BIS

BIS Quarterly Review

International banking and financial market developments

September 2018

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Monetary and Economic Department

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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.

Abbreviations

Currencies

ARS	Argentine peso	LVL	Latvian lats
AUD	Australian dollar	MAD	Moroccan dirham
BGN	Bulgarian lev	MXN	Mexican peso
BHD	Bahraini dinar	MYR	Malaysian ringgit
BRL	Brazilian real	NOK	Norwegian krone
CAD	Canadian dollar	NZD	New Zealand dollar
CHF	Swiss franc	OTH	all other currencies
CLP	Chilean peso	PEN	Peruvian new sol
CNY (RMB)	Chinese yuan (renminbi)	PHP	Philippine peso
COP	Colombian peso	PLN	Polish zloty
CZK	Czech koruna	RON	Romanian leu
DKK	Danish krone	RUB	Russian rouble
EEK	Estonian kroon	SAR	Saudi riyal
EUR	euro	SEK	Swedish krona
GBP	pound sterling	SGD	Singapore dollar
HKD	Hong Kong dollar	SKK	Slovak koruna
HUF	Hungarian forint	THB	Thai baht
IDR	Indonesian rupiah	TRY	Turkish lira
ILS	Israeli new shekel	TWD	New Taiwan dollar
INR	Indian rupee	USD	US dollar
JPY	Japanese yen	VES	Venezuelan bolivar
KRW	Korean won	ZAR	South African rand
LTL	Lithuanian litas		

Countries

AE	United Arab Emirates	GT	Guatemala
AO	Angola	HK	Hong Kong SAR
AR	Argentina	HR	Croatia
AT	Austria	HU	Hungary
AU	Australia	ID	Indonesia
AZ	Azerbaijan	IE	Ireland
BD	Bangladesh	IL	Israel
BE	Belgium	IN	India
BG	Bulgaria	IQ	Iraq
BH	Bahrain	IR	Iran
BM	Bermuda	IS	Iceland
BR	Brazil	IT	Italy
BY	Belarus	JP	Japan
CA	Canada	KE	Kenya
CH	Switzerland	KR	Korea
CL	Chile	KW	Kuwait
CN	China	KY	Cayman Islands
CO	Colombia	KZ	Kazakhstan
CR	Costa Rica	LB	Lebanon
CY	Cyprus	LK	Sri Lanka
CZ	Czech Republic	LT	Lithuania
DE	Germany	LU	Luxembourg
DK	Denmark	LV	Latvia
DO	Dominican Republic	MA	Morocco
DZ	Algeria	MM	Myanmar
EA	euro area	MO	Macao SAR
EC	Ecuador	MT	Malta
EE	Estonia	MU	Mauritius
EG	Egypt	MX	Mexico
ES	Spain	MY	Malaysia
ET	Ethiopia	NG	Nigeria
FI	Finland	NL	Netherlands
FO	Faeroe Islands	NO	Norway
FR	France	NZ	New Zealand
GB	United Kingdom	OM	Oman
GR	Greece	PE	Peru

Countries (cont)

PH	Philippines	TH	Thailand
PK	Pakistan	TR	Turkey
PL	Poland	TW	Chinese Taipei
PT	Portugal	UA	Ukraine
RO	Romania	US	United States
RS	Serbia	UY	Uruguay
RU	Russia	VE	Venezuela
SA	Saudi Arabia	VG	British Virgin Islands
SD	Sudan	VN	Vietnam
SE	Sweden	ZA	South Africa
SG	Singapore	AE	advanced economy
SK	Slovakia	EME	emerging market economy
SI	Slovenia		

Divergences widen in markets

Sentiment turned sharply in financial markets as 2018 moved into its second half. A renewed US dollar rally and escalating trade tensions resulted in an uneven tightening of global financial conditions. The Federal Reserve continued the gradual and predictable removal of monetary accommodation as the US economy gathered speed again, in part boosted by last year's fiscal stimulus. Yet financial conditions in the United States, if anything, eased further. Conditions tightened somewhat in the credit markets of some advanced economies (AEs). In contrast, financing tightened sharply in emerging market economies (EMEs), which saw their currencies depreciate and their access to borrowing wane, amid signs of market disarray in the most vulnerable economies.

US financial markets diverged from their peers. The US stock market sprinted ahead of those in both advanced and emerging economies, and its volatility edged lower. The steady accommodation provided by the ECB and the Bank of Japan (BoJ), together with a flight to safety from stressed EMEs, helped to keep a lid on long-term US government yields despite looming Treasury debt issuance. As a result, the US yield curve flattened further, nearing inversion. Overall, US financial conditions stayed looser than in the other main AEs. For instance, while credit spreads of US corporate borrowers stayed relatively flat between June and mid-September, European corporates saw moderately wider spreads that built upon a previous round of widening in May. These wider spreads were in part attributable to the higher borrowing costs faced by some European financial institutions, which reflected intra-euro area sovereign stress and the exposures of some banks to vulnerable EMEs.

The tighter financial conditions in EMEs built upon the pressure seen earlier in the year. Against the backdrop of a stronger US dollar, escalating trade tensions, and further signs of a slowdown in China, portfolio inflows remained limited. Compounded by domestic vulnerabilities, some countries experienced portfolio outflows, with policy or political uncertainty contributing to market stress in a few jurisdictions. Currency depreciation coincided with higher sovereign spreads, both for instruments denominated in US dollars and for those in local currency. The cumulative damage to EME assets since global trade tensions escalated in late March was in some respects greater than that resulting from the fallout of the 2013 taper tantrum, or the devaluation of the renminbi in August 2015. But sovereign spread levels at the current juncture stayed, by and large, below those of previous episodes and contagion from the most affected countries was limited. Nevertheless, as of mid-September, investors

remained uneasy about whether the financial stress in EMEs would increase and spread further.

US markets follow their own path

Global financial markets increasingly diverged during the period under review, which extended from early June to mid-September. In the wake of mounting trade tensions, risk assets in the United States outperformed those of other jurisdictions, sometimes by a large margin. Although the Fed tightened monetary policy while the ECB and the BoJ maintained accommodation, credit spreads widened more in the euro area than in the United States. This was in part the result of political tensions in the euro area and the sharp appreciation of the US dollar, which weighed heavily on EME assets and, relatedly, on European banks.

The divergence between US and other markets was most visible in equity prices. The outperformance of US stock markets was explained by solid corporate earnings and buybacks, boosted by the recent tax reform, and the exceptional returns of its technology sector. Despite escalating trade tensions, which typically induced drops in most stock markets on negative news days (Graph 1, first panel), the S&P 500 recouped all its previous losses, eventually surpassing the all-time high it had reached in late January. In contrast, other AE stock markets recorded relatively moderate gains, while the Chinese stock market extended the losses suffered earlier in the year. By mid-September, the Shanghai stock market index stood almost 15% below its early June levels (Graph 1, second panel), nearing the depths probed in early 2016. Other EME stock markets traded sideways in local currency, although they lost considerable ground in US dollar terms as currencies depreciated.

The implied volatilities of the major AE asset classes remained contained (Graph 1, third panel). Volatility in equity markets recorded brief spikes, but stayed below the post-Great Financial Crisis (GFC) averages, with the implied volatility of the US stock market edging below the levels prevailing in other AE stock markets. While exchange rate volatilities stabilised at their levels from earlier in the year, those of AE bond futures continued trending down through mid-September.

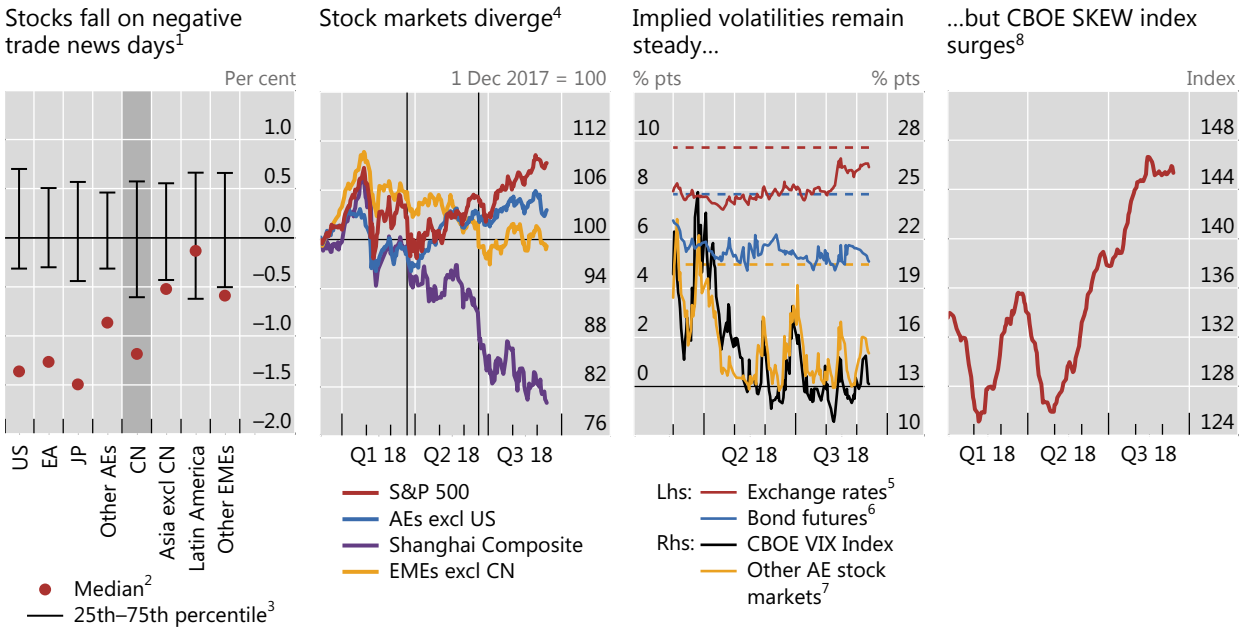
The solid returns and low volatility of the S&P 500 hid a sense of fragility. The cost of insuring against large drops of the S&P 500 in the options market became unusually large, as indicated by the peak reached by the SKEW index (Graph 1, fourth panel). This index had turned in late April as the escalation in US-China trade tensions continued.

Buoyed by a solid macroeconomic backdrop, markets took the Federal Reserve's gradual removal of accommodation in their stride. US growth hit a multi-year high in the second quarter, no doubt reinforced in the near term by the major fiscal stimulus, amid a strong labour market with the lowest unemployment since 2000, while core inflation reached the central bank's objective. Accordingly, the US central bank raised the fed funds target range by another 25 basis points in June, and continued the runoff of its balance sheet at the preannounced pace.

Monetary accommodation continued in the two other major currency areas. While the ECB announced that it expected to terminate its asset purchase programmes by end-2018, it indicated that interest rates would stay low for a prolonged period. Keeping to its policy of yield curve control, the BoJ reaffirmed its target for the benchmark 10-year government bond yield at 0%, although it

Stock markets diverge amid trade tensions, while volatility stays low

Graph 1



The vertical lines in the second panel indicate 22 March 2018 (US announces actions against China pursuant to United States Trade Representative (USTR) Section 301 investigation) and 19 June 2018 (US announces tariffs on additional $200bn of imports from China).

The dashed lines in the third panel indicate simple averages over the period from 1 January 2010 to 12 September 2018.

[1] Aggregates are weighted averages based on 2017 GDP and PPP exchanges rates. Latin America excluding AR; other EMEs excluding TR. [2] Daily returns on event dates: 1 March 2018 (US announces intention to impose tariffs on steel and aluminium imports); 22 March 2018 (US announces actions against China pursuant to USTR Section 301 investigation); 23 March 2018 (China announces retaliatory tariffs); 19 June 2018 (US announces tariffs on additional $200bn of imports from China); 25 June 2018 (Harley-Davidson announces partial shift of production overseas in response to EU tariffs); and 10 July 2018 (USTR releases a list of proposed targets for tariffs on $200bn of imports from China). [3] Interquartile distribution of daily returns on non-event days over the period January 2018–July 2018. [4] For AEs excl US and EMEs excl CN, simple average across country stock indices. [5] JPMorgan VXY Global index, a turnover-weighted index of the implied volatility of three-month at-the-money options on 23 USD currency pairs. [6] Implied volatility of at-the-money options on the long-term bond futures of DE, GB, JP and US; weighted average based on GDP and PPP exchange rates. [7] Implied volatility of the EURO STOXX 50, FTSE 100 and Nikkei 225 indices; weighted average based on market capitalisation. [8] Twenty-two business-day moving average.

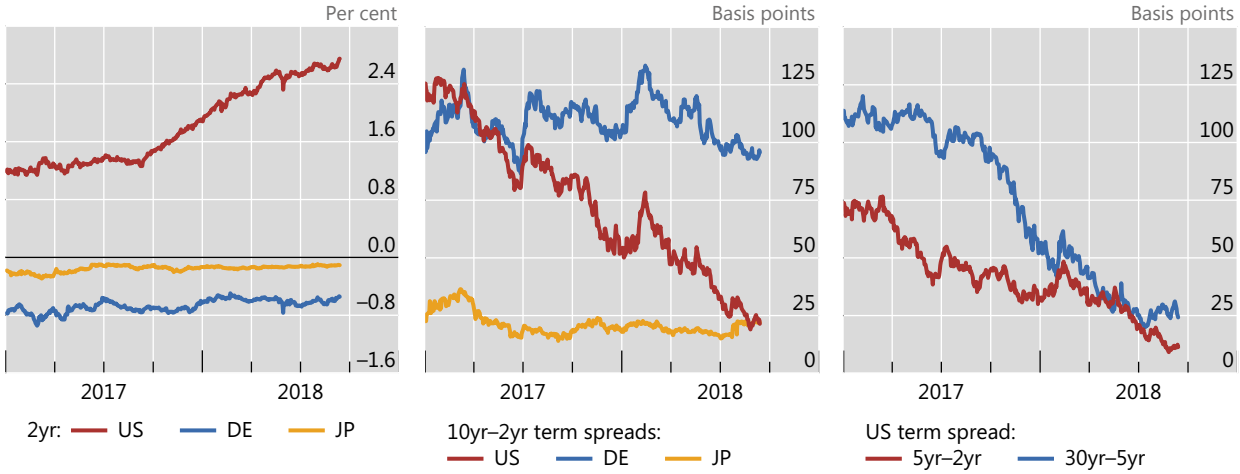
Sources: Bloomberg; Datastream; BIS calculations.

broadened the trading range from 10 to 20 basis points. The BoJ also provided forward guidance, by stating its intention to maintain the current low levels of short- and long-term interest rates for an extended period of time.

The term spread continued narrowing in the United States. Short-term yields rose further, but at a slower pace than earlier in the year (Graph 2, left-hand panel). And at the longer end, the 10-year yield fluctuated just below 3% for much of the period under review, in part weighed down by the flight to safety in the wake of stress in EMEs. By mid-September, the spread between 10- and two-year instruments was down to 25 basis points, almost the same as in Japan, and about 70 basis points below that of German bunds (Graph 2, centre panel). The compression extended to most of the term structure: yields at all maturities from two to 30 years were within 50 basis points of one another (Graph 2, right-hand panel). The low term premium helped to keep long-term yields low.[1]

[1] See B Cohen, P Hördahl and D Xia, "Term premia: models and some stylised facts", *BIS Quarterly Review*, September 2018.

Partly driven by flight to safety, the US yield curve flattens further[1] Graph 2



[1] Based on government bond yields.

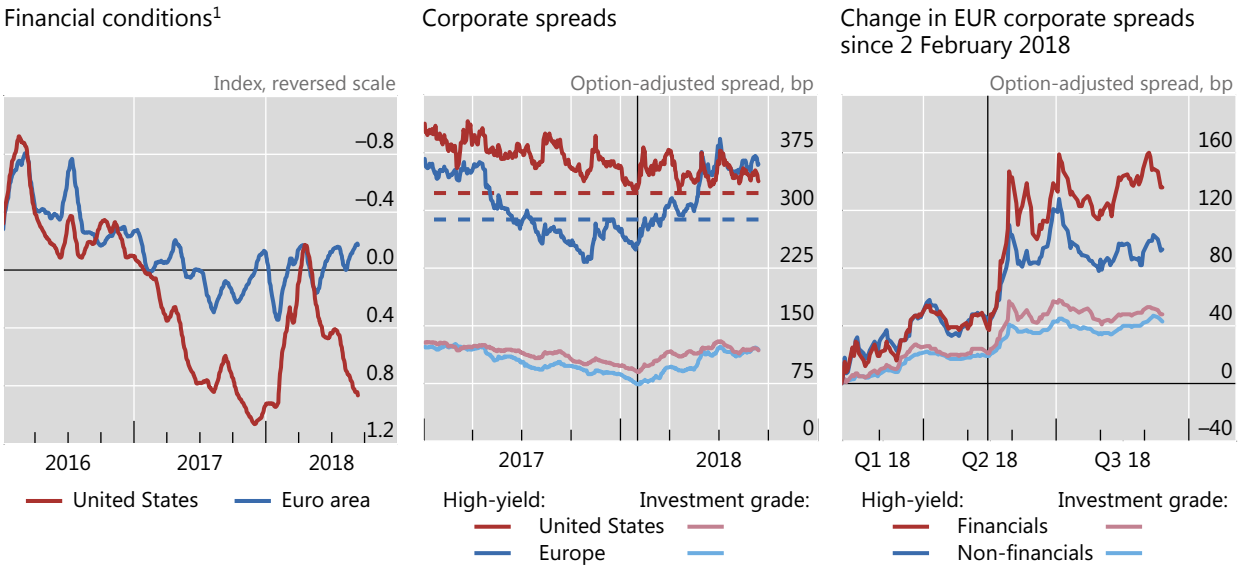
Sources: Bloomberg; BIS calculations.

Overall, US financial conditions eased further or stayed flat. Broad gauges of financial conditions had pointed to an easing since April, after a brief tightening period on the heels of February's spike in stock market volatility. The easing slowed in June but resumed in July as trade tensions escalated once again. The Bloomberg financial conditions index ended the review period within reach of the post-GFC trough recorded in late 2017 (Graph 3, left-hand panel). That said, US investment grade corporate credit spreads remained broadly unchanged, arresting the moderate widening trend that had followed the February market jitters. Corporate high-yield spreads in the United States, while volatile, stayed close to post-GFC averages (Graph 3, centre panel). Moreover, these spreads remained far below their long-term average of 1997, and not far from the very narrow levels they had reached before the GFC. In other words, the high level of risk-taking continued unabated, to a large extent.[2] Along the same lines, leveraged finance remained buoyant, bolstered by the ongoing search for yield, as investors flocked to floating rate instruments, probably fearing further increases in bond yields and hence capital losses – a prospect that the major fiscal stimulus so late in the expansion made all the more probable (Box A).

Comparable indicators of financial conditions for Europe stayed basically unchanged, and close to neutral (Graph 3, left-hand panel). Yet European corporate credit spreads rose further above the high plateau reached after a mid-May jump. On the whole, European investment grade corporate spreads fully caught up with the level of their US peers (Graph 3, centre panel). And European high-yield corporate spreads continued rising above their post-GFC average, even surpassing their US counterparts. A key factor was financial institutions' higher borrowing costs (Graph 3, right-hand panel), especially after the political tensions of mid-May in Italy and the currency crisis in Turkey during early August (Box B). Between June and mid-September, the high-yield spreads of European financial corporates rose about

[2] See C Borio, "Macroprudential frameworks: experience, prospects and a way forward", speech on the occasion of the BIS Annual General Meeting, Basel, 24 June 2018.

Financial conditions diverge as credit spreads rise further in Europe Graph 3



The vertical line in the centre panel indicates 2 February 2018 (US labour market report triggers stock market jitters); the vertical line in the right-hand panel indicates 15 May 2018 (leaking of Italian preliminary coalition agreement).

The dashed lines in the centre panel indicate simple averages over the period June 2005–June 2007.

[1] Bloomberg Financial Conditions Index; 22-business-day moving average; a positive (negative) value indicates accommodative (tighter) financial conditions relative to pre-crisis norms.

Sources: Federal Reserve Bank of St Louis (FRED); Bloomberg; ICE BofAML indices; BIS calculations.

30 basis points. In contrast, non-financial spreads increased only about 10 basis points. The magnitudes were much smaller in the investment grade space, but financial corporate credit spreads in Europe remained higher than non-financial ones.

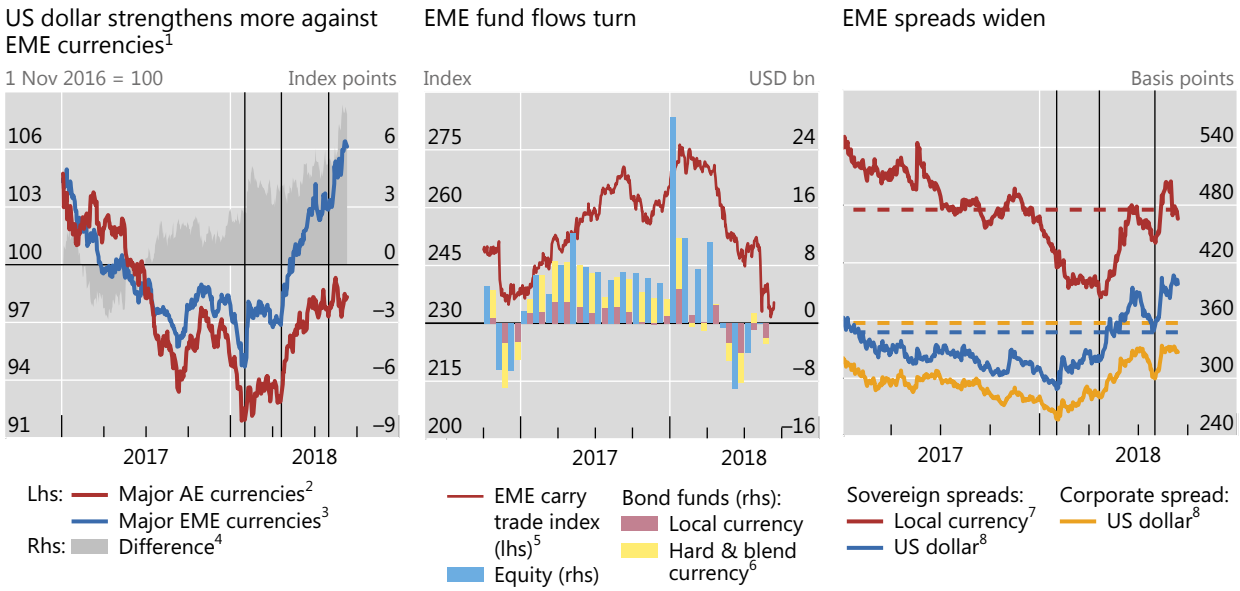
Sentiment towards EME assets turns sharply

Even as AE markets were buoyant or stable, sentiment turned sharply against EME assets. Several factors were at play. The common thread was the tightening of liquidity conditions linked to the Federal Reserve's removal of accommodation. The US dollar served as the main transmission channel. After a prolonged period of weakness that spanned all of 2017, the dollar had turned in early February following an unexpectedly strong US labour market report, which also rocked global stock markets.[3] Its appreciation accelerated in late April, while global trade tensions escalated. The appreciation put pressure on EME dollar borrowers and also eroded returns on EME local currency assets (including equity). As a result, portfolio inflows slowed down sharply, and turned into outright outflows in some jurisdictions. China's perceived slowdown, which trade disruptions could only worsen, contributed to souring the mood towards emerging markets as an asset class. The concurrent currency crises in Argentina and Turkey, though mostly driven by domestic factors, both reflected and cemented investors' broader change in attitude. The turbulence led investors to take a closer look at banks' exposures to EMEs (Box C).

