BANK FOR INTERNATIONAL SETTLEMENTS

BIS Quarterly Review

September 2013

International banking and financial market developments

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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.

Markets precipitate tightening[1]

Announcements in May that the Federal Reserve envisaged phasing out quantitative easing reverberated through global financial markets. These announcements triggered a surge in benchmark bond yields that spilled over across asset classes and regions in what market commentary referred to as a sell-off. During this episode, equities in both advanced and emerging market economies registered abrupt and sizeable losses. In addition, investor retrenchment from emerging economies led to steep depreciations of a number of local currencies. The sell-off abated in early July when the Federal Reserve, the ECB and the Bank of England reassured markets that monetary policy would remain accommodative until the domestic recovery was on a solid footing. As the rise in long-term interest rates continued, however, markets effectively precipitated a tightening of financial conditions worldwide.

The policy announcements occurred after a prolonged period of exceptional monetary accommodation in advanced economies, just as the economic outlook there was turning positive. They caught markets by surprise, reminding them that negative term premia cannot last indefinitely. Even though this resulted in temporarily higher market volatility, equities eventually recovered from the losses incurred during the sell-off. Furthermore, despite their rise, yields remained low by historical standards, thus perpetuating the relative appeal of higher-yielding asset classes. This extended the squeeze of credit spreads and fuelled strong issuance of bonds and loans in the riskier part of the spectrum, a phenomenon reminiscent of the exuberance prior to the global financial crisis.

The market-led tightening of financial conditions generated serious tremors in emerging market economies, which had been in a soft spot. The outlook for these economies was deteriorating, as imbalances inherited from a period of rapid credit and GDP growth were unwinding. The imported tightening thus amplified pressures on local markets and brought to the fore the vulnerability of countries dependent on fickle foreign capital. In the face of additional strong headwinds from escalating geopolitical tensions, the downward pressure on currency and equity values persisted in a number of emerging economies even after the sell-off had abated in advanced economies.

Global markets slide on monetary policy expectations

Market participants started pricing in the end of quantitative easing on 3 May, when upbeat news on employment confirmed the positive outlook for the US economy. This led to a bond market sell-off that set US Treasury yields on an upward path and effectively brought monetary tightening forward in time (Graph 1, left-hand panel). And even though higher policy rates remained a fairly distant prospect, volatility picked up and trading in the Treasury market reached record volumes owing to conflicting views on when and how various monetary policy instruments would be phased out.[2]

The US bond market sell-off reverberated globally, affecting a broad range of asset classes in both advanced and emerging market economies. For example, the yields on European long-term sovereign bonds also started their ascent on 3 May (Graph 1, centre panel) and the corresponding Japanese yields edged up. Mortgage-backed securities promptly followed suit, as less attractive refinancing prospects lengthened the duration of these instruments, thus increasing their interest rate sensitivity. At the same time, the rising yields in advanced economies set in motion a sustained depreciation of major emerging market currencies with respect to the US dollar (Graph 1, right-hand panel).

The markets for high-yield bonds and equities joined the sell-off with a three-week lag. This happened after 22 May, when the Federal Reserve Chairman stated that the Federal Open Market Committee could envisage reducing the pace of asset purchases to ensure that the stance of monetary policy remained appropriate as the

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Sovereign bond and currency markets

Graph 1
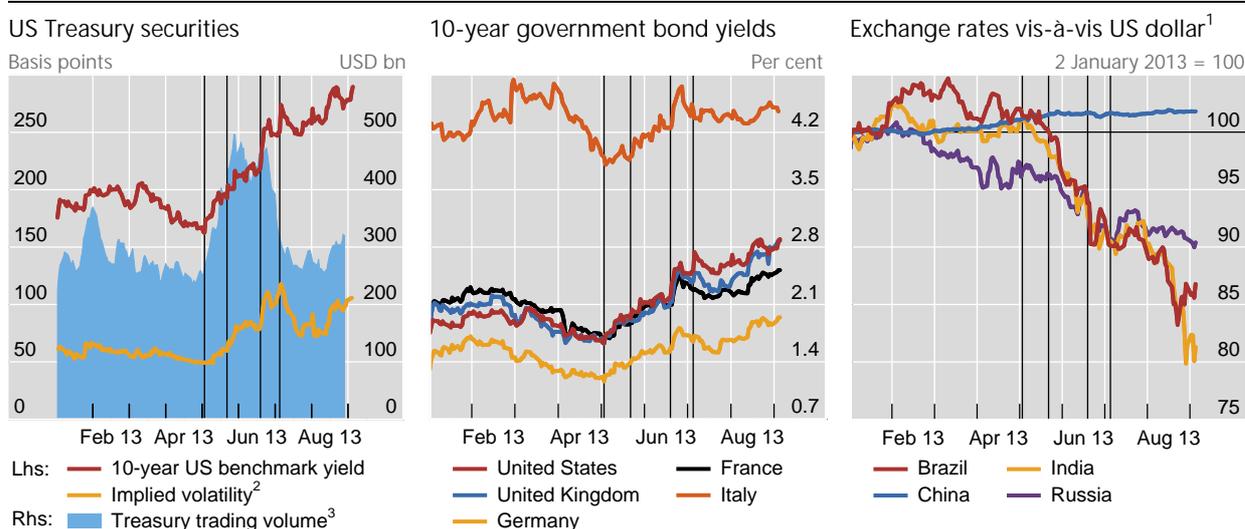
The black vertical lines indicate 3 May, 22 May, 19 June and 5 July 2013 respectively.

[1] US dollars per unit of local currency. A decrease indicates depreciation of the local currency.   [2] The Merrill Lynch Option Volatility Estimate (MOVE) is an index of Treasury bond yield volatility over a one-month horizon, based on a weighted average of Treasury options of two-, five-, 10- and 30-year contracts.   [3] Daily trading volume for US Treasury bonds, notes and bills, reported by ICAP; centred 10-day moving average.

Sources: Bloomberg; Datastream; national data; BIS calculations.

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[2]   Foreign residents reduced their holdings of long-term US securities by $77.8 billion in June, with net sales of US Treasury bonds accounting for $40.8 billion.

Corporate bond and equity markets

Graph 2

Corporate bond indices[1]	Equities in advanced economies	Equities in emerging markets[2]
Basis points	2 January 2013 = 100, local currencies	2 January 2013 = 100, local currencies
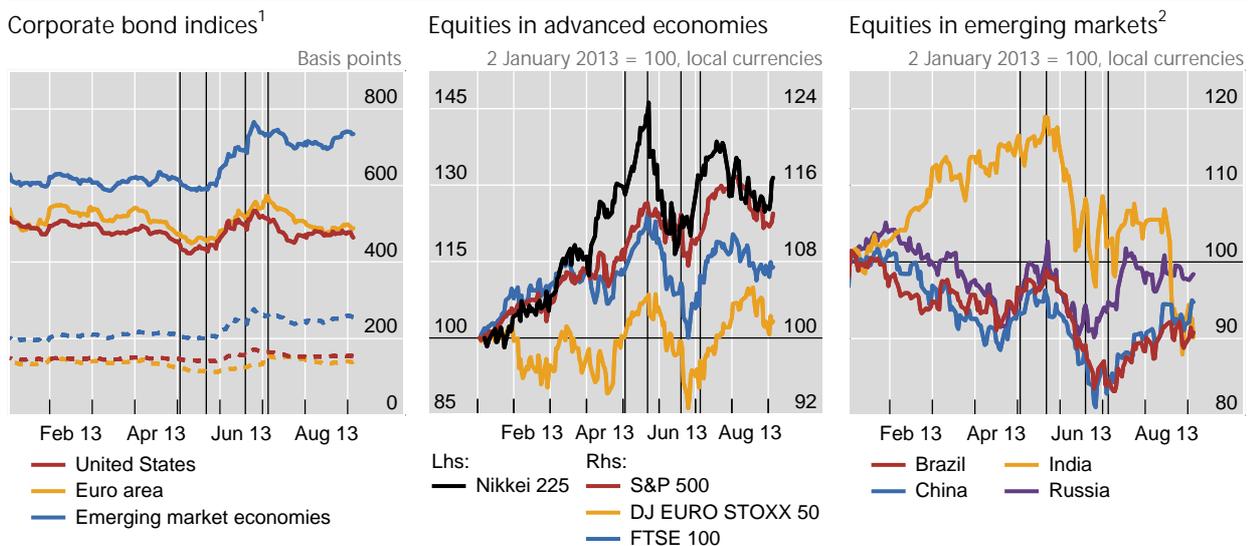
The black vertical lines indicate 3 May, 22 May, 19 June and 5 July 2013 respectively.

[1] High-yield (solid line) and investment grade (dashed line) option-adjusted spreads.   [2] Calculated by MSCI.

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

outlook for the labour market or inflation changed. On this statement, high-yield indices started cheapening markedly in advanced economies on both sides of the Atlantic, as well as in emerging market economies (Graph 2, left-hand panel). At the same time, a half-year rally in advanced economies' equity indices came to an end amid elevated volatility, as market players, scathed by years of sub-par returns, reassessed a rapidly evolving financial landscape (Graph 2, centre panel). And following their lacklustre performance earlier on, emerging market equity indices plummeted (Graph 2, right-hand panel).

Then, global markets evolved largely in sync until 19 June, when the Federal Reserve Chairman emphasised that the envisaged slowdown of asset purchases should be consistent with the unemployment rate decreasing to 7% by mid-2014. As an immediate response, market volatility and bond yields edged further up, and equity prices dropped abruptly. Within a week, however, the bearish mood in equity markets subsided, sending major indices on an upward path. Likewise, there soon was a distinct reduction in the upward pressure on US and emerging market corporate bond spreads, as well as on euro zone sovereign yields. By contrast, the sell-off on the US Treasury and the euro area corporate bond markets continued until early July, when major central banks joined forces to reassure markets that the monetary stance would remain supportive on the path to recovery.

To alleviate the market-induced tightening of funding conditions, central banks on both sides of the Atlantic issued forward guidance as regards the future path of monetary policy. The Federal Reserve had emphasised for some time the continuation of its low interest policy as long as macroeconomic conditions warranted it. On 4 July, the Bank of England and the ECB also took steps towards forward guidance by stating explicitly that rising bond yields were not in line with monetary policy intentions and fundamentals. In a clear departure from its previous communication practice, the ECB pledged that policy rates would remain at current or lower levels for an extended period of time, conditional on its assessment of

economic conditions. A month later, the Bank of England's new Governor confirmed the Bank's forward guidance by specifying that – barring unforeseen adverse developments[3] – the policy interest rate would not rise from 0.5% until unemployment declined to 7%. Under the Bank's own forecast, this would take until 2016.

By the time central banks' forward guidance finally halted the two-month-long gyrations in global markets, bond yields as well as equity and currency valuations had evolved substantially (Graphs 1 and 2). Between 3 May and 5 July, the yield on the 10-year US Treasury note increased by 100 basis points, to 2.74%. This run-up was similar to that over the last two months of 2010, which occurred in anticipation of monetary policy tightening, but fell short of the rate hikes during the episodes of actual tightening in 1994 and 2004. In addition, the May and June increases in the 10-year sovereign yields of Japan, Germany and the United Kingdom amounted to roughly 30, 50 and 75 basis points respectively. And even though they were in a sell-off mode for only part of this period, high-yield indices in advanced economies saw their spreads rise by 60 to 90 basis points. By contrast, mature equity markets went through swings without clear direction, with the EURO STOXX 50 and FTSE 100 registering 6% and 2% losses, and the Nikkei and the S&P 500 gaining 4.5% and 1%, respectively.

In emerging market economies, the concurrent losses were much larger. For instance, the yield on the composite emerging market high-yield index rose by 130 basis points and the equity indices of the BRIC economies lost 3–13% of their local currency values between 3 May and 5 July. Over the same period, the currencies of Brazil, India and Russia depreciated by roughly 10% with respect to the US dollar. Likewise, the yields on the latter two countries' US dollar-denominated bond indices rose by more than 100 basis points, outstripping the rise in yields on local currency bonds.

Broader perspective on the bond market sell-off

The announcements about the future path of US monetary policy occurred against an improving growth outlook in advanced economies, which stood in sharp contrast to the slowdown in emerging market economies. The US recovery proceeded at a moderate pace, even as unemployment was expected to decline only slowly. At the same time, upward revisions in growth neutralised any remaining fears of a triple-dip recession in the United Kingdom. In turn, the euro area emerged from a six-quarter contraction, with Germany and France pushing area-wide growth to a modest but positive 0.3% in the second quarter, a growth rate that was expected to weaken only slightly in the third quarter and then persist over the following year. In addition, market participants drew confidence from manufacturing PMI indices in the second and third quarters, pointing to expansion in most advanced economies (Graph 3, left-hand panel). On the other hand, PMI indices in emerging market economies generally deteriorated (Graph 3, centre panel). Moreover, the balance of economic surprises in major advanced economies moved into positive territory for

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[3]   The Bank of England specified that it would adjust the policy stance if it posed a significant threat to financial stability, if the Bank's own forecast of inflation 18 to 24 months ahead reached or exceeded 2.5% per annum or if the public's medium-term inflation expectations no longer remained sufficiently well anchored.

Macroeconomic backdrop

Graph 3

Advanced economy PMIs[1]

Emerging market PMIs[1]

Economic surprises[2]

United States — Euro area
United Kingdom — Japan

Brazil — India
China — Russia

G10 economies
Emerging market economies
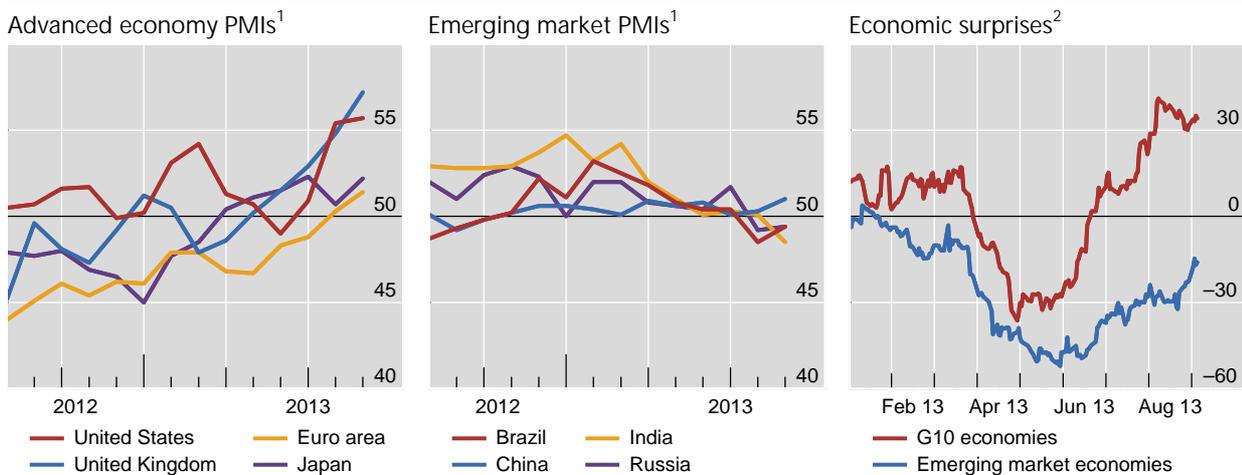
[1] Purchasing managers' index (PMI) derived from monthly surveys of private sector companies. Values above (below) 50 indicate expansion (contraction).   [2] The Citigroup Economic Surprise Indices are defined as the weighted sum of data surprises (balance of actual releases versus Bloomberg survey median). A positive reading indicates that economic releases have on balance beaten the consensus forecast. The indices are calculated daily in a rolling three-month window.

Sources: Bloomberg; Citigroup; Datastream; HSBC; Markit.

the first time since March but remained negative in emerging markets (Graph 3, right-hand panel).

It was the interplay between improving economic outlooks and anticipated changes to the monetary policy stance that shaped the recent behaviour of bond markets in advanced economies. The two drivers reinforced each other in raising the term premia embedded in bond prices. Even though credit spreads rose as a result, they remained below the levels seen in 2012, reflecting an ongoing search for yield.

Drivers of the rise in bond yields

An examination of the rise in US bond yields between May and July reveals as a key driver the uncertainty about the future stance of monetary policy. The sell-off mainly shifted bond yields at long maturities, while the short end of the yield curve remained anchored by the Federal Reserve's continued low interest rate policy (Graph 4, left-hand panel). In addition, the federal funds futures curve also shifted upwards, signalling market perceptions that a policy rate exit from the current 0–0.25% band had become quite likely to occur as early as in the second quarter of 2014 (Graph 4, centre panel). A model-based decomposition of the 10-year US Treasury yield, which sheds light on the various drivers of these shifts, indicates that the recent yield spike was largely the result of a rising term premium (Graph 4, right-hand panel).[4] This is consistent with markets reacting to uncertainty about the extent to which an improving economic outlook would affect future policy rates. It is also consistent with uncertainty as regards the impact that a reduction in the Federal Reserve's purchases of long-term Treasuries would have on these securities' prices.

[4]   In their recent entry in *Liberty Street Economics* (http://libertystreeteconomics.newyorkfed.org), Tobias Adrian and Michael Fleming also find that a rising term premium explains most of the recent bond market sell-off.

US interest rates

In per cent

Graph 4

Nominal yields	Federal funds futures curve	10-year yield decomposition[1]

Nominal yield:
- Three-month
- 10-year

Memo:
- - - *20-year average*
- · - *20-year average*

- 1 May 2013
- 4 July 2013
- 4 September 2013 (latest)

- Expected real yield
- Expected inflation
- Real premium
- Inflation premium
- Nominal yield
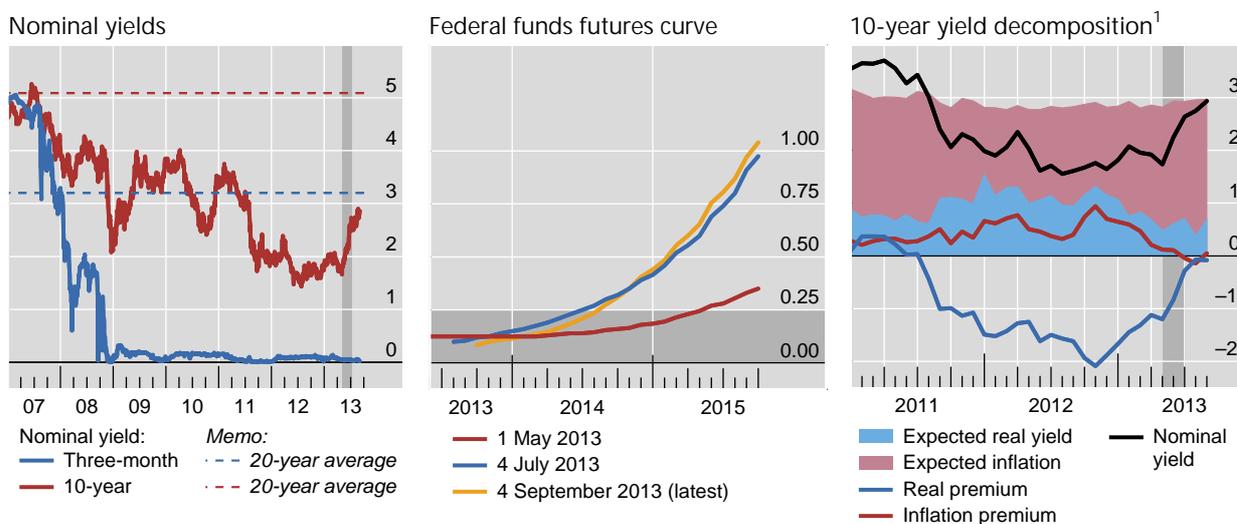
The shaded areas in the left- and right-hand panels indicate the bond market sell-off period, 3 May to 5 July 2013.

[1] Decomposition based on a joint macroeconomic and term structure model. See P Hördahl, O Tristani and D Vestin, "A joint econometric model of macroeconomic and term structure dynamics", *Journal of Econometrics*, vol 131, 2006, pp 405–44; and P Hördahl and O Tristani, "Inflation risk premia in the term structure of interest rates", *BIS Working Papers*, no 228, May 2007.

Sources: Bloomberg; Datastream; national data; BIS calculations.

In comparison, the bond market sell-offs in 1994 and 2003–04 were different in nature. During those episodes, long-term nominal yields rose together with policy rates or on the back of expected increases in future real interest rates and inflation. By contrast, inflation expectations were largely unchanged in the second and third quarters of 2013 (Graph 4, right-hand panel).

Their recent spike notwithstanding, bond yields in mature markets remained low by historical standards. For one, the yields on sovereign bonds in the largest world economies had been on a downward trend since 2007. And investment grade spreads in the United States, the euro area and the United Kingdom declined respectively by 75, 110 and 190 basis points between May 2012 and early September 2013, falling past their earlier troughs in 2010 and reaching levels last seen at end-2007. The evolution of the corresponding high-yield bond indices was similar, with spreads declining by 230 to 470 basis points over the same period.

Credit markets: in a persistent search for yield

The recent sell-off did little to undermine the relative appeal of riskier securities, which asserted itself in the second half of 2012 and persisted through the third quarter of 2013. Historically low yields in core bond markets were an important underlying factor drawing investors towards the higher returns of riskier assets. In principle, however, two additional factors are likely to have played a role as well. As uncertainty about the monetary stance made it more difficult to price interest rate risk, market-wide demand would shift towards securities less sensitive to such risk. This would include securities carrying a credit risk premium, which reduces duration, all else the same. In addition, to the extent that monetary conditions tighten only

when economic recovery gains momentum, securities exposed to both interest rate and credit risk would carry diversification benefits.

The attractiveness of riskier securities surfaced as a persistent squeeze of credit spreads (Graph 5, left-hand panel). The bond market sell-off in May and June reversed this process, but only temporarily in advanced economies. After their peak at mid-2012, credit spreads in these economies plummeted by more than 30% to reach roughly 350 basis points by early September 2013. Thus, while still well above their pre-crisis trough in 2006, they reached levels last seen at end-2007.

Recent debt issuance also reflected investors' interest in the riskier part of the credit spectrum. For instance, the high-yield share of aggregate bond issuance by European firms exceeded 15% in the first quarter of 2013, up from roughly 12.5% in 2012. In addition, banks increasingly funded themselves with subordinated debt, much of which was expected to be of sufficient loss absorbency to count towards regulatory capital. Compared with the 12 months to mid-2012, the issuance of subordinated debt increased almost tenfold in the United States and 3.5 times in Europe to reach roughly $22 billion and $52 billion respectively over the 12 months to mid-2013. Likewise, the market for contingent convertible capital instruments (CoCos) has been growing since 2011 (see the special feature in this issue).

A trend favouring riskier lending was also evident in the syndicated loans market. A concrete manifestation was the growing popularity of "leveraged" loans, which are extended to low-rated, highly leveraged borrowers paying spreads above a certain threshold (Graph 5, centre panel). The share of these loans in total new signings reached 45% by mid-2013, 30 percentage points above the trough during the crisis and 10 percentage points above the pre-crisis peak. Market commentary attributed part of this increase to renewed investor demand for collateral loan obligations, which furthered a shift of negotiating power to borrowers. Thus, just as

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Search for yield   Graph 5

Corporate credit spreads[1]   Syndicated lending, global signings   Covenants, leveraged facilities
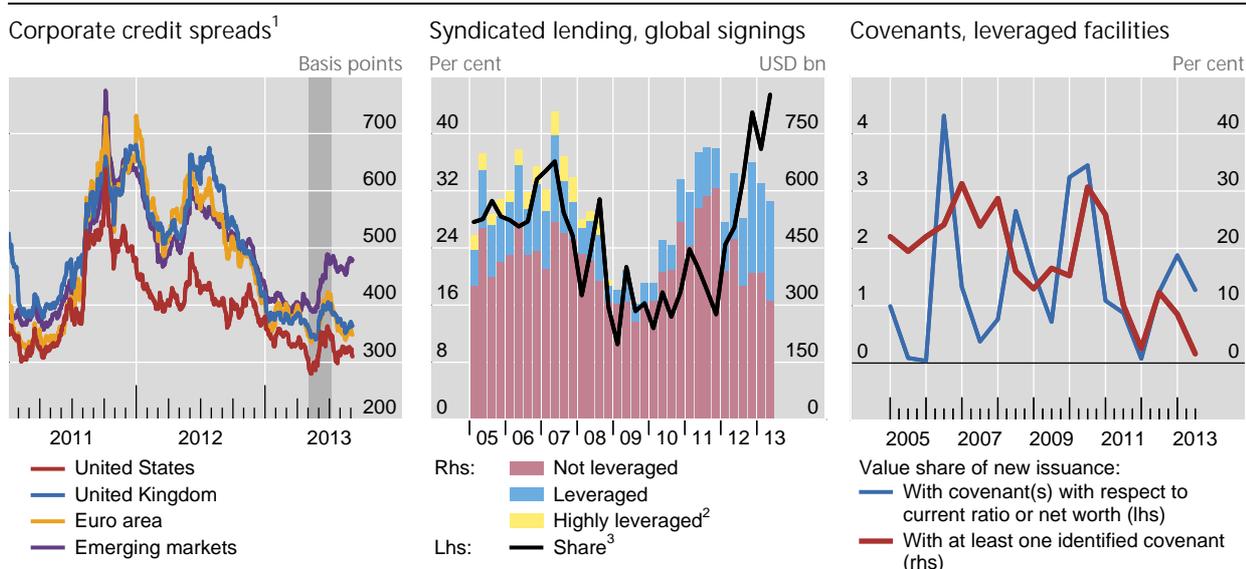
The shaded area in the left-hand panel indicates the bond market sell-off period, 3 May to 5 July 2013.

[1] High-yield minus investment grade option-adjusted spreads on corporate bond indices.   [2] Dealogic Loan Analytics does not distinguish between highly leveraged and leveraged for loans signed after 2008.   [3] Of leveraged and highly leveraged loans in total syndicated loan signings.

Sources: Bank of America Merrill Lynch; Dealogic Loan Analytics; BIS calculations.

leveraged loans were gaining in importance, a declining portion of the new issuance volume featured creditor protection in the form of covenants (Graph 5, right-hand panel).

Sell-off sparks exodus from emerging markets

The summer months of 2013 confirmed a reduction of the brisk growth in key emerging market economies and a clear deterioration in their outlooks (Graph 3). For some of these economies, the slowdown had deepened with the decline in the prices of certain commodities – notably, industrial and precious metals – after mid-2012. In addition, part of the slowdown was engineered by policymakers, which had been leaning against financial imbalances. For instance, a number of Latin American countries had implemented policies to limit the inflow of foreign capital, including taxes on foreigners investing in certain financial instruments. Meanwhile, Chinese authorities had taken steps to rein in credit expansion. Combined with a reduction in US dollar inflows, this policy initiative culminated in a liquidity squeeze in the local interbank market in June (see box). Even though August data releases surprised on the upside, previous below-expectation figures on China's growth had negative repercussions on other emerging markets. For instance, this translated into a substantial drop in the foreign demand faced by commodity exporters, such as Brazil and Russia.

Against this background, the improved growth prospects in advanced economies and the tightening of global financial conditions contributed to investors' retrenchment from emerging market economies. This resulted in sustained declines in the value of local assets. For example, while equities in advanced economies had largely recovered their June losses by end-August, a broad emerging market equity index continued to linger around 12% lower than in early May (Graph 6, left-hand panel), close to levels last seen at mid-2012. A similar pattern was also visible in flows into and out of bond market funds (Graph 6, centre and right-hand panels). Investors were quick to retreat from such funds worldwide in June, but while the flows promptly reversed and stabilised for advanced economies, investors continued to pull money out of emerging market funds. And the resulting cumulative outflows from June to August amounted to the cumulative inflows over the previous five months.

The investor retrenchment occurred on the back of mixed indicators of financial vulnerability in emerging market economies. Indeed, these economies' external debt and capital inflows were most recently lower as a share of GDP than before 2008. That said, many emerging economies had built up financial imbalances in the wake of rapidly expanding private borrowing. For instance, issuance of emerging market corporate bonds had gathered speed, as yields on such bonds had fallen to unusually low levels. And the negative side effects of rising indebtedness included growing signs of deteriorating lending standards in the banking sector, as indicated by rising volumes of non-performing loans (Graph 7, left-hand panel). Thus, given perceptions that the valuation of emerging market assets had been inflated by ample liquidity conditions in past years, investors rapidly shifted out of these assets as rising yields in advanced economies signalled the beginning of the end of easy credit.

Following a broad-based depreciation of emerging market currencies vis-à-vis the US dollar, investors refocused on the fundamentals of individual countries. As a

Equity indices[1]

Flows into emerging market bond funds

Flows into advanced economy bond funds

1 January 2013 = 100

USD bn

USD bn
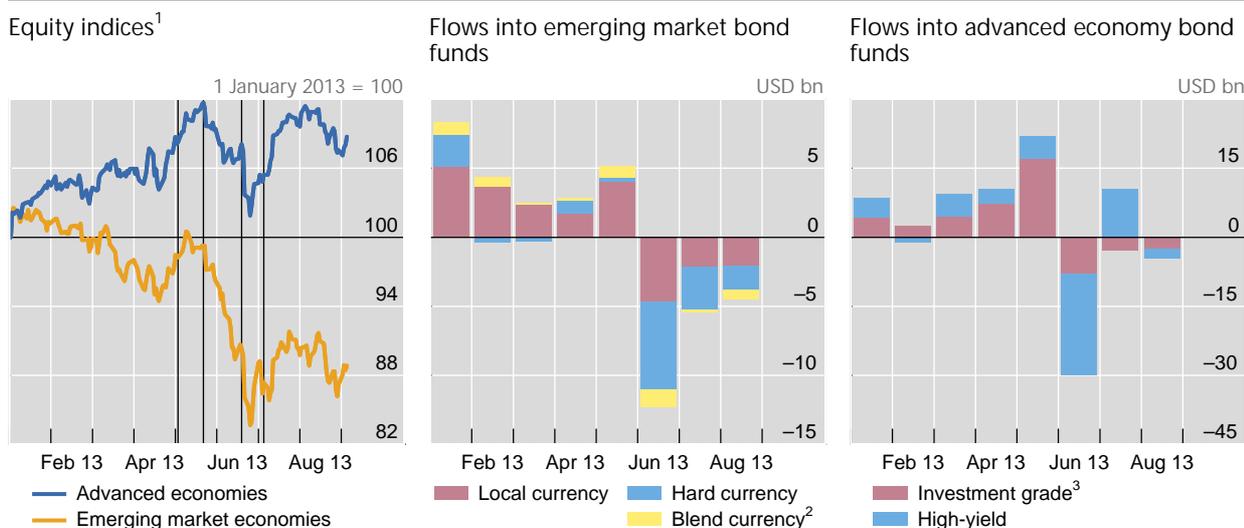
The black vertical lines indicate 3 May, 22 May, 19 June and 5 July 2013 respectively.

[1] Aggregates, calculated by MSCI.   [2] Funds investing in both local currency and hard currency bonds.   [3] Investment grade bond funds consist of short, intermediate and long-term bond and corporate funds, and total return funds.

Sources: Datastream; EPFR.

sign of the transition, the co-movement of depreciation rates, which had been quite strong in June and July, declined to levels seen earlier in the year (Graph 7, centre panel). In particular, investors zeroed in on countries with large current account deficits that are especially vulnerable to sudden capital outflows. Indeed, countries with high deficits, such as Brazil, India, Indonesia, South Africa and Turkey, experienced the sharpest currency depreciations (Graph 7, right-hand panel). As the negative outlook for India was reinforced by reports of rising bad loans at local banks, the rupee fell to an all-time low vis-à-vis the US dollar in late August. In Brazil, reports that the current account deficit was widening faster than expected – to $9 billion in July – added to downward pressures on the real stemming from political uncertainty. Similarly, Indonesia's rupiah fell on new data showing that the country's current account deficit had widened from 2.6% of GDP in the first quarter of the year to 4.4% in the second. Meanwhile, a number of central and eastern European countries benefited, as investors perceived them to be relative safe havens among emerging market economies. This was due to these countries' better current account balances, as well as their greater reliance on exports to the euro area, which had shown signs of recovery.

