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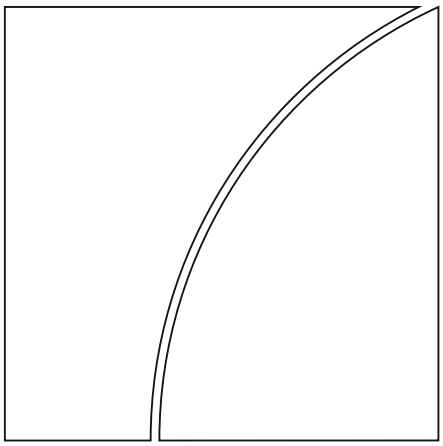
September 2016



International banking and financial market developments

BIS Quarterly Review
Monetary and Economic Department

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Recent enhancements to the BIS statistics

Special Features

Notations used in this Review

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

Differences in totals are due to rounding.

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

Dissonant markets?

Central banks reasserted their sway over financial markets in recent months, after two quarters punctuated by bouts of sharp volatility. Markets proved resilient to a number of potentially disruptive political developments. Nevertheless, questions lingered as to whether the configuration of asset prices accurately reflected the underlying risks.

With global growth showing moderate but persistent signs of strengthening and supportive monetary policy, investors' risk appetite seemed to return during the period under review. As a result, volatility in financial markets subsided, commodity prices edged higher, corporate credit spreads narrowed, stock markets rallied and portfolio flows to emerging market economies (EMEs) resumed. At the same time, yields in core fixed income markets plumbed new depths, and the pool of government debt trading at negative yields grew further to briefly exceed $10 trillion in July. As the summer went on, negative yields percolated to the high-grade corporate bond market, particularly in the euro area. The apparent dissonance between record low bond yields, on the one hand, and sharply higher stock prices with subdued volatility, on the other, cast a pall over such valuations. Banks' depressed equity prices and budding signs of tension in bank funding markets added another sobering note.

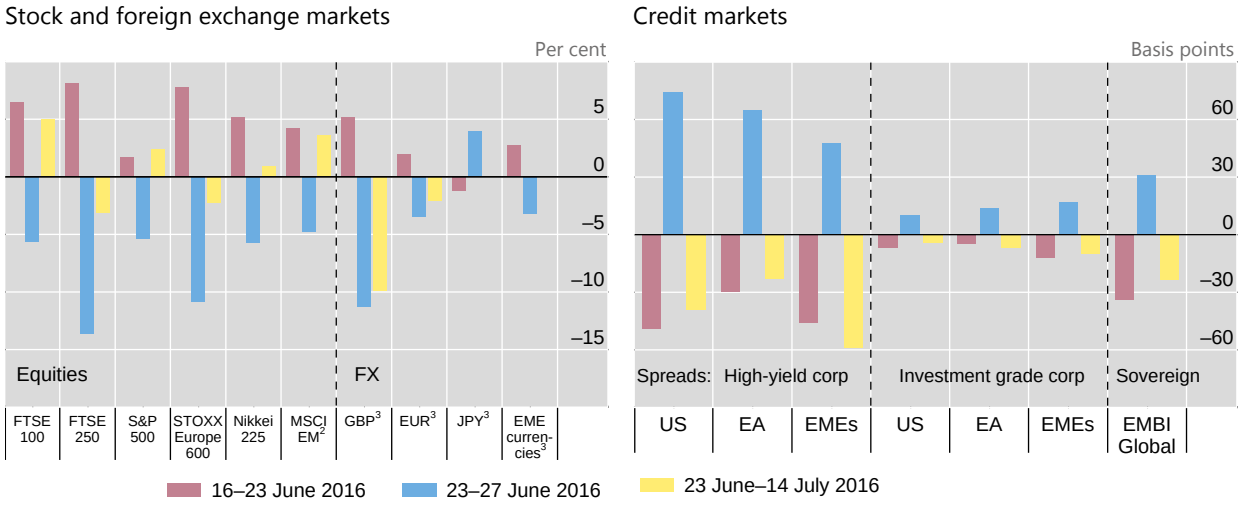
The outcome of the United Kingdom's referendum on European Union membership took many observers by surprise and caused a stir during a few trading days. But its impact soon subsided. Central banks' response, and investors' perception that an extended period of easy monetary policy would still lie ahead, appeared to play a soothing role.

Brexit: beyond the market response

The week preceding the 23 June referendum on the United Kingdom's membership in the European Union saw a wave of optimism that drove asset prices higher. UK and continental European stocks recorded large gains during that week, but valuations rallied across many jurisdictions. Corporate spreads tightened (especially in the high-yield space) and sterling appreciated 5% against the US dollar, briefly touching its high for the year (Graph 1, red bars in both panels).

Brexit vote had a transient impact on most asset prices[1]

Graph 1



EUR = euro; GBP = pound sterling; JPY = yen.

EA = euro area; EMEs = emerging market economies; US = United States.

[1] Changes over the stated period. [2] MSCI Emerging Markets index, in US dollars. [3] A decrease indicates depreciation of the stated currency against the US dollar. For the EME currencies, simple average of Brazilian real, Chinese renminbi, Colombian peso, Czech koruna, Hungarian forint, Indian rupee, Indonesian rupiah, Korean won, Malaysian ringgit, Mexican peso, Polish zloty, South African rand and Turkish lira.

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

The outcome of the vote took markets by surprise, triggering a swift repricing. Within the two trading days that followed, major stock indices in advanced economies (AEs) plummeted more than 5%, with the FTSE 250 shedding almost 15%. During the same time period, sterling nosedived by 10% and the US dollar appreciated across the board, except against the yen (Graph 1, blue bars in left-hand panel). Term spreads flattened in core bond markets with the 10-year–one-year gilt spread dropping almost 20 basis points (Graph 2, left-hand panel). Corporate high-yield spreads in the United States and the euro area widened by about 70 basis points, and investment grade spreads increased more than they had fallen the week before (Graph 1, blue bars in right-hand panel). EME benchmarks recorded more moderate swings, but followed basically the same path.

Despite the sharpness of the initial reaction, market conditions remained orderly, trading volume was high and valuations soon recovered. Central banks promptly announced their readiness to provide liquidity and ensure the proper functioning of markets.[1] Even during the plunge, market liquidity was adequate, not least in fixed income trading (Box A). Sentiment turned around the following week, and by mid-July, most asset classes had surpassed their 23 June closing prices. Even the FTSE 100, which includes UK companies with the largest exposure to foreign demand, closed 5% above its pre-referendum levels, buoyed by sterling's persistent

[1] The Federal Reserve, the ECB and the Bank of England released statements to that effect on 24 June, as did the People's Bank of China. The Global Economy Meeting, which is the main discussion forum for central bank Governors at the BIS, issued a press release endorsing the contingency measures put in place by the Bank of England. All statements emphasised collaboration among central banks in monitoring and addressing potential threats to financial stability.

depreciation.[2] That said, assets more closely related to the United Kingdom and Europe remained weaker. Sterling, the FTSE 250 (whose members tend to have a larger share of domestic revenue than the FTSE 100), European stocks and the euro remained below their immediate pre-referendum valuations (Graph 1, yellow bars).

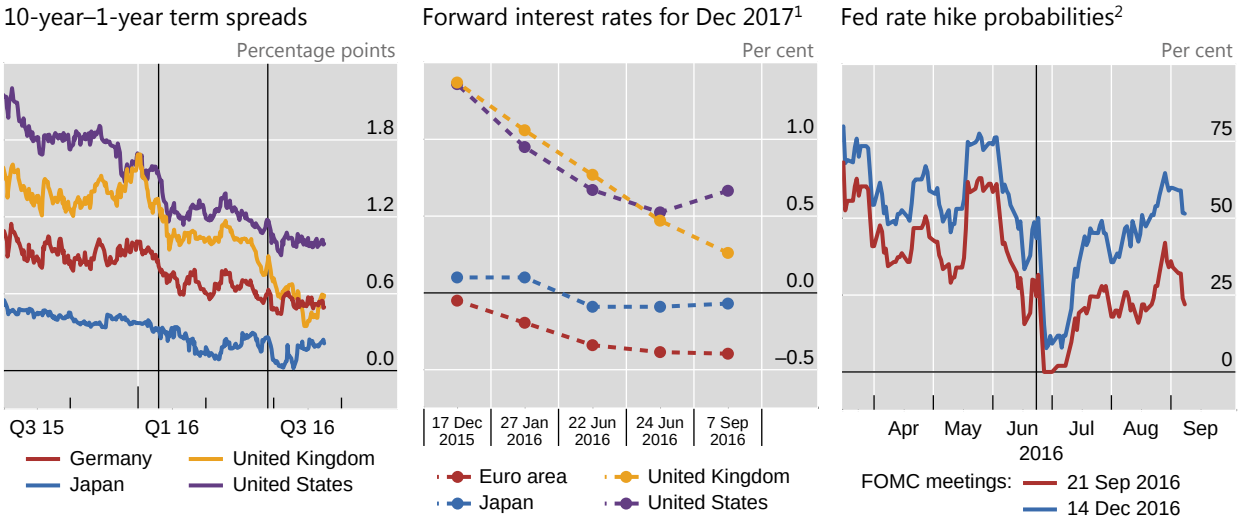
The Brexit vote triggered a broad-based reassessment of the future path of monetary policy globally. With improving headline growth still perceived as fragile in most AEs, and inflation persistently low, the additional uncertainty created by Brexit was seen as eliciting a distinct response from major central banks: policy rates would stay "lower for longer".

In the aftermath of the vote, markets expected the Bank of England to keep the policy rate unchanged at least through December 2017 (Graph 2, centre panel). However, on 4 August the central bank cut the policy rate by 25 basis points (it is now 0.25%), and expanded the government bond purchase scheme by £60 billion, bringing the total to £435 billion. It also established a new corporate bond purchase programme of £10 billion, and launched a new Term Funding Scheme that will provide funding for banks at rates close to the monetary policy rate. Forward interest rates for December 2017 quickly dropped to the new level of the policy rate, reflecting the view that a quick policy reversal was not expected.

Immediately after the vote, financial markets anticipated that the Federal Reserve would push the resumption of its hiking cycle further into the future (Graph 2, right-hand panel). Questions about the path of policy rates were compounded by the ongoing debate among economists about the apparent decline in the neutral interest

Brexit affected expectations of the monetary policy path

Graph 2



The vertical lines in the left-hand panel indicate 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves) and 23 June 2016 (Brexit referendum); the vertical line in the right-hand panel indicates 23 June 2016 (Brexit referendum).

[1] For the euro area, three-month Euribor futures; for Japan, three-month Tibor futures; for the United Kingdom, 90-day sterling futures and for the United States, 30-day federal funds rate futures. [2] Based on Bloomberg implied probabilities from federal funds rate futures, as of 7 September 2016.

Sources: Bloomberg; BIS calculations.

[2] However, in US dollar terms the FTSE 100 was almost 5% cheaper than before Brexit, suggesting that markets perceived some lasting deterioration in these companies' future business conditions.

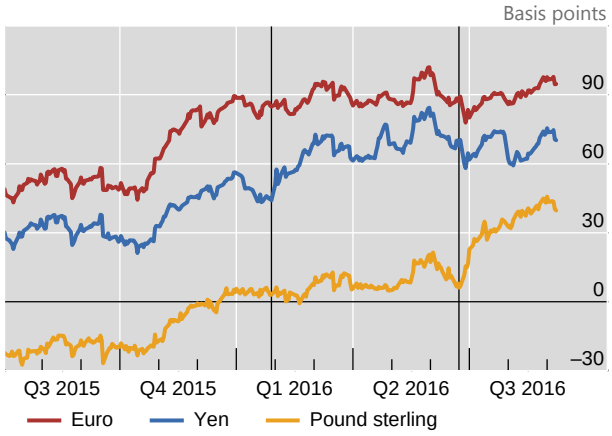
rate in the United States and elsewhere.[3] Given these short- and long-term considerations, the path towards "normalisation" looked more protracted and shallower than anticipated. In late July, on strong data releases about the US economy, markets adjusted their expectations about the timing of future rises in the federal funds rate (Graph 2, right-hand panel), but forward interest rates still pointed towards at most one increase through the end of 2017 (Graph 2, centre panel).

In the euro area and Japan, Brexit featured prominently among the risks to the economic outlook cited by central banks. On 21 July, the ECB reaffirmed its expectation that its key interest rates would stay at current or lower levels for an extended period of time, and well past the horizon of the asset purchase programme. Moreover, the bank stressed that this programme, provisionally scheduled to end in March 2017, could be extended until the Governing Council saw a sustained adjustment in the inflation path consistent with its target. On 29 July, the Bank of Japan announced extensions to its outstanding qualitative and quantitative easing (QQE) programme: it doubled the yearly pace of acquisition of exchange-traded funds (ETFs) to ¥6 trillion – equivalent to almost 8% of its flagship Japanese government bond (JGB) purchasing programme. Moreover, it announced additional measures aimed at alleviating growing tensions in the US dollar funding markets for

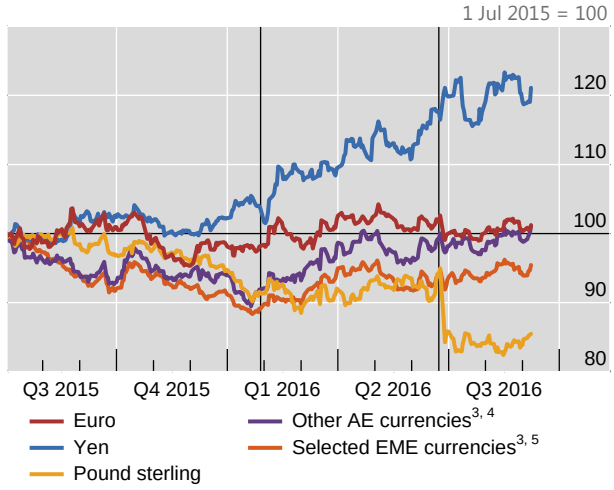
With expected monetary policy divergence bounded, dollar stabilised

Graph 3

Spread vis-à-vis one-year US dollar OIS[1]



Nominal bilateral exchange rates[2]



The vertical lines indicate 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves) and 23 June 2016 (Brexit referendum).

[1] Difference between the one-year US dollar overnight index swap (OIS) and the one-year euro/yen/pound sterling OIS. [2] A decrease indicates depreciation of the local currency against the US dollar. [3] Simple average of the currencies listed. [4] Australian dollar, Canadian dollar, New Zealand dollar, Norwegian krone, Swedish krona and Swiss franc. [5] Brazilian real, Chinese renminbi, Colombian peso, Czech koruna, Hungarian forint, Indian rupee, Indonesian rupiah, Korean won, Malaysian ringgit, Mexican peso, Polish zloty, South African rand and Turkish lira.

Sources: Bloomberg; national data; BIS calculations.

[3] The neutral interest rate (or "natural rate") is the rate consistent with output being at potential (and hence inflation being stable) in the long term. A lower natural rate would point to a more gradual "normalisation" process and to a lower end point. See Box IV.C in the BIS *86th Annual Report* and the references listed there for alternative views on the level of the natural rate, including one that explicitly incorporates the impact of the financial cycle.

Box A

Fixed income market liquidity in the wake of Brexit

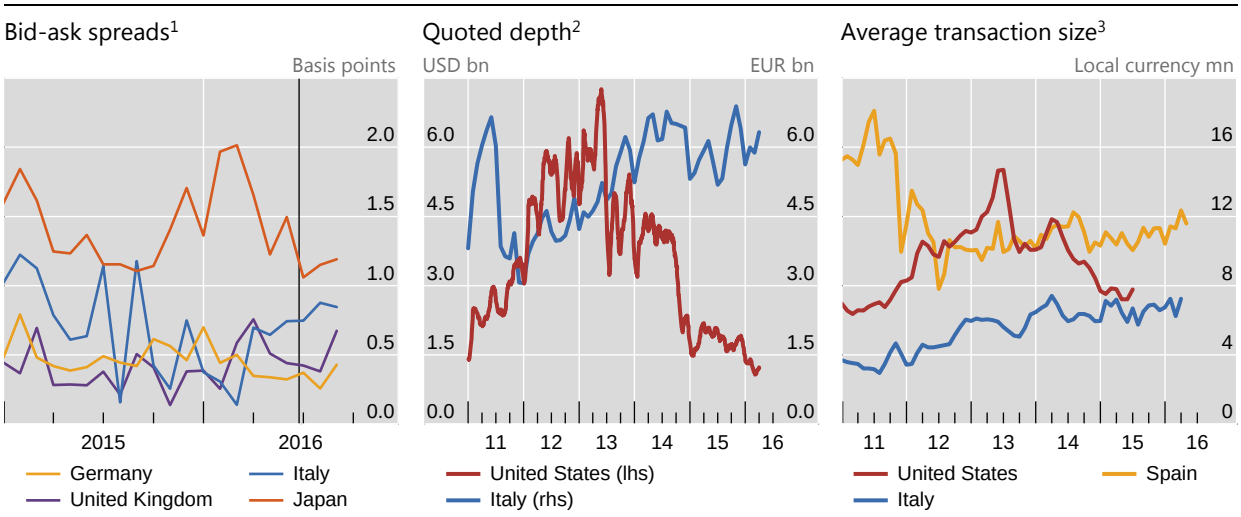
Before the UK referendum, many observers voiced concerns about whether markets would be resilient to an unexpected outcome. After the event, in core fixed income markets, and indeed most other markets, it was evident that the system was able to smoothly absorb the brief turbulence that followed (Graph A, left-hand panel). Markets went through the Brexit vote with little or no disruption to functioning. But questions about their underlying resilience remain.

Market liquidity can be defined as "the ability to rapidly execute large financial transactions at low cost with limited price impact".① As market-based finance gains importance in financial systems worldwide, market liquidity has become increasingly relevant to financial stability. This is especially true in the case of core fixed income instruments, which perform critical roles as investments, collateral and pricing benchmarks.

Taking a longer perspective, most indicators do not show a significant structural decline of liquidity in financial markets in recent years. For instance, bid-ask spreads have been stable and tight in major sovereign bond markets (Graph A, left-hand panel). While quoted depth and average transaction size have declined in some markets, in most cases they are not unusually low by historical standards (Graph A, centre and right-hand panels).

Core bond market liquidity stayed resilient through Brexit

Graph A



The vertical line in the left-hand panel indicates 23 June 2016 (Brexit referendum).

[1] Ten-year government bonds. [2] Quoted depth at the top five levels of both sides of the order book; for the United States, 21-day moving averages of average daily depth of on-the-run two-year US Treasury notes; for Italy, monthly averages of medium- and long-term Italian government bonds (exhibited in MTS Cash). [3] Average transaction size for two-year US Treasury notes, a weighted average of all Italian sovereign bonds and Spanish public debt; three-month moving averages.

Sources: Committee on the Global Financial System, *Fixed income market liquidity*, *CGFS Papers*, no 55, January 2016; national central banks; Thomson Reuters Eikon.

That said, financial markets have experienced a number of intense and short-lived episodes of stress in the last few years, such as the "flash rally" in US Treasury bonds on 15 October 2014 and the turbulence in the German bund market in May–June 2015. Although the explanations for these sudden changes in market conditions vary, the increased reliance of market participants on electronic trading platforms and the proliferation of trading algorithms in a number of key fixed income markets are likely to have been major factors. While the "electronification" of fixed income markets has contributed to reducing trading costs and improving liquidity in normal conditions, the spread of complex and often opaque trading strategies has raised concerns about potential implications for market stability in times of stress.

① Committee on the Global Financial System, *Fixed income market liquidity*, *CGFS Papers*, no 55, January 2016.

Japanese banks (see below).[4] Separately, the Japanese government bolstered its fiscal expansion plans.

During the period under review, the scope of expected monetary policy divergence between the United States, on the one hand, and the euro area and Japan, on the other, did not change much in markets' view (Graph 3, left-hand panel). Against this backdrop, the US dollar traded sideways against the euro and yen, and in fact most other currencies, after the initial reaction to Brexit (right-hand panel). The main outlier was sterling, which depreciated sharply after the referendum, while investors priced in a wider medium-term policy divergence between the United Kingdom and the United States (left-hand panel).

Central banks in other jurisdictions also followed an easing path. Most policy changes following the referendum resulted in an easing of policy, with Brexit or challenging global conditions often mentioned as the motivation. The only exceptions were some central banks in Latin America from large commodity producers, which increased rates in order to stabilise foreign exchange markets and contain inflationary pressures.

Core fixed income yields under pressure

As the perception of reinforced monetary accommodation took hold, yields in core fixed income markets stayed under pressure. Conservative estimates of the amount of government bonds trading at negative yields surpassed $10 trillion within days after Brexit (Graph 4, top left-hand panel).[5] Negative yields gradually spread to investment grade corporate bonds in AEs. By late August, some market sources reckoned that up to 30% of the euro area high-grade corporate fixed income market was trading at negative yields. In July, the German treasury was able to publicly place 10-year bunds at negative yields (–0.05%) for the first time ever. In the gilt market, Bank of England purchases, combined with institutional investors' initial reluctance to sell, drove yields to their historical troughs. By early September, maturities close to 10 years had notched up capital gains of almost 6% since the referendum. Some longer-dated gilts have seen price returns in excess of 20%. Thanks to capital gains from falling yields, returns in core fixed income markets this year have rivalled those of equity markets (Graph 4, top right-hand panel).

As a result, core bond yields continued to probe historical lows. The near zero short-term interest rates in the United States and the United Kingdom represented post-Great Depression troughs, while short-term rates in Germany and Japan reached unprecedented negative levels over the summer. The nominal yields of bonds with tenors close to 10 years were also at long-term lows in these countries as of the beginning of September (Graph 4, bottom left-hand panel).

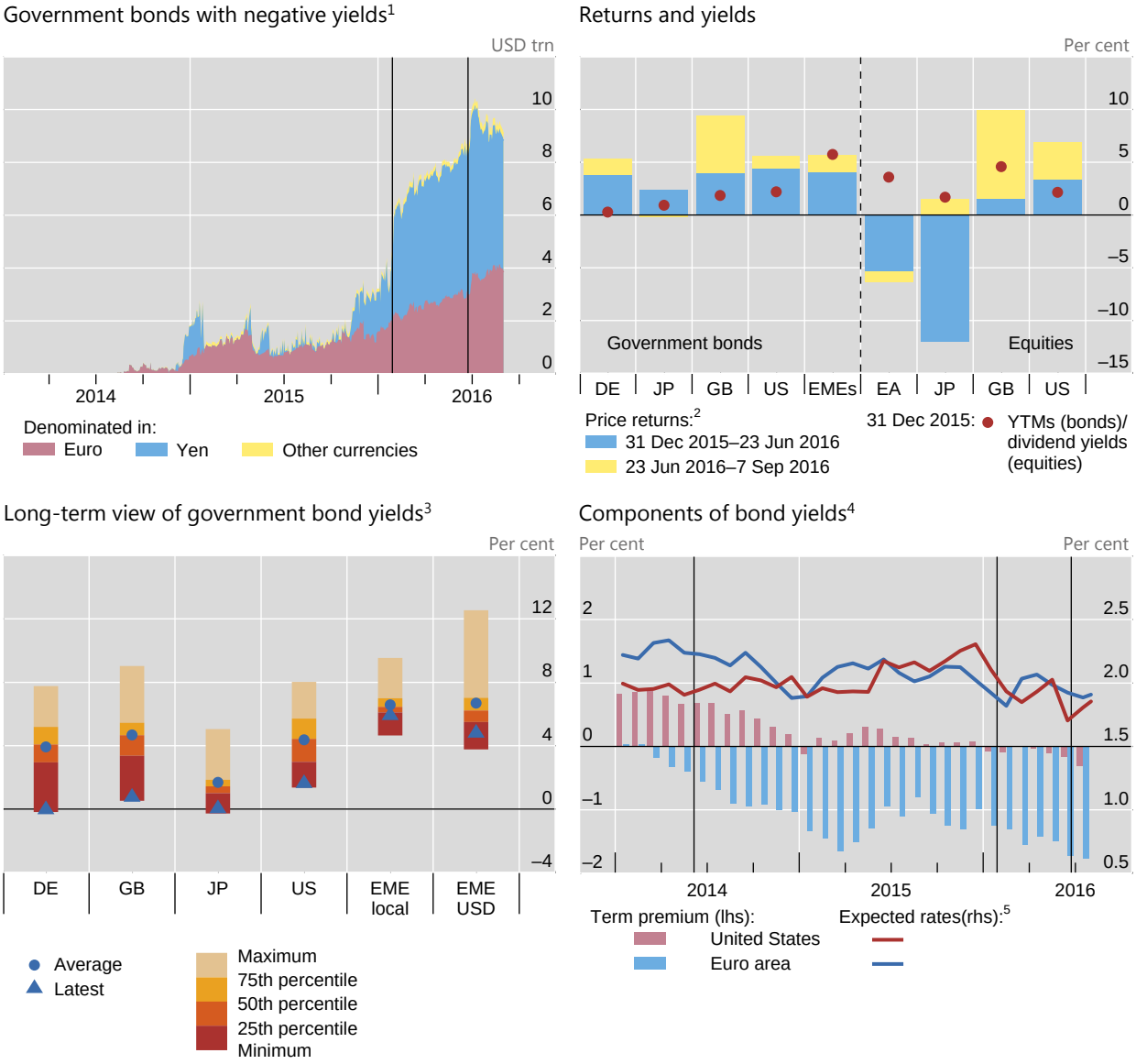
In this context, some observers wondered whether core fixed income markets might be overvalued. Defining overvaluation for government bonds is not straightforward, but a comparison with nominal GDP growth suggests that yields are

[4] Specifically, the Bank of Japan doubled its US dollar lending programme to $24 billion, and established a facility that will allow Japanese banks to borrow JGBs using their reserves. In turn, those bonds could be pledged in US dollar funding operations.

[5] Other estimates, which include high-grade corporate bonds, bring this number to a range between $13 trillion and $16 trillion.

Pressure on core fixed income yields

Graph 4



DE = Germany; EA = euro area; EME local = JPMorgan GBI-EM 7–10 years index, yield to maturity in local currency; EME USD = JPMorgan EMBI Global 7–10 years index, yield to maturity in US dollars; GB = United Kingdom; JP = Japan; US = United States.

The vertical lines in the top left-hand panel indicate 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves) and 23 June 2016 (Brexit referendum).The vertical lines in the bottom right-hand panel indicate 5 June 2014 (ECB announcement of negative rate on the deposit facility), 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves) and 23 June 2016 (Brexit referendum).

[1] Analysis based on the constituents of the Bank of America Merrill Lynch World Sovereign bond index. [2] Periodic returns over the stated periods. For government bonds, based on Barclay's aggregate bond indices, 7–10 years; for equities, based on equity indices. [3] Based on long-term historical values of 10-year government bond yields in local currency. [4] Decomposition of the 10-year nominal yield according to an estimated joint macroeconomic and term structure model; see P Hördahl and O Tristani, "Inflation risk premia in the euro area and the United States", *International Journal of Central Banking*, September 2014. Yields are expressed in zero coupon terms; for the euro area, French government bond data are used. [5] Difference between 10-year nominal zero coupon yield and 10-year estimated term premium.

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

on the low side. Over the past 65 years, 10-year bond yields have tracked fairly well the broad trends in nominal GDP growth across the United States, Germany, Japan and the United Kingdom. Presumably, real bond yields and expected inflation components of nominal yields have tracked developments in real GDP growth and

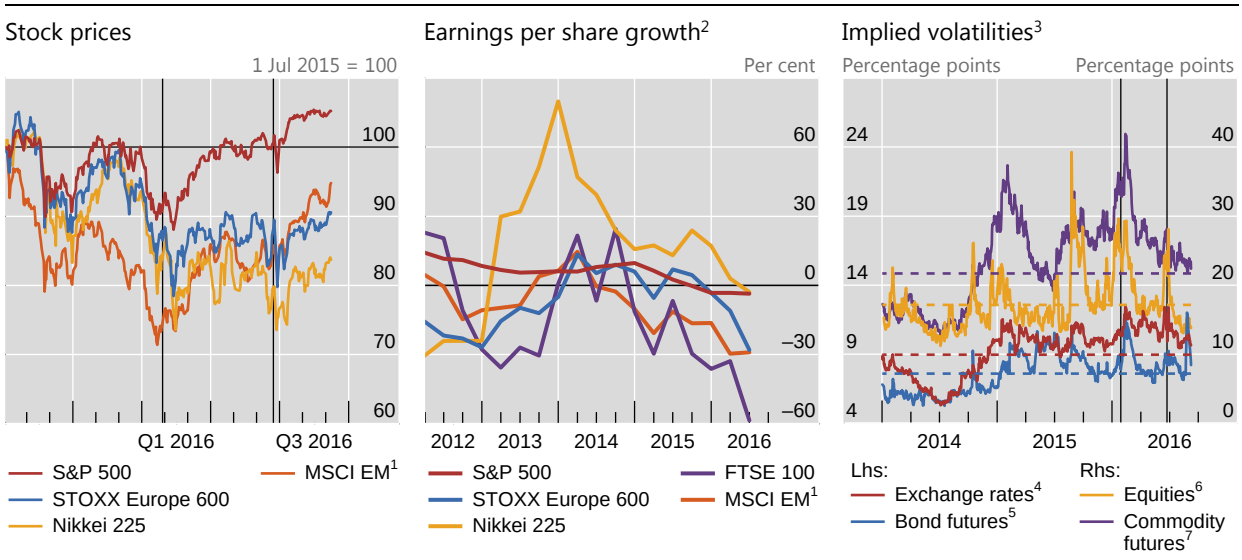
inflation, respectively. For some time now, nominal bond yields have been well below nominal GDP growth in all four countries.[6]

These historically low bond yields have coincided with low estimated term premia. The compression of term premia appears to have accelerated after the adoption of negative interest rates, first in the euro area, then in Japan. This compression seems to have been exacerbated by Brexit (Graph 4, bottom right-hand panel). Expectations of future interest rates have also played a role. As investors reassessed the likelihood for continued monetary accommodation in the largest currencies, nominal yields were pushed downwards (same panel). While this is especially true in the case of the United States, where a quicker expected pace of normalisation was partly reversed in early 2016, the expectations component played a smaller role in the euro area.

Exuberance prevails in other financial markets

While yields in core fixed income markets were reaching record lows further out the maturity curve, which would normally be associated with expectations of subdued growth, stock markets and other market segments showed renewed ebullience, highlighting the sense of dissonance.

Markets recovered after the turbulence at the start of the year — Graph 5



The vertical lines in the left- and right-hand panels indicate 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves) and 23 June 2016 (Brexit referendum).

[1] MSCI Emerging Markets Index, in US dollars. [2] Twelve-month trailing earnings per share, quarterly averages, year-on-year changes. [3] The dashed horizontal lines represent simple averages for the period 2012–15 for each implied volatility series. [4] JPMorgan VXY Global index, a turnover-weighted index of implied volatility of three-month at-the-money options on 23 USD currency pairs. [5] 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. [6] Implied volatility of S&P 500, EURO STOXX 50, FTSE 100 and Nikkei 225 indices; weighted average based on market capitalisation. [7] Implied volatility of at-the-money options on commodity futures contracts on oil, gold and copper; simple average.

Sources: Bloomberg; Datastream; EPFR; BIS calculations.

[6] For a more in-depth analysis of the current low interest rate environment, see BIS, *86th Annual Report*, 2016, Chapter II.

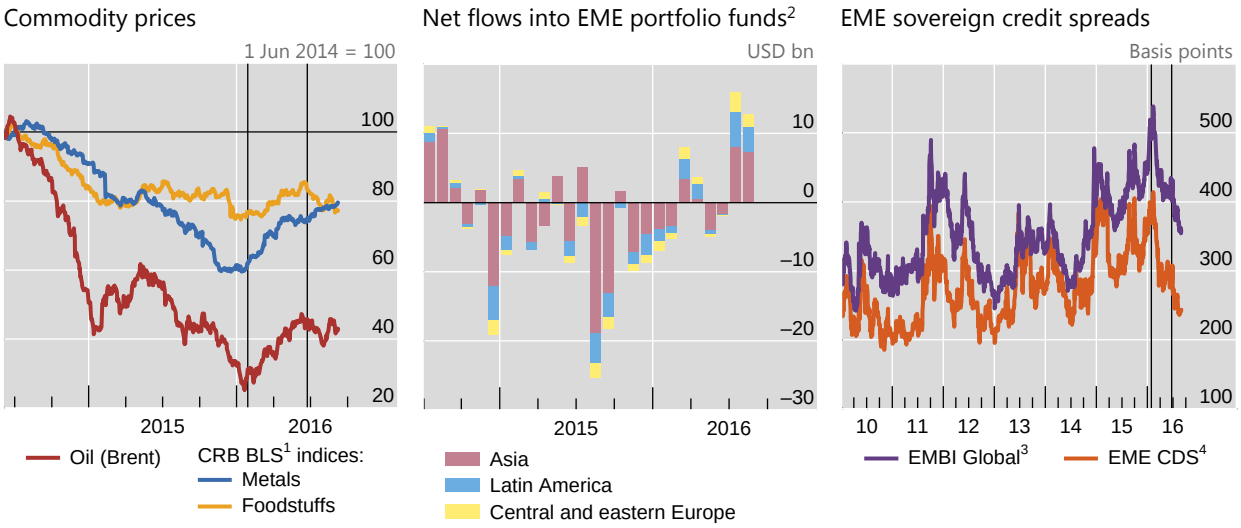
Markets had already started a recovery, after a rocky start to the year. The turnaround can be dated to the weeks between the Bank of Japan's adoption of negative interest rates on 29 January and the ECB's announcement of additional expansion on 10 March. In July and August, as Brexit receded in the financial markets' rear-view mirror, exuberance resumed in full force. By mid-July, despite flagging earnings, stock markets in the US had broken through all-time highs (Graph 5, left-hand and centre panels). Following a slump in the second quarter, equity prices in EMEs also bounced back and returned to levels last seen a year earlier. European and Japanese valuations were more tentative, as they wrestled with their own idiosyncratic uncertainties.

Implied volatilities trended down towards, or below, post-crisis averages (Graph 5, right-hand panel). Stock market volatility quickly approached the lows last seen in July 2014. Volatilities in other markets were less subdued, fluctuating around their recent averages and still far from 2014 depths. Brexit briefly boosted volatilities, but its impact was as transient as on prices. High valuations across most asset classes may have helped keep volatilities low.[7]

A traditional search for yield seemed to be driving developments in EME fixed income markets, supported by signs of an improving macroeconomic outlook. As commodity prices recovered from their early 2016 lows (Graph 6, left-hand panel), strong capital inflows to EMEs resumed (centre panel). While commodity prices were still far from the high levels observed before mid-2014, the mild recovery helped to

Commodity prices rebounded and flows to EMEs resumed

Graph 6



The vertical lines in the left- and right-hand panels indicate 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves) and 23 June 2016 (Brexit referendum).

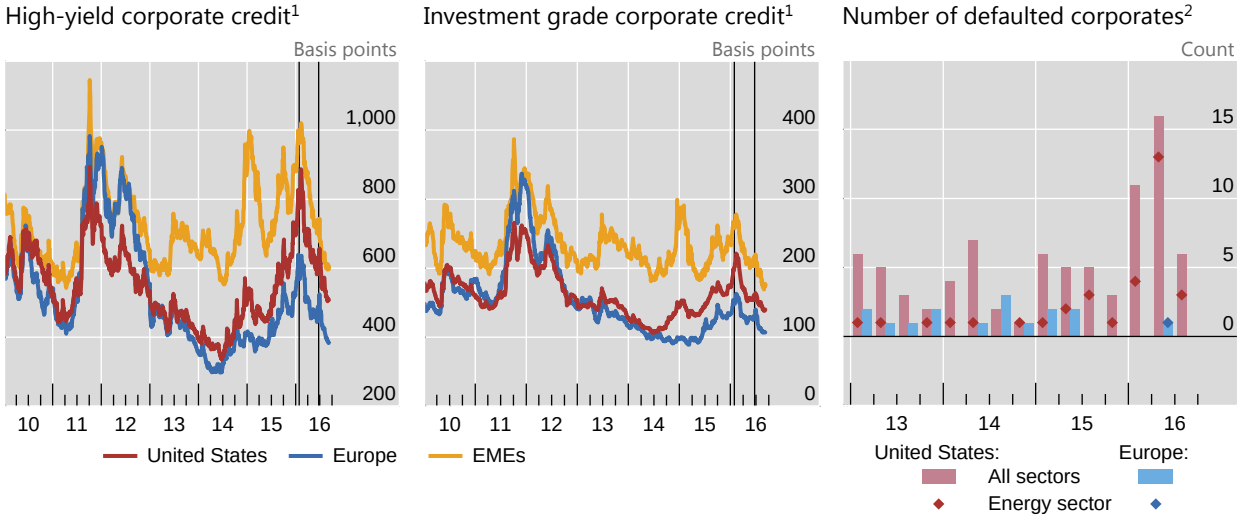
[1] Commodity Research Bureau – Bureau of Labor Statistics. [2] Monthly sums of weekly data across major economies in each region up to 31 August 2016. Data cover net portfolio flows (adjusted for exchange rate changes) to dedicated funds for individual EMEs and to EME funds with country/regional decomposition. [3] JPMorgan EMBI Global index, stripped spread. [4] Emerging markets CDX.EM index, five-year on-the-run CDS mid-spread.

Sources: US Energy Information Administration; Bloomberg; Datastream; EPFR; JPMorgan Chase; BIS calculations.

[7] For a discussion of volatility and a historical perspective, see BIS, "Volatility stirs, markets unshaken", *BIS Quarterly Review*, September 2014, pp 1–11.

Credit spreads tightened substantially despite a turn in the default cycle

Graph 7



The vertical lines in the left-hand and centre panels indicate 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves) and 23 June 2016 (Brexit referendum).

[1] Option-adjusted spreads over US Treasury notes. [2] Corporates in default on all of their long-term debt obligations; for Q3 2016, data up to 7 September 2016.

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

assuage concerns about the growth prospects for several large EMEs, especially in Latin America. More generally, there was an increasing perception that growth rates in EMEs had bottomed out. Sovereign and CDS spreads narrowed by 45 basis points after 23 June, and more than 150 basis points since late January (right-hand panel).

Conditions in private sector credit markets also eased significantly. Credit spreads in European and EME high-yield and investment grade corporates narrowed to levels not observed since early 2015 (Graph 7, left-hand and centre panels). US corporate spreads fell proportionally less, possibly hampered by the large oil sector exposure and continued signs of a turn in the default cycle (Graph 7, right-hand panel). The Bank of Japan's decision in January to implement a negative interest rate appears to have been a key turning point in these markets. The persistent gap between credit spreads denominated in US dollars and euros was reinforced by changes to the ECB asset purchase programme.[8] This encouraged the issuance of euro-denominated debt by US companies, whose subsequent swapping into US dollars has contributed to a widening of the cross-currency basis since 2014.[9]

[8] On 10 March, the ECB announced the addition of investment grade euro-denominated bonds issued by non-financial corporations to the mix of assets eligible for regular purchases. The ECB estimated that spreads on investment grade corporate bonds eligible to participate in the asset purchase programme tightened by 11 basis points during the subsequent two weeks. The effect went further, as high-yield bonds dropped by 25 basis points, and financial entity bonds (not eligible) fell by 5 basis points. See European Central Bank, *ECB Economic Bulletin*, issue 5, 2016, Box 2.

[9] See Box B in C Borio, R McCauley, P McGuire and V Sushko, "Covered interest parity lost: understanding the cross-currency basis", *BIS Quarterly Review*, September 2016, pp 45–64.

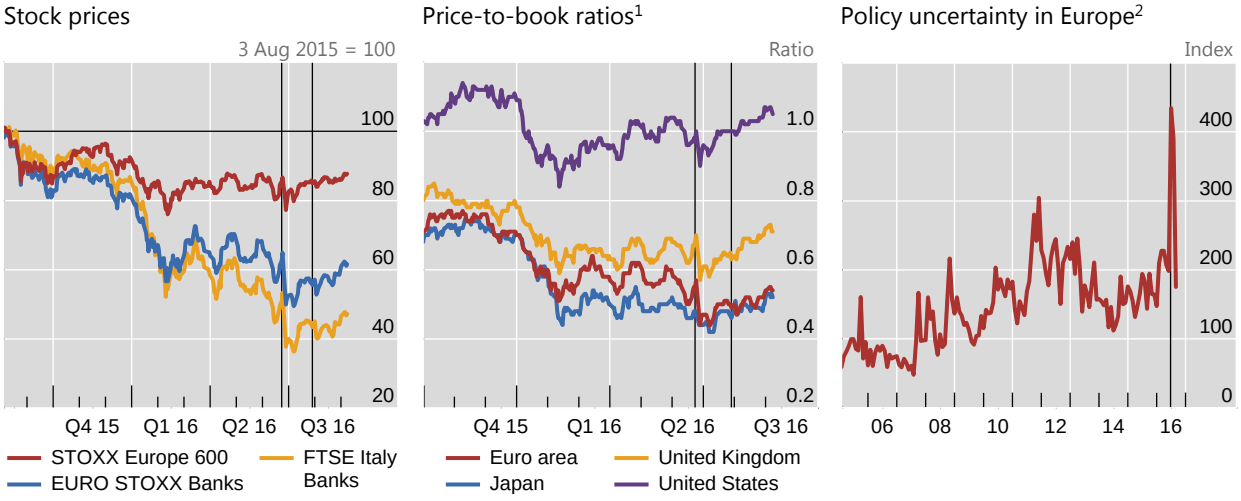
Bank valuations struggle

While equity markets in some jurisdictions were visiting new highs over the summer, banks' stocks headed down further and money markets displayed signs of tension, adding yet another dissonant note. Even though banks' debt-related instruments appeared to benefit from the global hunt for yield, their price-to-book ratios remained at the lower end of the post-Great Financial Crisis (GFC) range. Questions lingered about banks' ability to deliver adequate earnings in a context of compressed term premia and slow growth, especially in Japan and the euro area. Low and negative rates also presented banks with challenging trade-offs (Box B).

Expectations of sluggish AE growth and the uncertainty generated by the outcome of the UK referendum drove bank stocks down in June. The EURO STOXX Banks index plunged 18% the day following the vote, its worst fall ever (Graph 8, left-hand panel). The rising uncertainty put the spotlight on persistent questions about the condition of banks in continental Europe, with the main German bank stocks suffering double-digit losses and stocks of Italian and Spanish banks sinking to new lows. UK banks were also hit, as the outlook for the domestic economy worsened and a rethinking of business models became more pressing. The main UK lenders recorded sizeable stock price drops following the referendum results, in most cases in excess of 15%.

After this initial phase, however, bank equity valuations rebounded to different degrees across countries. The stimulus package announced by the Bank of England on 4 August allowed UK bank stocks to regain some ground, though they still traded at a fraction of their book value. Overall, the fall in the main UK and US bank equity indices proved to be short-lived, and stock prices soon reverted to their pre-

Brexit added to banks' woes — Graph 8



The vertical lines in the left-hand and centre panels indicate 23 June 2016 (Brexit referendum) and 29 July 2016 (announcement of the EU-wide stress test results); the vertical line in the right-hand panel indicates 23 June 2016 (Brexit referendum).

[1] For banks. [2] European news monthly index, based on newspaper articles regarding economic policy uncertainty; equal average across 10 European newspapers.

Sources: S Baker, N Bloom and S Davis, "Measuring economic policy uncertainty", *Quarterly Journal of Economics*, forthcoming, and www.policyuncertainty.com; Bloomberg; Datastream.

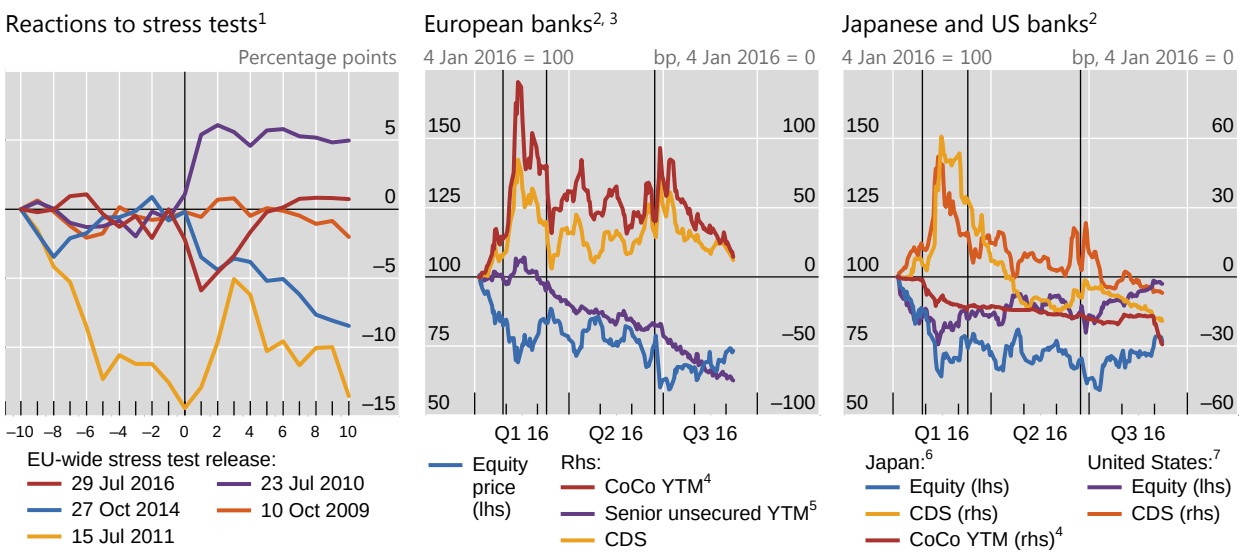
referendum levels. By contrast, the EURO STOXX Banks index was slower in regaining momentum. In early September stocks of euro area lenders were trading at less than 50% of their book values, pointing to increasing concerns about their ability to generate profits in a low-rate, low-growth environment (Graph 8, centre panel). While the increase in implied volatilities in the aftermath of the referendum was moderate, policy uncertainty in Europe became quite high. One index of uncertainty[10] in particular reached unprecedented levels in June (Graph 8, right-hand panel).

The low price-to-book ratios in the banking industry appear especially striking when compared to the relatively high valuations of broader equity benchmarks. In contrast to banks, low real interest rates tend to benefit non-financial corporations (NFCs), by reducing their net interest expenses and lowering the discount factors on their future earnings. Equity valuations for NFCs have also been boosted by share repurchases, which in the US increased by about 43% between 2011 and 2015

The results of the 2016 European Banking Authority (EBA) stress tests, released on 29 July, failed to reassure equity investors. The EBA found that only one (Monte dei Paschi di Siena) of the 51 banks under examination would default in the hypothesised adverse scenario. However, the published results implied that five banks

Weak earnings expectations added to doubts about banks' outlook

Graph 9



The vertical lines in the centre and right-hand panels indicate 29 January 2016 (Bank of Japan announcement of negative interest rates on reserves), 10 March 2016 (ECB announcement of expansion of its asset purchase programme) and 23 June 2016 (Brexit referendum).

[1] Cumulative abnormal returns of EURO STOXX Banks over STOXX Europe 600 over the stated window (business days). Zero indicates the date of the release or one business day after if the release was on a weekend or after market close. [2] Simple average, based on data availability, of the banks and bank holding corporations listed. [3] Barclays, Banco Santander, BBVA, Crédit Agricole, Credit Suisse, Deutsche Bank, Intesa Sanpaolo, Société Générale, UBS and UniCredit. [4] Yield to maturity (YTM); based on perpetual contingent convertible (CoCo) instruments. [5] YTM of senior unsecured bonds matching the selected CoCo instruments in terms of currency and remaining maturity as closely as possible. [6] For equities and CoCo instruments, Mizuho Financial Group, Mitsubishi UFJ Financial Group, Nomura Holdings, Sumitomo Mitsui Financial Group and Sumitomo Mitsui Trust Bank Ltd; for CDS, Mizuho Bank, Bank of Tokyo Mitsubishi UFJ, Nomura Holdings, Sumitomo Mitsui Banking Corporation and Sumitomo Mitsui Trust Bank Ltd. [7] Bank of America, Citigroup, Goldman Sachs, JPMorgan, Morgan Stanley and Wells Fargo.

Sources: Bloomberg; Datastream; Markit; BIS calculations.

[10] See S Baker, N Bloom and S Davis, "Measuring economic policy uncertainty", *Quarterly Journal of Economics*, forthcoming.

would fall short of the Basel III 7% Common Equity Tier 1 (CET1) requirement and two thirds of the banks would end up with a CET1 ratio below 10%.

The release of the stress test results did not have a long-lasting impact on markets, as the outcomes were, in most cases, aligned with investors' initial expectations. Bank stocks fell sharply when the results were released, but soon rebounded to pre-stress test levels. By comparison, previous tests had sometimes had a more sizeable and long-lasting effect on market valuations, whether positive (as in the case of the 2010 exercise) or negative (as in 2014; Graph 9, left-hand panel).

While European bank equity prices were weak, their senior debt and contingent convertible bonds (CoCos) regained some of the value lost during the first quarter of the year (Graph 9, centre panel). The combination of narrower CDS and CoCo spreads with plunging stock prices and reduced earnings expectations suggests that, despite investors' anticipation of persistently low profitability at the major European lenders, solvency concerns remain limited as a number of bank debt instruments benefited from the broader global search for yield.

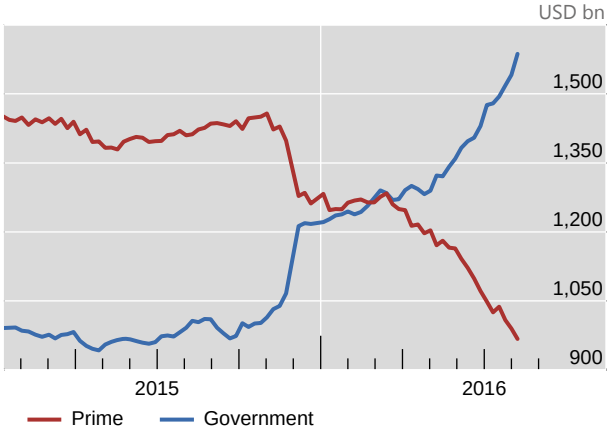
Difficulties in Europe were mirrored by challenges in the Japanese banking sector. In an effort to improve profitability, the three main Japanese banks sold a large quantity of government bonds in the second quarter, more than doubling net trading income with respect to the same period of the previous year. However, the negative rate environment and protracted low economic growth continued to erode banks' earnings, pushing equity valuations to new lows. At the same time, echoing the pattern seen in Europe, Japanese banks' CDS and CoCo spreads reverted to significantly lower levels, after the spike recorded at the beginning of the year (Graph 9, right-hand panel).

Positive results from US banks accentuated the divide with Europe and Japan. Earnings for the six largest US banks met or beat expectations in the second quarter, while most of the industry fared well in the Fed's stress tests, with the exception of the subsidiaries of two European banks. Net interest margins have remained substantially flat since the December rate increase by the Fed.

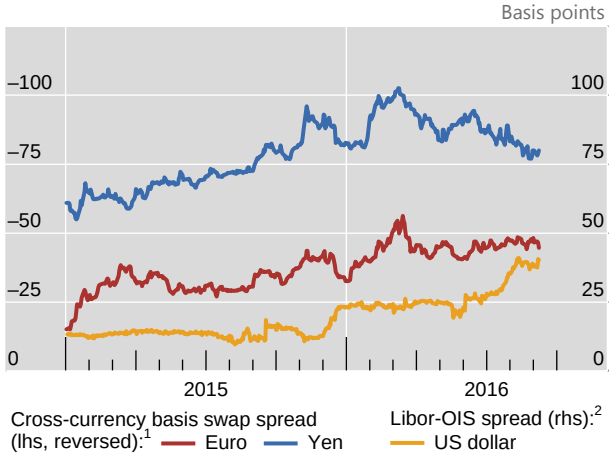
Increased stress in dollar funding markets

Graph 10

Money market fund assets by fund type



Libor-OIS and cross-currency basis swap spreads



[1] Five-year basis swap spreads versus the US dollar. [2] Three-month spreads.

Source: Bloomberg.

Recent strains in money markets added to this overall adverse landscape. The three-month US dollar Libor-OIS spread soared from 25 to about 40 basis points from early July to the end of August (Graph 10, right-hand panel). In the past, spikes in this gauge have been associated with concerns about counterparty credit risk, particularly during the GFC and the subsequent sovereign debt crisis in Europe. This time around, the increase seems to be mainly related to regulatory reforms designed to improve the resilience of the US money market fund (MMF) sector. In particular, starting on 14 October 2016, new rules will require prime MMFs (which invest in non-government assets) and tax-exempt institutional funds to adopt a floating net asset value structure. Moreover, they will be allowed to impose redemption gates and liquidity fees in the event of a large increase in outflows.

In anticipation of these rules, investments have been shifting away from prime funds towards government funds since late 2015. Since late June, this has resulted in nearly $250 billion in outflows from prime funds and more than $300 billion in inflows into government funds (Graph 10, left-hand panel). This has created incipient funding tensions for non-US, especially Japanese, banks which rely heavily on prime funds for their US dollar funding. In turn, these developments have created additional funding demand in the dollar/yen cross-currency swap market, widening pre-existing anomalies in the basis (Graph 10, right-hand panel).[11]

[11] See C Borio, R McCauley, P McGuire and V Sushko, "Covered interest parity lost: understanding the cross-currency basis", *BIS Quarterly Review*, September 2016, pp 45–64.

Box B

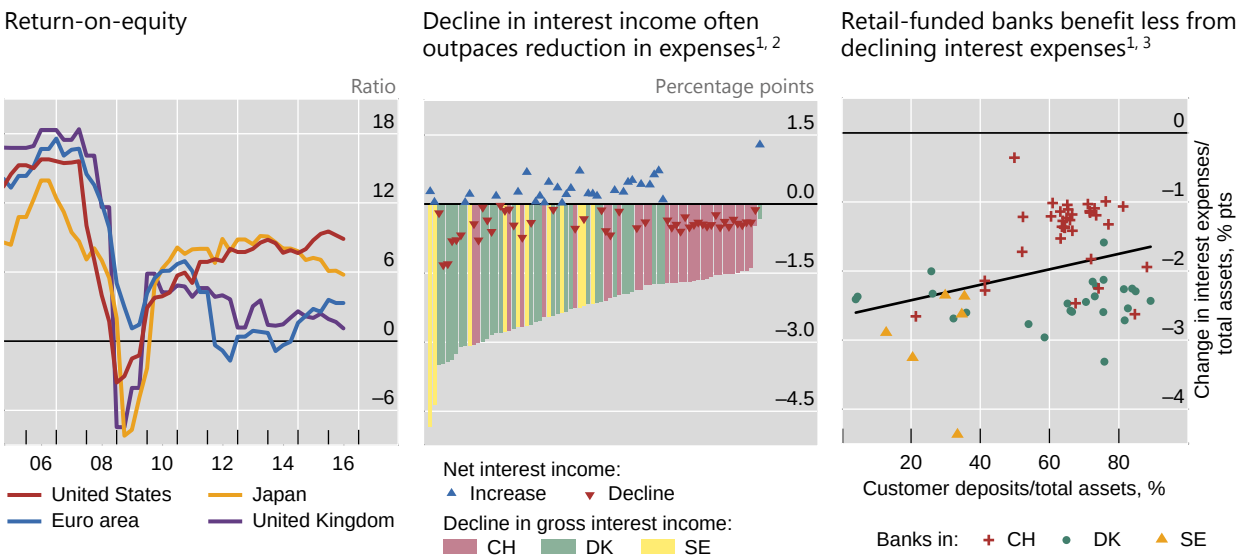
Negative rates and bank business models

Low profitability has challenged banks' traditional business models in the current environment of persistently low interest rates and compressed term premia.

Market valuations indicate that investors remain sceptical of banks' ability to generate earnings in a low-rate, low-growth environment. Bank return-on-equity ratios① have never recovered to the levels observed before the GFC, though they exhibit significant differences across jurisdictions (Graph B, left-hand panel). Flattening yield curves and low long-term rates are among the factors that markets are weighing more closely as they ask whether, and how, banks' profitability can recover.②

Banks struggle with falling margins

Graph B



CH = Switzerland; DK = Denmark; SE = Sweden.

[1] Based on a sample of 76 banks. [2] Each triangle (bar) represents the change in net (gross) interest income as a percentage of total assets for an individual bank from 2008 to 2015. [3] The horizontal axis refers to 2015 values; the vertical axis shows the change from 2008 to 2015. The black line represents a simple trend line.

Sources: Datastream; SNL; authors' calculations.

Profitability has been constrained by flatter yield curves. Long-term rates have fallen, especially where investors have expected low short-term rates to prevail for longer and central banks have engaged in large-scale asset purchases to compress term premia. A decline in the level of interest rates can improve banks' net income in the short run, as their portfolios of securities benefit from one-off capital gains, and also if funding for the banks becomes cheaper. However, in the long run the flattening of the curve can drive down returns from maturity transformation and compress net interest margins.

Furthermore, as interest rates decline and move into negative territory, repricing banks' liabilities in lockstep with assets in order to protect margins will become increasingly difficult. Banks appear reluctant to pass negative short-term rates to depositors. Thus, pressures on net interest margins are particularly pronounced in countries with negative interest rates. For example, many banks in Denmark, Sweden and Switzerland have seen the compression in gross interest income (bars in Graph B, centre panel) outpacing the reduction in interest expenses, resulting in declining net interest margins (triangles in same panel) over recent years. A critical issue in this context is the extent to which banks' liabilities are tilted in the direction of retail deposits and similar funding sources (right-hand panel).

Ultimately, country-specific factors will dictate whether and how banks can compensate for lower net interest margins. Stronger economies will allow banks to expand the volume of their traditional lending activities. Some banks may be able to compensate for part of their lost revenues by relying on alternative sources of income such as trading and fee-generating services, while others may be able to reap efficiency gains, for example by addressing overcapacity or by bringing down cost-to-income ratios.

① The reported return-on-equity ratios are unadjusted for risk. ② See C Borio, L Gambacorta and B Hofmann, "The influence of monetary policy on bank profitability", *BIS Working Papers,* no 514, 2015; and BIS, *86th Annual Report*, 2016, Chapter VI.

Highlights of global financial flows[1]

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 March 2016, and for international debt securities, available up to June 2016.

Takeaways

- International bank claims (cross-border bank claims plus local claims in foreign currencies) rose in the first quarter of 2016, for the first time since end-March 2015. On a year-on-year basis, international bank claims declined by 4.5%, undercut by an 8% year-on-year contraction in interbank claims.
- The stock of international debt securities continued to grow, with positive net issuance in the first and second quarters of 2016. By the end of Q2 2016, international debt securities were 2.1% above their level of a year earlier.
- The year-on-year growth rates of both US dollar cross-border loans to borrowers outside the United States and euro cross-border loans to borrowers outside the euro area turned negative in the first quarter of 2016. It was the first contraction since 2009 for dollar-denominated loans and the first since 2014 for euro-denominated loans.
- US dollar-denominated international credit (bank loans plus debt securities) to non-bank borrowers in emerging market economies (EMEs) saw another contraction (–$33 billion) in the first quarter of 2016, the third quarterly decline in a row. The outstanding stock fell to $3.2 trillion at end-March 2016.
- Cross-border bank claims on residents of China fell by $63 billion in the first quarter. The decline was smaller than those seen during previous quarters, but it still brought the annual growth rate down to –27%.
- Borrowing through international debt securities markets was more robust than borrowing through banks, with a revival of net issuance by financial sector

[1] This article was prepared by Torsten Ehlers (torsten.ehlers@bis.org) and Cathérine Koch (catherine.koch@bis.org). Statistical support was provided by Kristina Bektyakova, Bat-el Berger, Anamaria Illes and Pamela Pogliani.

borrowers in advanced economies in the first quarter of 2016, and strong quarterly net issuance from EME borrowers in the second.

- The medium-term trend towards greater use of the euro as a funding currency for non-financial debt securities issuers continued, despite the rebound in US dollar-denominated issuance in the second quarter of 2016.
- The recent UK referendum on membership of the European Union has drawn attention to how integrated banks in the United Kingdom are with the global banking system in general, and the rest of Europe in particular. Cross-border activity by banks *located* in the United Kingdom is notably greater than that by banks *headquartered* in the United Kingdom. The euro's share in cross-border claims of banks located in the United Kingdom amounted to 33% at end-March 2016 (see Box A, "The United Kingdom as a hub for international banking").
- The results of the recent BIS Triennial Survey of Foreign Exchange and Derivatives Markets show that over-the-counter (OTC) derivatives trading activity has continued to grow strongly in recent years, while the volume of exchange-traded derivatives has shown no clear trend (see Box B, "Exchanges struggle to attract derivatives trading from OTC markets").

Global credit remained weak in early 2016

Despite a turbulent start to the year in global financial markets (see "Uneasy calm gives way to turbulence", *BIS Quarterly Review*, March 2016, pp 1–14), *international bank claims* increased in the first quarter of 2016. But this increase only partially offset the large declines in the three previous quarters. As a result, international bank claims[2] decreased 4.5% on a year-on-year basis,[3] to $31.6 trillion, extending a slowdown that had started in mid-2015 (Graph 1, top panel). The year-long decline was driven by an 8% contraction in interbank credit.

Issuance of international debt securities[4] was more stable, with quarterly net issuance of $203 billion, and 2.2% year-on-year growth in the outstanding stock in the first quarter of 2016 (Graph 1, bottom panel). As confidence returned to financial markets in the second quarter (for which data are available only for international debt securities, ie not for international bank credit), net issuance rose further, to

[2] The term "international bank claims" as used in the BIS global liquidity indicators (GLIs) corresponds to its definition in the BIS locational banking statistics. International bank claims capture banks' cross-border claims in all currencies and their local claims in foreign currencies, where local claims refer to credit extended by banks' affiliates located in the same country as the borrower. The locational banking statistics 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.

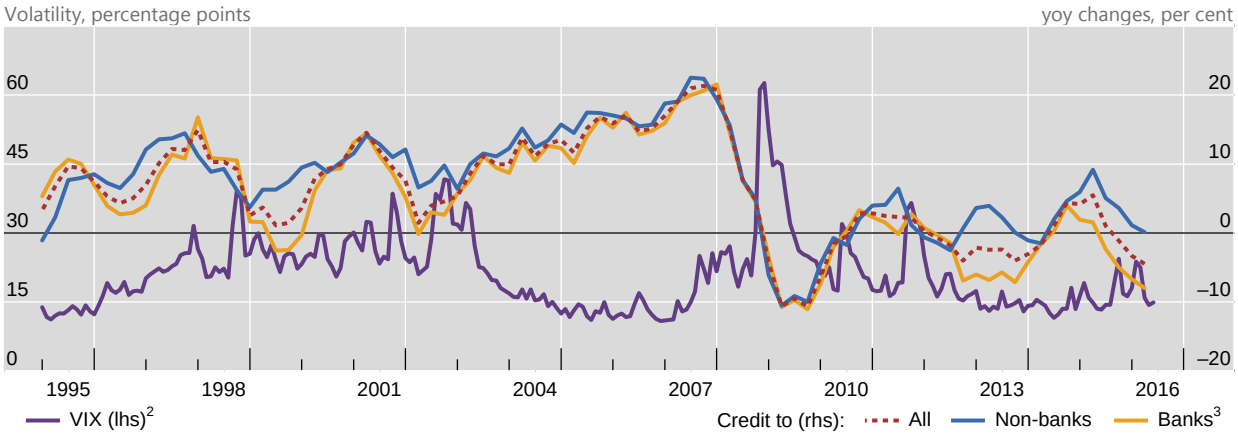
[3] Annual percentage changes reported for the international banking statistics are calculated as compounded quarterly percentage changes, based on the exchange rate-adjusted data published by the BIS. Annual growth rates for foreign currency credit are calculated as percentage changes in stocks compared with a year earlier, and are not adjusted for exchange rate changes.