[3] See "Volatility is back", *BIS Quarterly Review*, March 2018.

Sentiment shifts sharply against EMEs

Graph 4



The vertical lines in the left- and right-hand panels indicate 2 February 2018 (US labour market report triggers stock market jitters), 20 April 2018 (Argentina starts large intervention to support the peso) and 1 August 2018 (US government announces sanctions on Turkey).

The dashed lines in the right-hand panel indicate simple averages over the period January 2010–December 2017.

[1] Trade-weighted dollar indices, Board of Governors of the Federal Reserve System; an increase indicates appreciation. [2] Major currencies (AUD, CAD, CHF, EUR, GBP, JPY and SEK). [3] Other important trading partners (ARS, BRL, CLP, CNY, COP, HKD, IDR, ILS, INR, KRW, MXN, MYR, PHP, RUB, SAR, SGD, THB and VES). [4] Difference between the trade-weighted dollar index for other important trading partners and major currencies. [5] EM-8 carry trade index, which measures the cumulative total return of a buy and hold carry trade position that is long in eight EME currencies and fully funded with short positions in USD. [6] Blend currency funds invest in both local currency and hard currency bonds. [7] JPMorgan GBI index; spread over seven-year US Treasury securities. [8] JPMorgan EMBI Global (sovereign) and CEMBI (corporates) indices; stripped spread.

Sources: Federal Reserve Bank of St Louis (FRED); Bloomberg; EPFR; JPMorgan Chase; BIS calculations.

EME currency depreciation continued unabated in the period under review. Between June and mid-September, the trade-weighted US dollar gained more than 5% against major EME currencies while staying range-bound vis-à-vis major AE currencies (Graph 4, left-hand panel). This fall prolonged a trend that had started in February. Since then, EME currencies have weakened by about 12%, almost twice as much as AE currencies.

The long and unprecedented run of 16 consecutive months of net inflows to EME investment funds was cut short in May (Graph 4, centre panel). The slowdown had actually started in February for hard currency bond funds, and then extended to equity and local currency bonds as the US dollar appreciation accelerated in late April. This in turn reduced the returns on those assets for dollar-based investors. Unusually large EME carry trade returns[4] fell precipitously as from April, dropping in August below the low levels of November 2016 (Graph 4, centre panel).

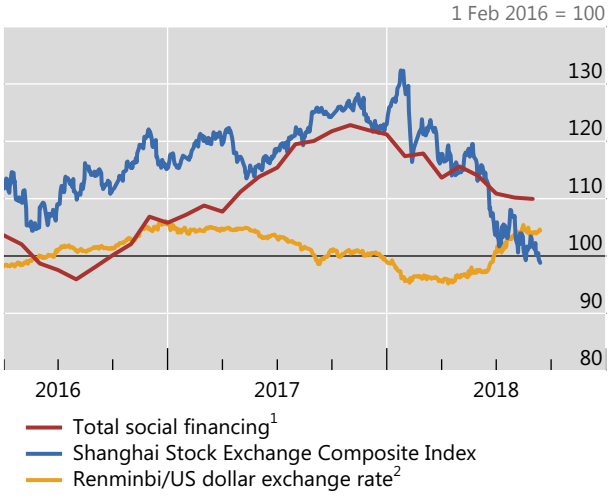
Consistent with exchange rate dynamics, EME sovereign spreads widened further during the review period. But spreads had been under pressure for most of the year. The spreads on US dollar-denominated debt for EME sovereigns had risen about 110 basis points since February (Graph 4, right-hand panel), decisively bolting above the

[4] In this context, an EME carry trade denotes a buy and hold position that acquires an interest-bearing instrument denominated in an EME currency and is fully funded with US dollar borrowing.

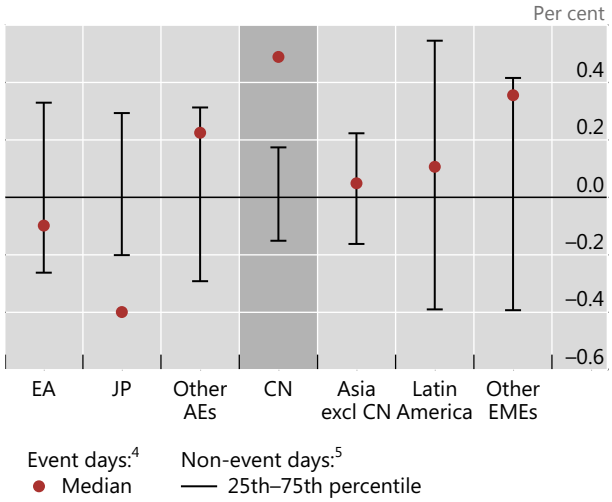
China slows as trade tensions add to deleveraging

Graph 5

China's deleveraging coincides with weaker equity market and exchange rate



Renminbi depreciates on negative trade news days[3]



[1] Twelve-month moving average. [2] An increase indicates depreciation against the US dollar. [3] Aggregates are weighted averages based on 2017 GDP and PPP exchanges rates. Latin America excluding AR; other EMEs excluding TR. A positive value indicates depreciation of the currency of the stated country/region against the US dollar. [4] See Graph 1, footnote 2. [5] See Graph 1, footnote 3.

Sources: Bloomberg; Datastream; BIS calculations.

post-GFC sovereign average in August. Spreads of local currency-denominated government bonds continued to fall for a few more weeks, reaching a turning point in late April. After a brief lull in June and July, these spreads spiked once again as Turkey came under stress in August.

Against this backdrop, concerns over decelerating economic activity in China added to investors' pessimism. On the back of the Chinese government's previous efforts to curb shadow banking activities, credit to the real economy had begun to decline and equity markets to slip starting late last year (Graph 5, left-hand panel). July's indicators of economic activity disappointed. The escalating US-China trade tensions further undermined stock prices and weighed on the Chinese currency: among a group of AE and EME currencies, the renminbi recorded unusually large daily depreciations in response to trade-related news (Graph 5, right-hand panel). To avoid excessive financial tightening, the People's Bank of China (PBC) chose to ease monetary conditions once again in late June, and the government unveiled fiscal stimulus packages in July, with both moves helping to stabilise markets.

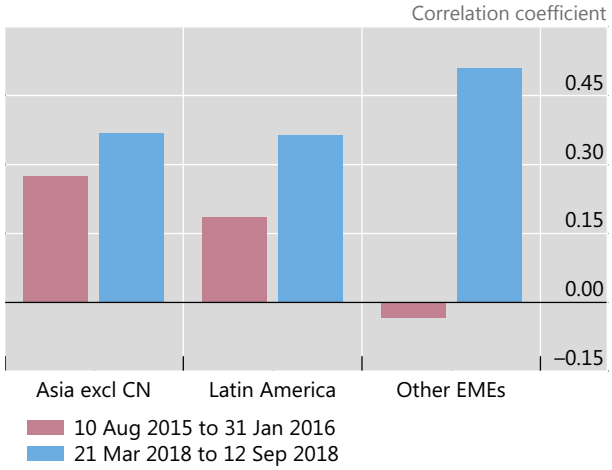
These warning signs had a particularly strong impact on EMEs, especially in Asia, and on commodity markets. The sensitivity of EME currencies to the renminbi's movements during this period was higher than during the stress that followed the renminbi depreciation of August 2015 (Graph 6, left-hand panel). The perceived economic slowdown seemed to contribute to a halt in the rally of oil prices in April, and heralded the substantial drop in some commodity prices that began in June – in particular, industrial metals and grains (Graph 6, right-hand panel).

This increasingly unforgiving environment heightened domestic vulnerabilities. The parallel currency crises in Argentina and Turkey illustrated the point. Both countries had already been in a vulnerable position for quite some time. Both had run persistently large current account deficits, and to a large extent used FX debt to finance a sizeable fiscal deficit (Argentina) and a private sector credit boom (Turkey).

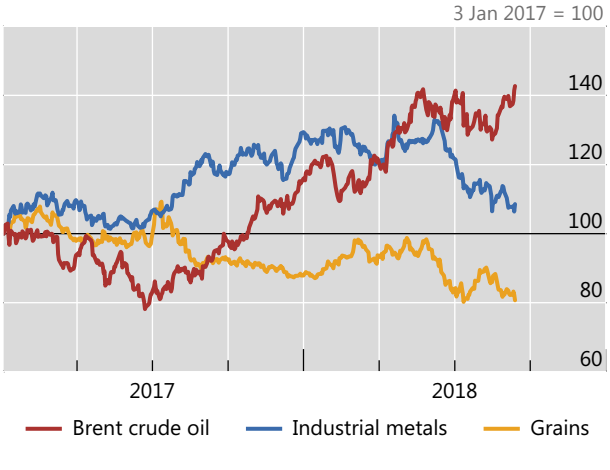
Spillovers from China to EMEs have been large

Graph 6

EME currencies more sensitive to renminbi than in 2015[1]



Commodity prices curbed



[1] Correlations between daily changes in local currency exchange rates and the renminbi against the US dollar over the stated periods; aggregates are based on medians across currencies in each region.

Sources: Bloomberg; BIS calculations.

In the case of Turkey, as political tensions with the United States came to the fore and doubts about central bank independence grew, the currency suddenly collapsed in early August. Argentina had been under pressure since late April, and the crisis finally flared up in late August after easing somewhat in between in the wake of an IMF standby agreement.

While contagion of severe stress was generally contained, these concurrent crises triggered spillovers to other EMEs. Those spillovers differed markedly across countries. As in previous episodes, the exchange rate was a good barometer of stress. The factors explaining differences in currency performance appeared to be related to countries' perceived vulnerability. In particular, countries with higher inflation and current account deficits tended to experience stronger currency depreciations (Graph 7, left-hand panel). Political uncertainty also sometimes played a role, as in the cases of Brazil and Russia, whose currency depreciations appeared to be out of line with their current account deficits and inflation rates. Higher inflation went hand in hand with higher sovereign spreads (Graph 7, centre panel). Thus, high-yield emerging markets, ie those presumably perceived as riskier at the outset, suffered heightened stress as sentiment turned.

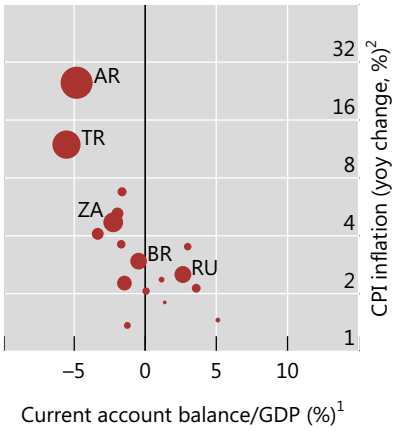
The recent episodes of financial stress followed a series of shocks to EME assets, dating back to the beginning of the trade tensions in March. For most asset classes, the cumulative toll surpassed the total impact of the shocks corresponding to the taper tantrum of 2013, while coming close to that experienced in the aftermath of China's devaluation in August 2015 (Graph 7, right-hand panel).[5] Yet so far, the levels

[5] The event window to measure the impact of the taper tantrum runs from 22 May 2013 (Fed Chairman's testimony before the US Congress) to 5 September 2013 (10-year US Treasury yield reaches a local peak). The event window to measure the impact of the renminbi devaluation and slowdown in China runs from 11 August 2015 (PBC announces its reform of the daily fixing of the renminbi) to 28 January 2016 (Shanghai Composite reaches a local trough after China's manufacturing purchasing managers' index disappoints on 31 December 2015). The qualitative

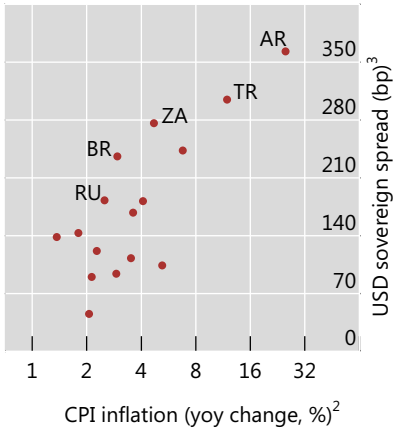
Financial conditions tighten for vulnerable EMEs

Graph 7

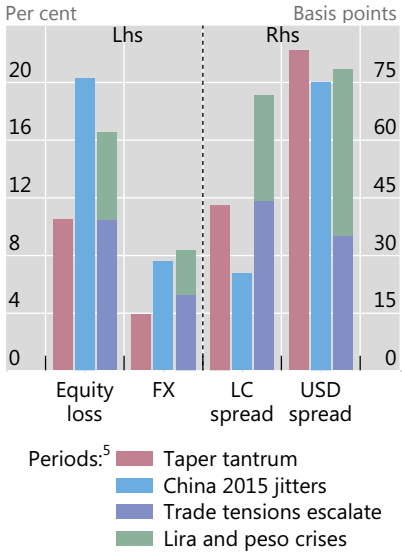
Spillovers from lira and peso crises reflect macro vulnerabilities



High inflation correlated with high yields



EME stress in 2018 comparable to previous episodes[4]



The size of each circle in the left-hand panel corresponds to local currency depreciation against the US dollar over the period from 31 July to 12 September 2018.

[1] 2017 data. [2] As of December 2017; logarithmic scale. [3] JPMorgan EMBI, Q4 2017 average. [4] Equity = MSCI Emerging Markets Index, in US dollar terms; FX = FX depreciation based on the trade-weighted USD index, other important trading partners; LC spread = JPMorgan GBI, local currency-denominated government bond spread; USD spread = JPMorgan EMBI, USD-denominated government bond spread. [5] Changes over the following periods: taper tantrum = 22 May to 5 September 2013; devaluation and slowdown in China (China 2015 jitters) = 11 August 2015 to 28 January 2016; trade tensions escalate = 22 March to 31 July 2018; lira and peso crises = 1 August 2018 to 7 September 2018.

Sources: Federal Reserve Bank of St Louis (FRED); IMF, *World Economic Outlook*; Bloomberg; Datastream; JPMorgan Chase; national data; BIS calculations.

of sovereign spreads during the current stress have stayed generally below those observed in previous events. For instance, as of mid-September the index of EME sovereign spreads in the US dollar was still below 415 basis points. That was the index's starting point before the August 2015 renminbi devaluation episode.

The shifts in FX and bond markets during the year also underscored EMEs' persistent sensitivity to the strength of the US dollar. Large depreciations contributed to credit risk concerns, and hence to wider spreads on US dollar-denominated bonds. At the same time, they exacerbated dollar-based investors' losses on local currency instruments. Thus, rises in local currency yields also ensued, and were significantly larger than in previous episodes of market distress (Graph 7, right-hand panel). EMEs' ability to issue bonds in their own currencies has improved markedly in recent years. But the vulnerability of local currency government debt to abrupt swings in the dollar suggests that local currency issuance has not yet succeeded in significantly insulating their financial conditions from exchange rate shifts.

results do not change significantly for alternative windows within 20 trading days either side of these end dates.

Box A

The rise of leveraged loans: a risky resurgence?

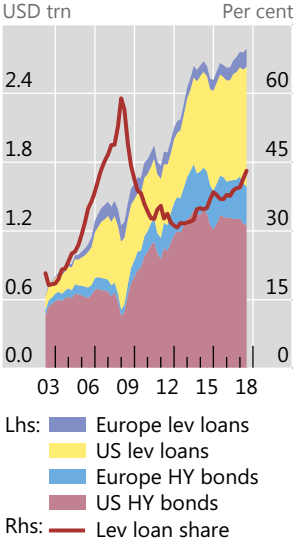
Tirupam Goel

Leveraged finance, comprising high-yield bond- and leveraged loan-based finance, has doubled in size since the Great Financial Crisis (GFC) (Graph A, first panel, shaded areas). A vehicle for investors' risk-taking, leveraged finance has behaved procyclically. The market for financing highly leveraged transactions flourished in the United States in the 1980s before collapsing during the recession of the early 1990s. It again grew rapidly in the mid-2000s before stalling during the GFC. Leveraged loan volumes have been particularly procyclical – rising faster than high-yield bonds in the run-up to the GFC and during the subsequent period of extraordinary monetary accommodation (Graph A, first panel, red line). Focusing on the recent growth of leveraged loans, this box examines the underlying drivers and the vulnerabilities that monetary policy normalisation may expose.

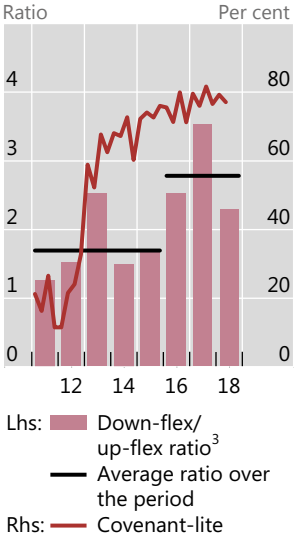
Investor demand supports leveraged loans relative to high-yield bonds

Graph A

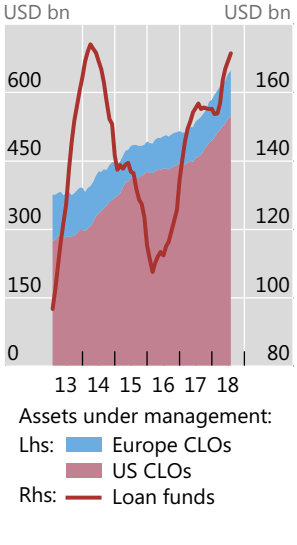
Loans gain share as leveraged finance grows[1]



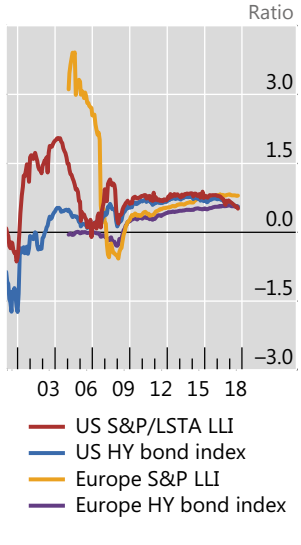
New issue pricing and covenant-lite loans reflect borrowers' market power[2]



Collateralised loan obligations (CLOs) and loan funds facilitate demand[4]



Sharpe ratios of loans and bonds have come closer[5]



[1] For institutional leveraged loans (lev loans), outstanding amounts are based on S&P/LSTA leveraged loan index (LLI) for the US, and S&P European leveraged loan index for Europe, where LSTA = Loan Syndications and Trading Association; for high-yield (HY) bonds, outstanding amounts are based on the USD high-yield ICE BofAML index for the US and the EUR high-yield ICE BofAML index for Europe. [2] Based on US market deals. [3] Annual ratio, except for 2018, in which case the ratio is based on flexes up to August 2018. [4] "US CLOs" covers USD-denominated issuances and "Europe CLOs" EUR-denominated issuances; "Loan funds" includes exchange-traded funds and covers US- and Europe-domiciled funds. [5] For each index, the Sharpe ratio is calculated as the excess annualised return of the index relative to three-month government bond yields (for the US, based on Treasury yields; for Europe, based on the euro area AAA-rated government bond spot yield curve), divided by the annualised standard deviation of index returns.

Sources: ECB; ICE BofAML indices; Lipper; Thomson Reuters Loan Pricing Corporation; BIS calculations.

Investor demand is an important driver of the recent growth in leveraged loans. For one, this is evident from investors' continuing willingness to accept weaker protection against deterioration in borrowers' repayment capacity. Specifically, the fraction of covenant-lite loans reached its post-GFC peak in late 2017 (Graph A, second panel), while the average number of covenants per loan with covenants has decreased by 25%. That investors are not necessarily being compensated for this risk can be seen in the behaviour of price flexes: adjustments to new-issue spreads that a loan arranger makes in order to clear the primary market. The ratio of down- to up-flexes has risen markedly in recent years, with borrowers benefiting from lower loan spreads (Graph A, second panel). In addition, strong investor demand for leveraged loans has supported refinancing. In the United States, for instance, debt refinancing has accounted for

60% of institutional leveraged loan issuance since 2015. This share increased during the first half of 2018. All this is consistent with investors reaching for yield in a low interest rate environment. The recent prospect of (continued) interest rate rises has increased the relative appeal of leveraged loans, which – unlike most high-yield bonds – offer a return that is indexed to the interbank rate.①

Developments in the securitisations market have also contributed to the growth in leveraged loans. Originator banks are finding it easier to securitise and sell these loans. This can be seen in the growing investment in loans by securitised structures such as collateralised loan obligations (CLOs), especially in the last couple of years (Graph A, third panel). Unlike during the run-up to the GFC, banks no longer effectively retain a large portion of these securitisations through off-balance sheet vehicles. Instead, the post-GFC risk retention rule requires banks to retain a relatively small portion of issued securitisations on their balance sheet. In the case of US open market CLO fund managers for whom this rule applied initially, a February 2018 court ruling reversed this requirement, further supporting the demand for loans. Also supporting demand is the strong growth in loan mutual funds since 2016 (Graph A, third panel). As a by-product of these developments, the substitutability between leveraged loans and high-yield bonds has increased from an investor's point of view, hence the convergence in their risk-return characteristics (Graph A, fourth panel).

Factors increasing the willingness of and incentives for banks to provide credit may also have been at work. Recent shifts in the approach to enforcing leveraged lending guidelines in the United States seem to have made it easier for banks to arrange such loans.② More broadly, the leveraged credit market has been buoyed by a favourable macroeconomic background and strong equity markets. Corporate restructurings such as mergers, acquisitions and leveraged buyouts have accounted for close to 40% of US institutional leveraged loan issuance since 2015.

As business cycles mature, however, investors may start to incur losses. The default rate of US institutional leveraged loans increased from around 2% in mid-2017 to 2.5% in June 2018. Going forward, as monetary policy normalises, the floating rate feature of leveraged loans could trigger defaults by worsening borrowers' debt coverage ratios (DCRs): the ratio of net operating income to debt service costs.③ Despite healthy corporate profits in the last few years, market participants have begun to report lower DCRs. Even the loan recovery rates during the next downturn could be smaller given that the debt cushion – ie the level of unsecured junior debt that absorbs losses before senior loans in a default – of leveraged loans has decreased.