In a number of countries with high current account deficits, high domestic inflation exacerbated the situation. At end-August, year-on-year WPI inflation in India was close to 6% and CPI inflation in Indonesia and Turkey was above 8%, partly because of significant currency depreciations that had raised import costs. And high rates of inflation may in turn lead to additional nominal depreciation, thereby fuelling a vicious circle.

Interbank volatility in China

Guonan Ma and Chang Shu

China's interbank market experienced a severe liquidity squeeze in June. The liquidity shortage started in May, with the benchmark overnight and seven-day repo rates gradually moving up towards 5% after staying in the 2–3% range in the first few months of this year (Graph A, left-hand panel). These rates then rose to above 10% in mid-June, soaring to record highs of 25% and 30% on 20 June before settling back into a still high range of 5–8% on 25 June 2013. Meanwhile, the Shanghai interbank offered rate (Shibor) spiked as well. The liquidity squeeze also led to large intraday rate movements. The biggest high-low daily range for the seven-day repo rate was 2,329 basis points on 20 June, compared with an average of 154 basis points in the first five months of 2013.

Interbank activity contracted significantly as a result. Interbank loans fell by over 60% from May to June to CNY 1.6 trillion (Graph A, centre panel). In July and August, the interbank lending volume rebounded to around CNY 2.4 trillion, but was still well below the monthly average of CNY 3.8 trillion in the first five months of this year, and the average of CNY 3.9 trillion for 2012.

Both supply and demand factors are likely to have contributed to the tighter funding conditions in the interbank market. On the supply side, a marked slowdown in US dollar inflows began in late May, entailing much less foreign exchange intervention and renminbi conversion. This was attributable to both domestic and global factors, including narrower trade surpluses (partly due to crackdowns on export over-invoicing), tightened rules on onshore US dollar lending, more bearish market sentiment about China's growth prospects, and a rise in global risk aversion upon intensified speculation over the United States' tapering of asset purchases. On the demand side, increased reserve requirements for banks from tighter rules on "wealth management products" and greater funding needs owing to reduced rollovers in these products compounded seasonal demand for liquidity, adding to market stress. The People's Bank of China (PBoC) did not initially meet surging demand in the interbank market, effectively allowing tighter funding conditions. This was interpreted by some market participants as reflecting the PBoC's intent to rein in the growth of lending to the shadow banking sector. There was even some speculation in the market that the PBoC was signalling monetary tightening. All these interpretations contributed to a more cautious lending stance by banks and the resultant liquidity squeeze.

The market calmed when the PBoC subsequently provided more liquidity and forcefully communicated its determination to stabilise markets. On 24 June, the central bank communicated its assessment that the overall liquidity condition was adequate, but acknowledged the challenges banks faced in managing liquidity at this juncture.

China interbank market and open market operation
Graph A

Short-term rates in interbank market — Per cent

Interbank market turnover — CNY trn

Open market operation, net[1] — CNY bn

7-day repos   3-month Shibor

Credit lending

Total   Reverse repos
Bills   Repos
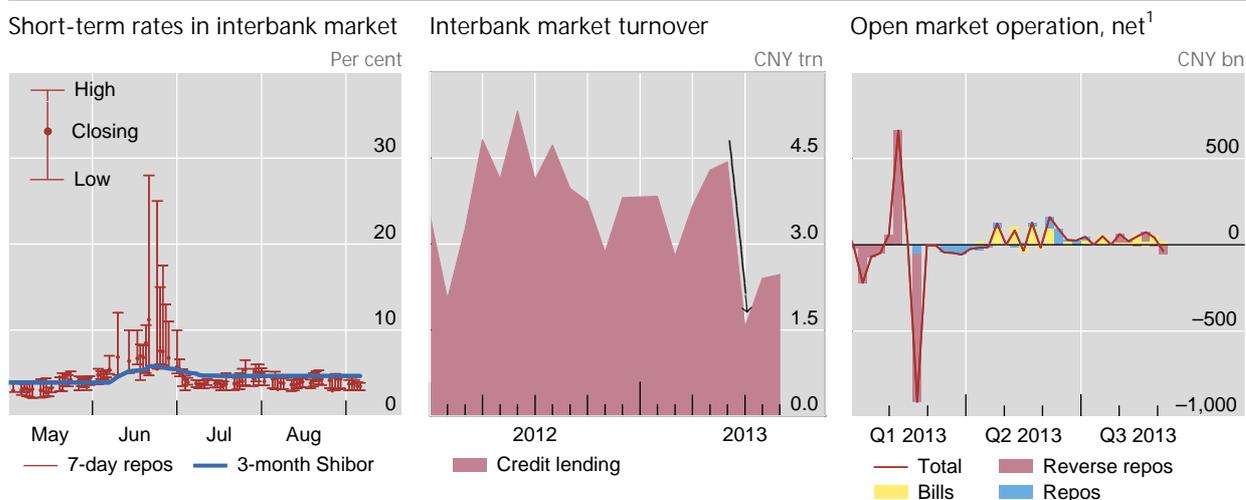
[1] A positive number indicates a net injection into the market.

Sources: Bloomberg; CEIC.

On 25 June, the PBoC stated its intention to "actively make use of open market operations, re-financing, short-term liquidity operations and [the] standing facility, to regulate interbank liquidity, limit unusual volatility, stabilise market expectations, and maintain money market stability". While liquidity provision through open market operations did not increase significantly (Graph A, right-hand panel), the central bank bilaterally provided liquidity to financial institutions that met macroprudential criteria but needed short-term liquidity support. Major commercial banks and policy banks with surplus liquidity were also encouraged to lend into the interbank market.

With emerging market authorities facing challenges on several fronts, their main policy responses aimed at curbing the depreciation of domestic currencies. In the face of rapidly declining investor confidence, the Reserve Bank of India intervened to put upward pressure on money market interest rates and imposed capital controls. By late August, however, there were few signs that this had slowed the pace of the rupee's depreciation. Indian officials also announced longer-term measures to contain the current account deficit, including taxes on silver and gold imports and steps to liberalise iron ore exports and to reduce India's dependence on imported coal. Likewise, the Indonesian, Turkish and Brazilian central banks raised policy rates and intervened in foreign exchange markets in an attempt to reduce the outflow of foreign capital and stabilise the domestic currencies. The sizeable foreign exchange interventions of several central banks contributed to significant reductions in official foreign reserves over the past few months.

Emerging markets: systemic and domestic problems   Graph 7

Loan quality[1]   Co-movement of depreciation rates   Deficits and currency depreciations

— Emerging Asia   — Emerging Europe   — Median correlation[2]
— Latin America
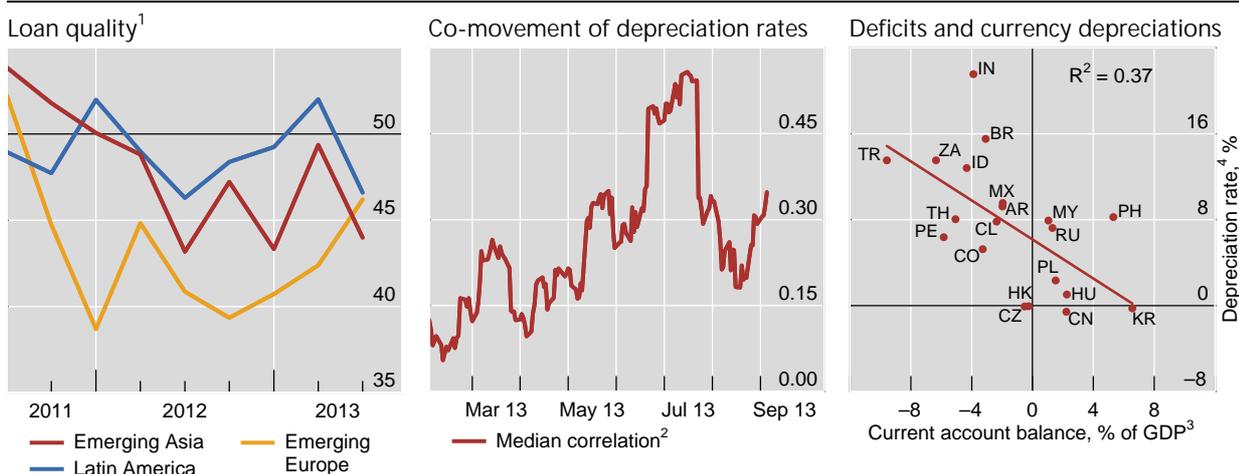
AR = Argentina; BR = Brazil; CL = Chile; CN = China; CO = Colombia; CZ = Czech Republic; HK = Hong Kong SAR; HU = Hungary; ID = Indonesia; IN = India; KR = Korea; MX = Mexico; MY = Malaysia; PE = Peru; PH = Philippines; PL = Poland; RU = Russia; TH = Thailand; TR = Turkey; ZA = South Africa.

[1] Diffusion index: values below 50 indicate a rising volume of non-performing loans. [2] Based on the US dollar exchange rates of the currencies of the countries appearing in the right-hand panel. Median of all pairwise correlations of the depreciation rates over the preceding month. [3] As of Q2 2013 (latest quarterly observation). [4] Against the US dollar, between 3 May and 4 September 2013.

Sources: IMF, *International Financial Statistics* and *World Economic Outlook*; CEIC; Datastream; Institute of International Finance; BIS calculations.

Highlights of the BIS international statistics[1]

The BIS, in cooperation with central banks and monetary authorities worldwide, compiles and disseminates several data sets on activity in international financial markets. This chapter summarises the latest data for the international banking market, available up to the first quarter of 2013. One box analyses the renewed cross-border expansion of Japanese banks. A second discusses the issuance of debt securities by Brazilian and Chinese financial and non-financial corporations in offshore financial centres.

During the first quarter of 2013, the cross-border claims of BIS reporting banks remained broadly unchanged. This reflected two major diverging trends in international banking markets. First, a decline in cross-border claims on banks, especially those located in the euro area, was largely offset by an expansion of claims on non-banks. Second, cross-border claims on advanced economies declined, while those on borrowers in emerging market economies increased sharply. Cross-border credit to China, Brazil and Russia expanded at a record pace, with banks absorbing the lion's share of the new funds. As a result, the share of interbank credit to emerging market economies as a percentage of total international interbank claims reached its highest level on record. The marked increase in cross-border credit to these economies in the first quarter of 2013 underpins a longer-term trend. Especially in emerging Asia and Latin America, countries generally have been affected less by the global financial crisis. This has been reflected in stronger growth of cross-border credit to these regions in recent years.

Japanese banks have returned recently as the world's largest providers of cross-border credit (see Box 1). They have increasingly been lending out of their offices abroad, whereas the share of cross-border claims booked in Japan has been declining. On a consolidated basis, Japanese banks' international expansion has been concentrated in claims on offshore centres and emerging market economies. Their international advance has been funded largely through sources in Japan.

Financial and non-financial corporations headquartered in emerging market economies have overtaken firms from the advanced economies as the largest group of issuers of corporate debt securities in offshore financial centres (OFCs). Box 2 shows that the surge in issuance is primarily due to borrowers in just two countries,

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China and Brazil. Issuing bonds through controlled entities in OFCs allows them to reach an investor base that would find it hard to invest locally.

The international banking market in the first quarter of 2013

The cross-border claims of BIS reporting banks declined by just $28 billion (0.1%) between end-December 2012 and end-March 2013 (Graph 1, top left-hand panel).[2] Cross-border claims denominated in euros fell by $145 billion or 1.4%, and those in sterling by $57 billion or 4.0%, while those in Japanese yen increased by $55 billion or 4.3% (Graph 1, top right-hand panel). The latter brought the cumulative increase of cross-border claims denominated in yen since the first quarter of 2012 to $114 billion, reflecting the cross-border expansion of Japanese banks (see also Box 1).

International banking activity in the first quarter of 2013 continued to be characterised by lower credit to banks and higher lending to non-banks. Cross-border claims on banks and related offices fell by $137 billion or 0.8% (Graph 1, bottom left-hand panel), whereas those on non-bank borrowers increased by $110 billion or 0.9% (Graph 1, bottom right-hand panel). This marked the fifth consecutive quarter of the redirection of lending between these counterparty sectors and brought the cumulative reduction in interbank positions since end-September 2011 to $2.2 trillion. This large contraction in cross-border interbank activity was mainly the result of reduced inter-office positions.

Cross-border credit across reporting regions showed diverging trends in the first quarter of 2013. Cross-border claims on advanced economies fell by $341 billion (1.5%). In contrast, claims on borrowers in emerging economies increased sharply by $267 billion (8.4%).

Credit to advanced economies

The decline in cross-border claims on advanced economies mainly reflected further contractions in interbank lending. According to the locational banking statistics by residence, claims on banks and related offices in advanced economies fell by $328 billion (2.4%) between end-2012 and end-March 2013.

The retreat in international interbank activity was most pronounced in Europe. Interbank claims (including inter-office positions) on banks in the United Kingdom fell the most, by $143 billion or 4.0% (Graph 1, bottom left-hand panel), reflecting reduced funding from banks in the United States, the Netherlands and Germany. Cross-border interbank credit to banks in the euro area contracted by $138 billion (2.7%), the fourth consecutive quarterly decline. This brought the cumulative reduction in interbank credit to the euro area to $597 billion since the easing of market tensions in the third quarter of 2012. This is well above the decline of only $146 billion seen during the second half of 2011 and first half of 2012, when the euro area crisis was at its most acute. Further deleveraging of banks in the euro

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

Changes in cross-border claims[1]

Exchange rate and break-adjusted changes, in trillions of US dollars   Graph 1

By counterparty sector
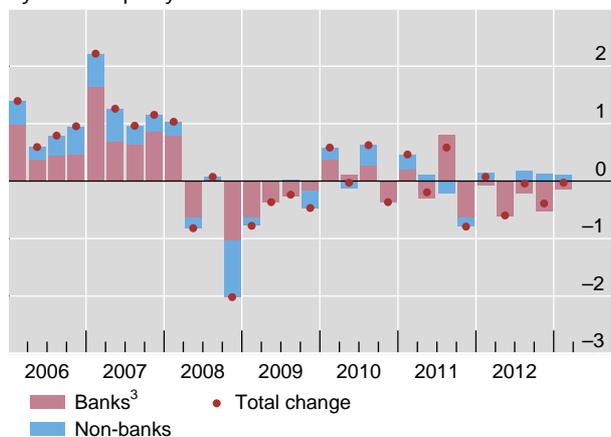
By currency
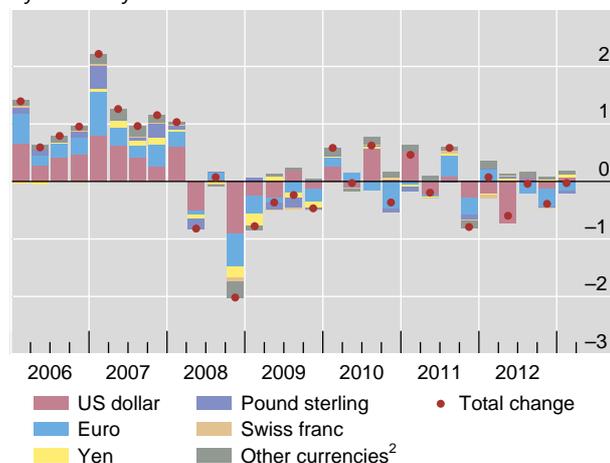
By residence of counterparty, banks[3]
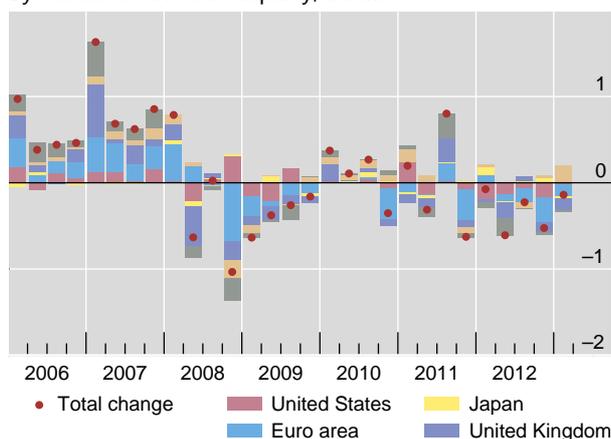
By residence of counterparty, non-banks
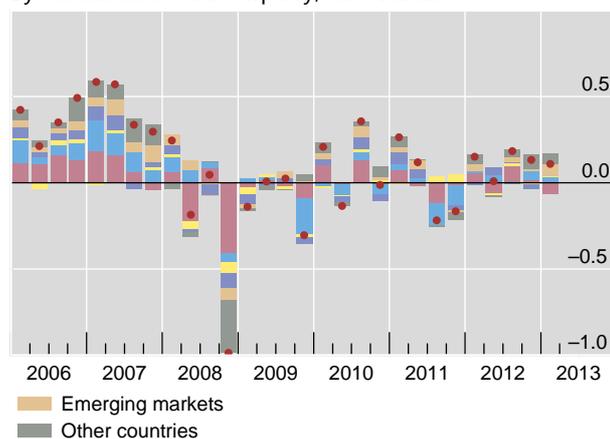
[1] BIS reporting banks' cross-border claims include inter-office claims.   [2] Includes unallocated currencies.   [3] Includes claims unallocated by counterparty sector.

Source: BIS locational banking statistics by residence.

area, partly related to the changing regulatory environment and the adjustment of business models, may explain why interbank activity has so far not regained previous levels, despite the waning of the euro area crisis. The fall in the first quarter of 2013 mostly reflected lower lending to banks in Germany, the Netherlands and Italy, while claims on banks in France, Spain and Luxembourg increased.

Cross-border claims on banks in the United States declined for a sixth quarter in a row, although the size of the contraction ($18 billion or 0.8%) was smaller than in previous quarters. Those on banks in Japan also fell (by $21 billion or 2.9%). The continued decline in cross-border interbank lending may be related to a shift in banks' funding models from interbank borrowing to borrowing from non-banks. The BIS locational banking statistics by residence show that, in terms of amounts outstanding, cross-border liabilities to the non-bank sector as a share of total cross-border liabilities increased strongly for banks in advanced economies in recent years.

Box 1

The return of Japanese banks

Adrian van Rixtel and Jeff Slee

Japanese banks have recently become once again the biggest suppliers of cross-border bank credit. The BIS consolidated banking statistics show that in 2011 Japanese banks replaced German banks as the world's largest international lenders. Japanese banks' share in the consolidated international claims of all BIS reporting banks rose from 8% in early 2007, prior to the start of the global financial crisis, to 13% at end-March 2013. On a consolidated basis, US banks were the next largest cross-border lenders, with a market share of about 12% at end-March 2013, followed by German banks at 11%.①

This marks a return of Japanese banks to the position that they held in the international banking market in the second half of the 1980s. According to the locational banking statistics, which include inter-office activity, Japanese banks' share of the cross-border claims of all BIS reporting banks peaked at no less than 36% in 1989 (Graph A, left-hand panel).② At that time, Japanese banks funded loans to borrowers in Japan through their overseas offices in order to avoid regulatory restrictions at home.③ They also provided a major share of commercial and industrial loans to US and emerging market borrowers, especially in Asia.④ But the severe banking crisis of the 1990s, in combination with banking deregulation at home, reversed Japanese banks' cross-border expansion sharply. Their market share reached a low in 2007 before rebounding.

The recent international expansion of Japanese banks reflects higher lending to offshore financial centres, emerging market economies and the United States (Graph A, right-hand panel). The increase in cross-border claims on offshore centres was driven mainly by claims on centres in the Caribbean, while Asia and Latin America were the main recipients of the increased credit to emerging market economies. As a result, Japanese banks' claims on borrowers in Latin America and the Caribbean increased to almost 20% of their consolidated international claims at end-March 2013, from 15% in late 2009 (Graph A, right-hand panel). In contrast, the share of claims on advanced

Japanese banks' cross-border activities

Graph A

Cross-border claims, including inter-office positions, by banking system[1]
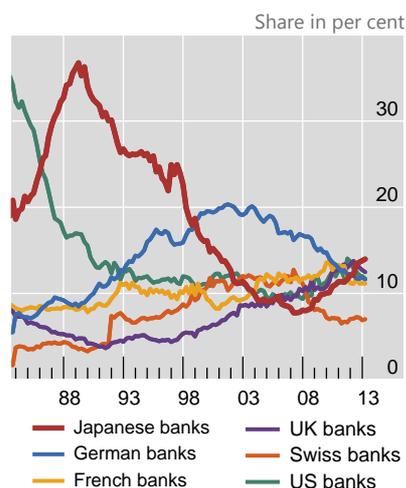
Japanese banks' cross-border claims and liabilities, by counterparty sector[1]
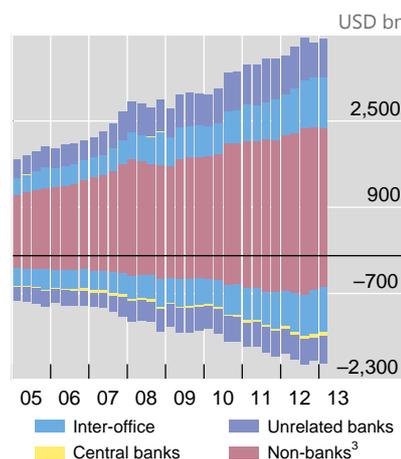
Japanese banks' consolidated international claims, by borrower country[2]
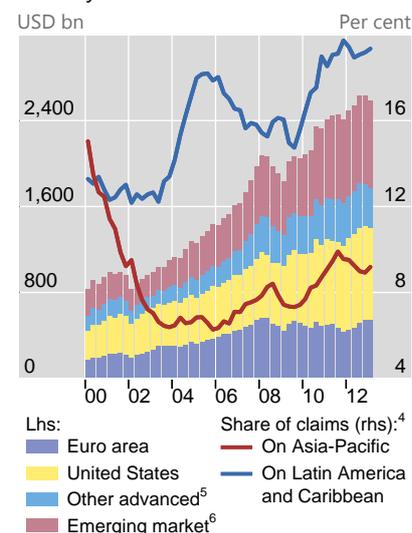
[1] Cross-border claims of banking offices located in BIS reporting countries, including claims of banks' foreign offices on residents of the home country.   [2] Cross-border claims in all currencies plus local claims in foreign currencies, excluding inter-office positions and excluding claims on residents of the home country (Japan).   [3] Including positions unallocated by sector.   [4] Claims on counterparties located in Asia-Pacific and Latin America and the Caribbean, including offshore centres in those regions, as a percentage of consolidated international claims.   [5] Excluding Japan.   [6] Including offshore financial centres.

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

economies fell from a high of 74% in late 2009 to 68% most recently. This was mainly driven by a retreat from the euro area, although Japanese banks' consolidated international claims on this region have been picking up gradually since the second quarter of 2012.

The locational statistics show that Japanese banks funded their cross-border expansion mainly through financing raised in Japan. While their cross-border claims increased to $4 trillion in the first quarter of 2013, their cross-border funding was only $2 trillion (Graph A, centre panel). The result is a cross-border funding gap of $2 trillion, which needs to be covered by domestic sources, notably through their large deposit base.⑤ Of the funding that Japanese banks raise from cross-border sources, the largest part is borrowed from non-banks.

The increase in cross-border lending by Japanese banks was accomplished partly through greater use of their global office network. These banks had closed or downsized many of their foreign offices in the wake of the banking crisis of the 1990s and conducted cross-border business increasingly from Japan. In fact, the share of cross-border claims booked in Japan in the total cross-border claims of Japanese banks reached its highest level in 2008, but since then has gradually declined. This development has been mirrored in a marked increase in cross-border claims booked by Japanese banks in their offices in the United States and other advanced economies.

① These figures exclude local claims in local currencies, ie credit extended by banks' affiliates located in the same country as the borrower. If local claims are included, then on the basis of consolidated *foreign* claims the market share of Japanese banks equalled 10% at end-March 2013, compared to 13% for UK banks, 11% for US banks and 9% for German banks.   ② The consolidated statistics are not available on a comparable basis for the 1980s because prior to 1999 they excluded claims on BIS reporting countries.   ③ H Terrell, R Dohner and B Lowrey, "The United States and United Kingdom activities of Japanese banks, 1980–1988", *North American Review of Economics & Finance*, no 1(1), 1990, pp 53–73; A van Rixtel, *Informality and monetary policy in Japan: the political economy of bank performance*, Cambridge University Press, 2002.   ④ R McCauley and R Seth, "Foreign bank credit to US corporations: the implications of offshore loans", *Federal Reserve Bank of New York Quarterly Review*, Spring 1992, pp 52–65; R McCauley and S Yeaple, "How lower Japanese asset prices affect Pacific financial markets", *Federal Reserve Bank of New York Quarterly Review,* Spring 1994, pp 19–33.   ⑤ Purely domestic positions will be captured in future as part of the enhancements to the BIS international banking statistics.

The decline in cross-border interbank liabilities of banks in the euro area showed a diverging pattern of adjustment across countries, in terms of the reduction in specific interbank sources of funding. The BIS locational banking statistics by nationality, which include a more detailed sectoral breakdown of interbank positions for reporting banks, cast further light on this.[3] Spanish, French and German banks reduced cross-border liabilities mainly through inter-office positions, which accounted for 82%, 65% and 60%, respectively, of the total contraction in their liabilities (Graph 2, left-hand panel). In contrast, Italian banks have lowered their cross-border funding since the second quarter of 2010 mainly through lower borrowing from unrelated banks, which accounted for 90% of the total decline in their cross-border liabilities (Graph 2, right-hand panel).

Credit to emerging market economies

The BIS locational banking statistics show that reporting banks' cross-border claims on borrowers in emerging market economies expanded strongly by $267 billion (8.4%) in the first quarter of 2013.[4] Higher lending to borrowers in Brazil, China and Russia accounted for 85% of the growth. The expansion in cross-border credit to

[3]   The BIS locational by nationality statistics provide information on the banking activity of all internationally active banks residing in the reporting country grouped by the nationality of the controlling parent institution. These statistics break down positions versus banks into positions versus related foreign offices (inter-office positions), other (or unrelated) banks and official monetary institutions. For more details, see *Guidelines to the international locational banking statistics*.

[4]   The BIS locational banking statistics by residence are described in footnote 2.

Changes in gross liabilities, by banking system and counterparty sector[1]

In billions of US dollars   Graph 2

Inter-office liabilities   Liabilities to unrelated banks

Spanish banks   French banks   Spanish banks   French banks
Italian banks   German banks   Italian banks   German banks
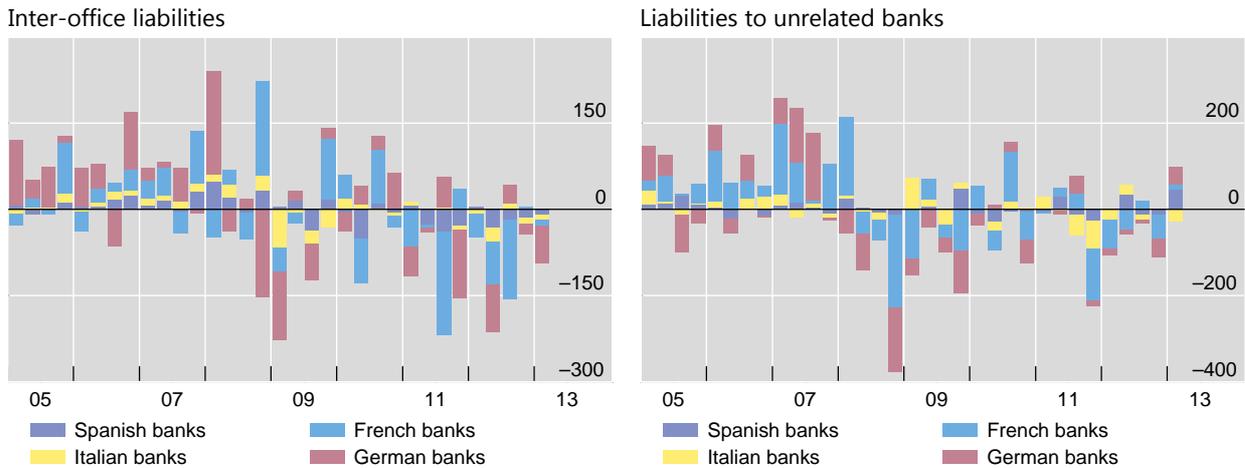
[1] Exchange rate and break-adjusted changes.

Source: BIS locational banking statistics by nationality.

emerging market economies was by far the largest quarterly increase on record, mainly reflecting buoyant interbank lending (up $199 billion or 12%). Cross-border claims on non-banks expanded by $68 billion (4.5%). Around half of the rise in cross-border lending to emerging market economies came from reporting banks in offshore centres. This was mainly driven by banks in Asian offshore centres ($93 billion or 13%), but also by banks in offshore centres in the Caribbean ($35 billion or 21%). The increased lending by banks in these offshore centres was almost fully absorbed by borrowers in China and Brazil. Banks located in the euro area increased their lending to emerging market economies for the first time since the second quarter of 2011. Banks in France, the Netherlands, Germany and Luxembourg accounted for most of this growth.

The sharp increase in cross-border credit to emerging market economies was driven mostly by borrowers in Asia-Pacific. Cross-border claims on borrowers in that region went up by $198 billion or 15% (Graph 3, top left-hand panel), to account for 45% of all cross-border claims on emerging markets at the end of March 2013, from 34% just five years ago. Most of the increase reflected higher claims on banks ($148 billion or 18%), while those on non-bank borrowers expanded by $50 billion (9.5%). With cross-border liabilities of BIS reporting banks to counterparties in Asia-Pacific increasing by only $19 billion, the region recorded a large net inflow of funds ($179 billion), especially to banks ($118 billion). This came at a time of increasing signs that the period of rapid credit growth in key economies in emerging Asia, such as China and India, was ending.

Cross-border credit to borrowers in China increased by $160 billion (31%) and accounted for 81% of the increase in cross-border claims on Asia-Pacific. Lending to banks in China (up $123 billion or 36%) accounted for the larger part of the increase in claims on Chinese residents. The consolidated banking statistics on an immediate borrower basis indicate that international claims on China tend to have shorter

maturities than those on other Asia-Pacific countries.[5] Claims on other large economies in Asia also rose (Chinese Taipei: $13 billion or 15%; Thailand: $7.1 billion or 13%; India: $5.9 billion or 2.7%; South Korea: $4.8 billion or 2.5%).

Cross-border credit to borrowers in Latin America and the Caribbean also increased strongly in the first quarter of 2013, by $44 billion or 7.1% (Graph 3, top right-hand panel). Again, this was driven by higher cross-border claims on banks (up $35 billion or 14%). Lending to Brazil expanded most strongly ($39 billion or 14%), especially to banks ($34 billion or 27%). It was the largest quarterly increase to this country on record, 36% larger than the previous record set in the third quarter of 2010. In contrast, cross-border claims on Argentina declined for the sixth consecutive quarter.

