this decline in potential output is permanent, this would significantly increase potential crisis costs and would strengthen the case for action to prevent them.

Expected costs. If higher bank capital requirements raise banks' costs, banks may respond by raising their lending spreads to counterbalance the decline in their return-on-equity (RoE). As a result, real economy borrowing costs may rise, translating into lower investment and equilibrium output. To estimate the magnitude of this effect in the long run, the LEI assumes that banks maintain a constant RoE by passing on to their customers all additional costs that are due to higher capital requirements. The estimated increase in lending spreads is then fed into a variety of macroeconomic models (that is, the dynamic structural general equilibrium models and semi-structural and reduced form models in use at participating central banks) to assess the resulting impact on GDP.

The headline result of this exercise is that a 1 percentage point increase in the CET1/RWA ratio translates into a 0.12% median decline in the level of output relative to its baseline (with the corresponding value for the liquidity requirements being a one-off 0.08% decline in the output level).② In addition, a companion study (BIS (2010)) found that the macroeconomic impact of the *transition* to higher capital requirements was expected to be limited. By design, these results are likely to overstate the true costs, given the underlying assumption that the Modigliani-Miller theorem③ is violated even in the long run and that the cost of issuing equity does not change with capital levels. In fact, banks' required RoE can be expected to decline as their balance sheet leverage and the riskiness of their equity fall.

① For more details, see BCBS (2010). ② The original result of 0.09% is stated in terms of tangible common equity over Basel II RWA, which corresponds to about 0.12% in terms of CET1/RWA given our estimated conversion factor of about 0.78. ③ The Modigliani-Miller theorem states that, under certain assumptions (such as the absence of taxes, bankruptcy costs, agency costs and asymmetric information), the value of a firm is unaffected by how that firm is financed (Modigliani and Miller (1958)).

from 14 advanced economies covering mainly the period from 1995 to 2012.[5] The re-scaled series are then grouped across banks by country and across four different regions (Asia-Pacific, euro area, North America, Other Europe). These are combined with the corresponding measures of RWA for the same set of banks to generate the calibration benchmarks described below.[6]

Applying the conceptual framework

Cyclical dimension: leverage over time

As discussed in the previous section, calibrating the LR to backstop the RWRs implies a close link between both regulatory requirements. Specifically, to ensure consistency, the minimum LR requirement needs to be set at a level that is commensurate with both the Basel III minimum Tier 1 capital target ratio of 8.5% and through-the-cycle values of the DR.[7]

As a preliminary step, to provide a sense of the range of possible minimum LR requirements, Graph 2 portrays scaled DRs (ie values for RWA/EXP_{LR} multiplied by the Tier 1 capital target ratio of 8.5%). The series indicate, for different points in time (Graph 2, left-hand panel) and geographical regions (centre panel), the LR value under the assumption that banks are operating at the Tier 1 RWR of 8.5%.

As expected, the values of these aggregates vary, across both time and regions. Overall, there appears to be a broadly declining trend, particularly for the larger banks, reflecting the pre-crisis boom as well as post-crisis business model adjustments and regulatory responses. In particular, many banks shifted their balance sheets towards assets with lower risk weights during and after the Great Financial Crisis (see eg BIS (2013)). As a result, scaled DRs are generally lower at the end of the sample than at the start. This would tend to skew analyses based only on the current low observations in the direction of low minimum LR requirements.

Median values by region (based on annual cross-sectional averages) range from around 3.7% (for Other Europe) to about 5.0% (for Asia-Pacific) for the full sample; whereas the most recent observations are equal or close to the minimum values observed over the full period (1995–2012). Country-level data show similar patterns (not pictured), with the cross-country average at 3.9% for 1995–2012 and 4.2% for 1995–2007.

Hence, across regions and time, a Tier 1 RWR of 8.5% has historically been consistent with scaled DRs in a range of about 4–5%. This is true in the aggregate (red line in the left-hand panel of Graph 2) as well as across regions (the median values in the centre panel) and countries. Interpreting these results as through-the-cycle values provides a set of calibration benchmarks for the LR, given the framework discussed above.

[5] The adjustment is necessary because Bankscope data do not have the granularity that would be required to construct LR exposure measures directly – especially in the context of the treatment of reverse repos and cash collateral, derivatives exposures, securities financing transactions and certain off-balance sheet items.

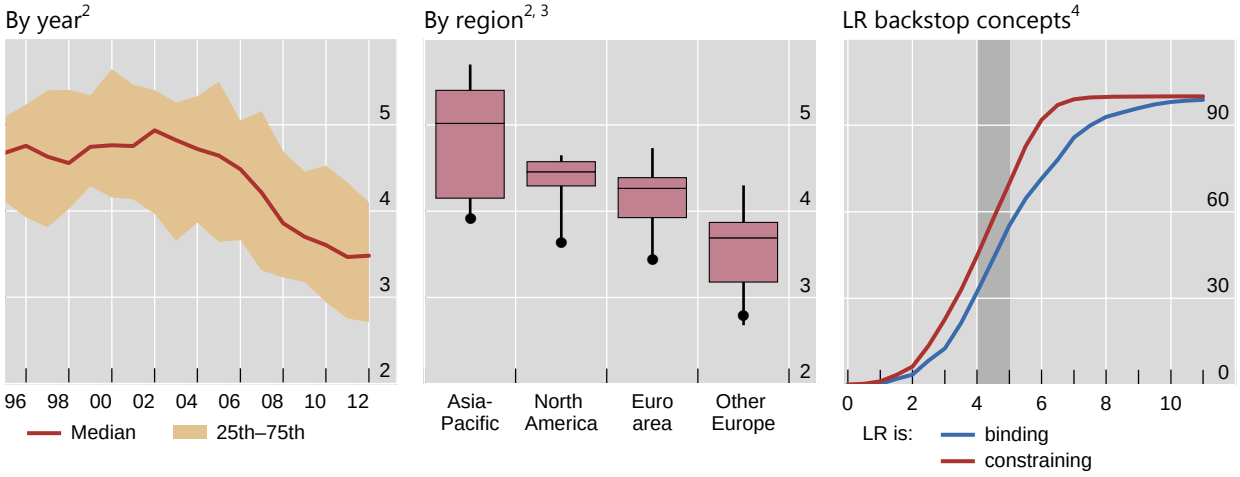
[6] For more detail on the data set, see Brei and Gambacorta (2014), especially Appendix A.

[7] The assumed RWR level of 8.5% reflects the sum of the Tier 1 capital requirement of 6% and the capital conservation buffer of 2.5% (which has to be met in terms of CET1 capital).

Historical bank data help derive conservative LR calibration benchmarks[1]

In per cent

Graph 2



[1] The benchmarks are conservative because most of the banks in the sample did not face an LR constraint during the period of observation. This will have skewed their business models in the direction of operating with a lower LR (ie a more leveraged balance sheet). [2] Scaled density ratios defined as RWA/EXP_{LR}, multiplied by a factor of 8.5%; aggregates based on unweighted individual bank data for the period 1995–2012; balanced sample including 34 large banks. [3] The median value is represented by a horizontal line, with 50% of the values falling in the range shown by the box. The highest and lowest values are represented by the upper and lower end points of the vertical lines. The black dots indicate the latest value, which corresponds to 2012. Asia-Pacific comprises Australia and Japan; the euro area includes Austria, Belgium, Germany, France, Italy, the Netherlands and Spain; North America comprises Canada and the United States; and Other Europe comprises Sweden, Switzerland and the United Kingdom. [4] Share of observations for which an LR requirement, as indicated by the value on the horizontal axis, would have been either binding or a more constraining requirement than a Tier 1 capital RWR of 8.5%. Unbalanced sample comprising 111 banks; 1995–2012. The grey shaded area indicates an LR range of 4–5%.

Sources: Brei and Gambacorta (2014); Bankscope; authors' calculations.

Backstop concepts

What does this imply for the two backstop concepts (ie whether the minimum LR requirement should, on average, be a binding or a constraining factor for banks' asset allocation decisions)? Graph 2 (right-hand panel) illustrates the results, based on the historical data described above.

The graph suggests that, at 3% – the current "test" level – the percentage of banks for which the LR would have been binding is rather low. Specifically, the ratio would have been binding for less than 15% of the bank-year observations (111 banks from 1995 to 2012) for banks meeting an 8.5% Tier 1 RWR (ie banks located in the blue-shaded area in Graph 1), and constraining for less than 25% (ie banks located below the red diagonal line in Graph 1; see Bank A).

For comparison, raising the LR to a minimum level of 4% would have resulted in the LR becoming a binding constraint for about 30% of the observations, while it would have constrained banks about 45% of the time. Setting an LR at 4.5%, ie towards the centre of the range implied by the historical data, raises these figures to about 45% and 55%, respectively. That is, calibration at these levels would have, from a historical perspective, resulted in the LR becoming as equally constraining a requirement on average as the RWR.

While this is technically at the top of the target range that still qualifies as a backstop, note that these are conservative numbers. The share of bound banks is biased upwards, because most of the banks in the sample *did not face* an LR

constraint during the period of observation. This will have skewed their business models in the direction of operating with a lower LR (ie a more leveraged balance sheet). Indeed, as suggested by end-2014 data (BCBS (2015)), a 3% minimum LR requirement would have been binding for only about 5% of the banks monitored by the BCBS, ie about one third of the 15% implied by using the historical data. Given the adjustments in bank capital levels since the crisis, any given minimum LR requirement has become less likely to bind. This suggests that a calibration aimed at binding or constraining a certain percentage of banks on average would need to set a minimum LR requirement *above* the values implied by historical observations.

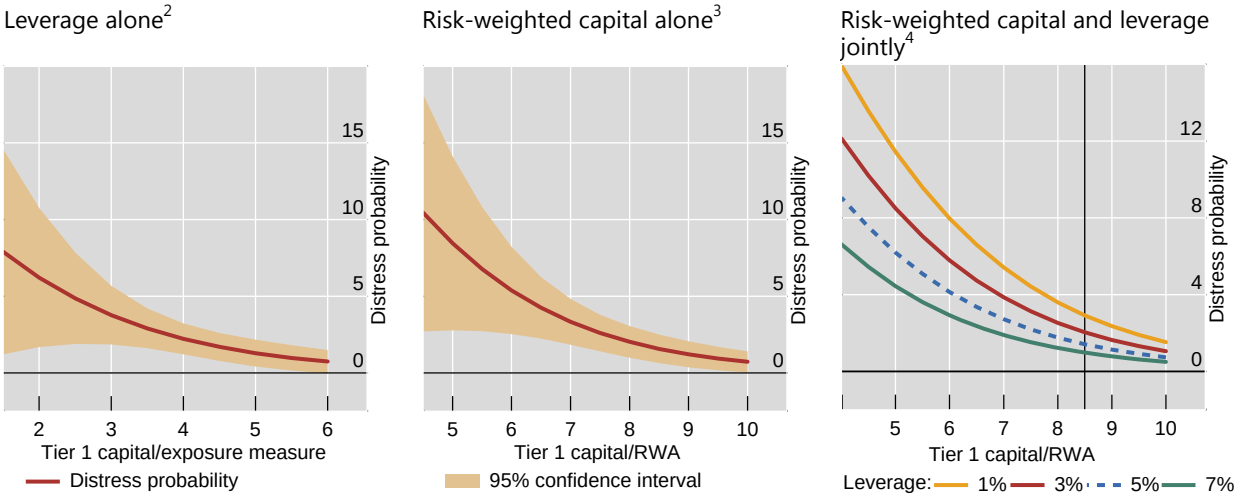
Cross-sectional dimension: leverage and bank distress

Calibration should also be informed by any additional benefits in terms of improved bank resilience that result from the LR. One way to include this cross-sectional dimension in LR calibration is to study the combined marginal predictive power of the RWRs and a corresponding minimum LR requirement for bank distress (BIS (2013)). Graph 3, which is based on a simple set of logistic regressions run on the bank data set described above, indicates how a low LR is associated with the likelihood that the bank will be facing distress within two years. An increase in the ratio from, for example, 3% to 5% lowers the likelihood of distress from about 3.8% to below 1.3% (red line, left-hand panel). By comparison, an increase in Tier 1 capital/RWA from 8.5% to 10% reduces the estimated probability of distress from about 1.6% to less than 1% (red line, centre panel).

Importantly, the signals produced by the two ratios are complementary (Graph 3, right-hand panel). In particular, if both ratios are low, this provides a

High leverage and low risk-weighted capital are signals of banks' distress risk

Estimated probability of distress in one year, in per cent[1] Graph 3



[1] Estimates based on a logistic regression of an indicator variable denoting a bank's individual rating below D on the variables indicated in each panel, lagged by two years, and a control variable for total assets (first lag) as well as a dummy variable to flag observations in the post-2007 period. The sample is an unbalanced panel of annual observations for 77 banks over the period 1995–2013. The vertical axis measures the estimated probability of distress for different values of the explanatory variable. Distress is the likelihood that the bank's operations, net of any external support, will receive a credit rating equivalent to distress or default. [2] Leverage is the ratio of Tier 1 capital to the LR exposure measure. [3] Risk-weighted capital is the ratio of Tier 1 capital to risk-weighted assets. [4] Probability of distress for a given level of risk-weighted Tier 1 capital (horizontal axis) at four different leverage ratios. The black vertical line indicates the 8.5% Tier 1/RWA minimum capital requirement.

Sources: Bankscope; Moody's; authors' calculations (based on BIS (2013) and data from Brei and Gambacorta (2014)).

stronger signal of future distress than would each ratio considered separately. Thus, a possible strategy for LR calibration is to set an objective in terms of distress probabilities and then estimate the LR that would have achieved this level of safety for a given RWR (eg a Tier 1/RWA ratio of 8.5%), based on historical data.

For the banks included in the data set available for this analysis, increasing the minimum LR requirement from 3% to 5% (ie to the upper end of the range provided above) is estimated to reduce banks' distress probability from about 2% to 1.4%. This implies that choosing a more conservative approach to LR calibration (ie targeting a higher share of bound or constrained banks) is likely to provide additional benefits in terms of bank resilience – an argument in favour of a calibration level at the higher end of the historically implied calibration range.

Macroeconomic impact: cost-benefit analysis

The third part of this section applies the BCBS's LEI framework (Box 2) to evaluate the costs and benefits of the LR and to provide a complementary calibration benchmark. The analysis presented here adds to the original LEI assessment by: (i) incorporating the recent academic literature; and (ii) accounting for the costs and benefits associated with the extra cushion of capital added via alternative minimum LR requirements.

Before starting the assessment, two effects of the Basel III reforms need to be taken into account. The first is the change in the definitions and calculation of capital and RWA. Specifically, all LEI estimates, which are based on a measure of tangible common equity (TCE) to RWA under the then prevailing definitions, need to be transformed into the new CET1/RWA metric. The second effect is the increase in minimum capital ratios due to more stringent RWRs. These new requirements suggest that the analysis should start from the assumption that banks meet a minimum CET1/RWA ratio of 7% (including the capital conservation buffer) under the Basel III rules (corresponding to Basel II TCE/RWA levels of about 9%).[8]

Next, as discussed in the previous section, an estimate of the implied capital shortfall for any given LR is derived. This is measured as the average supplementary Tier 1 capital (in proportion to RWA) that would have been required to meet different LR requirements (Table 1, line 1; Graph 4, left-hand panel) in the bank data sample used above. A minimum requirement of 3%, for example, would have, on average over the sample period, required extra Tier 1 capital holdings of 68 basis points of RWA. An LR of 5%, in turn, would have required AT1 capital worth about 3 percentage points of RWA.[9] To facilitate the mapping of these estimates into the LEI framework, the conservative assumption is made that banks meet any capital shortfall with CET1 capital, rather than relying on typically less costly AT1 capital instruments.

The next element is the reduction in the crisis probability due to higher levels of capital. The associated estimates are based on the LEI schedule, which provides a mapping of capital levels onto crisis probabilities. For the starting capital ratio of 7%

[8] For the purposes of this study, we estimate that the conversion factor for the transition from Basel II to Basel III capital ratios is about 0.78, with CET1/RWA (Basel III) ≈ 0.78 * TCE/RWA (LEI).

[9] The numbers are higher, and thus more conservative, than those implied by the latest Basel III monitoring results, which are based on end-2014 data; see Graph 4, left-hand panel.

Cost-benefit analysis suggests significant room for raising the minimum LR

In per cent — Table 1

	Minimum leverage ratio requirement			
	3	4	5	6
1) Increase in CET1/RWA based on historical data[1]	0.68	1.58	3.10	5.21
2) Expected marginal benefits				
2.1) Decrease in probability of systemic crises[2]	0.41	0.78	1.11	1.35
2.2) Expected marginal benefits (cost of crises = 63%)[3, 4]	0.26	0.49	0.70	0.85
2.3) Expected marginal benefits (cost of crises = 100%)[3, 4]	0.41	0.78	1.11	1.35
3) Expected marginal costs[4, 5]	0.08	0.19	0.37	0.63
4) Expected *net* marginal benefits[4, 6]				
4.1) Assuming cost of crises = 63%	0.18	0.30	0.33	0.22
4.2) Assuming cost of crises = 100%	0.33	0.59	0.74	0.72

[1] Average capital shortfall associated with a minimum LR of 3% (column 1) to 6% (column 4). The calculation is based on the assumption that the entire shortfall would be met with additional CET1. Based on historical data from 111 major banks (1994–2012); see Brei and Gambacorta (2014). [2] Percentage change in the probability of systemic crises given increased capital levels (line 1) from a starting level of no LR requirement and an RWR of 7% (CET1/RWA); extrapolated from the original LEI schedule. [3] The expected marginal benefits are given by multiplying the decrease in the probability of systemic crises (line 2.1) by the cost of crises. [4] As a percentage of the level of output per year. [5] The expected costs equal the increase in bank capital (line 1) times a drop in output of 0.12% per 1 percentage point increase in CET1/RWA ratios, based on the estimates from the LEI report. [6] The expected net marginal benefits are equal to the difference between expected marginal benefits (lines 2.2 and 2.3) and expected marginal costs (line 3).

Sources: BCBS (2010); BIS (2010); authors' calculations.

CET1/RWA (see above), the LEI schedule estimates a 1.6% probability of a systemic banking crisis, after taking the effects of the Net Stable Funding Ratio (NSFR) into account. The amount of reduction, given the expected increase in capital, follows from Table 1, line 2.1.

The costs of systemic crises represent another key element of the analysis. An important insight from the relevant literature is that the cumulative output losses of a crisis are large, but that estimates can vary significantly across different studies and data sets. Most of these studies, however, do not include the most recent, especially costly, crisis. Any update would be likely to increase crisis costs, in the direction of cumulative losses of around 100% of GDP in net present value terms (Box 2).[10] In what follows, estimates of both 63% (ie the original LEI estimate of the median cost of a systemic banking crisis) and 100% of GDP are used as alternative (moderate/high crisis costs) benchmark values.

To evaluate the expected marginal benefits (Table 1, lines 2.2 and 2.3), the reduction in the crisis probability that results from raising capital to meet the LR is multiplied by the cost of crises, using the 63% and 100% estimates, respectively.

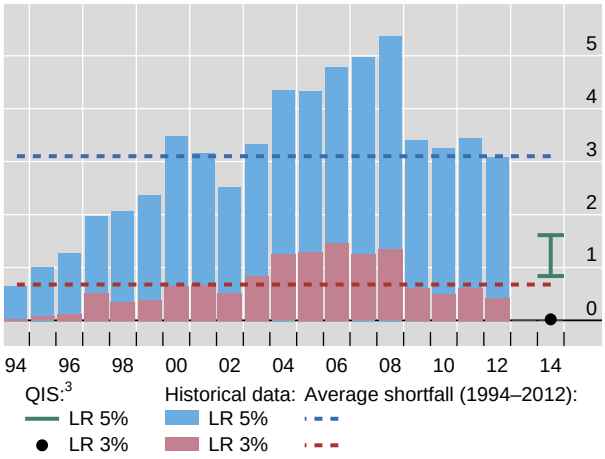
[10] In the widely used data set of Laeven and Valencia (2012), around 25% of the crisis observations relate to the most recent episode. Hence, assuming cumulative output losses of the recent crisis at 200% (the average of the Haldane (2010) and Ball (2014) estimates) and losses from previous crises of 63% (in line with the original LEI) gives a back-of-the-envelope estimate of about a 100% weighted average loss of output per crisis. This figure refers to the net present value of the cumulative loss in output, allowing for the possibility that banking crises have a permanent effect on the level of GDP (ie crises may induce a downward shift in the growth path). For more information on the methodology, see BCBS (2010), in particular Annex 1.

A minimum LR requires more bank capital, but yields sizeable economic benefits

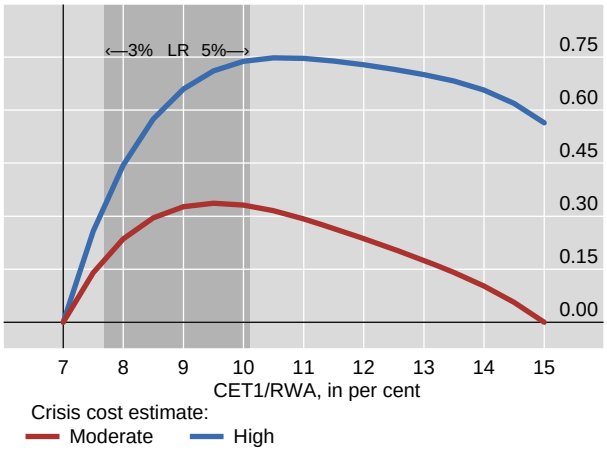
In per cent

Graph 4

Estimates of historical Tier 1/RWA shortfalls[1]



Expected net marginal benefits[2]



[1] Unbalanced sample comprising 111 banks from 14 jurisdictions. [2] The moderate crisis cost (LEI baseline) estimate assumes a cost of systemic crises equal to 63% of GDP, whereas the high crisis cost estimate assumes a cost of 100% of GDP. The grey shaded area indicates an LR range of 3–5%. [3] Shortfall for LR of 3% is based on the latest Basel III monitoring results, which rely on end-2014 balance sheet data; the range of shortfall estimates for an LR of 5% is based on regressing historical shortfalls at 5% LR on those at 3% LR; the range spans the midpoint estimate plus/minus two standard errors.

Sources: BCBS (2010); Brei and Gambacorta (2014); Bankscope; authors' calculations.

The final element of the analysis is an estimate of output costs from higher LR requirements due to any implied changes in lending spreads (Table 1, line 3). Specifically, the LEI report suggests a 0.12% loss in the level of output per percentage point increase in the required CET1/RWA ratio (Box 2).

In terms of calculations, the expected marginal costs result from combining the estimated increase in capital with the estimated output loss. This yields two sets of net benefit schedules based on alternative crisis cost estimates (Table 1, lines 4.1 and 4.2; Graph 4, right-hand panel). On this basis, the net economic benefits (measured by the impact on the level of output per year) of higher capital requirements are exhausted only after a very substantial increase from the baseline level of 7% of the CET1/RWA ratio – even if one uses the lower pre-crisis estimate of the cost of a financial crisis.

Overall, despite rising amounts of required additional capital, estimated net marginal benefits remain positive for the full range of alternative LR calibrations. This result is consistent with the calculations presented in Graph 4, suggesting considerable room for calibrating the LR towards the upper range of the benchmarks derived above.

In addition, as mentioned before, these figures are likely to overestimate any LR-implied impact for several reasons.

First, the sample data overstate the capital shortfall, because they cannot account for any adjustment in balance sheets that would have resulted from imposing an LR requirement at the time. The latest QIS data suggest, for example, that large internationally active banks, on average, had an LR of 5% as of end-2014,

while for smaller banks the average was 5.3%.[11] Only 10 of the nearly 200 banks monitored by the BCBS would not have met a fully phased-in minimum Basel III LR of 3%. These banks reported an aggregate shortfall of €7.4 billion. This shortfall amounted to less than 3 basis points of total RWA of the banks monitored by the BCBS, which is significantly less than the 68 basis points implied by the data used in the analysis presented above (Graph 4, left-hand panel).

Second, the LEI's cost estimates are (intentionally) biased upwards because they do not take into account that higher capital ratios will – over time – tend to reduce banks' funding costs (Box 2). Indeed, more recent studies confirm the conservative nature of the LEI estimate, which – if anything – looks more conservative now than it did back in 2010 (Table 2). With one exception, all of the analyses reviewed in Table 1 point to a decline in economic growth that is lower, often substantially so, than the one resulting from the LEI approach.[12] For example, Miles et al (2012), who seek to take the effects of reduced funding costs given enhanced capitalisation into account, find that a 1 percentage point increase in capital ratios reduces long-run GDP by less than 0.05%.

Third, the impact on lending and GDP need not be negative. An empirical analysis of German bank data by Buch and Prieto (2014) finds a positive long-term relationship between bank capital and loan volume, suggesting that higher

Impact of a 1 percentage point increase in capital ratios: selected estimates[1]

In basis points Table 2

	Increase in lending spreads	Decline in GDP growth, annual rate
BIS (2010)	15–17	4 over 4 years
LEI (BCBS (2010))	13	9 permanent
Institute of International Finance (2011)[2]	30–80	6 to 12 over 5 to 10 years
Cournède and Slovik (2011)	8–20	4 over 9 years
Elliott et al (2012)[2]	5–15	–
Miles et al (2013)	5.5	4.5 permanent
Oxford Economics (2013)[2]	15	1.6 over 9 years

[1] Capital definitions are not necessarily identical across studies. LEI results are stated in terms of the impact of a 1 percentage point change in TCE/RWA, as per the original capital ratio definition used in the LEI. [2] Also includes impact of other regulatory measures.

Sources: As listed; Cohen and Scatigna (2014).

[11] See BCBS (2015). The BCBS distinguishes between "Group 1" banks, which have Tier 1 capital of more than €3 billion and are internationally active, and "Group 2" banks, namely all other institutions that submit data for the monitoring exercise. According to the BCBS, "Group 1" covers most large, internationally active banks, but the "Group 2" sample is not necessarily representative of the worldwide population of banks that are not internationally active.

[12] Studies finding stronger effects than those estimated by the LEI typically focus on shorter-term, transitional adjustments and not those associated with a new steady state. See eg Mesonnier and Monks (2015) and Fraisse et al (2015).

capitalisation levels tend to have no negative effect on spreads and output in the long run. Similar effects are found in Gambacorta and Shin (2015), based on a broad set of internationally active banks.

Finally, given its cyclical features, the minimum LR requirement will tend to bind when profits are ample and raising equity is comparatively cheap. This should further reduce any costs, once the requirement has been fully phased in.

Conclusions

The final calibration of the Basel III minimum LR requirement by the BCBS is likely to need to take account of a variety of factors. An important one, as highlighted in the above analysis, is consistency with the existing RWRs. Given the risk-weighted Tier 1 requirement of 8.5%, therefore, the LR can be benchmarked against historically observed bank DRs.

Subject to various caveats (such as data quality and comparability across countries) and methodological constraints, scaled DRs are consistent, over the medium term, with a minimum LR requirement above the current "test" level of 3%, within a range of about 4–5%.

Thus, taking account of the implied conservative bias from using historical data (relative to the most recent BCBS monitoring results) as well as additional gains in terms of improved bank resilience and estimated net macroeconomic benefits, the analysis presented above suggests considerable room for manoeuvre in terms of higher LR calibrations – in particular for global systemically important banks (G-SIBs), where additional capital requirements are likely to reduce the risk of systemic crises most.

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Dietrich Domanski
dietrich.domanski@bis.org

Leonardo Gambacorta
leonardo.gambacorta@bis.org

Cristina Picillo
cristina.picillo@bis.org

Central clearing: trends and current issues[1]

Central clearing of standardised financial instruments, as promoted by the G20 Leaders, addresses some of the financial stability risks that materialised during the Great Financial Crisis. Its rapid evolution since 2009 may have changed the linkages between central counterparties and the rest of the financial system. Against the backdrop of these trends, this article discusses how, and through which mechanisms, central clearing might have affected systemic risk.

JEL classification: G01, G14, G18, G28.

The shift to central clearing is a key element of financial system reforms in the aftermath of the Great Financial Crisis. To reduce the systemic risks resulting from bilateral trading, the G20 Leaders agreed at the 2009 Pittsburgh Summit that all standardised derivatives contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties (CCPs). CCPs had, indeed, proved resilient during the crisis, continuing to clear contracts even when bilateral markets had dried up.

Since then, central clearing has evolved. The share of centrally cleared transactions has increased significantly; CCPs have expanded; the industry has remained highly concentrated; and the range of banks and other financial institutions that channel their transactions through CCPs has broadened. As a consequence, more and more connections in the global financial system run through CCPs. This growing interconnectedness raises the question whether CCPs might spread losses in the case of defaults, or intensify deleveraging pressures in ways that add to systemic stress.

Global standard setters have devoted considerable effort to strengthening the resilience of individual CCPs. They have required more stringent CCP risk management, with a focus on stress events. And they have adjusted the relative levels of capital and margin requirements for centrally cleared and non-centrally cleared products, so as to ensure that bank capital and liquidity requirements appropriately cover the risks associated with bank exposures to CCPs while maintaining incentives for central clearing. More recently, the focus has also turned to the issue of CCP recovery and resolution planning.

While progress in these vital areas has been impressive, the interaction between CCPs and the rest of the financial system remains, at best, imperfectly

[1] The views expressed are those of the authors and do not necessarily reflect those of the BIS. We thank Claudio Borio, Ben Cohen, Mathias Drehmann, Klaus Löber and Hyun Song Shin for helpful comments, and Tracy Chan and Anamaria Illes for excellent research assistance.

understood. This special feature discusses the evolution of central clearing since the Great Financial Crisis of 2007–09 and explores possible implications for systemic risk. The expansion of centrally cleared transactions and the horizontal integration in terms of both products and geographical reach may have altered the characteristics of systemic risk and crisis propagation mechanisms. Further analysis of the implications of central clearing for the behaviour of the financial system in normal and stressed conditions should help authorities to consider a macroprudential perspective to the regulation and supervision of financial systems that rely on central clearing.

The remainder of this article is organised as follows. The first section explores the functioning of a CCP, while the second describes some recent trends in central clearing. The third section analyses the main propagation channels through which central clearing could affect systemic risk. The last section concludes.

Central clearing in the financial system

A CCP is an entity that interposes itself between the two counterparties in a financial transaction. After the parties have agreed to a trade, the CCP becomes the buyer to every seller and the seller to every buyer. In doing so, the CCP reduces counterparty credit and liquidity risk exposures through netting. It also provides standardised and transparent risk management.

Central clearing fundamentally alters the linkages and exposures in the financial system. It replaces bilateral trading exposures between market participants with a centralised network of exposures between clearing participants and the CCP (Graph 1, left-hand panel). This implies that:

- the CCP combines the exposures to all clearing members on its balance sheet. If all clearing members can meet their obligations, the CCP runs regularly matched books. But if a participant defaults, it assumes the rights and obligations of the failed clearing participant; and
- instead of being subject to multiple exposures to a range of counterparties, each market participant maintains just a single trading exposure to the CCP. Because of multilateral netting, the size of this exposure is equivalent to the net position vis-à-vis all other clearing members.[2]

The network centre: CCP risks and risk management

The concentration of trading exposures in CCPs involves specific risks. One set of risks relates to the functioning of the CCP itself, including those risks stemming from the management of its activities (general business and operational risk). Another set arises from the possibility that a participant is unable to meet its trading obligations. This may give rise to liquidity risk, if the CCP has to advance payments that a participant cannot make, and to counterparty credit risk, if the participant is unable to cover losses on its positions because of its default.

[2] For example, as shown in the left-hand panel of Graph 1, participant E has bilateral exposures to participant A equal to +25, to B equal to +20 (60 – 40 = +20), and to C equal to –45. After multilateral netting, participant E's exposure to the CCP is zero.

To mitigate the risks resulting from a participant's default, a CCP marks positions to market and requires participants to settle losses and profits at least once a day by calling or paying "variation margins" (and in this way it runs regularly matched books). Should a participant be unable to meet its obligations, a CCP has a clear process in place either to transfer the participant's positions to other participants or to liquidate them ("close out"). The segregation of a participant's proprietary positions from those of its clients ("indirect CCP participants") makes it possible to transfer clients' positions to other participants ("portability").

If a clearing participant defaults, a CCP typically has three lines of defence to cover the resulting losses: (i) margins (initial and variation);[3] (ii) default fund contributions; and (iii) the CCP's own financial resources (capital). The size of the aggregate margin fluctuates on a day-to-day basis depending on prices and participants' positions. In contrast, the contributions to the default fund are defined less frequently, typically via stress testing. These amounts are therefore more stable and less volatile, but at the same time less risk-sensitive, than margin payments.

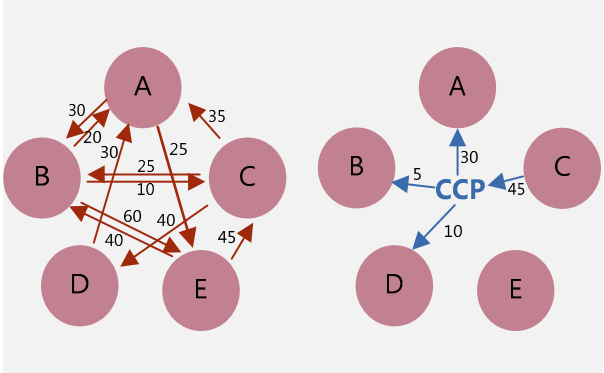
The sequence of resources to be used in the case of losses follows a predefined "waterfall" (Graph 1, right-hand panel). It typically starts from the participant's own contributions: first the margins, then the default fund. Then, if necessary, the CCP turns to others' resources: the contributions to the mutualised default fund and the CCP's own capital, with a sequence that depends on each CCP's internal rules. In the extreme case that prefunded resources are not sufficient to cover losses, the CCP calls on pre-agreed unfunded contributions. These resources are ring-fenced in order to keep them available even if contributors default.

The design of these three lines of defence has important implications for the functioning of a financial system in which central clearing is prominent. In particular, their design affects the incentives of clearing participants and the CCP itself. The mix of the provision for own exposures through margin payments, the mutualisation of losses among participants through default fund contributions and the "skin in the game" of CCP owners is intended to limit moral hazard and reduce asymmetric

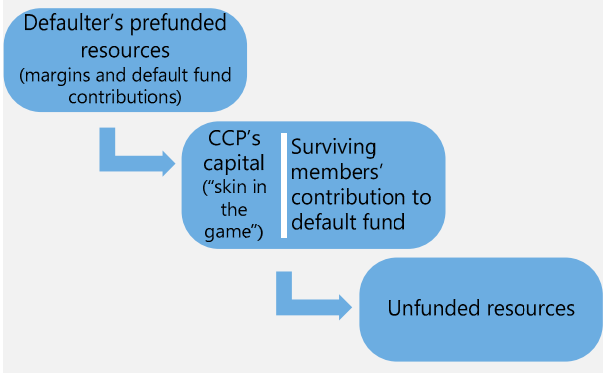
Exposures network and CCP waterfall

Graph 1

From non-centrally cleared to centrally cleared exposures



Waterfall of resources in the event of a CCP participant's inability to meet trading obligations



[3] Margins include both initial margins – a fixed, predetermined amount of cash or non-cash collateral posted to the CCP by each party in a transaction – and variation margins, which are payments arising as a result of changes in the value of positions. For an analysis of the impact of clearing on collateral requirements, see Duffie and Zhu (2011), Heller and Vause (2012) and Duffie et al (2015).

information problems.[4] At the same time, such measures create linkages between CCPs and banks (and other financial institutions) that go beyond the simple trading network described in the left-hand panel of Graph 1.

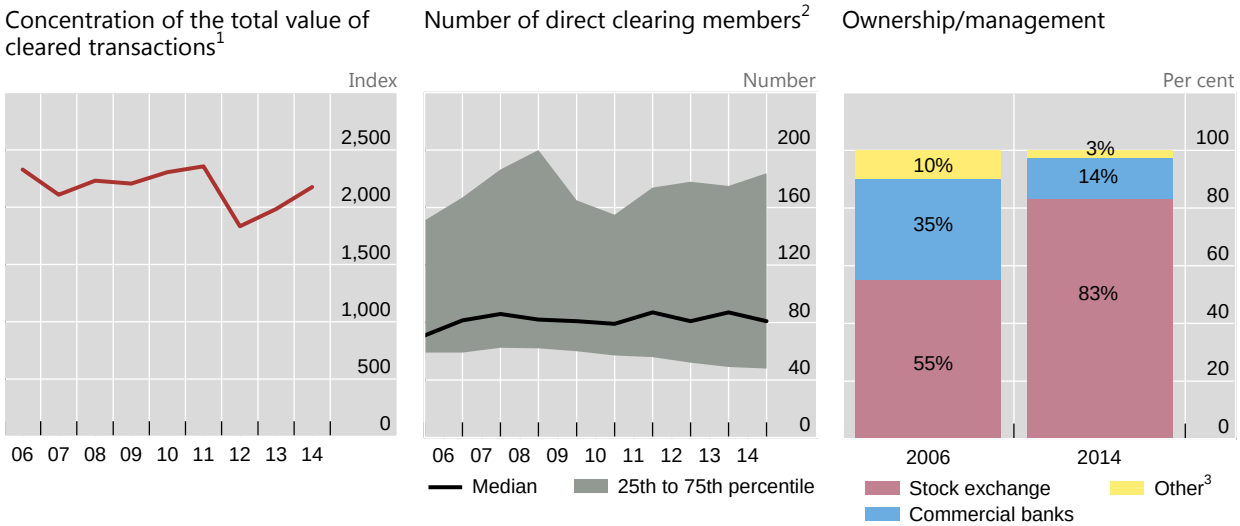
The network periphery: linkages with CCPs and associated risks

The links between CCPs and financial institutions take different forms, and create several layers of interconnection.