[4] The BIS defines international debt securities as securities issued by non-residents in all markets. For details, see B Gruić and P Wooldridge, "Enhancements to the BIS debt securities statistics", *BIS Quarterly Review*, December 2012, pp 63–76.

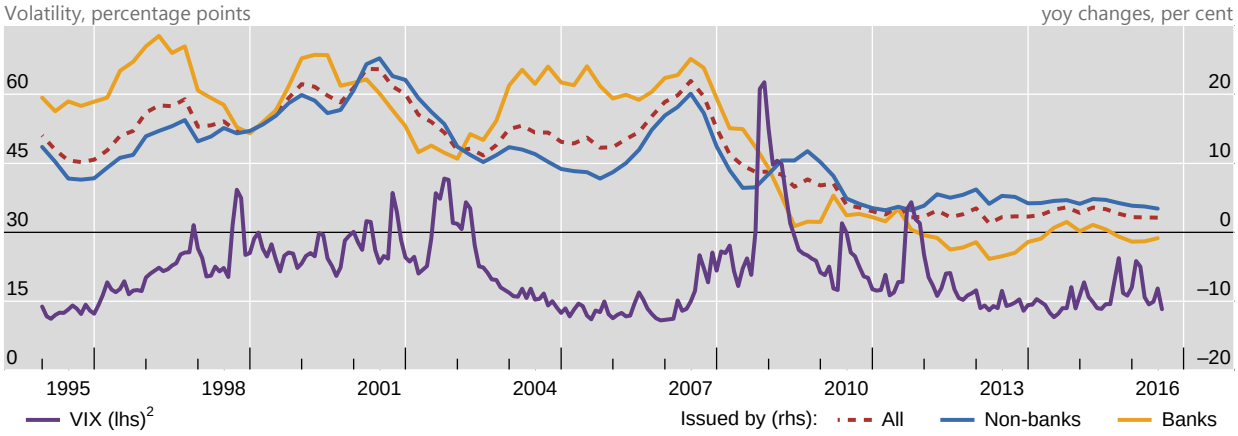
International bank claims, international debt securities and volatility

Graph 1

International bank claims[1]



International debt securities[4]



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] Including intragroup transactions. [4] All instruments, all maturities, all countries. Immediate issuer basis.

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

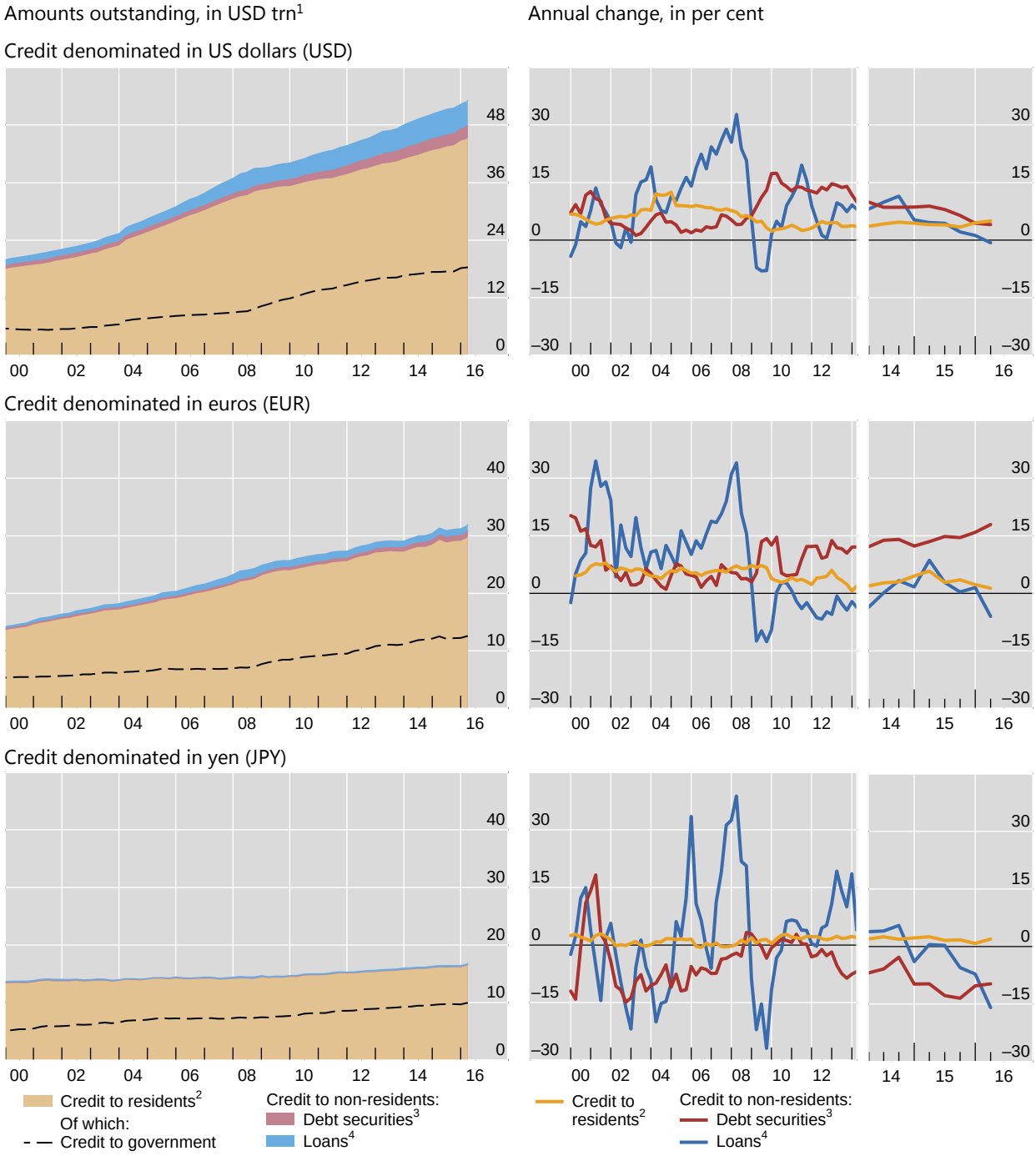
$246 billion. Nevertheless, year-on-year growth in the stock of international debt securities up to the second quarter remained essentially constant at 2.1%.

While net issuance by emerging market economies was relatively weak in the first quarter of 2016, it rose to a record high $128 billion in the second, pointing to a broader recovery of capital flows to EMEs.

Even though debt securities issuance by *banks* was positive in the first and second quarters, the stock contracted by 0.9% in the year to Q2 2016. For *non-bank borrowers*, the stock of international debt securities expanded by 3.4% over the same period – a slight slowdown in the rate of growth from previous quarters. One driving factor was the growth in credit to the *public sector*, in part driven by the greater financing needs of selected EME governments.

Global credit to the non-financial sector, by currency

Graph 2



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-December 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 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.

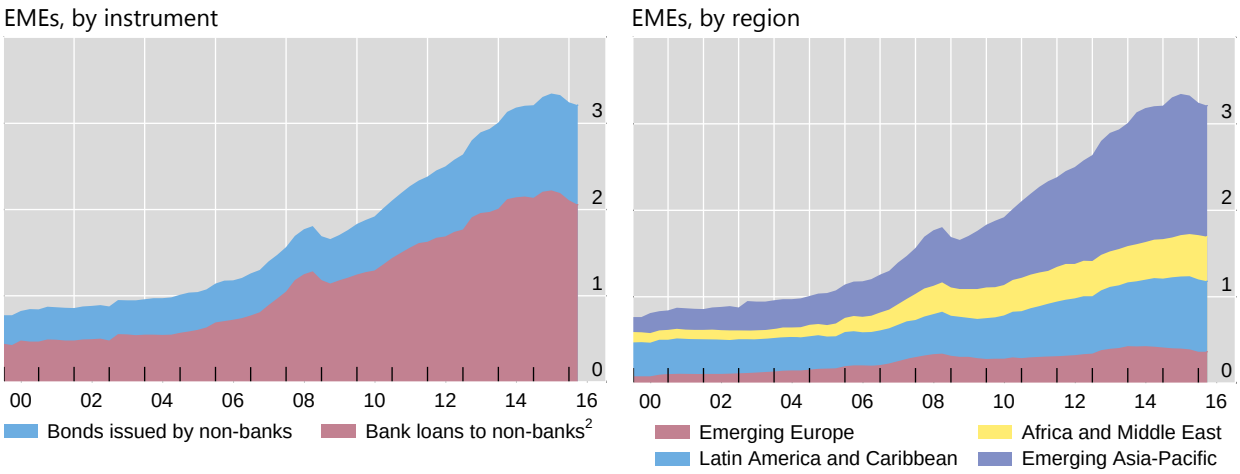
Sources: IMF, *International Financial Statistics*; Datastream; BIS debt securities statistics and locational banking statistics (LBS).

The year-on-year slowdown in international bank claims in early 2016 was reflected in an ongoing decline in foreign currency cross-border bank loans (mainly dollar- and euro-denominated loans) to the non-financial sector (Graph 2). Annual growth of US dollar-denominated bank loans to non-residents (ie dollar-denominated bank loans to borrowers outside the United States) turned negative in the first quarter, for the first time in several years. US dollar-denominated bank loans to non-residents in the non-financial sector fell 0.7% in the first quarter of 2016, the first decline since the Great Financial Crisis of 2007–09 (Graph 2, top panels). As credit through debt securities markets grew by 4% year on year, however, total US dollar credit (bank loans plus debt securities) to non-financial borrowers outside the United States edged up by 0.8% year on year, to $7.9 trillion at end-March 2016. Credit to non-bank borrowers (adding non-bank financial borrowers) grew 1.6% year on year, to $9.8 trillion at end-Q1 2016.

Euro-denominated bank loans to non-euro area residents also fell in year-on-year terms, reversing a recovery in 2014–15. In part, this reflected weakness in the European banking sector, with some banks pulling back their international lending (although, as discussed further below, banks from a number of European countries increased their lending in the first quarter). However, euro-denominated debt securities issuance continued to grow strongly as borrowers took advantage of very low yields and compressed risk premia (Graph 2, middle panels). As a result, the total stock of euro-denominated credit to non-euro area residents was $2.3 trillion ($2.7 trillion including borrowing by non-bank financial entities) at the end of the first quarter. This represented a 4.2% increase on a year earlier (a 4.4% increase including

US dollar-denominated credit to non-banks outside the United States[1]

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 onlent to non-banks.

Sources: Datastream; BIS debt securities statistics and locational banking statistics (LBS).

Early warning indicators for stress in domestic banking systems[1]

Table 1

	Credit-to-GDP gap[2]	Property price gap[3]	Debt service ratio (DSR)[4]	DSR if interest rates rise by 250 bp[4, 5]
Asia[6]	12.1	6.0	1.6	3.9
Australia	4.5	3.1	1.4	5.4
Brazil	4.6	–25.6	7.4	9.2
Canada	12.1	5.3	2.8	6.9
Central and eastern Europe[7]	–11.4	8.8	0.1	1.5
China	30.1	–1.9	5.4	8.7
France	–0.6	–11.2	1.0	4.1
Germany	–6.1	13.3	–1.8	0.0
Greece	–13.2	9.4		
India	–2.9		1.8	2.9
Italy	–13.7	–15.4	–0.1	2.0
Japan	4.1	15.6	–2.0	0.8
Korea	3.1	5.7	–0.6	3.0
Mexico	8.8	5.0	0.6	1.3
Netherlands	–20.2	–12.2	0.7	5.4
Nordic countries[8]	–0.8	4.1	1.0	5.0
Portugal	–40.5	12.4	–1.6	1.7
South Africa	–0.2	–9.0	–0.3	1.0
Spain	–47.6	–17.7	–3.2	–0.4
Switzerland	7.2	7.7	0.0	3.2
Turkey	9.6		5.7	7.3
United Kingdom	–27.0	–0.1	–1.7	1.0
United States	–9.9	4.7	–1.7	0.9
Legend	*Credit/GDP gap>10*	*Property gap>10*	*DSR>6*	*DSR>6*
	2≤Credit/GDP gap≤10		*4≤DSR≤6*	*4≤DSR≤6*

For the credit-to-GDP gap, data up to Q1 2016 except for Bulgaria, Latvia, Lithuania and Mexico, for which data end in Q2 2016; for the property price gap, data up to Q1 2016 except for Malaysia, for which data end in Q4 2015, and except for China, Germany, Hong Kong SAR, Indonesia, Korea, Mexico, the Netherlands, Norway, the Philippines, Singapore, South Africa, Sweden, Switzerland, Thailand and the United Kingdom, for which data end in Q2 2016; for the debt service ratio, data up to Q1 2016.

[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. 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 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 forecast. [8] Finland, Norway and Sweden.

Sources: National data; BIS; BIS calculations.

non-bank financial entities). Yen-denominated non-financial credit to non-residents, which was relatively small at $340 billion, continued its recent decline (Graph 2, bottom panels).

US dollar credit (bank loans and debt securities) to non-bank borrowers in EMEs also saw its first substantial year-on-year decline (Graph 3, left-hand panel) up to the first quarter of 2016 (–2.9%), as credit contracted in each of the previous three quarters. From a peak of $3.3 trillion at end-June 2015, the stock of US dollar credit to EMEs declined by $137 billion to $3.2 trillion at end-March 2016. This reflected a strengthening US dollar, slowdowns in several large EMEs and increased uncertainty in international financial markets. A reduction in US dollar borrowing by the emerging Asia-Pacific region (Graph 3, right-hand panel) was the main contributor (accounting for 86% of the total decline since end-June 2015). As net debt securities issuance by EMEs picked up in the second quarter of 2016, and recent signs of an increase in capital flows to EMEs are becoming more evident, the trend decline in the foreign currency liabilities of EME borrowers may have reversed in recent months.

Despite the slowdown in cross-border credit in late 2015 and early 2016, a number of countries still showed signs of strongly above-average domestic credit growth, which could sow the seeds for potential financial strains (see Table 1, where nearly all of the figures are for either Q1 or Q2 2016). According to the BIS early warning indicators, which are intended to capture financial overheating and potential financial distress over medium-term horizons, credit growth continues to be unusually high relative to GDP in several Asian economies as well as in Canada (first column). However, for most countries this gap has narrowed somewhat relative to previous readings. Property price growth has been closer to historical trends, although it is still unusually high in Germany, Japan and Portugal (second column). Estimated debt service ratios, which attempt to capture principal and interest payments relative to income, appear to be at manageable levels at current interest rates for most countries, although they point to potential concerns in Brazil, Canada, China and Turkey (third and fourth columns).[5]

International bank lending in Q1 2016

The latest BIS locational banking statistics show that cross-border bank claims (a subcomponent of international bank claims) rose by $451 billion during the early months of 2016. This took the outstanding stock to $27.5 trillion. Despite the latest quarterly increase, the annual growth rate remained negative, at –4.6%, with cross-border claims having fallen by a cumulative $1.3 trillion in the year to end-March 2016.

A $234 billion rise in the debt securities holdings of BIS reporting banks accounted for more than half of the overall increase, while loans contributed $137 billion. The remainder reflected an $80 billion rise in "Other instruments", which mainly consist of reporting banks' holdings of equity securities and derivative instruments with positive market value.

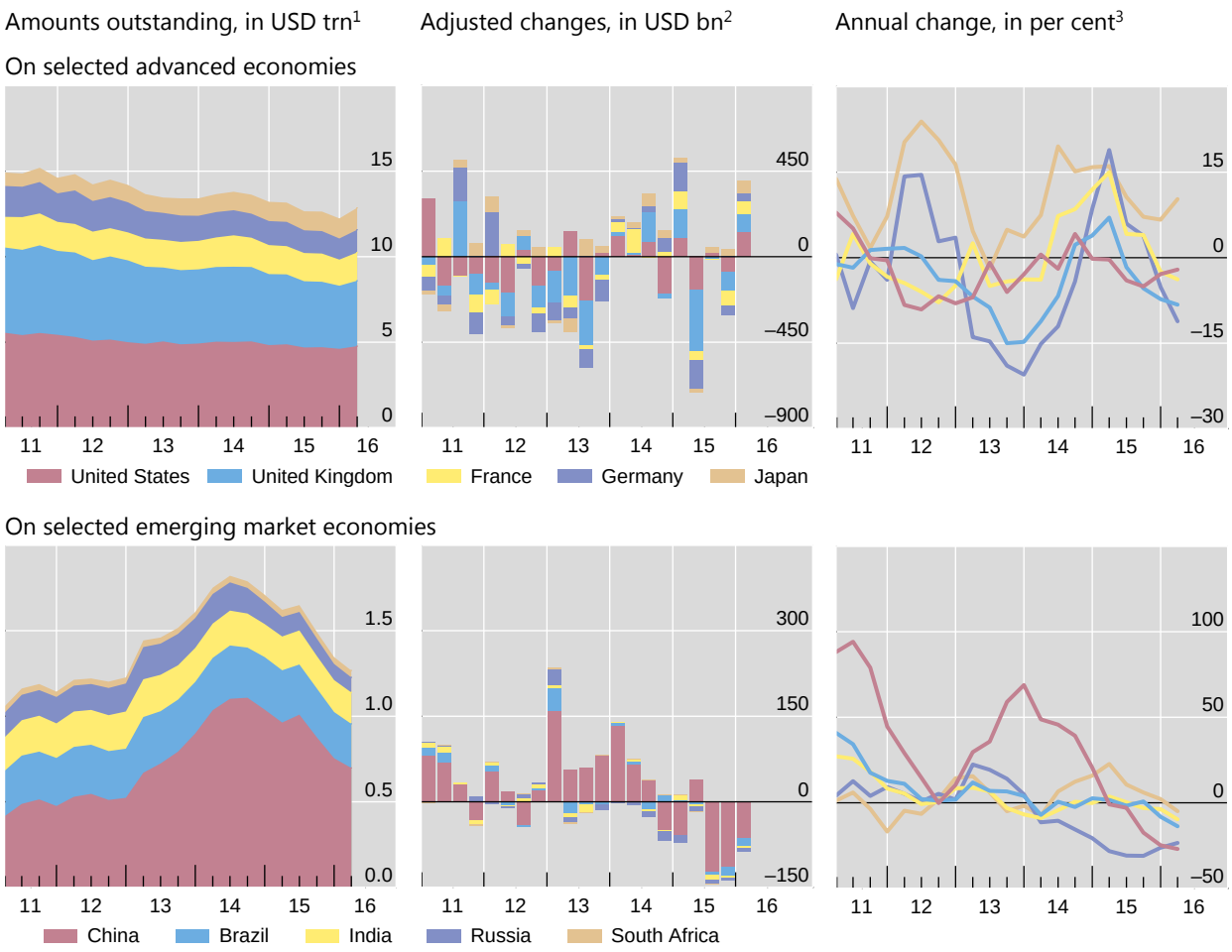
[5] See "Highlights of global financing flows", *BIS Quarterly Review,* March 2016, p 28, for further discussion of these indicators and their interpretation. See also "Recent enhancements to the BIS statistics", *BIS Quarterly Review*, September 2016, pp 35–44, for a discussion of the credit-to-GDP gap measure and the historical series.

Further shift towards the official sector in advanced economies

The quarterly increase in cross-border bank lending was entirely accounted for by a rise in claims on advanced economies (+$462 billion). Nevertheless, its year-on-year growth rate remained negative, at –4.2%.

Most of the increase in claims on advanced economies was due to a $358 billion expansion in cross-border lending to non-banks, which comprise governments, non-bank financial institutions and non-financial corporations. In terms of banks' consolidated[6] claims, international bank lending to the official sector – claims on

Cross-border claims, by borrowing country — Graph 4



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.

[6] The BIS consolidated banking statistics are structured according to the nationality of reporting banks and are reported on a worldwide consolidated basis, ie excluding positions between affiliates of the same banking group. Banks consolidate their inter-office positions and report only their claims on unrelated borrowers.

governments as well as deposits with central banks – in advanced economies has surged as a proportion of banks' total international assets, from 13% at end-March 2008 to 24% at end-March 2016, the highest level in more than 25 years.

Total cross-border claims on the United States rose by $130 billion between end-2015 and end-March 2016 (Graph 4, top panels). Claims on non-bank borrowers were especially strong. The BIS consolidated banking statistics indicate that, in the first quarter of 2016, the rise in international claims on US non-banks was split between borrowers in the official and non-bank private sectors, while international claims on banks contracted.

The rise in foreign banks' claims on the US official sector – which are composed of banks' holdings of US Treasury securities as well as their claims on the US Federal Reserve System[7] – continued a trend evident since the Great Financial Crisis of 2007–09. Claims on the official sector as a share of consolidated international claims on all US borrowers climbed by more than 20 percentage points between end-March 2008 and end-March 2016, from 9% to 33%. Over the same period, the outstanding total of international claims on the US official sector more than doubled, rising from $255 billion to $763 billion. By contrast, the shares of international claims on the US non-bank private sector and the US banking sector fell by 17 percentage points (from 69% to 52%) and 7 percentage points (from 22% to 15%), respectively.

In parallel with the growth in bank claims on the US official sector, the share of international claims on the official sector in the euro area has tended to increase recently. At end-March 2016, the official sector accounted for 27% of banks' consolidated international claims on euro area borrowers, up from 17% at end-March 2008. International claims on Japan were also skewed towards the official sector: the share of the official sector relative to all international lending rose by 4 percentage points (from 26% to 30%) between end-Q1 2008 and end-Q1 2016.

Further contraction in cross-border bank lending to EMEs

Cross-border bank credit to emerging market economies declined by $76 billion during the first quarter of 2016. This latest fall pushed the total outstanding down to $3.2 trillion, while further accelerating the annual pace of decline to –9%.

As in the preceding two quarters, diminishing claims on China drove the aggregate quarterly change in lending to EMEs (and to emerging Asia in particular). The $63 billion drop in cross-border bank credit to residents of China was smaller than those seen during previous quarters, but it still took the annual growth rate down to –27% (Graph 4, bottom panels). The outstanding total came to $698 billion as of end-March 2016. Since hitting its all-time high at end-September 2014, cross-border bank credit to China had contracted by a cumulative $367 billion (–33%) by end-March 2016, with interbank and inter-office activity leading the decline.

Between end-December 2015 and end-March 2016, claims on the rest of emerging Asia fell slightly (by $2 billion), while the year-on-year change was –6%. The latest decline resulted from a $16 billion fall in interbank activity and an $11 billion expansion of cross-border claims on the non-bank sector.

[7] For a more detailed treatment, see R McCauley and P McGuire, "Non-US banks' claims on the Federal Reserve", *BIS Quarterly Review*, March 2014, pp 89–97.

Cross-border bank credit to Latin America and the Caribbean contracted (by $9 billion) during the first three months of 2016, for an annual growth rate of –3%. This third consecutive quarterly decline was driven by a sharp fall in lending to Brazil (–$14 billion), whose cross-border borrowing contracted by 14% in the year to end-March 2016.

Claims on emerging Europe stagnated during the first quarter of 2016 on the back of divergent trends within the region. The annual growth rate came to –6%, similar to the average pace of decline seen over the past two years. Since end-March 2013, cross-border lending to Russia has fallen by a cumulative $96 billion.

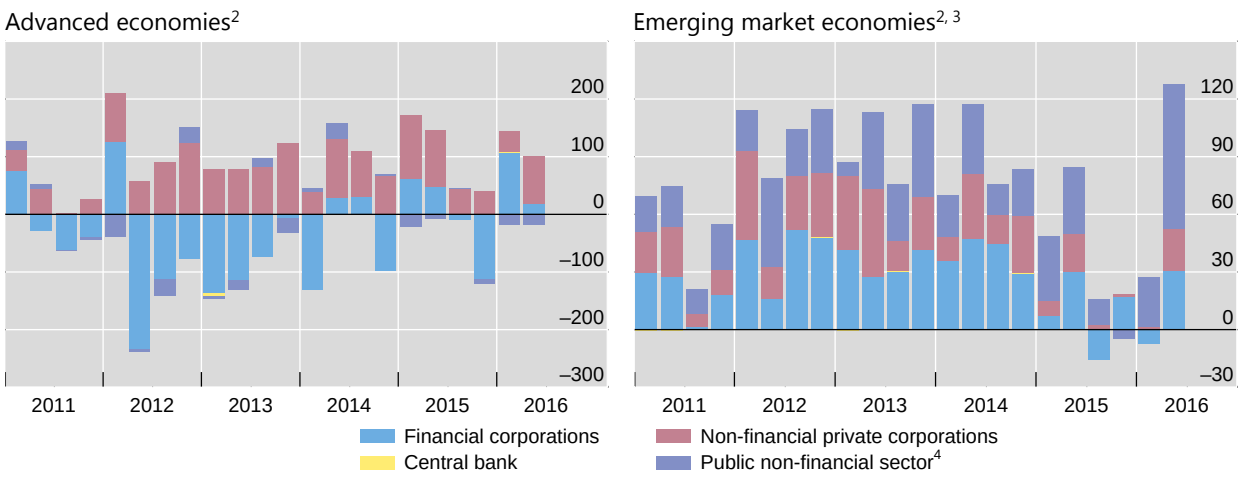
The euro gained ground in international debt securities

While net issuance of international debt securities was relatively weak in the second half of 2015, the first half of 2016 saw a revival in both advanced and emerging market economies, in particular in the second quarter. International issuance from advanced economy borrowers, especially financial sector borrowers, recovered in the first quarter of 2016. Strong net issuance continued, this time with substantive net issuance from the non-financial private sector, in the second quarter (Graph 5, left-hand panel). In EMEs, quarterly net issuance was weak in the first quarter of 2016 but hit $128 billion in the second, boosted by $76 billion in net issuance from the public non-financial sector (Graph 5, right-hand panel).

Despite the rebound in US dollar-denominated issuance in the second quarter of 2016, the medium-term trend towards greater use of the euro as a funding

International debt securities[1]

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

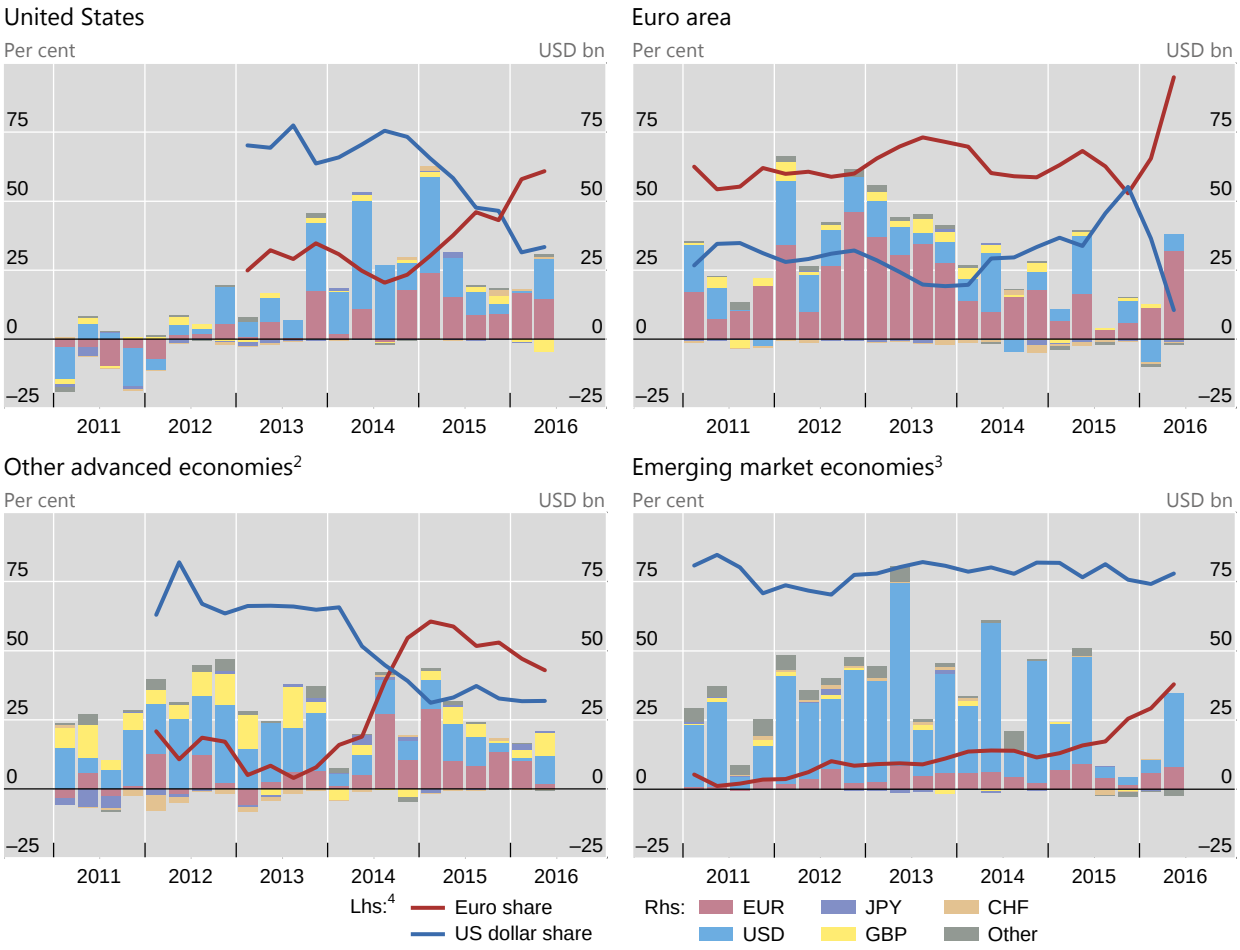


[1] All issuers, all maturities, by nationality of issuer. [2] See the *BIS Statistical Bulletin* for a list of countries. Sectors refer to issuer's parent. For details of classification, see "Introduction to BIS statistics", *BIS Quarterly Review*, September 2015, pp 35–51. [3] Including Hong Kong SAR and Singapore. [4] Public non-financial corporations, general government.

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

International debt securities – non-financial issuers[1]

Quarterly net issuance and currency composition — Graph 6



CHF = Swiss franc; EUR = euro; GBP = pound sterling; JPY = Japanese yen; USD = US dollar.

[1] Non-financial headquarters, by nationality of issuer. [2] See the *BIS Statistical Bulletin* for a list of countries. [3] Including Hong Kong SAR and Singapore. [4] Shares are calculated as cumulative net issuance in a given currency over the last four quarters, divided by the total cumulative issuance over the last four quarters in all currencies. The shares are plotted only for the period where the cumulative net issuance over the last four quarters is strictly positive, including the portions denominated in US dollars and euros.

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

currency for non-financial issuers continued.[8] For US non-financial issuers, euro-denominated debt accounted for the majority of net issuance outside the home market during the year from end-June 2015 to end-June 2016 (Graph 6, top left-hand panel).

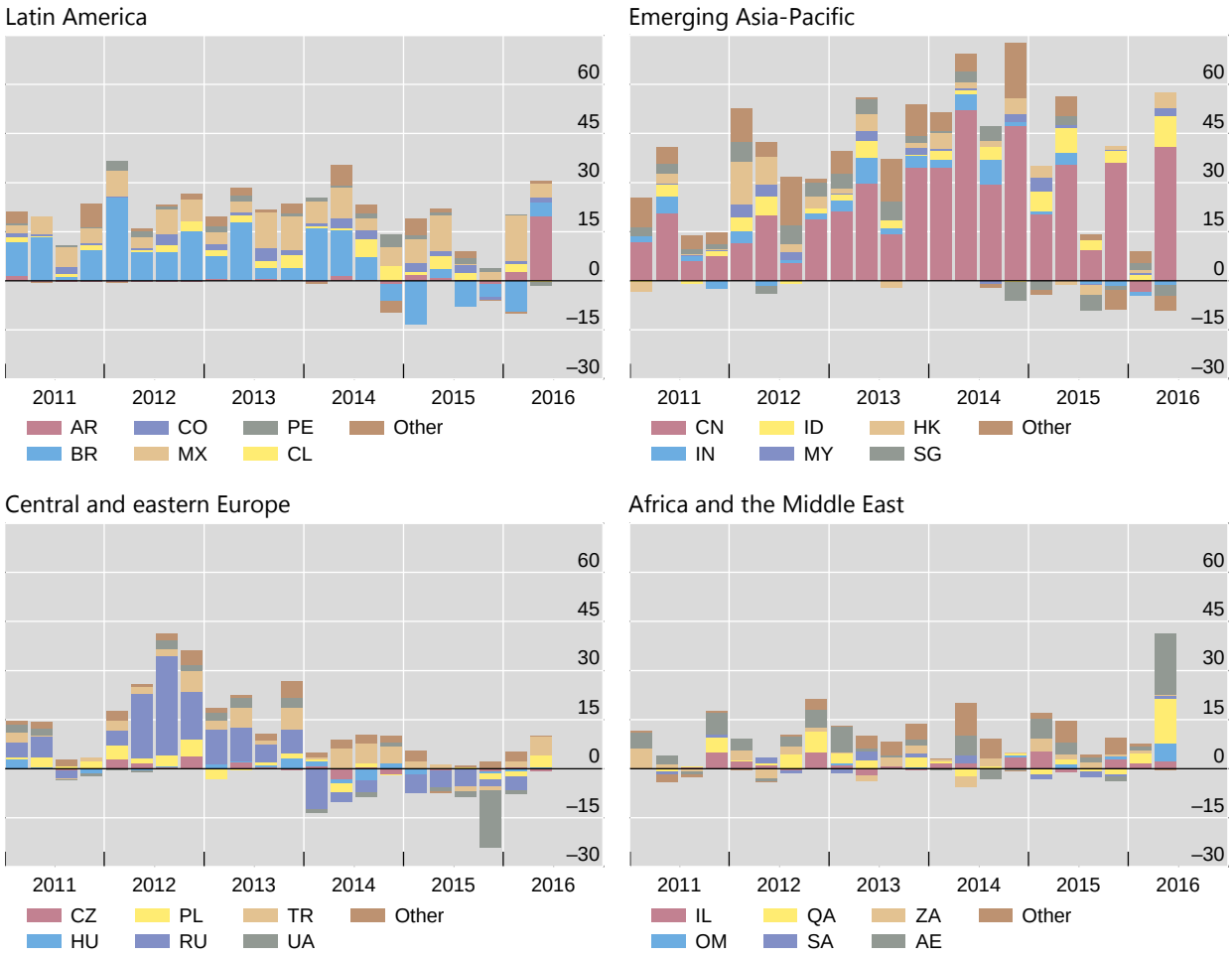
The shift to euro-denominated financing partly reflected the divergence in monetary policy between the Federal Reserve and the ECB, which has contributed to a widening gap between US dollar and euro yields. Thanks to comparatively lower corporate credit spreads for euro-denominated debt, the cost of issuance in euros has fallen well below the cost of issuance in US dollars for many issuers. As a result,

[8] The currency composition of financial sector issuers does not show a clear trend, and indeed has been very volatile over the past few years.

International debt securities[1]

Graph 7

Quarterly net issuance, in billions of US dollars



AE = United Arab Emirates; AR = Argentina; BR = Brazil; CL = Chile; CN = China; CO = Colombia; CZ = Czech Republic; HK = Hong Kong SAR; HU = Hungary; ID = Indonesia; IL = Israel; IN = India; MX = Mexico; MY = Malaysia; OM = Oman; PE = Peru; PL = Poland; QA = Qatar; RU = Russia; SA = Saudi Arabia; SG = Singapore; TR = Turkey; UA = Ukraine; ZA = South Africa.

[1] All issuers, all maturities, by nationality of issuer.

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

US corporates can obtain cheaper US dollar funding by issuing debt in euros and then swapping it back into US dollars, putting pressure on the cross-currency basis.[9] The lower spreads in turn reflect the ECB's decision in March 2016 to purchase investment grade non-financial corporate bonds from euro area issuers. Accordingly, issuers from the euro area have also increased the share of the euro in their net international issuance (Graph 6, top right-hand panel).

International issuers from emerging market economies, who traditionally have relied mostly on the US dollar as a funding currency, have also been increasing their net issuance in euros (Graph 6, bottom right-hand panel). While the share of the US dollar in annual net issuance of EME non-financial borrowers has remained high (at

[9] See C Borio, R McCauley, P McGuire and V Sushko, "Covered interest parity lost: understanding the cross-currency basis", *BIS Quarterly Review*, September 2016, pp 45–64.

around 75%), that of the euro has increased by more than 25 percentage points since end-2014, to around 38%[10] in the second quarter of 2016.

More broadly, the return of investors' risk appetite in the second quarter of 2016 is likely to have contributed to the revival of issuance by EME borrowers. At the same time, the revival was also driven by country-specific factors and may in part have reflected one-off events.

In Latin America, the government of Argentina returned to the international markets, with total net issuance of $19.6 billion in Q2 2016 (Graph 7, top left-hand panel) – almost entirely in US dollars.

In the emerging Asia-Pacific region, China dominated net issuance of international bonds, with $40.7 billion in the second quarter of 2016 (Graph 7, top right-hand panel). Of this total, $9.0 billion was issued by non-financial and $31.2 billion by financial corporations. This represented a substantial rebound from a weak first quarter, when Chinese corporates redeemed large amounts of US dollar-denominated bonds.[11] The stabilisation of the CNY/USD exchange rate during March–June 2016 is likely to have supported the rebound, after several bouts of turbulence in previous months.

Oil exporters in the Middle East were another source of the surge in international bond issuance (Graph 7, bottom right-hand panel). With oil prices reaching historical lows in February 2016, several governments turned to bond markets for funding. The United Arab Emirates ($14.4 billion net issuance), Qatar ($9 billion) and Oman ($5 billion) offered rare international bond placements in Q2 2016, all in US dollars. Overall, Africa and the Middle East contributed 32% of total net issuance by EMEs, close to the contribution from emerging Asia-Pacific (37%) and more than that from Latin America (23%).

Quarterly net issuance from central and eastern Europe (Graph 7, bottom left-hand panel) turned positive for the first time since end-2014, contributing around $9.4 billion (7%) to net issuance by EMEs in the second quarter of 2016.

[10] The dollar and euro shares in cumulative net issuance illustrated in Graph 7 add up, in some cases, to more than 100% because of negative net issuance in other currencies.

[11] See R McCauley and C Shu, "Dollars and renminbi flowed out of China", *BIS Quarterly Review*, March 2016, pp 26–7.

Box A

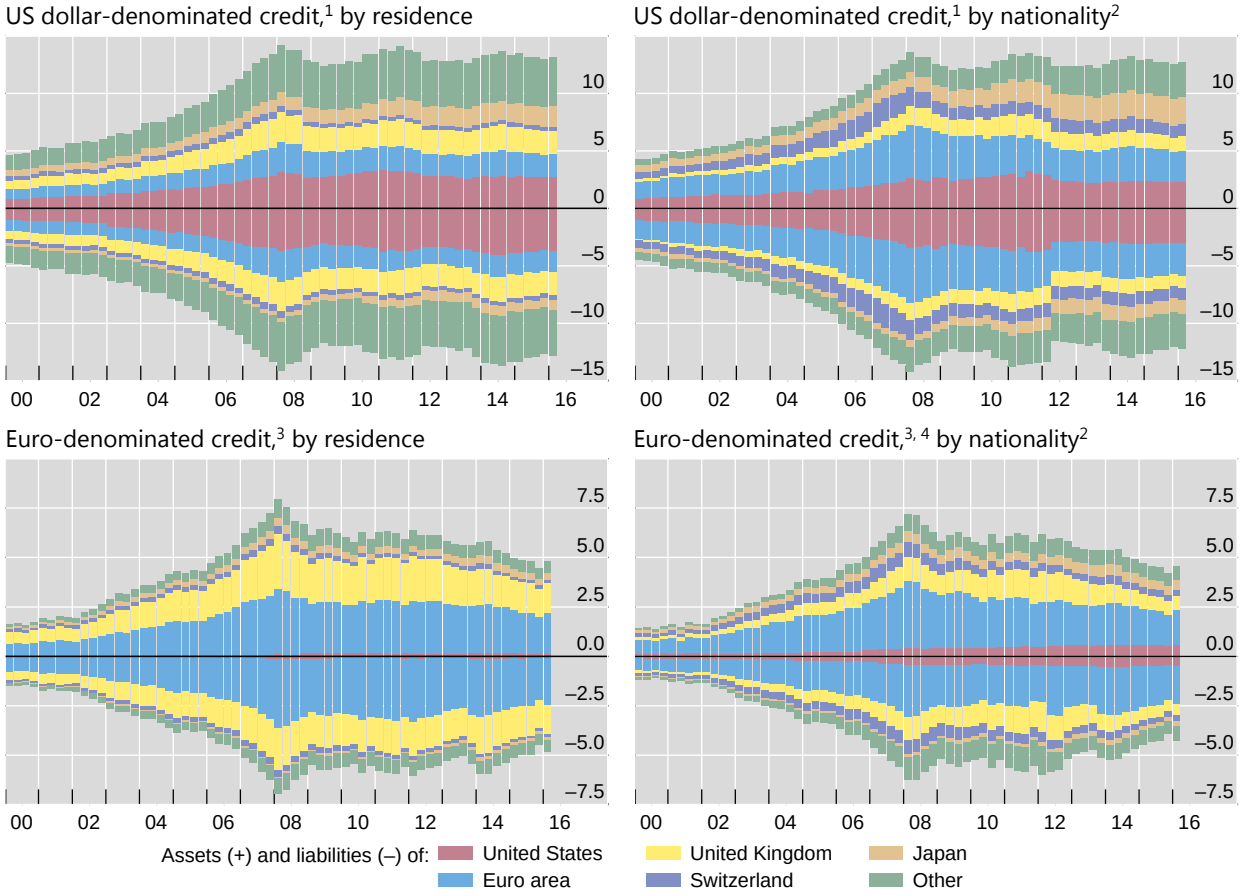
The United Kingdom as a hub for international banking

Cathérine Koch

The recent British vote to leave the European Union has focused attention on the role of the United Kingdom in the European and international banking systems.

Cross-border credit, all sectors

In trillions of US dollars — Graph A1



[1] Includes intra-euro area cross-border assets and liabilities. [2] The break in series between Q1 2012 and Q2 2012 is due to the Q2 2012 introduction of a more comprehensive reporting of cross-border positions (for more details, see http://www.bis.org/publ/qtrpdf/r_qt1212v.htm). [3] Excludes intra-euro area cross-border assets and liabilities. [4] Before Q2 2012: an estimate of intra-euro area cross-border assets and liabilities is obtained by applying the average share between Q2 2012 and Q1 2016 of intra-euro area assets and liabilities to all asset and liabilities of euro area banks.

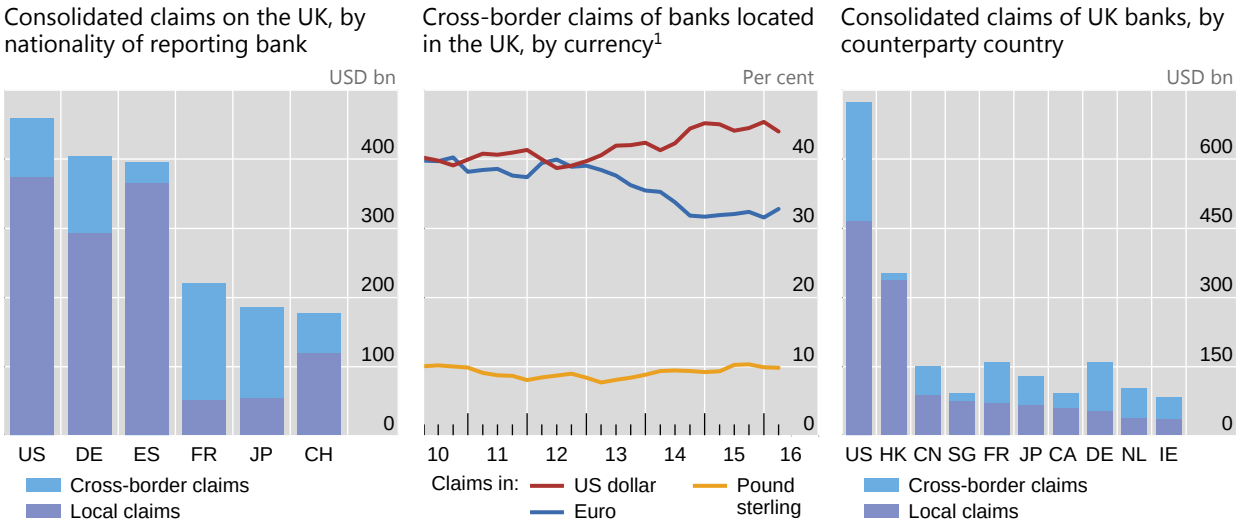
Source: BIS locational banking statistics, Tables A5 (by residence) and A7 (by nationality).

On a locational basis, the United Kingdom stands out as a prominent international banking hub. However, a large share of this activity is accounted for by banks from other countries with affiliates located in the United Kingdom. A comparison of the residence and nationality breakdowns of banks' total (worldwide) cross-border positions illustrates the distinction between the location of international bank activity and the nationality of the banks that perform it (Graph A1).① In both dollar and euro business, the amount of cross-border activity by banks *located* in the United Kingdom (the yellow areas in Graph A1, left-hand panels) is notably bigger than the cross-border business of banks *headquartered* in the United Kingdom (the yellow areas in Graph A1, right-hand panels). For other countries, eg Switzerland (the purple areas), the reverse is true.

As of end-Q1 2016, banks located in the United Kingdom reported total cross-border lending worth $4.5 trillion. They ranked first among all banks located in BIS reporting countries, followed by banks in Japan ($3.4 trillion) and the United States ($3.1 trillion). At the same time, with a total of $3.8 trillion, the United Kingdom was the second largest recipient of cross-border bank credit, surpassed only by the United States ($4.8 trillion). Interbank claims made up almost two thirds of all cross-border claims on the United Kingdom, with claims on related banks accounting for about one third of the interbank positions.

The United Kingdom as an international banking hub

Graph A2



CA = Canada; CH = Switzerland; CN = China; DE = Germany; ES = Spain; FR = France; HK = Hong Kong SAR; IE = Ireland; JP = Japan; NL = Netherlands; SG = Singapore; US = United States.

[1] As a percentage of outstanding cross-border claims in all currencies.

Source: BIS locational banking statistics and consolidated banking statistics on an ultimate risk basis.

A substantial share of foreign banks' business with the United Kingdom is booked through local offices in the United Kingdom, rather than cross-border (Graph A2, left-hand panel). On a consolidated ultimate risk basis, foreign claims② on UK residents amounted to $2.4 trillion as of end-March 2016, of which almost two thirds were booked locally. Among those internationally active foreign banks with local operations, US banks reported the largest outstanding foreign claims on the United Kingdom ($460 billion), followed by German ($404 billion) and Spanish banks ($396 billion). Claims of banks from BIS reporting EU member countries totalled $1.3 trillion. This amounted to 56% of all foreign claims on UK residents.③

At the same time, UK banks are also closely involved in the European banking system (Graph A2, right-hand panel). As of end-Q1 2016, UK banks' consolidated foreign claims on other EU countries reached $666 billion, or 21% of their global total, while those on euro area countries totalled $634 billion, or 20%. Nevertheless, their consolidated foreign claims on the United States ($724 billion) and Hong Kong SAR ($351 billion) were larger than those on any single EU member country.

The United Kingdom has a particularly important role as a redistribution hub for euro-denominated funds. Banks and other financial intermediaries located there (many of which are headquartered outside the United Kingdom) borrow euros from abroad and then invest them in euro-denominated cross-border claims. Banks located in the United Kingdom are the largest borrowers and lenders of euros outside the euro area. As of end-March 2016, about 54% of all worldwide unconsolidated euro-denominated cross-border claims booked outside the euro area and 60% of all liabilities were accounted for by banks resident in the United Kingdom. In recent years, this share has tended to decline, owing in part to a pickup in euro-denominated activity elsewhere in the world and also to exchange rate movements.

Indeed, ever since the launch of the single currency, euro-denominated positions have been a major part of the cross-border portfolios of banks located in the United Kingdom. For most of the 2000s, the share of the euro in the cross-border claims of banks in the United Kingdom hovered around 40% and was roughly equal to the share of claims denominated in US dollars (Graph A2, centre panel). Since 2012, while partly reflecting exchange rate movements, these shares have diverged. The euro's share declined from 39% at end-September 2012 to 33% at end-March 2016. Over the same period, the share of the US dollar in the cross-border claims of banks in the United Kingdom increased from 39% to 44%.

① For more information, see BIS locational banking statistics, Tables A5 and A7, www.bis.org/statistics/bankstats.htm; and H S Shin, "Global liquidity and procyclicality", speech at the World Bank conference on *The state of economics, the state of the world*, Washington DC, 8 June 2016. ② Foreign claims comprise cross-border claims plus local claims in all currencies, where local claims refer to credit extended by banks' affiliates located in the same country as the borrower. ③ Not all EU members report to the BIS banking statistics. The figures above include Austria, Belgium, Germany, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal, Spain and Sweden.

Box B

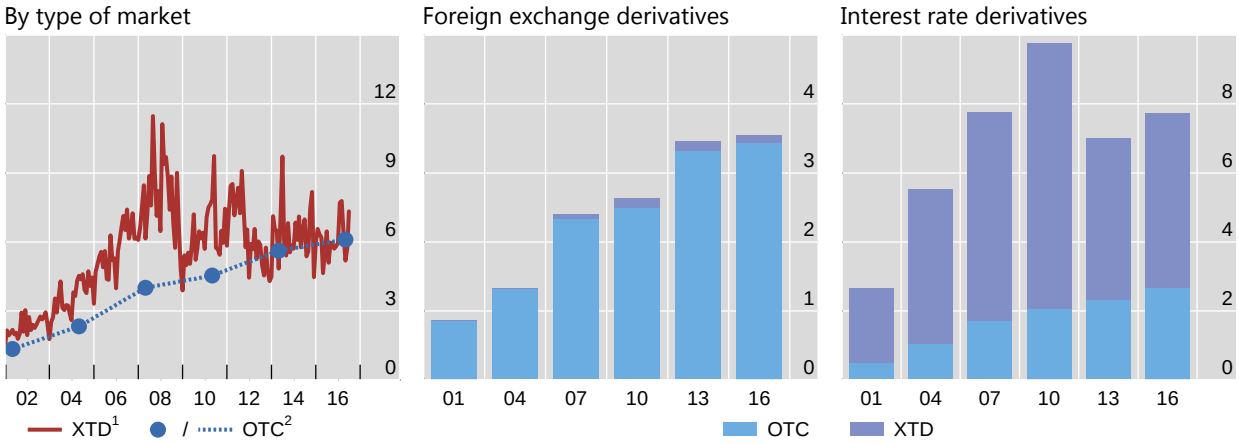
Exchanges struggle to attract derivatives trading from OTC markets

Robert McCauley and Philip Wooldridge

Exchanges have not won a bigger share of derivatives trading, according to the latest BIS Central Bank Triennial Survey of foreign exchange and over-the-counter (OTC) derivatives market activity. Since 2009, the trading of derivatives on exchanges has shown no trend, whereas their OTC trading has trended upwards (Graph B1, left-hand panel). The daily average turnover of foreign exchange and interest rate derivatives traded worldwide – on exchanges and OTC – rose from $10.5 trillion in April 2013 to $11.3 trillion in April 2016.① The exchange-traded share remained roughly 46%.

Global trading in foreign exchange and interest rate derivatives

Daily average turnover, in trillions of US dollars — Graph B1



OTC = over-the-counter derivatives; XTD = exchange-traded derivatives.

[1] Daily average turnover on exchanges worldwide, at a monthly frequency. [2] Daily average turnover in April, adjusted for local and cross-border inter-dealer double-counting, ie "net-net" basis. The line shows a linear interpolation of data between surveys.

Sources: Euromoney TRADEDATA; Futures Industry Association; The Options Clearing Corporation; BIS derivatives statistics and Triennial Central Bank Survey.

The Triennial Survey is the most comprehensive source of information on the size and structure of OTC markets.② Close to 1,300 financial institutions located in 52 countries participated in the latest survey, which was conducted in April 2016. When the results are combined with the BIS statistics on exchange-traded derivatives, they provide a global (albeit infrequent) snapshot of activity in derivatives markets.

Since the Great Financial Crisis of 2007–09, policymakers have sought to reduce systemic risks in OTC derivatives markets by promoting the trading of standardised contracts on exchanges or organised trading platforms and their clearing through central counterparties.③ While this might have been expected to lead to more trading on exchanges, the latest data suggest that innovations in OTC markets appear to have made OTC instruments more attractive. For example, exchange-like mechanisms have been introduced to trade OTC instruments, most notably swap execution facilities in the United States. Also, a growing share of OTC contracts is centrally cleared; the part of the Triennial Survey on outstanding amounts, to be published in November 2016, will provide comprehensive data on central clearing for the first time. Finally, dealers are compressing more and more OTC instruments – that is, market participants are working together to eliminate economically redundant contracts and thereby to reduce gross exposures.

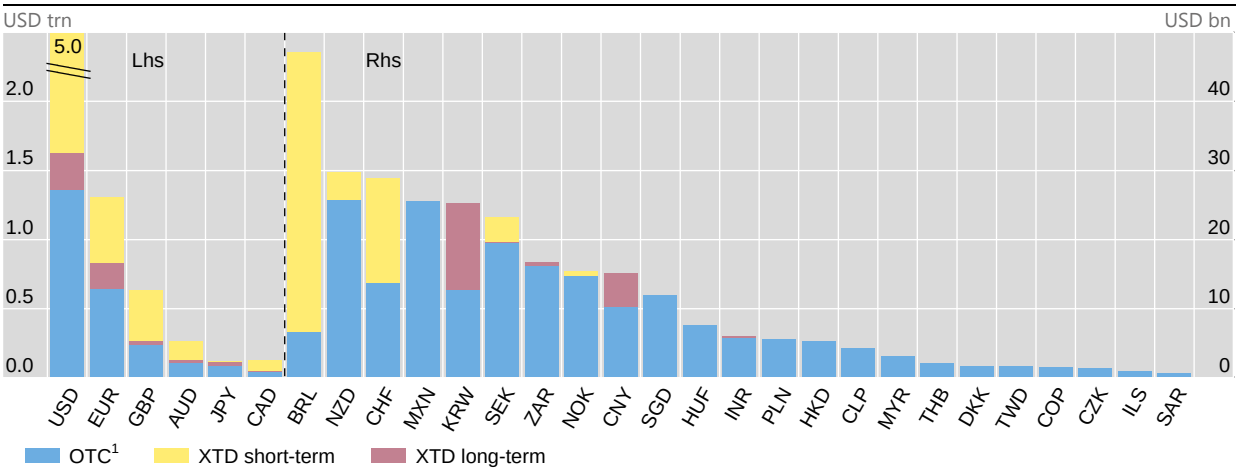
Foreign exchange derivatives continue to be traded overwhelmingly in OTC markets. The daily average turnover of foreign exchange derivatives in OTC markets exceeded $3.4 trillion in April 2016, compared with only $0.1 trillion traded on exchanges (Graph B1, centre panel). OTC markets dominate owing in large part to foreign exchange swaps. These are popular as funding instruments because they do not change foreign exchange exposures and so can be used to roll over hedges. Moreover, OTC deals better serve customised demands in OTC markets, such as matching cash flows on odd dates or trading currency pairs not involving the US dollar. In only three currencies do exchanges

account for a substantial share of FX derivatives activity: the Brazilian real, Indian rupee and Russian rouble, where exchanges accounted for 38%, 15% and 11% of turnover in April 2016, respectively.

Interest rate derivatives are traded mainly on exchanges, but the share traded in OTC markets is increasing. The daily average turnover of interest rate derivatives in OTC markets was $2.7 trillion in April 2016, compared with $5.1 trillion traded on exchanges (Graph B1, right-hand panel). The proportion traded on exchanges declined from around 80% in the 2000s to 67% in April 2013 and to 66% in April 2016. This shift towards OTC markets is explained partly by weak activity in derivatives on short-term interest rates, which dominate trading on exchanges (Graph B2). The sustained period of low and stable policy rates in major economies has reduced hedging and positioning activity in short-term rates, especially in euro and yen rates.④ That said, while a maturity breakdown of OTC interest rate derivatives is not collected, various data sources suggest that activity across the term structure is shifting gradually to OTC markets. Even at the long end, market participants appear to be switching from contracts based on government bond yields to ones based on private yields, namely interest rate swap rates.⑤

Turnover of interest rate derivatives, by currency

Daily average turnover in April 2016 — Graph B2



AUD = Australian dollar; BRL = Brazilian real; CAD = Canadian dollar; CHF = Swiss franc; CLP = Chilean peso; CNY = Chinese renminbi; COP = Colombian peso; CZK = Czech koruna; DKK = Danish krone; EUR = euro; GBP = pound sterling; HKD = Hong Kong dollar; HUF = Hungarian forint; ILS = Israeli new shekel; INR = Indian rupee; JPY = Japanese yen; KRW = Korean won; MXN = Mexican peso; MYR = Malaysian ringgit; NOK = Norwegian krone; NZD = New Zealand dollar; PLN = Polish zloty; SAR = Saudi riyal; SEK = Swedish krona; SGD = Singapore dollar; THB = Thai baht; TWD = New Taiwan dollar; USD = US dollar; ZAR = South African rand.

OTC = over-the-counter interest rate derivatives; XTD short-term = exchange-traded derivatives referencing short-term interest rates; XTD long-term = exchange-traded derivatives referencing long-term interest rates.

[1] Adjusted for local and cross-border inter-dealer double-counting, ie "net-net" basis.

Sources: Euromoney TRADEDATA; Futures Industry Association; The Options Clearing Corporation; BIS derivatives statistics and Triennial Central Bank Survey.

In emerging market economies, where activity is less likely to be dampened by persistently low policy rates, OTC markets are driving activity upwards in interest rate derivatives (Graph B2). The turnover of interest rate contracts denominated in EME currencies rose from $177 billion in April 2013 to $196 billion in April 2016 when measured at constant exchange rates, although the US dollar value of turnover fell owing to the depreciation of many EME currencies against the US dollar. Over the same period, the share of activity on exchanges fell from 58% to 30%. The only EME currencies where exchanges accounted for a sizeable share of activity in interest rate derivatives were the Brazilian real (86%), Korean won (50%) and Chinese renminbi (32%).

① Turnover refers to notional amounts valued in US dollars. The appreciation of the US dollar against many currencies between 2013 and 2016 reduced the US dollar value of derivatives denominated in other currencies. When valued at April 2016 exchange rates, the turnover of foreign exchange and interest rate derivatives in April 2013 was $9.6 trillion. ② For data and more information about the Triennial Survey, see www.bis.org/publ/rpfx16.htm. ③ Financial Stability Board, *OTC derivatives market reforms: tenth progress report on implementation*, November 2015, www.fsb.org/2015/11/otc-derivatives-market-reforms-tenth-progress-report-on-implementation/. ④ It has also shifted such trading further into the future. See L Kreicher and R McCauley, "Asset managers, eurodollars and unconventional monetary policy", *BIS Working Papers*, no 578, August 2016. ⑤ See L Kreicher, R McCauley and P Wooldridge, "Benchmark tipping in the global bond market", *BIS Working Papers*, no 466, October 2014, www.bis.org/publ/work466.htm.

Recent enhancements to the BIS statistics

The BIS has been enhancing its statistical offering to support monetary and financial stability analysis, in close coordination with central banks and international organisations. Some of this work has been undertaken in the context of the Data Gaps Initiative (DGI) endorsed by the G20.[1] In the current issue of the Quarterly Review, the BIS is introducing new statistics in the following areas:

- Detailed locational banking statistics shedding further light on the geography of international banking, specifically the claims and liabilities of banks in each reporting country on counterparties in more than 200 countries.
- Time series on credit-to-GDP gaps.
- Commercial property price indicators.
- Historical time series on consumer prices.

In addition, the BIS is making publicly available daily data on nominal effective exchange rates for 61 countries, to complement the monthly data already published. The daily data will be updated on a weekly basis.

[1] See FSB and IMF (2015).

Locational banking statistics by reporting country[2]

One of the enhancements to the international banking statistics (IBS) agreed by the Committee on the Global Financial System following the Great Financial Crisis of 2007–09 was to make the IBS more widely available (CGFS (2012)). The new tables and data published by the BIS in September 2015 were an important step in that direction (Avdjiev et al (2015)). The BIS and central banks continue to work towards publishing more data and improving the tools for accessing them.

Concurrently with this Quarterly Review, the BIS has started publishing more details at the reporting country level from the locational banking statistics (LBS), in particular the claims and liabilities of banks in individual reporting countries on counterparties in more than 200 countries. Previously, the BIS had made public only two types of aggregates in the LBS: the positions of banks in all reporting countries on counterparties in individual countries (Table A6 in the *BIS Statistical Bulletin* and the BIS Statistics Explorer), and the positions of banks in individual reporting countries on all counterparties abroad (Table A5). The BIS now discloses a matrix of reporting countries and counterparty countries, for the full history of the LBS. For example, whereas previously only the cross-border claims of all LBS-reporting banks on borrowers in China were published, now the location of those reporting banks is also disclosed. This information shows that, at end-March 2016, banks in Hong Kong SAR were the main creditors, accounting for 42% of cross-border claims on China's mainland borrowers, followed by banks in Chinese Taipei with 9%.

Such geographical details can be used to analyse how shocks might propagate across sectors and borders. For example, they can help track how funds are transferred from sources in one country via banks to users in another. They can also shed light on the complexity of banks' international operations.

When undertaking such analysis, it is very important to distinguish between the unconsolidated office-level view in the LBS and the consolidated group-level view in the consolidated banking statistics (CBS). The LBS capture the positions of banking offices *located* in a given country, following the same residency principles as national accounts and balance of payments. By contrast, the CBS capture the worldwide positions of banking groups *headquartered* in that country, using the consolidated approach followed by banking supervisors. Accordingly, the principal use of the LBS is to analyse capital flows between countries, whereas the CBS provide measures of banks' country risk exposures.[3]

The published matrix of reporting countries and counterparty countries covers the cross-border positions of banks located in up to 29 LBS-reporting countries on counterparties in more than 200 countries. As many as eight series are publicly available in the LBS for each reporting-counterparty country pair: total claims and liabilities on counterparties in all sectors and the non-bank sector, and the same details for the instrument component loans and deposits. Selected series are published in Table A6 of the *BIS Statistical Bulletin*, and all the data can be downloaded from the BIS Statistics Explorer, the BIS Statistics Warehouse or in a single CSV file. A matrix of reporting countries and counterparty countries is also published for the CBS, in Table B4 of the *BIS Statistical Bulletin*.