Growth rates of cross-border claims on residents of emerging markets, by region[1]

Quarter-on-quarter changes, in per cent   Graph 3
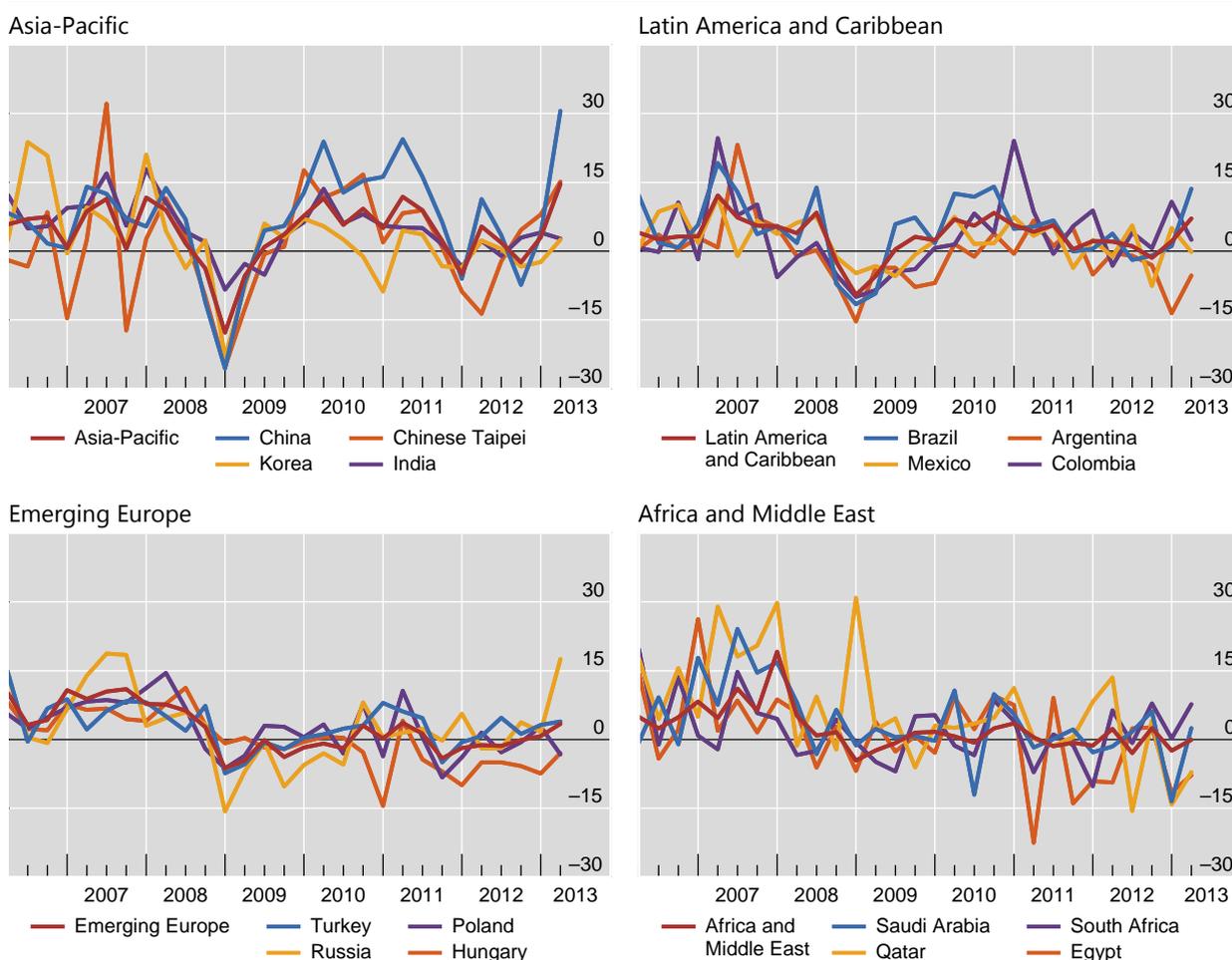
[1] Quarterly growth rates of BIS reporting banks' cross-border claims (including inter-office claims) in all currencies.

Source: BIS locational banking statistics by residence.

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[5] The consolidated banking statistics exclude positions between affiliates of the same banking group. Banks consolidate their inter-office positions and report only their claims on unrelated borrowers. International claims comprise cross-border claims in all currencies and local claims in foreign currencies, where local claims refer to credit extended by banks' affiliates located in the same country as the borrower.

Cross-border claims on the emerging economies of Europe increased in the first quarter of 2013 by $25 billion or 3.4% (Graph 3, bottom left-hand panel). This reflected an increase of $14 billion (3.8%) in lending to banks in the region and of $10 billion (3.0%) to non-banks. The expansion was driven by strong cross-border credit to borrowers in Russia (up $29 billion or 18%), which posted the largest quarterly increase on record. Cross-border claims on Turkey increased by $7.1 billion (3.9%), entirely owing to higher claims on banks. Cross-border claims on the other main economies in the region declined. Those on Hungary fell for the eight quarter in a row, by a cumulative total of $30 billion.

In contrast, cross-border claims on Africa and the Middle East remained broadly unchanged (Graph 3, bottom right-hand panel), as modest increases in lending to banks were largely cancelled out by lower claims on non-banks. Claims on South Africa and Saudi Arabia increased ($2.8 billion or 7.7% and $2.0 billion or 2.5%, respectively), while those on the United Arab Emirates and Qatar declined ($4.3 billion or 4.0% and $4.0 billion or 7.1%, respectively).

Interbank claims on emerging market economies, by region[1]

In billions of US dollars   Graph 4

Asia-Pacific

Latin America and Caribbean

Emerging Europe

Africa and Middle East
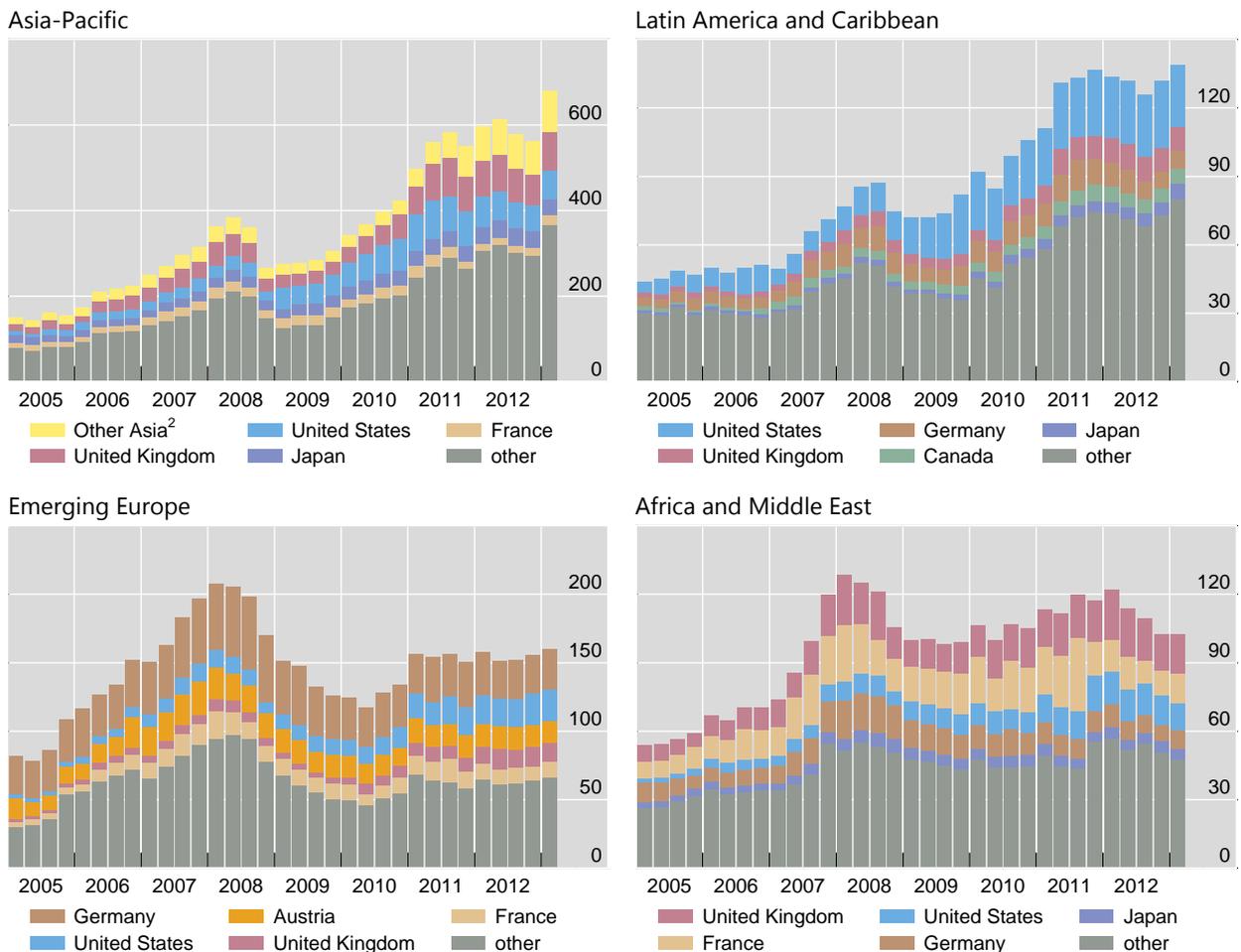
[1] Ranked by the five reporting banking systems with the largest interbank claims on the regions for which data are publicly available.   [2] Chinese Taipei, Hong Kong SAR, India, Korea and Singapore.

Source: BIS consolidated banking statistics (immediate borrower basis).

The strong expansion of interbank market activity towards emerging market economies has doubled the share of these countries in total international interbank lending. On a consolidated basis, claims on borrowers resident in these economies reached 14% of total international interbank lending in the first quarter of 2013, twice the level recorded five years ago. This development was mirrored by a decrease in the share of advanced economies to 81%, while that of offshore centres increased to 4%.

Higher lending to banks in Asia-Pacific was the main driver of the increase in international bank lending to emerging market economies. Almost two thirds of all interbank credit to emerging market economies went to banks in that region, compared with 47% five years earlier. This was mirrored by a significant decline in the share of interbank claims on emerging Europe and a more modest decline in that on developing Africa and the Middle East. UK banks and non-Japanese Asian banks in particular increased interbank lending to Asia-Pacific, to $91 billion and $98 billion, respectively, in the first quarter of 2013 (Graph 4, top left-hand panel).

In Latin America, US banks consolidated their position as largest interbank credit providers (Graph 4, top right-hand panel). German banks remained the largest interbank lenders to emerging Europe, although their market share has fallen since 2008, while US and UK banks increased their lending to banks in that region (Graph 4, bottom left-hand panel). French banks reduced their exposures to banks in Africa and the Middle East from the historical high recorded in 2011, followed by UK and US banks (Graph 4, bottom right-hand panel).

Box 2

Emerging market debt securities issuance in offshore centres

Robert N McCauley, Christian Upper and Agustín Villar

Financial and non-financial corporations from emerging market economies (EMEs) have increasingly turned to offshore financial centres (OFCs) to issue debt securities. At the end of June 2013, 25% of all international debt securities outstanding of EME corporates had been issued in OFCs, compared with 22% in the advanced economies (Graph B, left-hand panel). In the 12 months up to mid-2013, EME corporates raised $95 billion in OFCs, around one quarter of their overall issuance during that period. As a consequence, they have overtaken corporations headquartered in advanced economies ($32 billion) as the largest group of issuers in OFCs (Graph B, right-hand panel).

The surge in OFC issuance by EME corporations is primarily due to borrowers headquartered in just two countries, China and Brazil. Chinese firms' borrowing in OFCs shot up from less than $1 billion per annum in 2001 and 2002 to $51 billion in the 12 months up to mid-2013 (Graph C, left-hand panel). This amounts to approximately 70% of all international debt securities issued by Chinese financial and non-financial corporations. Brazilian firms have a much longer history of borrowing abroad, including in OFCs. After raising between $2 billion and $6 billion per year in OFCs between 2001 and 2005, they borrowed almost $20 billion between July 2012 and June 2013 (Graph C, centre panel). This represents 41% of total international issuance by Brazilian firms.

Issuing international bonds through controlled entities in OFCs allows Chinese and Brazilian firms to reach an investor base that would find it hard to invest locally.[①] Many institutional investors do not have the mandates or the technical capacity to invest in EME domestic bond markets. And even if they do, purchasing bonds issued in OFCs lessens their administrative burden as a more homogeneous regime across investments helps to reduce the hazards of dealing with dozens of tax and legal frameworks. Bonds and other debt securities issued in OFCs are also attractive to some investors for tax-reasons. Many countries apply withholding tax to investors resident in foreign jurisdictions that have an income tax rate lower than 20%. This group includes OFCs, where many funds that invest in emerging markets are registered. Finally, bonds issued by affiliated entities in OFCs may be less likely to be affected by capital controls than domestic securities. That said, this possibility should not be exaggerated: the government can also rule that foreign assets should be repatriated.

On the surface, the picture looks different for China. In contrast to Brazil, Chinese corporations have traditionally financed themselves domestically. At the same time, sustained growth and integration of the Chinese economy increases the demand of international investors for Chinese financial assets. It is therefore often cheaper

International debt securities by EME financial and non-financial corporations

Graph B

By residence of issuing subsidiary[1]
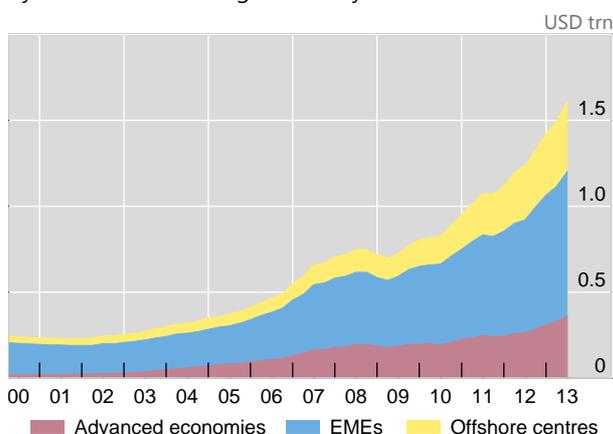
By nationality of issuers resident in off-shore centres[2]
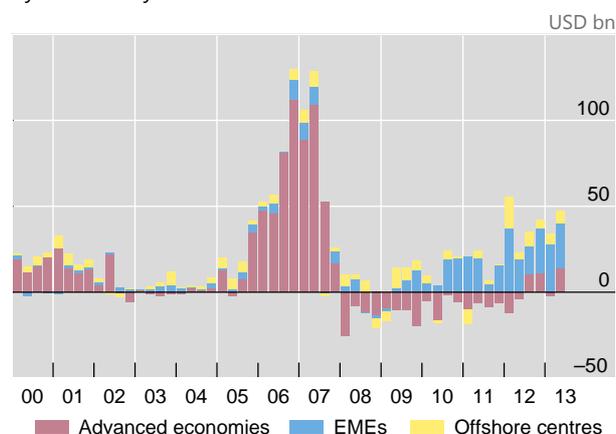
[1] Amounts outstanding. [2] Net issuance.

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

International debt securities[1]

In billions of US dollars

Graph C

Chinese nationals[2]

Brazilian nationals[2]

Chinese nationals[3]
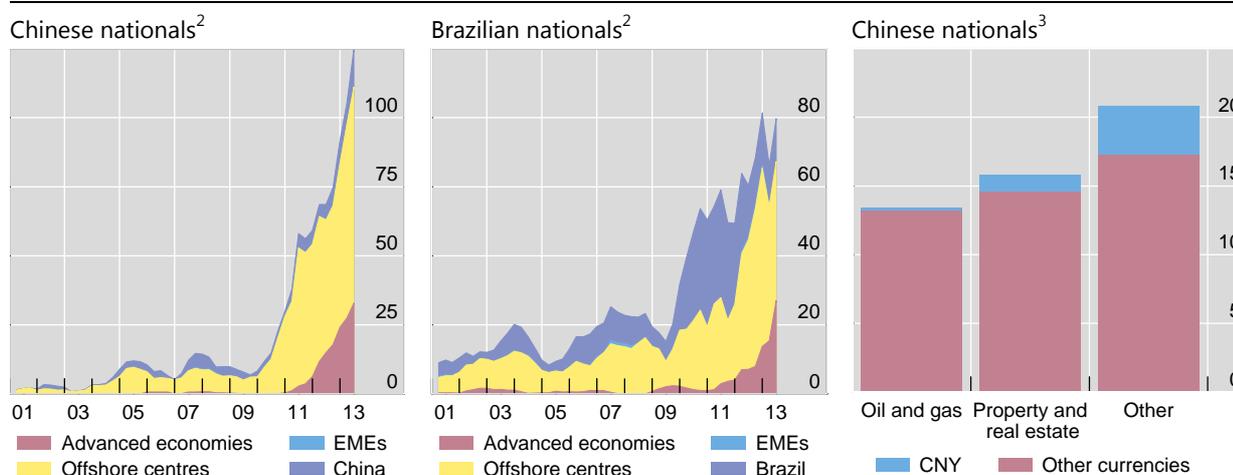
[1] Gross issuance by financial and non-financial corporations headquartered in Brazil or China.   [2] Twelve-month moving cumulative issuance, by residence of issuer.   [3] Cumulative issuance July 2012–June 2013, by activity of ultimate non-financial owner and currency of denomination.

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

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for Chinese nationals to raise funds abroad than domestically. This is particularly obvious for securities denominated in renminbi, where offshore yields tend to be well below those in China.② As a consequence, a significant share of Chinese corporate debt securities issued in OFCs, 16%, is denominated in renminbi.③ That said, the US dollar remains by far the most important currency of issuance for Chinese firms, accounting for 77% of corporate issuance in OFCs. Again, this could reflect differences in the cost of funding. Dollar-denominated rates are below comparable renminbi rates and many players expect an appreciation of the Chinese currency.

What do Chinese corporations do with the dollars raised by issuing debt securities in OFCs? First, around one third of offshore issuance is by Chinese financial institutions that fund dollar lending in China.④ Second, non-financial issuance could reflect the internationalisation of Chinese firms. Chinese corporations have been purchasing assets around the globe recently, and at least part of these purchases appears to have been financed by borrowing abroad. This could explain the relatively high share of firms in the oil and gas sector in Chinese non-financial corporations' offshore issuance (Graph C, right-hand panel). In addition, a good part of the firms in the "Other" sector appear to be manufacturers with overseas operations. That said, the share of firms in the property and real estate sector is even higher than that of those in oil and gas, suggesting that a sizeable part of the dollars raised abroad have found their way into China.

① For further details see S Black and A Munro, "Why issue bonds offshore?", *BIS Papers*, no 52, 2010, pp 97–144.   ② See G Ma and R N McCauley, "Is China or India more financially open?", *Journal of International Money and Finance*, 2013 (forthcoming).   ③ The share of domestic currency issuance by Brazilian corporates in OFCs is well below 1%.   ④ See D He and R N McCauley, "Transmitting global liquidity to East Asia: policy rates, bond yields, currencies and dollar credit", mimeo, 2013.

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How have banks adjusted to higher capital requirements?[1]

Spurred by stronger regulatory requirements, banks have steadily increased their capital ratios since the financial crisis. For a sample of 82 large global banks from advanced and emerging economies, retained earnings accounted for the bulk of the increase in risk-weighted capital ratios over the period 2009–12, with reductions in risk weights playing a lesser role. On average, banks continued to expand their lending, though lending growth was slower among advanced economy banks from Europe. Lower dividend payouts and wider lending spreads contributed to banks' ability to use retained earnings to build capital. Banks that came out of the crisis with higher capital ratios and stronger profitability were able to expand lending more.

JEL classification: E44, G21, G28.

The global financial crisis of 2007–09 highlighted the need for banking systems to be less leveraged, more liquid, more transparent and less prone to take on excessive risk. In the years since the crisis, both the private and public sectors have exerted pressure on banks to build larger buffers of high-quality capital and reduce the riskiness of their portfolios.

This feature documents the broad patterns in banks' approaches to achieving higher risk-weighted capital ratios since the crisis. It is essentially descriptive, and does not examine the reasons behind their different strategy choices. However, it presents the results against the background of concerns raised during the early debates over regulatory reform, such as the fear that, if regulators and markets forced banks to build up capital too rapidly, this would impose considerable short-term macroeconomic costs by inducing banks to pull back from lending to finance investment.[2]

A key finding is that the bulk of the adjustment has taken place through the accumulation of retained earnings, rather than through sharp adjustments in lending or asset growth. In a sample of 82 large global banks, banks from advanced economies increased their assets by 8% from 2009 to 2012, while emerging

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[2]   Some of the analyses of the likely macroeconomic impact of regulatory reform include: Macroeconomic Assessment Group (2010a, 2010b, 2011); BCBS (2010a); IIF (2011); Slovik and Cournède (2011); Elliott et al (2012); Miles et al (2013); and Oxford Economics (2013).

economy banks increased assets by 47%. However, European banks increased their lending more slowly than banks based in other regions. Among the advanced economy banks, a reduction in risk-weighted assets relative to total assets also played a role, albeit a secondary one. More profitable banks expanded assets and lending faster than others. There is some evidence for the importance of starting points – banks that came out of the crisis with relatively low levels of capital were more likely to pursue adjustment strategies involving slow asset growth.

The next section reviews the different strategies that banks can use to increase their capital ratios and the differing macroeconomic implications of these strategies if pursued on a large scale.[3] We then look at broad evidence on whether, and in what ways, some of these potential macroeconomic impacts materialised. The following sections look more closely at the adjustment paths taken by the banks in the sample. Changes in capital ratios are decomposed into factors reflecting changes in capital and changes in assets, and then each of these is studied in more detail. A concluding section recaps the main findings.

Channels of adjustment

A bank that seeks to increase its risk-adjusted capital ratio has a number of options at its disposal.

One set of strategies targets the bank's *retained earnings*. The bank could seek to reduce the share of its profit it pays out in dividends. Alternatively, it may try to boost profits themselves. The most direct way to do so would be by increasing the spread between the interest rates it charges for loans and those it pays on its funding. While competitive pressures may limit how much an individual bank can widen these spreads, lending spreads could rise across the system if all banks followed a similar strategy and alternative funding channels (such as capital markets) did not offer more attractive rates. Other ways to increase net income include increasing profit margins on other business lines, such as custody or advisory services, and reducing overall operating expenses.

A second strategy is to *issue new equity,* such as through a rights issue to existing shareholders, an equity offering on the open market or placing a bloc of shares with an outside investor. This is likely to be the least attractive option, however, given that a new share issue tends to reduce the market value of the existing shares.[4]

A third set of adjustment strategies involves changes to the *assets* side of the bank's balance sheet. The bank can run down its loan portfolio, or sell assets outright, and use the proceeds of loan repayments or asset sales to pay down debt. Less drastically, it can slow down lending growth, thereby allowing retained earnings and hence capital to catch up. In some cases, an asset sale can boost

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[3]   Higher capital requirements are only one element of a range of financial regulatory reforms that have been put in place since the crisis. Other key elements include liquidity requirements for banks, central clearing of standardised OTC derivatives and strengthened resolution regimes for financial entities. While some of these reforms may have potentially significant macroeconomic effects, they are not considered here.

[4]   See Myers and Majluf (1984).

capital through an accounting gain, as the assets are revalued relative to their purchase cost.

Finally, a bank can seek to reduce its *risk-weighted assets* by replacing riskier (higher-weighted) loans with safer ones, or with government securities.[5]

Banks' choices from among these various strategies will determine the macroeconomic impact of an increase in regulatory capital ratios. For example, if banks seek to slow lending, or reduce lending to riskier projects, this could constrain investment (and possibly consumption). Evidence that a slowdown in bank lending growth results from reduced bank loan supply, as opposed to reduced demand for loans from borrowers, would emerge in the form of tighter bank lending standards. A widening of bank lending spreads could also reduce investment on the margin, especially if it feeds into lending rates available in capital markets or through non-bank lenders. By contrast, if banks reduce dividend payouts or issue new shares, this may reduce the returns received by existing bank shareholders, but would have little or no impact on the broader macroeconomy.

It should be emphasised that neither a reduction in outstanding bank loans nor a slowdown in the growth of bank lending would necessarily be bad for the macroeconomy in the longer term. This is especially the case in the aftermath of a crisis that followed an unsustainable debt boom and left debt overhangs in its wake, as is the case at present. In the near term, as a precondition for a sustained recovery, non-performing and underperforming legacy assets are being written off and overleveraged borrowers are paying down their debts. The process of adjustment to a less leveraged economy has necessarily involved an extensive period of balance sheet clean-up and a shortfall of aggregate demand, a process that is by no means complete.[6] To support growth over the longer term, financial and non-financial actors will need to adapt to conditions of lower economy-wide leverage, in which only durably profitable projects are funded and unsustainable booms are avoided.

Bank capital, lending and growth in the aggregate

A series of Quantitative Impact Studies (QIS) conducted by the Basel Committee on Banking Supervision offer evidence of a significant aggregate rise in banks' capital ratios in recent years. The studies estimate average capital adequacy ratios for a global sample of banks according to the definitions that are scheduled to come into force in the Basel III framework.[7] Weighted average capital ratios for large, internationally active banks rose from 5.7% at the end of 2009 to 8.5% at end-June

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[5]   Given the wide range of outcomes that can emerge from commonly used risk models, a bank that uses internal models to derive its risk weights may have scope to "optimise" supervisory risk-weighted assets through modelling choices without making significant changes in its portfolio. See BCBS (2013c, 2013d).

[6]   Takáts and Upper (2013) find that declining bank credit to the private sector does not necessarily constrain growth in the aftermath of a financial crisis, in cases where such a crisis followed a rapid increase in debt. Bech et al (2012) find that private sector deleveraging during and after a crisis can even lead to a stronger recovery.

[7]   See BCBS (2010b, 2012a, 2012b, 2013a).

2012.[8] Those for a sample of smaller banks rose from 7.8% to 9.0% over the same period (Graph 1).

Leverage ratios (capital under the fully phased-in Basel III definition divided by total unweighted exposures) increased in parallel, from 2.8% to 3.7% for the first group and from 3.8% to 4.4% for the second. While the 2009 and 2012 figures for risk-weighted capital ratios and leverage ratios are not fully comparable, given differences in the sample, data quality and some of the relevant definitions, the size and direction of the true increase is likely to have been broadly in line with these results.

Many national authorities have also published figures on bank capital adequacy, though these do not always use common definitions for either the numerator (capital) or denominator (assets). They tend to confirm a picture of broadly rising capital ratios in the global banking system. For example, the ratio of capital to total assets for US commercial banks rose from 11.2% in December 2009 to 11.6% in December 2012.[9] The ratio for euro area monetary financial institutions, measured on a consolidated basis, increased from 7.6% to 9.1% over the same period.[10]

While bank capital has risen more or less steadily worldwide, the performance of credit aggregates and GDP has been mixed (Graph 2). In most advanced economies (top panels), a slow and uneven pace of recovery since the crisis has been accompanied by weak or contracting credit aggregates. This is so regardless of whether one looks at overall credit to the economy (top centre panel) or at bank-intermediated credit alone (top right-hand panel).[11] Many emerging economies,

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Common equity risk-weighted capital ratios under Basel III definitions

In per cent   Graph 1

31 Dec 2009   30 Jun 2011   31 Dec 2011   30 Jun 2012

■ Large, internationally active banks   ■ Other banks   — Basel III minimum (including capital conservation buffer)
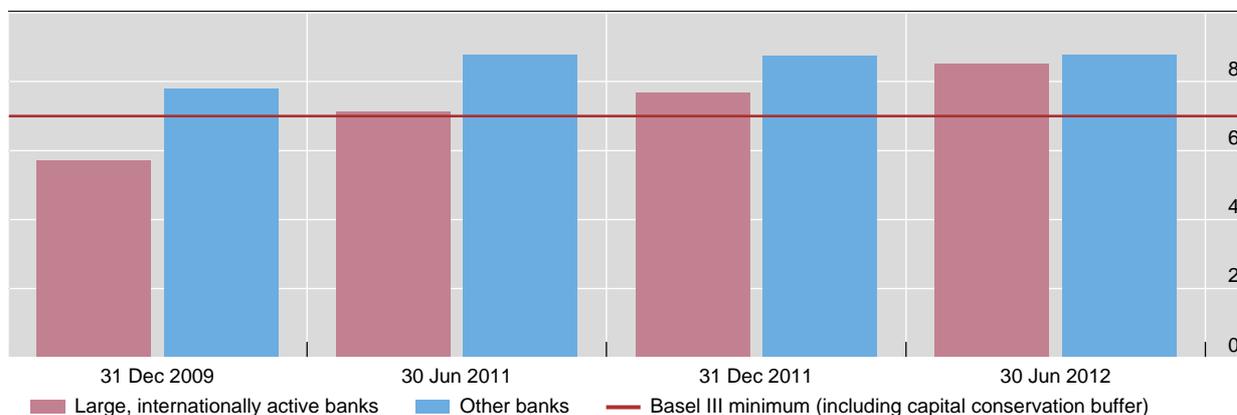
Source: Basel Committee on Banking Supervision.

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[8]   According to BCBS (2013e), the ratios for the group of larger banks rose to approximately 9% at end-2012.

[9]   www.federalreserve.gov/releases/h8/current/default.htm.

[10] www.ecb.europa.eu/stats/money/aggregates/bsheets/html/index.en.html. The US and European ratios are not strictly comparable, given differences in accounting conventions and reporting populations (for example, the European data include money market funds).

[11] The sharp increase in the bank credit figure for the United Kingdom in early 2010 reflects the return of certain formerly securitised assets to bank balance sheets.

GDP growth and lending to the private non-financial sector in selected economies

2009 Q4 = 100   Graph 2

Real GDP

Advanced economies

Total credit[1]

Bank credit[1]

Legend (advanced economies): United States — Euro area — United Kingdom — Japan — France — Germany

Emerging economies

Legend (emerging economies): Brazil — China — Russia — India — Mexico — Korea
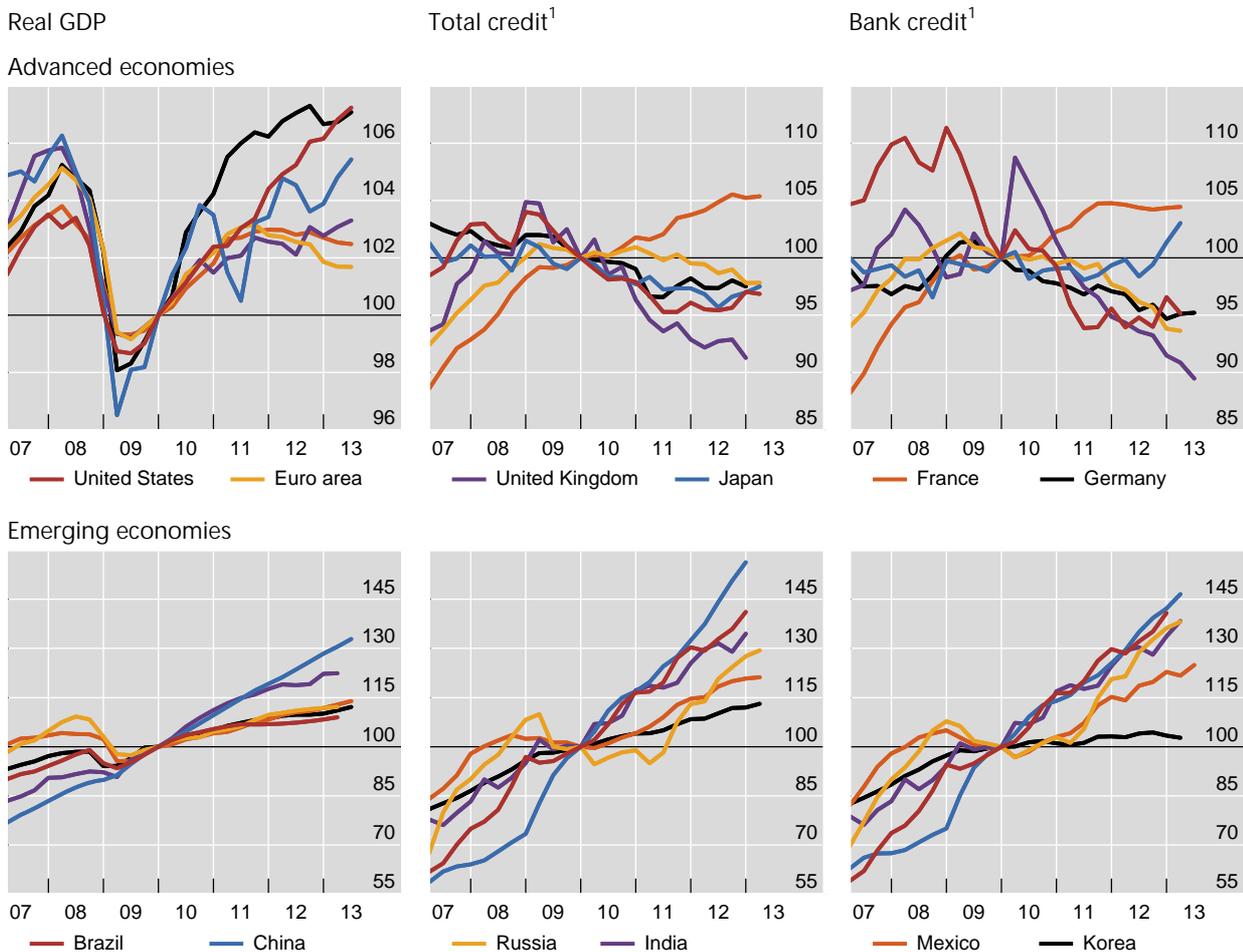
[1] Real, deflated by CPI.