First, at the most basic level, banks are CCP participants, namely users of central clearing services. Every systemically important bank participates in many CCPs, often in multiple jurisdictions. The overall number of direct participants in CCPs has been quite stable in recent years, although it varies considerably between CCPs (Graph 2, centre panel). The large CCPs that clear most of the available over-the-counter (OTC) derivatives have a relatively small number of clearing members, and fewer still that offer clearing to their clients. However, many small domestic CCPs, especially those operating in Asia, have a large number of direct participants. Broad direct access to CCPs facilitates expansion of central clearing and increases the scope for multilateral netting, but at the same time it multiplies interlinkages with banks. A larger number of firms with access may also mean a wider variation in the creditworthiness of a CCP's participants, increasing its exposure to a sudden deterioration in credit quality in a particular segment of the financial system.

Second, banks are key providers of financial resources to CCPs. As direct clearing participants, they supply default fund contributions. Banks also supply

CCPs: a concentrated industry with various links to banks — Graph 2



[1] Herfindahl index, ie the sum of the squares of the market shares of firms active in the industry. An industry consisting of a single firm has a Herfindahl index of 10,000, while an industry in which each of five firms has a 20% share has a Herfindahl index of 2,000. Index calculated using information from the CPMI Red Book statistics. [2] The solid line represents the median value of participants over the distribution. The shaded area delimits the second and third quartile of the distribution. [3] For example, another CCP, a clearing house or a non-bank financial firm

Sources: CPMI, *Statistics on payment, clearing and settlement systems in the CPMI countries* (Red Book); BIS calculations.

[4] CCPs' partial rather than full insurance against counterparty risk limits moral hazard and adverse selection (Biais et al (2012)).

liquidity lines or other backup facilities. If the ones that have committed to provide liquidity lines fail to do so, CCPs may be exposed to liquidity risk.

Third, banks are key providers of financial services to CCPs. For instance, CCPs typically rely on major banks to manage cash margins (mostly in repo transactions), and a CCP might need a custodian bank (or alternatively an operator of securities settlement systems) in order to deposit financial instruments posted as margin or as default fund contributions.

Finally, banks may also be the owners of CCPs. At the end of 2014, 14% of CCPs were directly owned or managed by commercial banks (Graph 2, right-hand panel). The ownership structures could affect risk behaviour. In the case of a *user-owned CCP*, the main objective for the owners is to reduce the cost for users and to maintain a homogeneous and high-quality participation base. Conversely, the main objective for a *non-user-owned CCP* is to maximise profits and increase participation (CPSS (2010)).

Recent trends in central clearing

Since the 2009 Pittsburgh Summit declaration, central clearing has grown significantly. In 2014, more than half of the notional amount outstanding of derivatives transactions was centrally cleared, almost double the percentage in 2009 (Graph 3, left-hand panel). This trend is likely to continue in the near future, boosted by the implementation of further clearing obligations in the European Union (Rahman (2015)).

There seems to be ample room for the further expansion of central clearing. A recent study by the FSB (2015) finds that, for most of the plain vanilla interest rate contracts, the amount centrally cleared (Graph 3, centre panel, red bars) could increase significantly in the next few years (blue bars). Even larger increases could potentially take place for other contracts such as credit default swaps, for which the centrally cleared volume is currently quite low.

Economies of scale create incentives for concentration and vertical integration in central clearing. The scope for netting increases with the range of cleared instruments and markets, and high fixed costs also favour larger CCPs. At the end of 2014, two CCPs accounted for nearly 60% of the total volume of cleared transactions reported to the Red Book,[5] a publication that compiles statistics covering centrally cleared transactions reported by members of the Committee on Payments and Market Infrastructures (CPMI).[6] And the Herfindahl index suggests a constant high degree of concentration (Graph 2, left-hand panel). CCPs are typically part of groups that include exchange and trading platforms and, in certain instances, central security depositories. In 83% of the cases, CCPs are directly owned or managed by the company operating the stock exchange (Graph 2, right-hand panel).

The market for central clearing is also more horizontally integrated than pre-crisis, in terms of both products and geographical reach. At the end of 2014, almost

[5] CPMI, Statistics on payment, clearing and settlement systems in the CPMI countries, www.bis.org/cpmi/publ/d135.htm, September 2015.

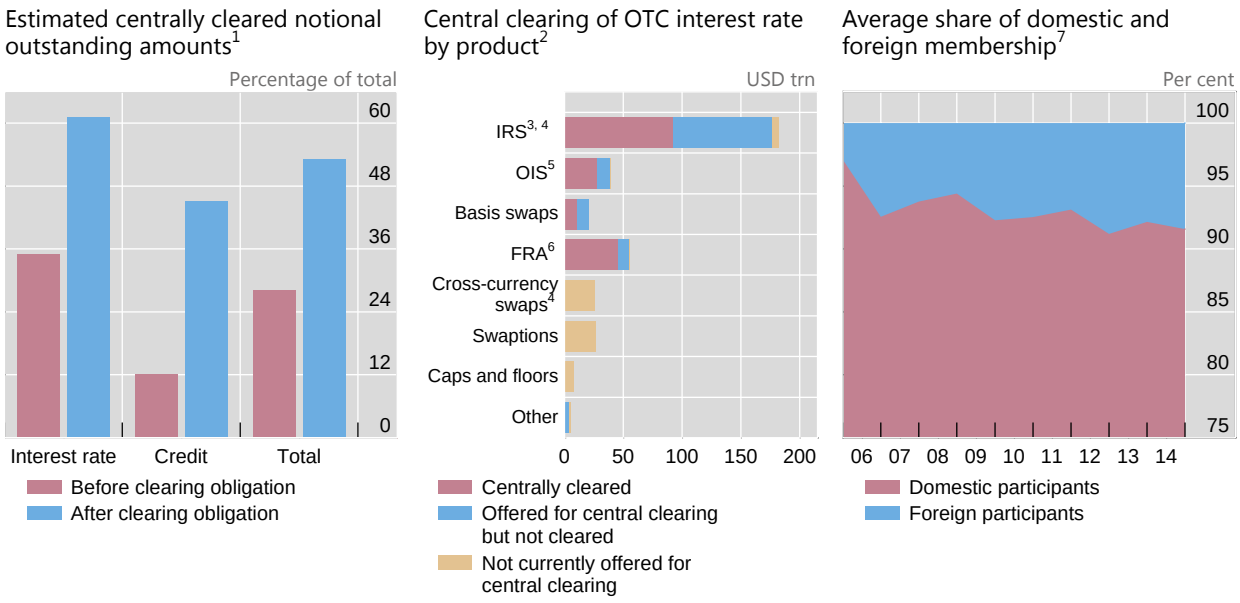
[6] www.bis.org/cpmi/membership.htm.

40% of CCPs simultaneously offered clearing services for derivatives, cash and repo markets (Table 1) and average foreign participation reached 8% (Graph 3, right-hand panel). These percentages were, respectively, 20% and 4% in 2006.[7] Horizontal expansion brings economies of scale and scope and, by providing some cross-product netting benefits, could reduce the need for collateral. Duffie et al (2015) find that, while mandatory central clearing increases collateral needs by about 30% as compared with the pre-reform case, it reduces collateral needs when CCPs offer more than one product in multiple markets.

Another evolving feature of central clearing is that, while the number of direct participants has remained quite stable, indirect participation in CCPs is growing (Cœuré (2014)). Because of fixed CCP participation costs, many small banks or financial intermediaries with limited activity in centrally cleared markets typically choose indirect access to comply with clearing obligations. In this tiered participation structure, the small number of direct clearing members that offer client clearing play an especially important role: non-clearing member firms in many cases

Evolution of the CCP industry

Graph 3



[1] Data are based on a June 2012 survey of participants representing around 75% of the global activity in the OTC derivatives market (FSB (2013, Appendix II)). Figures reflect market participants' expectations and are broadly confirmed by data for credit and interest rate derivatives collected in 2014 (FSB (2015)). [2] Outstanding notional amounts, as at end-June 2015; estimates are based on public trade repository information and present central clearing offerings of Asigna, ASX, BM&F BOVESPA, CCIL, CME, Eurex Clearing, HKEx, JSCC, KDPW, KRX, LCH.Clearnet, Nasdaq OMX, Moscow Exchange, SCH and SGX. Amounts cleared include transactions subject to mandatory clearing requirements in certain jurisdictions and those cleared voluntarily. Adjusted for double-counting of dealers' centrally cleared trades; amounts reported to DTCC by 16 large dealers. [3] Interest rate swaps. [4] Includes vanilla (> 98% of total) and exotic (< 2% of total) products as classified by DTCC. [5] Overnight indexed swaps. [6] Forward rate agreements. [7] Average share of foreign participation, per CCP. This excludes CCPs that have not reported details of foreign participation or that have reported inconsistent breakdowns of participants into domestic and foreign.

Sources: Cœuré (2014); FSB (2013, 2015); DTCC; various CCPs; CPMI Red Book statistics; FSB calculations; BIS calculations.

[7] A large proportion of OTC derivatives activity takes place outside the home jurisdiction of the CCP clearing the relevant market, and involves at least one overseas participant. Rahman (2015) shows that 60% of initial margin requirements at UK CCPs was accounted for by clearing members not located in the United Kingdom themselves, with the vast majority based outside the European Economic Area.

Product types cleared by CCPs

Percentage of CCPs offering clearing for a specific product type in 2014, by jurisdiction[1] Table 1

	Securities	Derivatives	Repos	All three[2]
Advanced economies	63.6	72.7	31.8	27.3
Europe	60.0	80.0	40.0	40.0
North America	50.0	50.0	25.0	0.0
Asia-Pacific	75.0	75.0	25.0	25.0
Emerging market economies	84.6	76.9	61.5	53.8
Asia	100.0	87.5	87.5	25.0
Latin America	60.0	60.0	20.0	87.5
Total	**71.4**	**74.3**	**42.9**	**37.2**

[1] CPMI Red Book statistics do not include some major CCPs that are not overseen by CPMI members. [2] Percentage of CCPs simultaneously offering clearing services for derivatives, cash (equity and fixed income) and repo markets.

Sources: CPMI, *Statistics on payment, clearing and settlement systems in the CPMI countries* (Red Book); authors' calculations.

are required to clear their OTC derivatives transactions centrally and otherwise would not be able to trade in those markets.

CCPs and systemic risk

The push towards central clearing is motivated by the experience of the Great Financial Crisis. After the Lehman Brothers default in September 2008, central counterparties continued to function smoothly despite abnormally high market volatility (Cecchetti et al (2009)). Within a short time frame, the positions of Lehman clients were either transferred to other, non-defaulting, CCP participants or liquidated. Moreover, preliminary econometric evidence (Box 1) suggests that banks operating in systems where a larger portion of transactions were cleared by CCPs were less likely to suffer a significant deterioration of solvency when the crisis hit.

Over the past few years, however, the financial system has evolved in ways that may affect the impact of central clearing on systemic risk. For example, better bank capitalisation is likely to have reduced default and counterparty credit risk. Greater reliance on collateral in wholesale financial markets may have altered liquidity dynamics in the financial system. And, finally, as described above, central clearing itself has evolved. This section discusses the relationship between central clearing and systemic risk in the light of these trends.

Propagation mechanisms

Clearing though a CCP creates a centralised network of trading exposures. Conceptually, this may influence systemic risk in two main ways. First, central clearing may affect the propagation of an (exogenous) shock through domino effects: the losses deriving from a counterparty default could trigger further defaults and spread the shock through the system. Second, central clearing, and the

CCPs and bank risk

In this box, we present evidence on how the probability of a bank becoming risky during the Great Financial Crisis was affected by the characteristics of the CCPs with which it was operating. Using a sample of 583 banks,① we first create a binary variable ("risky") that takes the value of 1 if the bank is in the top quartile of the distribution in terms of changes in its one-year expected default probability in the Q2 2007–Q2 2009 period, and 0 otherwise.

A bank's probability of belonging to the riskier group is then modelled as a function of a combination of factors, all measured pre-crisis. We relate this likelihood to a set of country-level macro variables (*Y*) and bank-specific characteristics (*X*). The vector *Y* includes: the number of consecutive quarters in which the real interest rate remained below the estimated natural rate as a measure of monetary policy looseness (*LOOSE*),② the annual growth rate in nominal GDP (*GDPN*) and quarterly changes in housing and stock market returns de-meaned from their long-run average (Δ*HP* and Δ*SM*). The vector *X* includes four bank-specific characteristics that could influence bank risk-taking: liquid assets over total assets (*LIQ*), the Tier 1 capital-to-assets ratio (*CAP*), securitisation activity (*SEC*) and excessive loan growth (*EXLEN*D).③

To identify the impact of central clearing, we include the value of CCPs' transactions divided by nominal GDP (*CCPT*)④ and interaction terms that multiply *CCPT* by a vector (*Z*) containing two variables related to CCP characteristics: (i) the share of transactions conducted – in a given country – through a CCP owned by a bank; and (ii) the share of CCPs' overall activity that was in derivative products.

The baseline empirical model is given by the following probit equation:

$$P\left[risky_{ik}=1\middle|X\right]=\Phi(Y'\beta+X'\gamma+\alpha CCPT+CCPT*Z'\lambda)$$

where *P* is the probability, Φ is the standard cumulative normal probability distribution, *Y* is a vector of regressors that include the macro variables of country *k* where bank *i* has its head office and *X* is a vector of bank-specific characteristics of the same bank *i* over the five years prior to the crisis (Q2 2002–Q2 2007). CCPs' transactions and characteristics are measured in 2007. This approach limits endogeneity problems by taking most of the right-hand variables from the pre-crisis period. The probit model is estimated by maximum likelihood.

Consistent with the existence of an "insulation" effect at the outbreak of the crisis, the CCP transaction variable has a negative coefficient (Table A). This suggests that banks operating in a system where a larger portion of transactions were cleared by CCPs were less likely to suffer a significant deterioration in solvency when the crisis broke out. The coefficients on the interaction terms between *CCPT* and CCP-specific characteristics indicate that banks operating in systems in which the CCP was owned by a bank became riskier.⑤ The findings further suggest that, if the CCPs operated in derivatives, the insulation effect was lower.

The results also show that liquid and well capitalised banks suffered less erosion of their solvency during the 2007–09 financial crisis. This is in line with Beltratti and Stulz (2009) and Detragiache and Merrouche (2010), who find that banks with more Tier 1 capital and more liquid assets performed better in the initial stages of the crisis. In line with Jiménez et al (2014) and Altunbas et al (2014), we find that a "too accommodative" monetary policy led to additional risk-taking by banks prior to the crisis.

We estimated the same model accounting for the initial level of the bank's expected default frequency (EDF) prior to the crisis and a bank competition variable, *COMP* (Boyd and De Nicolò (2005), Matutes and Vives (2000), Maddaloni and Peydró (2011)). However, the results remain unchanged (columns II and III).

① The sample includes banks headquartered in the European Union (EU 15) and the United States. For a full description of the characteristics of the database and variable definitions, see Altunbas et al (2012, 2014). ② This measure considers the number of consecutive quarters in which the difference between the real short-term and "natural" interest rate, calculated using the Hodrick-Prescott filter, is negative. Similar results are obtained using different measures of the Taylor rule. For more details, see Altunbas et al (2014). ③ We compute a bank-specific measure for credit expansion by subtracting from each bank's lending growth the average expansion in bank lending for the whole banking industry in that country. ④ Data are taken from the CPMI Red Book and are corrected for the number of domestic participants. In particular, to compute a proxy for the volume of cleared products in a given banking industry, we have multiplied the total volume of the CCP operating in that country by the ratio of domestic participants (domestic participants/total participants). For some countries not reporting to the Red Book, the volume cleared by the national banking industry has been proxied by the total volume of the foreign CCPs mostly used by the domestic banks to clear outright transactions. ⑤ In the case of a *user-owned CCP* (ie a bank that owns a CCP), the main objective for the owners is to lower the margins (costs) for the participants and to maintain a

Regression results

Table A

Dependent variable: $P(risky_{ik} = 1)$		(I) Baseline quotation	(II) Competition	(III) Initial EDF level effect
CCP transactions	CCP transactions over GDP	–0.0169*** (0.0061)	–0.0322** (0.0163)	–0.0379** (0.0170)
CCP transactions x *Share of CCP owned by a bank*	Additional effect for CCPs owned by a bank	0.0116* (0.0061)	0.0245* (0.0145)	0.0299** (0.0148)
CCP transactions x *Share of derivative products*	Additional effects for CCPs *clearing derivative products*	0.0160** (0.0068)	0.0280* (0.0143)	0.0338** (0.0146)
LOOSE	Number of consecutive quarters with interest rate below the benchmark	0.0512** (0.0242)	0.0484** (0.0209)	0.0527** (0.0233)
ΔHP	Quarterly changes in the housing price index (de-meaned)	–0.0172 (0.0603)	–0.1473 (0.1183)	–0.1401 (0.1154)
ΔSM	Quarterly changes in the stock price index (de-meaned)	0.3394*** (0.0720)	0.3905*** (0.0848)	0.4168*** (0.0863)
ΔGDPN	Changes in nominal *GDP*	–0.5379*** (0.1638)	–0.5031*** (0.1433)	–0.5078*** (0.1665)
LIQ	Liquidity-to-total assets x 100	–0.0039** (0.0016)	–0.0040** (0.0016)	–0.0042*** (0.0016)
CAP	Capital-to-total-assets ratio x 100	–0.0127** (0.0056)	–0.0124** (0.0055)	–0.0128** (0.0051)
SEC	Securitised loans over total lending	0.0487** (0.0227)	0.0509** (0.0226)	0.0591** (0.0246)
EXLEND	Excessive credit expansion (de-meaned)	0.0380*** (0.0064)	0.0389*** (0.0066)	0.0396*** (0.0063)
COMP	Competition index		–0.0232 (0.0182)	–0.0239 (0.0187)
EDF_LEVEL	Expected default frequency (one year ahead) in Q2 2007			0.0828*** (0.0278)
Number of observations		583	583	583
Pseudo R^2		0.129	0.132	0.148
Percentage correctly classified		76.8	76.2	76.3
Hosmer-Lemeshow test		596.8	578.6	596.1
Hosmer-Lemeshow test p-value		0.229	0.404	0.209

The equation models the probability of a bank *i* with head office in country *k* becoming risky during the crisis (ie of being in the last quartile of the distribution). The table reports the marginal effects. Robust standard errors clustered at bank level in parentheses. All explanatory variables except *LOOSE* and CCP indicators are expressed as average values over the period Q2 2002–Q2 2007. */**/*** represents significance levels of 10/5/1%.

Source: Authors' calculations.

homogenous, high-quality participation base because more user capital is at risk in the event of a participant's default. In this case, the stability of the CCP is more strictly dependent on the financial resources (including capital) of the users (ie banks), and the fragility of this configuration could increase during a global financial crisis when banks too are directly hit.

associated risk management practices, may affect the likelihood and impact of endogenous "run and deleveraging" mechanisms even in the absence of an initial default. While, in practice, both mechanisms may interact, considering them separately helps us to understand possible changes in the nature of systemic risk.

Domino effects

Whether, and under what conditions, central clearing absorbs or spreads losses depends on the size of the shock and on CCPs' financial resources. As long as the negative shocks are sufficiently small, a more densely connected financial network enhances financial stability (Acemoğlu et al (2015)): a properly resourced CCP would act as shock absorber. Ideally, losses would be fully covered with the defaulter's own prefunded resources, leaving other clearing members unaffected. However, once losses exceed the CCP's prefunded resources, the same features that make a financial system more resilient may become sources of instability. As a consequence, financial networks may be "robust-yet-fragile" (Haldane (2009)).

For example, the size of a shock would matter for systemic risk to the extent that defaults inflict a liquidity shortage on a CCP. If one or more clearing members fail to meet their clearing obligations, the CCP itself must provide liquidity in order to make timely payments to the original trading counterparties. The CCP's own liquid assets and backup liquidity lines made available by banks may provide effective insurance against liquidity shocks resulting from the difficulties of one or a few clearing members. But they can hardly provide protection in the event of a systemic shock, when a large number of clearing participants – potentially including the providers of liquidity lines – become liquidity-constrained, thereby triggering domino effects.

More generally, the activation of a CCP's unfunded liquidity arrangements or other recovery instruments may impose financial strains on clearing participants. The resulting unexpected liquidity demands could impose stress on other clearing members and, in an extreme case, trigger a cascade of defaults. Heath et al (2015) simulate the distribution of losses if a CCP limits or stops paying variation margin gains because prefunded resources have been exhausted. While the authors find little evidence of contagion, the spillover of stress depends on a number of factors, including the distribution and direction of positions among participants, the magnitude of price changes across product classes and their co-movement, and the overall financial position of participants at the time of the shock.

Ultimately, if the (exogenous) shock is so big that losses exceed the CCP's prefunded and callable resources, a CCP could be forced into resolution and fail. Such a failure may have system-wide effects: clearing participants might find it difficult to manage positions if a CCP fails; and all clearing participants would have to find alternative ways of closing trades, at a time when there might be heightened uncertainty about the value of the underlying exposures and the associated market and counterparty risk.

From an international perspective, risks can be correlated across CCPs in several jurisdictions. Given the overlapping memberships of many CCPs, liquidity problems at one CCP may well coincide with similar issues at others. A participant bank unable to meet obligations – possibly defaulting and entering resolution – could be a global player active in many centrally cleared financial markets and could therefore be a participant in several CCPs. In the extreme case, the default of common clearing members could threaten the resilience of several CCPs at the

same time. This, in turn, would impose strains on the surviving clearing members, propagating systemic risk.

Deleveraging and runs

A centralised structure of trading exposures may also affect the likelihood and nature of endogenous shocks in the form of forced deleveraging, fire sales and runs. The critical issue in this regard is the interaction between CCPs' risk management practices and those of clearing participants. On the one hand, if stringent risk management by a CCP replaces lax counterparty risk management in bilateral markets, central clearing would tend to reduce the risk of such procyclical behaviour. On the other hand, an unexpected tightening of CCP risk management could still lead to liquidity pressures on participants that could ultimately trigger fire sales and a self-reinforcing deleveraging (Morris and Shin (2008)).

One key determinant of possible procyclicality is the margining practices of CCPs (see eg Borio (2004)). Brunnermeier and Pedersen (2009) show that margins can be destabilising if lenders raise them when price volatility is expected to increase. A request for additional resources from a CCP in difficult times could put pressure on participant banks and indirectly affect the rest of the system. Even though regulation already requires CCP margins not to be "overly" procyclical, margin models based on value-at-risk methodologies could still understate the risk in calm conditions and amplify them in times of market stress (Abruzzo and Park (2014), Murphy et al (2014)).

A large decline in the market value of collateral could also trigger procyclical behaviour. A collateral squeeze, particularly if accompanied by high volatility in collateral markets, would reduce the value of initial margins posted to the CCP (also in a non-linear fashion) and trigger requests to members to replenish this value by posting additional collateral. This could force members to deleverage and potentially lead to fire sales precisely when the rest of the system is under stress.[8] The risk of such liquidity strains and deleveraging could be anticipated by the market, triggering "runs" on participants perceived as vulnerable and stoking expectations that become self-fulfilling (Diamond and Dybvig (1983)).

These mechanisms place a particular onus on ensuring that CCP risk management is robust to shifts in the prices of cleared instruments. A sudden increase in risk premia or an abrupt price realignment within specific asset classes could invalidate the assumptions underlying CCPs' risk management models and procedures. For example, the assumptions used in CCPs' risk management models about correlations among different portfolio exposures might break down under stress. In the same vein, an unexpected "freezing" of trading activity in some financial markets could make it impossible for the CCP to fulfil default management procedures, such as the sale of non-cash collateral to cover losses stemming from a participant's inability to meet its obligations.[9]

[8] This contagion process could be amplified by the fact that initial margin requirements are based (largely) on market risk indicators, and so may be expected to rise in times of market stress. Liquidity risk might also play a role, especially when there is a need to liquidate large volumes of offsetting positions.

[9] Even in the absence of market distress, CCPs' risk management measures could affect the underlying financial markets. For example, the cost of funding could rise following a margin increase on repo transactions (Miglietta et al (2015)). Also, prices could fall and market volatility rise

Post-crisis trends and systemic risk assessments

The discussion of the general mechanisms above suggests that the impact of central clearing on systemic risk depends on a range of factors. These include the financial strength of clearing participants and CCPs, the robustness of CCP risk management and the interaction of CCP margining and collateral practices with liquidity and volatility conditions in broader markets. Assessing the significance of these factors with any precision would require a thorough understanding of existing financial linkages and exposure between CCPs and clearing participants, and within the financial system more generally. Without such information, it is only possible to make general, often ambiguous, inferences about how recent trends may have influenced systemic risk.

Consider the risk of domino effects (or deleveraging pressures) because of defaults. On the one hand, banks' capital positions have strengthened significantly since the Great Financial Crisis. Basel III has introduced more stringent capital regulation, which is reflected in the increase in bank capital ratios (BCBS (2011)). Moreover, capital surcharges for global systemically important banks (G-SIBs) take into account systemic risks resulting from interconnectedness. The Basel III capital framework has also strengthened banks' capital requirements in relation to their CCP exposures (Box 2). And, as a greater share of transactions is cleared through CCPs, multilateral netting reduces exposure to counterparty risk.

By the same token, central clearing may increase scope for taking on leveraged positions by freeing up collateral. The net effect of central clearing on collateral demand depends on two developments that seem to work in opposite directions. On the one hand, the migration of previously uncollateralised bilateral positions to CCPs increases the need for collateral. Indeed, CGFS (2013) estimates that the shift of bilateral contracts to CCPs will increase collateral demands on aggregate by up to $1 trillion. On the other hand, multilateral netting reduces collateral needs. Heller and Vause (2012) estimate that a CCP that cleared all asset classes would require only 74% of the initial margin collateral that would be demanded by separate CCPs for each asset class.[10] The growing horizontal integration of CCPs, as discussed in the previous section, is likely to have added to these effects.

Questions also remain as to what combination of CCP financial resources and bank capital would provide the most effective protection against systemic risk. A trade-off exists between CCP prefunded resources, which represent self-insurance for the CCP and a cost for clearing members, and the reliance on unfunded liquidity provisions, which could put providers (whether participants or not) under pressure. Moreover, the capital of CCPs tends to be quite modest compared with their other prefunded resources, their gross exposures and the scale of their potential losses. The size of this capital cushion within the waterfall is typically a percentage of the

as an effect of the CCPs' management of the defaulter's position, which is likely to involve closing out the position and selling the defaulter's non-cash margins to cover losses (Wendt (2015)).

[10] Lewandowska (2015) finds that, in the case of CCPs that clear all asset classes and have a high number of direct clearing members and no indirect ones, (i) central clearing maximises netting efficiency and thereby reduces replacement cost risk, which represents the cost for the clearing members if they are forced to replace the contract with a defaulting party at the current market value; and (ii) central clearing mitigates the concentration of liquidation costs, improving the loss allocation across the CCP's participants. The lower the concentration of liquidation costs, the more widely distributed are the replacement costs (the cost of replacing the contracts of a defaulting member), reducing the burden on any single counterparty.

Box 2

Regulatory responses to CCP-related risks

In recent years, regulatory efforts to address the risks connected to central clearing have proceeded along two main lines: (i) strengthening the resilience of CCPs; and (ii) strengthening banks' capital requirements in relation to their CCP exposures. Work to further strengthen resilience of CCPs and banks' CCP exposures is still ongoing.①

Strengthening the resilience of CCPs

The regulatory approach to strengthening the resilience of individual CCPs reflects three features of central clearing.

The first is the critical role of sound risk management. This explains why regulation in recent years has increased **the requirements for sound CCP risk management practices**, namely through the Principles for Financial Market Infrastructures (PFMI) (CPSS-IOSCO (2012a)). The bar has been raised on how CCPs manage credit and liquidity risks – for example, by requiring CCPs that are exposed to particularly high risks (ie when operating in multiple jurisdictions or clearing complex products) to have financial resources to cover losses from the simultaneous default of at least the two largest participants. More demanding standards on transparency and the management of operational and general business risks have further strengthened CCPs (CPSS-IOSCO (2012b)).

The second feature that regulation has addressed is the importance of continuity in the provision of clearing services for systemic stability and – if this is not possible – of an orderly resolution of CCPs. Because even sound risk management may not prevent a CCP's default in extreme circumstances, emphasis has been placed on the need to develop **robust recovery and resolution regimes for CCPs** (CPSS-IOSCO (2012a), CPMI-IOSCO (2014), FSB (2014a)). The challenges in this respect are to define tools that take into account CCPs' specific characteristics (business model, liability structure) and to assess the extent to which tools that are already built into CCPs' risk management (eg bail-in tools) can also serve as recovery tools.

The third feature is the diversity of CCPs' organisational structures, functions and designs. Because of this, standard-setting bodies have introduced **broad international principles rather than detailed quantitative requirements**, supported by strong CCP governance and oversight arrangements, also at cross-border level. The CPMI and IOSCO are currently assessing the implementation of these standards across jurisdictions, such as the compliance and consistency outcomes of existing CCP stress testing, margin frameworks, prefunded loss absorption capacities and recovery planning.

Enhancing capitalisation of banks' exposures to CCPs

The bar has also been raised on how individual banks are required to cope with CCP-related risks. In particular, **minimum capital requirements** have been introduced – as part of the Basel III framework – to cover bank exposures to CCPs, which include both trade exposures and default fund contributions.② The same items are included in the denominator of the Basel III leverage ratio.③ Liquidity commitments that banks provide to CCPs are included among the obligations that need to be covered by liquid assets through the Liquidity Coverage Ratio (LCR).

Margin requirements for OTC derivatives (BCBS-IOSCO (2015)) **and minimum haircuts on securities financing transactions** such as repos (FSB (2014b)) seek to introduce positive margins for non-centrally cleared transactions in order to create or to preserve incentives for the banks to shift to central clearing.

① Together with the CPMI, IOSCO and the BCBS, the FSB is pursuing a coordinated work plan in four areas: (i) CCPs' resilience; (ii) CCPs' recovery; (iii) CCPs' resolution; and (iv) achieving a better understanding of the linkages between banks and CCPs. ② Banks' trade exposures to qualifying CCPs are risk-weighted by 2% (BCBS (2014a)). ③ The latter also includes off-balance sheet items converted using the standardised risk-weight factors subject to a floor of 10%. To avoid double-counting of exposures, a clearing member's trade exposures to qualifying central counterparties associated with client-cleared derivatives transactions may be excluded when the clearing member does not guarantee the performance of a qualifying central counterparty (QCCP) to its clients (BCBS (2014b)).

total capital and is uncorrelated with the risks incurred by the CCP should one or more participants fail to meet their trading obligations. A recent study by

Albuquerque et al (2015) indicates that the capital held by the five biggest CCPs in swaps is equivalent to just 2.6% of the sum of margin requirements and the default fund.[11]

The competitive dynamics in the CCP industry may work against a strengthening of capital buffers. Most CCPs are for-profit entities – typically vertically integrated with other financial market infrastructures, such as exchanges – that are strongly motivated to generate revenues by expanding their product offering and capturing market share. However, new products could bring incremental risk, which clearing members may end up bearing if the CCP does not increase its capital commensurately.

Turning to the risk of endogenous deleveraging, the assessment of the impact of post-crisis trends is similarly ambiguous. The fact that an increasing share of trading positions is subject to daily variation margin payments has arguably reduced the risk that counterparties are confronted with sudden big losses, as was for instance the case with AIG. However, the shift towards the centralised risk management of trading positions, including collateralisation and high-frequency margining, is also likely to affect market-wide liquidity dynamics. For example, extreme price movements in cleared financial instruments could result in large variations in the exposure of clearing members to the CCPs and therefore in the need for some of them to make correspondingly large variation margin payments. Such payments can be large, even if margin requirements remain unchanged. But they may be exacerbated if the CCP increases initial margins and/or tightens collateral standards in the face of unusually large price movements.

The interaction of such sudden and large shifts in collateral flows with the wider financial system is untested. The financial system as a whole has become much more reliant on high-quality collateral, increasing the risk that some market players could become collateral-constrained if risk premia rise sharply across the market. The demands and dispositions of CCPs could lead to big shifts in collateralised markets, adding to risk aversion and increasing pressure to reduce leverage in a procyclical manner. For example, CCPs are now huge players in reverse repo markets. ICE (one of the largest clearers of credit default swap contracts) held some $68 billion in collateral at end-2014, of which approximately $40 billion was in cash (Intercontinental Exchange Inc (2015)). LCH.Clearnet Ltd held comparable sums, amounting to $76 billion and $30 billion, respectively (LCH.Clearnet Group (2015)).

There is a consensus that the first line of defence against procyclical effects from central clearing consists in transparent, sound and robust CCP risk management practices. The CPSS-IOSCO *Principles for financial market infrastructures* (PFMI) have raised the bar for how CCPs manage credit and liquidity risks – for example, by requiring CCPs that are exposed to particularly high risks (ie when systemically important in multiple jurisdictions or when clearing complex products) to have financial resources to cover losses from the simultaneous default of at least the two largest participants (Box 2). Moreover, the PFMI require margin models not to be "overly" procyclical.

[11] Their approach implies an average "skin in the game" contribution for a CCP that trades interest rate swaps of 8.1% over the long term, while a clearing house that trades credit derivatives would contribute 11.4%.

Certain challenges stand in the way of designing and implementing sound CCP risk management. One is that CCPs may underestimate the initial margins for participants who are clearing members in multiple CCPs for the same product. For instance, large internationally active banks may split their positions across several CCPs. Limited information on the total centrally cleared positions of its members in a specific product could induce the CCP to underestimate initial margins needed to appropriately cover liquidity costs in the liquidation process. Since liquidity costs tend to increase in a non-linear way with the size of the portfolio, the simultaneous liquidation of the larger aggregated position will have a market liquidity cost that is higher than one which the individual CCPs may have factored into initial margins (Glasserman et al (2015)).

Moreover, intense competition between CCPs may result in weaker risk management standards. In addition to broadening the range of products that they clear, as mentioned above, CCPs may directly compete via their margin requirements. In fact, Abruzzo and Park (2014) find that differences in margin requirements for futures between two major CCPs are, all things equal, one important variable in explaining margin cuts, implying that margin-setting may reflect competitive pressures.

Conclusions

The shift to central clearing has started to mitigate the risks that emerged in non-centrally cleared markets before and during the Great Financial Crisis. It has reduced financial institutions' exposure to counterparty credit risk shocks through netting, margining and collateralisation. And it has placed the focus on the need for sound risk management in trading markets more generally.

But central clearing may give rise to other forms of systemic risk. In particular, the concentration of the risk management of credit and liquidity risk in the CCP may affect system-wide market price and liquidity dynamics in ways that are not yet understood. A large body of research has analysed the structure and behaviour of financial networks, but lack of data and, much more fundamentally, our incomplete understanding of the post-crisis financial system prevent us from assessing how exactly central clearing might affect systemic risks. The multifaceted linkages between banks and CCPs add to these difficulties. It is possible that CCPs can buffer the system against relatively small shocks, at the risk of potentially amplifying larger ones.

Global standard setters have concentrated on strengthening the resilience of individual CCPs and, more recently, on ensuring the continued provision of clearing services if a CCP goes into recovery or resolution. Future efforts to understand the implications of central clearing for the behaviour of the financial system in normal and stressed conditions should help authorities to consider a stronger macroprudential perspective in the regulation and supervision of financial systems that rely on central clearing.

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Marlene Amstad
marleneamstad@cuhk.edu.cn

Frank Packer
frank.packer@bis.org

Sovereign ratings of advanced and emerging economies after the crisis[1]

The three major credit rating agencies have reassessed sovereign credit risks in the light of the Great Financial Crisis, increasing the transparency of their methodologies. This has resulted in material shifts in the rank-ordering of risks. Simple statistical models explain the lion's share of ratings differentials and capture some, but not all, of the methodological changes. Support is not found for the hypothesis of bias against emerging market economies (EMEs). Some rating agencies other than the big three offer alternative risk rankings that are more favourable to EMEs. However, these tend to be less closely aligned with the rankings provided by market prices and institutional investors.

JEL classification: F34, G24, H63.

In recent years, the sovereign credit ratings of advanced economies (AEs) and emerging market economies (EMEs) have followed different paths. Years of reforms and strengthened macroeconomic frameworks have improved the sovereign credit ratings of most EMEs. During the Great Financial Crisis (GFC) of 2007–09 and the subsequent euro area debt crisis, the sovereign risk profile of many AEs deteriorated markedly. Since mid-2007, the average of the foreign currency sovereign ratings assigned by Moody's Investors Service, Standard & Poor's (S&P) and Fitch Ratings to 28 AEs has declined from AA+ to AA–, or by two full rating notches, while the average of the similar ratings assigned to 68 EMEs has been mostly stable. That said, there is still a considerable difference in credit ratings between the two sets of countries, some convergence notwithstanding (Table 1).

Among the various regions, Europe has borne the brunt of the decline in country risk measures since the crisis, at least according to the major rating agencies. The average rating of advanced European economies has declined by three notches, from AA+ to A+, although this hides significant variation between countries. For instance, Greece was downgraded from A to CCC and Italy from AA– to BBB. European EMEs have not gone unscathed, with mean ratings falling by one notch over the same time period, from BBB to BBB–. By contrast, the average rating of EMEs in Asia-Pacific rose by half a notch over the period, while the average rating of AEs in that region was down by just a fifth of a notch. In the Americas too, average ratings were up slightly for EMEs, and down by a fifth of a notch for AEs.

[1] 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 Jimmy Shek for his invaluable research assistance.