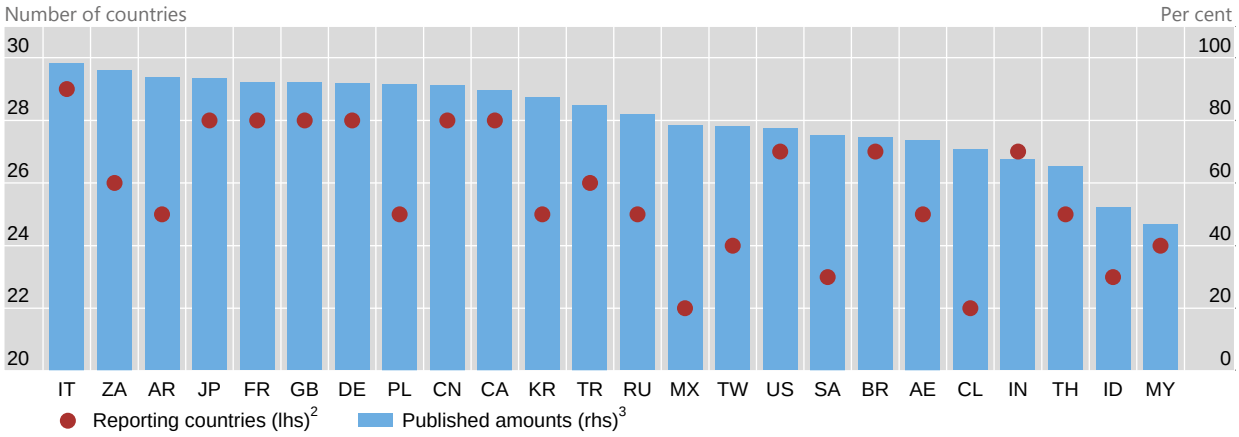
[2] This section was prepared by Swapan Kumar Pradhan and Philip Wooldridge.

[3] For discussion of the uses of the LBS and CBS, see BIS (2015).

Countries report to the BIS more details than these newly published series. However, the additional details are often less complete, owing to gaps in reporting. Moreover, granular data are often composed of data collected from very few banks. If an aggregate comprises data from only one or two banks, then its disclosure risks revealing proprietary information about those banks' activities. Consequently, reporting countries classify a significant part of the data that they report to the BIS as confidential and not for publication.[4] Confidentiality restrictions result in holes in the data that the BIS can make publicly available. Indeed, for 15 of the 44 countries that report the LBS, limited details are currently published, and even among the 29 countries for which more details are published, historical data for some quarters may not be shown.

On average, the published matrix covers 90% of cross-border claims, although for any given counterparty country coverage ranges from 40% to 100% depending on the relative importance of the reporting countries that have agreed to publish their data (Graph 1). For example, 29 reporting countries have agreed to publish their cross-border claims on Italy (red dots), which represents almost 100% of all cross-border claims on Italy (blue bars). Twenty-four countries publish this information for Malaysia, which covers a little under 50% of all banks' cross-border claims on that country.

Coverage of reporting country-level details published by counterparty country[1] Graph 1



AE = United Arab Emirates; AR = Argentina; BR = Brazil; CA = Canada; CL = Chile; CN = China; DE = Germany; FR = France; GB = United Kingdom; ID = Indonesia; IN = India; IT = Italy; JP = Japan; KR = Korea; MX = Mexico; MY = Malaysia; PL = Poland; RU = Russia; SA = Saudi Arabia; TH = Thailand; TR = Turkey; TW = Chinese Taipei; US = United States; ZA = South Africa.

[1] Based on cross-border claims outstanding at end-March 2016. Coverage of reporting country-level details varies across period, position type and counterparty country. [2] Number of LBS-reporting countries that publish data for the respective counterparty country. [3] Amounts published by reporting country (ie location of reporting bank) as a percentage of the total reported by all 44 LBS-reporting countries for the respective counterparty country.

Source: BIS locational banking statistics (LBS) by residence, Table A6.

[4] The reporting of such data to the BIS is critical to ensure that global aggregates, which sum data from all reporting countries, are as complete as possible. Data that are not for publication are disclosed to authorities that report the international banking statistics, subject to restrictions on their use and dissemination so as to ensure that the confidentiality of unpublished data is respected. Such data may be available to researchers through joint projects with staff at the BIS or reporting authorities. The BIS and many central banks offer research fellowships to support such projects, eg www.bis.org/research/fellowship.htm.

The credit-to-GDP gap[5]

The build-up of excessive credit features prominently in discussions about financial crises. While it is difficult to quantify "excessive credit" precisely, the credit-to-GDP gap captures this notion in a simple way. Importantly from a policy perspective, large gaps have been found to be a reliable early warning indicator (EWI) of banking crises or severe distress.[6] The BIS already reports examples of these gaps in the EWI tables that are released in the March and September Quarterly Reviews as part of the discussions of global liquidity conditions.[7]

Complementing the regular publication of the EWI tables, the BIS has started releasing time-series data for the credit-to-GDP gap.[8] The published series cover 43 countries starting at the earliest in 1961. Here we explain the methodology and data used.

The credit-to-GDP gap (gap_t) is defined as the difference between the credit-to-GDP ratio (c_t/y_t) and its long-run trend t_t:

$$gap_t = \frac{c_t}{y_t} - t_t$$

The trend to generate the credit-to-GDP gap is derived using a Hodrick-Prescott (HP) filter. The HP filter is a standard mathematical tool used in macroeconomics to establish the trend of a variable over time. Like any statistical concept, it is based on simplifying assumptions – in this case, that the original series (namely, the credit-to-GDP ratio: c_t/y_t) can be decomposed into two components: the trend t_t and the cycle. Hodrick and Prescott (1997) proposed obtaining the trend by solving the following optimisation problem:

$$\min_{\{g_t\}_{t=1}^{T}} \Sigma_{t=1}^{T} = \left(\frac{c_t}{y_t} - t_t\right) + \lambda \Sigma_{t=1}^{T} (t_{t+1} - 2t_t + 2t_{t-1})^2$$

where λ (lambda) is the smoothing parameter. The first term in the loss function penalises the variance of the cyclical component, while the second imposes a penalty on the lack of smoothness in the trend. Hence, the solution to the problem is a trade-off between the smoothness of the trend and how well it fits the original series.

When calculating the trend for the credit-to-GDP gap, three technical features are important:

First, to capture data constraints in day-to-day policymaking, the trend t_t is calculated by means of a one-sided (ie backward-looking) filter. In other words, the filter is run recursively for each period over an expanding sample, so that a trend for, say, end-2005 ($t_{2005\,Q4}$) only takes account of information up to the end of 2005 even if this calculation is done in 2016 when more observations have become available.

Second, we apply a much larger smoothing parameter λ than the one employed in the business cycle literature involving quarterly data. The parameter equals 400,000. This choice is motivated by the observation that credit cycles are on average

[5] This section was prepared by Mathias Drehmann; Marjorie Santos and José María Vidal Pastor provided research assistance.

[6] See Drehmann et al (2011) or Detken et al (2014).

[7] The most recent indicators are shown in BIS (2016).

[8] http://www.bis.org/statistics/c_gaps.htm.

about four times longer than standard business cycles. Empirically, this choice also leads to the best EWI performance.[9]

Last, we require at least 10 years of available data for the credit-to-GDP ratio before we publish a gap. Hence, if the credit-to-GDP ratio is first available in 1995, the credit-to-GDP gap series starts in 2005. We do so because the starting point for estimating the trend can have strong implications for the measurement of the gap if there is only a limited time series. Drehmann and Tsatsaronis (2014) show that this "start-point problem" is greatly diminished if at least 10 years of data are available.[10]

As input data, we use the credit-to-GDP ratio as published in the BIS database of total credit to the private non-financial sector (Dembiermont et al (2013)). The credit series capture total borrowing by the private non-financial sector (ie households and non-financial corporations) from all domestic and foreign sources, covering both bank and non-bank financing.[11]

Importantly, while the use of these total credit series as input data facilitates comparability across countries, it means that the credit-to-GDP gaps published by the BIS may differ from credit-to-GDP gaps considered by national authorities as part of their countercyclical capital buffer decisions. Given the EWI qualities of the gap, the indicator was adopted as a common reference point under Basel III to guide the build-up of countercyclical capital buffers (BCBS (2010)). Authorities are expected, however, to apply judgment in the setting of the buffer in their jurisdiction after using the best information available to gauge the build-up of system-wide risk rather than relying mechanistically on the credit-to-GDP guide. For instance, national authorities may form their policy decisions using credit-to-GDP ratios that are based on different data series from the BIS's as input data, leading to credit-to-GDP gaps that differ from those published by the BIS.

[9] See Drehmann et al (2010).

[10] The start point problem is the flip side to the well known "end-point" problem of the HP filter. Note, though, that the end-point problem does not invalidate the EWI ability of the credit-to-GDP gap. From a practical perspective, it would be impossible for the policymaker to apply a two-sided filter since the future is not known. But even if policymakers did somehow know the future values of the credit-to-GDP ratio and calculated credit gaps based on this knowledge, Drehmann and Tsatsaronis (2014) show that the resulting indicator would not outperform the gap calculated with the backward-looking HP filter except for exceedingly short forecast horizons of less than four quarters.

[11] Drehmann (2013) shows that the credit-to-GDP gap derived from total credit is a better EWI than if the credit takes only bank credit into account.

Commercial property price indicators[12]

In 2010, the BIS started disseminating a limited number of commercial property price indicators (CPPIs) collected from national central banks as part of its general work on property price statistics. Country coverage has improved significantly since then. The BIS will henceforth regularly publish these indicators as a separate data set on its website.[13] The BIS also plans to further expand the coverage of this new data set in the near future as more indicators become available across countries.

CPPIs have long been seen as a useful tool for monitoring financial stability and macroeconomic developments (see Graph 2 for commercial and residential property prices and GDP growth in the United States). Yet despite their importance, the availability and international comparability of CPPIs was limited before the Great Financial Crisis. After the crisis, the first phase of the G20's DGI initiative underlined the importance of CPPIs and members of the Inter-Agency Group on Economic and Financial Statistics (IAG)[14] were asked to improve their dissemination and to start methodological work for their compilation. The second phase of the DGI, initiated in 2015, builds on this preparatory work. It recommends that international organisations enhance methodological guidance on the compilation of CPPIs and encourages dissemination of data on commercial property prices via the BIS website.[15]

At present, there is no agreement on a single definition of commercial property. Experts from international organisations in charge of developing best practice guidelines on price statistics are tentatively considering a definition that would treat a property (together with the land on which it is situated) as "commercial" if the underlying activity creates market output with the aim of generating profits. Based on this consideration, commercial properties may include properties rented out at market prices; those under construction for future sale; and those used in the production of market goods and services (for example, retail premises, offices, factories and warehouses). But there are other considerations that can lead to substantial differences.[16] The commercial property price can be decomposed into the price of the land and the price of the structure. In case there is no price information on vacant land, statisticians may estimate the land value by deducting the construction costs from the price of the commercial property.

A number of potential sources can be used to measure commercial property price developments. The first and most preferred – but not always available – source is transaction records (official selling prices registered by land registries or tax authorities). A second and complementary source is appraisals or valuations (estimated prices based on expert judgment taking into account general market situation, the characteristics of the property and its location). Finally, financial market

[12] This section was prepared by Robert Szemere.

[13] http://www.bis.org/statistics/pp_commercial.htm.

[14] The IAG comprises the BIS, the ECB, Eurostat, the International Monetary Fund (IMF, Chair), the Organisation for Economic Co-operation and Development (OECD), the United Nations and the World Bank. It was established in 2008 to coordinate statistical issues and data gaps highlighted by the Great Financial Crisis and to strengthen data collection.

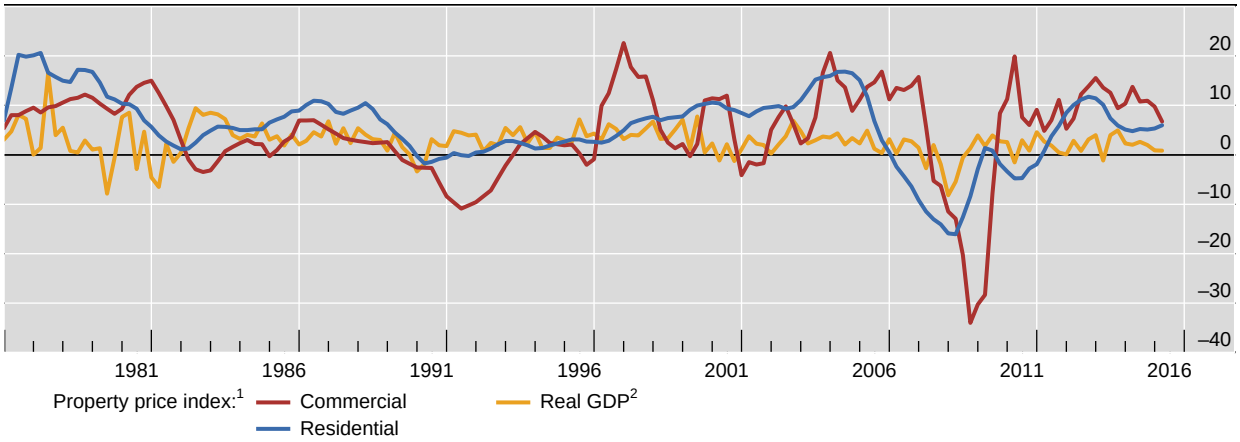
[15] The BIS is working closely with a number of organisations, especially the Deutsche Bundesbank, the ECB, Eurostat, the IMF and the OECD, in developing commercial and residential property price statistics.

[16] For instance, one may also decide to categorise properties based on their use (ie housing); in that case, flats and houses rented out would not be considered as commercial properties.

Commercial and residential property price developments and real GDP growth in the United States

Annual growth, in per cent

Graph 2



[1] Year-on-year growth rates. [2] Seasonally adjusted annual rate.

Source: Board of Governors of the Federal Reserve System.

indicators (for instance, the share prices of funds investing mainly or solely in commercial property, such as real estate investment trusts (REITs)) can provide an indirect source, with good timeliness but limited coverage.

Each of these sources has advantages and drawbacks. The main advantage of transaction-based data is that land registries capture all transactions which take place in a relevant territory. But the number of transactions on commercial properties is usually low, especially during recessions, which hampers the compilation of representative price indices. Therefore, compilers and statisticians have to use appraisals as a complementary source (or even the only one). However, appraisal-based data also present several drawbacks: they often cover only a fraction of the market; and the appraisal quality depends on the expertise of the appraiser, who moreover may be pressured to bias the appraisal in the direction desired by the payer (ie the buyer, or the financial institution providing the loan). The third source, financial market data, can provide almost real-time information. However, disentangling the price change of the underlying assets from other factors affecting a real estate fund's performance is not an easy task; in addition, the portfolio of such funds usually consists mainly of premium-segment properties, which does not reflect the whole market.

Commercial property prices are published only in a handful of places. In several countries, the low number of transactions and the heterogeneity of commercial properties have prevented the compilation of official, transaction-based and quality-adjusted statistics. In some cases, private commercial providers instead compile appraisal-based data sets, but they are often not available to the public. Furthermore, the lack of international compilation guidelines has so far hampered cross-country comparability.

The scarcity of data is reflected in the limited number of series in the BIS data set. Currently, the BIS publishes 25 commercial property price series covering 10 countries, far fewer than the close to 300 residential property price series covering 58 countries (Table 1 summarises information on the available data). Nonetheless,

Inventory of commercial property price data published by the BIS

Table 1

Countries	Number of series	Geographical coverage			Source of price information		Property type		Starting year;[1] frequency
		All	Cities	Capital	Trans-action	Appraisal	Only land	Building/ unit[2]	
Denmark	3	✓			✓	✓		✓	1992; quarterly
Euro area	1	✓			✓	✓		✓	2000; quarterly
Germany	6		✓		✓	✓		✓	1995; annual
Greece	4	✓		✓		✓		✓	2006; half-yearly
Hong Kong SAR	2	✓			✓			✓	1993; monthly
Indonesia	1			✓	✓			✓	2002; quarterly
Japan	3	✓	✓	✓		✓	✓		1955; half-yearly
Philippines	1			✓	✓		✓		2008; quarterly
Singapore	3	✓			✓			✓	1998; quarterly
United States	1	✓			✓	✓		✓	1945; quarterly

[1] Earliest, in case of more than one series. [2] For example: industrial, office or retail.

Source: BIS property prices statistics, based on national data.

data availability has improved somewhat recently and the DGI is likely to lead to further substantial improvements.

The main challenge in the coming years will be to expand country coverage while also enhancing the methodological guidance. The target set in the DGI is to reach a significant coverage of G20 economies by 2021. The ECB has already made progress towards improved coverage by mapping potential data sources, summarising the methodological challenges and publishing experimental data. Moreover, Eurostat, in cooperation with the aforementioned international organisations, will later this year publish a working paper summarising the various methodological and compilation issues. This publication will help statisticians compile and publish new indicators and will enhance the cross-country comparability of data.

Long series on consumer prices[17]

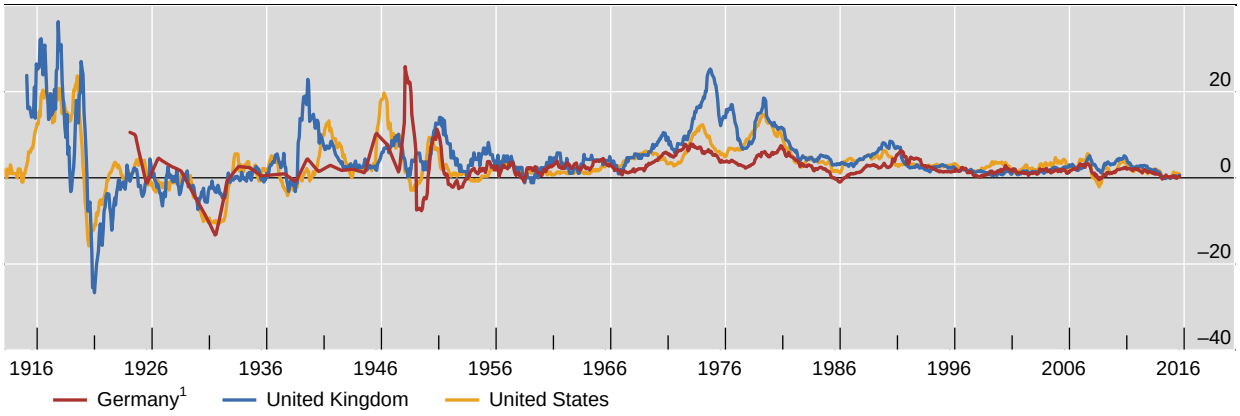
The BIS's data set on consumer prices contains long monthly and annual time series for 60 countries. The BIS long series have been used, in particular, for the calculation of the real effective exchange rate and real residential property price series published; they are also very useful in supporting economic research on macroeconomics and financial stability. These series are now available on the BIS website.[18]

The average length of the monthly series is close to 55 years. Some annual series go back to the middle of the 19th century – or even earlier for several countries (see Graph 3 for data from Germany, the United Kingdom and the United States). For each country, the data for the most recent periods correspond to the consumer price index published by national statistical offices. Proxy indicators, such as a consumer price index with limited coverage or a retail price index, were used to extend the series backwards as far as possible. The series have been constructed by joining those available for consecutive periods.

In undertaking this work, the BIS has worked very closely with national authorities to provide the most accurate data possible.

One hundred years of inflation

Year-on-year growth rates in consumer price indices, in per cent — Graph 3



[1] Based on annual data prior to 1950.

Sources: Deutsche Bundesbank; Bank of England; German Federal Statistical Office; UK Office for National Statistics; US Bureau of Labor Statistics; BIS calculations.

[17] This section was prepared by Robert Szemere.

[18] http://www.bis.org/statistics/cp.htm.

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Covered interest parity lost: understanding the cross-currency basis[1]

Covered interest parity verges on a physical law in international finance. And yet it has been systematically violated since the Great Financial Crisis. Especially puzzling have been the violations since 2014, even once banks had strengthened their balance sheets and regained easy access to funding. We offer a framework to think about these violations, stressing the combination of hedging demand and tighter limits to arbitrage, which in turn reflect a tighter management of risks and bank balance sheet constraints. We find empirical support for this framework both across currencies and over time.

JEL classification: F31, G15, G2.

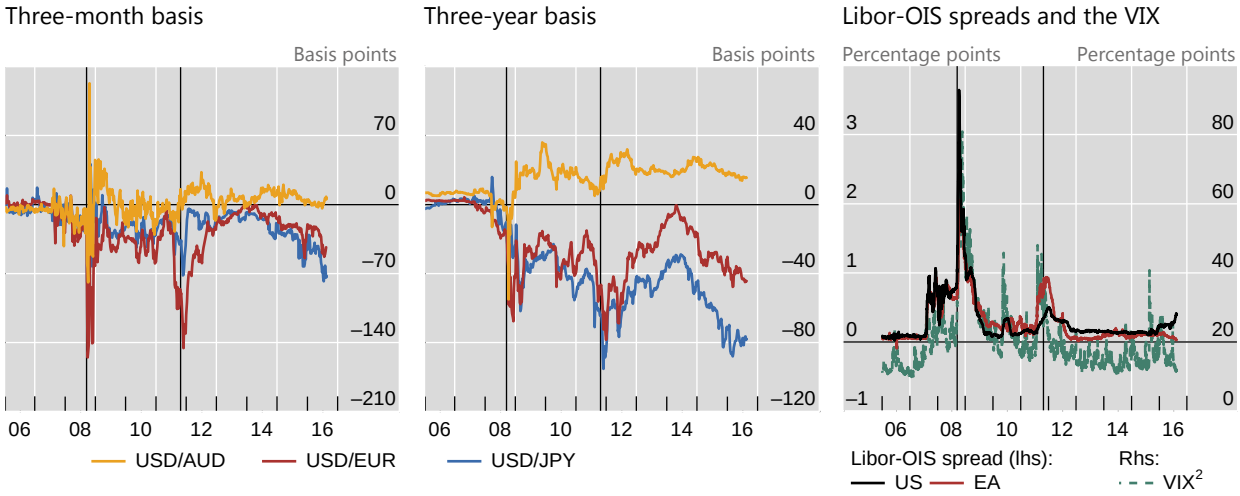
Covered interest parity (CIP) is the closest thing to a physical law in international finance. It holds that the interest rate differential between two currencies in the cash money markets should equal the differential between the forward and spot exchange rates. Otherwise, arbitrageurs could make a seemingly riskless profit. For example, if the dollar is cheaper in terms of yen in the forward market than stipulated by CIP, then anyone able to borrow dollars at prevailing cash market rates could profit by entering an FX swap – selling dollars for yen at the spot rate today and repurchasing them cheaply at the forward rate at a future date.

Yet since the onset of the Global Financial Crisis (GFC), CIP has failed to hold. This is visible in the persistence of a cross-currency basis since 2007. The cross-currency basis indicates the amount by which the interest paid to borrow one currency by swapping it against another differs from the cost of directly borrowing this currency in the cash market. Thus, a non-zero cross-currency basis indicates a violation of CIP. Since 2007, the basis for lending US dollars against most currencies, notably the euro and yen, has been negative: borrowing dollars through the FX swap market became more expensive than direct funding in the dollar cash market. For some currencies,

[1] The authors thank José María Vidal Pastor as well as Kristina Bektyakova, Branimir Gruić and Swapan Pradhan for research assistance; and Morten Bech, Matthew Boge, Wenxin Du, Teppei Nagano, Fabiola Ravazzolo and Jean-François Rigaudy for helpful discussions. We have also benefited from conversations with representatives of major dealer banks as well as supranational and agency debt issuers. In addition, we thank Benjamin Cohen, Dietrich Domanski, Torsten Ehlers, Cathérine Koch, Andreas Schrimpf, Hyun Song Shin, Konstantinos Tsatsaronis and Jens Ulrich for helpful comments. The views expressed are those of the authors and not necessarily those of the Bank for International Settlements.

Cross-currency basis against the US dollar, interbank credit risk and market risk[1]

Graph 1



[1] The vertical lines indicate 15 September 2008 (Lehman Brothers file for Chapter 11 bankruptcy protection) and 26 October 2011 (euro area authorities agree on debt relief for Greece, leveraging of the European Financial Stability Facility and the recapitalisation of banks). [2] Chicago Board Options Exchange S&P 500 implied volatility index; standard deviation, in percentage points per annum.

Sources: Bloomberg; authors' calculations.

such as the Australian dollar, it has been positive (Graph 1, left-hand and centre panels).

Initially, the violations of CIP were seen as a reflection of strains in global interbank markets. Specifically, heightened concerns about counterparty risk and constrained bank access to wholesale dollar funding inhibited arbitrage during the GFC, and again during the subsequent euro area sovereign debt crisis. But, puzzlingly, the violations have persisted even after these strains dissipated. The basis has widened since 2014, for both short- and long-term borrowing, despite fading concerns about bank credit quality and recovery in wholesale dollar funding markets.[2] Why has arbitrage not reduced the basis to zero?

In this special feature, we argue that the answer to this puzzle lies in the combination of the evolving demand for FX hedges and new constraints on arbitrage activity. The former explains why the basis opens up, and the latter why it does not close. A growing demand for dollar hedges on the part of banks, institutional investors and issuers of non-US dollar bonds has put pressure on the basis. At the same time, limits to arbitrage (in the sense discussed by Shleifer and Vishny (1997), among others) have become more binding. These reflect lower balance sheet capacity because of tighter management of the risks involved and the associated balance sheet constraints. Empirically, we find that proxies for the volume of hedging demand, together with proxies for balance sheet costs, help explain CIP violations, both across currencies and over time. If the factors we identify are the right ones, CIP deviations look to be here to stay even in non-crisis times, as long as the demand for currency hedges is sufficiently high and imbalanced across currencies.[3]

[2] Also, unlike in earlier US dollar funding stress episodes (Cetorelli and Goldberg (2011, 2012)), banks have drawn very little on central bank swap lines: https://apps.newyorkfed.org/markets/autorates/fxswaps-search-result-page.

[3] Sushko et al (2016) treat these issues from a more technical perspective and provide broader econometric results.

The rest of this feature is organised as follows. The first section lays out the framework for our analysis. The second and third sections examine, respectively, the variation of the basis across currencies and over time in the yen/dollar basis. The conclusion highlights some implications and outstanding questions.

A framework

The basic mechanics behind CIP are fairly simple. Interest rates in the cash market and the spot exchange rate can be taken as given – these markets are much larger than those for FX derivatives. Hence, it is primarily shifts in the demand for FX swaps or currency swaps that drive forward exchange rates away from CIP and result in a non-zero basis (Box A). Any such deviations should, in principle, immediately trigger arbitrage transactions, bringing the basis back to zero. The reason is that, in an ideal world, CIP arbitrage is treated as riskless. By construction, FX swaps do not entail an open currency position. In addition, it is assumed that the credit, counterparty, market and liquidity risks involved are negligible. Unimpaired access to cash and derivatives markets then allows arbitrageurs to close the basis.

In recent years, the textbook CIP arbitrage framework has been challenged in two ways. Initially, the focus was on the constraints on arbitrage arising from the banks' counterparty credit risk concerns and the wholesale US dollar funding strains that surfaced during crisis episodes. These episodes included the Japanese banking crisis (the "Japan premium", Hanajiri (1999)); the onset of the GFC in 2007–08 (eg Baba et al (2008), Baba and Packer (2009), Coffey et al (2009), Mancini-Griffoli and Ranaldo (2012), Levich (2012)); and the euro area sovereign debt crisis in 2011–12 (McCauley and McGuire (2014), Ivashina et al (2015)).

Since 2014, attention has shifted to other factors and constraints. Most studies have invoked some notion of capital constraints of CIP arbitrageurs in the face of FX swap funding demand from banks (Iida et al (2016)), from foreign currency bond issuers (Liao (2016)) or from broader saving and investment imbalances (Du et al (2016)).[4] Similarly, Shin (2016) attributes the persistent deviations from the CIP to a systemic risk factor linked to the US dollar's role as the global funding currency.[5]

Drawing on our more technical work (Sushko et al (2016)), the framework we propose in this study has two features. First, it focuses on one key source of pressure on the basis, namely net foreign currency hedging demand that is largely insensitive to the size of the basis. Second, similarly to other studies, it also assumes the presence of limits to arbitrage linked to the costs involved in deploying balance sheets, in turn reflecting tighter management of capital and funding risks. This can create a balance sheet constraint on CIP arbitrage that becomes more binding as the size of the aggregate FX hedging positions grows.

Our framework gives rise to two hypotheses. First, in the cross section, the size and sign of the basis across currencies should be related to the net hedging position

[4] He et al (2015) take the currency basis as given, to study the effects of FX swap market dislocations on the ability of non-US banks to supply US dollar loans when US monetary conditions tighten.

[5] Transaction costs also appeared to play a temporary role for some currencies in the aftermath of the Swiss National Bank's abandonment of the currency peg (Pinnington and Shamloo (2016)).

Box A

CIP, FX swaps, cross-currency swaps and the factors that move the basis

CIP is a textbook no-arbitrage condition according to which interest rates on two otherwise identical assets in two different currencies should be equal once the foreign currency risk is hedged:

$$\frac{F}{S} = \frac{1+r}{1+r^*}$$

where *S* is the spot exchange rate in units of US dollar per foreign currency, *F* is the corresponding forward exchange rate, *r* is the US dollar interest rate, and *r** is the foreign currency interest rate. In practice, the relationship between *F* and *S* is read off market transactions in FX instruments, notably FX swaps and cross-currency swaps.

In an FX swap, one party borrows one currency from, and simultaneously lends another currency to, a second party (see also Baba et al (2008)). The borrowed amounts are exchanged at the spot rate, *S*, and then repaid at the pre-agreed forward rate, *F*, at maturity. The implicit rate of return in an FX swap is determined by the difference between *F* and *S*, and the contract is typically quoted in forward points (*F* – *S*). If the party lending a currency via FX swaps makes a higher or lower return than implied by the interest rate differential in the two currencies, then CIP fails to hold. Typically, the US dollar has tended to command a premium in FX swaps. In this case, rearranging the CIP equation yields the following relationship between (*F* – *S*), *r* and *r**:

$$F - S > S\left(\frac{1+r}{1+r^*} - 1\right)$$

A positive ("wide") value of (*F* – *S*), above, indicates that a party lending US dollars sells the foreign currency forward at a higher dollar price than warranted by the interest differential. Equivalently, a party borrowing US dollars via an FX swap – say, to hedge its US dollar asset – is effectively paying a higher interest rate on the swapped dollars than is paid in the cash market.

A cross-currency swap is a longer-term instrument, typically above one year, in which the two parties also simultaneously borrow and lend an equivalent amount of funds in two different currencies. At maturity, the borrowed amounts are exchanged back at the initial spot rate, *S*, but during the life of the swap the counterparties also periodically exchange interest payments. In a cross-currency *basis* swap, the reference rates are the respective Libor rates plus the basis, *b*. Again, if the forward points (*F* – *S*) are greater than warranted by CIP, then, assuming a one-period maturity, the basis, *b*, will effectively be the amount by which the interest rate on one of the legs has to be adjusted so that the parity with the pricing of FX swaps holds:

$$F - S = S\left(\frac{1+r+b}{1+r^*}\right) - S$$

In the above example, the FX swap implied US dollar rate, $^{F}/_{S}\,(1+r^*)$, exceeds actual US dollar Libor, $1+r$, if the party borrowing US dollars in a cross-currency swap pays the basis, *b*, on top of US dollar Libor. Thus, failure of CIP has implications for the relative cost of funding in the cash and swap markets. Whenever CIP fails, one party ends up paying the currency basis on top of the cash market rates to borrow the corresponding currency, while the other counterparty in effect receives an equivalent discount when borrowing the other currency.

A number of factors can cause CIP to fail. For example, market liquidity in the underlying instruments may evaporate, so that the difference between bid and ask prices for forward and spot transactions is non-trivial. For simplicity, let us assume that *r** is sufficiently small, so that $1 + r^* \approx 1$. Denoting by S_a the spot ask rate and by F_b the forward bid rate, CIP deviations due to a drop in market liquidity will be given by:

$$b \equiv \frac{F-S}{S} - (r - r^*) = \frac{F}{S} - \frac{F_b}{S_a}$$

CIP can also fail because of credit risks in the underlying investments. If CIP arbitrage is conducted by global banks borrowing and lending in the respective Libor markets, then a rise in counterparty credit risks in the interbank markets, typically captured using Libor-OIS spreads, could result in CIP deviations. Similarly, if banks or asset managers engage in CIP arbitrage using government bonds in the two currencies, then deviations might result from differences in sovereign credit risks, typically measured using sovereign CDS spreads.

More generally, suppose *r* and *r** are the respective risk-free rates and *rp* is the risk premium for the underlying investment over the duration of the swap. Then CIP deviations measured using risk-free rates will be given by:

$$b \equiv \frac{F-S}{S} - (r - r^*) = rp$$

Even if risk premia in the underlying transaction are low, CIP deviations can arise if the demand to hedge one of the currencies is large. Then, even small risk premia can have big effects when scaled by the large size of the balance sheet exposures needed to meet the hedgers' demand. For example, Sushko et al (2016) show that CIP deviation can be proportional to the hedging demand multiplied by the per-dollar balance sheet costs of FX derivatives exposures:

$$b \equiv \frac{F-S}{S} - (r - r^*) \propto rp \times FX\ Hedging\ Demand$$

In each of the above examples, the price that is actually set in FX derivatives is that of the forward leg of the swap, *F*. As shown, CIP arbitrageurs will pass on their balance sheet costs of taking the other side of FX hedging demand via FX swaps as wider forward points, (*F* – *S*), than warranted by CIP. The per-dollar balance sheet costs themselves are represented by *rp* in this example. Since markets have to clear, the aggregate position of CIP arbitrageurs when the US dollar is at a premium in FX swaps will be equal to the aggregate net position of currency hedgers. The latter will be paying the forward points, *(F – S)*, to hedge their US dollar assets.

What are some of the real-world counterparts to *rp* in non-crisis times? In aggregate, *rp* will reflect any costs that banks or other participants assign to deploying their balance sheet in CIP arbitrage, which in turn will reflect their risk management practices. For individual players, these practices may even include absolute credit limits that would set a maximum for the underlying exposures to the underlying instruments and counterparties. Even without strict limits, the funding cost of the capital allocated to the arbitrage activity, notably to the (current and potential future) derivatives exposures involved, will prevent the basis from closing when it opens up owing to changes in hedging demand.

The specific constraints, and hence the instruments involved, will also depend on the players acting as arbitrageurs. For instance, for highly rated supranational and quasi-government agencies, which can arbitrage the long-term basis thanks to their top credit rating by issuing bonds in US dollars at attractive rates and then swapping them out, *rp* is more closely related to the costs of placing bonds in different currencies. For hedge funds, which rely on collateralised markets to fund CIP arbitrage, the price and availability of repo market funding will play a significant role.

vis-à-vis the US dollar. Second, over time, the evolution of the basis should depend on that of net dollar hedging needs. Let us first consider each of the two components of the framework – FX hedging demand and constraints on arbitrage – in more detail.

Demand for currency hedges: why the basis opens up

Hedging of open FX positions is the main proximate driver of the demand for FX swaps. We focus on three sources of hedging demand that are rather insensitive to the size of the basis, and, hence, exert sustained pressure on it even when it is non-zero: demand from banks, institutional investors and non-financial firms.

A first, structural source of demand for foreign currency hedges arises from *banks' business models*. For a long time, banks have been the main players running currency mismatches on their balance sheets (managed mainly via swaps). Banking systems may be structurally short or long in specific currencies, given their core deposit base. A shortfall in foreign currency funding can then be managed by cash borrowing in money and bond markets. The remaining gaps between banks' assets

Box B

Reverse yankee issuance in the euro and the EUR/USD basis

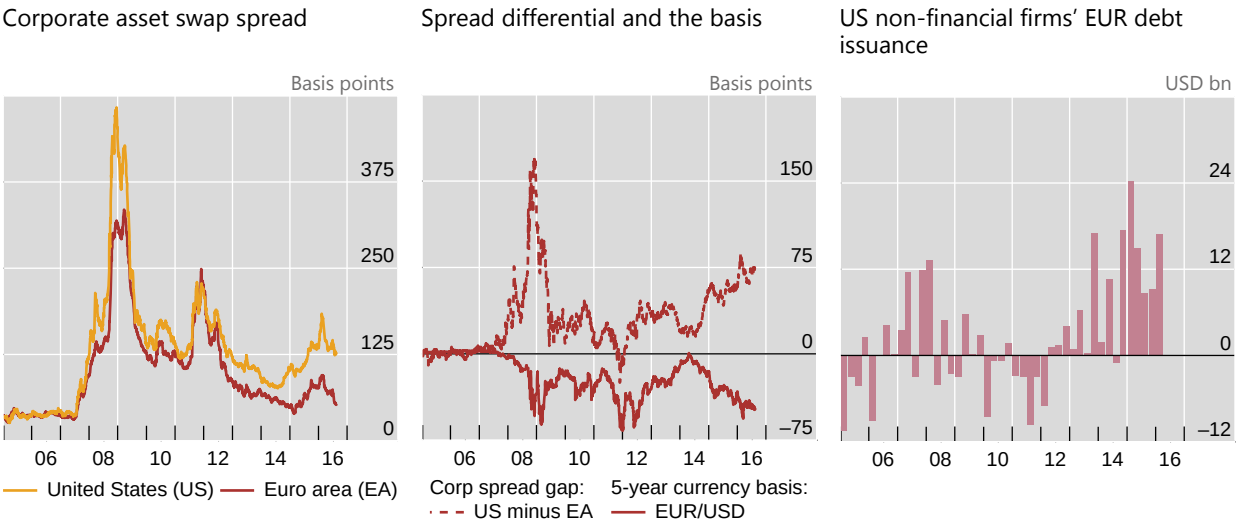
Corporate credit spreads in the euro bond market have fallen relative to those in the US dollar bond market, largely driven by ECB bond purchase programmes (Graph B, left-hand and centre panels). In response, US firms have found it more cost-effective to issue in euros, through so-called reverse yankee bonds, and then swap the proceeds into US dollars (right-hand panel). The hedging of currency risk by US firms issuing in the euro increases demand for cross-currency swaps. Hence, the widening of corporate asset swap spread differentials and the surge in euro issuance since 2014 have coincided with a marked widening of the currency basis (centre panel).

For example, consider a BBB-rated US telecoms firm whose bonds yield 100 basis points over the interest rate swap rate in dollars, but only 50 basis points in euros. If CIP held, the firm would save 50 basis points by issuing in euros and swapping back to dollars. In fact, the firm would have an incentive to do that for all its new debt. One can then see the widening of the basis as tending to reconcile the different spreads in the two markets.

According to data from Thompson Reuters, the majority of reverse yankee issuance has been long-term, with an average maturity of about 10 years and with 15- and 20-year tenors also commonplace. Issuance at shorter maturities is rare, because, from the perspective of the US non-financial issuer, the all-in issuance costs (ie taking the currency swap into account) of short-term euro-denominated debt are still greater than issuing short-term US dollar debt, owing to the wider currency basis relative to the corporate asset swap spread differential at the short end.

Corporate credit spreads, reverse yankee issuance and the EUR/USD basis

Graph B



Sources: Bank of America Merrill Lynch; Bloomberg; BIS debt securities statistics; authors' calculations.

and liabilities in a given currency would be closed using currency derivatives such as FX swaps.[6]

The second source of demand arises from the *strategic hedging decisions* of *institutional investors*, such as insurance companies and pension funds. Institutional

[6] For example, in the second half of 2015, temporary pressure on non-US banks' dollar funding emerged as US money market funds (MMFs) divested from their unsecured obligations. This reflected adjustment to US MMF regulatory reform set to take effect in October 2016. Still, at least in aggregate, non-US banks retained $5.5 trillion in deposits offshore and at their US branches in the last three quarters of 2015, which rose to $5.7 trillion in Q1 2016, according to BIS and Federal Reserve flow of funds data.

investors use swaps to strategically hedge foreign currency investments. In recent years, the term and credit spread compression on the back of unconventional monetary policies in major jurisdictions has boosted these cross-currency investment and funding flows.[7] These investors' hedge ratios tend to be quite insensitive to hedging costs and to move slowly over time.[8] Thus, anything that induces these investors to increase or reduce their foreign currency investments tends to put pressure on the basis.

The third source of demand arises from *non-financial firms' debt issuance* across currencies as they seek to borrow opportunistically in markets where credit spreads are narrower. Under normal market conditions and for most currencies, this may not be an important factor. But it can become quite relevant when credit spreads differ systematically, for example when they are compressed by central bank large-scale asset purchases. Recently, for instance, many US firms needing dollars have been issuing in euros to take advantage of very attractive spreads in that currency and have then swapped the proceeds into dollars (Box B). This allows them to use the dollars for their business purposes while avoiding a currency mismatch in euros. Essentially, through the swap market, they borrow dollars and lend euros.

Other factors could also put pressure on the basis, but we exclude them from our analysis because of data limitations. Firms' hedging of trade receivables or subsidiary cash flows are one case in point. Another could be speculative FX positions, which can rely on forwards and swaps (eg yen carry trades). We posit, therefore, that the sources of pressure we identify are sufficient to capture the key relationships.[9] At the more fundamental level, monetary (Box C) and financial conditions, as well as institutional differences across the respective jurisdictions, largely determine the extent of foreign currency funding and investment flows in the first place.

Limits to arbitrage: why the basis does not close

Structural changes in how market participants have been pricing market, credit, counterparty and liquidity risks post-crisis have tightened limits to arbitrage. Balance sheet space is rented, not free.[10] Specifically, as a result of tighter management of risks and related balance sheet constraints, arbitrage now incurs a cost per unit of balance sheet. This cost is passed on to the pricing of FX swaps, introducing a premium (or discount, depending on the currency) in response to imbalances in the swap market. One result is that the currency spot-forward relationship goes out of line with CIP (Box A).

[7] Domanski et al (2015) document increasing investment in long-term foreign currency bonds by the German insurance sector seeking to extend asset duration so as to match the rising duration of its liabilities as yields in the euro area fell to very low levels.

[8] The FX-hedged investment has a payoff that resembles the return of leveraged investors in the target bond market: in the case of bonds, this is equal to the excess of the bond yield over the short-term financing cost ("the carry"), plus or minus a price gain or loss on the bond.

[9] This would be so if the other sources of FX hedging demand co-move positively with those we identify. The exclusion of speculative demand may actually make it harder for us to find a relationship with hedging demand, as speculation may lead to offsetting pressure on the basis. For instance, easy monetary policy could boost FX-hedged investments in search of higher returns, but it could also encourage carry trades. Those carry trades could push down the forward rate even as hedging demand pushed it up.

[10] For a conceptual discussion, see Duffie (2016).

Arbitrage can be both costly and risky. Typically, it requires the arbitrageur to enlarge its balance sheet, incur credit risk in both borrowing and investing, and possibly face mark-to-market and liquidity risk (given the need to transfer collateral or take paper gains or losses) in the valuation of the positions.

While these risks and costs exist all the time, participants have been managing them more actively post-crisis. Before the GFC, these risks were not fully priced in the relevant markets and, partly as a result, dealer banks had raised their leverage to dangerous levels (Shin (2010)). The crisis brought them to light. Since then, pressure from shareholders, creditors and prudential authorities has reinforced and hard-wired participants' awareness. As a result, leverage has declined and there has been less willingness to deploy the balance sheet for activities that make heavy demands on it, such as arbitraging the basis.

Changes in regulation have reinforced market pressures for a tighter management of balance sheet risks. For example, changes related to credit value adjustments have sought to incentivise dealers to price the counterparty risk in their derivatives portfolios more accurately. Similarly, potential future exposure adjustment charges in both Basel III and US leverage ratios require market participants to hold capital in proportion to their derivatives and other exposures.[11]

The bottom line is clear. These tighter limits on arbitrage make it harder to narrow the basis whenever it opens up as a result of pressures that reflect underlying order imbalances. In particular, even in the absence of bank funding strains like those seen during the GFC, a sufficiently high net demand for currency hedges could result in persistent deviations from CIP.

The currency basis in the cross section

Can our framework help explain how the sign and, possibly, the size of the basis vary across currencies? We test this by juxtaposing quantitative indicators for the various players' hedging demands and the basis.[12] In evaluating the results, it should be borne in mind that the sample is necessarily limited, as we have to restrict it to freely tradable currencies in jurisdictions with no capital controls, with a highly rated sovereign and for which data are available.

Quantitative indicators of hedging demand

Assembling estimates of hedging demand runs into two types of limitation.

The first is conceptual. Some financial institutions play the dual role of putting pressure on the basis *and* arbitraging it. For instance, banks' business models may lead them to fund themselves through swaps in order to hedge their balance sheet mismatches, even as they act as arbitrageurs. This means that proxies for their swap positions conflate their two roles. However, and despite such ambiguity, our results suggest that the balance sheet hedging motive dominates.

[11] This need not result from individual pricing decisions. For instance, internal credit limits may constrain individual balance sheets and, in aggregate, be reflected in a larger basis.

[12] Our findings also hold if price indicators are used; see Sushko et al (2016).

The second relates to data availability. No statistics fully cover the hedging demand for a given currency; tough choices and approximations are needed. Hence, we focus on the three main sets of players – banks, institutional investors and non-financial firms – and even there we have to make a number of assumptions.

For *banks*, our benchmark measure is their "funding gap" in the US dollar.[13] The funding gap, derived from the BIS international banking statistics, is an estimate of banks' demand for hedging through the FX swap market (McGuire and von Peter (2009, 2012), Fender and McGuire (2010)). Specifically, for banks headquartered in a particular country (eg Japan or Australia), we measure the difference between their consolidated global on-balance sheet assets and liabilities in a particular foreign currency. Assuming that banks hedge their currency risk, the resulting gap indicates the size of their off-balance sheet position in a given currency, which will largely be managed by FX swaps.[14]

For *institutional investors*, we rely on central banks for estimates of Australian, euro area and Swedish institutions' hedged foreign assets; and on industry sources for Japanese life insurers' holdings and hedge ratios.[15] We neglect US investors' positions. This is not likely to be a problem, however, since US investors have more opportunity to diversify without buying foreign currency assets, given the size of the global dollar financial markets.[16]

For *non-financial firms*, we consider bonds outstanding issued by corporations headquartered outside the country, drawing on BIS international debt securities statistics. For instance, we take euro issues by US firms to fund their dollar operations, and exclude issues by banks to avoid double-counting.[17] We do not include dollar issuance by non-US firms because, given the predominance of the US dollar as an invoicing currency, many such firms do not hedge dollar debt (eg Borio (2016)).[18]

Graph 2 shows indicators of hedging demand from the various sectors for four jurisdictions for which we were able to obtain better data: Australia, the euro area, Japan and Sweden. A positive value for a bar indicates net borrowing of US dollars

[13] Except in the case of Sweden, where we also look at the euro (see below).

[14] Partly owing to data limitations, we do not include US banks' corresponding positions. US-headquartered banks' estimated net long positons in the key currencies we are considering are relatively small compared with non-US banks' net long dollar positions. As a result, the bulk of our analysis can safely focus on the latter.

[15] This means that, except for the euro area, we cannot single out US dollar holdings, so that our estimate is an upper bound for the institutions covered.

[16] Three quarters of US investors' holdings of foreign bonds were dollar-denominated at the end of 2014 (US Treasury et al (2016)). In general, hedge ratios for foreign equity holdings are low and well below those for bonds, so that they are less of an issue (although those of Japanese shares are often hedged). Hilander (2014, p 13) reports a 20% hedge ratio on foreign shares in Sweden.

[17] We could also include domestic currency issuance by foreign firms from outside the United States, which may hedge into the US dollar (given its extensive international use), or hedge back into eg the Australian dollar or Canadian dollar through the US dollar. So, our figure should best be regarded as a lower bound. At the same time, not all issuance need be hedged: some firms may prefer to incur currency risk in an attempt to lower their funding costs further.

[18] Moreover, given that credit spreads favour one currency over another, incentives to issue and put pressure on the basis are bound to be one-sided. In the case of the dollar/euro pair, for instance, where spreads have favoured issuance in euros, euro area issuers in dollars have typically been top-rated European supranationals and agencies, which can afford to issue in USD thanks to their top-notch creditworthiness. These institutions in effect operate as arbitrageurs, actively harvesting the basis (see also below). They do the same in the Australian dollar market.

CIP deviations and monetary policy announcements

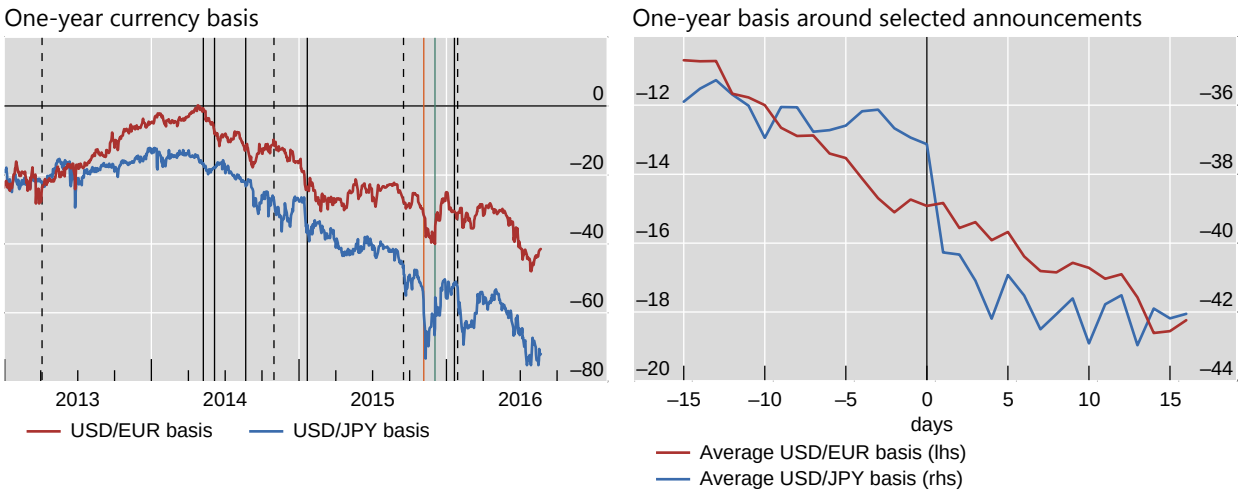
Monetary policy can boost hedging demand through both price and quantity effects. By lowering the yield curve and, in particular, by compressing the term premium and credit spreads, easing encourages investors to seek return and duration in foreign currency bonds and foreign issuers to sell bonds in the corresponding currency to obtain cheaper funding. Large-scale asset purchases strengthen these effects by withdrawing securities from the market. And so does the adoption of negative interest rates, which can result in negative yields stretching out to long maturities.①

Much of the widening of the USD basis since 2014 has coincided with monetary policy easing announcements by the Bank of Japan (BoJ) and the ECB. Indeed, the widening began in earnest with the ECB's ramping-up of easing measures, including the 5 June 2014 announcement of negative rates (Graph C, left-hand panel). The announcement of ECB government bond buying (quantitative easing, QE) on 22 January 2015 also had a significant impact on the USD/JPY basis, owing perhaps to expected policy contagion or more technical factors (eg French banks' role as JPY/USD arbitrageurs). Similarly, the BoJ's Quantitative and Qualitative Monetary Easing (QQE) announcements as well as its move to negative policy rates saw the USD/JPY basis widen. In fact, the short-term announcement effects were even starker for the BoJ (Graph C, right-hand panel).

One possible explanation for the responsiveness of the basis to monetary policy announcements is that the swap dealers that provide currency hedges expect the outflows from the euro or the yen to increase when the ECB or the BoJ eases policy. This includes the flows hedged for currency risk, which push up the demand for FX swaps or cross-currency swaps. Hence, the swap dealers set higher prices for currency hedges, which results in wider CIP deviations. Conversely, when the ECB or the BoJ surprises with less easing than anticipated, dealers revise downwards the expected hedging demand coming their way, lower their prices and, hence, help narrow the basis. This happened on 3 December 2015 (green vertical line, left-hand panel): the announced ECB stimulus was lower than what market participants had expected in the run-up to the Federal Reserve's first rate hike. Such expectations had been firming during the previous month following the upbeat US jobs data release in November (orange vertical line). After the ECB announcement, market participants revised down their expected volumes of cross-currency flows out of the euro area.

Monetary policy announcements and one-year currency basis

In basis points — Graph C



The solid vertical lines in the left-hand panel correspond to the following ECB monetary policy announcements: 8 May 2014, 5 June 2014, 22 August 2014 (Jackson Hole), 22 January 2015 and 21 January 2016. The green vertical line corresponds to the ("disappointing") 3 December 2015 ECB announcement. The orange vertical line indicates the 6 November 2015 US job report. The dashed vertical lines in the left-hand panel correspond to the following Bank of Japan monetary policy announcements: 4 April 2013, 31 October 2014, 29 January 2016 plus the 16 September 2015 (S&P) Japan downgrade. The same dates are used to calculate the basis reaction around the announcement dates.

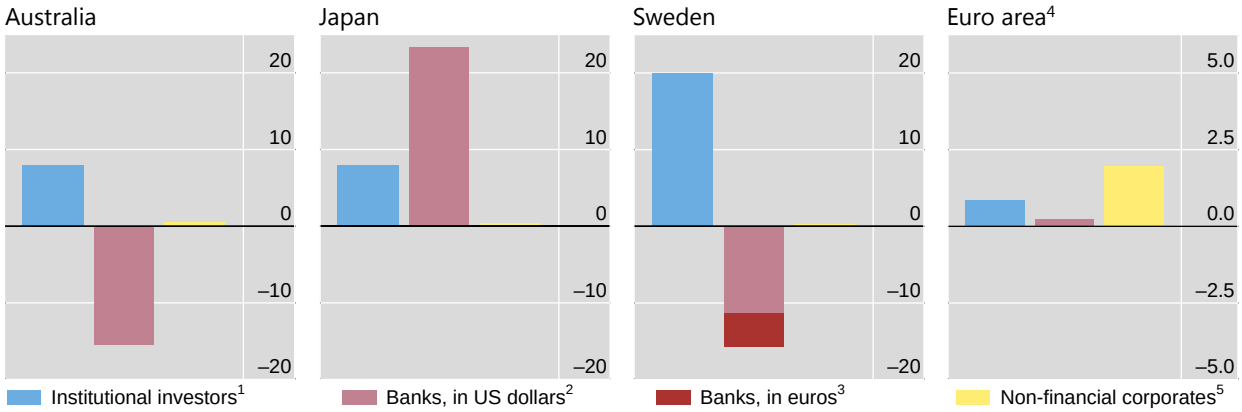
Sources: Bloomberg; BIS calculations.

① See Borio and Zabai (2016) for a survey of unconventional monetary policy measures that documents and discusses these effects. On the relationship of central bank deposit rate changes and the currency basis, see Bräuning and Ivashina (2016, Table IX).

Currency hedging by banks, institutional investors and non-financial corporates

As a percentage of 2015 GDP

Graph 2



[1] Foreign currency securities holdings of institutional investors (eg pension funds and insurance companies) multiplied by the respective currency hedge ratios; for the euro area, US dollar debt securities holding only, assuming 100% currency hedge ratios. [2] Each jurisdiction's BIS reporting banks' consolidated net US dollar assets. [3] Each jurisdiction's BIS reporting banks' consolidated net euro assets. [4] 2015 quarterly average. [5] Local currency debt outstanding issued by US non-financial corporations.

Sources: Hilander (2014); Rush et al (2013); ECB; Eurosystem Working Group on Securities Statistics; The Life Insurance Association of Japan; Barclays; BIS international banking statistics and debt securities statistics; authors' calculations.

against local currency via swaps (positive net FX hedging demand vis-à-vis the US dollar) for the corresponding sector, while a negative value shows net dollar lending. The figures are scaled by GDP.

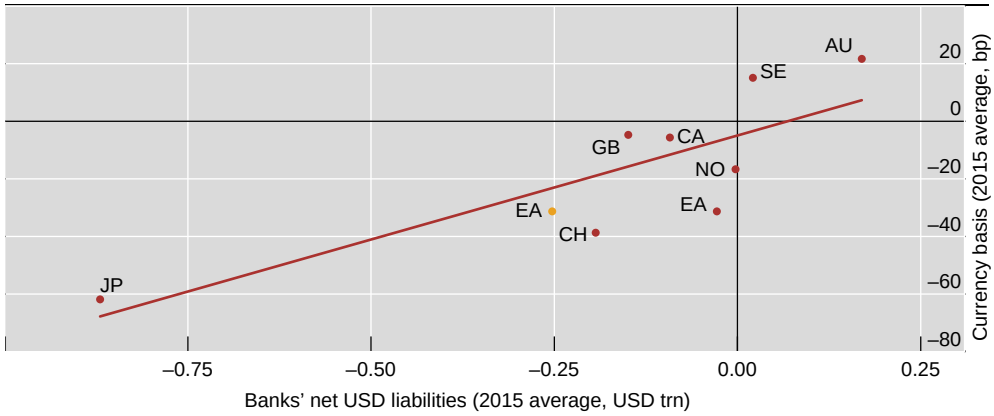
The graph reveals clear differences across countries and sectors. Especially noteworthy is the position of the banking sector relative to that of institutional investors. Where banks have a surplus of domestic currency deposits relative to domestic currency loans, they use the FX swap market to borrow dollars to hedge their dollar lending. In doing so, they compete with domestic institutional investors that use swaps to hedge their dollar investments. As a result, banks *add* to the aggregate hedging demand and hence to the size of the potential imbalance. This is the case in Japan, where they have used domestic yen deposits to fund their expansion abroad, mainly in dollars, by making heavy use of swaps. By contrast, in Australia and Sweden the banking sector provides a natural counterpart to institutional investors' hedging needs. That is, given the large domestic currency mortgage book relative to the domestic deposit base, banks rely on the FX swap market for funding. This *offsets* institutional investors' hedging demand.

The hedging needs of US corporate bond issuers, which add to those of domestic institutional investors, are in general quite small compared with those of other sectors. The main exception is the recent experience in the euro area, where US non-financial firms' issuance in euros has surged since 2014. This reverse yankee issuance reflects the fact that euro-denominated corporate credit spreads have fallen significantly relative to those in dollars, largely because of ECB bond purchase programmes (Boxes B and C).

The sign of the basis aligns quite well with these indicators. Where banks compete with institutional investors to borrow dollars through the swap market, as in Japan, the currency basis is negative, ie dollar borrowing via the FX swap market is in higher demand and hence more costly than in the cash market. The same is true in the euro area, where non-financial firms' demand for dollar borrowing via FX swaps

Currency hedging demand and three-year basis

Banks' consolidated net USD liabilities (plus EUR reverse yankee liabilities) Graph 3



AU = Australia; CA = Canada; CH = Switzerland; EA = euro area; GB = United Kingdom; JP = Japan; NO = Norway; SE = Sweden.

For Sweden, net euro liabilities (horizontal axis) and the SEK/EUR basis (vertical axis).

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

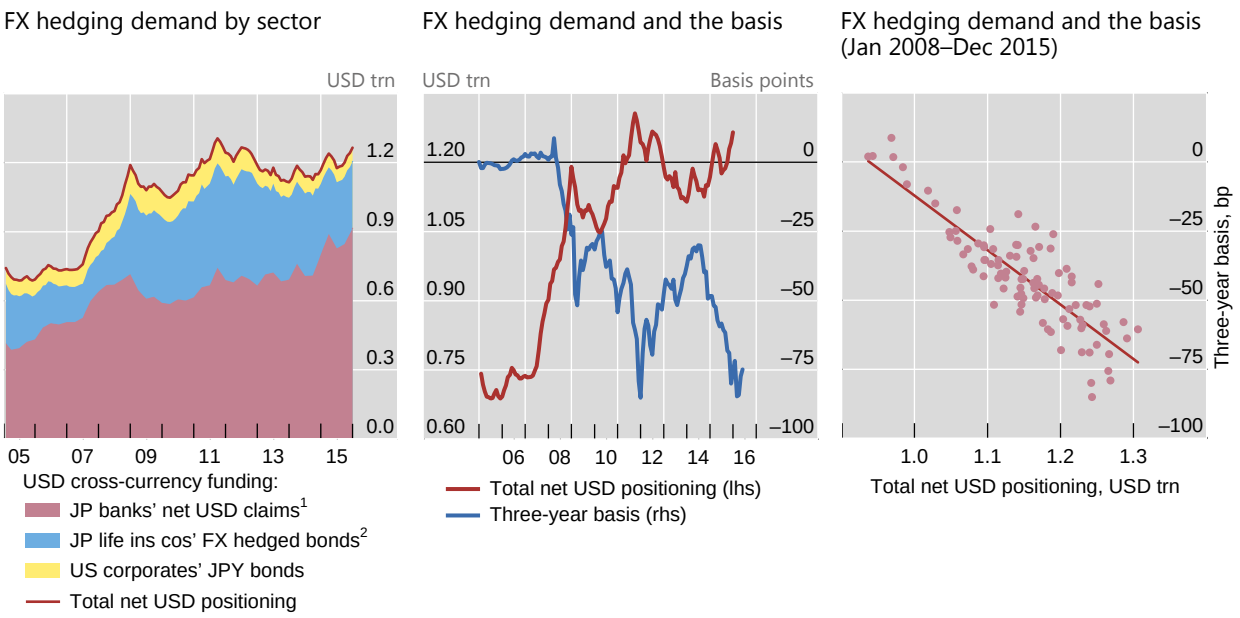
looms large. By contrast, in Australia, where banks offset institutional demand for hedges by lending dollars in the swap market, the currency basis is positive.

In the case of Sweden, the dollar basis is negative, even though banks are in the same position as those in Australia in that currency. However, the euro/krona basis is positive. This reflects the fact that the FX swap *euro* market, rather than the dollar market, is the marginal funding source for excess krona lending (darker colour bars), since swapping out of euros is more expensive than out of dollars. Accordingly, the picture in Sweden resembles that in Australia once the right currency pair is chosen.[19]

Focusing exclusively on the position of the banking sector in US dollars (or euros for Sweden) confirms the previous finding. In a sample of eight economies (now including also Canada, Norway, Switzerland and the United Kingdom), the banks' position is consistent with the sign of the basis (Graph 3). This also suggests that, in our sample, when banks are in the opposite position to institutional investors, their hedging needs are typically larger, so that they end up being the swing factor. Note also that Australian and Swedish banks' position is indeed exceptional: banks typically add to resident institutional investors' hedging needs, rather than offsetting them. In the case of the euro area, the fit improves significantly when we add euro-denominated bonds issued by US non-financial firms (reverse yankees). This addition raises our measure of currency hedging demand in the EUR/USD pair from less than $28 billion to as much as $250 billion (the EA dot moves to the left in Graph 3).

