

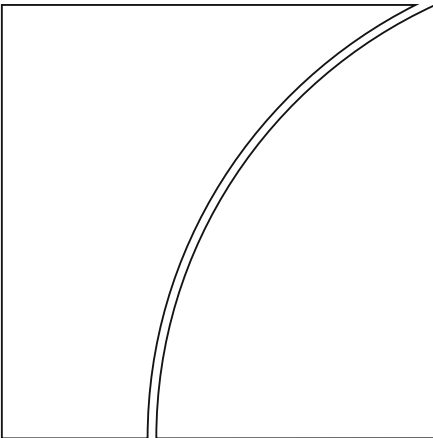


BANK FOR INTERNATIONAL SETTLEMENTS

BIS Quarterly Review

March 2016

International banking
and financial market
developments



BIS Quarterly Review
Monetary and Economic Department

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International banking and financial market developments

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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 gives way to turbulence

The Federal Reserve's interest rate lift-off in December did little to disturb the uneasy calm that had reigned in financial markets in late 2015. But the new year had a turbulent start, featuring one of the worst stock market sell-offs since the financial crisis of 2008.

At first, markets focused on slowing growth in China and vulnerabilities in emerging market economies (EMEs) more broadly. Increased anxiety about global growth drove the price of oil and EME exchange rates sharply lower and fed a flight to safety into core bond markets. The turbulence spilled over to advanced economies (AEs), as flattening yield curves and widening credit spreads made investors ponder recessionary scenarios.

In a second phase, the deteriorating global backdrop and central bank actions nurtured market expectations of further reductions in interest rates and fuelled concerns over bank profitability. In late January, the Bank of Japan (BoJ) surprised markets with the introduction of negative interest rates, after the ECB had announced a possible review of its monetary policy stance and the Federal Reserve issued stress test guidance allowing for negative interest rates. On the back of poor bank earnings results, banks' equity prices fell well below the broader market, especially in Japan and the euro area. Credit spreads widened to a point where markets fretted about a first-time cancellation of coupon payments on contingent convertible bonds (CoCos) at major global banks.

Underlying some of the turbulence was market participants' growing concern over the dwindling options for policy support in the face of the weakening growth outlook. With fiscal space tight and structural policies largely dormant, central bank measures were seen to be approaching their limits.

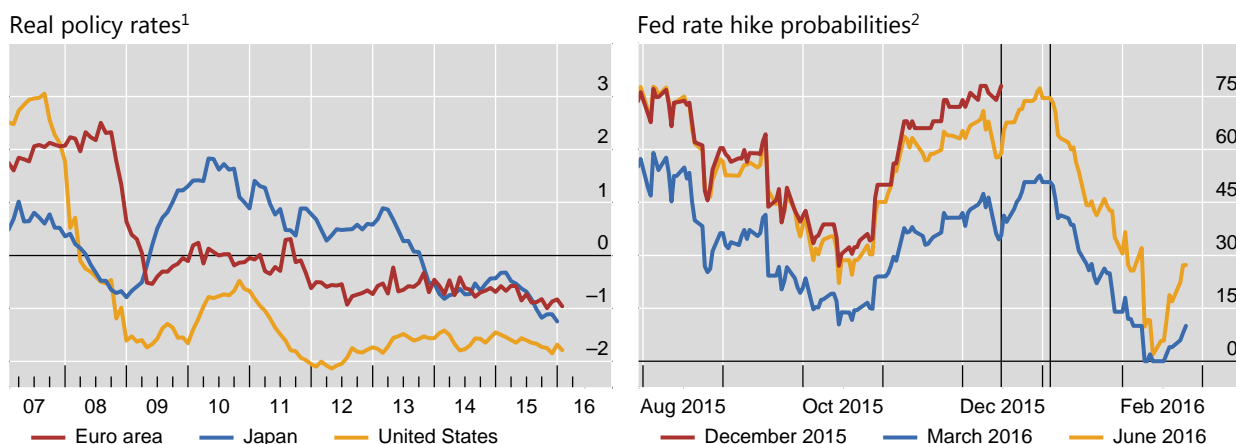
US monetary policy lift-off

On 16 December, the Federal Reserve raised the target range for the federal funds rate, after eight years of monetary policy easing across the major currency areas. Even after the increase, the US monetary policy stance remained highly accommodative: the increase in the federal funds target range was minimal – 25 basis points – and the stock of assets acquired over years of large-scale asset purchases was left unchanged. In real terms, the US policy rate had been negative since 2008 (Graph 1, left-hand panel). The Federal Open Market Committee (FOMC) signalled that the shortfall of inflation below its 2% objective, and uncertainty surrounding economic conditions

Lift-off and the expected pace of normalisation

In per cent

Graph 1



The vertical lines in the right-hand panel indicate 16 December 2015 (FOMC meeting) and 4 January 2016 (release of China's Caixin Manufacturing PMI).

¹ Nominal policy rate less consumer price inflation excluding food and energy. For Japan, core inflation excluding energy and food, adjusted for the consumption tax hike. ² Based on Bloomberg implied probabilities from federal funds rate futures.

Sources: Bank of Japan; Bloomberg; national data.

more broadly, were expected to warrant only gradual increases in the federal funds rate. Nonetheless, the decision marked a turning point in an era of extraordinary monetary accommodation.

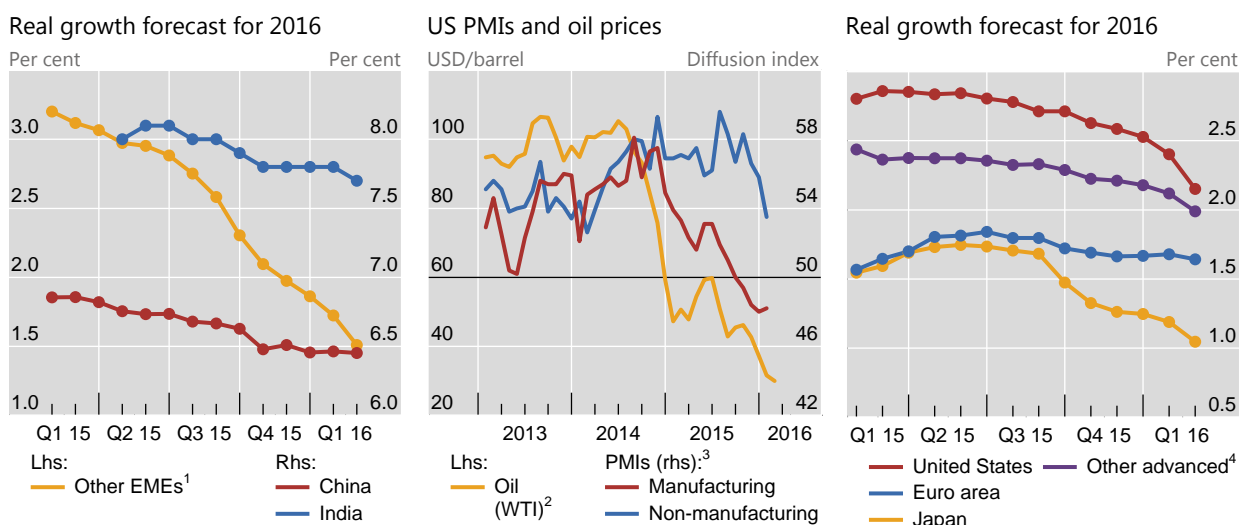
When the first US rate hike eventually came, it hardly caused a stir. The onset of the tightening cycle had long been expected, starting as early as May 2013, when expectations of an eventual “tapering” of asset purchases had reverberated through global financial markets. In the days before 16 December 2015, the futures-implied probability of a December lift-off was near 80%, reflecting confidence in the US economic outlook (Graph 1, red line in right-hand panel).¹ Apart from temporary volatility around the announcement date, the yield curve barely moved. Equity markets traded sideways, as one source of uncertainty was resolved. However, other sources of uncertainty soon appeared, and have come to dominate the scene.

Turbulence spreads from EMEs to AEs

The deterioration of global growth prospects unsettled financial markets from the start of the year.

The first phase of turbulence centred on anxiety over global growth in EMEs, and China in particular. China's reported growth slowed to 6.9% in 2015, the lowest official rate since 1990. Consensus forecasts for 2016 had been falling continuously over the previous 12 months (Graph 2, left-hand panel). The softness in manufacturing had long been offset by a growing service sector, but in December the services PMI stood at its weakest level in 17 months. Concerns about a slowdown in Chinese

¹ See “Uneasy calm awaiting lift-off”, *BIS Quarterly Review*, December 2015.



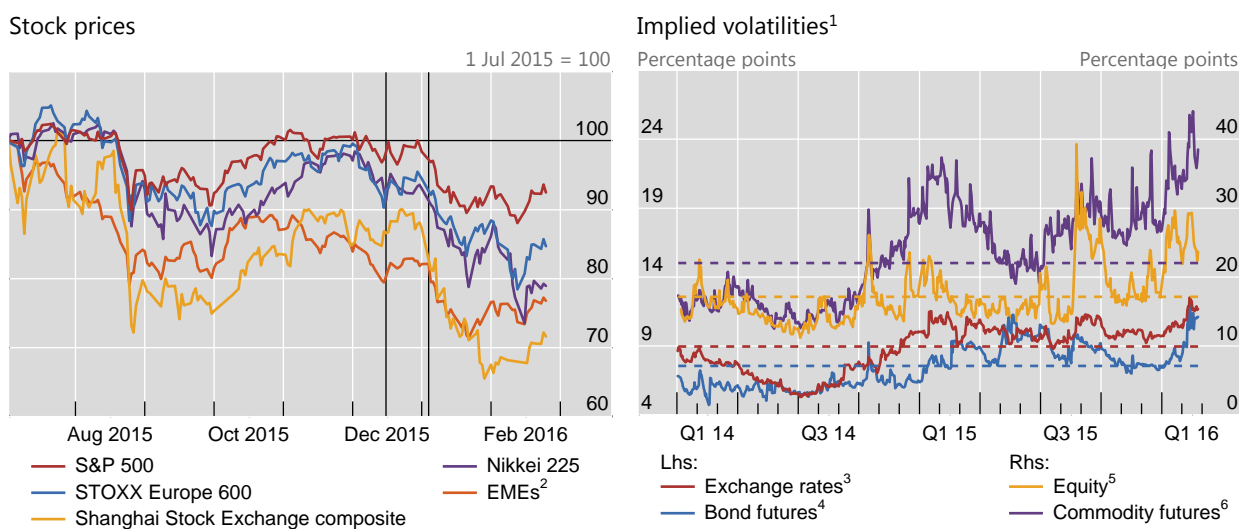
¹ Weighted average based on GDP and PPP exchange rates of Argentina, Brazil, Chile, Chinese Taipei, Colombia, the Czech Republic, Hong Kong SAR, Hungary, Indonesia, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Saudi Arabia, Singapore, South Africa, Thailand and Turkey; aggregations based on GDP and PPP exchange rates. ² Simple average across daily observations over each month. ³ Purchasing managers' indices (PMIs) from the Institute for Supply Management. A value above (below) 50 represents growth or expansion (contraction) within the sector of the economy compared with the prior month, and a value at 50 indicates an equal balance between managers reporting advances in their business and those reporting declines. ⁴ Weighted average based on GDP and PPP exchange rates of Australia, Canada, Denmark, Norway, Sweden, Switzerland and the United Kingdom.

Sources: Bloomberg; Consensus Economics.

manufacturing spread to other EMEs, for which 2016 growth forecasts had been falling rapidly in the second half of 2015 (Graph 2, left-hand panel). Worries about manufacturing were not limited to Asia: the strength of the US dollar and low oil prices cast a pall over the outlook for US manufacturing, which weakened relative to the non-manufacturing sector (centre panel). Indeed, the growth outlook for all major economic regions continued to deteriorate (right-hand panel).

Against this backdrop, disappointing news from China triggered market turbulence on the very first trading day of the year. As a closely watched manufacturing index pointed to renewed sectoral weakness, stock markets sold off in both advanced and emerging economies (Graph 3, left-hand panel). As the Shanghai Composite plunged over 15% in the first two weeks of the year, major AE stock markets dropped by almost 10%. During the first week alone, trading in China was halted twice in response to new market mechanisms that stop trading when losses reach a certain threshold, adding to market distress. Implied volatilities soared to peaks comparable to those observed in August 2015, and well above the subdued levels of the previous three years (Graph 3, right-hand panel). But in contrast to that short-lived episode, the rout in early 2016 lasted for several weeks.

Growing concern about the global economic outlook, in turn, led to further losses in commodity markets. The prospect of weaker demand, on top of the supply glut that had become apparent over the past 18 months, hit crude oil markets hard. Oil prices extended the slide of the second half of 2015, falling below \$30 per barrel for several days before rebounding to slightly above that level (Graph 4, left-hand panel). Brent settled 70% below the average nominal price observed between mid-2010 and mid-2014, the peak of the long boom in commodity prices which spanned over a decade. In fact, current oil prices barely exceed the average nominal price levels



The vertical lines in the left-hand panel indicate 16 December 2015 (FOMC meeting) and 4 January 2016 (release of China’s Caixin Manufacturing PMI).

¹ The dashed horizontal lines represent simple averages for the period 2012–15 for each implied volatility series. ² MSCI Emerging Markets Index in US dollars. ³ JPMorgan VXY Global index, a turnover-weighted index of implied volatility of three-month at-the-money options on 23 USD currency pairs. ⁴ 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. ⁵ Implied volatility of S&P 500, EURO STOXX 50, FTSE 100 and Nikkei 225 indices; weighted average based on market capitalisation. ⁶ Implied volatility of at-the-money options on commodity futures contracts on oil, gold and copper; simple average.

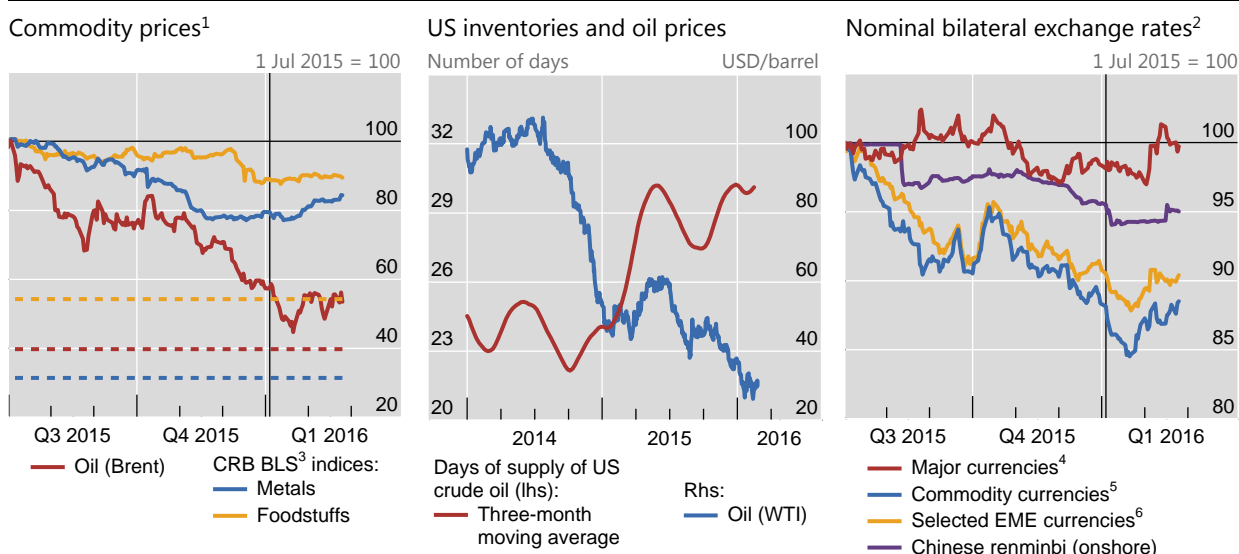
Sources: Bloomberg; Datastream; BIS calculations.

of the five years preceding 2002, right before the onset of the commodity price boom. Base metals and foodstuffs showed more resilience, not least because the respective indices had already dropped substantially prior to the recent turbulence. Their nominal prices remained well above pre-peak levels.

The heavy debt burden of producers (especially US shale companies) may have exacerbated the price decline.² Lower oil prices reduce the cash flows from current production and raise the risk of illiquidity and possibly debt defaults. Firms facing such strains may have maintained or even raised production to preserve liquidity and reduce debt, thereby contributing to further price declines. These forces may have been at play in the US market, where the large drop in oil prices went hand in hand with continuous increases in oil inventories (Graph 4, centre panel).

In the midst of a global risk asset sell-off, a general flight to safety strengthened the US dollar. Currencies of EMEs and commodity exporters tested new lows before finding support in mid-January at levels about 3% below year-end (Graph 4, right-hand panel). Concerns about renminbi depreciation also stirred foreign exchange market volatility. On 11 December 2015, the People’s Bank of China introduced the China Foreign Exchange Trade System (CFETS) reference basket, signalling a shift from a singular focus on the US dollar. Between August 2015 and late January 2016, the renminbi depreciated by 6% against the US dollar, while staying broadly stable vis-à-vis the CFETS basket. The country’s foreign exchange reserves dropped by more

² See D Domanski, J Kearns, M Lombardi and H S Shin, “Oil and debt”, *BIS Quarterly Review*, March 2015, pp 55–65; and S Dale, “New economics of oil”, presentation at the Society of Business Economists Annual Conference, London, 13 October 2015.



The vertical line in the left- and right-hand panels indicates 4 January 2016 (release of China's Caixin Manufacturing PMI).

¹ The dashed horizontal lines represent simple averages for the period 1998–2002 for each commodity index. ² A decrease indicates depreciation of the local currency against the US dollar. Simple average across the listed currencies (apart from Chinese renminbi). ³ Commodity Research Bureau – Bureau of Labor Statistics. ⁴ Pound sterling, euro and Japanese yen. ⁵ Australian dollar, Canadian dollar, Chilean peso, Norwegian krone and Russian rouble. ⁶ Brazilian real, Colombian peso, Czech koruna, Hungarian forint, Indonesian rupiah, Indian rupee, Korean won, Mexican peso, Malaysian ringgit, Polish zloty, Turkish lira and South African rand.

Sources: US Energy Information Administration; Bloomberg; Datastream; national data.

than \$300 billion over the same period, at a seemingly accelerating pace that unnerved investors. Expectations of further depreciation may have contributed to the sell-off in the domestic stock market, which in turn put further pressure on the currency. The combined impact of lower oil prices and a stronger US dollar has put substantial pressure on many EMEs at a time when the tide of global dollar liquidity appears to be turning.³

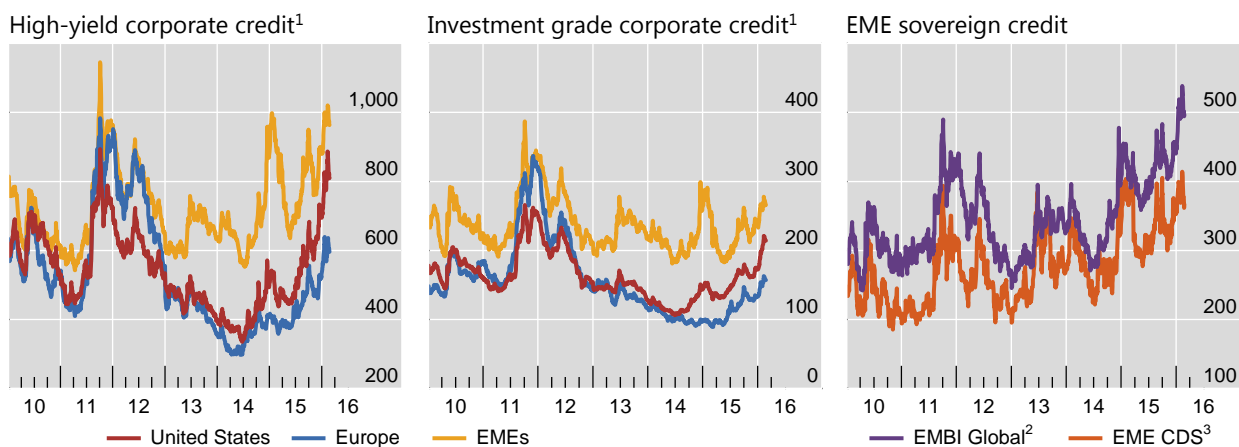
Global credit markets were also riled by turbulence. The low interest rate environment of the past few years had gone hand in hand with a search for yield that eased credit conditions, in particular for riskier borrowers. As market turbulence spread, AE high-yield credit came under unusual pressure, after having been buffeted by increasing headwinds since mid-2014 (Graph 5, left-hand panel). The widening of spreads was particularly sharp for US high-yield debt, which was weighed down by the underperformance of energy companies and fears of a rise in default rates (see Box 1). Since mid-2014, the US high-yield spread more than doubled, reaching levels comparable to the peaks observed during the European debt crisis in 2011. By comparison, the widening of corporate spreads was more moderate in Europe, with high-yield spreads halfway to their 2011 peaks. The divergence between the investment grade spreads across the two regions coincided with the onset of the oil price plunge in mid-2014, possibly reflecting concerns over contagion from the oil sector to other parts of the US economy (Graph 5, centre panel). Sovereign credit

³ See "Highlights of global financing flows", *BIS Quarterly Review*, March 2016, and J Caruana, "Credit, commodities and currencies", lecture at the London School of Economics and Political Science, London, 5 February 2016.

Market turbulence roils credit markets

Spreads, in basis points

Graph 5



¹ Option-adjusted spreads over US Treasury notes. ² JPMorgan EMBI Global index, stripped spread. ³ Emerging markets CDX.EM index, five-year on-the-run CDS mid-spread.

Sources: Bank of America Merrill Lynch; JPMorgan Chase.

spreads in EMEs also widened during the initial weeks of 2016, comfortably surpassing the heights recorded in 2011 (right-hand panel).

The monetary policy landscape across EMEs varied, reflecting the role played by commodities, exchange rates and other drivers of inflation. Central banks in emerging Asia and Europe, whose economies mostly benefited from the commodity price plunge, kept their monetary policies unchanged despite substantial currency depreciation. Commodity exporters, by contrast, tightened or signalled an inclination to tighten rates, as currency depreciation triggered strong inflationary pressures in spite of slowing economic activity. For most countries, however, the challenging global backdrop for exchange rates left limited space for monetary stimulus.

Turbulence extends as markets focus on banks

The ongoing financial turbulence against a weakening global backdrop gave way to a second phase of turbulence, in which markets focused on the possibility that central banks could drive interest rates further into negative territory and, in the process, add to the persistent weakness in bank profitability.

As turbulence rippled through emerging and advanced financial markets, the resulting flight to safety helped flatten yield curves in core bond markets. By late January, the term spread between the 10-year US Treasury bond and the three-month bill had dropped more than 50 basis points from the end of 2015 (Graph 6, left-hand panel) and the comparable spread for German bunds retreated by almost 40 basis points. In the past, flattening yield curves and widening credit spreads have often heralded weakness in economic activity (see Box 1).

Tensions in high-yield bond markets

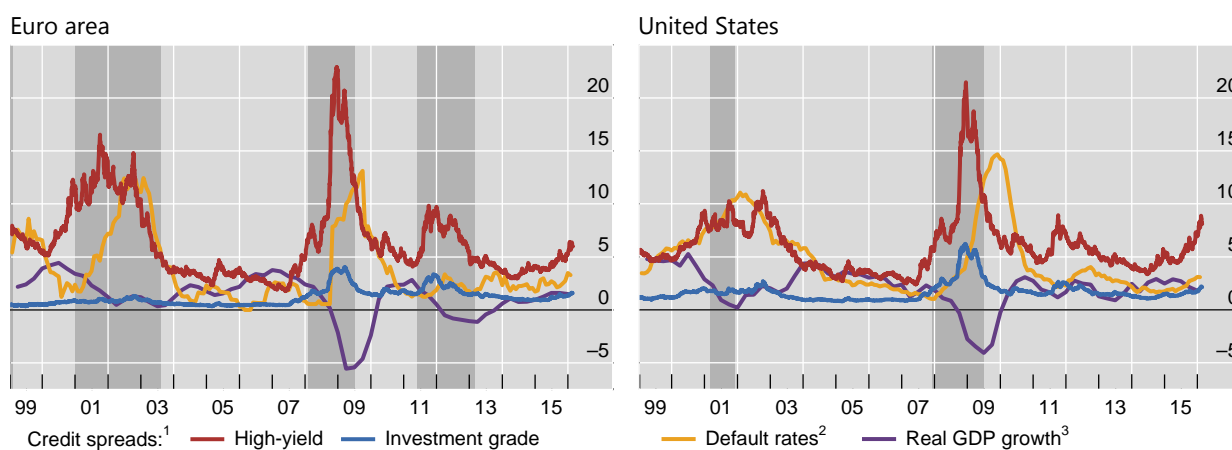
Ben Cohen and Gianpaolo Parise

The high-yield debt market was subject to significant tensions in 2015. The BofA Merrill Lynch US High Yield Index fell 4.6% and high-yield credit spreads exceeded 5% in Europe and 7% in the US (Graph A). At the end of 2015, market turbulence affected a number of specialised investment funds and severe investor redemptions forced them to try to unload illiquid assets as prices plunged. In the second week of December, the Third Avenue Focused Credit Fund stopped fulfilling investor sell orders and announced plans to liquidate its whole portfolio in an orderly fashion within one year. In the days following the events at Third Avenue, other high-yield oriented funds, including funds managed by Sunlion Capital Partners, Lucidus Capital Partners and Whitebox Advisors, either suspended redemptions or set plans to liquidate their holdings.

Credit spreads widen despite steady growth

In per cent

Graph A



The shaded areas indicate recession periods as defined by the OECD (euro area) and NBER (United States).

¹ Option-adjusted spreads on an index of local currency bonds issued by financial and non-financial corporations. ² Trailing 12-month issuer-weighted default rates by borrowers rated below investment grade. ³ Year-on-year growth rate of quarterly real GDP.

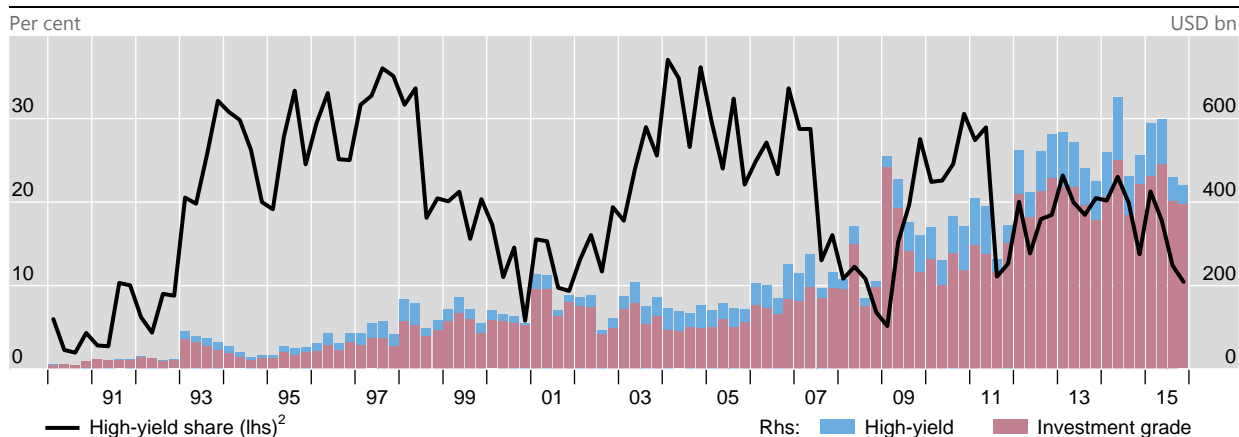
Sources: Bank of America Merrill Lynch; Moody's; national data.

As the difficulties on the demand side of the market emerged, the issuance of new high-yield securities slowed. While corporate bond issuance remained strong, issuance in the high-yield segment contracted, particularly in the second half of the year. From a low of \$98 billion in 2008, high-yield debt issuance had exceeded \$400 billion annually in 2013–14, before falling to \$334 billion in 2015 (Graph B).

The ongoing turmoil in the energy sector is central to explaining the tensions experienced by high-yield debt securities. The Merrill Lynch HY Energy Index plummeted in 2015, underperforming both US Corporate High Yield and Emerging Markets High Yield indices. Even though previous crises have also inflicted substantial losses on high-yield securities, the tensions in the energy sector are specific to the most recent period (Graph C). An increasing number of defaults toward the end of 2015, however, hints at the possibility of broader fragilities (Graph C, right-hand panel).

High-yield issuance weakens¹

Graph B



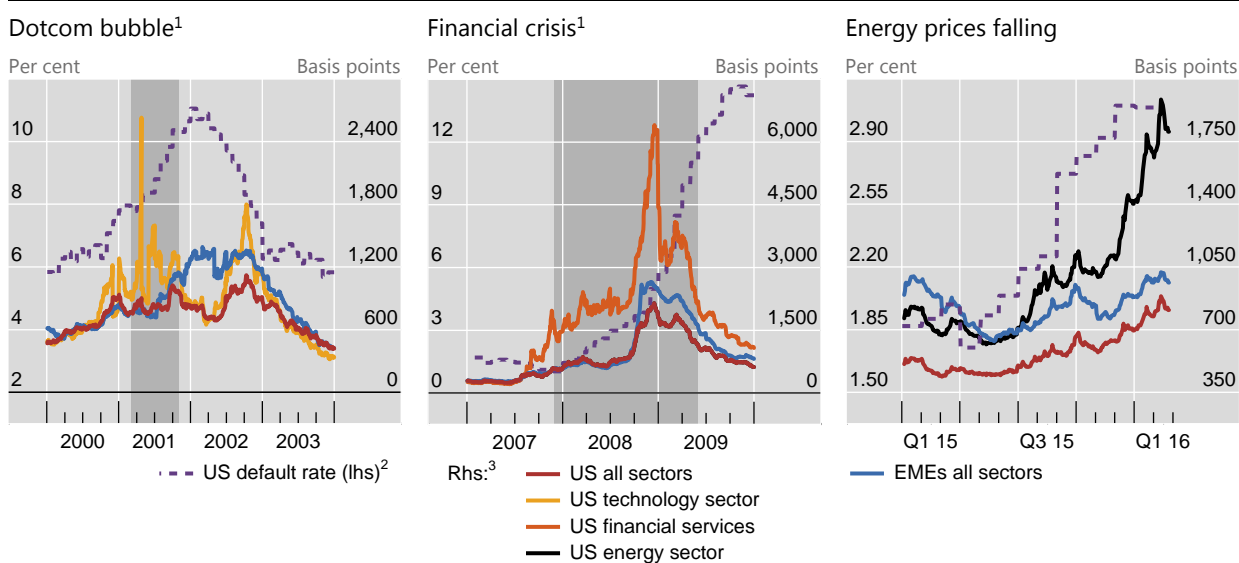
¹ Gross issuance of corporate bonds by non-financial corporations. ² Share of high-yield issuance in total corporate bond issuance.

Sources: Dealogic; BIS calculations.

Patterns of high-yield indices vary across episodes

In basis points

Graph C



¹ Shaded areas indicate NBER recessions. ² Trailing 12-month issuer-weighted default rates by borrowers rated below investment grade. ³ Option-adjusted spreads on an index of non-sovereign debt.

Sources: National Bureau of Economic Research; Bank of America Merrill Lynch; Moody's.

One interpretation of recent events is that the high-yield rout is an isolated development, driven by US oil industry weakness; another is that this is a “canary in the coal mine” moment signalling broader fragilities. Recent experience, supported by academic research, suggests that sharp increases in credit spreads are a leading indicator of recessions.^① This is the case even when wider spreads initially reflect sector-specific strains: high-yield credit spreads started to rise in the technology sector at the beginning of 2000, just before the burst of the tech bubble (Graph C, left-hand panel), while financial sector high-yield spreads rose in 2007, before the Great Financial Crisis (centre panel). Spreads of other risky securities in these episodes only started to widen when the broader economy turned down. More recently, while spreads have widened dramatically since the second quarter of 2015 in the energy sector, other credit spreads, including those on emerging market corporate debt, have crept up much more gradually (right-hand panel).

^① A Estrella and G Hardouvelis, “The term structure as a predictor of real economic activity”, *Journal of Finance*, vol 46, 1991, pp 555–76; A Estrella and F Mishkin, “Predicting US recessions: financial variables as leading indicators”, *Review of Economics and Statistics*, vol 80, 1998, pp 45–61; and J Faust, S Gilchrist, J Wright and E Zakrajsek, “Credit spreads as predictors of real-time economic activity: a Bayesian model-averaging approach”, *The Review of Economics and Statistics*, vol 95, no 5, 2013.

These developments sowed doubt among market participants about the positive outlook for the US economy, on which the Federal Reserve had predicted the December lift-off. External weakness, a strong dollar and widening credit spreads threatened to smother the recovery. With this new backdrop, market expectations of future rate hikes declined to a point that became inconsistent with the prospect of three to four rate increases in 2016 implied by FOMC participants’ monetary policy assessments (Graph 1, right-hand panel). By early February, the probability of a rate hike in March had dropped from 50% to near zero, and even a June hike came to be regarded as unlikely. The turbulence led markets to price in a very gradual pace of tightening. In contrast to expectations at the time of the December lift-off, by late January markets expected the federal funds rate to stay below 1% throughout 2017, and in February the expected pace of tightening fell even further (Graph 6, right-hand panel).

Policymakers in major AEs reacted to these developments with moves that were taken as pointing towards further accommodation. At its January meeting, the FOMC acknowledged the global financial turbulence and possible repercussions on the US economy, but did not signal a change to the previous guidance. But on 28 January markets took note of the Fed’s announcement of the guidelines for the 2016 banking stress test, which asked banks to consider the potential impact of negative Treasury bill rates as part of a “severely adverse scenario”. The previous week, the ECB left its monetary stance unchanged but announced a review in March, with markets regarding further accommodation as more likely. The BoJ surprised the markets on 29 January by introducing negative interest rates charged on the excess over required reserves and the balances accumulated by financial institutions under its quantitative and qualitative easing programme (QQE) and loan support programme. The BoJ thus joined the ECB and the Swiss National Bank in imposing negative rates on bank reserves (Graph 7, left-hand panel).⁴

The BoJ decision had an outside effect on financial markets. Japanese government bond yields fell to record lows across the curve, with negative yields at

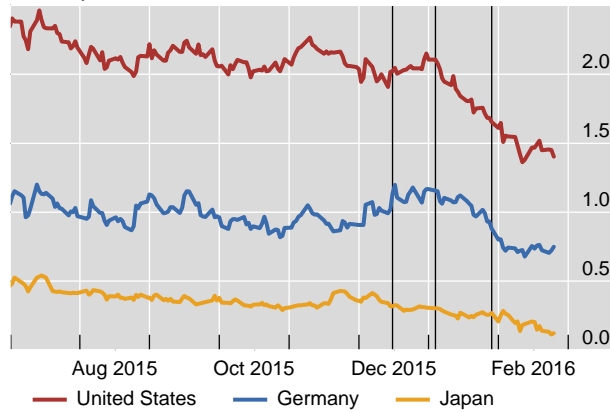
⁴ A total of five central banks moved their policy rates below zero, traditionally seen as the lower bound for nominal interest rates: Danmarks Nationalbank, the ECB, Sveriges Riksbank, the Swiss National Bank and the BoJ. The implementation of negative policy rates is discussed in detail in M Bech and A Malkhozov, “How have central banks implemented negative policy rates?”, *BIS Quarterly Review*, March 2016.

Turbulence triggers flight to safety

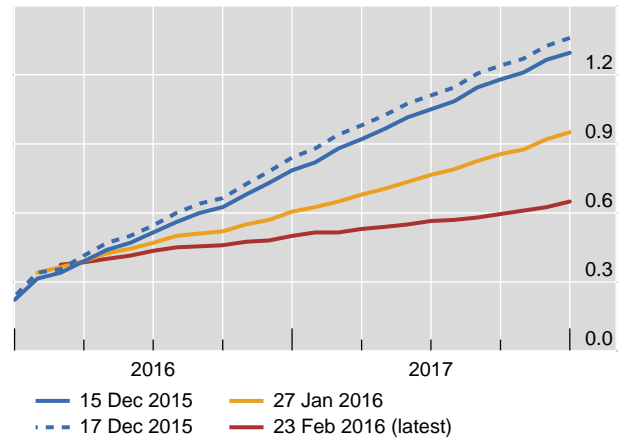
In per cent

Graph 6

Term spreads in core bond markets¹



US forward interest rate curves²



The vertical lines in the left-hand panel indicate 16 December 2015 (FOMC meeting), 4 January 2016 (release of China's Caixin Manufacturing PMI) and 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves).

¹ Defined as the spread between 10-year and three-month government bond yields. ² Thirty-day federal funds rate futures.

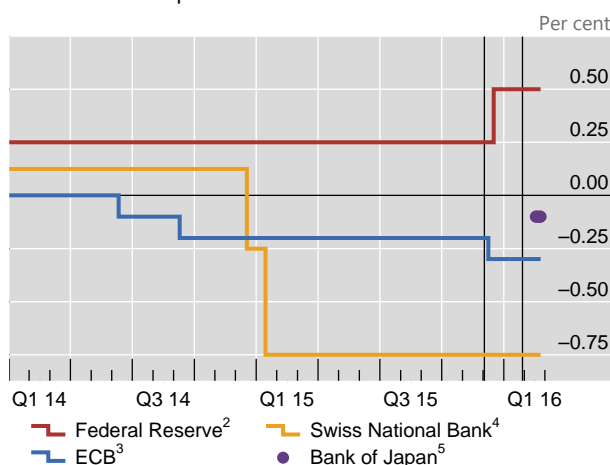
Source: Bloomberg.

all maturities out to 10 years. And after a fleeting rebound in the Japanese stock market and a short-lived depreciation of the yen, Japanese banks' stock prices fell sharply. This occurred even though the BoJ measure was designed to minimise the immediate impact on bank profitability.

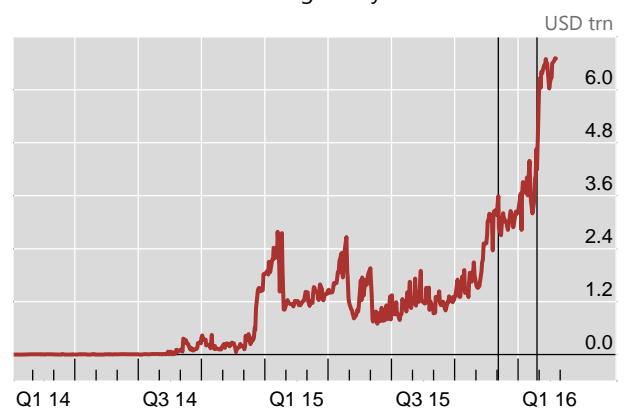
More debt trades at negative yields

Graph 7

Central bank deposit rates



Government bonds with negative yields¹



The vertical lines indicate 3 December 2015 (ECB reducing its deposit facility rate to -0.3%) and 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves).

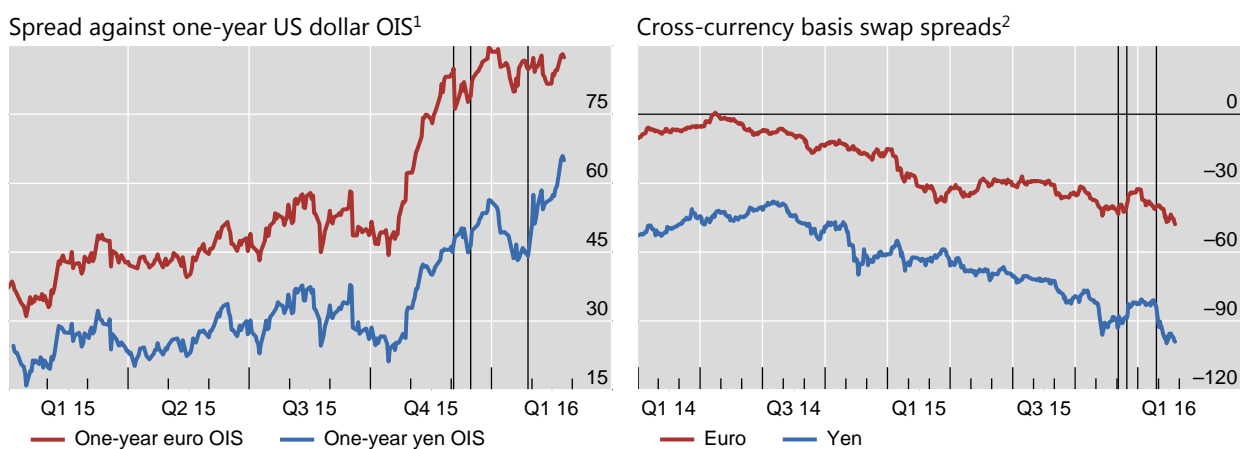
¹ Analysis based on the constituents of the Bank of America Merrill Lynch World Sovereign index as of 8 February 2016. ² Rate on excess reserve balance with the Federal Reserve. ³ Rate on the ECB deposit facility. ⁴ Interest rate charged by the Swiss National Bank on sight deposits. ⁵ Interest rate on the third tier of excess reserves held at the Bank of Japan.

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

Large swings in expected monetary policy divergence

In basis points

Graph 8



The vertical lines indicate 3 December 2015 (ECB reducing its deposit facility rate to -0.3%), 16 December 2015 (FOMC meeting) and 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves).

¹ Difference between the one-year US dollar overnight index swap (OIS) and the one-year euro OIS or one-year yen OIS. ² Five-year basis swap spreads versus the US dollar.

Source: Bloomberg.

As markets digested the implications of negative policy rates in Japan, they appeared to price in a further set of easing moves more generally. In a matter of days, the universe of sovereign bonds trading at negative yields expanded from \$4 trillion to more than \$6.5 trillion (Graph 7, right-hand panel). By early February, almost one quarter of the outstanding stock of sovereign bonds in the Merrill Lynch sovereign fixed income index were trading at negative yields. Among Japanese government bonds, that share exceeded 60%.

As the universe of bonds yielding negative rates expanded, markets became increasingly aware of new constraints and trade-offs that might limit policy options. By some reports, the pool of euro-denominated debt yielding less than the ECB deposit rate (currently at -0.3%) surged by a third after the ECB's policy meeting on 21 January. The rules governing the ECB's asset purchase programme make such securities ineligible for future ECB purchases. If price dynamics continued to shrink the universe of eligible securities, the scope of the asset purchase programme would thus narrow, unless the deposit rate were pushed further into negative terrain – which, in turn, was seen as possibly eroding euro area banks' future net interest margin.

These developments resulted in large swings in the extent of the divergence that market expected between G3 monetary policies going forward. A simple measure compares the expected average overnight rates over one year in the United States with the corresponding averages for the euro area and Japan (Graph 8, left-hand panel). This measure of policy divergence rose in late 2015 on the way to US lift-off, and declined in January as markets reduced their expected pace of US tightening. With the BoJ's foray into negative rates, however, the expected divergence widened again relative to the United States. Roughly in line with the divergence in monetary policies across the major currency areas, cross-currency basis swap spreads widened

against the dollar, by about 15 basis points in the case of the yen, and by 8 basis points for the euro (right-hand panel).⁵

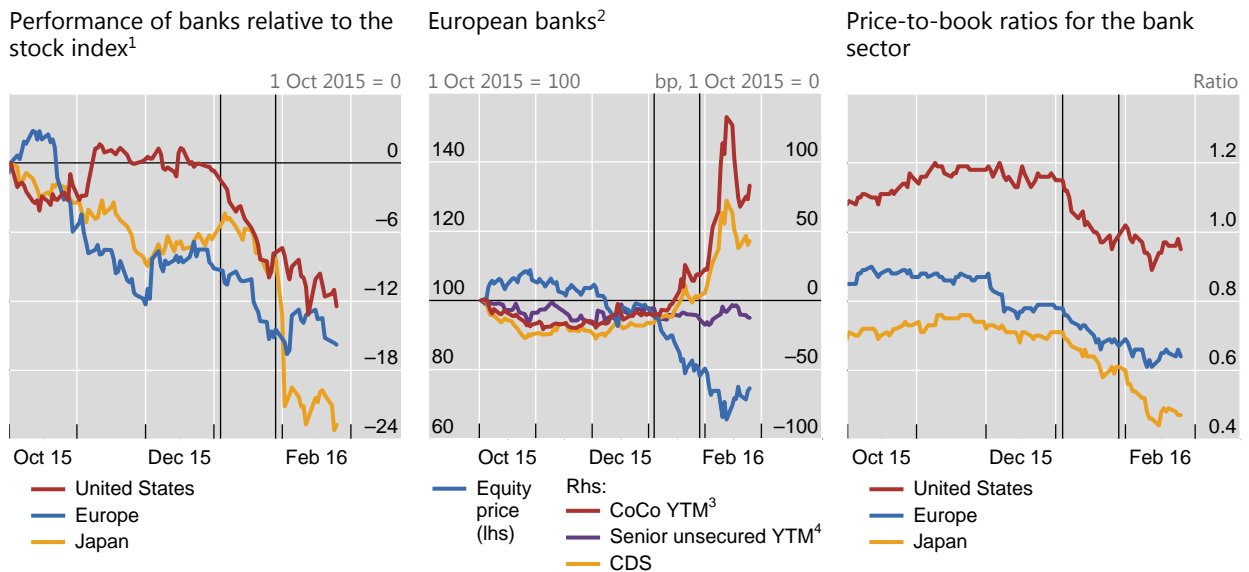
As stress reigned in financial markets and the global outlook deteriorated, tensions spread to the equity and debt obligations of major global banks. European bank shares had been trailing the broader market since mid-2015, but the gap widened in 2016 (Graph 9, left-hand panel). US banks also underperformed the S&P 500 index by 10% since early January, but Japanese banks plunged 15% vis-à-vis the Nikkei after the BoJ announcement.

Alongside falling share prices and widening credit default swap (CDS) spreads, the market for contingent convertible bonds (CoCos) of European banks took a remarkable dive (Graph 9, centre panel). The limited impact on senior bank debt spreads suggests that the size or quality of capital buffers were not the primary concern even as CDS spreads widened. But the possibility that European banks might have to suspend dividend distributions and CoCo coupon payments set in motion a dynamic that reinforced the plunge in bank valuations across asset classes (Box 2).

These developments led market participants to focus on bank profitability. The doubts markets harbour about the prospects of European and Japanese banks, in

Banks under pressure

Graph 9



The vertical lines indicate 4 January 2016 (release of China's Caixin Manufacturing PMI) and 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves).

¹ Calculated as the difference between the Datastream-compiled bank sub-indices for each region minus the STOXX Europe 600 for Europe, Nikkei 225 for Japan and S&P 500 for the United States. ² Simple averages of Barclays, Banco Santander, BBVA, Crédit Agricole, Credit Suisse, Deutsche Bank, Intesa Sanpaolo, Société Générale, UBS and UniCredit (based on data availability). ³ Yield to maturity (YTM); based on perpetual contingent convertible (CoCo) bonds. ⁴ Yield to maturity of senior unsecured bonds matching the selected CoCo bonds in terms of currency and remaining maturity as closely as possible.

Sources: Bloomberg; Datastream; Markit; BIS calculations.

⁵ On the achievements in rebuilding financial strength and the challenges facing banks in advanced economies, see BIS, "Old and new risks in the financial landscape", *85th Annual Report*, June 2015, pp 101–19.

Sell-off of European bank shares

Michael Chui

The securities of European banks were hit particularly hard in the first weeks of 2016. The STOXX Europe 600 index has fallen by 23% so far this year, and CDS and CoCo bond spreads have also risen sharply (Graph 9, centre panel). Concerns about the sector's prospects, particularly with respect to earnings, seem to have been on investors' minds. Price declines have been further exacerbated by market dynamics.

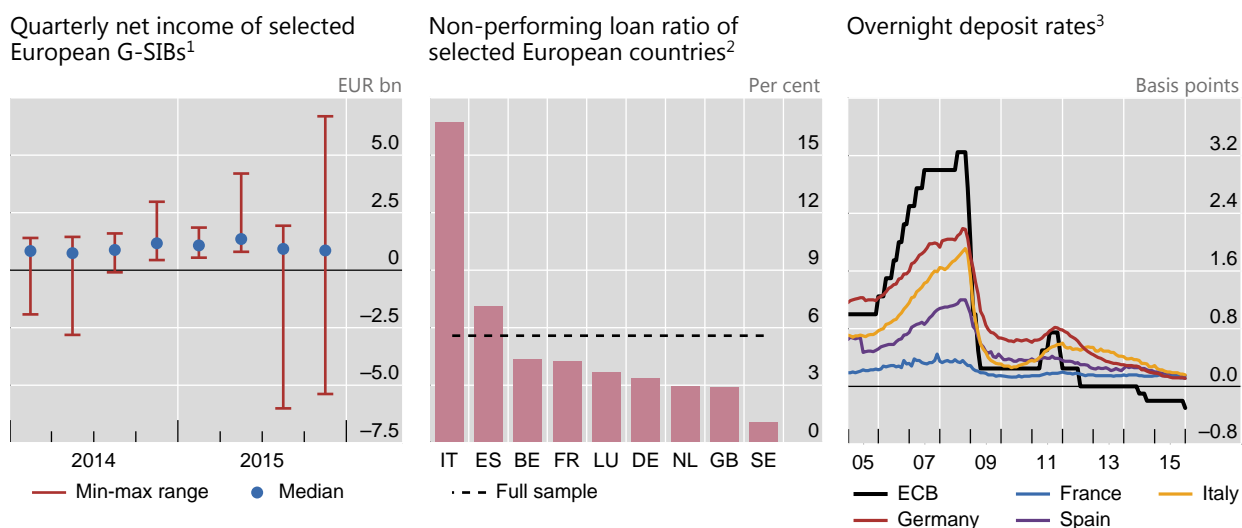
Investors' concerns about banks' condition have different facets. Several major banks reported larger losses or poor profits in the fourth quarter of 2015 (Graph D, left-hand panel). In addition, some banks are still hamstrung by the legacy of non-performing assets on their balance sheets (centre panel), and new uncertainties have emerged regarding the size of direct and indirect exposures to the energy sector.

Uncertainty about banks' earnings prospects have been heightened by the expectation that negative policy rates and exceptionally low interest rates out the yield curve may prevail for longer than originally anticipated. Interest margins have been squeezed, given banks' reluctance to pass negative rates on to depositors (Graph D, right-hand panel). Banks seem to have coped with the operational challenges so far, but this offers limited comfort if rates move lower and stay negative for a prolonged period.

Movements in the prices of bank securities have been exacerbated by market dynamics associated with the interactions between CoCos, equity and CDS. In Europe, the imposition of loss-sharing on junior creditors in recent bank resolutions and the clarification of the relevance of Tier 2 requirements for banks' ability to make coupon payments on CoCos may have focused investors' attention on potential sources of uncertainty.^① In particular, concerns about the likelihood of CoCo coupon cancellation amid large losses compress the value of these bonds. An actual cancellation would be a first-time event for CoCos as a new asset class. This prospect may have set in motion hedging activities, with the holders of CoCos shorting banks' equity and/or buying default protection to hedge further declines in CoCo prices, leading to a strong price co-movement of these instruments. With investors in CoCos bruised and equity prices weak, questions also arose over banks' ability to raise market-based capital in the future, if needed.

European banks under stress

Graph D



BE = Belgium; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; IT = Italy; LU = Luxembourg; NL = Netherlands; SE = Sweden.

¹ Includes BNP Paribas, Deutsche Bank, Credit Suisse, Groupe Cr dit Agricole, HSBC, ING Bank, Nordea, Santander, Soci t  G n rale and UBS. ² Based on the European Banking Authority's 2015 EU-wide transparency exercise data; non-performing loans/total loans as of June 2015. ³ For the ECB, standing facility deposit rate; for individual countries, overnight deposit rates for non-financial corporations and households, new business.

Sources: European Banking Authority; ECB; Thomson Reuters Eikon.

① See European Banking Authority, "Opinion of the European Banking Authority on the interaction of Pillar 1, Pillar 2 and combined buffer requirements and restrictions on distributions", 16 December 2015.

particular, have long been reflected in the extent to which their share prices traded below their book value (Graph 9, right-hand panel). Price-to-book ratios slid further during the turmoil, but the persistent gap between European and Japanese banks vis-à-vis their US peers remained. Banks' reluctance to pass negative rates on to depositors contributed to the gradual erosion in net interest income (Box 2).⁶ At the same time, concern over prospective bank earnings led market participants to look closely at the likely impact of an extended period of negative interest rates on bank profitability.

Underlying some of the turbulence of the past few months was a growing perception in financial markets that central banks might be running out of effective policy options. Markets pushed out further into the future their expectations of a resumption of gradual normalisation by the Fed. And as the BoJ and ECB signalled their willingness to extend accommodation, markets showed greater concerns about the unintended consequences of negative policy rates. In the background, growth remained disappointing and inflation stubbornly below targets. Markets had seemingly become uncertain of the backstop that had been supporting asset valuations for years. With other policies not taking up the baton following the financial crisis, the burden on central banks has been steadily growing, making their task increasingly challenging.

⁶ On related dislocations in fixed income derivatives markets, see the box by S Sundaresan and V Sushko in "Uneasy calm awaiting lift-off", *BIS Quarterly Review*, December 2015.

Highlights of global financing flows¹

The BIS, in cooperation with central banks and monetary authorities worldwide, compiles and disseminates data on activity in international financial markets. It uses these data to compile indicators of global liquidity conditions and early warning indicators of financial crisis risks. This chapter analyses recent trends in these indicators. It also summarises the latest data for international banking markets, available up to September 2015, and for international debt securities, available up to December 2015.

Takeaways

- International financing, as measured by the BIS global liquidity indicators (GLIs), slowed in the second half of 2015. Aggregate international bank credit in the third quarter declined compared with a year earlier. The stock of international debt securities grew in the year to December 2015, but at a slower pace than in recent years.
- US dollar credit to non-bank borrowers outside the United States stood at \$9.8 trillion in September 2015, essentially unchanged from the previous reading in June. Dollar borrowing by non-banks in emerging market economies (EMEs) stood at \$3.3 trillion, again unchanged from June. This was the first time since 2009 that the latter has stopped increasing.
- The stock of cross-border claims fell for the second consecutive quarter, due mainly to falling claims on major EMEs. The global contraction of \$157 billion between end-June and end-September 2015 was smaller than the previous quarter's and left outstanding claims at \$27 trillion. Banks' cross-border claims on EMEs declined by \$141 billion in the third quarter, or 6% year on year. The decline was primarily driven by claims on emerging Asia, and China in particular, while claims on other EMEs changed relatively little.
- The total amount of international debt securities outstanding decreased by 0.2% in the fourth quarter of 2015, with repayments exceeding new issues by \$47 billion.
- The contraction was mainly driven by weak issuance by financial companies in advanced economies. Net debt issuance by EMEs was relatively stable.

¹ This article was prepared by Ben Cohen (ben.cohen@bis.org), Cathérine Koch (Catherine.Koch@bis.org) and Gianpaolo Parise (gianpaolo.parise@bis.org). Statistical support was provided by Kristina Bektyakova, Bat-el Berger and Anamaria Illes.

- The euro as a currency of denomination gained popularity among non-financial issuers headquartered in the United States, with total net issuance in euros in the fourth quarter accounting for 48% of the US total.

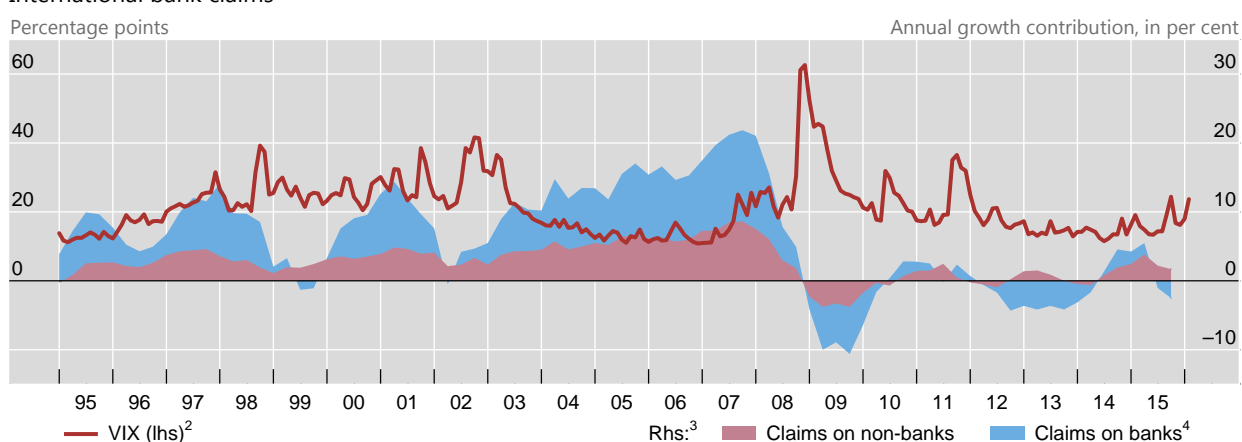
Global credit slows

International credit aggregates slowed in the third quarter of 2015. Aggregate international bank claims² contracted by 0.8% compared with a year earlier (Graph 1,

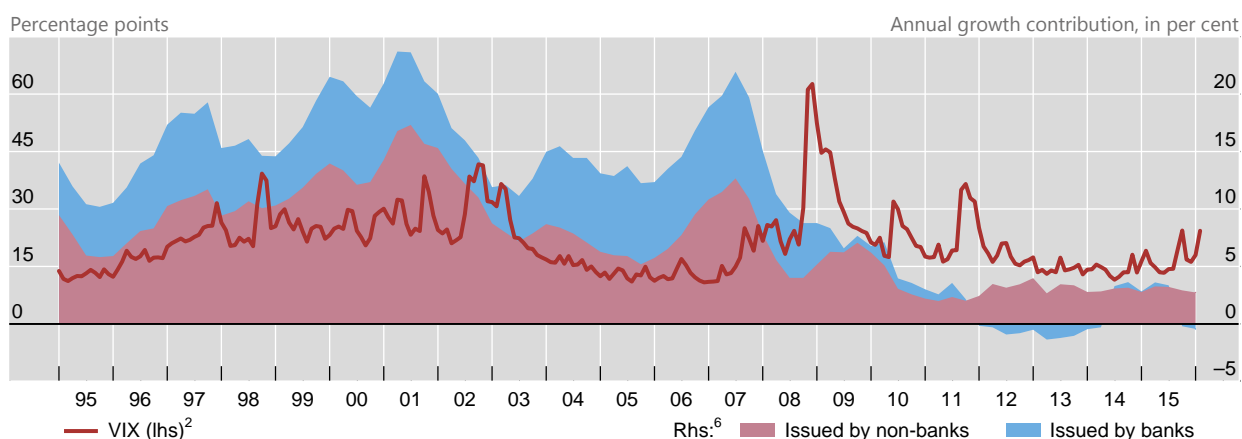
International bank credit, international debt securities and volatility

Graph 1

International bank claims¹



International debt securities⁵



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 Chicago Board Options Exchange S&P 500 implied volatility index; standard deviation, in percentage points per annum. ³ Contribution to the annual percentage change in credit to all sectors. ⁴ Including intragroup transactions. ⁵ All instruments, all maturities, all countries. Immediate issuer basis. ⁶ Contribution to the annual percentage change in amount outstanding in all sectors.

Sources: Bloomberg; Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS locational banking statistics (LBS); BIS calculations.

² International bank claims are the sum of banks' cross-border claims and their local claims in foreign currencies.

top panel). A decline in interbank claims outweighed a positive, but slowing, growth rate in bank claims on non-banks. This marked the first outright contraction in international bank claims overall since the first quarter of 2014. International debt securities issuance³ was more stable. The stock of outstanding securities fell slightly in the fourth quarter relative to the third, but was still 2.3% greater than a year earlier (Graph 1, bottom panel).⁴

As discussed later in these Highlights, however, debt securities issuance by emerging economies, while slightly positive on a net basis, was sharply lower throughout the second half of the year. International issuance continued to be dominated by non-banks.⁵

These developments in international bank and securities credit are significant because they may signal a turning point in global liquidity – loosely understood as the ease of financing in international financial markets.⁶ Periods of abundant international financing tend to coincide with exuberant attitudes towards risk, as signalled, for example, by relatively low levels of the VIX index, which measures market expectations of volatility as derived from option prices (Graph 1). In particular, borrowing in foreign currencies may create currency mismatches and fund unsustainable carry trades. At the same time, as growth in some of the larger emerging economies has slowed, reduced demand for credit has also played a role in the slowdown in international financing.

Indeed, the outstanding stock of credit to non-resident non-financial borrowers in dollars and euros stagnated in the third quarter. The stock of US dollar credit to non-financial borrowers outside the United States was essentially stable, at \$7.9 trillion, in the second quarter and the third (Graph 2, top panels). When non-bank financial borrowers are added, this amount rises to \$9.8 trillion, again with little change from the second quarter to the third (Graph 3, left-hand panel). US dollar credit to non-banks in emerging economies remained at around \$3.3 trillion (Graph 3, right-hand panel). As was the case throughout 2015, bank and securities credit in US dollars to non-residents diverged, with dollar-denominated bank lending outside the United States slowing significantly while non-resident securities issuance continued at a healthy pace (Graph 2, top right-hand panel).

Euro-denominated credit to borrowers outside the euro area was also flat, totalling \$2.2 trillion to non-financial borrowers and \$2.7 trillion when non-bank financials are included. Non-resident credit in Japanese yen remained relatively low, totalling \$392 billion, with both bank and securities credit to non-residents contracting in the third quarter (Graph 2, bottom panels).

³ International debt securities are bonds and money market instruments issued outside the borrower's home market.