Concerns also centre on funding and market liquidity risks. For one, the concentration of BBB borrowers has risen, which means that, in a downturn, downgrades among BBB borrowers to a BB or lower rating – ie speculative grade – would lead some investors to dump this debt.④ The relative illiquidity of leveraged loan markets could exacerbate the resulting price impact. Moreover, given that mutual funds are a major buyer, mark-to-market losses could spur fund redemptions, induce fire sales and further depress prices. These dynamics may affect not only investors holding these loans, but also the broader economy by blocking the flow of funds to the leveraged credit market.

① The interest rate on most loans is reset periodically to a spread over a reference rate, typically Libor or its equivalent. See www.leveragedloan.com/primer/, S&P Global Market Intelligence. ② In March 2013, US federal banking agencies issued Leveraged Lending Guidance (LLG) setting limits on parameters such as debt-to-income ratios and maturity. In October 2017, the US Government Accountability Office determined that the LLG is subject to the requirements of the Congressional Review Act, meaning that, in principle, the Congress can overturn it. See www.gao.gov/products/B-329272#mt=e-report. In early 2018, senior officials from some US banking agencies signalled greater accommodation with respect to leveraged lending. Relatedly, in September 2018, a joint statement by US banking agencies clarified the non-binding role of supervisory guidance, one that is distinct from laws or regulations. See www.federalreserve.gov/supervisionreg/srletters/sr1805a1.pdf. ③ See B Hofmann and G Peersman, "Is there a debt service channel of monetary transmission?", *BIS Quarterly Review*, December 2017. ④ For evidence on the increase in concentration of BBB borrowers, see "Strong outlook with low inflation spurs risk-taking", *BIS Quarterly Review*, September 2017.

Box B

Sovereign and bank tensions in the euro area

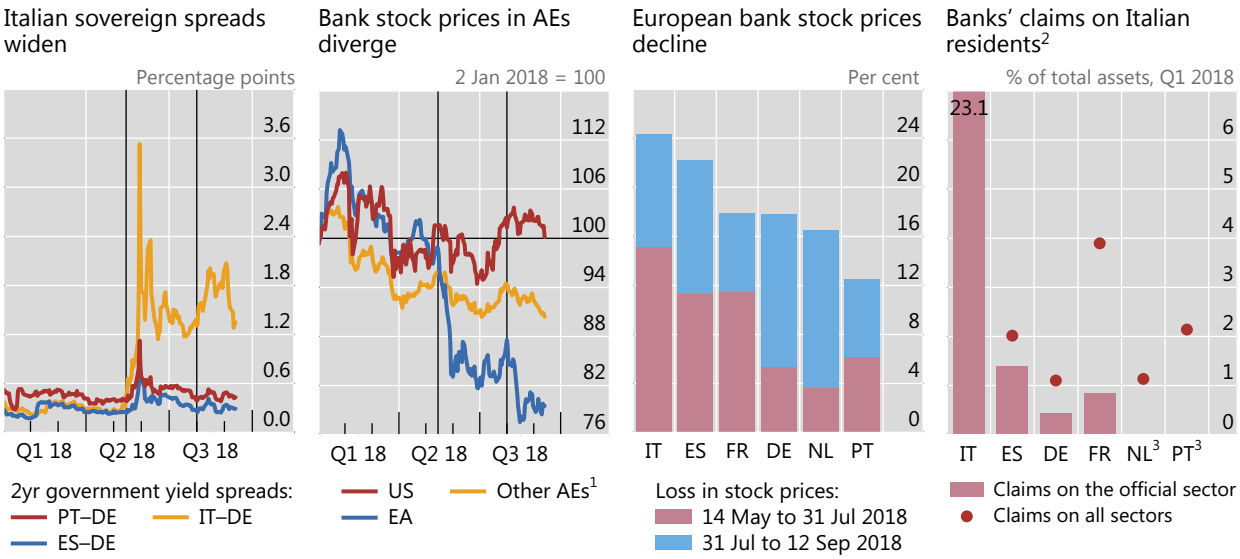
Fernando Avalos and Dora Xia

During the second and third quarters of 2018, tensions originating in international trade, the political landscape, and spillovers from the current stress in EMEs weighed on asset valuations in the euro area. Among others, markets focused particularly on the political situation in Italy and the crisis in Turkey, as well as trade tensions with the United States.

The Italian sovereign has recently gone through a series of idiosyncratic episodes of bond market stress. For instance, the spread of Italy's two-year yields vis-à-vis Germany's widened in the wake of the recent events in Turkey by much more than those of other euro area countries (Graph B, first panel). However, political events had already led to a significant widening in the Italian-German spread. The spread had begun to drift higher in mid-May with the leaking of a preliminary draft of the coalition's governing programme. And on 29 May, after the interim prime minister was appointed, it surged almost 200 basis points and reached levels not seen since August 2012. Although this spread increase surpassed any daily changes observed during the European sovereign debt crisis, the *level* of the Italian sovereign spread remained below those from the crisis period. Wider spreads seemed to reflect investors' concerns about future political uncertainty, especially over the potential fiscal policies of the new government.

Tensions build up in the euro area

Graph B



The vertical lines in the first and second panels indicate 15 May 2018 (leaking of Italian preliminary coalition agreement) and 1 August 2018 (US government announcement of sanctions on Turkey).

[1] Weighted average of AU, CA, CH, DK, GB, JP, NO and SE, based on market capitalisation. [2] On an ultimate risk basis, excluding derivatives and other potential exposures. [3] At the request of the respective reporting countries, claims on the Italian official sector for Dutch and Portuguese banks are not disclosed for confidentiality reasons.

Sources: Bloomberg; Datastream; IHS Markit; BIS consolidated banking statistics; BIS calculations.

The combination of stress in Italian sovereign bond markets and the currency crisis in Turkey put great pressure on euro area banks. Their stock prices vastly underperformed those of their peers from other advanced economies. An aggregate index tracking euro area banks' stock price performance dropped almost 20% from mid-May through mid-September (Graph B, second panel). In contrast, US banks traded sideways and other advanced economies' banks experienced much more moderate losses. The divergence between bank equity price performance in the euro area and the United States started in May, when political uncertainty in Italy increased. Euro area bank stocks traded sideways for several weeks afterwards, before the currency crisis in Turkey triggered another large step down.

Losses in bank stock prices varied significantly across countries. The losses from mid-May up to end-July were sharper for banks in France, Italy and Spain (Graph B, third panel, red bars). In part, this reflected banks' direct and indirect exposures to the Italian government and other Italian borrowers (fourth panel). The direct channel of transmission might work through large mark-to-market losses on government bond holdings and other assets, which would weaken banks' capital base. Potential indirect channels include tougher funding conditions as credit spreads rise for Italian banks and other large euro area banks.

Spillovers from the financial stress in Turkey deepened these concerns, as euro area banks were generally perceived as having large exposures to Turkish borrowers. To some extent, the correction triggered by the Turkish market turmoil had a greater impact on the banks that were most exposed to Turkish borrowers (Graph B, third panel, blue bars). But the losses were not necessarily proportionate to the size of the exposures. In fact, the underlying risk resulting from banks' country exposures is difficult to assess, as there are many factors that influence how banks might respond to adverse developments (Box C). Stock price losses may also have revealed investors' assessment about the prospective resilience of banks to future large shocks, as well as other country- and sector-specific developments. For example, German banks were hindered by their broader earning underperformance, and Italian banks were already perceived as relatively weaker.

Box C

Using the BIS consolidated banking statistics to analyse country risk exposures

A primer illustrated with banks' exposures to Turkey

Stefan Avdjiev and Philip Wooldridge

The BIS consolidated banking statistics (CBS) are a useful starting point for analysing banks' exposure to country risk – the risk that borrowers may be unable or unwilling to fulfil their foreign obligations for country-specific economic or political reasons beyond the usual counterparty-specific factors. However, the CBS provide only part of the information needed for a comprehensive analysis of these exposures. In this box, we summarise what the CBS show and do not show about them, using as an example the data published about Turkey in Table B4 on the BIS website.①

The CBS provide information about the country and sectoral composition of banks' assets on a worldwide consolidated basis. In particular, they capture the outstanding claims and other exposures of banking groups headquartered in 31 reporting countries on counterparties in over 200 borrower countries, excluding intragroup positions but including the business of foreign banking subsidiaries that are majority-owned or otherwise controlled by the group.②

At end-March 2018, foreign banks had $223 billion in outstanding loans, securities holdings and other claims on residents of Turkey (Graph C, left-hand panel). More than half of these claims ($135 billion) were on borrowers in the non-bank private sector – mainly non-financial corporations and households, with smaller amounts on non-bank financial institutions. Claims on banks accounted for a further $50 billion, with the remainder, $38 billion, on the official sector – government and central bank. On top of these claims, foreign banks had exposures to Turkey through three additional items: derivatives contracts with counterparties in the country, the positive market value of which stood at $4 billion at end-March 2018; credit protection sold against entities in Turkey and other guarantees extended ($53 billion); and outstanding credit commitments to resident borrowers ($22 billion).

For assessing banks' vulnerability to country risk, the absolute size of exposures is a less relevant metric than the relative size – for instance, scaled by banks' total equity or Tier 1 capital. Indeed, the banks with the largest absolute exposures to a country are often not those most exposed relative to capital. For example, at end-March 2018 Belgian banks' claims on Turkey (less than $1 billion) were much smaller than the claims of German banks (nearly $13 billion), but relative to total capital the two banking systems had similar exposures (2.3% and 2.4%, respectively).

Even when scaled, the CBS provide only a rough indication of which banks are the most vulnerable to country risk because of the high degree of aggregation and incomplete information. The CBS sum together the exposures of all banking groups headquartered in the reporting country and consequently may mask large differences among individual banks. They also sum together various types of exposures (eg loans, guarantees), which may have very different risk characteristics. Furthermore, some banks' outstanding exposures may be closer to their market value than those of others, depending on accounting practices and the share of the portfolio invested in assets with reliable fair market values. Finally, the CBS exclude provisions that banks might have set aside against potential losses.

Information about banks' business models is also relevant to understanding how banks might respond to adverse developments in a country. An especially important factor is the structure of banks' foreign business. Some banks conduct their international business mainly on a cross-border basis out of their home country or in financial centres. Other banks follow a multinational model and set up foreign subsidiaries, in which they invest specific amounts of capital and that borrow locally to finance assets. The CBS do not distinguish between these business models. Yet a multinational bank could choose to sell its subsidiary or even let it fail, writing down the capital that the bank invested in its subsidiary. If it were to do so, the bank's exposure would be limited to its equity participation in the subsidiary plus any intragroup funding and guarantees extended to the subsidiary. This sum is likely to be substantially smaller than the assets of the subsidiary that are included in the exposure measures of the CBS.

Whether a bank decides to take advantage of the option to reduce its exposure to its subsidiary depends on its assessment of the associated benefits and costs. A myriad of factors influence this decision, including: the amount of intragroup funding and guarantees extended to the subsidiary; the ownership structure (eg whether the subsidiary is wholly owned or a joint venture); the overall financial health of the group; risks to the reputation of other parts of the

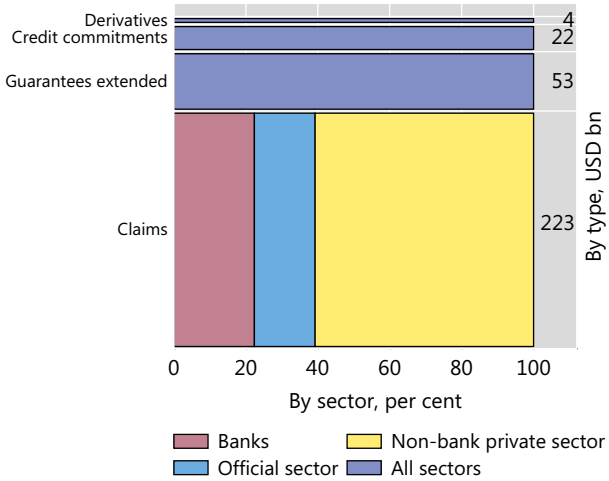
group; the regulatory framework (eg multiple- versus single-point-of-entry resolution regimes); the broader context in which the losses arise; and the prospects for a recovery from the economic or political uncertainty affecting the country.

The CBS provide some information, albeit imperfect, about the importance of subsidiaries by dint of the distinction between local and cross-border claims. Local claims are those booked by branches and subsidiaries located in the same country as the counterparty. Local claims can in turn be decomposed into those denominated in local currencies (LCLC) and those in foreign currencies (LCFC). In the CBS on an immediate counterparty basis, LCLC are published separately but LCFC are published jointly with cross-border claims as "international" claims. In Turkey, local claims denominated in the Turkish lira (TRY) amounted to $82 billion at end-March 2018. In addition, LCFC accounted for a substantial portion of the $164 billion in international claims. As a result, local claims denominated in all currencies accounted for over 50% of foreign banks' total claims on the country.

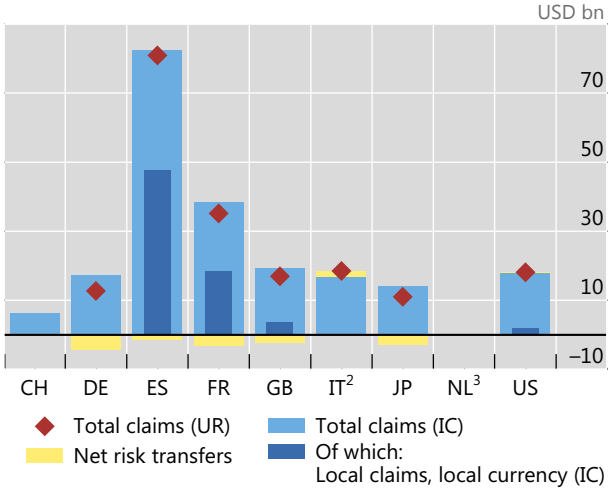
Foreign banks' exposures to Turkey

Outstanding consolidated exposures at end-March 2018 — Graph C

Total by type and counterparty sector[1]



By nationality of CBS-reporting bank



IC = immediate counterparty basis; UR = ultimate risk basis.

[1] CBS on an ultimate risk basis. The width of each bar is proportionate to the relative size of the respective exposure type. [2] CBS reported by Italian banks do not fully capture some joint ventures' assets. [3] At the request of the reporting country, CBS reported by Dutch banks are not disclosed for confidentiality reasons.

Sources: BIS consolidated banking statistics (CBS), Table B4.

The published CBS show that Spanish and French banks had the largest TRY-denominated local claims on Turkey, at $48 billion and $18 billion, respectively, at end-March 2018 (Graph C, right-hand panel). A substantial portion of these banks' international claims are also local claims, denominated in foreign currencies. Italian and Dutch banks also have exposures via local subsidiaries, but these are not adequately captured in the published CBS.③ Data from the European Banking Authority show that Italian banks had total exposures on Turkey, including guarantees and credit commitments, in excess of $67 billion and Dutch banks $34 billion, albeit at end-June 2017. Notably, in US dollar terms, the exposures of those banks with Turkish subsidiaries fell significantly in mid-2018 owing to the sharp depreciation of the TRY and the consequent decline in the US dollar value of their TRY-denominated claims.

Another way that banks can reduce their exposure to a given country or sector is by using credit risk transfer instruments to shift risks from one counterparty to another. One common example is buying credit protection through credit default swaps. The CBS on an ultimate risk (UR) basis take account of banks' use of such risk transfers and so provide a measure of banks' exposure that complements the on-balance sheet claims captured by the CBS on an immediate counterparty (IC) basis.

Banks tend to use risk transfers to hedge a larger share of their cross-border exposures than their local exposures. Consequently, country risk transfers tend to be proportionately larger for banks that conduct mostly cross-border business, as opposed to multinational banks with subsidiaries. For example, at end-March 2018 the IC claims of Spanish banks on Turkey, which are mostly booked through local subsidiaries, were only 2% ($1 billion) higher than their UR claims. By contrast, UK banks' IC claims, which are mostly in the form of cross-border claims, were 14% ($2 billion) higher than their UR claims.

In summary, the CBS provide a useful starting point for analysing banks' country risk exposures, based on a set of simple metrics. However, a fuller analysis requires them to be combined with information about banks' business models, financial health, consolidation and accounting practices, and risk transfers. Such information is regularly provided by supervisors and banks themselves, in their communications about the possible impact of and responses to adverse developments in borrower countries.

① For further discussion of what the CBS show, see BIS, "What the BIS banking statistics say (and what they do not) about banking systems' exposures to particular countries and sectors", *BIS Quarterly Review*, March 2011. ② The perimeter of consolidation is not harmonised across reporting countries. For a summary of differences, see BIS, "Potential enhancements to the BIS international banking statistics", Annex B, March 2017. ③ The CBS reported by Italian banks do not fully capture some joint ventures' assets, while the exposures of Dutch banks are not disclosed for confidentiality reasons.

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Global liquidity: changing instrument and currency patterns[1]

International (cross-border and foreign currency) credit, a key indicator of global liquidity, has continued to expand in recent years to 38% of global GDP. This growth has been driven by international debt securities issuance, while the role of banks has diminished – both as lenders and as investors in debt securities. The aggregate trend has been more pronounced for advanced economy than emerging market borrowers. For individual countries, however, the growth of bank loans and that of debt securities have tended to move in tandem, highlighting the cyclical nature of global liquidity. The US dollar has become even more dominant as an international funding currency – in particular for emerging market borrowers. However, dollar exposures in emerging market economies vary substantially across countries and sectors.

JEL classification: G10, F34, G21.

Global liquidity – the ease of financing in international financial markets – remains at the centre of policy debates (Cohen et al (2017), CGFS (2011), Borio et al (2011)). In the run-up to the 2007–09 Great Financial Crisis (GFC), the supply of international credit – comprising cross-border credit and credit in foreign currency whether or not it crosses a border – expanded rapidly. When the crisis hit, international credit evaporated, exposing financial vulnerabilities in both advanced and emerging market economies (EMEs).[2] Against the backdrop of major central banks' highly accommodative monetary policies, this key indicator of global liquidity picked up markedly since 2010, in particular in EMEs.

In contrast to the pre-GFC period, the increase in international credit since 2010 has been driven primarily by debt securities rather than bank loans (Avdjiev et al (2017), Turner (2013)). At the same time, the US dollar has become even more dominant as the prime currency of denomination since the GFC (Maggiori et al (2018)). This "second phase" of global liquidity implies that global financing conditions have become more sensitive to developments in the bond market, and even more tightly linked to US monetary policy (Shin (2013)). EME borrowers may be

[1] The authors would like to thank Stefan Avdjiev, Claudio Borio, Stijn Claessens, Ben Cohen, Robert McCauley, Patrick McGuire, Swapan-Kumar Pradhan, Hyun Song Shin, Nikola Tarashev and Philip Wooldridge for helpful comments and Zuzana Filková for excellent research assistance. The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS.

[2] Global liquidity can affect domestic financial conditions through a variety of transmission channels, including advanced country monetary policies and international spillovers (Cerutti et al (2017), McCauley et al (2015a), Rey (2013)). International credit is an important driver of credit conditions in EMEs (Ehlers and McGuire (2016), Avdjiev et al (2012)).

Key takeaways

- International credit (bank loans plus debt securities) to non-banks, a key indicator of global liquidity, has continued to expand in recent years, from 33% of global GDP in Q1 2015 to 38% in Q1 2018.
- The composition of international credit shifted from bank loans to debt securities, whose share in the total rose from 48% in Q1 2008 to 57% in Q1 2018.
- Global banks' international debt securities holdings fell from 40% of the total outstanding at end-March 2008 to 27% at end-March 2018, reinforcing the diminishing role of banks in driving international credit.
- The US dollar has become even more dominant as the prime foreign currency for international borrowing. Dollar credit to the non-bank sector outside the US rose from 9.5% of global GDP at end-2007 to 14% in Q1 2018.
- The growth in dollar borrowing by EMEs has been especially strong, but dollar exposures vary substantially both across countries and in terms of sectoral composition.

particularly vulnerable if they have relied heavily on US dollar-denominated debt securities, as international bond investors tend to retreat quickly when US rates rise. But EMEs' US dollar debt exposures can differ substantially not only across countries but also across sectors. In some EMEs the private corporate sector has been the main borrower of US dollars, while in others it has been the sovereign.

This feature documents and analyses the shift from international bank loans to debt securities in international credit, as well as the currency composition, building on the BIS global liquidity indicators (GLIs). The first section presents global trends and recent developments. The second contrasts the developments in advanced economies and EMEs. It documents how the shift away from bank loans towards debt securities has been more pronounced for advanced economies than for EMEs as a whole. At the country level, however, growth of bank loans and that of debt securities have moved in tandem for both advanced and emerging market economy borrowers. The third section focuses on EME foreign currency borrowing and highlights the different sectoral composition of US dollar credit across countries.

Recent trends in global liquidity

The quarterly BIS GLIs capture one aspect of the ease of global financing conditions.[3] They track the behaviour of international credit, which is an informative signal for the build-up of vulnerabilities (Aldasoro et al (2018)). The GLIs build on the BIS locational banking statistics and the BIS international debt securities statistics, as well as national data. This feature focuses on international credit (bank loans plus debt securities) to the non-bank sector[4] as a key element that directly influences

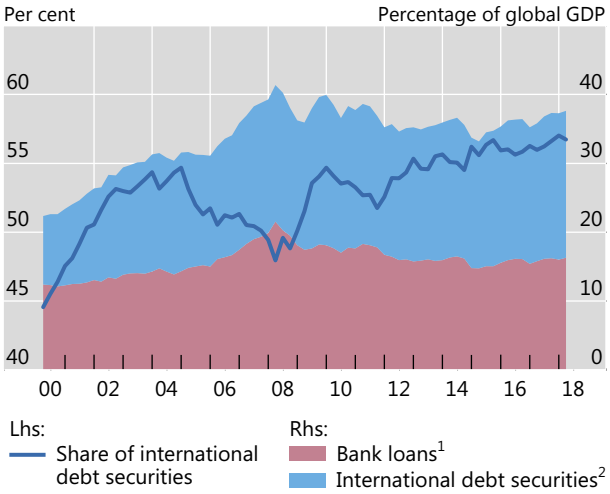
[3] CGFS (2011) notes that due to the elusive nature of the concept of global liquidity, a single measure is unlikely to capture all its relevant aspects. Borio (2013) qualifies that liquidity cannot be observed, but only its footprints. Important footprints other than international credit include indicators of risk perceptions and tolerance (eg the VIX) and of the terms and conditions at which funding is granted or assets are bought and sold (eg cost of funding, collateral terms, bid-ask spreads).

[4] Credit to the non-bank sector includes credit to non-bank financial corporations.