Movements in sovereign credit ratings, 2007–15

Table 1

		Number of countries	Average rating		Notch change,[1] 2007–15
			Mid-2007	October 2015	
Overall	AE	28	AA+	AA–	–2.1
	EME	69	BBB–	BB+	–0.2
Asia-Pacific	AE	5	AA+	AA+	–0.2
	EME	12	BBB–	BBB	0.6
Americas	AE	2	AAA	AAA	–0.2
	EME	20	BB	BB	0.2
Europe	AE	20	AA+	A+	–2.9
	EME	20	BBB	BBB–	–0.9
Sub-Saharan Africa	EME	8	BB	BB	–0.3
Middle East and North Africa	AE	1	A–	A+	1.3
	EME	9	BBB+	BBB	–0.5

Foreign currency ratings; the average of Moody's, Standard & Poor's and Fitch; the means of these averages are taken across subsamples. Numerical values for ratings are attached to ratings as follows: Ca/CC = 1, Caa3/CCC– = 2, Caa2/CCC = 3, Caa1/CCC+= 4, B3/B– = 5 and so on up to Aaa/AAA = 20. The ratings symbols of S&P and Fitch – eg BBB+ as opposed to Baa1 – are used to communicate results throughout the paper.

[1] A notch is the difference between A and A–, A– and BBB+ etc.

Sources: Bloomberg; BIS calculations.

While these rating adjustments largely reflect fiscal and macroeconomic developments, credit ratings have also changed because of evolving methodologies and approaches to the measurement of sovereign credit risk. The rating agencies now rely more on quantitative inputs than before. At the same time, they now place more emphasis on the implications for sovereign risk of monetary policy regimes, currency internationalisation, event risk and economic growth.

Our article is, to our knowledge, the first to examine whether the post-crisis revisions to sovereign rating methodologies are reflected in estimated rating models. We find that some variables have gained in significance, as might be expected, but we also find that a simple linear model fits less well than before, which may echo the increased dispersion of ratings following the crisis. At the same time, we find no quantitative support for the view that EME sovereigns are rated more severely than AE sovereigns by the major agencies, once other determinants of country risk are taken into account.

In the first section of this special feature, we review the post-crisis changes in sovereign rating methodologies. In the second, we report the results of linear regression models for ratings before and after the crisis. The third section compares major agency ratings with other metrics for sovereign risk, including the ratings of other agencies and market spreads. The fourth section concludes.

Rating methodologies and their post-crisis changes

What are sovereign ratings?

Sovereign ratings are opinions about the creditworthiness of sovereign borrowers that indicate the *relative* likelihood of default on their outstanding debt obligations.[2] Specifically, the major agencies often highlight that their ratings reflect the creditworthiness of a rated entity relative to that of other rated entities rather than vis-à-vis an absolute level of default risk. That said, the major agencies also document the (evolving) correspondence of their ratings to default probabilities.

The major rating agencies commonly limit their time horizon to between two and three years. Ratings are intended to reflect creditworthiness "through the cycle": perceived vulnerability to cyclical downturns, but not the current position in the cycle, should influence a rating (Kiff et al (2012)).

Sovereign ratings, like the ratings on other credits, involve the assessment of both the *ability* and the *willingness* to pay. As a result, qualitative factors related to institutional strength and the rule of law assume greater importance than they otherwise might. There can also be path dependence in willingness to pay: countries may be wary of the reputational cost of default (Eaton and Gersovitz (1981)).

Thus, it comes as little surprise that rating agencies look at a very large number of indicators when assessing a sovereign's credit quality. These include measures of fiscal strength (such as public debt and interest cost burdens), economic strength (per capita GDP, output growth and inflation), institutional strength (governance, the rule of law and corruption), the monetary regime (exchange rate flexibility, reserve currency status) and other factors such as foreign exchange reserves, monetary aggregates and credit to GDP.

Changes in methodologies since the crisis

In the wake of the GFC and the European sovereign debt crisis, the major rating agencies have independently revisited their sovereign risk methodologies. These rating methodologies detail and rationalise the factors that drive the final assessments of the likelihood of default.[3]

A common theme is that the rating agencies have sought to move towards systems that rely more on *quantitative inputs*, in part to make ratings more transparent and replicable. The methodologies mostly take the form of a scoring system that lists all considered factors along with limits to their lowest and highest weights. In 2008, Moody's introduced a methodology that puts more weight on quantifiable factors, which it further refined in 2010. In 2011, S&P added several

[2] Depending on the rating agency or type of rated entity, some ratings are intended to convey information about default probabilities while others refer to expected credit losses. But this distinction is unlikely to affect the rank-ordering of the sovereign credits examined in this feature.

[3] The following discussion draws upon Fitch Ratings (2014), Moody's Investors Service (2013) and Standard & Poor's (2014b) as well as other cited publications of the rating agencies. Although the major rating agencies do not always agree on sovereign risk assessments, and there are distinctions to be made between their methodologies, the differences between the big three agencies are not the focus of this article.

quantifiable factors to the ratings process. Fitch now uses a sovereign ratings model for foreign currency ratings based on 19 economic and financial variables that provide a benchmark for rating discussions. Even so, the methodologies still leave considerable room for qualitative adjustments and judgment.

At least four risk factors appear to have gained in importance in the methodologies, while one has lost ground.

To start with, differences in *monetary policy regimes* have come into sharper focus. Some sovereigns inside a currency union are now viewed as having less flexibility than those with an independent monetary policy. One agency may cut a sovereign rating by up to two notches if it views the union's monetary policy as inappropriate for the country concerned (Standard & Poor's (2014a)). Another agency assigns a lower rating to countries with inflexible exchange rate regimes.

Post-crisis, a number of AEs have relied on large-scale government bond purchases as part of their monetary policy toolkit. The three major agencies have generally taken the view that, over the relevant rating horizon, the corresponding potential for public debt monetisation does not call for downgrades. This reflects their judgment that somewhat higher inflation is not an adverse credit factor, and that the threshold beyond which such policies would pose a risk of much higher inflation – hence eroding economic or institutional strength – has not yet been reached.

Second, the degree of *currency internationalisation*, seen as a measure of the external liquidity available to a sovereign, has also gained in importance for some agencies. S&P has clarified the measures of internationalisation that can boost ratings, including the shares of the currency in global foreign exchange reserves and in global foreign exchange turnover. Sovereigns that can issue debt globally in their own currency are likely to be less vulnerable to a depreciation of the domestic exchange rate or shifts in sentiment on the part of foreign investors. Fitch argues for the importance of reserve currency status as a source of financing flexibility (Fitch Ratings (2013)), and also places weight on the openness and depth of domestic bond markets in both local and foreign currency.

Third, *event risk* – related to a sudden, extreme event that may severely strain public finances – has gained in importance. Related, *contingent liabilities* due to implicit guarantees in the event of distress of financial institutions and non-financial public sector enterprises have received more attention. S&P has revised its calculation of contingent liabilities, resulting in much higher estimates for total financial system liabilities.[4]

In addition, *financial cycles* are now given greater consideration. Credit booms can lower Moody's assessment of a sovereign's "economic strength" (and thus potentially its rating) by up to two rating notches. S&P will also reduce a rating if GDP growth has been fuelled by excessive credit growth and asset price increases. Fitch incorporates a Macroprudential Indicator (MPI) based on trends in credit growth and asset prices.

At the same time, the reliance on certain positive country attributes has been reduced. Most importantly, some agencies now place somewhat less emphasis on *per capita GDP* and greater emphasis than previously on *growth performance and potential*, taking into account multi-year averages to smooth cyclical effects as well

[4] For more on bank system rating assessments, see Packer and Tarashev (2011).

The frequency of split ratings

Table 2

		Mid-2007		2015 October	
		% with split rating (A)	% of (A) more than two notches	% with split rating (B)	% of (B) more than two notches
Overall	AE	28.6	25	46.4	23.1
	EME	51.7	17.9	54.0	11.7
Asia-Pacific	EME	46.7	21.4	41.2	0
Americas	EME	57.1	21.4	64	12.5
Europe	EME	57.8	19.2	53.8	17.9
Sub-Saharan Africa	EME	14.3	0	52.9	0
Middle East and North Africa	EME	45	0	52.4	18.2

Different foreign currency ratings assigned by major agencies for the same sovereign, calculated as a percentage of all possible rating pairs.

Sources: Bloomberg; BIS calculations.

as the outlook. In particular, Moody's changed its methodology in 2013 to recognise that potential growth can be just as important as per capita GDP when accounting for economic strength.

Split ratings

Differences in methodology contribute to differences in sovereign ratings across agencies (so-called "split ratings"). The frequency of split ratings for foreign currency sovereign debt in our sample is slightly above 50%. This is roughly the same as for corporates but well below that of the 70 largest international banks, which can be up to 90%. The frequency of split ratings has increased post-crisis, particularly for AEs (Table 2). Split ratings for AE sovereigns are now almost as common as for EME sovereigns, in sharp contrast to the pre-crisis situation. Greater disagreement is particularly evident for advanced European sovereigns, where the percentage of split ratings has soared from 22% to 48%.

Modelling sovereign ratings

This section explores how far changes in methodologies have been reflected in changes to the estimated determinants of ratings. We also ask whether there is evidence of bias against EMEs.[5] While we focus on the factors that have been prominent in the recent changes to agency methodologies, we also include others

[5] Policymakers in developing countries have been heard to complain of "prejudice in the models of Western-based agencies" (Wigglesworth (2012)). Gultekin-Karakaş et al (2011) find that high-income countries are more likely to get a strong rating, holding macroeconomic fundamentals constant. But these authors do not consider default history and some measures of institutional strength. Bartels and Weder di Mauro (2013) note that Moody's and S&P rate emerging market economies lower than does a European based agency (Feri), although they do not estimate a model for ratings and focus instead on evidence of herding behaviour in rating changes.

commonly cited in the literature. Since the role of public debt has gained particular attention, we first assess the bivariate relationship of debt and ratings for both AEs and EMEs, before developing a parsimonious multivariate model that controls for other key factors.

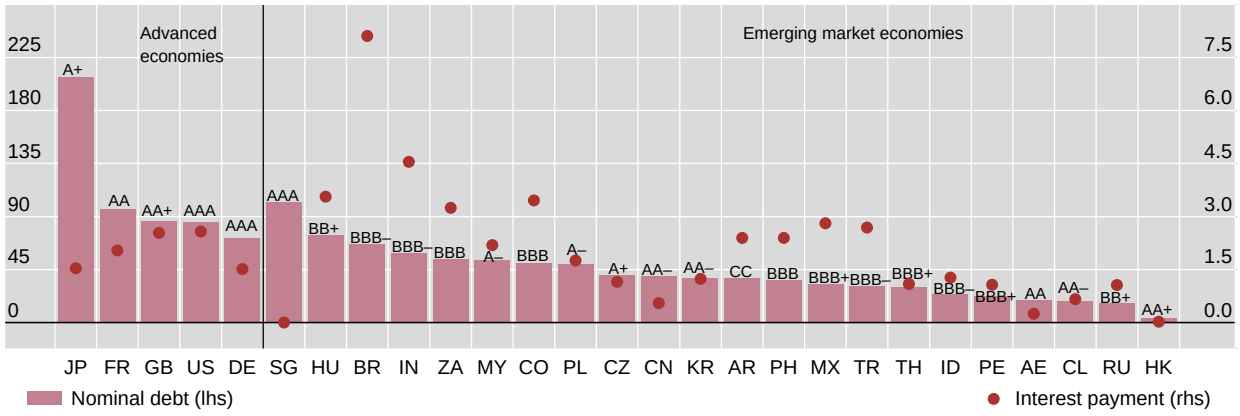
Sovereign ratings and public debt

EMEs tend to have lower ratings than AEs, despite generally lower ratios of outstanding government debt to GDP (bars in Graph 1). This difference in EME and AE debt burdens has diminished over time but has not disappeared.[6] Because interest rates tend to be higher in EMEs, the interest expenses of EMEs are roughly similar to those of AEs (dots in Graph 1). The stark difference between the two measures is shown by the examples of Japan and Turkey, rated AA– and BBB–, respectively. Japan's gross debt is well above 200% of GDP, while net interest expenses account for only 1.5% of GDP. Turkey's gross debt-to-GDP ratio is just above 30%, yet it pays net interest equivalent to over 3% of GDP, twice what Japan does. That said, some EMEs with very low debt levels, such as Hong Kong SAR and Saudi Arabia, are rated very highly.[7]

An alternative measure of debt load is debt affordability: higher interest-to-revenue ratios tend to translate into lower ratings for both AEs and

Ratings,[1] debt burden and interest expenses

As a percentage of GDP — Graph 1



AE = United Arab Emirates; AR = Argentina; BR = Brazil; CL = Chile; CN = China; CO = Colombia; CZ = Czech Republic; DE = Germany; FR = France; GB = United Kingdom; HK = Hong Kong SAR; HU = Hungary; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MX = Mexico; MY = Malaysia; PE = Peru; PH = Philippines; PL = Poland; RU = Russia; SG = Singapore; TH = Thailand; TR = Turkey; US = United States; ZA = South Africa.

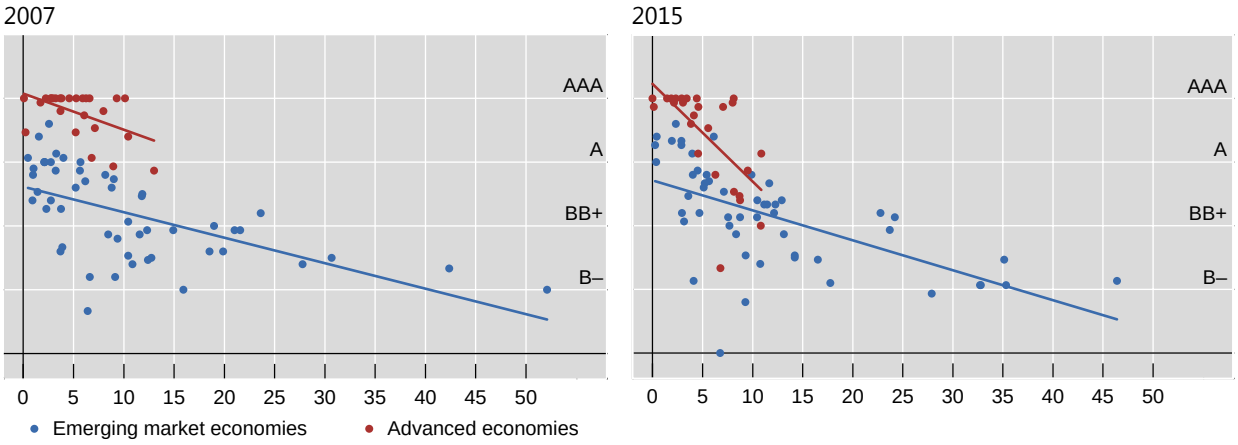
[1] Average credit rating of Moody's, S&P and Fitch for long-term foreign currency. For Argentina, average of Moody's and S&P. For the United Arab Emirates, Moody's only.

Sources: IMF, *International Financial Statistics* and *World Economic Outlook*; Bloomberg; national data; BIS calculations.

[6] In 2007, for any given debt-to-GDP ratio, virtually all EMEs scored lower ratings than AEs, by eight to 12 notches. By 2015, this difference, while still significant, had diminished by around two notches.

[7] The measurement of public debt stocks is also complicated by such matters as the obligations of subnational authorities and state-owned institutions (Dembiermont et al (2015)).

Foreign currency rating versus debt affordability[1] Graph 2



[1] Interest payments as a percentage of general government revenue.

Sources: IMF, *World Economic Outlook*; Bloomberg.

EMEs (Graph 2).[8] Using debt affordability (instead of debt burdens) considerably reduces the difference in the treatment of AE and EME debt ratios (Table 3). A simple regression of sovereign ratings on the debt burden (columns 1 and 2) and the EME designation indicates that EME status reduces a country's rating by about eight notches in both 2007 and 2015. But if debt affordability is used instead of debt burden (columns 3 and 4), the difference declines from around seven and a half notches in 2007 to five notches in 2015.

The importance of debt affordability shows that actual financing costs matter. The long post-crisis period of extremely low policy rates and unconventional monetary policy has lowered both long- and short-term interest rates, making debt more affordable. These factors, whether temporary or permanent, have indirectly supported the ratings of major AEs.[9]

Back-of-the-envelope calculations indicate that the interest rate burden in the major AEs would roughly double if the average interest rate on their debt reverted to its 2007 level, while that of most EMEs would increase by less. The speed with which higher interest rates feed into debt service burdens would, of course, also depend on the debt's maturity profile, which is typically longer in AEs.

Multivariate regression analysis

As agencies use a variety of indicators, any attempt to explain ratings based only on fiscal strength can be misleading. The direct weight of fiscal strength (regardless of how it is measured) in final ratings generally accounts for at most one third. Thus, we now turn to a model that considers the broad set of factors covered by rating

[8] All results also hold if non-linear regressions are used to account for the kink in the relationship between EME ratings and debt affordability apparent in Graph 2.

[9] The impact of ultra-low interest rates is reflected in the fact that the market values of government debt in the major AEs, as reported by the OECD, are well above the nominal values factored into ratings. For example, the value of the stock of outstanding French, Japanese, UK and US sovereign debt was around 25 percentage points higher than its nominal value. The use and interpretation of the concepts of market value and nominal amounts are discussed in Dembiermont et al (2015).

agencies. That said, we aim for a parsimonious model that covers only key categories of country risk based on a relatively small set of variables.

We examine a broad set of determinants covering fiscal, economic and institutional strength, the monetary regime, foreign reserves, credit exposure and EME designation. In line with the previous section, we consider both debt burden and debt affordability. We also consider default history in a broad as well as narrow definition. The cross-sectional samples comprise 82 countries (54 EMEs, 28 AEs) in 2007 and 81 countries (54 EMEs, 27 AEs) in 2015.[10]

Rating regressions

Table 3

	Bivariate regression		Bivariate regression		Multivariate regressions					
	Debt burden		Debt affordability		Debt burden		Narrow default definition[3]		Debt affordability	
	2007	2015	2007	2015	2007	2015	2007	2015	2007	2015
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
EME designation	–8.57***	–7.63***	–7.4***	–4.9***	0.14	–0.67	–0.98	–0.83	0.67	0.018
Fiscal strength:										
Public debt/GDP	–0.03****	–0.05***			–0.02**	–0.03***	–0.02*	–0.04***		
Interest/revenue			–0.16***	–0.23***					–0.07**	–0.012***
Economic strength:										
Log per capita GDP					1.32***	1.56***	1.72***	2.20***	1.22***	1.75***
GDP growth					–0.06	0.22	0.02	0.24	–0.07	0.40**
Institutional strength:										
Corruption perception[1]					0.06**	0.09***	0.06***	0.08***	0.06***	0.08***
Log inflation					–0.06	0.09	–0.03	0.17	–0.03	0.21**
Monetary regime:										
Reserve currency status					1.93**	1.29	1.65**	1.57*	1.32*	0.78
Free-floating					0.23	2.46***	–0.03	2.54**	–0.014	1.24
Foreign reserve/GDP					0.02**	0.02*	0.03**	0.02*	0.016	0.014
External assessment										
External debt/GDP					–0.01***	–0.0003	–0.001***	–0.001**	–0.003**	–0.0001
Original sin[2]					–2.25***	0.64	–2.05**	–0.28	–2.43***	1.34
Default history[3]					–1.81***	–2.45***	–2.08**	–3.96***	–1.81***	–2.33**
Credit/GDP					0.006****	–0.009	0.003	–0.004	0.007	–0.009
Adjusted R^2	0.62	0.47	0.67	0.52	0.87	0.77	0.87	0.78	0.87	0.77

Linear regression of the average credit rating of Moody's, S&P and Fitch on the variables shown in the table. A constant is included in the regressions but is not reported. **/* represents significance levels of 1/5%. Numerical values are attached to ratings as described in the note to Table 1. Sovereigns with ratings below B3/B– are not included in the regression.

[1] Corruption perception index as provided by Transparency International. [2] Roughly defined as the share of foreign currency debt in total debt. For further details, see the discussion of the OSIN2 measure in Borio and Packer (2004). [3] Base model: Bank of Canada, Database of Sovereign Defaults; narrow default definition: Moody's-rated sovereign bond defaults since 1983.

Sources: Ilzetzki et al (2011); Bank of Canada; IMF, *International Financial Statistics* and *World Economic Outlook*; Bloomberg; Moody's; Transparency International; BIS calculations.

[10] The regression results remain qualitatively the same when we run a regression for both periods on the same sample of 77 countries (50 EMEs, 27 AEs). Here we report the regressions from the two non-identical samples in order to make full use of the country information.

We first estimate a base case model including the above-mentioned factors and the debt burden to represent fiscal strength (Table 3, columns 5 and 6). Further, we identify a history of default as a sovereign default on any debt obligation since 1975 (using a public database provided by the Bank of Canada). We test for the model's sensitivity to a narrower definition of default – namely, one whereby a sovereign has defaulted on its bonds since 1983, according to Moody's (Table 3, columns 7 and 8). We also control for the potential collinearity of default history with other variables by running the regression without it (not shown here but available from the authors).

We find that ratings can be largely explained by a relatively small set of fewer than 10 variables. This is in line with the results of previous studies, including Cantor and Packer (1996), Borio and Packer (2004), Hill et al (2010) and De Vries and De Haan (2015).[11] Adding key variables to the EME designation and fiscal strength increases the adjusted R^2 from 0.6 in 2007 and 0.5 in 2015 to almost 0.9 in 2007 and 0.8 in 2015. The generally lower R^2 shown in Table 3 for 2015 may be related to the greater dispersion of ratings following the crisis, which may also be reflected in the growth of split ratings documented earlier.

Growth performance and potential, as proxied by the contemporaneous or three-year average (not shown) GDP growth rate, appear to have somewhat gained in importance, as suggested by some agencies' methodological revisions discussed above. The coefficient on GDP growth, which was insignificant and negative before the crisis, becomes positive across all specifications, and is statistically significant in one of the three reported specifications. At the same time, per capita GDP maintains its high statistical significance: a 10% increase in the level of per capita GDP adds 0.15 notches in 2015, slightly more than in 2007.

The regression results also reflect the new rating agency methodologies in that sovereigns with a *flexible exchange rate regime* and *reserve currency status* have higher ratings for a given level of debt. While in 2007 the nature of the monetary regime was mostly reflected in the reserve currency status variable, by 2015 the flexibility of the exchange rate regime, defined as a country having its own central bank and a free-floating currency, also had a significant positive effect. By 2015, exchange rate flexibility, other things equal, was associated with an increase in the sovereign rating of 2.5 notches in two of our specifications.

Fiscal strength appears to have increased in importance since the crisis. Every 10 percentage point increase in debt burden (public debt to GDP) lowers the rating by 0.2 notches pre-crisis and by 0.3 notches afterwards. And in the specifications with debt affordability, every 10 percentage point increase in interest-to-revenue lowers the rating by 0.7 notches pre-crisis and by 1.2 notches afterwards. Notably, the broader debt measure of external debt to GDP is either statistically insignificant, or significant but with a coefficient that is much smaller (one tenth) than that of the public debt-to-GDP variable.

Default history appears to have gained in importance since the crisis. Whereas pre-crisis the rating of a sovereign was lowered by close to two notches in countries with a history of default, this penalty increases to 2.5 notches in 2015. When default

[11] Cantor and Packer (1996) reach an adjusted R^2 of 0.9 in a cross section for 1995 with eight variables. Borio and Packer (2004) use different models, with the most parsimonious one obtaining an adjusted R^2 of 0.9 with seven variables covering 1996–2003. De Vries and De Haan (2015) examine the relationship between credit ratings and bond yield spreads of periphery countries in the euro area using a model that has an adjusted R^2 of 0.6.

is defined more narrowly, this finding is even starker. A default on one of a country's bonds since 1983 is associated with a sovereign rating that is two notches lower in 2007 and nearly four notches lower in 2015.

At the same time, the degree to which the sovereign's debt is in foreign currency appears to have lost its relevance. The decline of this factor may reflect the increased ability of EMEs to borrow in their own currency. Post-crisis, proxies for the exposure to debt in foreign currency have become statistically insignificant.

Other factors remain of similar importance before and after the crisis, such as indicators of *institutional strength* and *foreign exchange reserves to GDP*. A 10 percentage point increase in the ratio of foreign exchange reserves to GDP strengthens the rating by 0.4 notches. Institutional strength, as measured by the corruption perception index, is equally significant in both 2007 and 2015. By contrast, inflation is not statistically significant pre-crisis and remains generally insignificant afterwards.

A period in which credit grows faster than GDP, resulting in a higher *credit-to-GDP* ratio, is associated with a significant *strengthening* in ratings before the crisis for one specification. In 2015, the estimated coefficient sign changes to reflect the expected effect, whereby the risks of a potential credit boom lower ratings, but the coefficient is not statistically significant in any specification. Similar results hold when we use the size of the banking system to GDP. This may result from endogeneity: countries with financial systems that are strong for other (unobserved) reasons are able to support more rapid credit growth without it affecting their sovereign creditworthiness.[12]

Finally, the use of a multivariate estimation framework considerably reduces the "penalty" for the EME designation. In fact, when the variables discussed above are accounted for, the impact of the dummy for EME designation is much lower (less than one notch) both before and after the crisis, and statistically insignificant. This result holds even when per capita GDP, which is highly correlated with the EME designation, is dropped (not shown).

Do different sovereign risk metrics treat EMEs differently?

Assuming that our regressions adequately capture the rating agencies' methodologies, the previous results cast doubt on the hypothesis that ratings are lower for EME borrowers once a broad range of factors is considered. But the major agencies might still be emphasising other factors in a way that penalises EMEs. In the following, we compare the sovereign ratings of the big three rating agencies with alternative metrics for country risk – namely, ratings from other agencies, market measures of country risk and a survey of institutional investors.[13]

[12] Alternatives have been tested, such as deviations of credit from country-specific trends and the average ratio of credit to GDP over three years. But the fit was worse and in some specifications the sign on the coefficients did not make sense.

[13] Measuring the long-term default performance of EME and AE borrowers at similar rating levels would be the most direct way of checking the hypothesis of bias, but the scarcity of sovereign defaults would require a study using many decades of data. For an assessment of the performance of sovereign credit ratings in predicting defaults relative to bond prices in the interwar period, see Flandreau et al (2011).

Non-major rating agencies

The major agencies dominate the global credit rating industry and rate the vast majority of internationally issued bonds. However, many other agencies exist. Fully 10 agencies are recognised by the Securities and Exchange Commission (SEC) in the United States, and 25 (not counting subsidiaries of the big three) are registered or certified by the European Securities and Market Authority (ESMA).

While these other agencies tend to cover borrowers in their home country, rather than providing rankings of global credits, some of them offer global ratings to international investors. We examine below the sovereign ratings of three such non-major agencies. Dagong Global Credit Ratings is China's largest rating agency; after rating its first sovereign borrower in 2010, it now rates over 90 such borrowers. Feri AG is a German asset manager which has been rating sovereigns for more than 20 years (Bartels and Weder di Mauro (2013)). The Japan Credit Rating Agency (JCR) was founded more than 40 years ago and is the only Japanese rating agency whose ratings are recognised by the SEC and ESMA.

Comparing the sovereign ratings of the above three smaller rating agencies with those of the big three reveals some interesting patterns. Two of the three smaller agencies rate the United States significantly lower than the US-based major rating agencies. And all three give the sovereigns of their own headquartered countries the highest AAA rating, an opinion usually not shared by the other agencies.

On average, each of the three smaller rating agencies gives EME sovereigns higher ratings than the three major agencies (Table 4). Further, two of the three non-majors (Dagong and Feri) give AEs lower ratings on average. For these two, the gap between AE and EME ratings is four and two notches respectively, compared with five notches for the three majors and six for JCR.

Sovereign ratings by three non-US rating agencies

Table 4

Sovereign	Dagong[1]	JCR[1]	Feri[1]	*Memo: Big three (avg)*[1]
Advanced economies (average)	A+	AA+	A	*AA–*
Emerging market economies (average)	BBB	BBB+	BBB	*BBB–/BBB*
Brazil	BBB+	BBB	BBB	*BBB*
China	AAA	A+	AA–	*AA–*
France	A+	AAA	AA+	*AA*
Germany	AA	NA	AAA	*AAA*
India	BBB	BBB	BBB+	*BBB–*
Japan	A	AAA	AA–	*A+*
Mexico	BBB	A–	BBB+	*BBB+*
Russia	A	BB+	BB+	*BB+*
United States	A–	AAA	AA	*AAA*

[1] Long-term foreign issuer credit rating and long-term foreign default rating. Average rating is rounded – except in the case of an average at exactly half a notch, where both surrounding ratings are reported.

Rank-order correlation of different sovereign rating metrics

Table 5

Measure A	Measure B	Rank-order correlation
Moody's	Standard & Poor's	0.97
Avg of big three	Feri	0.96
Avg of big three	JCR	0.91
Avg of big three	Dagong	0.89
CDS spreads	Avg of Moody's, S&P and Fitch	0.90
CDS spreads	Feri EuroRating Services AG	0.91
CDS spreads	JCR	0.92
CDS spreads	Dagong	0.75
Institutional Investor rating	Avg of Moody's, S&P and Fitch	0.97
Institutional Investor rating	Feri	0.94
Institutional Investor rating	JCR	0.88
Institutional Investor rating	Dagong	0.91

Since JCR rates many fewer sovereigns than the other agencies, the rank-order correlations are not strictly comparable with the others.

[1] Five-year sovereign CDS spreads.

Sources: Bloomberg; Feri AG; *Institutional Investor*; authors' calculations.

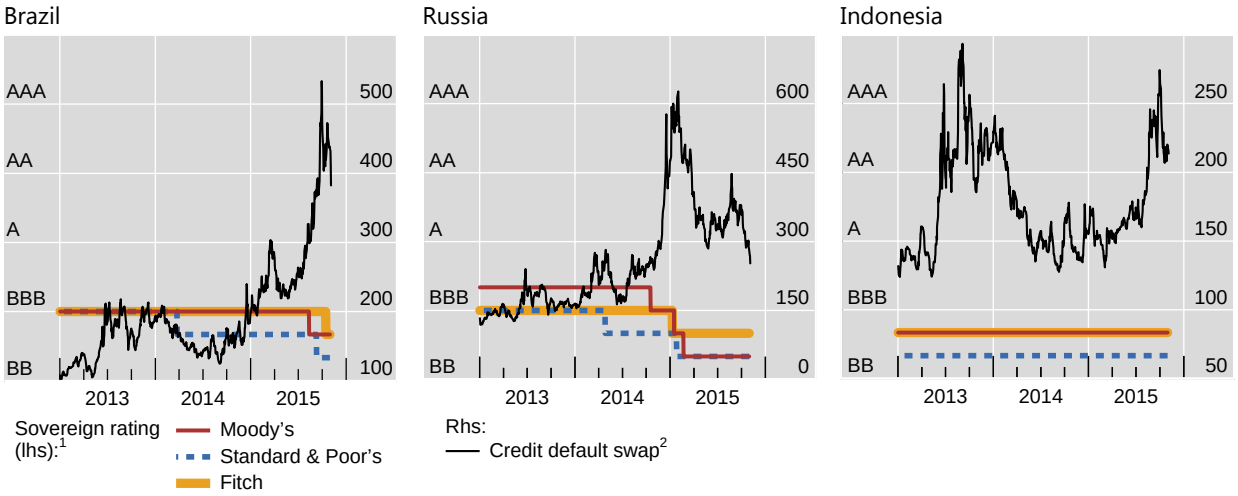
More generally, the ratings of non-major agencies tend to correspond less with those of the major agencies. This conclusion emerges if one considers the correlations of the sovereigns' rank-orderings (ie the highest rated one is rank 1, the second ranked 2 etc) with those of the major agencies (Table 5, rows 2–4). The rank-order correlations of each of the non-major agencies with the average ratings of the big three are much lower than, for example, the rank-order correlation between Moody's and S&P (Table 5, row 1).

Ratings and market credit spreads

Market credit spreads provide another set of country risk rankings at any point in time. Graph 3 illustrates the movements of credit default swap (CDS) spreads and sovereign (foreign currency) ratings for Brazil, Indonesia and Russia, three countries for which CDS spreads have been particularly volatile in the past two years. Three observations are worth highlighting. First, CDS spreads are much more volatile than ratings. As a case in point, during the "taper tantrum" of 2013, many sovereigns saw sharp increases in CDS spreads while ratings were stable. Second, CDS spreads for different EMEs co-move more closely than ratings, pointing to swings in global risk appetite as drivers of CDS markets. Third, downgrades, at least recently, have tended to follow rises in spreads rather than vice versa.

The first two observations can be explained by the nature of risks captured by the two measures and by the horizon over which they measure risk. Ratings are intended to look "through the cycle" and are meant to capture the relative risk of default. Under normal conditions, this should make them slow-moving, although rapid adjustments have on occasion occurred in the midst of crises. CDS spreads, by contrast, reflect the market's perception of risk at a particular point in time. Moreover, they capture not only the absolute risk of default but also other components such as liquidity conditions and the time-varying price of default risk.

Stable sovereign ratings and volatile CDS premia Graph 3



[1] Foreign currency long-term debt. [2] Five-year CDS premia, in basis points.

Sources: Bloomberg; Markit.

Many of these factors can change quite rapidly in response to general market conditions and investors' risk appetite.

To the extent that swings in global risk appetite can increase overall market risk premia without changing the relative riskiness of sovereign borrowers, rank-orderings of spreads should remain somewhat more stable over time, more akin to credit ratings. In July 2015, CDS markets ranked EME credits on average as actually slightly higher-risk,[14] and AE credits as correspondingly lower-risk, than did each of the big three rating agencies. At the same time, market rankings were significantly more correlated with ratings of the major agencies than with those of the non-major agency with the most sovereign ratings outstanding (Table 5, lines 5 and 8). Thus, credit markets do not appear to have shared the alternative vision of the balance of risks between EMEs and AEs offered by the smaller agencies in our sample.

Institutional Investor country risk rankings

Institutional Investor provides yet another metric against which to assess agency ratings. Every half-year, *Institutional Investor* surveys the top economists and analysts at global banks, securities and asset management firms. Those surveyed are asked to grade "each country from 0 to 100, with 100 representing the least likelihood of default". Responses are then weighted according to the global exposure of the participants' institutions.

Institutional Investor's rank-ordering of country credits is quite similar to that of the major rating agencies. In contrast to the non-major agencies, *Institutional Investor*'s mean rank-orderings for EMEs (and AEs) are quite close to those of the major rating agencies. In addition, the ratings of *Institutional Investor* show much

[14] For evidence that sovereign CDS markets price the EME designation, even after controlling for fundamentals, see Amstad et al (forthcoming).

higher rank-order correlation with those of the major agencies than they do with those of any of the non-major agencies sampled in this paper (Table 5, last four rows). Once again, the alternative measure of country risk does not support the view that the major agencies are relatively harsh on the EMEs. More specifically, if a bias does exist, it is one shared with financial markets and asset managers more generally.

Conclusion

Since the financial crisis, the major global credit rating agencies have implemented significant changes to their methodologies for assessing sovereign credit risk. More attention is now given to monetary policy regimes, currency internationalisation, financial cycles, event risk and economic growth more generally.

We find that some of these methodological changes are reflected in estimated simple models of sovereign credit ratings. Ratings appear to be somewhat more sensitive to certain variables – such as the existence of a flexible exchange rate regime and GDP growth – than before, in line with the changes implemented by the major agencies. That said, other methodological revisions do not appear to be strongly confirmed by the regression model – perhaps testifying to the difficulty of capturing all the determinants of ratings in a parsimonious linear framework.

We also ask whether, as has been suggested by some financial market observers, agencies discriminate against EME sovereign borrowers relative to AE sovereign borrowers. True, for a given debt burden, the rating of an EME borrower will be tend to be lower than that of an AE borrower. However, expanding the set of explanatory variables eliminates the "penalty" on EMEs.

We then compare the sovereign ratings of the big three rating agencies with alternative metrics for country risk: namely, the ratings of some smaller non-US agencies, CDS spreads, and a survey of institutional investors. The three non-major agencies rate EMEs higher than do the US major agencies. However, the more generous view towards EMEs is shared neither by markets, as measured by CDS spreads, nor by the opinions of asset managers, as proxied by the *Institutional Investor* survey of credit risk. If biases exist, they are widely shared.

In closing, a few caveats are in order. The validity of our test of bias against EMEs depends on our models reflecting sufficiently well the agencies' methodologies, and on the methodologies accurately capturing the factors affecting relative creditworthiness. Both conditions are difficult to establish. Further, it may be that other characteristics of ratings which we have not been able to compare across agencies in this feature – such as their procyclicality and the timing of their announcements – are what cause the greatest concern among EME policymakers. The field of sovereign ratings remains a fruitful one for further research.

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Annexes

BIS Statistics: Charts

The statistics published by the BIS are a unique source of information about the structure of and activity in the global financial system. BIS statistics are presented in graphical form in this annex and in tabular form in the *BIS Statistical Bulletin*, which is published concurrently with the *BIS Quarterly Review*. For introductions to the BIS statistics and a glossary of terms used in this annex, see the *BIS Statistical Bulletin*.

The data shown in the charts in this annex can be downloaded from the *BIS Quarterly Review* page on the BIS website (www.bis.org/publ/quarterly.htm). Data may have been revised or updated subsequent to the publication of this annex. For the latest data and to download additional data, see the statistics pages on the BIS website (www.bis.org/statistics/index.htm). A release calendar provides advance notice of publication dates (www.bis.org/statistics/relcal.htm).