⁴ The top and bottom panels of Graph 1 are not strictly comparable. In the top panel, bank credit is measured on a residence basis, analogously to balance of payments figures. The bottom panel tracks debt securities issued on international markets, some of which may nevertheless have been purchased by residents. There is some overlap, since banks hold substantial amounts of international securities in their portfolios.

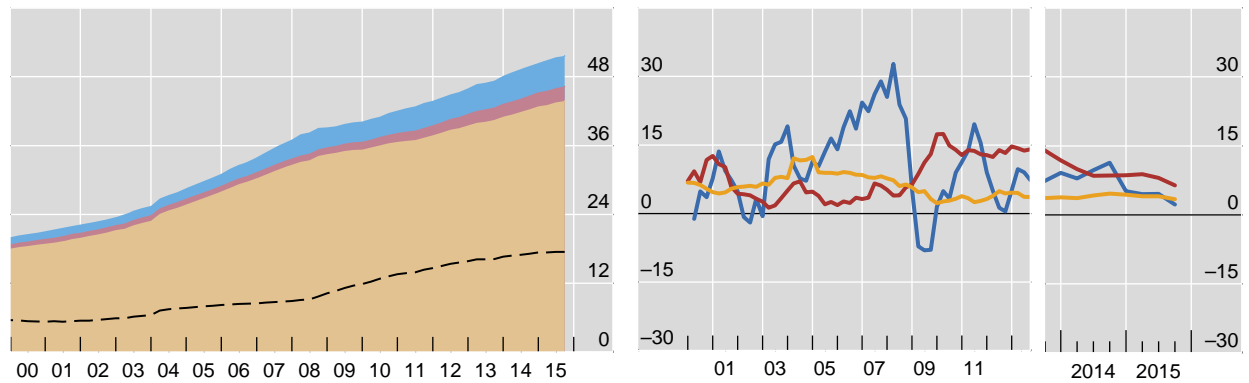
⁵ These aggregates, as well as those illustrated in Graphs 2, 3 and 5, are part of the GLIs tracked by the BIS. Further information on the GLIs is available at <http://www.bis.org/statistics/gli.htm>.

⁶ The GLIs build on Committee on the Global Financial System, "Global liquidity – concept, measurement and policy implications", *CGFS Publications*, no 45, November 2011 (<http://www.bis.org/publ/cgfs45.htm>). Data, analysis and research on global liquidity can be found on the BIS website at <http://www.bis.org/statistics/gli.htm>.

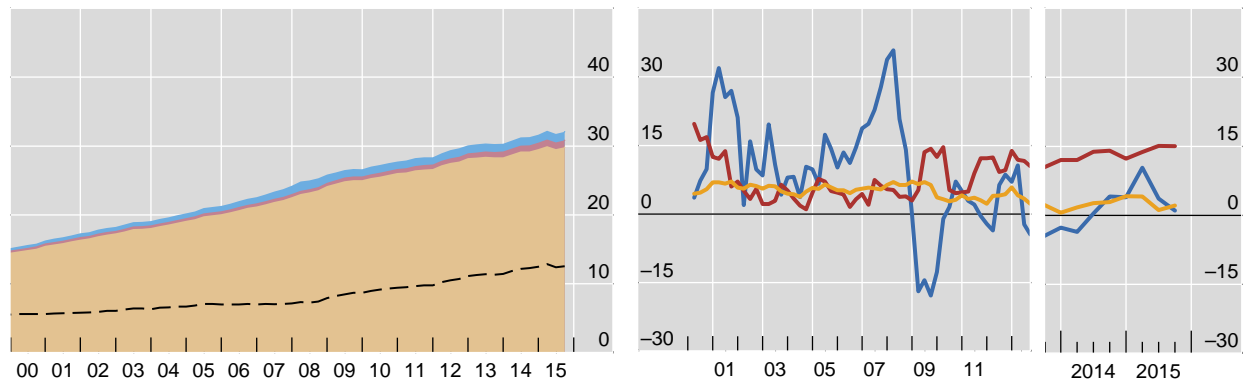
Amounts outstanding¹ (USD trn)

Annual change (per cent)

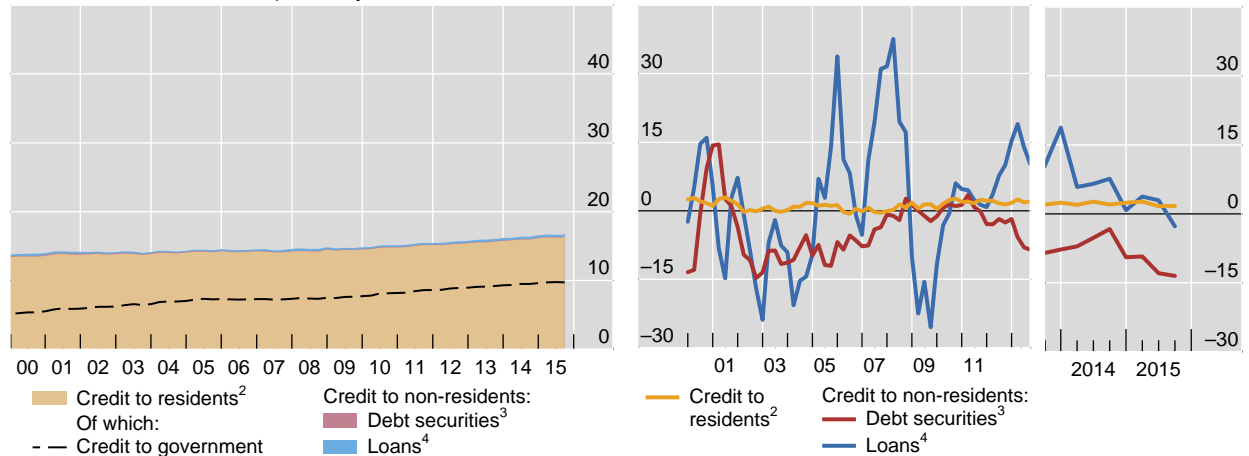
Credit denominated in US dollars (USD)



Credit denominated in euros (EUR)



Credit denominated in Japanese yen (JPY)



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

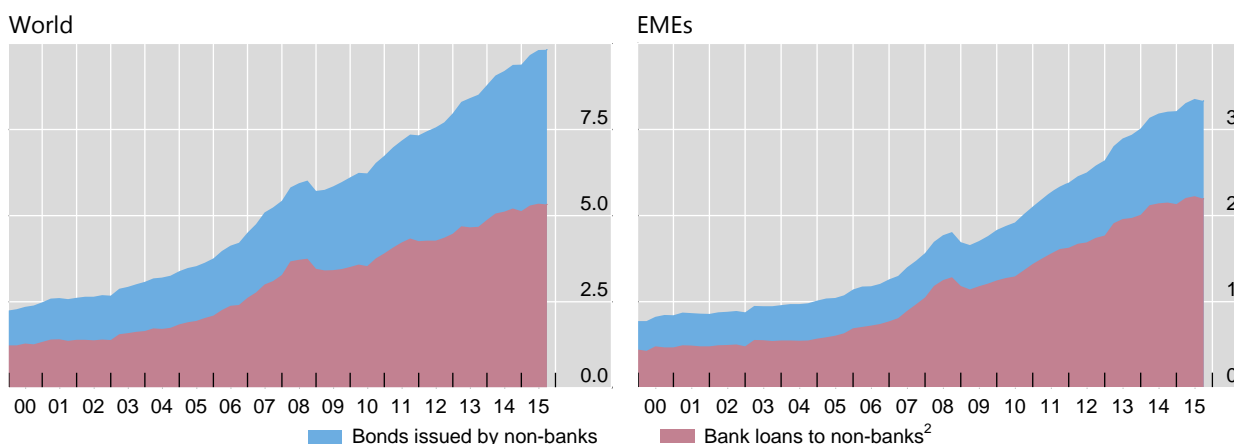
¹ Amounts outstanding at quarter-end. Amounts denominated in currencies other than USD are converted to USD at the exchange rate prevailing at end-September 2015. ² Credit to non-financial borrowers residing in the United States/euro area/Japan. National financial accounts are adjusted using BIS banking 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, comprise 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 are 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 onlent to non-banks.

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

US dollar-denominated credit to non-banks outside the United States¹

Amounts outstanding, in trillions of US dollars

Graph 3



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

¹ Non-banks comprise non-bank financial entities, non-financial corporations, governments, households and international organisations. ² Loans by LBS-reporting banks to non-bank borrowers, including non-bank financial entities, comprise cross-border plus local loans. For countries that are not LBS-reporting countries, local loans in USD are estimated as follows: for China, local loans in foreign currencies are from national data and are assumed to be composed of 80% USD; 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), on the assumption that these funds are lent to non-banks.

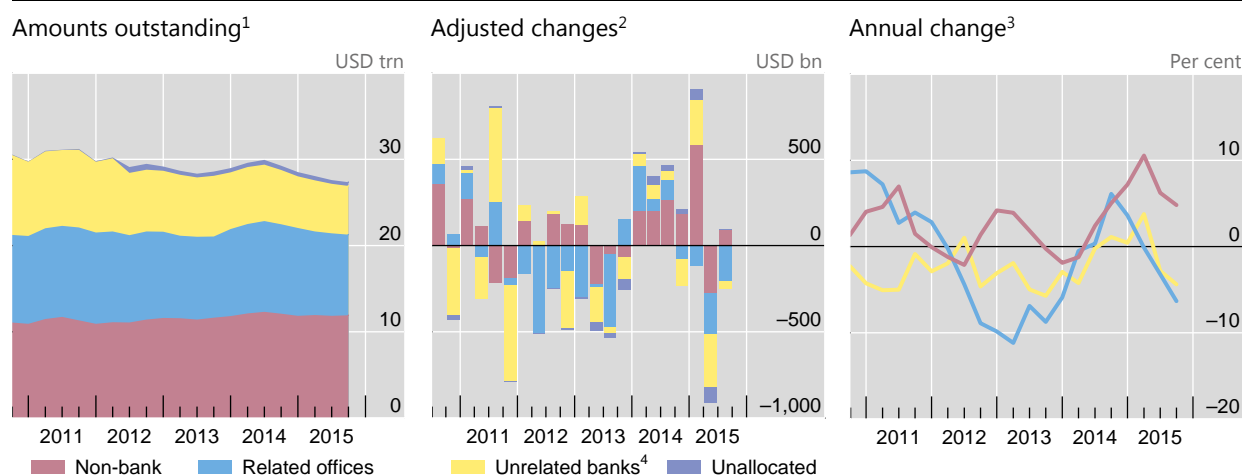
Sources: IMF, *International Financial Statistics*; BIS debt securities statistics; BIS locational banking statistics (LBS).

The slowdown in international credit aggregates which seems to have taken hold towards the end of 2015, and which has coincided with a sharp increase in the VIX, could signal a tightening of external financing conditions for emerging market economies. The consequences have been felt recently in turbulent markets ("Uneasy calm gives way to turbulence", *BIS Quarterly Review*, March 2016). The strength of the dollar since mid-2014 may have contributed, with a lag, to pressure on borrowers to reduce or reverse these positions. More recently, in some countries, such as China, tighter conditions have been reflected in a slowdown or reversal of some categories of capital flows and a reduction of foreign currency exposures (Box 1). If they persist, tighter global liquidity conditions may raise stability risks in some countries, especially those where other indicators already point to a heightened risk of financial stress (Box 2).

The remainder of these Highlights looks more closely at patterns of international financing in the second half of 2015. The next section considers international banking flows in the third quarter, including their breakdowns by borrower country and region. The following section looks at international debt securities issuance, based on data up to the fourth quarter of 2015. Box 1 looks at recent developments in capital flows to and from China, while Box 2 examines the BIS early warning indicators of banking distress.

International banking flows contract, led by EMEs

Outstanding cross-border claims of BIS reporting banks contracted during the third quarter of 2015 (Graph 4, left-hand and centre panels). While lending to EMEs



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.

Source: BIS locational banking statistics.

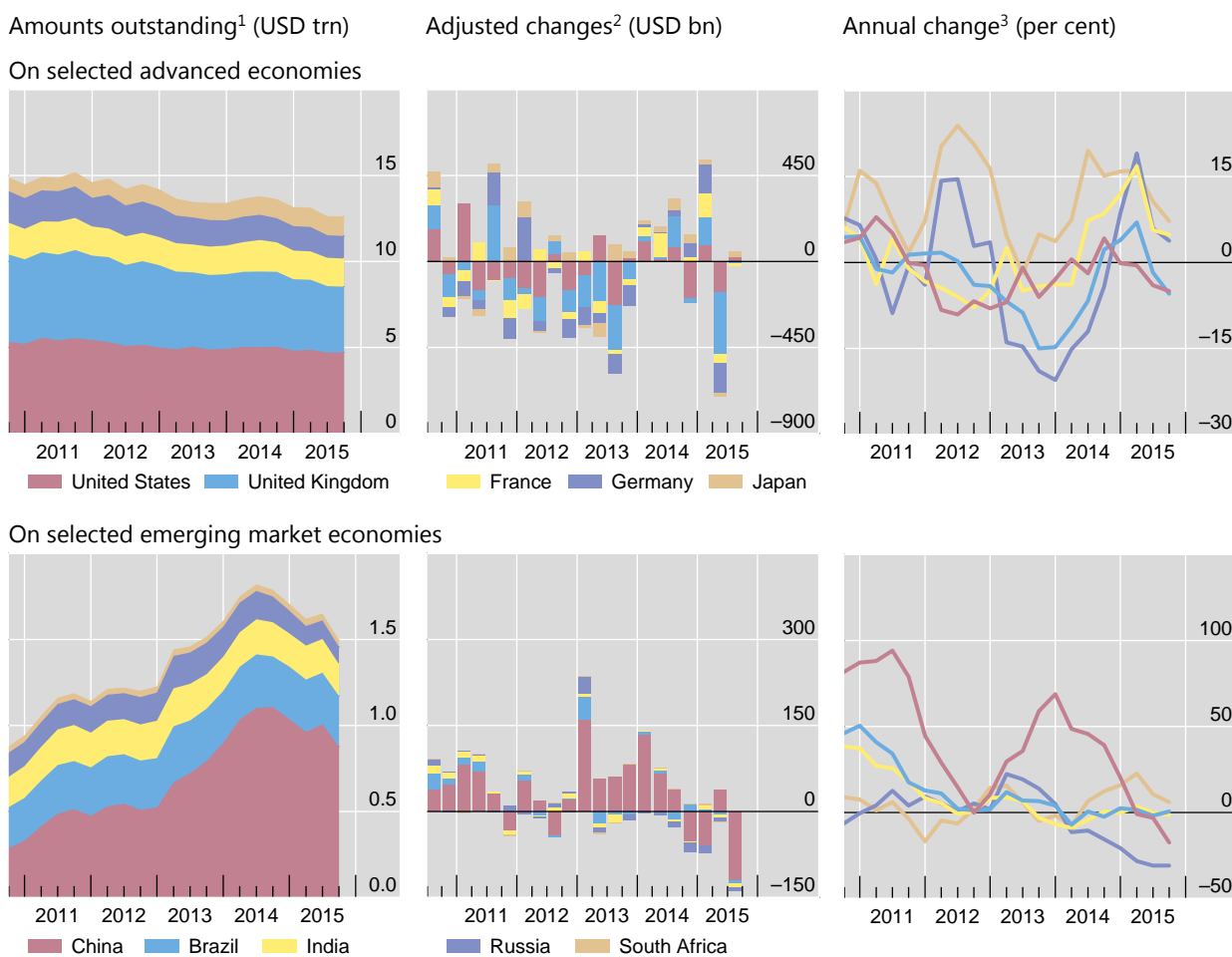
experienced a sharp decline, claims on advanced economies remained broadly unchanged.

Cross-border claims of BIS reporting banks fell by \$157 billion after adjusting for breaks in series and exchange rate movements.⁷ The quarterly decline, which followed a larger drop in the second quarter, left the outstanding amount of cross-border claims at \$27 trillion and nudged the year-on-year growth rate into negative territory (-1%).

Cross-border claims on banks and non-banks diverged in the third quarter (Graph 4, right-hand panel). The aggregate drop was driven by a \$251 billion decline in interbank claims. This was in turn driven by a fall in inter-office positions, leading to an annual rate of contraction of 5%. By contrast, cross-border claims on non-banks rose slightly.

Trends also diverged between the advanced and emerging economies. Aggregate cross-border claims on advanced economies remained virtually unchanged during Q3 2015, at \$20 trillion outstanding (Graph 5, top panels), while those on EMEs shrank by \$141 billion (Graph 5, bottom panels). Emerging Asia accounted for more than the overall decline (\$145 billion), as claims increased slightly on other EME regions.

⁷ These figures are drawn from the BIS locational banking statistics (LBS), which are structured according to the location of banking offices and capture the activity of all internationally active banking offices in the reporting country regardless of the nationality of the parent bank. Banks record their positions on an unconsolidated basis, including those vis-à-vis their own offices in other countries. Quarterly changes in outstanding amounts are adjusted for the impact of exchange rate movements between the ends of the respective quarters and for methodological breaks in the data series.



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.

Source: BIS locational banking statistics.

In particular, cross-border claims on China fell by \$119 billion during Q3 2015, reducing their outstanding stock to \$877 billion. This compares with the peak of \$1.1 trillion at end-September 2014. The annual pace of decline accelerated to -17% as of end-September 2015. A drop of \$100 billion in international interbank activity (including inter-office positions) with China was the main driver, but claims on the non-bank private sector also fell by \$19 billion. At end-September 2015, cross-border lending to banks in China still amounted to 61% of the country's total cross-border borrowing from BIS reporting countries, down from 68% within the past 12 months. On a consolidated basis, short-term international claims,⁸ with remaining maturities of up to one year, fell from their peak of \$858 billion in mid-2014 to \$625 billion at end-September 2015.

⁸ International claims in consolidated banking statistics (CBS) capture cross-border claims and local claims in foreign currency data, and are not adjusted for exchange rate changes.

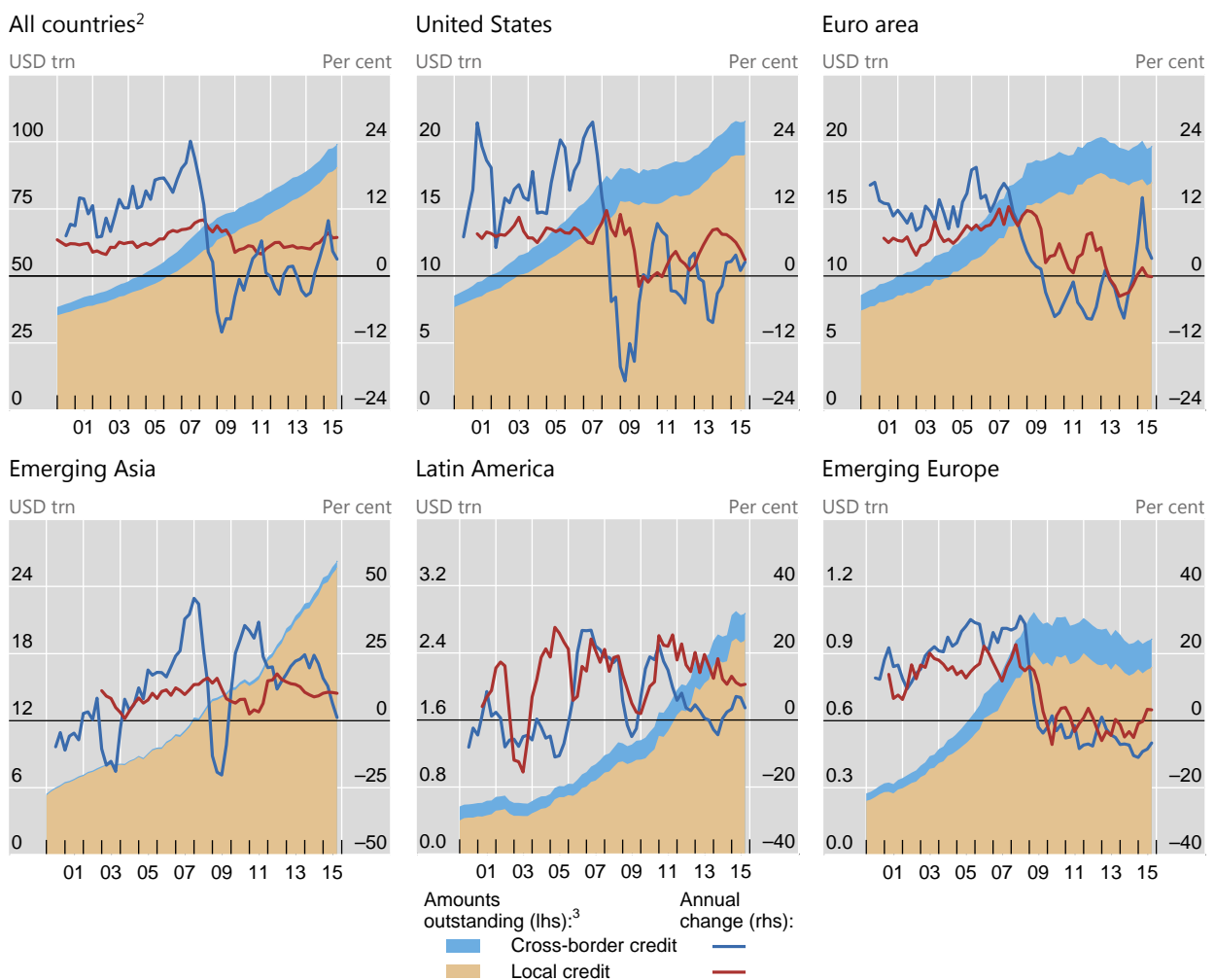
Banks from several advanced economies are exposed to China. UK banks ranked first, followed by those from the euro area, Japan and the United States.⁹ The trend towards a reduction of carry trade positions (short US dollars, long renminbi) discussed in the September 2015 *BIS Quarterly Review* continued into the summer and autumn of 2015 (Box 1).

Cross-border claims on emerging Asia excluding China fell by \$26 billion in the third quarter of 2015. The latest quarterly decline took the annual rate of contraction to -5% and the outstanding total to \$874 billion. Lending to Chinese Taipei

Global bank credit to non-banks, by borrower region

Banks' cross-border credit plus local credit in all currencies¹

Graph 6



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

¹ Cross-border claims (on non-banks) of LBS-reporting banks plus local claims (on non-banks) 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-September 2015.

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

⁹ For further details, see C Koch, "Foreign bank lending to China", *BIS Quarterly Review*, December 2015, pp 18–19.

contracted by \$8.8 billion, while cross-border claims on Korea shrank by \$7.9 billion and those on India by \$5.6 billion. In the year to end-September 2015, cross-border lending to Chinese Taipei contracted by 20%, while that to Korea and India by 7% and 1%, respectively.

Overall, cross-border lending flows to the other EME regions were relatively flat during Q3 2015. But this, conceals divergent trends across countries and regions (Graph 5, bottom panels). Cross-border lending to Latin America and the Caribbean remained virtually unchanged during Q3 2015. Claims on Brazil, however, fell by \$6 billion, reducing their annual growth rate to 1%, while claims on Colombia expanded by \$1.5 billion (or 17% year on year) and cross-border lending to Mexico remained virtually unchanged. Cross-border lending to emerging Europe fell by \$5.9 billion, while the annual pace of contraction stood at 7.5%. Lending to Russia contracted by \$7.0 billion, bringing the annual rate of decline to 30%. Cross-border claims on Turkey, the region's largest borrower, rose by \$2.6 billion, lifting their year-on-year growth rate to 1.3% at end-September 2015. Cross-border claims on developing Africa and Middle East continued to expand rapidly between end-June and end-September 2015. The latest \$11 billion quarterly increase took the annual rate of expansion to 8.7 %.

These divergent regional trends in international bank lending were reflected in patterns of cross-border bank credit to non-banks (Graph 6). In emerging Asia, cross-border credit to non-banks grew only 1% in the third quarter compared with a year earlier, continuing a sharp slowdown (Graph 6, bottom left-hand panel). Such credit, which at \$612 billion is quite small in absolute terms, had grown 6% year on year in the second quarter and at double-digit annual rates since 2009. As a result, domestic bank credit outpaced cross-border credit in the third quarter in emerging Asia, as it has in Latin America, emerging Europe and the United States for the past few years. Cross-border credit growth continues to exceed that of local credit in the euro area, although the pace slowed markedly in 2015 (Graph 6, top right-hand panel).

International debt securities issuance weakens

International debt securities issuance was weak in the last quarter of 2015. After falling to \$64 billion in the third quarter, net debt issuance turned negative at almost -\$47 billion, a reduction of 0.2% in the total amount outstanding after accounting for exchange rate movements. The negative number marked the largest contraction registered since the third quarter of 2012. The decline was driven by both a significant decrease in issuance by advanced economies and subdued issuance by emerging economies. Net issuance in advanced economies totalled -\$78 billion, reducing the amount outstanding by 0.5% from the previous quarter. EME borrowers issued \$16 billion on net, 0.5% more than in the previous quarter but still significantly less than in any other quarter after the financial crisis. Offshore centres and international organisations accounted for the remainder.

The fall in outstanding international debt in advanced economies was mainly driven by the financial sector. Net repayments by financial institutions rose to \$110 billion, decreasing the amount outstanding for this sector by 1% (Graph 7, top left-hand panel). Net issuance by European and US financial borrowers was particularly weak. Net issuance was also negative or low in most of the other advanced economies, with the exception of Australia and Japan. But non-financial corporations issued a net \$50 billion of new debt, increasing outstanding stocks by

International debt securities¹

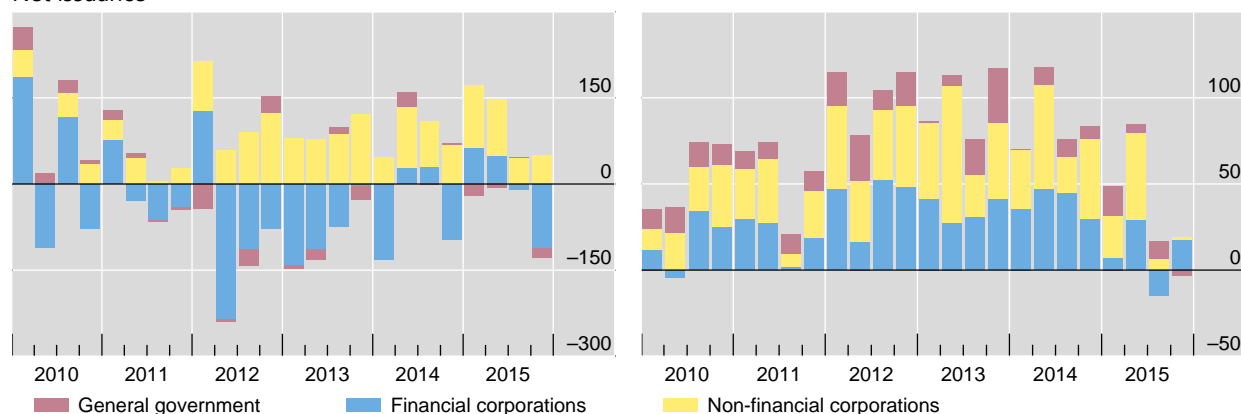
In billions of US dollars

Graph 7

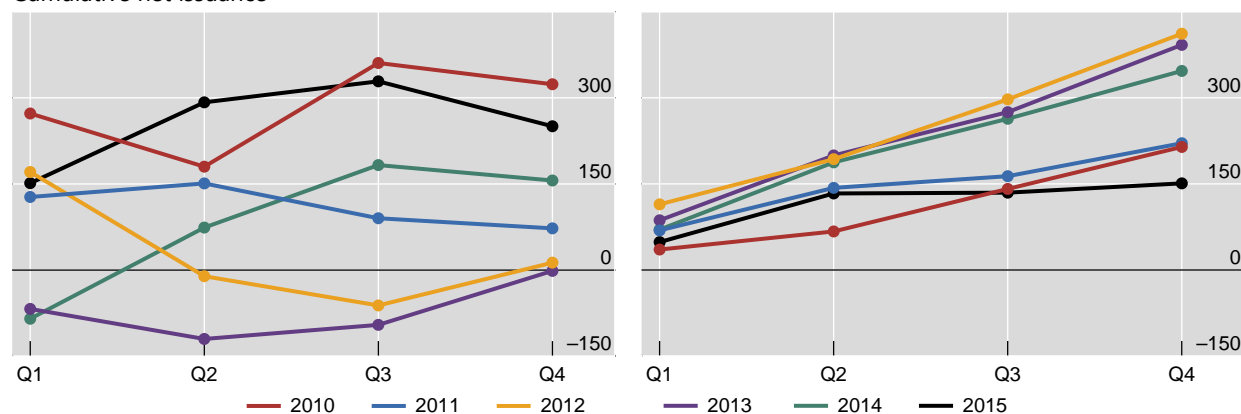
Advanced economies²

Emerging market economies^{2,3}

Net issuance



Cumulative net issuance⁴



¹ All issuers, all maturities, by nationality of issuer. ² See *BIS Statistical Bulletin* for a list of countries. Sectors refer to issuer's parent. For details of classification, see "Introduction to BIS statistics", *BIS Quarterly Review*, September 2015. ³ Includes Hong Kong SAR and Singapore. ⁴ Net cumulative quarterly issuance.

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

1%. Despite the negative number in the last quarter of the year, total net issuance by advanced economies in 2015, at \$250 billion, was the highest annual total since 2011 (Graph 7, bottom left-hand panel).

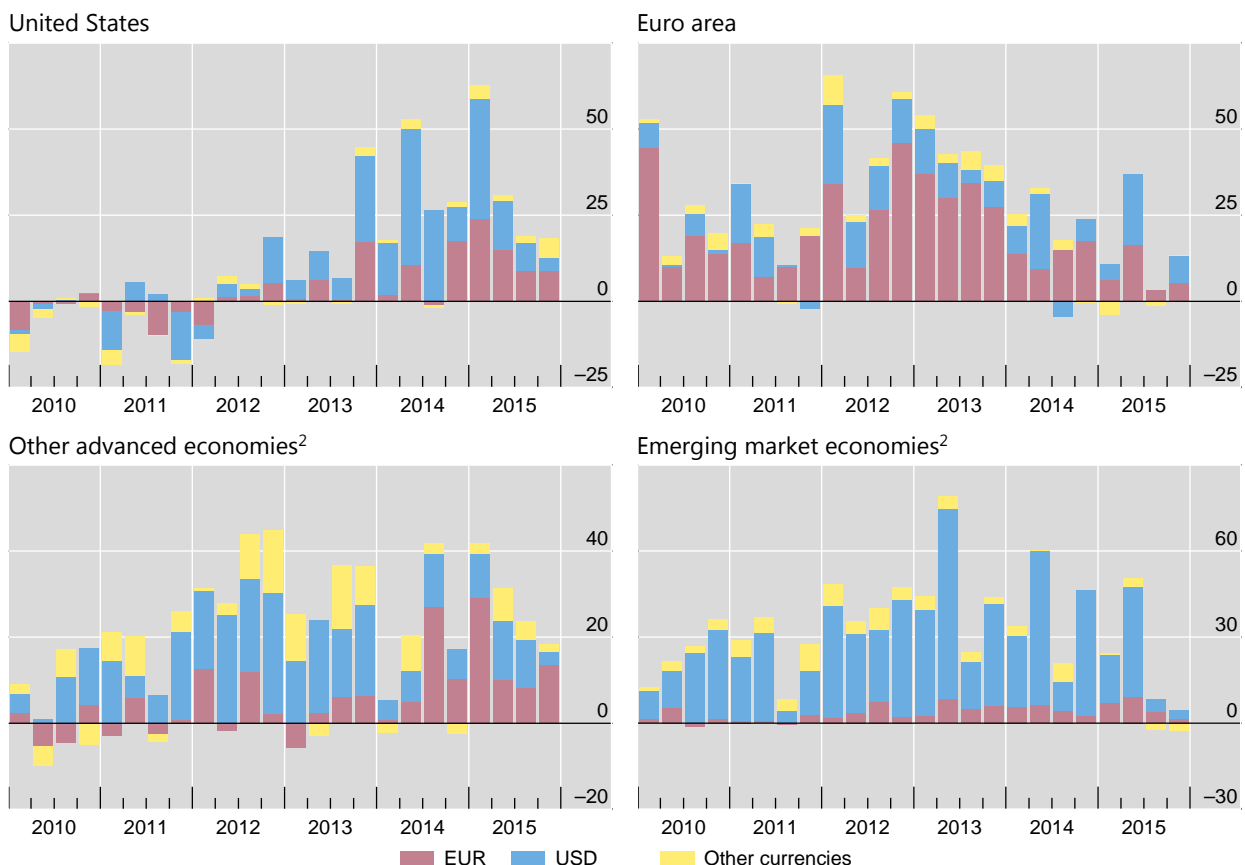
EMEs' net debt issuance was subdued at \$16 billion in the fourth quarter of 2015, representing an increase of 0.5% in the amount outstanding at the end of the previous quarter (Graph 7, bottom right-hand panel). Net issuance by financial corporations partially recovered after the net repayments registered in the third quarter of the year. Chinese banks, however, significantly increased their debt securities issuance in Q4, in contrast to the slowdown in their interbank borrowing in the third quarter, as noted above. The issuance of local debt in China remained strong, according to data from the People's Bank of China. Net issuance by non-financial corporations, however, was weak at \$2 billion in the fourth quarter of the year, similar to the low amount registered in the previous quarter (Graph 7, top right-hand panel). Net debt issuance by EMEs in 2015, at \$151 billion, was overall the lowest in six years.

The year 2015 marked a significant increase in the use of the euro as a currency of denomination for international debt securities issued by non-financial borrowers. In the last quarter of the year, net issuance of international debt securities in euros was \$29 billion, an increase of 1.5% in the amount outstanding. Non-financial borrowers headquartered in the United States issued \$9 billion in euro-denominated debt, an increase of 4% in the amount outstanding from the third quarter. This accounted for 48% of the net international issuance by US non-financial borrowers (Graph 8, top left-hand panel). Euro-denominated net issuance in the euro area remained strong in the fourth quarter at \$5 billion (Graph 8, top right-hand panel). Euro-denominated net issuance rose from 35% to 73% of the total in other advanced economies (bottom left-hand panel), and from 61% to 69% of the total in emerging economies (bottom right-hand panel). At the same time, issuance in other currencies weakened. Net issuance in dollars was \$18 billion, a less than 1% increase over the amount outstanding at the end of the previous quarter, and net issuance in sterling was \$4 billion, also a less than 1% increase in the total amount outstanding with respect to the previous quarter.

International debt securities¹

Quarterly net issuance, in billions of US dollars

Graph 8



¹ Non-financial headquarters, by nationality of issuer. ² See *BIS Statistical Bulletin* for a list of countries.

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

Dollars and renminbi flowed out of China

Robert N McCauley and Chang Shu

Persistent private capital outflows from China since June 2014 have led to two different narratives. One tells a story of investors selling mainland assets en masse; the other of Chinese firms paying down their dollar debt. Our analysis favours the second view, but also points to what both narratives miss – the shrinkage of offshore renminbi deposits.

Our approach, presented in the September 2015 *BIS Quarterly Review*, starts from the BIS international banking statistics reported by banks outside China.^① This contrasts with other analyses which typically take changes in official foreign reserves (plus current account surplus) as capital outflows, which require complicated estimation of valuation and other adjustments. To understand the cross-border outflow of capital in the BIS data, we follow the money from declining offshore renminbi deposits in East Asia and declining foreign currency loans at banks in mainland China, as reported by the People's Bank of China (PBoC). In addition, we exclude from the BIS data PBoC deposits with overseas banks, using new data consistent with the IMF's special data dissemination standard (SDDS).

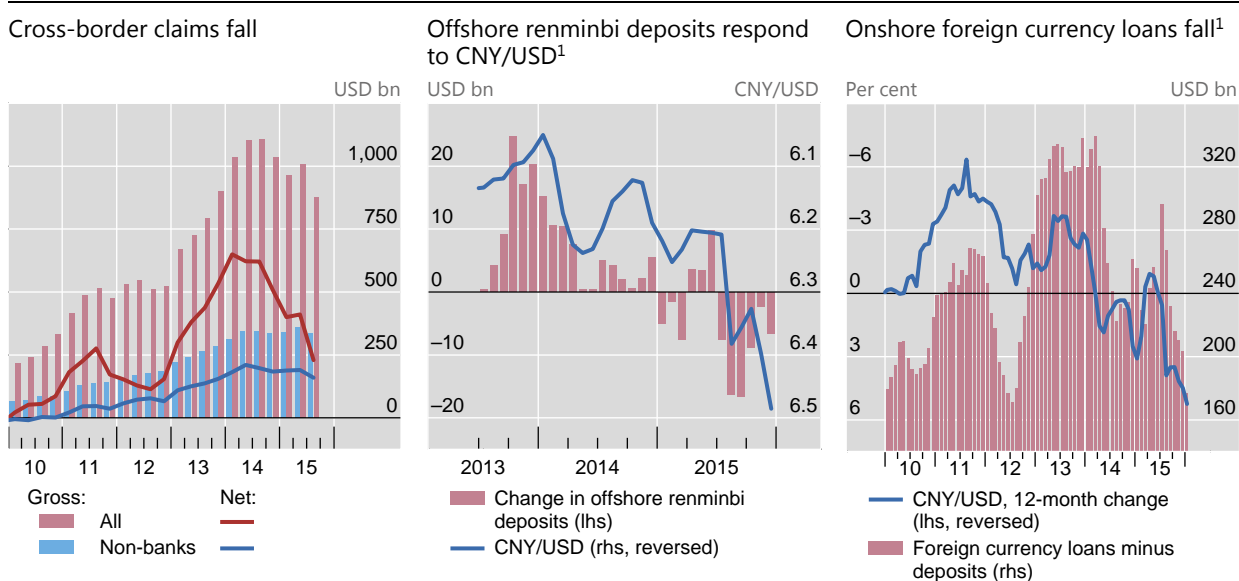
We start with a record \$175 billion net decline in BIS reporting banks' *cross-border* loans to China in Q3 2015 (Graph A, left-hand panel, blue line), almost double the outflow in Q1. It reflected both a sharp decline in loans to China and continued growth in liabilities to China (ie China's cross-border deposits). The new SDDS data show that \$12 billion of this Q3 outflow was due to an *increase* in Chinese official foreign exchange reserves deposited at banks located outside China (a capital outflow). That leaves \$163 billion of non-reserve outflows to be accounted for. National and BIS data suggest that these outflows through BIS reporting banks reflected a reduction of (i) renminbi deposits *offshore*, (ii) net dollar debt of Chinese firms *cross-border* and (iii) their net debt *within China*.

(i) *Offshore*, as firms and households reduced renminbi deposits, banks outside China in turn reduced their *cross-border* renminbi deposits with mainland banks. In particular, banks in Chinese Taipei, Hong Kong SAR, Korea, Macao SAR and Singapore reported a \$40 billion equivalent decline in renminbi deposits in Q3 2015, which was associated with depreciation in the renminbi/dollar rate (Graph A, centre panel). In response to lower demand for renminbi deposits, banks in these and other jurisdictions drew down their *cross-border* renminbi deposits with mainland banks, leading to a capital outflow of \$80 billion (PBoC data) that amounts to half of the \$163 billion outflow.

(ii) BIS data show that firms in China reduced their *cross-border* net debt (Graph A, left-hand panel, blue line). The share of this in currencies other than the renminbi, mostly the dollar, amounted to \$34 billion (directly included in the \$163 billion).

Bank-reported capital flowed out of China in Q3 2015

Graph A



¹ A decline indicates a depreciation of the renminbi.

Sources: Central Bank of the Republic of China (Taiwan); Hong Kong Monetary Authority; Bank of Korea; Monetary Authority of Macao; Monetary Authority of Singapore; Datastream; CEIC; BIS locational banking statistics by residence.

(iii) *Within China*, firms' reduction in net foreign currency loans from mainland banks led these banks in turn to reduce *cross-border* net liabilities in Q3 2015 (a capital outflow). PBoC data show that firms reduced their net foreign currency debt to banks in China by \$7 billion in Q3 (Graph A, right-hand panel). If mainland banks squared their position with BIS reporting banks outside China, this would have contributed to the \$163 billion outflow.

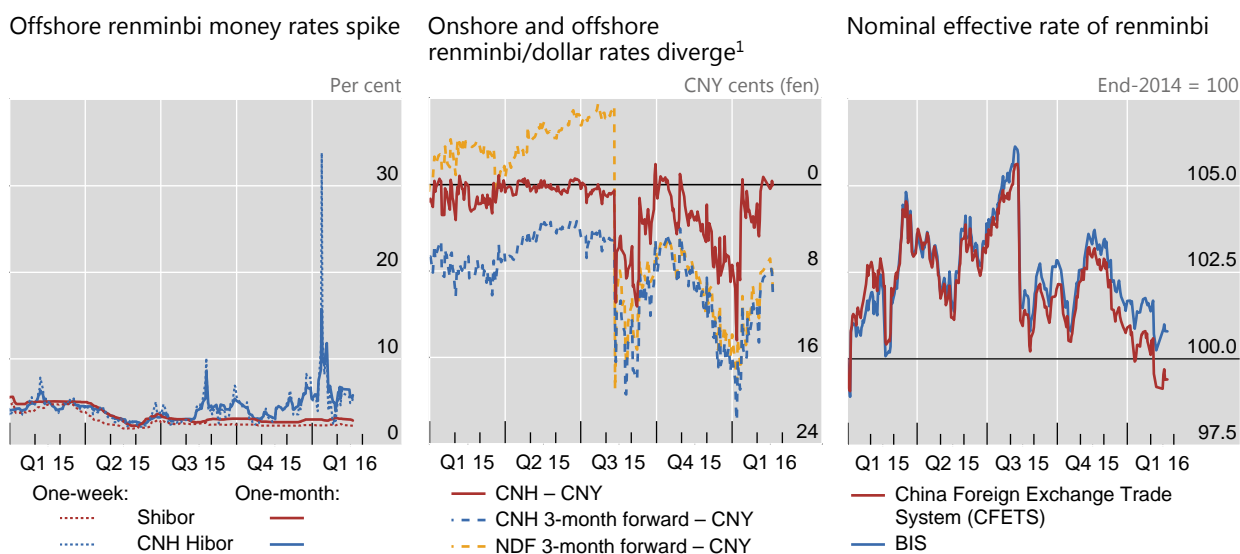
Overall, reduction of renminbi holdings offshore (\$80 billion), and Chinese firms' net repayment of foreign currency debts cross-border (\$34 billion) and within China (\$7 billion), amounted to \$121 billion. This can account for almost three quarters of the non-reserve outflows of \$163 billion revealed by the BIS banking data.

Partial data suggest that outflows from China continued in Q4 2015. The rundown of renminbi deposits offshore slowed, judging from both partner data (Graph A, centre panel) and the PBoC-reported renminbi deposits (down \$24 billion, versus \$80 billion in Q3). However, Hong Kong Monetary Authority data on cross-border claims on Chinese non-banks (close to 40% of the BIS total) for October and November show an acceleration of net outflows. In addition, onshore net foreign currency loans contracted faster, at \$29 billion (vs \$7 billion in Q3).

Q1 2016 price developments suggest greater strains than in the second half of 2015, with associated incentives for fund outflows. Many market participants interpreted the PBoC's management of the exchange rate in early January as signalling an intended depreciation against the dollar, and offshore interest rates briefly surged to levels exceeding those in August–September (Graph B, left-hand panel). Onshore and offshore spot rates diverged more than in Q3, and offshore forwards pointed to a sharper depreciation (Graph B, centre panel).^② ^③ And yet, this volatility in money market and bilateral exchange rates contrasted with the renminbi's limited fluctuation against a basket of trading partner currencies (Graph B, right-hand panel). To recap, our analysis suggests that recent outflows from China can be explained, to a large extent, by continued shrinkage of the offshore renminbi market and Chinese firms' paydown of net foreign currency debt. The PBoC's declared intention to keep the renminbi stable in effective terms would imply a weaker renminbi against the dollar were the dollar to appreciate against major currencies. In this event, offshore depositors might not hold onto maturing renminbi deposits and Chinese firms would still have reason to repay dollar-denominated debt.

Markets strained but effective renminbi stable?

Graph B



Hibor = Hong Kong Interbank Offered Rate; NDF = non-deliverable forward, which is settled on the onshore fixing in dollars; Shibor = Shanghai Interbank Offered Rate.

¹ Scale inverted so downward direction indicates depreciation relative to spot CNY. CNH and CNY quotes refer to the closing of each trading day.

Sources: Bloomberg; BIS.

① See R McCauley, "Capital flowed out of China through BIS reporting banks in Q1 2015", *BIS Quarterly Review*, September 2015, pp 28–9. ② Spot CNY/CNH gapped to CNY 14 cents (fen) on 6 January 2016, above the Q3 2015 high (11 fen) and close to 2010's all-time high of 15 in M Funke, C Shu, X Q Cheng and S Eraslan, "Assessing the CNH-CNY pricing differential", *Journal of International Money and Finance*, vol 59, 2015, p 250. In the forward market, the CNH and NDF markets priced in 2.5% and 3% depreciation over three months, compared with 0.7% in the CNY market. ③ As foreseen in R McCauley, C Shu and G Ma, "Non-deliverable forwards: 2013 and beyond", *BIS Quarterly Review*, March 2014, pp 75–88, NDF forwards have fallen to only half of forwards in the April 2015 Bank of England data from ¾ in 2013.

Early warning indicators

The BIS has analysed and monitored early warning indicators of domestic banking distress. These indicators capture financial overheating and signal potential banking distress over medium-term horizons. They are calibrated with reference to the signal-to-noise ratio, defined roughly as the ratio of correctly predicted historical episodes to false alarms.

Table A reports three indicators, measured in most cases as of Q3 2015. The first is the gap between the credit-to-GDP ratio and its long-term trend (first column). The second is the gap between the residential property price index and its long-term trend (second column). The last one is the difference between the debt service ratio (DSR) and its average over time. It is estimated under two different assumptions (third and fourth columns): one under current interest rates, the second at rates that are 250 basis points higher. Importantly, this second estimate assumes an immediate and full (100%) pass-through of interest rate changes into DSRs. It does not take account of the fact that many debt contracts are based on fixed rates and will not reprice immediately. Nor does it reflect the ways in which borrowers and lenders would respond to interest rate movements by changing debt maturities, repaying their obligations or other measures. As such it overestimates the impact.

All three indicators suggest that the risk of banking strains remains elevated in a number of economies and regions. This is in particular the case for Canada, China and Turkey, where the credit-to-GDP gaps are above 10%. The same is true for a grouping of Asian economies (Hong Kong SAR, Indonesia, Malaysia, the Philippines, Singapore and Thailand). The indicator for Brazil, after having been persistently above this threshold for quite some time, at 9.9%, is just below this level.^① In the past, two thirds of all readings above this threshold were followed by serious banking strains in the subsequent three years.^② The DSR-based indicators also point to several of these economies. The size of the property price gap is closer to historical trends for most of the economies listed, although Germany and Japan stand out. When assessing these indicators, it is important to consider that they do not explicitly take into account any strengthening of regulation since the previous episodes of stress.

^① See "Highlights of global financing flows", *BIS Quarterly Review*, September 2015, pp 33–4. ^② See M Drehmann, C Borio and K Tsatsaronis, "Anchoring countercyclical capital buffers: the role of credit aggregates", *International Journal of Central Banking*, vol 7, no 4, December 2011, pp 189–240.

Early warning indicators for stress in domestic banking systems¹

Table A

	Credit-to-GDP gap ²	Property price gap ³	Debt service ratio ⁴	Debt service ratio if interest rates rise by 250 bp ^{4,5}
Asia ⁶	16.3	8.5	1.9	4.3
Australia	4.9	5.1	0.9	4.7
Brazil	9.9	-13.9	6.6	8.4
Canada	12.3	8.7	2.3	6.3
China	27.6	-5.8	5.4	8.7
Central and eastern Europe ⁷	-10.9	6.8	0.5	2.0
France	1.5	-10.9	1.0	4.0
Germany	-5.8	10.6	-1.6	0.2
Greece	-10.9	5.4		
India	-3.2		1.8	2.9
Italy	-10.8	-16.2	0.6	2.8
Japan	4.7	13.6	-1.9	0.9
Korea	3.9	6.4	0.0	3.6
Mexico	7.3	4.2	0.5	1.2
Netherlands	-18.5	-15.3	1.0	5.8
Nordic countries ⁸	0.5	2.6	1.1	5.1
Portugal	-36.0	9.7	-0.9	2.5
South Africa	-1.4	-7.3	-0.7	0.6
Spain	-44.2	-21.7	-2.5	0.4
Switzerland	7.2	9.9	0.0	3.2
Turkey	15.6		5.5	7.1
United Kingdom	-30.1	0.5	-2.2	0.6
United States	-10.9	2.0	-1.9	0.7
<i>Legend</i>	<i>Credit/GDP gap > 10</i>	<i>Property gap > 10</i>	<i>DSR > 6</i>	<i>DSR > 6</i>
	<i>2 ≤ Credit/GDP gap ≤ 10</i>		<i>4 ≤ DSR ≤ 6</i>	<i>4 ≤ DSR ≤ 6</i>

Data up to Q3 2015, except for: the credit-to-GDP gap for Bulgaria and for Lithuania, for which data end in Q4 2015; and the property price gap, for which data end in Q2 2015 for China and in Q4 2015 for Canada, Germany, Greece, Hong Kong SAR, Korea, the Netherlands, Norway, the Philippines, Poland, South Africa, Switzerland, Thailand and the United Kingdom.

¹ Thresholds for red cells are chosen by minimising false alarms conditional on capturing at least two thirds of the crises over a cumulative three-year horizon. A signal is correct if a crisis occurs in any of the three years ahead. The noise is measured by the wrong predictions outside this horizon. Beige cells for the credit-to-GDP gap are based on guidelines for countercyclical capital buffers under Basel III. Beige cells for the DSR are based on critical thresholds if a two-year forecast horizon is used. For a derivation of critical thresholds for credit-to-GDP gaps and property price gaps, see M Drehmann, C Borio and K Tsatsaronis, "Anchoring countercyclical capital buffers: the role of credit aggregates", *International Journal of Central Banking*, vol. 7, no 4, 2011, pp 189–240. For DSRs, see M Drehmann and M Juselius, "Do debt service costs affect macroeconomic and financial stability?", *BIS Quarterly Review*, September 2012, pp 21–34. Simple average for country aggregates. ² Difference of the credit-to-GDP ratio from its long-run, real-time trend calculated with a one-sided HP filter using a smoothing factor of 400,000, in percentage points. ³ Deviations of real residential property prices from their long-run trend calculated with a one-sided HP filter using a smoothing factor of 400,000, in per cent. ⁴ For the DSR series and methodology, see www.bis.org/statistics/dsr/index.htm. Difference of DSRs from country-specific long-run averages since 1999 or later depending on data availability and when five-year average inflation fell below 10%, in percentage points. ⁵ Assuming that interest rates increase 2.50 percentage points and that all of the other components of the DSR stay fixed. ⁶ Hong Kong SAR, Indonesia, Malaysia, the Philippines, Singapore and Thailand; excluding the Philippines and Singapore for the DSR and its forecast. ⁷ Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Russia; excluding the Czech Republic and Romania for the real property price gap; excluding Bulgaria, Estonia, Latvia, Lithuania and Romania for the DSR and its forecasts. ⁸ Finland, Norway and Sweden.

Sources: National data; BIS; BIS calculations.

How have central banks implemented negative policy rates?¹

Since mid-2014, four central banks in Europe have moved their policy rates into negative territory. These unconventional moves were by and large implemented within existing operational frameworks. Yet the modalities of implementation have important implications for the costs of holding central bank reserves. The experience so far suggests that modestly negative policy rates transmit through to money markets and other interest rates for the most part in the same way that positive rates do. A key exception is retail deposit rates, which have remained insulated so far, and some mortgage rates, which have perversely increased. Looking ahead, there is great uncertainty about the behaviour of individuals and institutions if rates were to decline further into negative territory or remain negative for a prolonged period.

JEL classification: E42, E58, G21, G23.

With policy rates close to zero in the aftermath of the Great Financial Crisis, several central banks around the world have introduced unconventional policies to provide additional monetary stimulus. One example is the decision by five central banks – Denmark's Nationalbank (DNB), the European Central Bank (ECB), Sveriges Riksbank, the Swiss National Bank (SNB) and most recently the Bank of Japan (BoJ) – to move their policy rates below zero, traditionally seen as the lower bound for nominal interest rates. The motivations behind the decisions differed somewhat across jurisdictions, leading to differences in policy implementation.

This feature reviews the experience of the four central banks in Europe that have kept their policy rates below zero for more than one year, focusing exclusively on the technical aspects of the implementation of negative policy rates, their impact on the money market and their transmission to other interest rates. The feature does *not* address the broader question of whether negative rates are desirable as a policy strategy, as this would call for a broader analysis of their impact on the financial system and the macroeconomy. For instance, more recently their debilitating impact on banks' resilience through undermined profitability, coming on the heels of persistently ultra-low interest rates, has emerged as an important constraining factor.

The remainder of the feature is organised as follows. The first section describes the economic context for the introduction of negative policy rates, while the second looks at their technical implementation. The third section assesses the transmission

¹ The authors would like to thank Meredith Beechey Österholm, Matthias Jüttner, Benjamin Müller, Holger Neuhaus, Frank Nielsen and Marcel Zimmermann for valuable discussions, and Claudio Borio, Ben Cohen (the editor) and Dietrich Domanski for comments. The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements (BIS) or the Markets Committee.

of negative policy rates to money markets and other interest rates. The penultimate section takes stock of the factors that determine the lower bound for nominal interest rates. In concluding, the feature highlights a number of potential risks associated with using negative policy rates going forward.

Context for negative policy rates

While the ECB, SNB, DN and Riksbank all introduced negative interest rates in mid-2014 and early 2015 (Box 1), and all faced a challenging macroeconomic environment, their respective motivations differed somewhat. In some cases the central banks' declared objective was to counter a subdued inflation outlook, while in others they focused on currency appreciation pressures in the context of bilateral pegs or floors on their exchange rates.

The ECB moved its deposit rate into negative territory in mid-2014 to “underpin the firm anchoring of medium to long-term inflation expectations” (Draghi (2014)). Similar concerns led the Riksbank to implement negative interest rates starting in the first quarter of 2015 (Graph 1, left-hand panel). The aim was “safeguarding the role of the inflation target as a nominal anchor for price setting and wage formation” (Sveriges Riksbank (2015)). Negative interest rates in both cases complemented other unconventional measures. The ECB resumed its purchases of covered bonds and expanded its asset purchase programme to include government bonds and asset-backed securities. It also provided additional term funding to banks through targeted longer-term refinancing operations (TLTROs). The Riksbank began bond purchases that by mid-2016 are set to cover just over 30% of outstanding nominal government bonds, a proportion somewhat larger than the ECB's programme.²

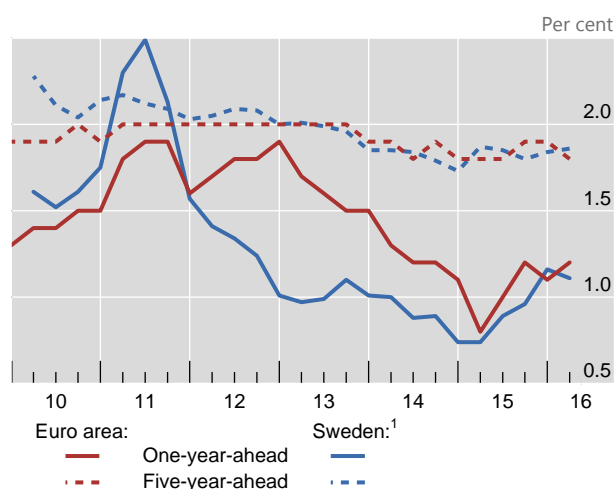
The euro area's new wave of monetary easing added to the appreciation pressure on the Swiss franc, which in 2011 had led the SNB to impose a floor vis-à-vis the euro. To stem the inflow of funds (Graph 1, right-hand panel) and maintain the floor, the SNB announced the introduction of negative interest rates (-0.25%) on sight deposit account balances in December 2014 (effective 22 January 2015). In mid-January, with pressure on the franc unabated, the SNB discontinued the minimum exchange rate and lowered the interest rate on sight deposit accounts further to -0.75%. The goal was to discourage capital inflows and thereby counter the monetary tightening due to the Swiss franc's appreciation. Still, pressure on the currency persisted and the SNB continued to accumulate foreign exchange reserves into the second half of 2015.

Following the SNB decision, DN, which maintains a nearly fixed exchange rate vis-à-vis the euro, saw a surge in demand for Danish kroner and intervened heavily in the FX market (Graph 1, right-hand panel). Moreover, the central bank cut the key monetary policy interest rate from just below zero to -0.75% in early 2015.³ These measures stabilised the krone, and, towards the end of February 2015, the inflow of funds ceased. Over the course of 2015, the situation gradually normalised, and DN sold part of the foreign exchange it had acquired back into the market. In January

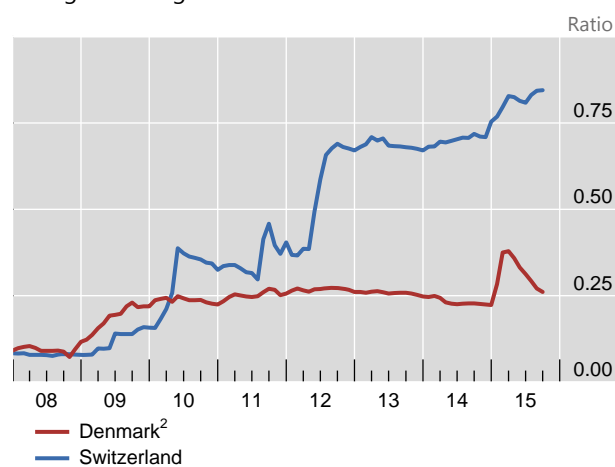
² While the Riksbank has no exchange rate operational target, it has stated that it is prepared to intervene on the foreign exchange market if the krona's appreciation threatens price stability. On 4 January 2016, its executive board took a delegation decision enabling immediate intervention on the foreign exchange market as a complementary monetary policy measure.

³ On the recommendation of Denmark's Nationalbank, the Ministry of Finance also temporarily suspended issuance of Danish government bonds.

Inflation forecasts



Foreign exchange reserves over nominal GDP



¹ For Q1 2016, data up to January 2016 only. ² Gross foreign exchange reserves minus foreign liabilities.

Sources: Datastream; TNS Sifo Prospera; national data.

2016, DN raised the key policy rate to -0.65% , thus narrowing the policy rate spread vis-à-vis the euro area.

Technical implementation of negative policy rates

The implementation of negative policy rates took place by and large within existing operational frameworks. The SNB had to change its terms of business to implement negative policy rates. Prior to December 2014, remuneration of reserves (positive or negative) was not part of the contractual framework for sight deposit accounts. Moreover, the SNB put in place individual exemption thresholds for sight deposit accounts so that only reserve holdings above the threshold earn negative interest (Box 2).

Even though wholesale changes were not needed at the other central banks, substantial “behind-the-scenes” work took place in every jurisdiction. Each central bank conducted an in-depth review of its IT systems as well as of its documentation and account rules. And several minor adjustments were made. Moreover, the central banks carefully signalled the possibility of negative interest ahead of time in order to prepare both financial institutions and the public at large.

Implementation modalities beyond the negative policy rates themselves have important implications for the costs to banks of holding central bank liabilities. In each case, the marginal remuneration of an additional unit of reserves differs from the average remuneration rate.

Moving into negative territory

Danmarks Nationalbank (DN), the European Central Bank (ECB), Sveriges Riksbank and the Swiss National Bank (SNB) all cut their key policy rates to below zero over the period from mid-2014 to early 2015 (Graph A, left-hand panel). The ECB moved first, on 11 June 2014, when it cut the deposit rate to –10 basis points after having signalled the possibility for at least a year. DN followed on 5 September 2014, when the rate on certificates of deposit was cut from +5 to –5 bp following a further rate cut by the ECB. The SNB went negative on 18 December 2014 when it announced that sight deposits exceeding a certain threshold would earn –25 bp effective 22 January 2015. The Riksbank cut its repo rate to –10 bp on 18 February 2015, whereas the Bank of Japan announced on 29 January 2016 that it would apply a rate of –10 bp to part of the balances in current accounts.

In Europe, central banks took more than one step into negative territory. The ECB lowered its deposit rate to –20 bp in September 2014 and further to –30 bp in December 2015, while the SNB announced a further 50 bp cut on 15 January 2015 in connection with the discontinuation of the minimum exchange rate vis-à-vis the euro. Appreciation pressure on the Danish krone led to four successive rate cuts over a period of two and half weeks that took DN to –75 bp in early February 2015. A reversal of the pressure on the krone led to an increase to –65 bp in early 2016. For its part, the Riksbank cut to –25 bp in March 2015, and further to –35 bp in July and –50 bp in February 2016.