[19] Hilander (2014, Table 5) shows that, in addition to Swedish banks, foreign banks too provide currency hedges to Swedish investors, balancing them against the hedges provided to non-Swedish holders of Swedish bonds.

Sources of currency hedging demand and the JPY/USD basis Graph 4



[1] Difference between gross US dollar assets and liabilities of Japanese banks; quarterly data linear-interpolated to monthly frequency. [2] Japan life insurance companies' currency-hedged US dollar bond holdings estimated by multiplying the stock of the insurance companies' FX bond holdings by their time-varying currency hedge ratios; monthly frequency.

Sources: Bank of Japan; Japanese Ministry of Finance; The Life Insurance Association of Japan; Barclays FICC Research; Bloomberg; BIS international banking statistics and debt securities statistics; authors' calculations.

The currency basis in the time series: the yen/dollar case

We next test our hypothesis by examining the time series of the yen/dollar basis. This has been the most extreme and persistent non-zero basis among the major currencies, with banks and institutional investors both bidding for hedges. Moreover, it is the currency pair for which better data on the evolution of institutional investors' hedging needs are available. Before turning to the evidence, a few facts can help set the context.

Demand for currency hedges and the basis

Our measure of the aggregate US dollar hedging needs of Japanese banks, institutional investors and US non-financial firms (samurai bond issuers) has increased considerably since the crisis: from $0.9 trillion in 2009 to over $1.2 trillion in 2015 (Graph 4, left-hand panel).

The banking sector has been the main driver, with its estimated dollar funding gap growing from around $0.6 trillion to $0.9 trillion. During this period, banks needed dollars to finance their overseas loan expansion and to hedge their own

foreign bond holdings.[20] Since 2015, Japanese banks have also relied more on FX swaps for USD funding due to the lower availability of wholesale USD funding, because of US MMFs' disinvestment from foreign banks' certificates of deposit and time deposits in anticipation of upcoming US MMF reform. Japanese banks have been especially affected, as they have been the largest foreign bank issuers of unsecured paper in US money markets; approximately two thirds of their $600 billion of liabilities in New York is unsecured funding (Pozsar and Smith (2016)).[21]

Thus, Japanese banks' reliance on swaps to fund their foreign assets has reduced their capacity to serve as counterparties to non-bank hedgers in cross-currency markets and to arbitrage the basis. In particular, Japanese life insurers' search for yield overseas has led them to increase FX-hedged investments in US dollar-denominated bonds (with average hedge ratios of 60–70%).[22] Issuance of samurai bonds has not played a significant role, owing to the thin corporate bond market in Japan.

Confirming our hypothesis, after a clear break during the GFC, a remarkably close relationship emerged between variations in our measure of hedging demand and the basis (Graph 4, centre and right-hand panels). This is shown using the three-year basis, but the picture would be similar for other maturities. Pre-crisis, the basis was very small and stable, regardless of hedging volumes; post-crisis, it has tracked them remarkably closely. In particular, an increase in hedging demand has coincided with a widening of the basis further into negative territory.

Tighter limits to arbitrage and the basis

The sudden break in the basis during the GFC points to the emergence of the limits to arbitrage discussed above. But is it possible to find more direct evidence of these new balance sheet constraints? Some developments are consistent with them.

First, as the GFC raised awareness of counterparty risk, many market participants switched from unsecured to secured funding sources, notably repo markets. Reliance on the repo market constrains the arbitrageurs' flexibility, since the borrower cannot obtain funds without having the underlying security to pledge as collateral. Since mid-2014, the Bank of Japan's move to increase government bond purchases (making them more scarce as collateral), even as the Federal Reserve stopped its net purchases, has made dollar repo funding more expensive relative to yen repo funding. As a result, arbitraging the yen/dollar basis has become more expensive, and the basis

[20] The figures for Japanese banks' net US dollar positions, which are derived from the BIS international banking statistics, include both these banks' own dollar positions and those managed on behalf of their clients (in trust accounts). As a result, the figures overstate the former. It is not known how much of trust account positions is hedged. However, for the analysis that follows, it is the dynamics of the series rather than the absolute amount that is important. As long as the share of the dollars held on behalf of clients in the total net dollar position of Japanese banks and their hedge ratios are relatively stable, then the inclusion of these positions should not bias our results.

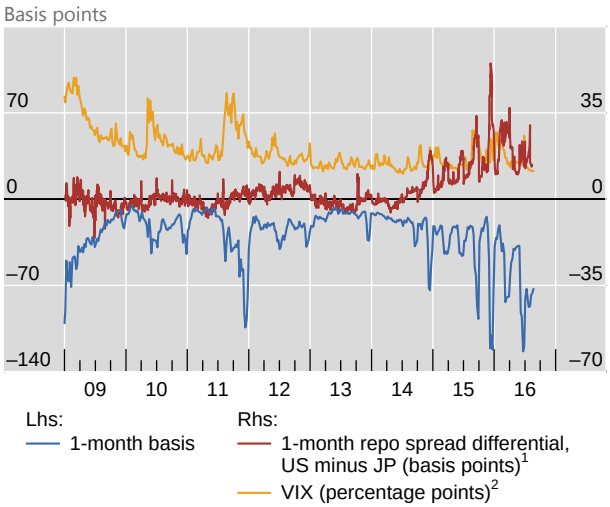
[21] Assets under management have been migrating from prime US institutional MMFs to government MMFs due to the reform to be phased in in October 2016. By August 2016, prime MMFs had lost more than $360 billion in assets, according to Fitch. Non-US banks, in particular, had lost substantial amounts of MMF funding, inducing them to seek other sources of US dollars, including through FX swaps.

[22] We obtained the time-varying hedge ratios of Japan's life insurance companies by courtesy of Barclays FICC Research team; see Barclays (2015). In contrast to those of life insurance companies, the hedge ratios for Japan's pension funds (dominated by the unhedged Government Pension Investment Fund) are low, and therefore ought not to affect the basis.

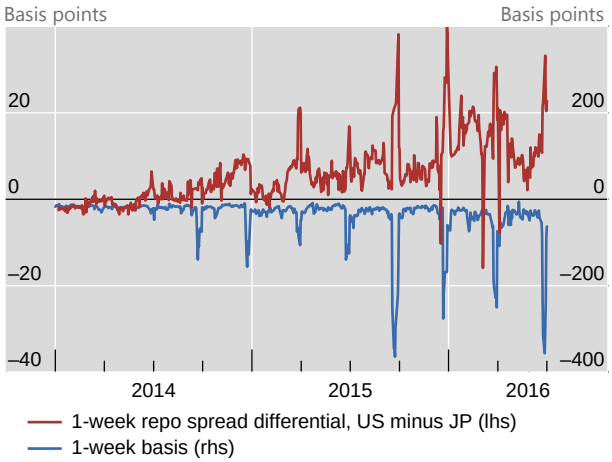
JPY/USD basis and US–Japan repo spreads

Graph 5

The basis and the US–JP repo spread differential



The basis and quarter-end jumps in the repo spreads[3]



[1] For the United States, repo rate minus federal funds rate; for Japan, repo rate minus call rate. [2] Chicago Board Options Exchange S&P 500 implied volatility index; standard deviation, in percentage points per annum. [3] Repo spreads and currency basis calculated using the respective OIS rates.

Sources: Bloomberg; authors' calculations.

has widened even when financial market volatility (the VIX) has remained within normal ranges (Graph 5, left-hand panel).

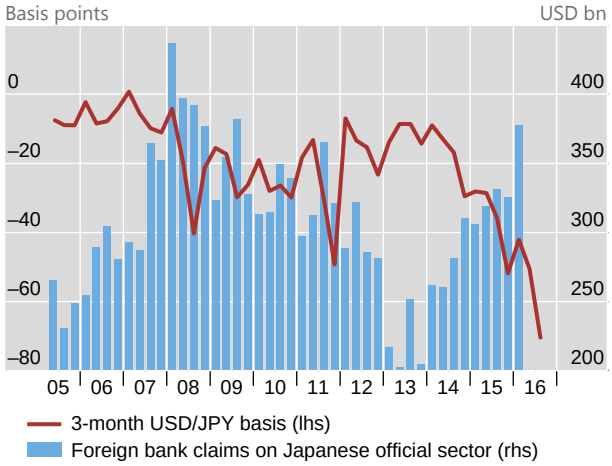
Second, since 2014 the basis has started to exhibit quarter-end spikes, along with repo rates, indicating that arbitrage has become harder (Graph 5, right-hand panel). This has coincided with the greater importance attached to quarter-end reporting and regulatory ratios following regulatory reforms.

Third, the riskiness of claims on the Japanese official sector may also have played a significant role. Banks' exposures to the Japanese official sector are already sizeable relative to their equity. As the basis widened, BIS reporting banks, especially big US, French and UK banks, increased their claims on the Japanese official sector from about $200 billion in Q4 2014 to $323 billion at the end of 2015, no doubt in part reflecting their arbitrage activities (Graph 6, left-hand panel). At the end of the period, their exposure to the Japanese official sector, including both the central bank and the government, represented 10–19% of their equity. The widening of the yen/dollar basis following Standard & Poor's downgrade of Japan in 2015 highlights the role of internal limits on these exposures as a factor constraining arbitrage (see also Box C).

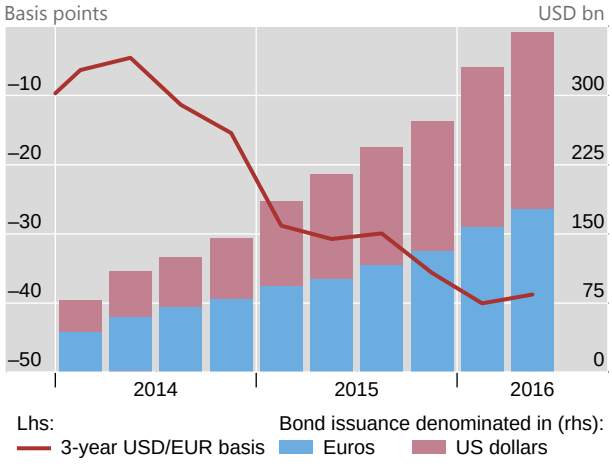
Finally, in less direct ways, developments in related markets can impede arbitrage activities. Markets for interest rate swaps are one such example. Top-rated European supranationals and agencies have relied on their funding cost advantage to arbitrage the basis by issuing bonds in US dollars and swapping the proceeds back into euros, thus collecting the currency basis (Box A and Du et al (2016)). This activity is reflected in the rising share of US dollar bond liabilities of major euro area supranational agencies compared with their home currency (ie euro) bond liabilities (Graph 6, right-hand panel). However, such "issuance arbitrage" slowed when the interest rate swap rate fell below the US Treasury yield in Q3 2015. Since such supranationals have to issue at rates above US Treasury yields, this inversion of US dollar interest rate swap

CIP arbitrage by banks in USD/JPY and by supranational bond issuers in USD/EUR Graph 6

Foreign bank claims on the Japanese official sector[1] and JPY/USD basis



European supranationals'[2] cumulative issuance in euros and US dollars and EUR/USD basis



[1] Non-Japanese banks' consolidated claims on an ultimate risk basis, including yen claims booked in Japan, on the official sector, which includes the Ministry of Finance and the Bank of Japan. There was a series break in Q1 2009, when two US securities firms started to report as bank holding companies. [2] European supranational and agency issuers include CADES, the EIB, Eurofima, the KfW and OKB.

Sources: Bloomberg; European Investment Bank (EIB); BIS international banking statistics and debt securities statistics; BIS calculations.

spreads sharply increased their costs of placing a 7- to 10-year bond in US dollars and swapping it into euros.[23]

Regression results

We next test for the presence of a link between hedging demand and the basis as well as the role of arbitrage constraints econometrically. Specifically, we add our quantitative indicator of aggregate hedging demand to standard specifications of the basis.[24] Our results provide evidence for such a link.

The standard specification for the three-month basis – the tenor on which most of the empirical work has focused – is shown in the first row of Table 1. The size of the basis is considered to be a function of counterparty risk (Libor-OIS spread), funding liquidity (repo spreads) and market liquidity (currency market bid-ask spreads). This is in the spirit of, for instance, Mancini-Griffoli and Ranaldo (2012) and Pinnington and Shamloo (2016). The specification performs reasonably well: the coefficients of the explanatory variables are all economically and statistically significant.

Once we add the quantitative indicator of hedging demand, the performance clearly improves (Table 1, second row). The indicator is added on its own and interacted with the Libor-OIS spread, as derived formally in Sushko et al (2016). In particular, the interaction of money market strains and hedging demand pressures

[23] At the end of 2013, major euro area supranationals had $660 billion equivalent in euro bonds outstanding, but only $355 billion in dollar bonds. In the following six quarters, they issued $192 billion in dollar bonds and only $178 billion in euro bonds, pointing to a shift of over $10 billion per quarter from euro to dollar.

[24] For a much more extensive analysis, see Sushko et al (2016).

Regression analysis of the JPY/USD basis, December 2007–December 2015 Table 1

Dependent variable	Libor-OIS (a)	**Demand (b)**	**Interaction (c) = (a) x (b)**	Repo spread difference (d)	FX bid-ask (e)	Constant	Obser-vations	R^2
Three-month	–113.62***			–29.30*	2.16***	–19.42***	72	0.679
	(27.00)			(17.10)	(0.74)	(2.54)		
Three-month	0.06	–1.53	**–44.48*** **	–44.70***	2.07***	–15.49***	67	0.794
	(33.90)	(1.16)	**(13.3)**	(13.60)	(0.52)	(2.3)		
Two-year	–16.23***	**–0.91****		–26.11***	–0.17	–0.25	67	0.506
	(4.30)	**(0.39)**		(6.00)	(0.23)	(0.76)		
Two-year	–10.02	**–0.88****	–2.42	–26.67***	–0.14	–0.14	67	0.509
	(13.10)	**(0.38)**	(4.80)	(5.98)	(0.23)	(0.81)		

Robust standard errors in parentheses; ***/**/* denotes significance at the 1/5/10% level. Unit root test (ADF) rejects the null in levels for three-month, which is regressed in levels; unit root test fails to reject null in levels for two-year, which is regressed in first differences. AR(1) not significant.

Source: Sushko et al (2016).

(column (c), in bold) matters and money market strains alone (column (a)) now no longer exert a significant impact. The coefficient on the interaction term suggests that a 1% rise in the Libor-OIS spread combined with 1% higher demand for forward hedges is associated with a 45 basis point wider basis. This result indicates that higher demand for hedges works together with the market dislocations identified in previous research to drive the basis.

Furthermore, for the two-year basis swap, the pressure of hedging demand has a direct (linear) effect on the basis (Table 1, third row, in bold), while the interaction term is no longer significant (fourth row). In particular, the estimated coefficient of –0.913 indicates that 1% higher demand for currency hedges translates into roughly a 1 basis point wider basis. This points to the cost of long-term cross-currency swaps being a more direct barometer of the imbalances in cross-currency flows hedged for currency risk, whereas the cost of short-term FX swaps is much more sensitive to risk premia and bank funding strains, particularly during crisis episodes (Graph 1).

Overall, the econometric evidence indicates that, while generally ignored, hedging demand played a role *even before* the widening of the basis from 2014, when market tensions were subdued. No doubt, heightened counterparty risks did influence the basis in 2008–09 and again in 2011–12. But the demand for dollar hedging has been at work throughout.[25] And it has continued to play a significant role since.

Conclusions

We have argued that the puzzling systematic and persistent violation of CIP since the GFC reflects the combination of FX hedging demand and limits to arbitrage arising from lower balance sheet capacity, in turn due to tighter management of risks and

[25] See Sushko et al (2016) for broader results, including panel evidence that extends the key results beyond the yen/dollar basis using exclusively the banks' position, for which consistent data are available.

associated balance sheet constraints. This explanation suggests that, even at the height of market tensions, hedging demand played an important, but underappreciated, role. We use BIS banking and debt securities statistics in combination with national data to construct estimates of currency hedging demand for select major currencies against the US dollar. We find that quantity-based indicators of hedging demand track the variation in the basis both across currencies at a given point in time and, in the case of the dollar/yen basis, over time.

Importantly, our analysis has been largely confined to the *proximate* determinants of the basis, as we have not looked much into the factors driving currency hedging demand in the first place. We have mainly limited ourselves to documenting the possible importance of extraordinary monetary accommodation by the Bank of Japan and the ECB in widening the basis around policy announcements.

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Foreign exchange market intervention in EMEs: what has changed?[1]

Since the Great Financial Crisis, emerging market economies have been more active in FX markets. As rising dollar debt and increased exposure to global financing flows have affected the demand and supply of foreign currency, financial stability has become an increasingly important motive for interventions. Adjustments in intervention tactics and instruments are consistent with a greater importance of financial stability considerations. Timely interventions can be effective in improving FX market liquidity, and there are credibility gains from holding foreign reserve buffers in countries with low credit ratings. Since the carrying costs of holding reserves have increased, countries with higher credit ratings may have incentives to reduce the size of reserve buffers.

JEL classification: E44, F30, F40, G10.

In the aftermath of the Great Financial Crisis (GFC), emerging market economies (EMEs) have experienced large shifts in FX market conditions. A period of sustained capital inflows and high commodity revenues between 2009 and 2013 resulted in appreciation pressure for many EME currencies. Since then, many countries have confronted strong depreciations of their domestic currencies against the backdrop of falling commodity prices, weaker domestic growth and tightening global liquidity conditions.

Many EME central banks have adjusted their FX market operations to the evolving market and policy backdrop. Large and rapidly shifting capital flows and widening currency mismatches seem to have added weight to policies aimed at containing exchange rate volatility and providing the private sector with insurance against exchange rate risks. Changes in the depth and functioning of FX markets have also led to adjustments in intervention methods and tactics. And, in some cases, FX intervention has been complemented by more active use of other instruments to manage capital flows – including reserve requirements as well as more traditional capital controls.

This special feature discusses how EMEs have adapted FX market operations in the light of these challenges. It argues that financial stability has become a more important motive for FX intervention, and that this has influenced the choice of instruments and intervention tactics. The boundary between FX intervention policy (which is aimed at influencing the exchange rate) and other aspects of central banks'

[1] The authors thank Claudio Borio, Ben Cohen, Angelo Duarte, Robert McCauley, Hyun Song Shin and Christian Upper for comments. Research assistance from Tania Romero, Julieta Contreras and Diego Urbina is acknowledged.

FX market operations (which aim at influencing market liquidity conditions more broadly) has often become blurred.[2] Moreover, a more prominent role for financial stability considerations has affected assessments of the effectiveness of FX intervention policy.

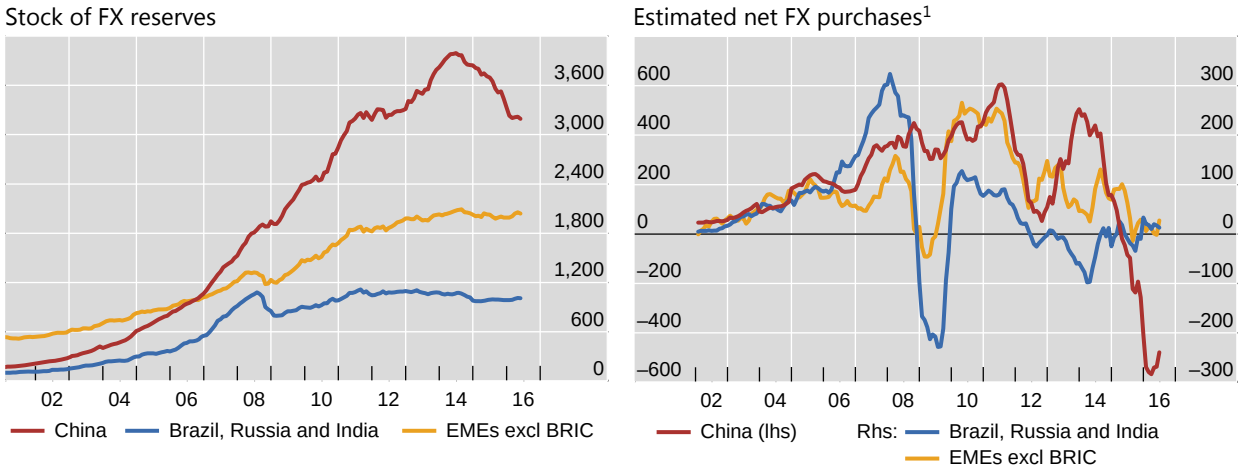
The next section provides some stylised facts on changes in intervention patterns since the GFC. The third section discusses how increasing foreign currency exposures and exchange rate volatility have affected the motives and goals of FX market intervention. The fourth section explores changes in central banks' intervention methods and tactics. The fifth section considers recent evidence on the effectiveness of intervention and changes in the costs of holding FX reserves as buffers. The conclusion sums up.

FX reserve changes and intervention patterns

The aftermath of the GFC has seen large changes in EMEs' FX reserves. Between 2009 and 2014, FX reserves rose from $4 trillion to $7 trillion (Graph 1, left-hand panel). Since then, they have declined by $900 billion. However, these changes in reported FX reserves may overstate the size of FX intervention because they include valuation effects.

Foreign reserves and estimated net FX purchases

In billions of US dollars — Graph 1



[1] Twelve-month moving sums. Based on actual intervention data whenever available; otherwise based on reserve variation net of valuation effects. Valuation gains and losses were computed based on the average currency composition for EMEs.

Sources: IMF, *Data Template on International Reserves and Foreign Currency Liquidity* and *International Financial Statistics*; national data; authors' calculations.

[2] Hence, in this article we consider all FX market or related operations of the central bank that could affect the exchange rate, even if this is not the primary objective. We use the terms FX market operations and FX intervention interchangeably.

Better estimates of intervention can be obtained by taking into account foreign reserve composition.[3] Such adjusted estimates indicate that in the past two years, valuation effects accounted for about half of the reported changes in aggregate FX reserves. Following a period of steady purchases in the run-up to the GFC, and large sales at the peak of the crisis, FX purchases resumed during 2010–11. Since 2013, major EMEs have on balance sold FX reserves, with China's sales since late 2015 standing out (Graph 1, right-hand panel).

Many countries seem to have become more active in FX markets since the GFC. Judging from the volatility of FX positions, this appears to be particularly the case for central banks in Asia and Latin America. As the first two columns of Table 1 show, the variation of reserve holdings (adjusted for valuation effects) has doubled since the crisis for Asian EMEs, and more than tripled for those in Latin America.

Increased intervention activity has coincided with higher exchange rate variability (Table 1, fifth and sixth columns). This suggests that authorities have intervened more in the face of greater exchange rate movements, without, however, eliminating fluctuations. At the same time, policy rate variability has decreased since the crisis in EMEs (last two columns). This is partly because global interest rates in core economies have approached their lower bound, compressing yields in other regions.

Central banks have also implemented FX or related derivatives transactions, which suggests that valuation-adjusted FX reserve changes may underestimate intervention activity. For example, the combined net long forward position of seven East Asian countries (aggregate of the net positions of Hong Kong SAR, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand) increased from just $22 billion in April 2009 to $235 billion in mid-2011. Since then, it has gradually

Variability of FX reserves, exchange rates and interest rates[1]

Coefficients of variation — Table 1

	FX reserves				Exchange rate		Interest rate	
	Adjusted stock[2]		Total stock					
	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
EMEs	0.116	0.255	0.094	0.184	0.060	0.119	0.251	0.177
Latin America	0.078	0.330	0.090	0.279	0.119	0.152	0.292	0.168
Emerging Asia	0.123	0.255	0.094	0.169	0.049	0.053	0.150	0.140
Other EMEs	0.161	0.188	0.165	0.147	0.069	0.199	0.261	0.243
Memo: Advanced SOEs[3]	*0.079*	*0.220*	*0.071*	*0.171*	*0.067*	*0.100*	*0.476*	*0.233*

[1] Median coefficients of variation of the variables shown for each region, where the average in the denominator is taken over both periods together. Exchange rate vis-à-vis the US dollar. Pre-crisis period = January 2003–June 2007; post-crisis period = April 2009–March 2016; monthly data. [2] After netting out currency valuation and estimated interest income gains, and including variation of net forward positions. Actual FX intervention amounts used when available. [3] Advanced small open economies (SOEs): Australia, Canada, Denmark, New Zealand, Norway, Sweden and Switzerland.

Sources: IMF, *Data Template on International Reserves and Foreign Currency Liquidity*; national sources; authors' calculations.

[3] The valuation adjustment considers changes in the exchange rates of global reserve currencies, and the average FX reserve composition for EMEs (based on the IMF Currency Composition of Official Foreign Exchange Reserves (COFER) database). We assume that the share in each currency is remunerated at the respective Libor rate.

declined, reaching $68 billion last February. In Latin America and other EMEs, FX derivatives and related instruments have also been used by authorities. However, in many cases these instruments are not readily comparable to spot market transactions: in Asia, some central banks seem to have used FX swaps for sterilisation purposes and a few central banks have used non-deliverable instruments, which do not involve actual exchange of FX (see discussion below).[4]

Financial stability and FX intervention

Central banks intervene in FX markets for various reasons: to control inflation, maintain competitiveness, support financial stability and build FX reserves for precautionary reasons (see Moreno (2005) for a review). These motives – which are not mutually exclusive – depend not only on countries' choice of monetary regime but also on their exposure to external developments, their aggregate balance sheet positions and macroeconomic circumstances.

The underlying reasons for FX intervention – maintaining macroeconomic and financial stability – have not changed fundamentally. However, a recent BIS survey (Mohanty and Berger (2013)) shows that a growing number of EME central banks have placed more emphasis on capital flow and exchange rate volatility. This indicates that greater weight may have been put on financial stability considerations. Indeed, the central banks of Hungary, Indonesia, Russia, South Africa and Turkey have stated that they engage in intervention with the aim of ensuring financial stability.[5]

Post-crisis trends in financial markets…

Since the GFC, two developments in particular may have increased the importance of financial stability considerations as a motive for FX market intervention.

One is the rapid growth of EME foreign currency debt. Borrowing in foreign currency, especially in US dollars, has risen at a rapid pace post-crisis. In particular, US dollar-denominated debt of EME non-bank borrowers has surged. At the end of 2015, it stood at $3.3 trillion (Graph 2, left-hand panel). Total FX debt now stands at 40% of GDP in emerging Asia and non-euro area European countries, and 25% in Latin America.

In many cases, rising foreign currency debt has not been matched with FX assets and revenues, and currency mismatches have therefore increased, especially on corporate balance sheets (Chui et al (2016)). The ratio of EME dollar debt to exports rose from 30% in mid-2008 to 49% at the end of 2015 (Graph 2, centre panel). Dollar liabilities have also increased relative to the stock of official FX reserves, even though this variation was somewhat less pronounced (Graph 2, right-hand panel). As a consequence, the non-financial corporate sector in many EMEs has to manage larger FX risks.

[4] Moreover, FX intervention may have taken place through state-owned commercial banks, and this would not be reflected in reported FX numbers.

[5] See Alper et al (2013), Balogh et al (2013), Mminele (2013), Warjiyo (2013) and Central Bank of the Russian Federation (2015).

US dollar credit to EMEs[1] Graph 2

[1] Total credit (bank lending and debt securities) to the non-bank sector denominated in US dollars. EMEs refer to "developing economies" in the BIS statistical tables. [2] US dollar value of total exports of goods, 12-month moving sum.

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

A second, related trend is growth in the holdings of EME securities, in particular debt, by foreign institutional investors.[6] Global asset managers hold a significant part of the foreign currency debt issued by EME corporates since the financial crisis. In addition, foreigners are major investors in EME local currency bonds, typically sovereign debt. In March 2016, they held an average of 24% of EME local sovereign debt, but foreign holdings reached around 34% in Malaysia and Mexico, and close to 38% in Indonesia and Peru.[7]

While EME sovereigns have been less active than the private sector in issuing foreign currency debt, they have nevertheless become increasingly exposed to global financing flows. Large foreign holdings of domestic EME bonds mean the currency as well as domestic financing conditions (notably bond yields) tend to be more exposed to swings in foreign investors' behaviour.

… and their implications for FX operations

These trends affect the supply of and demand for foreign currency, and the potential approach to FX intervention, in two ways.

First, the demand for foreign currency for hedging purposes has increased. Domestic entities, especially corporates, run larger FX exposures due to the issuance of foreign currency debt (Chui et al (2016)). Similarly, foreign investors may want to hedge the FX risk they face from holding EME domestic currency bonds. Both cases result in higher demand for insurance against a depreciation of the domestic currency.[8] In this setting, an illiquid FX market, as reflected, for example, in very large

[6] According to the IMF's Coordinated Portfolio Investment Survey (CPIS), the share of debt securities of 30 EMEs in the portfolio of investors from major economies grew from 4.5% in 2007 to 9% in 2015.

[7] Based on information for 16 EMEs from the Institute of International Finance (IIF).

[8] In line with this, some financial market analysts have indicated that foreign investors that invest in illiquid EME bond markets take long positions in FX derivatives as a proxy hedge against liquidity risk. This in effect transmits volatility from the fixed income market to the FX market.

bid-ask spreads, can imply large costs for the financial and non-financial sectors. If such costs are sufficiently high, investors may find it hard to close their positions, exposing them to losses and possibly posing systemic risks. These effects may be larger the more the economy is internationally integrated.

Second, there is a greater risk that booms and busts in capital flows will cause large shifts in exchange rates. Capital flows have grown in size, and have become more dependent on the risk perceptions of international investors and global liquidity conditions more generally. The risk-taking channel of the exchange rate may add an amplifier (Bruno and Shin (2015) and Hofmann et al (2016)): a depreciation of the local currency against the funding currency tightens the value-at-risk (VaR) constraints of global banks that supply credit to EMEs. A depreciation could therefore imply an undesired tightening of domestic financial conditions, which would hit asset prices and amplify losses faced by domestic agents that are indebted in foreign currency.

Under these conditions, central banks have incentives to build up their stocks of FX reserves. On the one hand, they can then deploy these reserves to meet the increased demand for foreign currency hedges. Central banks could intervene as needed in order to keep the short-term costs of liquidity insurance in check, preserve market functioning and also help investors needing to close positions in an EME currency to do so in a timely and cost-effective manner. This would include intervening on a larger scale during times of market stress.

On the other hand, sizeable FX reserve buffers can also help to protect the financial system from fluctuations in risk aversion in international markets by signalling the capacity to respond to FX funding stress.

The accumulation of reserves for these purposes raises issues. One is the trade-off between the advantages of building a large stock of FX reserves and the fact that such larger reserves may encourage risky position-taking. Another is that deploying foreign reserves to meet liquidity needs and mitigate the effects of sudden shifts in investor risk aversion may impair the credibility of the foreign reserve buffer and weaken investor confidence.

Instruments and tactics

The central bank's objectives in FX intervention have implications for the methods, tactics and instruments it uses in carrying out that policy. In the light of the discussion above, three points stand out.

First, authorities have increasingly used FX derivatives or related instruments. This has allowed them to provide hedges against FX risk and influence FX market liquidity and the exchange rate while economising on the use of FX reserves and retaining foreign reserve buffers. Table 2 provides an overview of such instruments.

Central banks have provided hedges against FX risk in two ways. One has been to deliver foreign currency that allows central bank counterparties to close FX positions. Spot market interventions provide FX now, FX forwards at a pre-defined future point in time, and FX options during a certain, pre-specified period. By writing FX options, the central bank provides protection against large FX moves. FX repos and swaps supply FX for the duration of the repo or swap, providing a hedge against maturity mismatches in FX. For example, FX repos may have allowed firms to repay

Instruments used for FX intervention Table 2

Instrument	Mechanism	Effects			Examples
		Provide hedge for FX exposure	Support FX market liquidity	Economise on use of FX reserves	
FX spot transaction	Central bank sells FX spot	Yes	Yes	No	
FX swap or FX repo	Central bank sells FX spot and purchases FX forward	Yes, against market risk or FX maturity mismatch	Possibly	Yes; only temporary supply of FX	Korea (FX swap), Brazil and Russia (FX repo)
Currency forward (non-deliverable, settled in local currency)[1]	Central bank pays domestic currency related to change in FX value	Domestic currency payment offsetting FX valuation losses	Possibly, if FX demand declines	Yes; no foreign currency payment	Brazil, Peru
FX index certificate	Central bank pays domestic currency equivalent of change in FX value	Domestic currency payment offsetting FX valuation losses	Possibly, if FX demand declines	Yes; no foreign currency payment	Peru
FX options	Central bank sells options to buy FX from its reserves if local currency depreciation exceeds threshold	Yes	Yes; supplies liquidity when demand for FX increases	Yes, partly. FX reserves sold only when market initiates purchases (ie options are exercised)	Colombia

[1] Referred to as swap cambial (currency or FX swap) in Brazil.

Source: National authorities.

foreign currency debt now, assuming an obligation to deliver foreign currency to the central bank in the future.[9]

Moreover, and increasingly, central banks have also provided protection against changes in the value of FX positions by paying the equivalent in domestic currency. Hence, currency swaps or indexed certificates settled in domestic currency do not provide the foreign currency that may be required to settle claims but may reduce the demand for FX resulting from a desire to avoid valuation losses.[10]

Second, intervention in the FX spot market continues to be important. Graph 1 shows that monetary authorities have implemented large sales of foreign

[9] As noted earlier, East Asian central banks use FX swaps routinely as sterilisation instruments, in which, after purchasing FX in the spot market, the central bank implements an FX swap in which it sells the FX spot and purchases FX forward. Their use for this purpose would not be comparable to the use of FX swaps for purposes of intervention to dampen illiquidity in the FX market, in which the central bank sells foreign currency spot and purchases it forward. Central banks may use FX swaps as sterilisation instruments when they are short of domestic assets to sell to sterilise FX intervention, or if swaps are cheaper than issuing central bank bills. In some cases, legislation prohibits the issuance of central bank debt.

[10] While purchasing contracts that provide such hedges is financially equivalent to taking positions in foreign currency, the effects on the exchange rate of interventions via such derivatives are likely to depend on the fraction of foreign exchange demand that is driven by financial, rather than transactional, reasons (Kohlscheen and Andrade (2014)).

reserves.[11] FX spot sales may at times be particularly effective in mitigating FX illiquidity or dampening sharp depreciation pressures because FX trading is concentrated in spot markets and because of the signalling effect of spot market intervention.

Third, as regards intervention tactics, a number of central banks have made use of transparent and rule-based FX interventions. For instance, Chile and Colombia implemented foreign reserve accumulation programmes with preannounced daily purchase amounts over a fixed period of time. The amounts in principle could not be readily adjusted in response to changes in the exchange rate.[12] Such rule-based intervention can be used to signal that any change in foreign reserves will be limited and predictable and that there is not an explicit intention to target the exchange rate.[13]

Another approach has been to announce criteria that would have to be met for FX intervention to take place. For example, beginning in December 2014 the Foreign Exchange Commission of Mexico announced conditions under which the Bank of Mexico would intervene in the FX market, by implementing rule-based auctions in which it was to sell $200 million per day, in order to maintain the orderly functioning of the local FX market and provide it with liquidity if needed.

However, in the post-crisis market context, transparent rule-based FX intervention mechanisms may face challenges. In Mexico, the rule-based mechanism was discontinued in February 2016, against the backdrop of pressures on the exchange rate from the use of the Mexican peso to hedge positions in other EME currencies ("proxy hedging") and signs of speculation by FX traders against the rule-based mechanism. At the same time, the authorities left open the possibility of future discretionary intervention.

The Mexican experience may also raise broader questions about the balance between rules and discretion. With the spread of electronic trading – which in 2015 accounted for about two thirds of FX cash market turnover, compared with less than half pre-crisis – the effectiveness of interventions seeking to influence the exchange rate level or dampen exchange rate volatility may increasingly depend on the central bank being able to surprise markets.[14]

[11] Central bank surveys both pre- and post-crisis confirm that many central banks intervene in the spot market (Canales-Kriljenko (2003), Mihaljek (2005) and Mohanty and Berger (2013)).

[12] However, central banks have sometimes discontinued foreign reserve accumulation programmes when depreciation pressures on the currency arose (eg Chile in 2008 and Colombia in 2014).

[13] In line with this, evidence indicates that these programmes affected the exchange rate upon announcement, but not when the operations were implemented (Fuentes et al (2013)).

[14] The issue of transparency in FX intervention has been the subject of much debate. Many authors have argued that central banks should conduct secret intervention so as to maximise the impact on the exchange rate (Dominguez and Frankel (1993), Neely (2005), Sarno and Taylor (2001)). Some central banks prefer secrecy to transparency, for instance when intervention may be perceived as being inconsistent with monetary policy goals. Others have argued that transparent intervention is preferable because it increases the power of the signalling and coordination channels, thereby enhancing the efficacy of intervention (Archer (2005)).

Effectiveness and costs of FX market operations

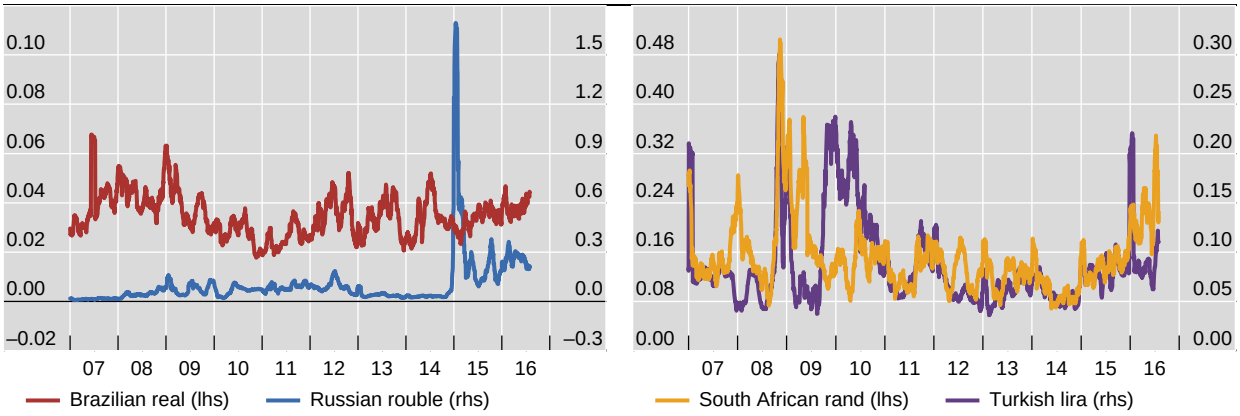
The effectiveness of FX intervention with respect to different objectives is the subject of a large body of research (see eg Galati and Disyatat (2005) and BIS (2013) for overviews). This section explores how effective FX interventions since the GFC may have been in pursuing the goals that are the focus of this paper: has intervention supported market liquidity and relieved short-term pressures that may disrupt market functioning? And have foreign reserve buffers helped to protect countries against sudden shifts in global market conditions?

FX intervention and liquidity

Timely interventions to ease FX market liquidity can be particularly effective when liquidity shortages are associated with amplifying effects, such as short covering of FX positions when the domestic currency is depreciating. Spikes in market illiquidity can trigger such feedback loops. Indeed, Graph 3, which shows the evolution of an FX market illiquidity index for four EMEs,[15] does point to sudden spikes or episodes of FX market illiquidity.[16] In some cases, episodes of illiquidity are confined to a specific currency. In other cases, the spikes reflect global factors, such as fluctuations in the US dollar[17] or global investor risk tolerance or risk perceptions.

FX market illiquidity for selected currencies

Twenty-two-day moving averages of FX illiquidity measure[1] Graph 3



[1] Illiquidity measures computed following the methodology described by Karnaukh et al (2015). Data up to 29 July 2016.

Sources: Karnaukh et al (2015); Bloomberg; Datastream; authors' calculations.

[15] The illiquidity index is computed following the methodology proposed by Karnaukh et al (2015). This illiquidity measure aggregates information on daily Bloomberg bid-ask quotes at 5 pm EST and a combination of high and low values over one day with high and low values over two days (this latter measure is based on Corwin and Schultz (2012), with information taken from Thomson Reuters). Karnaukh et al show that this daily indicator is highly correlated with an intraday indicator of FX market liquidity. The correlation has been attributed to the fact that the indicator aggregates from a larger set of information.

[16] Overall, looking at all EMEs, there is no clear long-term trend in FX market liquidity. For a recent model that relates FX market liquidity to exchange rate variations, see Gabaix and Maggiori (2015).

[17] Because of its role as the key funding currency, the global value of the US dollar can also be seen as a measure of risk (Shin (2016)). Credit flows to borrowers located outside the US increase whenever

US dollar sales increase FX market liquidity

Dependent variable: FX market illiquidity Table 3

	Brazilian real	Peruvian sol	Russian rouble	Turkish lira
USD sales	–0.536***	–0.634***	–0.146***	–0.324***
t-statistic	2.68	9.57	4.41	3.10
R^2 of first stage regression (reaction function)	0.010	0.236	0.128	0.022
Number of observations	1,342	1,533	649	1,128
Control variable	VIX			

This table shows the results of the regression $illiquidity_t = \alpha + intervention\ hat_t + \Delta vix_t + \varepsilon_t$, where $intervention\ hat_t$ is the predicted intervention (the instrumental variable for actual interventions). The prediction is based on the equation $intervention_t = \alpha + illiquidity_{t-1} + \Delta s_{t-1,t} + \Delta s_{t-22,t} + intervention_{t-1} + \varepsilon_t$, where $\Delta s_{t-1,t}$ and $\Delta s_{t-22,t}$ refer to local currency/USD exchange rate changes over the last day and over the last 22 days, respectively. Illiquidity measures computed following the methodology described by Karnaukh et al (2015). *t*-statistics are based on robust standard errors. The estimation is based on daily data from July 2009 to July 2016; the exact time span coverage may differ across countries. ***/**/* denotes results significant at the 1/5/10% level.

Source: Authors' calculations.

How have central bank net US dollar sales affected FX market illiquidity? To explore this question, we implement an empirical exercise based on complete FX market operations data for four EMEs at daily frequency. Our estimations are based on relatively long time series, which encompasses a continuous stretch of between 649 and 1,533 working days after the GFC, depending on the country in question.[18]

We deal with the potential endogeneity of interventions by using an instrumental variable method. Thus, actual interventions are replaced by predicted interventions, based on the estimates of a first-stage regression that is run over the entire sample period for each country.[19] The prediction regression considers previous day FX market illiquidity and intervention, as well as exchange rate depreciation during the previous day and over the last 22 working days. To estimate the impact of intervention on liquidity, in the second-stage regression we regress the illiquidity indicator on predicted intervention and market volatility.

The results suggest that FX intervention clearly has a significant and systematic impact on FX market liquidity (Table 3), as USD sales reduce the Karnaukh et al (2015) measure of market illiquidity in all four cases. The relative magnitude of the coefficients suggests that during our sample period a same-size USD sale has more significant effects on the market illiquidity measure in Peru than in Russia.[20]

Benefits and costs of FX reserve buffers

A larger foreign reserve buffer can affect a country's credibility, which has implications for the costs of external financing and the economy's resilience to external shocks. At

the dollar weakens. In other words, a strengthening US dollar tends to tighten funding liquidity conditions.

18 Based on data availability.

19 Intervention amounts refer to total USD sales, including through FX repos in the cases of Brazil and Russia.

20 The illiquidity measures have been standardised by de-meaning the series and dividing by the respective standard deviation.

the same time, there are costs to holding foreign reserves, including the cost of maintaining low-yielding assets on the public sector balance sheet.

To assess potential credibility effects of the foreign reserve buffer, we implement an empirical analysis that attempts to measure the impact of a given level of reserves on a country's sovereign risk premium, correcting for other relevant factors such as a country's growth rate and fiscal position (Table 4). More specifically, we implement a quantile regression on the determinants of risk premia (Koenker and Bassett (1978) and Koenker and Hallock (2001)). We study how the relative importance of key determinants of risk premia in EMEs (here proxied by the five-year sovereign CDS spread) increase as one moves from low-risk to high-risk country-year observations. As a proxy for the insurance provided through reserves, including against real shocks, we use the ratio of FX reserves to imports. Throughout, our control variables include

As market stress grows, so does the role of FX reserve buffers in containing risk

Dependent variable: sovereign risk premia in EMEs (five-year CDS spread) Table 4

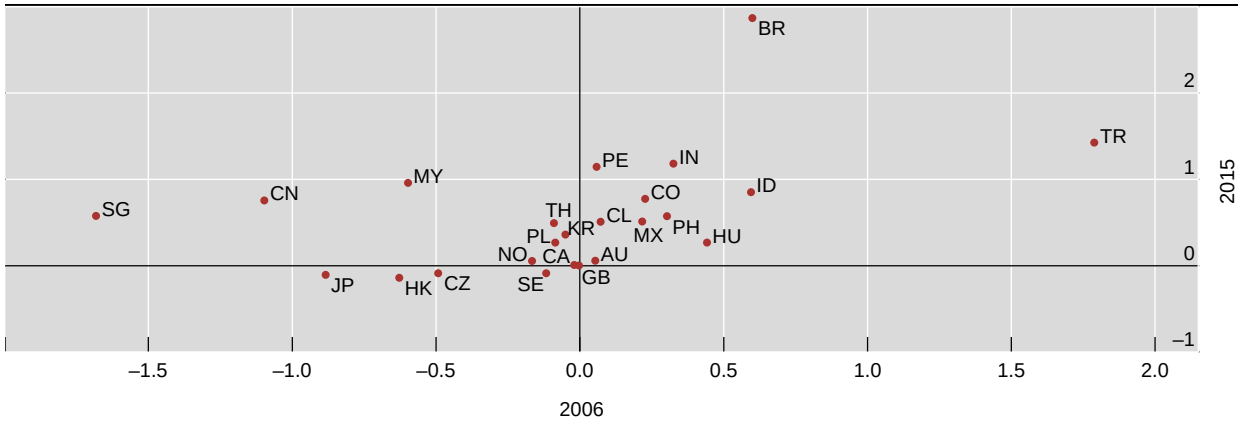
	Estimated at:				
	10th percentile (low CDS spread)	25th percentile	Median CDS spread	75th percentile	90th percentile (high CDS spread)
FX reserves/imports	–0.096	–0.286**	–0.464***	–0.702***	–1.016***
	(0.098)	(0.125)	(0.159)	(0.305)	(0.370)
CPI inflation	0.041***	0.063***	0.072***	0.097***	0.108***
	(0.010)	(0.011)	(0.014)	(0.018)	(0.022)
Fiscal balance/GDP	–0.051***	–0.057***	–0.071***	–0.118***	–0.161***
	(0.010)	(0.012)	(0.014)	(0.017)	(0.030)
Debt service/GDP	0.148***	0.138***	0.185***	0.292***	0.300***
	(0.019)	(0.025)	(0.038)	(0.048)	(0.083)
GDP growth	–0.032***	–0.030***	–0.029***	–0.042***	–0.041***
	(0.008)	(0.009)	(0.009)	(0.013)	(0.019)
Exchange rate appreciation	–0.019***	–0.020***	–0.021***	–0.025***	–0.049***
	(0.005)	(0.005)	(0.004)	(0.008)	(0.015)
US interest rate	–0.138***	–0.148***	–0.149***	–0.143***	–0.112**
	(0.015)	(0.017)	(0.021)	(0.030)	(0.048)
VIX	0.021***	0.025***	0.032***	0.036***	0.074***
	(0.216)	(0.300)	(0.326)	(0.582)	(1.581)
Estimation method	Quantile regression				
Country fixed effects	Yes				
Number of observations	945				
Pseudo R^2	0.438	0.434	0.425	0.424	0.500

The sample covers Q1 2000–Q4 2015; quarterly data. All explanatory variables are lagged. ***/**/* denotes results significant at the 1/5/10% level. Standard errors, in parentheses, obtained via bootstrapping. Countries covered are Brazil, Chile, China, Colombia, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Singapore, Thailand, Turkey and South Africa.

Source: Authors' calculations.

Interest rate differentials[1] have increased, raising the cost of holding FX reserves

Cost of FX holdings, as a percentage of GDP — Graph 4



AU = Australia; BR = Brazil; CA = Canada; CL = Chile; CN = China; CO = Colombia; CZ = Czech Republic; GB = United Kingdom; HK = Hong Kong SAR; HU = Hungary; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MX = Mexico; MY = Malaysia; NO = Norway; PE = Peru; PH = Philippines; PL = Poland; SE = Sweden; SG = Singapore; TH = Thailand; TR = Turkey.

[1] FX reserves multiplied by interest rate differentials. Interest rate differentials are calculated as the difference between the one-year US Treasury bill yield and the closest comparable domestic yield.

Sources: IMF, *Data Template on International Reserves and Foreign Currency Liquidity* and *International Financial Statistics*; Bloomberg; Datastream.

measures of inflation, the government budget position and a proxy for the aggregate debt service burden of the respective economy.[21]

While the size of the reserve buffer does not affect risk perceptions for countries at the low end of the sovereign risk spectrum, reserve holdings do reduce risk premia when risk levels are already high. A given reduction in FX reserves increases sovereign risk premia by more than twice as much at the 90th risk percentile than at the 50th percentile, and about 3.5 times as much as at the 25th percentile (Table 3, first row). In other words, market participants appear to attach increasing weight to buffer sizes as underlying risk grows.

One potential explanation for the above is that when financial stress is more likely, liquidity buffers could signal more capability to react and limit the effects of adverse shocks. This interpretation is corroborated by detailed studies such as that of Aizenman et al (2013), who find that international reserve buffers are the key mitigating factors of the most adverse effects of abrupt financial contractions.[22] That said, for many countries with lower risk premia the overall effect of FX reserve buffers on risk premia seems limited.

For a number of countries, the benefit of maintaining a foreign reserve buffer may be at least partly offset by the costs of holding foreign reserves. Graph 4 compares estimated quasi-fiscal costs of holding foreign reserves in 2006 and 2015 scaled by GDP. Carrying costs have increased for most countries in the scatter plot

[21] This is based on the product of the interest rate and the total (public and private) debt-to-GDP ratio. We also control for growth and exchange rate variation over the last quarter, as well as changes in the US monetary policy interest rate and in the VIX. All explanatory variables are lagged.

[22] Also, Jeanne (2016) shows that FX reserves could be welfare-enhancing when global banks face VaR constraints, as they could potentially stabilise the price of liabilities during the downturn.

(ie the relevant dots are above and to the left of the 45 degree line).[23] A number of countries had negative interest rate differentials and therefore negative carrying costs in 2006, but in most cases these had turned positive by 2015.

Conclusion

Central banks have been very active in FX spot and related derivatives markets since the GFC. Financial stability considerations appear to have been an important motive. In particular, central banks have sought to dampen the impact of capital flows and shifts in global liquidity conditions on the domestic economy. Supporting FX market functioning and liquidity seems to have been one specific goal. The build-up of FX reserve buffers seems to have been another, as indicated by the implementation of dedicated reserve accumulation programmes.

The empirical analysis reported in this article indicates that FX intervention can be effective in improving liquidity in the FX market. At the same time, the costs of running down foreign reserve buffers in terms of higher sovereign risk premia appear to be small, especially for countries that already enjoy strong credit ratings. Furthermore, the carrying costs of foreign reserves have risen in many countries since the GFC.

Against this backdrop, the greater weight of financial stability considerations may have made trade-offs related to FX intervention policies more complex. One issue is to weigh the benefits of maintaining large FX reserve buffers in terms of greater credibility of FX intervention policies, and possibly lower risk premia, against higher carrying costs of reserves and the opportunity cost of not using reserves (in terms of higher FX volatility).

Perhaps reflecting these trade-offs, central banks have implemented FX intervention or related operations in a way that suggests a desire to economise on the use of foreign reserves. Some have made more use of FX derivative and related markets. Others have selected instruments in which sales of FX are eventually reversed, or have supplied hedges against exchange rate movements that reduce the demand for foreign currency but do not actually involve central bank drawdowns of foreign reserves. They also have in some cases adopted rule-based FX intervention that signals that any changes in foreign reserves would be predictable and limited.

[23] One mitigating factor that tends to diminish carrying costs is if interest rate differentials reflect future depreciations, so that there are currency valuation gains.

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Domestic financial markets and offshore bond financing[1]

Firms in emerging market economies markedly increased their issuance of bonds in offshore markets after the Great Financial Crisis. By contrast, increases in offshore bond issuance by firms in advanced economies were more muted. An empirical analysis suggests that the less developed state of financial markets in emerging economies may have encouraged firms there to step up their offshore bond issuance as external financing costs fell. Firms appear to use the proceeds of offshore bonds to boost their holdings of short-term assets. This may raise financial stability concerns.

JEL classification: F23, F36, G15.

Firms from emerging market economies (EMEs) considerably stepped up their issuance of bonds in offshore bond markets after the Great Financial Crisis (GFC) of 2007–09. Taking advantage of easy external financing conditions and investor appetite for higher yields, many EME firms raised funds through bond issues outside their jurisdictions (McCauley et al (2015a)).

We examine whether limits to borrowing in domestic financial markets distorted firms' borrowing decisions, contributing to this surge in EME offshore bond issuance. We conduct the analysis by comparing EM bond issuers to firms located in small advanced economies. This analysis is carried out using a data set that matches bond- and firm-level data (aggregated by industry in part of our analysis), covering companies headquartered in 41 jurisdictions.

We find that limited financing opportunities in their domestic markets played an important role in inducing EME firms to raise funds overseas. We also show that firms use offshore bond proceeds to increase their holdings of short-term assets. This may raise financial stability concerns, for example by increasing the procyclicality of financing in the domestic financial sector.

The rest of the feature is organised as follows. The first section describes the characteristics of firms borrowing in offshore bond markets. The second section presents the empirical analysis. The third section concludes.

[1] The views expressed here are those of the authors and do not necessarily reflect those of the BIS. We are grateful to Claudio Borio, Dietrich Domanski, Torsten Ehlers, Branimir Gruić, Hyun Song Shin and Christian Upper for helpful comments and suggestions, and to Julieta Contreras and Tania Romero for excellent research support.

Characteristics of firms borrowing in offshore bond markets

Tracking firm-level financing in offshore bond markets

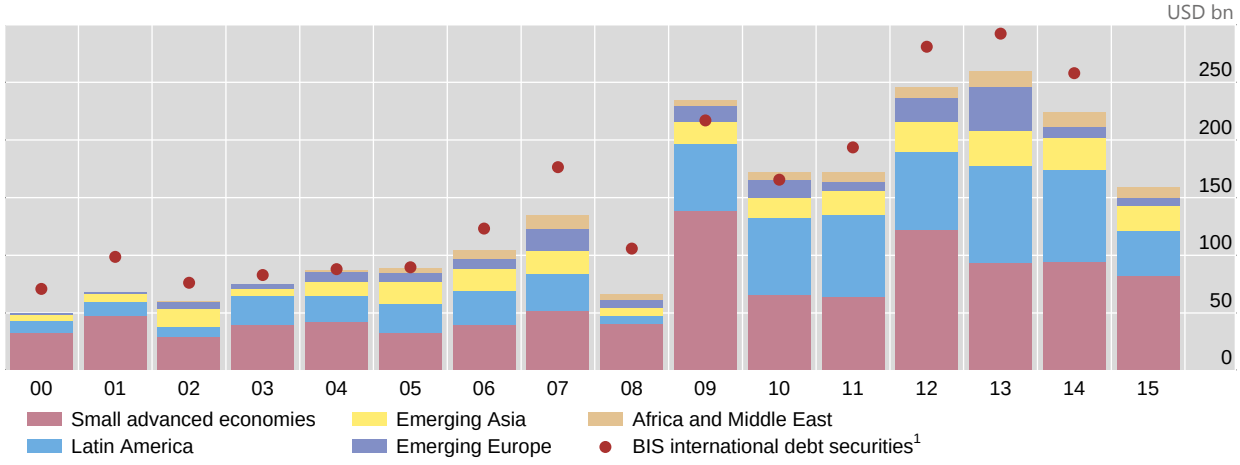
Our firm-level data set comprises bonds issued or guaranteed by firms headquartered in one of 34 emerging economies or seven small advanced economies and marketed outside their jurisdictions.[2] The data set covers the period 2000–15. The Annex provides further details.

We identify offshore bonds as those issued in a primary market outside the home country of the entity guaranteeing the bond. From the perspective of the economies covered, the major offshore markets are those of the European Union (Eurobonds) and the United States (yankee bonds). These two locations account for the bulk of international bond market activity.[3] Transactions are mostly in dollars and euros, which respectively represent 70% and 19% of the total amount in the sample; the proportion raised in local currency is 6%.[4]

By using this criterion we track firms' financing at a consolidated level. Our approach is broadly in line with that used in compiling the BIS international debt securities statistics, by nationality, according to the ultimate borrower sector. Bonds

Geographic distribution of firms active in offshore bond markets

Total bond issuance by region of headquarters — Graph 1



[1] Gross bond issuance by non-financial corporations (ultimate borrower sector), by nationality.

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

[2] Similar matched firm-bond-level data have been used to investigate the use of bond proceeds to hoard cash (Bruno and Shin (2015)) or the choice of primary market of issuance (Fuertes and Serena (2016)).

[3] Firms also issue global bonds, which are fully fungible securities issued simultaneously in two or more markets (for instance, yankee and Eurobond). Other primary bond markets are less popular, but do attract some firms: samurais, kangaroos and kiwis, for example, refer to bonds issued by foreign firms in the Japanese, Australian and New Zealand markets, respectively.

[4] The dollar is dominant in both the US and the EU markets, where it accounts for 91% and 51% of the total, respectively. The latter proportion rises to 74% in the case of issuances by emerging economy firms, and falls to 20% for the advanced economy companies in our sample.

issued by affiliates incorporated overseas are consolidated with the liabilities of the parent company, as long as the affiliates are not independent companies. They are thus classified according to the sector and country of the parent company. This overcomes a common limitation of other studies that focus on the immediate borrower, using a residence or balance of payments concept, which misses the relevance of the parent's nationality and sector. However, our measure differs from some previous approaches because we treat as standalone firms those that issue bonds without the explicit guarantee of their parent companies. Other measures group such bonds according to the parent company.

We use the primary market as the main criterion for determining whether a bond was issued offshore or onshore. While this is also the main criterion used to classify the market of issuance in the BIS international debt securities statistics, there are some methodological differences. Thus, we use the term "offshore issuance", consistent with research using similar data (Black and Munro (2010), Mizen et al (2012)).[5] See the Annex for a more detailed discussion.

Two important features of this data set are worth noting. First, the coverage of firms' offshore bond issuance is comprehensive, which allows us to highlight aggregate trends. In aggregate, the amount issued is similar in size to the totals reported by the BIS international debt securities statistics by nationality (Graph 1).[6] Second, since the data are compiled at the deal level, it provides the flexibility to carry out a sufficiently disaggregated analysis of industry- or firm-level financing patterns.

Table 1 summarises the offshore borrowing activity of firms in our data set. Some 2,300 companies have been active in offshore bond markets (compared with nearly 6,600 in local bond markets). Overall, these firms have issued a total of 7,200 bonds

Number of borrowing firms in onshore and offshore bond markets Table 1

	Number of firms[1]			Number of bonds issued		
	International issuers	Domestic issuers	Total	Offshore bonds	Local bonds	Total
Total	2,305	6,589	7,831	7,211	39,826	47,037
Small advanced economies	680	1,331	1,753	3,130	5,446	8,576
Latin America	380	1,103	1,324	1,431	3,802	5,233
Emerging Asia	956	2,941	3,316	2,057	27,372	29,429
Emerging Europe	225	1,097	1,275	440	2,642	3,082
Africa and Middle East	64	117	163	153	564	717

[1] See the Annex for the list of countries included in each region. Firms are classified as offshore (onshore) issuers if they have issued at least one bond outside (in) their local jurisdiction; the latter is defined by the headquarters of the company guaranteeing the bond (ie the local market of a US affiliate of a Brazilian firm is Brazil, except if issues debt without an explicit guarantee from its parent company; in this case it would be the United States). These groups are not mutually exclusive. The third column shows the total number of firms issuing bonds.

Sources: Bloomberg; authors' calculations.

[5] The term offshore issuance is sometimes used in a different sense: to refer to issuance by overseas affiliates.

[6] These differences can be explained by distinct coverage of data providers, or methodological differences, such as the treatment of standalone affiliates. For a more detailed discussion, see the Annex and Fuertes and Serena (2016).

outside their jurisdictions. Consistent with global trends, the majority of these placements are in the EU (the Eurobond market) or in the US market (yankee bonds).

Asia has the largest number of firms active in offshore bond markets (nearly 1,000), but the value of the debt issued by Latin American firms (USD 639 billion) overshadows that of debt issued by Asian ones (USD 273 billion). Most companies raise funds in foreign currency: only 14% have issued bonds in local currency.[7]

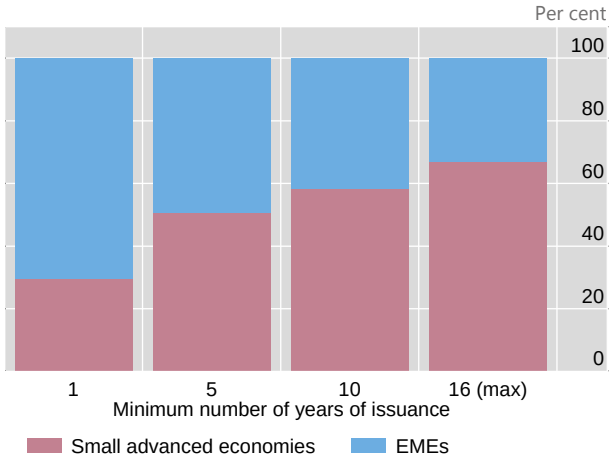
One quarter of the total number of companies are industrial, surpassing energy firms, which, however, account for the highest share of total proceeds (27% of the total, compared with 13% for industrial firms). Technology and health care firms borrow less frequently; these industries typically have high cash flow-to-fixed assets ratios and accordingly lower financing needs.

The increase in offshore bond issuance after the GFC was larger for EME firms, particularly those in Latin America and emerging Europe (Graph 1). In many EMEs, the growth of firms' bond financing in international markets has outpaced that of cross-border bank lending. In several jurisdictions, international bonds already constitute the bulk of foreign lending to the non-bank sector (McCauley et al (2015b)). However, offshore issuance by EME firms slowed from 2015 in the face of rising market uncertainty. In contrast, issuance by firms in small advanced economies has been more stable.