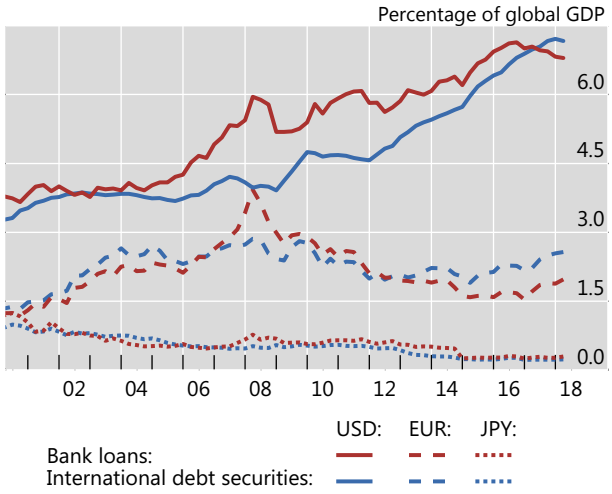
The share of debt securities and the US dollar in international credit has risen

International credit to the non-bank sector, amounts outstanding — Graph 1

International credit to non-banks by instrument



International credit to non-residents by instruments and currency



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

[1] Cross-border loans and local loans in foreign currency to non-bank borrowers. [2] By residence and immediate sector of issuer; all instruments; all maturities; non-bank issuers. International debt securities are debt securities issued by non-banks in a market other than the local market of the country where the borrower resides.

Sources: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS locational banking statistics and global liquidity indicators; BIS calculations; authors' calculations.

domestic credit conditions and external vulnerabilities in recipient countries (see box).[5] It underestimates the true level of non-banks' international borrowing, as it focuses on bank loans and debt securities. In particular, derivatives, such as FX swaps, could add substantially to the foreign currency obligations of non-banks.[6]

The post-GFC compositional shift in global liquidity has exhibited two main features. The first is the move from international bank loans to debt securities (Graph 1, left-hand panel). Cross-border and locally extended credit in foreign currency to the non-bank sector – as a share of global GDP – rose sharply in the run-up to the GFC. Bank loans grew especially fast in the last pre-crisis years. After falling sharply during the GFC, they have since remained essentially flat. By contrast, outstanding international debt securities have risen steadily since then, from 48% in the first quarter of 2008 to around 57% of total international credit in the first quarter of 2018.

The second defining feature is the rise of foreign currency US dollar credit (McCauley et al (2015a)). US dollar-denominated debt securities issued by non-US residents have been the key driver of this trend, surpassing bank loans for the first time in the second half of 2017 (Graph 1, right-hand panel). The overall amount of

[5] The BIS GLIs track various measures of international credit. See www.bis.org/statistics/about_gli_stats.htm. For methodological details, see BIS (2018).

[6] Similar to banks, non-bank financials such as investment or pension funds are likely to have large FX swap positions. See Borio et al (2017) for an estimation of the very large volume of banks' effective US dollar borrowing via FX swaps.

International credit to non-banks and the BIS global liquidity indicators

International credit to non-banks – the measure used throughout this feature – builds on the various measures in the BIS global liquidity indicators (GLIs). A key measure of the GLIs is credit to non-residents (ie foreign currency credit),① which measures credit to borrowers outside the jurisdiction where a currency is issued, for three major currencies (US dollar, euro and Japanese yen). For instance, US dollar credit to non-residents comprises all US dollar bank loans to and debt securities issued by residents outside the United States – be it cross-border or locally raised.② International credit to non-banks encompasses credit to non-residents in the three major currencies (Table A, row 1) but adds cross-border credit to residents (ie cross-border local currency credit) in these currencies (row 2) as well as cross-border and locally extended foreign currency credit in all other currencies (row 3). A significant part of the amount in row 2 ($5.8 trillion or 63% at end-March 2018) consists of euro-denominated cross-border credit to euro area countries.

Credit to non-residents in the GLIs can be broken down by instrument into bank loans and debt securities. However, banks do not just grant loans. They also can be significant holders of international debt securities (Table A, fifth column). As a result, it is misleading to identify securities issuance with capital market financing, as is often done. At end-March 2018, BIS reporting banks held about $4.7 trillion in international debt securities, more than a quarter of the total outstanding. Summing total bank loans (first column) and their debt securities holdings (fifth column) yields international bank claims on the non-bank sector – another key GLI.③

BIS GLIs and international credit

Outstanding credit to the non-bank sector at end-March 2018, in billions of US dollars Table A

	Bank loans, total	Bank loans: Cross-border	Bank loans: Local in foreign currency	International debt securities, total	Debt securities: Held by banks	Total
(1) International credit to non-residents[1] in major currencies	7,409	4,324	3,085	8,154	1,102	15,563
USD	5,554	3,323	2,231	5,860	811	11,414
Of which: to EMEs	2,085	1,041	1,044	1,582	171	3,667
EUR	1,615	872	743	2,104	290	3,719
Of which: to EMEs	511	260	251	282	38	792
JPY	240	129	111	190	…	430
Of which: to EMEs	44	26	19	27	…	72
(2) International credit to residents in major currencies	2,282	2,282	.	6,930[2]	2,487	9,212
Of which: euro credit to euro area countries	1,030	1,030	.	4,811	1,192	5,841
(3) International credit in other currencies	3,610	1,429	2,181	2,367	1,087	5,976
Of which: to EMEs	442	248	195	120	125	562
Total international credit (sum of (1), (2) and (3))[3]	13,301	8,035	5,266	17,450	4,676	30,751
Total international credit (% GDP)[4]	16.27	9.83	6.44	21.34	5.72	37.60

[1] Credit to borrowers outside the respective currency area. [2] International debt securities (IDS) are defined as those issued in a market other than that of the country where the borrower resides (Gruić and Wooldridge (2012)). This does not necessarily imply that the securities are held cross-border. Nevertheless, in most cases, the IDS represent a reasonably good approximation. [3] Calculation does not include national data for China and Argentina as in the GLIs. [4] Cumulative sum over quarterly global GDP in last four quarters, ending in Q1 2018.

Sources: IMF, *World Economic Outlook*; Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS locational banking statistics and global liquidity indicators; BIS calculations; authors' calculations.

① The GLIs are residence-based and therefore do not include credit borrowed by offshore entities. ② See www.bis.org/statistics/e2_1.pdf. ③ See www.bis.org/statistics/e1.pdf.

dollar credit to the non-bank sector outside the United States has climbed from 9.5% of global GDP at end-2007 to 14% in the first quarter of 2018. Since end-2016, however, the growth in dollar credit has been flat.

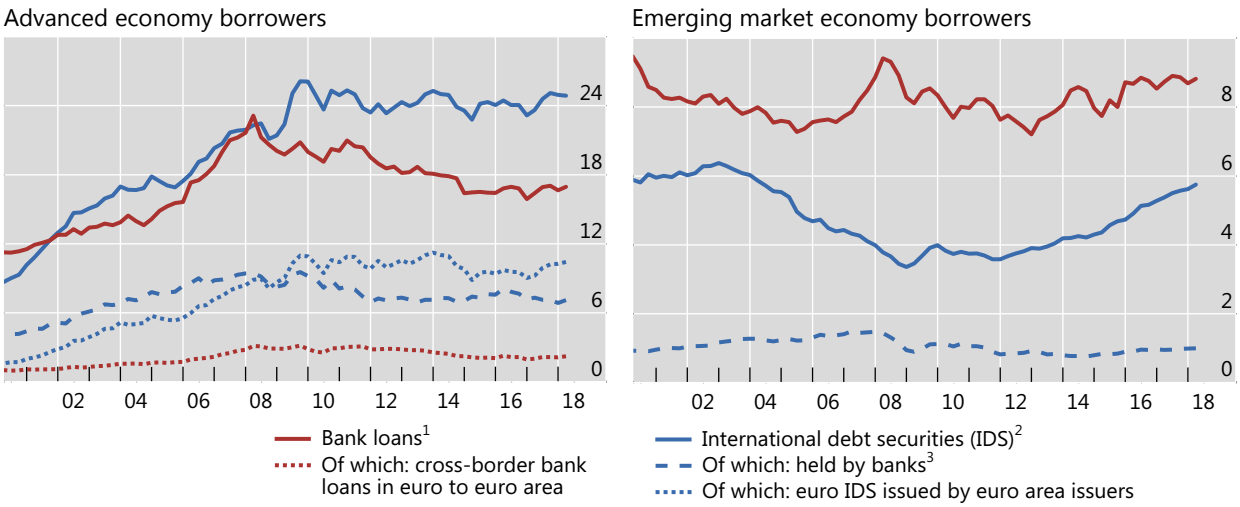
The shift from bank loans to debt securities

The shift towards international debt securities has been most pronounced in advanced economies (Graph 2, left-hand panel). Bank loans to this group of borrowers has been declining – with the decline accelerating after the euro zone sovereign debt crisis. This was to a large extent driven by European banks reducing their international loan exposures in response to the GFC and the euro area debt crisis – in particular those denominated in US dollars to US residents (McCauley et al (2017), Borio and Disyatat (2011)). Both euro-denominated cross-border bank loans and debt securities of euro area borrowers remained fairly stable and had little effect on the overall trend in the corresponding aggregates for advanced economies.

In EMEs, outstanding international debt securities have risen strongly as a share of GDP since 2010, albeit from a lower level than bank loans (Graph 2, right-hand panel). In contrast to advanced economies, bank loans to and debt securities issuance by EMEs have been growing in tandem in recent years. A tell-tale sign of the ease of financing conditions for EME borrowers has been the ability of sub-investment grade sovereigns to issue US dollar-denominated debt securities.[7]

The shift to debt securities has been stronger for advanced economy borrowers

Amounts outstanding, as a percentage of regional GDP — Graph 2



[1] Cross-border loans and local loans in foreign currency to non-bank borrowers. [2] By residence and immediate sector of issuer; all instruments; all maturities; non-bank issuers. [3] Cross-border debt securities holdings in all currencies and local holdings in foreign currency reported by LBS-reporting banks.

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

[7] Along with an increase in issuance volumes, the number of sovereigns with access to international debt markets has expanded (for example, it now includes the governments of Ghana and Jordan).

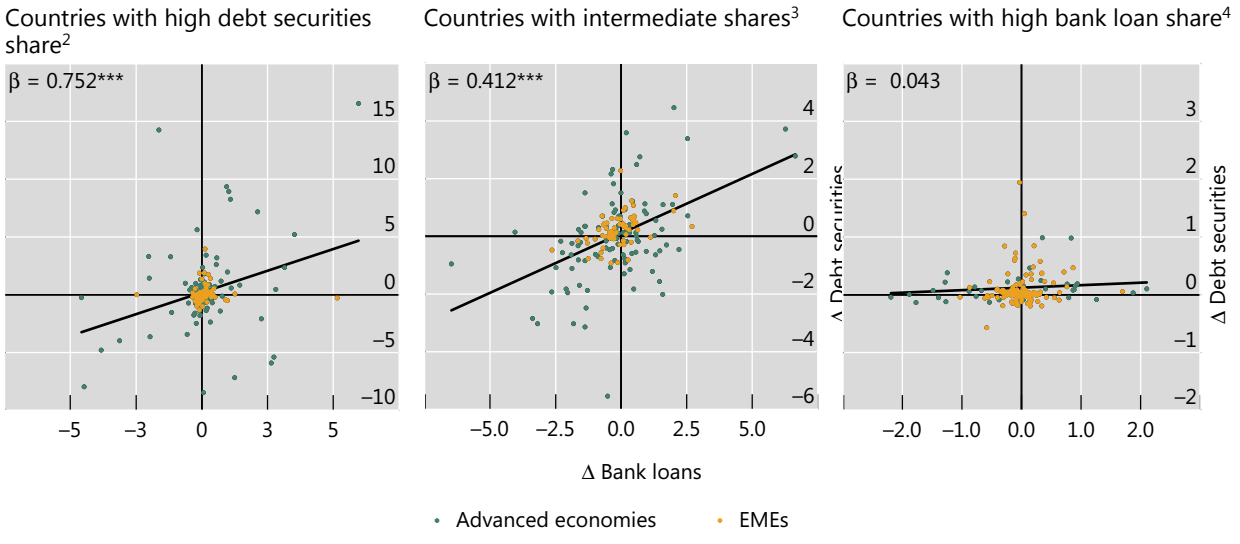
The distinction between bank loans and debt securities obscures the fact that a significant share of debt securities is held by banks and therefore represents bank credit. Just as they have done with bank loans, global banks have also reduced their international debt securities holdings. In particular in advanced economies, global banks seem to have reduced both loan and debt security positions, consistent with the rising role of non-banks in driving global liquidity. In EMEs, this trend is particularly visible in the contrast between the strong growth in international debt securities and flat bank holdings of debt securities (Graph 2, right-hand panel, solid blue versus dashed blue lines). Despite a 13 percentage point decline over the past decade, global banks' international debt securities holdings still account for a significant share in the total outstanding (27% at end-March 2018).

The highly aggregated view of advanced and emerging market economies conceals the complementarity of international bank loans and debt securities at the country level.[8] The fall in bank loans for advanced economy borrowers as a whole is effectively driven by four countries: France, Germany, the United Kingdom and the United States. At the country level, however, growth of bank loans is on average positively related to growth of debt securities for both advanced economy and EME borrowers (Graph 3).

The link between bank borrowing and debt securities issuance has tended to be the weakest for countries with a historically high bank loan share. In the extreme case where a borrower in a given country does not have access to debt securities markets,

International bank loans and debt securities are complements[1]

Quarterly changes in outstanding international bank loans and debt securities for selected countries — Graph 3



[1] In percentage points of country GDP, from Q1 2010 onwards. The distinction between countries with high debt security shares, intermediate shares and high bank loan shares is based on their average shares during Q1 2000–Q4 2009. β is the estimated slope; */**/*** indicate significance at the 10/5/1% level, respectively. [2] AR, CA, IT, MY and NL. [3] BE, GB, MX, NO and PL. [4] CH, CN, ID, IN and SA.

Sources: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS locational banking statistics; BIS calculations; authors' calculations.

[8] Many factors can affect the degree of complementarity or substitutability, in particular country-specific ones. Cerutti and Hong (2018) find evidence of a substitution of bank loans for debt securities for some advanced economy corporate and sovereign borrowers as well as EME sovereign borrowers. Becker and Ivashina (2014) find evidence of substitution at the firm level.

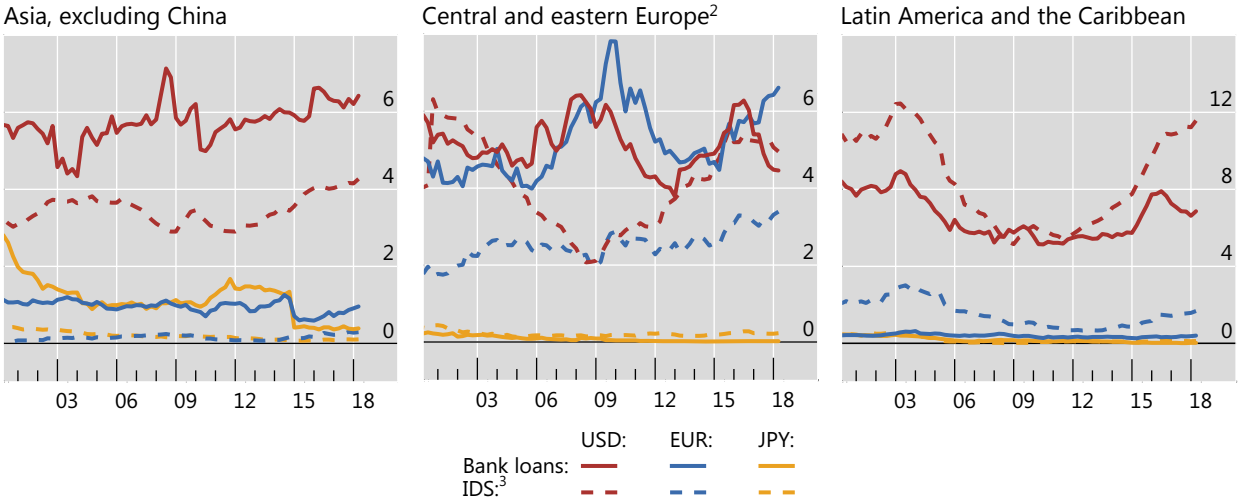
or has a strong preference for bank loans, any international borrowing will naturally be through bank loans. Indeed, for borrower countries with a high bank loan share, changes in international credit are almost entirely due to bank loans on average (Graph 3, right-hand panel). For borrower countries with historically high debt security shares, on the other hand, there is a strong positive relationship between changes in outstanding international bank loans and debt securities (left-hand panel). Borrower countries with intermediate shares still exhibit complementarity, but to a lesser degree (centre panel). In other words, there is a strong common and cyclical component for different instruments of international credit for countries that do not heavily rely on bank loans.

Foreign currency credit to EMEs

In all major emerging market regions, the growth of US dollar-denominated credit has outpaced that in other foreign currencies. The high share of dollar borrowing foreshadows risks that could materialise in the case of a persistent dollar appreciation.[9] A stronger dollar increases tail risks for global investors holding a diversified portfolio of EME assets (Avdjiev et al (2016)), which can lead to widespread reductions in EME exposures – especially of dollar bonds. This mechanism is likely to

Foreign currency credit to non-bank borrowers in EMEs

Amounts outstanding,[1] as a percentage of regional GDP — Graph 4



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

[1] Excludes Russia from reporting countries. [2] Excludes euro area countries from counterparty countries. [3] International debt securities (IDS) refer to debt securities by residence and immediate sector of issuer; all instruments; all maturities; non-bank issuers.

Sources: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS locational banking statistics and global liquidity indicators; BIS calculations.

[9] A strengthening bilateral dollar exchange rate can affect non-financial corporates by weakening their balance sheets (Bruno and Shin (2015)). This depends on the degree of hedging, for which only scant information is available. A stronger dollar can also affect sovereigns, as it tends to raise sovereign yields and CDS spreads more generally (Hofmann et al (2017)).

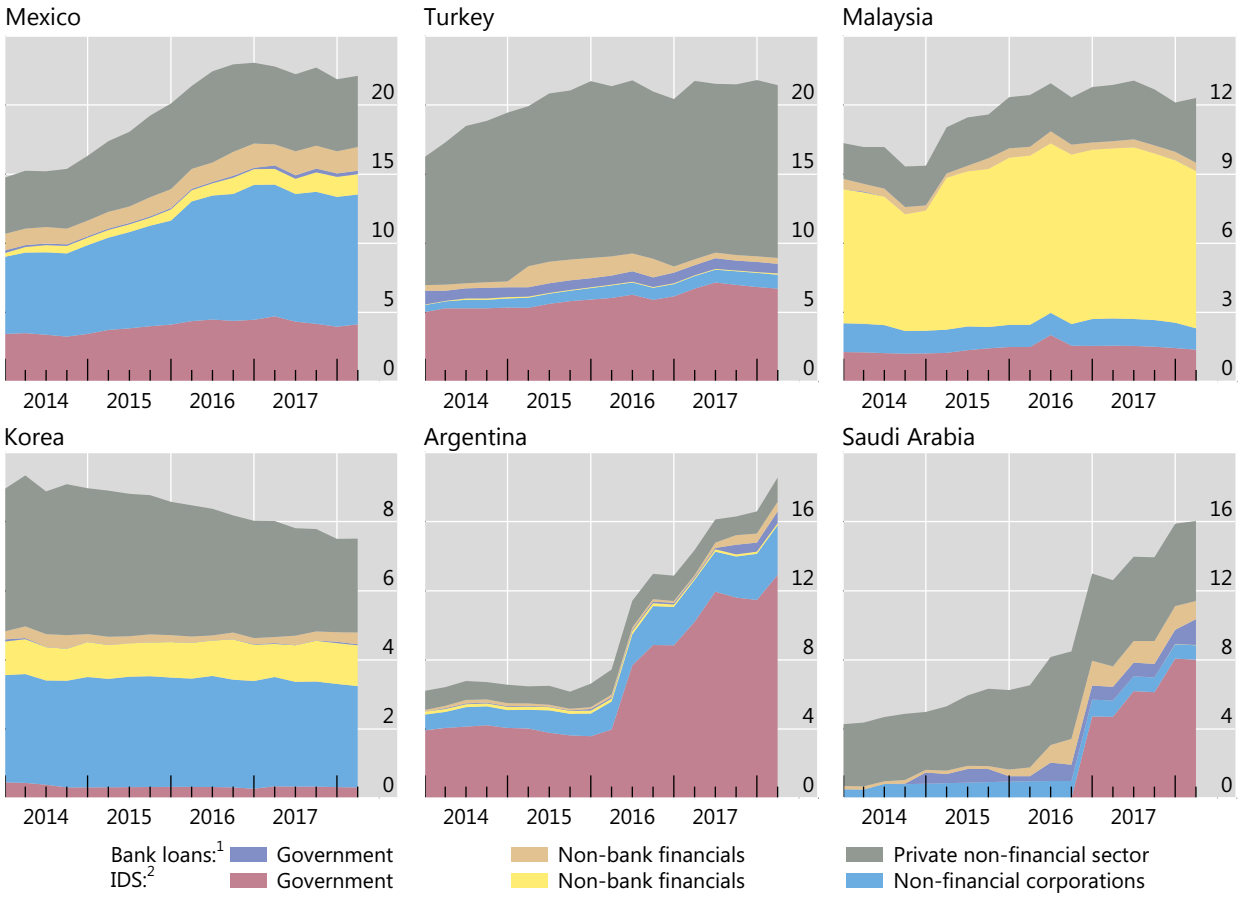
have contributed to the recent bout of turbulence in EMEs (see "Divergences widen in markets", *BIS Quarterly Review*, September 2018).

Across the major EME regions, the importance of the dollar as a funding currency varies, however. In emerging Asia, US dollar-denominated credit has been on the rise since 2010 – both as debt securities and as bank loans (Graph 4, left-hand panel). In central and eastern Europe, euro-denominated credit has traditionally played a relatively more important role. Yet the dollar dominates also in this region, despite the strong pickup in euro credit since 2015 (centre panel). In Latin America, US dollar credit has historically dominated and has grown strongly since 2010, driven by debt securities issuance (right-hand panel).

The increase in US dollar borrowing in EMEs has differed across sectors (McCauley et al (2015b)). In some major EMEs, corporate borrowing played a key role. In Mexico, non-financial corporates' dollar debt securities issuance has been a main driver of international borrowing by non-banks (Graph 5, top left-hand panel, blue area). Despite the relative decline in bank loans in the post-crisis period, US dollar bank lending to the private non-financial sector has also expanded in some countries,

The sectoral heterogeneity of US dollar borrowing across selected EMEs

Amounts outstanding, as a percentage of GDP — Graph 5



[1] Bank loans refer to cross-border loans as well as locally extended loans. For AR, MY and SA, only cross-border loans are included. Bank loans with an unallocated sector are attributed proportionally to the respective reported sectoral breakdown. [2] International debt securities (IDS) refer to debt securities by residence and immediate sector of issuer basis; all instruments; all maturities; non-bank issuers.