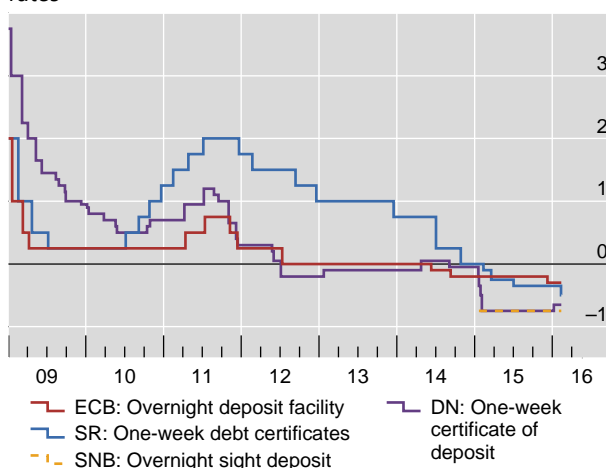
However, negative policy rates were not entirely new. The Riksbank had flirted with negative policy rates in 2009–10 (Graph A, right-hand panel). The repo rate was cut to 25 bp on 8 July 2009 and the overnight deposit rate was lowered to –25 bp in order to keep the interest rate corridor symmetrical at +/-50 bp. Still, the amount of funds on deposit overnight was minuscule, as the Riksbank typically uses daily fine-tuning operations (at 10 bp below the repo rate) to drain most excess liquidity prior to the close of business. DN had maintained negative certificate of deposit rates from mid-2012 to April 2014.

Central bank policy rates

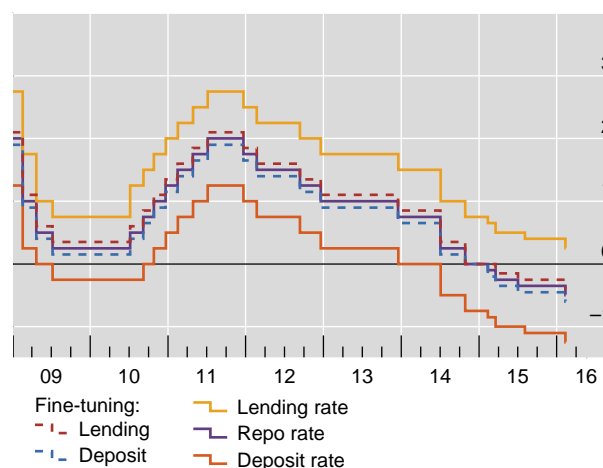
In per cent

Graph A

Key policy rates for implementation of negative interest rates



Sveriges Riksbank policy rates



DN = Danmarks Nationalbank; ECB = European Central Bank; SNB = Swiss National Bank; SR = Sveriges Riksbank.

Source: National data.

Design of remuneration schedules

In general, the four central banks are applying negative rates to the majority of accounts on their books with a view to limiting the potential for arbitrage between accounts.^①

The ECB, DN and SNB use some combination of exemption thresholds in computing the negative remuneration. The design and calibration of the remuneration schedules reflect a combination of the policy goals and the existing implementation frameworks. The SNB's exemption thresholds are determined in one of two ways. The first approach applies to all banks that have to fulfil minimum reserve requirements. This exemption threshold currently corresponds to 20 times the minimum reserve requirement prior to implementation (a static component) minus/plus any increase/decrease in the amount of cash held (a dynamic component). The dynamic component aims to prevent account holders from substituting cash for sight deposits. The second approach defines a fixed exemption threshold for all account holders not subject to the minimum reserve requirement. The minimum fixed threshold is CHF 10 million, a level chosen so as not to inhibit an institution's ability to settle Swiss franc payments.

While new for the SNB, tiered remuneration was already part of the operational framework at the other three central banks. In the Eurosystem, required reserves earn the Main Refinancing Operations (MRO) rate – currently at 5 basis points – whereas excess reserves currently “earn” –30 bp. In Denmark, the central bank offers one-week certificates of deposit funds with a yield currently at –65 bp. In contrast, overnight demand deposits in the current account earn zero. Both an aggregate limit and individual limits have been set on the amount of funds that can be held in the current accounts. If the aggregate limit is exceeded at the end of the day, then deposits exceeding the individual limits are converted into certificates of deposit. In addition to interest rates, DN has actively varied the current account limits – most recently increasing them in March 2015, and then lowering them in August 2015 and January 2016.

In Sweden, the Riksbank currently issues one-week debt certificates. Moreover, daily fine-tuning operations aim to drain any remaining reserves prior to the close of business, and hence banks hold only small amounts as overnight deposits with the central bank. At the moment, one-week debt certificates “yield” –50 bp and fine-tuning operations earn –60 bp, while any residual amounts left in the current account face a negative “remuneration” of –125 bp.

With the move below zero, the Bank of Japan adopted a remuneration schedule that will divide balances in the current accounts of financial institutions into three tiers. The three tiers are remunerated at +10 bp, 0 bp and –10 bp, respectively.

^① For government deposits, the treatment varies. In Switzerland, the sight deposits of the Federal Administration are exempt but balances are being monitored. In Denmark, government deposits earn negative interest only above a certain threshold; whereas in the euro area, government accounts are de facto subject to negative rates due to de minimis exemptions. In Sweden, the Riksbank has not been the government's bank since 1994.

The structure of liabilities and of their remuneration differs across central banks. In each jurisdiction, the banking system currently holds reserves and other central bank liabilities above required amounts (“liquidity surplus”). In the euro area and Switzerland the liquidity surplus is held as overnight deposits (reserves), whereas in Denmark and Sweden the central banks use a combination of overnight and one-week liabilities. In addition, the ECB, DN and SNB all exempt at least part of the reserve holdings from negative interest rates (Box 2).

As illustrated in Table 1 and Graph 2 (left-hand panel), the average remuneration rate on central banks' liabilities depends not only on the different policy rates, but also on the exemption thresholds. In mid-February 2016, the average rates were lowest at the Danish and Swedish central banks at just above –50 basis points. In comparison, the average rates at the SNB and ECB were around –25 basis points. Thus, the average remuneration was not necessarily the lowest in the jurisdictions with the most negative policy rates.

Central bank remuneration schedules (mid-February 2016)

Table 1

	European Central Bank	Sveriges Riksbank	Swiss National Bank	Danmarks Nationalbank
Exemption threshold	Minimum reserve requirement	.	Individual exemption	Current account limit
Aggregate amounts	Local currency, in billions			
Overnight deposits (reserves)				
Below threshold	113	-50 ¹	303	29
Above threshold	650		170	. ³
Term (one-week)	.	187	.	119
Policy rates	Basis points			
Overnight deposits (reserves)				
Below threshold	5	-60 ²	0	0
Above threshold	-30		-75	. ³
Term (one-week)	.	-50	.	-65
Weighted average rate	-25	-52	-27	-52
Marginal minus average rate⁴	-5	-8	-48	-13

¹ Amount of fine-tuning operations. In addition, overnight deposits with central bank represent SEK 0.01 billion. ² Rate applied to fine-tuning operations. Overnight deposits with central bank earn -125 basis points. ³ Amounts above the aggregate current account limit are converted into one-week certificates of deposit (Box 2). ⁴ Marginal rate is the rate on overnight deposits with central bank above exemption threshold.

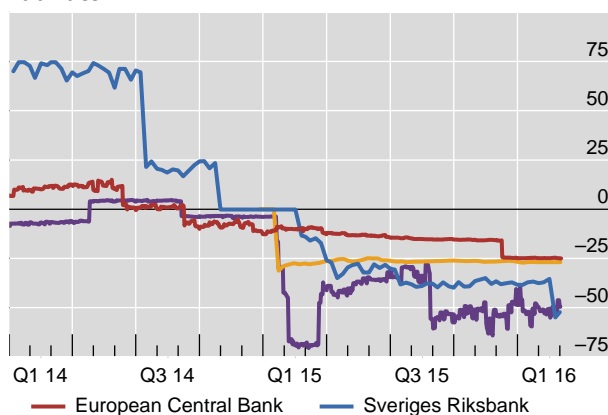
Sources: Central banks; authors' calculations.

Remuneration of central bank liabilities

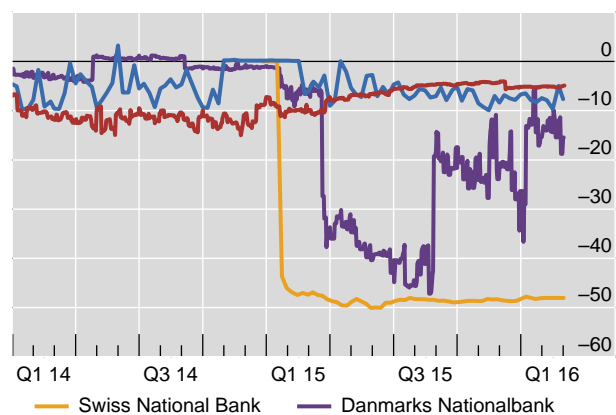
In basis points

Graph 2

Weighted average rate paid on non-cash central bank liabilities¹



Spread between marginal and average rate²



¹ The average rate paid by central banks on non-cash liabilities weighted by the amounts in corresponding accounts and facilities. ² The difference between the marginal remuneration of an additional unit of reserves and the weighted average rate paid on non-cash bank liabilities.

Sources: National data; authors' calculations.

Since going negative, the spread between marginal and average costs ranged from –11 to –47 basis points in Denmark, as the central bank actively adjusted its policy stance by varying the exemption thresholds. In contrast, the spread was mostly constant for the other three central banks (Graph 2, right-hand panel). For Switzerland, the spread has been around –50 basis points, whereas it was approximately –5 and –8 basis points for the ECB and the Riksbank, respectively.

Market functioning

The experience so far suggests that modestly negative policy rates are transmitted to money market rates in very much the same way as positive rates are. However, questions remain as to whether negative policy rates are transmitted to the wider economy through lower lending rates for firms and households, especially in rates associated with bank intermediation. Institutional and contractual constraints may create a discontinuity at the zero rate and impede the pass-through beyond money markets. Before addressing these broader issues of efficacy, we first examine the transmission of negative policy rates to the money markets.

Money markets

Overall, so far the introduction of modestly negative policy rates does not appear to have affected the functioning of money markets much. The pass-through to short-term money market rates has persisted, and the impact on trading volumes, which are already very low because of the abundant and cheap supply of reserves by central banks, appears in general to have been small.

In all four jurisdictions, the overnight rate has followed the policy rate below zero. Moreover, the negative policy rates have passed through to other money market rates (Graph 3).

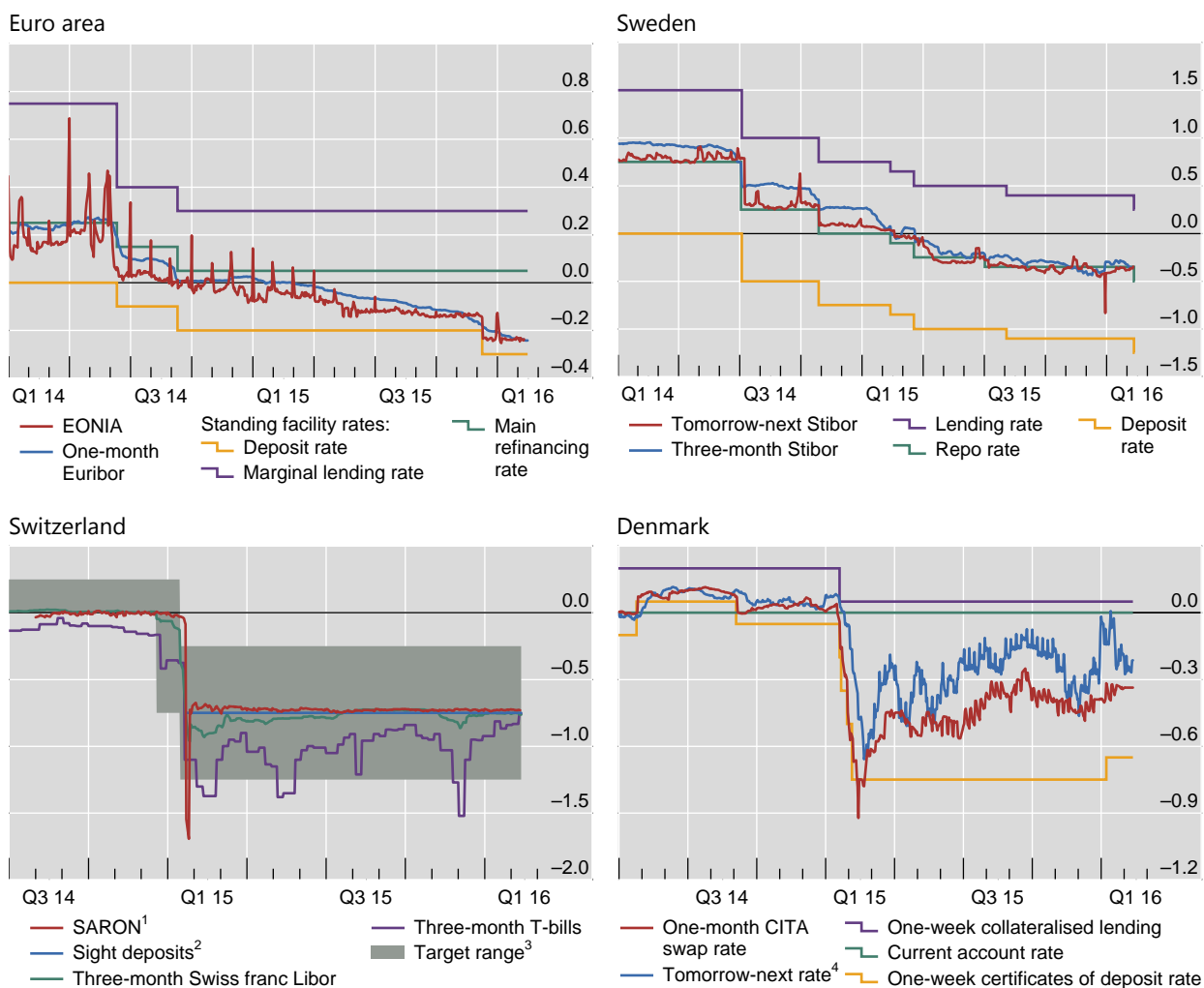
In the euro area and Switzerland, money market rates track the central bank deposit rate. In Sweden, money market rates closely follow the repo rate. In Denmark, the relationship has been somewhat less tight. On some days the tomorrow-next rate is close to the current account rate of zero, whereas on other days it is closer to (or even below) the certificate of deposit rate. This volatility results from a thin market, where on some days pricing can be driven by banks whose reserve holdings do not exceed their limit and earn a higher current account rate (Andersen et al (2015)).

In terms of money market volumes, experiences vary. In the euro area, money market volumes were stable after the ECB's deposit rate went negative in mid-2014. However, volumes have dropped across all maturities as excess liquidity in the banking system has increased. Anecdotal evidence suggests that banks seek to avoid negative rates by either extending maturities or lending to riskier counterparties. While negative rates may have improved market access for banks in the periphery countries of the euro area, other explanations for increased access are also possible – not least the introduction of the Single Supervisory Mechanism, its efforts to improve the health of balance sheets, and stronger economic and financial conditions. In Denmark, the turnover in the (unsecured) money market has declined since the introduction of negative interest rates. This decrease reflects, in part, the

Key policy and money market rates

In per cent

Graph 3



¹ The overnight Swiss average rate (SARON) replaced the repo overnight index (SNB) in August 2009. ² Charged on the portion of sight deposits exceeding the exemption threshold. ³ Shaded corridor represents the SNB target range for the three-month Libor rate. ⁴ Twenty-day moving average.

Sources: Bloomberg; national data.

higher amounts that banks were allowed to deposit “on demand” in their current accounts.

In contrast, trading in the Swiss (secured) money market has increased moderately. This increase in activity is a mechanical effect of the new individual exemption thresholds, as banks reshuffle reserves among themselves. Banks that hold levels of reserves below their exemption threshold are willing to borrow reserves up to that threshold, whereas those that hold levels of reserves above theirs are keen to lend. At the outset the exemption thresholds were not fully exploited, but over time a redistribution of reserves has taken place and this has led to a decrease in the non-exploited exemption thresholds. Most of this “reshuffling” is overnight.

Problems with money market instruments designed with only positive interest rates in mind have so far not materialised. For example, there is no evidence that repo market counterparties have strategically failed to deliver collateral to delay receiving

cash.⁴ And constant net asset value (NAV) money market funds in the euro area designed contractual provisions that work around NAV falling below 1 because of the simple pass-through of negative money market rates.⁵ The returns on these funds remained positive throughout the first half of 2015 as they lengthened the maturity in search of higher yields, but became systematically negative by the end of the year. A further shift from constant to variable NAV may be possible.

Transmission beyond money markets

The initial introduction of negative policy rates coincided with a decrease in longer-maturity and higher-risk yields, although simultaneous central bank asset purchase programmes and other factors behind the fluctuations in the risk premium make it difficult to isolate the effect of negative policy rates alone (Graph 4). In terms of operational matters, market participants initially faced some uncertainty related to how negative rates would be treated in connection with outstanding securities or existing contract types. A particular concern was the treatment of negative coupons in floating rate instruments and the ability for market infrastructures to accommodate negative interest rates.

In Switzerland, banks and other financial institutions, in general, adjusted their terms of business or financial contracts prior to the implementation of negative policy rates by, for example, introducing a zero lower bound on Libor-based mortgages. In Denmark, government-led working groups had to clarify both the tax treatment and the mechanics of dealing with negative mortgage bond coupons.⁶ In Sweden, elements of the clearing and settlement system were not designed to deal with negative coupon payments and had to be modified.

These technical issues have for the most part been resolved, and instances of market operational issues have been limited. In part, this is because, once spreads over the contractual reference rates are added, the resulting interest rates are less likely to be negative at current modestly negative policy rates. Nonetheless, new market practices can vary across individual banks and legal jurisdictions, including within the euro area, creating a risk of market segmentation.

Initially, there was some uncertainty as to how banks would treat their “wholesale” depositors, but they are now passing on the costs in the form of negative wholesale deposit rates. In some cases, banks have used exemption thresholds akin to those that central banks have applied to their reserves.

The key exception in terms of transmission has been banks’ reluctance to pass negative rates through to retail depositors. This reaction was motivated by the concern, shared by some central banks, that negative deposit rates would lead to substantial deposit withdrawals. In Switzerland, banks have responded to lower lending margins in some business lines by adjusting other selected lending rates upwards. In particular, Swiss banks have raised the lending rate on mortgages, even

⁴ Fleming and Garbade (2004) discuss the strategic fails in the context of negative special repo rates.

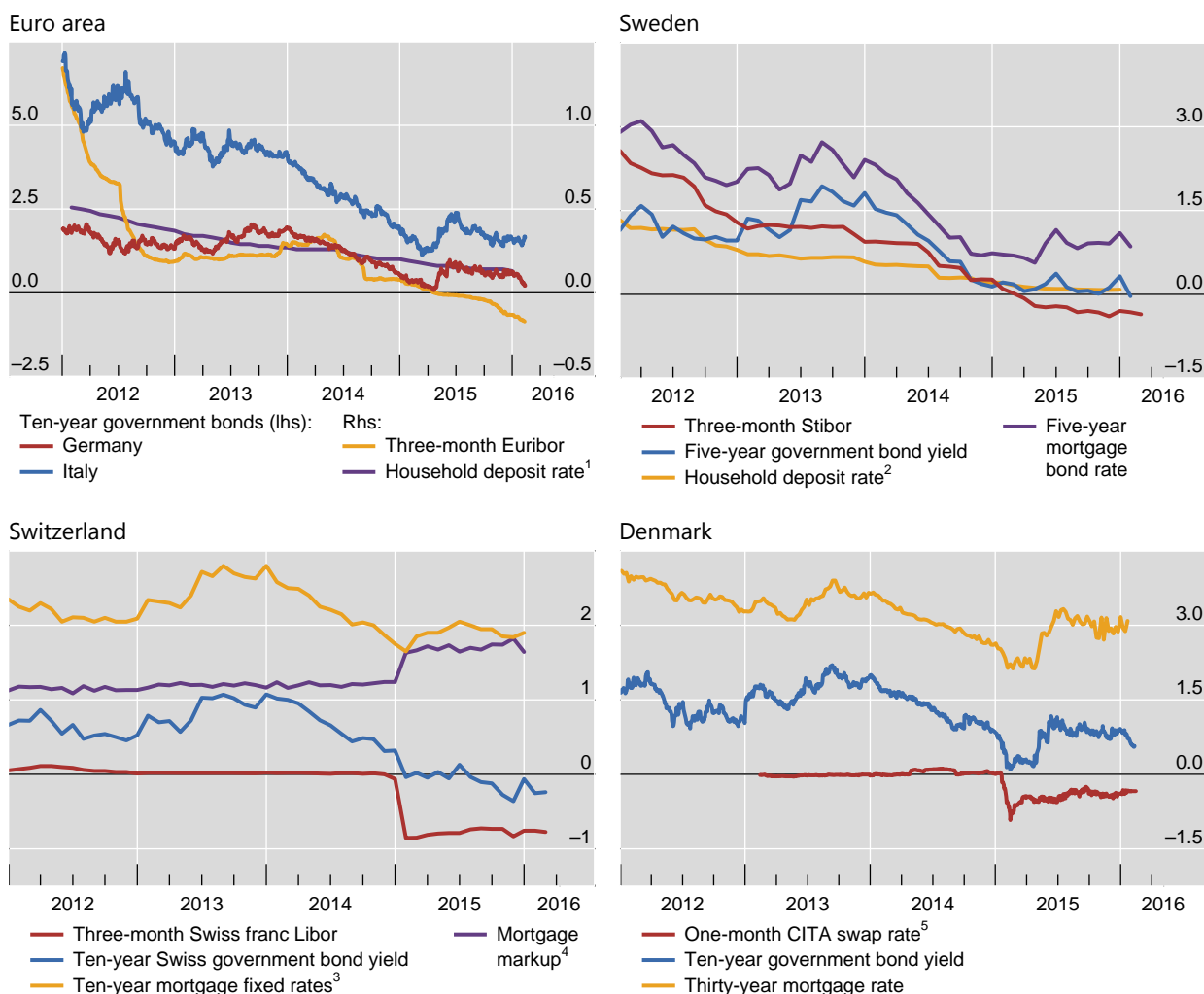
⁵ For example, under the Reverse Distribution Mechanism, investors’ shares are cancelled in proportion to the reduction in value due to negative interest rates, allowing the NAV to remain constant.

⁶ The Danish Ministry of Business and Growth has chaired a working group with the participation of the Danish financial sector to analyse the different aspects related to negative mortgage rates. Its findings were published in Working Group on Negative Mortgage Rates (2015).

Pass-through beyond money markets

In per cent

Graph 4



¹ Deposit rates for overnight loans on new deposits. ² Deposit rates offered by banks on new deposits, all accounts. ³ Rates on new loans. ⁴ Ten-year fixed mortgage rate minus 10-year interest rate swap. ⁵ Copenhagen interest T/N average (CITA) swap rates replaced Cibor in December 2012.

Sources: Bloomberg; national data.

as government and corporate bond yields fell in line with the money market rates (Graph 4, bottom left-hand panel).⁷

The Swiss experience points to a fundamental policy tension if the intention of negative policy rates is to transmit negative interest rates to the wider economy. If negative policy rates do *not* feed into lending rates for households and firms, they largely lose their rationale. On the other hand, if negative policy rates *are* transmitted to lending rates for firms and households, then there will be knock-on effects on bank profitability unless negative rates are also imposed on deposits, raising questions as to the stability of the retail deposit base. In either case, the viability of banks' business

⁷ In Denmark, where mortgage loans are primarily financed with pass-through bonds rather than deposits, mortgage rates fell together with money market rates and government bond yields. However, bank lending rates for new loans to non-financial corporations edged up in 2015.

model as financial intermediaries may be brought into question. The dilemma is less acute if the objective is to influence the exchange rate. In this case, however, other thorny issues arise, not least that of cross-border spillovers.

Institutional constraints may also create a demand for instruments with interest payments floored at zero. Investors, notably insurers, may be unwilling or unable to buy negative cash flow securities, and banks issuing covered bonds have often included an interest floor at zero in the documentation or assumed one implicitly. Such floors can weaken the link between the cash flows of floating rate loans, bonds issued by banks to finance them, and the interest rate swaps that are used to hedge the associated exposures and pass through negative interest payments. The resulting hedging difficulties have led to an increase in the demand for new instruments – for example, Euribor options with 0% strikes that cover the residual risk arising from the floor.

Technically, where is the effective lower bound?

Some other central banks close to the zero bound have adopted or have been considering negative policy rates. At the end of January 2016, the Bank of Japan announced that, “in order to achieve the price stability target of 2 percent at the earliest possible time” (Bank of Japan (2016)), remuneration of -0.10% would apply to any future increases in reserves.⁸ In December 2015, the Bank of Canada made an explicit reference to this possibility and changed its estimate of the lower bound for its policy rate from 0.25% to -0.50% (Bank of Canada (2015)). Still, questions regarding the specific implementation and the technically effective lower bound remain open.

The possibility of earning zero nominal interest by storing value in physical currency is the primary motivation for the concept of the *zero lower bound* in the academic literature.⁹ So far, negative policy rates have not led to an abnormal jump in the demand for cash across the four European jurisdictions under review (Graph 5), although this may be due to that fact that retail depositors have been shielded from negative rates so far. In the case of Denmark, the euro area and Switzerland, cash demand had already been on an increasing trend, in part because rates were already very low. Given transport, storage, insurance and other costs associated with holding cash in size, the effective lower bound on nominal interest rates is somewhere below zero.

The effective lower bound is, however, likely to move up if interest rates remain, or are expected to remain, negative for a long time. Agents may start adapting to the new environment and begin to innovate with a view to reducing the costs associated with physical currency use (eg McAndrews (2015)). Moreover, some of the costs of increasing cash usage are fixed, and incurring those may become profitable if interest rates are expected to remain negative for long.

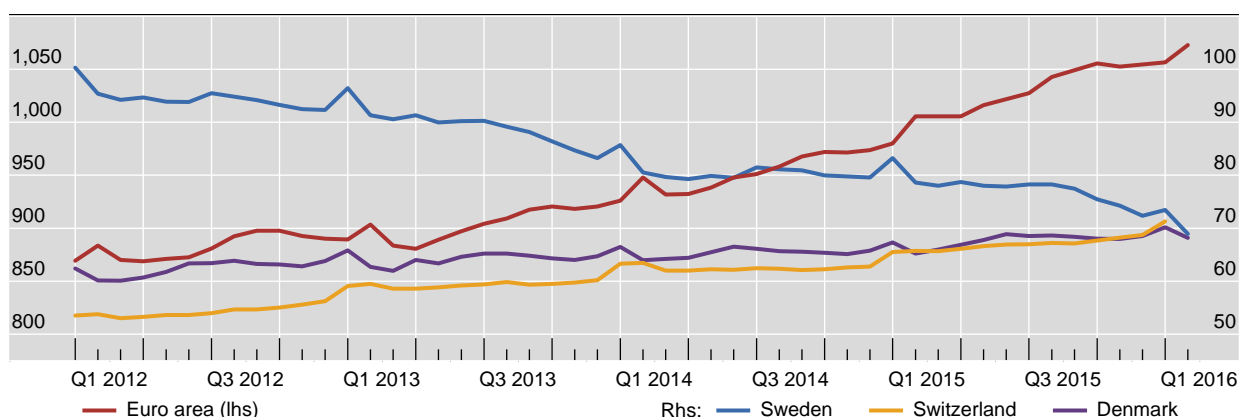
⁸ Under its Quantitative and Qualitative Monetary Easing programme, the Bank of Japan is buying assets to increase the monetary base by about ¥80 trillion annually.

⁹ See eg Hicks (1937): “If the cost of holding money can be neglected, it will always be profitable to hold money rather than lend it out, if the rate of interest is not greater than zero. Consequently the rate of interest must always be positive.”

Banknotes and coins in circulation

In billions of national currency units

Graph 5



Sources: European Central Bank; Datastream.

As alluded to above, the fact that retail bank customers have so far been shielded from negative rates has probably played a key role in keeping the demand for cash stable. The ability of the banking sector to limit the pass-through of negative rates is thus an important factor determining the effective lower bound (Alsterlind et al (2015)). Central banks' efforts to limit the cost of negative remuneration on the banking system were in some cases aimed at maintaining this ability. Other institutional factors, such as the prevalence of adjustable rate mortgages and more generally floating rate debt, can broaden agents' exposure to negative rates and affect the technical room central banks have to move interest rates into negative territory.

Conclusions

The introduction of moderately negative policy rates by the four central banks under review was by and large achieved within their existing operational frameworks. The experience so far suggests that modestly negative policy rates are transmitted through to money market rates in much the same way as positive rates are. It also appears that they are transmitted to longer-maturity and higher-risk rates, although this assessment is clouded by the impact of complementary monetary policy measures. By contrast, so far retail deposit rates have remained insulated, partly by design. And, at least in Switzerland, negative rates have actually raised, rather than lowered, mortgage rates.

So far, zero has not proved to be a technically binding lower limit for central bank policy rates. Nonetheless, there is great uncertainty about the behaviour of individuals and institutions if rates were to decline further into negative territory or remain negative for a prolonged period. It is unknown whether the transmission mechanisms will continue to operate as in the past and not be subject to "tipping points". Furthermore, an extended period of negative interest rates has so far been limited to the euro area and neighbouring economies. It is not clear how negative policy rates would play out in other institutional settings.

This special feature has examined exclusively the *technical* aspects of the implementation of negative policy rates. It has not addressed the question of the impact of negative policy rates on the financial system as a whole. Many questions remain. For instance, more recently, the debilitating impact of persistently negative interest rates on the profitability of the banking sector has emerged as an important consideration (BIS (2016)). Even more directly, such rates can weaken the profitability and/or soundness of institutions with long-duration liabilities, such as insurance companies and pension funds, seriously challenging their business models.¹⁰ And an assessment of their desirability would necessarily require an evaluation of their effectiveness in achieving the central bank objectives as well as their more general impact on financial and macroeconomic stability.¹¹ This, however, is beyond the scope of this special feature.¹²

¹⁰ For a more detailed analysis, see Borio et al (2015), CGFS (2011) and Domanski et al (2015).

¹¹ In addition, Friedman (1969) argues that non-zero nominal interest rates lead to a suboptimal quantity of money. In the case of negative nominal interest rates, the holders of physical currency, who receive a nominal return of zero, benefit from an implicit subsidy. See also Rognlie (2015).

¹² For a sceptical view concerning their desirability, see BIS (2015), Borio (2015) and Caruana (2016).

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Wealth inequality and monetary policy¹

This feature explores the recent evolution of household wealth inequality in advanced economies by looking at valuation effects on household assets and liabilities. Using household survey data, we analyse the possible drivers of wealth inequality and the potential effect of monetary policy through its impact on interest rates and asset prices. Our simulation suggests that wealth inequality has risen since the Great Financial Crisis. While low interest rates and rising bond prices have had a negligible impact on wealth inequality, rising equity prices have been a key driver of inequality. A recovery in house prices has only partly offset this effect. Abstracting from general equilibrium effects on savings, borrowing and human wealth, this suggests that monetary policy may have added to inequality to the extent that it has boosted equity prices.

JEL classification: D31, E52.

Inequality is back in the international economic policy debate. Evidence of a growing dispersion of income and wealth within major advanced and emerging market economies (EMEs) has sparked discussions about its economic consequences. Although there is no consensus on the relationship between inequality and growth, there are concerns that rising inequality may become a serious economic headwind.

While traditionally considered to be of secondary importance, questions about the possible distributional effects of monetary policy have recently come to the fore. Unprecedented monetary accommodation since the onset of the Great Financial Crisis (GFC) has given rise to concerns that monetary policy may have been contributing to inequality (Cohan (2014) and Wolf (2014)).

At least two arguments support the view that unconventional monetary policy may have had a larger than usual effect on the distribution of wealth – which we define as assets net of liabilities – across households. First, the short end of the yield curve has been at zero and the long end has been compressed for a long time. This suggests large and persistent valuation effects on financial assets. Second, some unconventional policy measures have explicitly targeted asset prices. As a result, the distributional effects of recent policy actions have attracted the attention of the general public, drawing central banks into the debate on inequality, as highlighted by several recent speeches by top monetary policymakers (Yellen (2015), Draghi (2015), Mersch (2014) and Haldane (2014)).

¹ The views expressed in this feature are those of the authors and do not necessarily reflect those of the BIS. We thank Claudio Borio, Ben Cohen, Mathias Drehmann and Hyun Shin for their comments. We also thank Sébastien Pérez-Duarte for his assistance with the Household Finance and Consumption Survey. Finally, we are grateful to Cristoph Lakner and Branko Milanović for sharing their estimates of the global distribution of income.

This special feature explores the evolution of wealth inequality since the GFC and the possible role of monetary policy. The next section analyses the evolution of wealth inequality around the crisis, focusing on the role of valuation effects from interest rate and asset price changes. The following section considers the role of monetary policy as a possible driver.

Wealth inequality since the Great Financial Crisis: a simulation

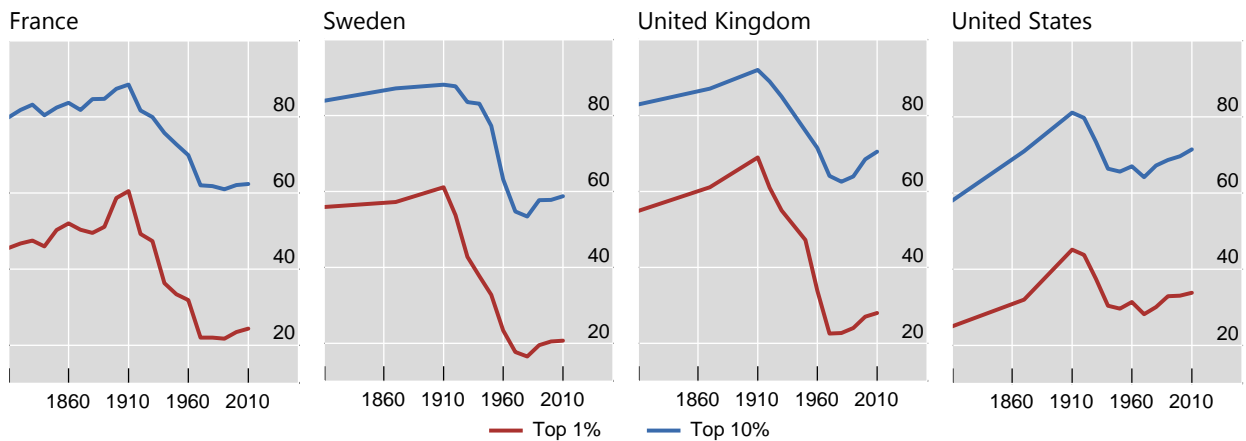
Wealth inequality has been rising in advanced economies (AEs) (Graph 1). Data available from 1810 to 2010 suggest that, as measured by the share of the top 1% of the wealth distribution, inequality has been increasing since the 1980s. While inequality remains below the levels prevailing in the second half of the 19th century, this rise marks the end of a trend of declining inequality that lasted for most of the 20th century.²

Wealth inequality has been increasing in tandem with income inequality (see the discussion in Box 1). Indeed, one popular explanation for the rise in wealth inequality is a “snowball effect” from rising income inequality. To the extent that those at the top of the income distribution save a larger fraction of their incomes, higher income

Wealth inequality has been increasing in advanced economies

Share of wealth accruing to the top of the distribution, 1810–2010; in per cent

Graph 1



The definition of wealth used in this graph is the sum of financial and non-financial assets minus the total amount of financial liabilities.

Source: Piketty (2014).

² Serious data limitations render comparisons very difficult. There has been debate about the reliability of wealth estimates for the United Kingdom (Graph 1, third panel). The *Financial Times* took issue with Piketty’s (2014) use of estate tax data from the UK authorities as those in charge of producing those data explicitly say that the data are best not used for the purpose of comparing wealth trends over time. The *Financial Times* (Giles (2014)) argued instead for using a survey of wealth in the United Kingdom; the latter data paint a different picture indicating that the share of wealth held by the top 1% of wealth holders in the United Kingdom is 44% rather than 71% (and has been flat in recent decades).

inequality adds to the concentration of wealth. In turn, for given returns on capital and labour, wealth concentration exacerbates income inequality (Saez and Zucman (2014)).

It is important to note at the outset that any assessment of trends in inequality suffers from serious data limitations. Typically, the data come from household expenditure surveys in which the top of the distribution tends to be underrepresented, especially with respect to wealth. To account for dynamics at the top, researchers have begun to use tax return data (eg Saez and Zucman (2014) and Alvaredo et al (2015)). Even so, tax avoidance and evasion may induce a downward bias in estimates of income and wealth at the top.

Box 1

Trends and drivers of income inequality

The recent debate has focused mostly on income inequality – the distribution of returns from labour and capital – within, but also across, countries.

Within countries, income inequality has risen globally. Graph A (left-hand panel) shows that there is a U-shaped time pattern in average income inequality, a pattern that is observable across economies. After thinning in the 1950s, 1960s and 1970s, the right tail of the income distribution has been getting fatter.^① The same U-shaped pattern is found in the share of income accruing to the top 1% of the distribution (Graph A, centre panel), suggesting that the top end of the distribution is an important driver of inequality. Rising income inequality within countries contrasts with narrower income dispersion across countries. Between 1988 and 2008, the global income distribution narrowed: the bottom tail of the distribution shifted to the right (Graph A, right-hand panel).^② This shift largely reflects growth in middle-income EMEs, especially China.

Rising income inequality within economies and a lower dispersion of incomes across countries are consistent with global factors driving inequality trends. Economic and financial globalisation is thought to have widened the income distribution by increasing the ratio of skilled to unskilled wages. Highly skilled workers benefit from global opportunities, whereas the low-skilled face stiff competition from (cheaper) foreign labour and a loss of bargaining power. By the same token, workers in EMEs have seen their wages rise relative to those of their AE counterparts even as low-skilled wages have fallen relative to those of more skilled workers within AEs. This process has likely been supported by skill-biased technological progress and by advances in information technology in particular.

The integration of the labour force of large EMEs into global production has probably reduced the rate of return on labour relative to capital. As a consequence, the returns to wealth (ie corporate profits, dividends, rents, sales of property, capital gains) and the share of capital in total income have increased. Given that the distribution of wealth is more concentrated than the distribution of income, a rising capital share increases income inequality.

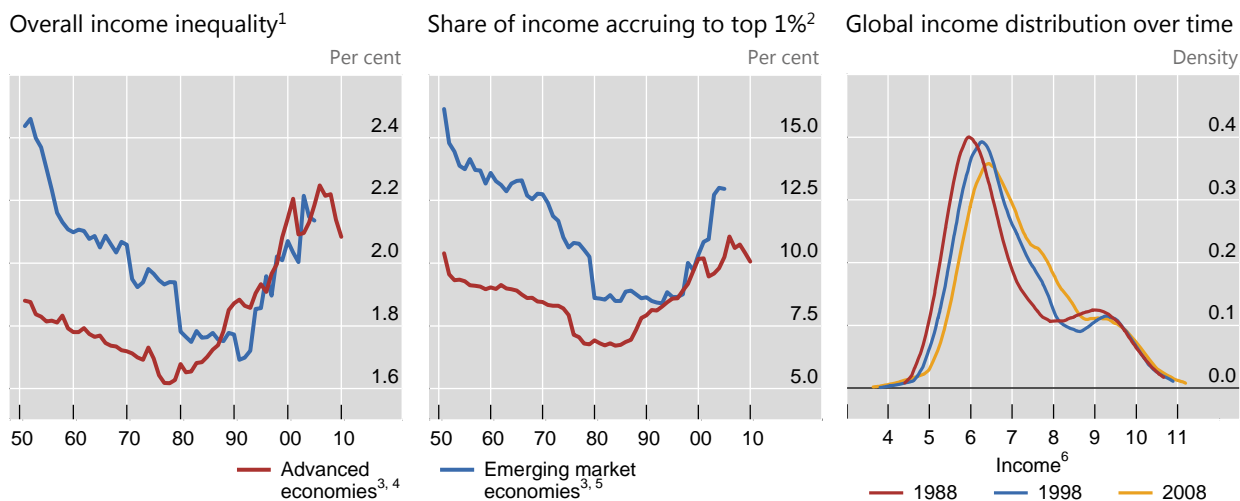
Moreover, the faster rise in remuneration at the very top of the income distribution relative to wage growth in the lower percentiles has been linked both to the rapid growth of the financial sector since the 1980s and to changes in the social norms that contribute to the determination of executive pay (Piketty (2014)).

Redistributive fiscal policies appear have reduced the level of inequality, especially in AEs, but they have not changed long-term trends (Graph B).^③

^① The left-hand panel of Graph A plots time series of the Pareto coefficient – a measure that captures the higher-income part of the distribution. The higher the Pareto coefficient, the fatter the upper tail of the income distribution. For concreteness, if the Pareto coefficient is 2, the average income of individuals with income above \$100,000 is \$200,000 and the average income of individuals with income above \$1 million is \$2 million. ^② Lakner and Milanović (2013) estimate the *global* distribution of income by aggregating *within country* household surveys. They correct for income underreporting at the top by using the discrepancy between consumption growth in national accounts and in household surveys. This is allocated to the top 10% of the income distribution by fitting a Pareto distribution to the upper tail. ^③ In the United States, for example, in 2010 the top 1% of households held about 35% of total wealth (see Graph 1, right-most panel) but 18% of total income (see Graph A, centre panel).

Income inequality has been increasing within countries but decreasing across countries

Graph A



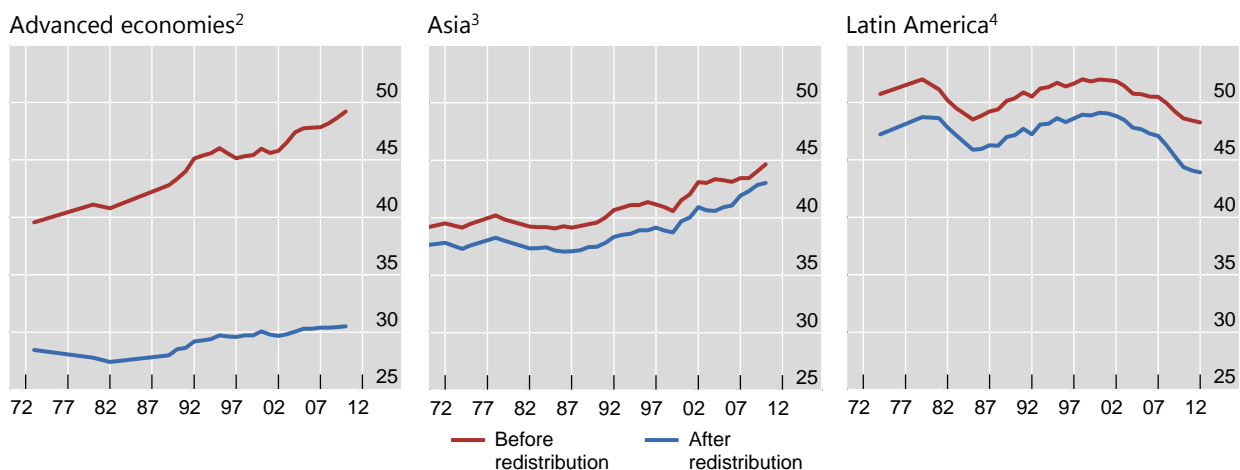
¹ Pareto coefficients; a higher coefficient means higher inequality. ² Excluding capital gains. ³ Simple average of the economies listed. ⁴ Australia, Canada, France, Germany, Ireland, Italy, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom and the United States. ⁵ Argentina, India, Korea, Malaysia, Singapore and South Africa. ⁶ Annual income, in PPP-adjusted 2005 US dollars and in natural logarithms.

Sources: Alvaredo et al (2015); Lakner and Milanovic (2013).

Redistribution decreases income inequality but does not affect trends

Gini coefficient, in per cent¹

Graph B



Before (after) redistribution indicates income pre (post)-tax and pre (post)-transfers.

¹ Simple average of the economies listed. ² Australia, Canada, Denmark, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. ³ China, India, Indonesia, Korea, Malaysia and Singapore. ⁴ Argentina, Brazil, Colombia and Mexico.

Source: Solt (2014).

How has wealth inequality evolved since the crisis? To answer this question, this section simulates the impact of observed changes in asset values on the wealth of different quintiles of household wealth distribution in six AEs. We emphasise the direct effects of valuation changes on wealth inequality, preparing the ground for a discussion of the possible role of unconventional monetary policy.

Methodology

The simulation focuses on the impact of changes in interest rates and asset prices on wealth inequality, abstracting from active portfolio shifts by households. The main reason for this approach is the lack of comparable time series data on the composition of households' balance sheets. We use microdata from the household surveys of six AEs (France, Germany, Italy, Spain, the United Kingdom and the United States). Those surveys are heterogeneous: they are conducted at different times; are of low frequency (every two to three years); differ in the granularity of their coverage of assets and liabilities; and, in some cases, have only one observation.

In order to be able to compare the evolution of household wealth across countries, we use a single point-in-time observation on the composition of balance sheets based on a consistent definition of asset classes. By doing so, we are implicitly assuming that portfolio composition is independent of macroeconomic and financial conditions.³ This assumption can be justified by thinking of our simulation as a partial equilibrium exercise seeking to determine the impact of changes in asset prices and interest rates on wealth inequality while holding the composition of assets and liabilities constant.⁴

We proceed in three steps. As a first step, we use the survey data to construct *household balance sheets* for the first to fifth quintiles of the wealth distribution in each country. We thus obtain portfolio weights for a number of broad asset classes (deposits, bonds, stocks, mutual funds and housing) and liabilities (mortgage and non-mortgage credit).⁵ Balance sheets for the selected quintiles are reported in Table 2, and a more detailed breakdown is illustrated in Graph A1 in the Annex.

³ There is considerable cross-country variation in the frequency and availability of surveys. For instance, the ECB plans to release its Household Finance and Consumption Survey (HFCS) every three years (as is the case for the US Survey of Consumer Finances (SCF)) but currently only one wave exists (released in 2013). The UK Wealth and Assets Survey (WAS) is conducted on a biennial basis, starting in 2006.

⁴ Moreover, surveys that are available at several points in time suggest that portfolio composition has typically remained fairly stable.

⁵ An important asset class that we exclude from our simulation is pensions. One reason is a lack of comparability between countries with pay-as-you-go and funded pension schemes. Another is that even for funded schemes, methodological challenges loom large. Surveys record pension assets as the sum of the value of current occupational pension wealth, retained rights in occupational pensions, current personal pension wealth, retained rights in personal pensions, additional voluntary contributions, value of pensions expected from former spouses/partners and value of pensions in payment. It is important to emphasise that those are only estimates. Modelling is needed to calculate the value of current occupational pension wealth, retained rights in occupational pensions etc for each household. As a result, the estimates are not readily comparable across surveys. Moreover, computing the impact of valuation changes on pension assets is only a meaningful exercise if we think about current personal pension wealth and occupational pension wealth (ie claims on pension funds) for which the underlying composition is not reported in the surveys.

As illustrated in Graph A1 in the Annex, the importance of pension assets varies significantly across countries. For example, in countries where the social security component of the pension system is small (United Kingdom and United States), pension assets account for a relatively large share of total

To construct comparable classes of assets and liabilities, we use categories reported in the ECB's Household Finance and Consumption Survey (HFCS). The first wave of this survey, which covers more than half of the countries in our sample, was released in 2013. For cross-country comparability, we chose survey years for the United Kingdom (WAS) and the United States (SCF) that would be as close as possible to those of the HFCS.⁶

The second step is to compute the growth rate of assets and liabilities. We assume that assets grow because of changes in asset prices and because cash flows are reinvested in the portfolio. Equivalently, there is no asset accumulation beyond cash flows, and no decumulation. As a result, the growth rate of assets is equal to the *return on assets*. For the sake of symmetry between the treatment of assets and liabilities, we assume that households do not pay down debt. Households issue only one-period debt and roll over both principal and interest in every period.⁷ Under these assumptions, the growth rate of liabilities is simply the *cost of debt*.

Since we have taken the composition of assets and liabilities to be fixed over time, the returns on assets and the cost of debt are simply linear combinations of the returns on the underlying assets and the cost of the underlying debt liabilities, weighted by their respective shares in total assets and liabilities (see Box 2). We use market data to determine asset returns and average lending rates to proxy for the cost of debt (Table 1). The resulting rates of return on assets and cost of debt liabilities are reported in rows 1 and 4 of Graph 2.

As a third and final step, we calculate our measure of wealth inequality as the ratio of the fifth quintile of the wealth distribution (q5) to the second quintile (q2), by analogy with percentile ratio measures commonly used for income inequality.⁸ By this metric, inequality increases when q5 accumulates wealth faster than q2 or, in other words, when the wealth growth differential between q5 and q2 is positive (see Box 2).⁹

assets (38% and 16%, respectively). In euro area countries, by contrast, estimates of the share of pensions in total assets tends to be smaller (1.3% in Italy, 2.4% in Spain, 8% in Germany and 12% in France).

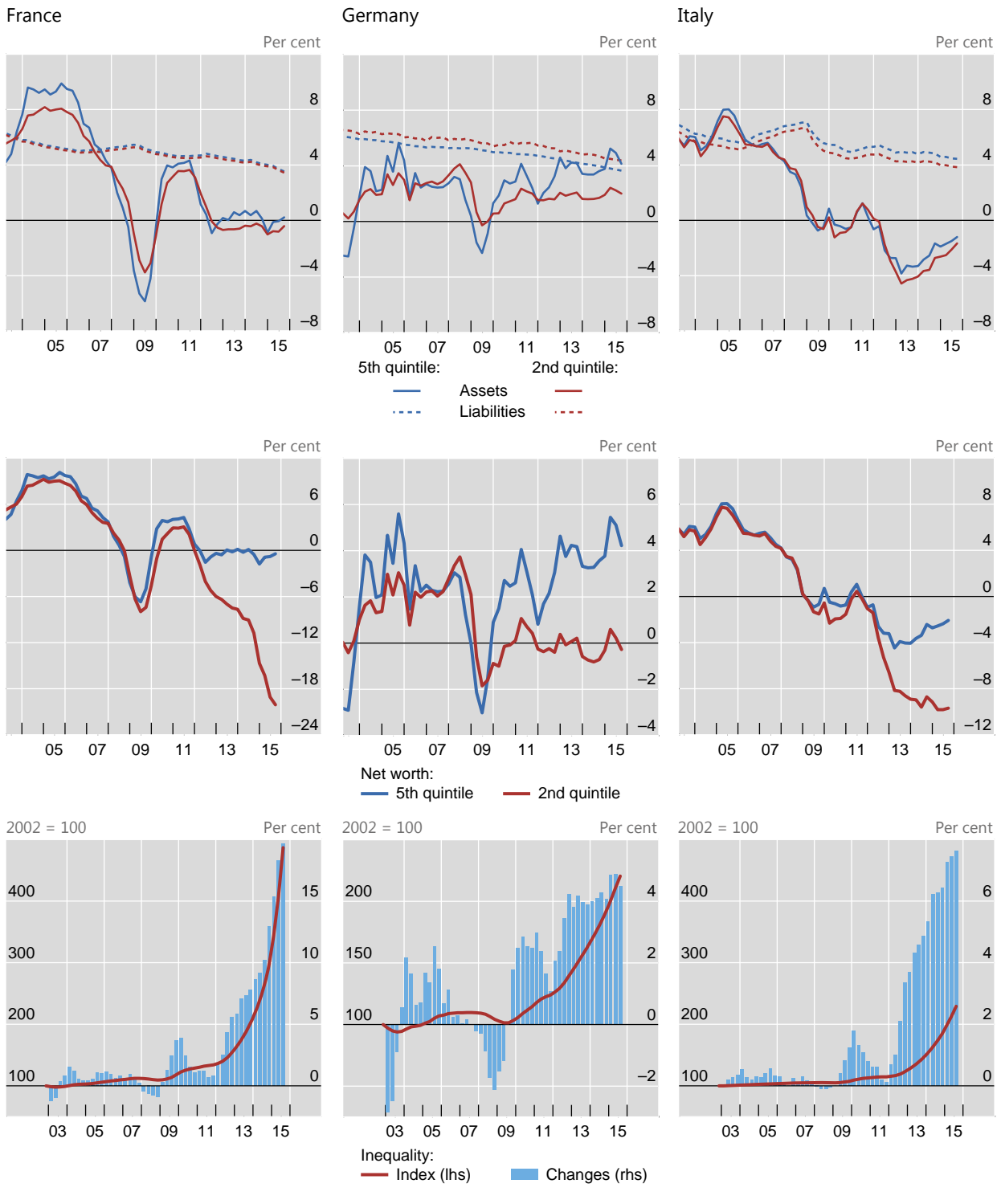
⁶ Survey fieldwork years: Germany: 2010–11; Spain: 2000–09; France: 2009–10; Italy: 2011; United Kingdom: 2011; United States: 2012.

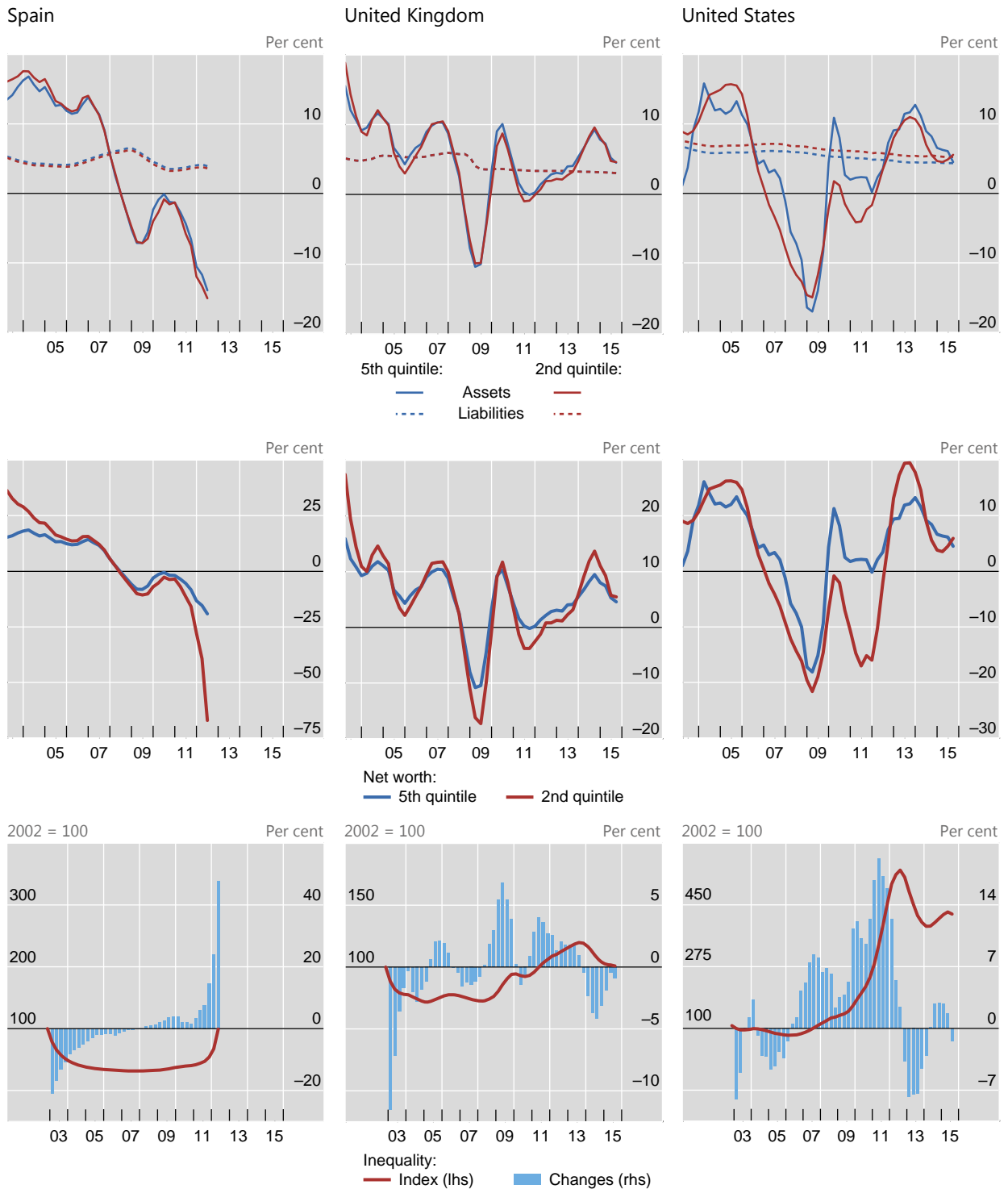
⁷ In principle, we could also have compounded the changes in the market value of liabilities (ie the present discounted value of cash flows associated with the loans), which would have preserved symmetry. For this calculation, however, we would have needed detailed information on the maturity and type of loans, which is not available in the surveys.

As a way to test for the sensitivity of our results to different assumptions about the dynamics of liabilities, we repeat all calculations by allowing mortgage liabilities to compound at the same rate as that of bonds, and non-mortgage liabilities at the same rate as that of deposits, the idea being that liabilities should be treated as an asset with a negative sign (see Graph A2 in the Annex). A comparison of Graphs 2 and A2 reveals that the dynamics of inequality (as displayed by the red line in row 3 of the two graphs) are unchanged although for some countries there are considerable differences in the levels. For instance, when we allow liabilities to compound as bonds and deposits, inequality grows much less in France and in the United States.

⁸ We considered using the q5/q1 ratio. However, there are quarters in which q1 has negative wealth for some of the countries in our sample. In this case, the ratio is negative and it is no longer a meaningful measure of inequality. The q5/q2 ratio, on the other hand, is consistently positive with the exception of Spain after Q2 2012. In the latter quarters of the sample, the second quintile of the Spanish wealth distribution has negative wealth as assets decline at a faster rate than liabilities rise.

⁹ Combining the stocks of assets and liabilities at survey time with the growth rates computed in the second step, we can construct time series for both sides of the balance sheet. We can then compute leverage as the ratio of assets to assets net of liabilities.





Change in inequality is equal to the difference in the growth rate of net wealth between the fifth and second quintiles. For details, see Box 2. Positive (negative) values are associated with an increase (decrease) in wealth inequality.

Sources: Eurosystem, ECB Household Finance and Consumption Survey (wave 1); Federal Reserve Board, Survey of Consumer Finances (2013); UK Office for National Statistics, Wealth and Assets Survey (wave 3); Bank of America Merrill Lynch; Datastream; national data; authors' calculations.

Return on assets and cost of debt used in the simulation

Table 1

Balance sheet item	Variable	Assumptions
Assets		
Deposits	Three-month interest rates	Remuneration of bank deposits at market rates
Bonds and equities	Domestic total return index for bonds/equities	Home bias in portfolio composition; all cash flows are reinvested in the same asset
Mutual fund shares	Return on domestic performance indices for different asset classes, weighted by country asset allocation according to International Investment Funds Association ¹	All quintiles demand same composition as offered by country-specific mutual fund industry; mutual funds perform as market benchmarks
Housing	Percentage changes in the domestic price of residential property	The quality of housing held by the poor and the rich is the same ²
Liabilities		
Debt	Average lending rates	All debt has a one period maturity; principal and interest are rolled over

¹ We do not have access to information about the composition of mutual funds in households' balance sheets (eg bond funds, equity funds, mixed funds). We get around this issue by imputing to each household an "average" country-specific composition based on industry data collected by the International Investment Funds Association (IIFA), and by exploiting the fact that mutual funds typically perform as well as (or slightly below) the corresponding market index. The IIFA is an organisation of national mutual fund associations. It provides statistics on the composition of national mutual funds between Q4 2013 and Q4 2015. There was little variation in the composition of mutual funds over this period. We used data from Q2 2014. See www.iifa.ca/industry_statistics/index.html. ² The return on housing is measured at the percentage change of a national index of property prices. As a result, it does not take into account potential systematic biases in the changes in the value of property held by the rich and the poor.

Results

The composition of household balance sheets in AEs varies considerably between the lower and the upper ends of the wealth distribution. Table 2 shows the composition of assets and liabilities for selected quintiles of the net wealth distribution according to national surveys (Graph A1 in the Annex provides a more detailed breakdown). Asset portfolios at the top of the wealth distribution are relatively diversified, including in particular significant holdings of equities and bonds. This contrasts with rather concentrated household portfolios at the bottom. These consist primarily of real estate, and contain financial assets mainly in the form of deposits. Leverage generally declines as households become richer, reflecting the fact that "poorer" households borrow to finance assets such as residential property and durable consumer goods.

Considering the tails of the wealth distribution – not shown here – generally reinforces this picture. The share of securities holdings, equity in particular, tends to be even higher at the top 5% or 1% of the distribution. Conversely, housing accounts for a higher share in the lowest net wealth quintile, for which low net wealth is in many cases a reflection of high levels of mortgage debt. In a number of cases, net wealth is negative, suggesting that liabilities, in the form of mortgage, consumer and other debt, exceed assets.¹⁰

¹⁰ These calculations do not take into account human wealth, that is, the capitalised value of labour income. As a result, they tend to understate the true value of household wealth.

Households' balance sheet composition by selected net wealth quintiles¹

Table 2

		Assets					Liabilities		Memo: Leverage
		Deposits	Stocks	Bonds	Mutual funds	Real estate	Mortgage debt	Other debt	
France	Q5	11.9	7.3	0.9	3.4	76.5	73.0	27.0	1.1
	Q2	34.5	1.2	0.0	0.8	63.5	78.4	21.6	1.6
	Δ	-22.6	6.1	0.9	2.6	13.0	-5.4	5.4	-0.6
Germany	Q5	16.2	3.8	3.4	5.0	71.7	91.8	8.2	1.1
	Q2	57.1	0.9	0.0	1.8	40.2	66.7	33.3	1.4
	Δ	-40.9	2.9	3.4	3.2	31.5	25.1	-25.1	-0.3
Italy	Q5	8.5	1.3	5.1	2.8	82.2	69.9	30.1	1.0
	Q2	13.7	0.3	2.2	0.6	83.1	80.4	19.6	1.2
	Δ	-5.2	1.0	2.9	2.2	-0.9	-10.5	10.5	-0.2
Spain	Q5	12.5	3.3	0.5	2.7	80.9	84.3	15.7	1.1
	Q2	5.1	0.2	0.1	0.3	94.4	89.7	10.3	1.3
	Δ	7.4	3.1	0.4	2.4	-13.5	-5.4	5.4	-0.2
United Kingdom	Q5	15.8	6.2	4.6	2.5	70.9	92.5	7.5	1.0
	Q2	17.9	1.6	1.1	0.1	79.3	87.8	12.2	1.7
	Δ	-2.1	4.6	3.5	2.4	-8.4	4.7	-4.7	-0.6
United States	Q5	12.4	15.1	3.4	14.6	54.5	90.9	9.1	1.1
	Q2	7.5	0.6	0.2	0.6	91.1	76.1	23.9	3.4
	Δ	4.9	14.5	3.2	14.0	-36.6	14.8	-14.8	-2.4

¹ As a percentage of total assets (liabilities); unconditional means.