Sources: OECD; Datastream; national data.

meanwhile, have enjoyed rapid GDP growth, often accompanied by even more rapid expansion of credit (bottom panels).

Graph 2 illustrates how GDP growth and aggregate credit growth have not always tracked one another since the crisis, especially in the advanced economies. This reflects the fact that many firms and households have been reducing their debt, even as new lending supports investment and consumption elsewhere in the economy. A key question is thus to what extent slow lending growth reflects post-crisis macroeconomic challenges that have constrained loan demand, especially sectoral debt overhangs and the euro area sovereign crisis, and to what extent it reflects tighter loan supply by banks.

Decomposing changes in the risk-weighted capital ratio

A closer look at bank balance sheet adjustments can shed further light on how banks have responded to tighter capital requirements. To understand these adjustments, we can decompose the change in risk-weighted capital requirements as follows:

$$\frac{K_1/RWA_1}{K_0/RWA_0}=\frac{\left(1+\frac{Inc_1}{K_0}-\frac{Div_1}{K_0}+\frac{Oth_1}{K_0}\right)}{\left(\frac{RWA_1/TA_1}{RWA_0/TA_0}\right)\left(\frac{TA_1}{TA_0}\right)} \tag{1}$$

where K_i is capital, RWA_i is risk-weighted assets and TA_i is total assets, at time i; while Inc_1 is net income, Div_1, is dividends and Oth_1 is other changes to capital (calculated as a residual) between time 0 and time 1. This decomposition allows us to isolate the three factors that influence a risk-weighted capital ratio: changes to capital, changes to the ratio of risk-weighted assets to total assets, and changes to total assets.

To analyse these factors, we drew data from the Bankscope database for a set of 82 banks. The sample was chosen so as to include as many significant institutions from the main global financial centres as possible, as well as banks from smaller centres and emerging economies. In some cases, these data were supplemented with financial statement figures reported by Bloomberg. Banks were included if they reported several years of reliable data in the relevant categories.

The sample thus covers banks from a wide range of advanced and emerging economies, though emerging regions outside Asia are under-represented.[12] It includes all but two of the 28 institutions identified by the Financial Stability Board as globally systemically important banks (G-SIBs) based on the methodology developed by the Basel Committee on Banking Supervision.[13] It covers 55% of the assets of all institutions in the Bankscope database, and 60% of the assets of the top 1,000 global banks as listed by *The Banker*.

In terms of weighted averages, using end-2012 total assets as weights,[14] the banks in our sample increased their risk-weighted common equity capital ratio from 11.6% at end-2009 to 14.2% at end-2012. Risk-weighted assets in the Bankscope database are measured using Basel II definitions. Since risk weights for many asset classes are higher under Basel III than Basel II, it is not surprising that these ratios are appreciably (5–6 percentage points) higher than those calculated by the Basel Committee in the QIS, which use Basel III weights. Despite this higher overall level, the increase in capital ratios from end-2009 to end-2012, which equals 2.7 percentage points after rounding, is in line with the QIS finding of an increase of 2.8 percentage points from end-2009 to June 2012.

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[12]   The dataset includes banks from 23 jurisdictions. The home economies classified as advanced are Australia, Austria, Belgium, Canada, France, Germany, Ireland, Italy, Japan, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States, The home economies classified as emerging are Brazil, China, Chinese Taipei, India, Korea, Malaysia, Russia and Thailand.

[13]   See FSB (2012) and BCBS (2013b). The two excluded G-SIBs are Banque Populaire of France and ING Groep of the Netherlands, for which we could not obtain a sufficient time series of risk-weighted asset data.

[14]   Unless otherwise stated, the figures in the text, graphs and tables in the remainder of the feature are weighted averages with end-2012 assets as weights.

The increase in reported risk-weighted capital ratios in the Bankscope data largely resulted from higher capital rather than lower risk weights or smaller assets. Common equity capital (the numerator of the right-hand side of equation (1)) increased by 34%, while risk-weighted assets (the denominator) rose by 5%. The overall increase in risk-weighted assets in turn resulted from an 8% decrease in the ratio of risk-weighted to total assets and a 14% increase in the level of total assets.

In order to better understand the impact of different factors, it is helpful to transform equation (1) so that the different quantities can be expressed as additive components of the percentage point change in the risk-weighted capital ratio. To do this we can take logarithms of both sides of equation (1) and then multiply both sides by a common factor. The resulting decomposition is as follows:

$$\frac{K_1}{RWA_1} - \frac{K_0}{RWA_0} = F \ln\left(1 + \frac{Inc_1}{K_0} - \frac{Div_1}{K_0} + \frac{Oth_1}{K_0}\right) - F\left(\ln\left(\frac{RWA_1}{TA_1}\right) - \ln\left(\frac{RWA_0}{TA_0}\right)\right) - F\ln\left(\frac{TA_1}{TA_0}\right) \quad (2)$$

where F, the normalisation factor, equals $(K_1/RWA_1 - K_0/RWA_0)/(\ln(K_1/RWA_1) - \ln(K_0/RWA_0))$.

Calculating the elements of equation (2) confirms that increases in capital drove increases in the overall ratio, both for the full sample and for most subsamples (Graph 3).[15] For the advanced economy banks, roughly three quarters of the overall increase of 3.0 percentage points reflected higher capital, while the rest resulted from a decline in risk-weighted assets. Total assets rose, subtracting the equivalent of 0.7 percentage points from the ratio, but this was counteracted by a significant fall in the ratio of risk-weighted to total assets, which added 1.4 percentage points.

Emerging economy banks, by contrast, increased both capital and total assets substantially. Their overall risk-weighted capital ratio increase of 1.1 percentage points reflects the fact that higher capital, which added 5.8 percentage points to the

Sources of changes in bank capital ratios, end-2009–end-2012

Normalised to percentage points of end-2009 risk-weighted assets   Graph 3

- ◆ Change in risk-weighted capital ratio
- ■ Change in total assets
- ■ Change in capital
- ■ Change in ratio of risk-weighted to total assets
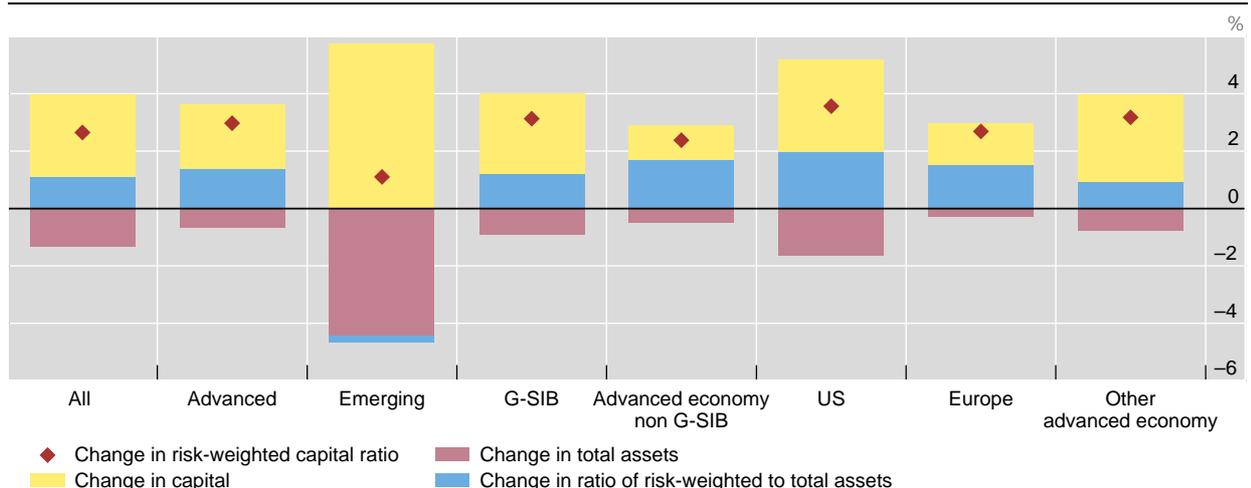
The graph shows the change in the ratios of common equity to risk-weighted assets at the (fiscal) year-end of 2009 and 2012, in percentage points. The overall change is shown by the red diamonds. The components of this change are the terms on the right-hand side of equation (2) in the text. All figures are weighted averages, using end-2012 assets as weights.

Sources: Bankscope; Bloomberg; BIS calculations.

[15] Detailed figures are available in a data appendix on the BIS website: www.bis.org/publ/qtrpdf/r_qt1309e_appendix.

risk-weighted capital ratio, outpaced the increase in risk-weighted assets, which subtracted 4.7 percentage points. Unlike the advanced economy banks, the increase in the risk-weighted assets of emerging economy banks actually outpaced their increase in total (unweighted) assets – in other words, their average level of risk weights increased.

The G-SIBs[16] increased their capital, assets and overall risk-weighted capital ratios by more than did the non-G-SIB advanced economy banks in the sample. The G-SIBs' common equity capital ratios increased by 3.1 percentage points. Most of this resulted from higher capital, which contributed 2.8 percentage points to the overall increase in the ratio. The reduction in the ratio of risk-weighted assets to total assets added a further 1.2 percentage points to the G-SIBs' capital ratio – but this was mostly counteracted by an increase in total assets, which reduced the capital ratio by 0.9 percentage points. Non-G-SIB advanced economy banks, by contrast, increased their capital ratios by 2.4 percentage points, of which about half reflected higher capital and half a reduction in risk-weighted assets. An increase in the ratio of risk-weighted to total assets was also an important contributing factor to the higher risk-weighted capital ratios of European banks.

Decomposing changes to capital

For the full sample, and for most subsamples, retained earnings (net income minus dividends) accounted for the bulk of the increase in capital from 2009 to 2012 (Graph 4). Graph 4 breaks down the increase in capital for the firms in the sample according to the three components in the numerator of the expression on the right-hand side of equation (1): net income,[17] dividends and other changes to

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Sources of increases in bank capital, end-2009–end-2012

Normalised to percentage points of end-2009 risk-weighted assets   Graph 4
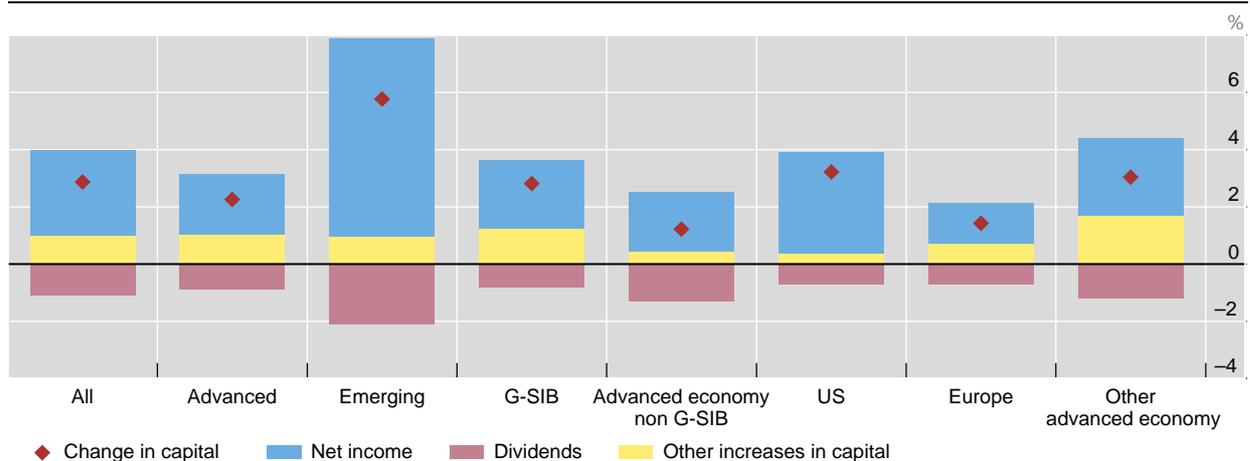
Sources: Bankscope; Bloomberg; BIS calculations.

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[16]   All of the G-SIBs but one (Bank of China) are based in advanced economies.

[17]   Net income is defined as earnings after taxes and before other changes, such as revaluation of available-for-sale securities, that do not flow through the income statement.

capital, using the transformation described in the previous section. This last term is calculated as a residual, based on reported data on common equity, net income and dividends. It comprises share issues and items that are not included in net income, such as gains and losses on fixed assets and available-for-sale securities. For the full sample of banks, retained earnings accounted for 1.9 out of the 2.9 percentage point increase in capital, while capital from other sources accounted for 1 percentage point.

For the G-SIBs, as well as for the advanced economy banks as a group, retained earnings were more than half of the overall increase in capital, accounting for 1.6 percentage points of the overall capital increase of 2.8 percentage points. Capital generated from other sources provided the rest, and was roughly equal to dividends paid. Retained earnings were more important for non-G-SIBs in the advanced economies than for G-SIBs, contributing 0.8 percentage points to an overall capital increase of 1.2 percentage points.

For banks in emerging economies, retained earnings were still more significant, contributing more than 80% to the overall increase in capital – 4.8 out of the total 5.7 percentage points. Dividend payouts were roughly twice other increases in capital for these banks (2.1 percentage points versus 0.9 percentage points). A very rapid accumulation of net income (corresponding to almost 7 percentage points in capital ratio terms) allowed these banks to increase their common equity quite substantially despite their relatively high dividend payouts.

The ability of banks to increase their capital by accumulating retained earnings did not result from especially strong improvements in profitability. Net income as a share of assets fell from 0.71% in the three years before the crisis to 0.52% in the 2010–12 period across the banks in the sample (Table 1). This ratio fell even more sharply for advanced economy banks – from 0.67% to 0.37% – but it rose for emerging economy banks, from around 1% to 1.23%. The fall in the return on assets

Changes in components of bank income

As a percentage of total assets   Table 1

	2005–07				2010–12			
	Net income	Net interest income	Operating expenses	Other income	Net income	Net interest income	Operating expenses	Other income
	a	b	c	d	a	b	c	d
All	0.71	1.34	1.61	0.98	0.52	1.62	1.64	0.54
Advanced	0.67	1.19	1.60	1.09	0.37	1.41	1.68	0.65
Emerging	1.02	2.91	1.71	–0.18	1.23	2.64	1.46	0.05
G-SIB	0.65	1.13	1.59	1.11	0.38	1.35	1.69	0.72
Non-G-SIB	0.76	1.41	1.61	0.96	0.42	1.62	1.60	0.40
United States	1.07	1.88	2.81	2.00	0.69	2.22	3.15	1.62
Europe	0.58	1.01	1.35	0.92	0.22	1.23	1.38	0.35
Other advanced	0.67	1.28	1.41	0.80	0.56	1.29	1.24	0.51

The figures in the table are weighted averages (using end-period assets as weights) for the ratios of different components of income to total assets, for the banks in the sample. They are related to one another as follows: a = b – c + d.

Sources: Bankscope, Bloomberg; BIS calculations.

primarily reflected a decline in "other income", which is calculated as a residual based on net income, net interest income and operating expenses.

One of the predictions about the impact of the transition to higher bank capital ratios – that it would lead to wider lending spreads – appears to be confirmed, though the widening was rather mild. Net interest income rose from 1.34% of assets to 1.62% for the full sample. This 28-basis point increase in the spread between banks' gross interest earnings and their funding costs works out to 11 basis points per percentage point of increase in the capital ratio – which is towards the bottom of the range of estimates for the likely increase in lending spreads produced by a number of studies before the crisis.[18]

Two other predictions – that banks would increase their income from non-interest sources and that they would reduce their operating expenses – do not seem to be supported. Operating expenses as a share of total assets were roughly unchanged. Income from sources besides net interest income fell for advanced economy banks, though it rose (from a net loss to a small profit) for banks in the emerging economies.

While overall profitability fell, increased earnings retention enabled banks to devote a greater share of income to accumulating capital (Table 2, first and third columns). Dividends fell from almost 40% of income before the crisis for banks in the sample to 27%. This decline entirely reflected a reduction in dividend payouts

Dividend payouts and returns on equity

In per cent   Table 2

	2005–07		2010–12	
	Div payout ratio	Return on equity	Div payout ratio	Return on equity
All	39.6	20.7	27.0	8.1
Advanced	41.3	21.2	26.3	5.7
Emerging	27.0	15.9	30.1	18.8
G-SIB	40.1	22.8	21.1	7.0
Advanced non-G-SIB	45.8	16.6	41.0	3.7
United States	58.2	15.9	20.1	7.6
Europe	36.7	22.6	21.7	3.9
Other advanced	31.0	21.5	43.8	9.5

Dividend payout ratio is dividends divided by net income. Return on equity is net income divided by common equity. Both are weighted averages across the corresponding group of banks, using end-period assets as weights.

Sources: Bankscope; Bloomberg; BIS calculations.

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[18] For example, the Macroeconomic Assessment Group (2010a) estimated that every percentage point of increased bank capital ratios would lead to a 15–17 basis point (bp) widening of lending spreads. IIF (2011) forecast a 30–80 basis point widening of spreads per additional percentage point of capital – while also estimating that banks would need to raise capital ratios by up to 5 percentage points. Elliott et al (2012), looking at the combined impact of higher capital and other regulatory reforms along with likely bank adjustment strategies, estimated that spreads would widen by 18 basis points in Europe, 8 basis points in Japan and 28 basis points in the United States. Miles et al (2013) find that every percentage point increase in the capital ratio from its 2009 level leads to around a 10 basis point increase in the lending rate. Oxford Economics (2013) estimates that a 1 percentage point rise in the common equity Tier 1 capital ratio for US banks would raise lending rates by 15 basis points.

by advanced economy banks, while the payout ratio rose slightly for emerging economy banks.

Falling profitability and rising capital have led to a decline in returns on equity. The ratio of net income to book equity fell sharply for the full sample, from almost 21% to around 8%, again reflecting a decline among the advanced economy banks (Table 3, second and fourth columns). Investors, not surprisingly, have not accepted lower returns on bank equity with equanimity; price-to-book ratios for many banks have been at or below 1 since the crisis, reflecting scepticism about earnings prospects as well as asset quality. However, a broad decline in returns on bank equity is to be expected as part of a shift to a less leveraged, better capitalised banking system.

Assets and lending

As already noted, the banks in our sample tended to see their assets grow during the period under consideration. They achieved increases in capital ratios by effecting greater increases in equity capital and, at least in the advanced economies, reducing their ratio of risk-weighted to total assets.

From 2009 to 2012, bank assets grew by 14.6%, based on a weighted average, across the sample (Table 3). Assets of emerging economy banks grew by 47.1%, much faster than advanced economy bank assets (7.6%). G-SIBs increased their assets slightly faster (9.5%) than did non-G-SIB advanced economy banks (7.3%), though the increase in gross lending by both of these groups was about the same.

Lending growth, whether calculated before (gross loans) or after (net loans) reserves for impaired and non-performing loans, largely tracked asset growth for most subsamples. For the US banks in the sample, assets grew by 12% while lending grew by 33%. However, for European banks, lending growth lagged far behind asset growth. Instead, these banks appear to have accumulated large amounts of "other assets", including cash and government securities.

Growth in categories of bank assets, 2009–12

In per cent   Table 3

	Assets	Gross loans	Net loans	Trading securities	Other assets
All	14.6	16.1	16.7	42.9	24.8
Advanced	7.6	9.1	9.4	−6.5	20.5
Emerging	47.1	48.7	49.2	283.2	44.8
G-SIB	9.5	10.0	11.6	−5.4	23.5
Advanced non-G-SIB	7.3	10.2	7.5	−6.8	16.4
United States	12.4	33.0	34.7	45.8	10.3
Europe	5.6	0.6	2.4	−27.5	25.9
Other advanced	12.4	14.9	11.1	4.0	18.1

The figures in the table are weighted averages of the percentage growth from end-2009 to end-2012 in the categories shown, using end-2012 assets as weights. Net loans are gross loans minus reserves against possible losses on impaired or non-performing loans.

Sources: Bankscope; Bloomberg; BIS calculations.

It should be emphasised that the figures in Table 3 break down asset growth by the nationality of the bank, not that of the borrower. While the Bankscope data do not separate foreign from domestic assets, the pullback in lending by European banks does not necessarily correspond to a reduction in credit provided to the banks' domestic economies. As documented by BIS (2012), European banks have moved to reduce their cross-border assets more readily than domestic assets in recent years.[19]

Some analysts have predicted that regulatory reforms and the experience of the crisis would induce banks to pull back from trading activities. Banks will need to hold more capital against securities inventories and derivatives positions, and some will be subject to structural regulatory initiatives such as the "Volcker rule" in the United States that place restrictions on trading. Advanced economy banks did reduce their stock of trading securities, by 6.5% from 2009 to 2012 (Table 3, fourth column). Emerging economy banks, by contrast, increased trading securities dramatically, almost tripling their holdings over this time, albeit from a relatively low base. Despite this rapid growth, at end-2012 trading securities accounted for only 3% of emerging economy bank assets, compared with 8% for advanced economy banks.

A closer look at adjustment strategies

A crucial question is the degree to which differences in growth rates of bank assets, and other adjustment measures undertaken by banks, reflect transitions to higher capital ratios as opposed to other factors such as macroeconomic conditions in the home economy. Table 4 presents the outcomes of regressions of different bank asset aggregates on increases in capital and other factors. The models are of the form:

$$Adj_i = (\beta_1 + \beta_2 Europe_i + \beta_3 Emerging_i) * \left(\frac{K_{i,0}}{RWA_{i,0}}\right)$$

$$+ (\beta_4 + \beta_5 Europe_i + \beta_6 Emerging_i) * \Delta\left(\frac{K_i}{RWA_i}\right)$$

$$+ (\beta_7 + \beta_8 Europe_i + \beta_9 Emerging_i) * \left(\frac{Net\ Inc_i}{Assets_i}\right) + \overrightarrow{Geog_i} \cdot \beta_{10\ldots13} + \varepsilon_i \qquad (3)$$

where i indexes banks, Adj_i is a variable measuring some aspect of banks' adjustment strategies, $Europe_i$ is a dummy variable set equal to one if a bank is based in an advanced European economy, $Emerging_i$ equals one if a bank is based in an emerging economy, and $Geog_i$ is the full vector of dummy variables where the bank's home country or region is equal to one.[20] Changes are measured from end-2009 to end-2012, while the net income-to-assets ratio is an average for the years 2010, 2011 and 2012. The interaction terms allow us to test the factors affecting the adjustment strategies of two sets of banks that stood out in the previous discussion, namely banks based in Europe and banks based in emerging economies. For the dependent variable, the four columns of Table 4 look at growth

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[19]   Avdjiev et al (2012) document how euro area banks reduced cross-border lending to emerging economies more than did banks based in other regions after the crisis.

[20]   Along with *Europe* and *Emerging,* dummies are included for the United States and for the other advanced economies.

in assets, gross loans, risk-weighted assets and the bank's stock of trading securities.

Banks which had strong risk-weighted capital ratios at end-2009 and high profitability in 2010–12 tended to increase their assets more than their peers (Table 4, first column). Specifically, a bank which had a 1 percentage point higher capital ratio at end-2009 was likely to have a 3 percentage-point higher rate of asset growth over the subsequent three years. A bank which had a half percentage point higher return on its assets in 2010–12, which is about one standard deviation for this sample of banks, tended to have a 12 percentage point higher rate of asset growth during this time. Once these effects are accounted for, the increase in the capital ratio does not have a statistically significant impact on asset growth. A similar relationship holds between the starting capital ratio, profitability and gross lending, though in this case the significance levels are weak (Table 4, second

Capital ratios, profitability and adjustment strategies   Table 4

Dependent variable	Growth in assets	Growth in gross loans	Growth in risk-weighted assets	Growth in trading securities
	1	2	3	4
Capital ratio End-2009	2.93**	2.17	0.41	45.96**
	(5.31)	(1.00)	(0.52)	(3.52)
Capital ratio* Europe	–3.14**	–2.45	–0.42	–43.00**
	(–3.12)	(–1.01)	(–0.39)	(–3.26)
Capital ratio* Emerging	–6.60**	–5.80*	–3.17	26.48
	(–3.43)	(–1.84)	(–1.41)	(0.35)
Change in capital ratio 2009–12	0.12	0.35	–0.30	4.58**
	(0.95)	(0.54)	(–1.35)	(3.09)
Change in capital ratio* Europe	–0.28*	–0.51	0.05	–4.47**
	(–1.81)	(–0.77)	(0.22)	(–2.96)
Change in capital ratio* Emerging	0.56**	0.57	0.84**	5.74
	(2.94)	(0.86)	(2.58)	(0.53)
Net income/assets 2010–12	24.54**	11.76	14.88	89.81
	(3.30)	(0.39)	(0.96)	(1.61)
Net income/assets* Europe	–5.29	11.56	13.02	–64.12
	(–0.58)	(0.37)	(0.80)	(–1.12)
Net income/assets* Emerging	33.73**	45.28	56.67**	24.22
	(3.17)	(1.47)	(3.40)	(0.11)
R^2	0.67	0.17	0.73	0.25
Number of observations	81	80	81	74

The table shows the coefficients from OLS regressions of the stated dependent variable on the independent variables and dummies for the United States, Europe, other advanced economies and emerging economies. Coefficients on the geographical dummies are not shown. T-statistics are in parentheses, based on White (heteroskedasticity-robust) standard errors. Assets, risk-weighted assets, gross loans and trading securities are measured from end-2009 to end-2012. "Europe" refers to European advanced economies. Risk-weighted assets use Basel-II risk weights. Gross loans are loans before provisions for impairments and non-performing loans. * and ** = significantly different from 0 at a 90% and 95% confidence level, respectively.

Sources: Bankscope; Bloomberg; BIS calculations.

column).[21] Put another way, the effects of starting conditions on bank asset growth hold *regardless* of how quickly the bank moved to increase its capital ratio.[22]

These effects varied in important ways for European and emerging economy banks. The coefficients on the interaction terms suggest that neither the starting capital ratio nor the increase in the capital ratio had an impact on how quickly European banks expanded assets and lending. The tendency for profitable banks to increase lending was the same for European as for other banks.

Emerging economy banks with high capital ratios in 2009 seem to have grown more slowly than those with lower ratios. However, emerging economy banks that increased their capital ratios during 2009–12 grew more quickly. And more profitable banks in the emerging world grew even more quickly than did profitable banks in advanced economies.

While banks that raised their risk-weighted capital ratio more sharply between 2009 and 2012 did not reduce their total assets or overall lending, they did tend to cut back on risk-weighted assets, though the effect is not significant (Table 4, third column). For every percentage point by which a bank increased its capital ratio during this period, its risk-weighted assets fell by about three tenths of a percentage point – though this effect went in the opposite direction for the emerging economy banks.

Banks that had high risk-weighted capital ratios in 2009, and those that increased their capital ratios subsequently, were more likely to increase their trading portfolios (Table 4, fourth column). A bank that had a one percentage point higher capital ratio at the end of 2009 was likely to increase its trading portfolio by almost half over the following three years, relative to other banks. Every percentage point increase in the risk-weighted capital added a further 5% of growth to trading assets. These effects were even stronger for banks from emerging economies, but they did not hold for European banks.

Conclusions

The process of adjustment to Basel III is not yet complete. The evidence presented here, however, suggests that most banks have achieved most of the adjustment to date through the accumulation of retained earnings. Banks in advanced economies have reduced dividend payouts as part of this process. Banks in emerging economies have enjoyed high earnings and asset growth, and have had little trouble using some of their strong earnings to increase their capital ratios. An additional, though secondary, role has been played by the shift to assets with lower risk weights by advanced economy banks. Banks in advanced economies have benefited from modestly wider net interest margins. Reductions in operating expenses do not appear to have played much of a role.

Banks in aggregate do not appear to have cut back sharply on asset or lending growth as a consequence of stronger capital standards. However, banks that had high capital ratios at the start of the process or strong profitability in the post-crisis

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[21]   The fall in significance appears to be due mostly to one outlying observation.

[22]   Kapan and Minoiu (2013) find that banks with higher, better-quality capital did not reduce lending during the financial crisis as much as did other banks.

years did tend to grow more than other banks. This points to the importance of solid bank balance sheets in supporting lending.

There has been a pronounced shortfall in lending growth among European banks, though they have accumulated other assets in the form of cash and securities. Some banks, especially in Europe, have cut back their trading portfolios.

Further research is needed to understand the interplay among these different adjustment strategies, and to trace their macroeconomic effects. It will be especially important to look more closely at the relative roles of regulation, macroeconomic factors, sovereign risk concerns and the disposal of legacy assets in the balance sheet adjustments that have been made by European banks.

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CoCos: a primer[1]

Contingent convertible capital instruments (CoCos) are hybrid capital securities that absorb losses when the capital of the issuing bank falls below a certain level. In this article, we go over the structure of CoCos, trace the evolution of their issuance, and examine their pricing in primary and secondary markets. CoCo issuance is primarily driven by their potential to satisfy regulatory capital requirements. The bulk of the demand for CoCos has come from small investors, while institutional investors have been relatively restrained so far. The spreads of CoCos over other subordinated debt greatly depend on their two main design characteristics – the trigger level and the loss absorption mechanism. CoCo spreads are more correlated with the spreads of other subordinated debt than with CDS spreads and equity prices.

JEL classification: G12, G21, G28.

Private investors are usually reluctant to provide additional external capital to banks in times of financial distress. In extremis, the government can end up injecting capital to prevent the disruptive insolvency of a large financial institution because nobody else is willing to do so. Such public sector support costs taxpayers and distorts the incentives of bankers.

Contingent convertible capital instruments (CoCos) offer a way to address this problem. CoCos are hybrid capital securities that absorb losses in accordance with their contractual terms when the capital of the issuing bank falls below a certain level.[2] Then debt is reduced and bank capitalisation gets a boost. Owing to their capacity to absorb losses, CoCos have the potential to satisfy regulatory capital requirements.

In this article, we examine recent developments and trends in the market for CoCos. Our analysis is based on a data set that covers $70 billion worth of CoCos issued between June 2009 and June 2013.[3] Several trends stand out.

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[1] The authors thank Claudio Borio, Stephen Cecchetti, Robert McCauley, Kostas Tsatsaronis and Christian Upper for useful comments and discussions. Emese Kuruc provided excellent research assistance. The views expressed are those of the authors and do not necessarily reflect those of the BIS.

[2] Non-CoCo debt instruments may also absorb losses. However, this could occur only upon the application of a statutory resolution regime at the point of non-viability.

[3] Our sample consists exclusively of CoCos issued by banks (ie it does not include those issued by insurance companies and other non-bank financial institutions). Data are obtained from Bloomberg and Dealogic.

First, the main reasons for issuing CoCos are related to their potential to satisfy regulatory capital requirements. Second, the bulk of the demand has come from private banks and retail investors, while institutional investors have been relatively restrained so far. Third, CoCo yields tend to be higher than those of higher-ranked debt instruments of the same issuer and are highly dependent on their two main design characteristics – the trigger level and the loss absorption mechanism. Finally, CoCo yields tend to be more correlated with those of other subordinated debt than with CDS spreads (on senior unsecured debt) and equity prices.

The rest of this article is organised as follows. In the first section, we describe the structure and design of CoCos. We discuss the reasons for CoCo issuance in the second section. In the third section, we examine the main groups of investors in CoCos. In the fourth and fifth sections, we study the pricing of CoCos in primary and secondary markets, respectively. The final section concludes.