A Locational banking statistics

B Consolidated banking statistics

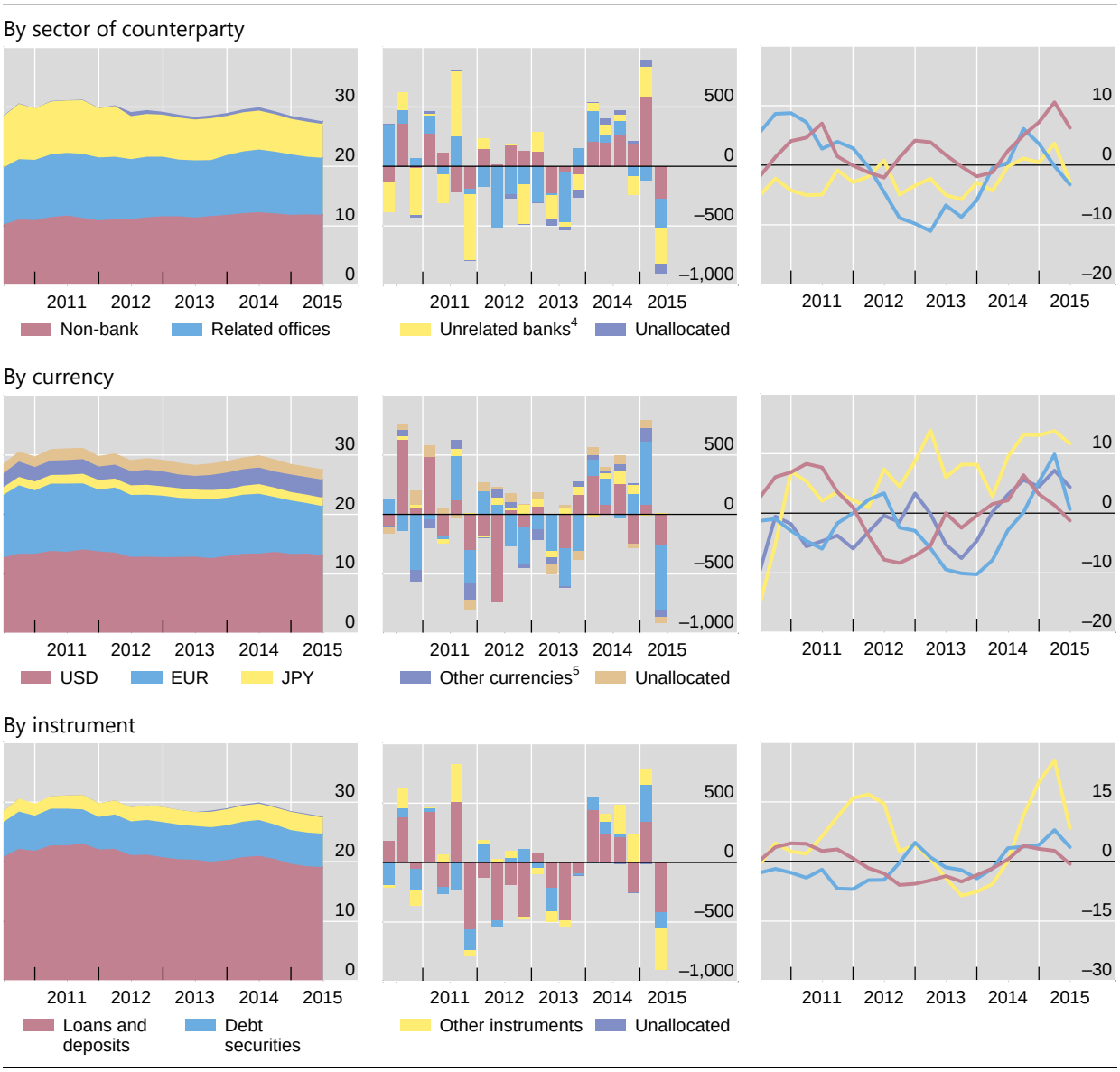
C Debt securities statistics

D Derivatives statistics

A Locational banking statistics

Cross-border claims, by sector, currency and instrument

Graph A.1



Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

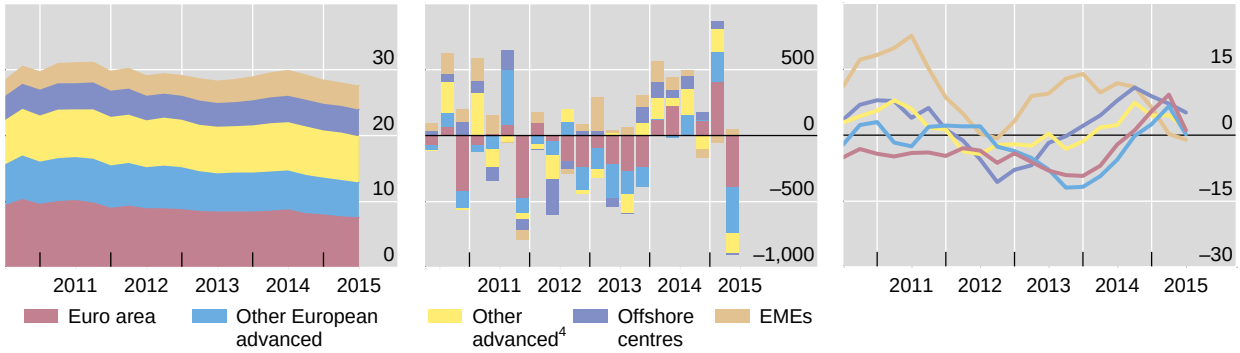
[1] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Quarterly changes in amounts outstanding, adjusted for the impact of exchange rate movements between quarter-ends and methodological breaks in the data. [3] Geometric mean of quarterly percentage adjusted changes. [4] Includes central banks and banks unallocated by subsector between intragroup and unrelated banks. [5] Other reported currencies, calculated as all currencies minus USD, EUR, JPY and unallocated currencies. The currency is known but reporting is incomplete.

Cross-border claims, by borrowing region

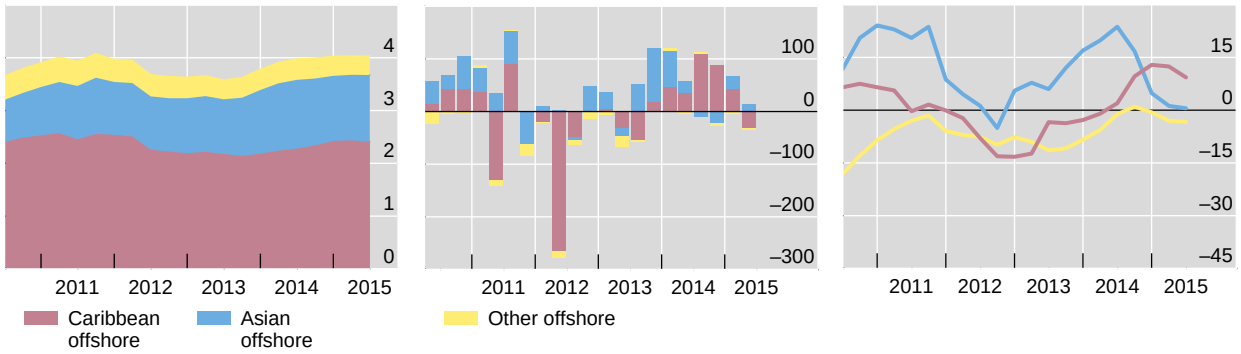
Graph A.2

Amounts outstanding[1] (USD trn)	Adjusted changes[2] (USD bn)	Annual change[3] (per cent)

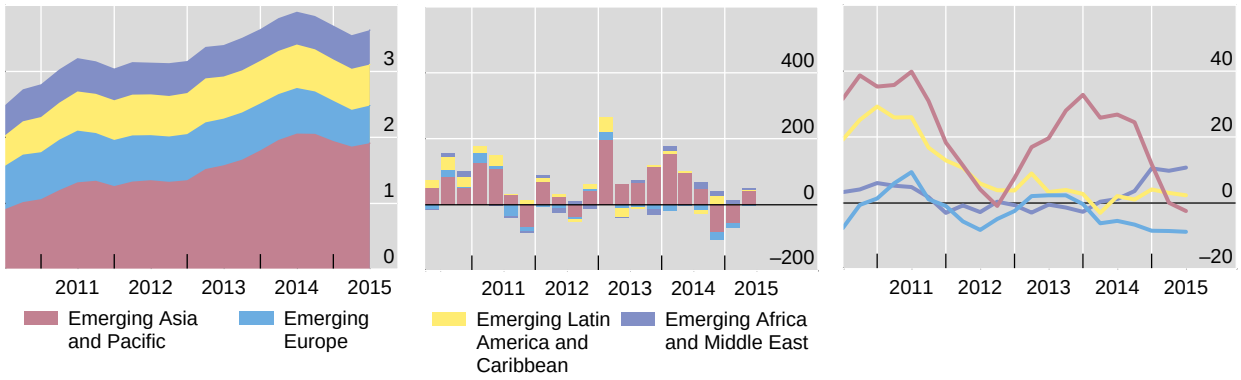
On all countries



On offshore centres



On emerging market economies



Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

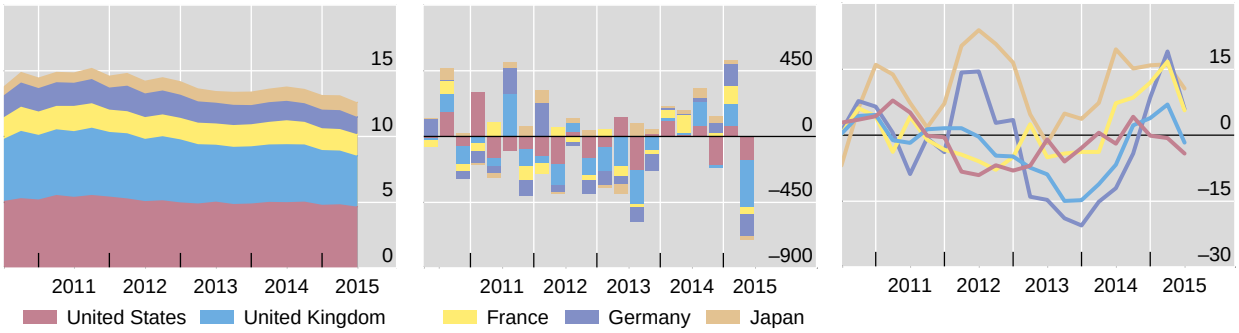
[1] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Quarterly changes in amounts outstanding, adjusted for the impact of exchange rate movements between quarter-ends and methodological breaks in the data. [3] Geometric mean of quarterly percentage adjusted changes. [4] Includes international organisations and cross-border amounts unallocated by residence of counterparty.

Cross-border claims, by borrowing country

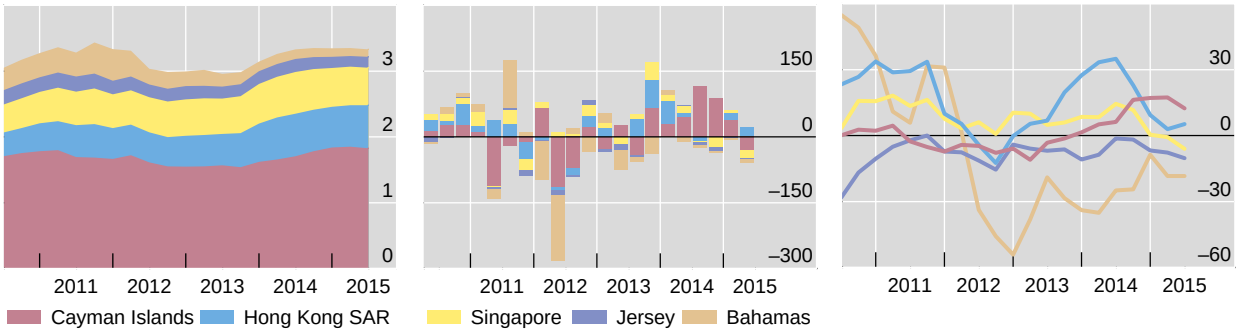
Graph A.3

Amounts outstanding[1] (USD trn) | Adjusted changes[2] (USD bn) | Annual change[3] (per cent)

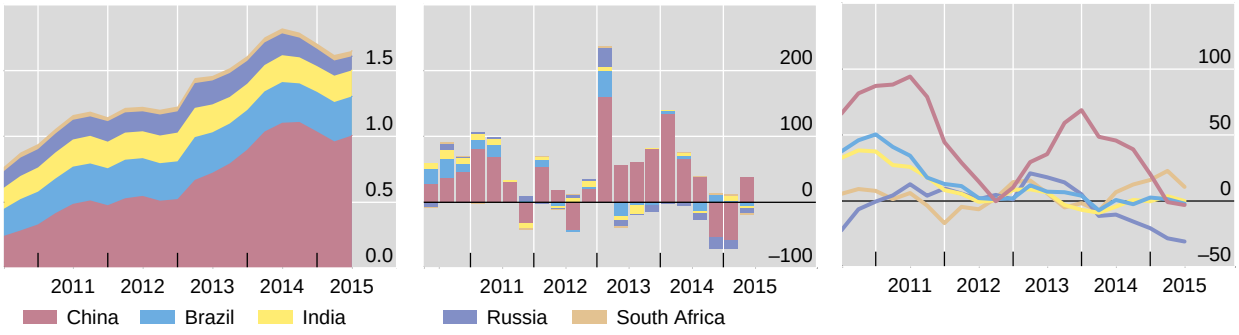
On selected advanced economies



On selected offshore centres



On selected emerging market economies



Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

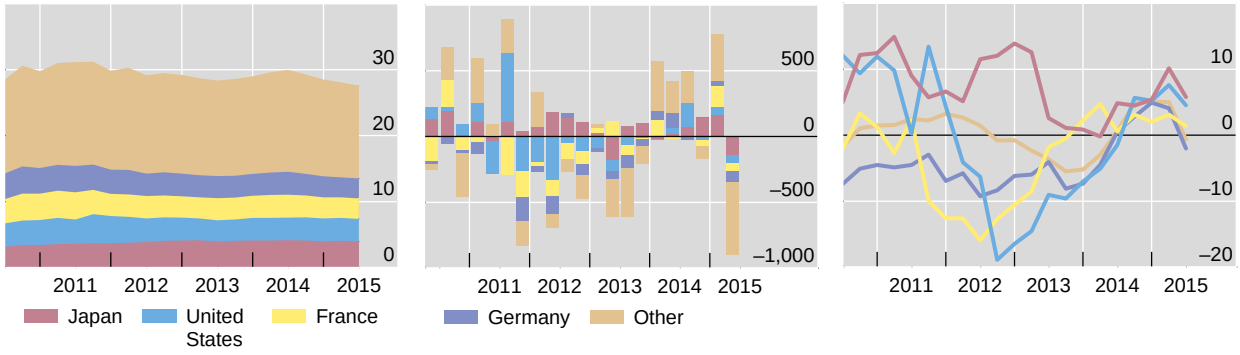
[1] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Quarterly changes in amounts outstanding, adjusted for the impact of exchange rate movements between quarter-ends and methodological breaks in the data. [3] Geometric mean of quarterly percentage adjusted changes.

Cross-border claims, by nationality of reporting bank and currency of denomination

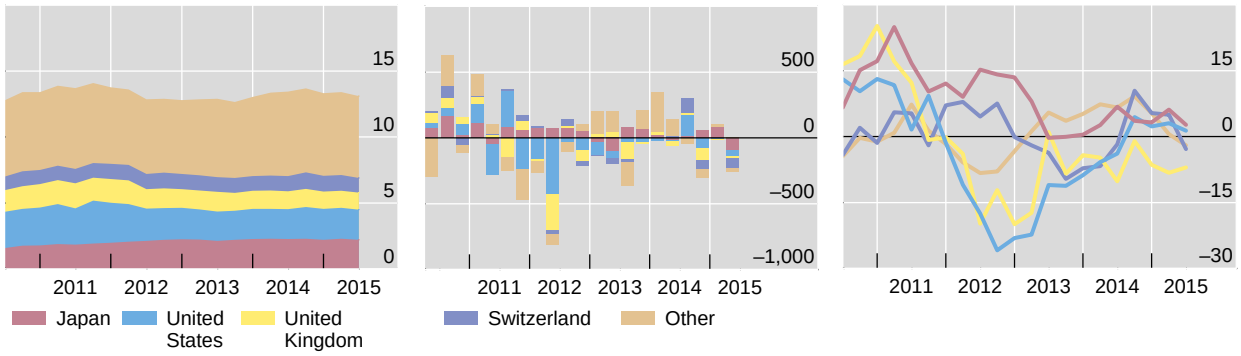
Graph A.4

Amounts outstanding[1] (USD trn) | Adjusted changes[2] (USD bn) | Annual change[3] (per cent)

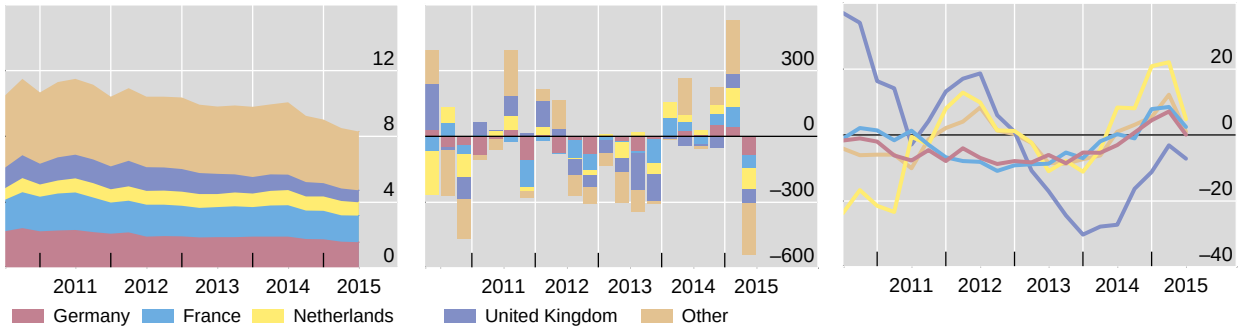
All currencies



US dollar



Euro

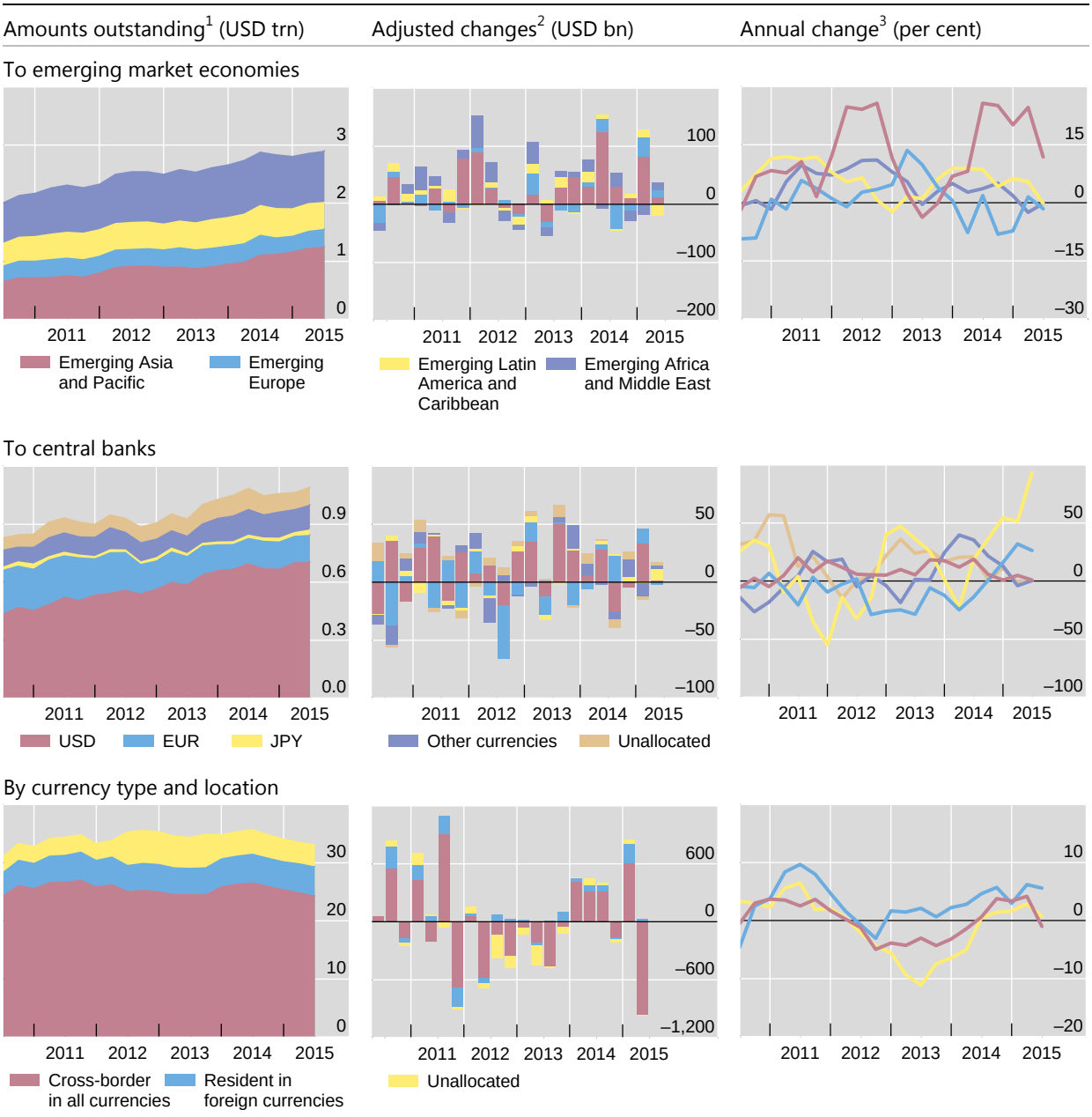


Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

[1] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Quarterly changes in amounts outstanding, adjusted for the impact of exchange rate movements between quarter-ends and methodological breaks in the data. [3] Geometric mean of quarterly percentage adjusted changes.

Cross-border liabilities of reporting banks

Graph A.5



Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

[1] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Quarterly changes in amounts outstanding, adjusted for the impact of exchange rate movements between quarter-ends and methodological breaks in the data. [3] Geometric mean of quarterly percentage adjusted changes.

B Consolidated banking statistics

Consolidated claims of reporting banks on advanced economies

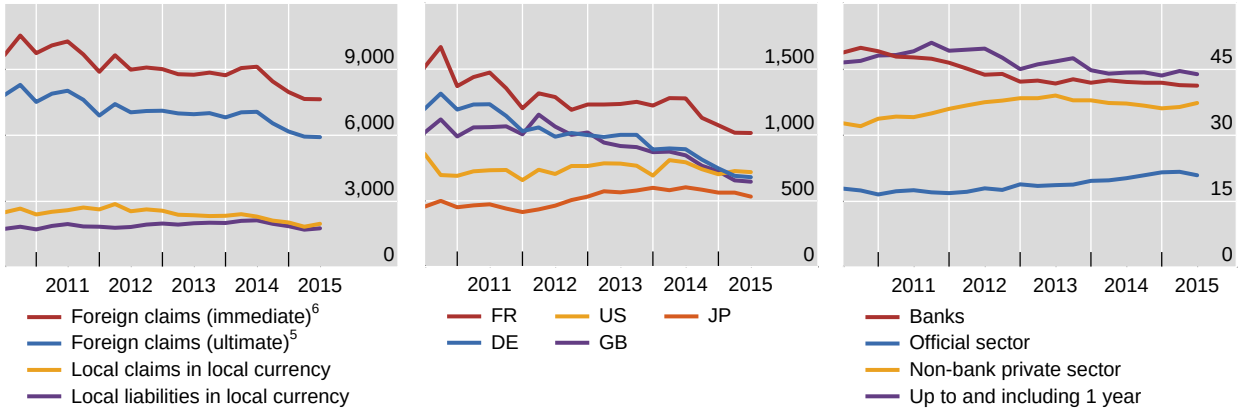
Graph B.1

Foreign claims and local positions[1, 2] (USD bn)

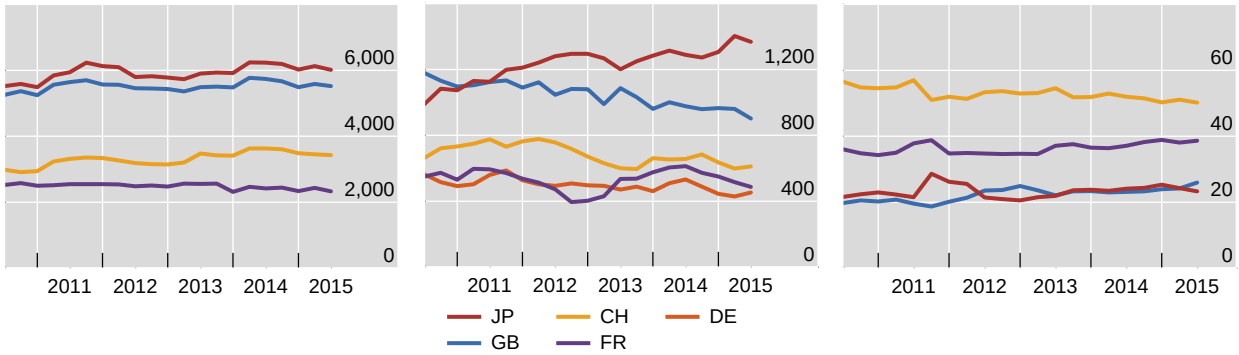
Foreign claims of selected creditors[1, 3] (USD bn)

International claims, by sector and maturity[4] (per cent)

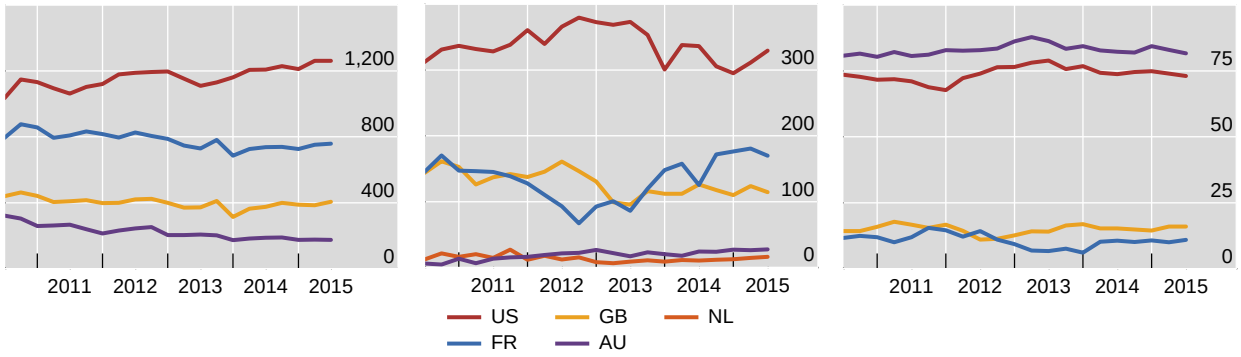
On the euro area



On the United States



On Japan



Further information on the BIS consolidated banking statistics is available at www.bis.org/statistics/bankstats.htm.

AU = Australia; CH = Switzerland; DE = Germany; FR = France; GB = United Kingdom; JP = Japan; NL = Netherlands; US = United States.

[1] Amounts outstanding at quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Excludes domestic claims, ie claims on residents of a bank's home country. [3] Foreign claims on an ultimate risk basis, by nationality of reporting bank. The banking systems shown are not necessarily the largest foreign bank creditors on each reference date. [4] As a percentage of international claims outstanding. [5] On an ultimate risk basis. [6] On an immediate counterparty basis. Includes the unconsolidated claims of banks headquartered outside but located inside CBS-reporting countries.

Consolidated claims of reporting banks on emerging market economies

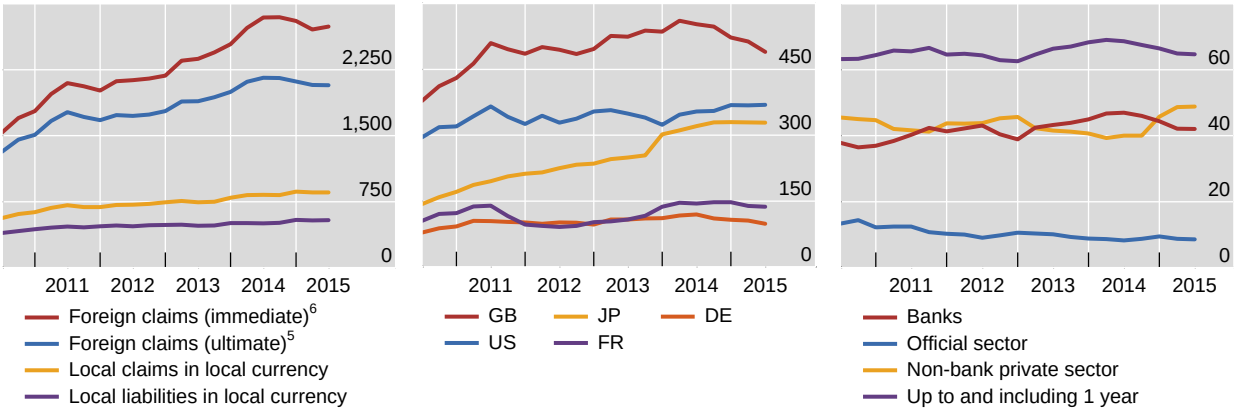
Graph B.2

Foreign claims and local positions[1, 2] (USD bn)

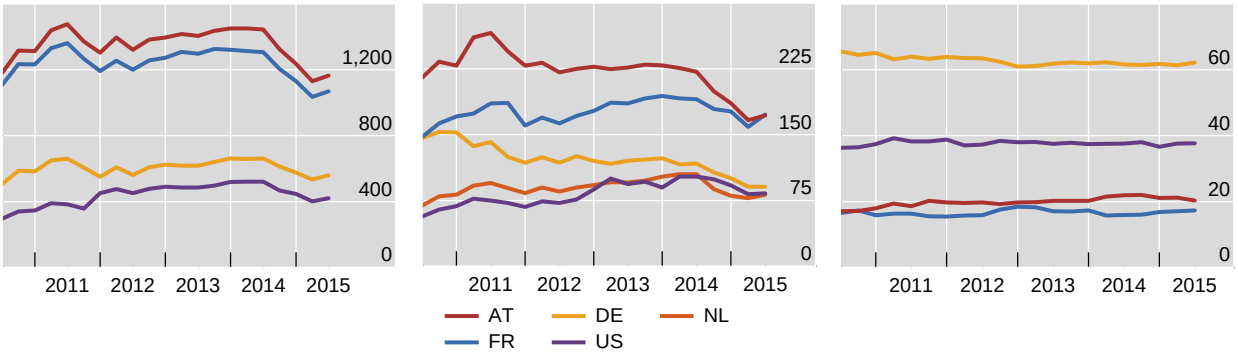
Foreign claims of selected creditors[1, 3] (USD bn)

International claims, by sector and maturity[4] (per cent)

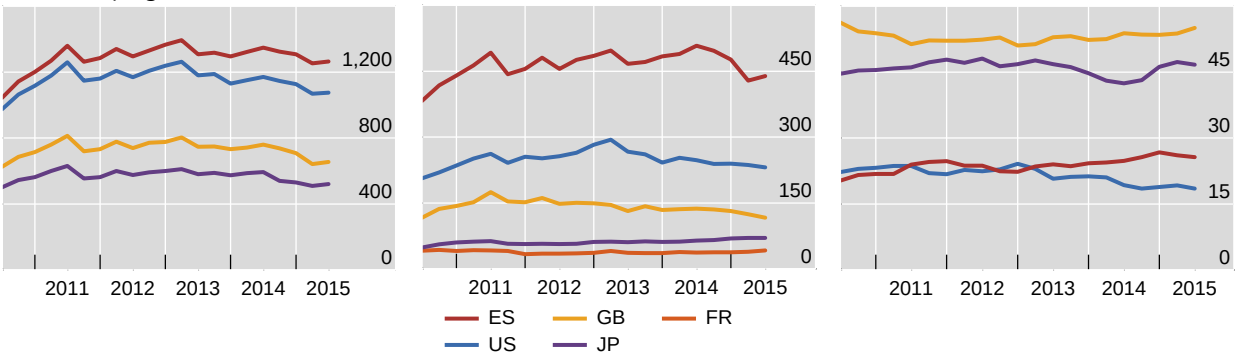
On developing Asia and the Pacific



On developing Europe



On developing Latin America and the Caribbean



Further information on the BIS consolidated banking statistics is available at www.bis.org/statistics/bankstats.htm.

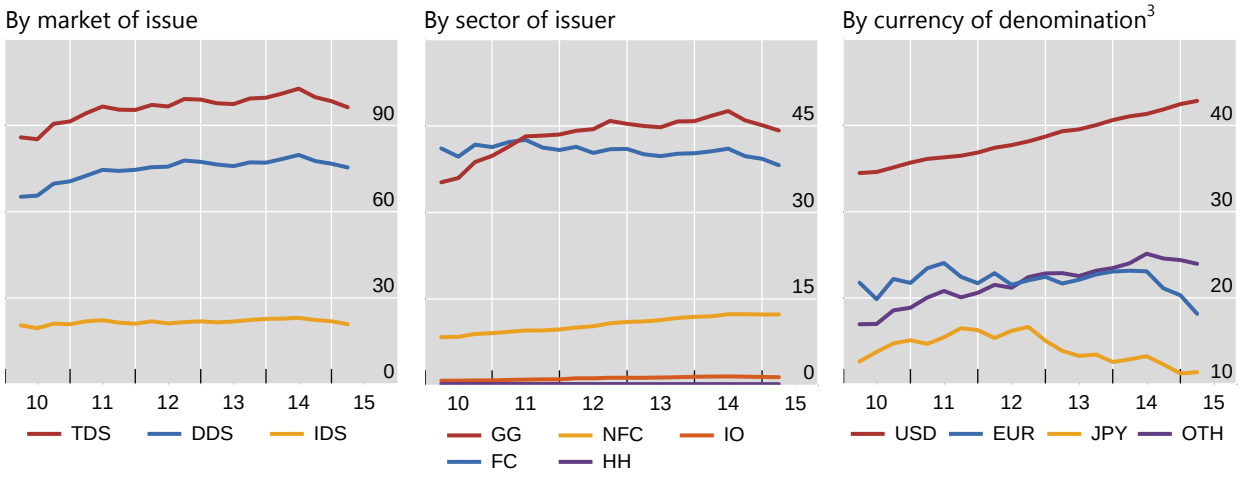
AT = Austria; CA = Canada; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; JP = Japan; NL = Netherlands; US = United States.

[1] Amounts outstanding at quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Excludes domestic claims, ie claims on residents of a bank's home country. [3] Foreign claims on an ultimate risk basis, by nationality of reporting bank. The banking systems shown are not necessarily the largest foreign bank creditors on each reference date. [4] As a percentage of international claims. [5] On an ultimate risk basis. [6] On an immediate counterparty basis. Includes the unconsolidated claims of banks headquartered outside but located inside CBS-reporting countries.

C Debt securities statistics

Global debt securities markets[1]

Amounts outstanding, in trillions of US dollars[2] Graph C.1



Further information on the BIS debt securities statistics is available at www.bis.org/statistics/secstats.htm.

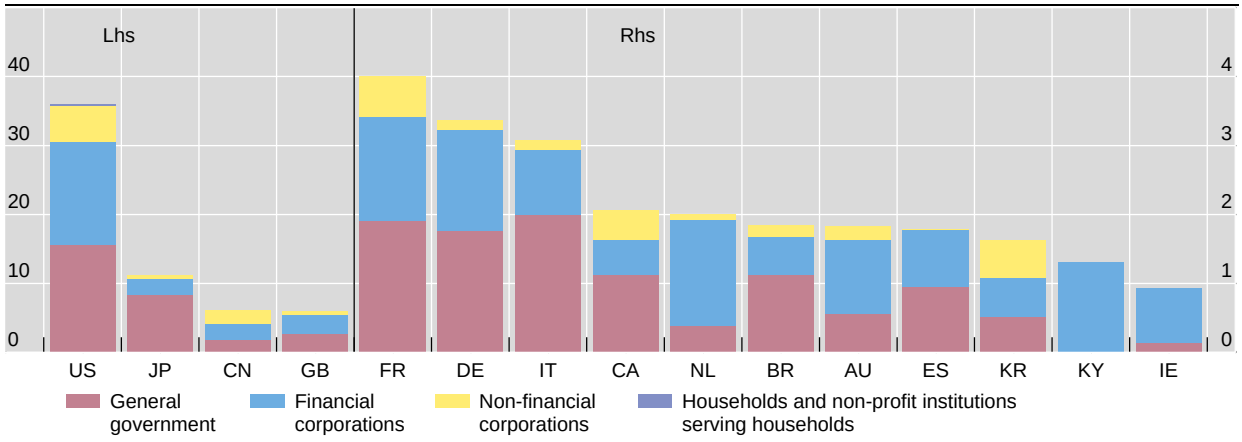
TDS = total debt securities; DDS = domestic debt securities; IDS = international debt securities; GG = general government; NFC = non-financial corporations; IO = international organisations; FC = financial corporations; HH = households and non-profit institutions serving households; USD = US dollar; EUR = euro; JPY = yen; OTH = other currencies.

[1] Sample of countries varies across breakdowns shown. For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. For countries that do not report either TDS or DDS, data are estimated by the BIS as IDS. [2] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [3] Where a currency breakdown is not available, DDS are assumed to be denominated in the local currency.

Sources: IMF; Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; national data; BIS debt securities statistics; BIS calculations.

Total debt securities, by residence and sector of issuer[1]

Amounts outstanding at end-March 2015, in trillions of US dollars[2] Graph C.2



Further information on the BIS debt securities statistics is available at www.bis.org/statistics/secstats.htm.

AU = Australia; BR = Brazil; CA = Canada, CN = China; DE = Germany; ES = Spain, FR= France; GB = United Kingdom; IE = Ireland, IT = Italy; JP = Japan; KR = Korea; KY = Cayman Islands; NL = Netherlands; US = United States.