Sources: Eurosystem, ECB Household Finance and Consumption Survey (wave 1); Federal Reserve Board, Survey of Consumer Finances (2013); UK Office of National Statistics, Wealth and Assets Survey (wave 3).

Results of the simulation of the evolution of wealth inequality are reported in Graphs 2 and 3. Graph 2 displays the time series of the returns on assets and the cost of liabilities (rows 1 and 4), wealth growth (rows 2 and 5) and the resulting quarterly changes in our measure of inequality together with the corresponding time series (rows 3 and 6).¹¹ Graph 3 decomposes the difference between the return on assets of q5 and q2 by asset category, indicating which asset class has driven the changes.

Four main observations stand out. First, wealth inequality – measured as the ratio of the net wealth of “richer” to “poorer” households – has *increased* in most countries since the GFC. Bearing in mind the limitations of our simulation, the numerical results should be interpreted as a broad indication of trends, rather than precise orders of magnitude.

The blue bars in rows 3 and 6 of Graph 2 show quarterly changes in inequality.¹² Drawing out a time series of cumulative changes in inequality by

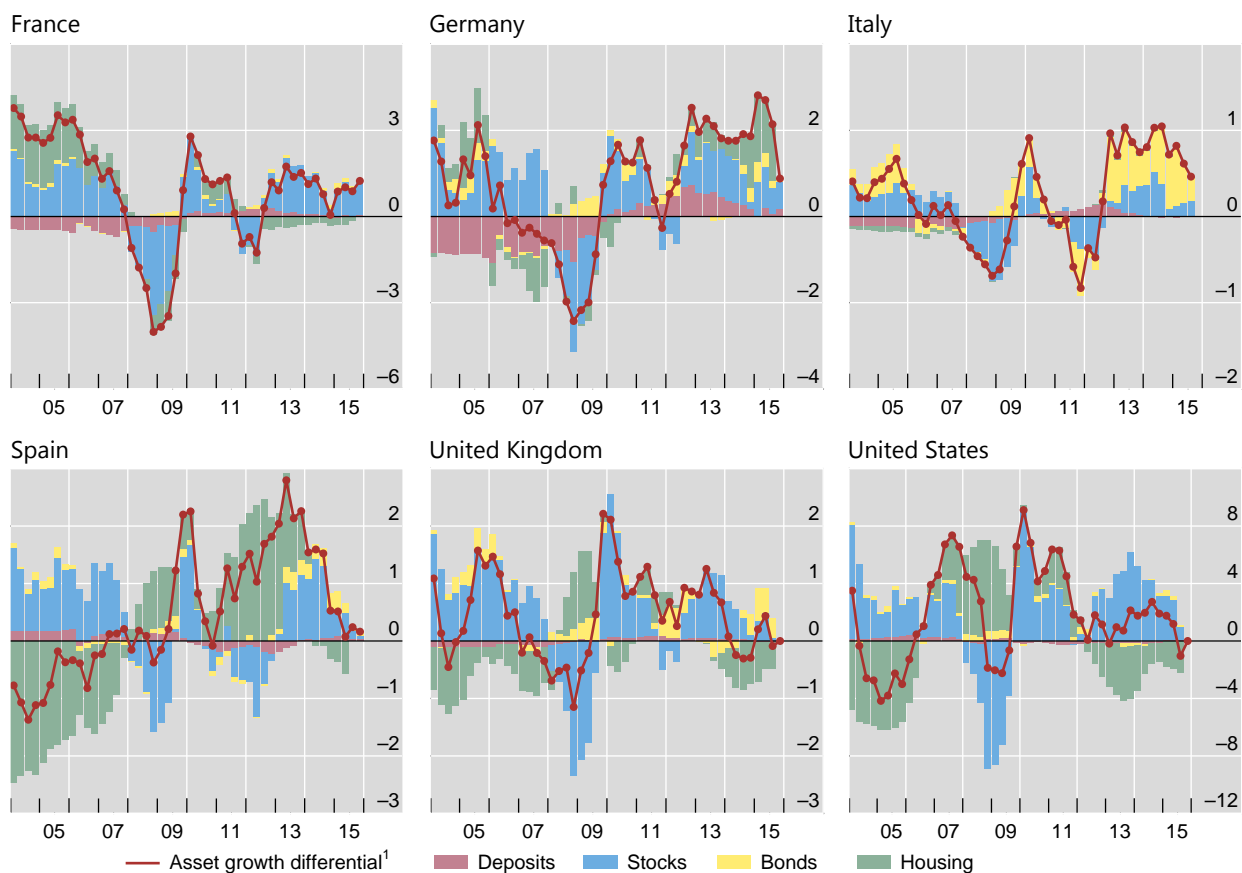
¹¹ The inequality time series are obtained by simple compounding based on quarterly changes.

¹² For all countries in the sample, changes in wealth inequality are driven by the dynamics of asset growth. A comparison of rows 1 and 4, and 3 and 6, in Graph 2 indeed reveals that the wealth growth differential, $\Delta w(5, t, t+1) - \Delta w(2, t, t+1)$, follows the same pattern as that of the asset return differential, $\Delta a(5, t, t+1) - \Delta a(2, t, t+1)$.

Stocks and housing drive the asset return differential

In per cent

Graph 3



¹ Difference between asset growth of the fifth and the second quintiles of the net wealth distribution.

Sources: Eurosystem, ECB Household Finance and Consumption Survey (wave 1); Federal Reserve Board, Survey of Consumer Finances (2013); UK Office for National Statistics, Wealth and Assets Survey (wave 3); Bank of America Merrill Lynch; Datastream; national data; authors' calculations.

compounding these quarterly changes suggests that the crisis coincided with large increases in inequality (Graph 2, rows 3 and 6, red line). During the period covered by our simulation, the net wealth of richer households grew twice as fast as that of poorer ones in Germany and Italy, four times as fast in the United States and five times as fast in France. In the United Kingdom, inequality is back to its pre-crisis level after an initial decline.

Second, on the asset side, *equity and housing* have been the most important drivers of inequality (Graph 3). Although differences in the shares of equity holdings are typically small (below 7 percentage points in most countries except in the United States with around 25 percentage points; see Table 2), stocks have experienced consistently larger gains and suffered consistently larger losses than other asset classes. Since 2010, high equity returns have been the main driver of faster growth of net wealth at the top of the distribution.

As regards housing, the combination of large swings in house prices and major differences in portfolio shares contributed significantly to changes in inequality. Over the past few years, the recovery of housing markets has tended to reduce wealth inequality in most countries, partly reversing the rise in inequality caused by the bust of housing markets during the GFC. Overall, the impact of equity prices on inequality seems to be much more cyclical, and less persistent, than that of house prices, which exhibit long booms and busts.

Third, *fixed income assets* – bonds and deposits – seem to have affected wealth inequality only in the trough of the recession between 2009 and 2010, and then again since 2012.¹³ One notable exception is Germany, where declining interest rates on deposits, which account for more than half of the assets of households in the lowest wealth quintile, have added to inequality. Our simulation may, however, overestimate the impact of lower interest rates in Germany: as in other countries, retail deposits are typically remunerated at rates that are stickier and lower than wholesale market rates. As a result, the change is likely to have been smaller than the one measured by our proxy.

Finally, differences in household leverage have amplified distributional effects. Intuitively, when households are highly leveraged, asset gains (losses) have a larger impact on their wealth (see Box 2). The large wealth growth differential of Spanish households in q2 and q5 after 2010 is due to higher q2 leverage, as is the one experienced by US households between 2009 and 2013 (Graph 2, centre rows). In our simulation, these differentials accumulate over time to generate the large increases in inequality we observe in the sample (rows 3 and 6 of Graph 2, red line).¹⁴

Monetary policy as a possible driver of wealth inequality

Monetary policy may affect household wealth through different channels. Interest rate changes directly affect the valuation of both financial assets (eg equities and bonds) and real estate as well as the cost of leverage. Conventional easing of monetary policy by lowering short-term interest rates tends to boost asset prices. This works through a lowering of the discount rates applied to future income flows from these assets, and possibly by raising profit expectations and/or reducing risk premia.

At the same time, changes in financial conditions brought about by an easy monetary policy can either increase household savings and/or increase liabilities as

¹³ This is consistent with the findings of Adam and Tzamourani (2015), who consider the distributional consequences of a 10% increase in bond, equity and house prices, respectively. Using HFCS data, they find that the impact of bond price changes on wealth inequality (as measured by percentage changes in the Gini coefficient) is negligible.

¹⁴ The wealth growth differential is highly sensitive to the way in which leverage is allowed to change endogenously in the simulation. As explained in Box 2, we combine the stocks of assets and liabilities at survey time with the time series for asset returns and the cost of debt to obtain time series for assets and liabilities, and a corresponding leverage series that matches the leverage ratio at survey time. If, instead, we had assumed a zero leverage differential between q2 and q5 at the beginning of the simulation, and allowed leverage to change endogenously with assets and liabilities (an approach that imposes no structure on leverage and allows it to be driven only by valuation changes in assets and liabilities), we would have obtained smaller leverage differentials throughout the simulation period, and therefore smaller wealth differentials.

Some inequality arithmetic

Let $a(q, t)$ and $l(q, t)$ denote assets and liabilities of quintile q of the wealth distribution at time t , respectively. Defining a number A of asset classes and a number L of liability classes, we have that $a(q, t) = \sum_{i=1}^A a(q, i, t)$ and that $l(q, t) = \sum_{j=1}^L l(q, j, t)$.^①

As discussed in more detail in the body of the text, we assume that the composition of household balance sheets at different quintiles of the wealth distribution is time-invariant. In practice, we fix the relative weights of different assets and liabilities on households' balance sheets. Let $\delta(q, i, t) = a(q, i, t)/a(q, t)$ denote the relative weight of asset i in the asset portfolio of quintile q at time t , with $\sum_{i=1}^A \delta(q, i, t) = 1$. Similarly, let $\delta(q, j, t) = l(q, j, t)/l(q, t)$ denote the relative weight of liability j in the liability portfolio of quintile q at time t , with $\sum_{j=1}^L \delta(q, j, t) = 1$. Under the assumption of fixed weights, $(\delta(q, i, t))_{i=1}^A \equiv (\delta(q, i))_{i=1}^A$ and $(\delta(q, j, t))_{j=1}^L \equiv (\delta(q, j))_{j=1}^L$.

We use microdata from household surveys to construct the weights $(\delta(q, i))_{i=1}^A$ and $(\delta(q, j))_{j=1}^L$. We consider five asset classes ($A = 5$) and two liability classes ($L = 2$). Under the assumption that there is no asset accumulation beyond capital gains and cash flows generated by each asset class (and no decumulation), the net growth rate of assets $\Delta a(q, t, t+1)$ is simply a linear combination of the returns on assets, $\Delta a(q, t, t+1) = \sum_{i=1}^A \delta(q, i) \Delta a(i, t, t+1)$.

We use market data to construct quarterly time series of these returns, $(\Delta a(i, t, t+1))_{i=1}^A$. For liabilities, we assume that households issue one-period debt that is rolled over in every period. As a result, the quarterly time series of the net growth rate of liabilities $\Delta l(q, t, t+1)$ is a linear combination of the underlying cost of debt, $\Delta l(q, t, t+1) = \sum_{j=1}^L \delta(q, j) \Delta l(j, t, t+1)$. The cost of mortgage and non-mortgage liabilities, $(\Delta l(j, t, t+1))_{j=1}^L$, is built using average lending rates. Finally, to compute the time series of quintile leverage, $(lev(q, t))_t$, we combine survey data on the stocks of assets and liabilities at survey time τ , $a(q, \tau)$ and $l(q, \tau)$, with the time series for asset returns and cost of liabilities. Applying the formula $x(q, t+1) = (1 + \Delta x(q, t, t+1))x(q, t)$, for $x = a, l$ allows us to recover time series for assets and liabilities.^② We then compute leverage as $lev(q, t) = a(q, t)/(a(q, t) - l(q, t))$. For all countries except Spain, our time series start in Q1 2003 and end in Q3 2015. For Spain, we end in Q2 2012, as in the most recent quarters "poor" households have negative wealth in the simulation (see also footnote 8).

Let $w(q, t)$ denote the wealth of quintile q of the wealth distribution at time t , $w(q, t) = a(q, t) - l(q, t)$. Our measure of wealth inequality is the ratio $w(5, t)/w(2, t)$. Inequality increases over time if $w(5, t+1)/w(2, t+1) - w(5, t)/w(2, t) > 0$, and decreases otherwise. Equivalently, inequality increases if the difference $\Delta w(5, t, t+1) - \Delta w(2, t, t+1) > 0$, where $\Delta x(q, t, t+1)$ denotes the (net) growth rate of the variable x associated with quintile q between time t and time $t+1$.

The growth rate of net wealth is given by the sum of the growth rate of assets and of liabilities, weighted by quintile leverage, $\Delta w(q, t, t+1) = \Delta a(q, t, t+1) lev(q, t) + \Delta l(q, t, t+1)(1 - lev(q, t))$, with $lev(q, t) = a(q, t)/w(q, t)$. As a result, the wealth growth differential between q5 and q2 is given by

$$\begin{aligned} \Delta w(5, t, t+1) - \Delta w(2, t, t+1) &= \Delta a(5, t, t+1) lev(5, t) - \Delta a(2, t, t+1) lev(2, t) \\ &+ \Delta l(5, t, t+1)(1 - lev(5, t)) - \Delta l(2, t, t+1)(1 - lev(2, t)). \end{aligned} \quad (1)$$

Here, $\Delta w(q, t, t+1)$ is the wealth growth rate of quintile q between quarter t and $t+1$; $\Delta a(q, t, t+1)$ represents the growth rate of assets, while $\Delta l(q, t, t+1)$ denotes that of liabilities; finally, $lev(q, t)$ is the leverage of quintile q in quarter t . Inequality increases if the left-hand side of equation (1) is positive, and decreases otherwise.

To tease out which underlying assets are responsible for the dynamics of the asset returns, we decompose the asset return differential as:

$$\Delta a(5, t, t+1) - \Delta a(2, t, t+1) = \sum_{i=1}^A \Delta a(i, t, t+1)(\delta(5, i) - \delta(2, i)), \quad (2)$$

that is, as the sum of the "portfolio weight differentials", $\delta(5, i) - \delta(2, i)$, weighted by the growth rate of the underlying asset, $\Delta a(i, t, t+1)$. The decomposition in equation (2) is illustrated in Graph 3 in the main text.

^① All relevant quantities referred to in this box are nominal. ^② We assign the values of assets and liabilities reported by the survey to the last quarter-year pair covered by survey-related fieldwork.

households take on more debt. These channels tend to work with different time lags, further complicating the assessment of the overall effect.

Notwithstanding the range of channels through which monetary policy may affect the distribution of wealth, the traditional view holds that such effects are small. As a by-product of the pursuit of macroeconomic stabilisation objectives, they net out over the business cycle. More generally, monetary policy that is neutral in the longer run should not have a lasting impact on inequality.

The role of unconventional monetary policies

Monetary policies in the aftermath of the GFC have raised questions about whether this assessment is still valid.

First, unconventional monetary policies have arguably relied more on wealth effects than conventional policy measures.¹⁵ With policy rates at, or even below, zero, central banks have directly aimed at influencing the composition of private sector portfolios and the price of risky assets. Portfolio rebalancing is thought to be one of the key channels for the transmission of unconventional policies (Bernanke (2012)). Communication about future policy intentions has also become more explicit (forward guidance) and has tried to steer market rates further out along the yield curve. In addition, by changing the size and composition of their balance sheets (balance sheet policies) central banks have begun to target financial conditions in specific markets (eg the housing market), and long-term interest rates and risk premia more generally.

Second, policy rates in major currency areas have been unusually low for an unusually long time – seven or eight years – which might suggest more persistent distributional effects than during a normal interest rate cycle. More fundamentally, this interest environment might be interpreted, in part, as the result of past policies that contributed to the financial busts which may give rise to questions about the long-run neutrality of monetary policy (Borio (2015)).

In addition, households may have become more sensitive to changes in interest rates and asset values over the past decade. For one, household balance sheets in AEs have expanded much faster than GDP, with total household assets and net wealth growing in tandem (Graph 4, left-hand panel). In addition, the share of capital income has been rising steadily since the 1980s and now accounts for about 30% of household income in AEs (right-hand panel).

Interpretation of the simulation results

While the simulation does not establish a direct link between wealth inequality and monetary policy, it sheds some light on the channels through which monetary policy might have had such effects. Four points stand out.

First, the simulation results suggest that the distributional effects of zero interest rates, forward guidance and large-scale asset purchases through their impact on bond prices have generally been modest. In particular, rising values of households' bond portfolios have not been associated with significant changes in wealth inequality. This

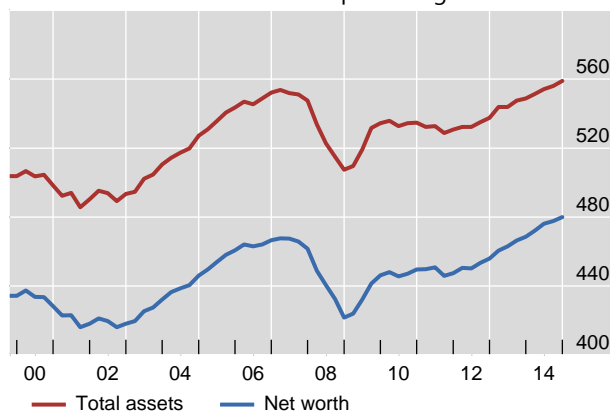
¹⁵ The conventional view is that monetary policy works via intertemporal substitution effects and that the distributional effects that arise from changes in interest rates (say, between borrowers and savers) net out over the business cycle.

Income shares and household wealth in advanced economies¹

In per cent

Graph 4

Household balance sheets as a percentage of GDP²



Income shares³



¹ Simple average of the economies listed in footnotes 2 and 3. ² The euro area, Japan, the United Kingdom and the United States. ³ France, Germany, Italy, Japan, the United Kingdom and the United States.

Sources: Piketty (2014); ECB; Federal Reserve Board; Japanese Cabinet Office; UK Office for National Statistics; authors' calculations.

is not surprising, given that the differences in the holdings of fixed income claims between "richer" and "poorer" households are generally relatively small.

Second, unconventional monetary policies might have had the most significant effects on the dynamics of wealth inequality through changes in equity returns and house prices.¹⁶ The evidence suggests that unconventional policies had a relatively strong and immediate effect on equity prices (see eg Rogers et al (2014)). As investors reshuffle their portfolios away from assets being purchased by the central bank towards other, potentially riskier, assets, the equity risk premium should decline, boosting equity prices further. And a low interest rate environment is likely to have encouraged a search for yield.

At the same time, lower interest rates should have supported real estate prices. House prices in the United States appear to have been positively affected by unconventional monetary policies (Gabriel and Lutz (2014)). The link between unconventional monetary policy and house prices has been relatively underexplored for the United Kingdom and the euro area. Nonetheless, it appears that central banks in these economies do pay attention to the possibility that unconventional measures may fuel housing booms.¹⁷

Third, for most countries in our sample, the *net distributional effect* of monetary policy depends on its relative impact on the value of housing assets and equities. Changes in house prices and equity returns tend to have opposite effects on inequality if housing assets are concentrated in "poorer" households and equity holdings are

¹⁶ Frost and Saiki (2014) study the impact of unconventional monetary policy on *income* inequality in Japan in a vector autoregression (VAR) framework. Using household survey data, they find that quantitative easing widened income inequality, especially after 2008 when policy became more aggressive. They identify capital gains resulting from higher asset prices as the main driver.

¹⁷ Reporting on the state of the housing price cycle in the euro area, the ECB recently listed "non-standard monetary policy measures [...] designed to keep interest rates low for some time to come" as one of the factors supporting house prices (ECB (2015)).

concentrated in “richer” ones.¹⁸ In these cases, to the extent that monetary policy has boosted equity prices more than house prices, it has tended to increase wealth inequality.

For illustration, consider the following example. In the United States, the share of equities in the portfolios of q5 households is about 15 percentage points higher than the corresponding share in the portfolios of q2 households while the share of real estate is about 35 percentage points lower. Hence, if monetary policy were to lift equity prices by 10%, it would have to raise house prices by about 4¼% to be distributionally neutral.

Finally, while monetary policy is likely to have contributed to lower borrowing costs, household leverage has further amplified the impact of lower asset returns on household inequality.

Conclusions

This feature has explored the recent evolution of household wealth inequality in AEs by simulating changes in the value of household assets and liabilities. The simulation results suggest that wealth inequality has generally risen in a sample of countries since the GFC.

The exercise provides tentative evidence of the relative importance of the channels through which monetary policy actions may have affected wealth inequality since the crisis. Taken at face value, our results suggest that the impact of low interest rates and rising bond prices on wealth inequality may have been small, while rising equity prices may have added to wealth inequality. A recovery of house prices appears to have only partly offset this effect.

However, important caveats apply when interpreting these results. First, the simulation is only a partial equilibrium exercise. Assets and liabilities vary over time not only because of valuation effects but also because of saving, borrowing and default, none of which are taken into account here. More fundamentally, our measure of wealth is incomplete. It does not capture the value of human capital, both in the form of the present value of future labour income and of accrued pension rights. As regards the former, monetary policy in the aftermath of the crisis obviously matters through its impact on unemployment and growth. Pension rights are not included in our study because of a number of conceptual challenges. That said, near zero or negative interest rates may well have had significant effects on such rights, not least through their impact on the viability of pension systems.

The empirical research on the nexus between monetary policy and inequality is still in its infancy. This reflects, on the one hand, the challenges associated with developing appropriate models that incorporate heterogeneous agents and the different channels through which monetary policy affects inequality. Moreover, data limitations are serious. This article suggests that further research on the distributional effects of monetary policy would be warranted. Because of their potential strength and persistence, understanding the distributional consequences of house price booms and busts – rather than the distributional impact of changes in bond prices – seems to be of particular importance.

¹⁸ In Italy, Spain, the United Kingdom and the United States, the “rich” hold relatively more stocks and the “poor” relatively more housing wealth. In other words, the “portfolio weight differential” between q5 and q2 is positive for stocks and negative for housing (see Table 2).

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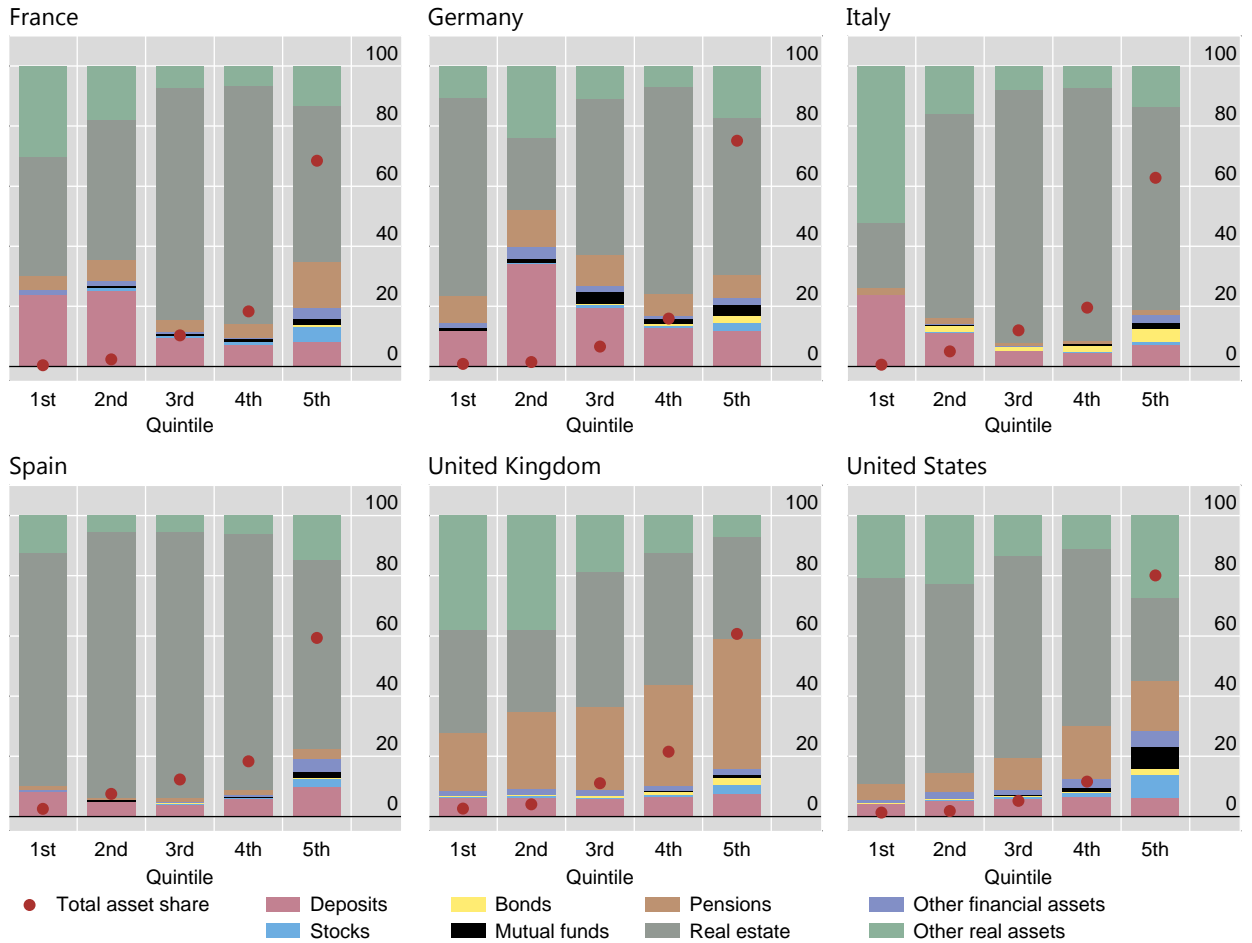
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Annex

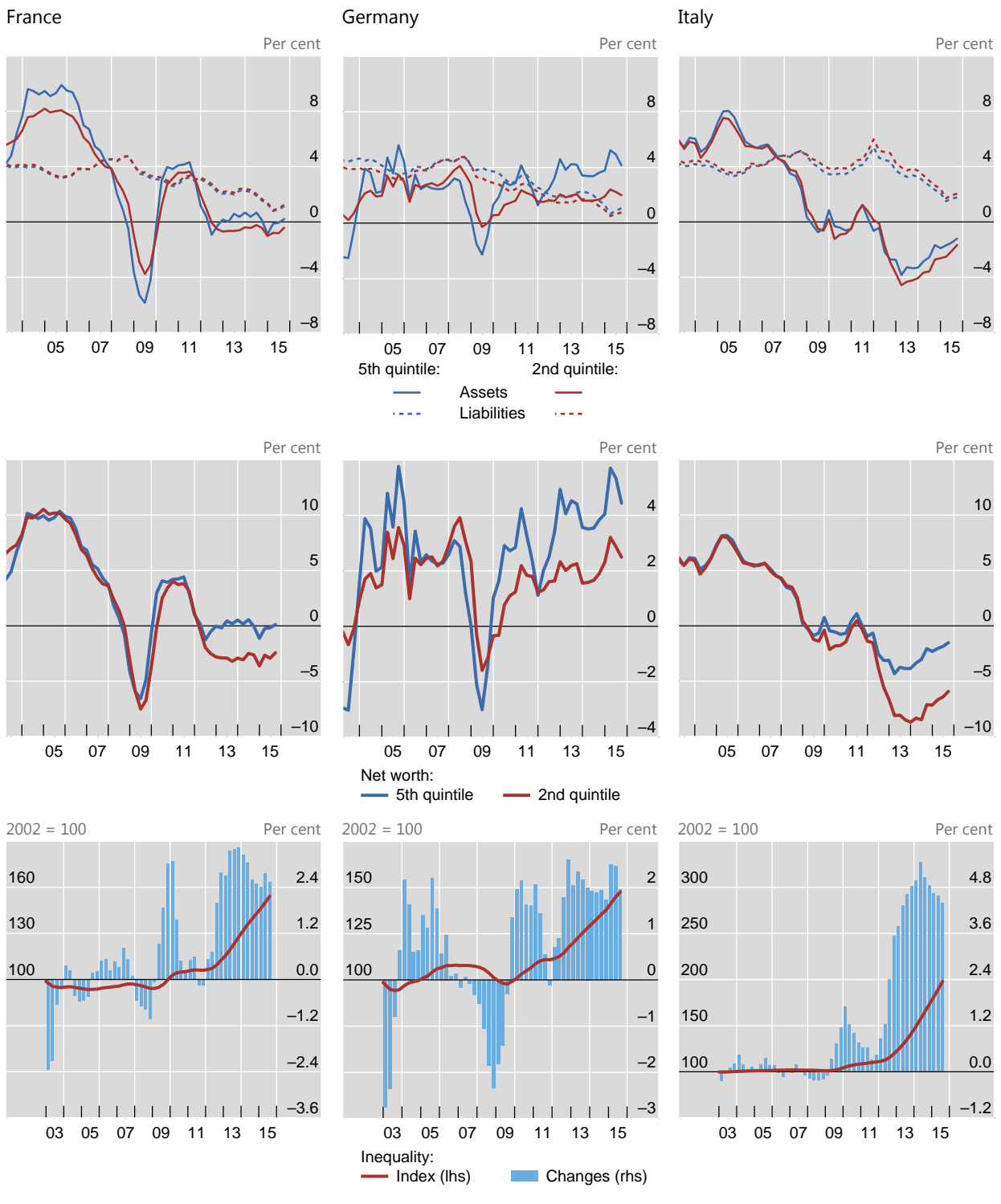
Distribution of assets by type, by net wealth quintile

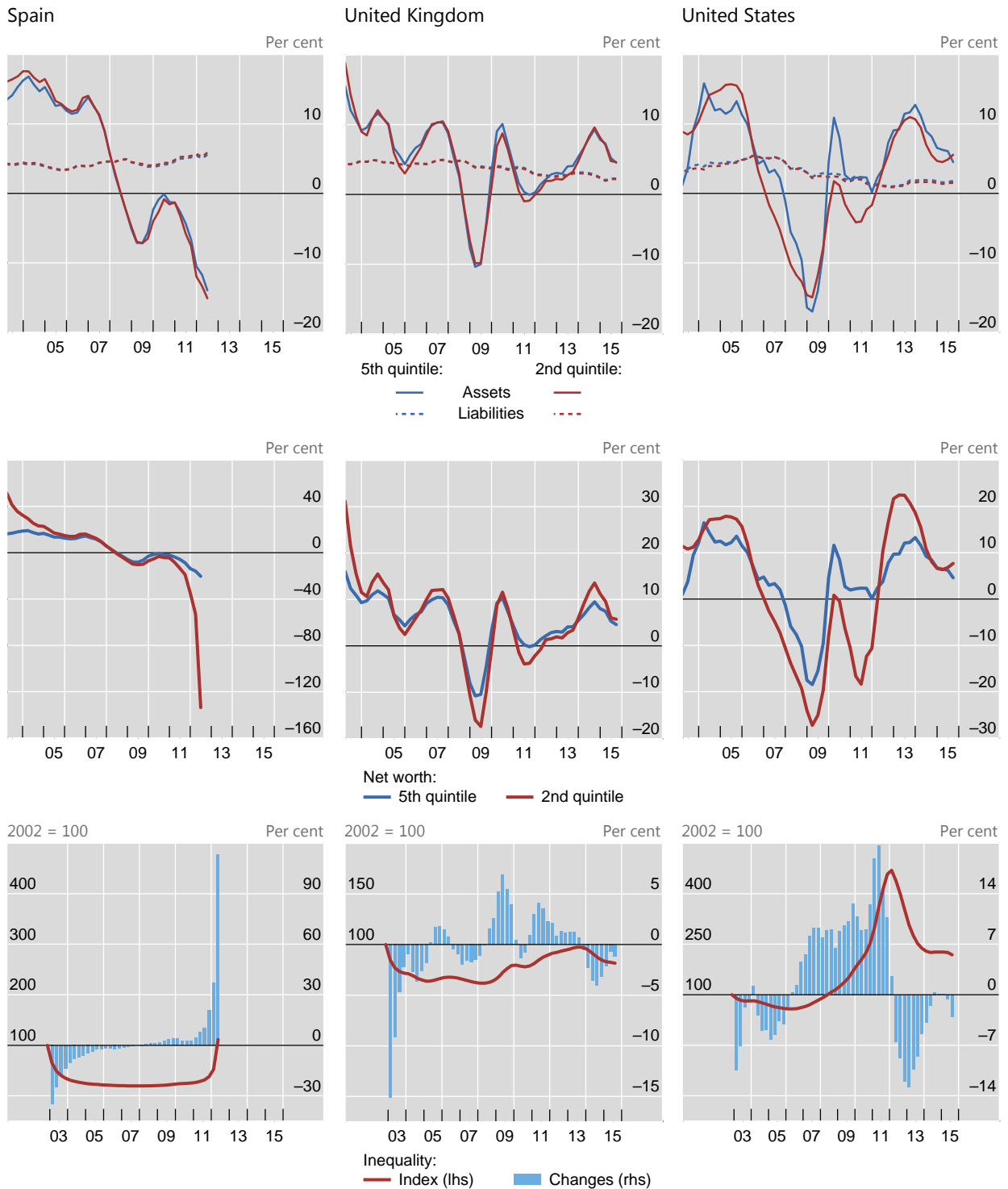
Percentage of total assets

Graph A1



Sources: Eurosystem, ECB Household Finance and Consumption Survey (wave 1); Federal Reserve Board, Survey of Consumer Finances (2013); UK Office for National Statistics, Wealth and Assets Survey (wave 3); authors' calculations.





Change in inequality is equal to the difference in the growth rate of net wealth between fifth and second quintiles. For details, see Box 2. Positive (negative) values are associated with an increase (decrease) in wealth inequality. In this simulation, housing debt is treated as bonds and non-housing debt as deposits.

Sources: Eurosystem, ECB Household Finance and Consumption Survey (wave 1); Federal Reserve Board, Survey of Consumer Finances (2013); UK Office for National Statistics, Wealth and Assets Survey (wave 3); Bank of America Merrill Lynch; Datastream; national data; authors' calculations.

The resilience of banks' international operations¹

This feature explores the resilience of banks' balance sheets after the 2008–09 financial crisis through the lens of a unique global data set crossing bank nationality and host country. We start by documenting post-crisis changes in the structure of BIS reporting banks' global operations across bank nationalities. We then zero in on the funding mix of banks' foreign affiliates (branches and subsidiaries) on the eve of the crisis, and how it helps explain the subsequent contraction of credit. We find that local claims backed by local funding made balance sheets more resilient, even after accounting for systematic differences between host countries and banking systems. By contrast, affiliates shrank more sharply if they had relied pre-crisis on non-core sources of funding, in the form of interbank, foreign currency and cross-border funding.

JEL classification: F34, G01, G21.

It is well known that international bank credit contracted sharply in the wake of the financial crisis of 2008–09, and again during the European sovereign crisis of 2010–12, with huge costs in terms of output and employment. What is less well understood is why, in both of these episodes, some banks' balance sheets contracted more sharply than others'. Many interrelated factors have played a role, including banks' business models, their asset quality and funding structures, recessions in countries they operated in, distressed funding and asset markets, and home and host country regulation.

This feature examines the role that banks' structure and funding mix played in the resilience of their balance sheets in the years following the financial crisis. To disentangle the various factors at play, we examine how the major banks' affiliates shed assets across host countries. We combine elements of the BIS international banking statistics to form a novel data set that crosses bank nationality and location to capture the balance sheets of *groups of affiliates* (eg German banks in the United Kingdom). This disaggregation of banks' consolidated balance sheets by host country matches the set of assets to the liabilities that support them. This reveals bank characteristics that other data sets conceal when they ignore the geography of banks' operations (as with data based on consolidated financial statements), or when they lump together domestic and foreign banks (as with national statistics).²

¹ The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. We are grateful to Natalya Martynova and Iman van Lelyveld for their collaboration at an early stage of this project, and to Jakub Demski for excellent statistical support. We also thank Claudio Borio, Ben Cohen, Dietrich Domanski, Krista Hughes, Robert McCauley, Hyun Shin, Kostas Tsatsaronis and seminar participants at the BIS for helpful comments.

² Our data set combines BIS locational and consolidated banking statistics for a time period preceding the recent enhancements to the statistics, discussed in Avdjiev et al (2015).

To explore the factors driving the balance sheet contractions in the wake of the crisis, we decompose their variation across affiliate groups into three sources. We find that they were larger for: (i) banks operating in troubled economies and offshore centres (*host country effect*); (ii) banks which, at a consolidated level, were more exposed to the financial crisis (*nationality effect*); and (iii) affiliates with a fragile funding mix. Our findings complement those of Hahm et al (2013), based on national data at the country level. By distinguishing banks in each host country by their nationality, our analysis also relates to Peek and Rosengren (1997), who trace how Japanese banks transmitted financial distress at home to the supply of credit in the United States through their US affiliates. The paper closest to ours is perhaps de Haas and van Lelyveld's (2014) study of multinational banking, using Bankscope data with less information on funding sources than is available in our data set.

A robust finding is that affiliate groups more attached to their host jurisdictions at the onset of the crisis – with local claims funded by local liabilities – experienced smaller balance sheet contractions in its aftermath. The local content in these affiliates' balance sheets, which often represents retail banking activity, provided resilience to their balance sheets when global wholesale funding markets seized up in the crisis. By contrast, affiliates that relied more on non-core liabilities, such as interbank, cross-border and cross-currency funding, experienced larger balance sheet contractions. These findings highlight that the way banks organise their international operations has important consequences for the distribution and resilience of global credit.

Banks' foreign positions during the crisis

Some banks weathered the 2008–09 financial crisis better than others. Graph 1 plots the stock of BIS reporting banks' foreign claims, ie credit that banks extend to borrowers outside their home country.³ Aggregated across all banks, foreign claims are still on a downward trajectory relative to global economic activity (Graph 1, left-hand panel). The contractions in European banks' balance sheets were amongst the most severe during the crisis, and were compounded by the European sovereign debt crisis starting in 2010 (centre panel).⁴ By contrast, Canadian, Japanese and Australian banks and several smaller banking systems experienced contractions following the crisis, but registered more robust growth in claims for much of the period thereafter (right-hand panel).

These differences across banking systems in part reflect the fact that the assets that lost value during the crisis were concentrated on European and US banks' balance sheets. But differences in business models also played a part; some banks extended more credit locally, to borrowers in the same host country, and often funded these claims from local sources too (McCauley et al (2012)). The large

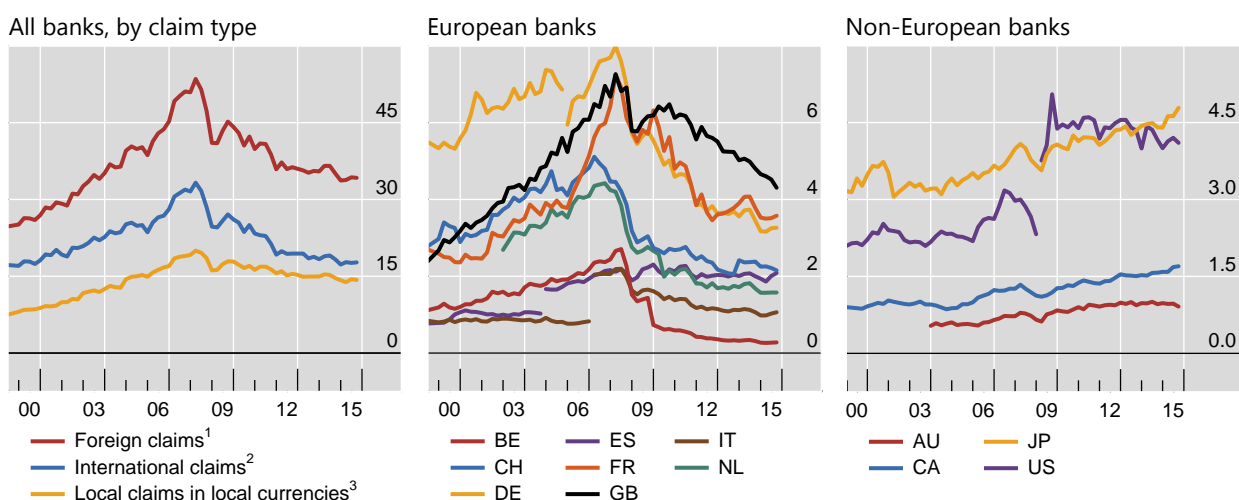
³ *Foreign claims* are a bank's financial claims on borrowers located outside the bank's home country, where "claims" includes both loans and holdings of financial securities. Foreign claims can be divided into *cross-border claims*, and *local claims* if the borrower is in the same country as the bank affiliate booking the claim. The term *international claims* refers to the sum of cross-border claims and local claims in foreign currencies (excluding local claims denominated in local currency).

⁴ Contractions in foreign claims can result from bank lending being reduced or written off, or securities being marked to market or sold at prices below book value. Another factor, valuation effects from the depreciation of currencies against the US dollar, is eliminated below.

Expansion and contraction in banks' foreign claims

As a percentage of world GDP

Graph 1



Gaps in the plotted series indicate breaks in series reflecting, for example, bank mergers or changes in the reporting population. Country codes denote the nationality of banks.

AU = Australia; BE = Belgium; CA = Canada; CH = Switzerland; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; IT = Italy; JP = Japan; NL = Netherlands; US = United States.

¹ BIS reporting banks' worldwide consolidated financial claims on counterparties outside their home country. ² Cross-border claims booked from all offices plus locally booked claims in foreign currencies booked in host countries. ³ Claims booked by banks' foreign affiliates denominated in the local currency of the host country vis-à-vis counterparties in the same host country.

Sources: IMF; BIS consolidated statistics (immediate borrower basis); authors' calculations.

internationally active Spanish banks are leading examples. In many host locations, this local activity reflects retail banking – eg credit to households and local businesses funded by retail and corporate deposits, mainly denominated in the local currency of the host country.

It is not obvious a priori what a local orientation implies for resilience. Local banking may represent relationships that banks maintain through good and bad times. Local business insulated many affiliates from the turmoil in global wholesale funding markets during the crisis; it may also have limited exposure to structured products, often held as cross-border claims on US borrowers. Depending on the host country, however, local claims may also have exposed affiliates to domestic property busts or to recessionary economies in the European sovereign debt crisis. This suggests that the stability implications of banks' organisational structure depend on the source of shocks and whether these are local or global in nature.

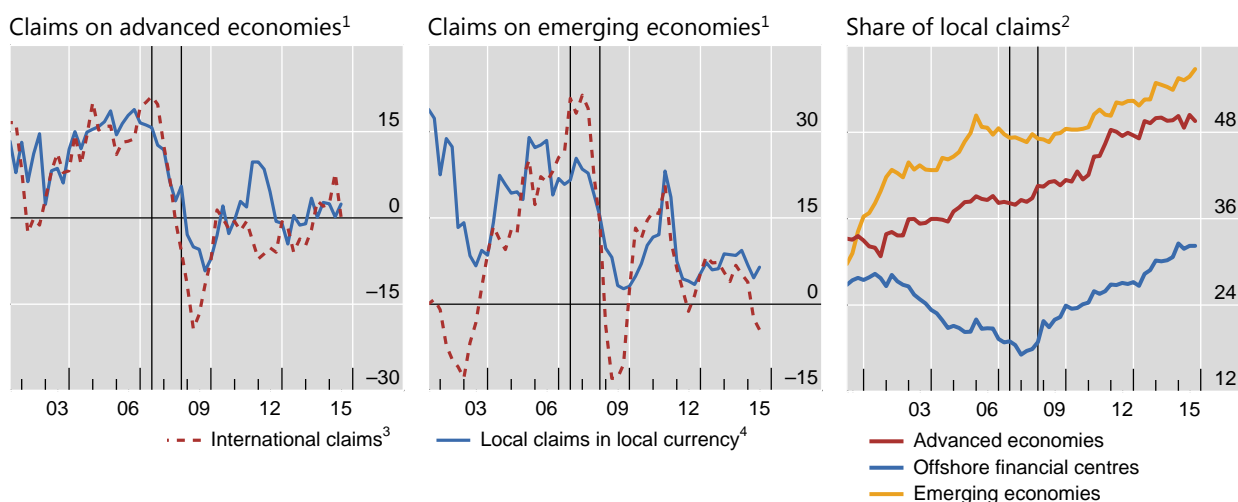
In aggregate, local positions seem to have provided resilience to banks' balance sheets during the financial crisis. Graph 2 compares the growth rates of international claims, which comprise cross-border and foreign currency claims, with those of local claims in local currencies. Both series are adjusted for breaks in series and exchange rate movements.⁵ Vis-à-vis both advanced economies (Graph 2, left-hand panel) and

⁵ The US dollar appreciated against the euro by 25% in the five months following the collapse of Lehman Brothers in the third quarter of 2008, and by even more against other currencies. Without adjustment, balance sheet positions denominated in currencies other than the US dollar register contractions when expressed in US dollar terms even in the absence of actual changes in the flow of credit.

The relative resilience of local claims

In per cent

Graph 2



The vertical black lines indicate end-Q2 2007, when global credit markets started to deteriorate, and end-Q3 2008, following the collapse of Lehman Brothers in mid-September of that year.

¹ Year-on-year growth rates of outstanding stocks adjusted for breaks in series and exchange rate movements. ² BIS reporting banks' combined local claims in local currencies as a share of total foreign claims vis-à-vis the group of countries listed in the legend. ³ Cross-border claims booked from all offices plus locally booked claims in foreign currencies booked in host countries. ⁴ Claims booked by banks' foreign affiliates denominated in the local currency of the host country vis-à-vis counterparties in the same host country.

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

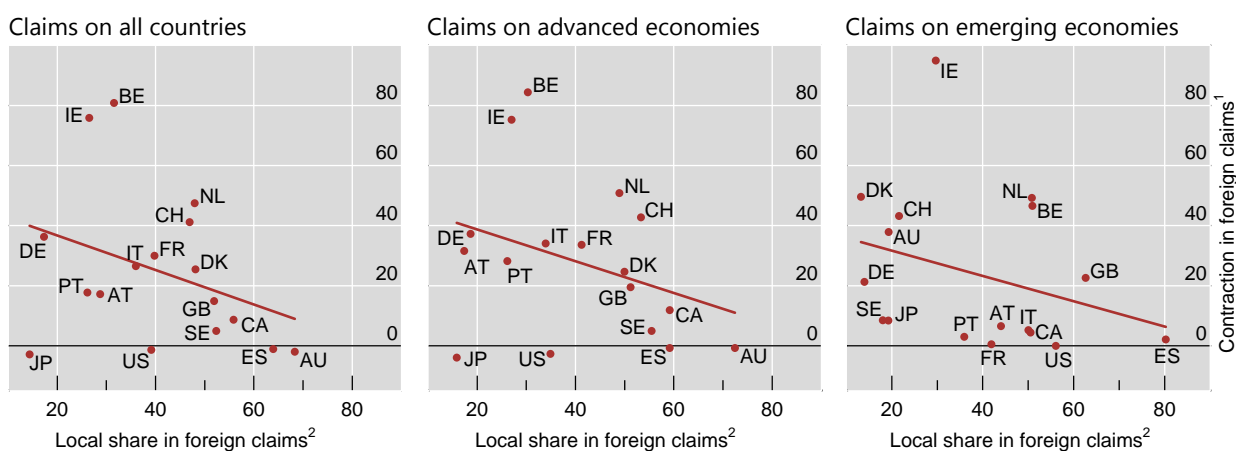
emerging market economies (EMEs) (centre panel), local claims in local currencies experienced much smaller contractions – and a smaller expansion in the run-up to the crisis – than did international claims. Indeed, vis-à-vis EMEs, the growth in aggregate local claims never turned negative post-crisis. As a result, local claims have been rising as a share of total foreign claims on all regions (right-hand panel).

At the level of individual banking systems, those with more of a local orientation on the eve of the crisis seemed to experience smaller balance sheet contractions once the crisis was under way. Graph 3 shows the contraction in 18 banking systems' consolidated foreign claims on counterparties in all countries (Graph 3, left-hand panel), in advanced economies (centre panel) and in EMEs (right-hand panel). These are plotted against the share of those claims that were booked locally in local currencies on the eve of the financial crisis. For each country grouping, there is a weak but discernible downward slope in the regression line. That said, there are some clear outliers. For example, Dutch and Belgian banks experienced some of the largest overall contractions, reflecting the breakup of ABN AMRO and Fortis. By contrast, Japanese banks hardly contracted at all, yet they had the lowest ratio of local claims to foreign claims. Japanese banks were less exposed to toxic assets, and suffered smaller losses during the crisis than did many European banking systems.

Local orientation mitigating the contraction in foreign claims

In per cent

Graph 3



AT = Austria; AU = Australia; BE = Belgium; CA = Canada; CH = Switzerland; DE = Germany; DK = Denmark; ES = Spain; FR = France; GB = United Kingdom; IE = Ireland; IT = Italy; JP = Japan; NL = Netherlands; PT = Portugal; SE = Sweden; US = United States.

¹ Peak-to-trough contractions in 18 banking systems' foreign claims on borrowers in the group of countries indicated in the panel heading. For each banking system, peak values are the maximum values observed in the Q1 2006–Q1 2009 period, and trough values the minimum values in the Q2 2009–Q2 2012 period. ² Share of foreign claims on borrowers in the group of countries indicated in the panel heading, booked as local claims in local currencies; average share during the Q1 2006–Q1 2009 period.

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

Banks have been urged by supervisors, shareholders and counterparties to make their balance sheets more resilient. The experience of the financial crisis shows that wholesale funding, in particular, can become unstable when market sentiment turns, making banks more vulnerable to financial shocks and economic downturns. By contrast, reliance on traditional retail deposit funding has been a stabilising force during periods of stress. Is the focus on funding structures justified? The next section more formally examines the relationship between banks' funding mix on the eve of the crisis and the resilience of their balance sheets in its wake.

Bank nationality, host country and the funding mix

As illustrated in Graph 3, some banking systems fared worse than others in terms of how much their balance sheets contracted in the aftermath of the crisis. In this section, we analyse to what extent this variation relates to banks' funding mix, while separating out factors common to each location (eg recession in the host country), as well as those factors common to banks headquartered in a particular country (eg crisis-related losses for the parent bank). To do so, we rely on a disaggregated data set, one that matches the assets of affiliate groups (branches and subsidiaries) with the liabilities funding them.

We combine data from the BIS international banking statistics (IBS) to provide a granular picture of the full balance sheets of banks' foreign affiliates. The data set aligns the assets booked by banks of a given nationality in a particular host country with the liabilities that fund those assets, at the level of affiliate groups (eg German

banks in the United Kingdom).⁶ This disaggregation allows us to see how banks of a specific nationality shed assets in every host country in which they operate, and observe differences that a consolidated view would conceal. In particular, we can isolate each affiliate group's local positions (assets and liabilities) and examine their contribution to balance sheet resilience. This allows us to test whether bank affiliates with stronger ties to local counterparties were in fact more stable. We also control for other aspects of their funding structure, notably their reliance on "non-core funding", which Hahm et al (2013) define as liabilities other than retail deposits.

For each affiliate group, assets and liabilities are broken down into the components shown in Table 1. Our measures of non-core liabilities make use of the currency of denomination, and the location and sector of the counterparty, ie the borrower. The availability of these dimensions distinguishes the BIS international banking statistics from other banking data sets and the studies using them.⁷ The counterparty can either be in the same jurisdiction (local) or abroad (cross-border). Furthermore, the counterparty can be a non-bank or a bank, and interbank positions can in turn be intragroup (within the same banking group), vis-à-vis other banks or vis-à-vis official monetary authorities.⁸ By excluding intragroup funding, our measure of interbank borrowing focuses on funding from unaffiliated banks. Finally, positions are also reported by the currency of denomination, including the main international currencies (US dollar, euro and yen), the local currency of the host country and other foreign currencies. Unfortunately, the IBS do not provide an instrument breakdown (eg deposits versus wholesale debt funding) at the level of bank affiliate groups. It is plausible, however, that the stability of a bank's funding depends as much on the behaviour of its counterparties as on the legal form of their claims, as noted by Hahm et al (2013).

Our analysis concentrates on banks' foreign affiliates. Banks' offices in the home country (eg French banks in France) are excluded, for two reasons. First, including the home offices in the empirical analysis would introduce a large element of domestic banking, whereas the focus of this study is on banks' foreign claims. For most banking systems, the balance sheets of home offices mainly consist of "strictly domestic" positions,⁹ whereas their foreign affiliates show more variation in their funding models across host countries. Second, the IBS do not contain the full balance sheet

⁶ "Bank nationality" is the country of a bank's headquarters, and the host country is the location where their foreign affiliates operate. The data are constructed by splicing together the BIS locational banking statistics by nationality (LBSN), which track the cross-border and local positions in foreign currencies for banks of different nationalities in a particular host (reporting) country; and the BIS consolidated banking statistics (CBS), which contain the local positions (claims and liabilities) in local currencies of these foreign affiliates in each host country (see McGuire and von Peter (2009) and Fender and McGuire (2010) for discussion).

⁷ Most publicly available data are consolidated worldwide balance sheets. Where data on unconsolidated entities are available, they may not report a comprehensive balance sheet for the location where bank affiliates operate, depending on the treatment of branches. Moreover, such data typically shed no light on the location of counterparties, nor do they identify the counterparty sector or the currency, yet all these aspects are key for the analysis of banks' funding mix. For example, de Haas and van Lelyveld (2014) are limited to studying deposit versus wholesale funding, as currency and counterparty information is unavailable in Bankscope.

⁸ Note that the counterparty sectoral breakdown is available for all cross-border positions and for local positions in foreign currencies, but not for local positions in local currencies. In constructing the overall interbank borrowing share for each affiliate group, we assume the sector shares for these positions are the same as those for which the breakdown is available.

⁹ These are positions booked by banks' home offices vis-à-vis their home country residents and denominated in the domestic currency.

Coverage of banks' foreign affiliates in the BIS international banking statistics¹

Table 1

Assets		Liabilities	
Position	Sectoral breakdown ²	Position	Sectoral breakdown ²
Cross-border claims	Yes	Cross-border liabilities	Yes
in local currency	Yes	in local currency	Yes
in foreign currencies	Yes	in foreign currencies	Yes
Local claims ³	Incomplete	Local liabilities ³	Incomplete
in local currency	No	in local currency	No
in foreign currencies	Yes	in foreign currencies	Yes

¹ Breakdown of items on the balance sheet of a bank or bank affiliate located in a particular host jurisdiction. ² Cross-border positions and local positions in foreign currencies can be further divided by counterparty sector (non-banks, unaffiliated banks, intragroup and official monetary authorities). ³ Local positions booked by banks' foreign affiliates with a counterparty located in the host country.

of banks' home offices since they miss the "strictly domestic" positions. Thus, even if there were a reason to include the home offices in the sample, few ratios used as explanatory variables can be calculated with precision.

The full data set captures the quarterly positions, from 1999 onward, of the foreign affiliates for 26 bank nationalities operating in 40 host countries.¹⁰ From an initial sample of 650 nationality-location pairs, we exclude 34 home offices and filter out observations with data shortcomings to create a sample of 255 affiliate groups spanning 17 parent countries and 38 different host jurisdictions, including major offshore centres.¹¹ The combined peak assets among affiliates in the sample equals \$24.4 trillion, or 90% of total assets of all affiliates (but only 53% of the full reporting population including all home offices). Credit to local borrowers accounts for nearly 50% of affiliates' total assets; the remainder consists of cross-border claims. The sample is unbalanced in the sense that not all bank nationalities have operations in all host countries.

We use a peak-to-trough approach to measure the contraction in the balance sheets of banks' foreign affiliates in the wake of the financial crisis. For each group of affiliates, the percentage contraction is calculated by comparing the peak value of total assets between Q1 2006 and Q1 2009 with the minimum asset value from Q2 2009 to Q2 2012. This approach takes into account that banks' assets peaked in different quarters, with most peaks occurring in Q4 2008 or Q1 2009; banks also shed assets at different rates and in different periods, eg due to the uneven effect across bank nationalities of the 2010–12 European sovereign debt crisis. Growth rates are calculated at constant exchange rates. The sample average of peak-to-trough

¹⁰ The data set is internally consistent in the sense that the sum of the balance sheets across all 40 host jurisdictions (including the home country) for any one bank nationality yields an aggregate (net of intragroup positions) value of foreign claims close to the value reported in the BIS consolidated banking statistics.

¹¹ We drop pairs where the matched LBSN and CBS data yield an incoherent picture of the affiliate groups' balance sheets (eg where total assets and total liabilities differ significantly), pairs where the affiliate groups' total assets (at the peak) are less than \$1 billion or lack essential breakdowns, and those with large jumps due to mergers and acquisitions.

contractions is between 34% and 36%, whether one uses the mean, weighted mean or median.¹²

Our cross-sectional regression relates the rate of contraction to pre-crisis ratios describing the structure of banks' asset and liabilities. The dependent variable, $-\Delta A_{in}/A_{in}$, is the percentage contraction of total assets booked by bank affiliates of nationality n in host country i , indexed by in . The minus sign means that positive values are contractions and negative values are expansions. These growth rates are regressed on various balance sheet ratios (R_{in}^r) specific to each affiliate group prior to the crisis, along with various controls,¹³

$$-\Delta A_{in}/A_{in} = \sum_r (\beta^r * R_{in}^r) + \log(A_{in}) + \log(d_{in}) + \lambda_i + \sigma_n + \varepsilon_{i,n}.$$

The factors driving credit contractions now fall into three groups. At the level of affiliates, the coefficients β^r measure the extent to which a particular funding ratio (r), such as interbank borrowing, accelerated (or mitigated if negative) the shedding of assets by the affiliates of nationality n in host country i . The controls include *balance sheet size* of the affiliates, measured as the logarithm of total assets (A_{in}), and the (log of) *geographical distance* to the affiliates' home country (d_{in}). We also add two groups of controls at the country level: σ_n captures factors common to all banks of a specific *nationality* n , such as their group-wide business model or home country regulation. Likewise, λ_i is a set of dummies that absorbs the factors affecting all affiliates operating in *host country* i , including local demand conditions and sovereign risk. In gauging these common effects, the fixed effects λ_i and σ_n are of interest in their own right, but also allow for consistent estimation of the funding ratios.¹⁴

The main explanatory variables include various affiliate-specific funding ratios, measured at the peak. *Local intermediation (LIM)* measures the attachment of bank affiliates to the host country in which they operate. It matches their local lending to their local funding, and expresses the minimum as a share of their balance sheet.¹⁵ The measure increases when affiliates both lend locally *and* fund these positions locally. It is close to zero, however, for affiliates specialised in fund-raising (borrowing funds to send them abroad), or those intermediating capital inflows (borrowing abroad to fund local credit). At 20%, the median of local intermediation is fairly low, since the sample consists of foreign branches and subsidiaries.

We also include measures describing banks' reliance on non-core funding identified in the literature (Hahm et al (2013), Yorulmazer (2014), Bruno and

¹² Shortening the trough window produces smaller contractions, but also tilts the results in favour of our hypothesis that local positions provided resilience. Our window includes the European sovereign debt crisis, where local business also declined as countries sank deeper into recession.

¹³ This equation is estimated with clustered standard errors allowing for correlation within the 17 bank nationalities in the sample.

¹⁴ This specification follows best practice in the gravity literature in international trade and finance (eg Anderson and van Wincoop (2003), Okawa and van Wincoop (2012)), where consistent estimates of the coefficients on bilateral variables (eg distance) are obtained by including fixed effects for each origin and destination country. In our context, the "bilateral" variables are the balance sheet ratios.

¹⁵ The share of local intermediation equals $LIM_{in} = 100 * \min\{LC_{in}, LL_{in}\} / TB_{in}$, where LC_{in} is local claims in all currencies and LL_{in} is local liabilities in all currencies in country i booked by bank affiliates from country n , expressed as a percentage of total balance sheet size TB_{in} . The extent of local intermediation also helps to identify banking groups that run a decentralised, multinational business model (McCauley et al (2012)).

Shin (2015)). Specifically, we construct *foreign currency funding*, the share of liabilities denominated in foreign currencies; *cross-border funding*, the share of liabilities raised cross-border; *interbank funding*, the share of liabilities borrowed from unaffiliated banks; and *net intragroup funding*, the share of liabilities that are cross-border transfers within a banking group. Each of these funding modes may be less stable than traditional core funding in domestic currency, from local sources and from non-bank counterparties (Hahm et al (2013)). The variable *US dollar funding needs* gauges the extent to which banks funded US dollar assets in a currency other than the US dollar; it is an indirect estimate of the demand for US dollar funding from the interbank market and through FX swaps.