Structure and design of CoCos

The structure of CoCos is shaped by their primary purpose as a readily available source of bank capital in times of crisis. In order to achieve that objective, they need to possess several characteristics. First, CoCos need to automatically absorb losses prior to or at the point of insolvency. Second, the activation of the loss absorption mechanism must be a function of the capitalisation levels of the issuing bank. Finally, their design has to be robust to price manipulation and speculative attacks.[4]

CoCos have two main defining characteristics – the loss absorption mechanism and the trigger that activates that mechanism (Graph 1). CoCos can absorb losses either by converting into common equity or by suffering a principal writedown. The trigger can be either mechanical (ie defined numerically in terms of a specific capital ratio) or discretionary (ie subject to supervisory judgment).

Triggers

One of the most important features in the design of a CoCo is the definition of the trigger (ie the point at which the loss absorption mechanism is activated). A CoCo can have one or more triggers. In case of multiple triggers, the loss absorption mechanism is activated when any trigger is breached.

Triggers can be based on a mechanical rule or supervisors' discretion. In the former case, the loss absorption mechanism is activated when the capital of the CoCo-issuing bank falls below a pre-specified fraction of its risk-weighted assets. The capital measure, in turn, can be based on book values or market values.

Book-value triggers, also known as accounting-value triggers, are typically set contractually in terms of the book value of Common Equity Tier 1 (CET1) capital as a ratio of risk-weighted assets (RWA). The effectiveness of book-value triggers depends crucially on the frequency at which the above ratios are calculated and publicly disclosed, as well as the rigour and consistency of internal risk models,

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[4]   These and other aspects of CoCo design are analysed in Albul et al (2012), Bolton and Samama (2011), Calomiris and Herring (2012), Culp (2009), Flannery (2009), Pennacchi et al (2011) and Sundarsen and Wang (2011), among others.
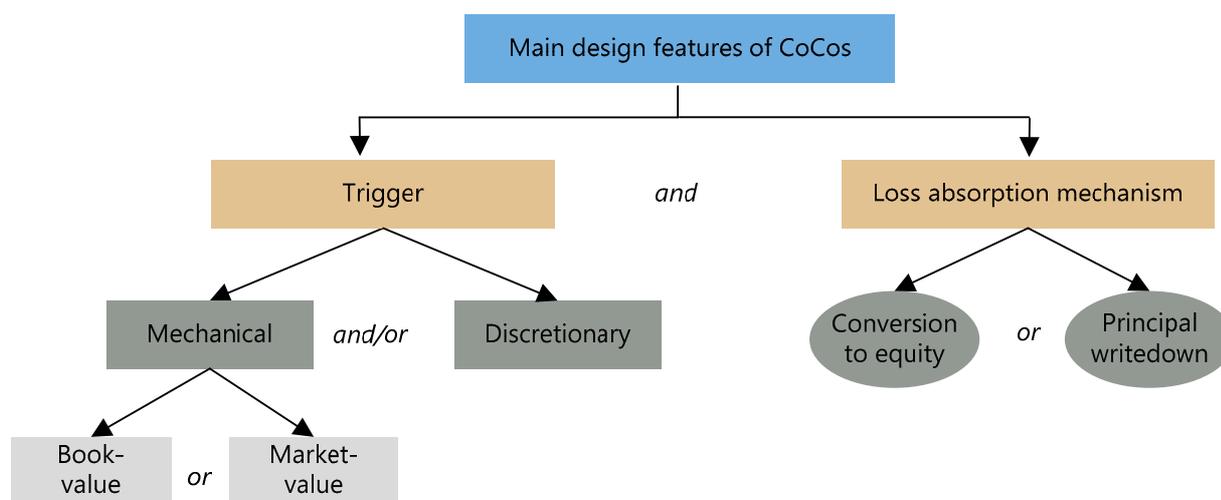
which can vary significantly across banks[5] and time. As a result, book-value triggers may not be activated in a timely fashion.[6]

Market-value triggers could address the shortcoming of inconsistent accounting valuations. These triggers are set at a minimum ratio of the bank's stock market capitalisation to its assets. As a result, they can reduce the scope for balance sheet manipulation and regulatory forbearance.

However, market-value triggers may be difficult to price and could create incentives for stock price manipulation. The pricing of conversion-to-equity CoCos with a market-value trigger could suffer from a multiple equilibria problem.[7] More specifically, since CoCos must be priced jointly with common equity, a dilutive CoCo conversion rate could make it possible for more than one pair of CoCo prices and equity prices to exist for any given combination of bank asset values and non-CoCo debt levels. Furthermore, under certain circumstances, holders of CE CoCos may have an incentive to short-sell the underlying common stock in order to generate a self-fulfilling death spiral and depress the share price to the point at which the market-value trigger is breached.

Finally, discretionary triggers, or point of non-viability (PONV) triggers, are activated based on supervisors' judgment about the issuing bank's solvency prospects. In particular, supervisors can activate the loss absorption mechanism if they believe that such action is necessary to prevent the issuing bank's insolvency. PONV triggers allow regulators to trump any lack of timeliness or unreliability of book-value triggers. However, unless the conditions under which regulators will

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[5]   BCBS (2013).

[6]   For example, had Citibank issued CoCos with even a high book-value trigger before November 2008, the loss absorption mechanism of those instruments would not have been activated prior to the government's injection of capital. Indeed, the bank's accounting regulatory capital ratios remained comfortably above the regulatory requirements even when its stock market capitalisation amounted to merely 1% of its reported risk-weighted assets. See Duffie (2009) for further discussion.

[7]   See Sundaresan and Wang (2011), Pennacchi et al (2011) and Calomiris and Herring (2013).

exercise their power to activate the loss absorption mechanism are made clear, such power could create uncertainty about the timing of the activation.

Loss absorption mechanism

The loss absorption mechanism is the second key characteristic of each CoCo. A CoCo can boost the issuing bank's equity in one of two ways. A conversion-to-equity (CE) CoCo increases CET1 by converting into equity at a pre-defined conversion rate. By contrast, a principal writedown (PWD) CoCo raises equity by incurring a writedown.

For CoCos with a CE loss absorption mechanism, the conversion rate can be based on (i) the market price of the stock at the time the trigger is breached; (ii) a pre-specified price (often the stock price at the time of issuance); or (iii) a combination of (i) and (ii). The first option could lead to substantial dilution of existing equity holders as the stock price is likely to be very low at the time the loss absorption mechanism is activated. But this potential for dilution would also increase the incentives for existing equity holders to avoid a breach of the trigger. By contrast, basing the conversion rate on a pre-specified price would limit the dilution of existing shareholders, but also probably decrease their incentives to avoid the trigger being breached. Finally, setting the conversion rate equal to the stock price at the time of conversion, subject to a pre-specified price floor, preserves the incentives for existing equity holders to avoid a breach of the trigger, while preventing unlimited dilution.

The principal writedown of a PWD CoCo could be either full or partial. Most PWD CoCos have a full writedown feature. However, there are exceptions. For example, in the case of the CoCo bond issued by Rabobank in March 2010, holders of CoCos would lose 75% of the face value and receive the remaining 25% in cash. One criticism of this type of loss absorption mechanism is that the issuer would have to fund a cash payout while in distress.

CoCo issuance

At the moment, the CoCo market is still relatively small, but it is growing. Banks have issued approximately $70 billion worth of CoCos since 2009. By comparison, during the same period they have issued around $550 billion worth of non-CoCo subordinated debt and roughly $4.1 trillion worth of senior unsecured debt. Nevertheless, CoCo issuance volumes have increased in each of the last two years and are on pace to grow once again in 2013.

The regulatory treatment of CoCos against the background of the need to boost capital has been the main driver of the supply of those instruments. Under Basel III, CoCos could qualify as either Additional Tier 1 (AT1) or Tier 2 (T2) capital (Graph 2).[8] The current Basel III framework contains two key contingent capital elements: (i) a PONV trigger requirement, which applies to all AT1 and T2

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[8]   AT1 and T2 are two of the three types of capital that banks can use in order to satisfy regulatory capital requirements under Basel III. See BCBS (2011) for more information.

Tier 2 (T2)

- Non-CoCo subordinated debt
- Low-trigger CoCos

Additional Tier 1 (AT1)

- Preferred shares
- High-trigger CoCos

Core Equity Tier 1 (CET1)

- Common shares
- Retained earnings

CET1
≥ 4.5% RWA

CET1+AT1
≥ 6% RWA

CET1+AT1+T2
≥ 8% RWA
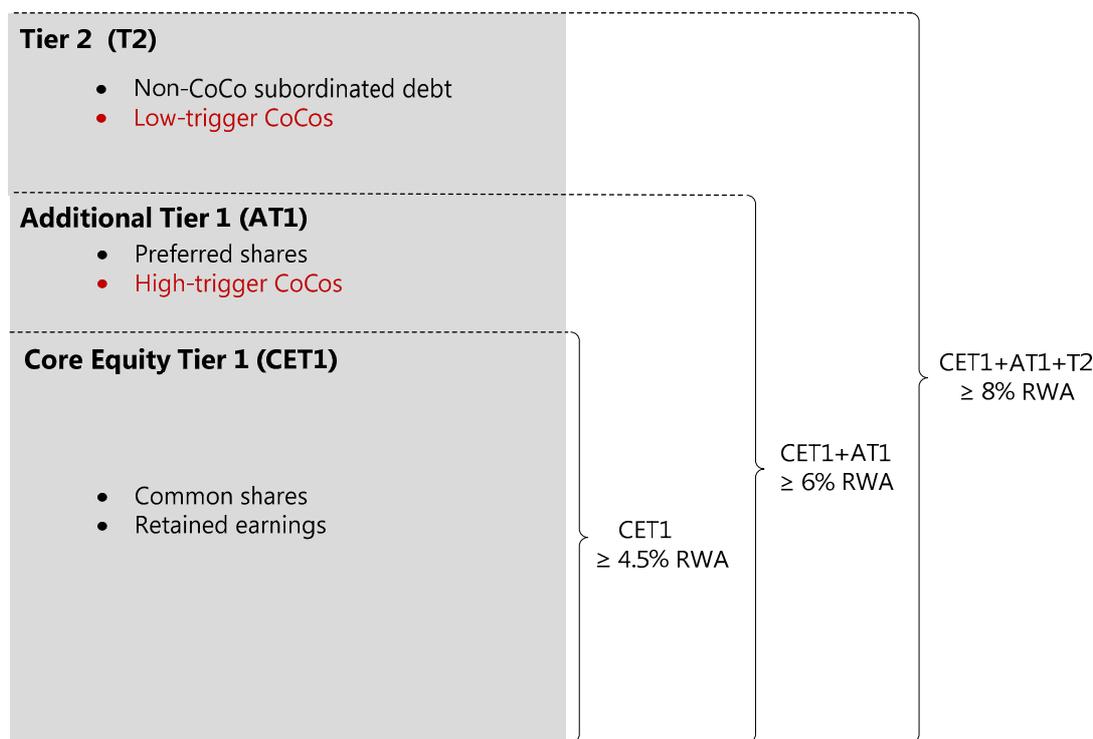
[1] The list of instruments in this graph is not exhaustive and is included solely for illustrative purposes. For a complete list of instruments and associated criteria for inclusion in each of the three capital buckets, see BCBS (2011). The above shares of RWA represent the bare minimum capital requirements and do not account for any add-ons, such as the capital conservation buffer, the countercyclical buffer and the SIFI surcharge.

instruments; and (ii) a going-concern contingent capital requirement, which applies only to AT1 instruments classified as liabilities.[9]

The inclusion of PONV clauses in CoCos is primarily motivated by regulatory capital eligibility considerations. As the adoption of Basel III has progressed across jurisdictions, the share of CoCos that have a PONV trigger has increased substantially over the past couple of years.

The selection of the trigger level is largely determined by the trade-off between regulatory capital eligibility considerations and cost of issuance. CoCos with low triggers have lower loss-absorbing capacity. As a result, they tend to be less expensive to issue, but are usually not eligible to qualify as AT1 capital. Nevertheless, low-trigger CoCos allow banks to boost their T2 capital in a cost-efficient manner.

Over time, as banks felt more pressure from markets and regulators to boost their Tier 1 capital, they started to issue CoCos with trigger levels at or above the preset minimum for satisfying the going-concern contingent capital requirement. As a consequence, the volume of CoCos classified as AT1 capital has increased considerably since the start of 2012 (Graph 3, top left-hand panel).

[9]   Equity AT1 instruments (eg preferred shares) do not need to meet the going-concern contingent capital requirement.

CoCo bond issuance

Graph 3

By regulatory capital classification

USD bn

Additional Tier 1   Tier 2
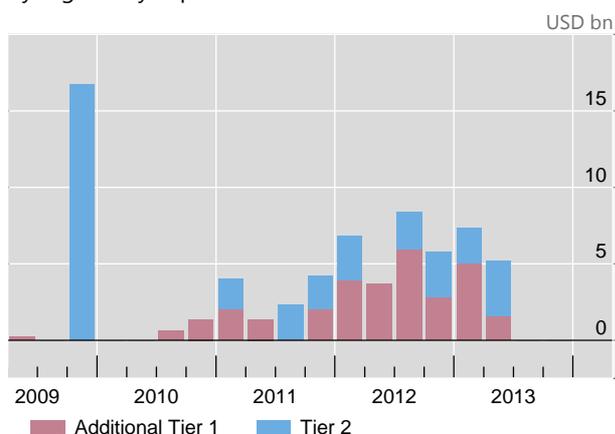
Ratio of CoCos with a 5.125% (CET1/RWA) trigger level[1]

Per cent

By type of loss absorption mechanism

USD bn

Conversion to equity   Principal writedown
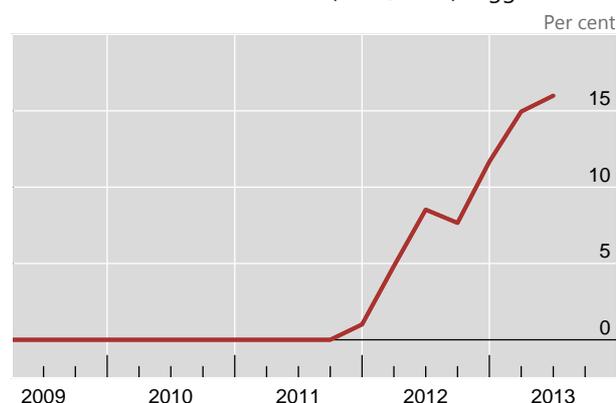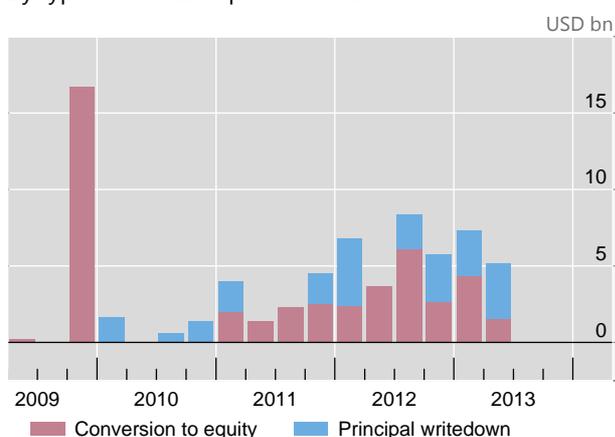
By nationality of issuing bank

USD bn

Rest of the world 17.1 — United Kingdom 20.7 — Ireland 4.1 — Netherlands 5.7 — Australia 7.1 — Switzerland 15.2
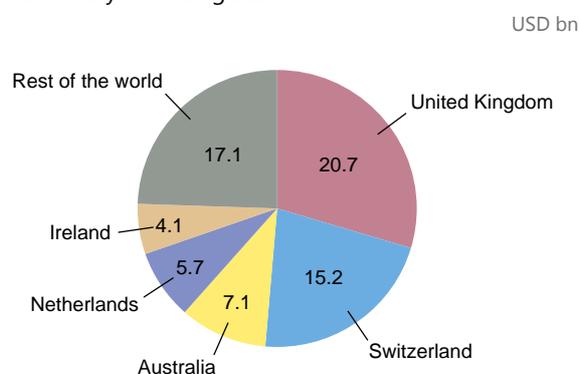
[1] Ratio of the volume of CoCos with a 5.125% (CET1/RWA) trigger level to the volume of all issued CoCos.

Sources: Bloomberg; Dealogic; authors' calculations.

Under Basel III, the minimum trigger level (in terms of CET1/RWA) required for a CoCo to qualify as AT1 capital is 5.125%. As a result, over the past couple of years, there has been a trend towards issuing CoCos with a trigger set exactly at that level (Graph 3, top right-hand panel). CoCos with such triggers are attractive for issuing banks due to the fact that they qualify as AT1 capital, while simultaneously being cheaper to issue than CoCos with higher trigger levels.

Regulatory capital eligibility considerations are a major factor not only in the selection of CoCo triggers, but also in the choice of their original maturity. In the Basel III framework, all AT1 instruments must be perpetual. That explains why over a third of all CoCos issued so far have no maturity date. The rest of the existing CoCos are dated and are therefore only eligible to obtain T2 capital status under Basel III. Most of them have an original maturity of approximately 10 years.

Capital eligibility considerations are not as important in the selection of the loss absorption mechanism. Regulatory requirements can be met with either CE CoCos or PWD CoCos. Nevertheless, the former dominated the initial stages of CoCo issuance (Graph 3, bottom left-hand panel). The most likely explanation for this is that CE CoCos tend to be cheaper for issuers than PWD CoCos (see below).

Nevertheless, issuance of PWD CoCos has picked up over time, in line with growing interest from fixed-income investors whose mandates often prevent them from holding CE CoCos. As a result, PWD CoCos have accounted for more than half of total CoCo issuance since the start of 2013.

CoCo issuance patterns are largely driven by the way Basel III is applied, or supplemented, by national regulators. As a result, the geographical distribution of issuers mainly reflects the regulatory treatment of CoCos across jurisdictions. Approximately 80% of the issuance has been done by European banks (Graph 3, bottom right-hand panel). UK banks have been the most active, having issued $21 billion worth of CoCos so far. They have been primarily motivated by their need to satisfy the loss-absorbing capital requirements of UK regulators. Swiss banks have also issued a substantial amount ($15 billion) of CoCos during our sample period. This could largely be attributed to the fact that the new regulatory regime in Switzerland requires Swiss banks to have 9% of risk-weighted assets in loss-absorbing instruments. Finally, the July 2013 entry into force of the Capital Requirements Directive IV, which transposes Basel III into EU law, is expected to stimulate a new wave of CoCo issuance by EU banks.

The issuance of CoCos is also affected by their tax treatment in different jurisdictions. If fiscal authorities treat CoCos as debt, then the interest expense associated with them is typically tax-deductible for the issuing bank. As a result, the tax classification of CoCos can have a significant impact on the after-tax interest expenses of issuing banks. While there is still considerable uncertainty in many jurisdictions, it appears that CoCos would not be tax-deductible in some countries. Preliminary estimates suggest that roughly 64% of CoCos have tax-deductible coupons, while approximately 20% do not. The tax treatment of the remaining 16% of CoCos is currently under review.[10]

Investors in CoCos

The bulk of the demand for CoCos has come from retail investors and small private banks. Large institutional investors have been relatively timid so far. The main factors suppressing the growth of the investor base at the moment are the absence of complete and consistent credit ratings for most CoCos and the inherent tension between the objectives of issuers' regulators and prospective buyers' regulators.

Main investor groups

According to market participants, three investor groups have been most active on the demand side of the primary market for CoCos. The bulk of the demand has come from retail investors and private banks in Asia and Europe. They have been enticed primarily by the relatively high nominal yield that CoCos offer in the current low interest rate environment. The second group consists of US institutional investors that look for alternative investment classes. Even though the CoCo volumes these investors have purchased are considerable relative to the size of the market, they are fairly modest compared to the overall size of their portfolios.

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[10]   The above numbers are based on a subsample of CoCos with a total volume of $36 billion. Currently, there is no information on the tax status of the rest of the CoCos in our sample.

Finally, European non-bank financial institutions represent a third investor group that has shown substantial interest in CoCos. Nevertheless, their demand is currently held back by the lack of clarity about how CoCo assets on their balance sheets will be treated by their national regulators.

Data from Dealogic on the institutional breakdown of investors for a sample of CoCo issues with a combined volume of roughly $13 billion provide further details on the major investors in CoCos. Private banks and retail investors were responsible for 52% of the total demand in the sample. Asset management companies accounted for another 27%. Hedge funds (9%) and banks (3%) were much less active. Finally, demand from insurance companies was also limited (3%), most likely reflecting the fact that Solvency II and National Association of Insurance Commissioners (NAIC) regulations are expected to apply a significant capital charge to CoCo investments.

Factors influencing the size of the CoCo investor base

Increasing participation of traditional institutional investors like asset management companies, insurance companies and pension funds is necessary for the CoCo market to become a deep and liquid source of capital for banks. However, several factors are holding back demand from these investors.

The absence of a complete set of credit ratings for CoCos has been a significant hurdle on the growth path of this young market. The mandates of many institutional investors prevent them from holding financial instruments that do not have a credit rating or are rated below a certain level. In addition, an investment grade credit rating is a necessary condition for the inclusion of any security in many of the major bond indices.

Three main factors can explain credit rating agencies' initial reluctance to rate CoCos. First, the heterogeneity in the regulatory treatment of CoCos across jurisdictions hinders the creation of consistent rating methodologies. In addition, credit rating agencies are concerned that certain high-trigger CoCos have the potential to invert the traditional hierarchy of investors.[11] Finally, the existence of discretionary triggers creates valuation uncertainty, which further complicates the ratings process.

More than half of all CoCos are currently unrated. Until recently, only Standard & Poor's and Fitch rated (some, but not all) CoCos. Moody's did not rate them until May 2013, when it started rating some low-trigger CoCos. According to the S&P rating methodology, a CoCo rating should be at least two to three notches below the issuer's credit rating and cannot exceed BBB+.[12] Further downward notching is applied to instruments with triggers near or at the point of non-viability and to those that have a discretionary trigger. On average, CoCo ratings are approximately one notch lower than those of other subordinated debt and more than five notches below those of senior unsecured debt of the same issuer.

An additional factor limiting demand for CoCos is the inherent tension between the objectives of issuing banks' regulators and the regulators of potential CoCo bondholders. On the one hand, issuing banks' regulators aim to provide an

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[11]   In some cases, holders of CoCos can incur losses ahead of equity holders (eg when the loss absorption mechanism of a high-trigger/PWD CoCo is activated).

[12]   Standard & Poor's (2011).

automatic source of high-quality capital for banks in times of stress. This translates into a preference for instruments with greater loss absorption capacity. On the other hand, the regulators of prospective CoCo buyers are primarily concerned about the potential losses that those institutions might suffer on their CoCo holdings. As a result, they are likely to steer them towards instruments with a smaller loss absorption capacity.

Increasing the congruency and clarity of the regulatory treatment of CoCos across jurisdictions and fine-tuning their design could help to enhance the investor base by attracting more traditional fixed income investors. However, the risk-sharing capacity of these instruments also depends on the scope for diversification they offer and on the systemic importance of their buyers.

CoCos can provide strong diversification benefits only if the issuing banks' tail risk has low correlation with the portfolios of CoCo bondholders. Insurance of natural catastrophes is a useful analogy to assess the capacity limits of CoCos. Though the monetary costs of such events are high, their occurrence is independent from the business cycle. This implies that exposure to natural disaster risk through securities like catastrophe bonds provides diversification benefits for traditional investors. Unlike natural catastrophes, however, bank failures are correlated with the business cycle, limiting CoCos' diversification capacity in that regard.[13]

The ability of CoCos to reduce systemic risks depends heavily on whether their buyers are themselves systemically important. As a consequence, regulators may want to discourage CoCo holdings by banks. At the same time, the systemic risk associated with other large institutional investors should also be taken into consideration. More specifically, CoCo holdings should be distributed not in a way that simply shifts the concentration of risk across different sectors of the financial system, but rather in a manner that reduces the amount of systemic risk.

Primary market pricing of CoCos

The main determinants of the pricing of CoCos are their position in the bank's capital structure, the loss absorption mechanism and the trigger.

The yields on CoCos are consistent with their place in the bank's capital structure. CoCos are subordinated to other debt instruments as they incur losses first. Accordingly, the average CoCo yield to maturity (YTM) at issuance tends to be greater than that of other debt instruments (eg other subordinated debt and senior unsecured debt). The YTM of newly issued CoCos is on average 2.8% higher than that of non-CoCo subordinated debt and 4.7% higher than that of senior unsecured debt of the same issuer.

The preferences of CoCo bondholders and equity holders diverge when it comes to the trigger level. All else the same, CoCos with relatively low triggers offer more favourable terms to holders of CoCos than to equity holders since the trigger is less likely to be breached and the former group is less likely to absorb losses. By contrast, for a given YTM level, equity holders prefer high-trigger CoCos since they are more likely to lead to early loss absorption by holders of CoCos. As a

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[13] See Jaffee and Russell (1997) and Ibragimov et al (2008) for a discussion on the limits of insurability, and Froot (2001) for an analysis of the catastrophe bond market.

consequence, one can expect that the yields of high-trigger CoCos would on average be higher than those of low-trigger CoCos.

The interests of CoCo bondholders and equity holders also differ when it comes to PONV triggers. Issuing banks prefer these triggers since they are a necessary condition for regulatory capital eligibility under Basel III. Conversely, holders of CoCo favour instruments without PONV triggers because, all else the same, they increase the probability of the loss absorption mechanism being activated.

CoCo and equity holders also have conflicting interests when it comes to the loss absorption mechanism. All else the same, equity holders find PWD CoCos more attractive, since they avoid dilution and shift the cost of financial distress to CoCo bondholders. Conversely, for a given YTM level, holders of CoCos tend to prefer the CE clause over the PWD clause since the former gives them partial compensation, in the form of shares, when the trigger is breached, whereas the latter does not.[14] That said, some CoCo holders seem to find the PWD feature attractive because it provides more clarity about the loss absorption amount than the CE feature. In addition, the PWD clause is favoured by those institutional fixed income investors that have manable 1dates which prevent them from holding equity instruments.

Table 1 presents data on the pricing of several groups of CoCo bonds, divided according to their two principal characteristics, ie the trigger level and the loss absorption mechanism.[15]

CoCos with a PWD clause tend to have higher YTMs at issuance than those with a CE clause. On average, the YTM of PWD CoCos is approximately 3.9% higher than that of non-CoCo subordinated debt of the same bank. By contrast, the comparable spread for CE CoCos is only 2.5%.

Low-trigger CoCos tend to command a lower yield premium than high-trigger ones. The average YTM spread at issuance for high-trigger CoCos over other

Primary market pricing of CoCo bonds

YTM[1] spread at issuance over non-CoCo subordinated bonds, in per cent[2]   Table 1

	All	Conversion to equity (CE)	Principal writedown (PWD)
All	2.8	2.5	3.9
Low-trigger[3]	2.5	2.3	4.8
High-trigger[4]	3.6	3.5	3.6

[1] YTM = yield to maturity. [2] Weighted averages based on issued amounts. [3] Mechanical trigger level ≤6% (CET1/RWA). [4] Mechanical trigger level >6% (CET1/RWA).

Sources: Bloomberg; Dealogic; authors' calculations.

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[14] In theory, the principal writedown mechanism embedded in a CoCo could be temporary or permanent. The former offers the possibility of a "write-up" if the bank restores its financial health; the latter does not. In practice, most CoCos that have been issued so far have a permanent principal writedown mechanism, reflecting regulatory requirements that seek a permanent increase in equity on the trigger event.

[15] While informative, the sample statistics reported in Tables 1 and 2 should be interpreted with caution due to the fact that, as discussed above, the size of the CoCo market is still relatively small and, as a result, the sampling uncertainty is non-negligible.

subordinated debt is 3.6%. By contrast, that spread is only 2.5% for low-trigger CoCos.

Consistent with the preferences of issuers and investors, the CoCos that are least costly to issue are those that feature a combination of a low trigger and a CE loss absorption mechanism. The average spread on that CoCo type over other subordinated debt of the same bank is 2.3%. By contrast, the corresponding average spread for CE CoCos with a high trigger is 3.5%. High-trigger CoCos with a PWD feature are even costlier – their average YTM spread at issuance over non-CoCo subordinated debt is 3.6%. Finally, the most expensive group of CoCos in our sample are those that have a PWD feature and a low trigger. Their average YTM spread at issuance is 4.8%.

Table 1 contains a pair of relative pricing metrics that is puzzling at first glance. Namely, PWD CoCos with a low trigger command a higher yield than their high-trigger counterparts (column 1), even though economic intuition suggests that the opposite should be true. One possible explanation for that apparent pricing anomaly is that most of the low-trigger PWD CoCos in our sample have a PONV clause, whereas the majority of the high-trigger PWD CoCos do not. As discussed above, the PONV clause raises the probability that the loss absorption mechanism will be activated, which causes investors to demand a higher premium for holding CoCos with a PONV clause.

Secondary market trading of CoCos

The trading of CoCos on secondary markets can provide further insights into the properties of these instruments. In order to gauge the degree of co-movement between CoCos and other debt and equity instruments of the same bank, we have calculated the correlation between the daily changes in the CoCo bond spread, on the one hand, and the daily changes in the non-CoCo subordinated debt spread, the CDS spread (on senior unsecured debt) and the equity price of the same issuer, on the other hand (Table 2). Several patterns stand out.

First, CoCo spreads are most strongly correlated with the spreads of other subordinated debt (Table 2, column1). The average correlation coefficient for that pair of instruments in our sample is 0.44. The correlations of CoCos with CDS spreads and equity prices, although significant, are not as strong (0.38 and –0.25,

Correlations between CoCo bond spreads[1] and prices/spreads of other instruments of the same issuer[2] Table 2

	Subordinated bond spread[3]	CDS spread[4]	Equity prices[5]
All	0.44	0.38	−0.25
Low-trigger[6]	0.50	0.42	−0.25
High-trigger[7]	0.32	0.30	−0.26

[1] Daily changes in the spread between the yield to maturity (YTM) of a CoCo bond and a corresponding government bond (matched by currency and maturity). [2] Weighted averages based on issued amounts. [3] Daily changes in the spread between the YTM of a non-CoCo subordinated bond and a corresponding government bond (matched by currency and maturity). [4] Daily changes. [5] Daily percentage changes. [6] Mechanical trigger level ≤6% (CET1/RWA). [7] Mechanical trigger level >6% (CET1/RWA).

Sources: Bloomberg; Dealogic; Markit; authors' calculations.

## Debt, CoCo and equity price reactions to news about capital

On 14 June 2012, the Swiss National Bank (SNB) criticised in its *Financial Stability Report* the low level of capitalisation of Credit Suisse, urging the bank to increase its capital by suspending dividends and/or by raising fresh capital through a rights issue.[1] We examine how the SNB announcement, which came as a surprise to financial markets, affected the prices of various debt and equity instruments issued by Credit Suisse.

The reaction of CoCo bond spreads was consistent with the place of that type of instrument in the capital structure. Their market value was more sensitive to the news than the market values of other, more senior, debt instruments, but less sensitive than the market value of equity, which is a more junior claim. On the day the SNB report was published, the equity price of Credit Suisse dropped by more than 10% while the yield on the bank's CoCos maturing in February 2041 rose by 39 basis points or 5.8%. By comparison, the yield to maturity on non-CoCo subordinated debt with a similar remaining maturity as the CoCo increased by 23 basis points while the yields on more senior debt issues and CSD spreads hardly moved.

[1] SNB (2012).