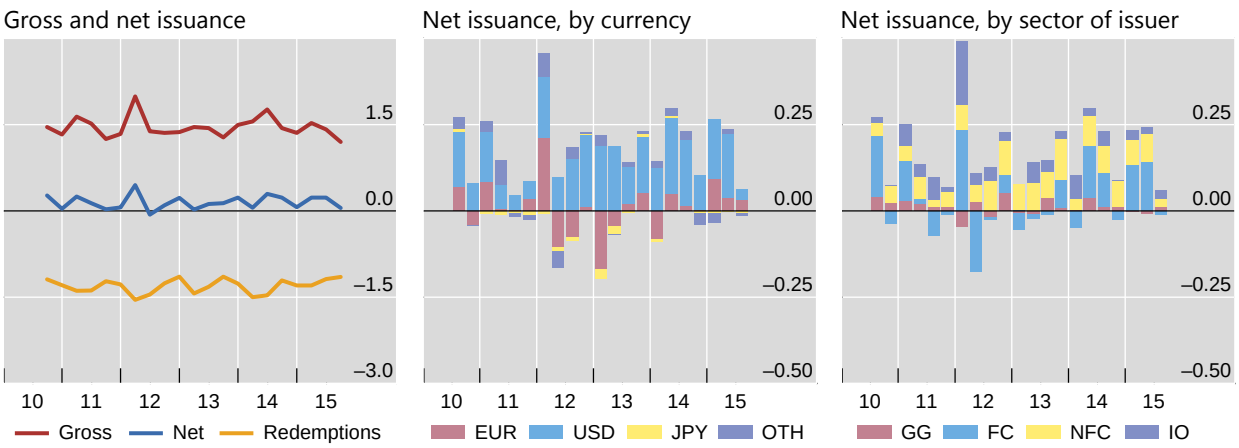
[1] For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. [2] Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Sources: National data; BIS debt securities statistics.

International debt securities, by currency and sector

In trillions of US dollars

Graph C.3



Further information on the BIS debt securities statistics is available at www.bis.org/statistics/secstats.htm.

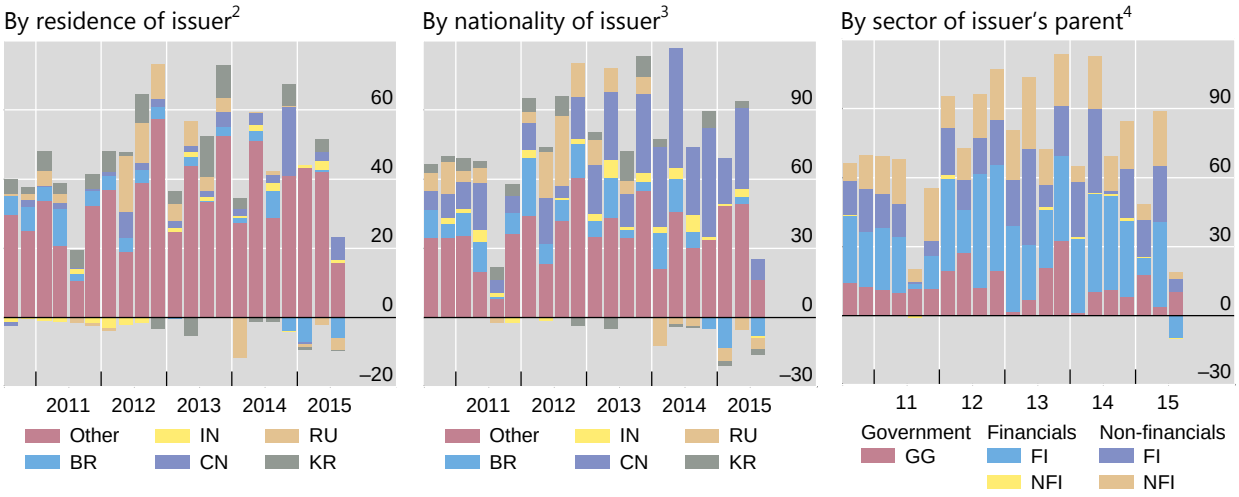
EUR = euro; USD = US dollar; JPY = yen; OTH = other currencies; GG = general government; FC= financial corporations; NFC = non-financial corporations; IO = international organisations.

Sources: IMF; Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS debt securities statistics.

International debt securities issued by borrowers from emerging market economies[1]

Net issuance, in billions of US dollars

Graph C.4



Further information on the BIS debt securities statistics is available at www.bis.org/statistics/secstats.htm.

BR = Brazil; CN = China; IN = India; KR = Korea; RU = Russia; GG = general government; FI = financial corporations; NFI = non-financial corporations.

[1] For the sample of countries comprising emerging market economies, see the glossary to the *BIS Statistical Supplement*. [2] Country where issuer resides. [3] Country where issuer's controlling parent is located. Includes issuance by financing vehicles incorporated in offshore financial centres with parents based in an emerging market economy. [4] By nationality, ie issuers with parents based in an emerging market economy. Issuers are grouped by sector of their parent.

Sources: IMF; Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS debt securities statistics.

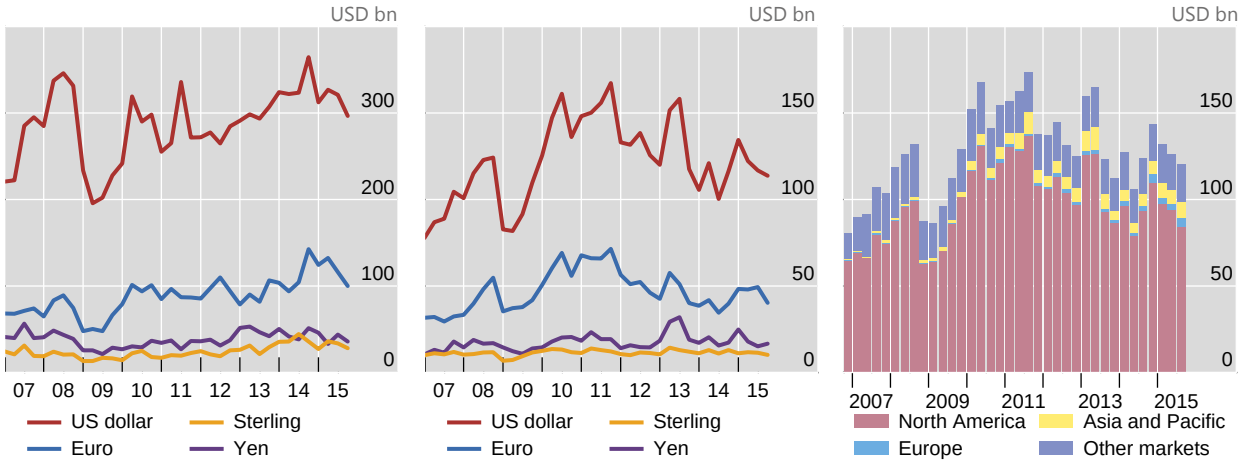
D Derivatives statistics

Exchange-traded derivatives

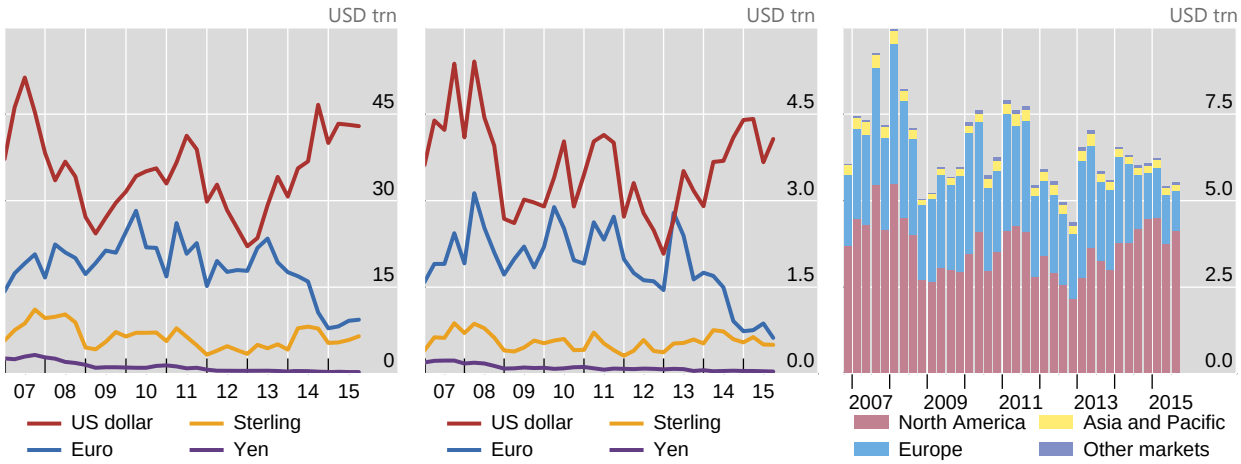
Graph D.1

Open interest, by currency[1] | Daily average turnover, by currency[2] | Daily average turnover, by location of exchange[2]

Foreign exchange derivatives[3]



Interest rate derivatives[3]



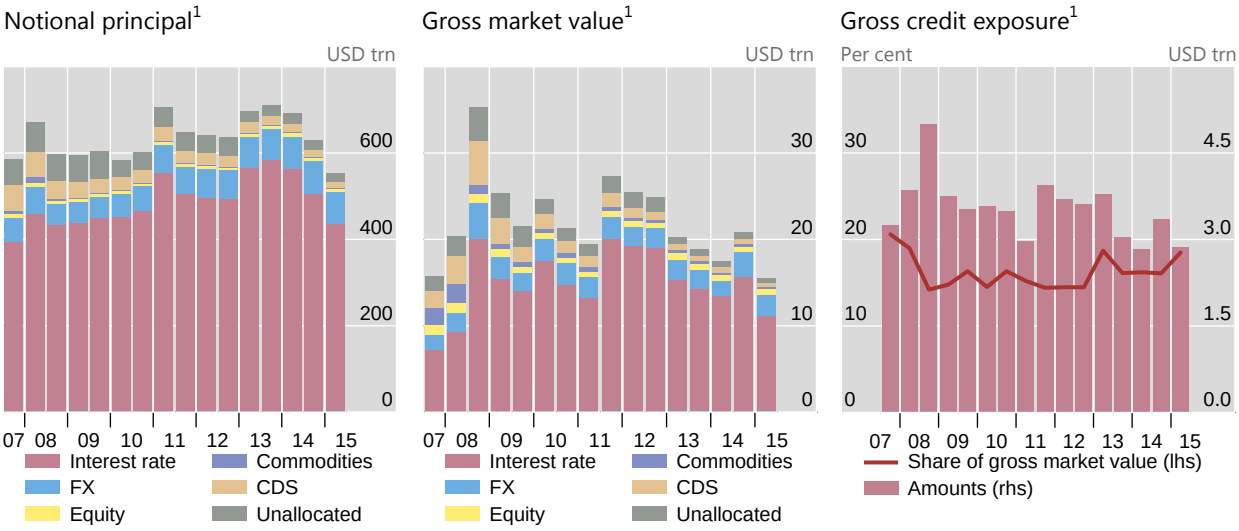
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/extderiv.htm.

[1] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Daily turnover averaged over the quarter. [3] Futures and options.

Sources: FOW; Futures Industry Association; BIS derivatives statistics.

Global OTC derivatives markets

Graph D.2



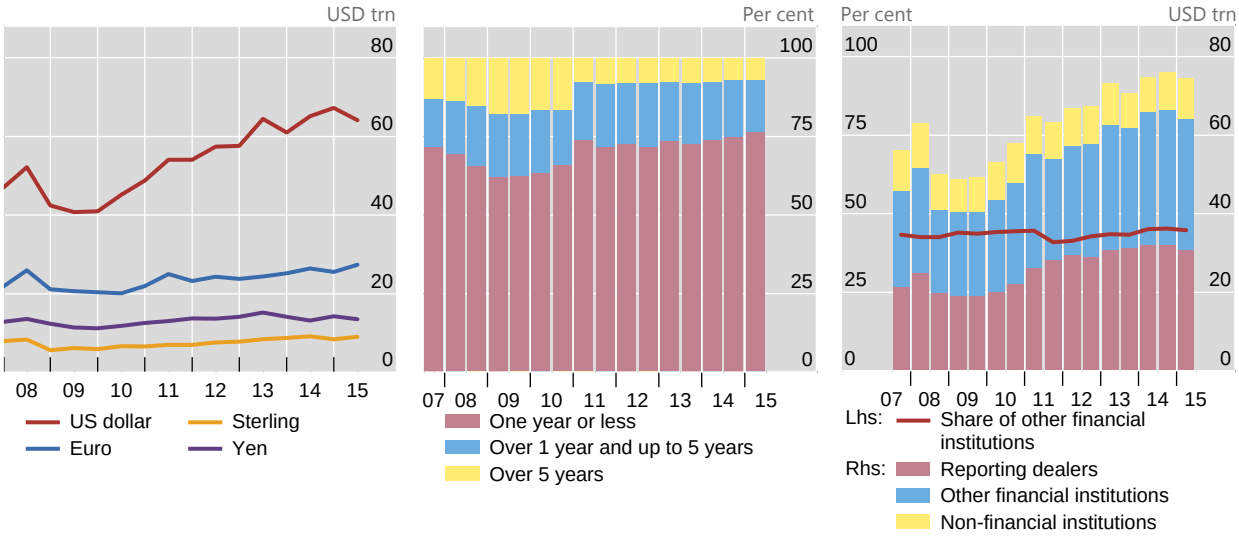
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

OTC foreign exchange derivatives

Notional principal[1]

Graph D.3



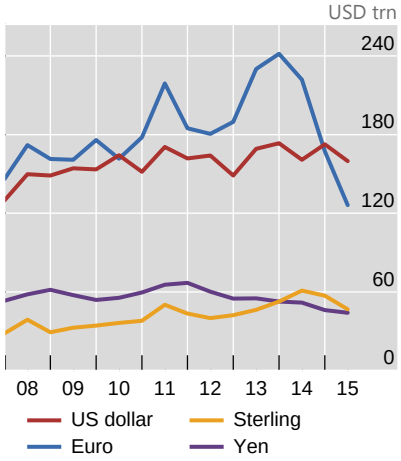
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

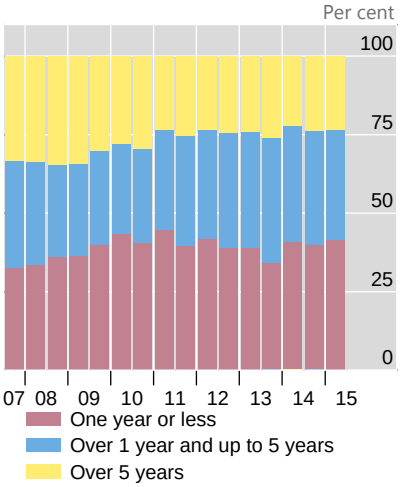
OTC interest rate derivatives

Notional principal[1] Graph D.4

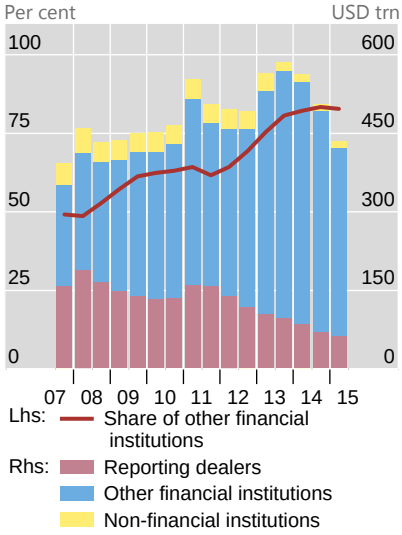
By currency



By maturity



By sector of counterparty



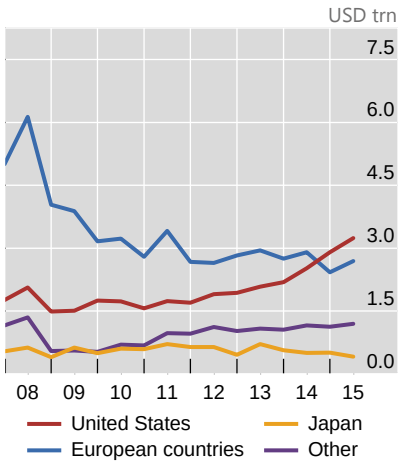
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

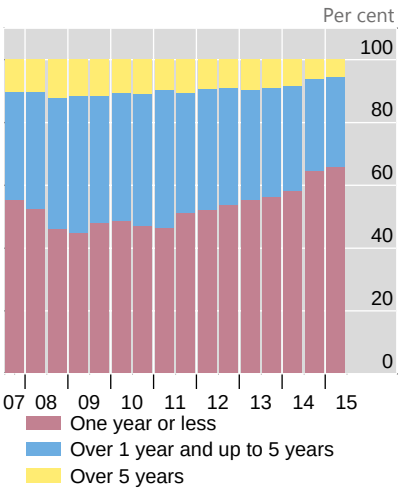
OTC equity-linked derivatives

Notional principal[1] Graph D.5

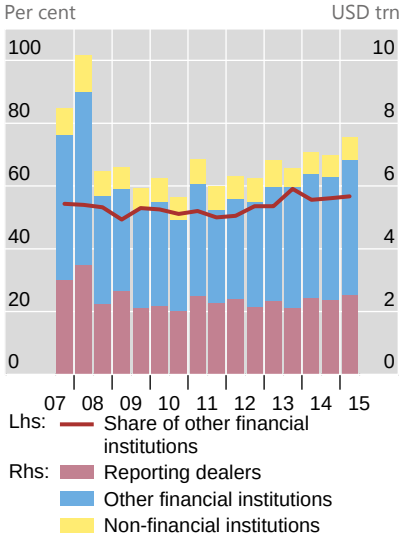
By equity market



By maturity



By sector of counterparty



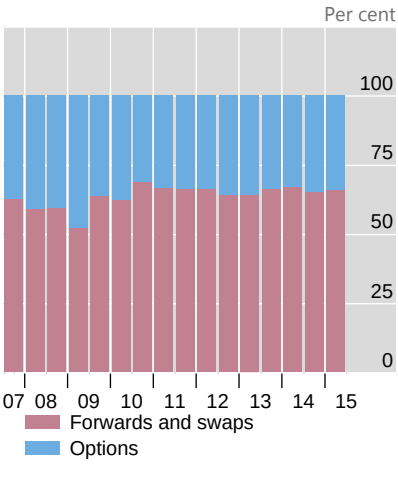
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

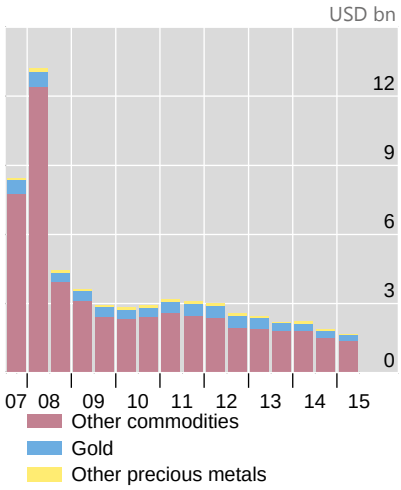
OTC commodity derivatives

Graph D.6

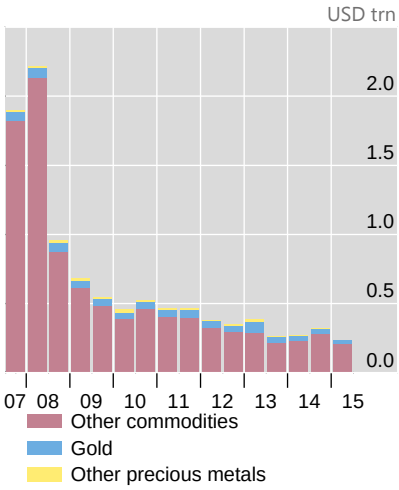
Notional principal, by instrument[1]



Notional principal, by commodity[1]



Gross market value, by commodity[1]



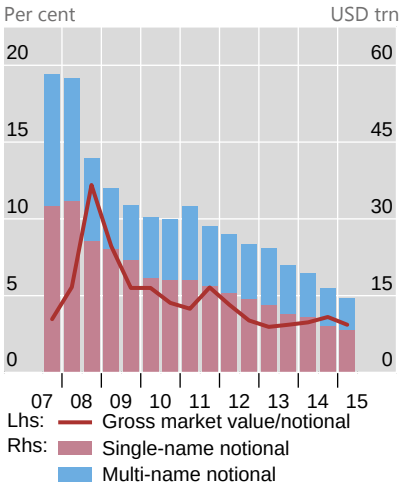
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

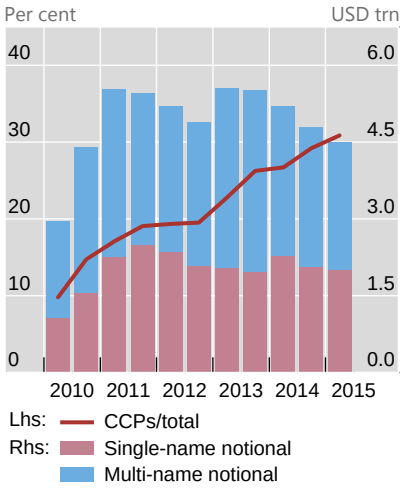
Credit default swaps[1]

Graph D.7

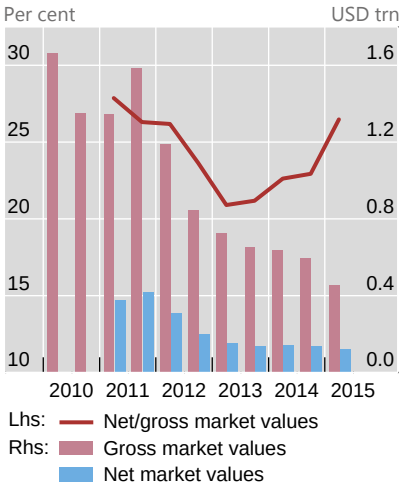
Notional principal



Notional principal with central counterparties (CCPs)



Impact of netting

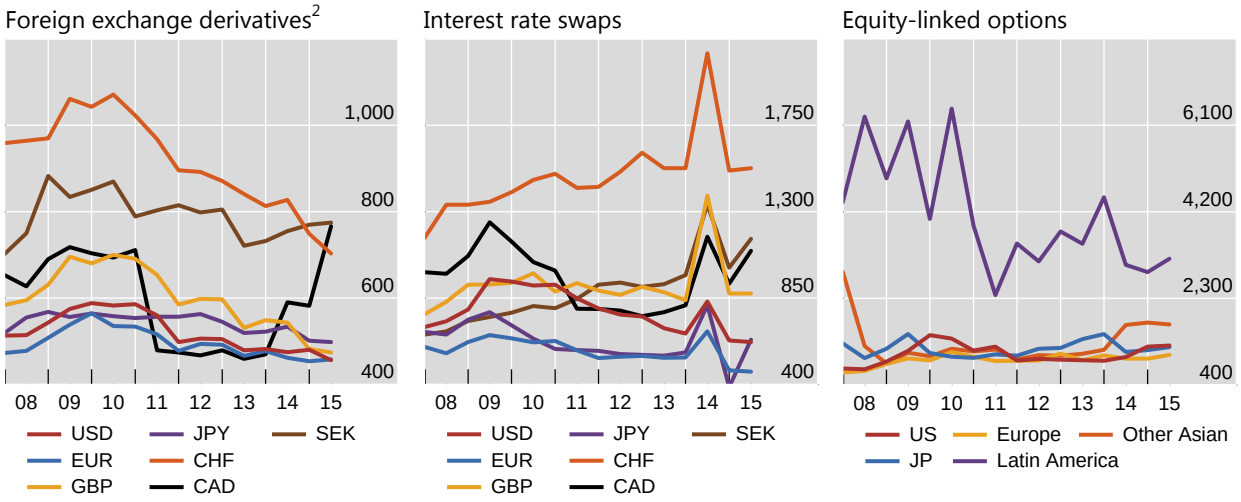


Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Concentration in global OTC derivatives markets

Herfindahl index[1] Graph D.8



Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

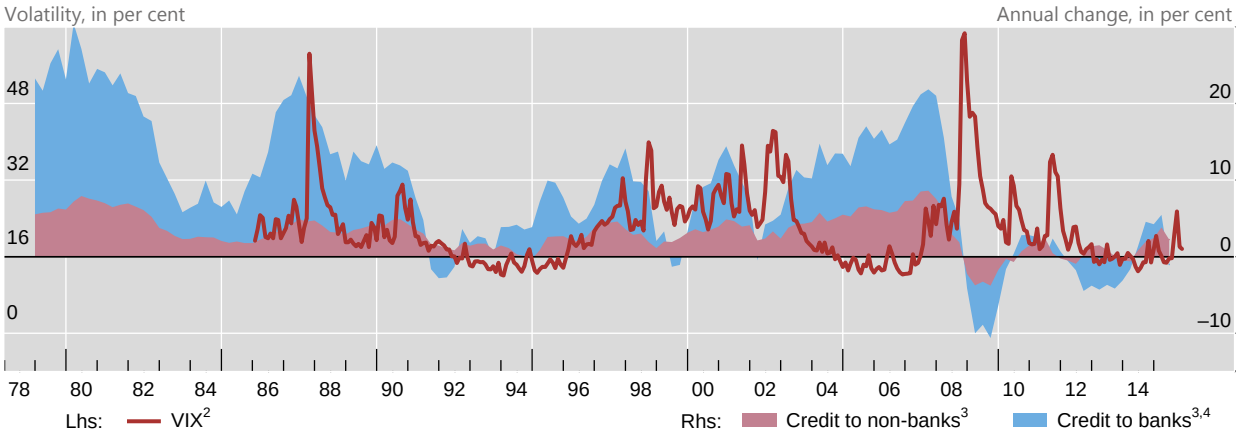
CAD = Canadian dollar; CHF = Swiss franc; EUR = euro; GBP = pound sterling; JPY = Japanese yen; SEK = Swedish krona; USD = US dollar. JP = Japan; US = United States.

[1] The index ranges from 0 to 10,000, where a lower number indicates that there are many dealers with similar market shares (as measured by notional principal) and a higher number indicates that the market is dominated by a few reporting dealers. [2] Foreign exchange forwards, foreign exchange swaps and currency swaps.

E Global liquidity indicators

Growth of international bank credit[1]

Graph E.1



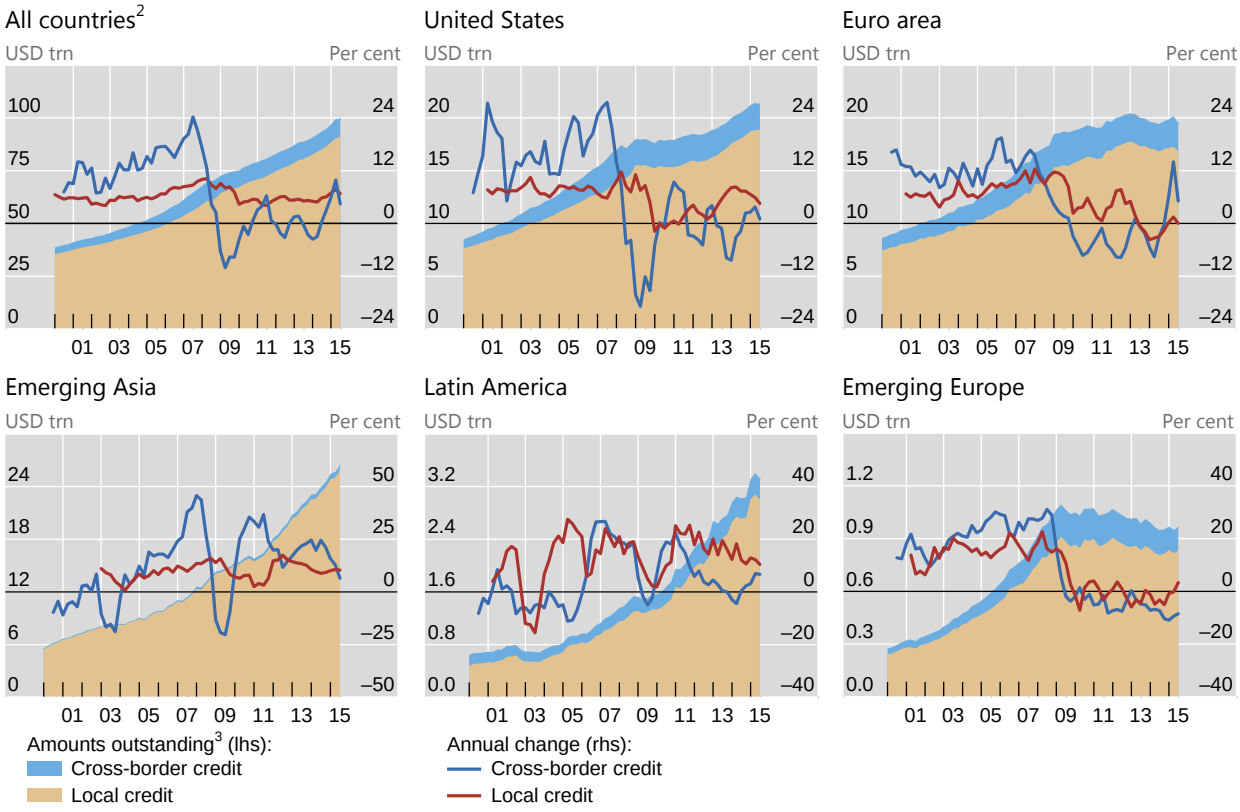
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[1] LBS reporting banks' cross-border claims plus local claims in foreign currencies. [2] VIX refers to the Chicago Board Options Exchange Market Volatility Index. It measures the implied volatility of S&P 500 index options. [3] Contribution to the annual percentage change in credit to all sectors. [4] Including intragroup transactions.

Sources: Bloomberg; BIS locational banking statistics.

Global bank credit to the non-bank sector, by residence of borrower

Banks' cross-border credit plus local credit in all currencies[1] Graph E.2



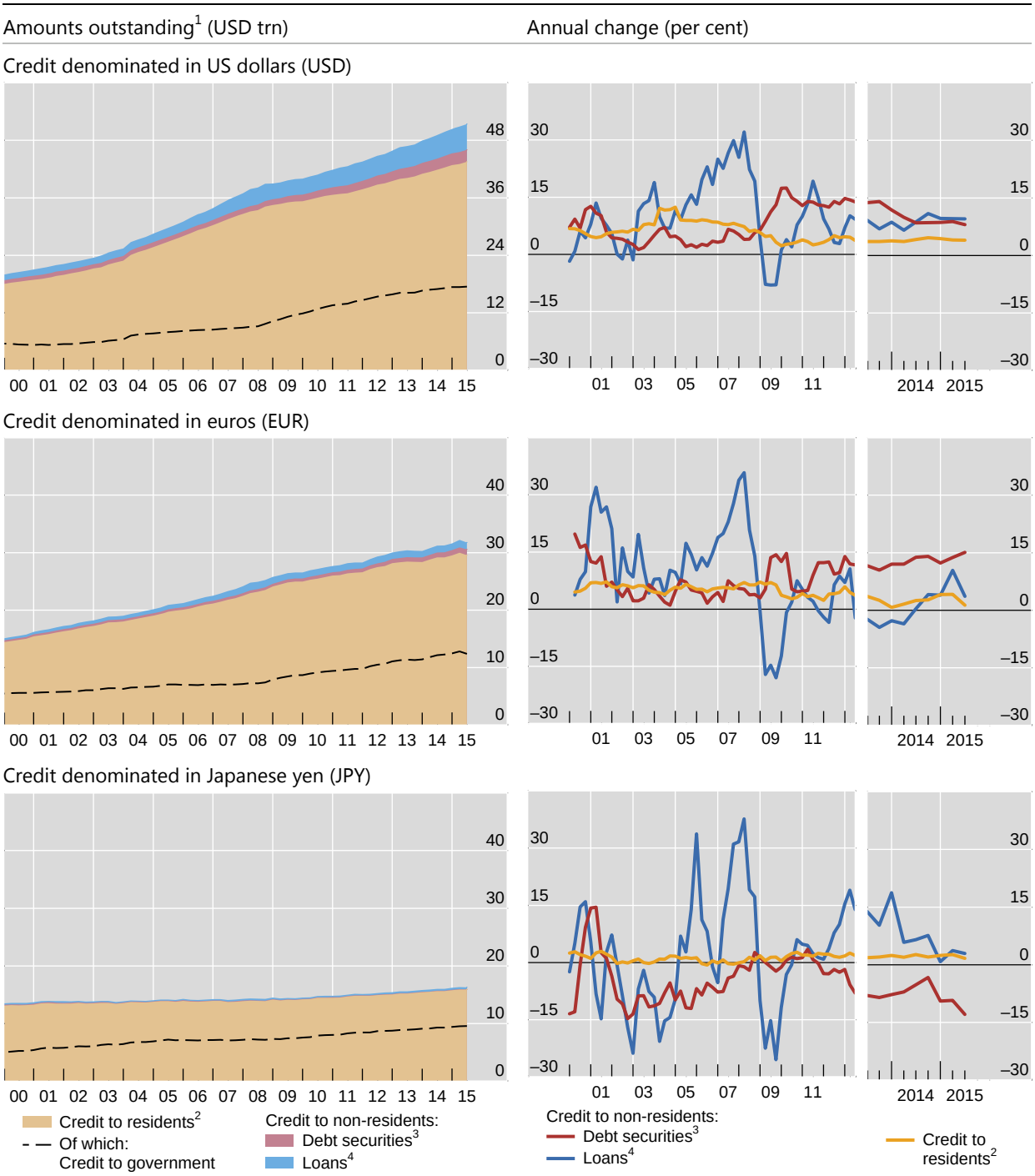
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[1] Cross-border claims of LBS reporting banks plus local claims of all banks. Local claims are from national financial accounts and include credit extended by the central bank to the government. [2] Sample of 52 countries. [3] Amounts outstanding at quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing at end-June 2015.

Sources: IMF, *International Financial Statistics*; BIS locational banking statistics; BIS calculations.

Global credit to the non-financial sector, by currency

Graph E.3



Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[1] Amounts outstanding at quarter-end. Amounts denominated in currencies other than USD are converted to USD at the exchange rate prevailing at end-June 2015. [2] Credit to non-financial borrowers residing in the United States/euro area/Japan. National financial accounts are adjusted using BIS banking and securities statistics to exclude credit denominated in non-local currencies. [3] Excluding debt securities issued by special purpose vehicles and other financial entities controlled by non-financial parents. EUR-denominated debt securities exclude those issued by institutions of the European Union. [4] Loans by LBS reporting banks to non-bank borrowers, including non-bank financial entities, comprises cross-border plus local loans. For countries that are not LBS reporting countries, local loans in USD/EUR/JPY are estimated as follows: for China, local loans in foreign currencies are from national data and assumed to be composed of 80% USD, 10% EUR and 10% JPY; for other non-reporting countries, local loans to non-banks are set equal to LBS reporting banks' cross-border loans to banks in the country (denominated in USD/EUR/JPY), on the assumption that these funds are on-lent to non-banks.

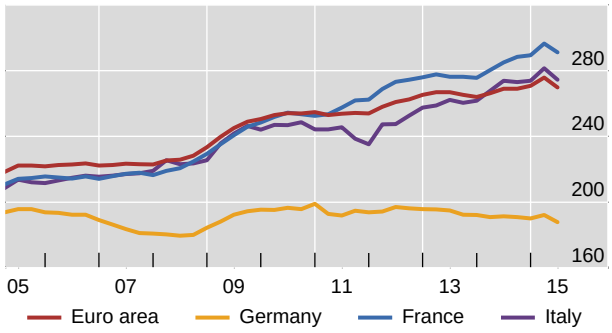
Sources: IMF, *International Financial Statistics*; Datastream; BIS debt securities statistics; BIS locational banking statistics.