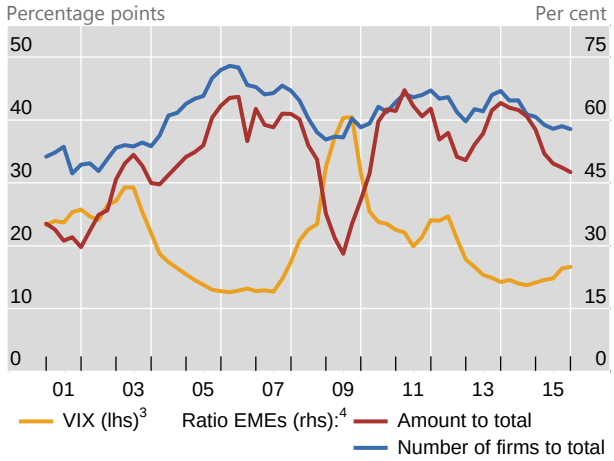
Less frequent and more volatile offshore bond market issuance by EME firms

Graph 2

Distribution of firms by frequency of issuance in offshore bond markets[1]



Bond issuance of EME firms and market volatility[2]



[1] Frequency of issuance in offshore bond markets of emerging market and advanced economy firms. The frequency is bound between 1 (if a firm issues in any one year) and 16 (if it issues in all years). By construction, the proportion of firms issuing in at least one year is the same as the one reported in Table 1, first column. [2] The red line shows, at every quarter, the fraction issued by EME firms relative to the total raised by the firms covered in the analysis; the blue line shows the ratio computed for the number of firms. All series are measured as four-quarter moving sums. [3] Chicago Board Options Exchange S&P 500 implied volatility index; standard deviation, in percentage points per annum. [4] EMEs as a percentage of all jurisdictions covered in the analysis.

Sources: Bloomberg; authors' calculations.

[7] The percentage is 36% for small advanced economies and is below 10% in most emerging economies. South Africa is a remarkable exception: 11 out of 33 firms active offshore have issued bonds in the local currency. Also, 46 out of 166 Brazilian companies issuing bonds offshore have issued in Brazilian reals.

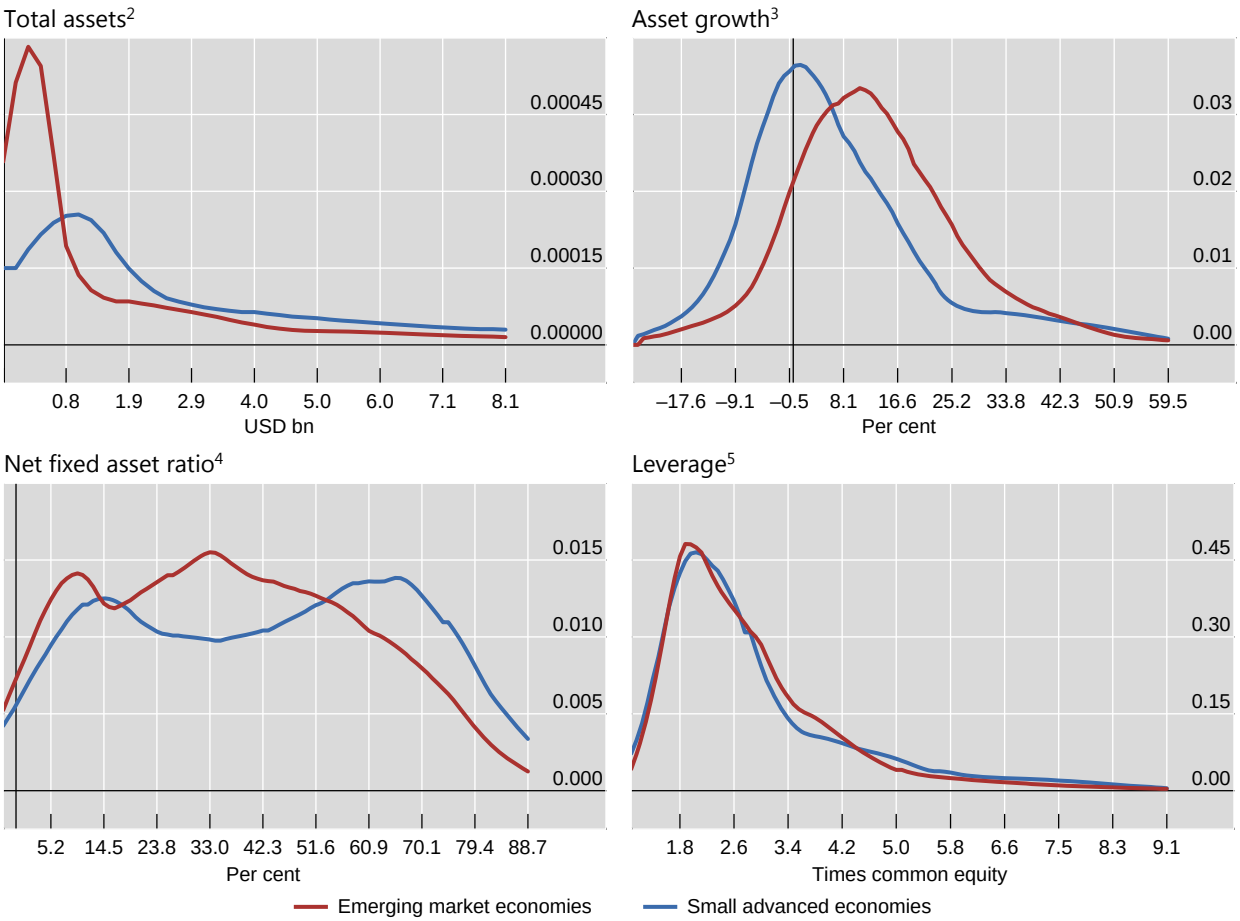
Within the universe of issuing firms, 49% of total debt is issued offshore and 51% onshore. Firms issuing only onshore account for 26% of total debt issued. Among such firms, industrial and utilities companies have a more prominent role than energy firms. As described, most bonds issued offshore are in foreign currency; bonds issued onshore are overwhelmingly denominated in domestic currency, with a negligible 3% of amount issued in foreign currency (mostly dollars).

EME firms issue less regularly in offshore bond markets

EME firms issue less frequently in offshore bond markets than do firms from our sample of small advanced economies. For 2000–15, EME firms account for 71% of issuers who issued in at least one year; however, they account for only 40% of issuers who issued in at least 10 of the 16 years (Graph 2, left-hand panel). Thus, there is a large number of infrequent issuers from EMEs, and these, on aggregate, account for

EME borrowers less well suited for arm's length finance[1]

Density — Graph 3



[1] Kernel densities estimated for firms issuing offshore bonds. The Annex lists the countries classified as emerging market economies (EMEs) and small advanced economies (AEs). For each firm, the last available value of each variable is used; when firms issue for several years in a row, the information for the most recent year is used. The kernel is estimated using an adaptive kernel density estimation – varying bandwidth – and the Epanechnikov function. In the top left-hand panel, observations are plotted only until the 95th percentile due to the long tail; the largest EME firms shown in Table 2 are thus not shown here. [2] Mean values are $6.9 billion (EMEs) and $13.8 billion (AEs). [3] Geometric mean of asset growth in the five years before bond issuance; mean values are 17% (EMEs) and 13% (AEs). [4] Net fixed assets to total assets; mean values are 36% (EMEs) and 44% (AEs). [5] Total assets to common equity; mean values are 3.9 (EMEs) and 5.9 (AEs).

Sources: Bloomberg; authors' calculations.

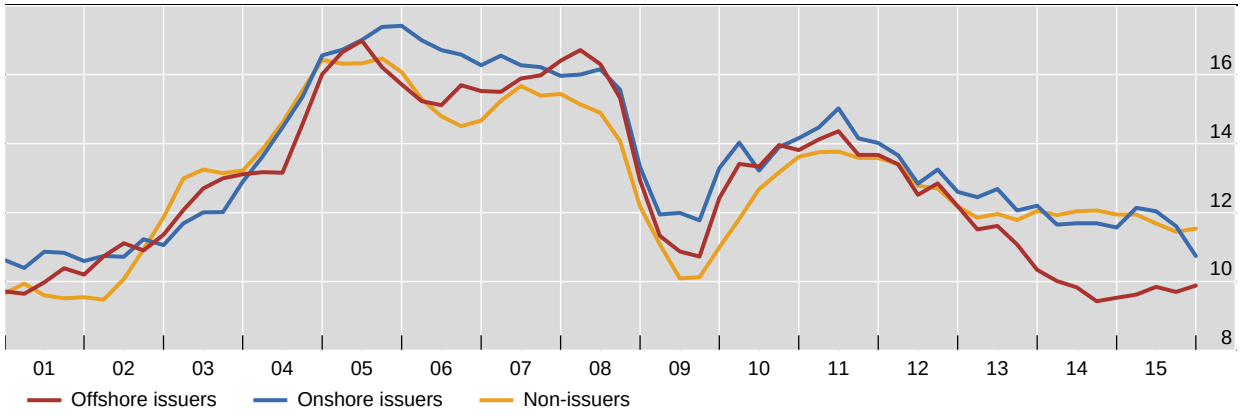
the bulk of the amount issued. The experienced issuers in our sample tend to come from the small advanced economies.

Issuance by EME firms is also more volatile. Graph 2 (right-hand panel) shows that issuance is correlated with shifts in market risk aversion, as measured by the VIX.[8] In particular, the graph illustrates the negative correlation between the VIX and aggregate offshore bond issuance. This correlation is twice as high for firms in EMEs than for other small open economies. The share of EME firms in the total number of firms issuing offshore bonds thus increases when the VIX is abnormally low and shrinks when the VIX rises. A similar, and even stronger, pattern is found for the amount issued. Investors appear to be less receptive to offshore EME issues when risk aversion is high.

One explanation for these patterns is that EME issuers are less well suited for arm's length finance through bond issuance, only tapping markets when external financing conditions are easy (ie borrowing is procyclical with respect to the financial cycle). In fact, compared with their counterparts in small advanced economies, firms headquartered in EMEs tend to have fewer assets (Graph 3, top left-hand panel),[9] faster recent growth (top right-hand panel) and a lower proportion of fixed to total assets (bottom left-hand panel). All this points to greater information asymmetries facing the EME issuers: it is harder for them to credibly demonstrate their economic value to investors, since a larger share of this value reflects intangible assets and future growth opportunities. By contrast, their leverage is about the same (bottom right-hand panel).

Return-on-equity[1]

In per cent — Graph 4



[1] Four-quarter moving average of the median return-on-equity for the EME firms included in each category. Data are from a panel of 1,100 representative EME firms.

Sources: Bloomberg; S&P Capital IQ; authors' calculations.

[8] For related findings, see Feyen et al (2015).

[9] Graph 3 and the left-hand panel of Graph 5 use kernel density estimation. A kernel density provides a smooth visual representation of the frequency of different values of a random variable (eg the value of assets over a sampled population) that is clearer and more accurate than the widely used (discrete) histogram. Technically, a kernel (a weighting function) is used to provide a smooth estimate of the underlying statistical density of a random variable. Scott (1979) shows that the kernel density estimate converges more quickly than a histogram to the underlying density for continuous random variables.

Main issuers in offshore bond markets

Top 10 companies with the largest amount issued in offshore markets, for each jurisdiction Table 2

Company name	Country	Number of offshore bonds[1]	Value of offshore bonds[1]	Total assets[2]
PEMEX	Mexico	136	118,121	148,611
Petrobras	Brazil	47	62,278	299,749
America Movil	Mexico	68	55,854	86,683
Roche	Switzerland	30	55,548	76,105
PDVSA	Venezuela	18	47,096	231,120
Gazprom	Russia	42	42,169	403,955
BHP Billiton	Australia	44	38,045	124,580
Volvo	Sweden	262	35,878	23,785
Statoil	Norway	47	32,419	131,729
Nestlé	Switzerland	101	31,153	134,269

[1] Total number (in units) and value of bonds (in millions of US dollars) issued in the period 2000–15 outside the home country of the firm, by the parent company and its affiliates, provided that the latter are guaranteed. [2] Total assets in millions of US dollars in the last year in which the firms tapped offshore bond markets.

Sources: Bloomberg; authors' calculations.

Additional perspective can be gained by examining the evolution of profitability (as measured by the return-on-equity) for three types of emerging market firm: firms that have borrowed in offshore bond markets, firms that have borrowed onshore (but not offshore), and firms that have not borrowed in bond markets (Graph 4). Overall, the profitability of firms that have borrowed in offshore markets has been lower than that of onshore borrowers for extended periods, particularly since the GFC. The gap in the profitability of offshore versus onshore issuers has widened recently. Tests of differences of medians or means indicate that the gap is statistically significant. We obtain similar results looking at other measures of profitability, such as the return-on-assets and net income margin.

While the bulk of EME firms that borrow offshore tend to be small and to issue infrequently, a small group of very large firms issues regularly in the international bond markets (Table 2). These firms are at the 95th percentile of the distribution of EME firms illustrated in Graph 3 (upper, left-hand panel). These larger firms account for 27% of the total amount of EME offshore debt issued, which, while significant, is not the bulk of issuance for these firms.

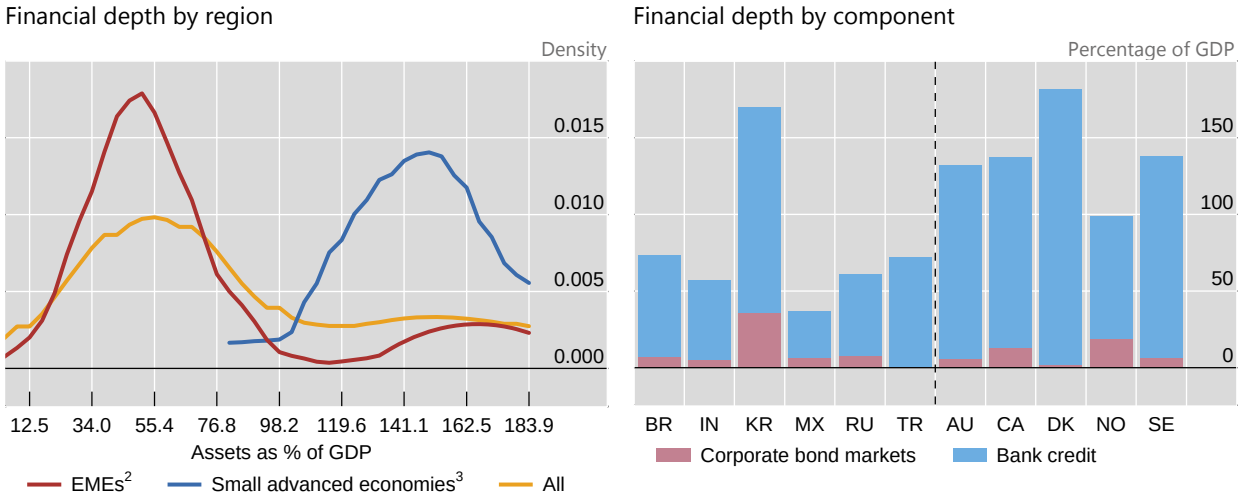
Domestic borrowing options and offshore bond issuance

Market imperfections that limit domestic borrowing options can influence firms' decisions to issue bonds offshore. Small and opaque firms that incur high costs on account of asymmetric information might be expected to borrow not from markets but from banks, which are more efficient in monitoring borrowers.[10] Over time, they

[10] See Diamond (1984). Small firms may also be unable to access financial markets because of high fixed issuance costs, such as underwriting, registration or legal fees. The evidence for US markets supports this view (Denis and Mihov (2003)).

Cross-country differences in financial market depth[1]

Graph 5



AU = Australia; BR = Brazil; CA = Canada; DK = Denmark; IN = India; KR = Korea; MX = Mexico; NO = Norway; RU = Russia; SE = Sweden; TR = Turkey.

[1] Onshore financial market depth measured as the sum of corporate bond market debt plus bank credit, in the last year for which data are available. [2] See the Annex for the list of EMEs. [3] Australia, Canada, Denmark, New Zealand, Norway, Sweden and Switzerland.

Sources: IMF, *International Financial Statistics* and *World Economic Outlook*; World Bank, *World Development Indicators*; Bloomberg; national data; authors' calculations.

may rely less on banks and issue debt in financial markets. This could result from improved access to such markets, or from limits on banks' capacity to provide credit (for example, ceilings on large exposures).

Whether firms choose to raise additional debt onshore, either from banks or local capital markets, or offshore (in the Eurobond or yankee markets) depends on the relative benefits and costs. On the one hand, accessing offshore financial markets involves high fixed costs. Companies of uncertain quality are likely to be charged a higher risk premium, since a lack of familiarity exacerbates the problems of informational asymmetries. Access to offshore bond markets might also be more costly for firms based in countries with poor legal systems or weak institutions. Capital controls that restrict offshore bond issuance may also play an important role.

On the other hand, the depth and liquidity of offshore bond markets may imply lower costs of issuance, particularly when external financing costs fall, for example as a result of lower investor risk aversion. In spite of the costs cited above, it may therefore actually be easier and cheaper to issue in offshore financial markets if onshore financial markets are shallow or subject to more restrictions, as is generally the case in EMEs. Unfavourable conditions for local borrowing in EMEs could thus explain increased reliance on offshore financing during periods of lower risk aversion.

The depth of onshore debt markets is likely to be an especially important factor in deciding whether to issue offshore (Black and Munro (2010)). One measure of market depth is the sum of funds obtained locally from banks and capital markets as a ratio to GDP. On this basis, onshore financial depth tends to be much lower for EMEs than for our set of small advanced economies (Graph 5, left-hand panel). Among the largest countries included in emerging market indices, only Korea ranks similarly to the small advanced economies (Graph 5, right-hand panel). The other EME

countries lag well behind: corporate bond markets are thin, and bank credit is lower as a share of GDP, despite rapid growth in recent years.[11]

Such factors might induce firms to issue bonds overseas when external financing becomes cheaper, even when they have no immediate need for cash. Non-bank lenders might be expected to monitor the use of funds less intensively than would international banks. Thus, arm's length borrowing could be associated with hoarding of cash or short-term assets (Bruno and Shin (2015)). At an aggregate level, bond issuance would be decoupled from capital expenditure.

Empirical model

To explore if limits to borrowing onshore affect firms' offshore debt issuance, we estimate a reduced-form model, using an industry-country-quarter data panel. We restrict our analysis to sectors[12] rather than individual firms because, at the time of writing, a fully balanced panel of data covering the 41 jurisdictions was not available.[13] In particular, we test the hypothesis that looser external financing conditions increase offshore debt issuance to a greater degree in countries where the domestic financial system is less developed and, accordingly, where firms are more likely to have unmet financing needs. The model is defined by two equations:

$$y_{ijt} = \begin{cases} y^*_{ijt} & if \quad y^*_{ijt} > 0 \\ 0 & if \quad y^*_{ijt} \leq 0 \end{cases} \qquad (1)$$

$$y^*_{ijt} = \beta' z_{ijt} + \gamma_1 G_t + \gamma_2 FD_{jt} + \gamma_3 G_t FD_{jt} + \varepsilon_{ijt} \qquad (2)$$

where y^*_{ijt} is the logarithm of the gross US dollar value of bonds issued offshore (by industry *i*, based in country *j*, in quarter *t*) and z_{jt} is a vector of country-specific controls comprising country fixed effects, GDP per capita, GDP growth and industry fixed effects to account for each industry's demand for financing.[14] G_t is the standardised measure of the time-varying external financing conditions in offshore markets, as represented by the VIX. We saw earlier that a lower VIX tends to be associated with greater EME offshore bond issuance; an explanation could be that the VIX is an indicator of risk aversion and hence of the tightness of external financing conditions. FD_{jt} refers to domestic financial market attributes, which we measure with three variables: the depth of the onshore financial market (measured as in Graph 4, that is, as the sum of bank credit to the non-financial sector and non-financial corporate bonds outstanding), the presence or absence of capital controls on local bond markets, and the presence or absence of withholding taxes on corporate bond income. The tables in the Annex provide further details of the variables used. As

[11] The results are similar when we use a broader measure of onshore depth which includes cross–border bank lending to non-banks. Cross-border lending adds to onshore financial market depth since the borrowing transaction is onshore, although the funds originate from abroad.

[12] Industries are classified according to the Global Industry Classification Standard (GICS), which classifies firms in 10 sectors: Basic Materials, Communications, Consumer Discretionary, Consumer Staples, Energy, Health Care, Industrial, Technology, Utilities and Financials. In this exercise, we remove financial firms.

[13] That said, some preliminary analysis of firm-level data tends to confirm the results.

[14] As discussed above, industries differ in their dependence on financial markets. For example, due to operational aspects, firms in the technology or health care sector have high internal cash flows and less need for external financing; in contrast, energy and utilities companies have substantial fixed assets and a high dependence on debt to carry out their activities. Reliance on offshore bond borrowing might also be higher for industries with more dollar assets.

negative values of the dependent variable y^*_{ijt} are ruled out, we estimate a censored regression model using maximum likelihood.

To determine whether limits to domestic borrowing encourage more offshore bond issuance when external financing conditions improve, we interact G_t and domestic financial market attributes FD_{jt}. The impact (partial effect) of external financing conditions on the amount issued is then a function of financial market attributes. Formally, x_{ijt}

$$\frac{dE(y_{ijt}|x_{ijt})}{dG_t} = [\gamma_1 + \gamma_3 FD_{jt}]\Phi\left(\frac{\beta' x_{ijt}}{\sigma}\right) \qquad (3)$$

where x_{ijt} is a vector of explanatory variables. The empirical results will focus on equation (3). We expect the coefficient γ_3 on FD_{jt} to have a negative impact, so that offshore bond financing declines with financial deepening.[15] To gauge by how much, we measure the derivative on the left-hand side by using the coefficients from equation (2) for low and high values of FD_{jt}.

Less developed onshore markets make borrowers look offshore

Our estimation results confirm that easier external financing conditions increase the amount issued in offshore bond markets, even when other variables are taken into account (Table 3, panel A). This finding is consistent with previous research (McCauley et al (2015a), Feyen et al (2015)). However, we also find that this effect varies with onshore financial market depth (column 1). It is twice as large for firms based in countries with low onshore market depth (we define "low" market depth as percentile 5; "high" market depth as percentile 95; and "medium" as the average).[16]

In addition, we also find that capital controls on foreign investments in local bonds matter, as does taxation of income on local corporate bonds (Mizen et al (2012)). The impact of global financial conditions is much larger for firms in countries that restrict foreigners' investments in local bond markets, or have withholding taxes on bond income (Table 3, panel A, columns 2 and 3).

Advanced economies rank high in our measure of financial depth, never use capital controls and rarely have withholding taxes on bonds. This can explain the more muted reaction of firms to external financing conditions, as described in the previous section.

We conduct several robustness checks. The results hold when we use net flows, other measures of external financing conditions, such as the MOVE index,[17] or when we use a broader measure of onshore market depth that includes cross-border bank lending to domestic non-banks. And to explore whether the results are driven by a few unrepresentative borrowers, we exclude the offshore bond issuance of the top 10

[15] In the case of continuous variables such as financial depth, empirical tests of the hypothesis are different from a standard Wald test of the interaction term. Even if γ_3 is not significant, its impact can be significant for relevant values of financial depth since its standard error includes $\text{cov}(\gamma_1, \gamma_3)$ (Brambor et al (2006)).

[16] Financial depth enters in the econometric model as a continuous variable, and the partial effect is thus a function of this continuous measure. To gauge its shape, we report this effect in Table 3 at three specific points: two values at the tails and, since financial depth is standardised, with respect to the mean and the average.

[17] The MOVE index – the Merrill Lynch Option Volatility Estimate – measures the implicit volatility in the US Treasury markets.

Marginal impact of external financing conditions on offshore bond issuance: effects of onshore financial market attributes[1]

Dependent variable: offshore bond issuance Table 3

Financial market attributes (FD) as:	All issuers			Excluding top 10 issuers		
	Financial depth	Controls on bond inflows (Yes/No)	Withholding tax (Yes/No)	Financial depth	Controls on bond inflows (Yes/No)	Withholding tax (Yes/No)
Panel A: External financing conditions measured with the VIX						
Low/Yes	–0.411***	–0.250***	–0.170***	–0.439***	–0.251***	–0.175***
Medium	–0.338***			–0.363***		
High/No	–0.212***	–0.128***	–0.029	–0.234***	–0.126***	–0.033
Number of observations	19,379	20,421	26,595	19,379	20,421	26,595
Uncensored	2,094	2,562	2,960	1,976	2,425	2,808
Panel B: External financing conditions measured with the nominal bilateral US dollar exchange rate						
Low/Yes	0.144**	0.036	–0.034	0.217***	0.065*	–0.009
Medium	0.048			0.090**		
High/No	–0.108	–0.022	–0.101***	–0.114	–0.012	–0.089***
Number of observations	16,578	17,640	23,121	16,578	17,640	23,121
Uncensored	2,405	2,562	2,958	2,270	2,426	2,807

[1] The marginal impact of external financing conditions is a function of onshore financial market attributes. In panel A, external financing conditions are measured with the VIX, standardised and winsorised at 1%: the lower the VIX, the easier external financing conditions. In panel B, with the nominal bilateral US dollar exchange rate: the higher the value, the greater is the appreciation of the domestic currency. This table summarises these effects, measuring them at different values of onshore financial markets attributes. Columns 1–3 report the results when the dependent variable is total amount issued. In columns 4–6, issuance by the top 10 issuers – which account for 23% of the total – is removed. We use alternative proxies for financial markets attributes (FD): in columns 1 and 4 we use financial depth, measured as the cross-country standard deviation with respect to the quarterly mean; in columns 2 and 5, we use a dummy on capital controls on foreign investment in local bond markets; and in columns 3 and 6 we use a dummy on withholding taxes on bond income. All models are estimated correcting for left-censoring (number of uncensored observations at the bottom of the table. */**/*** denotes significance at 10/5/1% level. In columns 1 and 4, we report semi-elasticities at low, medium and high financial depth, which correspond to percentile 25, the average, and percentile 75; in the other columns, we report marginal effects when the corresponding dummy (capital controls or withholding taxes) takes value 1 and 0.

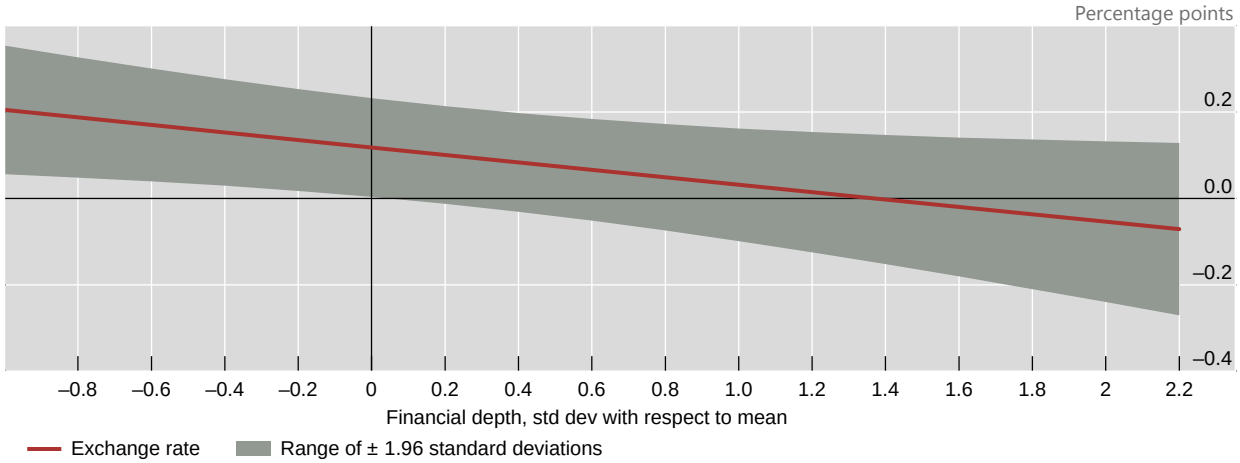
Sources: Bloomberg; authors' calculations.

issuers in the sample; these account for 23% of the total amount and 795 bonds. The results are virtually unchanged, and of similar size (columns 4–6).

To provide additional perspective on the role of external financing conditions, we replace the VIX as the measure of such conditions with the nominal bilateral US dollar exchange rate (Table 3, panel B). From the perspective of international investors, dollar weakness strengthens firms' balance sheets if they have borrowed in foreign currency. Thus, it improves companies' ability to raise funds (Avdjiev et al (2015)).

Domestic currency appreciation does indeed encourage offshore bond borrowing, which is mostly in foreign currency. The effect is stronger if firms are incorporated in countries with low market depth; its impact fades, and eventually becomes statistically insignificant, if onshore financial markets are deep (Table 3, panel B, column 1). The results are particularly strong when we exclude the top 10

Marginal impact of exchange rate: function of onshore financial market depth[1] Graph 6



[1] Marginal impact of the exchange rate on offshore bond issuance excluding the top 10 issuers. The exchange rate is measured as the standard deviation with respect to the historical average of the nominal exchange rate vis-à-vis the US dollar: positive (negative) values indicate strength (weakness) of the domestic currency. The graph shows how this impact is a function of onshore financial market depth – plotted for values ranging from one standard deviation below to 2.2 standard deviations above the mean, which correspond to the fifth and 99th percentiles, respectively, of the distribution of market depth.

Sources: Bloomberg; authors' calculations.

issuers (columns 4–6).[18] To further gauge this impact, we evaluate the results at the range of values of financial depth between our low and high thresholds. We find that the impact is positive and statistically significant from zero for levels of onshore development up to 0.2 standard deviations above the mean (Graph 6). In the last quarter with available data, this cutoff corresponds roughly to financial markets that are slightly deeper than those of Croatia.

Finally, we examine the impact of external financing conditions on onshore bond issuance (Table 4). This is qualitatively similar, underscoring that external financing conditions are also transmitted to local bond markets (Sobrun and Turner (2015)). However, the impact is half the size of that on offshore bond issuance, suggesting that integration remains incomplete and that there are still incentives for firms to borrow offshore. Low financial depth and withholding taxes on corporate bond income strengthen the impact of external financing conditions on onshore bond issuance, but surprisingly capital controls do not have an effect.

Overall, the results confirm that the impact of global financial conditions on firms' offshore bond financing is stronger when onshore financial markets have shortcomings. The findings can help explain why many EME firms hasten to issue offshore bonds when external financing is cheap.

[18] The reason may be that these large companies are more likely to invest abroad. As a result, the value of their assets might be less affected by the domestic exchange rate.

Marginal impact of external financing conditions on onshore bond issuance: effects of onshore financial market attributes[1]

Dependent variable: onshore bond issuance; external financing conditions measured with the VIX Table 4

Financial market attributes (FD) as:	All issuers			Excluding top 10 issuers		
	Financial depth	Controls on bond inflows (Yes/No)	Withholding tax (Yes/No)	Financial depth	Controls on bond inflows (Yes/No)	Withholding tax (Yes/No)
Low/Yes	–0.226***	–0.095***	–0.125***	–0.233***	–0.091***	–0.128***
Medium	–0.192***			–0.196***		
High/No	–0.130***	–0.075***	–0.033***	–0.129***	–0.079***	–0.033**
Number of observations	16,578	18,144	23,976	16,578	18,144	23,976
Uncensored	4,411	4,788	5,514	4,373	4,751	5,474

[1] The marginal impact of external financing conditions on onshore bond issuance is a function of onshore financial markets attributes. See footnote in Table 3.

Sources: Bloomberg; authors' calculations.

How offshore bond proceeds are used

How offshore bond proceeds are invested can have implications for financial stability. In particular, firms might act as surrogate financial intermediaries, raising funds offshore to invest them in short-term financial assets. This could accentuate the procyclicality of the domestic financial system and pose the risk of sudden reversals.

To shed light on this issue, we first test whether in our sample offshore bond issuance is allocated to short-term financial assets, as measured by current assets, and whether it differs from the allocation of onshore bond proceeds. Bonds issued in offshore markets by firms in the sample are overwhelmingly denominated in dollars and, conversely, issuances in onshore markets are mostly in local currency. A recent study by Bruno and Shin (2015) performs a related analysis.[19]

For the period 1998–2014, we adapt the bond use equation introduced by Bruno and Shin (2015, Tables 9 and 10), and apply it to a panel of 1,100 representative EME firms.[20] The dependent variable is the change in current assets, which is the sum of cash and cash equivalents, marketable securities and other short-term investments, accounts and notes receivable, inventories and other current income. The right-hand side variables are offshore bond proceeds, onshore bond proceeds, other revenues and total assets. We perform the estimation at one- to three-year horizons.

As shown in Table 5, offshore bond proceeds have a positive and statistically significant impact on firms' holdings of current assets, which increases at two- and three-year horizons (columns 1–3). In contrast, onshore bond proceeds have no impact on such holdings (other sources of revenue do have an impact, but it is smaller). The impact of offshore bond proceeds on current assets is even stronger in the post-crisis period (columns 4–6).

[19] While we analyse offshore versus onshore bond issuance, Bruno and Shin (2015) examine US dollar versus non-US dollar bond issuance. Their findings support the view that US dollar bond issuance by EME firms may reflect carry trades. Accordingly, our results are consistent with theirs.

[20] This sample is also used in Graph 4.

Bond proceeds and current assets[1]

Dependent variable: change in current assets — Table 5

	(1) t=1	(2) t=2	(3) t=3	(4) t=1	(5) t=2	(6) t=3
Offshore proceeds	0.226**	0.288**	0.305*	0.336***	0.399***	0.367**
	(3.37)	(2.94)	(2.40)	(5.65)	(5.73)	(2.89)
Onshore proceeds	0.093	0.135	0.184*	0.035	0.036	–0.031
	(1.67)	(1.92)	(2.27)	(0.52)	(0.52)	(–0.37)
Other revenues	0.333**	0.316**	0.360***	0.295*	0.285***	0.254*
	(3.22)	(3.26)	(4.01)	(2.71)	(3.83)	(2.58)
Ln(assets)	–0.021***	–0.021**	–0.018*	–0.021**	–0.027*	–0.026
	(–5.73)	(–3.51)	(–2.48)	(–3.57)	(–2.69)	(–1.95)
Number of observations	10248	9178	8158	3296	2497	1782
R-squared	0.144	0.194	0.242	0.141	0.228	0.272
Number of countries	35	35	35	35	35	33

[1] The dependent variable is the natural log of the change in the ratio of cash and short-term liabilities divided by total assets, plus one. Offshore proceeds, onshore proceeds and other revenues are expressed as ratios to total assets. The series and the regressions are estimated over one- to three-year horizons. Standard errors (clustered by country) are reported in parenthesis. */**/*** denotes significance at the 10/5/1% level. Columns (1) to (3) are estimated over the full sample period 1999–2014, while columns (4) to (6) are estimated over the post-crisis period 2010–14.

Sources: Bloomberg; authors' calculations.

As noted earlier, since about 2009, firms issuing bonds offshore have consistently been less profitable than firms issuing bonds (only) onshore or firms that issue no bonds. Firms that have relied on offshore bond financing thus appear to be less able to generate profits even if they are exposed to higher risks. The lower profitability of firms that rely on offshore bond financing may reflect macroeconomic conditions or may indicate that they are using the proceeds from offshore financing in a less productive way.

Conclusions

Two results of our analysis may be highlighted. First, firms' demand for offshore bond financing depends on their ability to raise funds locally. If borrowing in domestic markets is relatively constrained, as is the case in less developed domestic financial markets, an easing of external financing conditions increases the incentive to issue debt offshore.

Second, our empirical analysis indicates that offshore bond proceeds tend to be associated with increased investment in short-term assets. This could raise financial stability concerns. In particular, an increased volume of such investments could pose the risk of sudden reversals and might amplify financial cycles. In contrast, onshore bond proceeds are not linked to higher holdings of short-term assets.

Our results imply that policies that deepen domestic markets by reducing the cost of onshore borrowing could slow the growth of offshore bond issuance by EME firms. This could help alleviate some of the concerns about financial stability noted above.

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Annex: Data description

In this article, we use a data set that matches all the bonds issued in the period 2000 to 2015 with firm-level data for the company backing the bond. Its features are described in detail in Fuertes and Serena (2016). The data series are described in more detail in Tables A1 and A2.

The data set covers non-financial firms headquartered in 41 jurisdictions, comprising 34 emerging economies and seven small advanced economies. The countries and regions covered are: Latin America: Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru and Venezuela; emerging Europe: Bulgaria, Bosnia, Croatia, Estonia, Hungary, Lithuania, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey and Ukraine; Africa and Middle East: Egypt, Morocco, Nigeria, Saudi Arabia, South Africa and the United Arab Emirates; emerging Asia: India, Indonesia, Malaysia, the Philippines, Thailand and South Korea; small advanced economies: Australia, Canada, Denmark, New Zealand, Norway, Sweden and Switzerland.

It does not include firms based in the euro area countries, Japan, the United Kingdom or the United States during the full period under analysis. Domestic bond markets in these larger advanced economies are deeper and more receptive to new issues. As a consequence, firms based in these countries would find it less costly to issue onshore than do firms in small open economies.[21]

Firms' financing patterns are monitored at a consolidated level, broadly in line with the BIS international debt securities statistics, by nationality, according to the ultimate borrower sector.

This is underscored by the similarity of these measures, on an aggregate level (see Graph 1). There are three potential explanations for the differences. First, while our measure is broadly consistent with the criteria used in the BIS nationality measure, we make a distinction between affiliates which are financially dependent on their parent companies, and those which are standalone companies. Unlike the BIS nationality measure, we classify standalone affiliates according to the country of

Use of proceeds estimation variables — Table A1

Variable	Definition
Current assets change	Change in the ratio of current assets to total assets. Change in current assets measured alternatively at three horizons: one, two and three years ahead. Scaled by total assets at date zero. Current assets includes cash and cash equivalents, marketable securities and other short-term investments, accounts and notes receivables, inventories, and other current income.
Other revenues change	Cumulative change in other revenues. Changed in other revenues measured alternatively at three horizons: one, two and three years ahead. Scaled by total assets at date zero. Other revenues is defined as net income plus depreciation and amortisation plus other non-cash adjustments plus changes in non-cash working capital.
Offshore bond proceeds	Sum of proceeds of bonds issued offshore accumulated at three horizons: one, two and three years. Scaled by total assets at date zero.
Onshore bond proceeds	Sum of proceeds of bonds issued onshore accumulated at three horizons: one, two and three years. Scaled by total assets at date zero.

[21] The data set also does not cover China, which is experiencing a process of external financial liberalisation that distorts domestic firms' access to local and international bond markets.

Description of variables

Table A2

Variable	Definition	Sources
Dependent variable		
Total offshore bonds	Logarithm of the amount issued by industry i, country j, at quarter t, constructed using firm-level data	Bloomberg; authors' calculations
Excluding top 10 issuers	Same measure excluding the 10 largest offshore bond issuers, listed in Table 1	Bloomberg; authors' calculations
Other variables		
VIX	Standard deviations with respect to average VIX, winsorised at 1%: negative values low external financing costs	Chicago Board Options Exchange; authors' calculations
Nominal bilateral US dollar exchange rate	Negative standard deviations with respect to average: positive values indicate low external financing costs, local currency strength	National data; authors' calculations
Capital controls on foreign investment in local bond markets	Dummy variable taking value of 1 if the bond inflows restriction category is non-zero	Fernández et al (2015)
Withholding tax on bond income	Dummy variable taking value of 1 if residents in Luxembourg are subject to withholding taxes in corporate bond income, 0 if exempted. Time invariant variable, measured as of 2014	KPMG (2015); authors' calculations

incorporation of the affiliate. Thus, a company such as Jaguar Land Rover – which borrows without explicit support from Tata Motors, its Indian parent company – is treated as a UK-based company. Second, offshore bonds are defined as those marketed outside the jurisdiction of the issuer, as given by the registration domain (ISIN/CUSIP). This definition stresses the primary market, consistent with the BIS definition (Gruić and Wooldridge (2012)). However, ours is a narrower measure, since bonds issued domestically under foreign law, or subsequently listed overseas, are not reclassified. For this reason we use the term offshore bonds, instead of international, which should be reserved for the broader concept. Finally, the coverage of data providers might be different.

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The ECB's QE and euro cross-border bank lending[1]

There is growing evidence that the currency distribution of cross-border credit affects international monetary policy spillovers. While the existing literature has concentrated primarily on the US dollar, this article focuses on the euro. We find that the ECB's quantitative easing of January 2015 had a larger positive impact on cross-border bank credit in lender-borrower pairs with a higher share of euro-denominated bank claims. The effect was especially pronounced for lending to advanced economies outside the euro area. By contrast, the estimated effects on cross-border lending to EME borrowers were insignificant.

JEL classification: F34, G15, G21.

The question of international monetary policy spillovers has gained prominence in the light of the exceptionally accommodative post-crisis monetary policy stance of advanced economy central banks. There is growing evidence that the currency distribution of cross-border credit plays a crucial role in determining the size, distribution and direction of such spillovers. McCauley et al (2015) have demonstrated that since the Great Financial Crisis, the outstanding US dollar credit to non-bank borrowers outside the United States has increased from $6 trillion to $9 trillion. Bruno and Shin (2015a) have documented that episodes of US dollar appreciation are associated with deleveraging by global banks and a tightening of global financial conditions. More recently, Avdjiev and Takáts (2016) have found that a higher bilateral US dollar share on the eve of the 2013 "taper tantrum" was associated with a lower growth rate of cross-border bank lending in its aftermath.

Virtually all existing studies examining the impact of the currency composition of international lending flows on cross-border monetary policy spillovers have concentrated on the US dollar. In this article, we shift the focus to the euro cross-border bank lending network, the second largest network after the US dollar network. More concretely, we take advantage of the recent enhancements to the BIS international banking statistics (IBS) to ask to what extent the share of euro-denominated cross-border bank claims explains the cross-sectional variation of the impact of the ECB's January 2015 quantitative easing (QE) programme on cross-border bank lending.

[1] The authors thank Claudio Borio, Ben Cohen, Dietrich Domanski, Robert McCauley, Patrick McGuire and Hyun Song Shin for useful comments and discussions. Pamela Pogliani provided excellent assistance with the data from the BIS international banking statistics. The views expressed are those of the authors and do not necessarily reflect those of the BIS.

Our results indicate that a higher euro share in cross-border claims on the eve of the 2015 ECB QE announcement was associated with stronger growth in cross-border bank lending during this quarter. This result appears to be driven primarily by lending to advanced economies outside the euro area. By contrast, the estimated effects on cross-border lending to borrowers in emerging market economies (EMEs) tend to be insignificant.

Our findings contribute in two ways to the literature on the role of cross-border bank currency networks in the international transmission of monetary policy shocks. First, our results imply that the US dollar network is not unique and that the euro cross-border bank lending network responds to monetary policy shocks in a similar manner. This finding accords with emerging evidence that the euro is starting to take on some of the characteristics of the US dollar as a global funding currency (Shin (2015)). Second, our results suggest that currency networks respond to monetary policy shocks symmetrically. That is, the response to an easing shock (such as the one studied in this article) appears to be qualitatively similar to the response to a tightening shock (such as the 2013 Fed taper tantrum examined in Avdjiev and Takáts (2016)).

The rest of the feature is organised as follows. The next section introduces the BIS cross-border bank lending data used in our empirical analysis. The third section documents how widely the euro is used and how cross-border bank lending evolved before and after the January 2015 ECB QE announcement. The fourth section analyses the ECB QE econometrically to show how cross-border lending responded to euro loan exposure. The fifth section concludes.

Cross-border bank lending data

Our empirical analysis takes advantage of the Stage 1 Enhancements to the BIS international banking statistics (IBS). With these enhancements, the IBS now reflect the three key dimensions of international banking activity needed for our empirical exercise – (A) the borrower's residence, (B) the lending bank's nationality and (C) the currency composition of cross-border claims (Avdjiev et al (2015a)).[2]

The three dimensions yield a fairly comprehensive view of cross-border banking activity. Dimension (A), the residence of the borrower, helps to identify the country-specific borrowing drivers of cross-border bank lending dynamics. In particular, it lets us identify and control for factors related to credit demand in the borrowing country.

Dimension (B), the lender's nationality, ie the home of the highest-level banking entity in the corporate chain, respects the contours of banks' consolidated balance sheets rather than national borders. The international finance literature has traditionally focused on the residence of financial intermediaries as a key determinant of their behaviour. But Fender and McGuire (2010) and Cecchetti et al (2010) have argued that the lending bank's nationality tends to be much more relevant than its residence for the purposes of identifying the decision-making unit on the credit

[2] Previously, the BIS IBS data illuminated only two of the above three dimensions. The consolidated data set gave the nationality of the lending banks (dimension A) and the borrower's residence (dimension B), but provided no currency breakdown (dimension C). By contrast, the locational data did reveal the currency composition of banks' cross-border claims (dimension C), but not the borrower's residence (dimension B, locational by nationality) or the nationality of the lending bank (dimension A, locational by residence).

supply side. Nationality should better capture the factors that influence a bank's lending decisions, such as the performance or equity constraints of the bank as a whole.

The bank's nationality rather than its residence is especially useful if the loan is booked in an international financial centre. To see this, consider a German bank that lends to a borrower in Malaysia via its Hong Kong branch. Our proxy establishes a link between the German banking system (as the lender) and Malaysia (as the borrowing country). The alternative, ie looking at the bank's residence, would identify two cross-border bank lending links: one from Germany to Hong Kong SAR and another between Hong Kong and Malaysia. This would lead to two problems. First, one would consider Hong Kong as the borrowing economy in the former loan (Germany-Hong Kong), even though the loan is only intermediated through Hong Kong. Second, one would treat the Hong Kong banking system as the lender in the latter loan (Hong Kong-Malaysia), even though the Hong Kong-based banking unit is not the original supplier of credit.

Finally, we need the third dimension, currency denomination (C), for two reasons. First, the currency composition is used to investigate the impact of exposure to euro-denominated lending. Second, and more subtly, we also need to control for the impact of currency fluctuations on changes in the outstanding stocks of cross-border bank claims. Since cross-border bank claims are expressed in US dollars, currency movements lead to fluctuations in the dollar value of the claims. Adjusting for currency movements is particularly relevant when investigating the impact of monetary policy, because of its close relationship with the exchange rate.

The euro cross-border bank lending network

The euro is the second most used currency for cross-border bank lending. As of end-Q1 2016, euro-denominated cross-border claims (net of intra-euro area cross-border claims) stood at nearly $5 trillion, or 21% of the global aggregate (Table 1). The only currency with a higher global share is the US dollar, accounting for around $13 trillion (or 55% of the global total).

The share of euro-denominated cross-border claims varies considerably by borrowing region (Table 1). For advanced European countries outside the euro area, the euro share in cross-border bank lending (32%) is almost equal to that of the US dollar (35%). In emerging Europe, the share of euro-denominated claims (40%) exceeds that of US dollar claims (31%). By contrast, non-European EMEs borrow only a small fraction in euros (6.5%).

As discussed in the previous section, the enhanced BIS IBS contain information on the nationality of lending bank in addition to the country of the borrower and the currency of denomination.[3] These more granular breakdowns indicate that the regional aggregates in Table 1 conceal even greater differences at the individual country level across both lending banking systems and borrowing countries. To illustrate these variations, we present a global "heat map" of the euro's shares in bilateral cross-border lending (Graph 1). The colour coding of each cell reflects the

[3] Using the enhanced IBS, we can simultaneously identify the nationality of the lending bank, the country of the borrower and the currency of denomination for approximately 90% of the global stock of cross-border bank claims outstanding at the end of Q1 2016.

Currency composition of cross-border bank lending at end-Q1 2016 Table 1

	Percentage shares		
	US dollar	Euro	Yen
All borrowing countries[1]	**54.6**	**20.6**	**6.7**
Advanced economies[1]	51.7	25.4	5.9
Euro area (EA)[1]	30.3	51.4	4.6
Non-EA advanced	58.0	17.8	6.3
Non-EA advanced Europe	34.9	31.6	3.3
United States	87.4	5.8	1.7
Japan	47.4	9.7	37.9
Other advanced	51.2	12.7	3.5
Offshore centres	66.1	6.1	14.1
Emerging markets	59.7	12.1	2.3
Emerging Europe	30.9	40.1	1.1
Other EMEs	65.4	6.5	2.5
Memo: intra-euro area	*8.3*	*88.3*	*0.3*

[1] Net of intra-euro area cross-border bank claims.

Source: BIS locational banking statistics.

euro's share of cross-border claims between a particular lending banking system (columns) on a particular borrowing country (rows).

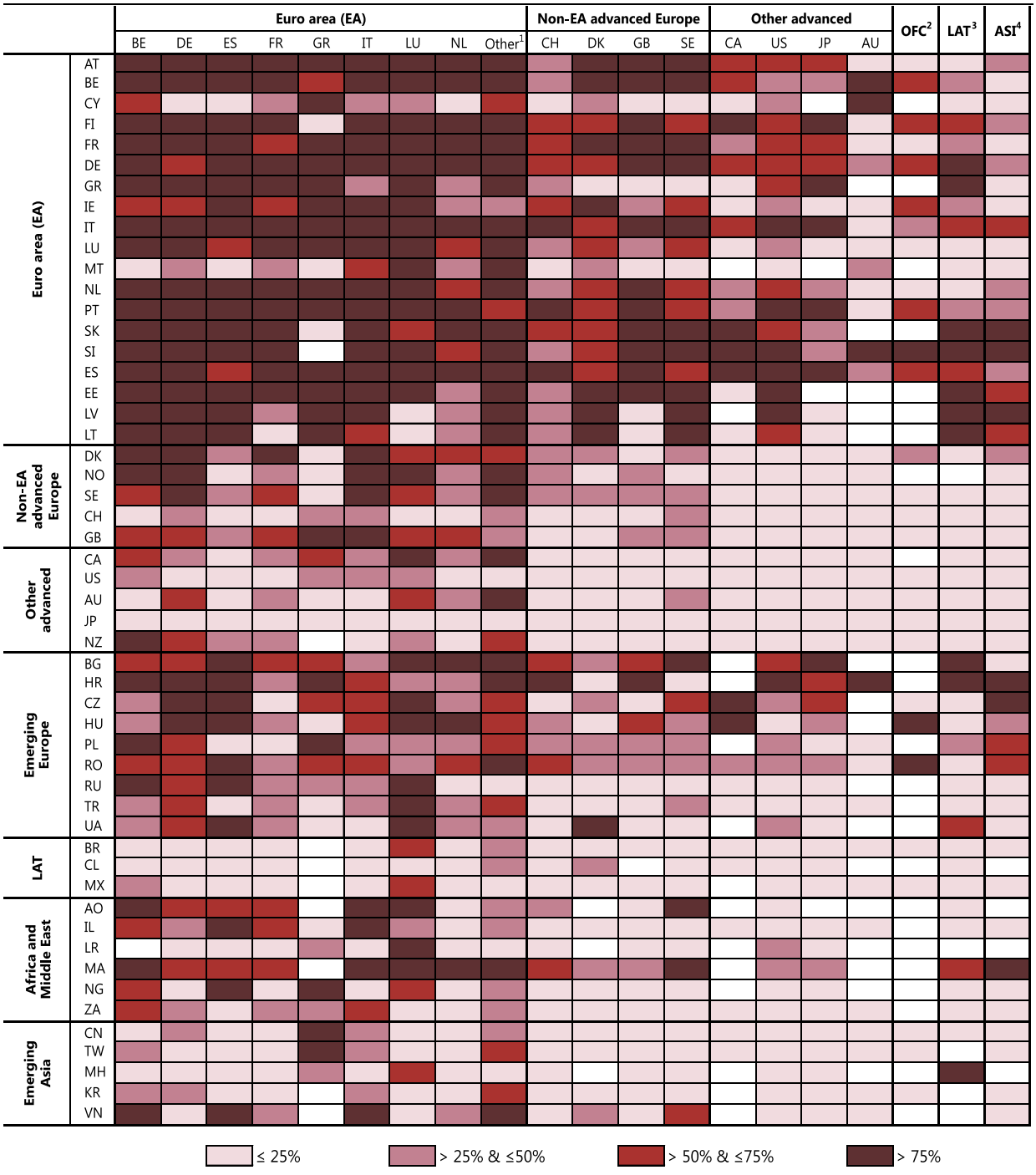
Following the reasoning outlined above, we aggregate the lending banks in Graph 1 based on their nationality, rather than on their residence. To see the empirical relevance of this distinction, consider the column for UK-*owned* banks. Only 2% of their claims on Japan are denominated in euros. By contrast, the corresponding share for banks *located* in the United Kingdom is much larger, at 22%. The large difference between the two respective shares is due mainly to the United Kingdom's role as a large global financial centre that hosts many banks headquartered in the euro area, which differ from UK-*owned* banks (Shin (2016)). This difference illustrates the fallacy of the "triple coincidence" in international finance – the traditional analytical framework that treats a GDP area, financial decision-making unit and currency area as identical (McCauley et al (2010), Shin (2012) and Avdjiev et al (2015b)).

Graph 1 reveals that, although the majority of global cross-border bank lending is denominated in US dollars, there is a clearly defined euro network comprising mainly the euro area and emerging Europe. Most of the claims originating from European banks or directed towards (advanced and emerging) European borrowers tend to be denominated in euros.

Euro's share in cross-border bank lending in Q1 2016

By nationality of lending bank (columns) and residence of borrower (rows), in per cent

Graph 1



ASI = Emerging Asia; LAT = Latin America; OFC = Offshore centres.

AO = Angola; AT = Austria; AU = Australia; BE = Belgium; BG = Bulgaria; BR = Brazil; CA = Canada; CH = Switzerland; CL = Chile; CN = China; CY = Cyprus; CZ = Czech Republic; DE = Germany; DK = Denmark; EE = Estonia; ES = Spain; FI = Finland; FR = France; GB = United Kingdom; GR = Greece; HR = Croatia; HU = Hungary; IE = Ireland; IL = Israel; IT = Italy; JP = Japan; KR = Korea; LR = Liberia; LT = Lithuania; LV = Latvia; LU = Luxembourg; MA = Morocco; MH = Marshall Islands; MT = Malta; MX = Mexico; NG = Nigeria; NL = Netherlands; NO = Norway; NZ = New Zealand; PL = Poland; PT = Portugal; RO = Romania; RU = Russia; SE = Sweden; SI = Slovenia; SK = Slovakia; TR = Turkey; TW = Chinese Taipei; UA = Ukraine; US = United States; VN = Vietnam; ZA = South Africa.

[1] Austria, Cyprus, Finland, Ireland and Portugal. [2] Hong Kong SAR, Panama and Singapore. [3] Brazil, Chile and Mexico. [4] Chinese Taipei, India and Korea.

Source: BIS locational banking statistics.

Cross-border bank lending before and after the 2015 ECB QE announcement

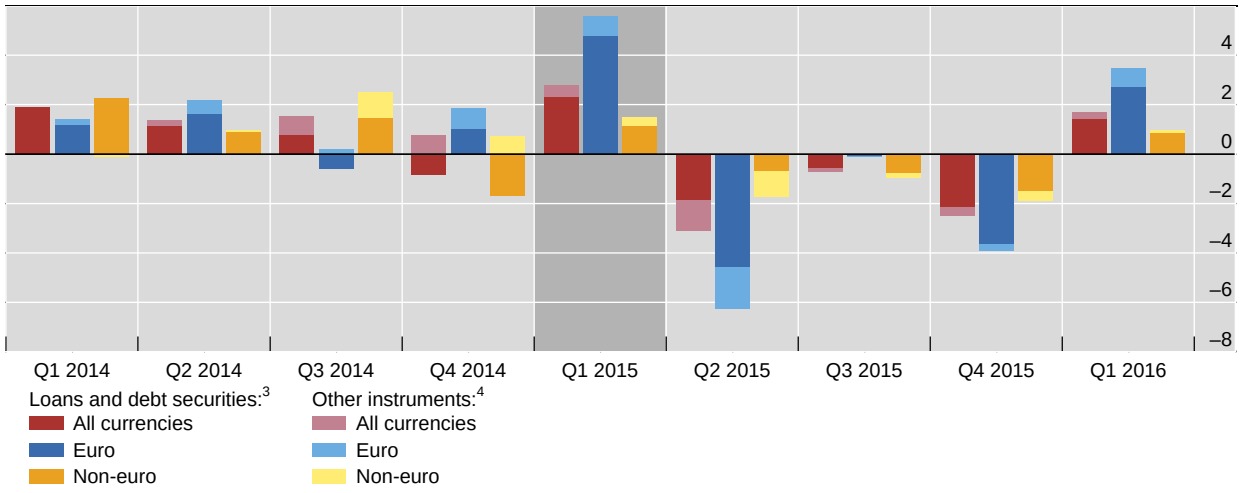
The growth rate of cross-border claims rose considerably during the quarter of the ECB QE announcement. In Q4 2014, the quarter preceding the ECB QE announcement, cross-border bank claims declined by 0.1% (Graph 2).[4] In Q1 2015, the quarter of the January 2015 ECB QE announcement, cross-border claims grew by 2.8%. Euro-denominated claims grew much faster (5.6%) than claims denominated in other currencies (1.5%).

The size of the wedge between the growth rates of euro and non-euro claims in Q1 2015 varied considerably across borrower groups. The gap was especially large for claims on non-European advanced economies (10.2% for euro claims versus 1.4% for non-euro claims) and non-euro area European advanced economies (8.3% for euro claims versus 2.2% for non-euro claims). By contrast, claims on EMEs contracted at roughly the same pace in both currency segments (–0.5% for euro claims versus –1.6% for non-euro claims).

The overall $791 billion increase in cross-border claims during Q1 2015 was boosted by a $145 billion rise in "other claims", which capture primarily reporting banks' derivatives positions and equity holdings. That said, the overwhelming majority of the overall increase ($657 billion) was due to a surge in banks' cross-border loans and holdings of debt securities.[5]

Cross-border bank flows by instrument and by currency of denomination[1]

Quarterly growth rate, in per cent[2] Graph 2



The grey shaded area indicates the quarter of ECB quantitative easing (Q1 2015).

[1] Total for all BIS reporting lending banking systems and counterparty countries. [2] Adjusted for exchange rate fluctuations and breaks in series. [3] Cross-border loans and holdings of debt securities. [4] Other claims, comprising mainly reporting banks' derivatives positions and equity holdings.

Source: BIS locational banking statistics.

[4] These quarterly changes, like the others discussed in this feature, are corrected for exchange rate changes and breaks in series.

[5] The breakdown by instrument (loans vs debt securities vs "other instruments") in the above paragraph is obtained from the BIS locational banking statistics by residence (LBSR). The amounts

The surge in cross-border bank lending that took place in Q1 2015 was followed by a contraction in the subsequent quarter. Nevertheless, a large portion of the $881 billion overall decline in claims during Q2 2015 was due to a $359 billion fall in "other claims" (BIS (2015)). On net, banks' cross-border loans and holdings of debt securities still recorded a sizeable ($141 billion) expansion during the first half of 2015.

Empirical analysis

In selecting the sample for our analysis, we aim to include all internationally relevant national banking systems on the lending side and the main borrowing countries. On the lending side, we select 28 major national banking systems, which together accounted for 95% of all outstanding cross-border claims in the BIS locational data at end-Q1 2016. On the borrower side, we follow the framework of Avdjiev and Takáts (2014, 2016) and include 51 recipient countries whose cross-border bank borrowing exceeded $10 billion at end-Q3 2014 (see the detailed list of countries in the Annex Table A1).[6] Finally, to abstract from claims for which the lender and the borrower are both from the same currency jurisdiction (ie the euro area), we exclude the cross-border claims of euro area banks on euro area borrowers (EA-on-EA claims) from our econometric analysis.

Potential drivers

To control for as many lender and borrower characteristics as possible, we examine a benchmark empirical specification, which includes a broad set of potential explanatory variables.

Our key explanatory variable of interest is the share of euro-denominated claims, which could have affected cross-border bank lending through several channels. First, a monetary loosening by the ECB should ease financing conditions in euros both within and outside the euro area. This would tend to lower banks' funding costs. To the extent that lower funding costs in a given currency translate into higher lending, this would stimulate cross-border bank credit. Second, the euro share could have made an impact through the international risk-taking channel of monetary policy (Rey (2015) and Bruno and Shin (2015b)). The euro's depreciation, triggered by a loosening monetary policy shock, would lift the net worth and the (perceived) creditworthiness of borrowers with euro liabilities and local currency assets. This would, in turn, increase banks' willingness to lend to such borrowers, ultimately lifting cross-border bank lending flows. A third channel may have worked through the hedging demand of institutional investors, who are likely to have been prompted to insure against further euro depreciation as a result of the ECB's QE announcement.

reported in loans, debt securities and "other instruments" do not add up exactly to the total for all instruments due to the fact that a small fraction of total claims is unallocated by instrument. Unfortunately, an instrument breakdown is not available in the BIS locational banking statistics by nationality (LBSN). That is why, in our benchmark empirical analysis, which uses the LBSN dataset, we focus on banks' total claims rather than on banks' loans and holdings of debt securities.

[6] In the specifications that include euro area borrowers, we include all euro area countries regardless of whether they pass the above threshold. This provides us with a consistently defined (de facto) control group, which helps us isolate the effect on cross-border lending to borrowers outside the euro area.

In addition to the euro share, we also include the change in the bilateral exchange rate (of the borrower's local currency against the euro) and its interaction with the euro share variable due to the key role that the euro exchange rate plays in a couple of the above channels.

Following Cetorelli and Goldberg (2012), we also control for strategic considerations. More precisely, we create variables that measure (a) the strategic importance of each borrowing country for each lending banking system; and (b) the importance of each lending banking system for each borrowing country. We define (a) as the share of cross-border claims that lending banking system X has allocated to borrowing country Y, and (b) as the share of cross-border bank claims on borrowing country Y from lending banking system X.

In addition, we include four control variables on the lending banking system side: the changes in the average bank CDS spreads and bank equity prices during the ECB QE quarter, as well as the domestic credit growth and deposit growth. We also examine five borrowing country variables: GDP growth, growth of credit to the private sector, current account balance, the government budget balance and government debt.

These factors might work differently in EMEs, which tend to have weaker balance sheets or fewer sophisticated domestic institutional investors. We control for these differences by introducing an EME borrower dummy and its interactions with the euro share and with the borrowing country-specific controls.

Benchmark specification

The data structure and the timing of the ECB QE announcement guide our regression setup. The IBS are reported at a quarterly frequency and the ECB QE was announced in January 2015. In our benchmark specification we therefore compare the growth in cross-border bank claims in Q1 2015 against their growth in Q4 2014.