Sources: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS locational banking statistics; BIS calculations; authors' calculations.

including Turkey (top centre panel). Dollar borrowing by non-bank financial corporates is less prevalent overall, but plays a large role in Malaysia (top right-hand panel) as well as Korea (bottom left-hand panel). Yet Korea has been unique among the major EMEs in its consistent reduction of overall non-bank US dollar borrowing.

While EME corporates have been significant borrowers of US dollars, sovereign debt issuance has also played an important role. Argentina is a case in point, with a sharp increase in debt securities issuance by the sovereign since early 2016 (Graph 5, bottom centre panel). Similar increases took place in some oil-exporting economies, such as Saudi Arabia (bottom right-hand panel; see also BIS (2017)).

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Fintech credit markets around the world: size, drivers and policy issues[1]

Fintech credit has grown rapidly around the world in recent years, but its size still varies greatly across economies. Differences reflect economic development and financial market structure: the higher a country's income and the less competitive its banking system, the larger is fintech credit activity. Fintech credit volumes are also greater in countries with less stringent banking regulation. Fintech credit offers an alternative funding source for businesses and consumers, and may improve access to credit for underserved segments. It may enhance the efficiency of financial intermediation. However, as shown by some failures and conduct problems, it also gives rise to a number of challenges for regulators. Many of these are centred on ensuring adequate consumer and investor protection. For financial stability, challenges and benefits may arise if the fintech credit sector grows further, or if banks make greater use of similar technological innovations in their credit provision.

JEL classification: E51, G23, O31.

Financial innovations enabled by digital technology, or "fintech", have started to play an important role in the provision of many financial services. While technological development in finance is not new (Dermine (2016)), progress has arguably sped up in the digital age. Fundamental advances in the internet, mobile communications, distributed computing, and information collection and processing have underpinned a range of recent innovations in finance (see FSB (2017a) and IMF (2017) for an overview). Consumers in both advanced and emerging market economies have increasingly adopted digital financial services that are more convenient (Ernst and Young (2017)).

Given the importance of credit for the economy, this special feature focuses on the development of fintech credit. We define it as credit activity facilitated by electronic platforms that are not operated by commercial banks.

While fintech credit has grown rapidly around the world, the volume of activity (per capita) varies greatly across economies. We find that these differences, to the extent they can be explained, reflect factors that also affect more traditional forms of credit. Notably, the higher a country's income level, the larger is fintech credit activity.

[1] Parts of this special feature draw on CGFS-FSB (2017), a report on fintech credit prepared by a working group established by the Committee on the Global Financial System (CGFS) and the Financial Stability Board (FSB). The authors acknowledge the valuable comments provided by Claudio Borio, Benjamin Cohen, Ingo Fender, Hyun Song Shin and Kostas Tsatsaronis, and thank Matthias Lörch and Jimmy Shek for excellent research assistance. The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements (BIS), the CGFS or the FSB.

Key takeaways

- Fintech credit has grown rapidly in recent years, and is larger in some economies, notably China, the United States and the United Kingdom.
- The size of an economy's fintech credit market is positively related to its income level, and negatively related to the competitiveness of its banking system and the stringency of its banking regulation.
- Fintech credit offers an alternative funding source for businesses and consumers, and may improve access to credit for underserved segments.
- But, as some operational failures and conduct problems highlight, fintech credit poses challenges for regulators in ensuring adequate consumer and investor protection.

Reflecting its competition with other sources of credit, the volume of fintech credit is greater the less competitive the country's banking system is. Yet, in contrast to other forms of credit, fintech credit volumes are currently higher in economies with less stringent banking regulation.

For regulatory authorities, the rapid development of fintech credit gives rise to opportunities, but also challenges. If managed well, there may be broad benefits for financial inclusion and financial system diversity. Challenges currently centre largely on ensuring adequate consumer and investor protection through licensing and conduct regulation. Hence, concerns have arisen about growing fintech credit losses and poor business conduct in some economies, exemplified by recent platform failures in China. Concerns about financial stability may also emerge if the sector grows further (CGFS-FSB (2017)). A review of regulatory approaches reveals commonalities, but also key differences, such as in risk management rules for fintech credit firms. This relates in part to different perspectives on how to balance risks with the goal of fostering greater innovation.

The remainder of this feature is organised as follows. First, after introducing our definition (Box A), we sketch how fintech credit platforms operate and contrast this with credit provision by the traditional banking sector. Next, we show how the size, growth and nature of fintech credit markets have evolved across jurisdictions. We then examine the factors that might determine fintech credit using simple regression analysis. We also present a case study of China (Box B), currently the single largest fintech credit market. We go on to discuss the potential benefits and risks of fintech credit for end users and the broader economy and financial system. Finally, we detail some of the approaches regulatory authorities have taken.

How does fintech credit work?

Fintech credit is facilitated by electronic (online) platforms. Platforms can vary significantly in design, but they all use digital technologies and innovations to interact fully (or largely) with customers online and process large amounts of customer information.[2] Platform business models have generally become more complex since the industry's inception in 2005 with the UK platform Zopa.

[2] Key digital innovations include application programming interfaces (APIs), artificial intelligence and machine learning, and predictive data analytics (FSB (2017a), IMF (2017)).

Box A

Defining and measuring fintech credit

There is no internationally agreed definition of fintech credit. We define fintech credit broadly to include all credit activity facilitated by electronic (online) platforms that are not operated by commercial banks. This approach is consistent with that taken in CGFS-FSB (2017).

This definition of fintech credit encompasses all credit activity facilitated by platforms that match borrowers with lenders (investors). Depending on the jurisdiction, these platforms are referred to as "peer-to-peer (P2P) lenders", "loan-based crowdfunders" or "marketplace lenders".① It also includes platforms that use their own balance sheet to intermediate borrowers and lenders. In principle, the credit activity of platforms provided by technology companies can also be included.

Compared with other credit providers, a unique characteristic of fintech credit entities is that they make use of digital technologies and innovations to interact fully (or largely) with customers online and process large amounts of customer information. At this point, commercial banks, even those with online services, do not digitise credit processes to the same degree and typically use offline processes and staff. Crucially, unlike fintech credit platforms, banks also accept demand deposits. This function is a key reason why commercial banks are subject to various prudential regulations and supervision, including extensive data reporting requirements. To date, fintech credit providers generally lie outside this prudential regulatory (and reporting) perimeter. For this reason, fintech credit is effectively considered part of the alternative credit market.

Measuring the size of fintech credit is challenging, in part because of its novelty, small size and diversity. Official national data are limited, as fintech credit platforms are not subject to regulatory reporting requirements in most jurisdictions. Hitherto, the most comprehensive data have been collected by the Cambridge Centre for Alternative Finance (CCAF), together with academic or industry partners. These data are compiled by surveying fintech platforms, and where possible supplemented with other information from public reporting and secondary sources (such as platform websites). Private sector data providers such as industry bodies or firms producing fintech credit analytics also provide some statistics (eg AltFi Data, WDZJ.com, the Crowd Institute and P2PFA).

These and other data yield a reasonable picture of the size and recent growth of fintech credit markets across economies. However, there are several limitations. First, they do not include all platforms; some sources consider only the largest ones, in part because many platforms have very little turnover. Second, they exclude some types of activity that could arguably be considered as fintech credit. For example, online mortgage lenders, prominent in some countries, are generally left out, even when they automate nearly all processes and match borrowers with institutional investors.② Similarly, in China, and more recently in the United States and some Latin American countries, large technology or "big tech" firms, excluded from most data sources, have become important lenders. Most notably, some e-commerce platforms now extend credit to merchants using their platform.③ Given these limitations, the amount of fintech credit is likely to be underestimated for some (key) jurisdictions. Lastly, data on the stock of total fintech credit, as opposed to new credit originated, are generally not available. While individual platforms may disclose very granular data on loan amounts, types, maturities, interest rates, defaults, etc, these data too are not available consistently for the sector as a whole.

① These credit platforms are often grouped under the umbrella term of "internet finance" or "digital finance", which also includes platforms that facilitate equity or donation crowdfunding, or provide wealth management and insurance solutions. ② Prominent examples in the United States are Quicken Loans, Loandepot, Guaranteed Rate and Amerisave. ③ For instance, Alifinance and its successor Ant Financial have provided loans and short-term funds to small and medium-sized enterprise vendors on Alibaba's platforms since 2010 (Chen (2016)). Amazon Lending provides loans to merchants on Amazon. In Argentina, Brazil and Mexico, Mercado Crédito provides working capital loans to entrepreneurs on Mercado Libre.

In a simple peer-to-peer (P2P) business model, the online platform provides a low-cost standardised loan application process and facilitates direct matching and transacting of borrowers and investors (lenders).[3] Prospective borrowers provide information on their own finances and the project for which they seek funding; investors then review it on the platform (most often only after the platform has verified it). Once a borrower and investor are matched, loan contracting comes into force directly between them. This ensures that the investor, rather than the platform operator, takes on the risks immediately. Investments and loans are usually duration-matched, with investors unable to liquidate their investments before expiration. The only way for an investor to take money out early is to find another investor willing to take over the investment. Some P2P platforms assist this process by providing a secondary market where investor sales can take place or a credit's rights can be transferred.

Once the loan is originated, the credit platform acts as an agent for the investors by servicing the loan in return for ongoing fees. The platform maintains records, collects borrower repayments, distributes cash flows to investors, and manages the recovery of unmet obligations.

To improve the information investors have when selecting individual loans, most platforms provide additional services such as borrower screening and loan pricing. An assessment of borrowers' credit quality is usually communicated in the form of a credit grade, which can then be used to set a loan interest rate (ie a fixed-price offer posted to investors). Some platforms apply more market-determined pricing mechanisms (such as auctions). That said, several prominent platforms in the United Kingdom and the United States have switched to posted fixed prices (spreads or interest rates) in recent years (Franks et al (2018) and Wei and Lin (2016)).[4]

Credit platforms typically encourage investors to spread risks. Investors can choose to spread their investments across (portions of) multiple loans, and often can automatically gain exposure to a portfolio of loans based on the risk category and terms they select. Among P2P consumer platforms, more than 95% in the United States and 75% in Europe use an auto-selection process (Cambridge Centre for Alternative Finance (CCAF) and Chicago-Booth Polsky Center (2017); CCAF (2018)). Indeed, it has become increasingly common in a number of countries for platforms to structure investments as units in a (diversified) loan pool (ASIC (2017a), FCA (2018a), Shen and Li (2018)). This portfolio approach can be combined with advertised target rates of return.

Partial protection against loan defaults is another platform service. For example, platforms in several countries maintain a contingency fund that is designed to top up payments to investors if a borrower defaults.

In facilitating credit, fintech platforms can provide monitoring and servicing functions similar to those of traditional credit providers such as banks. For most platforms, a key difference is the lack of a balance sheet for intermediating borrowers and lenders and assuming credit and other risks. Consequently, rather than earning

[3] In this respect, P2P credit platforms operate similarly to online retail marketplaces such as eBay, AirBnB and Alibaba's Taobao. However, they have features that go beyond the infrastructure needed to effectively match user preferences.

[4] Vallee and Zeng (2018) discuss a similar change – the removal by LendingClub, a US platform, of 50 out of 100 variables on borrower characteristics in 2014. They show that such moves are consistent with platforms managing adverse selection by more sophisticated investors relative to less sophisticated investors.

a net interest margin, most credit platforms use an agent model that depends on retaining and attracting an investor base to generate fee revenue. However, a minority of platforms in some jurisdictions retain loans on their balance sheet, operating more like non-bank credit intermediaries. Prior to a ban in 2016, many platforms in China also offered return or capital guarantees and promised investors the ability to redeem their investment (Box B).[5] Such practices, in effect, generate a claim on the platform's balance sheet and a liquidity mismatch, and thus give rise to the risk of a "run" on the platform.

Another important distinction between banks and fintech credit platforms is the lack of a branch distribution network and the digitalisation of most customer and loan origination processes. Notably, this includes credit decisions, where predictive algorithms and machine learning techniques are more common.[6] In the process, many platforms tend to assess a much wider array of data than other lenders typically do, including non-traditional sources such as information from online spending behaviour or social media (US Department of the Treasury (2016), Jagtiani and Lemieux (2018b)) as well as digital footprints (Berg et al (2018)). For instance, the website of one Indian P2P platform claims that its credit assessment involves a review of more than 1,000 data points per borrower. Some fintech lenders make use of detailed customer information not available to other firms or credit providers, such as tax returns or, in the case of big tech conglomerates, proprietary data from online retail marketplaces or mobile payment information.[7]

Of course, banks have access to exclusive customer data from their deposit and lending books. Banks have also begun to make greater use of new digital techniques, including applications in credit risk modelling. But they are generally not yet as advanced, in part due to some operational constraints, such as data quality and consolidation issues (van Liebergen (2017)).

Finally, from the retail investor perspective, fintech credit is a new investment category distinct from lower-yielding, but safer, bank deposits.[8] Moreover, fintech credit to businesses can be more diversified than single-company credit and more closely tailored to investor preferences in terms of risk and maturity. In this respect, it is similar to some asset management products, such as corporate bond funds.

Fintech credit market development

Available data show that fintech credit activity has expanded rapidly in many countries over recent years, albeit from a very low base. Estimates from the CCAF indicate that $284 billion in such credit was extended globally in 2016, up from $11 billion in 2013 (Graph 1, left-hand panel). Fintech credit has, however, evolved

[5] Since the 2016 ban, Chinese platform practices and investor expectations around guarantees and redemptions have been somewhat ambiguous (see eg Chorzempa (2018)). A Swedish platform that filed for bankruptcy in 2016 had offered guarantees and easy access to funds (CGFS-FSB (2017)).

[6] Machine learning comprises a set of statistical tools designed to fit the data or describe patterns in them, and is distinct from more inferential modelling (FSB (2017b), van Liebergen (2017)). Machine learning algorithms often involve extremely large data sets.

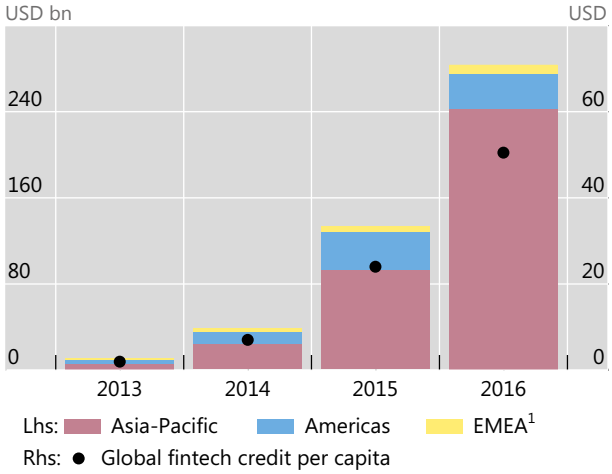
[7] See Hau et al (2018) for an account of Ant Financial's credit scoring model and credit evaluation process.

[8] It is important to note that fintech credit does not come with many of the safeguards of bank deposits, such as deposit insurance.

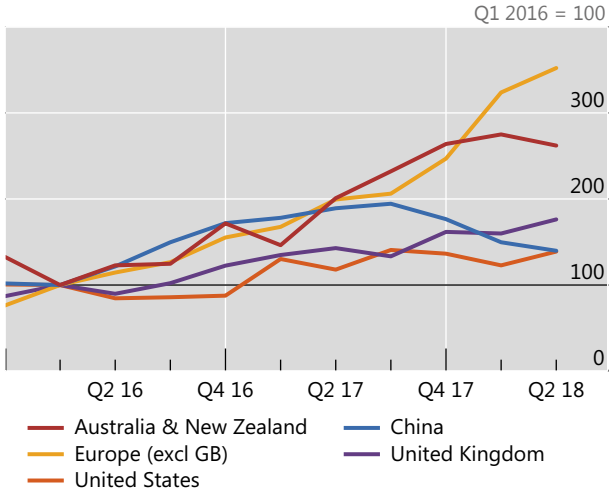
Rapid growth of fintech credit

Graph 1

Global volume of new fintech credit



Fintech credit volumes, selected countries2



[1] Europe, Middle East and Africa. [2] Data are based on two platforms for Australia and New Zealand, all platforms covered by WDZJ.com for China, 32 platforms for Europe, 30 for the United Kingdom and six for the United States.

Sources: AltFi Data; Cambridge Centre for Alternative Finance and research partners; WDZJ.com; authors' calculations.

rather unevenly across jurisdictions. In absolute terms, China was by far the largest market in 2016; the United States and the United Kingdom followed at a distance, with other large advanced economies further behind (Annex Table 1). In per capita terms, fintech credit was relatively high in several smaller economies, including Estonia, Georgia and New Zealand.

After very rapid growth in 2013–16, more recent data indicate a slowdown in many major jurisdictions. New lending volumes in China have even declined noticeably over the past few quarters (Graph 1, right-hand panel). In spite of solid growth, fintech credit represents a very small share of overall credit flows in most jurisdictions. Market shares are higher in China, with WDZJ.com estimating that it accounted for about 13% of overall new lending in the first half of 2018. In the United States, credit volumes, as measured by the CCAF, amounted to about 4% of overall net loan originations in 2016.

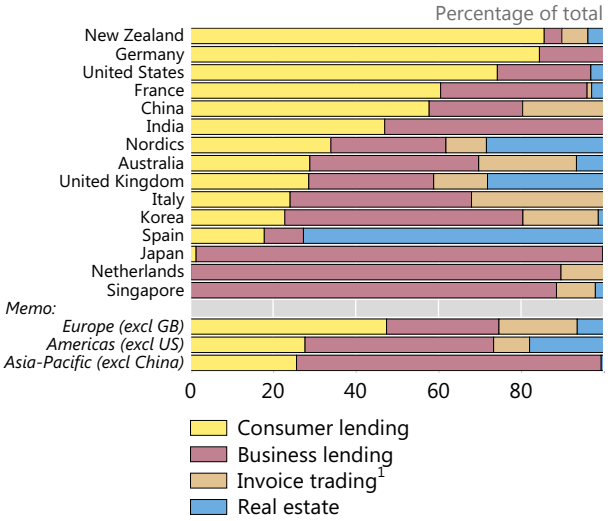
Fintech credit appears to play a larger role in specific market segments. For instance, in the United Kingdom it constituted about 15% of the lending flow of comparable bank credit to consumers and small and medium-sized enterprises (SMEs) in 2016 (CCAF (2017)). In the United States, it accounted for as much as 36% of unsecured personal loans extended in 2017 (Levitt (2018), citing TransUnion data). Estimated fintech mortgage originations (not included in the CCAF or AltFi data) amounted to 8–12% of the total in 2016 in the United States (Buchak et al (2017), Fuster et al (2018)).[9] The fintech lender Quicken Loans was the single largest mortgage originator in late 2017 (Sharf (2018)).

[9] Both studies use US Home Mortgage Disclosure Act (HMDA) data to track mortgage origination in the United States in recent years. Both consider Quicken Loans, Guaranteed Rate and Movement Mortgage to be fintech lenders. However, while Buchak et al (2017) also count Amerisave Mortgage, Cashcall Inc and Homeward Residential as fintech lenders, Fuster et al (2018) do not.

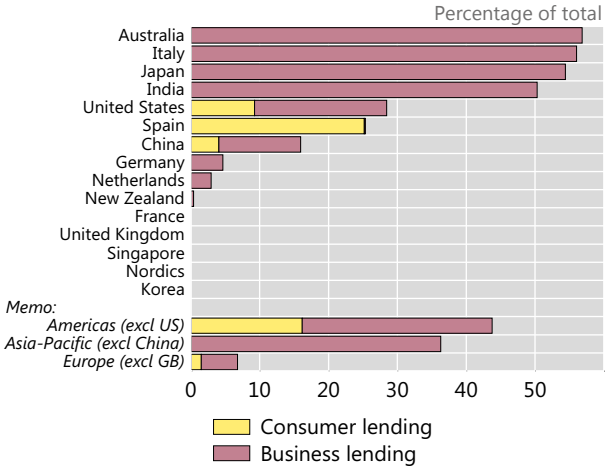
Fintech credit characteristics differ across countries

Graph 2

Volumes in 2016 by borrowing sector, ranked by consumer lending



On-balance lending platform volumes in 2016, ranked by highest share



[1] Includes a small amount of debt securities for some countries.

Source: Cambridge Centre for Alternative Finance and research partners.

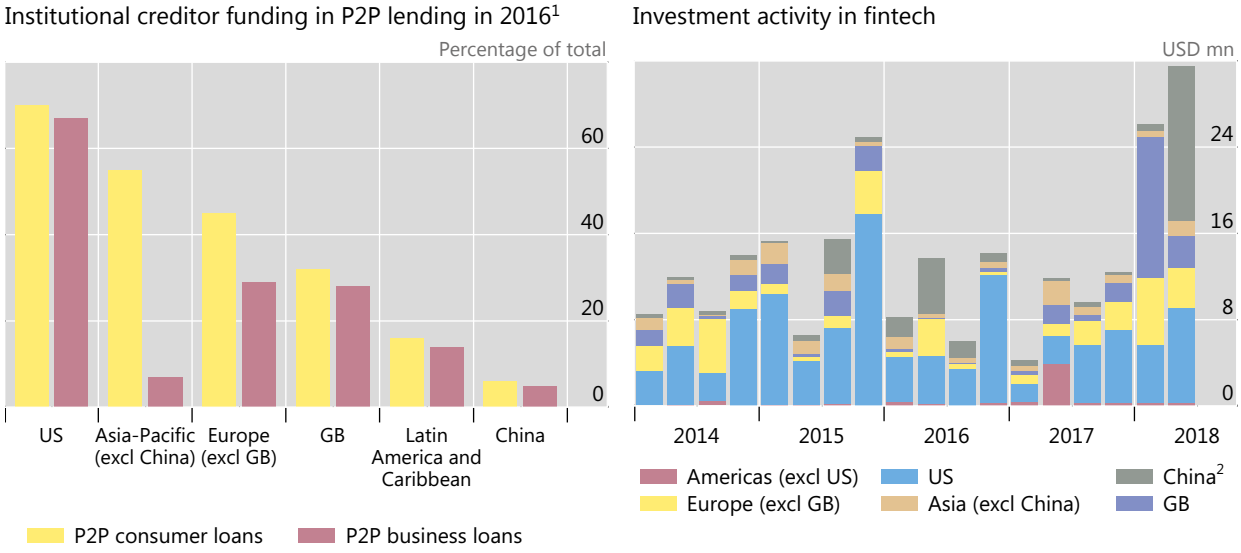
Most consumers use fintech providers to refinance or consolidate existing debts, but some use it to finance major purchases (such as vehicles or real estate). Borrowing by students to fund higher education is prominent in the United States and China.[10] On the business side, small and micro enterprises typically seek funds for working capital or investment projects. Financing can also be in the form of "invoice trading", whereby investors purchase discounted claims on a firm's invoices (receivables).