F Statistics on total credit to the non-financial sector

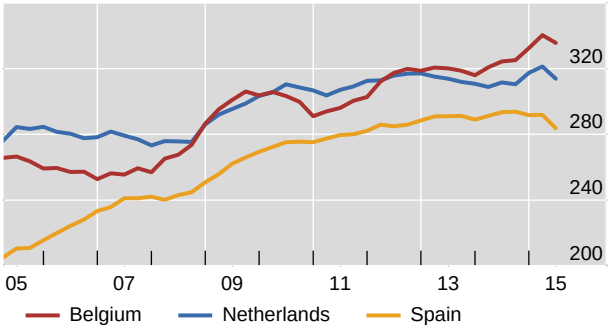
Total credit to the non-financial sector (core debt)

As a percentage of GDP — Graph F.1

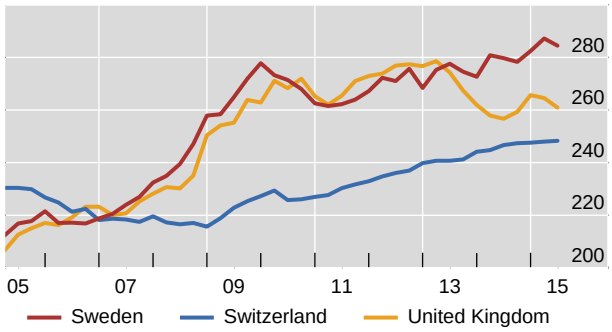
Euro area: aggregate and major countries



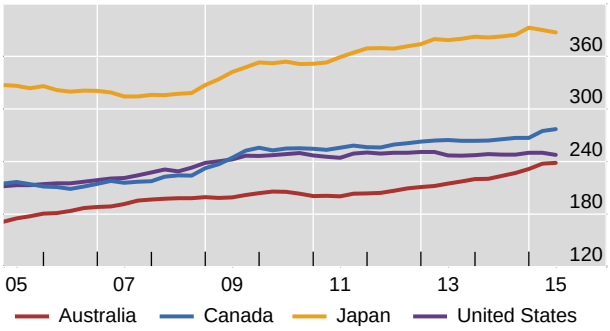
Euro area: other countries



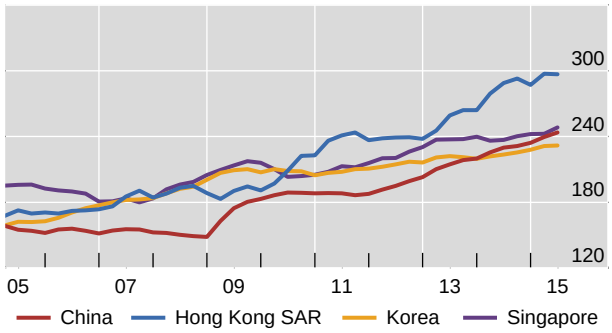
Other European countries



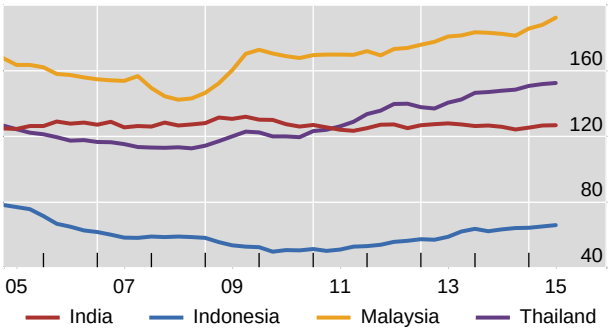
Major advanced economies



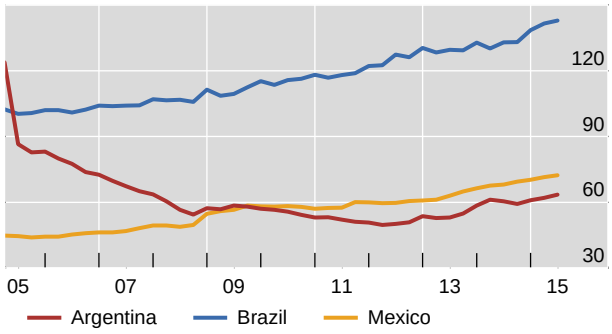
Emerging Asia



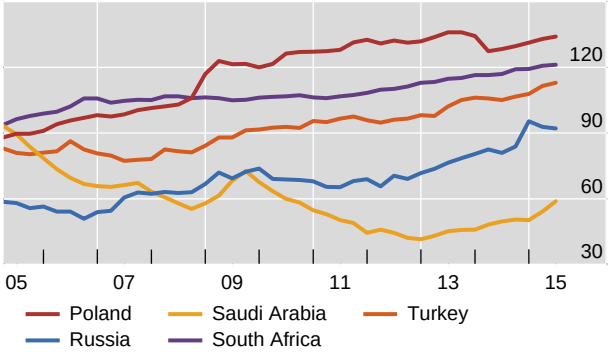
Other emerging Asia



Latin America



Other emerging market economies

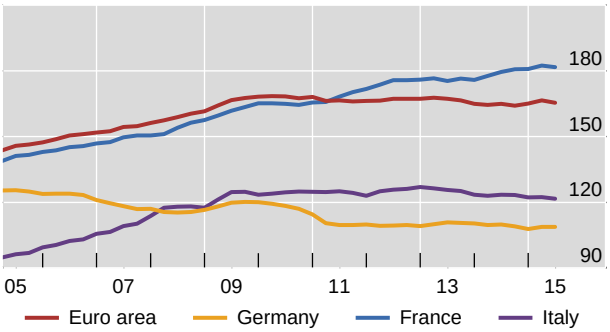


Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

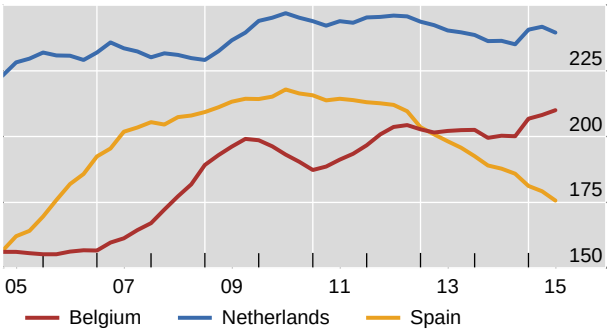
Total credit to the private non-financial sector (core debt)

As a percentage of GDP — Graph F.2

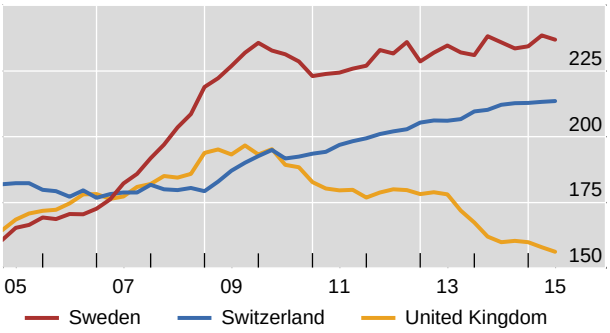
Euro area: aggregate and major countries



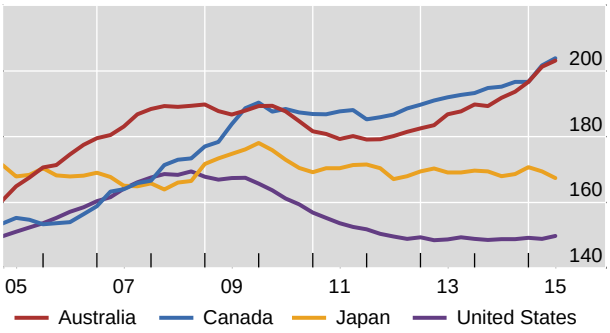
Euro area: other countries



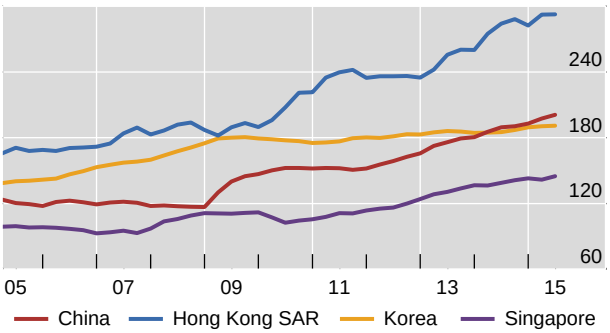
Other European countries



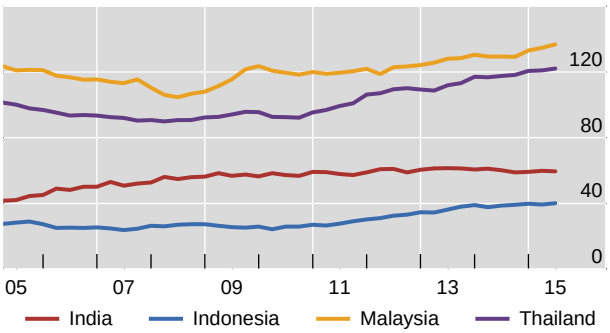
Major advanced economies



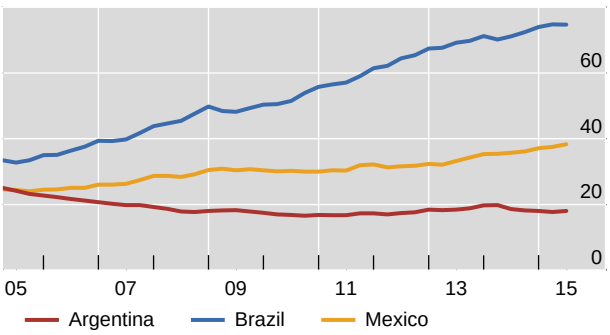
Emerging Asia



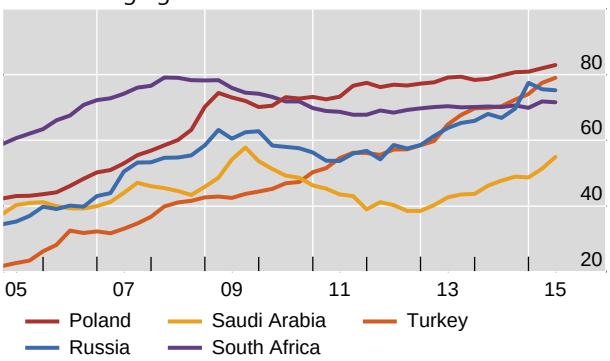
Other emerging Asia



Latin America



Other emerging market economies

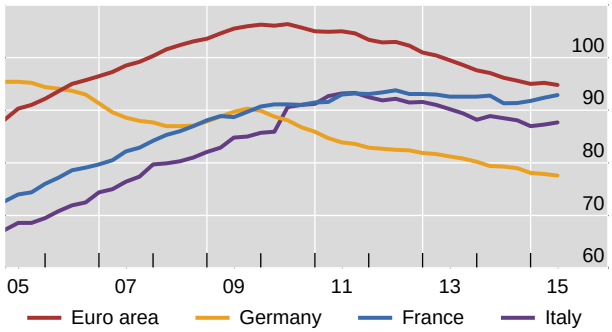


Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

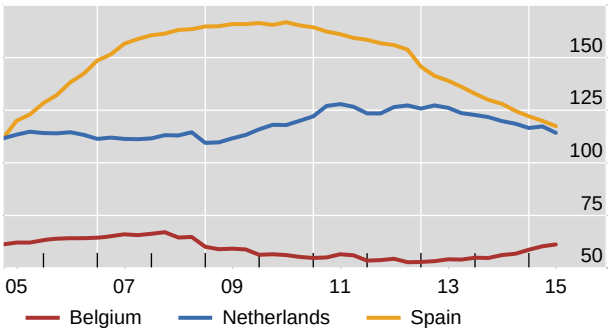
Bank credit to the private non-financial sector (core debt)

As a percentage of GDP — Graph F.3

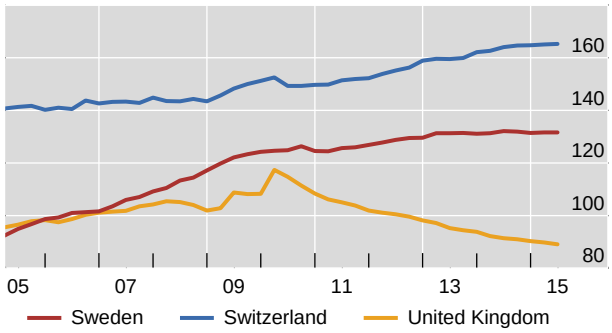
Euro area: aggregate and major countries



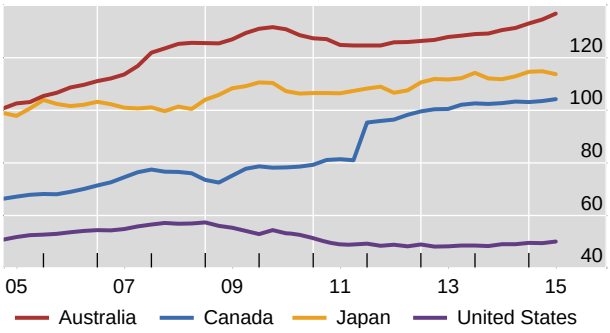
Euro area: other countries



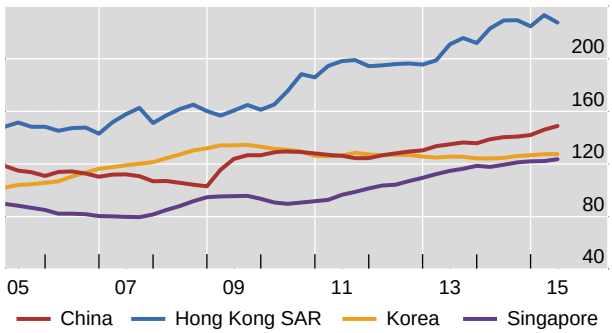
Other European countries



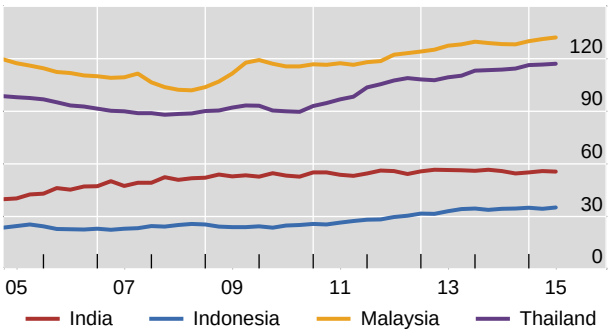
Major advanced economies



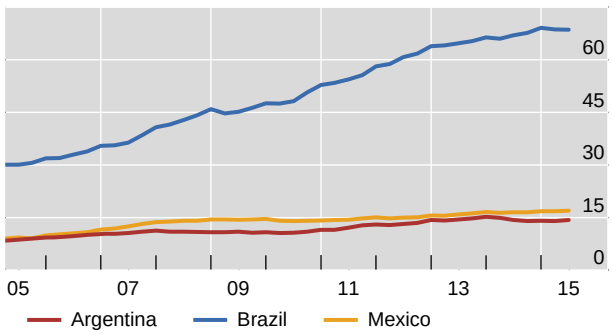
Emerging Asia



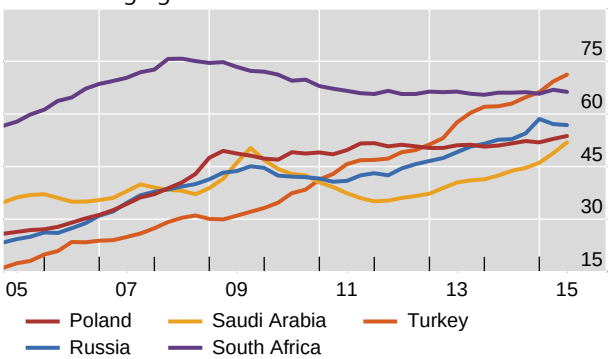
Other emerging Asia



Latin America



Other emerging market economies

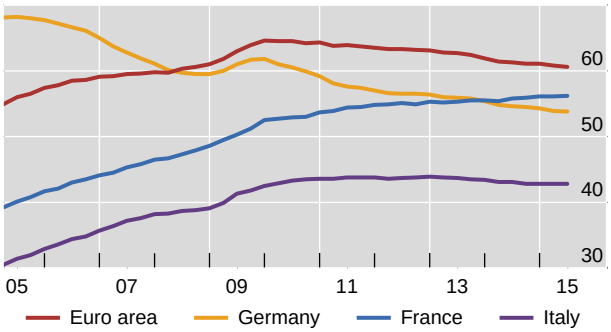


Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

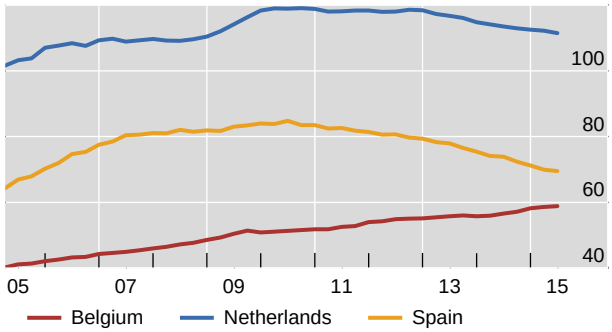
Total credit to households (core debt)

As a percentage of GDP — Graph F.4

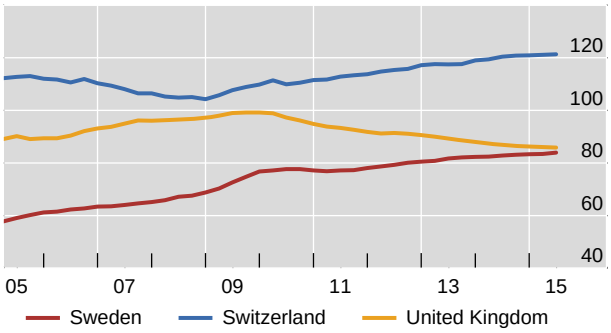
Euro area: aggregate and major countries



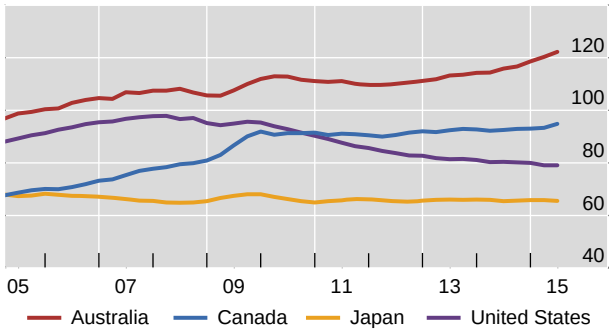
Euro area: other countries



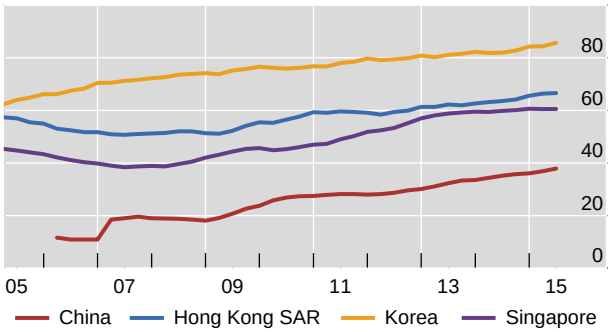
Other European countries



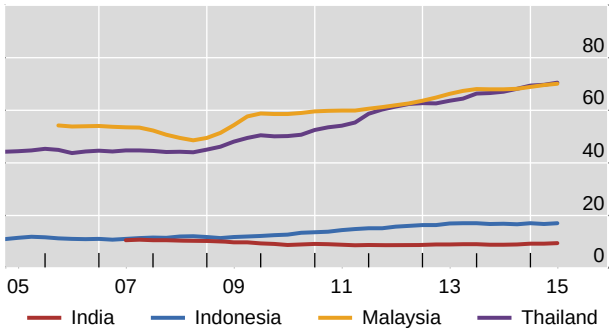
Major advanced economies



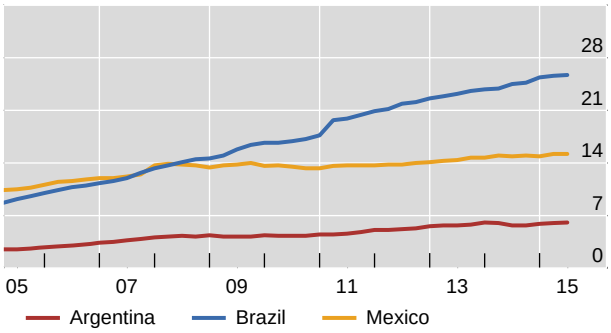
Emerging Asia



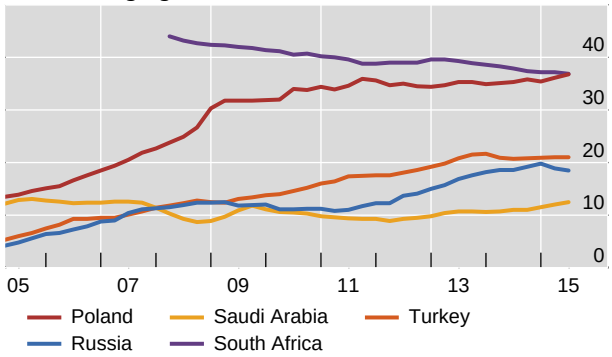
Other emerging Asia



Latin America



Other emerging market economies

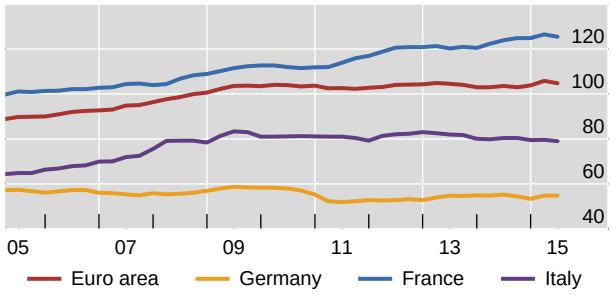


Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

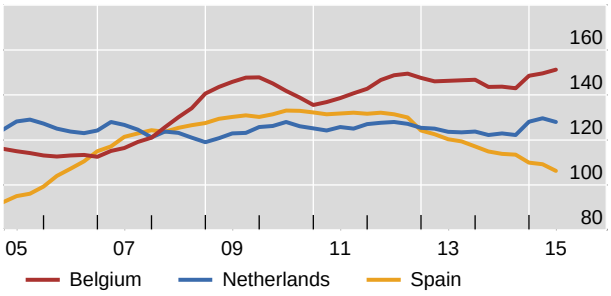
Total credit to non-financial corporations (core debt)

As a percentage of GDP — Graph F.5

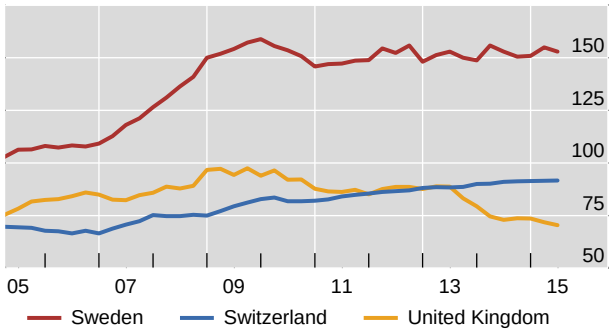
Euro area: aggregate and major countries



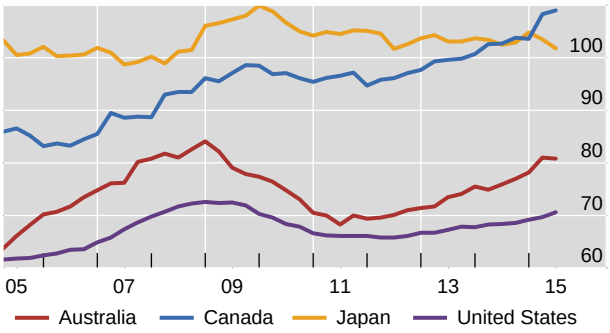
Euro area: other countries



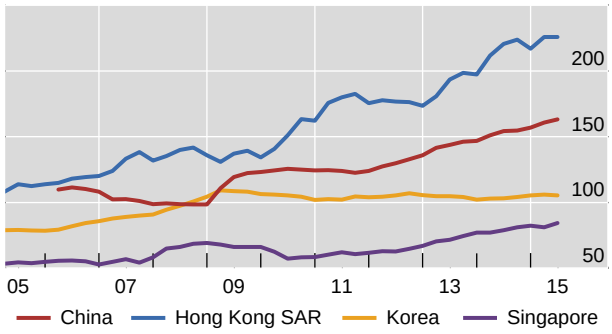
Other European countries



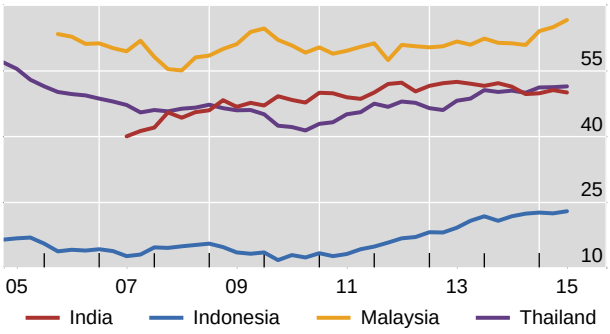
Major advanced economies



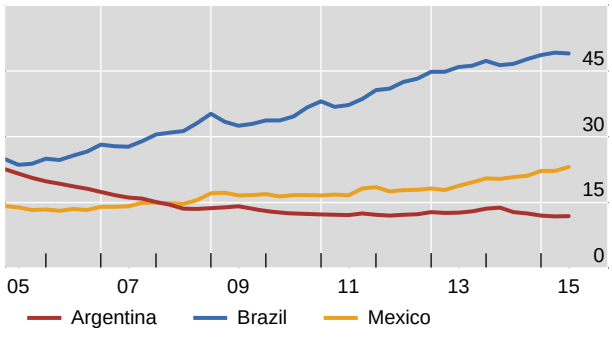
Emerging Asia



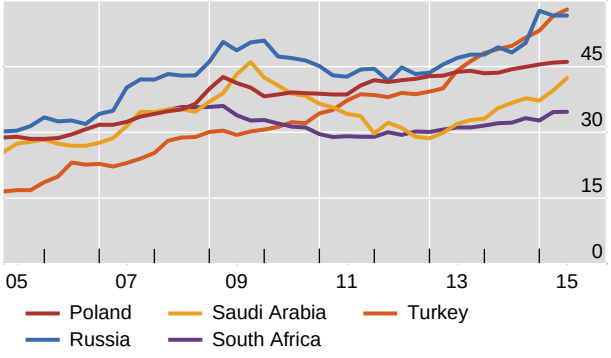
Other emerging Asia



Latin America



Other emerging market economies

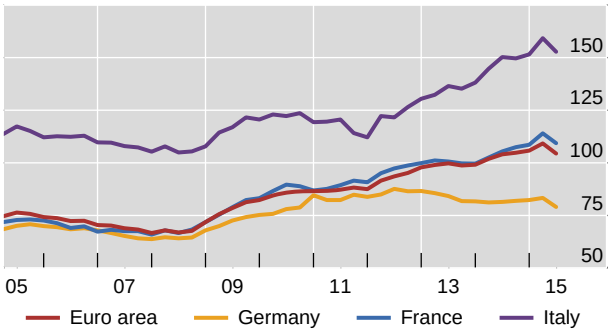


Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

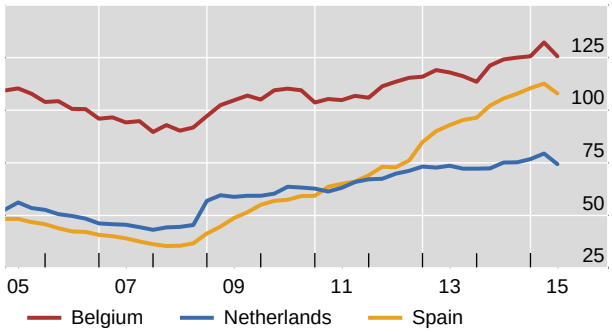
Total credit to the government sector at market value (core debt)[1]

As a percentage of GDP — Graph F.6

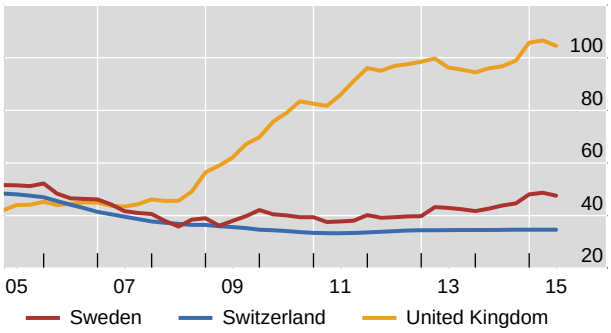
Euro area: aggregate and major countries



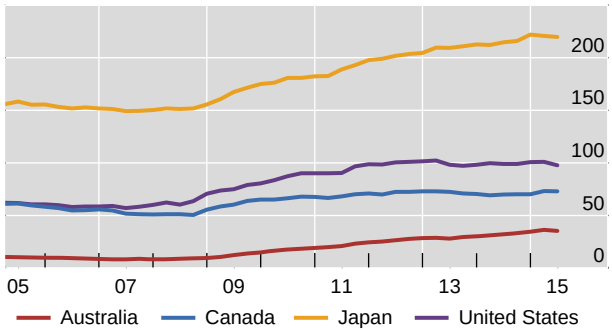
Euro area: other countries



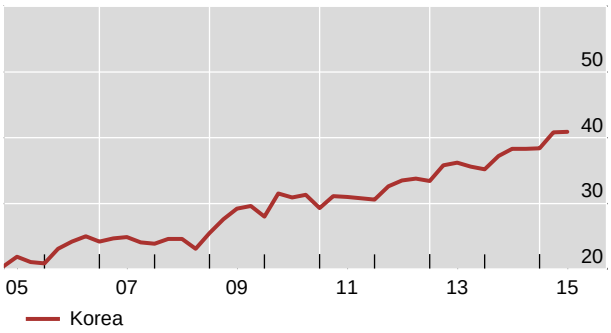
Other European countries



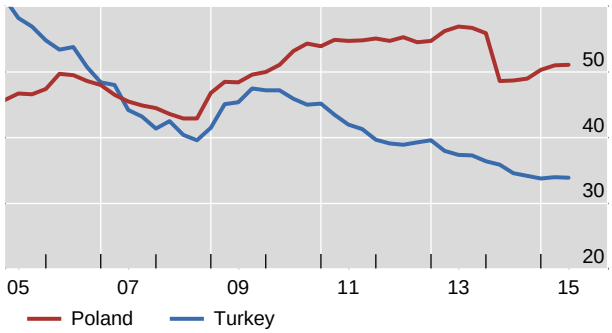
Major advanced economies



Emerging Asia



Other emerging market economies



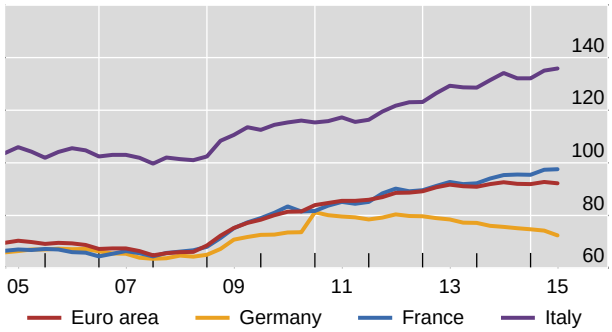
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

[1] Consolidated data for the general government sector.

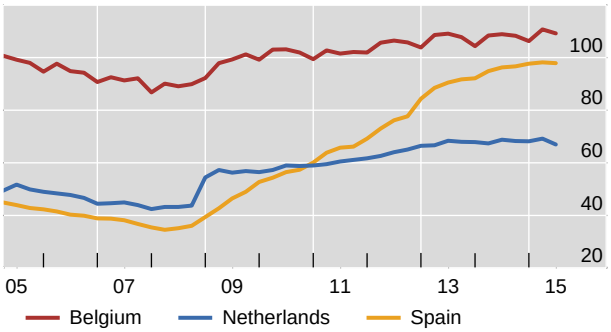
Total credit to the government sector at nominal value (core debt)[1]

As a percentage of GDP — Graph F.7

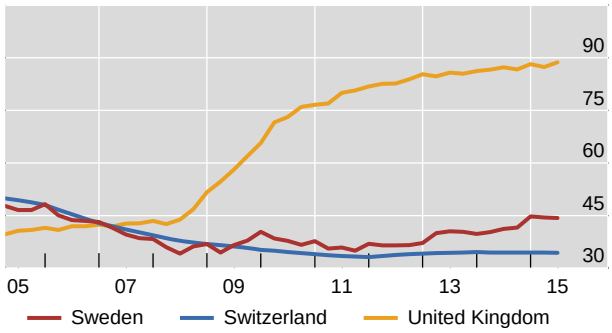
Euro area: aggregate and major countries



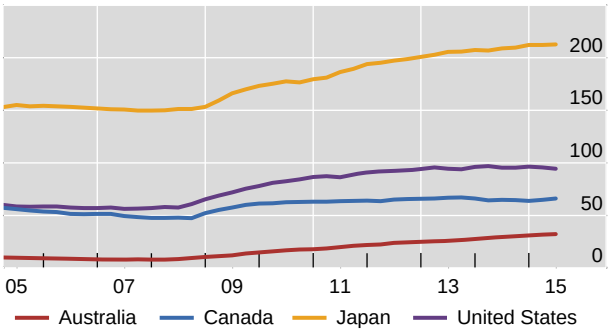
Euro area: other countries



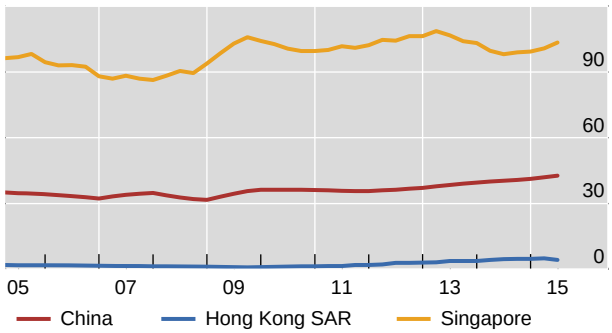
Other European countries



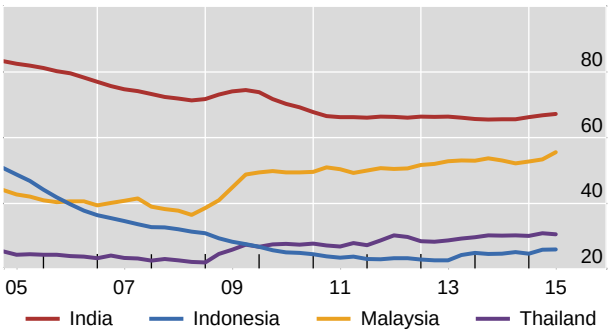
Major advanced economies



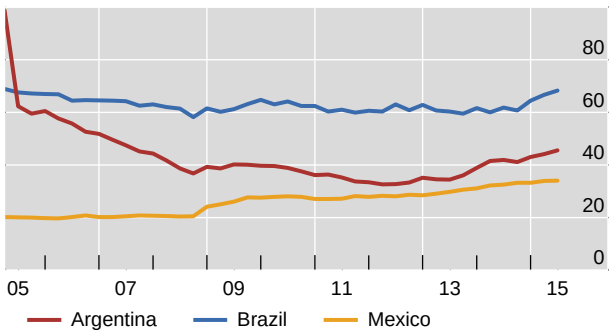
Emerging Asia



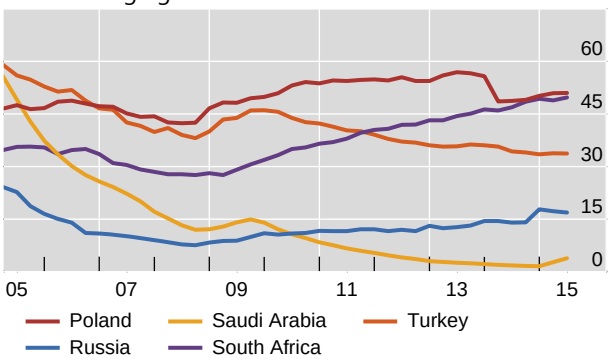
Other emerging Asia



Latin America



Other emerging market economies



Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

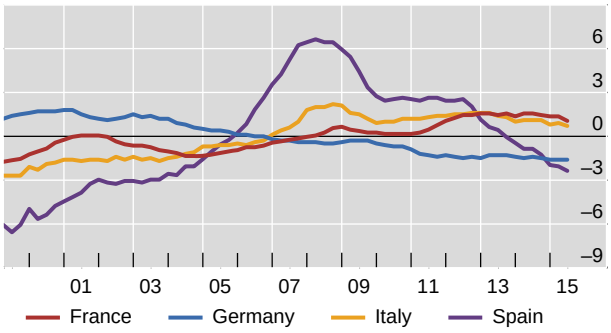
[1] Consolidated data for the general government sector; central government for Argentina, Indonesia, Malaysia, Mexico, Saudi Arabia and Thailand.