Credit Suisse debt and equity prices, June 2012

Graph A

Index (13 June 2012 = 100)   Basis points (13 June 2012 = 0)

Lhs:
— Equity price

Rhs: — CoCo bond YTM   — Senior unsecured bond YTM
     — Subordinated bond YTM — CDS spread
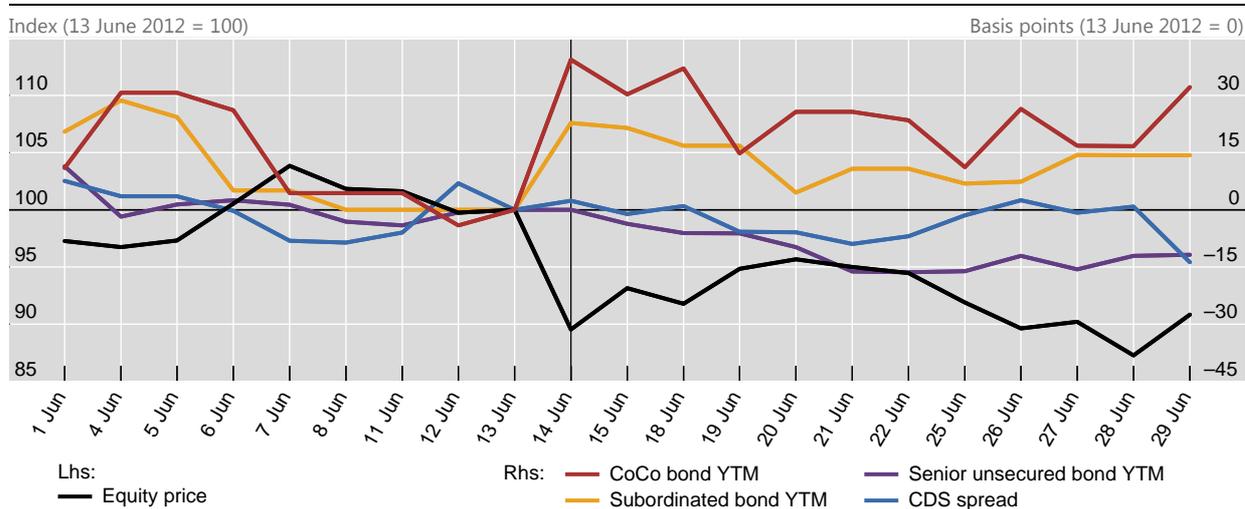
YTM = Yield to maturity.

Sources: Bloomberg; Markit.

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respectively). These general observations are in line with the conclusions of a case study on the reactions of the share price of Credit Suisse and the spreads on its bonds to adverse news about the bank's level of capitalisation (see box).

Second, non-CoCo subordinated debt spreads and CDS spreads tend to be more correlated with the spreads of low-trigger CoCos than with those of high-trigger CoCos (Table 2, columns 1 and 2). The average correlation coefficient between low-trigger CoCos and non-CoCo subordinated debt in our sample (0.50) is considerably higher than the one between high-trigger CoCos and non-CoCo subordinated debt (0.32). Similarly, the average correlation coefficient between low-trigger CoCos and CDS spreads (0.42) is substantially higher than the one between high-trigger CoCos and CDS spreads (0.30). Intuitively, low-trigger CoCos are likely to suffer losses at the same point as other subordinated debt – the point of

insolvency. By contrast, high-trigger CoCos are likely to suffer losses much earlier than non-CoCo subordinated debt.

Finally, the trigger level does not appear to affect the correlations between CoCo spreads and equity prices (Table 2, column 3). This result is somewhat surprising since, all else the same, high-trigger CoCos should be more informationally sensitive than low-trigger ones due to the fact that the former are more likely to absorb losses. Therefore, one could expect that high-trigger CoCos would behave more like equity than low-trigger CoCos. Yet the average correlation coefficient between low-trigger CoCos and equity prices (–0.25) is almost the same as the one between high-trigger CoCos and equity prices (–0.26).

Conclusion

In this feature, we reviewed the structure, issuance patterns and pricing of CoCos. The design of CoCos is shaped by their primary goal of being a readily available source of bank equity in times of crisis. CoCo issuance is primarily driven by the need to satisfy regulatory capital requirements. The demand for CoCos has so far been held back by the scarcity of credit ratings and the lack of consistent regulatory treatment.

The pricing of CoCos in primary markets is consistent with their position in banks' capital structures. The main determinants of CoCo yields are the mechanical trigger level, the loss absorption mechanism, and the existence of a discretionary trigger. In secondary markets, CoCo bond yields are most highly correlated with those of other subordinated debt, albeit with a considerable degree of variation between high- and low-trigger CoCos.

Looking ahead, CoCos have the potential to strengthen the resilience of the banking system. Their ability to do so will depend on the scope for diversification, the capacity for reducing systemic risk and the coordination of their treatment between the regulators of issuers and prospective buyers.

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Interest rate pass-through since the financial crisis[1]

Policy rates in advanced economies are at record lows and central banks have resorted to unconventional policy tools, but there are concerns that the low policy rates have not been transmitted to lending rates for households and non-financial firms. In this special feature, we investigate whether the pass-through of monetary policy to rates on bank loans to non-financial firms has been impaired in the aftermath of the Great Recession. Our results suggest that the difference between lending rates to the non-financial corporate sector and policy rates is currently close to the pre-crisis level in the United States and Germany, but remains higher in peripheral euro area countries.

JEL classification: E43, E52, C32.

Over the past few years, monetary policy in advanced economies has been exceptionally accommodative. Policy rates have been near zero for an unprecedented length of time. In addition, major central banks have taken non-standard monetary policy actions to encourage banks to lend, with the ultimate goal of providing economic stimulus. By doing so, policymakers have tried to directly influence interest rates in specific segments of the debt market.

While central bank interventions have largely succeeded in keeping interest rates on government bonds low (Meaning and Zhu (2011)), there have been doubts about their ability to effectively stimulate borrowing by households and non-financial firms. Lending rates have indeed declined since the onset of the Great Recession, but has the pass-through of monetary policy to bank lending rates been as strong as in the past?

This special feature empirically investigates the response of lending rates to monetary policy rates in major advanced economies, and assesses whether and to what extent such response has changed since the onset of the Great Recession. In a nutshell, our results suggest that the pass-through of monetary policy has not worked as in the pre-crisis period, and that borrowers have benefited from low policy rates only to a limited extent, especially in euro area peripheral countries.

The article is structured as follows: first, we describe the channels through which monetary policy transmits to lending rates and present evidence on the

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evolution of the lending spread since the onset of the Great Recession. We then investigate the factors driving lending rates by decomposing the "lending spread" into different components. Finally, we relate the most important of such components to credit risk.

The transmission of monetary policy via interest rates

Over the last few decades, setting policy rates has been viewed as the standard tool of monetary policy. The implementation of the monetary policy stance via open market operations ensures that policy rates transmit to the interest rates at which financial institutions refinance themselves. In turn, competition in lending and funding markets should ensure that changes in the policy stance are also passed on to other interest rates. A reduction in the policy rate is thus expected to translate into a decline in lending rates for firms and households, which should stimulate consumption and investment. This is the interest rate channel of monetary policy transmission, which is the main focus of this special feature.

The transmission of policy rates to lending (and deposit) rates – the interest rate pass-through – is, however, far from mechanical and is affected by various factors. For instance, financial intermediaries may require a higher compensation for risk due to slowing economic activity. In this case, a reduction in the policy rate would only partially be passed on to firms or households. Conversely, low perceived risk can magnify the pass-through and lead to an overheating of the economy.

The empirical literature on the transmission of monetary policy is vast. Bernanke and Blinder (1992) investigate the response of credit aggregates to monetary policy shocks. Borio and Fritz (1995) and Cottarelli and Kourelis (1994) focus more specifically on the pass-through of policy rates to lending rates, which we also focus on in this special feature. Studies on the heterogeneity in the pass-through at the individual bank level are limited to a few country studies (Weth (2002), Gambacorta (2008)). The bulk of the empirical literature has resorted to cointegrated time series models (Engle and Granger (1987)) to account for co-movements of policy and lending rates (see de Bondt (2005) and references therein). A recent contribution (European Central Bank (2013)) focuses on major euro area countries, reporting evidence of heterogeneity between core and peripheral countries.

Lending spreads since the crisis

A first rough indicator of the effectiveness of the interest rate channel is the lending spread, ie the difference between lending and policy rates. In Graph 1 we plot the spread between lending rates and the overnight interbank rate,[2] together with a dashed line marking the pre-crisis (ie up to August 2008) average. Data are at monthly frequency and start in January 2002 for all countries except France (January

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[2]   Here, as is common in the empirical literature, we proxy monetary policy with the overnight interbank rate. This also serves the purpose of abstracting from strains in the interbank money market that may have played a role in the early moments of the crisis in particular. The role of the spread between the interbank and the policy rate is examined in the next section.

Spread between rates on loans to non-financial firms and the overnight interbank rate[1]

In basis points   Graph 1

| United States and United Kingdom | Germany and France | Italy and Spain |
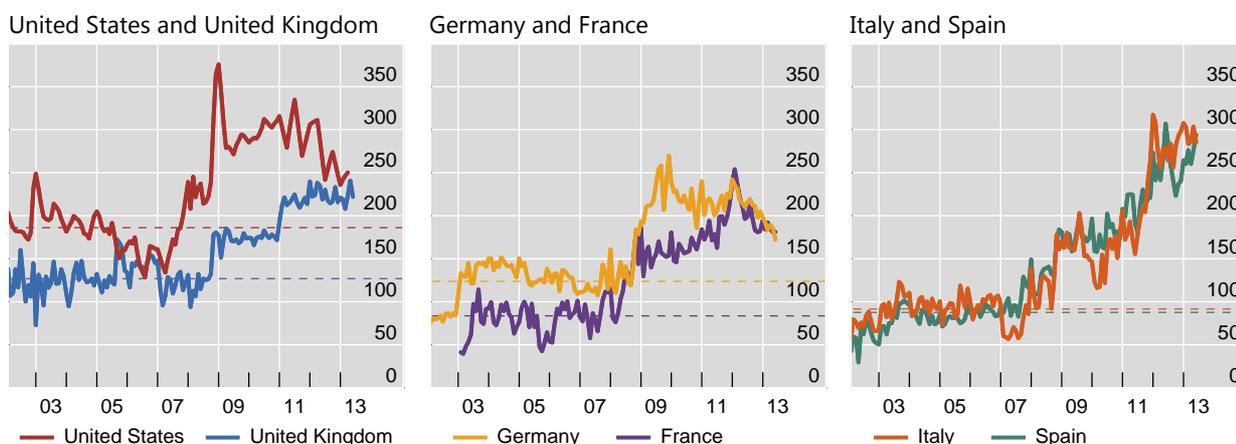
[1] For definitions of the lending rates, see Box 1. The overnight interbank rate corresponds to the effective federal funds rate for the United States, overnight GBP LIBOR for the United Kingdom and EONIA for the euro area countries. Dashed lines represent the pre-crisis average (January 2002–August 2008; for France, January 2003–August 2008).

Sources: Bank of England; ECB; Federal Reserve; Bloomberg; DataStream; BIS calculations.

2003);[3] further details are reported in Box 1. After the onset of the Great Recession, spreads drifted away from their pre-crisis average in all countries, suggesting a change in the medium-run relationship between policy and lending rates. The issue is further discussed using a more formal statistical framework in Box 2.

In the United States, spreads surged in the aftermath of the Lehman Brothers bankruptcy, but narrowed thereafter. Over the past two years they trended down and are now approaching the pre-crisis average. In the United Kingdom, by contrast, spreads rose first after the Lehman bankruptcy, and then again with the emergence of the euro area sovereign debt crisis. The spread is currently about 100 basis points than in the pre-crisis period.

Results for the euro area differ substantially across countries. Spreads for France and Germany steadily trended down over the past year, bringing the lending rate close to its pre-crisis average. By contrast, Italian and Spanish firms saw their borrowing costs rise progressively in spite of the ECB's accommodative monetary policy stance. In Italy, spreads remained relatively subdued until 2010, possibly thanks to the limited exposure of Italian banks to the financial turbulence. However, they quickly surged thereafter, reflecting the sharp deterioration of the economic outlook. In Spain, the increase in spreads also intensified with the deepening of the recession in 2011. In May 2013, Spanish and Italian firms were thus facing borrowing rates around 200 basis points above the pre-crisis average.

[3]   Our sample choice is motivated by data availability: pre-2002 series for lending rates in euro area countries and in the United Kingdom are based on different definitions. Our sample therefore covers only one important recession. This is a serious shortcoming since lending rates appear to be stickier when policy rates go down than when they go up (Mojon (2000)). However, during the latest recession, spreads in the United States – where lending rates are available from the early 1990s – widened significantly more and for longer than during the 1990 and the 2001 recessions.

Box 1

Data on interest rates

We collected data on interest rates for France, Germany, Italy, Spain, the United Kingdom and the United States. Coverage starts in January 2002 (except for Spain and France, for which it starts in April 2002 and January 2003, respectively) and ends in May 2013 for the United Kingdom and the euro area countries and in March 2013 for the United States. All rates are annualised.

The US policy rate is the federal funds target rate up to December 2008 and the midpoint of the target range thereafter. For the United Kingdom, we use the bank rate as published by the Bank of England. For the euro area, we use the main refinancing rate up to the introduction of fixed rate full allotment in October 2008 and the deposit facility rate thereafter (Beirne (2012)). The overnight interbank rate is the euro overnight index average (EONIA) for the euro area countries, the effective federal funds rate for the United States and overnight GBP Libor for the United Kingdom. The source for the secondary market one-year sovereign bond yield for the United Kingdom and the euro area countries is Bloomberg. The yield for the United States is obtained from the Federal Reserve, and is defined as the nominal constant maturity yield. Both sources provide daily data which are converted to monthly frequency by averaging daily observations.

Collecting lending rates was more challenging, since reporting practices differ across countries, and definitions are not homogeneous. We tried to use rates that match as closely as possible. For the euro area countries, we collected monthly data from the ECB that refer to the interest rate on loans over €1 million, other than revolving loans and overdrafts, convenience and extended credit card debt to non-financial firms for new businesses (see ECB (2003) for further details). The series starts in January 2003, and we used national central banks' data to backdate it further.[1]

For the United States, data come from the Federal Reserve *Survey of Terms of Business Lending* for commercial and industrial loan rate spreads over the target federal funds rate, extended during the reporting period by loan size (see Brady et al (1998) for further details). The data are available only at quarterly frequency and were thus linearly interpolated so that we could perform the analysis using monthly data. We use the reported spread for commercial and industrial loans over $1 million. Summing the reported spread over the target federal funds rate with the target rate itself gives us the effective loan rates in the United States.

For the United Kingdom, data are obtained from the Bank of England, which reports the monthly average across monetary and financial institutions of the weighted average interest rate on other loans and new advances between £1 million and £20 million to private non-financial firms (see Reynolds et al (2005) for further details). The series starts in January 2004, and we backdated it using the fixed lending rate on outstanding loans for non-financial firms.

Information on the maturity of the loans included in the basket is more scant. The United States reports the average maturity of the loans included in the basket, which was less than 1.5 years in May 2013. It also indicates that the average number of months after the last rate fixation was around 10. For the United Kingdom, Al-Dejaily et al (2012) state that over 90% of new loans had an original rate fixation period of less than one year. For the euro area, no explicit information on the maturity is available, but the original rate fixation is reported to be less than one year.

[1] We did not backdate the data for France since the national source data shows a break when joined with the ECB data.

Decomposing the lending spread

The fact that lending spreads have increased does not constitute evidence that the pass-through has been impaired. Indeed, the lending spread is expected to vary over time as a function of the business cycle and other factors affecting the transmission mechanism. To gauge the nature of such factors, one can decompose

the lending spread into three components, each representing a different aspect of risk:

$$r_l - r_p = (r_l - r_g) + (r_g - r_b) + (r_b - r_p).$$

Starting from the right, the first component is the spread between the overnight interbank rate r_b and the policy rate r_p. Overnight interbank rates are often interpreted as target rates for monetary policy.[4] Therefore, the two rates should normally be very close to each other, and misalignments signal strains in the interbank money market, including any credit or liquidity risk involved in lending to banks.

The second component is the spread between the yield of a one-year government bond r_g and the overnight interbank rate. Due to the mismatch in maturities, this element includes the term premium as well as a measure of the credit risk of the government relative to that of the banks. This spread should be negative if government bonds are considered to be free of credit risk and if the term premium is low.

Finally, the spread between the lending rate r_l and the government bond yield captures the credit risk on entrepreneurial activities and the willingness of the bank to take on this risk. Such a premium can indeed be expected to be higher in a downturn, and can be pushed up further by financial intermediaries' need to deleverage, ie improve their capitalisation ratio.[5]

In Graph 2, we report the evolution of these components for the United States, the United Kingdom, Germany, France, Italy and Spain. Since the onset of the Great Recession, the spread between lending rates and policy rates (the red line) has widened in all countries. Spreads have recently narrowed in the United States, Germany and, to a lesser extent, France, but have further increased in the United Kingdom, Italy and Spain. Strains in the interbank markets (green area) played a role in the aftermath of the Lehman bankruptcy and, for euro area countries, after the eruption of the sovereign debt crisis, but since then they have remained subdued in all countries.

Risk on government bonds (yellow area), as one may expect, played a significant role in the widening of lending spreads in Italy and Spain after 2010. Following the ECB's announcement of the Outright Monetary Transactions (OMT) programme in August 2012, these spreads moderated, although lending rates failed to decline. On the other hand, during episodes of financial market turbulence, safe haven flows exerted downward pressure on government bond yields in the United States and United Kingdom, as well as Germany and France. This is reflected in a negative contribution to the lending spread.

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[4]   This hinges on the fact that the interbank money market is believed to be the primary channel for the implementation of monetary policy. When the crisis erupted, the interbank market broke down, and liquidity-easing measures implemented by central banks generated a larger than usual mismatch between official policy rates and interbank rates. See Beirne (2012) for a detailed analysis on the euro area.

[5]   Given that the maturity of loans included in the computation of the lending rate varies, the term premium could also partially affect this component. However, since we estimate the average maturity of the loans included in the computation of the lending rates to be around one year, this effect should be small. The spread between the lending rate and the government bond yield can also be influenced by oligopolistic power in specific sectors of the lending markets. However, the sample we consider is sufficiently short to assume this factor to be constant.

Decomposition of the lending spread

In basis points   Graph 2

United States

United Kingdom

$r_l - r_p$ [1] $r_l - r_g$ [2] $r_g - r_b$ [3] $r_b - r_p$ [4]

Germany

France

Italy

Spain
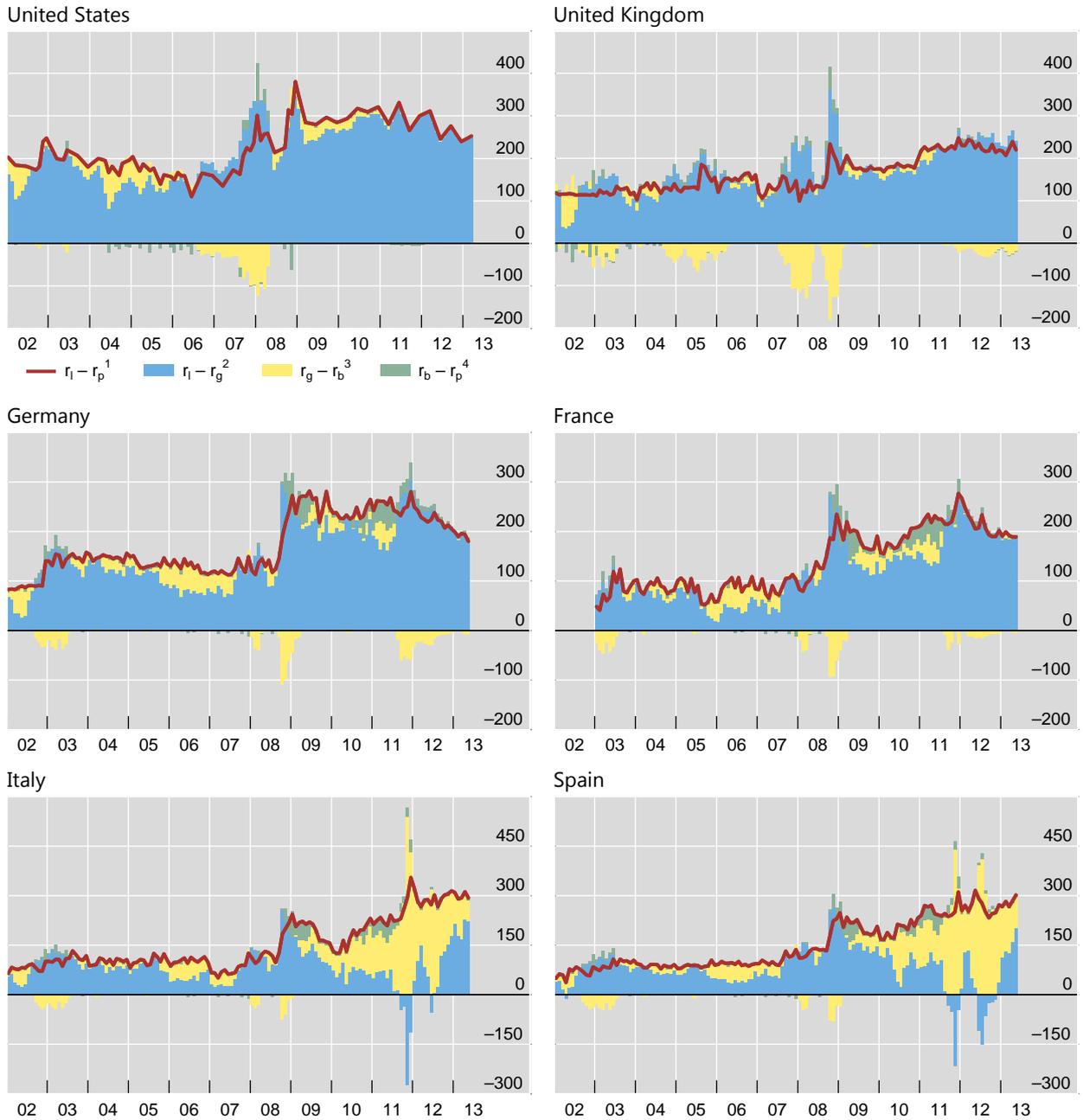
[1] Spread between the rate on loans to non-financial firms and the central bank policy rate. [2] Spread between the rate on loans to non-financial firms and the 12-month sovereign bond yield. [3] Spread between the 12-month sovereign bond yield and the overnight interbank rate (effective federal funds rate for the United States, overnight GBP Libor for the United Kingdom and EONIA for the euro area countries). [4] Spread between the overnight interbank rate and the policy rate.

Sources: Bank of England; ECB; Federal Reserve; Bloomberg; Datastream; BIS calculations.

For all countries, the surge in the spread between lending rates and government bond yields (blue area) explains the bulk of the lending spread in the wake of the Great Recession. As mentioned above, this component incorporates the

Box 2

Cointegration of policy and lending rates

The results reported in Graph 1 can be formalised by resorting to an econometric model which links lending rates to other interest rates in a cointegration framework. We estimate separate models for each country under scrutiny. The specification we adopt for euro area countries is:

$$r_l = \alpha + \beta r_b + e,$$

while for the United States and the United Kingdom it is

$$r_l = \alpha + \beta r_b + \gamma r_g + e.$$

The rationale for including government bond yields in the specification is that failing to do so would neglect the potential impact of large-scale asset purchases implemented by the Federal Reserve and the Bank of England. Estimation is performed using the fully modified OLS estimator proposed by Phillips and Hansen (1990).①

To pin down the level of bank lending rate that would have prevailed, given the current monetary policy stance, if the pass-through had worked as in the pre-crisis period, we first estimate cointegrating equations up to August 2008. We acknowledge that the sample is short and only covers a period of strong economic and financial expansion; results should therefore be taken as illustrative.

We then compute the fitted values for the rate on loans to non-financial firms, and interpret these as benchmark rates, ie the rates that would have prevailed given the current monetary policy stance had the pass-through worked as in the pre-crisis period. To gauge the deviation of actual rates from the medium-run benchmark level, we subtract the fitted values from the actual (observed) values for lending rates. Results are reported in Graph A, and basically convey the same message as the informal analysis in Graph 1.

The fact that the difference between actual and fitted values drifts away from zero constitutes indirect evidence that the relationship tying together lending and policy rates has been subject to a structural change since the onset of the Great Recession. Of course, given the coverage of our sample, such change could be due to the economic downturn itself rather than some other form of impairment in the transmission of monetary policy.

① Further details on the coefficient estimates and cointegration tests, as well as on the stability of the cointegrating relationship, are contained in a companion working paper (Illes and Lombardi (2013)).

Spread between actual and benchmark rates on loans to non-financial firms[1]

In basis points   Graph A
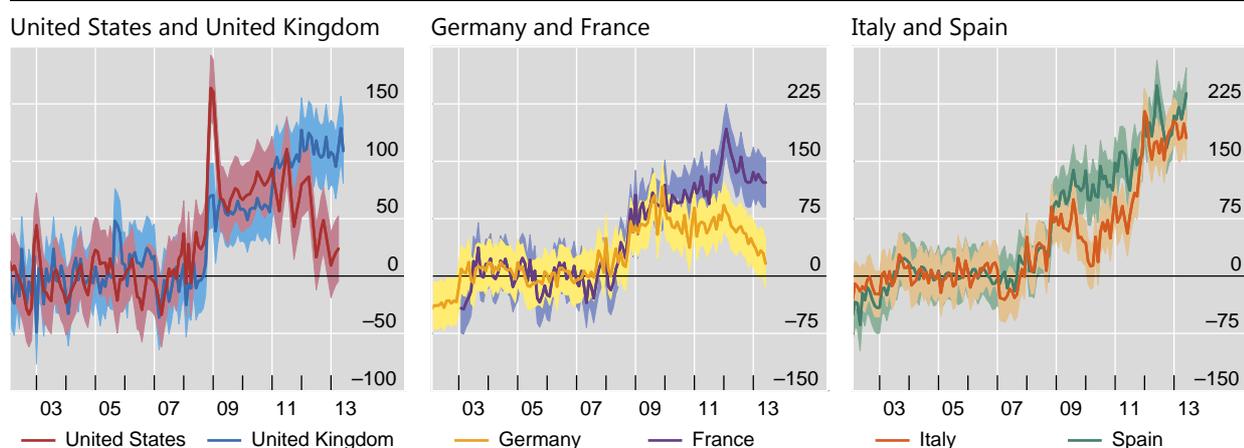
[1] Difference between actual rates and those implied by the cointegrating model. The ranges represent 90% confidence intervals.

Sources: Bank of England; ECB; Federal Reserve; Bloomberg; Datastream; BIS calculations.

Changes in the credit quality and in the spreads between rates on loans to non-financial firms and the overnight interbank rate[1]

Changes since August 2008, in basis points   Graph 3

United States and United Kingdom   France, Italy and Spain

- United States[4]   - United Kingdom[5]   - France[6]   - Italy[5]   - Spain[7]
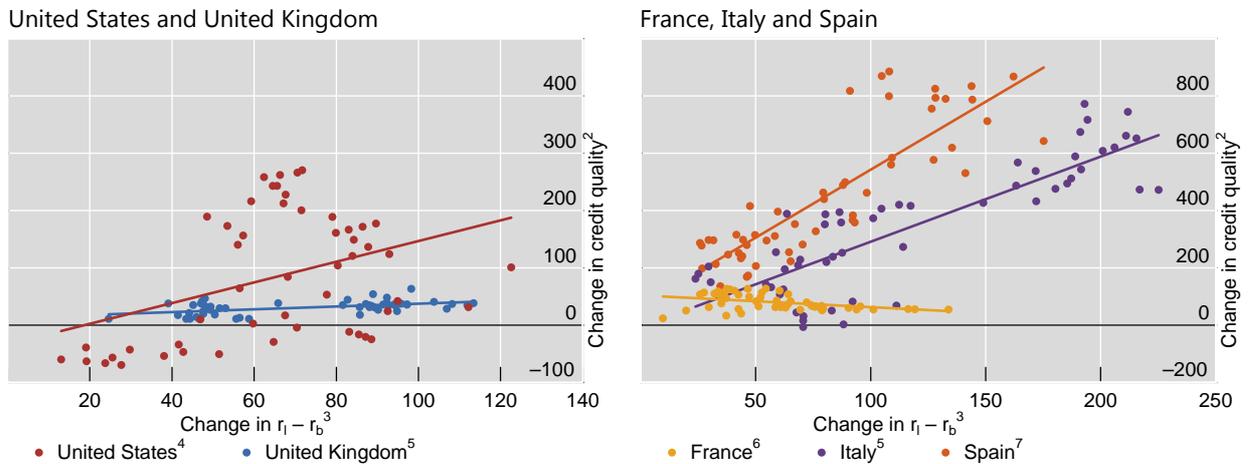
[1] No data available for Germany for non-performing loans. For definitions of the lending rates, see Box 1.   [2] A positive change represents a deterioration in credit quality   [3] Spread between rates on loans to non-financial firms and the overnight interbank rate (effective federal funds rate for the United States, overnight GBP LIBOR for the United Kingdom and EONIA for euro area countries).   [4] All banks' delinquency rates on commercial and industrial loans.   [5] Write-offs as a percentage of total lending to private non-financial firms.   [6] Gross doubtful debts as a percentage of total lending to private non-financial firms.   [7] Ratio of bad loans to total lending.

Sources: Bank of England; ECB; Federal Reserve; Bloomberg; Datastream; BIS calculations.

premium for heightened risk due to stagnant economic activity,[6] as well as that related to the need of the banking system to deleverage. This component has recently become smaller in the United States, France and Germany, but has remained large in the United Kingdom.

So, deviations of the lending spread from the pre-crisis average may reflect a deterioration of the economic outlook leading lenders to require higher premia rather than a tightening in the supply of credit. To provide further evidence in this direction, Graph 3 plots the spread between lending rates and interbank rates against a measure of credit risk, ie the change in the percentage of non-performing loans since the onset of the Great Recession.[7] The expected sign of the relationship is positive, but this is not the case in all countries: the slope is nearly flat in the United Kingdom and France.

Conclusion

Overall, the message one can take from our results is that the policies of near-zero interest rates maintained by central banks of major advanced economies have

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[6]   Of course, the increase in the perception of risk could also be interpreted as a correction from the systematic underpricing of risk that took place in the years preceding the Great Recession.

[7]   This is only a rough measure of credit risk and has a number of caveats. First, accounting conventions and definitions of a non-performing loan differ across countries. Second, the recognition of losses can be delayed when banks are short of capital. Due to a lack of data on non-performing loans we could not include Germany in the analysis.

lowered lending rates to non-financial firms only to a limited extent. This lesser pass-through seems to be related in part to the higher premium for risk required by financial intermediaries.

Results for euro area countries are very diverse. Firms in Italy and Spain continue to face high bank financing costs. At the same time, lending rates in Germany and France trended downwards over the last few years. Divergent trends in lending rates are a clear challenge for the formulation of monetary policy.

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Mind the gap? Sources and implications of supply-demand imbalances in collateral asset markets[1]

Increasing demand for collateral assets in the aftermath of the financial crisis has raised concerns about a shortage of high-quality assets (HQA). Drawing on a recent report by the Committee on the Global Financial System, we argue that such concerns seem unjustified. In aggregate, the increase in the supply of HQA appears sufficient to meet the additional demand arising from both market forces and regulatory changes. But given the uneven distribution of HQA among market participants, higher demand is likely to trigger market responses that could themselves generate risks for the financial system and thus warrant further monitoring.

JEL classification: G21, G28.

The use of collateral in financial transactions is on the rise, driven by both market forces and regulatory changes. This has triggered concerns about possible shortages of collateral assets and the associated implications for financial markets.[2]

A variety of factors has lifted demand for collateral. In response to counterparty risk concerns triggered by the financial crisis, issuers and investors have shown increased appetite for secured long-term bank debt, such as covered bonds. Likewise, funding activity has shifted from short-term unsecured lending to repo markets. Many banks, especially in Europe, have become increasingly dependent on collateralised borrowing, leading to rising bank asset encumbrance levels – a sign of rising demand for certain types of collateral for funding purposes.