The first observation, confirming the earlier graphical discussion, is that there are systematic differences across banking systems and across host countries. A regression with no affiliate-specific variables shows that the country-specific controls jointly account for 44% of the variation in balance sheet contractions. The *host country effect* shows that the average contraction across all affiliates in a given location was larger in troubled economies and some offshore centres serving as conduits. Offices in Ireland, Greece, Luxembourg, the Cayman Islands, the Bahamas, Jersey and Guernsey shed more than 40% of their assets. Similarly, claims booked by offices in the United Kingdom contracted by 36% on average, partly because many banks held structured finance products that lost value in the crisis with their affiliates in London and other financial centres (if not their home offices).

For its part, the *nationality effect* alone explains 31% of variation in the credit contractions across affiliates. This captures the commonality among affiliates from the same parent country, across all host countries. For example, Fortis and ABN AMRO were broken up during the crisis, and so the aggregate balance sheets of Belgian and Dutch banks' affiliates (as reported to the IBS) contracted in many host locations. The nationality effect implies that Belgian and Dutch banks on average shed, respectively, 15% and 18% more of their assets than banks of other nationalities.¹⁶ Similarly, being an affiliate of a German bank added 22 percentage points to the average contraction in any given host country. By contrast, having a Japanese or Australian parent mitigated the predicted contraction by 16 and 21 percentage points, respectively, since the respective banking groups emerged from the crisis largely unscathed.

The strength of these commonalities sets a high hurdle for finding any additional significance in the funding ratios of interest. Against this background, Table 2 builds up our regression in several steps, where each model includes fixed effects and two further controls. In all models, *balance sheet size* turned out to limit the subsequent contraction, perhaps because larger affiliates had better access to funding markets, and ultimately to the lender of last resort. By contrast, the *geographical distance* between bank affiliates and their headquarters generally added to the predicted contractions, implying that affiliates active in host countries further from home tended to shed more assets.¹⁷ Ideally, we would also control for asset quality as a possible driver of balance sheet contractions, but data limitations at the affiliate level are prohibitive. The fixed effects may capture some patterns in banks' exposure to

¹⁶ The specific numbers for the nationality fixed effects quoted here differ slightly from those of Model IV shown in Table 2. Note that the results in Table 2 are robust to the exclusion of all Dutch and Belgian affiliate groups from the sample. They are also robust to the inclusion of major offices of Austrian and Irish banks.

¹⁷ For example, being 10,000 km away from home was associated with 4% more balance sheet contraction than being located 3,700 km from headquarters. This distance effect hints at international banks' post-crisis drive to refocus on their core business closer to home.

non-performing assets, to the extent that these were booked in certain countries (eg financial centres) or concentrated in specific banking systems.

A second finding is that the *pairing* of local assets with local funding apparently provided resilience, as witnessed by the variable *LIM* in Model I. This happens to be the most robust regressor at the affiliate level, explaining 5% of the variance in balance sheet contractions. The estimated coefficient (–0.4) suggests that banks doing 10% more business locally shrank by 4 percentage points less on average. When *LIM* is replaced by the share of local claims or the share of local liabilities, these are also significant, both alone and jointly. But it is the combined local focus on both sides of the balance sheet (*LIM*) that best explains the affiliates’ resilience, presumably because it is more indicative of retail business. In analogous regressions (not shown)

The resilience of banks’ foreign operations

Dependent variable: peak-to-trough percentage contractions in total assets¹

Table 2

	Model I	Model II ²	Model III ³	Model IV ³
Local intermediation ⁴	–0.42*** (–8.16)	–0.47*** (–4.52)		–0.28*** (–4.90)
Cross-border funding ⁵		–0.22** (–2.48)	0.13* (1.74)	
Interbank funding ⁶		0.10** (2.51)	0.23*** (3.70)	0.24*** (3.95)
Foreign currency funding ⁷		0.15*** (2.83)	0.11** (2.14)	0.08* (1.90)
USD funding needs ⁸			0.24*** (3.76)	0.15** (2.20)
Net intragroup funding ⁹				0.14* (1.78)
Balance sheet size ¹⁰	–3.47*** (–4.35)	–3.83*** (–4.69)	–4.43*** (–5.40)	–3.19*** (–3.99)
Distance to home ¹¹	3.46*** (3.39)	3.67*** (3.54)	3.61*** (3.59)	3.56*** (3.50)
Fixed effects λ_i, σ_n	<i>Included in all columns (not shown)</i>			
Number of observations	255	253	250	250
Measure of fit (R^2)	0.53	0.54	0.55	0.56

Estimation coefficients are shown with t-values in parentheses. Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

¹ Percentage contraction in total balance sheet assets of affiliate groups (branches and subsidiaries) of banks of a given nationality located in a particular host jurisdiction (eg US banks in the United Kingdom), *excluding* banks’ home offices (eg UK banks in the United Kingdom). Peak asset values are taken between Q1 2006 and Q1 2009, and trough values between Q2 2009 and Q2 2012. These observations are regressed on measures of affiliates’ liability structure and controls, including fixed effects by nationality and location in all columns. ² Non-core measures defined as percentages of total liabilities. ³ Non-core measures defined as ratios of non-core to core liabilities. ⁴ Local intermediation as a share of total balance sheet; in per cent (see footnote 15 in the main text). ⁵ Cross-border liabilities as a share of total liabilities (Model II) or as a ratio to local liabilities (Models III–IV). ⁶ Interbank liabilities (excluding intragroup funding) as a share of total liabilities (Model II), or as a ratio to liabilities to non-banks (Models III–IV). ⁷ Foreign currency liabilities as a share of total liabilities (Model II), or as a ratio to local currency liabilities (Models III–IV). Foreign currencies are currencies other than the domestic currency of the host country. ⁸ Net borrowing of US dollars via the interbank market and through FX swaps if positive, as a share of total assets. ⁹ Net intragroup funding, if positive, as a share of total liabilities. ¹⁰ Natural log of total assets (in USD millions). ¹¹ Natural log of distance (in kilometres) between host country and the affiliates’ country of headquarters.

Sources: CEPII; BIS consolidated banking statistics; BIS locational banking statistics; authors’ calculations.

of the contraction in each affiliate group's *local claims* only, on the share of local assets backed by local liabilities, the coefficient is also highly significant at -0.6 .¹⁸

The remaining columns in Table 2 introduce measures of affiliate groups' reliance on non-core funding. *LIM* continues to enter significantly, with the size of the estimated coefficient falling as more variables are added. Model II lends some support to the conjecture that foreign currency, cross-border and interbank liabilities were more fragile forms of funding. The coefficient on *foreign currency funding* indicates that for every 10% of foreign currency borrowing in their funding mix, affiliates subsequently shed 1.5% more assets. *Interbank funding* has a similar effect. Oddly, *cross-border funding* appears to slow down banks' post-crisis contraction, but this is because *LIM* already captures the stabilising role of local (as opposed to cross-border) funding.¹⁹

It is possible that non-core funding becomes unstable only when excessive reliance is placed upon it. Model III includes the same non-core liabilities, but expressed as ratios to core liabilities (rather than shares of total liabilities).²⁰ The ratio transform magnifies the difference between banks that rely more heavily on non-core funding, notably those beyond 80% – a threshold that may well alarm creditors. Here, all three dimensions of non-core funding have some explanatory power with the expected sign. Interbank funding from unaffiliated banks appears to contribute most strongly to the subsequent contraction in assets, followed by cross-border and foreign-currency borrowing. These results complement Hahm et al (2013), who show that non-core/core ratios help predict credit and currency crises.

Model III also includes one currency-specific variable, *US dollar funding needs*. This estimate of affiliates' net short-term borrowing in US dollars turns out to be the most significant variable amongst the various currency-related funding ratios. Taken at face value, the coefficient predicts 2.4% more asset shedding for every 10% of an affiliate's balance sheet funded by short-term dollar funding. Dollar funding needs played a central role in the financial crisis: many (notably European) banks faced difficulty in rolling over these funding positions during the crisis (McGuire and von Peter (2012)).

Finally, Model IV includes *net intragroup funding* (alongside *LIM*) to examine whether pre-crisis reliance on internal capital markets helped affiliates support their balance sheet. Although this measure is not always significant, the estimate suggests that pre-crisis net recipients, if anything, shrank more during the crisis. This does not imply that intragroup transfers were unhelpful once the crisis broke out; rather, the generalised seizure of global wholesale funding made it difficult for banking groups to maintain active internal markets to fund affiliates across multiple host countries. Indeed, de Haas and van Lelyveld (2014) find that foreign bank subsidiaries reduced credit growth more aggressively than domestic banks in 2008–09 – in contrast to earlier experience where internal markets helped to smooth more localised funding crises.

¹⁸ A similar result is obtained from regressing the contraction in *local claims in local currency* on the share that is funded by *local liabilities in local currency*.

¹⁹ Dropping *LIM* from this regression yields a statistically insignificant coefficient on the cross-border share; much of the information in the cross-border share is also contained in the foreign currency share (the correlation between these shares equals 71%).

²⁰ Core liabilities are simply total liabilities minus non-core liabilities as defined above. The typical affiliate group in the sample has non-core funding shares of about 70% of total liabilities, leading to median non-core/core ratios of 2.4 ($\approx 70/30$), in the three dimensions.

In sum, several funding variables at the affiliate level help explain why some banks cut credit more than others in the years after 2008. That said, there are systematic patterns in the way banks shed assets that relate to their nationality and location, as identified by the fixed effects. Some host countries were hit harder during the crisis, affecting all offices located there. For its part, the nationality effect is particularly potent in explaining credit contractions, pointing to a strong commonality among banks from the same home country.

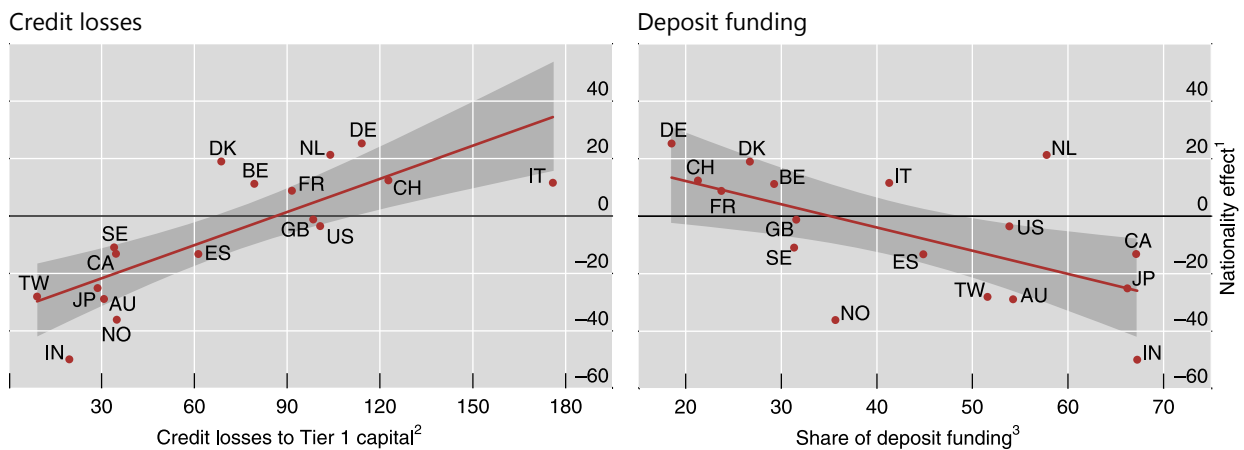
Some banking systems shrank their operations in many locations, possibly due to financial distress at the group level. Credit losses in the financial crisis are known to have decimated the capital base of many internationally active banks. That this in turn led banks to cut credit can be gleaned from Graph 4 (left-hand panel): banking systems recording greater *credit losses* tended to shrink their balance sheets by more – and do so in many locations. The nationality effect correlates as strongly with banks' reliance on *deposit funding* (Graph 4, right-hand panel): the more banks relied on deposits in their overall funding structure, the less their affiliates abroad cut credit in the aftermath of the crisis.

We are led to the conclusion that funding structures may be more important than the measures of fit in Table 2 suggest. The two sets of fixed effects absorb all factors common to host countries or to bank nationalities, respectively, and that includes the extent to which funding structures were systematically more fragile among banks of particular nationalities, or among affiliates in certain locations (such as financial centres). The full effect of funding models should therefore add their contribution to the size of the overall contractions embodied in the fixed effects.

Drivers of the nationality effect

In per cent

Graph 4



AU = Australia; BE = Belgium; CA = Canada; CH = Switzerland; DE = Germany; DK = Denmark; ES = Spain; FR = France; GB = United Kingdom; IN = India; IT = Italy; JP = Japan; NL = Netherlands; NO = Norway; SE = Sweden; TW = Chinese Taipei; US = United States.

The red line represents the simple linear projection using only the variable shown on the horizontal axis as a regressor. The shaded area is the 95% confidence interval.

¹ Contribution of bank nationality to the average contraction of affiliates' balance sheets, from the nationality fixed effects of Model IV in Table 2. ² Total credit losses reported between 2008 and 2010 by major banks headquartered in the countries shown, as a share of the same banks' combined Tier 1 capital as of end-2008. For each bank entering these country aggregates, total credit losses are taken to be the larger value from two different sources: the maximum of non-performing loans reported in 2008–10 (SNL Financial), and reported credit losses on loans and securities (Bloomberg). ³ Total deposits as a percentage of total debt liabilities (including domestic banking liabilities) as of end-2008, weighted average across major banks headquartered in the countries shown.

Sources: Bloomberg; SNL Financial; authors' calculations.

Other factors, when included, instead may mitigate the measured importance of funding models: we lacked the data to control for affiliates' asset quality, surely another key driver of credit contractions following the financial crisis. Disentangling the complicated interplay between funding models and other drivers at the levels of affiliates, banking groups and host countries certainly warrants further work.

Conclusions

The structure of international banking in the post-crisis period was shaped by forces that surfaced in the financial crisis and its aftermath. Using a novel data set on major banks' foreign affiliates, this feature explores how the credit contractions across host countries and banking systems relate to their pre-crisis funding structures. Our findings suggest that local relationships helped sustain credit after the financial crisis, and that banks shed more assets when their funding mix depended on non-core liabilities, such as cross-border, interbank and foreign currency liabilities. However, the strong commonality across affiliates of the same nationality points to the importance of bank health at the group level. Banks with larger credit losses and non-core funding spread credit contractions across many host countries. This complements other evidence in the literature that global banks can have a stabilising or destabilising effect on the economies they operate in, depending on the nature of the shocks they face.

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Hanging up the phone – electronic trading in fixed income markets and its implications¹

This article explores drivers and implications of the rising use of electronic and automated trading in fixed income markets – a process we refer to as “electronification”. We take stock of the current state of electronic trading and how it has changed the market ecosystem, its resilience and its overall functioning. We argue that the impact of electronic and automated trading is visible in a number of dimensions of market liquidity and price efficiency. With market participants adjusting to the new market structure, several new challenges have emerged that warrant attention from policymakers.

JEL classification: F31, G12, G15, C42, C82.

Electronic and automated trading have become an increasingly important part of fixed income markets in recent years. They have replaced voice trading as the new standard for many fixed income asset classes – market participants are literally “hanging up the phone”. For the most actively traded instruments, the take-up of electronic and automated trading has reached levels similar to those observed in equity and foreign exchange markets, although other fixed income segments (eg high-yield corporate bonds) still lag behind.

“Electronification” (ie the rising use of electronic trading) is shaping the process of price formation and the nature of liquidity provision. It has facilitated automated trading (AT), particularly in the form of high-frequency trading (HFT) strategies in fixed income futures and wholesale markets for major benchmark bonds.² New market participants (outside the traditional dealer community) have emerged and actively participate in these markets as liquidity providers and seekers. And, reinforced by changes in the nature of intermediation, innovative trading venues and protocols have proliferated. What many of these initiatives have in common is that they aim to overcome some of the liquidity challenges inherent in asset classes where trading is infrequent, such as corporate bonds.

¹ The authors would like to thank Claudio Borio, Ben Cohen (the editor), Dietrich Domanski, Michael Fleming, Corey Garriott, Eleonora Iachini, Bob McCauley, Ernst Schaumburg and Brian Weller for helpful comments. The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements, the Committee on the Global Financial System or the Markets Committee.

² For the purpose of this article, we define AT as a trading technology in which orders and trade decisions are made electronically and autonomously, ie with no human intervention (Markets Committee (2011)). HFT is a subset of AT in which orders (including order cancellations) are submitted and trades executed at high speed (Markets Committee (2016)).

These trends can have broad implications for the functioning of financial markets and the distribution of risks among their participants. Given the importance of fixed income markets for the funding of the real economy and financial stability more broadly, policymakers have a strong interest in assessing how electronification may be affecting market quality. By market quality, we mean the extent to which it is possible to transact at prices that accurately reflect the fundamental value of the asset, with immediacy, and in volume. The concept can be viewed as the amalgamation of price efficiency and market liquidity.³

Drawing from two recent reports by the Committee on the Global Financial System (CGFS) and the Markets Committee (MC), respectively, this feature takes stock of the current state of electronic trading in fixed income markets and investigates its drivers and the implications for the market ecosystem and its functioning.⁴ The remainder of the article is organised as follows. The first section describes how the market structure is evolving. The second looks at its current state based on an MC survey of electronic trading platforms (ETPs). The third explores the possible implications of these changes for market quality, the nature of liquidity and its monitoring. The last section concludes with a discussion of policy challenges.

How is the market structure evolving?

Traditionally, trading in fixed income securities has been centred on dealers (large banks or securities houses) and their network of trading relationships. Trades have been executed bilaterally – over the counter (OTC) – that is, without a centralised marketplace or exchange.⁵

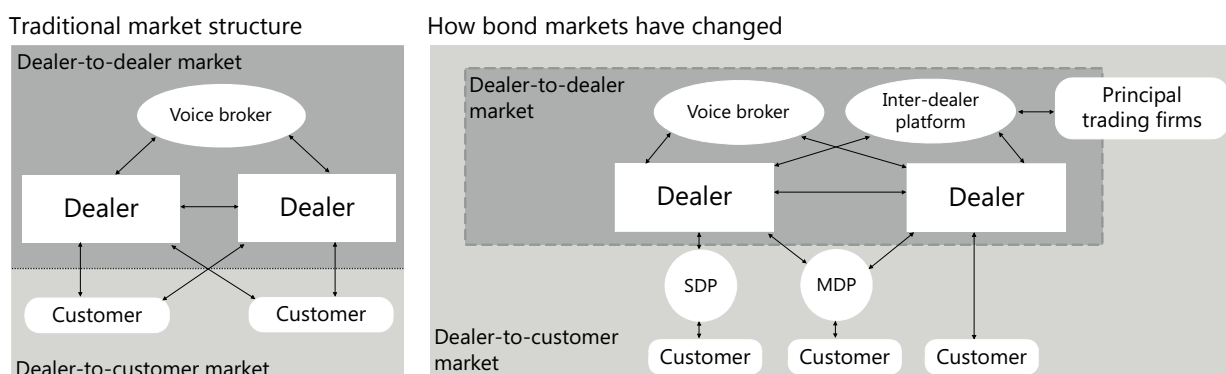
This market structure separated the dealer-to-dealer market, in which dealers trade exclusively with one another, and the dealer-to-customer market, in which they trade with customers, such as asset managers, pension funds, insurance companies and corporations (Graph 1, left-hand panel). Market participants predominantly negotiated terms of a trade via telephone or electronic chatting systems (ie bilaterally). The process of matching buyers and sellers involved significant search costs (Duffie (2012)). A customer needed to contact one or more dealers, asking for currently available prices and quantities to buy or sell a specific security. Within the dealer-to-dealer market, specialised voice brokers helped facilitate and anonymise the matching process by exchanging information on dealers' buy and sell interest.

Fixed income markets experienced a major shift starting in the late 1990s (Graph 1, right-hand panel). At that time, ETPs started to gain traction in dealer-to-dealer markets for the most actively traded sovereign bonds. One example was the launch of EuroMTS in 1998 as a pan-European platform for sovereign bonds, agency

³ "Market liquidity" can be broadly defined as the ability to rapidly execute large financial transactions at low cost with limited price impact (CGFS (1999)). The price of an asset is considered to be efficient if it reflects the asset's fundamental value based on all the information available to market participants at any given point in time (see Markets Committee (2016) for a discussion).

⁴ CGFS (2016) and Markets Committee (2016).

⁵ Interestingly, however, government and corporate bonds in the United States once traded actively on the New York Stock Exchange, and bond trading on the exchange was still active until the late 1940s, before migrating to OTC markets (Biais and Green (2007)). A detailed discussion of electronic trading in the US Treasury market is provided by Mizrach and Neely (2006) and Fleming et al (2014).



MDP = multi-dealer platform; SDP = single-dealer platform.

Source: Markets Committee (2016).

bonds and repos. eSpeed and BrokerTec, both founded in 1999, are examples of ETPs for dealer-to-dealer trading of benchmark (“on-the-run”) US Treasury securities.

Electronic trading in the dealer-to-customer segment emerged around a similar time. It has taken two basic forms: single-dealer platforms (SDPs) and multi-dealer platforms (MDPs). SDPs are proprietary trading systems offered by a single dealer to its clients. Trading via SDPs essentially represents an electronic version of the bilateral dealer-client OTC market. MDPs, by contrast, allow end investors to request quotes from a number of dealers simultaneously, effectively putting dealers in competition for the transaction as in a multilateral auction. This mechanism tends to lower the costs of finding a counterparty with offsetting trading interest. MDPs also automate record-keeping, making it easier to audit best execution.⁶

The main driver of electronic trading has probably been the potential to reduce the cost of trading and improve market liquidity. One key advantage of ETPs is automating the processing and settlement of trades, so-called straight through processing. This reduces the need for human processing, lowering both the cost of trading and operational risks. That said, other factors, such as regulation, have also incentivised market participants to trade electronically (see the discussion in Box 1).

The shift towards electronic trading changed how market participants interacted in a variety of ways. One aspect is the change from on-the-phone bilateral negotiation to multilateral, often anonymous, interaction on screen. Trading on those ETPs geared towards the most liquid government securities, for example, is often based on a central limit order book (CLOB). A CLOB is a trading protocol where market participants submit limit orders that are stored in a queue based on predefined rules. Limit orders, if not cancelled, are executed against matching incoming market orders.⁷

⁶ Examples of SDPs are Barclays’ BARX, Deutsche Bank’s Autobahn and Citibank’s Velocity. Major MDPs include Tradeweb, MTS BondVision and Bloomberg.

⁷ Priority is usually given to the limit order with the best price, ie the lowest sales offer (best ask) and the highest buy offer (best bid). If the price of two orders is the same, priority is given to that submitted to the CLOB first (“price-time priority”). CLOBs are often “pre-trade transparent”, in the sense that any participant may view the set of bids and offers at which one can sell or buy, respectively, at any time. Moreover, many platforms enable trading that remains anonymous before the trade, subject to predefined counterparty credit limits. Transaction prices and volumes are often disclosed post-trade (“post-trade transparency”).

What is driving the electronification of fixed income markets?

Several factors have been supporting the rise of electronic trading in fixed income markets, including: (i) the reduction in trading costs due to technological advances; (ii) changes in the demand for liquidity services; and (iii) regulatory reforms, which provide both direct and indirect incentives to trade electronically.

Technological advances, such as the significant rise in computing speed and capacity, have enabled ETPs to match and process increasingly large numbers of trades. This has contributed to lowering the marginal and average costs of each individual trade as well as to reducing search costs, which in turn raises the incentives for market participants to trade on ETPs. In addition, the entry barriers for new platform providers, such as the fixed cost of building new trading systems, have declined and have benefited from favourable funding conditions. As a result, the number of ETPs offering trading in fixed income instruments has further increased. Even though this may reduce market liquidity by fragmenting trading activity, increasing competition among ETPs can be expected to reduce the price charged to market participants for trading, thereby reinforcing the push towards electronification.

Changes in the demand for liquidity services represent another driver of electronic trading. For one, the expansion of primary bond issuance over the past few years and increased bond holdings by market participants that seek to adjust their portfolio allocations at short notice (eg funds that face redemptions) have raised the potential size of secondary bond markets. This suggests greater opportunity for economies of scale to be realised by ETPs, in particular for standardised products that are traded frequently. Another trend, as emphasised by many market participants, is an increasing demand for price transparency. In this regard, ETPs provide an efficient means of monitoring markets, comparing prices (eg of multiple dealers) and documenting that trades have been executed at the best available price. Furthermore, the persistent decline in the level of yields over recent years has induced many fixed income investors to monitor their cost of trading more closely, incentivising greater use of electronic trading and automated execution of their portfolio reallocations.

The broader post-crisis response has provided additional impetus to the electronification of fixed income markets. **Regulatory reforms** to contain systemic risks in the financial system have provided both direct and indirect incentives for electronic trading. Mandatory clearing of standardised OTC derivatives and supplementary trade reporting requirements, for example, have directly induced a shift in trading activity to ETPs. In addition, ensuring compliance with enhanced pre- and post-trade transparency requirements provides another strong incentive to move trading activity. Other regulatory changes, arguably reinforcing market-driven adjustments after the crisis, have raised banks' costs of taking risk. Moving trading activity to ETPs is one way to compensate for the reduced liquidity provision by these traditional market-makers. This is because ETPs enable banks to provide liquidity at lower cost (see above) or offer the opportunity for other market participants to provide liquidity (see the section on market implications).

Electronification has also meant that AT – a common feature in other asset classes for more than a decade – has also become prevalent in some fixed income segments, such as on-the-run government securities and fixed income futures. AT is a trading technology in which order and trade execution decisions are generated autonomously by computer algorithms. A notable form of AT is high-frequency trading (HFT), which critically relies on high speed and tight intraday inventory positions.⁸ To gain an edge in terms of speed, market participants employing AT/HFT strategies – henceforth labelled principal trading firms (PTFs) – place their servers in the vicinity of the matching engine of the exchange or electronic platform. The

⁸ AT and HFT strategies can be roughly grouped in three categories: (i) trade execution; (ii) market-making; and (iii) directional, relative-value and arbitrage strategies (Markets Committee (2016)). Algorithms, however, often do not follow a single trading strategy, but may switch between strategies over time depending on market conditions. See also Markets Committee (2011) for a discussion of HFT in the foreign exchange market.

universe of PTFs is fairly opaque and diverse.⁹ In addition, many of the traditional market participants have also invested in AT technology in recent years.

The growing presence of PTFs has affected the nature of liquidity provision on formerly exclusively dealer-to-dealer platforms and blurred the traditional market boundaries (Graph 1, right-hand panel). Some sovereign bond markets, especially the most liquid ones, have seen a significant rise in AT activity. Recent estimates suggest that over 50% of trading volumes in benchmark US Treasury securities on formerly exclusively dealer-to-dealer venues can be accounted for by PTFs (US Joint Staff Report (JSR) (2015)). The most advanced HFT strategies thrive in highly liquid markets with CLOBs, such as futures and benchmark sovereign debt. Firms pursuing HFT strategies tend to generate a large number of orders, hold open positions for short periods (often seconds or less) and cancel a large share of orders that they generate (often over 80%), which is possible only in markets that are very liquid at the outset.¹⁰

Dealer-to-customer platforms, by contrast, are usually based on the request for quote (RFQ) trading protocol, a multilateral electronic version of OTC trading. In this case, platform users may query market-makers to request prices on an order of a particular size. One alternative protocol is "click-to-trade" (CTT), where readily executable prices are streamed to platform participants, typically for smaller trade sizes. Trading protocols such as RFQ are amenable only to the subset of AT strategies in which speed is less critical. RFQ platforms, however, do not present algorithms with a continuous market. It is hence no surprise that bond market segments trading infrequently, such as non-benchmark sovereign or corporate bonds, which mostly trade via RFQ platforms, do not (currently) see much HFT. That said, AT is also prevalent on such platforms in the sense that dealers respond automatically to trading requests (auto-quoting) or submit algorithmically generated orders for risk management purposes. Most end users, however, interact manually with RFQ platforms.

Corporate credit markets have recently seen a wave of platform initiatives and innovative trading protocols which allow investors to negotiate with players outside the traditional dealer-intermediated market. A common objective is to pool liquidity outside the dealer community and enable multilateral communication of trading intentions. New trading protocols are largely based on variants of RFQ, as the illiquidity of some fixed income assets makes them unsuitable for CLOBs. Platform providers are also considering protocols that would allow members to negotiate with each other. Participants may submit indications of interest to a non-public order book and receive notice of indications of similar size and price from other market participants. Dark platforms – so called because they match participants anonymously – are allowing buyers and sellers to negotiate directly but anonymously. Others are looking to create standardised secondary market auctions (creating a window of liquidity in specific instruments) to centralise previously untapped pools of liquidity. The success of these new platform initiatives, however, has been limited thus far.

Overall, these developments have led to a more diverse market structure (Graph 1, right-hand panel). Today's market features greater connectivity among the different players, more transparency and a greater variety of trading protocols. That said, the share of electronic trading in many fixed income segments remains below that observed for other asset classes. Its share in cash equities and foreign exchange

⁹ In some instances, PTFs have been set up by former floor or pit traders from stock and commodity exchanges, adopting similar types of trading strategies, yet based on computer algorithms.

¹⁰ In voice trading, many expressions of trading interest also do not ultimately result in a trade.

is estimated to be around 80% and 70%, respectively. In comparison, for US Treasuries and European government bonds the equivalent shares are 70% and 60%. For covered bonds, the share of trading that is done electronically is about one half (Greenwich Associates (2014)). A key factor behind the slower adoption of electronic trading in fixed income has been the greater heterogeneity of the traded instruments (eg different coupons, maturities, embedded options, covenants) and the resulting difficulty in finding matches in supply and demand.

A survey of electronic trading platforms

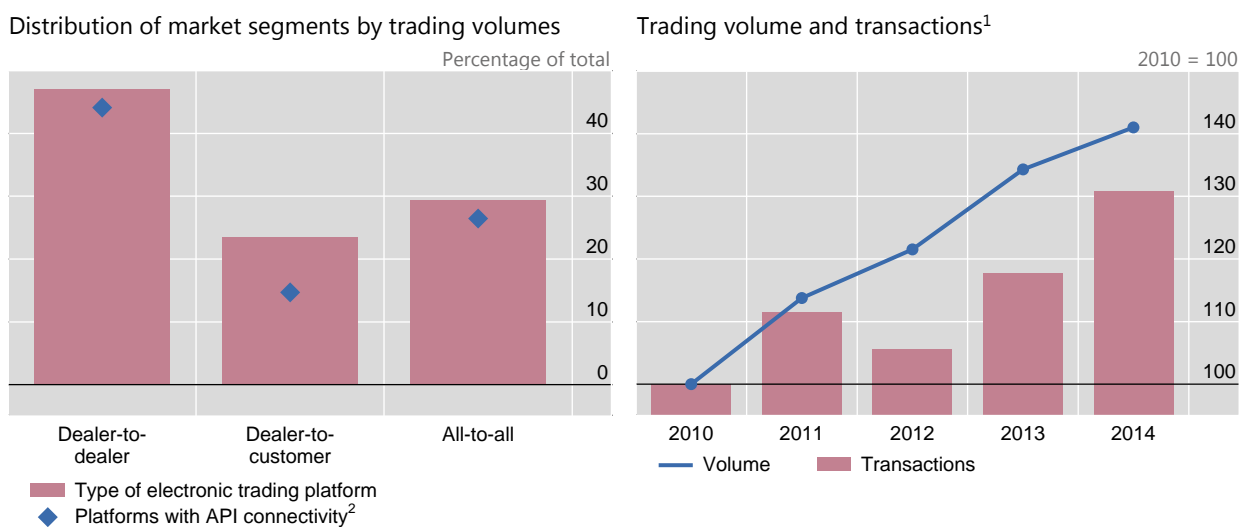
To shed further light on the current state of electronic trading in fixed income markets, we draw on a recent survey of trading platforms conducted by an MC study group. The survey targeted more than 30 fixed income ETPs operating worldwide, including some in emerging market economies. It covered different platform types (eg dealer-to-dealer and dealer-to-client) and instruments (eg sovereign, quasi-sovereign and corporate bonds as well as fixed income derivatives). Information was also collected on different trading protocols (CLOB, CTT and RFQ).

How have electronic trading volumes evolved?

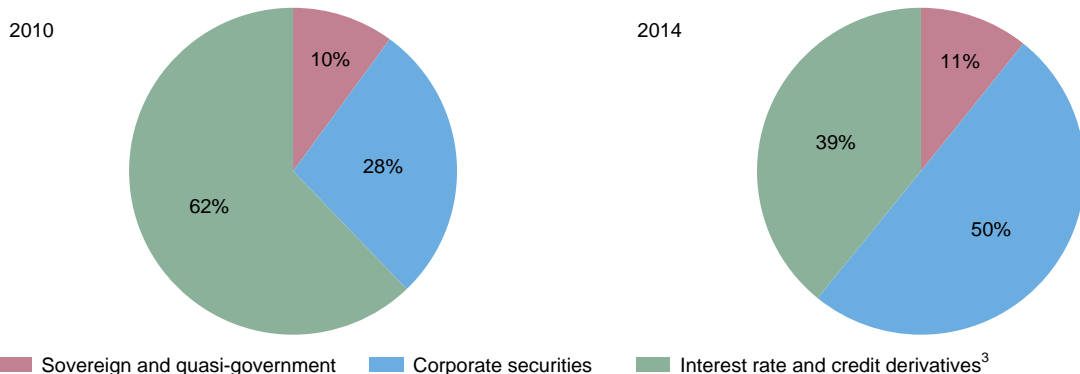
In the survey, dealer-to-dealer platforms account for the largest share of trading – roughly 45% in 2014 – whereas all-to-all (ie platforms that enable any member to trade with any other member) and dealer-to-customer platforms account for around 30% and 25%, respectively (Graph 2, top left-hand panel).

Fixed income electronification has been growing steadily over the past five years, and AT has become more prevalent. Average daily turnover on electronic platforms has been trending up for most types of instruments and across the different types of platforms. In aggregate, average daily trading volume rose by about 40% from 2010 to 2014 (Graph 2, top right-hand panel). The number of transactions, a key indicator of trading activity, also rose (same panel). Across all platforms, transactions went up by roughly one third. The evolution of average trade sizes has differed across market segments. It has fallen on platforms geared towards dealer-to-dealer trading and increased in the dealer-to-customer segment.

A major driver of the rise in electronic trading volumes has been a pickup in corporate bond trading (Graph 2, bottom panels). Trading of corporate securities has more than doubled over the past five years, although starting from a low base. Possible reasons include the record issuance of corporate securities during much of the post-crisis low-yield environment and the growing popularity of this asset class among asset managers. Electronic trading via platforms, in turn, may have helped overcome some of the liquidity challenges that have confronted credit markets, eg by facilitating the matching of buyers and sellers and by reducing the reliance on individual dealers. By comparison, electronic trading in other instruments has been less buoyant. That of sovereign and quasi-government securities grew at a slower rate, about 20% between 2010 and 2014. And trading volumes for derivatives products have actually fallen, contracting by about one third. This is consistent with a decline in outstanding positions in OTC derivatives markets more broadly, as documented elsewhere (eg Schrimpf (2015)).



Instrument distribution by year



¹ Based on average daily trading volume and transaction data, excluding repo and fixed income futures for selected platforms. ² API = application programming interface. ³ Interest rate swaps, fixed income options and credit default swaps.

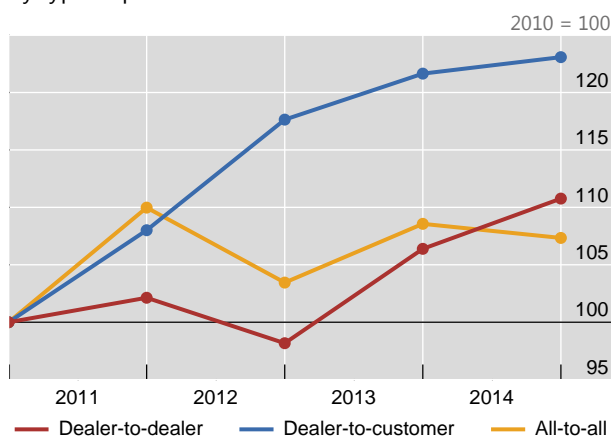
Sources: Markets Committee (2016); authors' calculations.

How are electronic trades executed?

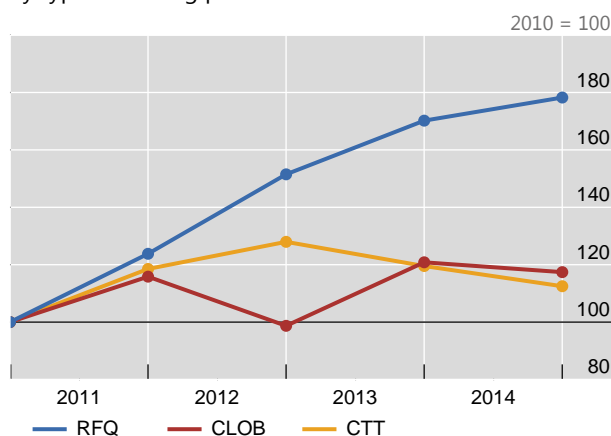
The survey shows that electronic trading volumes grew most in the dealer-to-customer segment, where end users can put multiple dealers in competition for a trade (Graph 3, top left-hand panel). This is further corroborated by data that distinguish platforms according to the prevailing trading protocol. Platforms relying on RFQ, as is commonly the case for MDPs, have seen the largest rise in volumes over the past five years (Graph 3, top right-hand panel). A smaller increase took place on dealer-to-dealer platforms; but even here volumes still rose by about a quarter from 2010 to 2014. All-to-all platforms, however, contributed little to the rise in aggregate volumes. This was also reflected in the sluggish growth of CLOB-based trading over the past years.

The survey confirms that on dealer-to-dealer platforms, about 90% of the trades were executed via a CLOB while the remainder relied on direct streaming of executable prices (CTT) (Graph 3, bottom left-hand panel). Similarly, on all-to-all platforms the majority of the trades are also done via CLOB. By comparison, the

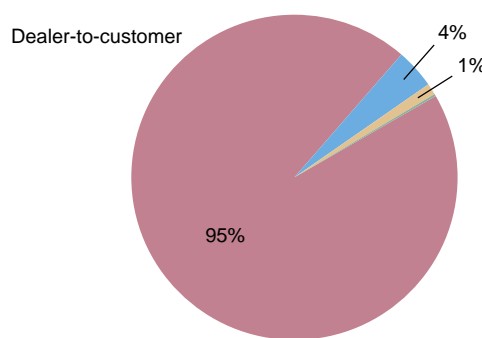
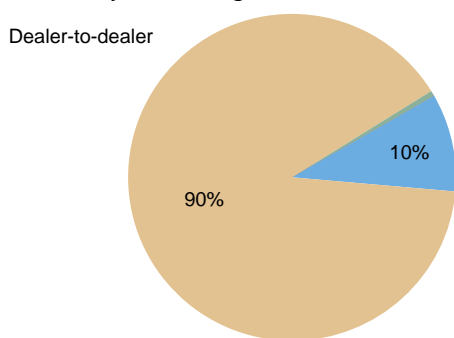
By type of platform¹



By type of trading protocol¹



Protocols by market segment



RFQ = request for quote (request for market); CLOB = centralised limit order; CTT = click-to-trade.

RFQ = request for quote (request for market); CLOB = centralised limit order; CTT = click-to-trade.

¹ Based on average daily trading volume and transaction data, excluding repo and fixed income futures for selected platforms, broken down by either market segment (dealer-to-dealer, dealer-to-customer, all-to-all) or trading protocol (RFQ, CLOB, CTT).

Sources: Markets Committee (2016); authors' calculations.

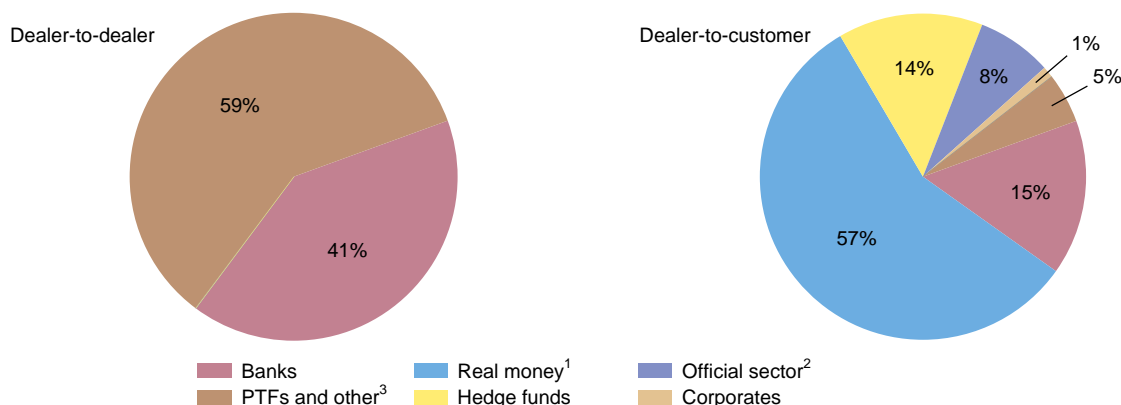
dealer-to-customer market relies predominantly on RFQ, accounting for more than 95% of trades on MDPs (Graph 3, bottom right-hand panel).

Survey data also point to an increase in AT. The proportion of trades executed via algorithms went from about a third in 2010 to roughly 45% in 2014. The majority of surveyed ETPs reported having application programming interface (API) connectivity, which is a prerequisite for AT. API connectivity is notably less prevalent on MDPs geared towards dealer-to-customer markets, but is a common feature of dealer-to-dealer platforms and all-to-all platforms.

Who trades electronically?

The survey results on platform trading by various types of market participants suggest that dealers' dominance has diminished. Indeed, on dealer-to-dealer platforms the share of volume generated by traditional players such as banks and broker-dealers has declined significantly. These players now account for only 41% of volume on dealer-to-dealer platforms (Graph 4, left-hand panel). The remainder is largely accounted for by PTFs. These have assumed a key role as liquidity providers on some

Participation of different customer bases by market segment



¹ Mutual funds, pension funds, insurance companies and wealth managers. ² Governments, central banks and other monetary authorities. ³ Principal trading firms and other investors.

Sources: Markets Committee (2016); authors' calculations.

formerly exclusively dealer-to-dealer venues, especially in the most liquid financial instruments. Many of the employed algorithms emulate a market-making strategy that relies on the submitting and cancelling of limit orders in rapid succession. The main purpose is to profit from the bid-ask spread, while ensuring tight risk control over inventory positions and minimising the risk of transacting with an informed counterparty. Limit orders offer an option to buy or sell a specified quantity, thereby providing immediacy to other market participants.

Non-bank financial institutions also play a key role as market participants on dealer-to customer platforms. These venues are used primarily by asset managers, which account for more than on half of the volumes (Graph 4, right-hand panel). The remainder is accounted for by several end user types, including banks, hedge funds, governments, central banks and other monetary authorities, whose combined trading activity amounts to approximately 37% of total volume.

Implications for market quality

Electronification can support market quality by enhancing both price efficiency and market liquidity. By reducing the need for human intervention, it enables market participants to detect and exploit arbitrage opportunities more quickly, ensuring that new information is readily accounted for in asset valuations across a broad range of markets.¹¹ It also helps reduce trading costs by enabling greater transparency and, hence, increasing competition among market participants (eg Brogaard, Garriott and

¹¹ Research on the impact of electronic trading, and of AT in particular, on market quality is growing. Due to data limitations, work has mostly focused on asset classes other than fixed income, however. For FX markets, for example, Chaboud et al (2014) suggest that algorithmic traders eliminate arbitrage opportunities, thereby enforcing FX pricing relationships as well as contributing to lower volatility. Likewise, HFT activity has been found to support faster price discovery, as suggested by recent analysis of equity markets (eg Hendershott et al (2011), Menkveld (2013), Brogaard, Hendershott and Riordan (2014)).

Pomeranets (2014)).^{12, 13} Moreover, execution algorithms have enabled market participants to optimise the implementation of their trading strategies, with large orders being split into multiple ones and/or routed towards the most liquid trading venues.

While these benefits are present during normal market conditions, a different question is how electronic trading affects the ability of markets to cope with stress (see also Box 2). During such episodes, market conditions hinge on the capacity and willingness of intermediaries to stand ready as suppliers of immediacy and on traders' ability (eg access to funding) to arbitrage across markets. How electronic trading shapes the business models of market-makers and arbitrageurs as well as of fundamental traders is thus crucial to understanding market dynamics during strained conditions.

In many fixed income segments, dealers remain the key liquidity providers. While PTFs employing market-making strategies have become supplementary suppliers of immediacy on some formerly exclusively dealer-to-dealer venues, they typically take on inventory risk only for very short periods. This is because most PTFs, thus far, have operated with little risk-bearing capital and lack the balance sheet capacity to warehouse inventory over longer periods of time – an important requirement to “make markets” in less frequently traded assets (eg off-the-run government bonds, corporate bonds). Thus, despite the transition from voice to electronic trading, liquidity conditions in many fixed income segments remain largely dependent on dealers' capacity and willingness to make markets. Indeed, as highlighted by the survey of ETPs, most trading in the dealer-to-customer market relies on dealers quoting prices either in response to a customer's request (RFQ) or continuously (CTT).

Current developments in fixed income trading also reflect a broader post-crisis response. Following the Great Financial Crisis and in response to regulatory reforms, dealers have raised their capital buffers and have reduced their trading book exposures (CGFS (2014, 2016), Fender and Lewrick (2015)). This has improved dealers' resilience while at the same time increasing the cost of supplying immediacy. Dealers have responded by adjusting the way they provide liquidity services, including by relying more on electronic means to interact with their clients. Automation of market-making and hedging, whereby large numbers of quotes are frequently updated in response to evolving market conditions, has been a key trend, as it helps dealers manage their inventory risk more efficiently and save costs. Some dealers are also reportedly shifting their immediacy services from a principal- to an agency-based model, ie executing customer orders by finding an offsetting order in the market, rather than taking exposures on their own balance sheets. These adjustments may have contributed to falling dealer bond inventories amid broadly

¹² Transaction costs for bonds with a high propensity to execute on platforms, for example, are significantly lower on platforms than for trades of the same securities executed via phone (Hendershott and Madhavan (2015)). Other studies, such as Mizrahi and Neely (2006), also find that ETPs offer superior liquidity.

¹³ Bessembinder and Maxwell (2008), for example, discuss how improved post-trade transparency in the US corporate bond market following the introduction of mandatory trade reporting contributed to a significant decline in transaction costs. Choosing the degree of transparency, however, also implies a number of trade-offs, as discussed in Scalia and Vacca (2001).

Is electronification harming market robustness?

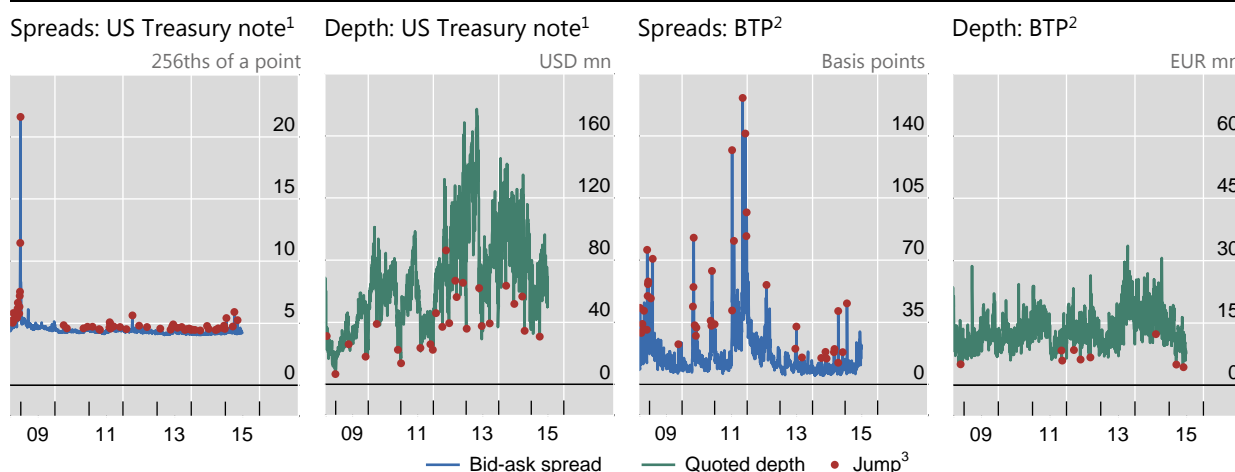
While electronic trading has clearly altered the provision of liquidity, it is difficult to assess empirically how these changes have affected market robustness, broadly defined as the market's ability to absorb shocks (eg large order imbalances). One reason is a lack of detailed data on trading activity prior to the advent of electronic trading. A second reason is that many factors can affect liquidity conditions, making it difficult to single out the impact of any individual one (CGFS (2016)). Some tentative insights, however, can be drawn from comparing electronic markets that differ with regard to how they source liquidity. Graph A depicts the bid-ask spreads and quoted depth since 2008 for 10-year US Treasury notes and 10-year Italian government bonds (buoni del tesoro poliennali (BTPs)), respectively. For the former, trading takes place on a fully automated CLOB, with PTFs accounting for a sizeable share of liquidity provision. For the latter, liquidity is exclusively provided by dealers that commit to quoting executable prices (CTT). Clearly, this comparison is subject to several caveats: each market was exposed to different conjunctural and systemic shocks (eg the euro area sovereign debt crisis), and each comprises different market participants that may be subject to varying constraints (eg funding liquidity conditions).

Keeping these big caveats in mind, some tentative observations may be drawn from the data. One is that transitory jumps in liquidity conditions occur in both markets. This reflects the fact that ETPs can help pool liquidity, but that they cannot generate liquidity when markets face order imbalances. A second observation is that liquidity conditions on the US Treasury market appear to be characterised by less volatile bid-ask spreads. While spreads do jump (the red dots in Graph A indicate changes by more than two standard deviations), they have remained in a narrow range, closely tied to the minimum tick size (1/64th of a point). Adverse changes in liquidity conditions, however, occur through adjustments in quoted depth. The BTP market, by comparison, appears to undergo larger adjustments in spreads during stressed periods, with quoted depth remaining fairly stable (Graph A, third and fourth panels).

It is difficult to judge, based on this comparison, which of the two market structures ensures more robustness. While, on the one hand, CLOBs with significant HFT presence may support trading at tight spreads throughout strained market conditions, market depth could prove shallow and fleeting if investors seek to trade large quantities. Quote-driven markets, on the other hand, benefit from the capacity of dealers to warehouse assets over an extended period of time (in contrast to the typical HFT liquidity providers), which may help absorb temporary order imbalances. Dealers, however, will seek to mitigate risks to their balance sheets by widening spreads in situations of elevated market uncertainty, implicitly charging investors for the cost of these higher risk exposures.

Liquidity dynamics depend on the market structure

Graph A



The red dots represent jumps in liquidity conditions based on daily observations.

¹ Ten-year US Treasury notes ² Ten-year Italian government bonds (BTPs). ³ A jump is defined as a rise (decline) in spreads (the percentage change in quoted depth at the first tier) of at least twice its standard deviation. The standard deviation is calculated by using a trailing window that includes the past 250 observations (ie trading days).

Sources: CGFS (2016); national data.

unchanged (or even increasing) trading volumes (CGFS (2014, 2016)).¹⁴ At the same time, the reduction in dealers' warehousing of assets implies that execution risks have been passed on to investors.¹⁵

Changes in how dealers and, to an increasing extent, non-dealers provide immediacy also have a number of implications for the behaviour of market liquidity during strained conditions. One concern is that abrupt but short-lived price swings ("flash crashes") may become more frequent in highly automated fixed income markets. The activity of PTFs and the role of AT during specific episode of outsize volatility and extreme intraday movements such as the flash rally in the US Treasury market on 15 October 2014 are a case in point. While it has proved difficult to identify specific trigger events, a key finding of JSR (2015) is that trading algorithms may have contributed to extreme price swings on that day. PTFs and bank dealers both managed the risk of volatility by reducing liquidity to the market, with market depth (as measured by outstanding orders in the CLOB) declining to very low levels right before the period of extreme volatility. Notably, PTFs were the largest contributors to this decline in depth, but maintained narrow bid-ask spreads throughout the event. Bank dealers, by comparison, responded by widening their bid-ask spreads.

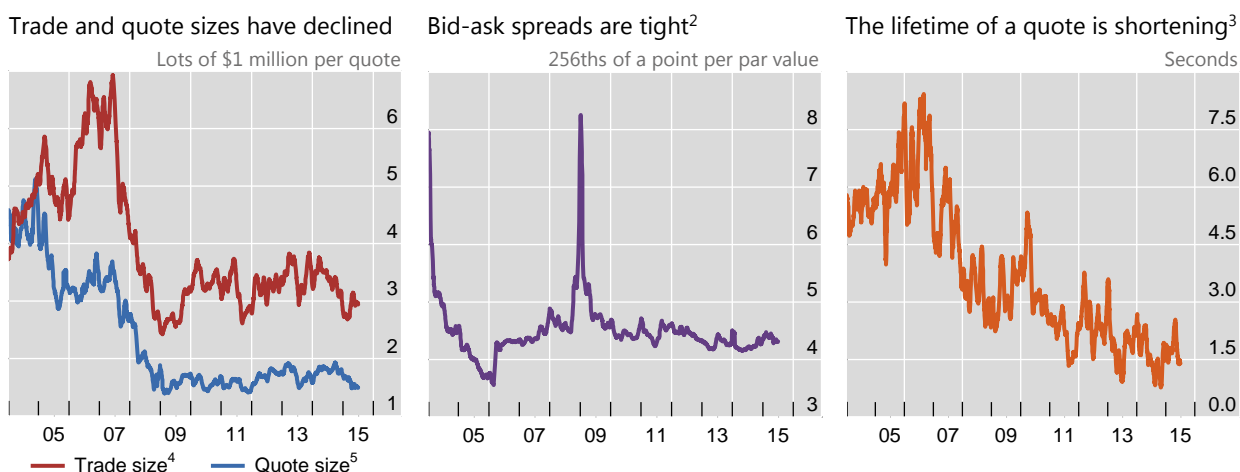
This event, among others, illustrates that the increasing complexity of trading algorithms and their possible interactions represent a source of risk that can act as an amplifier in stress episodes. For one, large price movements or price gapping during stressed periods can prove difficult to incorporate in trading algorithms. Liquidity providers' risk monitoring thus often includes measures to interrupt quoting ("panic buttons"). Yet, while suspending liquidity provision may appear rational from an individual market participant's point of view, it raises the risks for the remaining liquidity providers.

Overall, these developments imply that electronic trading may have changed the dynamics – particularly the speed and visibility – of market responses to imbalances in demand and supply. It is, however, important to note that the basic underlying economic mechanism of how illiquidity risks unfold (Borio (2004), Shin (2010)) appears to have remained largely unchanged. Indeed, irrespective of the underlying market microstructure, market conditions remain susceptible to a sudden evaporation of liquidity (Box 2). These are situations in which both human traders as well as PTFs as the "new market-makers" (eg Menkveld (2013)) have always been reluctant to step in as shock absorbers (eg Adrian et al (2013)).

An important takeaway from the above discussion is that traditional gauges of liquidity conditions may be less suitable in the new market environment. HFT strategies enable the submission of highly competitive prices (resulting in narrow spreads), even in highly volatile conditions (eg JSR (2015)). These strategies manage the risk of being picked off by an informed market order by quoting in limited size and updating orders (ie cancelling and submitting new orders) at a very high frequency. This may lead to conflicting signs of liquidity conditions (Graph 5): while tight bid-ask spreads suggest ample market liquidity, limited quoted depth and small

¹⁴ The analysis by the CGFS points to a number of other drivers of dealer inventories: (i) a reassessment of the risk-return trade-off by banks following large losses on trading positions during recent crises; (ii) an increase in regulatory capital charges on risk exposures (eg due to the leverage ratio or the revised framework for market risk); and (iii) low returns on securities held in inventory (so-called "carry") given the low interest rate environment.

¹⁵ Execution risks include the risk of changes in the price of the underlying asset during the time between the placement of the order and its execution.



¹ Twenty-one-day trailing moving averages for benchmark 10-year US Treasury notes. ² Difference between the best bid and ask price, averaged over all observations each day. ³ Median value. ⁴ Summing all quantities from each trade, aggregating across different counterparties and price levels, and averaging over all unique trades on each day. For example, if a dealer placed a buy order of \$100 million which matched with a resting order from another dealer of \$50 million at \$100 and a resting order of \$50 million at \$101, the trade size for this trade would be \$100 million. ⁵ Average size of all outstanding limit orders based on all unique quotes on each day.

Source: Markets Committee (2016).

trade sizes indicate the opposite.¹⁶ The lifetime of orders in turn shortens, making it increasingly difficult to assess whether the market is actually liquid since orders could be cancelled instantaneously (“fleeting”) as soon as market participants intend to trade. Given this new market environment, additional metrics may be needed to monitor liquidity conditions more accurately (O’Hara (2015)). One such measure could be implementation shortfall (eg Hendershott et al (2011), which captures the total costs of establishing a position in a security of a given size.

Conclusions

Trading in fixed income markets is becoming more automated as electronic platforms explore new ways to bring buyers and sellers together. In the most liquid markets, traditional dealers are increasingly competing with new market participants whose trading strategies rely exclusively on sophisticated computer algorithms and speed. Some dealers, in turn, have embraced automated trading to provide liquidity to customers at lower costs and with limited balance sheet exposure.

To some extent, these trends resemble those witnessed in other markets, where electronic and automated trading have long become the prevailing market standard. Indeed, much of the innovation in trading protocols and (HFT) algorithms is based on importing technology initially developed for equities that has subsequently spilled over to foreign exchange markets (Markets Committee (2011)). This suggests that

¹⁶ The proliferation of complex order types further complicates the assessment of liquidity conditions. One example is partially hidden orders (“iceberg” orders) that allow market participants to show only part of the quantity they are willing to trade. This implies that quoted depth provides only a partial picture of the available quantities that can be traded at the bid and ask price.

many of the market implications – and the associated policy challenges – will increasingly shape trading in fixed income markets as well.

As discussed in Markets Committee (2016) and CGFS (2016), there are several areas that may warrant further policy attention. First, the impact of electronic trading needs to be appropriately monitored. The above discussion highlights how standard liquidity metrics need to be supplemented by alternative measures to reflect the changes in liquidity provision. Second, more research is needed to inform policymakers about the impact of automated trading on market quality and how to address any associated market failures. Third, with trading activity increasingly gravitating towards platforms, ensuring their robustness as well as their capacity to deal with market stress becomes a key financial stability issue. With dealers closing down traditional trading desks (“hanging up their phones”), while their e-trading desk algorithms connect to an expanding set of multilateral platforms, the fallback option of returning to voice trading may no longer be viable. Finally, regulation and best practice guidelines need to adapt as markets evolve. This could include assessing the scope and capacity of existing supervision as well as the effectiveness of existing mechanisms to deal with market stress episodes.

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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).