G Debt service ratios for the private non-financial sector

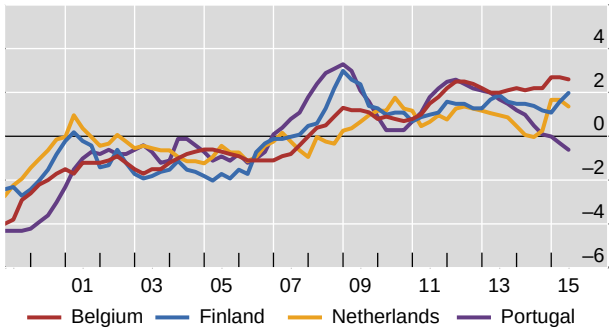
Debt service ratios of the private non-financial sector

Deviation from country-specific mean; in percentage points[1] Graph G.1

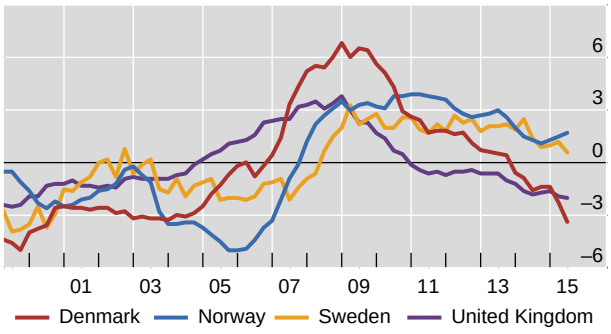
Euro area: major countries



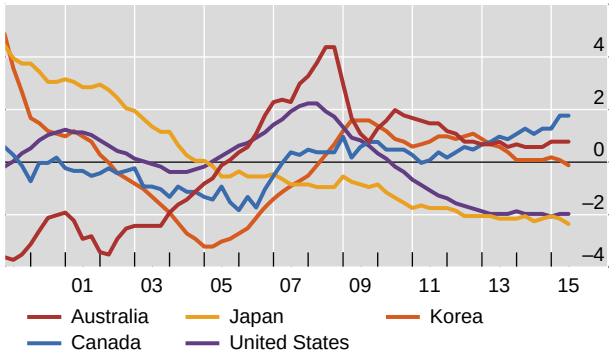
Euro area: other countries



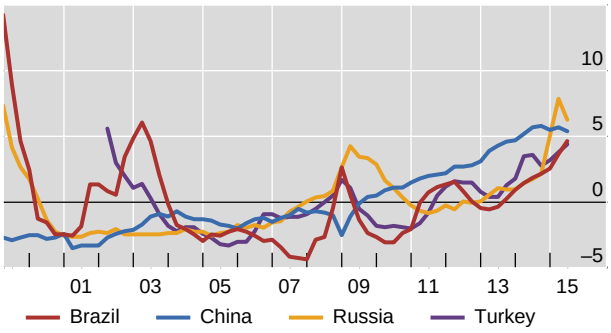
Other European countries



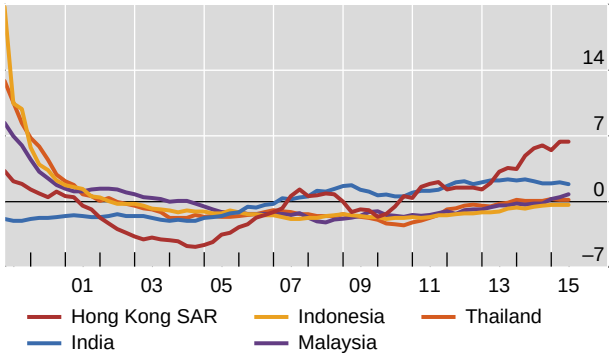
Other economies



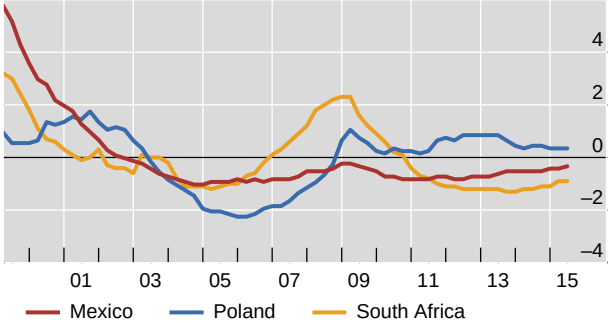
Major emerging markets[2]



Emerging Asia[2]



Other emerging markets[2]

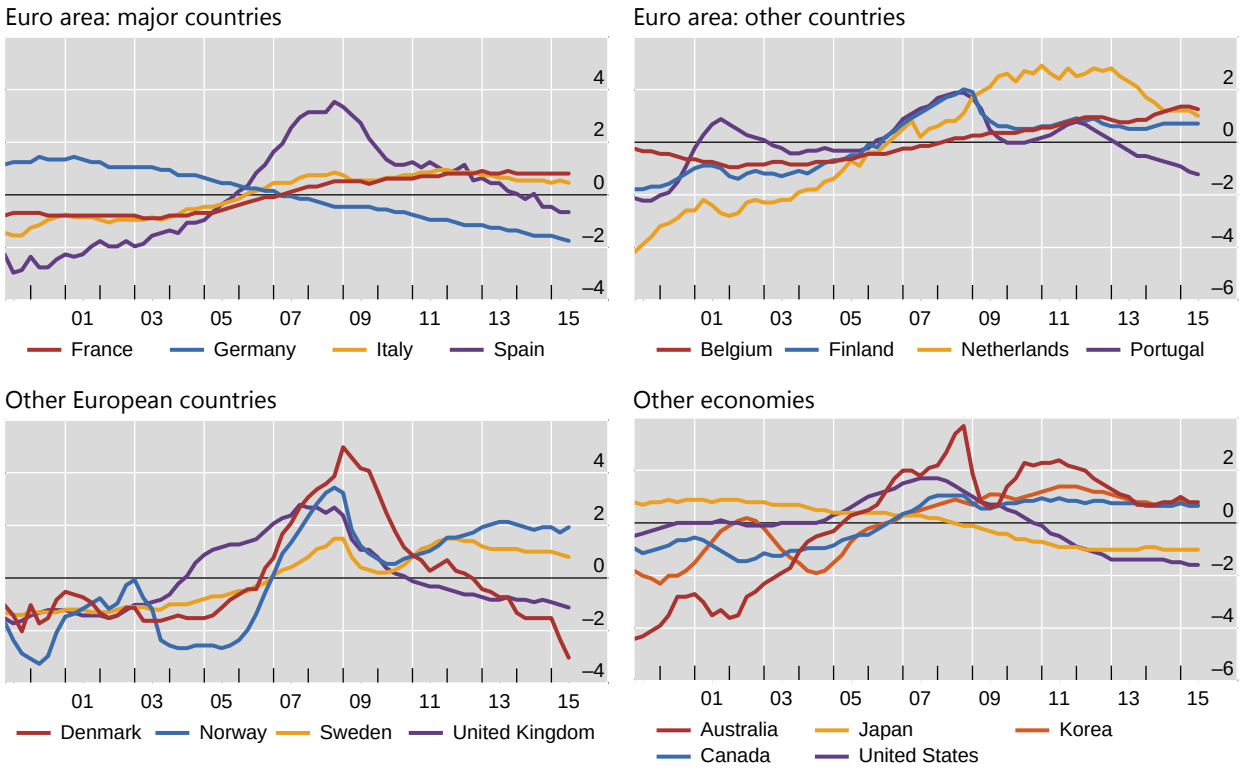


[1] Country-specific means are based on all available data from 1999 onwards. [2] Countries which are using alternative measures of income and interest rates. Further information is available under "Metholodogy and data for DSR calculation" at www.bis.org/statistics/dsr.htm.

Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

Debt service ratios of households

Deviation from country-specific mean; in percentage points[1] Graph G.2

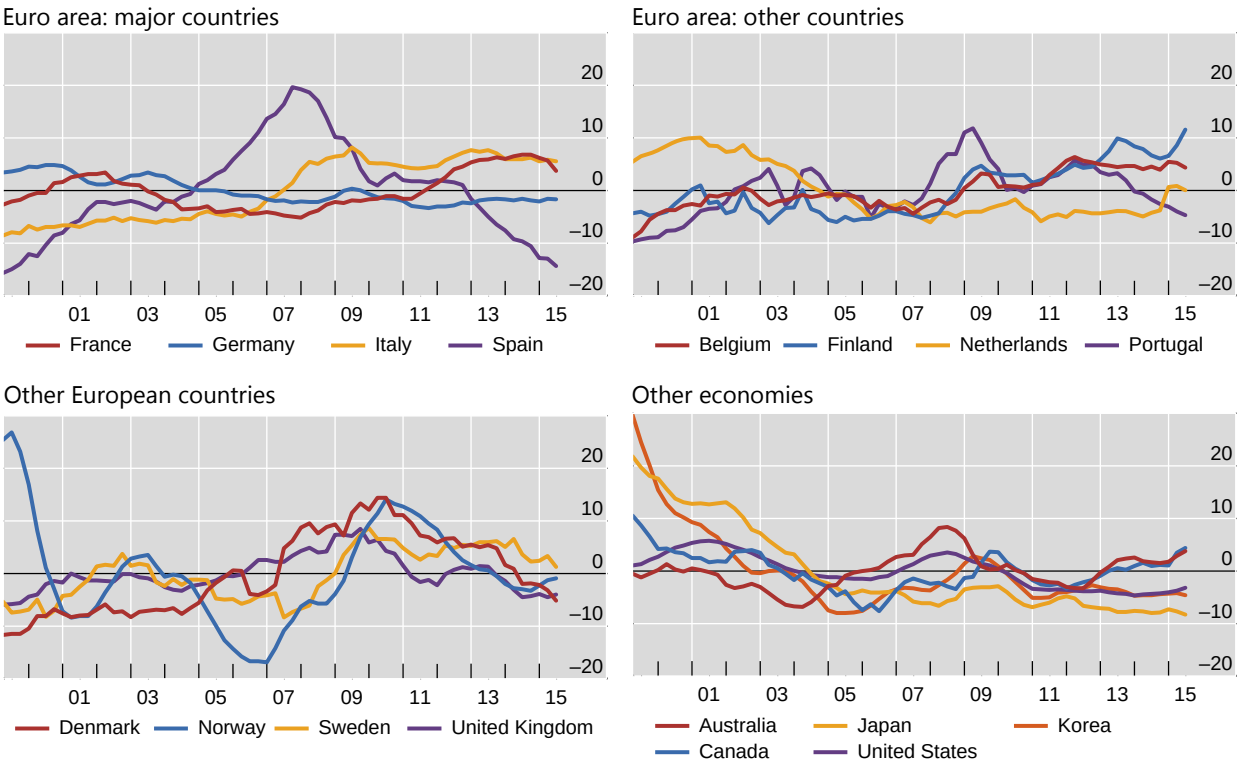


Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

[1] Country-specific means are based on all available data from 1999 onwards.

Debt service ratios of non-financial corporations

Deviation from country-specific mean; in percentage points[1] Graph G.3



Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

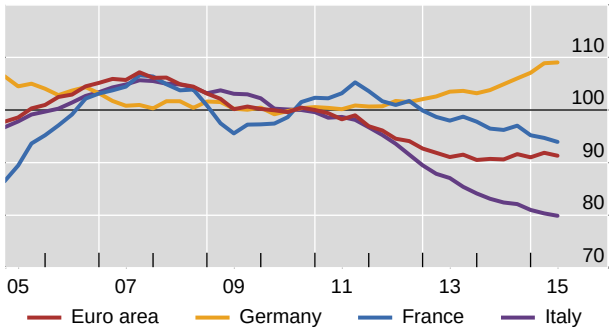
[1] Country-specific means are based on all available data from 1999 onwards.

H Property price statistics

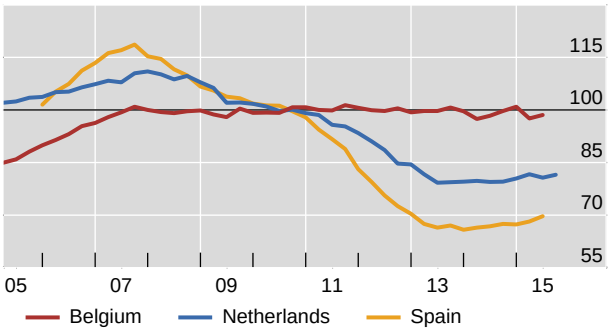
Real residential property prices

CPI-deflated; 2010 = 100 Graph H.1

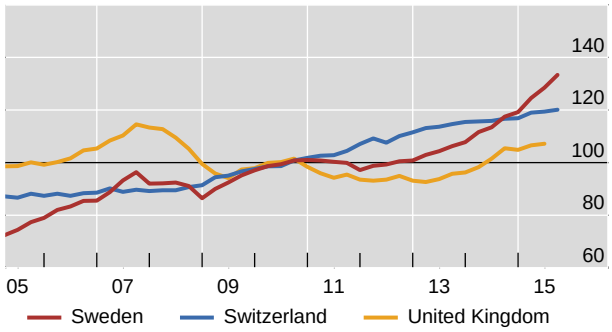
Euro area: aggregate and major countries



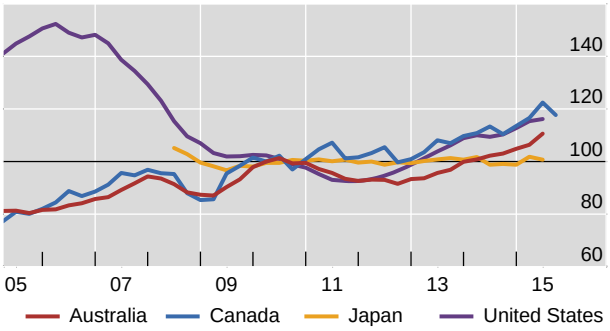
Euro area: other countries



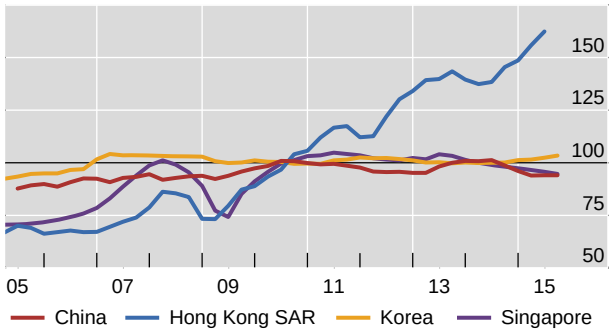
Other European countries



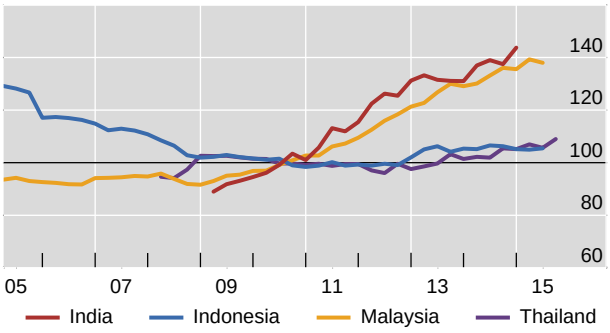
Major advanced economies



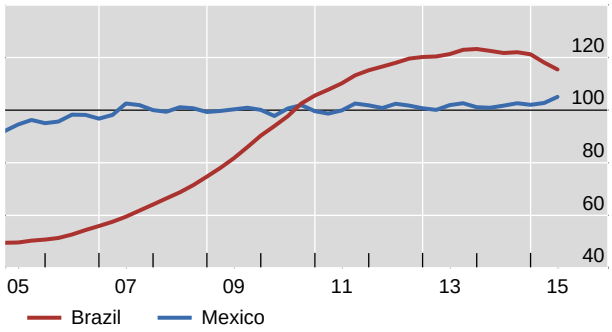
Emerging Asia



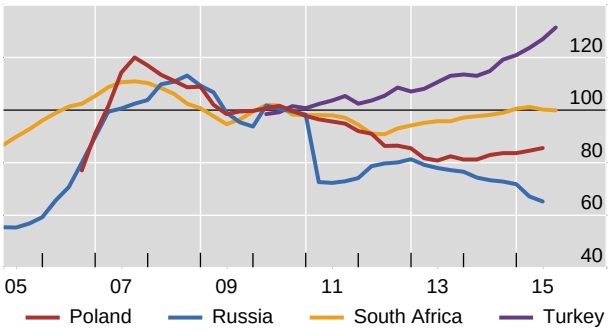
Other emerging Asia



Latin America



Other emerging market economies



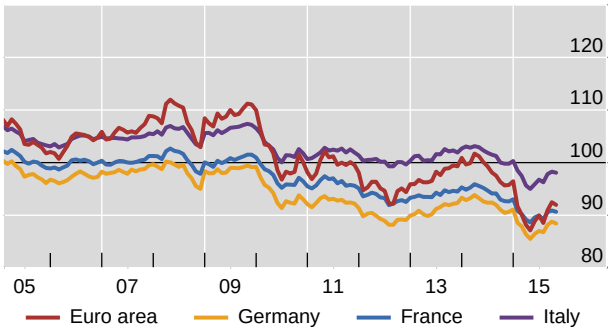
Further information on the BIS property price statistics is available at www.bis.org/statistics/pp.htm.

I Effective exchange rate statistics

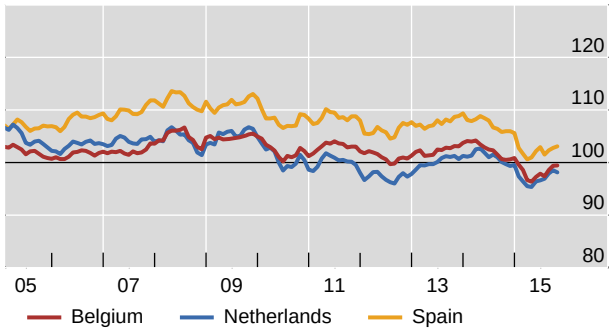
Real effective exchange rates

CPI-based; 1995–2005 = 100[1] Graph I.1

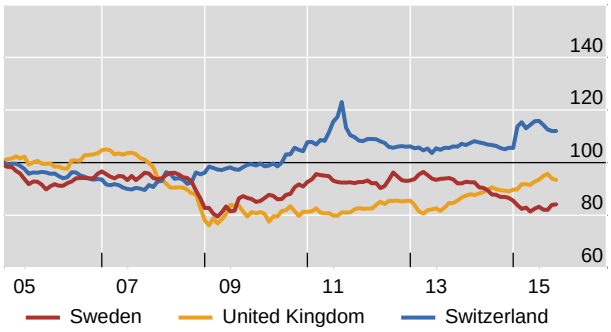
Euro area: aggregate and major countries



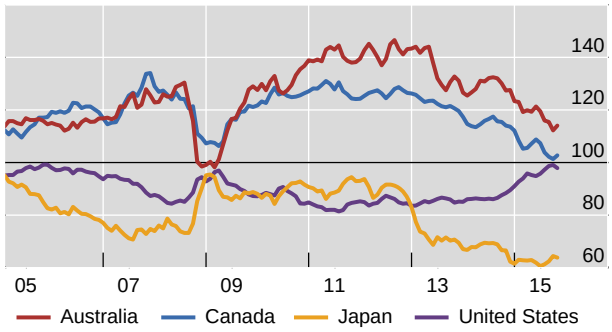
Euro area: other countries



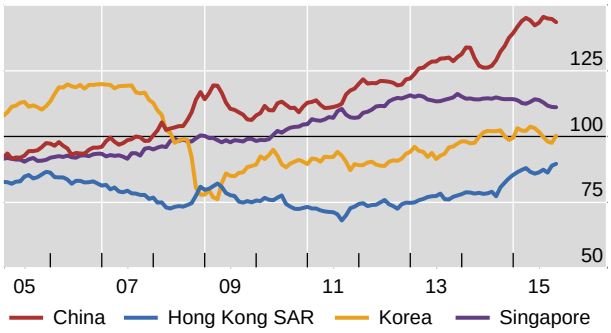
Other European countries



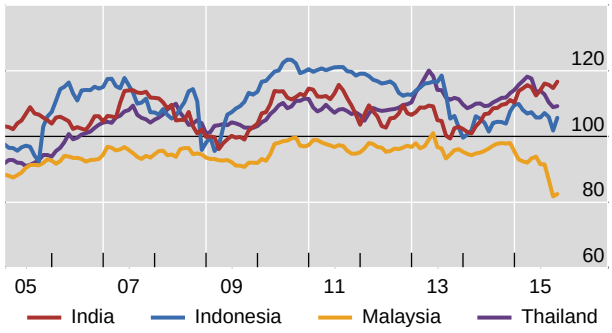
Major advanced economies



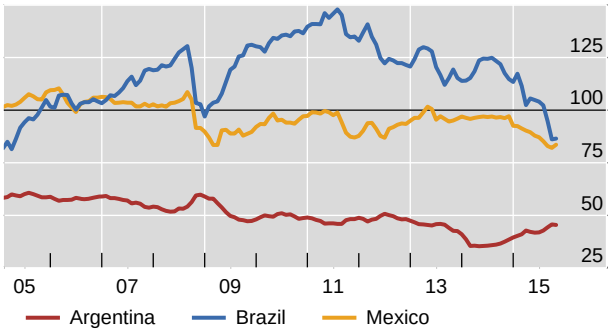
Emerging Asia



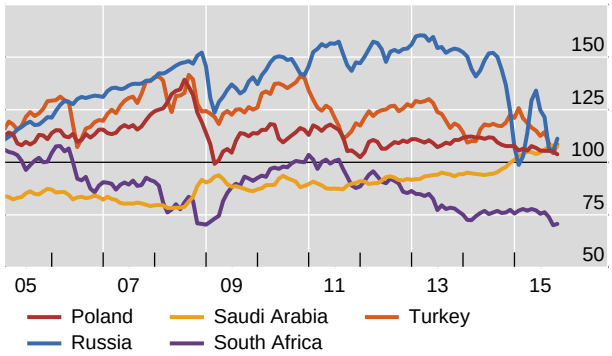
Other emerging Asia



Latin America



Other emerging market economies



Further information on the BIS effective exchange rate statistics is available at www.bis.org/statistics/eer.htm.

[1] An increase indicates an appreciation in the economy's currency in real terms against a broad basket of currencies.

Special features in the BIS Quarterly Review

September 2015	Introduction to BIS statistics	
September 2015	Enhanced data to analyse international banking	Stefan Avdjiev, Patrick McGuire and Philip Wooldridge
September 2015	A new database on general government debt	Christian Dembiermont, Michela Scatigna, Robert Szemere and Bruno Tissot
September 2015	How much income is used for debt payments? A new database for debt service ratios	Mathias Drehmann, Anamaria Illes, Mikael Juselius and Marjorie Santos
September 2015	International monetary spillovers	Boris Hofmann and Előd Takáts
September 2015	The rise of regional banking in Asia and the Pacific	Eli M Remolona and Ilhyock Shim
March 2015	The costs of deflations: a historical perspective	Claudio Borio, Magdalena Erdem, Andrew Filardo & Boris Hofmann
March 2015	Oil and debt	Dietrich Domanski, Jonathan Kearns, Marco Jacopo Lombardi & Hyun Song Shin
March 2015	(Why) Is investment weak?	Ryan Banerjee, Jonathan Kearns & Marco Lombardi
March 2015	Financial inclusion - issues for central banks	Aaron Mehrotra & James Yetman
March 2015	Shifting tides - market liquidity and market-making in fixed income instruments	Ingo Fender & Ulf Lewrick
December 2014	Currency movements drive reserve composition	Robert N McCauley & Tracy Chan
December 2014	Securitisations: tranching concentrates uncertainty	Adonis Antoniades & Nikola Tarashev
December 2014	Bank business models	Rungporn Roengpitya, Nikola Tarashev & Kostas Tsatsaronis
December 2014	Non-financial corporations from emerging market economies and capital flows	Stefan Avdjiev, Michael Chui & Hyun Song Shin

Recent BIS publications[1]

BIS Papers

What do new forms of finance mean for EM central banks?

Lending Papers in this volume were prepared for a meeting of senior officials from central banks held at the Bank for International Settlements.

Financial intermediation in emerging market economies (EMEs) has been transformed over the past decade: a higher volume of bond financing has gone hand-in-hand with a growing internationalization of financial markets and significant changes to the balance sheets of banks. The 2015 Deputy Governor meeting examined three interrelated aspects of the new forms of financial intermediation in EMEs: (a) the role of banks; (b) the role of debt securities markets; and (c) implications of recent changes in financial intermediation for monetary policy.

One conclusion is that greater access of households to bank credit and of EME corporations to domestic and external bond markets is a double-edged sword. On the one hand, it has helped foster financial development, diversifying funding sources and reducing credit risk concentration. On the other hand, it has also been accompanied by increased risks and vulnerabilities - as the financial market turbulences of 2015 illustrated. Domestic bond markets now react more strongly to global forces. Larger foreign currency debt has made many companies more vulnerable to exchange rate shocks. Credit cycles have also become more pronounced. These developments raise questions about the appropriate instruments for EME monetary authorities as they seek to contain monetary and financial stability risks.

Cross-border financial linkages: challenges for monetary policy and financial stability

Lending Ever more extensive global financial linkages are changing in ways that have significant implications for policy. Asia-Pacific countries have experienced a particularly rapid growth in financial flows since the crisis. Against this background, the BIS's Representative Office for Asia and the Pacific and the Reserve Bank of New Zealand (RBNZ) co-hosted a conference on cross-border financial linkages with a view to fostering research on implications of these important developments. The conference marked the completion of the BIS Asian Office's research programme in this area.

The event brought together senior officials and researchers from central banks, international organisations and academia. Governor Graeme Wheeler of the Reserve Bank of New Zealand made the opening remarks. Papers presented at the conference covered patterns of cross-border linkages, foreign exchange markets and exchange rate risks, financial market spillovers in Asia-Pacific, and policies to deal with capital flows and their effectiveness. The volume comprises the opening speech and papers presented at the conference.

[1] Requests for publications should be addressed to Bank for International Settlements, Press & Communications, Centralbahnplatz 2, CH-4002 Basel. These publications are also available on the BIS website (www.bis.org).

BIS Working Papers

A search-based model of the interbank money market and monetary policy implementation

Morten Linneman Bech and Cyril Monnet

We present a search-based model of the interbank money market and monetary policy implementation. Banks are subject to reserve requirements and the central bank tenders reserves. Interbank payments redistribute holdings and banks trade with each other in a decentralized (over-the-counter) market. The central bank provides standing facilities where banks can either deposit surpluses or borrow to cover shortfalls of reserves overnight. The model provides insights on liquidity, trading volume, and rate dispersion in the interbank market - features largely absent from the canonical models in the tradition of Poole (1968) - and fits a number of stylized facts for the Eurosystem observed during the recent period of unconventional monetary policies. Moreover, it provides insights on the implications of different market structures.

External shocks, banks and optimal monetary policy in an open economy

Yasin Mimir and Enes Sunel

We document empirically that the 2007-09 Global Financial Crisis exposed emerging market economies (EMEs) to an adverse feedback loop of capital outflows, depreciating exchange rates, deteriorating balance sheets, rising credit spreads and falling real economic activity. In order to account for these empirical findings, we build a New-Keynesian DSGE model of a small open economy with a banking sector that has access to both domestic and foreign funding. Using the calibrated model, we investigate optimal, simple and operational monetary policy rules that respond to domestic/external financial variables alongside inflation and output. The Ramsey-optimal policy rule is used as a benchmark. The results suggest that such an optimal policy rule features direct and non-negligible responses to lending spreads over the cost of foreign debt, the real exchange rate and the US policy rate, together with a mild anti-inflationary policy stance in response to domestic and external shocks. Optimal policy faces trade-offs in smoothing inefficient fluctuations in the intratemporal and intertemporal wedges driven by inflation, credit spreads and the real exchange rate. In response to productivity and external shocks, a countercyclical reserve requirement (RR) rule used in coordination with a conventional interest rate rule attains welfare levels comparable to those implied by spread- and real exchange rate-augmented rules.

Expectations and risk premia at 8:30am: Macroeconomic announcements and the yield curve

Peter Hördahl, Eli M Remolona and Giorgio Valente

We investigate the movements of the yield curve after the release of major U.S. macroeconomic announcements through the lenses of an arbitrage-free dynamic term structure model with macroeconomic fundamentals. Combining estimated yield responses obtained using high-frequency data with model estimates using monthly data, we show that bond yields move after announcements mostly because of revisions to expectations about short-term interest rates. Changes in risk premia are also sizable, partly offset the effects of short-rate expectations and help to account for the hump-shaped pattern across maturities. Most announcement responses are due to changes in expectations about the output gap.

Modelling the time-variation in euro area lending spreads

Boris Blagov, Michael Funke and Richhild Moessner

Using a Markov-switching VAR with endogenous transition probabilities, we analyse what has triggered the interest rate pass-through impairment for Italy, Ireland, Spain and Portugal. We find that global risk factors have contributed to higher lending rates in Italy and Spain, problems in the banking sector help to explain the impairment in Spain, and fiscal problems and contagion effects have contributed in Italy and Ireland. We also find that the ECB's unconventional monetary policy announcements have had temporary positive effects in Italy.

Due to the zero lower bound these findings are amplified if EONIA is used as a measure of the policy rate. We did not detect changes in the monetary policy transmission for Portugal.

Capital flows and the current account: Taking financing (more) seriously
Claudio Borio and Piti Disyatat

This paper questions the appropriateness of popular analytical frameworks that focus on current accounts or net capital flows as a basis for assessing the pattern of cross-border capital flows, the degree of financial integration and the vulnerability of countries to financial crises. In the process, it revisits the Lucas paradox, the Feldstein-Horioka puzzle and the notion of sudden stops. It argues that, in a world of huge and free capital flows, the centrality of current accounts in international finance, and hence in academic and policy debates, should be reconsidered.

Breaking free of the triple coincidence in international finance
Stefan Avdjiev, Robert Neil McCauley and Hyun Song Shin

The traditional approach to international finance is to view capital flows as the financial counterpart to savings and investment decisions, assuming further that the GDP boundary defines both the decision-making unit and the currency area. This "triple coincidence" of GDP area, decision-making unit and currency area is an elegant simplification but misleads when financial flows are important in their own right. First, the neglect of gross flows, when only net flows are considered, can lead to misdiagnoses of financial vulnerability. Second, inattention to the effects of international currencies may lead to erroneous conclusions on exchange rate adjustment. Third, sectoral differences between corporate and official sector positions can distort welfare conclusions on the consequences of currency depreciation, as macroeconomic risks may be underestimated. This paper illustrates the pitfalls of the triple coincidence through a series of examples from the global financial system in recent years and examines alternative analytical frameworks based on balance sheets as the unit of analysis.

The evolution of inflation expectations in Canada and the US
James Yetman

We model inflation forecasts as monotonically diverging from an estimated long-run anchor point towards actual inflation as the forecast horizon shortens. Fitting the model with forecaster-level data for Canada and the US, we identify three key differences between the two countries. First, the average estimated anchor of US inflation forecasts has tended to decline gradually over time in rolling samples, from 3.4% for 1989-1998 to 2.2% for 2004-2013. By contrast, it has remained close to 2% since the mid-1990 for Canadian forecasts. Second, the variance of estimates of the long-run anchor is considerably lower for the panel of Canadian forecasters than US ones following Canada's adoption of inflation targets. And third, forecasters in Canada look much more alike than those in the US in terms of the weight that they place on the anchor. One explanation for these results is that an explicit inflation targeting regime (Canada) provides for less uncertainty about future monetary policy actions than a monetary policy regime where there was no explicit numerical inflation target (the US before 2012) to anchor expectations.

Do banks extract informational rents through collateral?
Bing Xu, Honglin Wang and Adrian Van Rixtel

This paper investigates if informational monopolies resulting from relationship lending and bank market concentration allow for rent extraction through collateral. Our identification strategy hinges on the notion that informational equalization shocks (such as equity IPOs) erode rent seeking opportunities, while competing theories do not rely on information asymmetries among lenders. Using a unique hand-collected database of 9,288 bank loans obtained by 649 listed Chinese firms, we find that collateral incidence is positively associated with relationship intensity and bank market concentration, while this effect is moderated for post-IPO loans. These results are obtained controlling for a large number of loan and firm characteristics, monetary policy variables and regional macroeconomic characteristics. We also demonstrate important cross-sectional variation among borrowing firms: rent extraction through collateral is significantly less pronounced for less risky firms. Our results hold for a battery of robustness tests, both included in the paper and in an Internet appendix (available

upon request). Furthermore, we provide new evidence on the determinants of collateral in Chinese bank lending markets.

Does variance risk have two prices? Evidence from the equity and option markets
Laurent Barras and Aytek Malkhozov

We formally compare two versions of the market Variance Risk Premium (VRP) measured in the equity and option markets. Both VRPs follow common patterns and respond similarly to changes in volatility and economic conditions. However, we reject the null hypothesis that they are identical and find that their difference is strongly related to measures of the financial standing of intermediaries. These results shed new light on the information content of the VRP, suggest the presence of market frictions between the two markets, and are consistent with the key role played by intermediaries in setting option prices.

Optimal inflation with corporate taxation and financial constraints
Daria Finocchiaro, Giovanni Lombardo, Caterina Mendicino and Philippe Weil

This paper revisits the equilibrium and welfare effects of long-run inflation in the presence of distortionary taxes and financial constraints. Expected inflation interacts with corporate taxation through the deductibility of i) capital expenditures at historical value and ii) interest payments on debt. Through the first channel, inflation increases firms' taxable profits and further distorts their investment decisions. Through the second, expected inflation affects the effective real interest rate, relaxes firms' financial constraints and stimulates investment. We show that, in the presence of collateralized debt, the second effect dominates. Therefore, in contrast to earlier literature, we find that when the tax code creates an advantage of debt financing, a positive rate of long-run inflation is beneficial in terms of welfare as it mitigates the financial distortion and spurs capital accumulation.

The hunt for duration: not waving but drowning?
Dietrich Domanski, Hyun Song Shin and Vladyslav Sushko

Long-term interest rates in Europe fell sharply in 2014 to historically low levels. This development is often attributed to yield-chasing in anticipation of quantitative easing (QE) by the European Central Bank (ECB). We examine how portfolio adjustments by long-term investors aimed at containing duration mismatches may have acted as an amplification mechanism in this process. Declining long-term interest rates tend to widen the negative duration gap between the assets and liabilities of insurers and pension funds, and any attempted rebalancing by increasing asset duration results in further downward pressure on interest rates. Evidence from the German insurance sector is consistent with such an amplification mechanism.

Monetary policy and financial spillovers: losing traction?
Piti Disyatat and Phurichai Rungcharoenkitkul

Has financial globalisation compromised central banks' ability to manage domestic financial conditions? This paper tackles this question by studying the dynamics of bond yields encompassing 31 advanced and emerging market economies. To gauge the extent to which external financial conditions complicate the conduct of monetary policy, we isolate a "contagion" component by focusing on comovements in measures of bond return risk premia that are unrelated to economic fundamentals. Our contagion measure is designed to more accurately capture spillovers driven by exogenous global shifts in risk preference or appetite. The analysis reaches several conclusions that run counter to popular presumptions based on comovements in bond yields. In particular, emerging market economies appear to be much less susceptible to global contagion than advanced economies, and the overall sensitivities to contagion have not increased post-crisis.

Leverage on the buy side
Fernando Avalos, Ramon Moreno and Tania Romero

This paper investigates the microeconomic determinants of leverage decisions by asset managers. Investment funds (the "buy side") have significantly increased their share of global capital flows in recent years. Unconventional monetary policies in advanced economies have squeezed returns while reducing borrowing costs, which in principle creates an incentive for asset managers to use more leverage. We start by studying the recent behaviour of fund

leverage in different asset categories at an aggregate level. Leverage appears to have increased significantly in funds focused on the fixed income markets of emerging economies. Then we analyse the microeconomic factors that shape the leverage decision. In line with theory, we find that leverage rises with expected returns, and falls with market risk and borrowing costs. Transaction costs are also mentioned in the literature as another factor that should inhibit leverage. Lacking the requisite data, we introduce as proxies changes in capital controls and macroprudential policies, because they tend to affect expected returns in comparable ways. We find that tighter capital controls on inflows increase leverage rather than decrease it, but that macroprudential measures have no discernible effect. Finally, we discuss these results and their policy implications.

Optimal time-consistent macroprudential policy
Javier Bianchi and Enrique G Mendoza

Collateral constraints widely used in models of financial crises feature a pecuniary externality: Agents do not internalize how borrowing decisions taken in "good times" affect collateral prices during a crisis. We show that agents in a competitive equilibrium borrow more than a financial regulator who internalizes this externality. We also find, however, that under commitment the regulator's plans are time-inconsistent, and hence focus on studying optimal, time-consistent policy without commitment. This policy features a state-contingent macroprudential debt tax that is strictly positive at date t if a crisis has positive probability at t + 1. Quantitatively, this policy reduces sharply the frequency and magnitude of crises, removes fat tails from the distribution of returns, and increases social welfare. In contrast, constant debt taxes are ineffective and can be welfare-reducing, while an optimized "macroprudential Taylor rule" is e effective but less so than the optimal policy.

The impact of CCPs' margin policies on repo markets
Arianna Miglietta, Cristina Picillo and Mario Pietrunti

This paper quantifies the impact on the cost of funding in repo markets of the initial margins applied by central clearing counterparties (CCPs). We use contract-level data on the general collateral (GC) segment of Italy's MTS Repo market between January 2011 and April 2014. The analysis shows that the initial margins, paid by all participants, had a positive and significant effect on the cost of funding. Such an impact is consistent across different model specifications and data subsamples.

The influence of monetary policy on bank profitability
Claudio Borio, Leonardo Gambacorta and Boris Hofmann

This paper investigates how monetary policy affects bank profitability. We use data for 109 large international banks headquartered in 14 major advanced economies for the period 1995-2012. Overall, we find a positive relationship between the level of short-term rates and the slope of the yield curve (the "interest rate structure", for short), on the one hand, and bank profitability - return on assets - on the other. This suggests that the positive impact of the interest rate structure on net interest income dominates the negative one on loan loss provisions and on non-interest income. We also find that the effect is stronger when the interest rate level is lower and the slope less steep, ie that non-linearities are present. All this suggests that, over time, unusually low interest rates and an unusually flat term structure erode bank profitability.

The determinants of long-term debt issuance by European banks: evidence of two crises
Adrian Van Rixtel, Luna Romo González and Jing Yang

This paper is one of the first to investigate the determinants of bond issuance by European banks. We use a unique database of around 50,000 bonds issued by 63 banks from 14 European countries, allowing us to differentiate between different types of long-term debt securities. By investigating at the individual bank level, we are able to test explicitly a broad set of hypotheses from both the corporate finance and banking literature on the drivers of bond issuance. We use both country and bank-specific financial characteristics as explanatory variables. With respect to the country determinants, our findings suggest that "market timing" (low interest rates) drove issuance before but not during the crisis, when access to

funding became more important than its cost. Moreover, during the crisis years, country-risk characteristics became drivers of bond issuance, while for banks from the euro area periphery central bank liquidity substituted for unsecured long-term debt. We also show that heightened financial market tensions were detrimental to bond issuance, and more strongly so during crisis episodes. Our results yield strongly significant coefficients for the bank-specific variables, with signs as expected. We find evidence of "leverage targeting" by issuing long-term debt during the crisis years. The positive and significant coefficient for the capital ratio supports the "risk absorption" hypothesis, suggesting that larger capital buffers enhanced the risk-bearing capacity of banks and allowed them to issue more debt. Moreover, banks with deposit supply constraints and relatively large loan portfolios issued more bonds, both before and since the crisis years. We also find that higher rated banks were more likely to issue bonds, also during the crisis period. Stronger banks issued especially unsecured debt, while weaker banks resorted more to issuance of covered bonds. Overall, our results suggest that stronger banks - including those from peripheral countries - maintained better access to longer-term funding markets, even during crisis periods. Our results pass several robustness tests. We present an additional aggregated country analysis in a separate appendix.

International reserves and gross capital flow dynamics
Enrique Alberola-Ila, Aitor Erce and José María Serena

This paper explores the role of international reserves as a stabiliser of international capital flows, in particular during periods of global financial stress. In contrast with previous contributions, aimed at explaining net capital flows, we focus on the behaviour of gross capital flows. We analyse an extensive cross-country quarterly database, comprising 63 countries for the period 1991-2010, using standard panel regressions. We document significant heterogeneity in the response of resident investors to financial stress and relate it to a previously undocumented channel through which reserves act as a buffer during financial stress. A robust result of the analysis is that international reserves facilitate financial disinvestment overseas by residents - a fall in capital outflows. This partially offsets the drop in foreign capital inflows observed in such periods. For the whole sample, we also find that larger stocks of international reserves are linked to higher gross inflows and lower gross outflows. These results, which challenge current approaches to measuring reserve adequacy, call for refining such tools to better account for the role of resident investors.