Regulatory changes add to this increased demand. One factor is derivatives regulation, as more stringent collateralisation requirements in over-the-counter (OTC) derivatives markets (BCBS and IOSCO (2013)) or the requirement for central clearing of all standardised OTC derivatives come into force. Another factor is capital and liquidity regulation. New rules under Basel III will require banks to maintain larger buffers of high-quality liquid assets (HQLA; see Box). European insurance firms, in turn, are likely to add to the demand for high-quality assets (HQA), given new requirements under Solvency II (CGFS (2011a)).

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[2] This is not a new phenomenon; see CGFS (2001) for earlier coverage of related concerns.

A key question is how the supply of collateral assets will react to this additional demand and whether any supply-demand imbalances are likely to have adverse effects that may warrant a response from policymakers. Drawing on recent work by the Committee on the Global Financial System (CGFS),[3] this article investigates these issues from a financial system perspective.[4] Using a simple supply-demand framework, it contrasts shifts in the demand for collateral assets with actual and expected supply side changes that affect both the outstanding stock of eligible assets as well as how these assets are utilised, a concept sometimes described as collateral velocity. We argue that a lasting, widespread scarcity of collateral assets in global financial markets is unlikely, but that possible endogenous adjustments in market practices might warrant the attention of policymakers.

The first section looks at the key drivers of collateral demand to provide an overview of the size and direction of any shift in aggregate demand for collateral assets. The second section turns to the supply side, investigating how quantities, prices and market practices are likely to respond to any structural increase in collateral demand. The third section discusses implications for markets and policy, followed by a short conclusion.

Changes in the demand for high-quality assets

Structural versus cyclical factors

Demand for collateral assets is changing, owing to both structural and cyclical factors. A key factor on the structural side is regulatory reform, which will be covered in more detail below. Cyclical factors are more difficult to assess, in part because empirical analyses are lacking that would help quantify their impact on overall collateral demand. Moreover, even cyclical developments can have a structural component (or turn structural over time), implying that additional assumptions would have to be made in order to arrive at a fuller assessment.

Shifts in bank funding patterns, for example, respond to changes in the risk preferences of investors in bank debt and can significantly influence the demand for collateral assets. In periods of heightened counterparty credit risk, banks' reliance on repo market funding will thus tend to increase, replacing unsecured funding. The recent experience in some euro area economies is one obvious example. However, whether and to what degree such developments are lasting, rather than purely cyclical, depends on a variety of factors, including the success of sovereigns and banks in improving their creditworthiness.

Another example is demand from the official sector stemming from both its foreign exchange (FX) reserve management and monetary policy operations. Investment of FX reserve holdings, predominantly in assets denominated in the major reserve currencies, rose by about $4 trillion between 2007 and 2012 (Graph 1,

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[3]   The CGFS is a BIS-based committee of senior central bank officials that monitors developments in global financial markets for central bank Governors (see www.bis.org/about/factcgfs.htm).

[4]   Specifically, this article draws heavily on the recent CGFS (2013) report entitled *Asset encumbrance, financial reform and the demand for collateral assets* (www.bis.org/publ/cgfs49.htm), which was prepared by a Working Group chaired by Aerdt Houben (Netherlands Bank).

High-quality assets: demand and supply factors

Graph 1

Outstanding government debt and FX reserves

USD trn (left) / USD trn (right)

Lhs: —— Official FX reserves[1]
Government debt (rhs)[2]:
- Europe
- Japan
- United States
- Canada

Supply of high-quality (liquid) assets for major currencies

USD trn

CAD · EUR · GBP · JPY · USD

- Narrow measure (HQLA)
- Broad measure (HQA)

Gross issued and retained secured bank bonds in the euro area[3]

EUR bn, inverted

05 06 07 08 09 10 11 12 13

- ABS and MBS
- Covered bonds
- Government-guaranteed
- Retained issues

[1] Sum of the official FX reserves for the following countries: Australia, Brazil, Canada, Chile, China, Czech Republic, Denmark, the euro area, Hungary, India, Indonesia, Japan, Korea, Mexico, Poland, Russia, South Africa, Sweden, Switzerland, Turkey, the United Kingdom and the United States.   [2] Outstanding amount of central government debt securities for major advanced economies.   [3] To highlight how public sector support has eased bank funding strains during different phases of the financial crisis, the amount of government-guaranteed bonds and retained issues that may serve as collateral in central bank funding operations are presented on an inverted axis of ordinates.

Sources: World Bank; Dealogic; national data; CGFS report no 49; authors' calculations.

left-hand panel). If not utilised via activities such as securities lending, these assets will not be available to the private sector, changing the overall distribution of collateral assets across the economy. Detailed information on such practices, however, is scarce.

Central bank operations have also affected collateral demand in ways that make it difficult to assess the net impact. On the one hand, large-scale purchases of domestic HQA (see box), such as those conducted by major central banks over recent years, have absorbed significant quantities of collateral assets. On the other hand, these purchases have resulted in the creation of high-quality liquid claims on these same central banks, mitigating the impact of their asset purchases on net HQA demand. At the same time, central bank funding based on a broader set of eligible assets has allowed banks to transform non-HQA into claims on the central bank, raising net HQA supply. This was a significant factor in a number of euro area jurisdictions as the sovereign debt crisis deepened.

Structural factors: regulatory reform

Key regulatory initiatives that increase the demand for collateral assets include reforms in derivatives markets, the new liquidity coverage ratio (LCR) and changes to capital requirements under Basel III and Solvency II.

Collateral asset terms

What determines whether an asset is considered to be a collateral asset and how is its quality established? Although, in principle, any asset can be employed to collateralise a claim, market participants, regulators and academics typically take different views of collateral assets.① This article considers three – clearly overlapping – definitions:

High-quality liquid assets (HQLA): This relatively narrow definition is based on regulatory considerations. HQLA include only those assets that qualify in meeting the LCR requirement. Key characteristics of these assets are their low credit and market risk. They are also expected to be easy to value, exchange-listed, traded in active markets, unencumbered, liquid during times of stress and, ideally, central bank-eligible.

High-quality assets (HQA): This term includes all assets that market participants can use to meet collateral requirements in derivative transactions. Notwithstanding regulatory guidance on eligibility criteria (eg BCBS–IOSCO (2013) for non-centrally cleared derivatives), the boundaries of the HQA set are largely determined by market practice and may, for example, be subject to cyclical developments or competitive pressures to broaden eligibility criteria among CCPs. This is the relevant definition for assessing the impact of OTC derivatives reforms.

Collateral assets: The broadest definition refers to all assets on which market participants rely in collateralised funding transactions. This definition extends well beyond HQLA and HQA, including assets such as mortgages or other credit claims that are pooled to collateralise covered bonds, agency and private-label mortgage-backed and asset-backed securities.

① See CGFS (2013).

Derivatives reforms

Reforms in OTC derivatives markets are increasing demand for HQA. This occurs primarily through new requirements for initial margin on both centrally and non-centrally cleared OTC derivatives trades.[5]

Several studies have estimated the impact of derivatives reforms on HQA demand. The BCBS and IOSCO, for example, put the total initial margin required to collateralise exposures from non-centrally cleared trades at around €0.7 trillion ($0.9 trillion), given existing transaction volumes.[6] Initial margin requirements for centrally cleared derivatives could add another €0.1–0.6 trillion ($0.1–0.7 trillion) under normal market conditions (eg Heller and Vause (2012) and Sidanius and Zikes (2012)).

Yet the range of existing estimates is significant. This reflects differing methodologies as well as varying assumptions about future market developments. Rising fragmentation of central clearing and an associated reduction in multilateral netting, for example, would tend to increase collateral demand (CGFS (2011b)), even though the scale of this effect is not yet clear. This has to be set against the phasing-in of the new requirements over several years, which will give market

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[5] Both parties to a centrally cleared derivatives transaction are subject to the requirement. For uncleared transactions, a full two-way margin is proposed as well. Variation margin, on the contrary, should not have a first-order effect on the aggregate demand for collateral, even though precautionary holdings of HQA may increase to meet future margin calls.

[6] The study reports a range of €0.7–1.7 trillion for an initial margin exemption threshold between €50 million and zero, assuming that netting, hedging and diversification benefits across asset classes are not recognised. The second consultative document BCBS-IOSCO (2013) recommends the exemption threshold to be €50 million, so that the lower end of the range would be the relevant estimate of the initial margin requirements for non-centrally cleared trades.

participants time to adjust their business models so as to reduce their collateral needs.

Liquidity regulation

The LCR seeks to strengthen banks' resilience to severe liquidity shocks. Specifically, it will require banks to hold an amount of HQLA equal to or greater than their net cash outflow over a 30-day period (BCBS (2013)). Assessing the impact of the LCR based on end-2011 data (BCBS (2012)), the BCBS estimates that banks would face an aggregate shortfall of €1.8 trillion (about 3% of the banks' total assets). Notably, the study neither includes all banks affected by the LCR nor does it account for banks holding excess HQLA as an additional liquidity buffer.

Nevertheless, actual HQLA shortfalls are likely to be significantly lower than the 2011 estimate for a variety of reasons. Most importantly, the study provides a static assessment of banks' HQLA demand and cannot account for the likely adjustment in banks' balance sheets, funding patterns and lending behaviour to mitigate any shortfalls. In addition, current estimates are based on the 2010 formulation of the LCR and do not reflect the revisions to the LCR definition, as announced in January 2013, that will further reduce additional HQLA demand.

Capital requirements

Changes to capital requirements to be introduced under Basel III and Solvency II will raise demand for both HQA and some debt instruments that are secured by collateral assets (such as covered bonds). Yet, as issuer incentives will also change, only qualitative observations on the overall impact on net HQA demand are possible at this stage (see separate section on HQA supply below).

One example is the lower capital requirement that will apply to exposures from repo transactions under Basel III – especially those secured by HQA – as compared to those from unsecured money market transactions. While this is likely to raise demand for repo funding and, hence, for HQA as collateral, this increase may be counterbalanced by incentives to raise the supply of specific types of secured debt. Specifically, both Basel III and Solvency II apply lower capital charges for covered bonds than for other bank debt. This could induce insurance companies, typically large investors in such instruments, to shift demand from unsecured bank debt to covered bonds, leading banks to adjust their issuance patterns accordingly.

Changes in the supply of high-quality assets

The discussion so far suggests that, even though estimates are subject to considerable uncertainty, various reform initiatives – including liquidity regulation and derivatives reforms – may increase the structural demand for HQA and other collateral assets by about €3.1 trillion ($4 trillion), spread out over the next several years.[7] Other, more cyclical factors are also important.

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[7] Of these, as detailed above, some €1.8 trillion are due to the implementation of the LCR, while reforms in derivatives markets that seek to raise the amount of centrally cleared transactions and broaden margining practices for bilaterally cleared ones are expected to add another €0.6 trillion and €0.7 trillion, respectively, to the demand for HQA

Will these changes be met by increasing supply? The supply of HQA to the financial system is to some extent exogenous, ie largely independent of any developments on the demand side. For example, when driven by the financing needs of governments or non-financial corporates and changes in their creditworthiness. But, as mentioned above, it is important to recognise the ability of the financial sector to adjust to signs of collateral scarcity: by increasing either the stock of eligible (or potentially eligible) collateral assets, or by raising what is sometimes termed the velocity of collateral (IMF (2012)), ie intensifying the utilisation of the existing stock of collateral assets via collateral reuse and securities lending. Both sets of factors will be assessed in more detail below.

Independent supply factors

Sovereign issuers, including central banks and entities issuing instruments supported by government guarantees, are the dominant suppliers of HQA in most jurisdictions. Private debt issued by highly rated non-financial corporates can add to the supply of HQA in the financial system. The contribution to HQA supply from each of these sources has a strong cyclical component, with the usual expansion of public debt issuance countervailing the typical decline in private – and sometimes also public – sector creditworthiness during economic downturns.

Accordingly, several measures suggest that, despite the observed slippage in issuer quality, the supply of publicly issued HQA has risen significantly in recent years. The market capitalisation of benchmark indices, for example, implies an increase in the outstanding amounts of AAA- and AA-rated government bonds by $10.8 trillion between 2007 and 2012 (CGFS (2013)). Yet benchmark indices only include the more liquid and actively traded securities and are thus a better approximation of changes in HQLA than of the overall HQA volume outstanding.

For comparison, central government debt securities data for major advanced economies suggest an increase of $15 trillion (Graph 1, left-hand panel). Data gathered in CGFS (2013) for the major currencies, including high-quality private debt, indicate an aggregate supply of HQLA of $48 trillion, and $53 trillion under the broader HQA definition (Graph 1, centre panel). These estimates come on top of aggregate cash balances and any liquid claims on central banks.

Whether or not an asset qualifies as HQA depends on the use market participants can make of it (see Box). Domestic public debt, for example, is likely to be considered as HQA for domestic regulatory uses, even if the credit quality of the sovereign issuer deteriorates. Foreign investors, however, would likely consider these issues as HQA only up to a certain issuer credit risk level and to the extent that they can be used to collateralise financial transactions (eg are eligible collateral with CCPs or accepted by counterparties in non-centrally cleared derivative transactions). These considerations constrain the ability of the public sector to provide HQA from an international perspective.

Market-driven supply factors

Adjustment mechanisms

Imbalances in supply and demand for collateral assets, at both the aggregate and market levels, will trigger adjustments in the effective supply of these assets that will tend to alleviate potential shortages. One such mechanism is adjustments to

eligibility requirements in private transactions, which broaden effective collateral supply for a given volume of transactions. In addition, banks and other financial institutions are able to create HQA through the pooling of balance sheet assets and overcollateralising them. The issuance of covered bonds, as mentioned above, uses this mechanism. Banks may also securitise assets to create HQA that are then shifted off the balance sheet. Here, the pooled assets are usually tranched into high- and low-quality assets and may benefit from external credit enhancement.

Changes in investor risk perceptions can, however, hamper the efforts of financial market participants to increase the effective HQA supply in these ways. One example is the collapse of global securitisation markets from 2007, when the valuation of complex collateral pools was increasingly called into question. This continues to hinder banks from creating HQA by issuing asset- and mortgage-backed securities (excluding those with public sector support). Covered bond issuance, by contrast, has remained an important funding source for European banks, adding to the supply of HQA at the system level. Public sector enhancement of bank bonds via government guarantees, in turn, has been a complementary source of HQA in times of stressed financial conditions (Graph 1, right-hand panel).

Another mechanism that enhances supply is the more effective utilisation of available HQA by raising collateral velocity. For example, effective collateral supply can be increased by rehypothecation of collateral assets posted, or of assets held in the custody accounts of prime brokers. Securities lending and similar transactions can be used in a similar fashion. Even a modest increase in securities lending by holders of large investment portfolios – FX reserve managers and institutional investors – would contribute to a significant increase in HQA availability for market transactions. This, however, would require these investors to overcome any existing operational constraints on such activities.

Assessing the scarcity of collateral assets

The above discussion highlights the mechanisms through which shortages of collateral assets can be addressed: increasing the stock of eligible assets (eg broadening the pool and issuance of eligible collateral) and raising collateral velocity (eg more efficient collateral management; creating incentives for securities lending and similar activities). As these mechanisms allow an effective increase in the net supply of collateral assets, a generalised and persistent scarcity of these assets is unlikely to occur. Given the uneven distribution of collateral assets, however, localised and temporary supply-demand imbalances are possible.

One way to assess the strength of these imbalances (and of related incentives for market-based responses) is to move beyond volume considerations and look for price indicators of collateral scarcity. A key such indicator is the spread between the sovereign general collateral (GC) term repo rate and the corresponding overnight index swap (OIS) rate, a close proxy for the risk-free rate. It reflects market conditions in collateralised funding markets, where one participant makes funds available and accepts collateral in return. The other participant borrows the funds and can use them to finance the securities provided as collateral. A net increase in the demand for HQA then results in the collateral asset becoming more valuable, with a corresponding fall in the interest rate on the secured transaction. As a result, declining or negative GC-OIS spreads usually indicate that cash investors prefer to obtain high-quality collateral (high demand for HQA) to secure their loans even if this translates into lower returns.

Collateral repo spreads and transformation transactions

Graph 2

One-month general collateral repo spreads

bp

- United States[1]
- Japan[1]
- United Kingdom[1]
- Germany[2]
- France[2]

Collateral transformation transactions

Percentage of respondents

Dealers · Hedge funds · Trading REITs · Mutual funds and ETFs · Pension plans and endowments · Insurance companies

Providing HQA:
- Current activity
- Discussion of prospective transactions

Sourcing of HQA:
- Current activity
- Discussion of prospective transactions

[1] One-month GC repo rate minus one-month OIS rate. [2] One-month GC repo rate minus one-month EONIA rate.

Sources: Bloomberg; Federal Reserve; authors' calculations.

Recent data illustrate this point. GC–OIS spreads have been relatively tight in the past few years for major economies outside the euro area (Graph 2, left-hand panel). This is consistent with the absence of an increase in the net aggregate demand for HQA in these jurisdictions. In contrast, spreads for GC repos backed by German and French government bonds became significantly more negative from the second half of 2011, consistent with a relative shortage of securities issued by highly rated sovereigns in the euro area during the acute periods of the European sovereign debt crisis.

Qualitative indicators, based on a survey of US senior credit officers (Board of Governors of the Federal Reserve System (2012)), tell a similar story. According to dealers surveyed in late 2012, the volume of collateral transformation transactions, which are used by certain market participants to obtain higher-quality collateral in exchange for assets of lesser quality or liquidity (see Graph 3 for an illustration), had remained broadly unchanged in net terms from the beginning of 2012 – both for transactions that source and provide HQA. At the same time, despite the relative lack of current activity, up to two thirds of respondents reported frequent or at least some discussions with clients about prospective transactions (Graph 2, right-hand panel). Of the different client types, hedge funds and insurance companies were seen as more likely to be engaged in discussions about sourcing collateral, whereas interest across other client types was more balanced.

Overall, neither price nor quantity indicators currently indicate any signs of a broad-based collateral shortage at the aggregate level. Moreover, known supply-demand dynamics in collateral asset markets argue against expectations of any future lasting, aggregate shortages of collateral assets to meet increased demand from regulatory initiatives or other factors. Nevertheless, there are good reasons to believe that the increased collateralisation of financial transactions and endogenous

responses to temporary supply-demand imbalances in collateral asset markets will have effects that can be quite transformational for financial markets. These issues will be examined in the next section.

Implications for markets and policy

Market perspective

Regulatory reforms address a number of important financial stability concerns. Reforms in OTC derivatives markets, for example, are designed to mitigate risks from counterparty credit exposures, while liquidity regulation and capital requirements aim to improve the resilience of banks and bank funding. These measures, as suggested above, will structurally increase the demand for HQA. Yet higher demand will, in turn, provide for market responses that could increase financial system interconnectedness, opacity and procyclicality.

### Interconnectedness and opacity in markets

Higher HQA demand will tend to make these assets more expensive, incentivising market participants to increase their supply via repo transactions, securities lending and collateral transformation services. While these activities will ease any supply-demand imbalances and support market liquidity, they will also make the financial system more interconnected, establishing or reinforcing interdependencies between financial infrastructures, institutional investors and banks.

For example, subject to operational and regulatory constraints, pension funds and insurers may lend out their HQA holdings to financial institutions that need to post collateral at a CCP. Custodians, in turn, have incentives to lift their revenues by helping insurance companies and other financial institutions to more actively manage those parts of their HQA holdings that are currently idle.[8] This would add new links and counterparty exposures across different parts of the financial system and may raise concentration levels (eg as a result of increased reliance on a small number of service providers). Without appropriate disclosure, it would also increase financial system opacity, particularly if collateral were increasingly sourced from or moved to entities outside the regulated financial sector (eg shadow banks; see IMF (2012)).

Procyclicality and "fair weather" effects

Another implication is increased procyclicality, combined with higher funding and rollover risks. During economic downturns, the effects of the economic cycle on bank leverage and credit supply can be amplified when the market value of collateral assets in financial transactions moves procyclically. This is because falling asset values, combined with higher haircuts, require more assets to be pledged to raise, say, a given level of repo funding or to meet initial margin requirements on derivatives exposures (CGFS (2010)). Once started, such a process can feed on itself, with falls in market prices and/or rising haircuts triggering calls for additional

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[8]   A recent study (Accenture-Clearstream (2011)) estimates that idle collateral assets on financial institutions' balance sheets generate carrying costs and inefficiencies worth €4 billion annually.
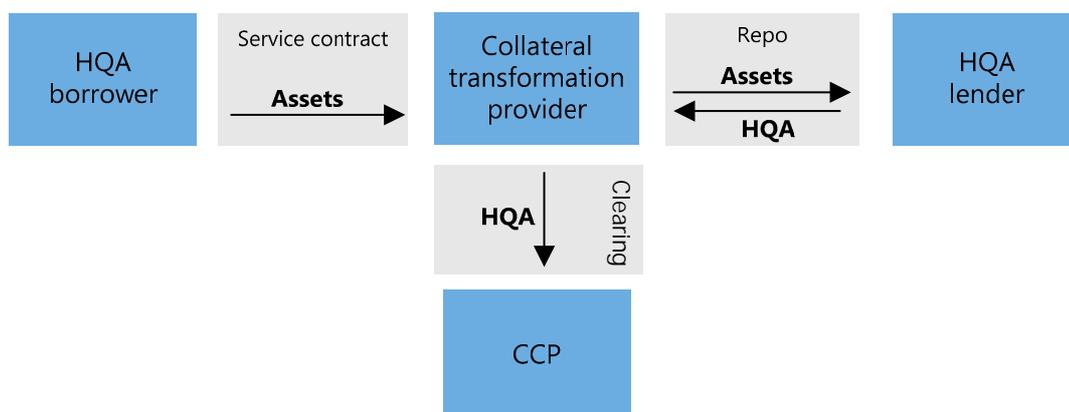
collateral assets that may then turn into asset liquidations to obtain the necessary collateral.[9]

Current developments would add to these effects primarily through broader eligibility requirements as well as through collateral transformation and similar activities. Even though the margin requirements introduced by OTC derivatives reforms will need to be met by HQA for which market valuations should, in principle, prove relatively resilient, broader eligibility for other uses and rising reliance on collateral transformation transactions would contribute to greater financial system procyclicality by adding poorer quality assets to the collateral chain. An illustrative example is shown in Graph 3, in which the borrower exchanges poorer quality assets for HQA to meet the margin requirements of a centrally cleared derivatives transaction. The collateral transformation provider, in turn, sources the HQA (eg cash) from the repo market, lending out the borrower's assets. To simplify the example, the provider also acts as the borrower's clearing member, posting the HQA as margin with the CCP.

This setup brings about a number of potential stability implications. For one, HQA lending institutions could find their claims collateralised by assets that may prove to be illiquid, and more difficult to value during stressed market conditions than implied by lenders' risk management frameworks. Repo fails could then prompt fire sales of these assets, adding to the pressure on asset valuations and prompting HQA lenders to exit such activities. The result could be pronounced "fair weather" effects in collateral markets, with sudden withdrawals of HQA supply during times of stress that would prevent borrowers from meeting their CCP margin requirements. In this case, risks would quickly propagate through the financial system.

[9] Studies of developments in US repo markets during the financial crisis provide some detail on the mechanisms at play. Haircuts were little changed for public and public-guaranteed securities – perceived as safe assets in times of crisis – containing the contraction of those parts of the repo market for which these securities represented the majority of collateral assets (Krishnamurthy et al (2012)). Haircuts, by contrast, rose significantly for collateral assets that had suffered sizeable valuation losses (eg private-label securitisations) adding to funding pressures for banks reliant on the US interdealer repo market (see, for example, Gorton and Metrick (2010)).

Increased maturity transformation represents another source of risk that will tend to become particularly acute in stressed environments. Borrowers seeking HQA to collateralise derivative transactions with long-term maturities will be exposed to rollover risk, given that collateral transformation transactions will tend to be short-term, reflecting limited liquidity (higher costs) at longer maturities in the underlying repo market.[10] Collateral transformation providers acting as clearing members, in turn, may need to advance HQA on CCP margin calls, leaving them exposed to the HQA borrowers' counterparty risks.

Policy perspective

The above discussion suggests that policy responses to current developments in collateral asset markets should focus primarily on measures that can help address system interconnectedness, opacity and procyclicality. In addition to broader efforts supporting the creditworthiness of both the public and private sectors to increase the supply (eg through a broader and more stable issuer universe) and reduce the demand for collateral assets (eg through reduced reliance on collateralised funding), three policy areas will be particularly important: transparency and system monitoring, prudential safeguards, and liquidity backstops.

Enhancing transparency and system monitoring

Market discipline is the first priority. Changing regulatory environments and business practices always invite financial innovation, and market responses to signs of supply-demand imbalances in HQA markets will be no different. Many of the markets that will be key to such responses remain in their infancy, but their growth potential is large (Graph 2, right-hand panel). This suggests a need for policy to ensure that developments and risk management practices in these markets are closely monitored and that market discipline is enhanced as much as possible.

A key requirement for effective market discipline is appropriate disclosure. One basic issue in this context is the benchmarking of how markets are evolving to give market participants a sense of the scale of the associated risks. For example, while broad information on the wider repo and securities lending markets is available from industry surveys and existing statistical data sets, these are often not detailed enough to capture different market segments. This lends support for more granular and flexible data collections aimed at gauging market developments over time. More detailed disclosures at the individual institution level, as currently being promoted by the Financial Stability Board (FSB) in other areas, could also be helpful (see, for example, Enhanced Disclosure Task Force (2012)).

At the same time, a distinction must be made between the information that financial institutions have to report to their supervisors and information that they disclose to the public. Currently, supervisory reporting schemes do not necessarily contain sufficient detail regarding financial institutions' collateral management and collateral transformation activities. Existing risk management frameworks may struggle to cope adequately with these new activities. Supervisors may thus need to require the regular reporting of detailed information on the nature and scope of any collateral transformation activities and how these affect the risk profile of

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[10]   While broadening the collateral eligibility criteria at CCPs to accept poorer-quality assets could reduce the risks associated with collateral transformation, this would shift credit and liquidity risks directly to the CCP and not address procyclicality effects.

supervised entities (eg via any effects on asset encumbrance levels).[11] In addition, given concerns over additional funding and operational risks and their amplification in times of stress, supervisors need to ensure that risk management and operational procedures are designed to withstand periods of stress without negative knock-on effects. This is best done through stress tests aimed at overcollateralisation levels, haircuts and other parameter settings which lessen the risk that additional assets will be liquidated in times of stress.

Building prudential safeguards

Key to any policy response to developments in collateral asset markets is that market responses to supply-demand imbalances can play out safely and efficiently. One such response is enhanced disclosure and stress testing, as discussed above. Another response is a more direct effort to create robust market practices, such as harmonisation measures and the establishment of market standards.

Standardisation or harmonisation of the collateral used in secured funding transactions can promote liquidity within the relevant asset markets. One example is the standardisation of Danish mortgage bonds, which is often credited with having supported the development of liquid and transparent markets for such bonds, aiding market functioning and the reliability of secured mortgages as a funding tool in times of stress (Dick-Nielsen et al (2012)). With this in mind, authorities may wish to consider working with market participants to harmonise collateral standards in market transactions. This would help stabilise bank funding as well as alleviate possible future shortages of collateral assets.[12]

A related approach is the promotion of best practice in securities financing markets and for shadow banking activities more generally (FSB (2013)). This includes ongoing work to strengthen collateral valuation practices and implement through-the-cycle or minimum haircuts to reduce system procyclicality (CGFS (2010) and BCBS–IOSCO (2013)).[13]

Provision of liquidity backstops

Liquidity backstops are a means of providing liquidity transformation in situations of severe collateral shortage. In contrast to other market participants, the central bank can provide liquidity in its own currency at all times. It is thus uniquely positioned to absorb liquidity shocks, such as those caused by a severe shortage of HQLA, but is also ultimately reliant on other central banks if the shortage concerns foreign currency collateral.

Central banks have provided liquidity backstops throughout the financial crisis. In some cases, this has been within their regular operational frameworks, as banks have tapped central bank funding using assets they could no longer place in stressed markets, as witnessed by the increase in so-called retained issues in the euro area during the financial crisis (Graph 1, right-hand panel). In other cases,

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[11]   For more detail on policy issues raised by rising asset encumbrance levels, see CGFS (2013).

[12]   Some harmonisation efforts are already under way. In Europe, for example, these include the covered bond label initiative and the prime collateralised securities initiative.

[13]   Central banks, working with other standard setters as well as the private sector, have a particular role to play in this context. Given their own involvement in collateral asset markets, they can be instrumental in developing best practice standards for collateralised funding, including disclosure requirements, and helping to implement them through their operational procedures.

central banks responded to signs of collateral shortage by broadening the eligibility criteria of their lending facilities to ease banks' access to central bank liquidity. Among these measures, expanding the range of eligible foreign currency-denominated (cross-border) assets, as some central banks have done, could be particularly helpful in facilitating the flow of collateral in private markets.

One question is whether the crisis experience suggests a more active and permanent role for central banks in addressing real or perceived HQLA shortages. Yet, the balance of the associated costs and benefits is less than clear. One issue is that the acceptance of less liquid assets may expose the central bank to increased credit risk. Another issue is adverse selection and moral hazard. Despite the conservative rates that tend to apply to their operations, central banks adopting a more active role in providing liquidity transformation could be left with less liquid and harder-to-value assets that banks would avoid pledging in private markets. Thus, banks might be encouraged to become complacent in managing their liquidity needs.

These issues imply that structural adjustments to central banks' operations will not be the first choice when addressing the risks associated with any collateral shortages, underscoring the importance of transparency and prudential safeguards as the main lines of defence. An exception may be the approach based on committed liquidity facilities (CLFs) taken by Australia in the context of Basel III liquidity requirements. Given its reliance on up-front fees, it is consistent with the goals of liquidity regulation, while having the potential to serve as a safety valve for situations in which scarcity of HQLA turns out to be more of a problem than currently expected (Stein (2013)).

Conclusion

Ongoing regulatory reforms, such as increased liquidity buffers and strengthened margining requirements in OTC derivatives markets, are designed to enhance the safety and robustness of the financial system. Attaining the full benefits of these policy initiatives, however, will require their cumulative effects on the financial system to be monitored, including the impact on the markets for collateral assets, where current reforms will contribute to a structural shift in demand.

While this additional structural demand will be sizeable, as argued above, there is no evidence of any lasting current or prospective scarcity of collateral assets at the financial system level. Both price and volume indicators suggest that, over time, supplies will adjust to meet expected increases in collateral asset demand. The distribution of collateral assets, however, matters in that supply-demand imbalances and associated price changes will generate powerful incentives for endogenous private sector responses. While these will help mitigate any shortage of collateral assets, they could also turn out to be quite transformational from a financial system perspective.

Private sector responses to rising collateral demand will occur through a variety of channels. These include the pooling and securitisation of assets, changes to collateral eligibility in private transactions, collateral optimisation, and collateral re-use and transformation. While the mechanics of these responses differ considerably, they are all likely to come at the cost of increased interconnectedness, procyclicality and financial system opacity as well as higher operational, funding and rollover

risks. In addition to efforts supporting the creditworthiness of both the public and private sectors (which would increase the supply of collateral assets and reduce demand for them), policy responses should focus primarily on monitoring and stress testing these endogenous market adjustments and on designing measures that lessen any adverse implications for market functioning and financial stability.

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Database for policy actions on housing markets[1]

A new database for policy actions on housing markets covers 60 economies worldwide from January 1990 (or earliest date available) to June 2012. Policy actions are summarised by type, region, timing and direction. We suggest how the database might help policymakers and researchers to review what types of policy action were taken in other economies and to assess their effectiveness.

JEL classification: E50, G28.

Housing markets have fomented a lengthy catalogue of financial crises in advanced and emerging economies alike. Seeking to moderate the frequency and severity of booms and busts in housing credit and house prices, monetary and prudential authorities around the world have applied various types of policy measures that influence primarily housing markets or the provision of housing credit.

In this special feature, we present a database for such policy actions that covers 60 economies worldwide from January 1990 (or the earliest available date) to June 2012. We first describe how we drew on the official publications of central banks and financial authorities to select and consistently document policy actions. The database covers a wider range of countries and measures, as well as a longer time span, than any previously available reference source. We also provide some stylised facts on what type of measures were used, in which countries and regions, and on how these policies have evolved over time.