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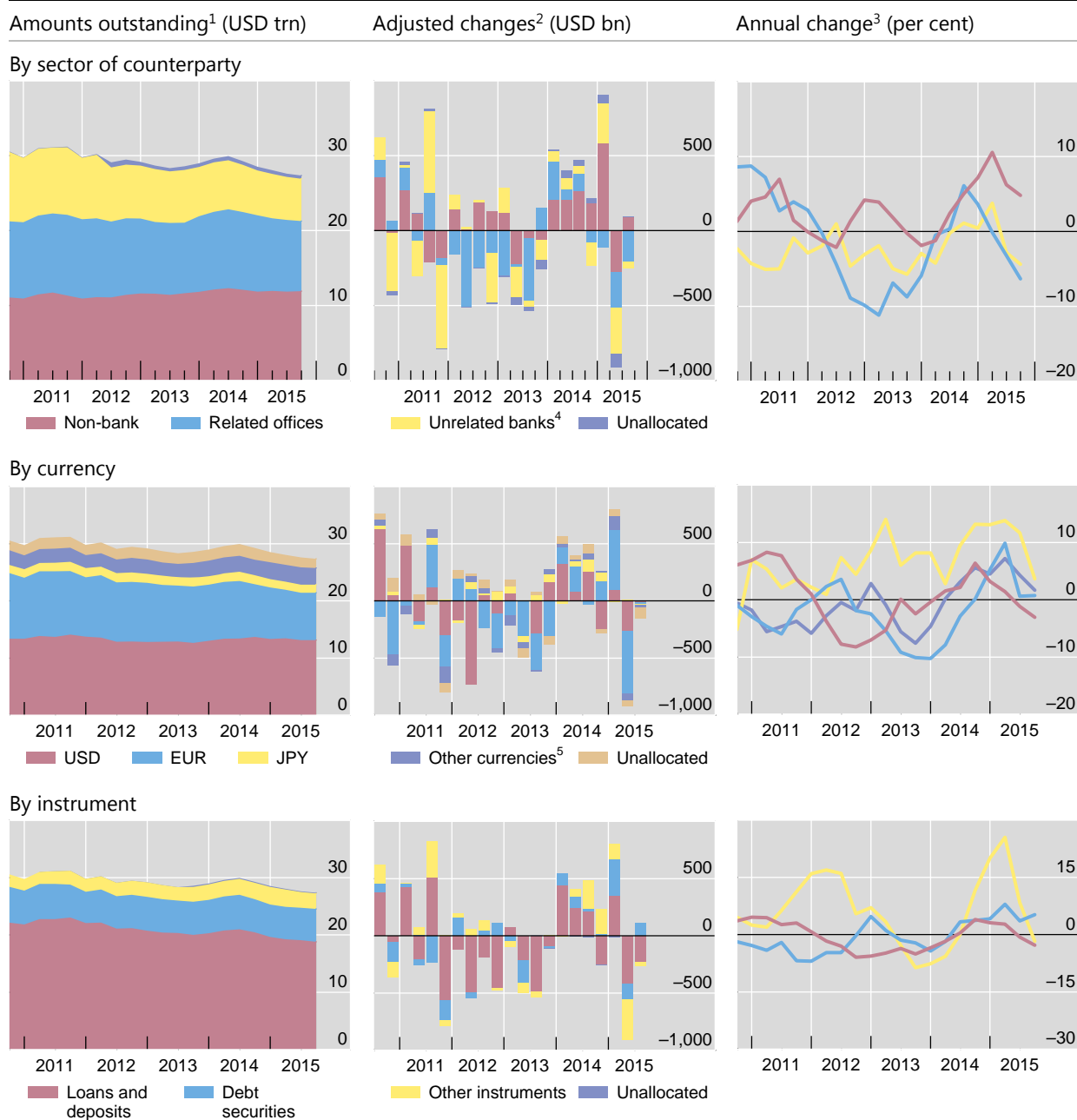
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A Locational banking statistics

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

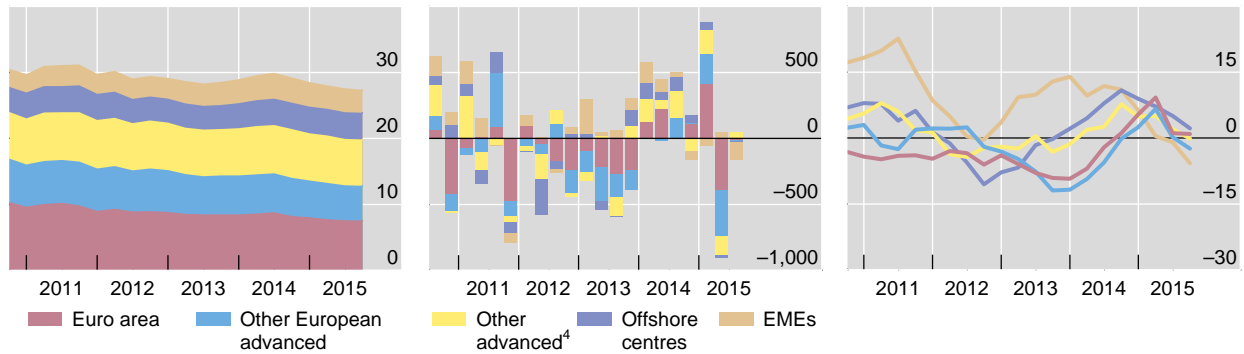
Graph A.2

Amounts outstanding¹ (USD trn)

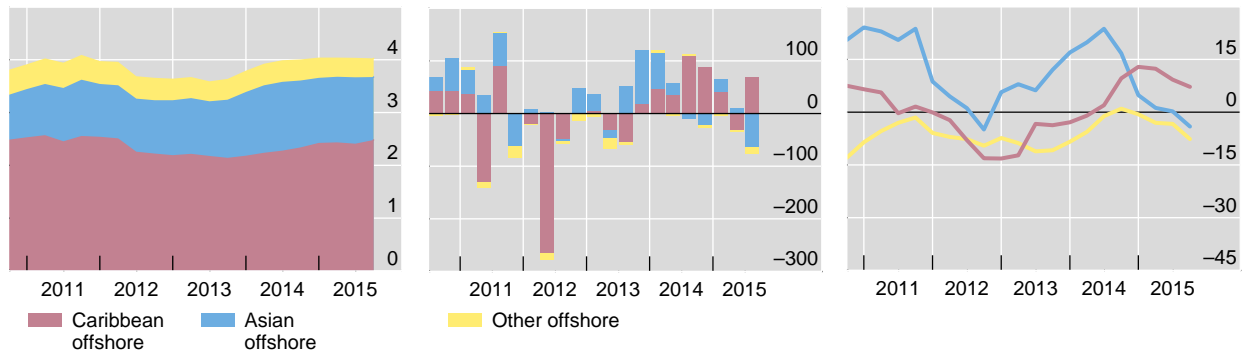
Adjusted changes² (USD bn)

Annual change³ (per cent)

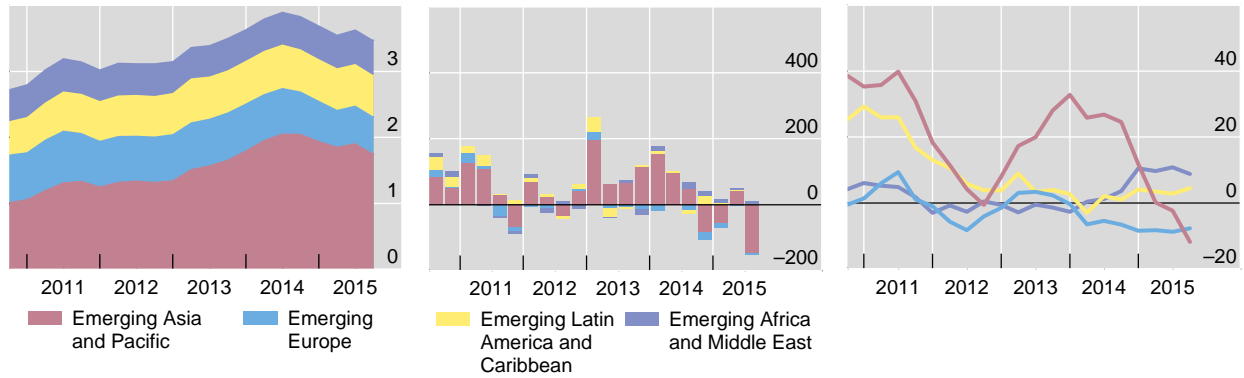
On all countries



On offshore centres



On emerging market economies

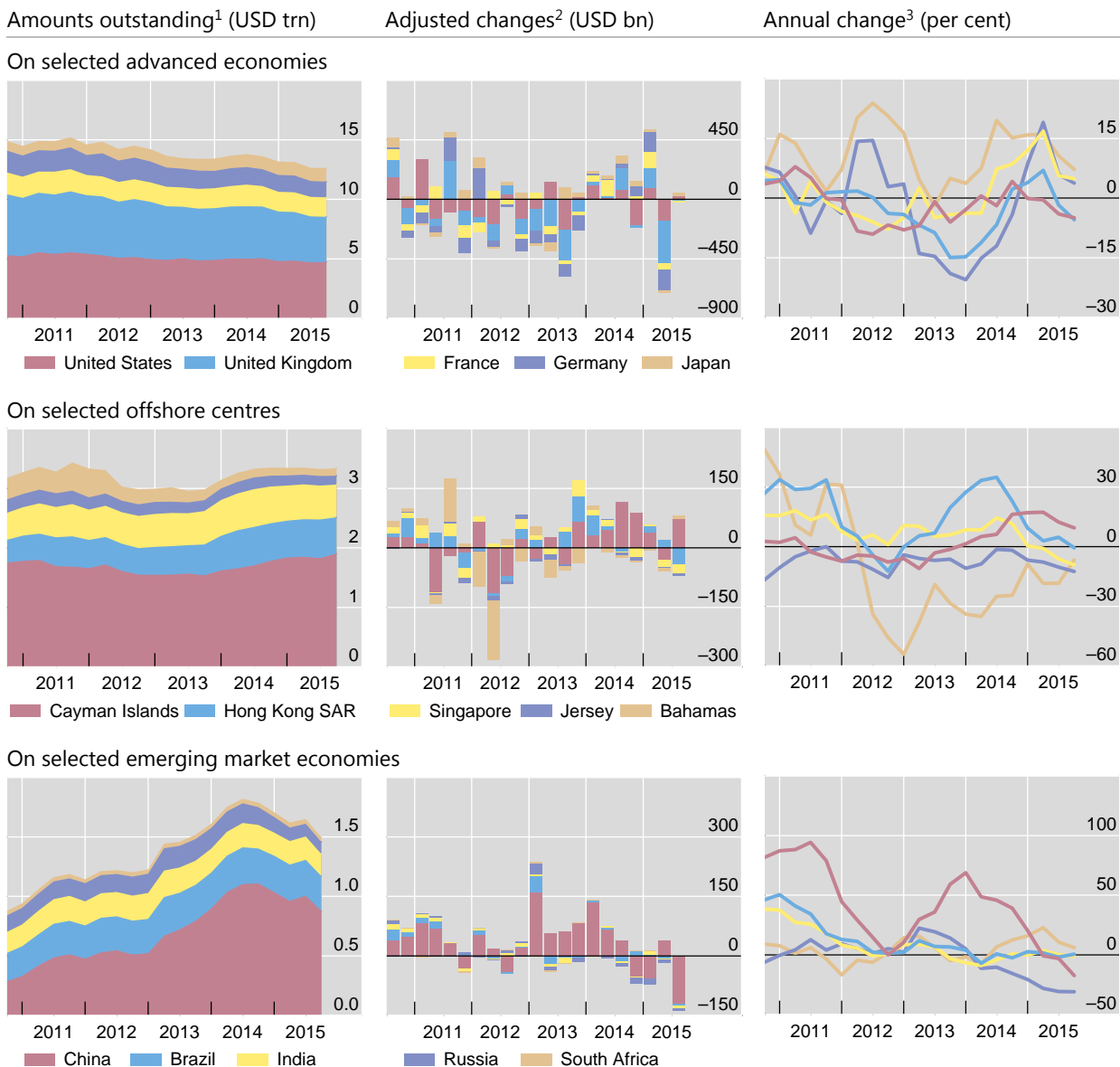


Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

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



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.

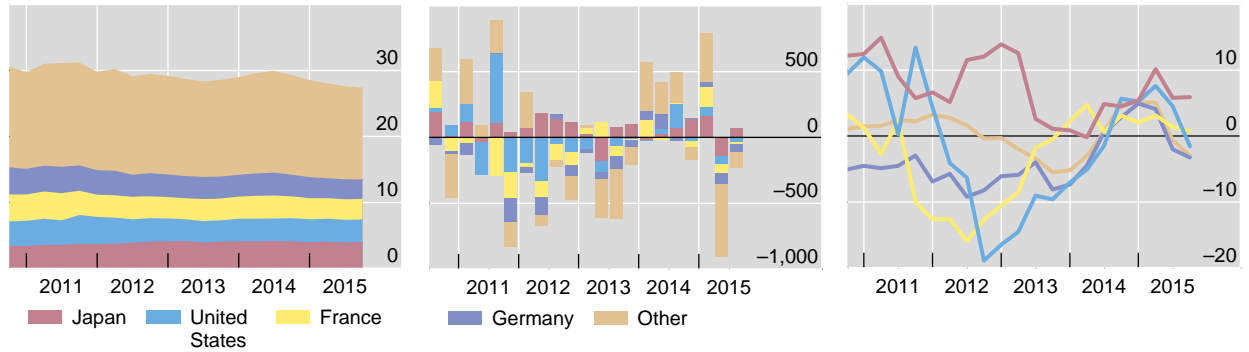
Cross-border claims, by nationality of reporting bank and currency of denomination Graph A.4

Amounts outstanding¹ (USD trn)

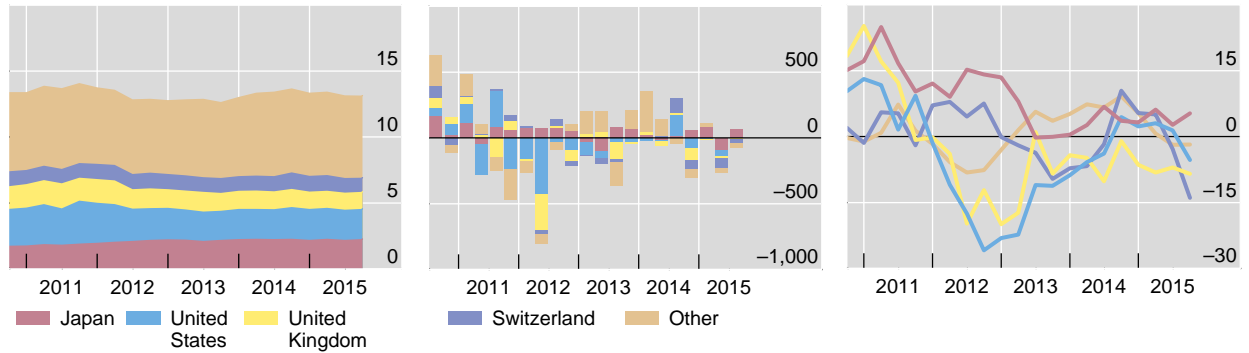
Adjusted changes² (USD bn)

Annual change³ (per cent)

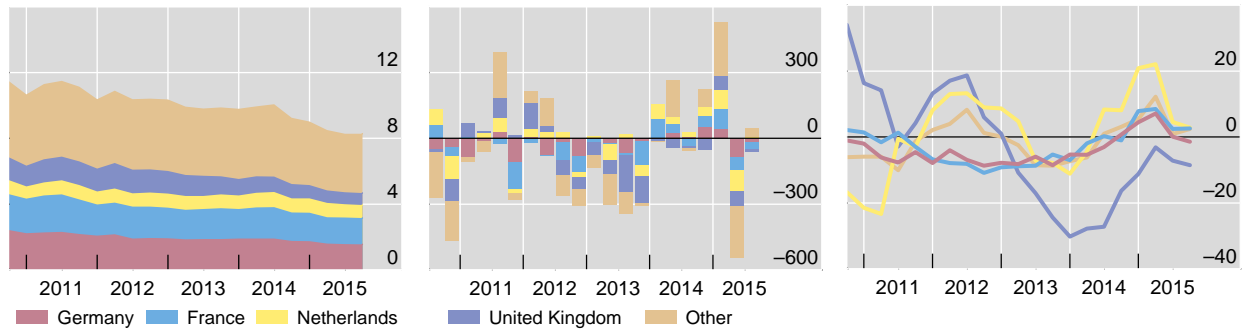
All currencies



US dollar



Euro

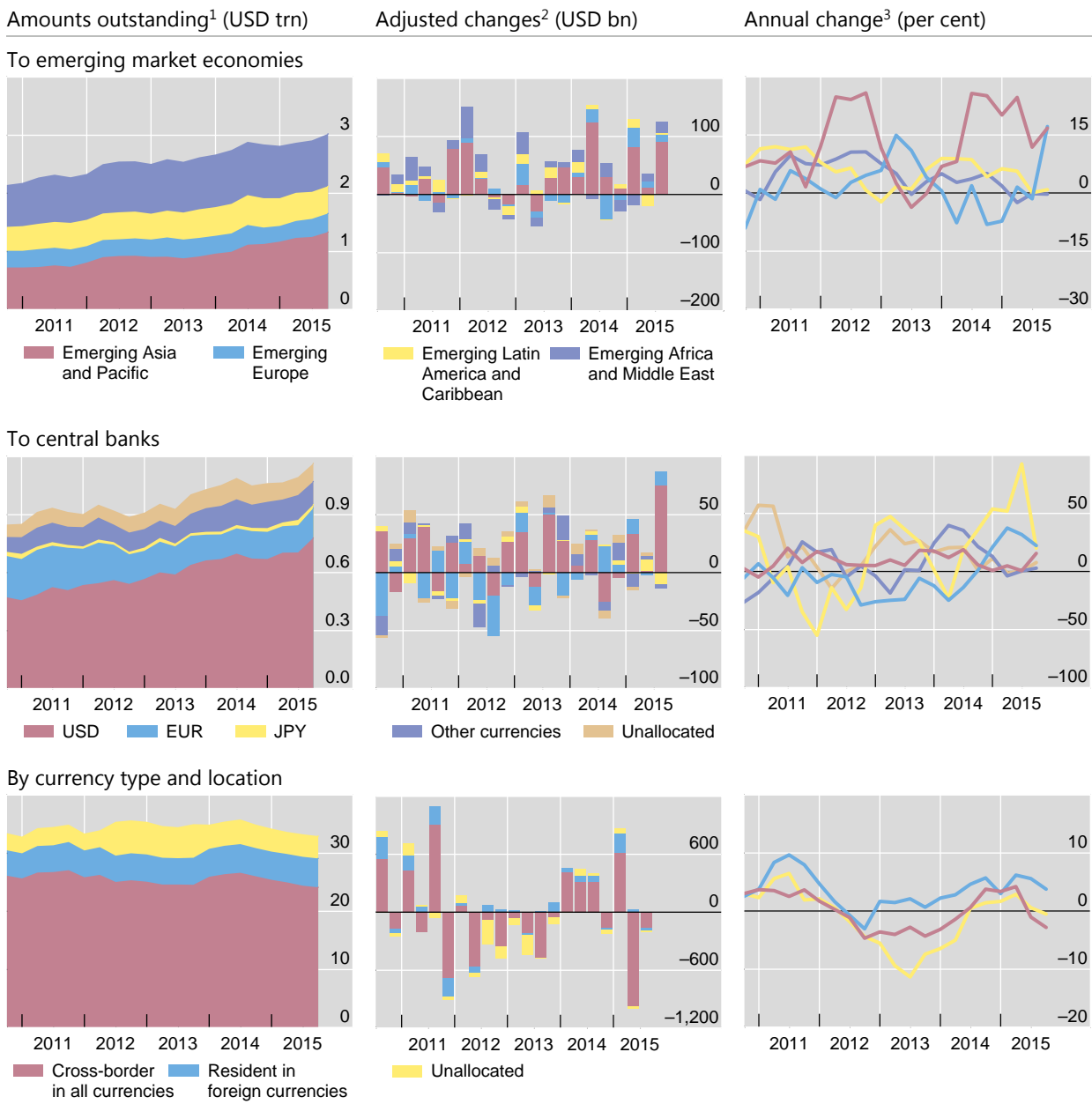


Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

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

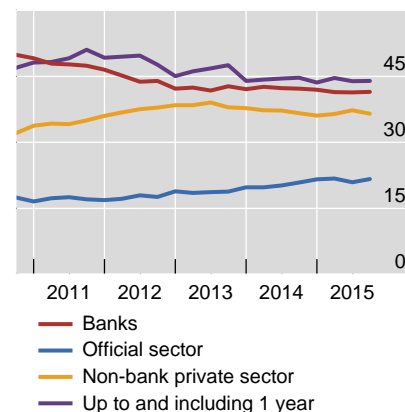
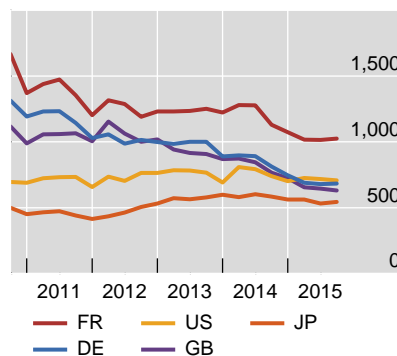
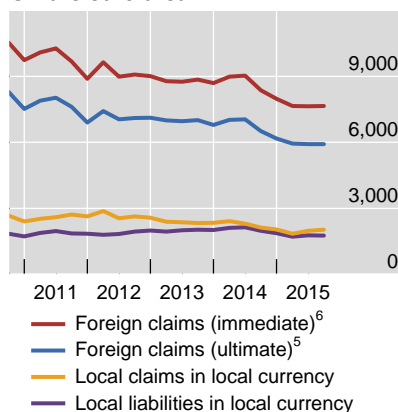
Graph B.1

Foreign claims and local positions^{1,2}
(USD bn)

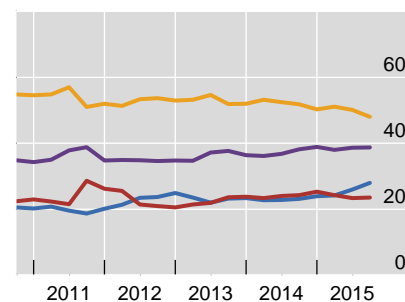
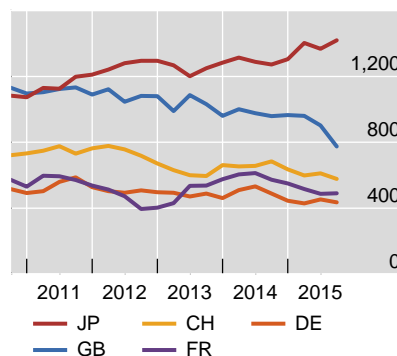
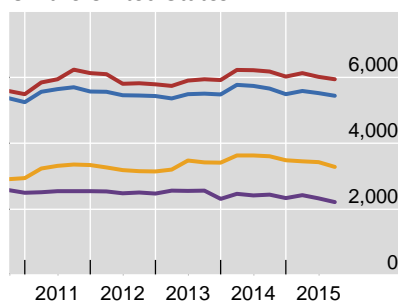
Foreign claims of selected
creditors^{1,3} (USD bn)

International claims, by sector and
maturity⁴ (per cent)

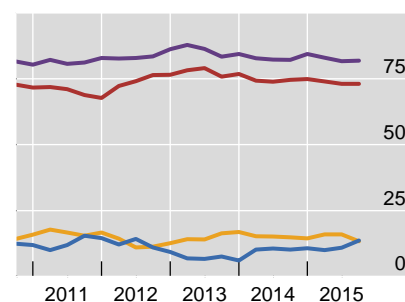
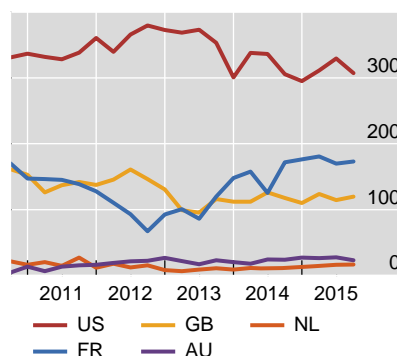
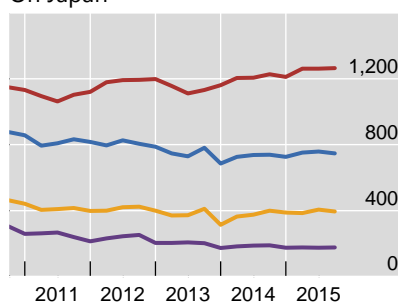
On the euro area



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

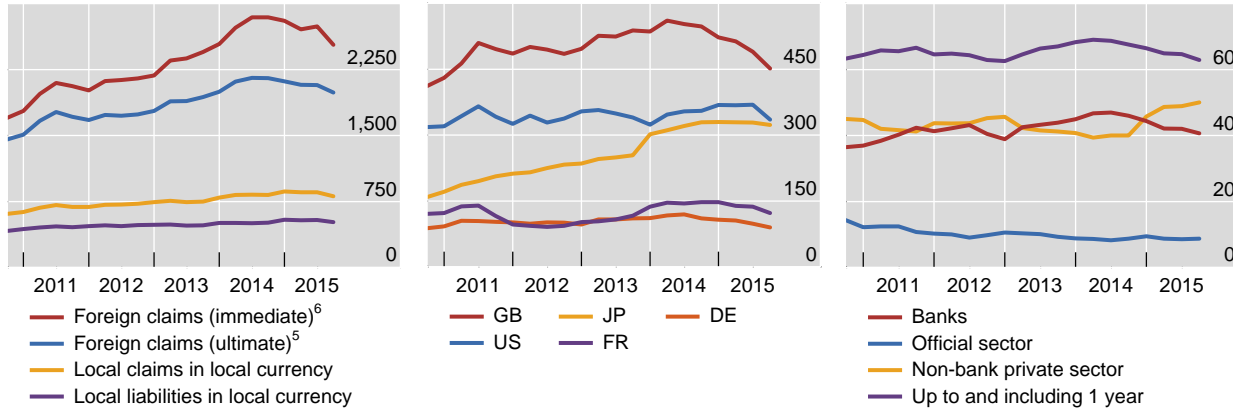
Graph B.2

Foreign claims and local positions^{1, 2}
(USD bn)

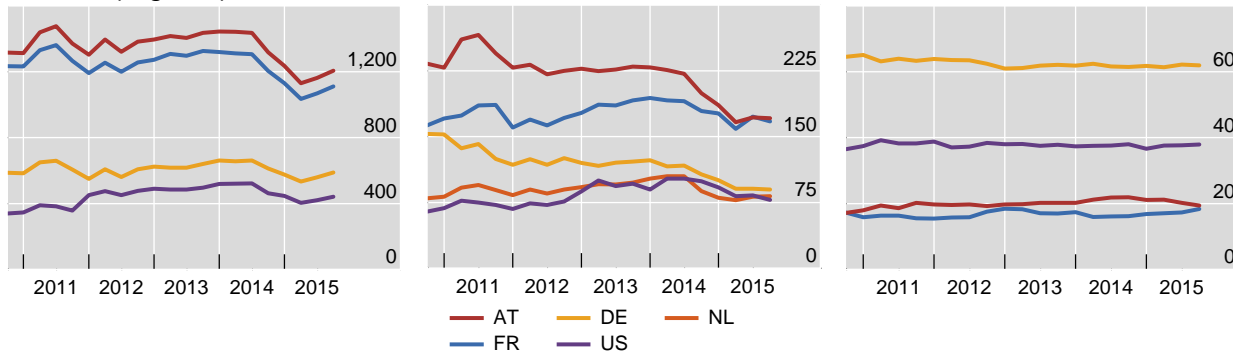
Foreign claims of selected
creditors^{1, 3} (USD bn)

International claims, by sector and
maturity⁴ (per cent)

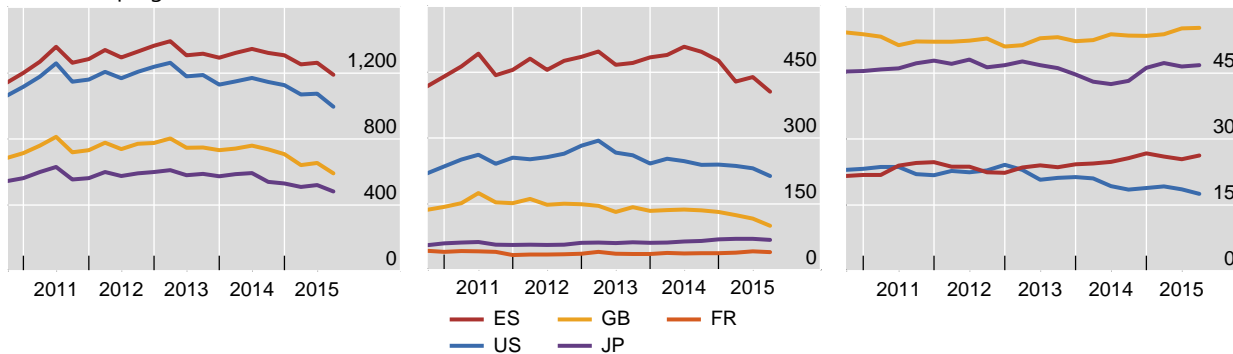
On developing Asia and the Pacific



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.

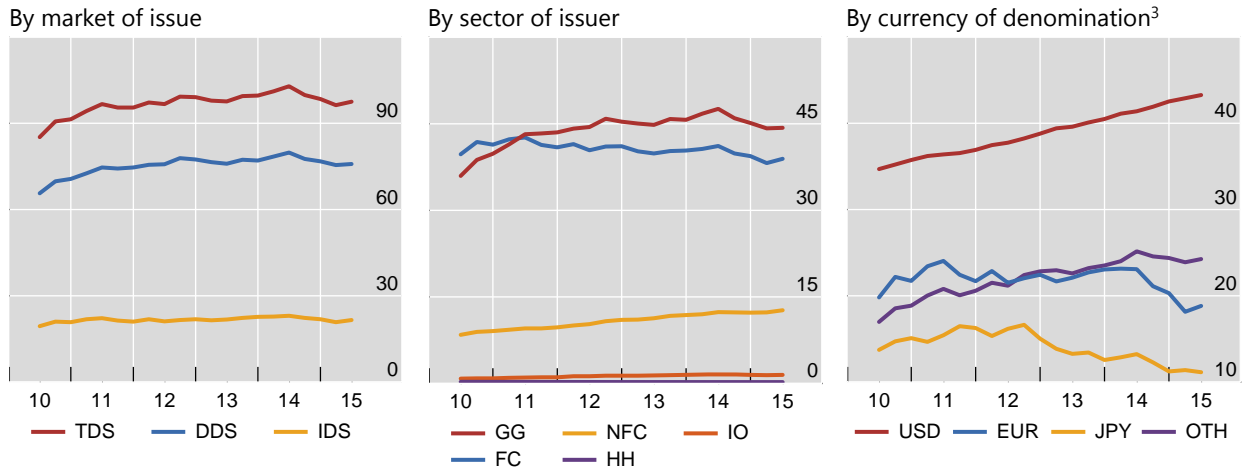
¹ Amounts outstanding at quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. ² Excludes domestic claims, ie claims on residents of a bank's home country. ³ Foreign claims on an ultimate risk basis, 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 markets¹

Amounts outstanding, in trillions of US dollars²

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.

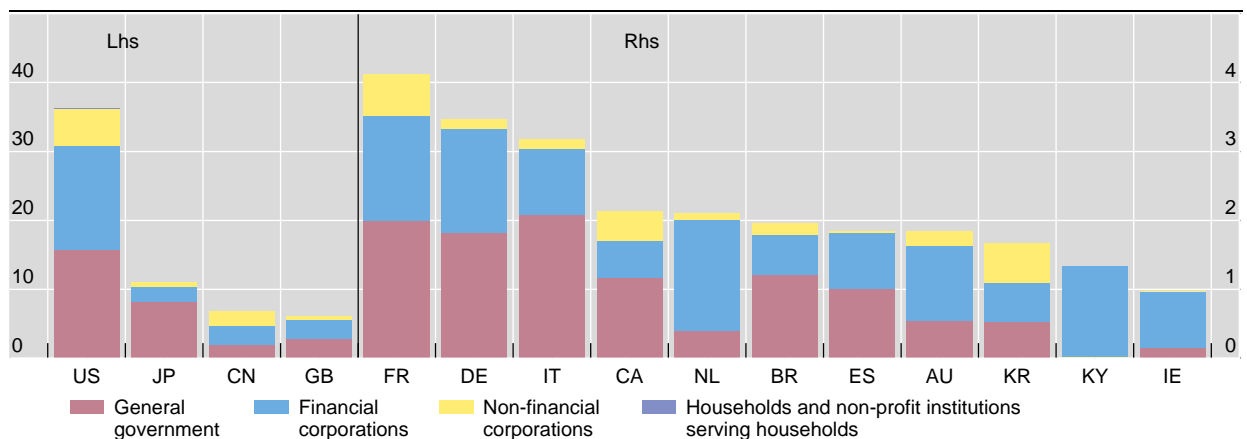
¹ Sample of countries varies across breakdowns shown. For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. For countries that do not report either TDS or DDS, data are estimated by the BIS as IDS. ² At quarter-end. Amounts denominated in currencies other than the US dollar 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 issuer¹

Amounts outstanding at end-June 2015, in trillions of US dollars²

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.

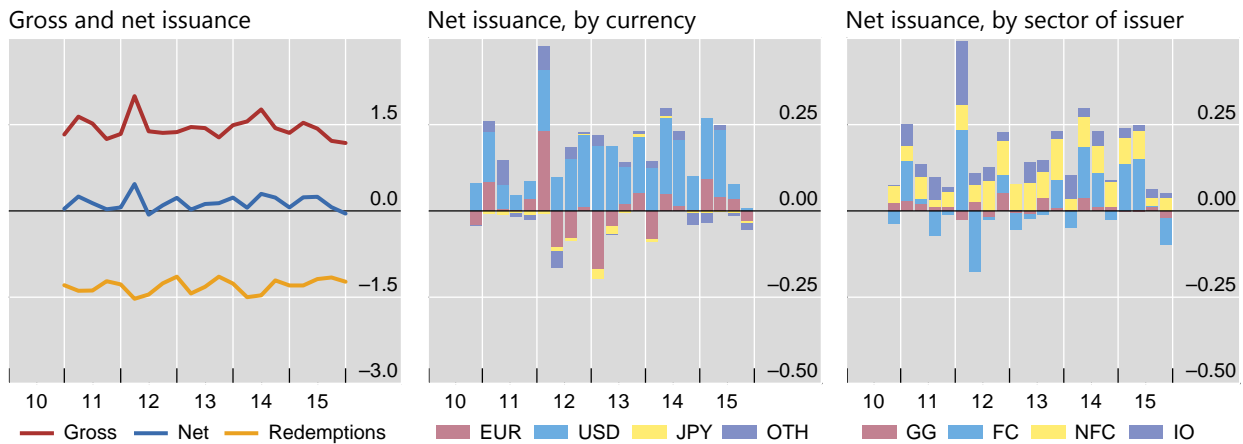
¹ For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. ² Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

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.

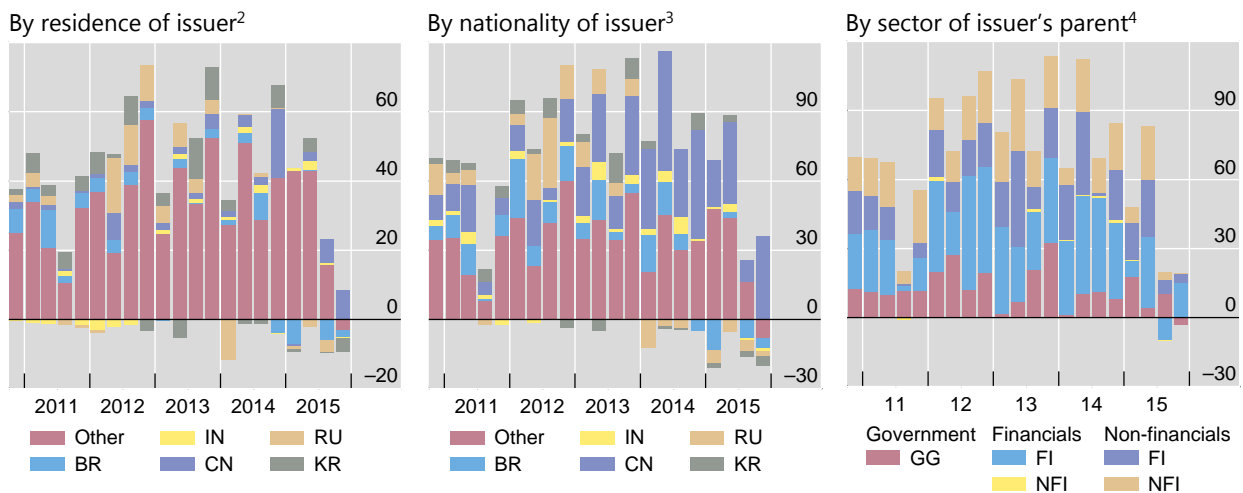
EUR = euro; USD = US dollar; JPY = yen; OTH = other currencies; GG = general government; FC= financial corporations; NFC = non-financial corporations; IO = international organisations.

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

International debt securities issued by borrowers from emerging market economies¹

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

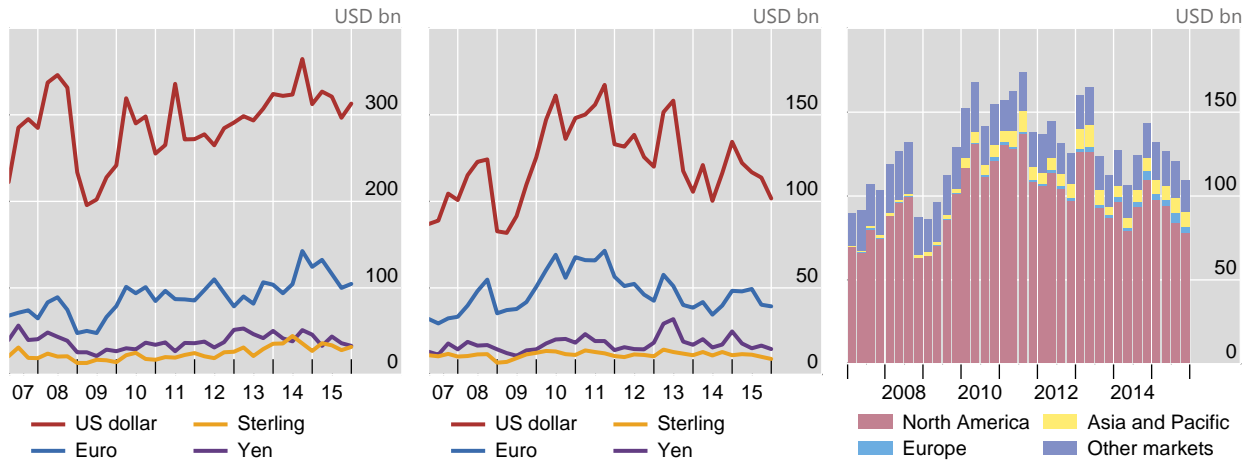
Graph D.1

Open interest, by currency¹

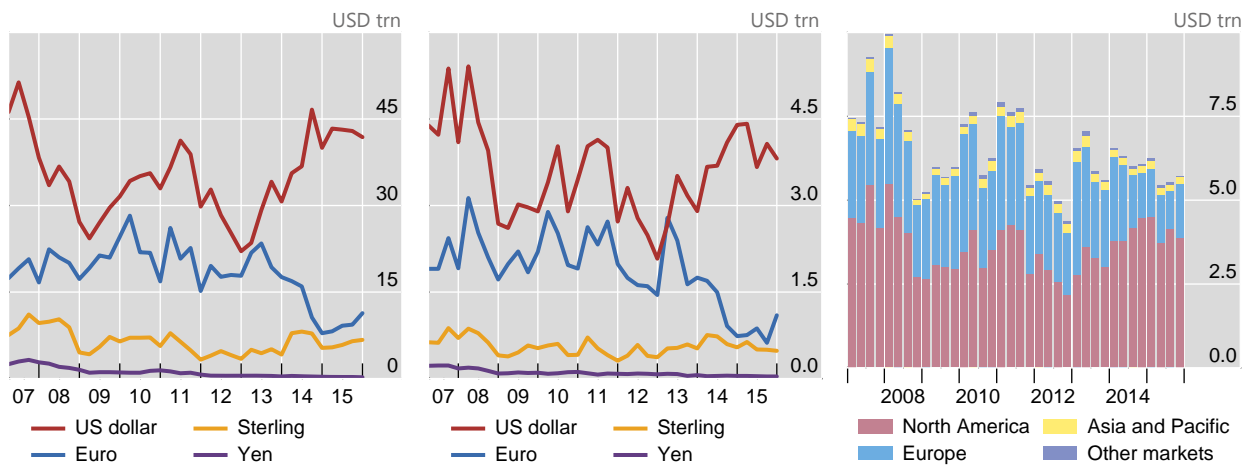
Daily average turnover, by currency²

Daily average turnover, by location of exchange²

Foreign exchange derivatives³



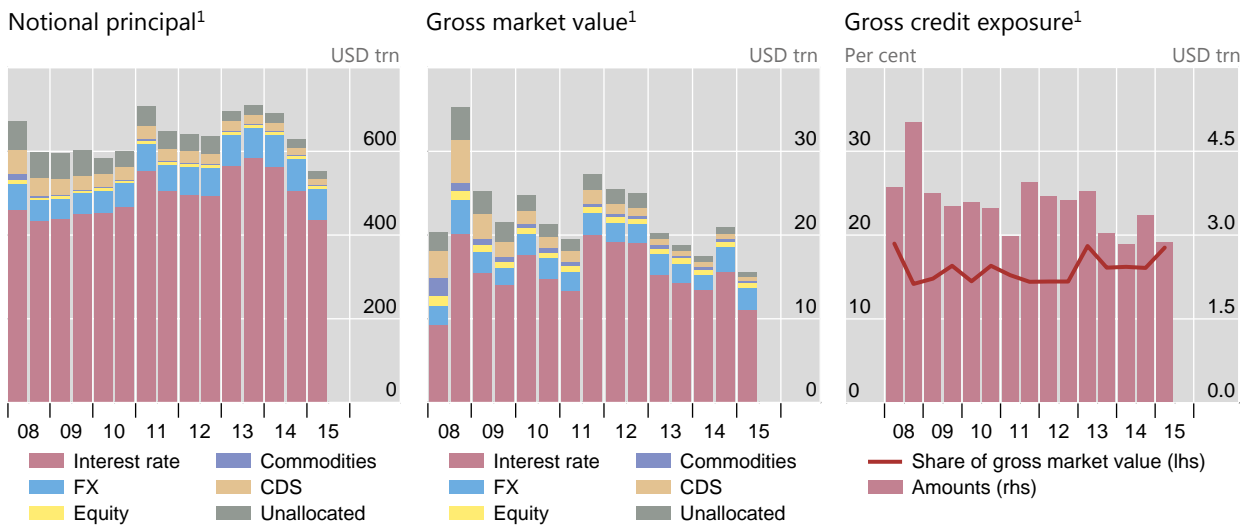
Interest rate derivatives³



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; The Options Clearing Corporation; BIS derivatives statistics.



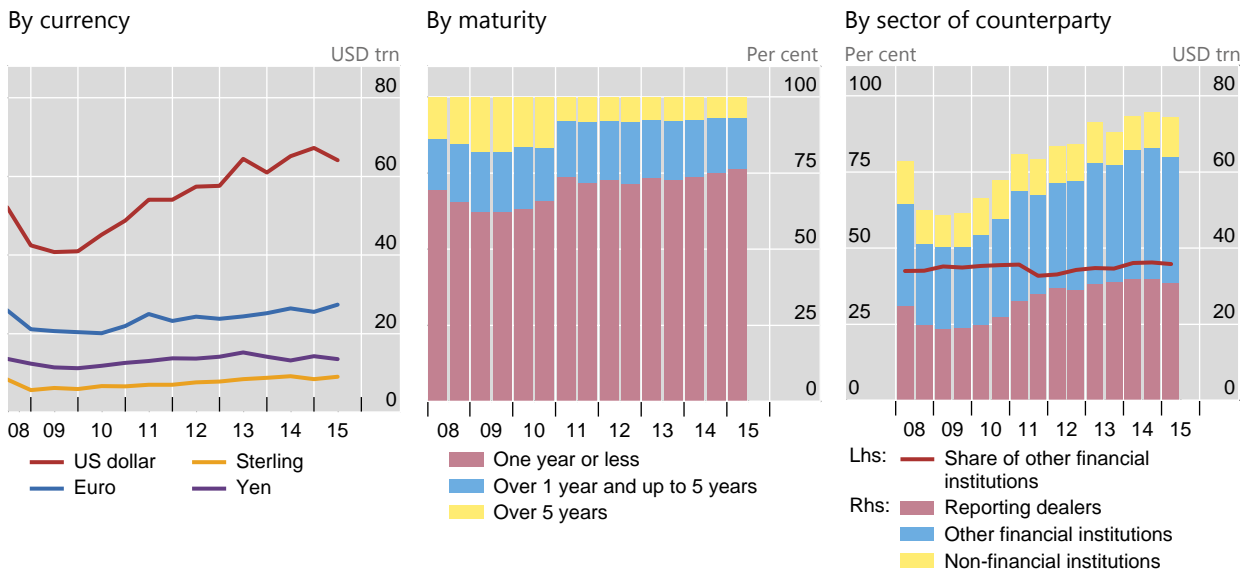
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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 principal¹

Graph D.3



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

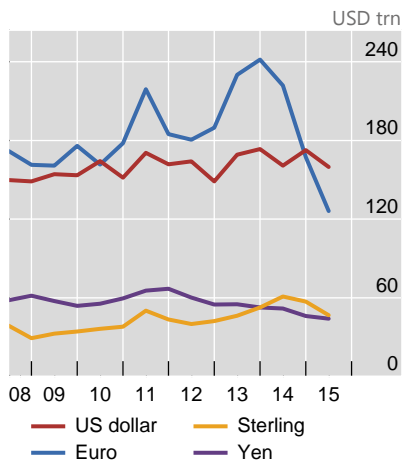
¹ At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

OTC interest rate derivatives

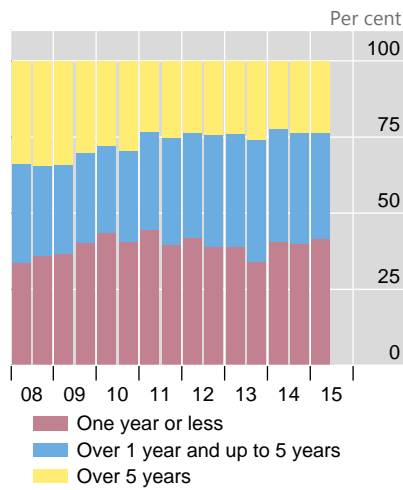
Notional principal¹

Graph D.4

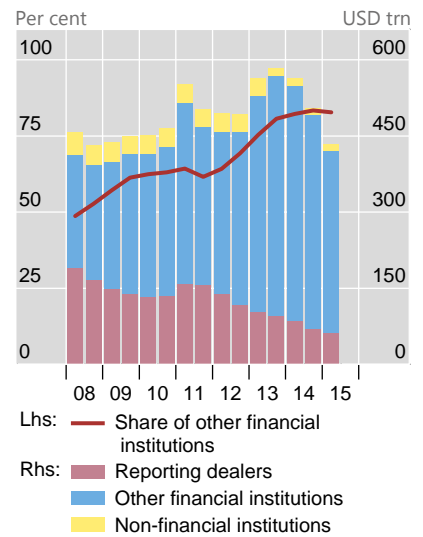
By currency



By maturity



By sector of counterparty



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

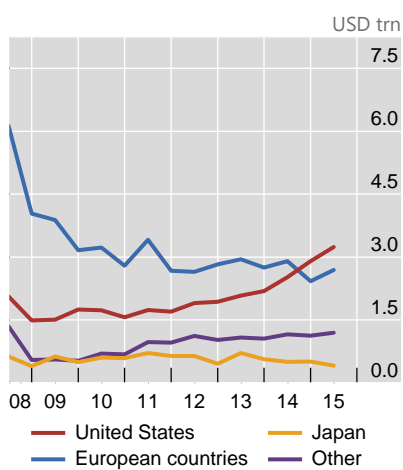
¹ At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

OTC equity-linked derivatives

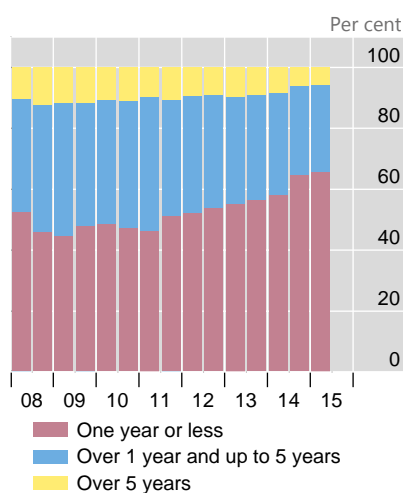
Notional principal¹

Graph D.5

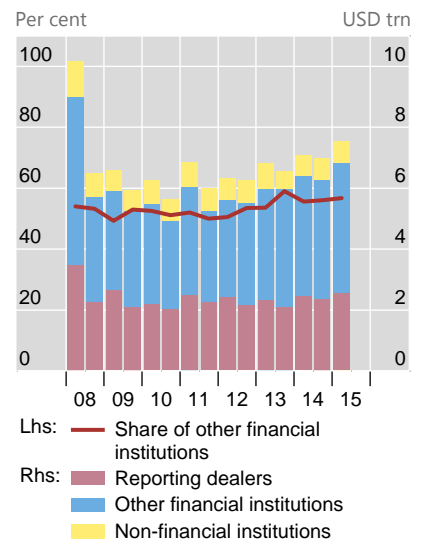
By equity market



By maturity



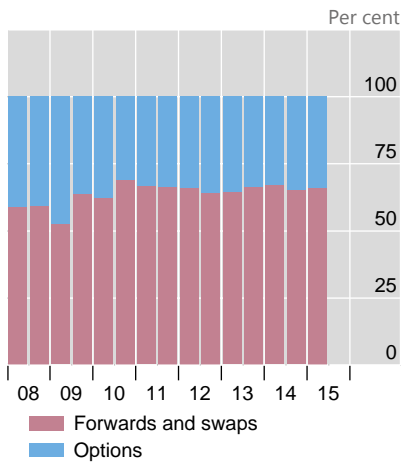
By sector of counterparty



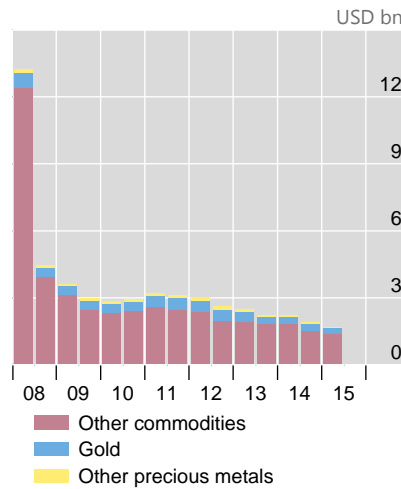
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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.

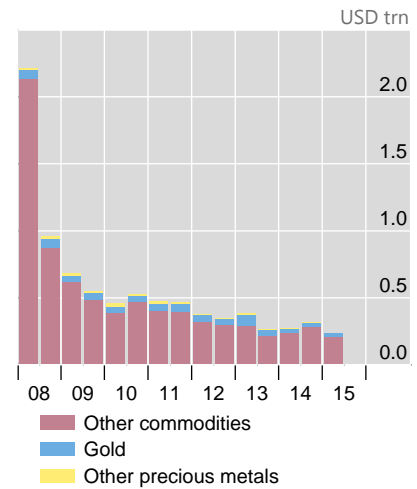
Notional principal, by instrument¹



Notional principal, by commodity¹



Gross market value, by commodity¹

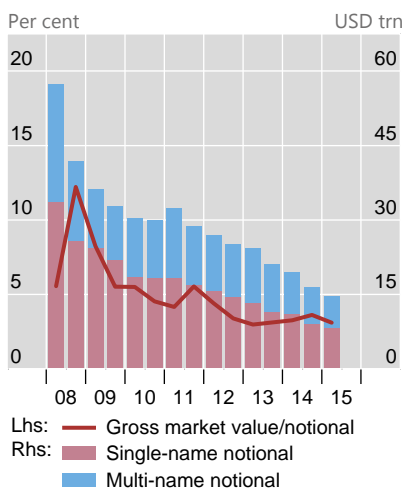


Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

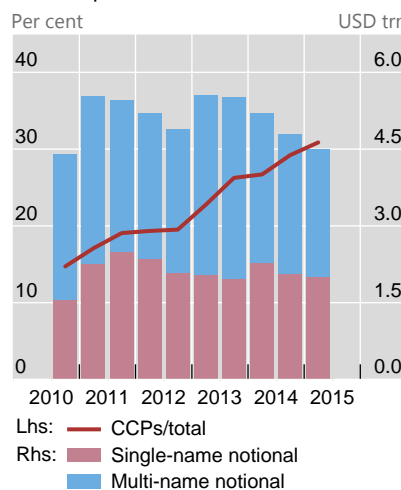
¹ At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Credit default swaps¹

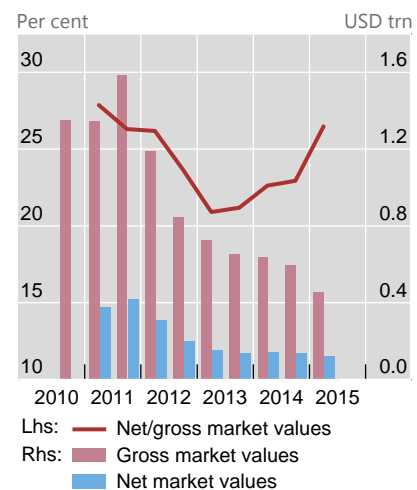
Notional principal



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.

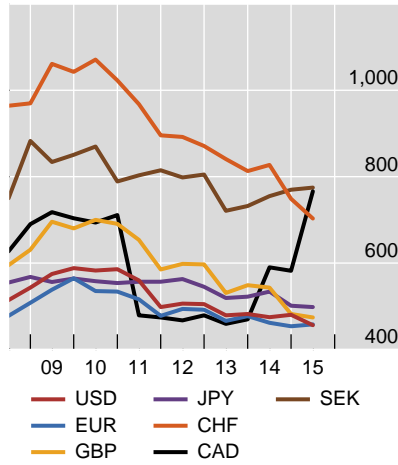
¹ At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Concentration in global OTC derivatives markets

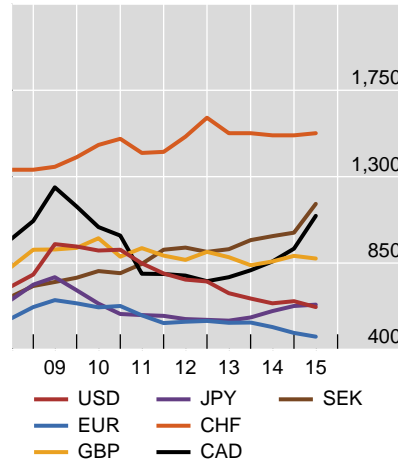
Herfindahl index¹

Graph D.8

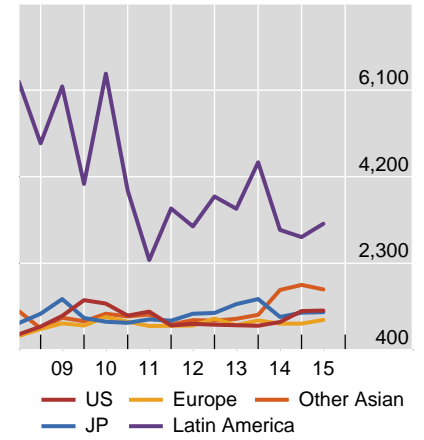
Foreign exchange derivatives²



Interest rate swaps



Equity-linked options



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

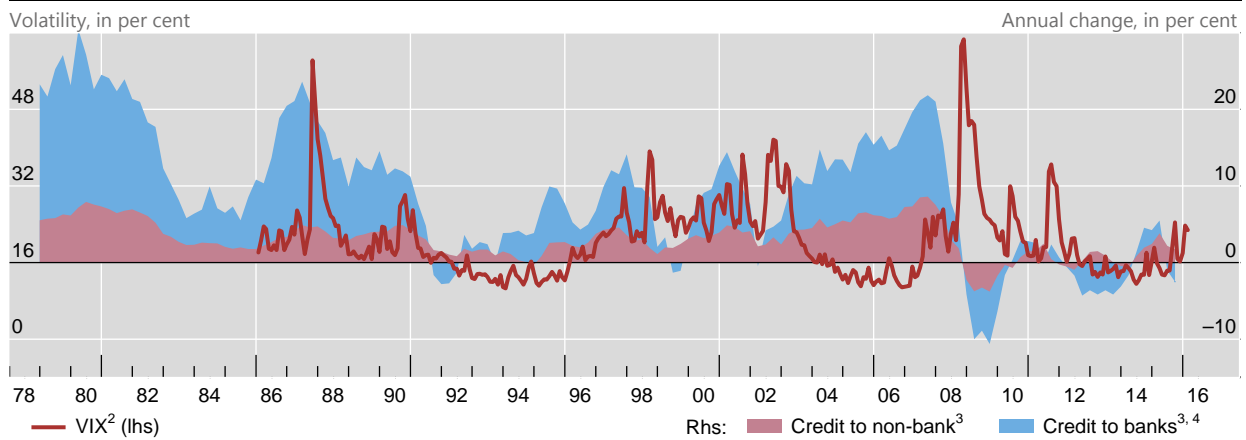
CAD = Canadian dollar; CHF = Swiss franc; EUR = euro; GBP = pound sterling; JPY = Japanese yen; SEK = Swedish krona; USD = US dollar. JP = Japan; US = United States.

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 credit¹

Graph E.1



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

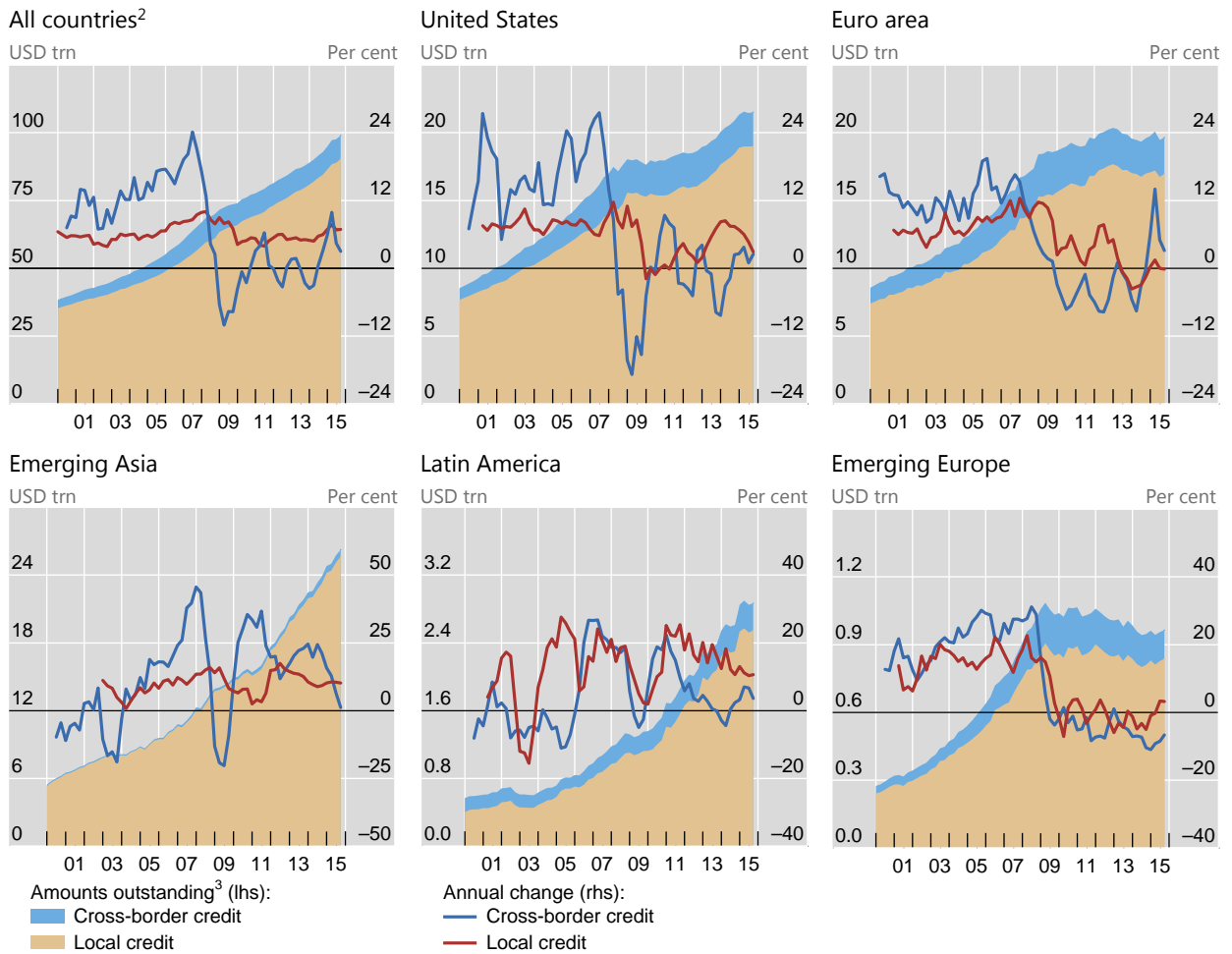
¹ LBS reporting banks' cross-border claims plus local claims in foreign currencies. ² VIX refers to the Chicago Board Options Exchange Market Volatility Index. It measures the implied volatility of S&P 500 index options. ³ Contribution to the annual percentage change in credit to all sectors. ⁴ Including 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 currencies¹

Graph E.2



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

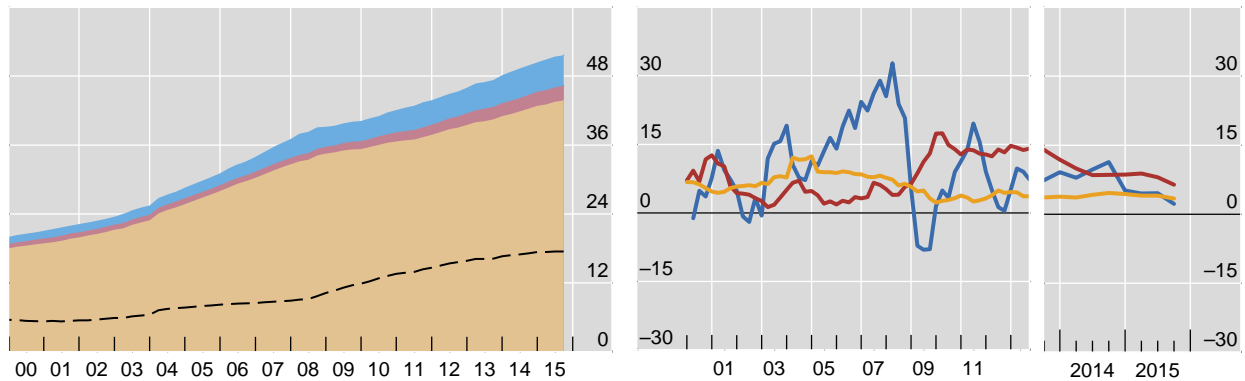
¹ Cross-border claims of LBS reporting banks plus local claims of all banks. Local claims are from national financial accounts and include credit extended by the central bank to the government. ² Sample of 52 countries. ³ Amounts outstanding at quarter-end. Amounts denominated in currencies other than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

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

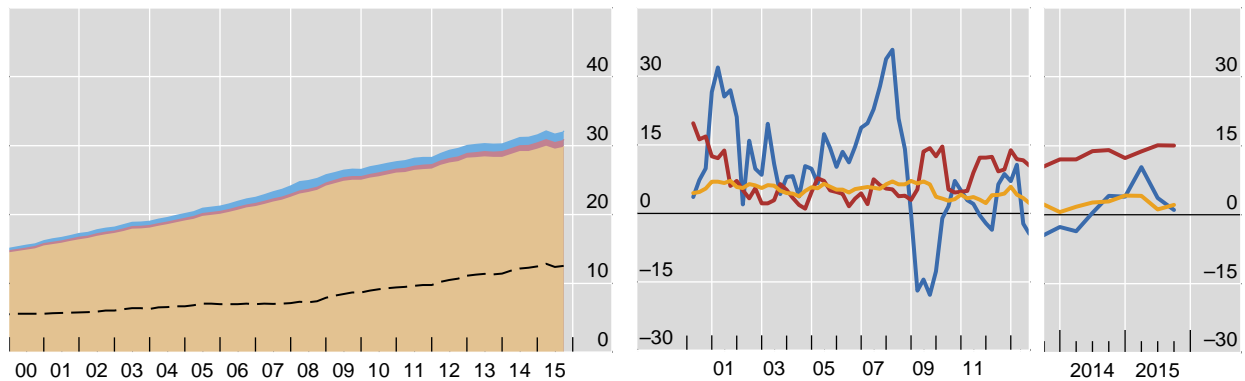
Amounts outstanding¹ (USD trn)

Annual change (per cent)

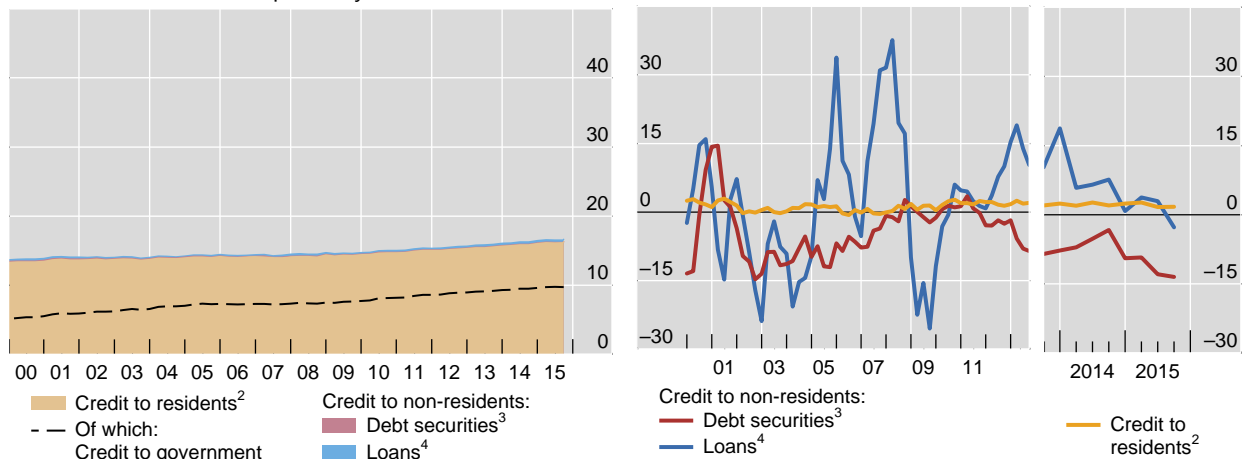
Credit denominated in US dollars (USD)



Credit denominated in euros (EUR)



Credit denominated in Japanese yen (JPY)



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-September 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.