The composition of credit activity by borrower segment varies across countries. In Germany, New Zealand and the United States, consumers are by far the largest borrowers (Graph 2, left-hand panel). In contrast, in Japan, the Netherlands, Singapore and several other markets, lending to businesses is more prevalent. In Australia and Italy, invoice trading accounts for a relatively large share. Business lending tends to be the main credit type for fintech credit platforms that retain loans on their own balance sheets (right-hand panel).

In many jurisdictions, especially China, fintech investors are mainly individuals, as suggested by the P2P branding of many platforms. However, in some countries, institutional investors have gained ground. For example, the available data suggest that, in 2016, institutional investors funded the majority of new loans in the United States and parts of Europe (Graph 3, left-hand panel). Indeed, because of their significant involvement, fintech lending in the United States is now typically referred to as "marketplace lending" rather than P2P lending (US Department of the Treasury (2016, 2018)). Institutional investors can fund loans on credit platforms in bulk. Securitisation has become another important funding avenue in the United States,

[10] In China, "campus" loans came under stringent regulatory scrutiny and were suspended in June 2017 (Box B).

Institutional funding and fintech investment are higher in some markets Graph 3



[1] Private equity, venture capital, and mergers and acquisitions. [2] Venture capital only.

Sources: Cambridge Centre for Alternative Finance and research partners; KPMG; authors' calculations.

with around $13 billion of investments in P2P loan securitisations issued in 2017 (US Department of the Treasury (2018)).

What drives fintech credit?

Despite the global reach of technology, the size of fintech credit differs markedly across countries. This points to the likely role of country-specific factors. Which have been the drivers of fintech credit?

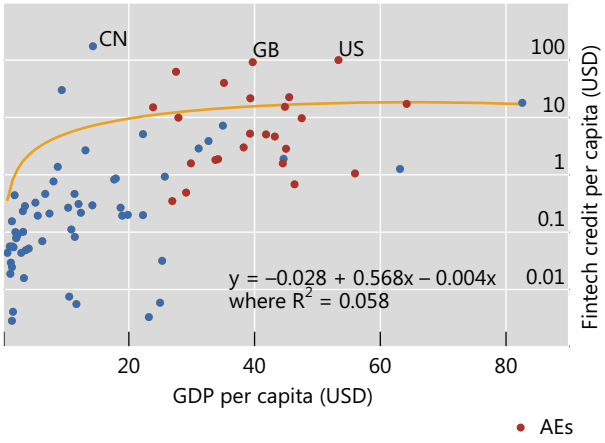
Some factors have had an impact on all forms of credit. These include a country's economic growth, its level of economic and financial development, and the quality of its legal and other institutions (eg Demirgüç-Kunt and Levine (2018)). Another set of factors might relate to the degree of competition in credit markets. A less competitive banking system could mean higher margins on bank credit and thus boost alternative credit sources like fintech credit. Furthermore, if platforms are able to better assess borrower information or reach customers than existing credit providers, fintech credit could be greater in jurisdictions where accessing credit is more difficult. Deeper capital markets, as in the United Kingdom and the United States, can help to provide funds for platforms to develop (Graph 3, right-hand panel).

The intensity and quality of financial regulation could also matter. A priori, the overall effects can be ambiguous. More stringent overall regulation might engender trust in new forms of financial intermediation. Alternatively, it could inhibit innovation and deter potential market entrants. Sector-specific rules can matter too. In particular, less intense regulation of fintech activities could aid their growth; it could even encourage regulatory arbitrage to the extent that similar risks are regulated more tightly in the traditional lending sector.

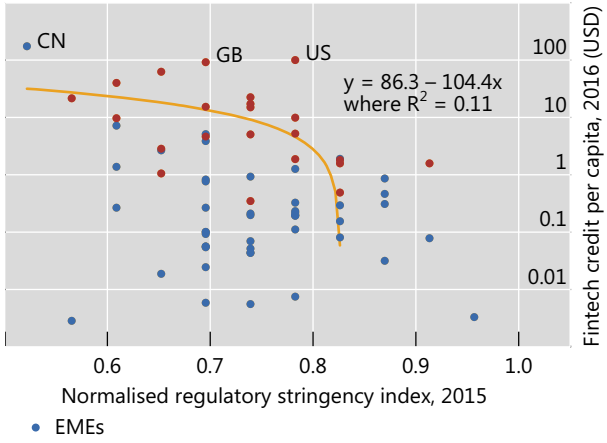
Fintech credit is correlated with economic development and regulatory stringency[1]

Graph 4

Fintech credit and GDP per capita by country, 2016



Fintech credit by country and regulatory stringency



AEs EMEs

[1] Vertical axis uses a logarithmic scale.

Sources: IMF, *World Economic Outlook*; World Bank, *Bank Regulation and Supervision Survey*; Cambridge Centre for Alternative Finance and research partners; authors' calculations.

Recent cross-country research on the drivers of fintech activities provides useful insights. Rau (2017) finds that barriers to entry and prevailing financial depth (ie credit to GDP) help promote the volume of crowdfunding, as do the rule of law, control of corruption, and quality of regulation in general.[11] Moreover, crowdfunding is larger in economies where existing intermediaries are more profitable, suggesting that a lack of competition also matters. Navaretti et al (2017) find that investment in fintech firms (scaled by GDP) is higher where an economy has greater financial depth, as proxied by ratios of credit and bank assets to GDP, and lower where the banking sector is more regulated, suggesting that regulatory arbitrage plays a role.

Simple bivariate evidence points to fintech credit having a positive, non-linear relationship with GDP per capita (Graph 4, left-hand panel) and a negative relationship with banking regulation stringency (right-hand panel).[12]

To better understand the relative importance of possible fintech credit drivers, we conduct a multivariate cross-country regression analysis for a sample of 63 economies for 2016, based on the following baseline specification:[13]

$$c_i = \alpha_i + \beta_1 y_i + \beta_2 y_i^2 + \gamma LI_i + \delta RS_i + \varepsilon_i$$

where c_i is the volume of fintech credit per capita in economy i in 2016; y_i is the log of GDP per capita in economy i, which we treat as a measure of economic development, and the variable y_i^2 captures possible non-linearity in the relationship; LI_i is the Lerner index of banking sector markups (an indicator of market power) in

[11] In addition to credit activity, crowdfunding includes equity capital raising and funding via donations.

[12] Regulatory stringency is constructed as an index based on the World Bank's Bank Regulation and Supervision Survey. The index takes a value between 0 (least stringent) and 1 (most stringent) based on 18 questions about bank capital requirements, the legal powers of supervisory agencies, etc.

[13] A number of further control variables were included and were generally found not to be statistically significant. The online appendix provides further details.

Regression results for fintech credit volumes across countries, 2016 Table 1

	Total fintech credit	Total fintech credit	Business credit	Consumer credit
	(1)	(2)	(3)	(4)
GDP per capita[1]	0.208***	0.201***	0.188***	0.081
GDP per capita squared[1]	–0.002*	–0.002*	–0.002*	–0.001
Lerner index[2]	3.295*	2.575*	2.225	2.450
Normalised regulation index[3]	–11.550**	–9.492**	–9.091*	–8.101*
CN dummy		4.038***		
US dummy		3.447***		
UK dummy		2.941***		
Constant	4.310	2.979	2.596	4.017
N	63	63	50	50
R squared	0.582	0.662	0.525	0.182

[1] Average from 2013–15; GDP per capita, in USD thousands. [2] Average from 2010–15. [3] In 2015.

*/**/*** indicates statistical significance at the 5/1/0.1% level.

Sources: IMF, *World Economic Outlook*; World Bank, *Bank Regulation and Supervision Survey* and Global Financial Development Database; Cambridge Centre for Alternative Finance and research partners; authors' calculations.

economy i;[14] and RS_i is a regulatory stringency index for the banking sector of economy i, as constructed by Navaretti et al (2017) (a higher value indicates more stringent regulation). All explanatory variables are lagged, and most are averaged over a number of years to avoid short-run variations driving our results.

The regression results confirm that an economy's fintech credit volume per capita is positively associated with GDP per capita (Table 1, column (1)). Since GDP per capita is likely to be a proxy for many other aspects of a country's stage of development (indeed, it is highly correlated with several of the other possible explanatory variables we examined), the relationship could capture any of several possible effects. In any event, this result confirms a broad positive relationship between a county's overall economic and institutional development and the depth of fintech credit. The negative coefficient estimate on squared GDP per capita suggests that such effects become less important at higher levels of development.

The positive coefficient estimate on the Lerner index suggests that there is more fintech credit activity in those jurisdictions with a less competitive banking sector. This is consistent with the notion that fintech credit offers relatively lower costs and greater convenience in these countries. The relationship, however, is not that important economically.

We find that more stringent banking regulation deters fintech credit activity. This could have several possible explanations. It could suggest that fintech regulations are also more liberal in jurisdictions where banking regulation is more liberal. Conversely, it may be more difficult to launch new lending activities in countries with relatively strict prudential and bank licensing regimes. This provides some evidence against the argument that regulatory arbitrage boosts fintech activity in general. That said, it does not rule out its role in individual countries.

[14] The index relates the market price of a product or service to the marginal cost of producing it. It ranges from 0 for a perfectly competitive market to 1 in case of a monopoly.

Dummy coefficient estimates indicate that the amount of fintech credit in the three largest markets – China, the United States and the United Kingdom – is much larger than what would be suggested by the drivers included in our model (column (2)). This suggests that there might be country-specific factors at work. However, the impact of the other variables that we consider remains strong. Box B explores some of the idiosyncratic factors underlying the larger amount of fintech credit activity in China.

Our analysis suggests that, under various different model specifications, GDP per capita and its quadratic term account for 64–78% of the explained variation in fintech credit volume per capita. The stringency of banking regulation explains 14–20%, the banking sector markup (Lerner index) 1–2%, and the country dummies about 10%, 5% and 6% for China, the United States and the United Kingdom, respectively.

The drivers of fintech business credit segments appear to be very similar to those of overall fintech credit, except that the banking sector markup is no longer statistically significant (column (3)). For consumer credit, our model does not perform as well: the R^2 is lower (column (4)), and the coefficient estimates for GDP per capita and banking sector markup are not statistically significant. On the other hand, regulatory stringency does appear to depress consumer credit activity, similar to the cases of aggregate and business fintech credit.

Implications for credit availability and risk

Given how young the industry is, it is too early to properly evaluate its impact on end users, ie lenders and borrowers, let alone on financial stability and the economy at large. Moreover, differences in institutional arrangements and data limitations make it hard to generalise. Nonetheless, with these caveats in mind, it is possible to identify some benefits and risks, drawing also on the findings of recent analytical work.

With respect to the impact on users, in principle the use of new digital technologies and more granular customer data promise greater convenience, lower transaction costs and better credit risk assessments. Some micro-evidence of specific markets and platforms is consistent with this notion. Fuster et al (2018) find that fintech lenders in the United States improve borrower convenience by processing mortgages 15–30% faster than other lenders, on average. The authors do not find evidence of higher (conditional) default rates. Jagtiani and Lemieux (2018b) find that rating grades of the US platform LendingClub, which are assigned based on non-traditional data, predict loan performance well and allow certain borrowers to obtain more favourable terms. In a similar vein, Berg et al (2018) find that a German P2P platform's default risk assessments, incorporating data on the digital footprints of customers registered on its website, outperform its assessments based on credit bureau data alone.

There is also evidence that fintech platforms have widened access to credit (De Roure et al (2016), Jagtiani and Lemieux (2018a), Baeck et al (2014), US Department of the Treasury (2016)). For the United States, Tang (2018) finds that P2P lending is a substitute for bank lending in that it serves infra-marginal bank borrowers, but also complements bank lending for small-scale loans. In China, fintech credit is arguably well suited to fund small firms and less affluent consumers: with their access to traditional bank credit limited, these borrowers have often had to

resort to informal private and more expensive lenders. For instance, there is evidence that automated credit lines to firms trading on Alibaba's e-commerce platform increase access to credit for firms with a low credit score (Hau et al (2018)). In a survey of retail borrowers on a large Chinese platform, more than half reported that they had no borrowing history from a financial institution (Deer et al (2015)). Similarly, a survey of businesses borrowing on platforms in Chile and Mexico found that half had no access to other external funding sources and very few had bank loans (CCAF and Inter-American Development Bank (2018)).

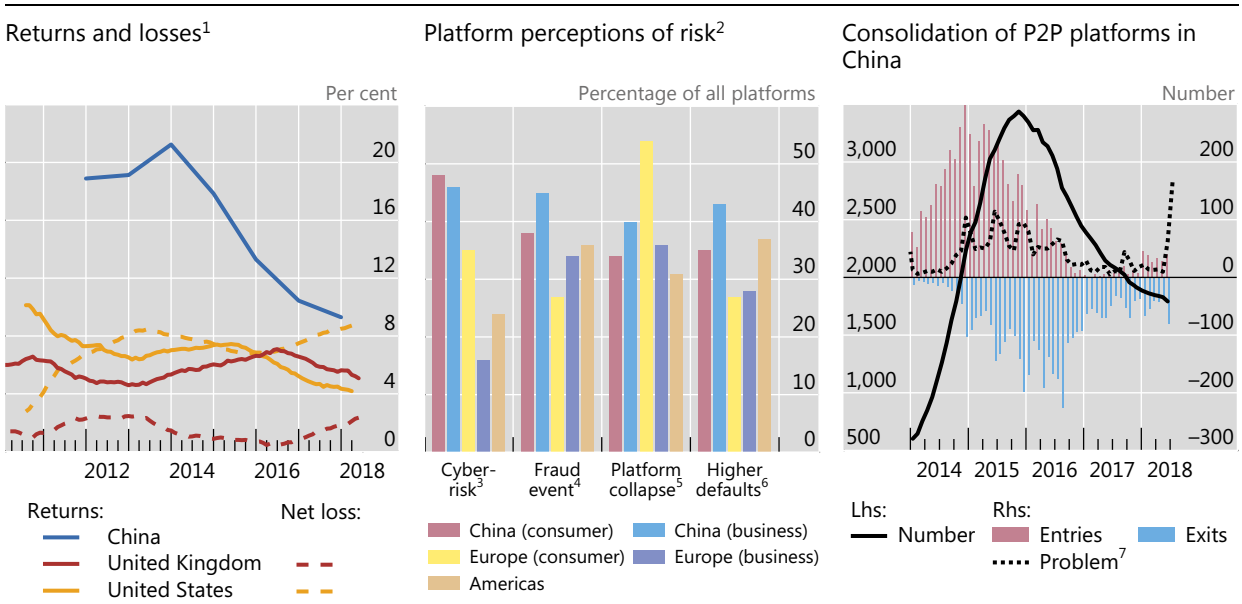
Notwithstanding these benefits, the resilience of new fintech credit processes and firms has not yet been tested over a full economic and credit cycle. Hence, it is not clear how fintech credit will perform when conditions deteriorate.

There are cautionary indicators in some countries. For instance, higher platform default rates have reduced investor returns in China, the United States and the United Kingdom (Graph 5, left-hand panel). Moreover, a significant share of platforms identify the risk of higher default rates as a very high or high (Graph 5, centre panel). Default rates have also increased recently in Australia (ASIC (2017b)) and Korea (Bank of Korea (2018)). For most of these countries, higher fintech credit default rates have occurred at a time when non-performing loan rates in the banking sector are historically low. It is thus possible that, in their drive to expand, some fintech platforms have catered for a higher share of riskier, marginal borrowers. Indeed, some evidence (Chava and Paradkar (2018)) suggests that entry of a fintech credit platform can leave consumers more indebted, with increased default probabilities.

Aside from lower returns, investor confidence has also been shaken by some business misconduct and failures. For example, in 2016 investor demand for fintech

Fintech credit performance has weakened in the major markets

Graph 5



[1] Data based on all platforms covered by WDZJ.com for China, four large platforms for the United Kingdom and two large platforms for the United States. [2] Share of platforms that perceive a very high or high risk for that risk category. [3] Cyber-security breach. [4] Fraud involving high-profile loans/deals. [5] Collapse of a well known platform due to malpractice. [6] Notable increase in default rates. [7] Those that face difficulties in coping with cash withdrawals by lenders, are under investigation or have "runaway bosses".

Sources: AltFi Data; Cambridge Centre for Alternative Finance and research partners; WDZJ.com.

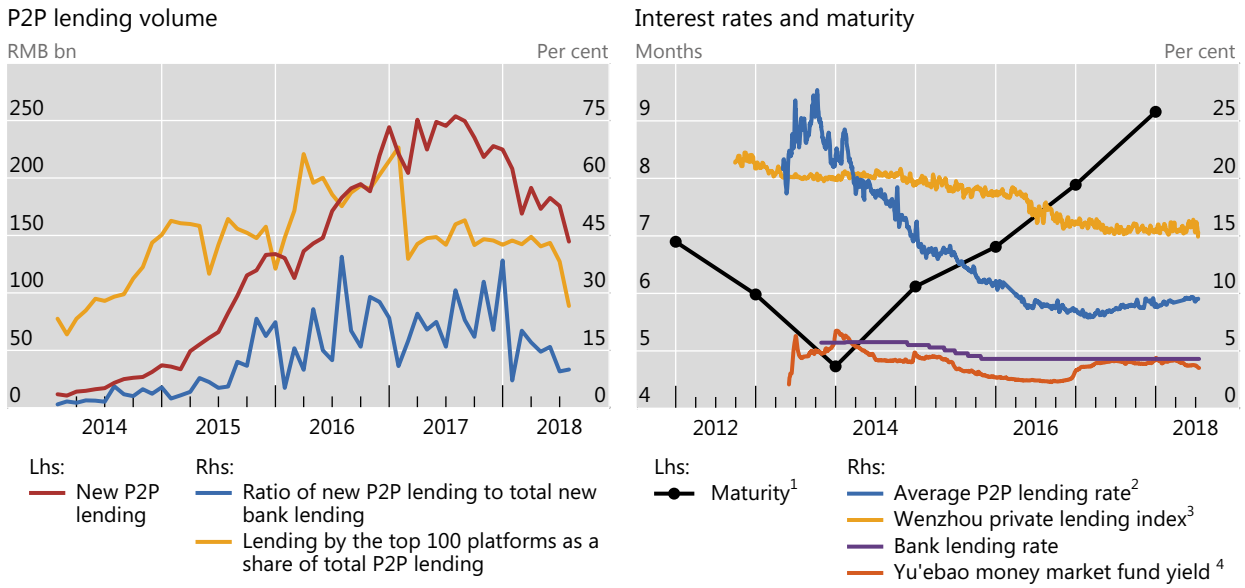
Box B

P2P lending in China

P2P lending has become a significant source of funds for small firms and consumers in China. The ratio of new P2P loans to new bank loans rose to almost 40% in June 2016, before falling to less than 10% in June 2018 (Graph B, left-hand panel). As P2P loans mainly meet borrowers' short-term funding needs, maturities are rather short (right-hand panel); the ratio of outstanding P2P loans to bank loans was only about 1% in June 2018. Market concentration is low and falling: the top 100 platforms' share was below 30% in July 2018 (left-hand panel).

The P2P lending market in China

Graph B



[1] Average maturity of P2P lending. [2] Seven-day moving average of one-year rate. [3] The Wenzhou Index, released by the Wenzhou Municipal Government Finance Office, tracks private lending. [4] Seven-day rate on Yu'ebao money market fund.

Sources: CEIC; WDZJ.com; Wind.

Several unique factors have contributed to the more rapid rise of P2P lending in China. First is the relative availability of financial services: P2P lending caters to borrowers that formal credit intermediaries typically ignore, especially small and micro firms and consumers on whom the creditworthiness information is at best imperfect. P2P lending rates, though higher than those of banks, are far lower than the private lending rates available for such borrowers (Graph B, right-hand panel). Limited alternative investment opportunities and the promise of higher returns have also attracted many retail investors. Second, Chinese consumers, merchants and investors have enthusiastically embraced mobile technology for financial transactions, including payments (Ernst and Young (2017)). Third, an initially more permissive regulatory environment encouraged firms to innovate and expand, with a growing number of platforms supported by the state and venture capital. In recent years, however, the regulatory regime has tightened.

The modalities and risks in the Chinese P2P lending market have changed over time. In the early period following its inception in 2007, P2P credit firms in China operated simple matching models, whereby investors bid for contracts offered by borrowers. From around 2012 onwards, platforms moved to more complex structures where investor funds were pooled (Shen and Li (2018)). Many platforms provided guarantees on loan principal and interest, and promised "rigid redemptions". But risks rose due to inappropriate market practices and fraud, including Ponzi schemes. Defaults surged and the number of problem platforms reached 114 in June 2015. Over the next two years, authorities implemented a nationwide "clean-up" that aimed to ensure internet finance firms acted as information rather than as credit intermediaries. New rules prohibited existing practices by P2P firms such as raising funds for themselves or guaranteeing investments, and mandated the depositing of client funds. Further specific measures were taken in 2017: new student loans were banned and the regulation for cash loans was tightened. The industry has consolidated significantly, with many problem platforms exiting the market (Graph 5, right-hand panel). Yet this process is still incomplete; risks remain and the number of problem and failed platforms has risen sharply in recent months.

credit took a hit when the largest US platform, LendingClub, had to repurchase loans that did not conform to buyer requirements and senior executives' conflicts of interests emerged. In China, the P2P industry has seen a sharp rise in the number of "problem platforms" over recent years. Many platforms there promised unrealistic returns and/or "rigid redemptions"; instances of fraud were also common.[15] These issues, together with tighter regulation and measures designed to encourage the exit of non-qualified P2P platforms, contributed to a significant decline in entrants and a surge in platform exits in 2015–16 (Graph 5, right-hand panel). These issues gained widespread media attention in July and August 2018 after a spate of failures (eg Chorzempa (2018)).

These recent experiences highlight several key questions for platform users, operators and regulators. How well do investors and borrowers understand the risks they are facing? Do fintech credit platforms disclose risks appropriately? Are platform fees and interest rates reasonable?[16] Are business models overly complex? Do platforms have adequate operational risk management practices, including for data and cyber-security risks?

Turning to broader systemic impacts, at this stage the small size of fintech credit in many jurisdictions limits its impact on the economy and financial stability. Nonetheless, CGFS-FSB (2017) identifies a range of benefits and risks should the sector become much larger.