The database will be useful to both policymakers and researchers. It may help policymakers review what types of policy action were used by authorities worldwide when seeking to influence housing credit and house prices. It will also support researchers who wish to assess the effectiveness of policy actions that influence primarily housing markets. For example, Kuttner and Shim (2013) use these data, together with changes in policy rates and fiscal policy measures, to analyse the effects of monetary, prudential and fiscal policy measures on housing credit and house prices in 57 economies.

About the database

We collected information on various types of policy action affecting housing markets. The resulting database covers the central banks and financial authorities of 60 economies. Our sample includes 13 economies in Asia-Pacific, 15 in central and eastern Europe, seven in Latin America, four in the Middle East and Africa, two in North America and 19 in western Europe. The monthly data span the period from January 1990 to June 2012.[2] Table 1 provides further details of the database's coverage. We focus on monetary policy measures (excluding policy rate changes) and prudential measures affecting housing credit or house prices.

Instead of relying on an ad hoc questionnaire in compiling our data set, we referred to the official publications and press releases of central banks and financial authorities of 60 economies.[3] We also made reference to the lists of policy actions in the following secondary sources, but such measures are included from these sources only when they could be verified from official data:

- Borio and Shim (2007), who record that 18 economies applied non-interest rate monetary policy and macroprudential measures affecting housing credit and prices;

- Crowe et al (2011), who record that 24 economies experiencing real estate booms took some action;

- Hilbers et al (2005), who show that 10 central and eastern European countries that experienced rapid growth of private sector credit took some policy measures in or before 2005;

- Lim et al (2011), who, reporting the results of an IMF survey, list macroprudential measures taken by 40 economies; and

- Tovar et al (2012), who describe measures taken by Bolivia, Brazil, Colombia, Peru and Uruguay to slow down credit growth.

Key selection criteria

Among policy actions that directly or indirectly affect housing market-related activities, we focus on those that have been frequently used to significantly influence housing credit and house prices. In particular, we collect information on prudential measures that directly influence housing credit, and on monetary policy measures that influence house prices indirectly via the availability of housing loans.

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[2]   The actual starting year varies between 1990 and 2003, depending on the economy.

[3]   There are clear benefits and drawbacks to this approach. In terms of benefits, our approach should in principle provide a complete list of all relevant policy actions officially published by central banks and financial authorities, while an ex post survey could suffer from incomplete identification of relevant policy actions. Moreover, by reading through official publications, we can obtain full and accurate information on potentially relevant policy actions. These details allow us to use consistent criteria when determining which measures to include and how to record them consistently. Another benefit of relying on official publications is accurate identification of the implementation date of each policy action. One disadvantage of using official sources is the language barrier for some countries, given that English translations for such documents may be unavailable for earlier periods. Also, for a limited number of countries, archives available on the websites of relevant authorities or offline publication archives available from the BIS library may have one or two missing years. Therefore, we may have omitted relevant policy actions taken in these missing years.

Database coverage
Table 1

Asia-Pacific [13]	Australia (1996;1998)	China (1998;1998)	Hong Kong SAR (1990;1991)	India (1998;1999)	Indonesia (2003;2008)
	Japan (1999;1990)	Korea (2002;1990)	Malaysia (1990;1990)	New Zealand (1990;2010)	Philippines (1990;1990)
	Singapore (1996;1996)	Thailand (1999;1999)	Chinese Taipei (2006;2000)		
Central and eastern Europe [15]	Bulgaria (1990;1990)	Croatia (1997;1998)	Czech Republic (1995;1990)	Estonia (1993;1997)	Hungary (2000;2000)
	Latvia (1992;2000)	Lithuania (1994;2000)	Poland (1997;2002)	Romania (1998;1998)	Russia (1998;1992)
	Serbia (1999;2002)	Slovakia (1993;1995)	Slovenia (1996;2000)	Turkey (1996;2002)	Ukraine (2001;2001)
Latin America [7]	Argentina (2000;2002)	Brazil (1997;1994)	Chile (1991;1991)	Colombia (1992;1999)	Mexico (1999;2011)
	Peru (2000;2000)	Uruguay (2001;2001)			
Middle East and Africa [4]	Israel (1999;1998)	Saudi Arabia (1998;2007)	South Africa (2001;1998)	United Arab Emirates (2001;2011)	
North America [2]	Canada (1990;1992)	United States (1990;1990)			
Western Europe [19]	Austria (1998;1999)	Belgium (1997;2000)	Denmark (2003;2002)	Finland (1997;1990)	France (1997;1990)
	Germany (1990;1993)	Greece (1998;1999)	Iceland (1997;1999)	Ireland (1999;1991)	Italy (1990;1993)
	Luxembourg (1999;1997)	Malta (1998;1990)	Netherlands (1998;1995)	Norway (1998;1991)	Portugal (1996;1991)
	Spain (1998;1999)	Sweden (1997;1991)	Switzerland (1990;2005)	United Kingdom (1990;1991)	

The first year listed in brackets for each economy shows the earliest year for which official source materials from central banks and financial authorities were reviewed in order to identify relevant measures. The second year listed in brackets shows the year that a relevant policy action is first recorded in the database for each economy. The figures in square brackets indicate the number of economies in each region.

Sources: National sources; authors' calculations.

When we note a relevant policy measure, we do not consider the policymaker's intention or objectives as stated in the official record: what matters is the fact that the measure was taken. For instance, we include a measure in our data set even if a central bank changed, say, its reserve requirements for reasons other than the state of the housing market. The omission of measures with other aims that nevertheless did affect the housing market could bias any quantitative studies assessing their effectiveness.[4] Also, our database contains prudential measures taken from both microprudential and macroprudential perspectives.

[4] That said, the announcement of an intended policy action may have some informational content. For example, when a regulator announces that cooling down a housing boom is one of its policy objectives, this statement may have a signalling effect. If clearly stated, a policy objective may indicate the possibility that the authorities will take additional action until the desired effect is achieved.

We include only policy actions that fall into one of the categories we chose ex ante and describe below. So, for example, we do not include policy measures such as raising risk weights on foreign exchange exposures or strengthening the requirements for assessing the financial situation of borrowers with weak or incomplete credit information. We also exclude recommendations or non-binding guidelines without legal force, as well as statements by authorities that warn of housing price misalignments or foreshadow possible policy actions.

Monetary policy measures

Among monetary policy measures, we consider (i) reserve requirements; (ii) credit growth limits; and (iii) liquidity requirements. All of these directly affect the amount of funds available for lending to the private sector including potential homebuyers. Changes in policy rates and asset purchase programmes aimed at lowering long-term interest rates or mortgage rates are not included in the database because we are interested in the impact of administrative measures, and because policy rates and asset purchase programmes are already well documented.

Reserve requirements (RR)

With reserve requirements, banks are required to hold at least a fraction of their liabilities as liquid reserves. These are normally held either as reserve deposits at the central bank or as vault cash. Regulations generally specify the size of required reserves according to the type of deposit (eg demand, savings or time deposits), their currency of denomination (domestic or foreign currency) and their maturity.

The database includes changes in the various forms of reserve requirements. In particular, we consider changes in the reserve requirement ratio and reserve base.[5] We also include both average reserve requirements, where a certain reserve requirement ratio applies to all outstanding eligible liabilities, and marginal reserve requirements, which impose additional reserve requirements that are usually very high on any additional liabilities that banks have assumed after a certain cut-off date or that exceed a specified limit. Finally, we consider reserve requirements on both domestic and foreign currency liabilities.

Limits on credit growth (Credit)

When an economy experiences rapid credit growth, the central bank may impose a quantitative ceiling on the rate of credit growth per month or year, or a maximum per-month or per-quarter increase in lending. Such limits to credit growth include actions that specify a quantitative limit on the rate of credit growth and penalties for exceeding this limit.

Liquidity requirements (Liq)

Liquidity requirements typically take the form of a minimum ratio for highly liquid assets, such as government securities and central bank paper, vis-à-vis certain types of liability. These are prudential regulations with the purpose of ensuring that banks can withstand severe cash outflows under stress. However, liquidity requirements act in a similar way to reserve requirements in that they influence the amount of

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[5]   We do not include changes in the remuneration rates, reserve maintenance periods or averaging methods because our focus is on policy actions that directly affect the aggregate quantity of funds available for lending. However, it should be noted that this distinction is not clear-cut, given that reserve requirements also operate by influencing the cost of lending.

funds available for lending to the private sector. In this article, we classify liquidity requirements as a part of monetary policy action.

Prudential measures

Financial authorities use various prudential measures to steer the provision of housing credit. We focus on five specific types: (i) the maximum loan-to-value ratio; (ii) the maximum debt-service-to-income ratio; (iii) risk weights on housing loans; (iv) loan loss provisioning applied to housing loans; and (v) limits on banks' exposure to the housing sector.

Maximum loan-to-value ratio and loan prohibition (LTV)

Financial authorities impose a maximum loan-to-value (LTV) ratio or lower an existing one in order to slow down housing loan growth and build up buffers within banks against potential losses from housing loans. The authorities may also choose to prohibit certain types of housing loan, which is equivalent to applying a zero LTV ratio. For example, when China's housing markets were overheating in 2012, the authorities prohibited banks from making loans on second or third houses, and prevented banks from lending to foreigners and non-residents for the purpose of house purchases. We include only nationwide restrictions; in cases where these measures apply only to individual cities, we consider them nationwide if restrictions on lending are imposed in several cities across the country.

Maximum debt-service-to-income ratio and other lending criteria (DSTI)

Another policy that is frequently used to curb the provision of housing credit is to restrict the debt-service-to-income (DSTI) ratio (or debt service ratio) applied to borrowers for house purchases. Typically, financial authorities specify a certain percentage of the borrower's monthly income as the maximum amount of monthly repayments on a home loan. Less frequently, limits on the loan amount are expressed as a multiple of household income (ie maximum debt-to-income ratio) or as a minimum debt-service-to-debt ratio. In addition, when financial authorities shorten the maximum maturity of mortgage contracts or eliminate preferential interest rates for mortgage loans, mortgage borrowers find that their debt repayments increase, which induces them to borrow less. This type of measure is categorised under "other lending criteria".

Risk weights on housing loans (RW)

Under Basels I, II and III, housing loans are subject to risk weights that differ from those applied to corporate or sovereign exposures. Raising the risk weight on housing loans makes it more costly for banks to extend them and, at the same time, banks are induced to build up buffers against potential losses. Often, risk weights are differentiated by the actual LTV ratio for individual loans. For example, the portion of a housing loan's LTV ratio that exceeds a certain threshold (eg 80%) may carry a higher risk weight.

Loan loss provisioning applied to housing loans (Prov)

Similar in effect to risk weights, general and specific loan loss provisions can be increased for housing loans to make them more costly, thus putting a brake on

housing credit growth.[6]

Limits on banks' exposure to the housing sector (Expo)

Limits on banks' exposure to the housing sector will slow housing credit growth and reduce the losses from housing loans should house prices fall. Sometimes, such limits are set as a percentage of a bank's equity. Included in the database are limits on foreign currency lending to unhedged borrowers as a percentage of the bank's equity, since they target the risks stemming from foreign currency-denominated housing loans to households whose income is mainly in local currency.

Documentation of policy actions

Using the selection criteria outlined in the previous subsection, we collected relevant information from official national sources. Each policy action has dates for its announcement and implementation, which are quite often different. The timing of a policy action is based on the implementation date, not the announcement date: we believe this is a more meaningful way of timing a policy action, given that official sources may not disclose its exact announcement date. That said, the announcement date can sometimes be more important than the implementation date because many actions depend on the steering of expectations rather than on current conditions in the housing and mortgage markets. Some, but not all, policy actions recorded in the database also contain the announcement date.

The database aims for easy-to-read and consistent documentation of relevant policy actions taken in different economies. In particular, text entries in the database are organised in the following format: when, why, who introduced what measures, changed a measure from where to where, or rescinded (or reversed) a measure introduced earlier. The web appendix[7] for this article contains a table showing what measures were taken by the authorities of an economy in a given month. Table 2 shows an excerpt from the appendix table.

Among the entries in the appendix table, those in blue cells are relevant actions that we identify as tightening measures and those in yellow cells are the ones identified as loosening measures. The entries in white cells refer to actions for which we do not have enough information to decide whether they tightened or loosened borrowing conditions.[8] These measures are documented in the appendix table, but they are not counted in the next section when we summarise stylised facts on policy actions.

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[6] We do not include policy actions that raise provisioning ratios on bad loans since these actions build up buffers inside banks against losses incurred on bad lending and hence do not affect the supply of new loans.

[7] www.bis.org/publ/qtrpdf/r_qt1309i_appendix.xls.

[8] In particular, when two or more measures of the same type with opposite effects, such as a tightening of reserve requirements and a loosening of reserve requirements, were introduced at the same time, the overall effect is sometimes ambiguous. Also for some countries, we know that the operational framework for a type of policy action, such as reserve requirements, changed to a new framework in a given month. However, we were able to obtain detailed information only on the new framework. In this case, it is unclear whether the change had tightening or loosening effects.

Excerpt from the appendix table

Table 2

	China
June 2006	On 1 June 2006, the authorities reduced the maximum LTV ratio applied to housing loans extended by commercial banks from 80% to 70%, while the ratio remained at 80% for housing loans to owner-occupiers with a property size below 90 square metres.
July 2006	On 5 July 2006, the central bank raised the reserve requirement ratio by 0.5 percentage points, from 7.5% to 8% for state-owned commercial banks and joint-stock commercial banks, and from 8% to 8.5% for urban credit cooperatives and financial institutions with capital adequacy ratios below a certain level.
August 2006	On 15 August 2006, the central bank raised the reserve requirement ratio by 0.5 percentage points to 8.5% (and to 9%, respectively).
September 2006	
October 2006	
November 2006	On 15 November 2006, the central bank raised the reserve requirement ratio by 0.5 percentage points to 9% (and to 9.5%, respectively).
December 2006	
January 2007	On 15 January 2007, the central bank raised the reserve requirement ratio by 0.5 percentage points to 9.5% (and to 10%, respectively).
February 2007	On 25 February 2007, the central bank raised the reserve requirement ratio by 0.5 percentage points to 10% (and to 10.5%, respectively).
March 2007	
April 2007	On 16 April 2007, the central bank raised the reserve requirement ratio by 0.5 percentage points to 10.5% (and to 11%, respectively).
May 2007	On 15 May 2007, the central bank raised the reserve requirement ratio by 0.5 percentage points to 11% (and to 11.5%, respectively).
June 2007	On 5 June 2007, the central bank raised the reserve requirement ratio by 0.5 percentage points to 11.5% (and to 12%, respectively).
July 2007	
August 2007	On 15 August 2007, the central bank raised the reserve requirement ratio by 0.5 percentage points to 12% (and to 12.5%, respectively).
September 2007	On 25 September 2007, the central bank raised the reserve requirement ratio by 0.5 percentage points to 12.5% (and to 13%, respectively). On 27 September 2007, the authorities imposed a maximum LTV ratio of 60% for borrowers applying for second mortgage loans. On 27 September 2007, the authorities raised the minimum lending rate from 0.9 times to 1.1 times the benchmark lending rate of a given maturity.
October 2007	On 25 October 2007, the central bank raised the reserve requirement ratio by 0.5 percentage points to 13% (and to 13.5%, respectively).
November 2007	On 26 November 2007, the central bank raised the reserve requirement ratio by 0.5 percentage points to 13.5% (and to 14%, respectively).
December 2007	On 25 December 2007, the central bank raised the reserve requirement ratio by 1 percentage point to 14.5% (and to 15%, respectively).
January 2008	On 28 January 2008, the central bank raised the reserve requirement ratio by 0.5 percentage points to 15% (and to 15.5%, respectively).
February 2008	
March 2008	On 25 March 2008, the central bank raised the reserve requirement ratio by 0.5 percentage points to 15.5% (and to 16%, respectively).
April 2008	On 25 April 2008, the central bank raised the reserve requirement ratio by 0.5 percentage points to 16% (and to 16.5%, respectively).
May 2008	On 20 May 2008, the central bank raised the reserve requirement ratio by 0.5 percentage points to 16.5% (and to 17%, respectively).

Stylised facts

This section presents stylised facts on the policy actions documented in the database. The following subsections show how these policy actions have been used in 60 economies over the past two decades or so, first by type and region, then over time and finally by direction (that is, tightening or loosening).

Type, extent and region

In this subsection, we transform the detailed list of policy actions in the appendix table into tables that show the number of policy actions in various dimensions.[9] Table 3 shows how many policy actions were adopted in the 60 economies for each of the nine different types of measure over the past two decades or so. These amount to 836 in total.

Policy actions by type and region

Number of policy actions[1]   Table 3

Region	Asia-Pacific [13][2]	Central and eastern Europe [15]	Latin America [7]	Middle East and Africa [4]	North America [2]	Western Europe [19]	All economies [60]
RR	150 (6.5)	221 (8.5)	87 (7.9)	6 (1.1)	7 (1.6)	52 (1.4)	523 (4.9)
Credit	4 (0.2)	7 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.1)	14 (0.1)
Liq	30 (1.3)	4 (0.2)	6 (0.5)	0 (0.0)	0 (0.0)	13 (0.4)	53 (0.5)
Monetary total	184 (7.9)	232 (8.9)	93 (8.4)	6 (1.1)	7 (1.6)	68 (1.9)	590 (5.5)
LTV	56 (2.4)	11 (0.4)	2 (0.2)	0 (0.0)	4 (0.9)	21 (0.6)	94[3] (0.9)
DSTI	20 (0.9)	12 (0.5)	1 (0.1)	1 (0.2)	2 (0.4)	9 (0.2)	45[4] (0.4)
RW	14 (0.6)	19 (0.7)	5 (0.5)	3 (0.5)	0 (0.0)	9 (0.2)	50 (0.5)
Prov	16 (0.7)	10 (0.4)	6 (0.5)	1 (0.2)	0 (0.0)	4 (0.1)	37 (0.3)
Expo	11 (0.5)	8 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)	20 (0.2)
Prudential total	117 (5.0)	60 (2.3)	14 (1.3)	5 (0.9)	6 (1.3)	44 (1.2)	246 (2.3)
Total	301 (12.9)	292 (11.3)	107 (9.7)	11 (2.0)	13 (2.9)	112 (3.1)	836 (7.9)

[1] The values in brackets show the average number of policy actions per country per decade. The number of years for each country that we use for calculating the average value is the difference between June 2012 and the earlier of the two coverage years shown in Table 1. [2] The figures in square brackets indicate the number of economies in each region. [3] The sum of policy actions involving maximum loan-to-value (LTV) ratios and loan prohibitions. The number of actions involving maximum LTV ratios only is 81. [4] The sum of policy actions involving maximum debt-service-to-income (DSTI) ratios and other lending criteria. The number of actions involving maximum DSTI ratios only is 28.

Sources: National sources; authors' calculations.

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[9] In order to effectively discuss stylised facts on the use of various types of policy measure, we need to count the number of actions taken by a given jurisdiction in each month. When two actions of the same type were taken on the same date, we consider them as one single measure. On the other hand, when two actions of the same type were taken on different dates in a calendar month, we consider them as two separate measures. For example, if a maximum LTV ratio changes in a month for many different types of borrowers or regions, they are counted as one measure. However, if in the same month the authorities also prohibit certain types of housing loans on a different date, this loan prohibition measure is counted as separate from the maximum LTV measure. Finally, when a central bank raises the reserve requirement ratio on the same eligible liabilities twice on two different dates in a calendar month, these actions are counted as two different measures.

We observe 590 monetary policy actions associated with the three types of non-interest rate monetary policy measure outlined in the previous section. In particular, reserve requirements have been used most frequently among all the nine types of policy action. An important reason could be that changes in reserve requirements can be used for many purposes whereas the other measures influence primarily the housing market. In particular, reserve requirements directly influence overall liquidity in the banking system and are often used as a fine-tuning device in response to rapidly changing liquidity conditions in the market. Also, when a central bank conducts monetary policy by targeting monetary aggregates without actively using interest rate policy, reserve requirements are often used as one of the main tools for influencing the extension of bank credit. Authorities in 48 economies changed their reserve requirement ratio or reserve base at least once between January 1990 and June 2012. The other two types of monetary policy measure, liquidity requirements and credit growth limits, were used much less frequently by fewer than 10 economies for each type.

We also find 246 prudential policy actions related to the five types of prudential measure. Among the five types, financial authorities used maximum LTV ratios and loan prohibitions most frequently, in total 94 times. They also changed risk weights on housing loans 50 times, and introduced or changed maximum DSTI ratios and other lending criteria 45 times. Loan loss provisioning rules on housing loans and limits on banks' exposure to the housing sector were used less frequently than the others, 37 and 20 times, respectively.

When we examine how these policy actions have been taken by region, it is important to calculate the number of policy actions per country per year, since the number of countries varies greatly by region and also the number of years for which data are available differs across countries. We find that the 13 economies in the Asia-Pacific region were the most active users of prudential measures in terms of the average number of actions per country per decade among all six regions. By contrast, the 15 central and eastern European countries and the seven Latin American countries were the most active users of monetary policy measures.

We can also identify which economies were active users of monetary and prudential measures. In particular, the economies that have taken 10 or more monetary policy actions per decade are China, India and the Philippines in Asia-Pacific; Croatia, Romania, Russia, Serbia and Ukraine in central and eastern Europe; and Brazil, Peru and Uruguay in Latin America. Several economies in Asia-Pacific (China, Hong Kong SAR, India, Korea and Singapore), central and eastern Europe (Romania and Serbia) and western Europe (Iceland) have adopted prudential measures five or more times per decade.

Trend over time

Since we have documented policy actions implemented by each economy every month from January 1990, we can show which types of measures were actively used over the past two decades or so. Table 4 shows, for each of the nine types of measure, how many policy actions per country per decade were taken in all 60 economies in the 1990s, the 2000s and between January 2010 and June 2012. The right-hand column of Table 4 shows that the total number of policy actions per country per decade has steadily increased since the 1990s.

This increase in policy activism has been driven more by prudential than by monetary policy. The trend is clearly reflected in the relative shares of monetary and

Policy actions over time

Number of policy actions per country per decade[1]

Table 4

	Monetary				Prudential						Total
	RR	Credit	Liq	Total	LTV	DSTI	RW	Prov	Expo	Total	
1990–99	4.9	0.2	0.7	5.8	0.4	0.1	0.2	0.1	0.2	1.0	6.8
2000–09	4.6	0.1	0.4	5.2	0.8	0.5	0.6	0.5	0.2	2.6	7.8
2010–Jun 2012	6.0	0.1	0.3	6.4	2.1	0.9	0.7	0.3	0.1	4.1	10.5

[1] When we calculate the number of policy actions, we first divide the total number of policy actions taken by all economies in a decade by the sum of the number of coverage years for each economy in the decade, and then multiply the average number of actions per country per year by 10 to rescale it to the number of actions taken in a decade.

Sources: National sources; authors' calculations.

rudential measures over time. In the 1990s, the share of monetary policy actions was 85%, while that of prudential policy actions was 15%. The share of prudential policy actions more than doubled to 33% in the 2000s, and increased further to 39% between January 2010 and June 2012, led by the active deployment of LTV and DSTI measures.

What explains this shift from monetary to prudential measures over time? One reason could be that reserve requirements have lost their importance as monetary policy tools after many central banks started to adopt interest rate policy and inflation targeting as the main part of their monetary policy framework from the 1990s. Another possible reason could be that, since the 1990s, financial cycles such as housing credit and house price cycles have become longer, larger and less synchronised with business cycles and inflation cycles (see Drehmann et al (2012)). In response, policymakers in many economies have increasingly resorted to prudential measures specifically affecting the housing sector. Finally, financial authorities in many countries have shifted towards explicit macroprudential objectives after the recent financial crisis.

More specifically, we can compare how different regions have used monetary and prudential policy actions over time (Graph 1). In the Asia-Pacific region, prudential measures have gained more importance since the 1990s. In particular, after the Asian financial crisis in the late 1990s, the Asia-Pacific economies applied prudential measures more actively in the first decade of this century than previously. Especially since 2010, the region's authorities have used prudential policy almost as often as monetary policy. This contrasts with the central and eastern European and Latin American economies, which have relied much more on monetary than on prudential measures. Finally, the North American economies stopped using non-interest rate monetary policy actions from the 2000s onwards, and have relied on prudential measures instead.

Tightening or loosening

Finally, we can show whether policy actions have been used to tighten or loosen borrowing conditions. Table 5 lists the number of tightening and loosening measures for each region and type of action. We find that monetary policy moves in all economies are roughly balanced between tightening and loosening, while prudential measures are heavily tilted towards tightening. We note, however, that the relative use of tightening and loosening measures for each country is closely

Policy actions by region over time[1]

Number of policy actions per country per decade[2]

Graph 1

Asia-Pacific [13]

Central and eastern Europe [15]

Latin America [7]

Middle East and Africa [4]

North America [2]

Western Europe [19]

■ Monetary ■ Prudential
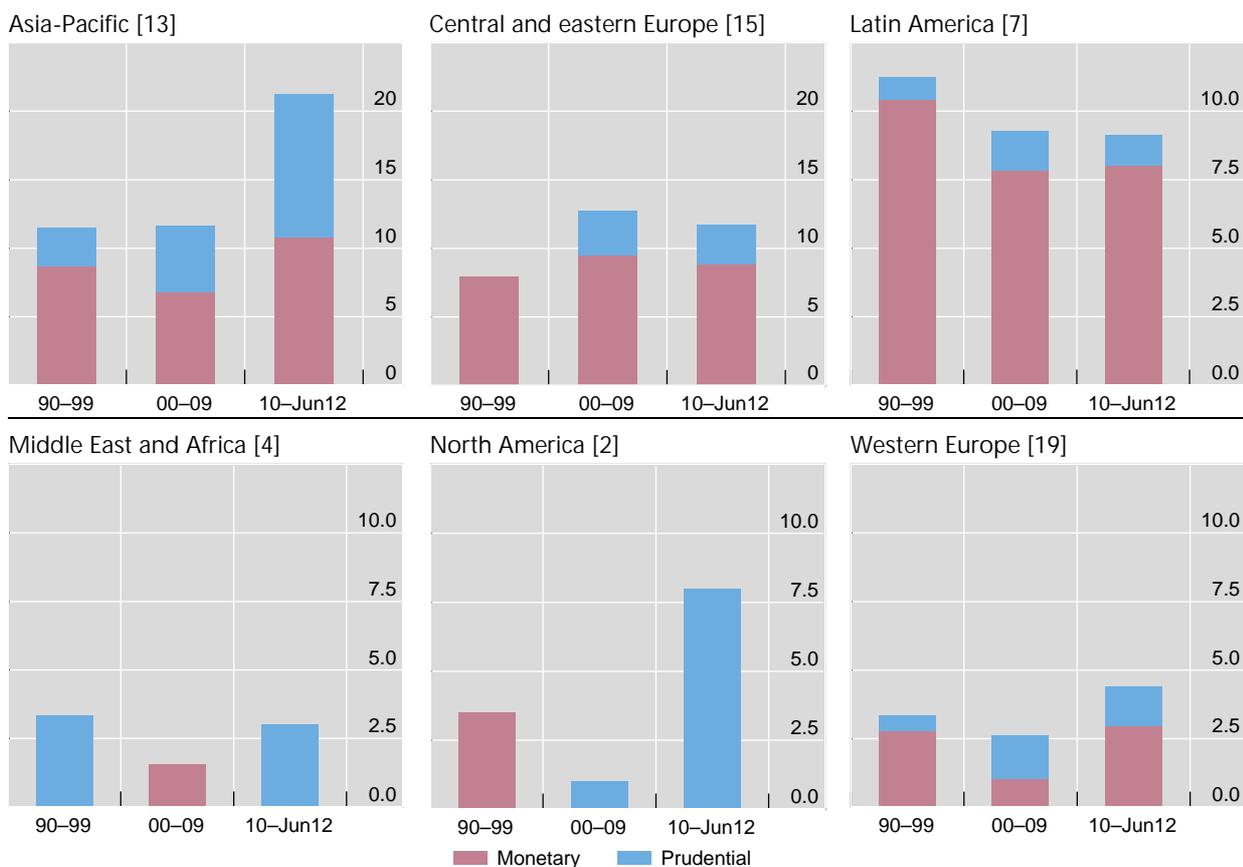
[1] The figures in square brackets indicate the number of economies in each region. [2] When we calculate the number of policy actions, we first divide the total number of policy actions taken in all economies in one region in a decade by the sum of the number of coverage years for each economy in the region in the decade, and then multiply the average number of actions per country per year by 10 to rescale it to the number of actions taken in a decade.

Sources: National sources; authors' calculations.

related to the relative length of boom and bust periods in its housing market during the period covered in the database. Adjusting the number of tightening and loosening measures in relation to booms and busts in housing markets for each country is beyond the scope of this article.

Nevertheless, we can compare the choice of whether to tighten or loosen monetary policy with the same choice for prudential policy in each region. We find that, in each of the six regions, the share of tightening actions in prudential measures was greater than that of tightening actions in monetary policy measures. This finding implies that prudential measures were more tilted towards tightening than were monetary policy measures in all regions. One possible reason could be that, in principle, regulators could tighten prudential standards during a housing boom to stem housing credit growth, and loosen them during a crisis to increase buffers above the regulatory minima. In reality, however, regulators often find it difficult in mid-crisis to relax prudential measures that were tightened pre-crisis because market participants might then get the impression that banks were lacking in solvency or liquidity.

Policy actions by direction

Number of policy actions   Table 5

	Asia-Pacific [13]	Central and eastern Europe [15]	Latin America [7]	Middle East and Africa [4]	North America [2]	Western Europe [19]	All economies [60]
RR	90/60	115/106	43/44	4/2	0/7	3/49	255/268
Credit	3/1	4/3	0/0	0/0	0/0	2/1	9/5
Liq	13/17	0/4	6/0	0/0	0/0	4/9	23/30
Monetary total	106/78	119/113	49/44	4/2	0/7	9/59	287/303
LTV	41/15	8/3	1/1	0/0	4/0	12/9	66/28
DSTI	16/4	11/1	1/0	1/0	2/0	4/5	35/10
RW	13/1	11/8	3/2	3/0	0/0	6/3	36/14
Prov	14/2	8/2	6/0	1/0	0/0	2/2	31/6
Expo	5/6	4/4	0/0	0/0	0/0	1/0	10/10
Prudential total	89/28	42/18	11/3	5/0	6/0	25/19	178/68

The first value in each cell represents the number of tightening measures, and the second value the number of loosening measures. The figures in square brackets indicate the number of economies in each region.

Sources: National sources; authors' calculations.

Conclusion

A new database for policy actions on housing markets draws on official publications of central banks and financial authorities in 60 economies over the past two decades or so to provide a comprehensive and consistent documentation of such actions. These data show that the Asia-Pacific economies were the most active users of prudential measures, whereas central and eastern European and Latin American countries were the most active users of monetary policy actions (excluding policy rate changes). In addition, we find that prudential measures have been used more frequently in recent years and were more tilted towards tightening than were monetary policy actions. These findings are in line with the increasing interest of policymakers in prudential measures that specifically influence housing credit booms.

For policymakers, the database will show what policy measures other jurisdictions have adopted to tackle the problems associated with booms and busts in housing credit and house prices. However, as collecting these data is very costly, we do not plan to update the database regularly.

For researchers, the database will help to support empirical analyses. In particular, dummy variables could be constructed for each type of policy action, as could numerical variables representing the size or intensity of changes in the policy actions. For example, by constructing dummy variables using the database, Kuttner and Shim (2013) find that certain types of prudential policies and fiscal measures tend to slow house price and housing credit growth. Also, since the database covers a wide range of non-interest rate monetary policy measures such as reserve requirements, it would be possible to gauge the impact of these measures on more general credit growth such as the total credit to the private non-financial sector recently published by the BIS (see Dembiermont et al (2013)).

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