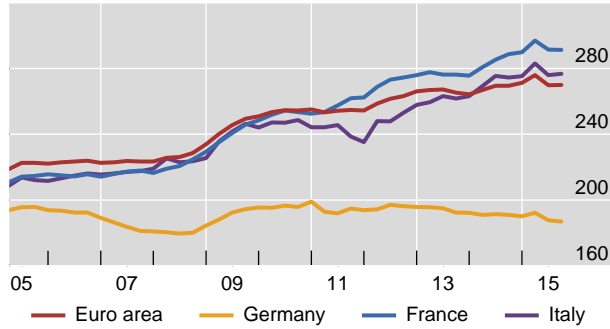
F Statistics on total credit to the non-financial sector

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

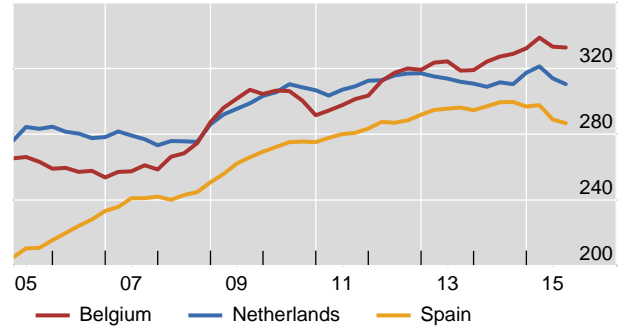
As a percentage of GDP

Graph F.1

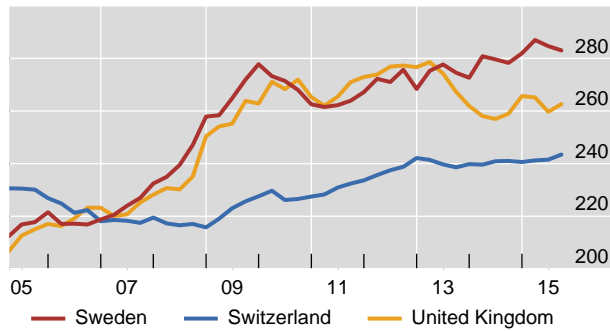
Euro area: aggregate and major countries



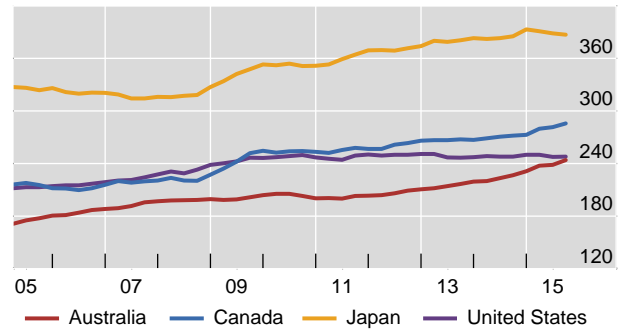
Euro area: other countries



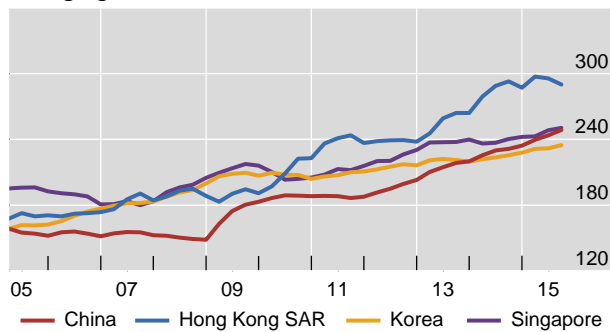
Other European countries



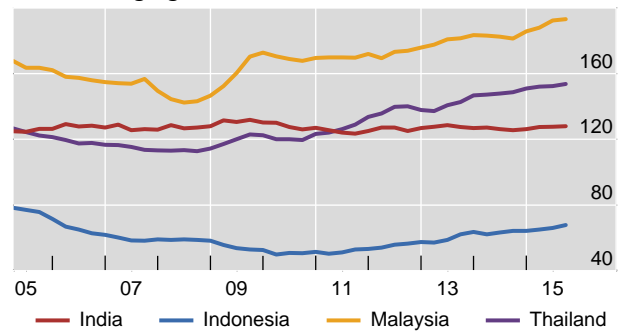
Major advanced economies



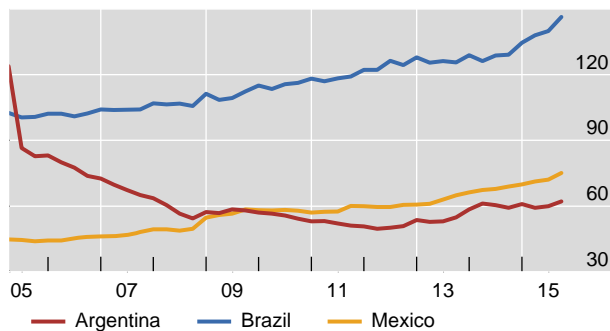
Emerging Asia



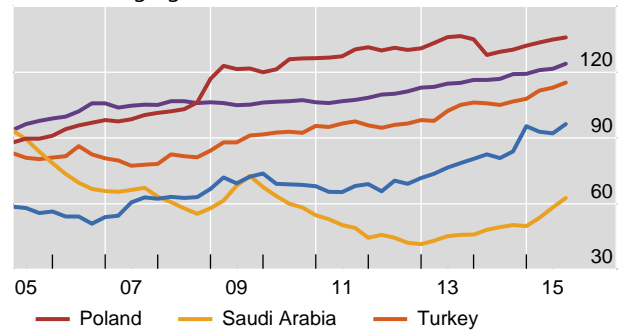
Other emerging Asia



Latin America



Other emerging market economies



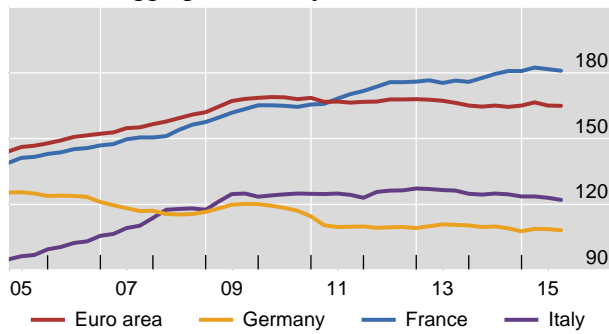
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

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

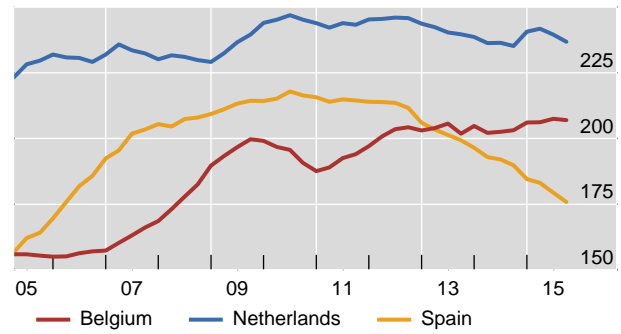
As a percentage of GDP

Graph F.2

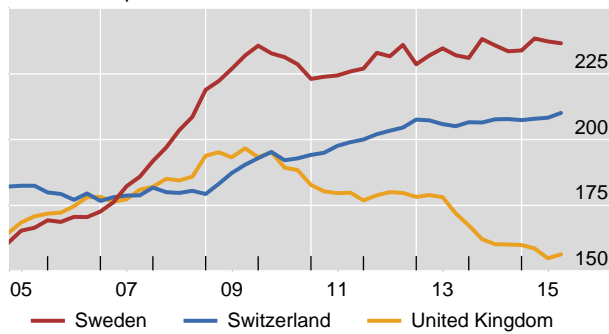
Euro area: aggregate and major countries



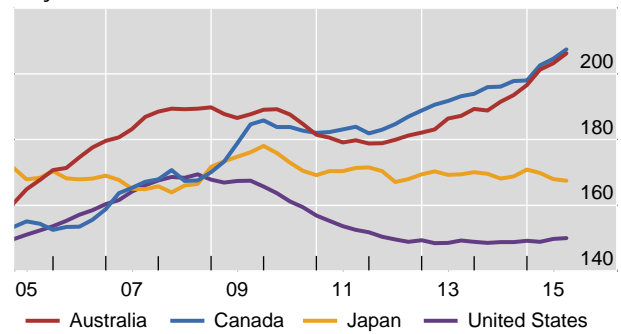
Euro area: other countries



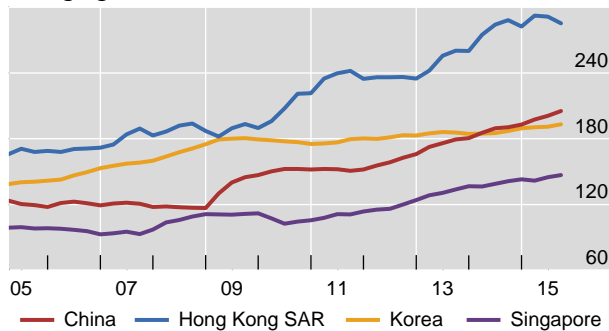
Other European countries



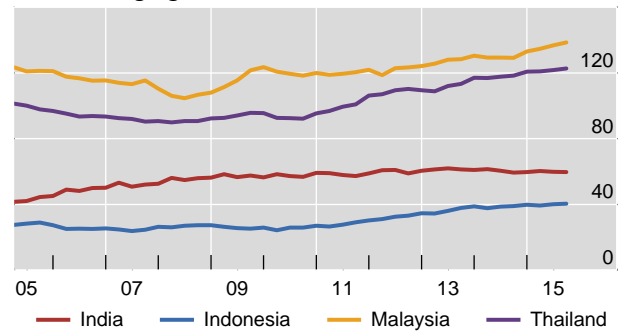
Major advanced economies



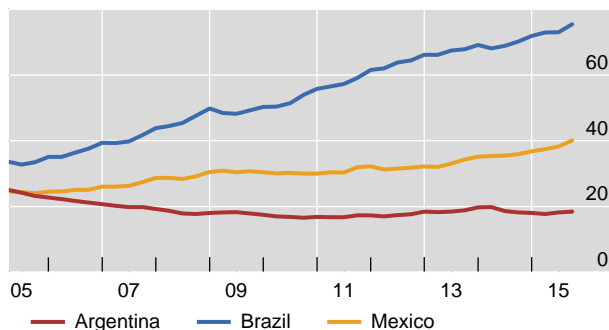
Emerging Asia



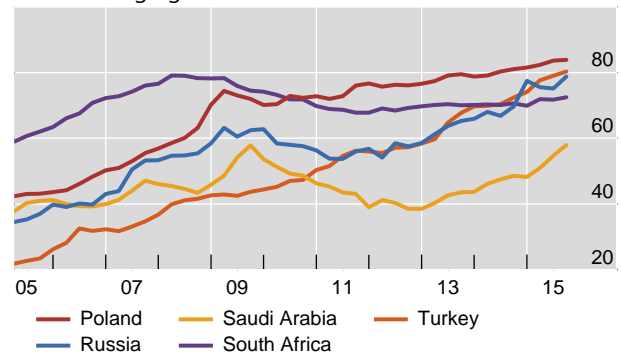
Other emerging Asia



Latin America



Other emerging market economies



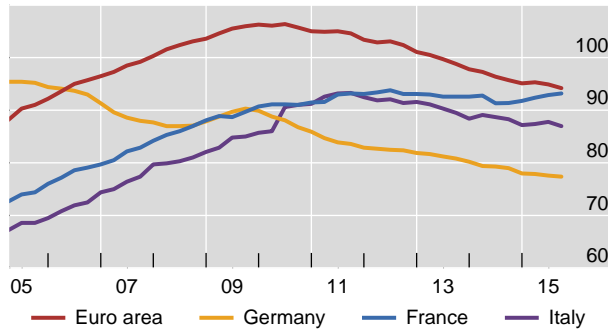
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

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

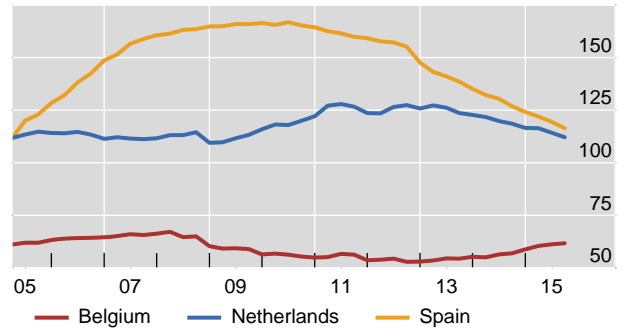
As a percentage of GDP

Graph F.3

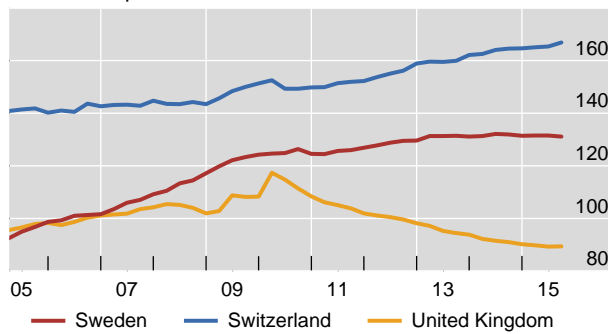
Euro area: aggregate and major countries



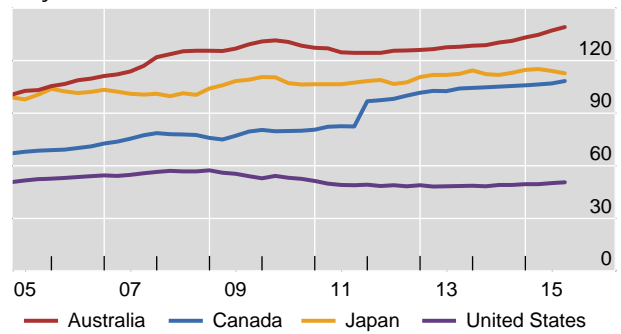
Euro area: other countries



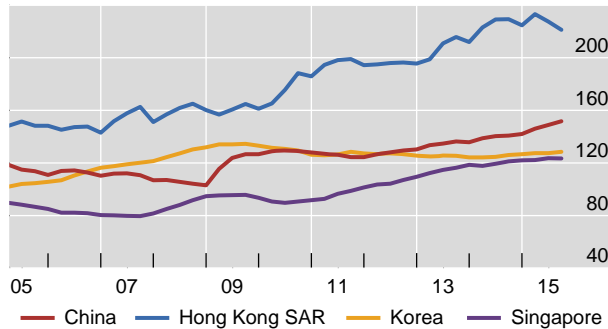
Other European countries



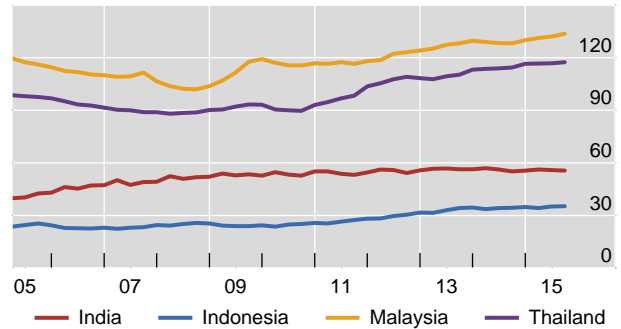
Major advanced economies



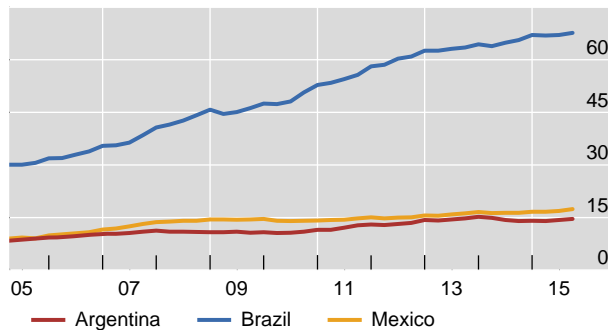
Emerging Asia



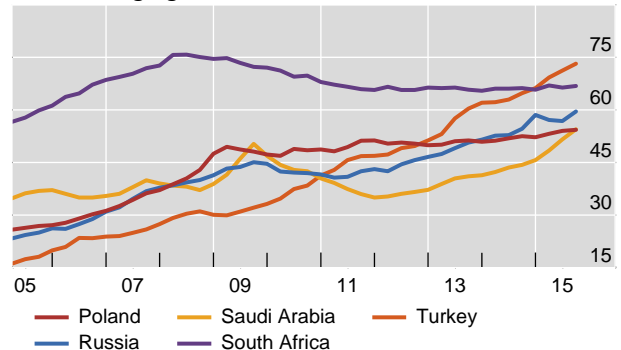
Other emerging Asia



Latin America



Other emerging market economies



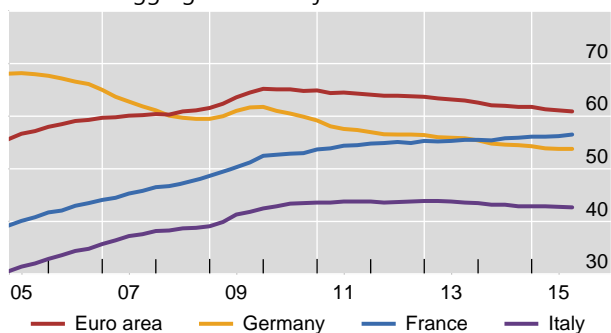
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Total credit to households (core debt)

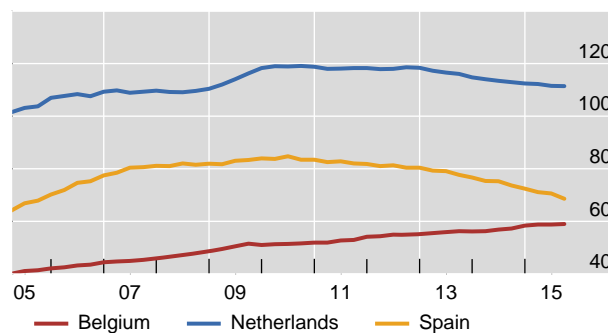
As a percentage of GDP

Graph F.4

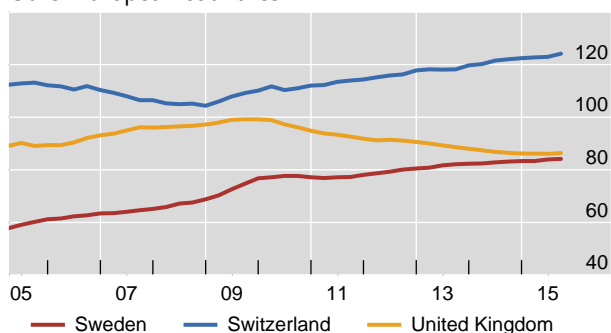
Euro area: aggregate and major countries



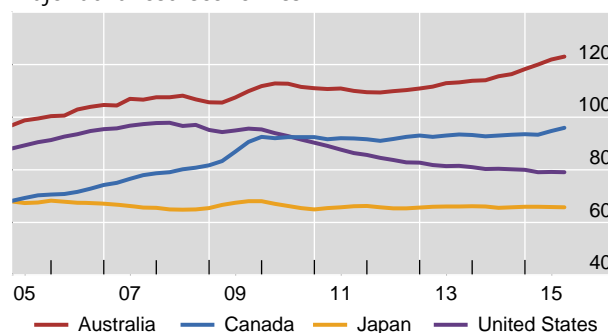
Euro area: other countries



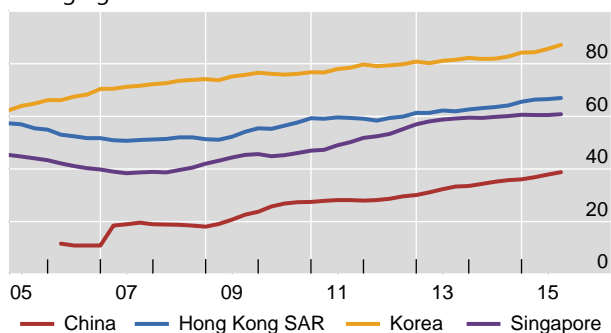
Other European countries



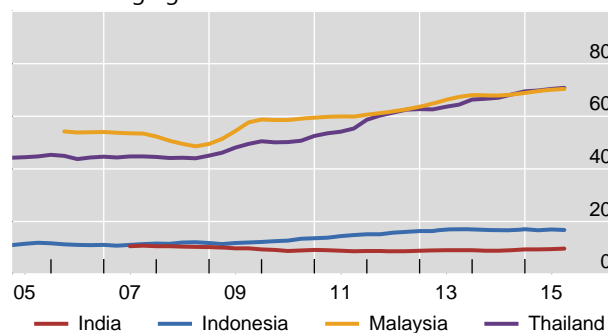
Major advanced economies



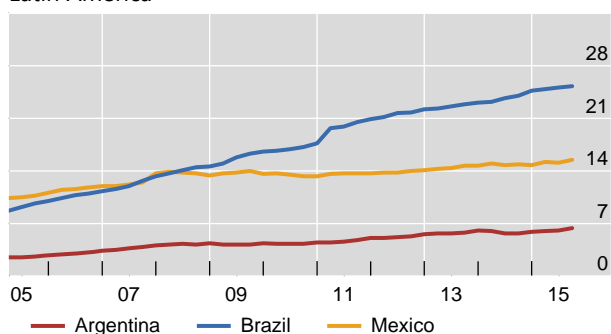
Emerging Asia



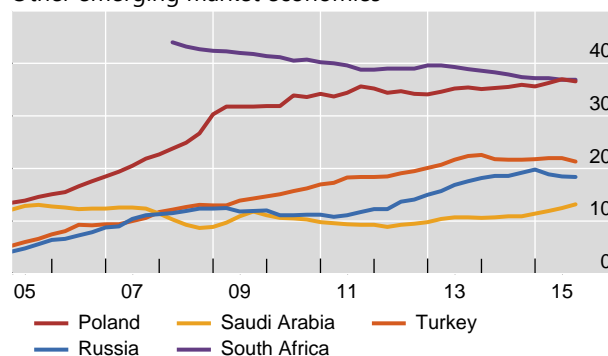
Other emerging Asia



Latin America



Other emerging market economies



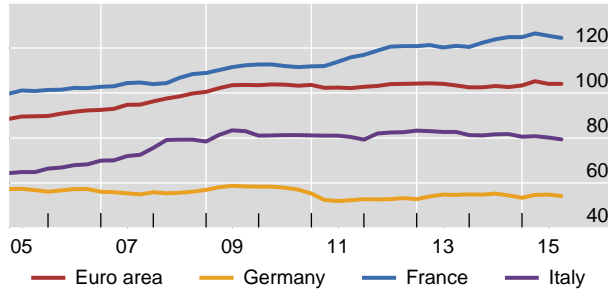
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Total credit to non-financial corporations (core debt)

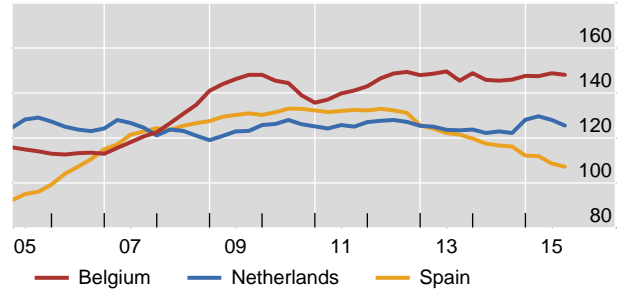
As a percentage of GDP

Graph F.5

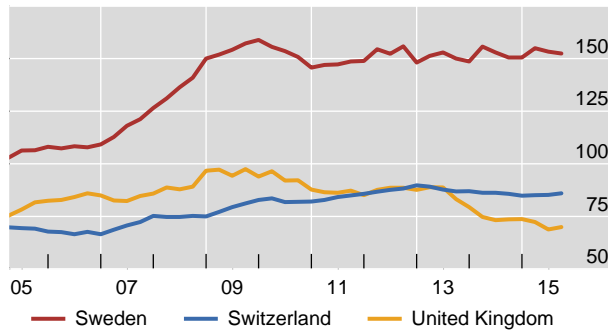
Euro area: aggregate and major countries



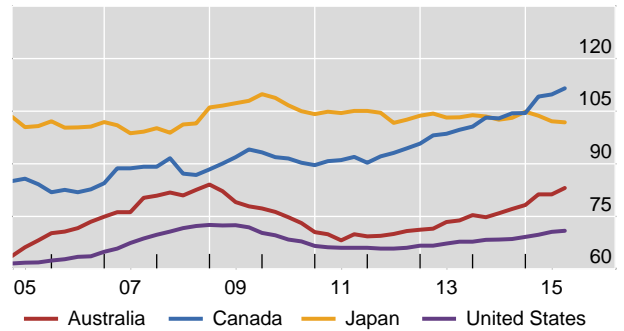
Euro area: other countries



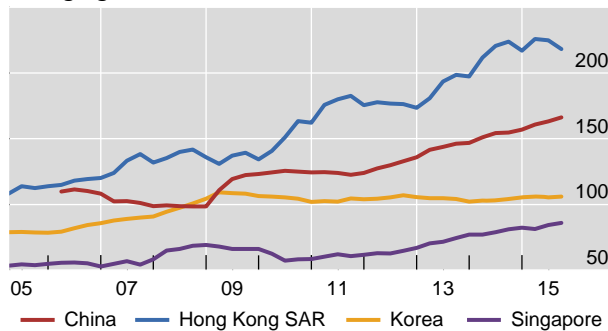
Other European countries



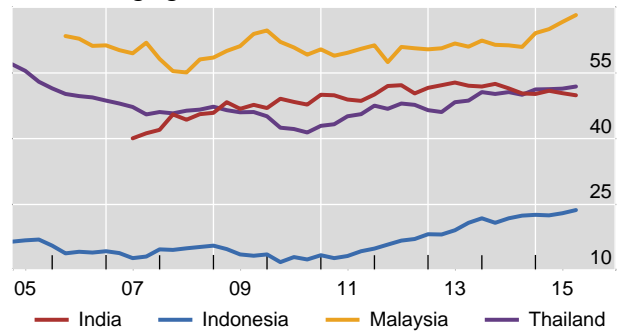
Major advanced economies



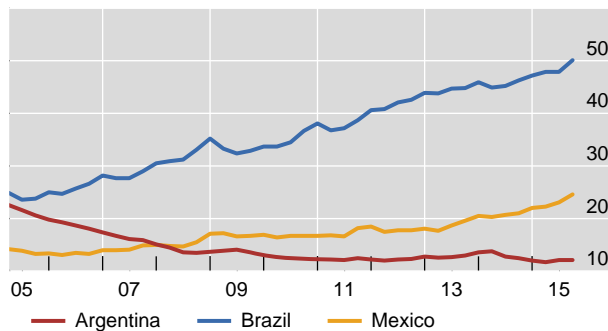
Emerging Asia



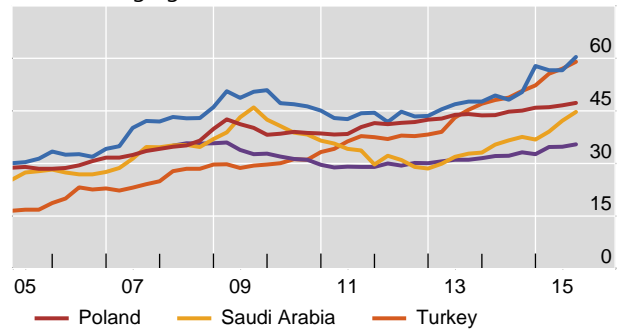
Other emerging Asia



Latin America



Other emerging market economies



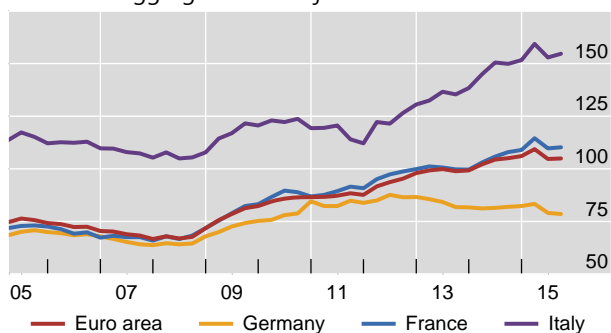
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

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

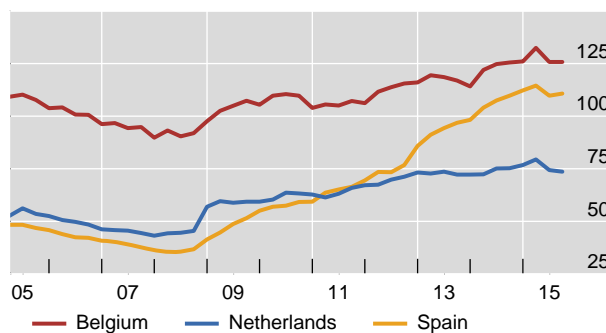
As a percentage of GDP

Graph F.6

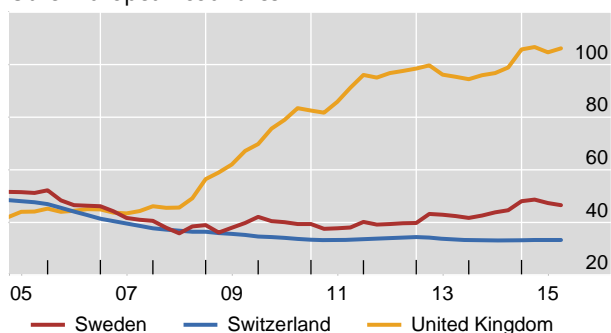
Euro area: aggregate and major countries



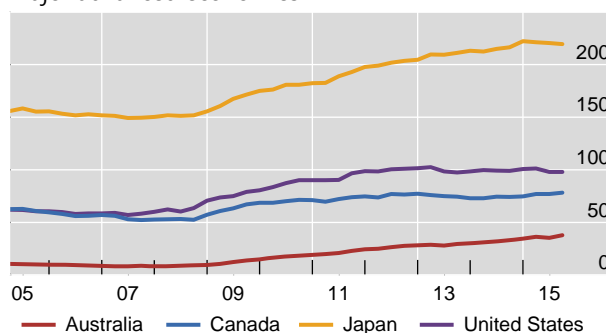
Euro area: other countries



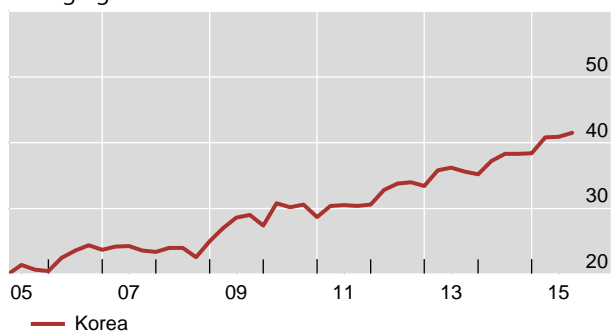
Other European countries



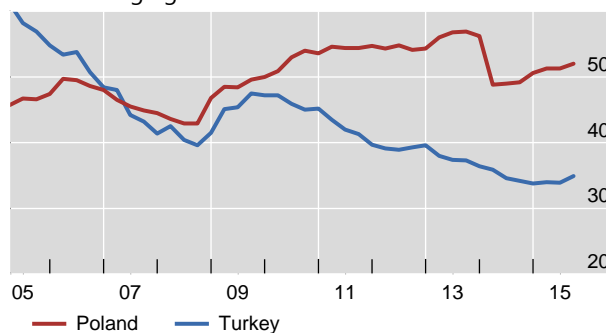
Major advanced economies



Emerging Asia



Other emerging market economies



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

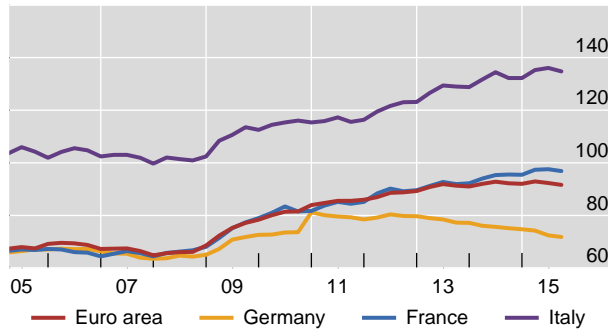
¹ Consolidated data for the general government sector.

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

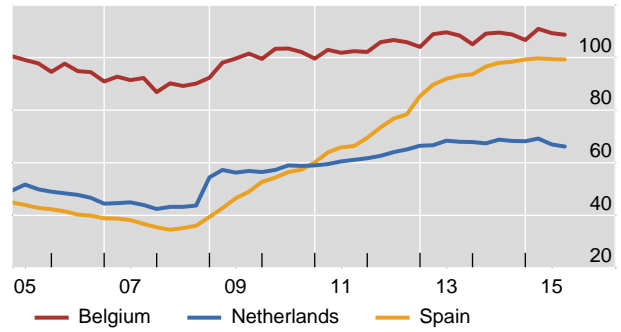
As a percentage of GDP

Graph F.7

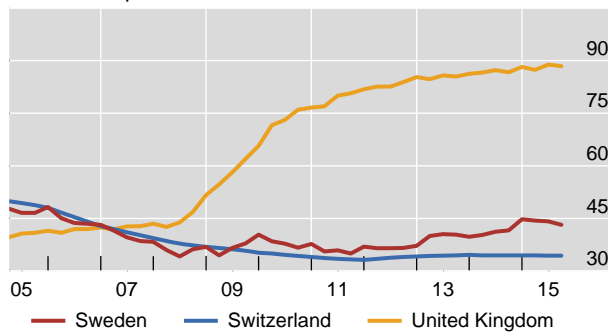
Euro area: aggregate and major countries



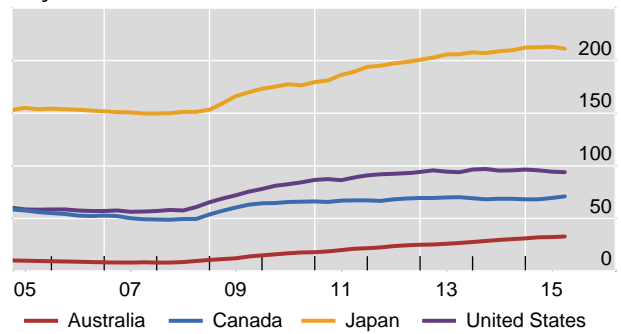
Euro area: other countries



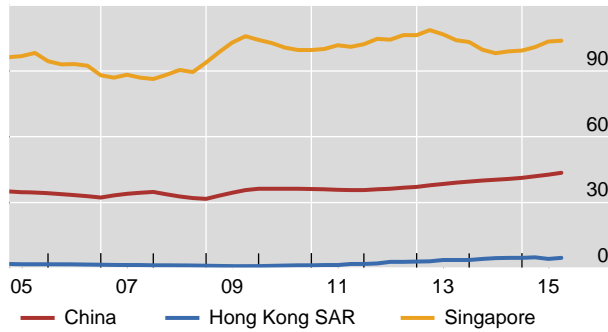
Other European countries



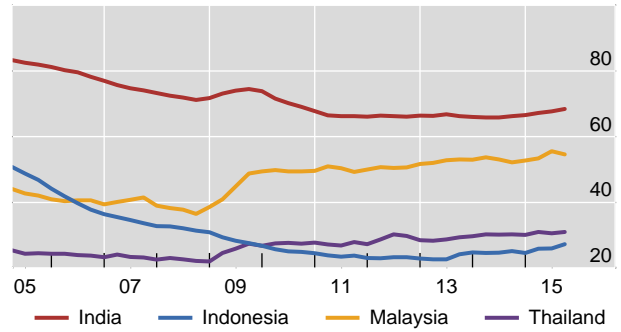
Major advanced economies



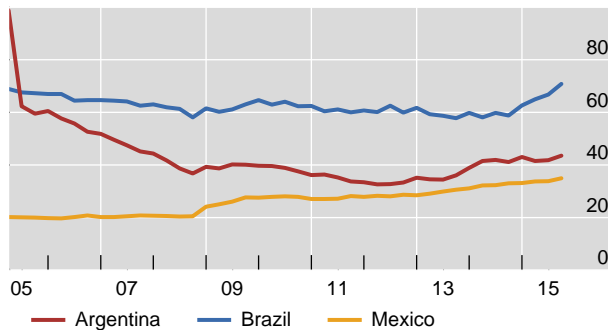
Emerging Asia



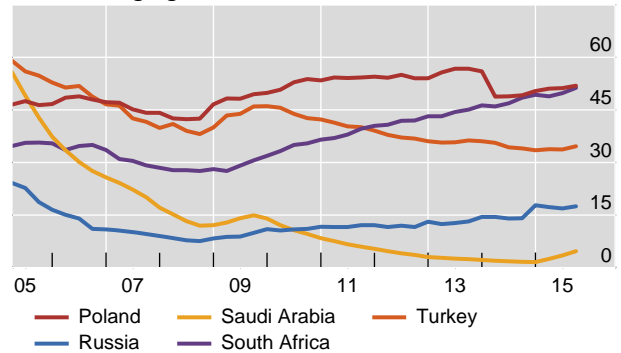
Other emerging Asia



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.

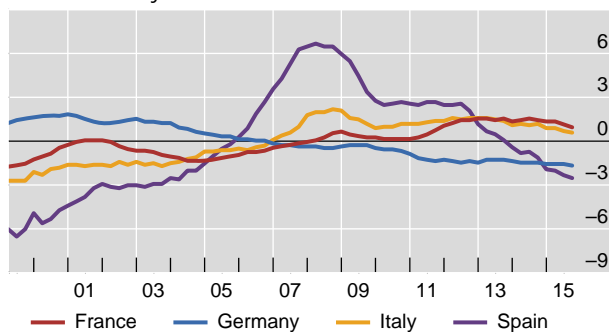
G Debt service ratios for the private non-financial sector

Debt service ratios of the private non-financial sector

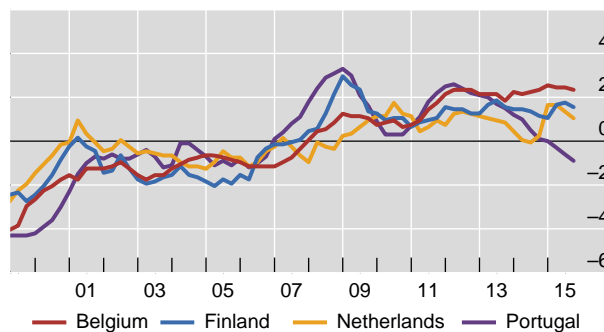
Deviation from country-specific mean; in percentage points¹

Graph G.1

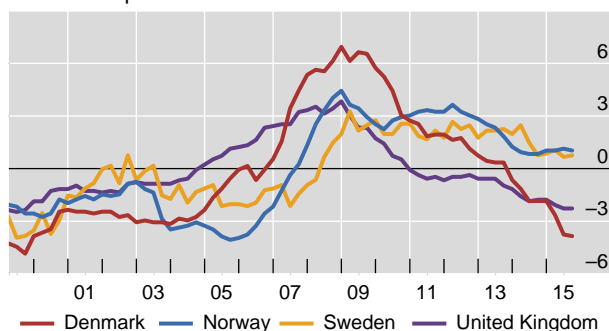
Euro area: major countries



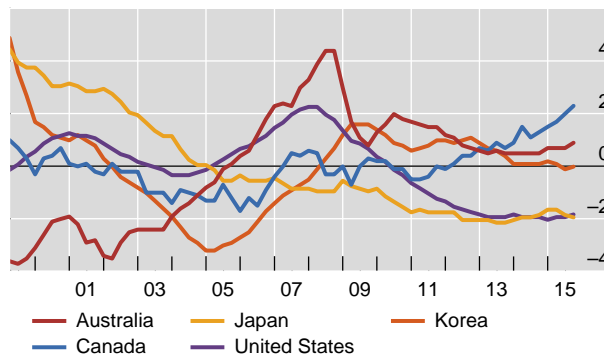
Euro area: other countries



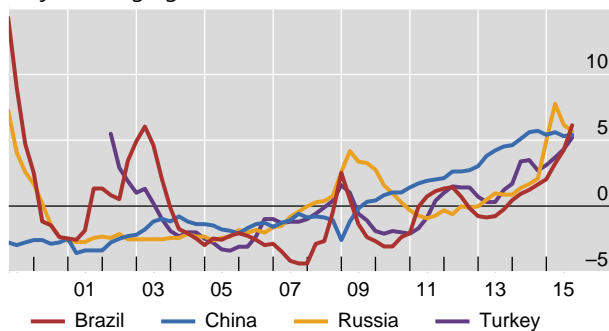
Other European countries



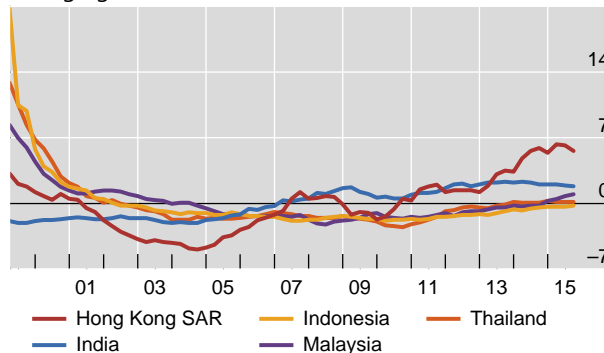
Other economies



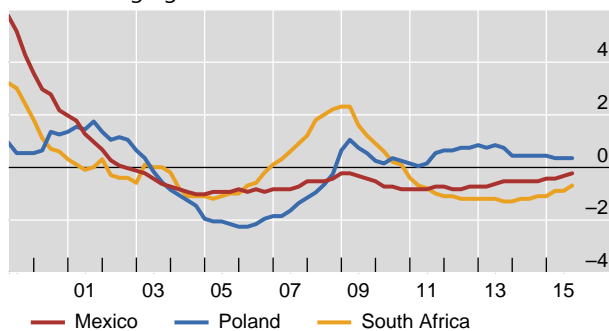
Major emerging markets²



Emerging Asia²



Other emerging markets²



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 "Methodology and data for DSR calculation" at www.bis.org/statistics/dsr.htm.

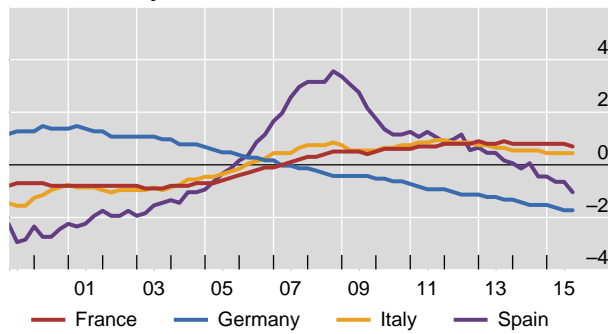
Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

Debt service ratios of households

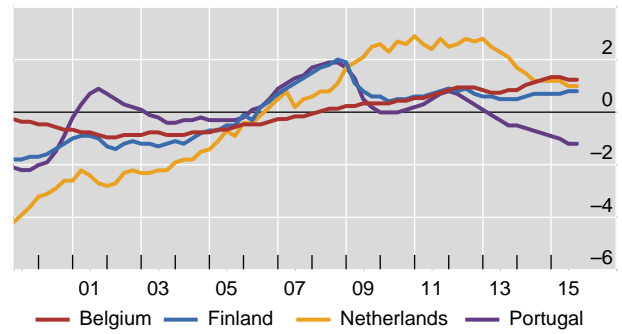
Deviation from country-specific mean; in percentage points¹

Graph G.2

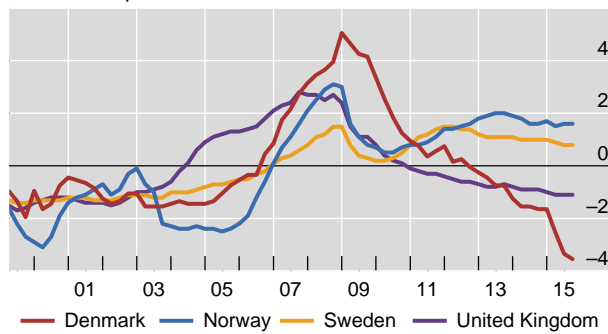
Euro area: major countries



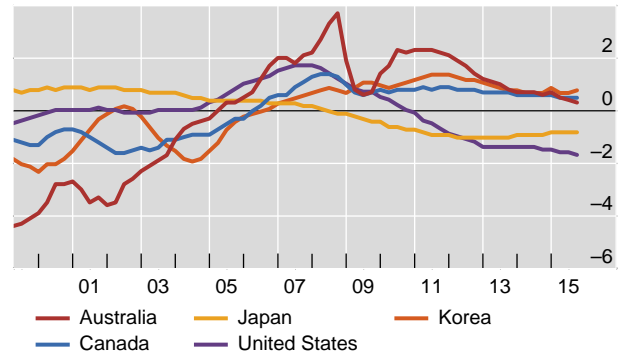
Euro area: other countries



Other European countries



Other economies



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

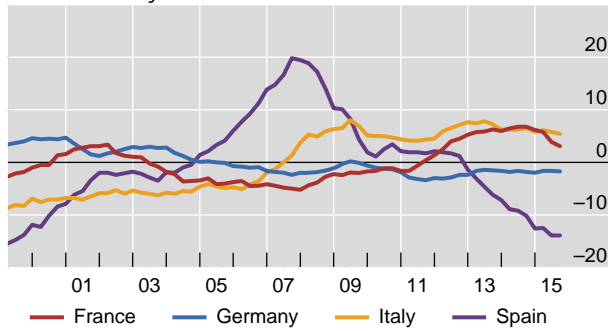
¹ Country-specific means are based on all available data from 1999 onwards.

Debt service ratios of non-financial corporations

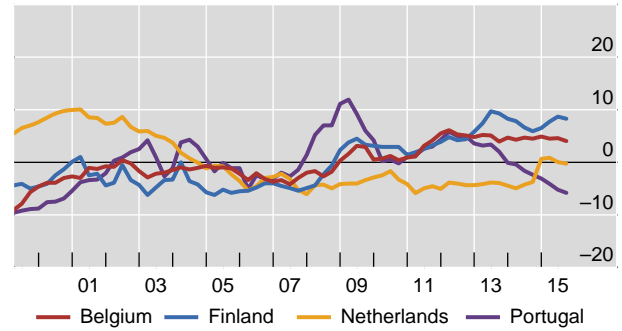
Deviation from country-specific mean; in percentage points¹

Graph G.3

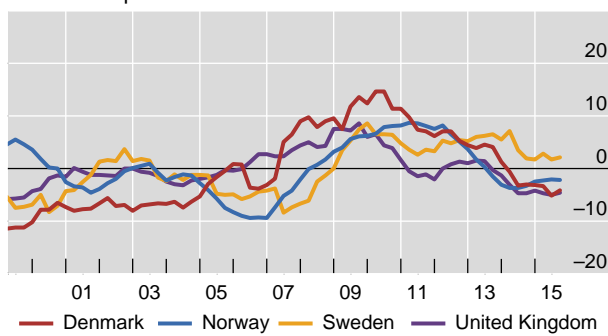
Euro area: major countries



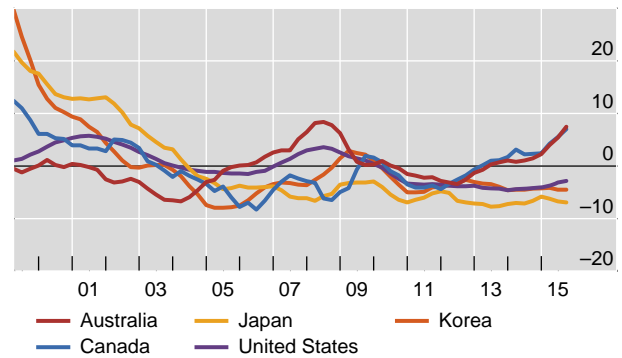
Euro area: other countries



Other European countries



Other economies



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.

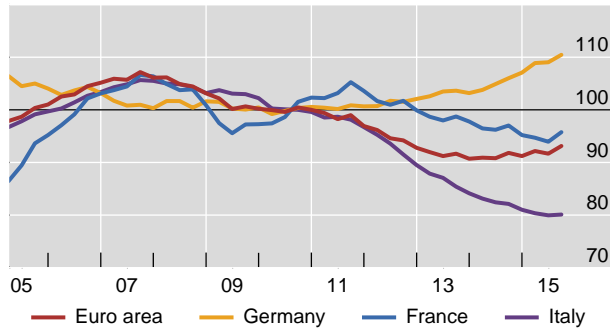
H Property price statistics

Real residential property prices

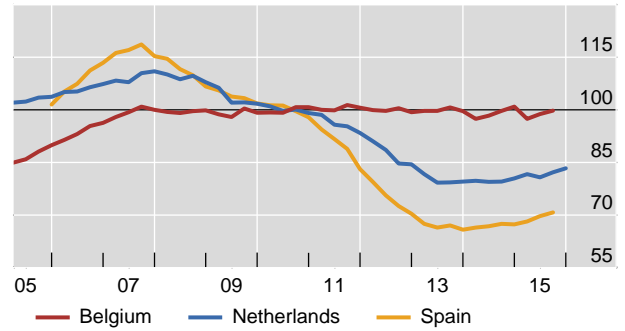
CPI-deflated; 2010 = 100

Graph H.1

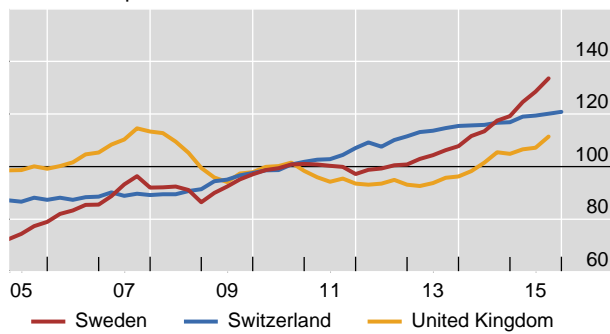
Euro area: aggregate and major countries



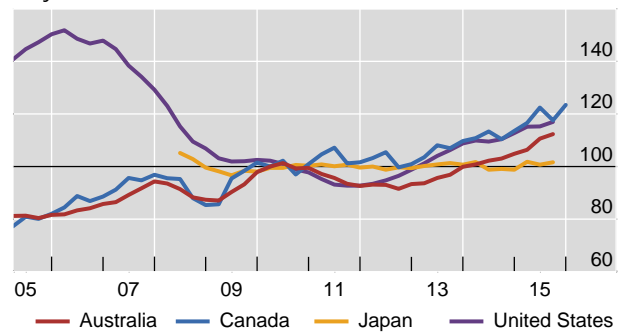
Euro area: other countries



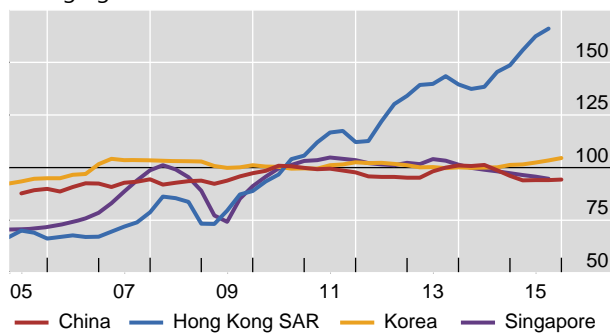
Other European countries



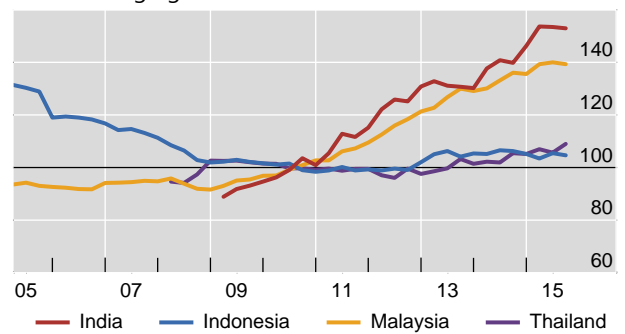
Major advanced economies



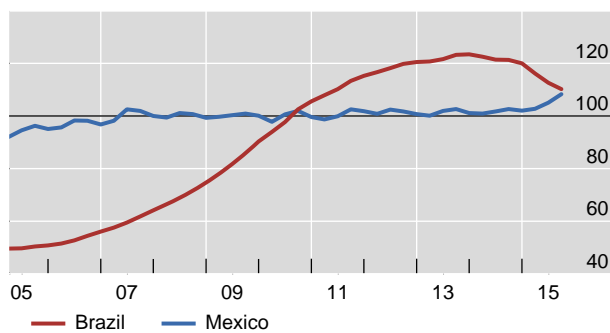
Emerging Asia



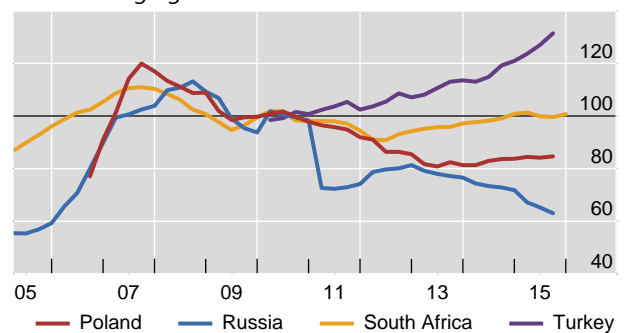
Other emerging Asia



Latin America



Other emerging market economies



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

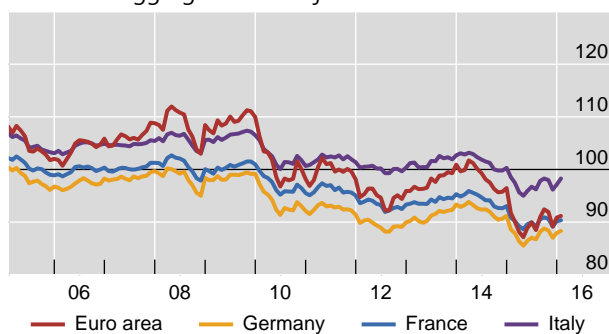
I Effective exchange rate statistics

Real effective exchange rates

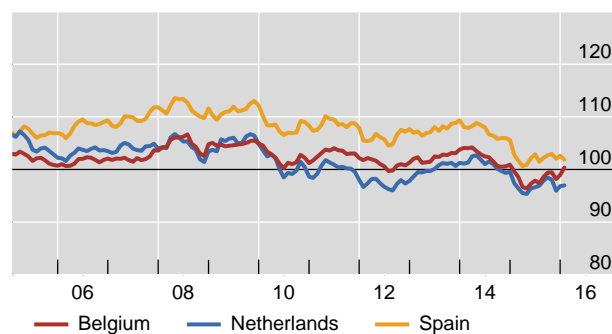
CPI-based; 1995–2005 = 100¹

Graph I.1

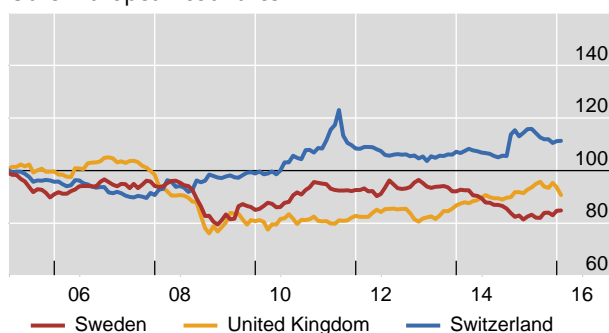
Euro area: aggregate and major countries



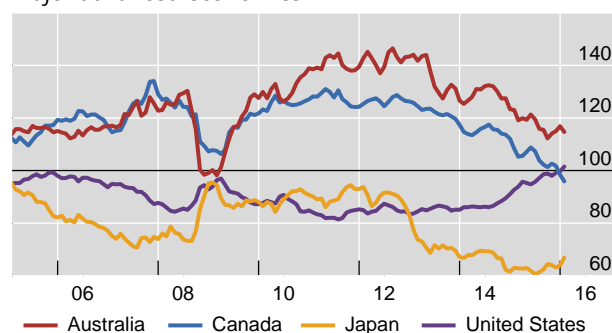
Euro area: other countries



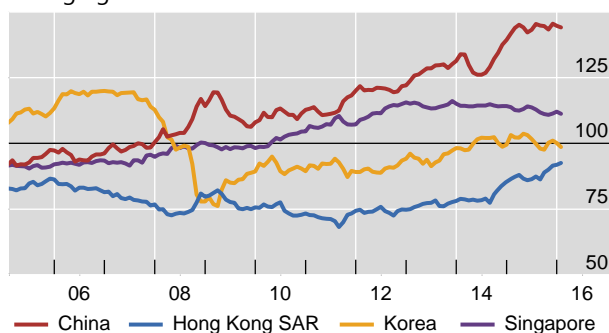
Other European countries



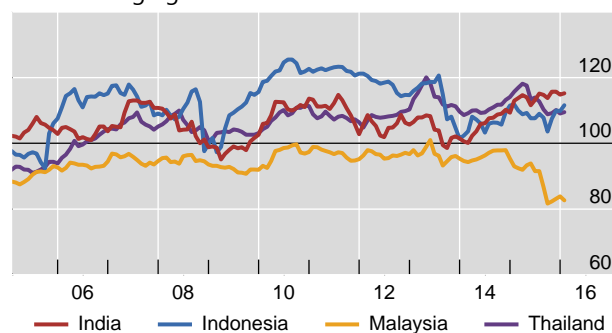
Major advanced economies



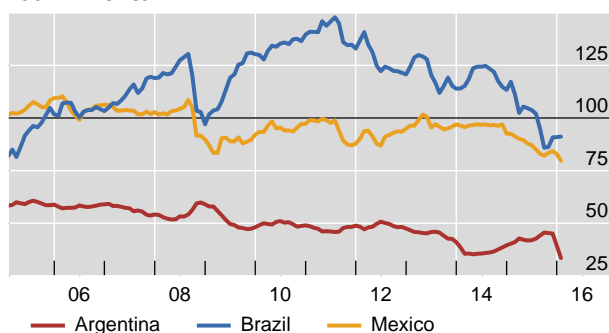
Emerging Asia



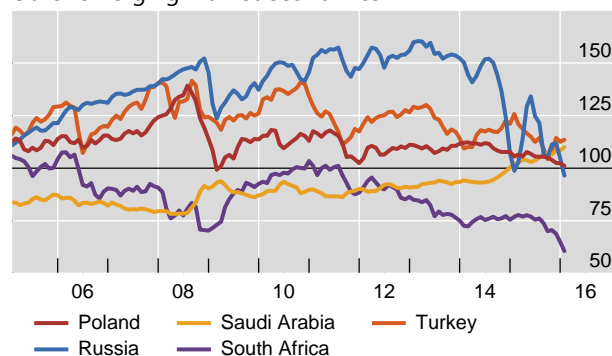
Other emerging Asia



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

December 2015	Dollar credit to emerging market economies	Robert Neil McCauley, Patrick McGuire & Vladyslav Sushko
December 2015	Calibrating the leverage ratio	Ingo Fender & Ulf Lewrick
December 2015	Central clearing: trends and current issues	Dietrich Domanski, Leonardo Gambacorta & Cristina Picillo
December 2015	Sovereign ratings of advanced and emerging economies after the crisis	Marlene Amstad & Frank Packer
September 2015	Introduction to BIS statistics	
September 2015	Enhanced data to analyse international banking	Stefan Avdjiev, Patrick McGuire & Philip Wooldridge
September 2015	A new database on general government debt	Christian Dembiermont, Michela Scatigna, Robert Szemere & 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 & Marjorie Santos
September 2015	International monetary spillovers	Boris Hofmann & Előd Takáts
September 2015	The rise of regional banking in Asia and the Pacific	Eli M Remolona & 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

Recent BIS publications¹

BIS Working Papers

Booms and banking crises

Frederic Boissay, Fabrice Collard and Frank Smets

Banking crises are rare events that break out in the midst of credit intensive booms and bring about particularly deep and long-lasting recessions. This paper attempts to explain these phenomena within a textbook DSGE model that features a non-trivial banking sector. In the model, banks are heterogeneous with respect to their intermediation skills, which gives rise to an interbank market. Moral hazard and asymmetric information in this market may lead to sudden interbank market freezes, banking crises, credit crunches and severe recessions. Those "financial" recessions follow credit booms and are not triggered by large exogenous adverse shocks.