Among the potential benefits are broad economic effects stemming from greater financial inclusion and alternative funding and investment options. Any such effects could be relatively large in those emerging market economies where access to credit and investment products is more limited. Greater diversity in the sources of credit could lower the risks that the economy faces when a few banks dominate credit provision. For example, some platforms may be able to continue to facilitate credit in the event that there are idiosyncratic problems in the banking sector. Credit platforms could also allow governments to revive credit markets after a banking crisis.

Fintech credit could also yield benefits through its impact on commercial banks. There are already signs that commercial banks have begun using fintech credit innovations to improve efficiency. Some banks now partly rely on fintech platforms' credit assessment processes; others have recently set up their own credit platforms. In addition, many banks are now using or introducing machine learning techniques, most commonly in retail credit portfolios (IIF (2018)). This could widen any economic and financial effects.

At the same time, a higher share of fintech credit could present risks. Broader credit access and greater competition in credit markets could weaken lending standards, particularly if they were to come at a time when overall credit growth was already rapid. Fintech credit provision could also be more procyclical than traditional credit. Compared with bank deposits, fintech investments can be more prone to investors' search for yield, as seen for some platforms in the recent upswing. An undiversified business model and lack of access to public safety nets make fintech

[15] Wang et al (2016) find that those Chinese P2P platforms set up more recently, with a narrower range of or extreme interest rates and non-diversified projects, tend to have a lower survival probability and shorter life expectancy.

[16] In the United Kingdom, the Financial Conduct Authority (FCA (2018a)) has identified some poor business practices that it believes cause actual or potential harm to users. In broad terms, these relate to investors not receiving certain information and not understanding risks; and the fairness of platform costs and returns.

credit more vulnerable to investor pullback, and thus to sharp contractions in times of stress. In addition, more credit activity outside the prudential regulatory net could limit the effectiveness of credit-related countercyclical macroprudential measures.[17]

A related risk is the potential for fintech innovations to erode incumbent banks' profitability and franchise values. Should these disruptions occur too quickly, they could undermine banks' resilience and amplify stress, given banks' provision of critical financial services other than credit.

Regulatory frameworks

How can public policy balance risks and benefits? What role should regulation play?

To the extent that fintech credit firms are regulated, they can be drawn into either existing or new regulatory frameworks. An important guiding principle is likely to be neutrality – ensuring that regulation does not favour one entity or form of activity over another provided the risks are the same (BIS (2018)). For this reason, authorities may apply stricter treatment for certain types of activity, such as where a claim on the platform's balance sheet is generated or where retail investors and consumers are involved. For example, in Australia and the Netherlands, fintech credit providers must apply for a specific licence (and meet the associated stricter requirements) to facilitate credit to consumers.

In the United States, platforms engaging in credit origination can be subject to licensing requirements in each state where they operate. For this reason, many platforms partner with banks to originate loans agreed online. There is a similar practice in Germany, where platforms are prohibited from engaging in lending without a banking licence and related prudential oversight.

A number of countries have introduced specific new regulations and licence regimes (Table 2). These changes have all occurred since 2015, and some are quite recent. For instance, Brazil and Mexico introduced new rules and licencing practices in early 2018. Licences to operate fintech credit platforms can be subject to general requirements for adequate governance and risk management arrangements, as well as targeted rules, such as those for managing client money. Minimum capital requirements have been imposed in Spain and the United Kingdom, and will enter into force in Switzerland in January 2019. As discussed in Box B, in 2016 the Chinese authorities began introducing new rules to prohibit some high-risk business models and practices, and mandated filing and information disclosure requirements.

At the same time, many authorities have attempted to ensure that the regulatory framework does not stifle innovation and market entry. This can be particularly important in those emerging market economies where efficiency and access benefits are potentially large. Authorities in a range of jurisdictions have put in place innovation facilitators, including: "regulatory sandboxes" for testing new technologies in a controlled environment; "innovation hubs" supporting new firms navigating existing regulation; and "accelerators" promoting specific tasks of policy relevance,

[17] Braggion et al (2018) show that, in China, P2P loans increased significantly in cities that became subject to loan-to-value caps in 2013, as P2P credit firms did not tighten their pricing and screening in response to the influx of new borrowers. These borrowers were found to have ex post higher default rates.

Selected features of dedicated fintech credit policy frameworks Table 2

Jurisdiction	Tax incentives	Regulations[1]	Licensing / authorisation[1]	Investor protections[1]	Risk management requirements[1]
Australia	—	—	—	—	—
Brazil	—	✓	✓	✓	—
Canada	—	—	—	—	—
Chile	—	—	—	—	—
China	✓	✓	✓	✓	✓
Estonia	—	—	—	✓	—
Finland	—	✓	✓	—	—
France	✓	✓	✓	✓	✓
Germany	—	—	—	—	—
Japan	✓	—	—	—	—
Korea	—	—	—	—	—
Mexico	—	✓	✓	—	✓
Netherlands	—	—	—	✓	—
New Zealand	—	✓	✓	—	✓
Singapore	—	—	—	—	—
Spain	—	✓	✓	—	✓
Switzerland[2]	—	✓	✓	✓	✓
United Kingdom	✓	✓	✓	✓	✓
United States	—	—	—	—	—

[1] Specific rules for fintech credit that are separate from pre-existing rules for other financial intermediaries. [2] New rules effective from 2019.

Sources: CGFS-FSB (2017); national authorities

sometimes with funding support.[18] Some jurisdictions have introduced specific tax incentives for investors.[19]

The development of fintech credit markets can also impact the supervision of existing financial intermediaries. Banks may interact with fintech credit platforms and firms supplying fintech credit assessment services, or adopt fintech innovations in their own loan origination processes. These processes may present new reputational and operational risks, including cyber-risks and third-party risks (BCBS (2018)).

Finally, the emergence of fintech credit markets poses broader monitoring challenges. As the sector grows, there will be a need to incorporate fintech developments into financial stability assessment frameworks. FSB (2017a) highlights the importance of monitoring potential related macro-financial vulnerabilities, as well as the role of fintech credit and changes in market structure. Recent country reports,

[18] There have also been some cross-border initiatives. For instance, the UK Financial Conduct Authority has put out a consultation paper, FCA (2018b), proposing a Global Fintech Innovation Network to help startups to access multiple regulators simultaneously. In addition, a number of authorities have launched bilateral cooperation with other authorities around fintech innovation.

[19] There is also a specific example of direct investment in fintech credit. To boost lending to small businesses, the government-owned British Business Bank invested £100 million over 2014–17 for lending through Funding Circle, a UK credit platform (British Business Bank (2017)).

such as US Department of the Treasury (2018), also highlight the need to monitor fintech credit developments.[20] Cooperation between authorities can facilitate learning from each other's monitoring and regulatory experiences.

Conclusion

Fintech credit has grown rapidly since its inception in 2005. Fintech credit volumes per capita appear to reflect a number of factors. The economy's overall development, the competitiveness of the economy's formal banking sector, and the strength of its regulatory environment play important roles. Despite its fast expansion, fintech credit remains relatively small in most economies. It is, however, considerably larger in China, the United States and the United Kingdom, as well as in specific market segments.

Fintech credit has in some cases helped improve credit access for financially underserved firms and individuals, while providing additional options to investors. Yet rising credit losses in some jurisdictions suggest that these innovations need to be further tested over a full financial and economic cycle. The diversity of business models across the industry has given rise to significant challenges for practitioners and policymakers alike. These challenges include ensuring adequate consumer and investor protection, and the timely assessment of overall financial stability and economy-wide risks. The challenges and benefits arising from fintech credit may become greater if commercial banks make more extensive use of these innovations.

[20] In June 2017, the Chinese National Internet Finance Association (NIFA) launched its Internet Financial Registration and Disclosure Service Platform, which aims to provide more timely information to both the supervisory authorities and the public. By the end of 2017, 116 platforms had joined the system and disclosed operational information.

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Annex: Fintech credit volumes by country

Fintech credit volumes

Annex Table 1

	Level (USD, in millions)		Annualised growth 2013–16 (%)	*Memo: Volume per capita in 2016 (USD)*
	2013	2016		
Australia	12	549	258	*22.5*
Brazil	1	61	294	*0.3*
Canada	8	169	176	*4.7*
Chile	12	93	98	*5.1*
China	5,547	240,905	252	*174.2*
Colombia	…	131	…	*2.7*
Estonia	…	83	…	*63.0*
Finland	…	119	…	*21.7*
France	59	338	79	*5.2*
Georgia	…	111	…	*30.1*
Germany	48	233	69	*2.8*
India	4	90	182	*0.1*
Ireland	…	81	…	*17.3*
Israel	…	33	…	*3.9*
Italy	0	114	…	*1.9*
Japan	79	380	69	*3.0*
Korea	1	368	617	*7.2*
Mexico	1	106	373	*0.9*
Netherlands	48	165	51	*9.7*
New Zealand	<1	190	668	*40.1*
Nigeria	…	36	…	*0.2*
Poland	…	35	…	*0.9*
Singapore	0	101	…	*18.0*
Spain	4	85	177	*1.8*
Sweden	…	7	…	*0.7*
United Kingdom	906	6,068	88	*92.4*
United States	3,757	32,414	105	*100.2*
World	10,555	283,529	199	*50.5*
Memo:				
Africa and Middle East	*42*	*134*	*47*	*0.2*
Asia-Pacific (ex China)	*98*	*1,757*	*162*	*1.0*
Americas (ex US)	*22*	*612*	*203*	*1.1*
Central and eastern Europe	*14*	*120*	*105*	*0.5*
Europe (ex GB)	*266*	*1,639*	*83*	*2.6*
Latin America and Caribbean	*14*	*442*	*216*	*0.8*
Nordics	*112*	*214*	*24*	*10.1*

Sources: Cambridge Centre for Alternative Finance and research partners; IMF, *World Economic Outlook*; BIS calculations.

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Regulating cryptocurrencies: assessing market reactions[1]

Cryptocurrencies are often thought to operate out of the reach of national regulation, but in fact their valuations, transaction volumes and user bases react substantially to news about regulatory actions. The impact depends on the specific regulatory category to which the news relates: events related to general bans on cryptocurrencies or to their treatment under securities law have the greatest adverse effect, followed by news on combating money laundering and the financing of terrorism, and on restricting the interoperability of cryptocurrencies with regulated markets. News pointing to the establishment of specific legal frameworks tailored to cryptocurrencies and initial coin offerings coincides with strong market gains. These results suggest that cryptocurrency markets rely on regulated financial institutions to operate and that these markets are segmented across jurisdictions, bringing cryptocurrencies within reach of national regulation.

JEL codes: E42, E51, F31, G12, G28, G32, G38.

Cryptocurrencies[2] such as Bitcoin[3] or Ethereum have attracted much attention, because of both meteoric price swings and their advocates' claim of a new model of decentralised trust. Many are analysing the validity of such claims and the economics of the underlying technology (Biais et al (2018), BIS (2018), Carstens (2018a,b,c), CPMI (2015), Huberman et al (2017), Landau (2018)). Concurrently, many national authorities and international bodies have expressed concerns (eg G20 Finance Ministers and Central Bank Governors (2018), FSB (2018), Carney (2018)).

[1] We thank Codruta Boar and Giulio Cornelli for excellent research assistance and David Archer, Morten Bech, Claudio Borio, Benjamin Cohen, Jon Frost, Benoît Mojon and Hyun Song Shin for their comments. The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. This special feature uses text excerpts from BIS (2018).

[2] Terminology on this topic is fluid and evolving, with related legal and regulatory ambiguities. The use of the term "cryptocurrencies" in this special feature is not meant to indicate any particular view of what the underlying protocol-based systems are; typically, they lack the key attributes of a sovereign currency and their legal treatment varies across jurisdictions. In some cases, the feature refers to specific cryptocurrencies or cryptoassets as examples. These examples are not exhaustive and do not constitute any endorsement by the authors, the BIS, or its shareholders of any cryptocurrency, firm, product or service.

[3] We distinguish between the protocol and network of users and miners of a cryptocurrency, and the unit of a cryptocurrency. For example, the unit of the Bitcoin cryptocurrency is bitcoin, while the unit of the Ethereum cryptocurrency is ether.

Key takeaways

- Cryptocurrencies such as Bitcoin have attracted much attention because of their meteoric price swings, but have also raised concerns for regulatory authorities.
- While cryptocurrencies are often thought to operate out of the reach of national regulation, in fact their valuations, transaction volumes and user bases react substantially to news about regulatory actions.
- News events related to general bans on cryptocurrencies or to their treatment under securities law have the greatest adverse effect on valuations, followed by news on combating money laundering and the financing of terrorism, and on restricting the interoperability of cryptocurrencies with regulated markets. News pointing to the establishment of legal frameworks tailored to cryptocurrencies and initial coin offerings coincides with strong market gains.
- Because they rely on regulated financial institutions to operate and markets are (still) segmented across jurisdictions, cryptocurrencies are within the reach of national regulation.

Many of the concerns raised would also apply to other asset classes and emergent technologies. But what sets cryptocurrencies apart is that they can function without institutional backing and are intrinsically borderless.[4] This raises the question of whether one can expect regulation – in particular national regulation – to be effective.

To shed light on this issue, we examine whether and how regulatory actions and communications about such actions have affected cryptocurrency markets. We do so using an event study approach. A number of jurisdictions have announced that they are considering whether and how to respond, and some have already responded. We use the market reactions to these regulatory statements and decisions to assess the anticipated effects on cryptocurrency markets.

Our four main findings are as follows. First, the market responds most strongly to news events regarding the legal status of cryptocurrencies. Besides general bans on their use for financial transactions, news events related to their possible treatment under securities market law have strongly adverse impacts, as do events explicitly signalling that cryptocurrencies will not be treated as a currency. News indicating possible novel legal frameworks tailored to cryptocurrencies and initial coin offerings (ICOs) coincides with strong market gains. Second, regulatory news regarding anti-money laundering/combating the financing of terrorism (AML/CFT) measures and limits on the interoperability of cryptocurrencies with the regulated financial system adversely impacts cryptocurrency markets. Third, authorities' unspecific general warnings have no effect, nor does news regarding the likelihood of central bank digital currency (CBDC) issuance. Last, large price differences sometimes prevail across jurisdictions, suggesting some market segmentation.

Overall, our analysis suggests that, at the current juncture, there is scope to apply regulations, if so decided. And it also indicates that regulation need not be bad news

[4] Note that only those cryptocurrencies based on permissionless, decentralised protocols are open to anyone and thus entity-free. By contrast, cryptocurrencies running on permissioned protocols give select actors special access rights. Inasmuch as those select actors can be identified, such cryptocurrencies can be identified with legal entities. See BIS (2018) for a discussion of the differences between permissionless and permissioned cryptocurrencies.

for the markets, with price responses notably signalling a clear preference for a defined legal status, albeit a light regulatory regime.

To tackle regulatory concerns, authorities will first need to clarify the regulatory classification of cryptocurrency-related activities, and to do so using criteria based on economic functions rather than the technology used. Related, the boundaries among national regulatory bodies may need to be redrawn to clarify responsibilities. Authorities will need to vigilantly monitor developments and address regulatory issues arising from the global dimension of cryptocurrencies. For policies to remain effective, and especially in case the market further develops and international arbitrage increases, rules and enforcement will need to be coordinated and enforced across the globe. But the absence of such coordination need not be an impediment to effective intervention.

This special feature is organised as follows. We first briefly review the current debate on why and how to regulate cryptocurrencies to help us classify news about (possible) policy interventions by category and regulatory stance. We then assess the effects of such news events on prices, trading volumes and other dimensions, including cross-border, based on a new data set of regulatory news events. Lastly we draw some lessons from our analysis.

An empirical investigation

Classifying news on cryptocurrency regulation

The goals of regulating cryptocurrencies are largely similar to those for other financial assets and services and can be classified into three categories: combating the use of funds for illicit activities;[5] protecting consumers and investors against fraud and other abuses; and ensuring the integrity of markets and payment systems and overall financial stability. Regulatory authorities have a number of tools at their disposal for addressing these goals.

First, to address illicit use, responses can be aimed at those firms providing access to cryptocurrencies. Most consumers and investors do not directly own or trade cryptocurrencies, but rather use crypto-wallets and other intermediaries that hold claims on their behalf. Many relevant regulations may already pertain to such crypto-infrastructure providers; similarly, existing rules and enforcement mechanisms can be adapted to address specific issues. For example, AML/CFT regulations already in place can often be extended to cryptocurrencies. And existing consumer and investor protection laws and regulations can often be applied or adapted.

Second, regulations can target the interoperability of cryptocurrencies with regulated financial entities, including commercial banks, credit card companies and exchanges. Such regulated entities enable individuals to convert sovereign currency to cryptocurrencies and back. Rules can also be developed and applied with regard to the admissibility of cryptocurrencies and related products (such as derivatives or exchange-traded funds (ETFs)) on regulated exchanges. And regulation can address whether and how banks are allowed to deal in cryptocurrency-related assets for their

[5] For examples highlighting the use of cryptocurrencies for illegal activities, see Fanusie and Robinson (2018) and Foley et al (2018).

customers or on their own behalf, and, if trading is allowed, what the associated tax implications are.

Third, authorities can clarify the legal status of cryptocurrencies. This shapes issues such as consumer protection (eg how to treat ownership rights, theft and mis-selling) and retail use (eg who may legitimately trade cryptocurrencies and under what conditions). Another key legal status issue is whether cryptocurrencies are treated as securities – ie tradable instruments used to raise funds by representing a promise to pay in the future – and thus come under heightened regulation and oversight. Alternatively, they could be considered generic assets (ie tangible or intangible things that can be owned or controlled, eg houses, commodities, patents), which means they can be held and traded, including on organised exchanges, without necessarily having to satisfy strict securities market rules and face corresponding oversight.[6]

To analyse these issues, we draw on Auer and Claessens (2018), who assemble a data set of news events regarding policy statements made by regulatory bodies, central banks and relevant international institutions and standard-setting bodies related to cryptocurrencies markets over the past years. Regulatory news events are classified into one of the three above main categories. In addition to classifying by regulatory aspects, we also differentiate events by regulatory stance. For this we use a simple coding scheme, namely a binary variable taking a value of +1 for events associated with tougher or more sharply defined regulation and –1 for events pointing to less stringent or less defined regulation.[7] Additionally, we also code two auxiliary categories: one for general information and warnings issued to the general public on cryptoassets, and one on authorities' statements on CBDCs.[8] We include all news events from the start of 2015 to the end of June 2018 as reported by the news agency Reuters, with the sample criterion being inclusion in this news channel.

In total we identify 151 regulatory news events.[9] Graph 1 gives a breakdown of events by country, type and score (left-hand panel), by country (centre panel), and over time (right-hand panel). The left-hand panel shows that, after general warnings, news events related to interoperability are the most common. The centre panel shows that most news events are in China, India, Japan, the United Kingdom and the United States. The right-hand panel shows that news events have increased over time.

[6] Here the novelty and complexity of the underlying technology, as well as its rapid evolution, can make it difficult to design and apply regulation and oversight. The main conundrum is that the same technology can be, and often is, used for a variety of economic purposes. For example, ICOs are being used by technology firms to raise funds for projects unrelated to cryptocurrencies. Other than semantics – auctioning coins instead of shares – ICOs are no different from initial public offerings, so it would be natural to apply similar regulation and supervision policies to them. But some ICOs also double as "utility tokens" that essentially promise future access to software such as games or music albums. This does not constitute investment activity and instead calls for the application of consumer protection laws by the relevant bodies.

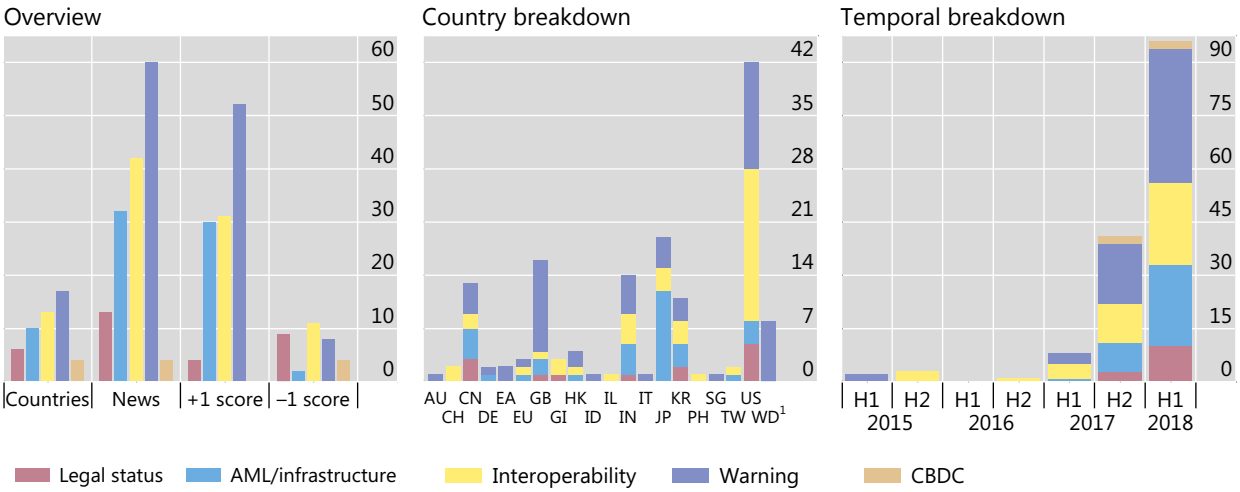
[7] In making these assessments, we follow the news agency interpretation of the news events, and thus rely on the news agency to judge the importance of the news.

[8] Bech and Garratt (2017) and CPMI and MC (2018) provide introductions to and economic analyses of CBDCs.

[9] Events relate to actions and statements made by authorities in and officials of Australia, China, Chinese Taipei, Gibraltar, Hong Kong SAR, India, Indonesia, Israel, Japan, Korea, the Philippines, Singapore, Switzerland, and the United States, as well as the European Union and its member states, and select international institutions, groupings and regulatory bodies (euro area institutions, BIS, IOSCO, FSB and G20).

A news database on cryptocurrency-related policies

Number of news headlines — Graph 1



Legal status = specific legal framework + currency – securities – ban: specific legal framework: +1 if handled under a specific legal framework different from the one for securities; currency: –1 if against classifying cryptocurrencies as currency; securities: +1 if in favour of classifying cryptocurrencies as securities and –1 if against classifying cryptocurrencies as securities; ban: +1 if a ban is called for, decided or implemented.

AML/infrastructure = AML/CFT + infrastructure regulation: AML/CFT: +1 if stricter regulation called for, decided or implemented; infrastructure regulation: +1 if stricter regulation on crypto-exchanges or wallet providers is called for, decided or implemented; –1 if less strict regulation called for, decided or implemented.