We start with a regression that includes all the candidate explanatory variables discussed in the previous section. Formally, we estimate the following equation:

$$\begin{aligned}\Delta XBC_{b,l} = {} & c + \alpha_1 EURShare_{b,l} + \alpha_2 BorrowerShare_{b,l} + \alpha_3 LenderShare_{b,l} \\ & + \beta_1 BER_b + \beta_2 BER_b EURShare_{b,l} \\ & + \gamma_1 BankSharePrice_l + \gamma_2 BankCDS_l + \gamma_3 Credit_l + \gamma_4 Deposit_l \\ & + \delta_1 CAB_b + \delta_2 Credit_b + \delta_3 GBal_b + \delta_4 GDebt_b + \delta_5 RGDP_b \\ & + \theta_1 EME_b + \theta_2 EME_b EURShare_{b,l} \\ & + \theta_3 EME_b CAB_b + \theta_4 EME_b Credit_b + \theta_5 EME_b GBal_b + \theta_6 EME_b GDebt_b + \theta_7 EME_b RGDP_b + \varepsilon_{b,l}\end{aligned} \quad (1)$$

Our dependent variable $\Delta XBC_{b,l}$ represents the change in the growth rate, ie the acceleration (adjusted for exchange rates and breaks in series) of lending banking system l's cross-border claims on borrowing country b between the ECB QE quarter (Q1 2015) and the preceding quarter (Q4 2014). Formally:

$$\Delta XBC_{b,l} = \left(\frac{flow1Q15_{b,l}}{stock4Q14_{b,l}}\right) - \left(\frac{flow4Q14_{b,l}}{stock3Q14_{b,l}}\right) \quad (2)$$

Our independent variables are defined as follows: c is a constant; $EURShare_{b,l}$ is the share of euro-denominated cross-border bank claims of lending banking system l on borrowing country b (as of end-December 2014, in percent); $BorrowerShare_{b,l}$

measures the importance of each borrowing location *b* for each lending banking system *l* in terms of cross-border claims in all currencies (as of end-September 2014, in percent); $LenderShare_{b,l}$ measures the importance of each lending nationality *l* for each borrowing location *b* in terms of cross-border claims in all currencies (as of end-September 2014, in percent); BER_b is the percentage change in the bilateral exchange rate (of the borrower's local currency against the euro) between end-Q4 2014 and end-Q1 2015, where a positive change indicates appreciation of the local currency of borrowing country *b* vis-à-vis the euro; $BankSharePrice_l$ is the bank equity price growth in the home country of the lending banking system *l* between Q4 2014 and Q1 2015 (in percent); $BankCDS_l$ is the change in US dollar-denominated five-year bank CDS spreads in the home country of the lending banking system *l* between Q4 2014 and Q1 2015 (in basis points); $Credit_l$ is the average annual real bank credit growth to the private non-financial sector in the home country of lending banking system *l* during the year preceding Q4 2014 (in percent); $Deposits_l$ is real deposit growth for lending banking system *l* in 2014 (in percent); CAB_b is the 2014 current account balance of borrowing country *b* (in percent of GDP); $Credit_b$ is the real bank credit growth to the private non-financial sector in the borrowing country *b* during the three years preceding Q4 2014 (cumulative, in percent); $GBal_b$ is the 2014 general government budget balance of borrowing country *b* (in percent of GDP); $GDebt_b$ is the 2014 general government gross debt of borrowing country *b* (in percent of GDP); $RGDP_b$ is the real GDP growth in borrowing country *b* in Q1 2015 (quarter-on-quarter, in percent); EME_b is a dummy for borrowers in emerging markets and $\varepsilon_{b,l}$ is an error term.

As smaller volumes tend to be highly volatile (plausibly reflecting shocks that are more idiosyncratic), we weight each observation *b,l* by the size of the respective bilateral stock of outstanding cross-border claims.[7] In order to reduce the effect of possibly spurious excessive outliers, we also winsorise (ie limit the extreme values of) our dependent variable (ie the change in the growth rate of cross-border bank lending) at the 1st and 99th percentiles.

Main results

The benchmark regression results indicate that the share of euro lending in a given bilateral lending relationship prevailing prior to the ECB QE operations had a highly statistically significant positive impact on cross-border bank lending (Table 2, column 1, in bold). On average, a 10 percentage point higher euro share on the eve of the 2015 ECB QE was associated with an acceleration in cross-border bank lending growth of 1.3 percentage points during Q1 2015 (ie the ECB announcement quarter). The above relationship between the euro share and cross-border bank lending during Q1 2015 did not hold for EMEs. There, the impact of the euro exposure (ie the sum of the standalone euro share and the euro share–EME interaction term coefficients) was not statistically significant.

Next, we examine whether eliminating variables that are not statistically significant from the benchmark regression alters the main results (Table 2, column 2). We start by running a regression that includes all candidate explanatory variables discussed in the previous section. Then we exclude the variable with the lowest

[7] More specifically, the weight that we assign to each observation is equal to the square root of cross-border claims that lending banking system *l* had on borrowing country *b* in total cross-border bank lending as of end-September 2014 (the weight variable is not shown in equation (1) to ease the overview).

Regression results[1, 2] Table 2

Selected variables	All borrowers		Adding EA_b dummy and its interactions		Removing EA_b from sample	
	(1)	(2)	(3)	(4)	(5)	(6)
Cross-border bank lending denominated in euros *(EURShare$_{b,l}$)*	**0.13*** **	0.14***	0.17***	0.14***	0.19***	0.22***
EME$_b$ dummy – EUR share interaction *(EME$_b$*EURShare$_{b,l}$)*	**–0.18*** **	–0.19***	–0.2***	–0.2***	–0.22***	–0.25***
EA$_b$ dummy – EUR share interaction *(EA$_b$*EURShare$_{b,l}$)*			–0.11			
Bilateral exchange rate vs the euro *(BER$_b$)* [3]	**0.37****	0.38***	0.48**	0.29**	0.54**	0.52***
Exchange rate – EUR share interaction *(BER$_b$*EURShare$_{b,l}$)* [3]	**0.01***	0.01**	0.01	0.01**	0.00	
Sum of *(EURShare$_{b,l}$)* and *(EME$_b$*EURShare$_{b,l}$)* [4]	**–0.05**	–0.06	–0.03	–0.06	–0.03	–0.03
Sum of *(EURShare$_{b,l}$)* and *(EA$_b$*EURShare$_{b,l}$)* [4]			0.06			
R-squared, %	**15.17**	14.72	15.79	14.50	15.39	14.65
Number of observations	**1007**	1181	1007	1181	738	826

(1) is our main benchmark equation with 51 borrowers and all candidate explanatory variables listed in equation 1; (2) is the equation resulting after iterative exclusion of variables with lowest t-statistic, in absolute value terms; (3) and (4) additionally include euro area borrower dummy and its interactions with the euro share and the borrower-specific controls, and are full and post-iterative variable exclusion regressions, respectively; (5) and (6) exclude euro area borrowers from the sample, and are full and post-iterative variable exclusion regressions, respectively.

[1] ***/**/* denotes significance at 1/5/10% level. [2] The dependent variable represents the change in the growth rate of lending banking system *l*'s cross-border claims on borrowing country *b* between the ECB quantitative easing quarter (Q1 2015) and the preceding quarter (Q4 2014). [3] *BER$_b$* is the percentage change in the bilateral exchange rate between end-Q4 2014 and end-Q1 2015, where a positive change indicates appreciation of the local currency of borrowing country *b* against the euro. [4] Wald test of linear restrictions on the coefficients; the asterisks, if any, indicate whether the specified sums of coefficients are significantly different from zero.

Source: Authors' calculations.

t-statistic (in absolute value terms). Next, we re-run the regression with the remaining variables. We continue this iterative procedure until all remaining explanatory variables are statistically significant at the 10% level. The results from the post-elimination regression show that the coefficients on the main euro share variables remain virtually unchanged.

Potential explanations

There are several potential explanations for our main findings. First, our results could reflect that a loosening of monetary policy in a given currency typically eases financing conditions in that currency, tending to lower banks' funding costs. To the extent that lower funding costs in a given currency translate into higher lending in that currency, cross-border bank credit would increase. And the size of the overall increase would naturally depend on the share of lending in that currency.

Second, the results could also be driven by the international risk-taking channel of monetary policy (Rey (2015) and Bruno and Shin (2015a)). When a global funding currency (such as the US dollar or the euro) depreciates, the effect is to increase the net worth of foreign borrowers (ie borrowers based outside the respective currency area) with currency mismatches on their balance sheets. This improves their perceived creditworthiness and ultimately lifts cross-border bank lending flows.

The third possible explanation for our main results is related to the hedging demands of institutional investors with currency mismatches on their balance sheets (Borio et al (2016) and Sushko et al (2016)). When a central bank (such as the ECB) in charge of a global funding currency signals an upcoming loosening of its monetary policy stance, the hedging demands of such investors tend to increase (Shin (2016)). This increase in hedging demand is typically met via FX swaps from internationally active banks, which would sell euros spot and buy euros forward from the institutional investor. The spot leg of the above transaction would show up as a euro loan on the balance sheet of the reporting bank. Moreover, if the reporting bank borrows the euros that it provides in the spot leg of the above transaction from another bank located in a different country, this would lead to a further increase in the cross-border interbank lending activity.[8]

The second and the third possible explanations for the statistical significance of the euro share apply only to borrowers outside the euro area. To the degree these channels are at work, one could expect that the estimated impact of the euro share would be larger for borrowers outside the euro area. We examine this hypothesis by estimating two additional specifications of our main regression. In the first, we add a dummy variable for euro area borrowers (Table 2, columns 3 and 4). In the second, we exclude euro area borrowers from the sample altogether (Table 2, columns 5 and 6). In all of these additional specifications, the euro share not only remains highly statistically significant, but also increases considerably in magnitude. These results could be interpreted as evidence in support of the second and the third explanations.

In the meantime, some clues about the relative likelihood of the above explanations emanate from the fact that our results are primarily driven by lending to (non-euro area) advanced economies and tend to be insignificant for lending to EME borrowers. Namely, the regional patterns in our results make the second explanation less likely since the international risk-taking channel of monetary policy tends to be stronger for EME borrowers than for borrowers in advanced economies. By contrast, they strengthen the case for the third potential explanation, since institutional investors, and their respective hedging demands, tend to be much larger in advanced economies than in EMEs.

Nevertheless, the above reasoning provides only tentative hints about the relative weight of the contributions of each of the above explanations. Properly identifying and quantifying those factors would certainly require a substantial amount of further research.

Robustness

We start our robustness checks with specifications that alter the timing in the regression framework. First, we consider the build-up of QE expectations prior to the official announcement. Although the official ECB QE announcement was made in January 2015, senior ECB officials had given strong hints about the launch of the

[8] Note that the above effect would be present even if the reporting bank is located in the same country as the institutional investor whose hedging demand it accommodates. In this case, the spot leg of the FX swap transaction would show up as an increase in the net local currency assets of the reporting bank. Nevertheless, to the extent that the borrowing bank would need to borrow the euros from another (related or unrelated) bank located in a different country, this would still result in an increase in cross-border interbank claims.

programme on multiple occasions in the latter part of 2014. As a consequence, the euro exchange rate had started to decline well ahead of the official announcement.

To examine this possible expectation effect, we re-estimate the benchmark regression on an earlier and longer time window that compares the period between end-September 2014 and end-March 2015 with the period between end-March 2014 and end-September 2014 (Table 3, column 1). Furthermore, we perform additional robustness checks of the analysis for this alternative window by inserting a dummy variable for euro area borrowers (Table 3, column 2) and by excluding euro area borrowers from the regression (Table 3, column 3). Even though the euro share coefficients become a bit smaller relative to the benchmark window, they retain their sign and statistical significance.

Another potential timing concern is related to the partial reversal of flows in Q2 2015. It is possible that the positive impact of the euro share detected in Q1 2015 was wiped out in the subsequent quarter. To test this, we re-estimate the benchmark regression on an extended time period. Namely, we compare the growth rates of cross-border bank claims during the period Q1–Q2 2015 with those from Q3–Q4 2014. We start by re-running our benchmark specification for this alternative window (Table 3, column 4). We then repeat the analysis while inserting a dummy variable for euro area borrowers (Table 3, column 5) and while excluding euro area borrowers (Table 3, column 6). Again, the euro share coefficients decline slightly relative to their counterparts from the benchmark window, but remain positive and strongly statistically significant.

Alternative regression specifications[1]

Table 3

	Q4 2014–Q1 2015[2]			Q1–Q2 2015[3]		
Selected variables	(1) All	(2) Add EA_b controls	(3) Remove EA_b	(4) All	(5) Add EA_b controls	(6) Remove EA_b
Cross-border bank lending denominated in euros *(EURShare$_{b,l}$)*	0.04**	0.1***	0.1***	0.08***	0.12**	0.13**
EME$_b$ dummy – EUR share interaction *(EME$_b$*EURShare$_{b,l}$)*	–0.09*	–0.16***	–0.15***	–0.11**	–0.15**	–0.15**
EA$_b$ dummy – EUR share interaction *(EA$_b$*EURShare$_{b,l}$)*		0.00			–0.08	
Sum of *(EURShare$_{b,l}$)* and *(EME$_b$*EURShare$_{b,l}$)* [4]	–0.05	–0.06	–0.05	–0.03	–0.02	–0.03
Sum of *(EURShare$_{b,l}$)* and *(EA$_b$*EURShare$_{b,l}$)* [4]		0.1***			0.05	
R-squared, %	13.00	15.73	16.14	10.05	10.62	9.82
Number of observations	1007	1007	735	989	989	718

(1) and (4) are equations with 51 borrowers and all candidate explanatory variables listed in equation 1. Variable calculation was adjusted according to each of the alternative timing specifications; (2) and (5) additionally include euro area borrower dummy and its interactions with the euro share and the borrower-specific controls; (3) and (6) exclude euro area borrowers from the sample.

[1] ***/**/* denotes significance at 1/5/10% level. [2] The dependent variable represents the change in the average growth rate of lending banking system *l*'s cross-border claims on borrowing country *b* between the alternative specification of ECB quantitative easing (QE) episode (Q4 2014 and Q1 2015) and the two quarters preceding it (Q2 and Q3 2014). [3] The dependent variable represents the change in the average growth rate of lending banking system *l*'s cross-border claims on borrowing country *b* between the alternative specification of ECB QE episode (Q2 and Q1 2015) and the two preceding quarters (Q3 and Q4 2014). [4] Wald test of linear restrictions on the coefficients; the asterisks, if any, indicate whether the specified sums of coefficients are significantly different from zero.

Source: Authors' calculations.

We also show that excluding explanatory variables, one at a time, does not materially affect the euro share results.[9] The euro share coefficient remains positive and significant at the 1% level in all specifications. The euro share interaction term with EMEs becomes insignificant in only one case, when dropping borrowing country credit. Most importantly, the extensive control for EME behaviour that we apply in our benchmark model does not drive the significant euro share coefficient estimates: even when dropping the EME dummy and all EME interaction terms, the euro share coefficient estimate remains positive and highly significant.

Finally, we also check that our results do not depend on outliers. Hence, we systematically exclude, one by one, each lending banking system and each borrowing country. The results remain robust to these exclusions. The euro share coefficient remains highly significant in all cases.

Conclusion

This special feature provides evidence that the currency denomination of cross-border bank claims was a significant driver of the cross-sectional variation in cross-border bank lending in response to the January 2015 ECB QE announcement. More concretely, higher shares of euro-denominated claims were associated with greater expansions in cross-border bank lending. This result appears to be driven primarily by lending to advanced economies outside the euro area. By contrast, the estimated effects on cross-border lending to EME borrowers tend to be insignificant.

The findings suggest that the US dollar network, which has been the main focus of the existing literature on the topic, is not unique. The euro cross-border bank lending network responds to monetary policy shocks in a qualitatively similar manner. Furthermore, the reactions of currency networks to an easing monetary policy shock (such as the 2015 ECB QE announcement) are symmetric to their response to a tightening monetary policy shock (such as the 2013 Fed taper tantrum).

The results are particularly relevant for policymakers in borrowing countries that rely heavily on cross-border bank lending. They suggest that credit supply depends not only on the health of lending banking systems (as already documented in the existing literature), but also on the currency denomination of cross-border bank lending. For example, euro lending by Swiss banks to Poland can be affected by the ECB's monetary policy, even though neither country is part of the euro area. Given the extraordinary monetary policies implemented by central banks in advanced economies over the past few years and the large stocks of cross-border loans denominated in foreign currencies, our findings suggest that policymakers should closely monitor the currency denomination of cross-border bank lending as they assess the potential impact of possible policy moves, both in their own economies and abroad.

[9] When removing an explanatory variable, we also remove the interaction terms in which it enters.

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Annex

Country list[1]

Table A1

Lending banking systems	Borrowing countries
Euro area (EA): Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.	**Euro area (EA)**: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain.
Non-EA advanced economies: Australia, Canada, Denmark, Japan, Norway, Sweden, Switzerland, the United Kingdom and the United States.	**Non-EA advanced economies:** Australia, Canada, Denmark, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom and the United States.
EMEs: Brazil, Chinese Taipei, India, Korea, Mexico and Turkey.	**EMEs**: Angola, Brazil, Bulgaria, Chile, China, Chinese Taipei, Croatia, the Czech Republic, Hungary, Israel, Korea, Liberia, Mexico, Morocco, Nigeria, Poland, Romania, Russia, South Africa, Turkey, Ukraine and Vietnam.

[1] The cross-border bank lending volume of the Marshall Islands exceeded the $10 billion threshold at end-Q3 2014; however, this country was removed from the borrower country list in the econometric analysis sample due to unavailability of private sector credit data. Borrower countries Estonia and Latvia would not have been included based solely on cross-border bank lending volumes; however, their inclusion – which allows us to include all euro area members – does not materially affect our empirical results due to the small size of these two countries. Note, further, that we include all euro area countries only as borrowing countries – as lending banking systems, the database is still limited to BIS reporting countries and therefore excludes several smaller euro area countries (Estonia, Latvia, Lithuania, Malta, Slovakia and Slovenia). Finally, we exclude offshore financial centres due to the idiosyncratic nature of cross-border bank flows directed towards them.

Annexes

BIS Statistics: Charts

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

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

A Locational banking statistics

B Consolidated banking statistics

C Debt securities statistics

D Derivatives statistics

E Global liquidity indicators

F Statistics on total credit to the non-financial sector

G Debt service ratios for the private non-financial sector

H Property price statistics

I Effective exchange rate statistics

J Credit-to-GDP gaps

K Consumer price indices

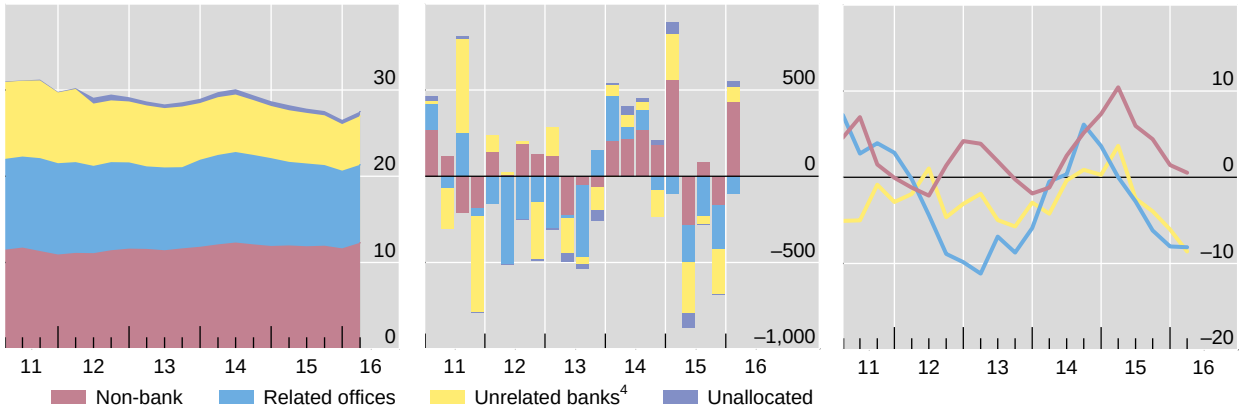
A Locational banking statistics

Cross-border claims, by sector, currency and instrument

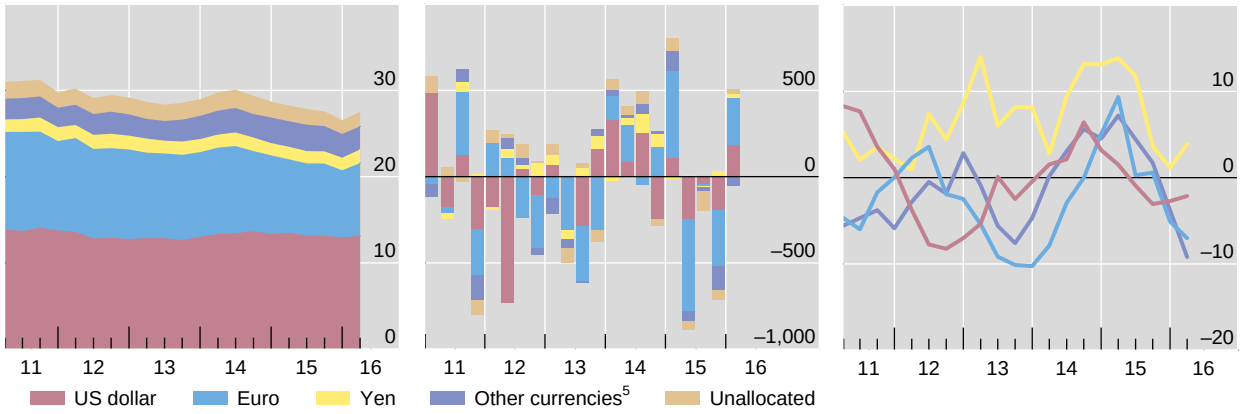
Graph A.1

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

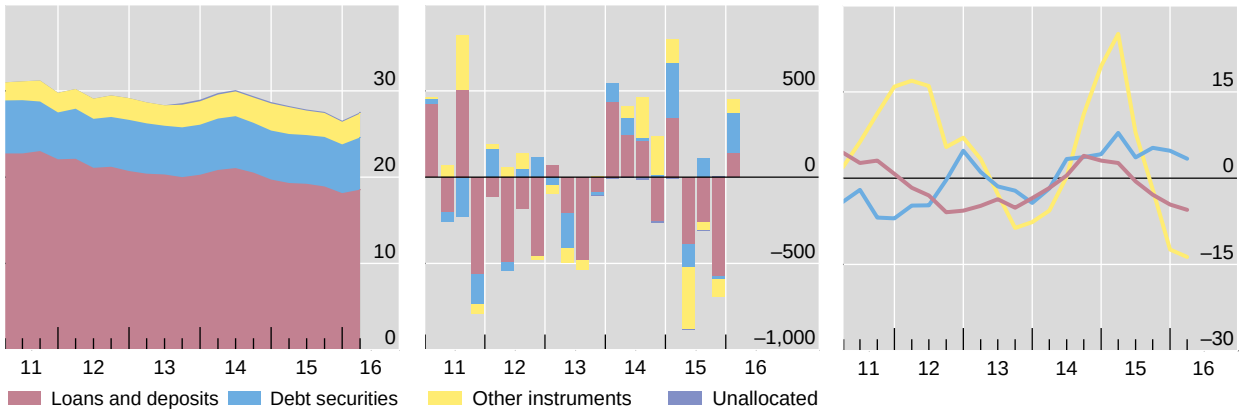
By sector of counterparty



By currency



By instrument



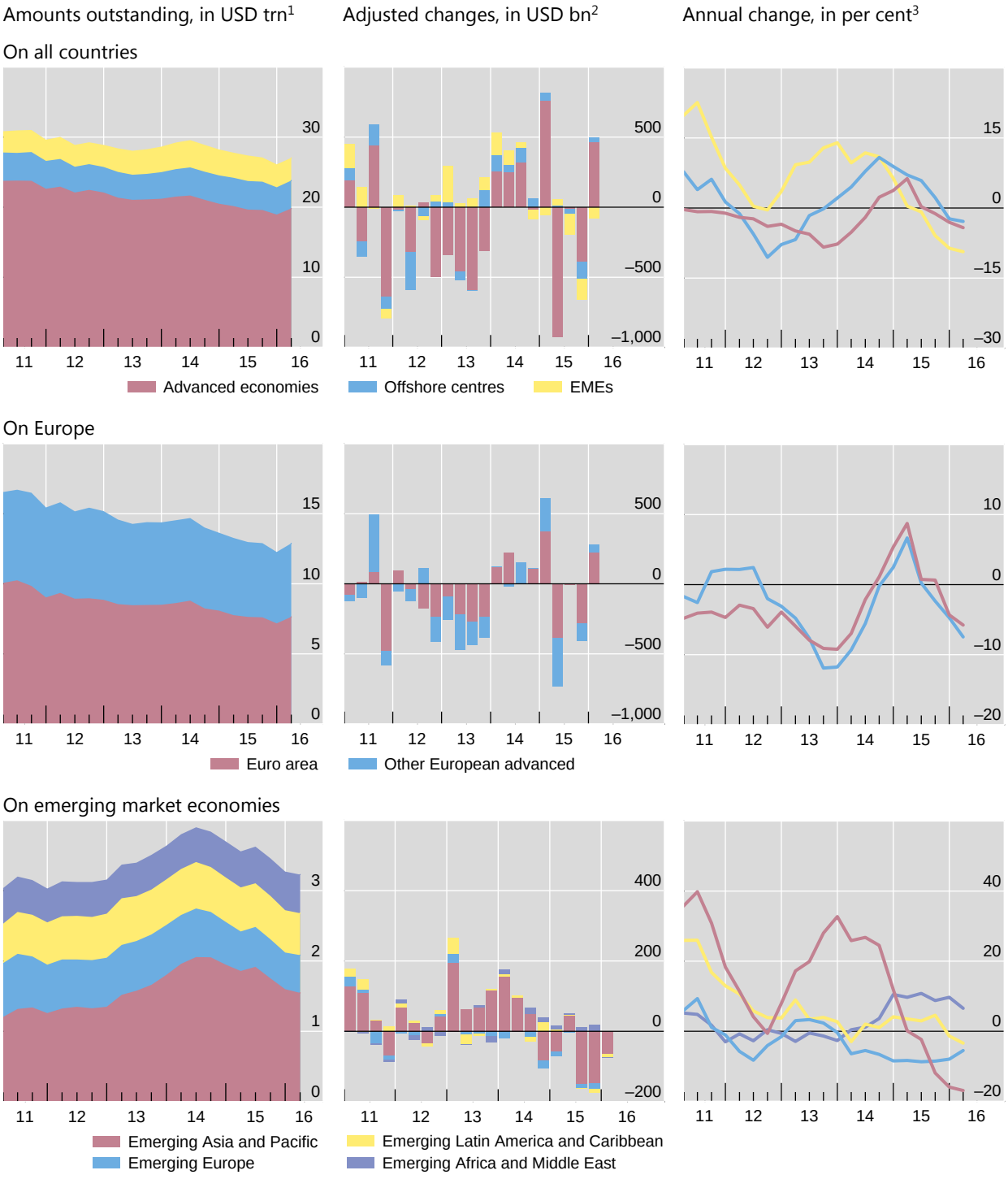
Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

[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 US dollar, euro, yen and unallocated currencies. The currency is known but reporting is incomplete.

Source: BIS locational banking statistics.

Cross-border claims, by borrowing region

Graph A.2



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.

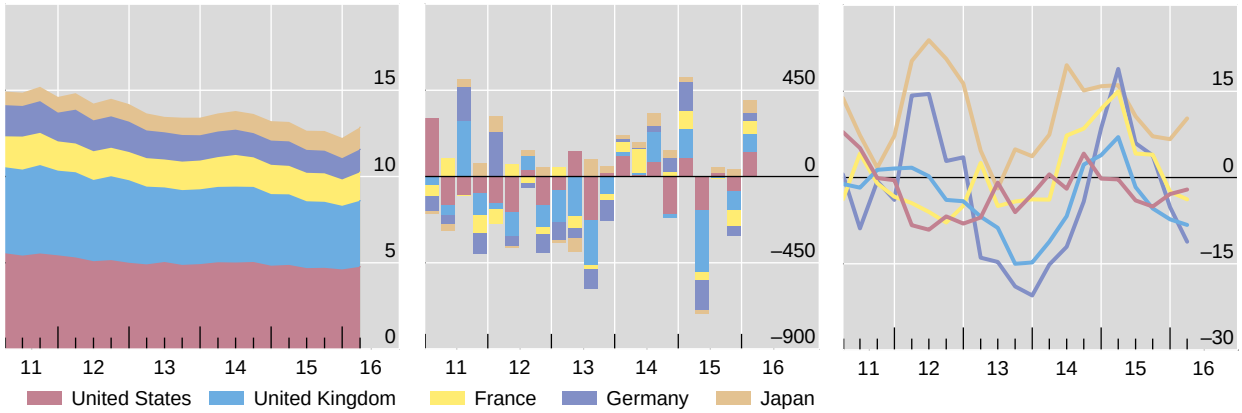
Source: BIS locational banking statistics.

Cross-border claims, by borrowing country

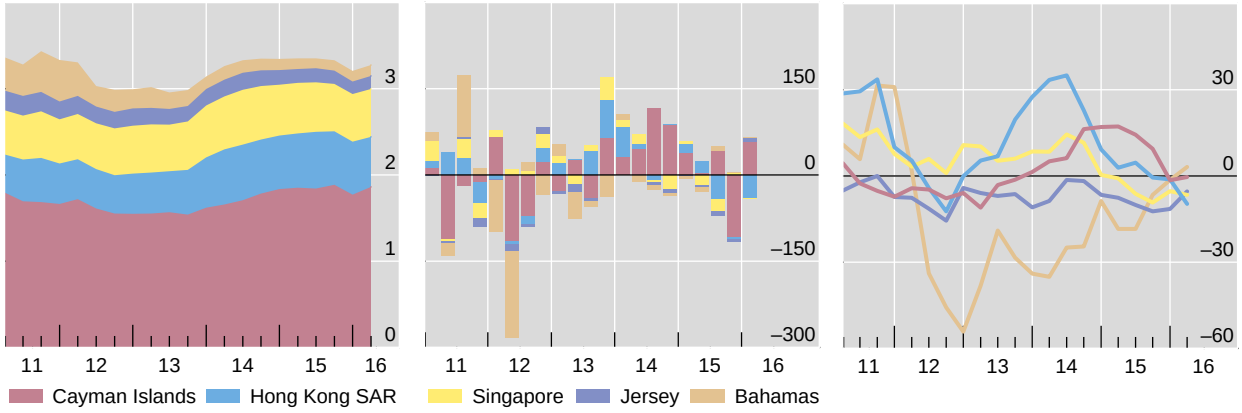
Graph A.3

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

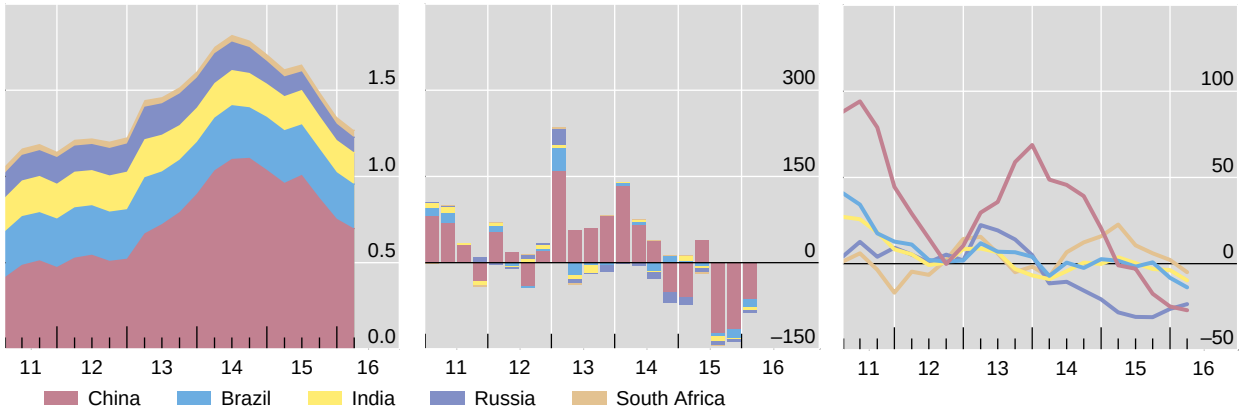
On selected advanced economies



On selected offshore centres



On selected emerging market economies



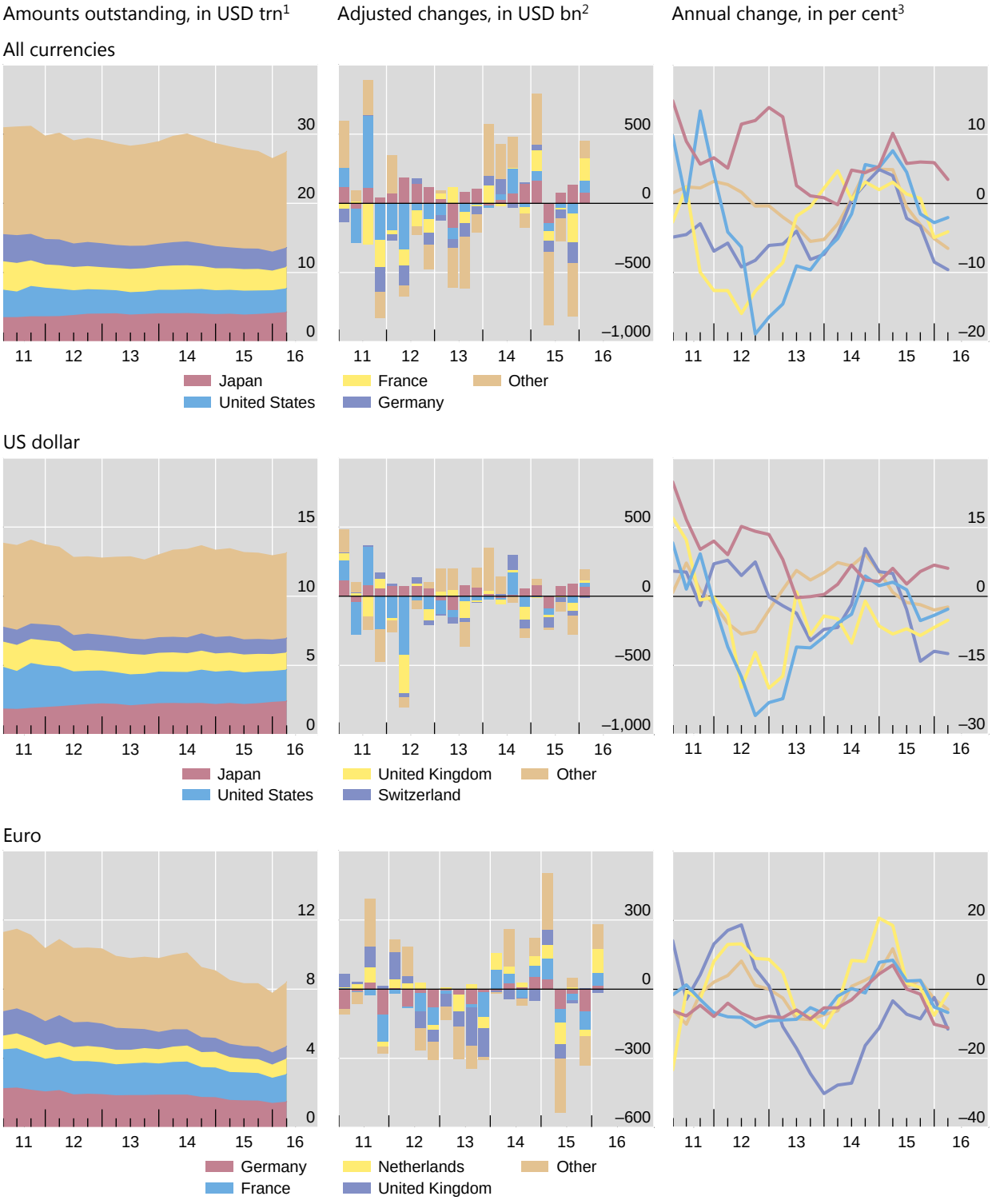
Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

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

Source: BIS locational banking statistics.

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

Graph A.4



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.

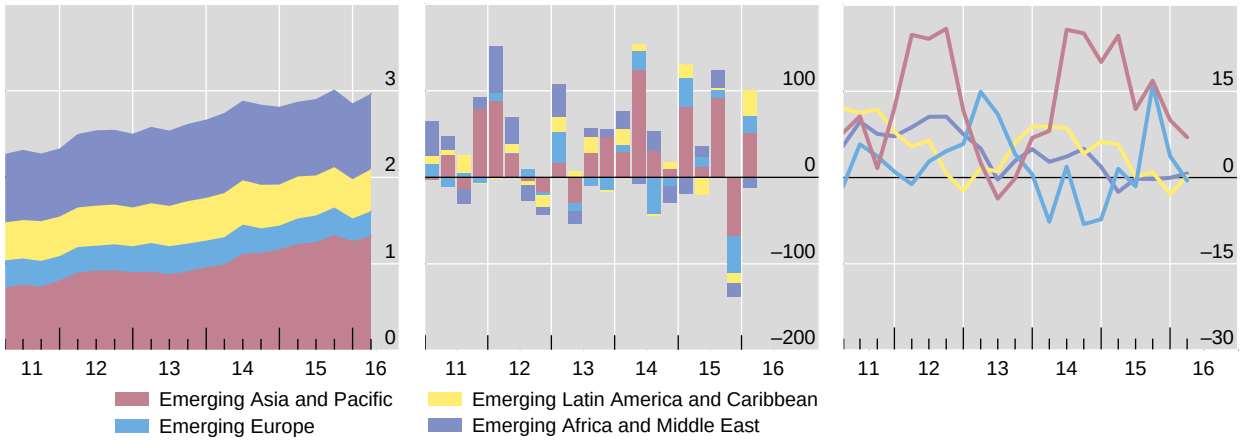
Source: BIS locational banking statistics.

Cross-border liabilities of reporting banks

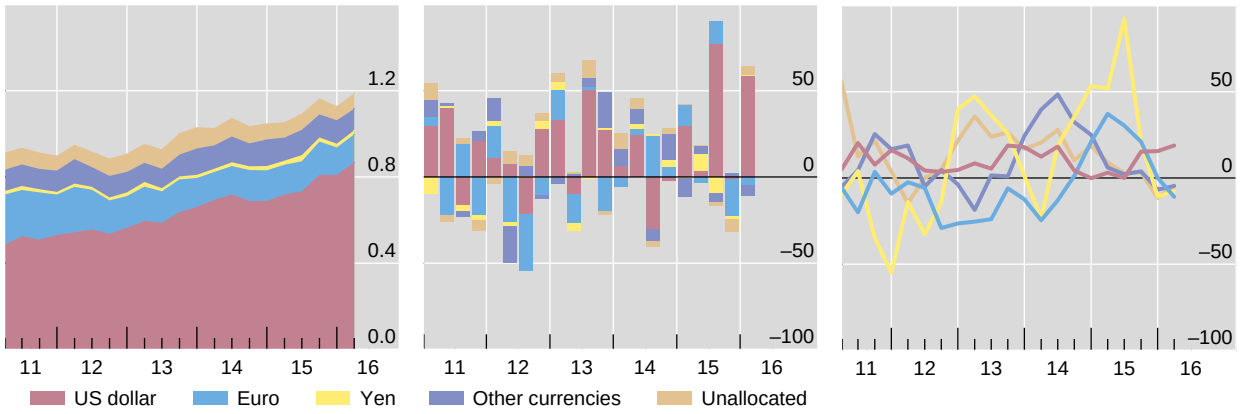
Graph A.5

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

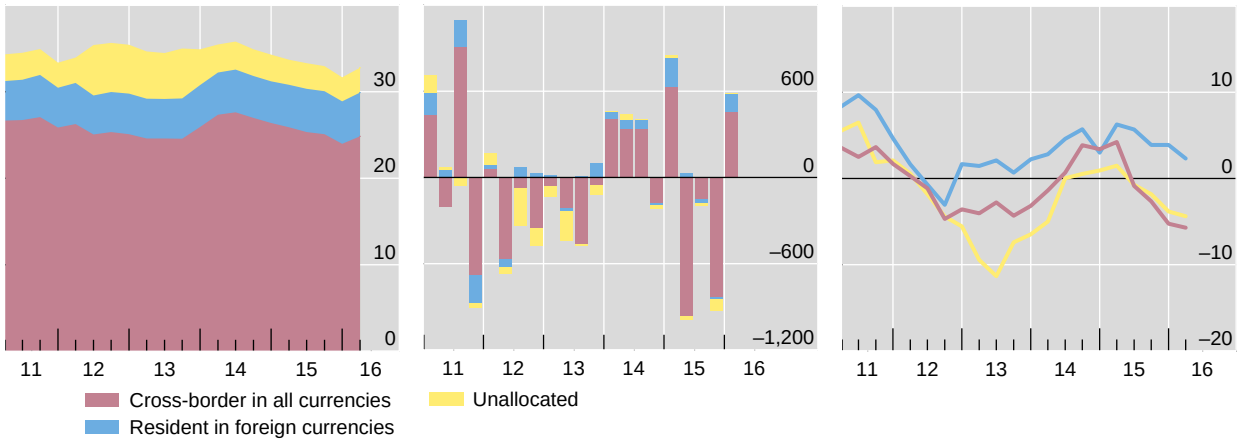
To emerging market economies



To central banks



By currency type and location



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.

B Consolidated banking statistics

Consolidated claims of reporting banks on advanced economies

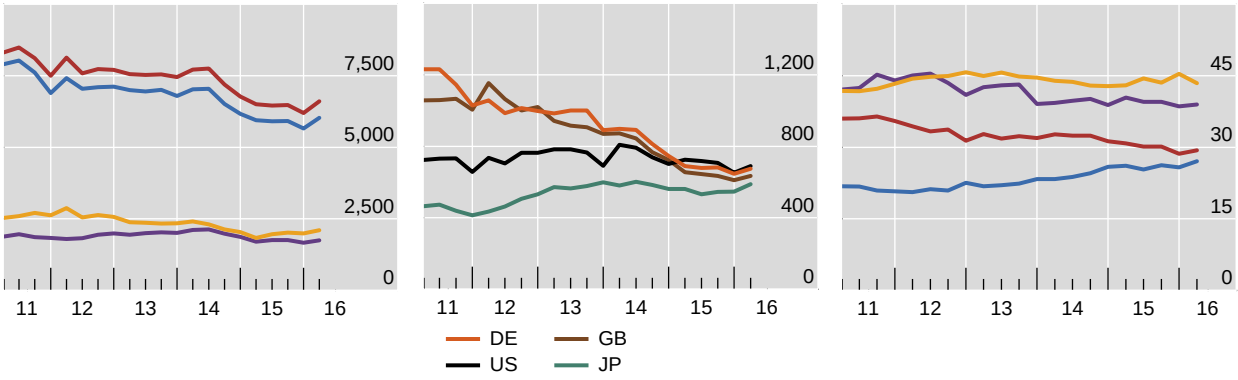
Graph B.1

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

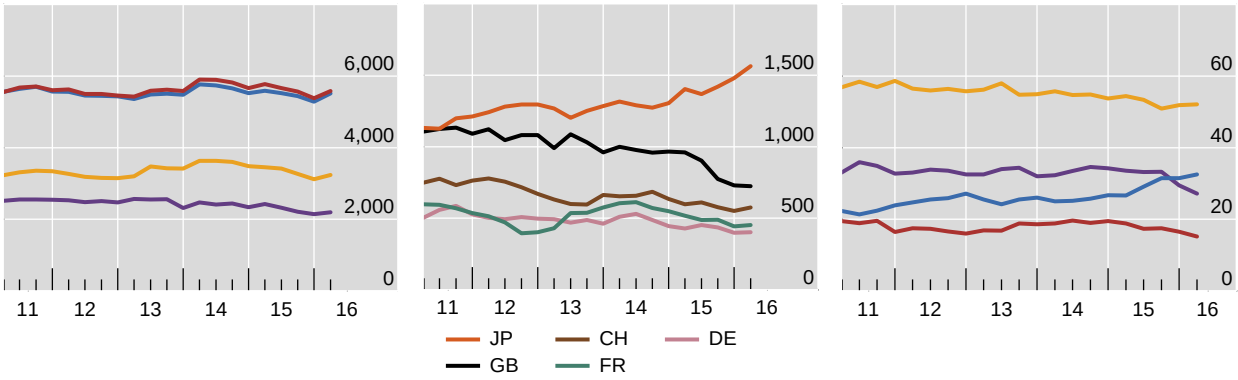
Foreign claims of selected creditors, in USD bn[1, 3]

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

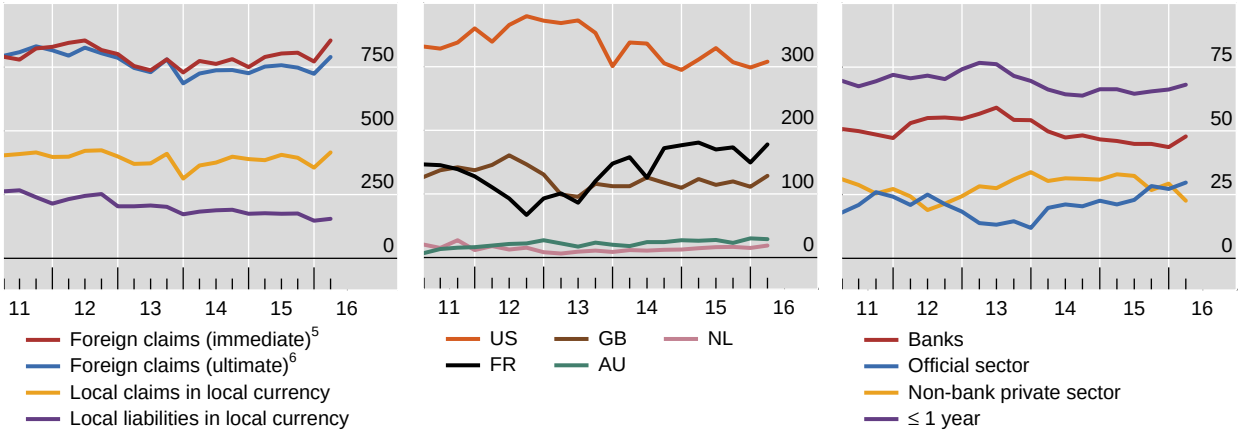
On the euro area



On the United States



On Japan



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

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

[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 immediate counterparty basis. Includes the unconsolidated claims of banks headquartered outside but located inside CBS-reporting countries. [6] On an ultimate risk basis.

Source: BIS consolidated banking statistics (CBS).

Consolidated claims of reporting banks on emerging market economies

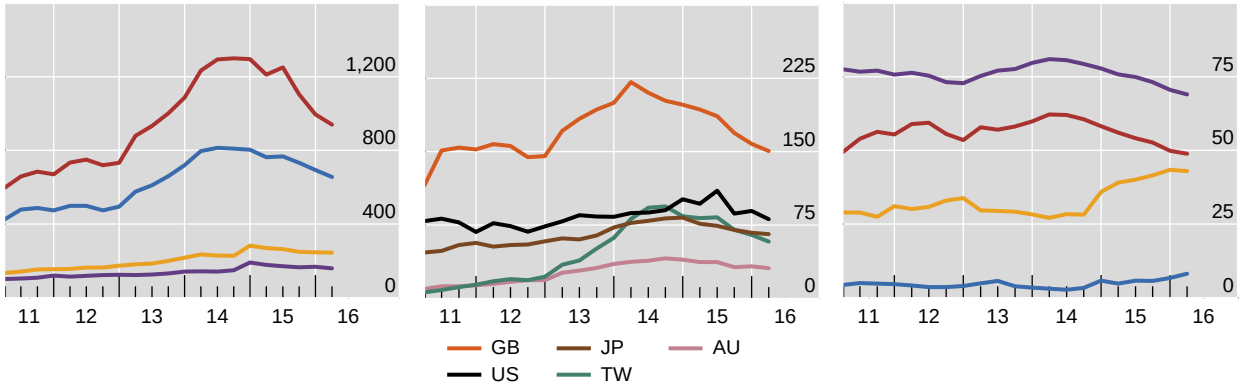
Graph B.2

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

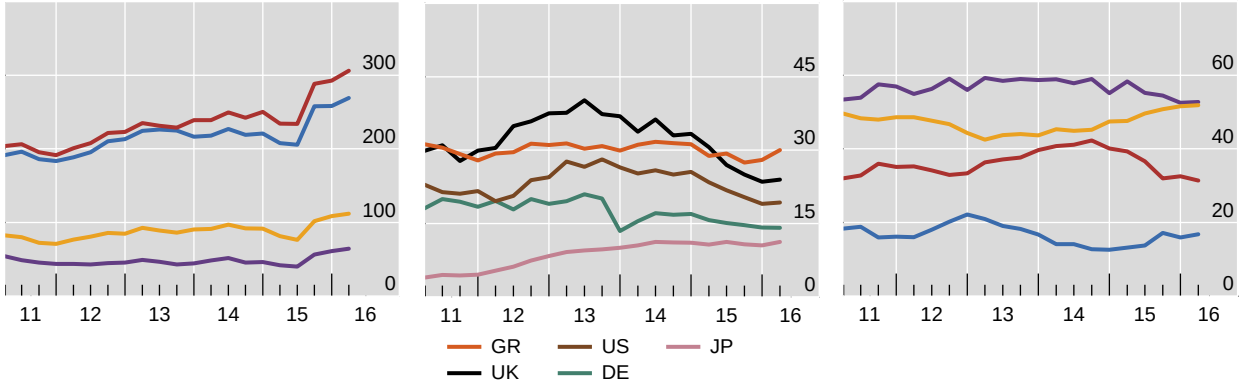
Foreign claims of selected creditors, in USD bn[1, 3]

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

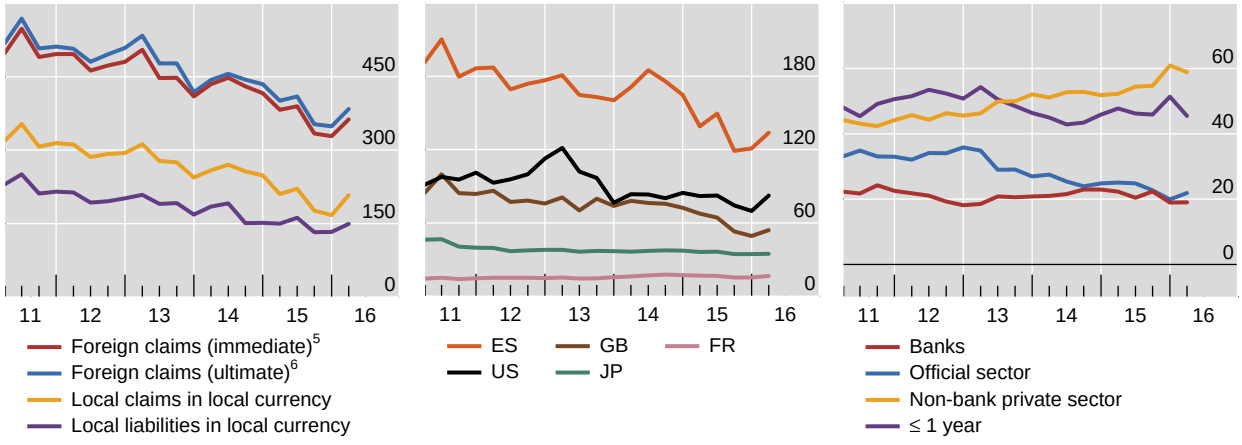
On China



On Turkey



On Brazil



AU = Australia; DE = Germany; ES = Spain; GB = United Kingdom; GR = Greece; JP = Japan; NL = Netherlands; TW = Chinese Taipei; US = United States.

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

[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 immediate counterparty basis. Includes the unconsolidated claims of banks headquartered outside but located inside CBS-reporting countries. [6] On an ultimate risk basis.

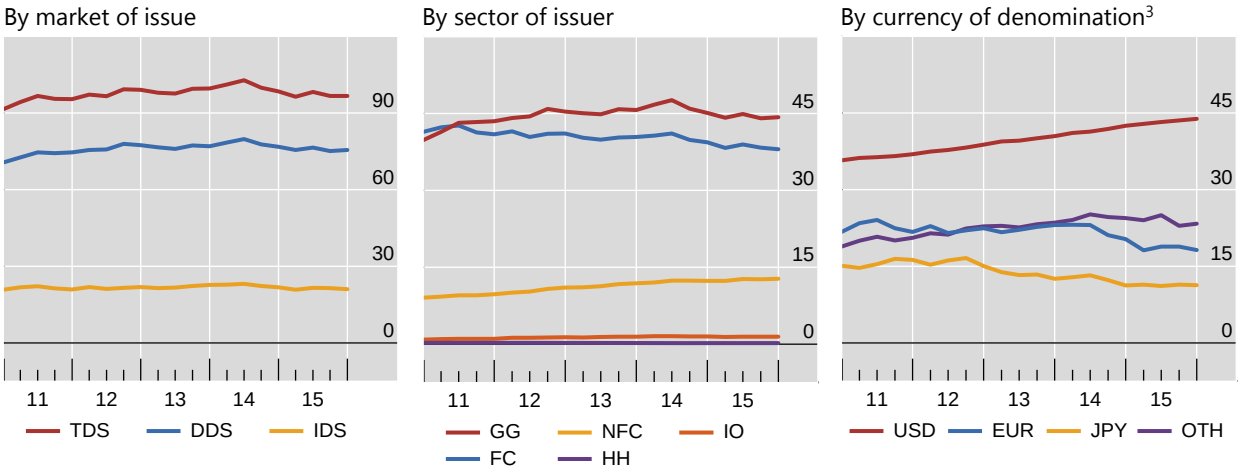
Source: BIS consolidated banking statistics (CBS).

C Debt securities statistics

Global debt securities markets[1]

Amounts outstanding, in trillions of US dollars[2]

Graph C.1



DDS = domestic debt securities; IDS = international debt securities; TDS = total debt securities.

FC = financial corporations; GG = general government; HH = households and non-profit institutions serving households; IO = international organisations; NFC = non-financial corporations.

EUR = euro; JPY = yen; OTH = other currencies; USD = US dollar.

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

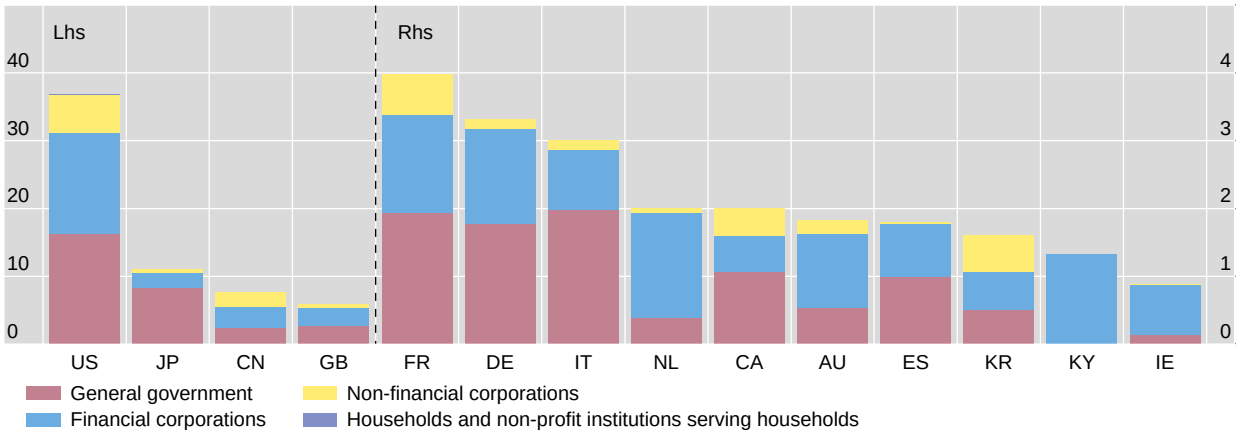
[1] Sample of countries varies across breakdowns shown. For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. For countries that do not report either TDS or DDS, data are estimated by the BIS as IDS. [2] At quarter-end. Amounts denominated in currencies other than the US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

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

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

Amounts outstanding at end-December 2015, in trillions of US dollars[2]

Graph C.2



AU = Australia; 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.

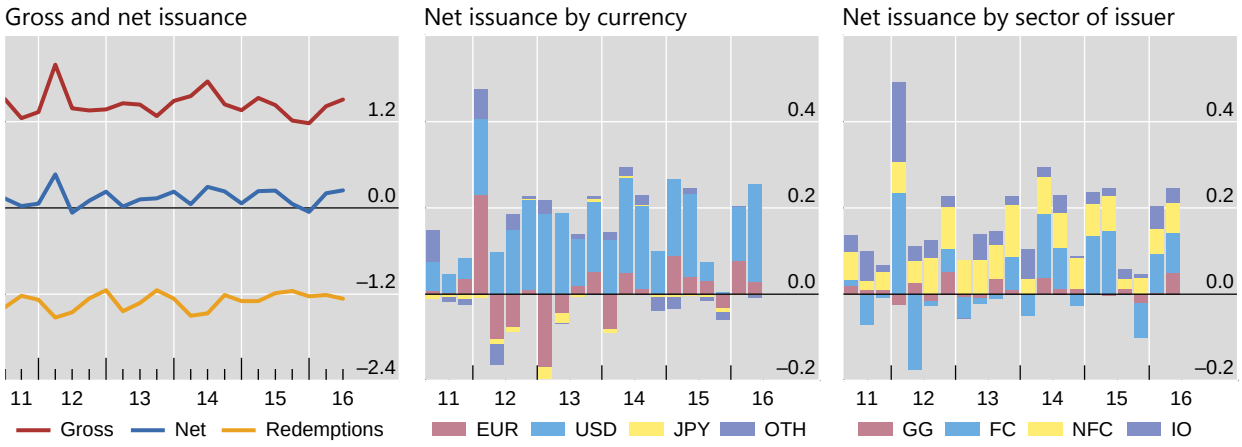
Further information on the BIS debt securities statistics is available at www.bis.org/statistics/secstats.htm.

[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



EUR = euro; JPY = yen; OTH = other currencies; USD = US dollar.

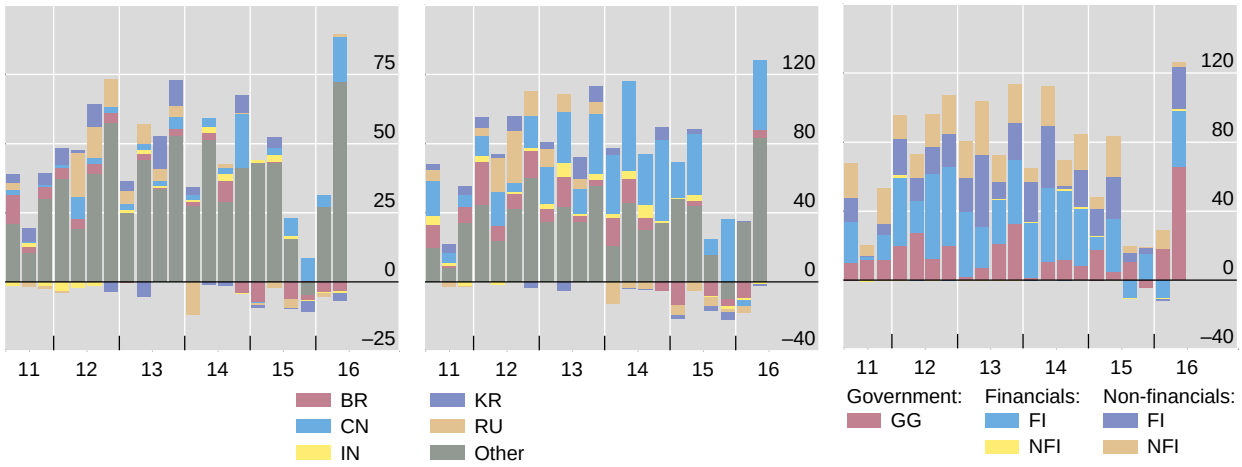
FC= financial corporations; GG = general government; IO = international organisations; NFC = non-financial corporations.

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

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

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

Net issuance, in billions of US dollars — Graph C.4



BR = Brazil; CN = China; IN = India; KR = Korea; RU = Russia.

FI = financial corporations; GG = general government; NFI = non-financial corporations.

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

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

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

D Derivatives statistics

Exchange-traded derivatives

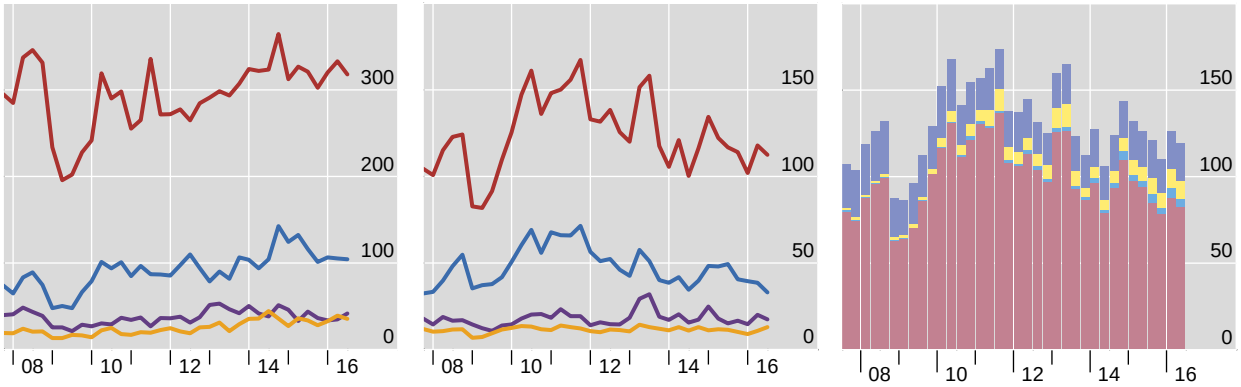
Graph D.1

Open interest, by currency[1]

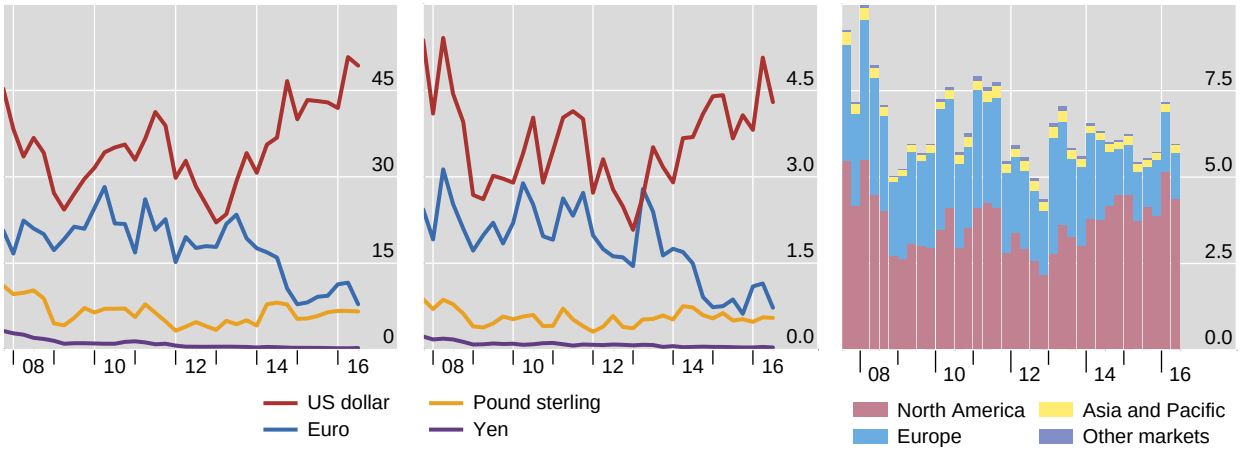
Daily average turnover, by currency[2]

Daily average turnover, by location of exchange[2]

Foreign exchange derivatives, USD bn[3]



Interest rate derivatives, USD trn[3]



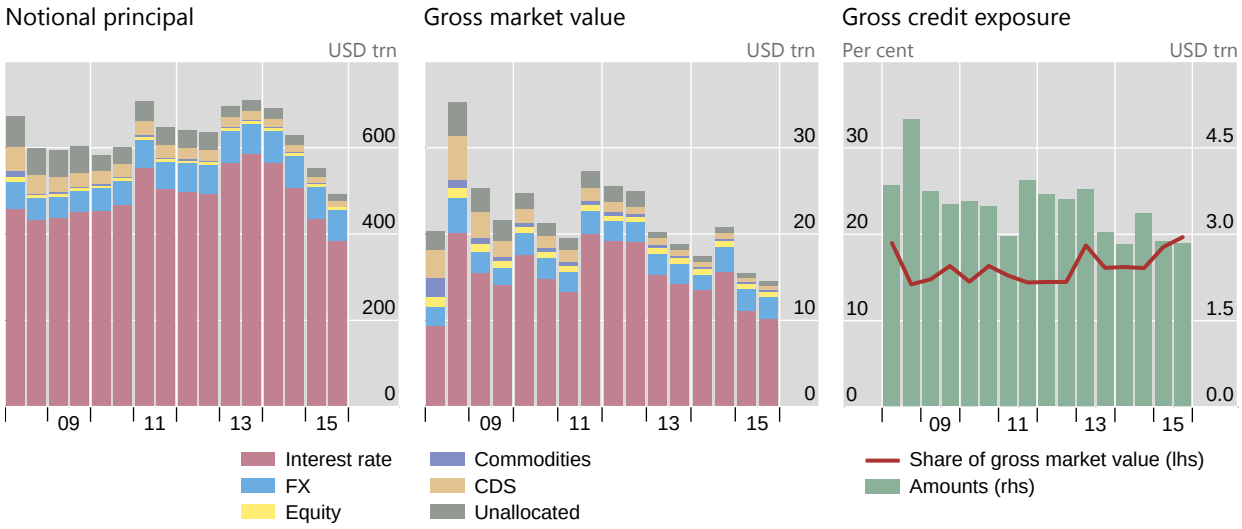
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/extderiv.htm.