What drives inflation expectations in Brazil? Public versus private information

Waldyr D Areosa

This article applies a noisy information model with strategic interactions à la Morris and Shin (2002) to a panel from the Central Bank of Brazil Market Expectations System to provide evidence of how professional forecasters weight private and public information when building inflation expectations in Brazil. The main results are: (i) forecasters attach more weight to public information than private information because (ii) public information is more precise than private information. Nevertheless, (iii) forecasters overweight private information in order to (iv) differentiate themselves from each other (strategic substitutability).

Fiscal policy and the cycle in Latin America: the role of financing conditions and fiscal rules

Enrique Alberola-Ila, Iván Kataryniuk, Ángel Melguizo and René Orozco

A stronger macroeconomic position when the financial crisis erupted allowed Latin American economies to mitigate its impact through fiscal expansions, reversing the characteristic procyclical behaviour of fiscal policy. At the same time, in the last two decades fiscal rules have been extensively adopted in the region. This paper analyses the stabilising role of discretionary fiscal policy over time, and the role of fiscal financing conditions and fiscal rules in this evolution in a sample of eight Latin American economies. The analysis shows three main results: i) fiscal policies became countercyclical during the crisis, but they have turned procyclical again in recent years; ii) financing conditions are confirmed to be a key driver of the fiscal stance, but their relevance has recently diminished; and iii) fiscal rules are associated with a more stabilising role for fiscal policy.

Bank standalone credit ratings

Michael R King, Steven Ongena and Nikola Tarashev

We study a unique experiment to examine the importance of rating agencies' private information for bank shareholders. On July 20, 2011, Fitch Ratings refined their bank standalone ratings, which measure intrinsic financial strength, from a 9-point to a 21-point scale. This refinement did not affect their all-in ratings, which combine assessments of intrinsic strength and extraordinary sovereign support and provide an estimate of banks' creditworthiness. Thus, the impact of the standalone rating refinement was clearly limited to

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).

bank shareholders. We find evidence suggesting that the refinement resulted in higher than expected standalone ratings, but we find only weak evidence of ratings catering. We also find a positive relationship between stock price reactions and rating surprises, revealing that the rating refinement delivered useful information about the importance of bank characteristics for assessing intrinsic financial strength.

How do global investors differentiate between sovereign risks? The new normal versus the old

Marlene Amstad, Eli M Remolona and Jimmy Shek

When global investors go into emerging markets or get out of them, how do they differentiate between economies? Has this behaviour changed since the crisis of 2008 to reflect a "new normal"? We consider these questions by focusing on sovereign risk as reflected in monthly returns on credit default swaps (CDS) for 18 emerging markets and 10 developed countries. Tests for breaks in the time series of such returns suggest a new normal that ensued around October 2008 or soon afterwards. Dividing the sample into two periods and extracting risk factors from CDS returns, we find an "old normal" in which a single global risk factor drives half of the variation in returns and a new normal in which that risk factor becomes even more dominant. Surprisingly, in both the old and new normal, the way countries load on this factor depends not so much on economic fundamentals as on whether they are designated an emerging market.

Self-oriented monetary policy, global financial markets and excess volatility of international capital flows

Ryan Niladri Banerjee, Michael B Devereux and Giovanni Lombardo

This paper explores the nature of macroeconomic spillovers from advanced economies to emerging market economies (EMEs) and the consequences for independent use of monetary policy in EMEs. We first empirically document the effects of US monetary policy shocks on a sample group of EMEs. A contractionary monetary shock leads a retrenchment in EME capital flows, a fall in EME GDP, and an exchange rate depreciation. We construct a theoretical model which can help to account for these findings. In the model, macroeconomic spillovers are exacerbated by financial frictions. We assess the extent to which domestic monetary policy can mitigate the negative spillovers from foreign shocks. Absent financial frictions, international spillovers are minor, and an inflation targeting rule represents an effective policy for the EME. With frictions in financial intermediation, however, spillovers are substantially magnified, and an inflation targeting rule has little advantage over an exchange rate peg. However, an optimal monetary policy markedly improves on the performance of naive inflation targeting or an exchange rate peg. Furthermore, optimal policies don't need to be coordinated across countries. Under the specific set of assumptions maintained in our model, a non-cooperative, self-oriented optimal policy gives results very similar to those of a global cooperative optimal policy.

International trade finance and the cost channel of monetary policy in open economies

Nikhil Patel

This paper models the interaction between international trade finance and monetary policy in open economies and shows that trade finance affects the propagation mechanism of all macroeconomic shocks that are identified to be drivers of business cycles in advanced economies. The model is estimated with Bayesian techniques using output, price and bilateral trade data from the US and the Eurozone. The estimation exercise shows that trade finance conditions, which in turn are driven by US interest rates, are critical in explaining economic fluctuations. Quantitatively, trade finance has a larger impact on spill over effects of shocks to foreign countries, implying that incorporation of trade finance is particularly important when modelling small open economies.

Sovereign yields and the risk-taking channel of currency appreciation

Boris Hofmann, Ilhyock Shim and Hyun Song Shin

Currency appreciation against the US dollar is associated with the compression of emerging market economy (EME) sovereign yields. We find that this yield compression is due to reduced risk premiums rather than expectations of interest rates already priced into forward

rates. We explore a model which ties together dollar credit to EME corporates, sovereign tail risks and global investor portfolio adjustments driven by economic capital constraints. Consistent with our model, we find no empirical association between currency appreciation and sovereign spreads when we use the trade-weighted effective exchange rate that is unrelated to the US dollar.

Exchange rates and monetary spillovers

Guillaume Plantin and Hyun Song Shin

When does the combination of flexible exchange rates and domestic inflation-oriented monetary policy guarantee insulation from global financial conditions? We examine a dynamic global game model of international portfolio flows where, for some combination of parameters, the unique equilibrium exhibits the observed empirical feature that currency appreciation goes hand-in-hand with lower domestic interest rates and higher credit growth. When reversed, tighter monetary conditions go hand-in-hand with capital outflows and currency depreciation.

Is macroprudential policy instrument blunt?

Katsurako Sonoda and Nao Sudo

Since the global financial crisis of 2008, macroprudential instruments have attracted an increasing amount of attention as potentially the best tools for stabilizing boom-and-bust cycles. This is because, in contrast to short-term interest rates, macroprudential instruments are regarded as particularly precise tools that act only on the area of concern. In this paper, we conduct an empirical examination to determine if this is the case by studying relevant areas of the Japanese economy from the 1970s to 1990s. We focus on a policy instrument called Quantitative Restriction (QR) implemented by the government. QR explicitly required banks to curb their lending to the real estate industry and related activities, and was used in the wake of the credit boom. We construct shocks to QR using narrative records of the government, and estimate their impact on the macroeconomy. We find that QR affected the aggregate economy as well as the real estate sector and land prices. In order to see why QR was a "blunt" instrument, we conduct a cross-sectional analysis using individual bank data and disaggregated industry group data. We find evidence that shocks to QR affected the aggregate economy by damaging the balance sheets of banks and non-financial firms.

Interbank networks in the national banking era: their purpose and their role in the panic of 1893

Charles W Calomiris and Mark A Carlson

The unit banking structure of the United States gave rise to a uniquely important interbank correspondent network, which linked banks throughout the country during the National Banking Era. During normal times, these interbank network relationships provided banks with access to money markets, facilitated payment processing, and helped banks meet legal reserve requirements. We collect and analyse data on individual correspondent relationships of national banks to map the structure of the network, identify the factors that led banks to adopt different correspondent network structures, and examine the consequences of network choices for bank liquidity risk. Banks' network profiles differed according to the range of services they needed or provided to their customers. For instance, banks providing more checking services focused their interbank relationships on banks in New York City, which was central to the payment clearing system. Location characteristics also mattered; banks in areas with more manufacturing firms maintained more network connections. Differences in network profiles propagated liquidity risk during the Panic of 1893, one of the most severe panics of the National Banking Era. Banks with relatively high two-sided interbank liquidity risk - those that both held more of their liquid assets with their correspondents and were funded to a greater extent by the deposits of other banks - were more likely to close. New York City banks suspended convertibility during the crisis. Banks that relied more heavily on New York correspondents as a source of liquidity were more likely to close.

Labour reallocation and productivity dynamics: financial causes, real consequences

Claudio Borio, Enisse Kharroubi, Christian Upper and Fabrizio Zampolli

We investigate the link between credit booms, productivity growth, labour reallocations and financial crises in a sample of over twenty advanced economies and over forty years. We produce two key findings. First, credit booms tend to undermine productivity growth by inducing labour reallocations towards lower productivity growth sectors. A temporarily bloated construction sector stands out as an example. Second, the impact of reallocations that occur during a boom, and during economic expansions more generally, is much larger if a crisis follows. In other words, when economic conditions become more hostile, misallocations beget misallocations. These findings have broader implications: they shed light on the recent secular stagnation debate; they provide an alternative interpretation of hysteresis effects; they highlight the need to incorporate credit developments in the measurement of potential output; and they provide a new perspective on the medium- to long-run impact of monetary policy as well as its ability to fight post-crisis recessions.

Managing price and financial stability objectives - what can we learn from the Asia-Pacific region?

Soyoung Kim and Aaron Mehrotra

The international financial crisis led many central banks to adopt explicit financial stability objectives. This raises the question of how central banks deal with policy trade-offs resulting from potential conflicts between price and financial stability objectives. We analyse this issue in the Asia-Pacific region, where many economies with inflation targeting central banks have adopted macroprudential policies in order to safeguard financial stability. Using structural vector auto regressions that identify both monetary and macroprudential policy actions, our results highlight similarities in the effects of monetary and macroprudential policies on the real economy. Tighter macroprudential policies used to contain credit growth have also had a negative impact on output and inflation. The similar effects of monetary and macroprudential policies could create challenges for policy, given the frequency of episodes where low inflation coincides with buoyant credit growth.

Mortgage risk and the yield curve

Aytek Malkhozov, Philippe Mueller, Andrea Vedolin and Gyuri Venter

We study the feedback from the risk of outstanding mortgage-backed securities (MBS) on the level and volatility of interest rates. We incorporate the supply shocks resulting from changes in MBS duration into a parsimonious equilibrium dynamic term structure model and derive three predictions that are strongly supported in the data: (i) MBS duration positively predicts nominal and real excess bond returns, especially for longer maturities; (ii) the predictive power of MBS duration is transitory in nature; and (iii) MBS convexity increases interest rate volatility, and this effect has a hump-shaped term structure.

The supply side of household finance

Gabriele Foà, Leonardo Gambacorta, Luigi Guiso and Paolo Emilio Mistrulli

We propose a new, data-based test for the presence of biased financial advice when households choose between fixed and adjustable rate mortgages. If households are wary, the relative cost of the two types should be a sufficient statistic for a household contract choice: the attributes of the bank that makes the loan should play no role. If households rely on banks' advice to guide their choice, banks may be tempted to bias their counsel to their own advantage. In this case bank-specific supply characteristics will play a role in the household's choice above any role they play through relative prices. Testing this hypothesis on a sample of 1.6 million mortgages originated in Italy between 2004 and 2010, we find that the choice between adjustable and fixed rates is significantly affected by change in banks' supply factors, especially in periods during which banks do not change the relative price of the two mortgage types. This supports the view that banks are able to affect customers' mortgage choices not only by pricing but also through an advice channel.

Commercial bank failures during The Great Recession: the real (estate) story **Adonis Antoniadis**

The primary driver of commercial bank failures during the Great Recession was exposure to the real estate sector, not aggregate funding strains. The main "toxic" exposure was credit to non-household real estate borrowers, not traditional home mortgages or agency MBS. Private-label MBS contributed to the failure of large banks only. Failed banks skewed their portfolios towards product categories that performed poorly on aggregate. In addition, within each product category they held assets of lower quality than those held by survivor banks.

Basel Committee on Banking Supervision

General guide to account opening **February 2016**

The Basel Committee on Banking Supervision has revised the General guide to account opening, first published in 2003.

The Basel Committee issues this guide as an annex to the guidelines on the Sound management of risks related to money laundering and financing of terrorism¹, which was first published in January 2014. These guidelines revised, updated and merged two previous publications of the Basel Committee, issued in 2001 and 2004.

Most bank-customer relationships start with an account-opening procedure. The customer information collected and verified at this stage is crucial to the bank in order for it to fulfil its AML/CFT obligations, both at the inception of the customer relationship and thereafter, but it is also useful in protecting it against potential abuses, such as fraud or identity theft. The policies and procedures for account opening that all banks need to establish must reflect AML/CFT obligations.

The revised version of the General guide to account opening and customer identification takes into account the significant enhancements to the Financial Action Task Force (FATF) Recommendations and related guidance. In particular, it builds on the FATF Recommendations, as well as on two supplementary FATF publications specifically relevant for this guide: Guidance for a risk-based approach: The banking sector and Transparency and beneficial ownership, both issued in October 2014.

As for the remainder of the guidelines, the content of the proposed guide is in no way intended to strengthen, weaken or otherwise modify the FATF standards. Rather, it aims to support banks in implementing the FATF standards and guidance, which requires the adoption of specific policies and procedures, in particular on account opening.

A consultative version was issued in July 2015. The Basel Committee wishes to thank all those who took the trouble to express their views during the consultation process.

Minimum capital requirements for market risk **January 2016**

The 2007–08 period of severe market stress exposed weaknesses in the framework for capitalising risks from trading activities. In 2009, the Committee introduced a set of revisions to the Basel II market risk framework to address the most pressing deficiencies. A fundamental review of the trading book was also initiated to tackle a number of structural flaws in the framework that were not addressed by those revisions. This has led to the revised market risk framework, which is a key component of the Basel Committee's reform of global regulatory standards in response to the global financial crisis.

The purpose of the revised market risk framework is to ensure that the standardised and internal model approaches to market risk deliver credible capital outcomes and promote consistent implementation of the standards across jurisdictions. The final standard

incorporates changes that have been made following two consultative documents published in October 2013 and December 2014 and several quantitative impact studies.

The key features of the revised framework include:

- A revised boundary between the trading book and banking book
- A revised internal models approach for market risk
- A revised standardised approach for market risk
- A shift from value-at-risk to an expected shortfall measure of risk under stress
- Incorporation of the risk of market illiquidity

An explanatory note has been published to provide a non-technical description of the rationale and main features of the January 2016 revisions to the market risk framework.

The revised market risk framework comes into effect on 1 January 2019.

**Guidance on the application of the Core principles for effective banking supervision to the regulation and supervision of institutions relevant to financial inclusion
December 2015**

This consultative document builds on past work by the Committee to elaborate additional guidance in the application of the Committee's Core principles for effective banking supervision to the supervision of financial institutions engaged in serving the financially unserved and underserved. This includes a report of the Range of practice in the regulation and supervision of institutions relevant to financial inclusion, and expands on Microfinance activities and the Core Principles for Effective Banking Supervision.

The proposed Guidance identifies 19 of the total 29 Core Principles where additional guidance is needed, and both Essential Criteria and Additional Criteria which have specific relevance to the financial inclusion context. The Guidance is intended to be useful to both BCBS member and non-member jurisdictions, including those jurisdictions in which supervisors are striving to comply with the Core Principles and who may implement this Guidance gradually over time.

The Committee welcomes comments on this consultative document. Comments should be uploaded here by Thursday 31 March 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.

**Guidance on credit risk and accounting for expected credit losses
December 2015**

This document sets out supervisory guidance on sound credit risk practices associated with the implementation and ongoing application of expected credit loss (ECL) accounting frameworks. The move to ECL accounting frameworks by accounting standard setters is an important step forward in resolving the weakness identified during the recent financial crisis that credit loss recognition was too little, too late. It is also consistent with the April 2009 call by G20 Leaders for accounting standard setters to "strengthen accounting recognition of loan loss provisions by incorporating a broader range of credit information".

This guidance, which should be viewed as complementary to the accounting standards, presents the Committee's view of the appropriate application of ECL accounting standards. It provides banks with supervisory guidance on how the ECL accounting model should interact with a bank's overall credit risk practices and regulatory framework, but does not set out regulatory capital requirements on expected loss provisioning under the Basel capital framework.

The failure to identify and recognise increases in credit risk in a timely manner can aggravate underlying weaknesses in credit quality, adversely affect bank capital adequacy, and hinder appropriate risk assessment and control of a bank's credit risk exposure. The bank risk management function's involvement in the assessment and measurement of accounting ECL

is essential to ensuring adequate allowances in accordance with the applicable accounting framework.

In June 2006, the Basel Committee issued supervisory guidance on Sound credit risk assessment and valuation for loans to address how common data and processes may be used for credit risk assessment, accounting and capital adequacy purposes and to highlight provisioning concepts that are consistent in prudential and accounting frameworks. This document replaces the Committee's previous guidance.

Identification and measurement of step-in risk - consultative document December 2015

The objective of the proposals included in the Consultative Document Identification and measurement of step-in risk is to mitigate potential spillover effects from the shadow banking system to banks. This work falls within the G20 initiative to strengthen the oversight and regulation of the shadow banking system and mitigate the associated potential systemic risks.

Step-in risk refers to the risk that a bank will provide financial support to an entity beyond, or in the absence of, its contractual obligations should the entity experience financial stress. The proposals would form the basis of an approach for identifying, assessing and addressing step-in risk potentially embedded in banks' relationships with shadow banking entities (although without limiting the proposals to specific entities).

To capture and address such risk, the focus is on the identification of unconsolidated entities to which a bank may nevertheless provide financial support, in order to protect itself from any adverse reputational risk stemming from its connection to the entities. The proposals also include potential approaches that could be used to reflect step-in risk in prudential measures. Further consideration is being given to how the proposals should be incorporated into the regulatory framework and their potential impact.

The Committee welcomes comments from the public on all aspects of the proposals described in this document by Thursday 17 March 2016 using the following link: www.bis.org/bcbs/commentupload.htm. All comments will be published on the Bank for International Settlements website unless a respondent specifically requests confidential treatment.

Progress in adopting the Principles for effective risk data aggregation and risk reporting December 2015

This is the Basel Committee's third progress report on banks' adoption of the Committee's Principles for effective risk data aggregation and risk reporting. Published in 2013, the Principles have the objective of strengthening risk data aggregation and risk reporting at banks to improve their risk management practices and decision-making processes. Firms designated as global systemically important banks (G-SIBs) are required to implement the Principles in full by 2016.

This report reviews banks' progress in 2015. G-SIBs are increasingly aware of the importance of this topic and have moved towards implementing the Principles. Nevertheless, important challenges remain. This report makes additional recommendations to promote adoption of the Principles, including:

- Supervisors should conduct more in-depth/specialised examinations on data aggregation requirements to evaluate weaknesses;
- Banks should have governance arrangements in place for manual processes; and
- Banks' compliance with the Principles should be subject to an independent evaluation in early 2016.

The Principles apply initially to all global systemically important banks. In addition, the Committee recommends that national supervisors apply the Principles to institutions identified as domestic systemically important banks three years after their designation.

Revisions to the Standardised Approach for credit risk - second consultative document December 2015

The second consultative document on Revisions to the Standardised Approach for credit risk forms part of the Committee's broader review of the capital framework to balance simplicity and risk sensitivity, and to promote comparability by reducing variability in risk-weighted assets across banks and jurisdictions.

These proposals differ in several ways from an initial set of proposals published by the Committee in December 2014. That earlier proposal set out an approach that removed all references to external credit ratings and assigned risk weights based on a limited number of alternative risk drivers. Respondents to the first consultative document expressed concerns, suggesting that the complete removal of references to ratings was unnecessary and undesirable. The Committee has decided to reintroduce the use of ratings, in a non-mechanistic manner, for exposures to banks and corporates. The revised proposal also includes alternative approaches for jurisdictions that do not allow the use of external ratings for regulatory purposes.

The proposed risk weighting of real estate loans has also been modified, with the loan-to-value ratio as the main risk driver. The Committee has decided not to use a debt service coverage ratio as a risk driver given the challenges of defining and calibrating a global measure that can be consistently applied across jurisdictions. The Committee instead proposes requiring the assessment of a borrower's ability to pay as a key underwriting criterion. It also proposes to categorise all exposures related to real estate, including specialised lending exposures, under the same asset class, and apply higher risk weights to real estate exposures where repayment is materially dependent on the cash flows generated by the property securing the exposure.

This consultative document also includes proposals for exposures to multilateral development banks, retail and defaulted exposures, and off-balance sheet items. The credit risk standardised approach treatment for sovereigns, central banks and public sector entities are not within the scope of these proposals. The Committee is considering these exposures as part of a broader and holistic review of sovereign-related risks.

The Committee welcomes comments on all aspects of this consultative document and the proposed standards text. Comments on the proposals should be uploaded here by Friday 11 March 2016. All comments will be published on the website of the Bank for International Settlements unless a respondent specifically requests confidential treatment.

Committee on the Global Financial Systems

Fixed income market liquidity January 2016

Fixed income markets are in a state of transition. Dealers have continued to cut back their market-making capacity in many jurisdictions. Demand for market-making services, in turn, continues to grow. This report - prepared by a Study Group chaired by Denis Beau (Bank of France) - explores recent trends in fixed income market liquidity, following up on earlier analysis by the CGFS (see CGFS Publications, no 52).

Thus far, the effects of diverging trends in the supply of and the demand for liquidity services have not manifested themselves in the price of immediacy services but rather they are reflected in possibly increasingly fragile liquidity conditions. Key drivers of current trends in liquidity include the expansion of electronic trading, dealer deleveraging, possibly reinforced by regulatory reform, and unconventional monetary policies. Given the transitional state of fixed income markets, regulators appear to be facing a short-term trade-off between less risk-taking by banks and more resilient market liquidity. Yet, in the medium term, measures to bolster market intermediaries' risk-absorption capacity will strengthen systemic stability, including through a more sustainable supply of immediacy services. Overall, the report

underscores the need for a close monitoring of liquidity conditions as well as an ongoing assessment of how new liquidity providers and trading platforms are affecting the distribution of risks among market participants.

Committee on Payments and Market Infrastructures

Clearing of deliverable FX instruments

February 2016

The Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) have issued this statement on the clearing of deliverable FX instruments by CCPs. The statement clarifies the expectations of CPMI and IOSCO - as originally set out in the Principles for Financial Market Infrastructures - with respect to CCP clearing of deliverable FX instruments and the associated models for effecting their settlement.

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

December 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.

Harmonisation of the Unique Product Identifier - consultative report

December 2015

G20 Leaders agreed in 2009 that all over-the-counter (OTC) derivatives contracts should be reported to trade repositories (TRs) as part of their commitment to reform OTC derivatives markets in order to improve transparency, mitigate systemic risk and protect against market abuse. Aggregation of the data reported across TRs is necessary to help ensure that authorities are able to obtain a comprehensive view of the OTC derivatives market and activity.

Following the 2014 FSB Feasibility study on approaches to aggregate OTC derivatives data , the FSB asked the CPMI and IOSCO to develop global guidance on the harmonisation of data elements reported to TRs and important for the aggregation of data by authorities, including Unique Transaction Identifier (UTIs) and Unique Product Identifiers (UPIs).

This consultative report is one part of the CPMI-IOSCO Harmonisation Group's response to its mandate. It makes proposals for the harmonised global UPI, whose purpose is to uniquely identify OTC derivatives products that authorities require to be reported to TRs. The UPI would consist of a product classification system and associated code. The focus of this report is the product classification system.

The report seeks general and specific comments and suggestions from respondents by 24 February 2016, to be sent to both the CPMI secretariat and the IOSCO secretariat.

Besides this consultative report, the CPMI and IOSCO have already issued a consultative report on Harmonisation of the Unique Transaction Identifier and Harmonisation of key OTC derivatives data elements (other than UTI and UPI) - first batch and plan to issue a separate consultative report on the UPI code as well as consultative reports on further batches of key data elements (other than UTI and UPI) in the coming months.

Implementation monitoring of PFMI: Level 2 assessment report for Australia

December 2015

The Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) continue to closely monitor the implementation of the Principles for financial market infrastructures (PFMI). The principles

within the PFMI (the Principles) set expectations for the design and operation of key financial market infrastructures (FMIs) to enhance their safety and efficiency, and, more broadly, to limit systemic risk and foster transparency and financial stability. The Principles apply to all systemically important payment systems (PSs), central securities depositories (CSDs), securities settlement systems (SSSs), central counterparties (CCPs) and trade repositories (TRs) (collectively FMIs). These FMIs collectively clear, settle and record transactions in financial markets. In line with the G20's expectations, CPMI and IOSCO members have committed themselves to implementing and applying the PFMI in their respective jurisdictions.

This report presents the conclusions drawn by the CPMI and IOSCO from a Level 2 assessment of whether, and to what degree, the legal, regulatory and oversight frameworks, including rules and regulations, any relevant policy statements, or other forms of implementation applied to systemically important PSs, CSDs/SSSs, CCPs and TRs in Australia, are complete and consistent with the Principles.

Conducted as a peer review during 2015, this Level 2 assessment reflects the status of the Australian legal, regulatory and oversight framework as of 15 May 2015. Accordingly, assessment ratings reflect the implementation measures in place as of 15 May; other measures that were introduced after this date, or other material developments, are noted where relevant but were not considered in assigning ratings of consistency.

The authorities responsible for regulation, supervision and oversight of FMIs in Australia are the Reserve Bank of Australia (RBA) and the Australian Securities and Investments Commission (ASIC). The RBA has sole responsibility for PSs, while ASIC has sole responsibility for TRs. ASIC and the RBA have co-regulatory responsibilities for CCPs and CSDs/SSSs based on the legal framework of the Corporations Act. The RBA is responsible for ensuring compliance with the Financial Stability Standards and reduction of systemic risk, while ASIC is responsible for ensuring compliance with the remaining obligations under the Corporations Act.

Overall, the assessment found that Australia has consistently adopted most of the Principles in all types of FMI. The RBA and ASIC took differing approaches to the adoption of the PFMI, which reflect their different approaches to policy and rule-making. For PSs, the RBA's adoption of the Principles through a policy statement was assessed to be consistent and complete. For CCPs and CSDs/SSSs, the RBA and ASIC have largely adopted the Principles consistently, with three areas that were found to be broadly consistent. For TRs, while ASIC's rules do not always mirror the language and structure of the Principles, the relevant requirements were found generally to have been implemented in a consistent or broadly consistent way - with five areas of broad consistency.

Implementation monitoring of PFMI: Assessment and review of application of Responsibilities for authorities November 2015

The Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) continue to closely monitor the implementation of the Principles for financial market infrastructures (PFMI). The PFMI are international standards for payment, clearing and settlement systems, and trade repositories. They are designed to ensure that the infrastructure supporting global financial markets is robust and well placed to withstand financial shocks.

This report presents the findings of the CPMI-IOSCO assessment of the completeness and consistency of frameworks and outcomes arising from jurisdictions' implementation of the Responsibilities for authorities in the PFMI. The assessments covered implementation of the Responsibilities across all financial market infrastructure (FMI) types in 28 participating jurisdictions. The work on the Responsibilities was carried out as a peer review during 2015 and the assessment ratings for each jurisdiction reflect the implementation measures in place as at 9 January 2015; other measures implemented after this date, or other material developments, are noted where relevant but were not considered when assigning ratings of observance.

Overall, the assessment revealed that a majority of the jurisdictions had achieved a high level of observance of the Responsibilities. Of the 28 jurisdictions assessed, 16 fully observed the five Responsibilities for all FMI types; an additional two jurisdictions either fully or broadly observed each of the five Responsibilities for all FMI types.

With respect to specific FMI types, jurisdictions most frequently fell short of a fully observed rating in the case of trade repositories (TRs). Five of the participating jurisdictions had TR regimes that were still in development and were therefore determined to be "not ready for assessment". In addition, several other jurisdictions lacked clear criteria and/or fully disclosed policies to support their regulation, supervision and oversight of TRs.

With respect to specific Responsibilities, considerable variability was observed in implementation measures for the Responsibility on cooperation with other authorities. This was due partly to the fact that many cooperative arrangements are new, but may in some cases also reflect different interpretations among authorities of the expectations in this area.

CPMI and IOSCO will review the Responsibilities in light of the findings of this assessment and consider the need for additional guidance. Further, as jurisdictions gain greater experience with cooperative arrangements, particularly cross-border arrangements for central counterparties (CCPs) and TRs, CPMI and IOSCO expect to consider new developments as part of a follow-up exercise to this report.

Markets Committee

Electronic trading in fixed income markets

Publications No 7 January 2016

Electronic trading has become an increasingly important part of the fixed income market landscape. It has enabled a pickup of automated trading in the most liquid market segments. Innovative trading venues and protocols - reinforced by changes in the nature of intermediation - have proliferated, and new market participants have emerged.

These recent changes have resulted in a transformation of the market structure, the process of price discovery and nature of liquidity provision. This report - prepared by a Study Group chaired by Joachim Nagel (Deutsche Bundesbank) - explores how ongoing developments are affecting market structure and functioning. It also discusses challenges for policymakers at the current juncture.

Drawing on a survey of trading platforms, the report sheds light on the evolution of trading volumes and usage of trading protocols in various market segments. The report further explores how electronification may be affecting market quality. Electronic and automated trading overall tends to have a positive impact in terms of market quality, but there are exceptions. There is a risk that liquidity may have become less robust and prices more sensitive to order flow imbalances. Electronic trading, in particular automated and high-frequency trading, also poses a number of challenges to policymakers, including the need to monitor its effect on market liquidity and functioning and to ensure appropriate governance of automated trading.

Speeches

The movie plays on: a lens for viewing the global economy

Speech by Mr Claudio Borio, Head of the Monetary and Economic Department of the BIS, at the FT Debt Capital Markets Outlook, London, 10 February 2016.

This presentation suggests an alternative lens through which to view the global economy's struggle to achieve sustainable and balanced growth, reflecting a failure to prevent the build-up and collapse of hugely damaging financial booms and busts. A symptom of the current malaise can be seen in interest rates that have been exceptionally low for an exceptionally long time, with a record high amount of global sovereign debt trading at negative yields. To break out of this trap, there is a need to take a longer-term view and rebalance policies towards structural measures, abandoning the debt-fuelled growth model that has brought us to the current predicament

Credit, commodities and currencies

Lecture by Mr Jaime Caruana, General Manager of the BIS, at the London School of Economics and Political Science, London, 5 February 2016

The global economy finds itself at the centre of three major economic developments: disappointing economic growth, especially in emerging economies; large shifts in exchange rates; and a sharp fall in commodity prices. These should not be seen as one-off shocks or headwinds but manifestations of a major realignment of economic and financial forces.

This emphasises the need to take a long-term perspective on economic developments and in policy responses and to consider the cumulative evolution of stocks, such as the stock of debt. Total debt in the global economy, including public debt, has increased significantly since the crisis (end of 2007).

These transitions and realignments inevitably bring short-term discomfort in the financial markets. But depending on the policy responses, they could eventually allow renewed and, above all, more sustainable and resilient growth, both in advanced economies and in a number of key emerging economies.

Seven don'ts and one hope: The nexus between prudential and monetary policies

Speech by Mr Claudio Borio, Head of the Monetary and Economic Department of the BIS, at the SUERF-Deutsche Bundesbank-IMFS Conference on "SSM at 1", Frankfurt, 3-4 February 2016.

In the hope of edging closer to taming the financial cycle, this presentation puts forward seven suggested "don'ts": don't oversimplify the distinction between micro- and macroprudential policy; don't underestimate the role of capital as the basis for lending; don't set overly ambitious goals for macroprudential frameworks during busts; don't regard the length of the financial cycle as a reason to forget monetary policy; don't overlook the impact of the financial cycle on productivity growth; don't think of a financial stability-oriented monetary policy simply as "leaning-against-the wind"; don't presume that even monetary and prudential policies combined can tame the financial cycle.

Old and new challenges for 2016 and beyond: strengthening confidence by re-anchoring long-term expectations

Speech by Mr Luiz Awazu Pereira da Silva, Deputy General Manager of the BIS, at the Lamfalussy Lecture Series: Professor Lamfalussy Commemorative Conference, Budapest, 1 February 2016.

The global financial crisis challenged how we analyse and conduct economic policy. While we understand global financial cycles much better and managed to avoid a repeat of the Great Depression, we are still stuck in a volatile low-growth environment. One reason is a lack of "confidence" in a structural sense: markets still cannot firm up their expectations about what is a long-term sustainable growth rate, a reasonable return on savings and on how to price assets. Hence, they remain unanchored and volatile. We need to help re-anchor them first by

showing a roadmap toward the gradual normalisation of monetary conditions. And we need also to go beyond that, and show the need to undertake the necessary "structural reforms" to make our socio-economic contracts more sustainable and resolve uncertainties about present and intergenerational resources allocation - uncertainties that increase risk premia and dampen growth perspectives. If we strengthen confidence and re-anchor long-term market expectations, we will help the financing of the real economy and contribute in the long term to a more TFP-based sustainable growth.

Persistent ultra-low interest rates: the challenges ahead

Closing speech by Mr Jaime Caruana, General Manager of the BIS, at the Bank of France-BIS Farewell Symposium for Christian Noyer, Paris, 12 January 2016.

It is a great pleasure and privilege for the BIS to co-organise and to participate in this symposium in honour of Christian Noyer.

Christian has served as a central banker in an era of unprecedented challenges. One major challenge was the establishment of the euro, to which Christian made a major contribution as Vice-President of the ECB.

Those were quite exciting days, but in retrospect they were really days of tranquillity. A far greater challenge for central banks, and for Christian as Governor of the Bank of France, has been the management of the various stages of financial and economic crisis since 2008.

The excellent presentations and discussions we have here today illustrate not only the complexity of this period, but also the amount of work that has been done to help understand the many puzzles and challenges - as François Villeroy de Galhau put it in his opening remarks¹ - and how to address them.

It is beyond doubt that the swift actions of central banks when the crisis first hit were crucial for preventing a financial and economic meltdown. As Christian himself has emphasised,² an important element of this crisis response was the close cooperation among central banks, through constant dialogue and, more concretely, cooperative actions such as the establishment of currency swap lines.

As the acute phase of the crisis is now well behind us, the key question becomes how central banks can best support the recovery, to make it not only more robust than what we have seen so far but also sustainable. This has proven to be a very challenging question. In the aftermath of the crisis, central banks have had to operate in uncharted waters, characterised by low growth, below-target inflation and unusually low interest rates - as well as financial fragility and rising debt.

In one of his speeches, Christian has highlighted the need to broaden the spectrum of views available to policymakers in order to avoid "groupthink" and "intellectual capture".³ In this vein, the debates we have here today are important because there is not yet the necessary convergence of minds about the right analytical framework to use for understanding the new reality we face. Central banks have been working hard to update their analytical tools, and so have international organisations such as the IMF.

The BIS, as well, has played a part. Under the guidance of our Board, chaired by Christian until late last year, and in collaboration with the various Basel-based international committees, we have been promoting the exchange of views and cooperation in different areas.

Our own research has also been striving to better understand the phenomenon of low growth, low inflation and low rates - as well as its complex relationship with financial booms and busts (ie financial cycles). We have sought to contribute to the debates by bringing a perspective that is longer-term than the typical policy horizon. As such, we put less emphasis on the cyclical aspects of aggregate demand, and pay more attention to the more entrenched impediments to growth - factors that are slow-moving but whose effects cumulate over time. In particular, we focus on impaired balance sheets and resource misallocations. Since these impediments cannot ultimately be removed exclusively by expansionary monetary policy, prolonged monetary easing alone may not succeed in reviving economic dynamism. A combination of policies will be required.

And from this longer-horizon perspective, we see persistently low or negative interest rates - which are the result of not only central bank actions but also market participants' perceptions - as not a sustainable equilibrium, but rather at least in part a disequilibrium phenomenon. Let me briefly elaborate.

Why are interest rates so low?

In the BIS view, the recession that accompanied the Great Financial Crisis was not a typical postwar business cycle recession. Rather, it was a balance sheet recession, associated with the bust phase of the financial cycle.

Balance sheet recessions commonly coincide with permanent output losses and weak recoveries. The permanent output losses after the financial bust reflect, to a considerable extent, the fact that output growth was unsustainable during the preceding boom.

Two legacies of the boom require further analysis. One is the combination of a debt overhang and disruptions to financial intermediation. This is quite well known. A lot of work has been done in the wake of the crisis to improve the workings of the financial system.

The other, perhaps less well analysed so far, is the drag on growth that arises from the resource misallocations that occur during the credit boom. Recent BIS research using data from 21 advanced economies since 1979 finds evidence that credit booms undermine productivity growth, primarily through the misallocation of resources.⁴ During periods of strong credit growth, workers shift to sectors with lower productivity gains, notably construction. This reallocation depresses aggregate productivity growth and thus potential output.

Importantly, even though the misallocations take place during the boom, their effects linger on and become much more impactful if a financial crisis materialises, as the economy then needs to shift workers away from the previously overextended sectors. Our analysis suggests that the magnitude of these effects is not negligible.⁵

What does all this imply for interest rates?

Clearly, monetary policy is essential in a crisis for stabilising the financial system and the macroeconomy. But in the wake of a balance sheet recession, where weak demand may not be the only problem, monetary easing cannot be the only answer.

If we accept that some deeper, often country-specific, impediments to growth are at work, then the appropriate policy response needs to include measures such as determined balance sheet repair and structural reforms to facilitate resource reallocations. A resilient financial system and flexible economy make monetary policy more efficient. Moreover, relying too much on the support from monetary policy may, over time, weaken the incentives for other actors to address the underlying problems through repairs and reforms. If this reliance persists, low rates could become self-validating. This is a key concern.

There are other concerns as well. As mentioned by a number of speakers today, a prolonged period of very low interest rates can have unintended consequences in the financial sector: erosion of interest margins for financial institutions, incentive for excessive financial risk-taking, asset price inflation, etc.

There can also be consequences in the real sector. For example, as people in ageing societies worry more about their retirement, persistently low interest rates may increase precautionary savings and weaken consumption. Analogously, funding deficits in corporate pension plans may constrain companies' capacity to make new investments. These effects warrant further investigation.

Furthermore, there are spillovers and spillbacks. Persistently low interest rates in the core advanced economies have spilled over to other economies less affected by the crisis. These spillovers work through various channels: from investors' search for yield and co-movements in global bond markets to policy reactions to avoid large interest rate differentials. These spillovers can fuel the build-up of financial imbalances in the receiving economies. Rapidly rising property prices, expanding credit and increasing indebtedness, including in foreign

currency debt, point to such imbalances. When these economies enter the late stages of the boom, their vulnerabilities may spill back to the originating economies.

Challenges ahead

What are the challenges ahead?

As mentioned by Stan Fischer, quantifying the trade-offs is a challenge.⁶ Part of the difficulty in assessing the costs and benefits of alternative policies is that the traditional analytical frameworks do not take enough account of the endogenous build-up of financial imbalances, which may accumulate slowly but then assert themselves quite powerfully. As such, these frameworks tend to underestimate the influence of monetary policy on the financial cycle. They also tend to underestimate the international dimension, in the form of policy spillovers and spillbacks.

This suggests that we need to develop better analytical frameworks that can allow us to study the interaction between finance and macroeconomics. In addition to taking a long-term perspective, this effort will require two things.

One is to think holistically. A holistic approach to macroeconomic and financial stability will involve a suite of policies: prudential, macroprudential, monetary and fiscal policies - and no less importantly, structural reforms. Since the interest rate determines the universal price of leverage in a given currency, monetary policy is a key factor in the financial cycle. A holistic approach would call for a monetary policy that responds more symmetrically to the financial cycle to help contain financial imbalances. Fiscal policy, for its part, should ideally create some additional fiscal space during financial booms in order to have enough capacity to address financial busts. All this will have to be complemented with a greater degree of attention to the slow-moving factors that sap productivity. Such drags on long-term growth tend to be not visible during financial booms, but become apparent during the busts.

The other requirement is to think globally. An important element for greater global financial stability is a better appreciation of cross-border spillovers in the conduct of national policies. Importantly, thinking global is not incompatible with central banks' domestic mandates - consider it a kind of enlightened self-interest. In improving our collective understanding of how spillovers and spillbacks work, central bank dialogue and cooperation are essential ingredients.

Conclusion

Let me conclude by noting that, in confronting and tackling these challenges, we would be well advised to follow Christian's example and his work - always inspired by pragmatism, inclusiveness, cooperation and good governance. Indeed, Christian has been a key player in crisis management, in endeavours to improve policy frameworks and in strengthening central bank cooperation.

Christian, you have worked steadily and effectively for the collective good of this community. As BIS Chairman, you gave direction and guidance in times when central banks faced unprecedented challenges. Under your chairmanship, many initiatives that are crucial for the BIS itself and for its collaboration with central banks and other institutions came to fruition. We have to build on to this work and to nurture the close cooperation among central banks in order to successfully meet the challenges of the future.

In closing this symposium, I would like to thank the Bank of France for inviting the BIS to be a part of this special event and for the excellent organisation. Many thanks also to the speakers. But most of all, I want to thank you, Christian. We as a community owe you an enormous debt. It is a debt of gratitude - the only type of debt we won't mind having more of! We wish you all the best in your future endeavours.

Where's the inflation, Mr Shin?

Interview with Mr Hyun Song Shin, Economic Adviser and Head of Research of the BIS, Frankfurter Allgemeine Zeitung, 27 December 2015.

Hyun Song Shin, Economic Adviser and Head of Research of the BIS, explains why prices are not rising despite the glut of money and why the situation is nonetheless dangerous.

Mr Shin, everybody expected to see inflation this year, but prices are hardly rising. What's happened?

Economists are still struggling to figure out the full story on inflation. The simple stories that people tell are no longer adequate. These simple stories are domestic and short-term: If the economy is depressed, you have low inflation. If the economy is overheated, you have high inflation. We are realising that this cannot be the full story. Otherwise we should be seeing higher inflation by now.

Inflation is only 0.2% in Europe and 0.5% in the US, although the central banks are doing everything in their power to drive it up to 2%. What's going wrong?

Inflation is not only a domestic and short-term phenomenon - the kind of phenomenon monetary policy can influence. Inflation also depends on global and long-term factors. The most important story is global. Ultimately, inflation is falling nearly everywhere in the world.

Why?

In the short term, that's down to the fall in the price of oil and other commodities. The low oil price lowers the price for fuel and thereby affects inflation. But there are important long-term stories as well.

For example?

Globalisation and demography. When the emerging economies started to produce for the world markets, we suddenly had a lot more supply, a so-called supply shock, which put pressure on prices and kept them low. That is one global long-term story. Then there are the long-term domestic factors. Even in countries that are not so open to the world market, we have seen inflation falling. One possible reason is demography - although some economists disagree. If you have an old population, there is a greater need to save. That leads to less consuming, so lower demand, which in turn leads to subdued inflation. You can see that in Japan, for example.

How do central banks fit into this story?

If you have a short-term view of the world and believe that a short-term lack of demand is the main reason for low inflation, this is where central banks play a role. You would say: Inflation is not close to 2%, so we have to use expansive monetary policy to help replace this missing demand. But that is too simple, as discussed already. There are multiple factors that alter inflation; not all of them can be influenced by central banks.

Is that a problem?

If you are trying to hit an inflation target irrespective of the state of the economy, you may be introducing other distortions into the financial system that will be ultimately more damaging.

So do we perhaps not have any need for rising prices, inflation?

People tend to associate inflation with situations like the Great Depression. They believe: If you hit deflation, ie falling prices, this will trigger a chain reaction which will lead to some very bad outcomes: a deflationary spiral where prices go down further and further. The problem is that there is little empirical evidence for this phenomenon outside the Great Depression. If you look at recent cases of deflation, you cannot find this spiral. Nor does history support the conclusion that low inflation is always associated with low output and is a sign of a depressed economy.

So everybody is wrong? All those economists and central bankers who feared a situation like the Great Depression after the financial crisis?

The Great Depression was a very singular event. You cannot generalise it. Switzerland, for example, has had a mild deflation during the last few years and the economy is not doing badly. The idea that if inflation hits zero, the economy comes to an immediate standstill, is simply not true.

ECB president Mario Draghi has been trying all year to reach the inflation target of "under, but close to 2%" the whole year. Is he wrong?

I cannot comment on the actions of individual central bankers, but I should say I am not against inflation targets for central banks. They have been a major achievement in making monetary policy more systematic. But the problem starts when inflation is the only goal and we take actions in order to bring back inflation which have side effects.

What are the dangers?

To understand them, we have to think globally. Central banks have an influence on exchange rates and debt, both domestically and in other countries. For example, if monetary policy in the US is expansionary, the dollar depreciates. For other countries, dollars are consequently cheaper and they borrow more in dollars, so the debt in dollars outside the United States goes up. The same happens in Europe. When the euro depreciates, as it has done this year, then foreigners borrow more in euros.

Foreigners borrowing in dollars and euros? That doesn't sound like a danger.

But it can be over a longer horizon. Emerging markets have been borrowing a great deal in US dollars. \$9.8 trillion is the amount that non-banks outside the United States have borrowed in dollars. Of that, \$3.3 trillion has gone to emerging economies. This has happened because the dollar has been depreciating for many years. Now the dollar is going back up again. And that is causing problems. Many of the projects that were financed with dollar debt are now being stopped or reversed.

Is that one of the reasons why China is having economic problems at the moment?

Not just China. Corporate investment has been very important for emerging markets, especially for oil and gas firms. If that slows down because dollar debt gets more expensive, then growth also slows down.

What does that mean for us?

The slower growth in emerging markets is exerting a drag on global growth. For example, this year. One of the reasons why US policymakers have been so concerned about global developments has been the slow growth in emerging markets - which hasn't come out of the blue. It is the result of monetary policy.

Central banks caused China's problems?

That is too simple. There are several causes. But monetary policy is one of them.

What concerns you most? That central banks are buying large amounts of government bonds - so-called "quantitative easing" (QE)?

It is not just QE. We have to think about what happened before the 2008 crisis. Central bankers concentrated purely on stabilising output and inflation. They did not think much about the ever accumulating debt and leverage. When that unwound, it hit back and undermined domestic stability as well. That has to change. Whoever thinks "what happens outside my borders does not matter to me" is being short-sighted. We are living in a global village. Keeping your own house in order is inseparable from keeping the neighbourhood in order.

The US central bank, the Fed, last week ushered in a small revolution, raising interest rates after a seven-year low-interest phase. What will happen now?

We are now going through a realignment of global forces. Imagine a table with an array of compasses. All of the needles are pointing in the same direction. But then you move the pole, and all the needles are shifting. That is exactly what is happening at the moment. The needles are financial market prices, growth rates, debt levels. The monetary stance is the pole, and it is shifting all of those needles at the same time. That has an enormous impact.

Should we be afraid of what the new year will bring?

We are looking ahead to a major realignment, just as I said. That is going to have real economy knock-on effects. We are already seeing some effects in the form of lower commodity prices. That is a boost for demand for many countries, like a tax cut. But if you are a commodity producer, this is a very negative shock. Falling commodity prices will also keep inflation low. Whether we will see still larger disruptions depends very much on financial regulation and banking supervision. If they have been rigorous enough, this could mitigate the effect.

German investors are concerned that interest rates are so low. They blame the ECB and Mario Draghi for this. Is that right?

Low interest rates are an intended effect of monetary policy. You can see that long-term rates in Europe are going down, including in Germany. It is no accident that this started in the middle of 2014, when there was first talk of the central bank buying government bonds in large amounts.

Are low interest rates a cause for concern - also for our economy?

Low interest rates can be distortionary. The risk of them falling lower becomes much larger. One could get into a circle. Like a dog chasing its tail.

How so?

It's like in the poem by Stevie Smith, Not waving, but drowning. The idea of the poem is: Here is a drowning man waving in the water and the people think: Oh, he's waving. But in reality, he is drowning. The same can happen with low interest rates. In standard textbooks, they are considered a good thing, stimulating the economy, a sign of exuberance. But there is the possibility that low rates can be a sign of distress and low returns as well. If rates stay low for a long time, this will eat into the profitability of insurance companies and the solvency of pension funds. They will, in the search for yield, look to buy longer-term assets, which will lower rates even further. In Europe, interest rates fell very fast in 2014 and the early part of 2015.

Then Europe is not waving but drowning?

If you mean interest rates: Yes, on that count, Europe is closer to drowning than to waving. If you mean the real economy: No, the European economy is doing better.

"Sudden floods" and sudden stops of capital flows in an environment of ultra-low interest rates: an equal opportunity menace for emerging market and advanced economies alike

Remarks by Mr Luiz Awazu Pereira da Silva, Deputy General Manager of the BIS, at the 51st SEACEN Governors' High-Level Seminar, Manila, 26 November 2015.

<http://www.bis.org/speeches/sp151216.pdf>

Exchange rates and the transmission of global liquidity

Speech by Mr Hyun Song Shin, Economic Adviser and Head of Research of the BIS, at the Bank of Korea-IMF conference "Leverage in Asia: Lessons from the Past, What's New Now?, and Where to Watch Out For?", Seoul, 11 December 2015.

What is the economic impact of currency depreciation? Is it expansionary or contractionary? Traditional arguments in the spirit of the Mundell-Fleming model suggest that it is expansionary as it boosts net exports and output. But the combination of slowing growth and deep depreciations in emerging market currencies suggest that the traditional explanation is incomplete. Borrowing in international currencies generates another link between exchange rates and economic activity that operates through financial channels; currency depreciation undermines balance sheet strength and tightens financial conditions, sapping economic activity. Government fiscal positions suffer knock-on effects due to increased tail risks, further tightening financial conditions and amplifying the downturn. Even the deployment of large central bank foreign exchange reserves may not be sufficient to reverse such a growth slowdown.

Revisiting monetary policy frameworks in the light of macroprudential policy

Panel remarks by Mr Jaime Caruana, General Manager of the BIS, at the IMF seminar on "Revisiting monetary policy frameworks", Lima, 10 October 2015.

It is a real pleasure to be part of this panel. In my remarks, I would like to take a look at the nexus of monetary and macroprudential policies.

I will point out that the often proposed separation principle - whereby macroprudential policy should deal with financial booms and busts (the financial cycle) while monetary policy should deal with inflation and shorter-term output fluctuations (the business cycle) - is intuitive, but unconvincing as a general proposition. I will first offer three reasons why the separation principle is not compelling. I will then address three typical concerns about using monetary policy to deal with financial imbalances.

The conclusion I draw is that, given the great economic costs of financial instability, we need to rebalance policy priorities towards reducing the likelihood of such instability. While there is some acceptance of the idea that monetary policy has a role to play in leaning against the financial cycle in some circumstances,¹ I will argue that this case applies much more generally.

Given how powerful monetary policy is in affecting the price of leverage, credit growth, asset prices and financial risk-taking, simply arguing that it forms the last line of defence is inadequate and somewhat risky. It assigns too modest a role to such an influential policy. The proposed rebalancing of policy priorities will no doubt require additional analysis. But relying exclusively on macroprudential policies to tame the financial cycle would simply be insufficient.

In fact, I would go further and argue that even using both macroprudential and monetary policies may still be insufficient in some situations because the endogenous build-up of financial imbalances can be very powerful. In such cases, policymakers will also need other policies - not only prudential/macroprudential and monetary, but also fiscal policy or even structural reforms - to address the imbalances.

Part of the problem in discussing the costs and benefits of alternative policies is that current models and traditional analytical approaches take little or no account of the endogenous cumulative effects of interest rates being too low for too long. They tend to assume that monetary policy has limited influence on the financial cycle - and hence on the costs of financial booms and busts. The international dimension of monetary policy, the spillovers and spillbacks, also tend to be underestimated.

Why the separation principle is not convincing

The separation principle has the merit of yielding clear and neat policy assignments: monetary policy for price stability and macroprudential policy for financial stability. However, the real world is more complicated than that. This principle is therefore not very convincing as a general rule, for three reasons.

Same channels of influence

First, both macroprudential policy and monetary policy fundamentally influence the same channels - funding costs, leverage incentives and risk-taking - which, in turn, affect credit growth, asset prices and the macroeconomy. As such, these two policies are not really neatly separable - they often interact and can create tensions. For example, in a situation where policy rates are lowered for business cycle reasons and macroprudential tools are tightened to address credit booms and rising asset prices, economic agents face incentives to borrow more and to borrow less at the same time.

One consequence of this observation, also supported by empirical evidence, is that the two sets of tools are most effective when used as complements, pulling in the same direction.²

Different effectiveness

Second, although macroprudential policy tools have the advantage of being more targeted to specific sectors or practices, experience suggests that these tools are not as effective as

monetary policy rates in preventing excessive risk-taking that is widespread across the financial system.

To be clear, macroprudential policy can be helpful in increasing the resilience of the financial system, ie in building buffers that will protect it when a boom turns to bust. Research also shows that some tools, such as requirements on the loan-to-value ratio (LTV) or the debt-to-income ratio, can be effective in influencing credit and property price developments, ie in constraining the build-up of financial imbalances in the first place. That being said, estimates of such effects generally imply that these instruments would need to be tightened by quite a lot in order to be able to contain the typical dynamics during a boom.³

In contrast, the monetary policy rate is the key determinant of the universal price of leverage in a given currency. It is not susceptible to regulatory arbitrage, and it affects all financing in the economy. In particular, if the price of leverage has been too low for a long time, allowing financial risk-taking to take hold and spread across the system, it would then be much more difficult for macroprudential policy tools to address the excessive credit growth and asset price increases.

This point is consistent with the experience of some economies that have made extensive use of macroprudential measures in recent years against the backdrop of very accommodative monetary policy conditions. I can cite, for instance, Hong Kong and Switzerland, among others. Despite the tightening of macroprudential tools such as LTV requirements and countercyclical capital buffers or dynamic provisions, these economies have not been able to fully avert the build-up of financial imbalances.⁴

This challenge is also reminiscent of Spain's experience in the 2000s, when it found out that dynamic provisions could not be sustained at levels sufficient to contain the credit boom. Moreover, being in a monetary union, Spain could not have independently used monetary policy to deal with the boom. A monetary union is a special case in this regard.

Market-driven booms

Third, there are market-driven booms - and this reinforces my previous points. Financial intermediation has been changing: capital markets are gaining prominence and the search for yield is an active mechanism for transmitting financial conditions across markets. Most of our experience so far with macroprudential tools has come from banking. But now, imbalances are building not so much in the banking sector but in capital markets, which are not within the direct reach of traditional macroprudential tools.

In this situation, monetary policy again has an advantage. By changing the universal price of leverage in a given currency, it affects all financing denominated in that currency and is much better positioned to work in a world in which capital markets are vast and macroprudential tools are narrowly directed at banks.

What I would conclude from all this is that exclusive reliance on macroprudential tools to deal with financial stability risks is insufficient and ill advised. Macroprudential tools can increase resilience. They can address localised issues, such as the overheating of specific markets. And they provide policymakers with additional options to lean against the build-up of financial imbalances. But they cannot "get in all the cracks" in the system, as Jeremy Stein so aptly put it.⁵ Arbitrage can move the build-up of financial imbalances from one place to another, finding the inevitable cracks that exist in any prudential regulatory regime. For this reason, there is a case for using monetary policy.

Concerns about using monetary policy to deal with financial imbalances

Let me now turn to the typical concerns about using monetary policy to deal with financial imbalances. These concerns should be taken seriously. But I believe they are manageable - and they should be managed.

Lack of good metrics

One often cited argument is the lack of good metrics with which to track the financial cycle. This is a serious concern for policymakers. But one should recognise that the past decade has seen considerable progress in devising and improving such metrics. One practical approach,

followed by economies such as Hong Kong, Norway and the United Kingdom when setting countercyclical capital buffers, is to track credit and asset price developments, and to compare current dynamics to historical benchmarks.

At the same time, one should not forget that even the more familiar yardsticks used in monetary policy are themselves not without problems. Take, for example, the output gap, a measure for economic slack, which is not observed directly and thus has to be estimated. It is known that the estimates are subject to considerable uncertainty.⁶

In fact, some recent research suggests that using information about the financial cycle, such as the behaviour of credit and property prices, can produce better estimates of potential output and underlying slack compared with using traditional methodologies, which often draw on the behaviour of inflation.⁷ In this sense, metrics informed by the state of the financial cycle may help improve the calibration of monetary policy and fiscal policy.

Policy trade-offs

A second, and more challenging, concern is the potential trade-offs between financial stability on the one hand, and price stability and near-term output stabilisation on the other.

To some extent, this concern can be ameliorated by looking at the relevant policy horizon. Financial vulnerabilities build up over time. And a financial bust can have long-lasting effects on the macroeconomy, including on inflation. Hence, extending the policy horizon beyond the traditional two to three years would help to reconcile the financial stability objective with the traditional price stability (and output growth) objective. After all, financial instability is a concern precisely because of the damage it imposes on the real economy.

However, I should note that extending the policy horizon should not be interpreted as extending point forecasts. Rather, it is intended as a means to examine more systematically the risks to the macroeconomic outlook posed by financial factors, given their longer fuse.

Deviation from mandate

A third concern is deviation from mandate. Given the potential trade-offs I just described, there would be times when the price stability objective (eg inflation target) could not be achieved as quickly as one would like because of financial stability considerations. If one is going to tolerate such deviations of inflation from target, how long should this be allowed to last? And how much importance should one attach to such deviations?

The real concern here, I believe, is the worry that if the deviation from the stated target persists for a long time, it might lead to a loss of central bank credibility. If this is indeed the issue, then our view is that the monetary policy framework should explicitly provide for tolerance of such deviations if and when they are deemed appropriate for achieving its objective over the longer term. Of course, the allowance should be based on proper analysis of the reasons underlying the deviations.

Much less clear, however, is whether allowing such tolerance would necessarily constitute a deviation from the mandate (eg price stability). Central bank mandates are typically worded generally enough to accommodate different ways to interpret and implement them in practice. In particular, given the large negative impact financial crises can have on the real economy, sustainable price stability or macroeconomic stability can indeed be thought of as encapsulating financial stability.

This suggests that the first priority should be to: (i) make use of all the existing room for manoeuvre; (ii) develop a better explanation for why a near-term deviation from target may sometimes be justified for the longer-term good; and (iii) build a constituency for a more systematic incorporation of financial stability concerns into central bank decisions.

In addition, transparency with respect to financial stability policies could be helpful in this regard. Disclosing financial stability decisions and actions, and the reasons behind them, could help to manage expectations about how a central bank would deal with financial stability risks and the potential impact of policy actions. That said, I do recognise that interpreting mandates flexibly in difficult and uncertain times is not at all an easy task.

Conclusion

On balance, arguments against incorporating financial stability considerations systematically into monetary policy, while not without merit, are nonetheless not fully convincing. They tend to overestimate how much is known about the business cycle but underestimate how much has been learned about the financial cycle. They also tend to put too much faith in the ability of macroprudential policy to deal with financial stability risks but underappreciate monetary policy's role in determining the price of leverage and in influencing borrowing and risk-taking behaviour across the board.

Although there may be near-term trade-offs, financial stability and price stability are really two sides of the same coin over the longer horizon. If the ultimate goal of monetary policy is to promote sustainable economic growth, then there is good reason to call for a rebalancing of policy priorities towards mitigating financial booms and busts, which can inflict long-lasting damage on the real economy. Such a rebalancing would be challenging and would confront policymakers with tough questions. But relying exclusively on macroprudential tools to address financial stability risks is simply insufficient. There is a case for including monetary policy in this effort.

Macroprudential policies: What have we learnt?

Speech by Mr Claudio Borio, Head of the Monetary and Economic Department of the BIS, at the Bank of Italy Conference "Micro and Macroprudential Banking Supervision in the Euro Area", Università Cattolica del Sacro Cuore, Milan, 24 November 2015.

Post-crisis, macroprudential frameworks have rightly become an essential pillar of financial stability policies. This presentation addresses the implications of the financial cycle for their design, including objectives, instruments and governance as well as, more specifically, the strengths and limitations of macro-stress tests and network analysis. It highlights the areas where the scope for further work is greatest, including international co-ordination, the role of non-banks and sovereign risk. Addressing financial stability is a task that requires the active support of other policies, including monetary and fiscal policy. Macroprudential frameworks must be part of the answer, but cannot be the whole answer.