Higher bank capital requirements and mortgage pricing: evidence from the Countercyclical Capital Buffer (CCB)
Christoph Basten and Catherine Koch

How has the CCB affected mortgage pricing after Switzerland became the first country to activate this Basel III macroprudential tool? By analyzing a database with several offers per mortgage request, we construct a picture of mortgage supply and demand. We find, first, that the CCB changes the composition of mortgage supply, as relatively capital-constrained and mortgage-specialized banks raise prices more than their competitors do. Second, risk-weighting schemes linked to borrower risk do not amplify the CCB's effect. To conclude, changes in the supply composition suggest that the CCB has achieved its intended effect in shifting mortgages from less resilient to more resilient banks, but stricter capital requirements do not appear to have discouraged less resilient banks from risky mortgage lending.

Global dollar credit and carry trades: a firm-level analysis
Valentina Bruno and Hyun Song Shin

We conduct a firm-level analysis of borrowing in US dollars by non-financial corporates from outside the United States. The dataset combines bond issuance data with firm-level financial information. We find that firms with already high cash holdings are more likely to issue US dollar-denominated bonds, and that the proceeds of the bond issue add to cash holdings. The tendency to add cash is more pronounced during periods when the dollar carry trade is more favourable and is prevalent for emerging market firms.

Basel Committee on Banking Supervision

Making supervisory stress tests more macroprudential: Considering liquidity and solvency interactions and systemic risk
November 2015

In the run-up to the financial crisis, banking supervisors largely followed a microprudential approach towards assessing banks. As such, many of the "first-generation" stress tests used by bank supervisors after the crisis focused on solvency risks. Some supervisors also considered liquidity risks, but these risks were often viewed as independent of solvency risks. Additionally, authorities' stress tests often did not consider the potential interlinkages in the banking system or ways in which bank behaviour might collectively prove destabilising to the financial system.

However, the failure to adequately model interlinkages and the nexus between solvency risk and liquidity risk within and across banks led to a dramatic underestimation of the risks to, and vulnerabilities of, financial systems in many economies. The prior Basel Committee working paper 24 contains a summary of case studies, which discusses some liquidity and solvency interactions at large banks. Building on the experiences of different countries, this paper suggests that authorities should emphasise developing integrated liquidity and solvency stress tests (as opposed to stand-alone liquidity stress test exercises).

The paper offers several approaches to incorporating liquidity effects and their interactions with solvency that differ in their level of comprehensiveness and sophistication. In particular, the paper offers contributions to three key areas. First, micro stress tests provide a basis for developing and enriching stress tests by considering channels in addition to the standard credit channel through which shocks can be transmitted. Second, an analysis of estimated interactions between liquidity and solvency risks, using both regulatory and market-based measures, at the micro level will help improve stress testing models for individual banks. Finally, the third layer - network analysis and agent-based models - prove useful for broadening stress tests, as these models consider contagion through common exposure, interbank funding relationships and the endogenous behaviour of banks.

Fundamental review of the trading book - interim impact analysis
November 2015

The Basel Committee on Banking Supervision has today published the results of its interim impact analysis of its fundamental review of the trading book. The report assesses the impact of proposed revisions to the market risk framework set out in two consultative documents published in October 2013 and December 2014. Further revisions to the market risk rules have since been made, and the Committee expects to finalise the standard around year-end.

The analysis was based on a sample of 44 banks that provided usable data for the study and assumed that the proposed market risk framework was fully in force as of 31 December 2014. It shows that the change in market risk capital charges would produce a 4.7% increase in the overall Basel III minimum capital requirement. When the bank with the largest value of market risk-weighted assets is excluded from the sample, the change in total market risk capital charges leads to a 2.3% increase in overall Basel III minimum regulatory capital.

Compared with the current market risk framework, the proposed standard would result in a weighted average increase of 74% in aggregate market risk capital. When measured as a simple average, the increase in the total market risk capital requirement is 41%. For the median bank in the same sample, the capital increase is 18%.

Compared with the current internally modelled approaches for market risk, the capital requirement under the proposed internally modelled approaches would result in an increase of 54%. For the median bank, the capital requirement under the proposed internally modelled approaches is 13% higher.

Compared with the current standardised approach for market risk, the capital requirement under the proposed standardised approach is 128% higher. For the median bank, the capital requirement under the proposed standardised approach is 51% higher.

Implementation of Basel standards - A report to G20 Leaders on implementation of the Basel III regulatory reforms
November 2015

Full, timely and consistent implementation of Basel III remains fundamental to building a resilient financial system, maintaining public confidence in regulatory ratios and providing a level playing field for internationally active banks. This report updates G20 Leaders on progress in the implementation of the Basel III regulatory reforms since November 2014, when the Basel Committee last reported to the G20.

The report summarises the steps taken by Basel Committee member jurisdictions to adopt the Basel III standards, banks' progress in bolstering their capital and liquidity positions, the consistency of implementation in jurisdictions assessed since the Committee's last report and the Committee's implementation work plan. It is accompanied by a separate report from the Committee to G20 Leaders on finalising the post-crisis reforms.

Finalising post-crisis reforms: an update - A report to G20 Leaders
November 2015

This report reviews the Basel Committee's work since the global financial crisis to strengthen the international regulatory framework for banks. The measures introduced by the Committee include:

- increasing the quality and level of capital;
- enhancing risk capture;
- constraining leverage and excessive concentration;
- adding a macroprudential dimension to the regulatory framework;
- addressing liquidity risk; and
- enhancing supervision and promoting consistent global implementation of the Basel framework

The report also provides an update on the Committee's substantial progress towards finalising its post-crisis reforms, which includes revising the standardised approaches for determining regulatory capital and measures to reduce excessive variability in risk-weighted assets. The Committee is well on track to finalise the remaining elements of the regulatory reform agenda for global banks.

Capital treatment for "simple, transparent and comparable" securitisations - consultative document
November 2015

In November 2015 the Basel Committee on Banking Supervision released a consultative document on *Capital treatment for "simple, transparent and comparable" securitisations*. This proposal builds on the revised capital standards issued by the Committee in December 2014.

The *Criteria for identifying simple, transparent and comparable securitisations* (STC criteria) were published by the Basel Committee and the International Organization of Securities Commissions in July 2015. The July 2015 STC criteria are designed to mitigate securitisation risks, including uncertainty related to asset risk, structural risk, governance and operational risk. Transactions that comply with these criteria should therefore have lower structural and model risk.

The July 2015 STC criteria noted that additional or more detailed criteria, such as those related to the credit risks of the underlying securitised assets, may be necessary based on specific needs and applications. Given that greater prescriptiveness is required for using the STC criteria in regulatory capital requirements, the Committee proposes to supplement the July 2015 STC criteria with additional criteria for the specific purpose of differentiating the capital treatment of STC from that of other securitisation transactions. The additional criteria would, for example, exclude transactions in which the standardised risk weights for the underlying assets exceed certain levels.

Compliance with the expanded set of STC criteria provides additional confidence in the performance of the transactions. The Committee is proposing to reduce minimum capital requirements for such STC securitisations by reducing the risk weight floor for senior exposures, and by rescaling risk weights for other exposures. A range for the potential reduction in capital charges is suggested. The Committee will make a final decision on calibration in 2016 based on further analysis and assessment of the quantitative impact of the proposals.

The Committee welcomes comments on this consultative document. Comments should be uploaded here by Friday 5 February 2016 or they may be sent by post to: Secretariat of the Basel Committee on Banking Supervision, Bank for International Settlements, CH-4002 Basel, Switzerland. All comments will be published on the website of the Bank for International Settlements unless a respondent requests confidential treatment.

TLAC Holdings - consultative document
November 2015

The Basel Committee's TLAC Holdings consultative document sets out its proposed prudential treatment of banks' investments in TLAC. It is applicable to all banks subject to the Basel Committee's standards, including both G-SIBs and non-G-SIBs.

The proposed treatment is for banks to deduct from their regulatory capital their holdings of TLAC instruments, subject to thresholds. It also addresses the treatment of holdings of instruments that rank pari passu to TLAC in the creditor hierarchy. The objective of the proposed treatment is to support the TLAC regime by reducing the risk of contagion if a G-SIB should enter resolution.

The TLAC regime also necessitates changes to Basel III to specify how G-SIBs must take account of the TLAC requirement when calculating their regulatory capital buffers. In particular, any Common Equity Tier 1 that is being used to meet the TLAC requirement cannot be used to meet the regulatory capital buffers. The proposed changes to Basel III to give effect to this requirement are set out in the consultative document.

The Committee welcomes comments on the TLAC holdings consultative document. Comments on the proposals should be uploaded here by Friday 12 February 2016. Alternatively, comments may be sent by post to: Secretariat of the Basel Committee on Banking Supervision, Bank for International Settlements, CH-4002 Basel, Switzerland. All comments may be published on the website of the Bank for International Settlements unless a respondent requests confidential treatment.

TLAC Quantitative Impact Study (QIS) Report
November 2015

The *TLAC Quantitative Impact Study* (QIS) Report analyses the TLAC levels and shortfalls at G-SIBs based on the FSB's consultative version of the TLAC term sheet, published in November 2014. The TLAC QIS is a critical component of the impact analysis of the *TLAC regime*. In particular, it provides the main data set that is the basis for the report led by staff of the Bank for International Settlements: *Assessing the economic costs and benefits of TLAC implementation*. The TLAC QIS report also examines the extent that G-SIBs and non-G-SIBs are currently invested in TLAC instruments, which helps to inform the prudential treatment of *TLAC holdings*.

Haircut floors for non-centrally cleared securities financing transactions - consultative document
November 2015

In October 2014, the FSB published a report on *Strengthening Oversight and Regulation of Shadow Banking - Regulatory framework for haircuts on non-centrally cleared securities financing transactions* and introduced a framework for haircut floors for non-centrally cleared SFTs. As part of this framework, the FSB recommended that the Basel Committee on Banking Supervision (BCBS) incorporate the haircut floors into the capital requirements for non-centrally cleared SFTs by setting higher capital requirements for transactions with haircuts

traded below the haircut floors. The objective of the BCBS proposal is to create incentives for banks to set their collateral haircuts above the floors rather than hold more capital.

Frequently asked questions on the Basel III Countercyclical Capital Buffer
October 2015

To promote consistent implementation of the Basel III countercyclical capital buffer, the Basel Committee on Banking Supervision has issued frequently asked questions and other supporting information.

The information published today includes a list of all prevailing and pre-announced buffers, as well as developments related to domestic rule-making. The information is presented for both Basel Committee member jurisdictions, as well as select non-member jurisdictions. The dedicated website can be found here. This webpage will be updated as jurisdictions inform the Committee of changes to domestic countercylical capital buffer requirements. Interested stakeholders can sign up for a email alert when information is updated.

The countercyclical capital buffer requirement, when activated by member jurisdictions, will be phased in from 1 January 2016.

Ninth progress report on adoption of the Basel regulatory framework
October 2015

This updated *Progress report on adoption of the Basel regulatory framework* provides a high-level view of Basel Committee members' progress in adopting Basel III regulations as of end-September 2015.

The report focuses on the status of domestic rule-making processes to ensure that the Basel standards are transformed into national law or regulation according to the internationally agreed timeframes. The report is based on information provided by individual members as part of the Committee's Regulatory Consistency Assessment Programme (RCAP). The report includes the status of adoption of the risk-based capital standards, the liquidity standards (LCR and NSFR), the framework for systemically important banks (SIBs), the leverage ratio, the revised Pillar 3 disclosure requirements and the large exposure framework.

In addition to periodically reporting on the status of adoption, all Committee members undergo an assessment of the consistency of their domestic rules with the Basel standards. The Committee believes that disclosure provides additional incentive for members to fully comply with the international agreements.

Regulatory Consistency Assessment Programme (RCAP) – report on risk-weighted assets for counterparty credit risk (CCR)
October 2015

This report presents the findings from a hypothetical test portfolio exercise to examine variability in banks' modelling of derivatives, and specifically in exposure modelling. The report focuses on the internal models method (IMM) and the advanced credit valuation adjustments (CVA) risk capital charge for over-the-counter (OTC) derivative trades. The study is a part of the Basel Committee's Regulatory Consistency Assessment Programme (RCAP), which is intended to ensure consistent implementation of the Basel framework. This exercise completes the Committee's review of trading-related internal models and follows two earlier exercises that focused on market risk RWAs.

The report analyses the variability of risk-weighted assets outcomes, highlights good practices and identifies areas where additional attention from banks and supervisors is required to mitigate unwarranted RWA variability. In this regard, an important aim of the report is to support implementation and supervision of CCR models.

The results show considerable variability in the outcomes of CCR models, which is typically higher for CVA models than for IMM models. Overall, the level of variability is similar to the variability of other market risk model outcomes observed in previous exercises. Key drivers for the variability include differences in banks' modelling choices, as well as differences in supervisory practices.

Basel III Monitoring Report
September 2015

This report presents the results of the Basel Committee's latest Basel III monitoring exercise. The study is based on the rigorous reporting process set up by the Committee to periodically review the implications of the Basel III standards for banks. The results of previous exercises in this series were published in March 2015, September 2014, March 2014, September 2013, March 2013, September 2012 and April 2012.

Data have been provided for a total of 221 banks, comprising 100 large internationally active banks ("Group 1 banks", defined as internationally active banks that have Tier 1 capital of more than €3 billion) and 121 Group 2 banks (ie representative of all other banks).

The results of the monitoring exercise assume that the final Basel III package is fully in force, based on data as of 31 December 2014. That is, they do not take account of the transitional arrangements set out in the Basel III framework, such as the gradual phase-in of deductions from regulatory capital. No assumptions were made about bank profitability or behavioural responses, such as changes in bank capital or balance sheet composition. For that reason, the results of the study are not comparable to industry estimates.

Data as of 31 December 2014 show that all large internationally active banks meet the Basel III risk-based capital minimum requirements as well as the Common Equity Tier 1 (CET1) target level of 7.0% (plus the surcharges on global systemically important banks - G-SIBs - as applicable). Between 30 June and 31 December 2014, Group 1 banks reduced their capital shortfalls relative to the higher Tier 1 and total capital target levels; the additional Tier 1 capital shortfall has decreased from €18.6 billion to €6.5 billion and the Tier 2 capital shortfall has decreased from €78.6 billion to €40.6 billion. As a point of reference, the sum of after-tax profits prior to distributions across the same sample of Group 1 banks for the six-month period ending 31 December 2014 was €228.1 billion.

Under the same assumptions, there is no capital shortfall for Group 2 banks included in the sample for the CET1 minimum of 4.5%. For a CET1 target level of 7.0%, the shortfall narrowed from €1.8 billion to €1.5 billion since the previous period.

The average CET1 capital ratios under the Basel III framework across the same sample of banks are 11.1% for Group 1 banks and 12.3% for Group 2 banks.

Basel III's Liquidity Coverage Ratio (LCR) came into effect on 1 January 2015. The minimum requirement is set initially at 60% and will then rise in equal annual steps to reach 100% in 2019. The weighted average LCR for the Group 1 bank sample was 125% on 30 June 2014, up from 121% six months earlier. For Group 2 banks, the weighted average LCR was 144%, up from 140% six months earlier. For banks in the sample, 85% reported an LCR that met or exceeded 100%, while 98% reported an LCR at or above 60%.

Basel III also includes a longer-term structural liquidity standard - the Net Stable Funding Ratio (NSFR) - which was finalised by the Basel Committee in October 2014. The weighted average NSFR for the Group 1 bank sample was 111% while for Group 2 banks the average NSFR was 114%. As of December 2014, 75% of the Group 1 banks and 85% of the Group 2 banks in the NSFR sample reported a ratio that met or exceeded 100%, while 92% of the Group 1 banks and 93% of the Group 2 banks reported an NSFR at or above 90%.

All data, including for previous reporting dates, reflect revisions received up to 28 August 2015 with the exception of Table A.20, which was revised on 21 September 2015.

Committee on Payments and Market Infrastructures

Guidance on cyber resilience for financial market infrastructures - CPMI-IOSCO consultative paper
November 2015

Financial market infrastructures (FMIs) play a critical role in promoting the stability of the financial system. In this context, the level of operational resilience of FMIs, including cyber resilience, can be a decisive factor in the overall resilience of the broader financial system.

This consultative document provides principles-based guidance for FMIs to enhance their cyber resilience, cognisant of the dynamic nature of cyber threats and the importance of interconnected entities for the resilience of individual FMIs. This guidance also recognises some of the unique challenges that cyber risk presents to FMIs' traditional operational risk management frameworks, such as the need for a fast and safe resumption of core services following a cyber-attack. In doing so, it does not aim at introducing new standards but rather at elaborating on the principles which are already established in the Principles for financial market infrastructures (PFMI).

Digital currencies
November 2015

Digital currencies, and especially those which have an embedded decentralised transfer mechanism based on the use of a distributed ledger, are an innovation that could have a range of impacts on various aspects of financial markets and the wider economy. These could include potential disruption to business models and systems, as well as facilitating new economic interactions and linkages.

Currently, such schemes are not widely used or accepted, and they face a series of challenges that could limit their future growth. However, some digital currency schemes have demonstrated that their underlying technology could feasibly be used for peer-to-peer transactions in the absence of a trusted third party. Such technology may have potential to improve some aspects of the efficiency of payment services and financial market infrastructures (FMIs) in general. In particular, these improvements might arise in circumstances where intermediation through a central party is not currently cost-effective.

This report considers the possible implications of interest to central banks arising from these innovations.

Correspondent banking - consultative report
October 2015

Correspondent banking is an essential component of the global payment system, especially for cross-border transactions. Through correspondent banking relationships, banks can access financial services in different jurisdictions and provide cross-border payment services to their customers, supporting, inter alia, international trade and financial inclusion.

Until recently, banks have maintained a broad network of correspondent relationships, but there are growing indications that this situation might be changing. In particular, some banks providing these services are cutting back the number of relationships they maintain.

The CPMI consultative report provides some basic definitions, outlines the main types of correspondent banking arrangement, summarises recent developments and touches on the underlying drivers. The report reviews certain technical measures relating to: (i) know-your-customer (KYC) utilities; (ii) the increased use of the Legal Entity Identifier (LEI); (iii) information-sharing mechanisms; and (iv) improvements in payment messages. Following a detailed assessment of the advantages and disadvantages of each of these technical measures, the report puts forward four recommendations for consideration by the industry and authorities.

Statistics on payment, clearing and settlement systems in the CPMI countries - Figures for 2014 - preliminary release
September 2015

This is an annual publication that provides data on payments and payment, clearing and settlement systems in the CPMI countries.

This version of the statistical update contains data for 2014 and earlier years. There are detailed tables for each individual country as well as a number of comparative tables.

Please note that this publication contains some provisional data for 2014 while some others are not yet available.

Progress report on the CCP workplan
September 2015

As noted in the F*SB's Ninth Progress Report on Implementation of OTC Derivatives Market Reforms* (July 2015), the BCBS, CPMI, FSB and IOSCO are implementing a workplan on the resilience, recovery planning, resolvability and interdependencies of CCPs. This is a progress report on that work from the chairs of the committees involved.

Payment aspects of financial inclusion
September 2015

The Committee on Payments and Market Infrastructures (CPMI) and the World Bank Group have issued the consultative report *Payment aspects of financial inclusion*.

The report provides an analysis of the payment aspects of financial inclusion, on the basis of which it sets out guiding principles designed to assist countries that seek to advance financial inclusion in their markets through payments.

The report is being issued as a consultation document. Comments are invited from any interested parties, and should be sent to the CPMI and the World Bank Group by 7 December 2015; please mention "PAFI" in the subject line of your e-mail. A final version of the report will be published subsequently.

Speeches

External dimension of monetary policy

Remarks by Mr Hyun Song Shin, Economic Adviser and Head of Research of the BIS, at the Board of Governors of the Federal Reserve System conference "Monetary policy implementation and transmission in the post-crisis period", Washington, DC, 13 November 2015.

International spillovers and spillbacks are not a recent phenomenon. They result from past monetary policy actions. Due to the "triple coincidence" accounting convention - whereby the GDP area, decision-making unit and currency area are assumed to be one and the same - policymakers missed massive build-ups in borrowing in the past. While the protagonists have changed (dollar borrowers are emerging market corporates rather than European banks, and the borrowing is done through corporate bonds rather than wholesale bank funding), the same mechanisms are at work today. Even if monetary policy cooperation is limited by domestic central bank mandates, enlightened self-interest should be enough motivation to take account of spillovers and spillbacks.

Revisiting three intellectual pillars of monetary policy received wisdom

Speech by Mr Claudio Borio, Head of the Monetary and Economic Department of the BIS, at the Cato Institute, Washington, DC, 12 November 2015.

The speech questions three deeply held beliefs that underpin current monetary policy received wisdom: it is appropriate to define equilibrium (or natural) rates as those consistent with output at potential and with stable prices (inflation); it is appropriate to think of money

(monetary policy) as neutral, ie as having no impact on real outcomes, over medium- to long-term horizons relevant for policy - 10-20 years or so, if not longer; and it is appropriate to set policy on the presumption that deflations are always very costly. Based on these considerations, the speech draws two conclusions: the well-known trend decline in real interest rates is, at least in part, a disequilibrium phenomenon, not consistent with lasting financial, macroeconomic and monetary stability; and there is a need to adjust current monetary policy frameworks so that monetary policy plays a more active role in preventing systemic financial instability and its huge macroeconomic costs. This calls for taking financial booms and busts more systematically into account.

Economic Forum: Policy Lessons and the Future of Unconventional Monetary Policy

Panel with Mr Claudio Borio, Head of the Monetary and Economic Department of the BIS, at the Sixteenth Jacques Polak Annual Research Conference: "Unconventional Monetary and Exchange Rate Policies", Washington, DC, 5–6 November 2015.

In the closing panel of the IMF's 16th Jacques Polak Annual Research Conference, Claudio Borio discusses unconventional monetary policies in a broader context. In his view, today's persistently low rates are not necessarily equilibrium rates because of their long-term costs. Monetary policy needs to be more symmetrical over financial booms and busts, and unconventional measures are best seen as crisis management tools.

Regulatory stability and the role of supervision and governance

Keynote address by Mr Jaime Caruana, General Manager of the BIS, at the Tenth High-level Meeting on Global Banking Standards and Supervisory Priorities in the Americas, jointly organised by the Association of Supervisors of Banks of the Americas (ASBA), the Basel Committee on Banking Supervision (BCBS) and the Financial Stability Institute (FSI), Montevideo, 28 October 2015.

Supervision has a number of important functions. In addition to the consistent implementation of regulation, supervision can complement regulation in dealing with the financial sector's continuous innovation and adaptation, thereby reducing the need for frequent rule changes and promoting regulatory stability. Moreover, supervision can go beyond the quantitative requirements to address qualitative matters such as corporate governance, influencing banks to change their risk culture for the better. In short, there is a lot that supervisors can and should do to help make banks not only more resilient but also more reliable - and thus more able to perform their intended economic and social function.

Beyond zero rates and unconventional monetary policy

Panel remarks by Mr Jaime Caruana, General Manager of the BIS, at the Sixth Annual Conference organised by the Central Reserve Bank of Peru and the Reinventing Bretton Woods Committee, on "Monetary and financial shifts: challenges and possible outcomes", Lima, Peru, 6 October 2015.

Monetary policy in major currencies can spill over to emerging market economies (EMEs) through various channels. Spillovers from global financial conditions have the effect of constraining EMEs' policy choices, making more likely the build-up of vulnerabilities, which are now appearing to spill back to world growth. This experience strengthens the argument for anticipating such spillovers and factoring them into policy ex ante, in a spirit of "enlightened self-interest", rather than only reacting to the spillbacks ex post. It also underscores the importance of persevering with policies that foster economic and financial resilience.

Challenges for the global economy

Presentation by Mr Claudio Borio, Head of the Monetary and Economic Department of the BIS, at the Belgium Financial Forum, Bruxelles, 14 September 2015.

Drawing on the latest BIS Annual Report, the presentation assesses the challenges the global economy is facing and possible policy responses. The lens used to elaborate the diagnosis and identify possible remedies focuses on financial, medium-term and global factors, whereas the prevailing perspective focuses more on real, short-term and domestic factors. A

key issue is how to interpret the trend decline in interest rates and their persistent unusually low levels: it is argued that this need not be an equilibrium phenomenon, fully consistent with lasting financial, monetary and macroeconomic stability.

Easing has induced easing

Interview with Mr Claudio Borio, Head of the Monetary and Economic Department (MED), in Börsen-Zeitung, conducted by Mr Mark Schrörs and published on 25 August 2015.

Mr Borio, China is on everyone's lips at the moment. There are increasing concerns about a "hard landing" of the economy and a bursting of the credit bubble. How worried are you about the recent developments? Do you see a risk that China could be the starting point of the next global recession or the next global financial crisis?

For quite some time now, a number of countries that escaped the global financial crisis largely unscathed have been exhibiting symptoms that are qualitatively similar to those that prevailed pre-crisis in those countries that would later be hardest hit by it: strong credit expansion and a strong increase in asset prices, especially property prices, on the back of high risk-taking and, for some, of the commodity price boom. These are symptoms of a strong financial boom that typically leads to a bust, with possibly large macroeconomic costs. This is true in particular of a number of emerging market economies (EMEs), including some of the largest, but also, to a lesser extent, of some advanced economies. China is one of these countries. We have to watch this very closely.

So there is a reason to worry globally?

The EMEs' heft in the global economy has increased substantially since the Asian financial crisis. So, should they run into trouble, the impact on the rest of the world would be larger. There are some positive developments suggesting that, in several respects, many EMEs are in a better shape than they were at the time. They have better macroeconomic policies, including greater exchange rate flexibility, they have strengthened their financial infrastructure and financial regulation, notably through macroprudential measures, and they have greatly increased their foreign exchange reserves. But this is no panacea against crises.

Regarding China, some observers argue that the link between the Chinese financial system and the global financial system is weak and that, because of that, there is no risk of a global financial crisis as in 2007-08.

I don't want to speculate about the next big crisis. But I would caution against underestimating the financial linkages. And, of course, China has a major impact on trade and commodity prices. Moreover, it is shared vulnerabilities that matter most.

You have mentioned greater exchange rate flexibility as an indicator of strength. Does that mean you welcome the new exchange rate regime in China? This has initially led to a depreciation of the renminbi - which has induced concerns about an intensified "currency war".

The fact that China is structurally moving towards a more market-oriented exchange rate regime is without doubt a positive development. The more general question is how the depreciation of the renminbi fits into the bigger global picture we have been seeing for some time.

And what is your answer?

In general, exchange rates can redistribute growth - from faster-growing to slower-growing countries. When they do so, this is positive. It is also natural that the exchange rate has come to play a greater role in monetary policy since the financial crisis: in the countries that have been hardest-hit by it, and with interest rates pushed so low, domestic transmission channels have been impaired. But the problem is that, in general, currency appreciations have not been welcome. The consequence is that easing has induced easing.

And in the end there is competitive devaluation and a race to the bottom when it comes to interest rates.

Some people argue that the world economy has been suffering for quite some time from a large deficiency of aggregate demand and hence that this exchange rate-induced generalised easing has been good for the world economy. At the BIS, we have a different view because we are more focused on medium-term financial booms and busts: instead of being a positive sum game, the process can be a negative sum game. The expansionary monetary policy has been transmitted to countries that did not need it, fuelling financial booms there.

The cooling-down of the Chinese economy and the depreciation of the renminbi have also led to concerns that global inflation, which is already very low, will be dampened further. What is your view on that?

Sometimes we seem to believe that we know more about the inflation process than we *actually do - we do not fully understand what drives it. Having said this, at the BIS we are of the view that global factors have often been underestimated. We think that there are still significant disinflationary forces coming from technological progress and, above all, the globalisation of the world economy. These secular factors are headwinds that have held inflation down despite very easy monetary policies. But these are welcome supply side forces, which support the economy. On top of that, there are some cyclical factors at the moment.*

For example, the oil price, which nosedived in 2014 and which has fallen again recently after it had recovered somewhat earlier this year.

In our judgment, until recently at least, this has largely been a supply side story. As highlighted in our Annual Report, OPEC's decision not to cut oil production despite the price collapse was seen as a regime change. More recently, perceptions of demand weakness seem to have been playing a bigger role.

So renewed deflation concerns are exaggerated?

We have done a lot of work here on deflation episodes in history. One main message is that the link between falling goods and services prices and output growth is very weak. The only evidence comes from the Great Depression. Nor have we found evidence of so-called "debt deflation", meaning a negative spiral between the price level and debt. By contrast, the data indicate that asset price deflations, especially property price falls, are more costly and that what is dangerous is a downward spiral between property prices and debt.

Does that mean that central banks should not overreact - even if inflation rates will go down again in the near future?

When calibrating a response, central banks should always look closely at which factors are influencing prices. Our research simply suggests that, when disinflationary forces reflect positive supply side factors, they are benign. And it also indicates that deflation is no red line in the sense that, if you cross it, you fall into the abyss. More generally, it suggests that there is also a case for paying greater attention to financial booms and busts, and hence to the longer-term consequences of the response.

After years of low inflation rates, some observers are already saying inflation is "dead".

This is by no means true. A number of countries have high inflation rates. To assume inflation is "dead" is the best way to make sure that it will become a big problem again.

For years, the Bank for International Settlements (BIS) has been calling for policymakers to shift away from a short-term focus on macroeconomic variables like production and inflation and to adopt a longer-term perspective, including one that pays more attention to the financial cycle. But the central banks' decisions are still very much dominated by the former. How frustrated are you by that?

We have to distinguish a couple of aspects here. As regards thinking, there has been a shift. It had already started before the financial crisis, but it intensified after it. It is now recognised that financial stability is very important. And many central banks are now of the view that very low interest rates for a very long time can raise financial stability risks. The other issue is how best to respond.

And here there is hardly any visible change.

I think that things have also shifted a little bit. But you are right: many central banks believe that it is exclusively the task of macroprudential regulation and supervision ...

... which focuses on the financial system as a whole ...

... to deal with these risks. We do not share this view: financial booms are too powerful to be constrained through macroprudential measures alone. Their active use, for instance, has not prevented the emergence of signs of financial imbalances in Asia. In comparison with central banks, at the BIS we have the luxury of not having to press the button and of not facing the constraints of national mandates. This allows us to see the picture from a different perspective. And our institutional duty is to say what we think is right.

Some experts say financial stability should become an explicit mandate for central banks.

The first priority should be to use as much as possible the flexibility that the existing monetary policy frameworks provide - even if we are aware of the serious political constraints and communication challenges. A lot depends on how central banks judge the potential trade-offs. Changing the mandate should not be taboo, but should only be done as a last resort.

The BIS is always warning of the risk of overburdening central banks. But is there not also a risk that central banks could become overburdened if they also had to safeguard financial stability?

No, I don't think so. Safeguarding financial stability is a natural central bank task, and it cannot be performed fully successfully by others. Monetary policy has a huge influence on financial markets, and hence on financial stability; it can thus effectively complement macroprudential measures. And this would also bring central banks closer to their origins. What I worry about is something completely different.

That is to say?

It is the growing perception that central banks can be the answer to all our economic problems. The great danger is that more and more people come to believe that everything can simply be solved with money and that central banks can produce infinite amounts of it. This could cause big problems in the future. This is why we insist that people should demand less from central banks and that structural policies should play a much greater role.

At the moment, the Fed is heading for a first interest rate increase after six and a half years of a zero interest rate policy. The IMF has warned against possible turbulences in financial markets. Do you also see a risk that the US interest rate reversal could jolt financial markets?

The Fed will increase the interest rate only when it thinks that the US economy is strong. That strength would help the world economy. In addition, to minimise the shock, the Fed has almost preannounced this step and been very cautious in its communication - not only regarding the "lift-off" but also regarding what it will do thereafter. But in assessing the impact, we should bear in mind that, as noted earlier, there are financial vulnerabilities in the global economy. And in the past, a monetary policy tightening in the US and an appreciation of the dollar have triggered turbulence in EMEs. This has to do, in particular, with the special role of the dollar.

The dollar is the world's dominant currency.

Yes, as such, the US sets the tone for global financial markets. And, more directly, financial conditions there have an impact because many borrowers around the world - in more recent years, especially companies - have heavily borrowed in dollars. For instance, since early 2009, the amount of dollar credit to non-banks in EMEs has almost doubled.

Because interest rates have been so low for so long in the US.

Yes, interest rates have been exceptionally low for an exceptionally long time. This is unprecedented. And it has led to aggressive risk-taking in financial markets. Furthermore, many of those who are active in the financial markets now have no first-hand experience of how to respond to rising interest rates: they were not even around the last time it happened. But having said all this, one thing is also clear: the longer the interest rate reversal is delayed, the riskier the situation will become.

The Fed has announced that it will increase rates very gradually. Between 2004 and 2006, it also tightened very gradually, raising interest rates by 25 basis points per meeting. A lot of people are saying that this contributed to the financial excesses that led to the financial crisis. Do you see the risk that the Fed is repeating a mistake?

There is a tendency to emphasise the risk of acting too early and too strongly at the expense of the risk of acting too late and too gradually. This can be dangerous. Raising interest rates too late and too slowly can fuel financial booms, and the following busts can be highly damaging. It is also very important to keep a steady hand when normalising monetary policy, and not to be deterred by spikes in short-term financial market volatility. This volatility may be inevitable given the initial conditions.

In its recent Annual Report, the BIS calls for more central bank cooperation, even including joint decisions on interest rates and exchange rate interventions. Do we need a new Bretton Woods?

No, that's not the point. But a key drawback of the existing international monetary and financial system is that it tends to heighten the risk of financial imbalances. First of all, we call for an enlightened self-interest. Central banks should take better account of the consequences of their decisions on others, especially because these will have repercussions on their own economy ("spillbacks"). This enlightened self-interest is particularly important for countries with an international currency. They have a special responsibility.

But this is not always sufficient from your point of view?

We should also not exclude the possibility of joint decisions. We have seen this in times of crisis. But it could also make sense for crisis prevention. And then, ideally, once could even go one step further. Policymakers around the world could agree internationally on common rules constraining national policies. This would increase discipline on a national level.

Do you think this is realistic?

At the moment, this is not on the cards. But national frameworks do not sufficiently take into account financial booms and busts. If they did, this would remove a major source of negative international spillovers. This would significantly reduce the need for further cooperation, but not eliminate it. To move in this direction, we need greater agreement on diagnosis.

And in the end, would one also need a global central bank? Some experts have pushed this idea from time to time.

No, this is out of the question. We know how difficult it is to have a central bank covering a number of very different economies. The euro area is an example of this. It is neither feasible nor desirable to have a world central bank.

A lot of observers say the problems in the euro area are the consequence of the fact that it is a monetary union without a fiscal or a political union. Is a political union a precondition for a successful monetary union?

To succeed, the euro area needs a high degree of economic integration and a clear political commitment to the project and to common rules. These rules have to be consistent with the agreed level of solidarity. That does not necessarily mean a political union.

In financial markets, there are concerns about reduced market liquidity, also as a consequence of large-scale asset purchases by central banks. How worried are you?

One point is clear: it is unrealistic to assume that markets will remain liquid even if one-sided order imbalances develop, as a result of, say, a fundamental rethink on the part of market participants of where prices should be. No one wants to stand in the way of an oncoming train . What worries us more is the "illusion of liquidity" in good times, meaning that investors may come to believe that there will always be enough liquidity for them to get out in time. This, in turns, fuels risk-taking and increases the likelihood of market stress. Even then, what is crucial in the end is whether problems in the financial markets stay in financial markets or spill over to the real economy, causing lasting damage. There is a risk of overreacting to spikes in financial market volatility.

And what about the role of central banks?

If central banks engage in large-scale asset purchases, it is quite possible that they may reduce liquidity in some market segments. They are aware of this risk, and they are trying to minimise it. But what matters more for me is the risk that market participants may increasingly come to perceive central banks as "buyers of last resort", as it were. This can increase risk-taking und thereby contribute to the illusion of liquidity.

Isn't it already a fact that market participants perceive central banks as "buyers of last resort"?

The idea of a "central bank put" has often been raised - meaning that central banks will always come to the rescue if markets come under stress. Central banks have clearly said that this is not the case: they would tailor the response, if at all needed, to circumstances. But this does not yet seem to have been fully recognised by everybody.

There is also much discussion about the increasing importance of asset managers for financial markets. How big is the risk stemming from this development?

We have to watch closely how the structural shift from banks to capital markets in general, and the boom of the asset management industry in particular, change market dynamics. The much greater heft of the asset management industry could lead to sharper market movements. The high size concentration of the industry may play a role, but what matters more is common behaviour across funds, when they tend to move in the same direction. This herd behaviour could have big implications.

Allow me to ask a "heretical" question at the end: You have said that we do not know as much about inflation as we had thought - and this is also prominent in the BIS Annual Report. But at the same time, we are only in the early stages of developing an understanding of the financial cycle. Does that mean that central banks at present hardly know what they are doing?

No, I would not put it this way. Like everyone else, central banks are doing their best to understand what is going on and work out how best to respond to it. But at the moment, this is not that easy. Therefore, it makes sense to adjust decision-making processes to take full account of this uncertainty. The worst mistakes in history have been made when people assumed they knew much more than they actually did - that they had finally found the right answers. There is a need for modesty and humility.

On the centrality of the current account in international economics

Keynote speech by Mr Claudio Borio, Head of Monetary and Economic Department of the BIS, at the ECB-Central Bank of Turkey conference "Balanced and sustainable growth – operationalising the G20 framework", Frankfurt, 28 August 2015.

The current account occupies a central position in international economics and policy debates. Indeed, in G20 policy debates the term "global imbalances" is treated as almost synonymous with "current account imbalances". Current account imbalances do matter and they can be a problem. But this speech argues that this centrality is not that helpful in understanding how the global economy works, especially in a world of free and huge capital flows. And it may even lead to the wrong policy prescriptions, including not paying sufficient attention to potentially more disruptive financial imbalances. A key reason is that, analytically, the current account is asked to shed light on issues for which it is ill-suited, such as the amount of financing a country gets from, or provides to, others, the direction of that financing (who lends to whom) and financial instability.