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

Sources: Euromoney TRADEDATA; Futures Industry Association; The Options Clearing Corporation; BIS derivatives statistics.

Global OTC derivatives markets[1]

Graph D.2



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

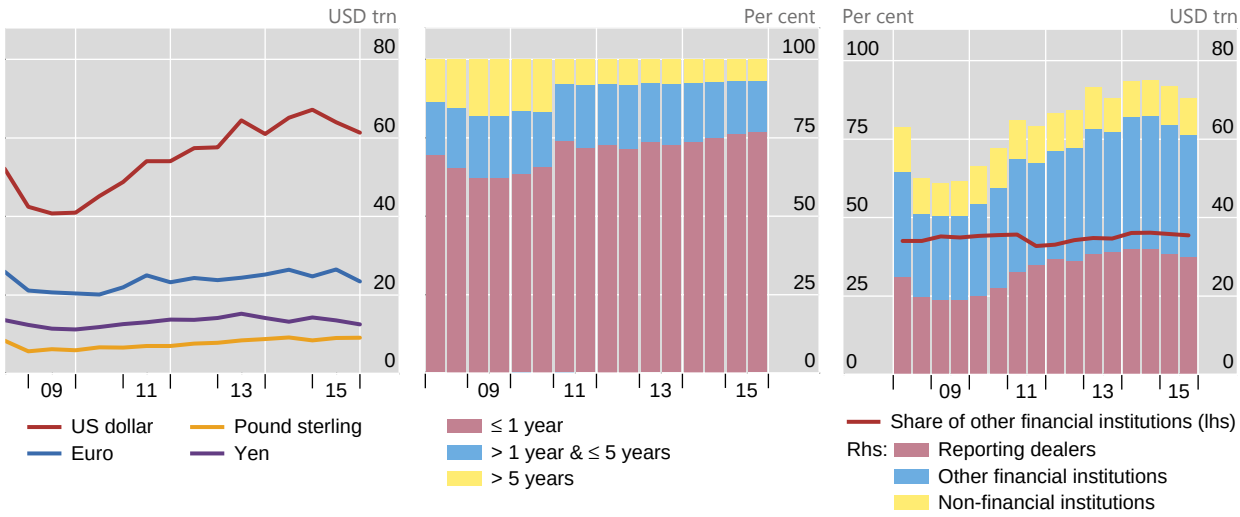
[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

OTC foreign exchange derivatives

Notional principal[1]

Graph D.3



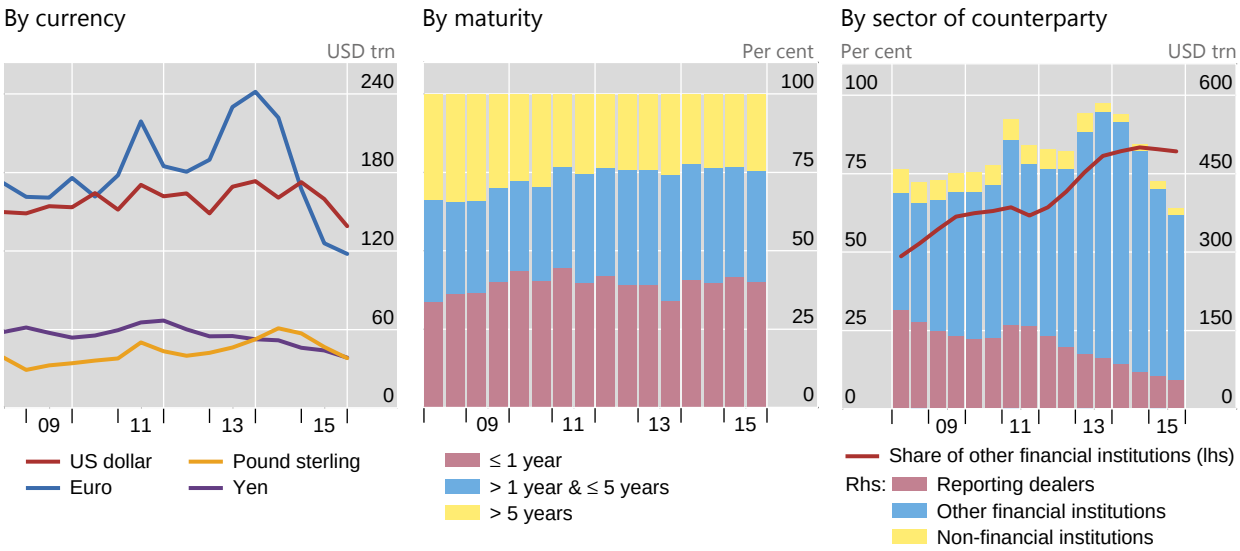
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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

Source: BIS derivatives statistics.

OTC interest rate derivatives

Notional principal[1] Graph D.4



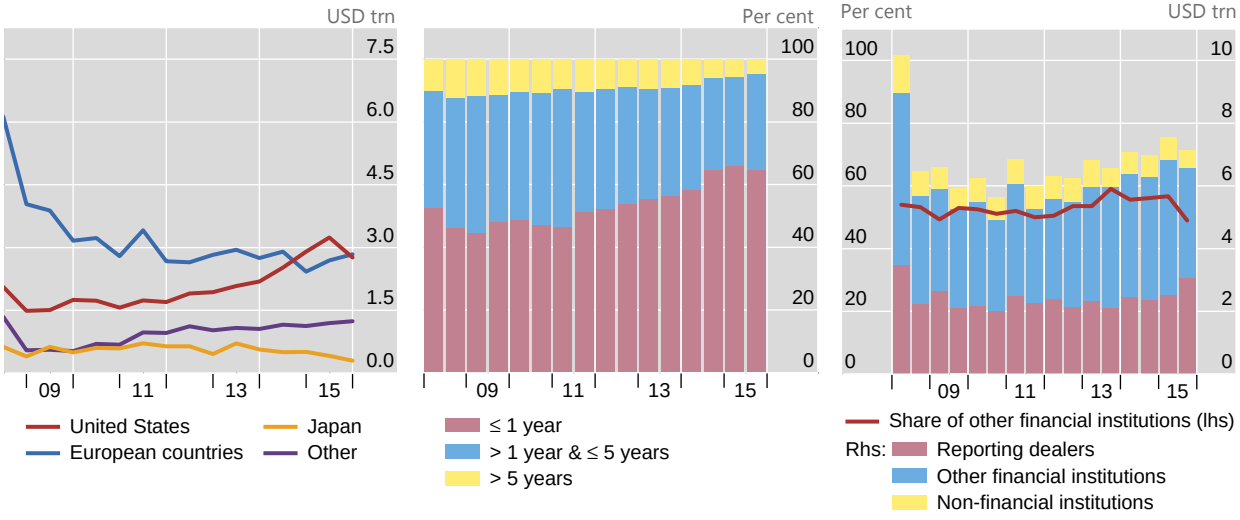
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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

Source: BIS derivatives statistics.

OTC equity-linked derivatives

Notional principal[1] Graph D.5



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

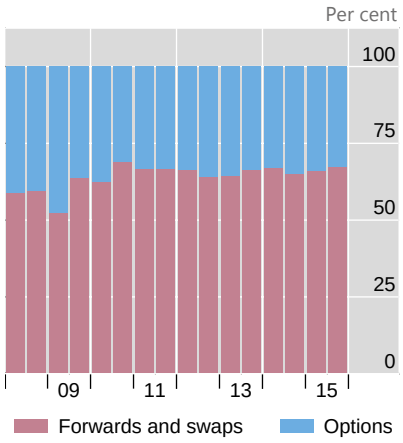
[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

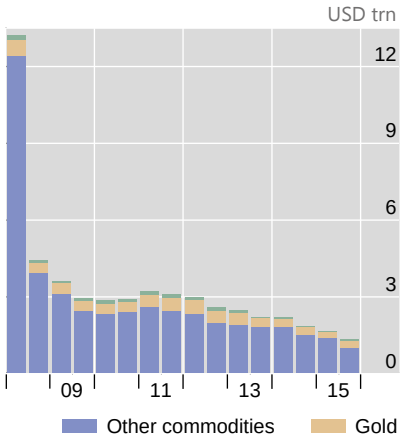
OTC commodity derivatives[1]

Graph D.6

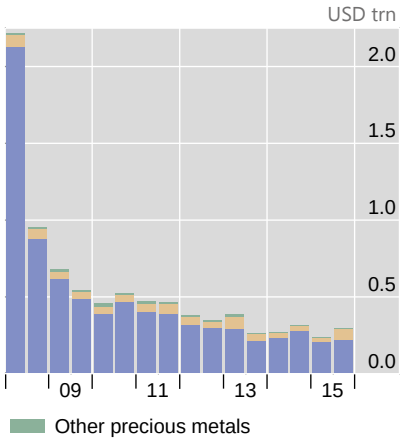
Notional principal, by instrument



Notional principal, by commodity



Gross market value, by commodity



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

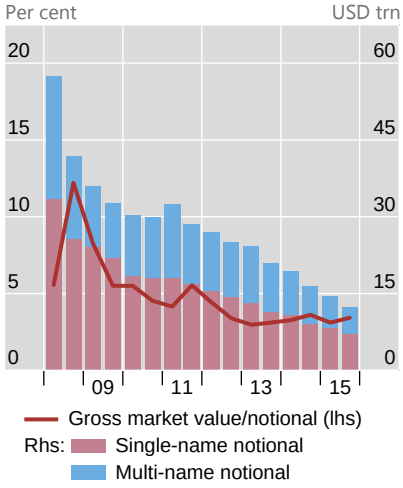
[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

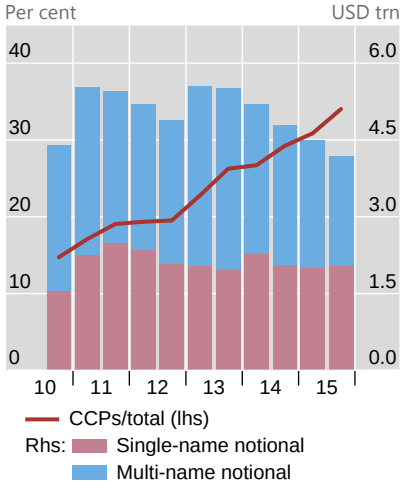
Credit default swaps[1]

Graph D.7

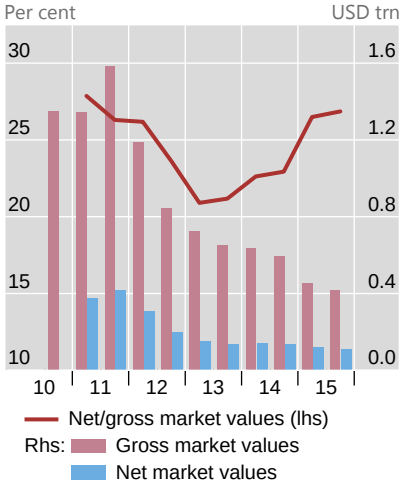
Notional principal



Notional principal with central counterparties (CCPs)



Impact of netting



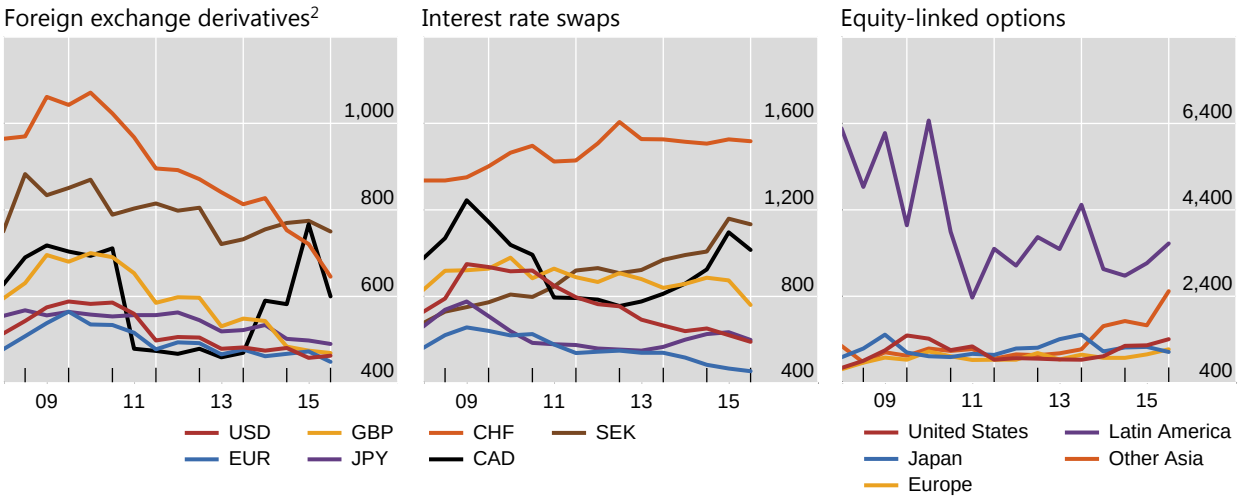
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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

Source: BIS derivatives statistics.

Concentration in global OTC derivatives markets

Herfindahl index[1] Graph D.8



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

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

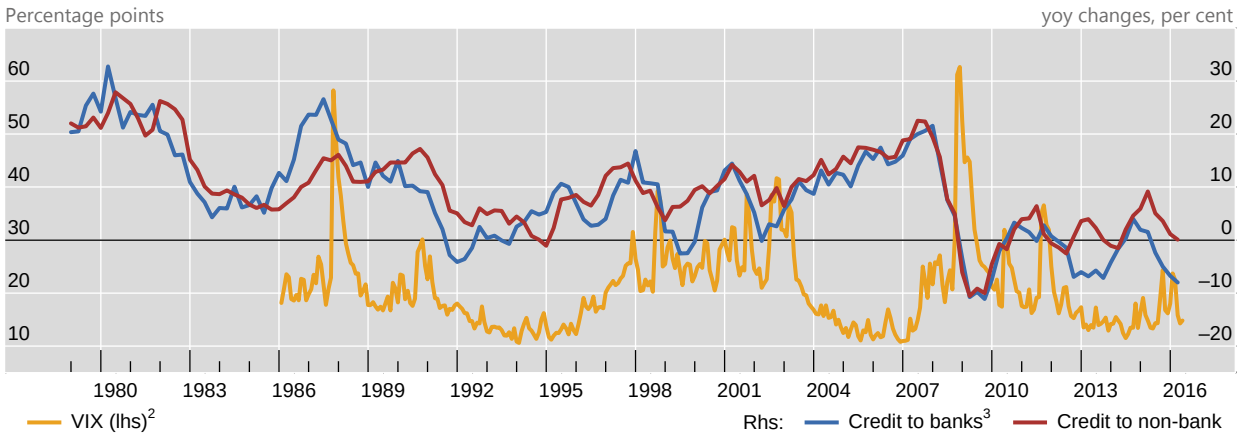
[1] The index ranges from 0 to 10,000, where a lower number indicates that there are many dealers with similar market shares (as measured by notional principal) and a higher number indicates that the market is dominated by a few reporting dealers. [2] Foreign exchange forwards, foreign exchange swaps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

Source: BIS derivatives statistics.

E Global liquidity indicators

Growth of international bank credit[1]

Graph E.1



In June 2016, the presentation of data in this graph was revised to show the year-on-year changes in credit, instead of the contribution to growth, and to exclude credit unallocated by sector, which was previously included in credit to banks.

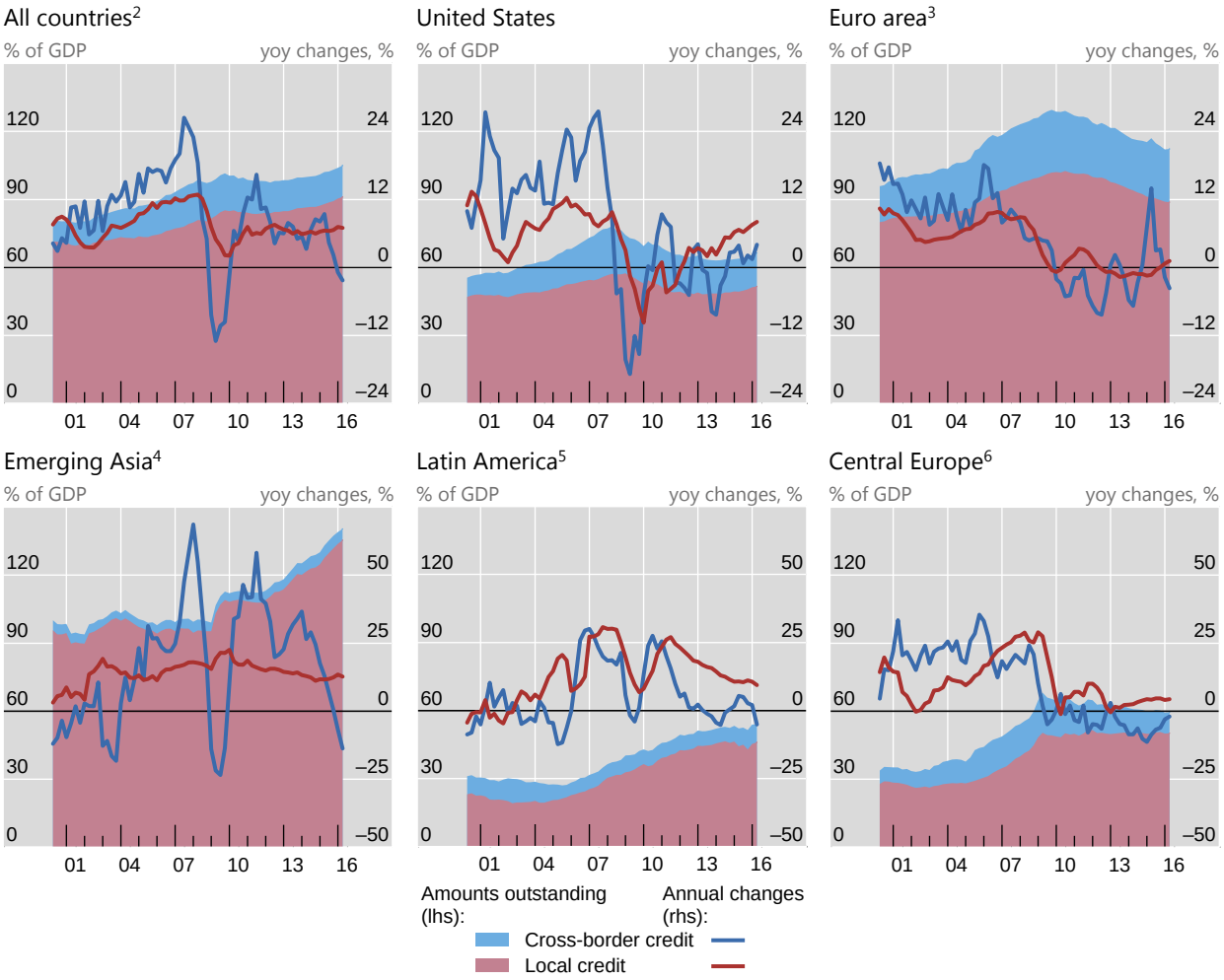
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[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] Including intragroup transactions.

Sources: Bloomberg; BIS locational banking statistics (LBS).

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

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



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

[1] Cross-border claims of LBS reporting banks to the non-bank sector plus local claims of all banks to the private non-financial sector. Weighted averages of the economies listed, based on four-quarter moving sums of GDP. [2] Australia, Canada, Denmark, Japan, New Zealand, Norway, Russia, Saudi Arabia, South Africa, Sweden, Switzerland, Turkey and the United Kingdom, plus the countries in the other panels. [3] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. [4] China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Singapore and Thailand. [5] Argentina, Brazil, Chile and Mexico. [6] The Czech Republic, Hungary and Poland.

Sources: BIS credit to the non-financial sector and locational banking statistics (LBS); BIS calculations.

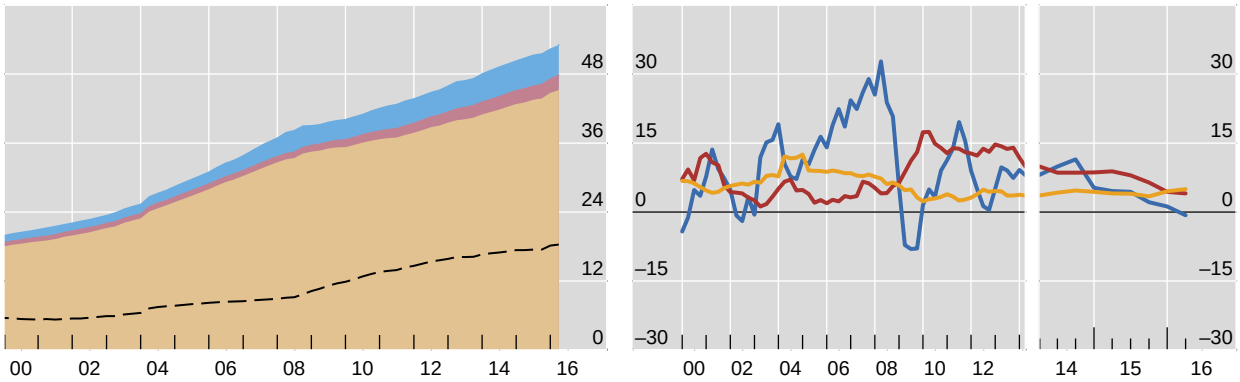
Global credit to the non-financial sector, by currency

Graph E.3

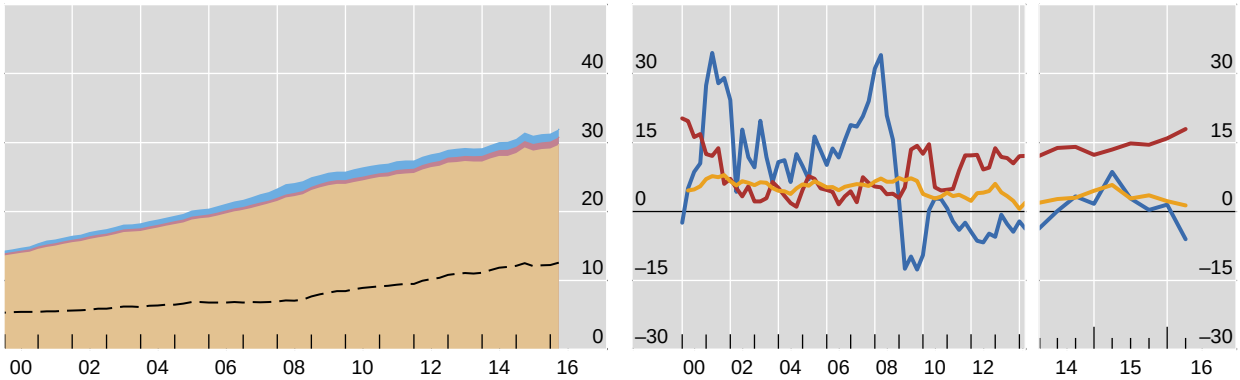
Amounts outstanding, in USD trn[1]

Annual change, in per cent

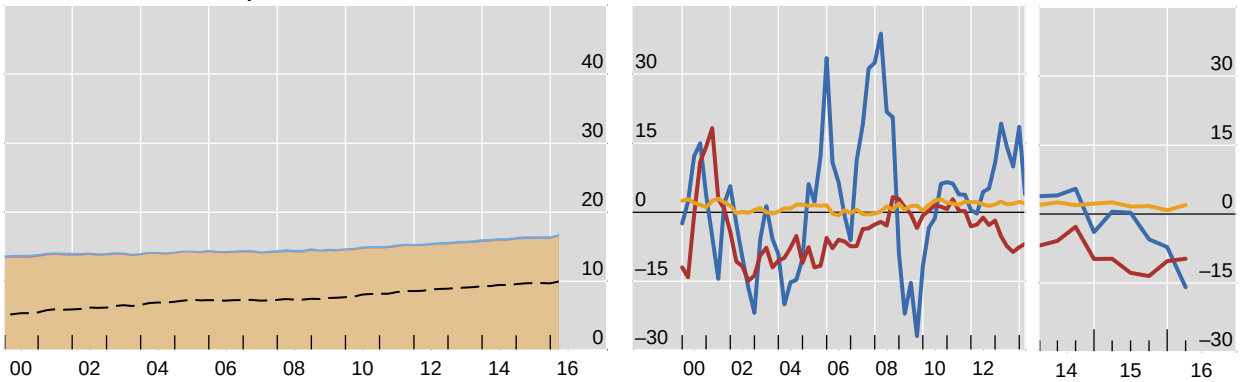
Credit denominated in US dollars (USD)

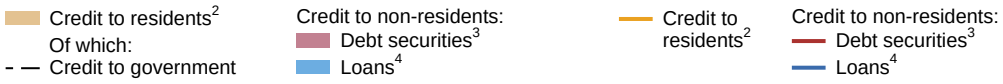


Credit denominated in euros (EUR)



Credit denominated in yen (JPY)





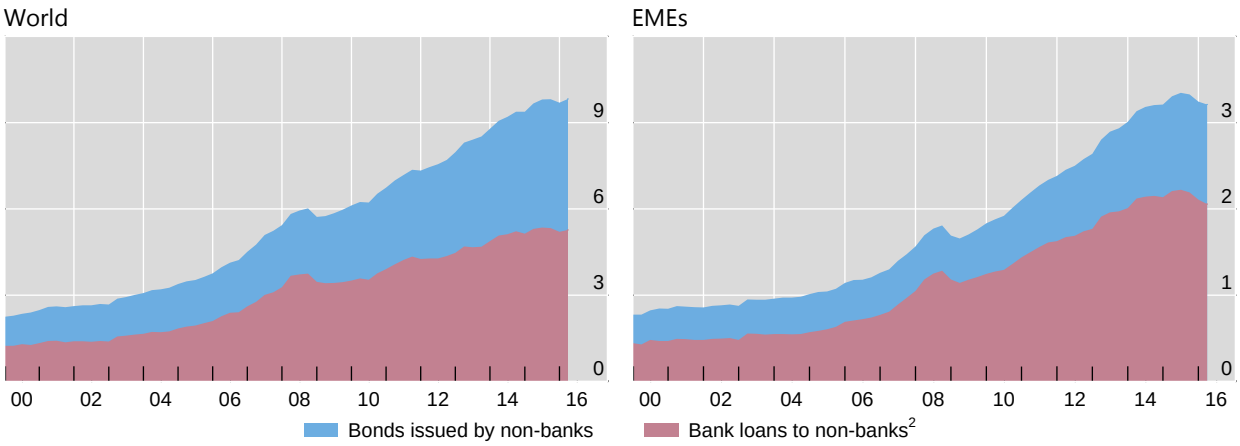
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[1] Amounts outstanding at quarter-end. Amounts denominated in currencies other than USD are converted to USD at the exchange rate prevailing at end-December 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 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 and locational banking statistics (LBS).

US dollar-denominated credit to non-banks outside the United States[1]

Amounts outstanding, in trillions of US dollars — Graph E.4



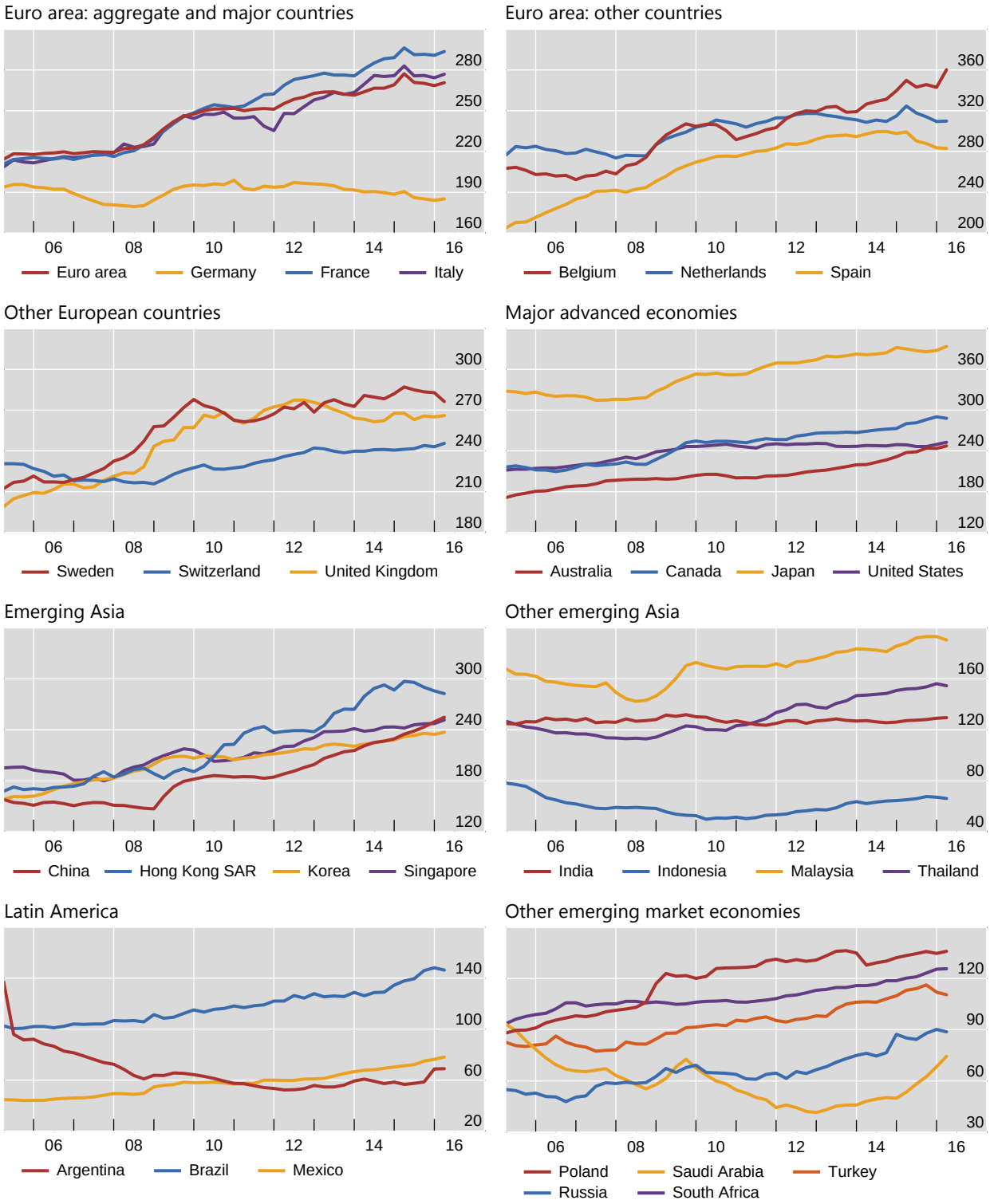
[1] Non-banks comprise non-bank financial entities, non-financial corporations, governments, households and international organisations. [2] Loans by LBS-reporting banks to non-bank borrowers, including non-bank financial entities, comprise cross-border plus local loans. For countries that are not LBS-reporting 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 onlent to non-banks.

Sources: Datastream; BIS debt securities statistics and locational banking statistics (LBS).

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



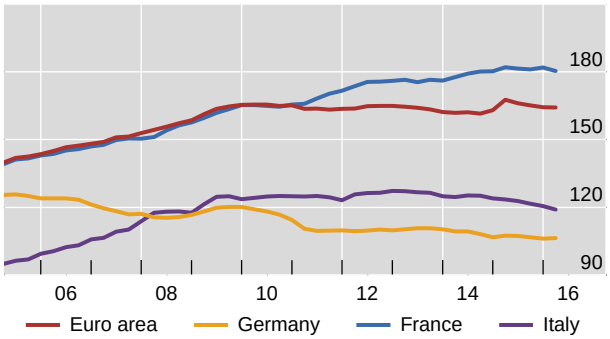
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

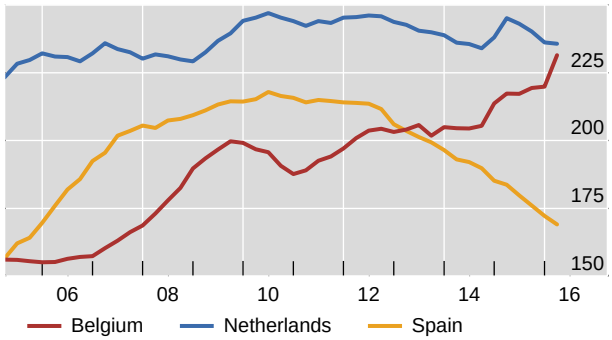
Total credit to the private non-financial sector (core debt)

As a percentage of GDP — Graph F.2

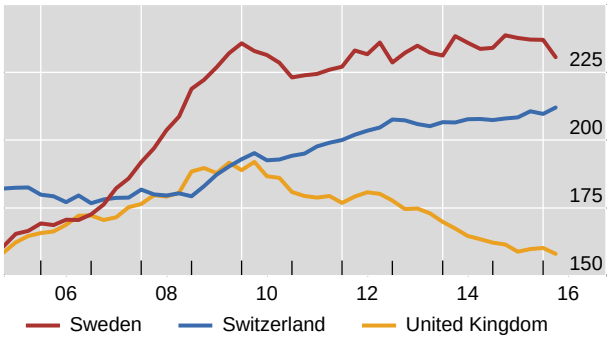
Euro area: aggregate and major countries



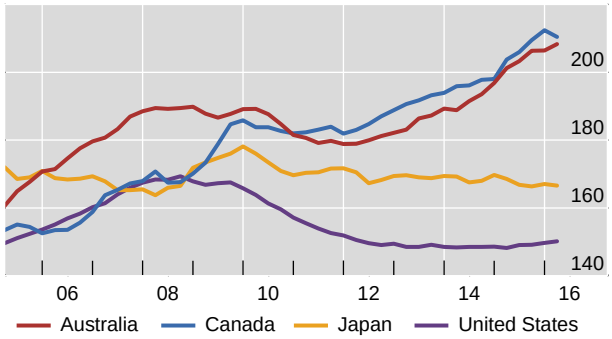
Euro area: other countries



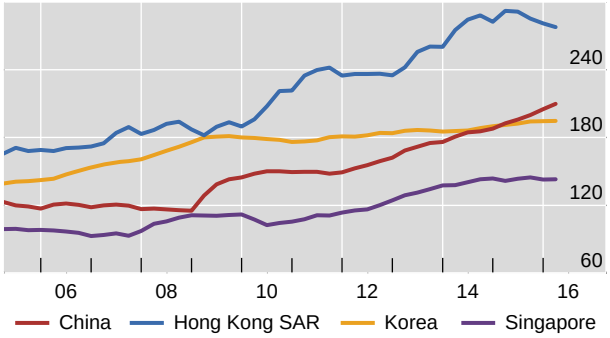
Other European countries



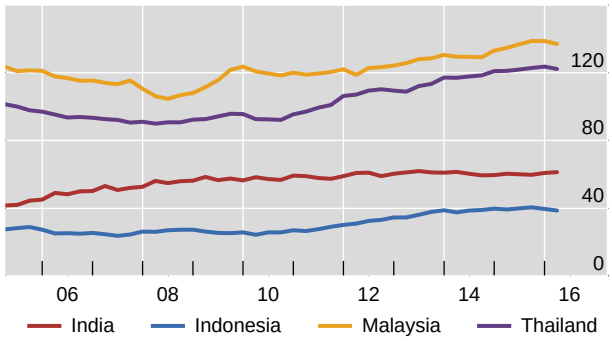
Major advanced economies



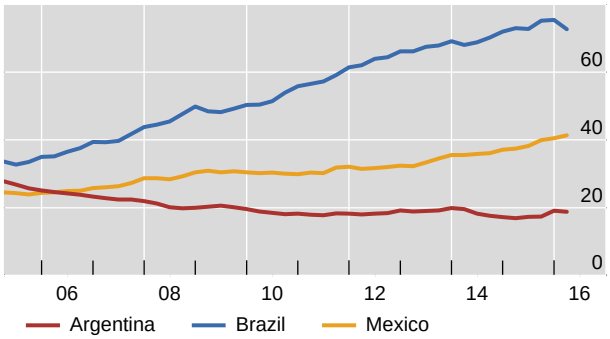
Emerging Asia



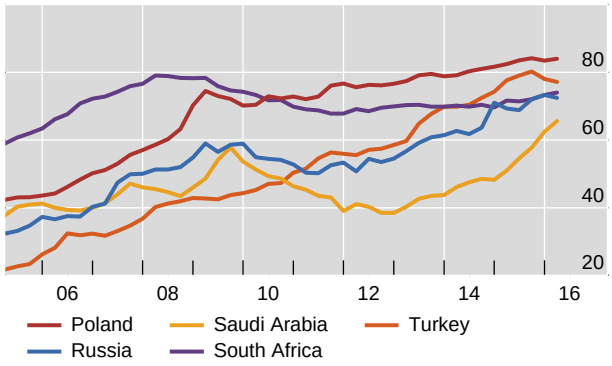
Other emerging Asia



Latin America



Other emerging market economies



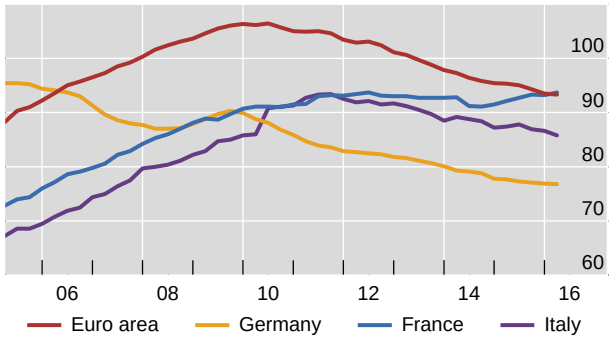
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

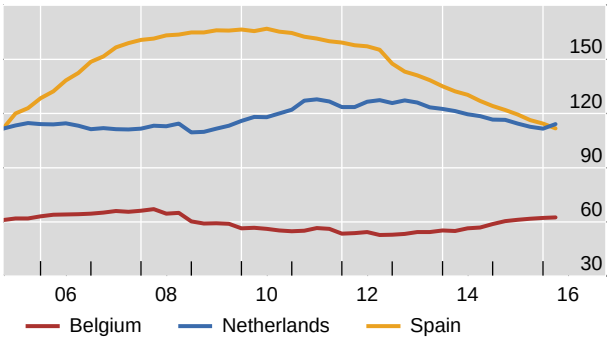
Bank credit to the private non-financial sector (core debt)

As a percentage of GDP — Graph F.3

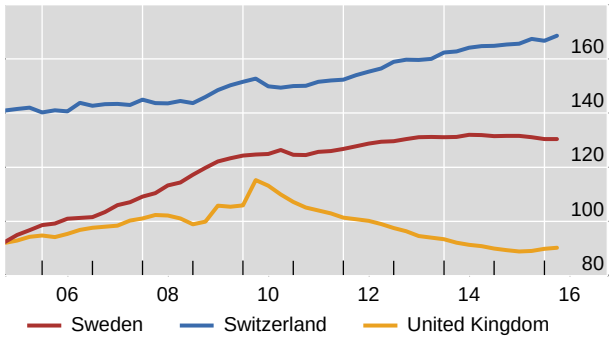
Euro area: aggregate and major countries



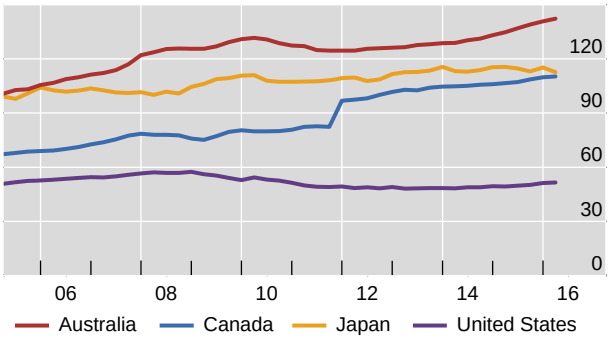
Euro area: other countries



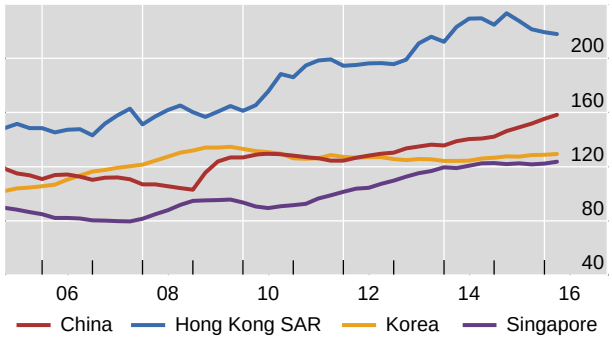
Other European countries



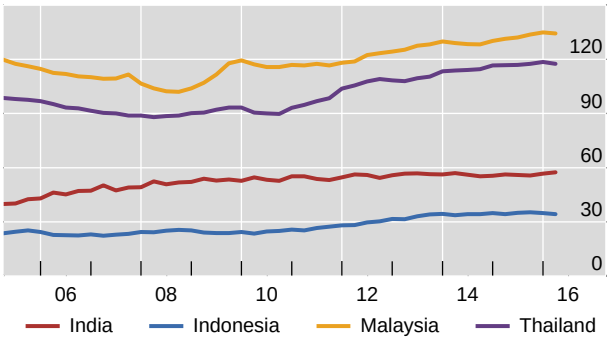
Major advanced economies



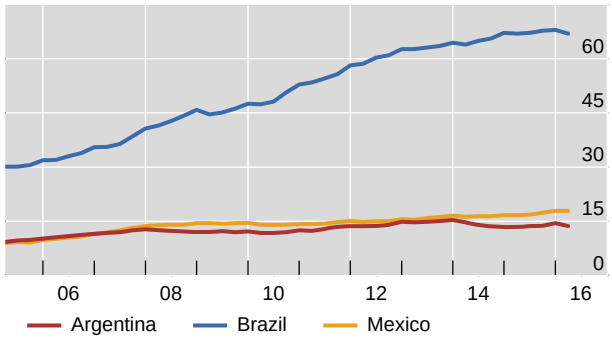
Emerging Asia



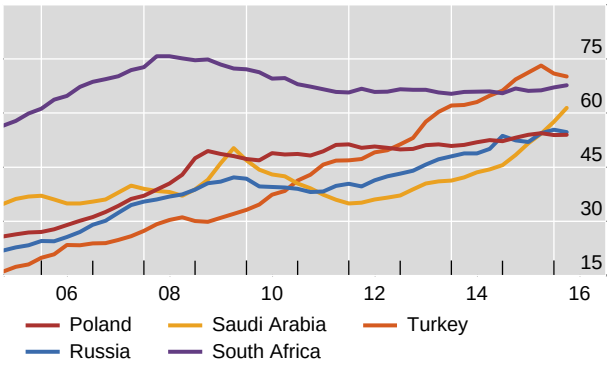
Other emerging Asia



Latin America



Other emerging market economies

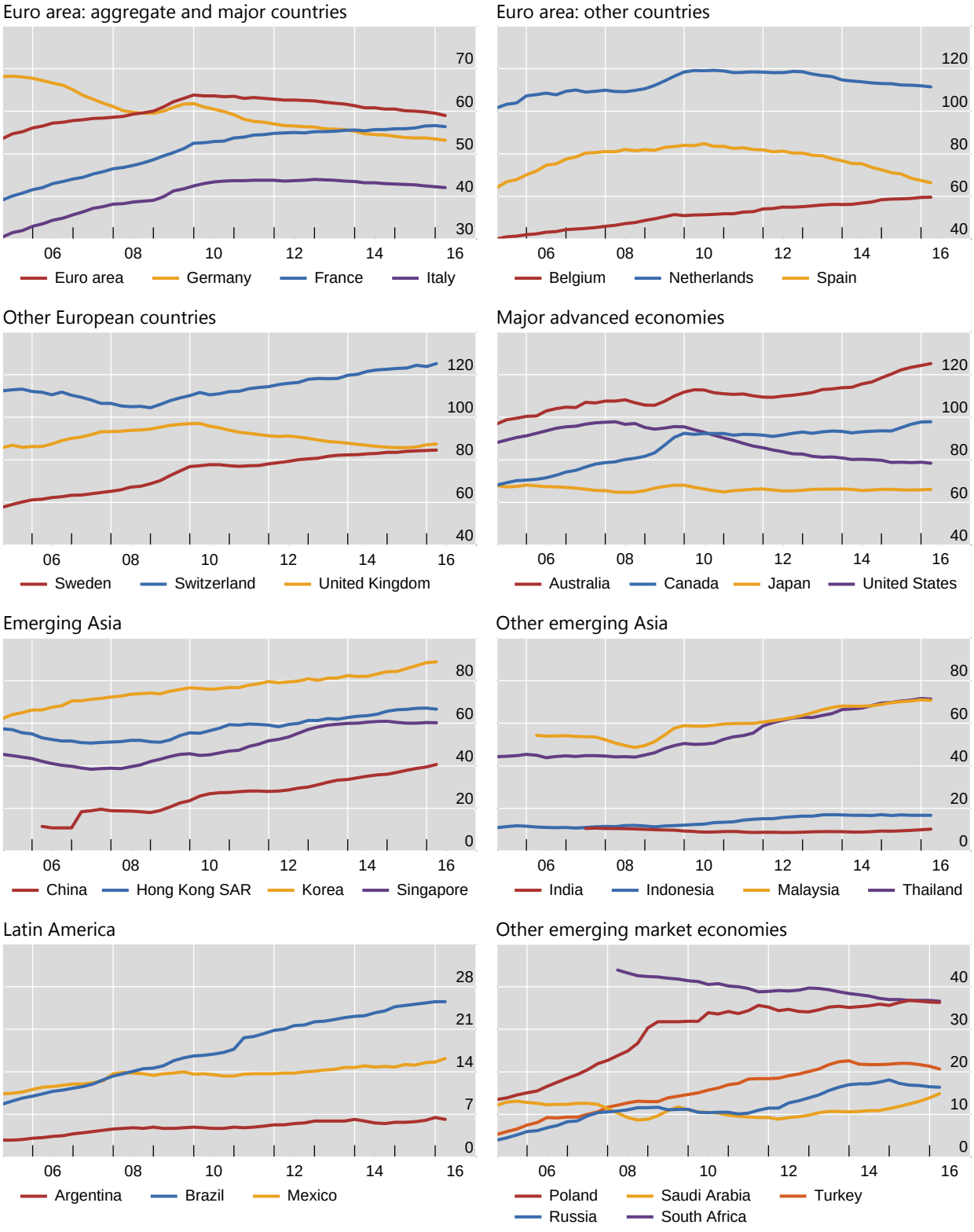


Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

Total credit to households (core debt)

As a percentage of GDP — Graph F.4



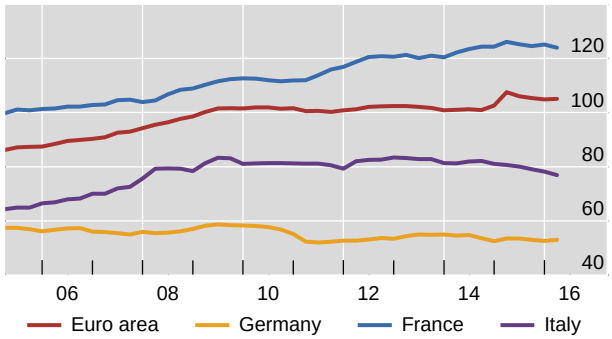
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

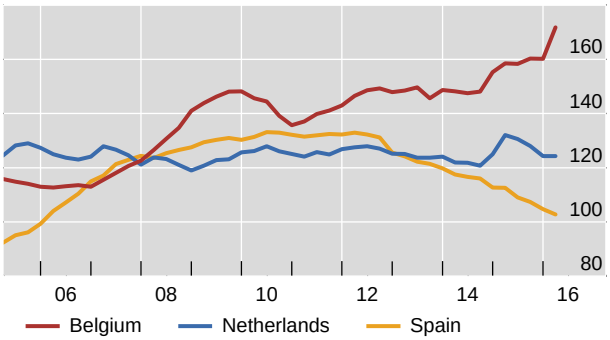
Total credit to non-financial corporations (core debt)

As a percentage of GDP — Graph F.5

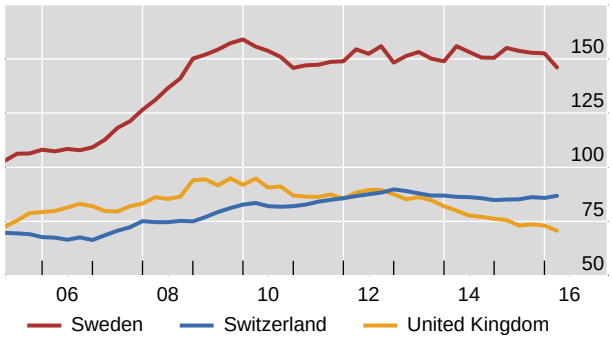
Euro area: aggregate and major countries



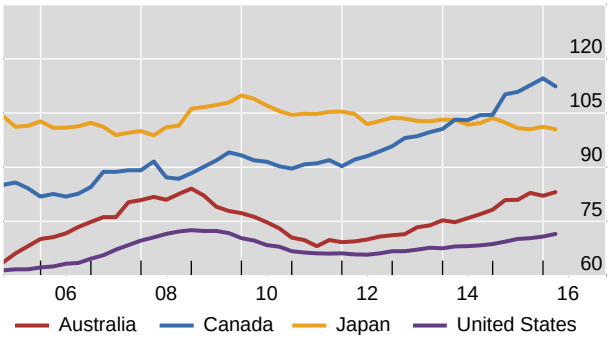
Euro area: other countries



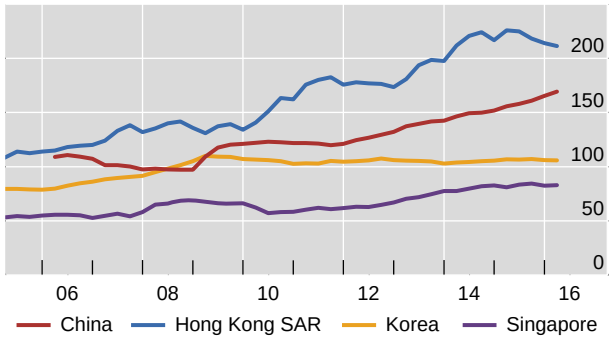
Other European countries



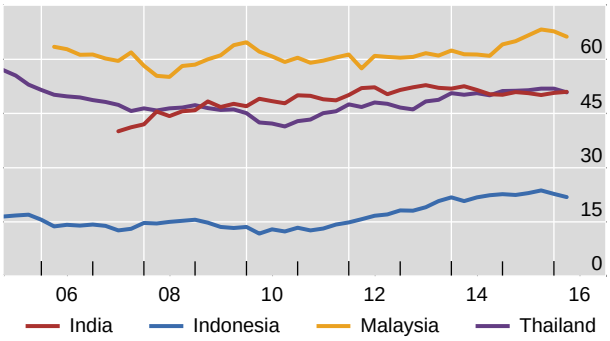
Major advanced economies



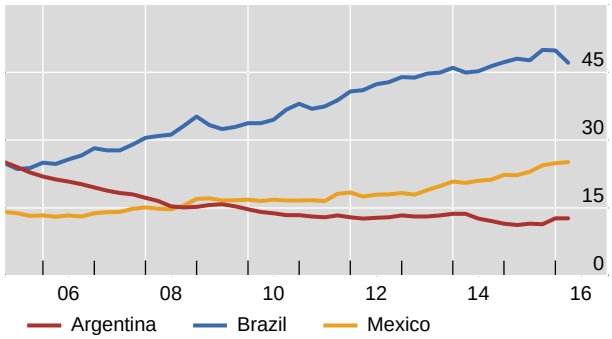
Emerging Asia



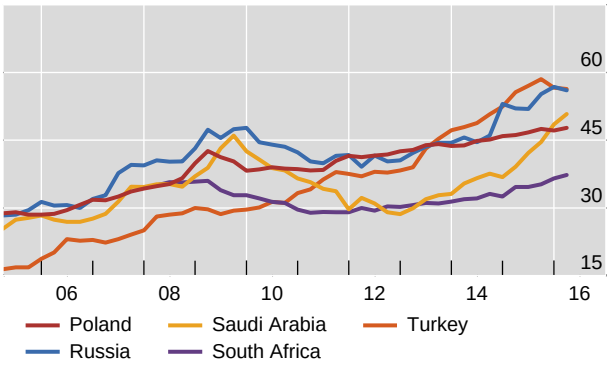
Other emerging Asia



Latin America



Other emerging market economies

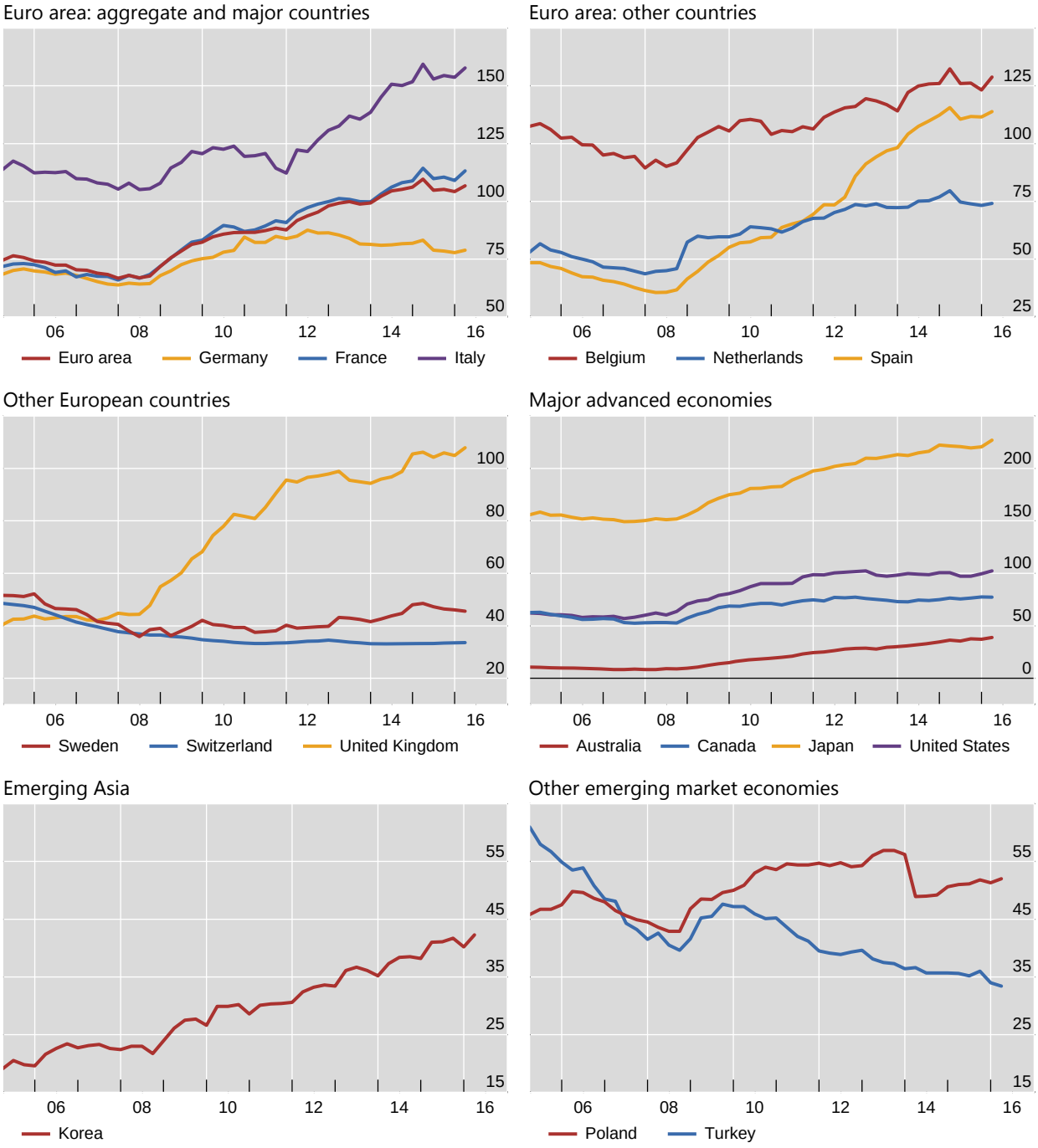


Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

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

As a percentage of GDP — Graph F.6



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

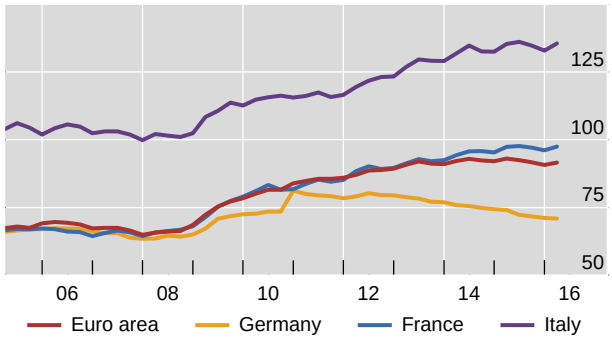
[1] Consolidated data for the general government sector.

Source: BIS total credit statistics.

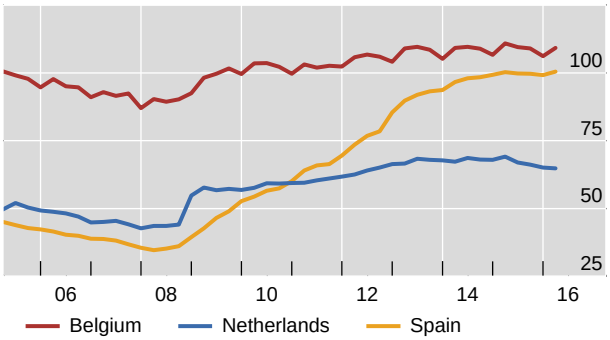
Total credit to the government sector at nominal value (core debt)[1]

As a percentage of GDP — Graph F.7

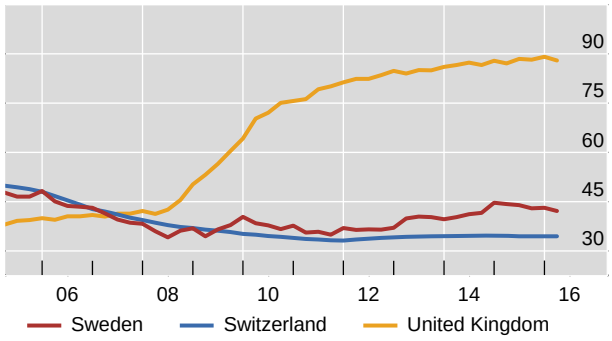
Euro area: aggregate and major countries



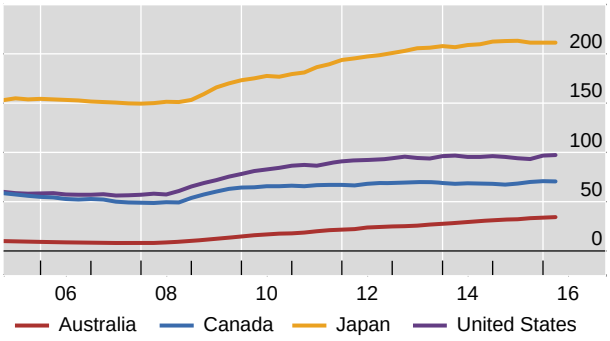
Euro area: other countries



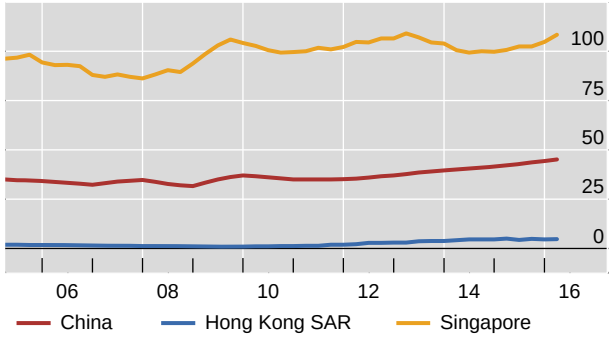
Other European countries



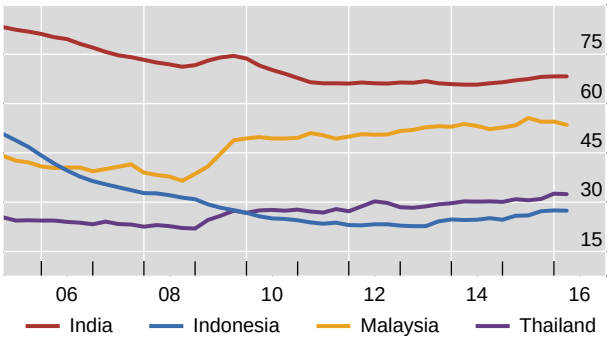
Major advanced economies



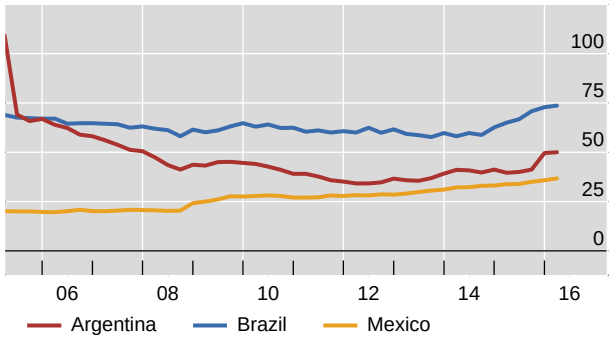
Emerging Asia



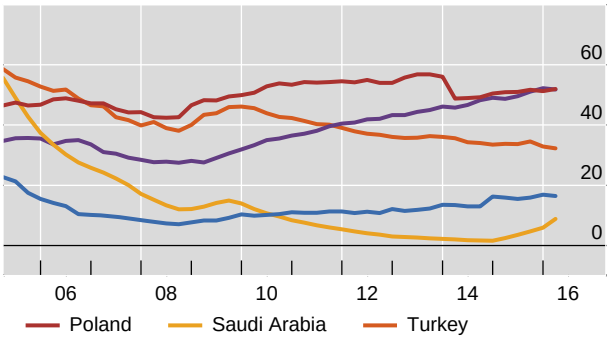
Other emerging Asia



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.

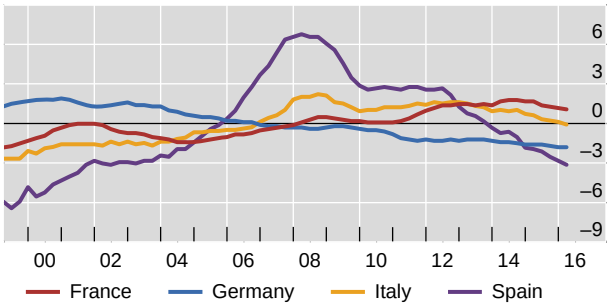
Source: BIS total credit statistics.

G Debt service ratios for the private non-financial sector

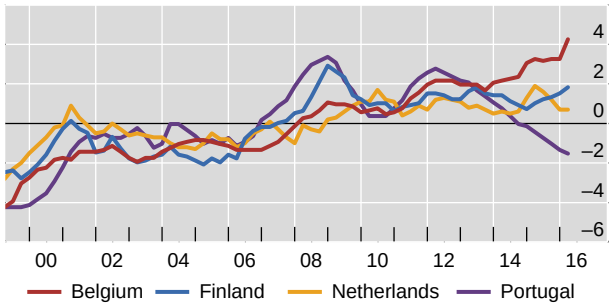
Debt service ratios of the private non-financial sector

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

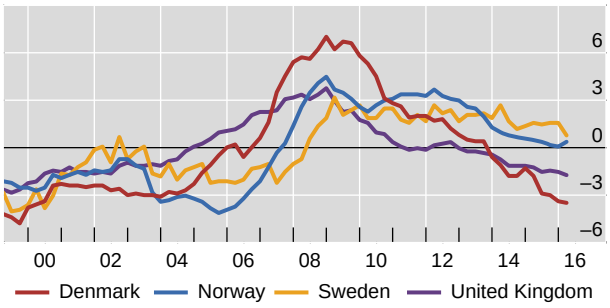
Euro area: major countries



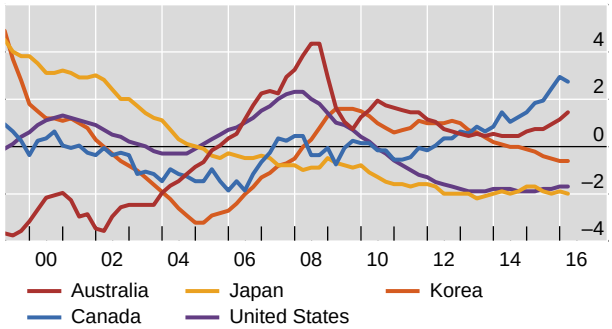
Euro area: other countries



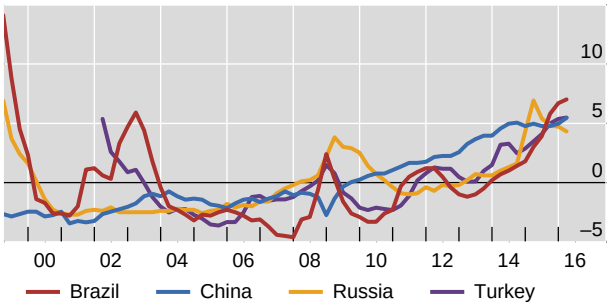
Other European countries



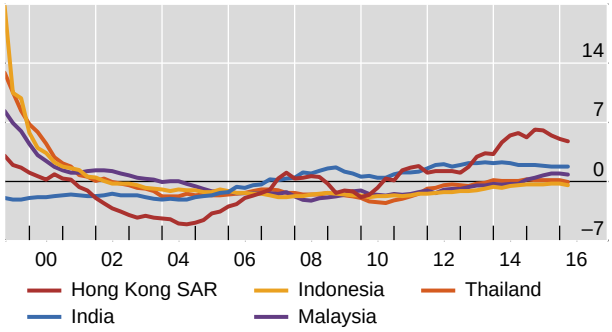
Other economies



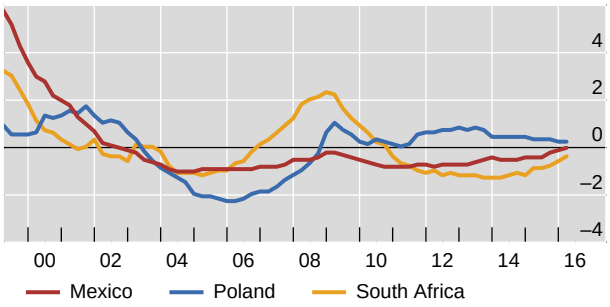
Major emerging markets[2]



Emerging Asia[2]



Other emerging markets[2]



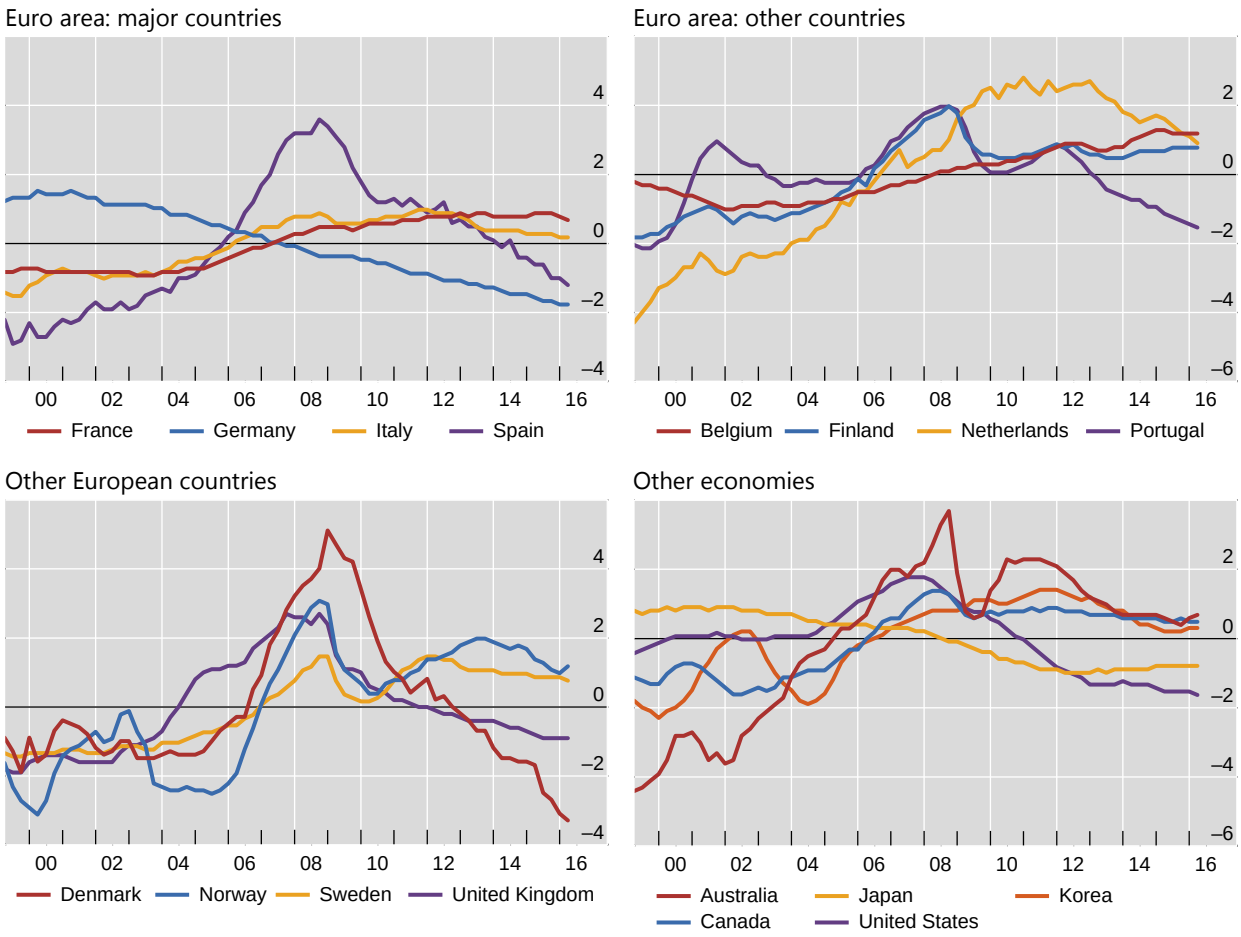
Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

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

Source: BIS debt service ratios statistics.

Debt service ratios of households

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



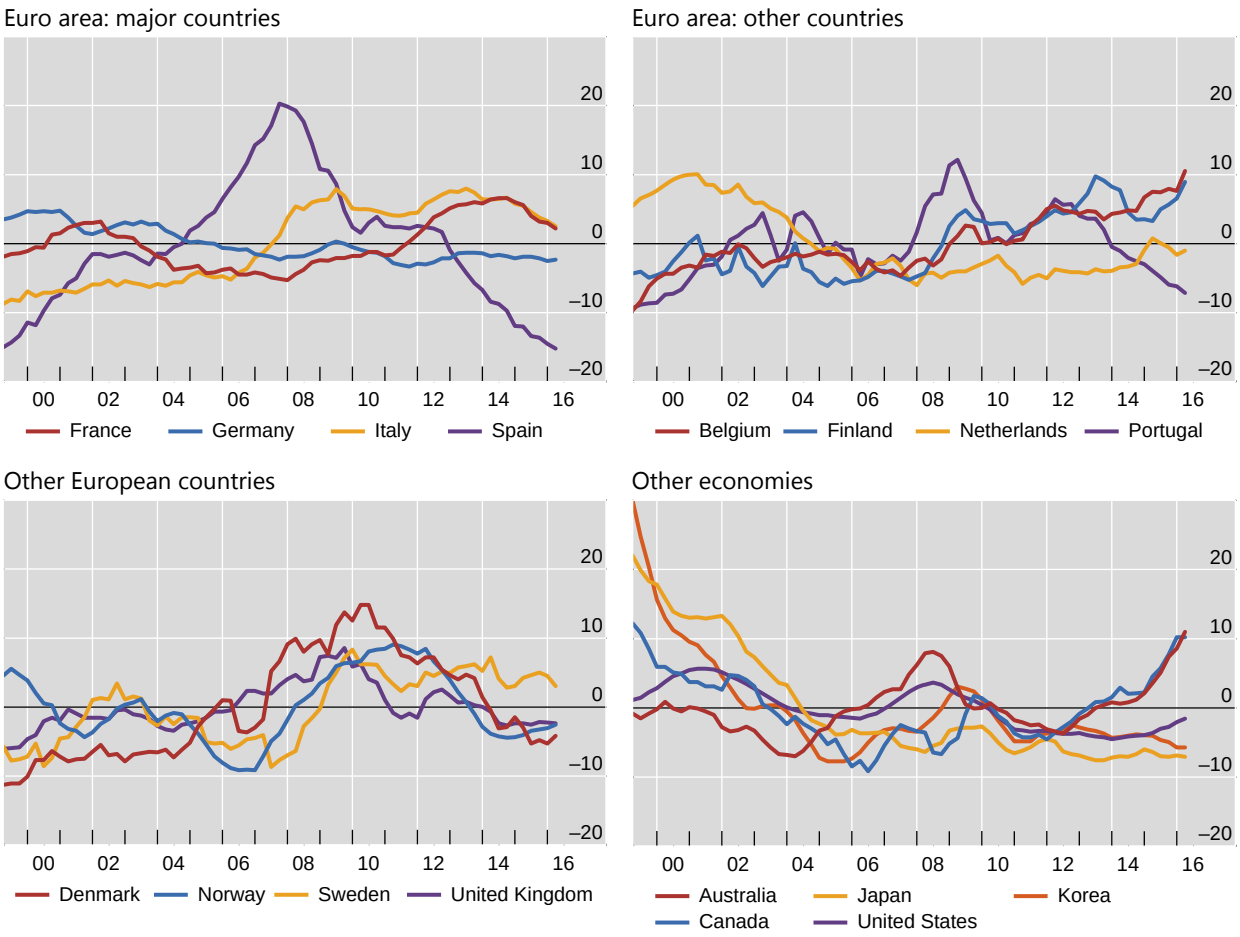
Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

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

Source: BIS debt service ratios statistics.

Debt service ratios of non-financial corporations

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



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

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

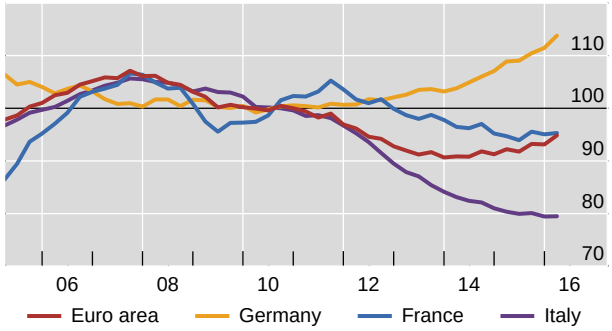
Source: BIS debt service ratios statistics.

H Property price statistics

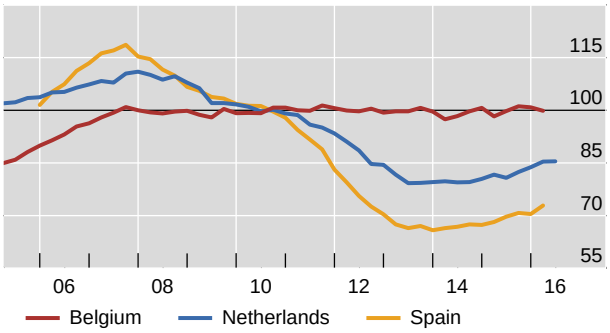
Real residential property prices

CPI-deflated, 2010 = 100 Graph H.1

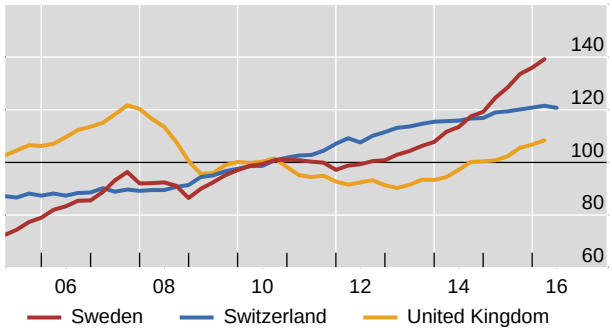
Euro area: aggregate and major countries



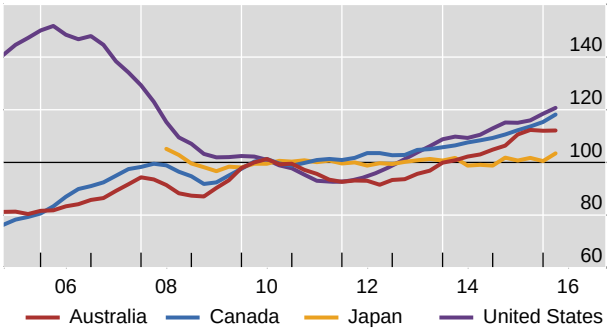
Euro area: other countries



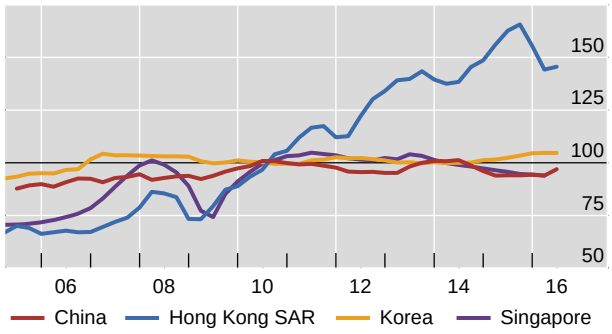
Other European countries



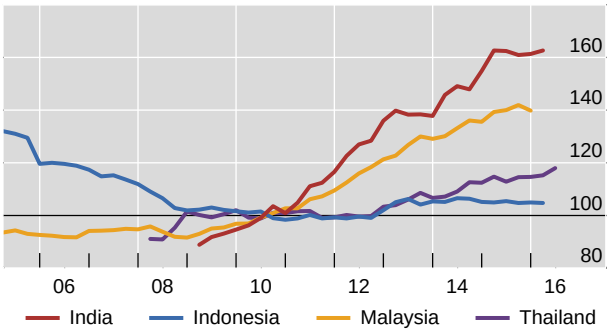
Major advanced economies



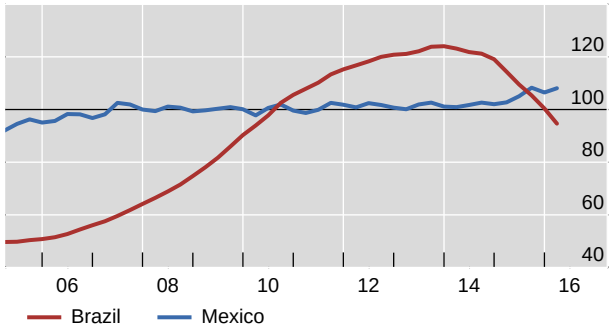
Emerging Asia



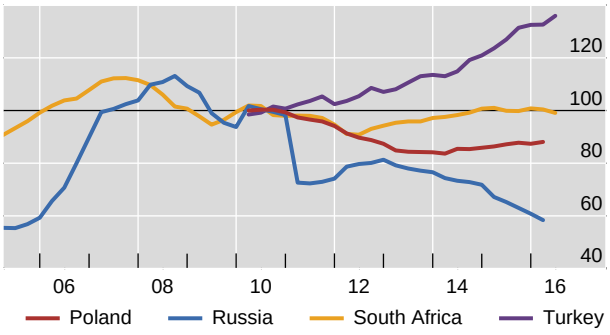
Other emerging Asia



Latin America



Other emerging market economies



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

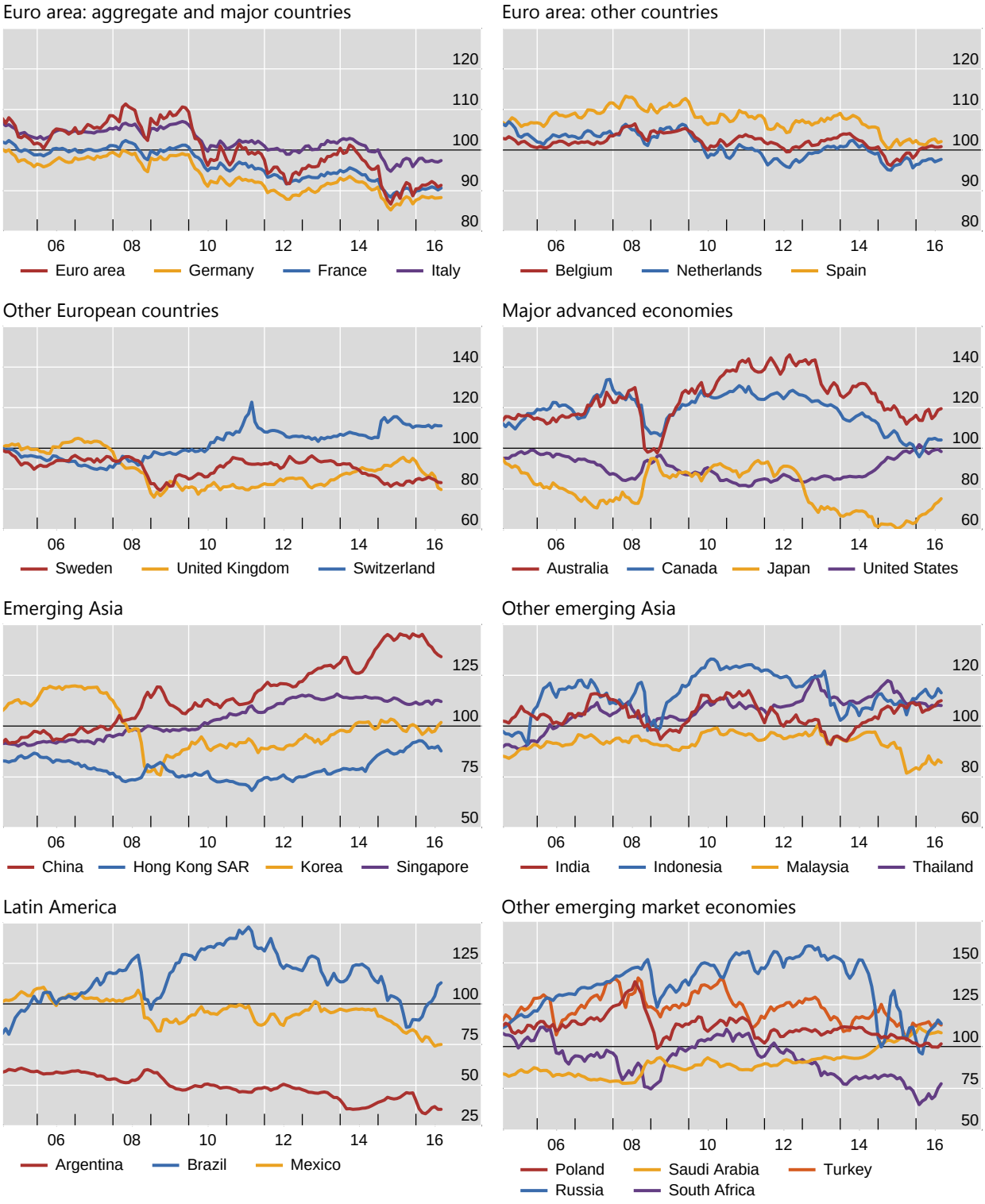
Source: BIS property prices statistics.

I Effective exchange rate statistics

Real effective exchange rates

CPI-based, 1995–2005 = 100[1]

Graph I.1



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

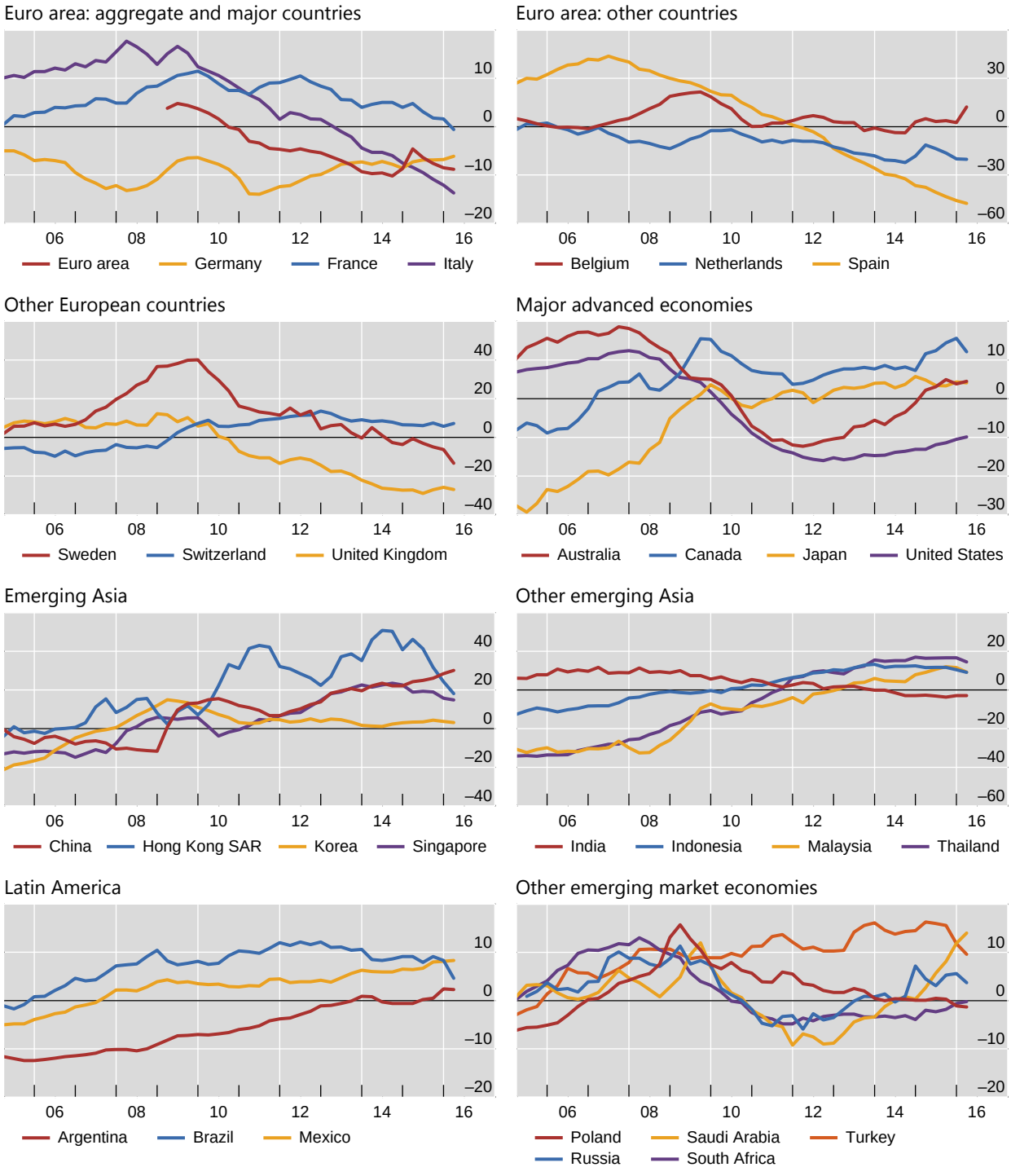
[1] An increase indicates a real-term appreciation of the local currency against a broad basket of currencies.

Source: BIS effective exchange rates statistics.

J Credit-to-GDP gaps

Credit-to-GDP gaps

In percentage points of GDP — Graph J.1



[1] Estimates based on series on total credit to the private non-financial sector. The credit-to-GDP gap is defined as the difference between the credit-to-GDP ratio and its long-term trend; the long-term trend is calculated using a one-sided Hodrick-Prescott filter with a smoothing parameter of 400,000. Further information on the BIS credit-to-GDP gaps is available at www.bis.org/statistics/c_gaps.htm.

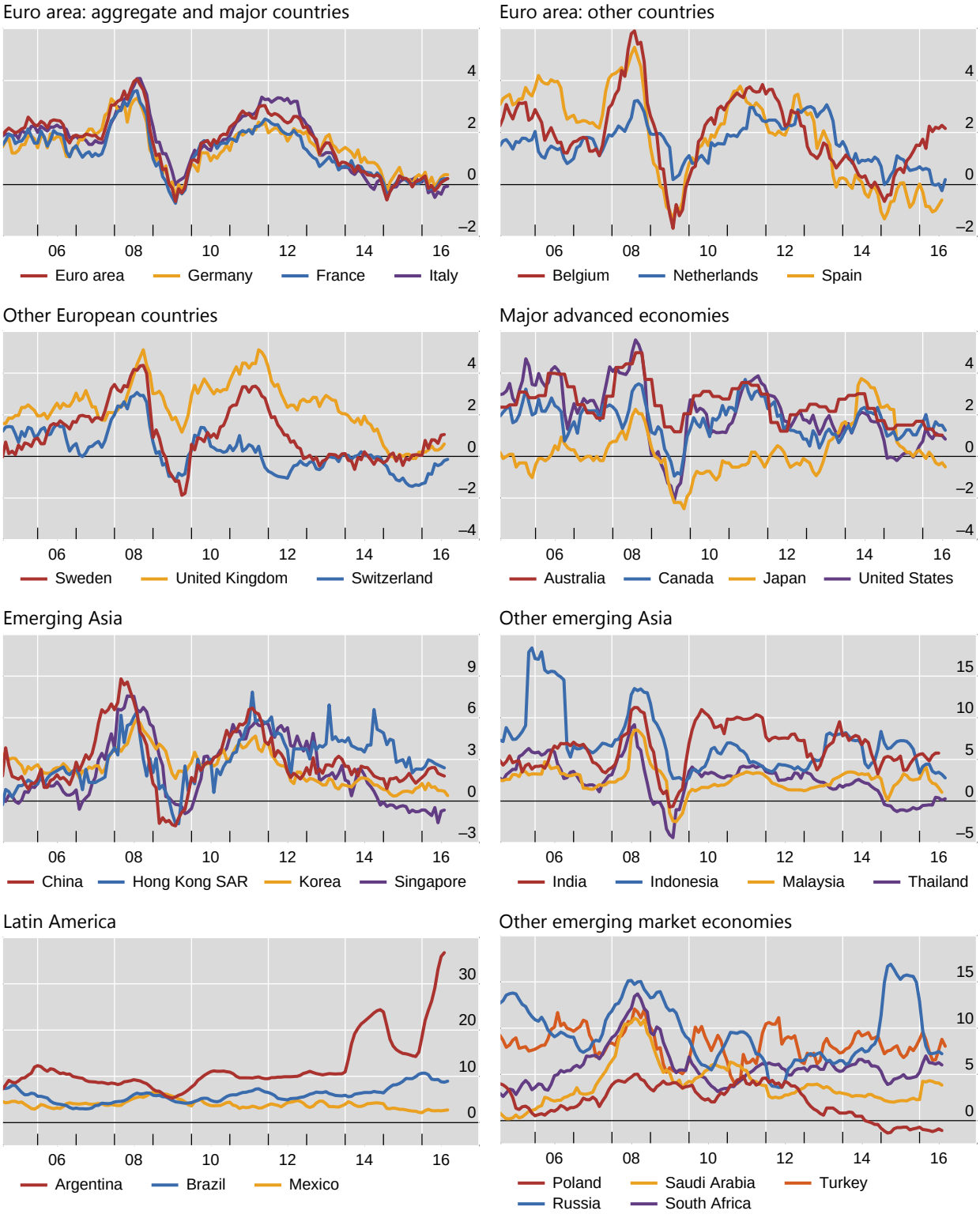
Source: BIS credit-to-GDP gaps statistics.

K Consumer prices

Consumer prices

Year-on-year percentage changes

Graph K.1



Further information on the BIS consumer prices is available at www.bis.org/statistics/cp.htm.

Source: BIS consumer price statistics.

Special features in the BIS Quarterly Review

March 2016	How have central banks implemented negative policy rates?	Morten Bech & Aytek Malkhozov
March 2016	Wealth inequality and monetary policy	Dietrich Domanski, Michela Scatigna & Anna Zabai
March 2016	The resilience of banks' international operations	Patrick McGuire & Goetz Von Peter
March 2016	Hanging up the phone – electronic trading in fixed income markets and its implications	Morten Bech, Anamaria Illes, Ulf Lewrick & Andreas Schrimpf
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

Recent BIS publications[1]

BIS Papers

A spare tire for capital markets: Fostering corporate bond markets in Asia
BIS Papers No 85, June 2016

The eight local currency bond markets in which the Asian Bond Funds 2 (ABF2) invests have continued to develop since 2011. But the development of corporate bonds continues to lag that of government bonds. We focus on areas where we believe there remains work to be done to foster corporate bond markets. In primary markets, we suggest measures to expand the range of credit quality and develop infrastructure bonds as an asset class. In secondary markets, we recommend enhancing liquidity through developing regional mechanisms to increase post-trade transparency as well as through developing hedging markets. In repo markets, there may be room for conducting a survey to fill information gaps and identify where policy actions might have the greatest effect.

Towards a "new normal" in financial markets?
BIS Papers No 84, May 2016

The 14th BIS Annual Conference took place in Lucerne, Switzerland, on 26 June 2015. The event brought together a distinguished group of central bank Governors, leading academics and former public officials to exchange views on the topic "Towards 'a new normal' in financial markets?" The papers presented at the conference and the discussants' comments are released as BIS Working Papers nos 561 to 564.

BIS Working Papers

Regional pull vs global push factors: China and US influence on Asia-Pacific financial markets
Chang Shu, Dong He, Jinyue Dong and Honglin Wang
September 2016, No 579

This paper compares spillovers from the US and Chinese financial markets to the rest of Asia-Pacific. Structural VAR analysis points to the growing influence of Chinese equities and currency movements. In normal times China's influence in the equity market has risen to a level close to that of the United States, although the relative impact of the United States became stronger in crisis periods. Nonetheless, China's bond market remains a negligible player. The influence of China may be interpreted as a "regional pull" factor, while that of the United States remains a key "global push" factor.

Asset managers, eurodollars and unconventional monetary policy
Lawrence L Kreicher and Robert Neil McCauley
August 2016, No 578

An asset manager's rapid liquidation in the weeks around the end of September 2014 of a very large position in eurodollar futures, a huge derivatives market that allows traders to position on the future path of dollar money rates, raises two questions. What is the profile of

[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 (http://www.bis.org/).

asset managers in this key market? And how has the Federal Reserve's unconventional monetary policy, including forward guidance about policy rates, affected this market? Asset managers generally hold the largest eurodollar positions among buy-side traders but play a lesser role in day-to-day trading. Second, the Fed's unconventional policy saw the average maturity of eurodollar contracts traded between 2008 and 2014 double and it has remained at an elevated maturity since then. Moreover, from 2012 into 2015 eurodollar turnover responded more strongly to Federal Reserve announcements than to macroeconomic news, a finding analogous to that of Filardo and Hofmann (2014) for yields. In 2015 asset managers took a large short position in eurodollar futures; this unprecedented position would profit if the Federal Reserve's own projections of policy rates ("dots") were realised. Judging from eurodollar futures, asset managers now play an important role in facilitating or hindering the transmission of monetary policy to market rates.

Are star funds really shining? Cross-trading and performance shifting in mutual fund families
Alexander Eisele, Tamara Nefedova and Gianpaolo Parise
August 2016, No 577

The majority of financial trades take place in open and highly regulated markets. As an alternative venue, large asset managers sometimes offset the trades of affiliated funds in an internal market, without relying on external facilities or supervision. In this paper, we employ institutional trade-level data to examine such cross-trades. We find that cross-trades used to display a spread of 46 basis points with respect to open market trades before more restrictive regulation was adopted. The introduction of tighter supervision decreased this spread by 59 basis points, bringing the execution price of cross-trades below that of open market trades. We additionally find that cross-trades presented larger deviations from benchmark prices when the exchanged stocks were illiquid and highly volatile, during high financial uncertainty times, and when the asset manager had weak governance, large internal markets, and a strong incentive for reallocating performance. Finally, we provide evidence suggesting that cross-trades are more likely than open-market trades to be executed exactly at the highest or lowest price of the day, consistent with the ex post setting of the price. Our results are consistent with theoretical models of internal capital markets in which the headquarters actively favors its "stars" at the expense of the least valuable units.

Crises and rescues: liquidity transmission through international banks
Claudia Buch, Catherine Koch and Michael Koetter
August 2016, No 576

This paper studies how global banks transmit liquidity shocks via their internal capital markets. The unexpected access of German banks' affiliates located in the United States (US) to the Federal Reserve's Term Auction Facility (TAF) serves as our liquidity shock. Using microdata on all affiliates abroad, we test whether affiliates located outside the US adjusted their balance sheets during periods, when the US-located affiliate of the same parent received TAF loans. Our analysis has three main findings. First, during periods of active TAF borrowing, foreign affiliates of parent banks with high US dollar funding needs reduced their foreign assets by less. We identify those parents based on their pre-crisis exposure to the US asset-backed commercial paper (ABCP) market. Second, foreign affiliates in financial centers also shrank their assets less. Third, there is no evidence that the ABCP exposure per se is driving the reduction of activity outside the US. In sum, our results show that the TAF program spilled over into foreign markets, while highlighting the importance of actively managed internal capital markets and the increased centralization of global banks' liquidity management at the domestic parent during and after the financial crisis

Housing collateral and small firm activity in Europe
Ryan Niladri Banerjee and Kristian S Blickle
August 2016, No 575

We investigate the importance of the housing-based collateral lending channel on firm borrowing, investment and employment. We focus on small firms in France, Italy, Spain and the United Kingdom. To identify a credit supply effect, as opposed to a home-equity driven demand effect, we compare activity in similar firms that differ by the degree of financial opacity, and therefore the degree of their reliance on collateral to overcome borrowing

constraints. We find that changing house prices have a more pronounced effect on borrowing, investment and employment in financially more opaque firms. This relationship is particularly strong in southern Europe (Italy and Spain), where financial frictions are larger and the use of collateral more important.

Low long-term interest rates as a global phenomenon
Peter Hördahl, Jhuvesh Sobrun and Philip Turner
August 2016, No 574

International linkages between interest rates in different currencies are strong, and ultra-low rates have become a global phenomenon. This paper compares how interest rates in advanced economies and in emerging economies are conditioned by two global benchmarks - the Federal funds rate at the short end and the "world" real interest rate at the long end. Real equilibrium policy rates (the natural rate) have fallen in many countries, and short-term rates worldwide have been further depressed by many years of the US policy rate close to zero. Nevertheless, changes in the Federal funds rate have less effect on longer-term rates, and thus on financing conditions, than is often supposed. The decline in the world long-term rate since 2008 has been driven almost entirely by a fall in the world term premium (negative in nominal terms since mid-2014). The world short-term rate expected over the long run has fallen only modestly over the past seven years or so, and is now just over 2% (compared with around 4% pre-Lehman).

Intraday dynamics of euro area sovereign credit risk contagion
Lubos Komarek, Kristyna Ters and Jörg Urban
July 2016, No 573

We examine the role of the CDS and bond markets during and before the recent euro area sovereign debt crisis as transmission channels for credit risk contagion between sovereign entities. We analyse an intraday dataset for GIIPS countries as well as Germany, France and central European countries. Our findings suggest that, prior to the crisis, the CDS and bond markets were similarly important in the transmission of sovereign risk contagion, but that the importance of the bond market waned during the crisis. We find flight-to-safety effects during the crisis in the German bond market that are not present in the pre-crisis sample. Our estimated sovereign risk contagion was greater during the crisis, with an average timeline of one to two hours in GIIPS countries. By using an exogenous macroeconomic news shock, we can show that, during the crisis period, increased credit risk was not related to economic fundamentals. Further, we find that central European countries were not affected by sovereign credit risk contagion, independent of their debt level and currency.

Housing prices, mortgage interest rates and the rising share of capital income in the United States
Gianni La Cava
July 2016, No 572

One Piketty (2014) documents how the share of aggregate income going to capital in the United States has risen in the post-war era. Rognlie (2015) has since shown that this is largely due to the housing sector. This paper explores the determinants of the secular rise in the share of housing capital income (or 'rental income') in the US economy. I first decompose the aggregate national accounts by geographic region and also by type of housing. I then exploit variation across US states in factors that could explain housing capital income, such as interest rates, housing prices and income growth.

The analysis shows that the long-run increase in the aggregate share of housing capital income is mainly due to higher imputed rental income going to owner-occupiers. I also find evidence that the rise in the share of housing capital income over recent decades reflects a combination of: 1) lower real interest rates; 2) lower consumer price inflation; and 3) constraints on the supply of new housing in some large US cities. In effect, the paper documents that the fall in nominal interest rates over the 1980s and 1990s raised the demand for housing and pushed up housing prices and rents (relative to non-housing prices) in supply-constrained areas. I estimate that the long-term decline in interest rates can explain more than half the increase in the share of nominal income spent on housing since the early 1980s

On the transactions costs of quantitative easing
Francis Breedon and Philip Turner
July 2016, No. 571

Most quantitative easing programmes primarily involve central banks acquiring government liabilities in return for central bank reserves. In all cases this process is undertaken by purchasing these liabilities in the secondary market rather than directly from the government. Yet the only practical difference between secondary market purchases and bilateral central bank/Treasury operations is the transactions costs involved in market operations. This paper quantifies the significant cost of this round-trip transaction - government issuance of liabilities and then central bank purchase of those liabilities in the secondary market.

Unconventional monetary policies: a re-appraisal
Claudio Borio and Anna Zabai
July 2016 No 570

We explore the effectiveness and balance of benefits and costs of so-called "unconventional" monetary policy measures extensively implemented in the wake of the financial crisis: balance sheet policies (commonly termed "quantitative easing"), forward guidance and negative policy rates. Our objective is to provide the reader with a helpful entry point to the burgeoning empirical literature and with a specific perspective on the complex issues involved. We reach three main conclusions: there is ample evidence that, to varying degrees, these measures have succeeded in influencing financial conditions even though their ultimate impact on output and inflation is harder to pin down; the balance of the benefits and costs is likely to deteriorate over time; and the measures are generally best regarded as exceptional, for use in very specific circumstances. Whether this will turn out to be the case, however, is doubtful at best and depends on more fundamental features of monetary policy frameworks. In the paper, we also provide a critique of prevailing analyses of "helicopter money" and explore in more depth the role of negative nominal interest rates in our fundamentally monetary economies, highlighting some risks.

Monetary policy, the financial cycle and ultra-low interest rates
Mikael Juselius, Claudio Borio, Piti Disyatat and Mathias Drehmann
July 2016 No 569

Do the prevailing unusually and persistently low real interest rates reflect a decline in the natural rate of interest as commonly thought? We argue that this is only part of the story. The critical role of financial factors in influencing medium-term economic fluctuations must also be taken into account. Doing so for the United States yields estimates of the natural rate that are higher and, at least since 2000, decline by less. As a result, policy rates have been persistently and systematically below this measure. Moreover, we find that monetary policy, through the financial cycle, has a long-lasting impact on output and, by implication, on real interest rates. Therefore, a narrative that attributes the decline in real rates primarily to an exogenous fall in the natural rate is incomplete. The influence of monetary and financial factors should not be ignored. Exploiting these results, an illustrative counterfactual experiment suggests that a monetary policy rule that takes financial developments systematically into account during both good and bad times could help dampen the financial cycle, leading to higher output even in the long run.

Output gaps and policy stabilisation in Latin America: the effect of commodity and capital flow cycles
Enrique Alberola-Ila, Rocío Gondo, Marco Jacopo Lombardi and Diego Urbina
June 2016 No 568

We provide a measure of the output gap that filters out the impact of the commodity and net capital inflows booms for Latin American countries. These two factors temporarily boost output and so are likely to push up estimates of potential growth in the region to unrealistic levels, thereby resulting in an underestimation of the output gaps during the upswing of the commodity cycle. We also shed light on the interaction between the two components. The results show that commodity prices has been the dominant factor explaining deviation of activity from sustainable levels. The timely consideration of these factors could prevent a procyclical fiscal policy bias in the region.

Understanding the changing equilibrium real interest rates in Asia-Pacific
Feng Zhu
June 2016 No 567

This paper studies the evolution of the equilibrium real interest rate (ie natural or neutral interest rate) in Asia-Pacific. I take an empirical approach to estimate the rate, simple estimates suggest that except for China, and Thailand since 2005, the natural interest rate may have declined substantially in Asian-Pacific economies since the early or mid-1990s, by over 4 percentage points on average. In many economies the rate has turned negative. The tendency has become more accentuated in the 2000s, especially since the onset of the global financial crisis. Yet simple natural interest rate estimates are unreliable, which vary significantly over time and across the economies.

I use frequency-domain techniques to examine the relationship between the long-run component of real interest rate and those of population characteristics, globalisation, and a range of macroeconomic and financial variables (eg credit and asset prices). I estimate spectral and cospectral densities, coherency and the frequency-specific coefficients of correlation and regression proposed by Zhu (2005). the association seems to be broad and strong between the natural interest rate and the low-frequency trend components of demographic and global factors in Asia- Pacific, but weak between the natural interest rate and trends in asset prices, creditto GDP ratio and trend growth in many economies in the region. In most cases, the natural interest rate seems to be correlated with broad measures of long-term financial sector development, and trends in saving rate and investment ratio.

Monetary facts revisited
Pavel Gertler and Boris Hofmann
June 2016 No 566

This paper uses a cross-country database covering 46 economies over the post-war period to revisit two key monetary facts: (i) the long-run link between money growth and inflation and (ii) the link between credit growth and financial crises. The analysis reveals that the former has weakened over time, while the latter has become stronger. Moreover, the money-inflation nexus has been stronger in emerging market economies than in advanced economies, while it is the other way round for the link between credit growth and financial crises. These results suggest that there is an inverse relationship between the two monetary facts. The money-inflation link is weaker in regimes characterised by low inflation and highly liberalised financial systems, while the reverse holds true for the credit-crisis nexus.

The Collateral Trap
Frederic Boissay and Russell Cooper
June 2016 No 565

Active wholesale financial markets help reallocate deposits across heterogeneous banks. Because of incentive problems, these flows are constrained and collateral is needed. Both the volume, the value, and the composition of collateral matter. We make a distinction between "outside collateral" and "inside collateral". The use of inside assets, such as loans, creates a "collateral pyramid", in that cash flows from one loan can be pledged to secure another. Through collateral pyramids the financial sector creates safe assets, but at the cost of exposing the economy to systemic panics. Outside collateral, such as treasuries, serves as foundation of, and stabilises, the pyramid. There is a threshold for the volume of treasuries, below which investors panic, the pyramid collapses, and there is not enough safe assets to support wholesale market activity; a situation that we call "collateral trap".

Moore's Law vs. Murphy's Law in the financial system: who's winning?
Andrew W Lo
May 2016 No 564

Breakthroughs in computing hardware, software, telecommunications and data analytics have transformed the financial industry, enabling a host of new products and services such as automated trading algorithms, crypto-currencies, mobile banking, crowdfunding and robo-advisors . However, the unintended consequences of technology-leveraged finance include firesales, flash crashes, botched initial public offerings, cybersecurity breaches, catastrophic algorithmic trading errors and a technological arms race that has created new winners, losers

and systemic risk in the financial ecosystem. These challenges are an unavoidable aspect of the growing importance of finance in an increasingly digital society. Rather than fighting this trend or forswearing technology, the ultimate solution is to develop more robust technology capable of adapting to the foibles in human behaviour so users can employ these tools safely, effectively and effortlessly. Examples of such technology are provided.

Who supplies liquidity, how and when?
Bruno Biais, Fany Declerck and Sophie Moinas
May 2016 No 563

Who provides liquidity in modern, electronic limit order book, markets? While agency trading can be constrained by conflicts of interest and information asymmetry between customers and traders, prop traders are likely to be less constrained and thus better positioned to carry inventory risk. Moreover, while slow traders' limit orders may be exposed to severe adverse selection, fast trading technology can improve traders' ability to monitor the market and avoid being picked off. To shed light on these points, we rely on unique data from Euronext and the AMF, the French financial markets regulator, enabling us to observe the connectivity of traders to the market, and whether they are proprietary traders. We find that proprietary traders, be they fast or slow, provide liquidity with contrarian marketable orders, thus helping the market absorb shocks, even during a crisis, and they earn profits while doing so. Moreover, fast traders provide liquidity by leaving limit orders in the book. Yet, only prop traders can do so without making losses. This suggests that technology is not enough to overcome adverse selection; monitoring incentives are also needed.

Expectations and investment
Nicola Gennaioli, Yueran Ma and Andrei Shleifer
May 2016 No 562

Using micro data from the Duke University quarterly survey of Chief Financial Officers, we show that corporate investment plans as well as actual investment are well explained by CFOs' expectations of earnings growth. The information in expectations data is not subsumed by traditional variables, such as Tobin's Q or discount rates. We also show that errors in CFO expectations of earnings growth are predictable from past earnings and other data, pointing to the extrapolative structure of expectations and suggesting that expectations may not be rational. This evidence, like earlier findings in finance, points to the usefulness of data on actual expectations for understanding economic behaviour.

Mobile collateral versus immobile collateral
Gary Gorton and Tyler Muir
May 2016 No 561

The pre-crisis financial architecture was a system of mobile collateral. Safe debt, whether government bonds or privately produced bonds, ie asset-backed securities, could be traded, posted as collateral, and rehypothecated, moving to its highest value use. Since the financial crisis, regulatory changes to the financial architecture have aimed to make collateral immobile, most notably with the BIS "liquidity coverage ratio" for banks. In the face of the Lucas critique, how should these policies be evaluated? We evaluate this immobile capital system with reference to a previous regime, which had this feature: the US National Banks Era.

Basel Committee on Banking Supervision

Implementation of Basel standards - A report to G20 Leaders on implementation of the Basel III regulatory reforms
August 2016

Full, timely and consistent implementation of Basel III remains fundamental to building a resilient financial system, maintaining public confidence in regulatory ratios and providing a level playing field for internationally active banks. This report • updates G20 Leaders on

progress and challenges in the implementation of the Basel III regulatory reforms since November 2015, when the Basel Committee last reported to the G20.

The report summarises the steps taken by Basel Committee member jurisdictions to adopt the Basel III standards, banks' progress in bolstering their capital and liquidity positions, the consistency of implementation in jurisdictions assessed since the Committee's last report and the Committee's implementation work plan.

Frequently asked questions on the revised Pillar 3 disclosure requirements
August 2016

The Committee has received a number of interpretation questions related to the January 2015 publication of the revised Pillar 3 disclosure requirements. To promote consistent global implementation of the requirements, the Committee has agreed to periodically review FAQs and publish answers along with any technical elaboration of the standard and any interpretative guidance that may be necessary. The FAQs published today correspond to the text set out in the standard.

Committee on the Global Financial Systems

Experiences with the ex ante appraisal of macroprudential instruments
July 2016 No 56

This report provides an overview of the experiences central banks have gathered with ex ante appraisals of macroprudential instruments and identifies areas where further analytical development would be particularly useful. It starts with a description of different approaches policymakers have used to produce quantitative and operational objectives for macroprudential policy, and a classification of the analytical methodologies employed in appraisals. The main part of the report discusses how these different methodologies have been used in practice to assess the impact of macroprudential instruments in different stages of practical decision-making such as: the assessment of risks and vulnerabilities as well as the selection of the appropriate instrument, the timing of the activation of the instrument, and the calibration of the intensity of the instrument. In all cases the discussion is illustrated with actual experiences in different jurisdictions.

Committee on Payments and Market Infrastructures

Harmonisation of the Unique Product Identifier - second consultative report
August 2016 No 151

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 the Unique Transaction Identifier (UTI) and the Unique Product Identifier (UPI).

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 derivative products that authorities require to be reported to TRs. The UPI system will assign a code to each OTC derivative product that maps to a set of data elements describing the product in a corresponding reference database. The first consultative report

on the Harmonisation of the UPI was issued in December 2015. The focus of this second consultative report is the format of the UPI code and the content and granularity of the UPI data elements.

Progress report on the CCP workplan
August 2016 No 150

The BCBS, CPMI, FSB and IOSCO are implementing a workplan on the resilience, recovery planning, resolvability and interdependencies of CCPs. This is a progress report on that work from the chairs of the committees involved.

Resilience and recovery of central counterparties (CCPs): Further guidance on the PFMI - consultative report
August 2016 No 149

CCPs have become increasingly critical components of the financial system in recent years, due in part to the introduction of mandatory central clearing for standardised over-the-counter derivatives in some jurisdictions. It is vital that each CCP is sufficiently resilient to withstand clearing member failures and other stress events, and that it has in place a credible recovery plan.

The proposed guidance outlined in this consultative report provides further clarity and granularity on several key aspects of the PFMI to further improve CCP resilience. These are: governance, credit and liquidity stress testing, margin, a CCP's contribution of its financial resources to losses, and its coverage of credit and liquidity resource requirements. The report also proposes guidance that is intended to facilitate a CCP's development of its recovery plan by building on and reiterating certain aspects of the Recovery report.

The guidance is not intended to create additional standards for CCPs beyond those set out in the Principles for financial market infrastructures・ (PFMI), but rather to provide a more granular description of how the CPMI and IOSCO expect the PFMI to be implemented by CCPs.

Implementation monitoring of PFMI: Level 3 assessment - Report on the financial risk management and recovery practices of 10 derivatives CCPs
August 2016 No 148

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 reviews financial risk management and recovery practices in place at a selected set of derivatives CCPs. The findings show that CCPs have made important and meaningful progress in implementing arrangements consistent with the standards. Some gaps and shortcomings have nevertheless been identified, notably in the areas of recovery planning and credit and liquidity risk management. The report also identifies a number of other differences in the outcomes of implementation across CCPs. They may reveal differences in interpretation or approach that could materially affect resilience.

Correspondent banking - final report
July 2016 No 147

The Committee on Payments and Market Infrastructures has issued the final report on Correspondent banking. This builds on an earlier version of the report that underwent public consultation in late 2015 and helps alleviate some of the costs and concerns affecting correspondent banking activities.

The report provides some basic definitions, outlines the main types of correspondent banking arrangement, summarises recent developments and touches on the underlying drivers. The report then develops recommendations on certain measures relating to (i) know-your-customer (KYC) utilities; (ii) use of the Legal Entity Identifier (LEI) in correspondent banking;

(iii) information-sharing initiatives; (iv) payment messages; and (v) use of the LEI as additional information in payment messages.

Guidance on cyber resilience for financial market infrastructures
June 2016 No 146

The Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) have published the Guidance on cyber resilience for financial market infrastructures ・ ("Cyber Guidance"). This builds on an earlier version of the report that underwent a three-month public consultation.

The safe and efficient operation of financial market infrastructures (FMIs) is essential to maintaining and promoting financial stability and economic growth. The Cyber Guidance aims to add momentum to and instil international consistency in the industry's ongoing efforts to enhance its cyber resilience. This includes the ability of FMIs to pre-empt cyber attacks, respond rapidly and effectively to them, and achieve faster and safer target recovery objectives if the attacks succeed. In addition, the Cyber Guidance provides authorities with a set of internationally agreed guidelines to support consistent and effective oversight and supervision of FMIs in the area of cyber risk.

At its core, the Cyber Guidance requires FMIs to instil a culture of cyber risk awareness and to demonstrate ongoing re-evaluation and improvement of their cyber resilience posture at every level within the organisation. Furthermore, while the guidance is directly aimed at FMIs, it is important for them to take on an active role in reaching out to their participants and other relevant stakeholders to promote understanding and support of resilience objectives and their implementation. Effective solutions may require collaboration between FMIs and their stakeholders as they seek to strengthen their own cyber resilience.

The Cyber Guidance does not establish additional standards for FMIs beyond those already set out in the Principles for Financial Market Infrastructures (PFMI). Instead, the document is intended to be supplemental to the PFMI, primarily in the context of governance (Principle 2), the framework for the comprehensive management of risks (Principle 3), settlement finality (Principle 8), operational risk (Principle 17) and FMI links (Principle 20).

Implementation monitoring of PFMI: Third update to Level 1 assessment report
June 2016 No 145

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 provides jurisdictions' updated self-assessments of their progress towards adopting the legislation, regulations and other policies that will enable them to implement the 24 Principles for FMIs and four of the five Responsibilities for authorities included in the PFMI. It shows that good progress continues to be made by the 28 participating jurisdictions since the previous update in June 2015. The next update of the Level 1 assessment will be conducted in 2017.

Speeches

Helicopter money" - reality bites

Commentary by Mr Claudio Borio, Head of the Monetary and Economic Department of the Bank for International Settlements, and Mr Piti Disyatat, Executive Director of the Puey Ungphakorn Institute for Economic Research, Bank of Thailand, in Nikkei Asian Review, published on 4 September 2016.

Since the Great Financial Crisis, central banks in the major economies have adopted a whole range of new measures to influence monetary and financial conditions. The measures have gone far beyond the typical pre-crisis mode of operation - controlling a short-term policy rate and moving it within a positive range - and have therefore come to be known as "unconventional monetary policies." To be sure, some of these measures had already been pioneered by the Bank of Japan roughly a decade earlier in the wake of that country's banking crisis and uncomfortably low inflation. But no one had anticipated that they would spread to the rest of the world so quickly and become so daring, testing the boundaries of the unthinkable.

As growth has remained disappointing and inflation stubbornly below targets, the range and size of these measures have increased. Hence the growing use of long-term liquidity support, large-scale asset purchases, sizable increases in bank reserves (so-called QE) and, of late, even the introduction of negative policy rates. In the wake of these measures, the central banks' monetary base (cash and bank reserves) has ballooned in step with the overall size of their balance sheets

With central banks delving further down into their box of unconventional tools, calls for them to take a deep breath and pull out "helicopter money" have intensified. What was just a thought experiment designed to shed light on how money affects the economy is now threatening to become a reality. Proponents・ of this tool - more soberly described as "overt money financing" of government deficits - see it as a sure-fire way to boost nominal spending by harnessing central banks' most primitive power: their unique ability to create money at will. But can helicopter money work in the way its proponents claim? And is the balance of benefits and costs worth it? Our answer to both of these questions is no.

Proponents argue that helicopter money is special because it amounts to a permanent increase in non-interest bearing central bank liabilities ("money") as the counterpart of the deficit. This form of financing is most effective because money is free and debt is not. Permanent monetary financing means less government debt and thus lower interest payments forever. All else equal, this saving should boost nominal demand, as there would be no need to raise additional taxes. Moreover, the argument continues, the central bank is then free to increase interest rates again whenever it wishes while the lower amount of debt outstanding will still yield savings. This is the best of all possible worlds: Demand is boosted without the collateral damage of prolonged exceptionally low interest rates.

Towards financial stability-oriented monetary policy? Some evidence

Presentation on the BIS Annual Report by Mr Claudio Borio, Head of the Monetary and Economic Department, on the occasion of the Bank's Annual General Meeting, Basel, 26 June 2016.

Should monetary policy take financial stability into account? If so, what would such a policy look like? These questions have gained greater prominence recently as tensions between price and financial stability have increased, while new research has found that a leaning-against-the-wind strategy would yield little or no benefits in terms of output and inflation. Drawing on BIS research presented in the Annual Report, this presentation argues that a financial stability-oriented monetary policy can yield significant benefits. For this to be the case, such a policy would need to keep an eye on financial stability all the time, during the whole financial cycle, so that the economy never strays too far away from "financial equilibrium".

Liquidity, leverage and macro risk

Presentation on the BIS Annual Report by Mr Hyun Song Shin, Economic Adviser and Head of Research, on the occasion of the Bank's Annual General Meeting, Basel, 26 June 2016.

The realignment of the global economy has been most evident in the large adjustments of exchange rates. The Annual Report examines how these exchange rate adjustments have been both a symptom of and a catalyst for recent events. Apparently disparate issues, such as market liquidity, currency market anomalies and the risk-taking capacity of financial intermediaries, can be understood better by reference to a few common themes, especially

the role of accumulated stocks in accentuating the impact of shocks. Our findings reinforce the macroeconomic rationale for prudential policy. A better capitalised financial sector is conducive not only to greater resilience of the financial system, but also to greater risk-taking capacity in support of more liquid financial markets and better macro outcomes.

General Manager's speech: Global realignment and policy rebalancing

Speech and presentation of the key messages of the BIS Annual Report delivered by Mr Jaime Caruana, General Manager of the BIS, on the occasion of the Bank's Annual General Meeting, Basel, 26 June 2016.

Drawing on the Annual Report, the speech discusses the realignment taking place in the global economy and the required rebalancing of policies. The large exchange rate and commodity price movements that had played out even before the recent market disturbances can only be fully understood by considering long-term trends in the global economy. Rising debt, lower productivity growth and diminishing room for policy manoeuvre have contributed to a build-up of vulnerabilities that give rise to three threats: macroeconomic instability; the adverse effects of persistently low interest rates; and a loss of confidence in policymaking. Countering these threats requires that prudential, fiscal and structural policies take on a more prominent role. More realism and clarity about what central banks can and cannot achieve would facilitate the rebalancing. Recent shocks make this task more complex, but also more necessary.

The renminbi in the SDR basket and its future role in the international financial system

Remarks by Mr Peter Zöllner, Head of Banking Department of the BIS, at the 2016 MEFMI Governors' Forum, Dar Es Salaam, 20 June 2016.

This debut represents an acknowledgment of China's remarkable success in opening up its markets, and it elevates the renminbi to the ranks of the most important international currencies.

I will approach this talk by first outlining some basic facts about the SDR and its origins. I will then move to an analysis of the major steps in the renminbi's progress towards becoming an international currency worthy of SDR status. Finally, I will discuss what inclusion in the basket means for the renminbi as a reserve currency. Here, I will also touch on how the BIS has been preparing for this change.

Global liquidity and procyclicality

Speech by Mr Hyun Song Shin, Economic Adviser and Head of Research of the BIS, at the World Bank conference "The state of economics, the state of the world", Washington DC, 8 June 2016.

A stronger US dollar is putting strains on global financial markets and the banking system, leading to tensions not only in emerging market economies, but in "safe haven" currencies such as the Japanese yen and the Swiss franc. One intriguing development has been the breakdown of covered interest parity (CIP), which ensures that interest rates implicit in currency markets are consistent with those in money markets. CIP broke down during the financial crisis, and deviations have reappeared in the last 18 months, with the size of the deviations fluctuating in step with a stronger dollar. The breakdown reflects, in part, the tensions created by the divergence of monetary policy among major central banks and the withdrawal of easy dollar credit conditions that prevailed after the financial crisis, all in the context of the dollar's special role in the global financial system. As the dollar has strengthened, investors have found it harder to roll over hedges put it place when the US currency was depreciating and investors were borrowing more in dollars to take advantage of low interest rates. BIS data show that the euro and the yen may be starting to take on the features of an international funding currency, following in the footsteps of the dollar.

How can emerging market economies best cope with the current complex global economic environment?

Remarks by Mr Luiz Awazu Pereira da Silva, Deputy General Manager of the BIS, at the XVIII Annual Inflation Targeting Seminar of the Central Bank of Brazil, Rio de Janeiro, 20 May 2016.

Although it may not be an immediate threat, a bond yield snapback would pose an important challenge to the macro and financial stability of both EMEs and some AEs. EMEs in particular need to be vigilant while the potential exists for such a development. There is a need to put or keep one's house in order to benefit from strong macro fundamentals. Doing so will also create conditions that allow structural reforms to be implemented as needed and in a consensus-building manner, and that promote a stable and sustainable growth horizon for both domestic and foreign investors.