Interoperability = regulated institutions + taxation + ICO + listing application: regulated institutions: +1 if holding/trading restrictions on regulated institutions called for, decided or implemented; taxation: +1 if taxes called for, decided or implemented; –1 if taxes uncalled for or tax-exempt status is granted; ICO: +1 if sheds a bad light and –1 if sheds a good light; listing application: +1 if rejected; –1 if granted.

Warning: +1 if it raises the level of concern; –1 if it reduces or removes concern.

CBDC: –1 if it is against possible issuance of central bank digital currency (there are no cases of +1).

[1] WD = world (BIS, G20 and IOSCO).

Source: Auer and Claessens (2018).

The price impact of regulatory news on bitcoin

We assess the intraday impact of regulatory news events first on the price of bitcoin, and then on the prices of other cryptocurrencies and on other aspects of the cryptocurrency markets. Prices are forward-looking and, using a standard event study methodology (Campbell et al (1996)), are often used to assess the eventual impact of corporate and public actions.

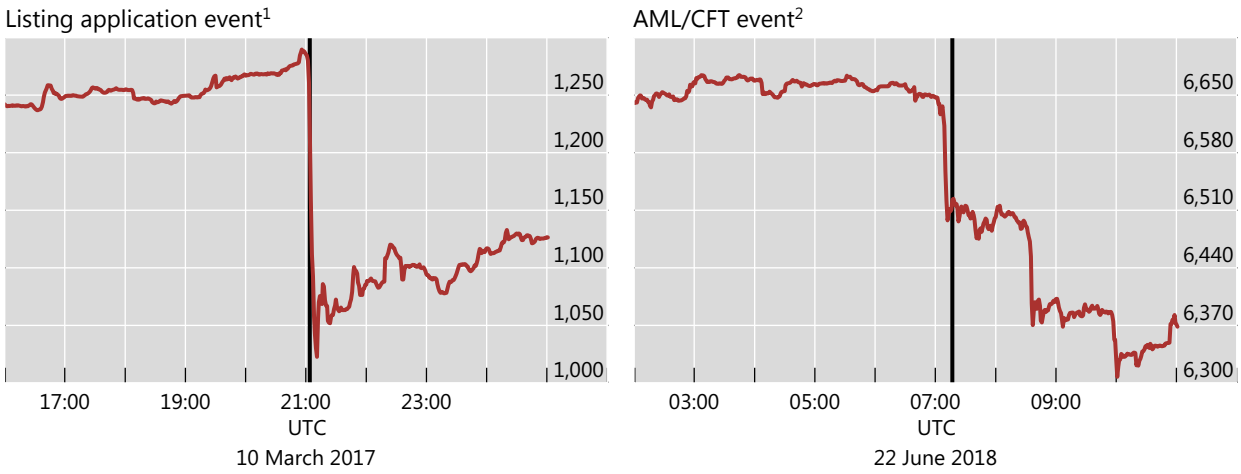
To illustrate our methodology, consider two events. One is the decision by the United States Securities and Exchange Commission (SEC) in March 2017 to turn down a proposal to alter stock exchange rules so as to allow the creation of an ETF for bitcoin. In the five minutes around the announcement, the price of bitcoin dropped by 16% (Graph 2, left-hand panel).[10] Another event is the Japanese Financial Services Agency (FSA) ordering six cryptocurrency exchanges to improve their money laundering procedures (June 2018). Again, prices tanked – although it seems to have

[10] Relatedly, the SEC's reconfirmation of the denial of a bitcoin ETF fund listing on 26 July 2018 sent the price of bitcoin tumbling from $8,220 to $7,920 (–3.7%) within a short period.

Bitcoin intraday price reaction to two news events

In US dollars

Graph 2



[1] The vertical line indicates 21:04 on 10 March 2017 (news headline: "US SEC rejects application to list Bitcoin ETF"). [2] The vertical line indicates 07:17 on 22 June 2018 (news headline: "RPT – Japan FSA says ordered 6 cryptocurrency exchanges to improve business, over lax money laundering measures").

Source: CoinDesk.

taken several hours, until the start of the US trading day, for this measure to have its full effect (right-hand panel).[11]

Using the same methodology, we can assess how prices on average adjust across news events (Graph 3), differentiating between favourable and unfavourable ones.[12] We find that favourable events coincide on average with a 0.33% return in the 120 minutes around the events (left-hand panel), and a 1.52% return in the 24-hour window around them (right-hand panel). Unfavourable events are associated with a 0.32% and 3.12% lower return over similar windows, respectively. Events appear to already affect prices several hours before the news release, suggesting the news is in fact released gradually and information flows via other channels.

We next examine price responses to the various types of news over a longer window, to accommodate such gradual release. We examine the 24-hour and 10-day price responses.

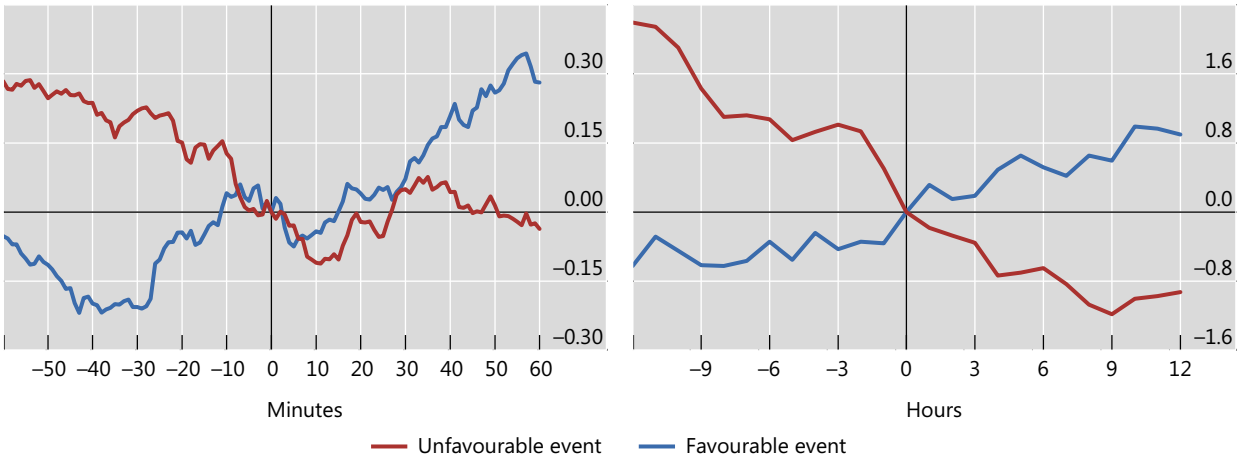
Graph 4 examines returns surrounding four specific categories of legal news. The price responses signal a clear market preference for a defined legal status, but under a light regulatory regime. News pointing to an outright ban and non-recognition of the instruments as currencies is associated with negative returns, and strongly so for bans. However, news suggesting that cryptocurrencies could be treated as securities

[11] This event may have had a particularly profound effect as it contrasted with the previously held belief that the FSA was sympathetic towards cryptocurrencies compared with other financial supervisors.

[12] We winsorised the price changes at the 5% and 95% level to avoid outliers that possibly reflect data limitations. We analyse general communications or statements on CBDC separately below.

News impact on intraday bitcoin price

In per cent — Graph 3



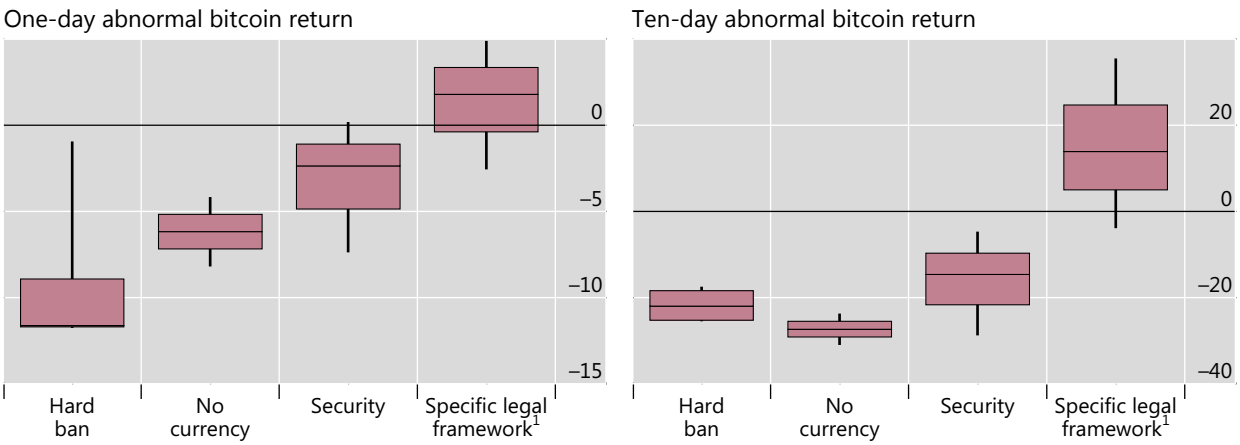
Average change in the bitcoin price relative to its price at the time of the news event. The data have been winsorised using the 5th and 95th percentiles as thresholds.

Sources: Auer and Claessens (2018); Thomson Reuters Eikon; CoinDesk; authors' calculations.

also leads to negative returns, probably reflecting the expectation that cryptocurrencies would be regulated more stringently. In contrast, the introduction of a specific, non-security legal framework generates positive returns, most likely as those frameworks generally come with oversight rules that are milder than those under securities law. The responses are qualitatively consistent between the one-day (left-hand panel) and the 10-day impact (right-hand panel), with the latter generally more pronounced.

Legal status news and bitcoin returns

In per cent — Graph 4



The box plots show minimum, lower quartile, median, upper quartile and maximum.

[1] Other than a security legal framework.

Sources: Auer and Claessens (2018); Thomson Reuters Eikon; CryptoCompare; authors' calculations.

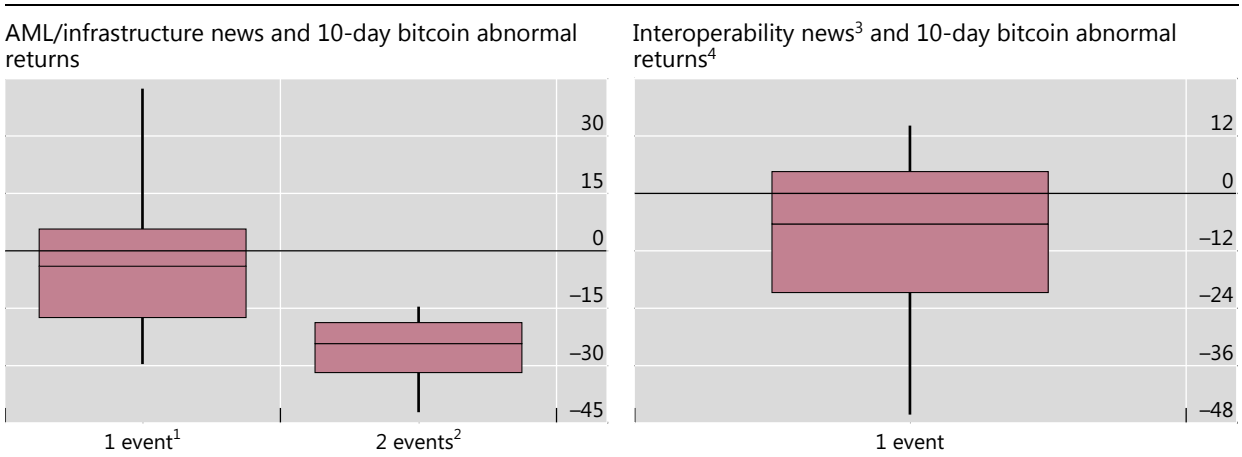
We next examine news regarding AML/CFT and cryptocurrency-related infrastructure regulations. We identified 32 such news events. An example of favourable news was in February 2018, when officials from the SEC and the Commodity Futures Trading Commission (CFTC) issued statements before the US Congress that news agencies interpreted as "putting crypto-currencies on a relatively long leash".[13] Examples of adverse news events were when the German Federal Financial Supervisory Authority (BaFin) issued an order in January 2018 to shut down a German-based crypto-exchange when on the same day the Japanese authorities announced mandatory IT security measures for crypto-exchanges.[14]

News indicating more restrictive AML standards for, and stricter regulation of, crypto-infrastructure providers is mostly associated with negative returns (Graph 5, left-hand panel). Such news led to negative returns over a 10-day window, with a median effect of around 4 percentage points, but with a wide distribution. For those days with more than one event, effects are much larger, some 24 percentage points.

AML/infrastructure and interoperability news and bitcoin returns

In per cent

Graph 5



The box plots show minimum, lower quartile, median, upper quartile and maximum.

[1] An event with an AML/infrastructure news score of –1 on 6 Feb 2018 (10-day bitcoin (BTC) return of 11.92%) is not included. [2] Refers to days on which two or more separate events occurred. [3] News in any one of the following categories: regulated institutions, ICO, listing application or taxation. [4] Does not include events with a interoperability news score of –1 on 16 Jul 2015 (10-day BTC return of –1.94%), 25 Jul 2016 (10-day BTC return of –26.8%), 27 Jan 2017 (10-day BTC return of 11.87%), 25 Apr 2017 (10-day BTC return of 14.91%), 24 Jul 2017 (10-day BTC return of –5.63%), 29 Sep 2017 (10-day BTC return of 2.75%), 24 Nov 2017 (10-day BTC return of 25.73%), 28 Nov 2017 (10-day BTC return of 36.48%), 14 Dec 2017 (10-day BTC return of –24.76%), 21 Mar 2018 (10-day BTC return of –21.77%) and 14 Jun 2018 (10-day BTC return of –10.45%).

Sources: Auer and Claessens (2018); Thomson Reuters Eikon; CryptoCompare; authors' calculations.

[13] The chairmen of the SEC and the CFTC testified before the US Senate Committee on Banking, Housing and Urban Affairs on 7 February 2018 (Clayton (2018) and Giancarlo (2018)). The news event as reported by Reuters was: "The watchdogs did not […] demand immediate and sweeping new powers. Instead, they acknowledged the potential benefits of digital coinage, including lower costs for businesses, and advocated a 'do no harm' approach to new rules" (Beddor (2018)).

[14] Since the data are collapsed to the daily frequency, there can be more than one news event on a day, and the resulting variable can thus take a negative or positive integer value greater than +1, or smaller than –1. There are 86 cases for which we use the overall daily news score.

Finally, we look at 42 news events related to interoperability with regulated markets and entities, of which four pertain to the interoperability of cryptocurrencies with banks, four to taxation, 20 to decisions on ICO applications and 14 decisions to listing applications for ETFs or derivatives. Interoperability is on average also associated with a decline, of some 6.4 percentage points (Graph 5, right-hand panel).

Regression analysis

We next investigate the price responses to regulatory news events using regressions, which allows us to examine statistical significance and the joint effects of news concerning various types of regulation. We estimate the following regressions in the 10-day window starting two days before the event and ending eight days after the event:

$$log\left(P_{BTC,t+8}/P_{BTC,t-2}\right) = \alpha + \beta R_t^{indicator} + \varepsilon_t$$

where in this specification *P* is again the price of bitcoin, R_t is the regulatory score for each news event in the specific category on date t (or 0 if there is no event). In the regressions we thus also include the days without regulatory news to control for the "normal" daily movements in prices (or other dependent variables).

As before, news events are "signed" to reflect their expected impact on cryptocurrency usage. Specifically, we code legal status news as:

$$R_t^{LegalStatus} = R_t^{Framework} + R_t^{Currency} - R_t^{Ban} - R_t^{Security}$$

ie $R_t^{LegalStatus}$ takes a value of +1 for a favourable news event, eg when a specific cryptocurrency framework is announced or news indicates that cryptocurrencies will not be considered to be a "security", and –1 whenever news indicates a ban, that cryptocurrencies are not considered as currencies, or that they will be considered securities. This coding scheme implies that positive values of $R_t^{LegalStatus}$ are favourable events for cryptocurrencies.

Considering news events in terms of the three categories, the results confirm that events in each category have an economic and statistically significant impact (Table 1, columns 1–3). There is little change in the magnitudes of coefficients when estimated jointly (column 4). Importantly, the regression results show that the economic impact is again the largest for news about the legal status of cryptocurrencies. News in the other two categories has a statistically significant, but smaller, impact in terms of average market response.

Warnings disseminated by government agencies have no statistically significant effect on valuations (column 5). And the positive, but not significant, coefficient for the news on the stance of senior officials regarding CBDC (column 6) suggests that CBDCs are not seen as relevant for privately issued cryptocurrencies.

The wider crypto-ecosystem responses to regulatory news

Next we show that news events also affect the prices of cryptocurrencies other than bitcoin, cryptocurrency transaction volumes, the number of addresses[15] (a gauge for

[15] The number of active addresses equals the number of unique cryptocurrency addresses that contain any funds. Though users typically own multiple addresses, unless regulation primarily affects the average number of addresses per user, the decline in the number of addresses also indicates a decrease in the number of active users.

The price impact of regulatory news: regression results Table 1

	Dependent variable: 10-day response of BTC/USD price					
	(1)	(2)	(3)	(4)	(5)	(6)
AML or crypto-exchange regulation	–7.680***			–6.082***		
	(2.070)			(2.074)		
Interoperability with banks or exchanges		–5.832***		–5.150***		
		(1.836)		(1.829)		
Legal status of cryptocurrencies			17.302***	16.448***		
			(3.499)	(3.489)		
General warnings					–1.147	
					(1.504)	
Authorities' views on CBDC						9.077
						(6.368)
Observations	1,272	1,272	1,272	1,272	1,272	1,272
R-squared	0.01	0.01	0.02	0.03	0	0

Standard errors in parentheses; ***/**/* denotes results significant at the 1/5/10% level.

Sources: Auer and Claessens (2018); Thomson Reuters Eikon; CryptoCompare; authors' calculations.

the underlying number of users) and the profitability of mining cryptocurrencies. Since this analysis spans seven cryptocurrencies and up to seven variables of interest, we reduce its dimensionality for conciseness. Specifically, we construct a global cryptocurrency regulatory news index (CRNI). Since we have already established which types of news matter for Bitcoin, we construct this index as a linear combination of the three sets of consequential regulatory news, with weights equal to the average news impact on bitcoin prices (regression coefficients from the joint model in column 4 of Table 1):

$$CRNI_t = -16.448\, S_t^{Legal} + 5.150\, S_t^{Interoperability} + 6.082\, S_t^{AML/Inf}$$

This index captures how, on a given day, regulatory events would have moved the price of bitcoin. We then gauge the price responses of other cryptocurrencies to changes in this index, ie we essentially see whether the prices of these other cryptocurrencies reacted more or less strongly to regulatory news than bitcoin did, on average. Regression results for a range of prices are presented in Table 2, panel A. In column 1 the dependent variable is the change in the price of bitcoin, which shows by construction an elasticity of one.[16] In columns 2–7, the dependent variable is the change in the price of ether (based on the Ethereum protocol), Bitcoin Cash, Litecoin, Monero, Zcash, and XRP (based on Ripple), respectively.

[16] Most news events (both favourable and unfavourable) took place since end-2017, a period when the price of cryptocurrencies has been in decline. But the downward trend (at –0.31% per day during the first seven months of 2018, or roughly –0.026% in a 120-minute window) is an order of magnitude too small to explain the patterns. To nevertheless investigate whether this trend affects our results, we re-estimated the specification for either all days in 2017 or only the first six months of 2018. Results are very similar to and statistically insignificant from –1 (–0.93 or –0.85, respectively), showing that on event days, price movements deviated significantly from the general pattern.

Response of prices and network volumes across cryptocurrencies Table 2

Cryptocurrency (unit)	Bitcoin	Ethereum (ether)	Bitcoin Cash	Litecoin	Monero	Zcash	Ripple (XRP)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Panel A: 10-day percentage change in cryptocurrency price (in US dollars)						
Change in CRNI	–1.000***	–0.927***	–1.164**	–0.823***	–1.162***	–0.726**	–0.708**
	(0.151)	(0.309)	(0.466)	(0.243)	(0.284)	(0.337)	(0.338)
	Panel B: 30-day percentage change in transaction numbers						
Change in CRNI	–1.289***	–1.171***	–0.282	–2.073***			–0.253
	(0.156)	(0.281)	(0.541)	(0.449)			(0.330)
	Panel C: 30-day percentage change in transaction volume (in US dollars)						
Change in CRNI	–1.343***	–3.368***	–1.738***	–1.516**			
	(0.427)	(1.052)	(0.647)	(0.695)			
	Panel D: 30-day percentage change in active addresses						
Change in CRNI	–1.161***	–1.495***	–0.224	–1.431***			
	(0.140)	(0.351)	(0.703)	(0.303)			
	Panel E: 30-day percentage change in mining profitability						
Change in CRNI	–2.491***	–1.520***	–1.317***	–1.849***			
	(0.330)	(0.524)	(0.450)	(0.394)			
Observations (Panel A)	1,272	1,219	327	1,264	1,264	589	1,252

Standard errors in parentheses; ***/**/* denotes results significant at the 1/5/10% level.

Sources: Auer and Claessens (2018); Thomson Reuters Eikon; www.bitinfocharts.com; authors' calculations.

In terms of the responsiveness of cryptocurrencies compared with that of bitcoin,[17] we find that both "Bitcoin clones" – Bitcoin Cash and Litecoin – as well as the second largest cryptocurrency by valuation, Ethereum, react significantly to CRNI (columns 2–4). The impact is not significantly different from 1, however, ie they are as strongly affected by these news events as bitcoin is. We next examine so-called "dark coins" Monero and Zcash – that add an extra layer of anonymity. Monero reacts significantly and more strongly than bitcoin (column 5), while Zcash (for which we only observe less than two years of data given its shorter life span) reacts less (column 6). The XRP token also react less, which may reflect that its network of trusted nodes is centrally controlled by its issuer Ripple, making the XRP token distinct from other, permissionless, cryptocurrencies.

[17] Other coefficients have the interpretation of reacting in the same (opposite) direction and more (less) strongly than bitcoin does, depending on the coefficients being greater (smaller) than +1 (–1).

The remainder of Table 2 shows that regulatory news also affects the number and the volume of transactions, the number of active addresses, and the profitability of mining. These statistics are only available for Ethereum and non-anonymous Bitcoin offshoots (Table 2, panels B–E). In these regressions, the dependent variable is a slower-moving, aggregate volume rather than a forward-looking price, so we expand the time window, defining the dependent variable as the percentage change of each aggregate from the 30 days preceding the event to the 30 days thereafter.

Bitcoin, Litecoin and Ethereum react strongly to news events as captured by the coefficient of CRNI for the number and the volume of transactions (in US dollars). The number of active addresses also responds strongly to CRNI, which may indicate that stronger regulation results in a decline in the number of users. The evidence for Bitcoin Cash is somewhat mixed: the number of transactions reacts little, while the average transaction volume reacts strongly, implying an increase in the average transaction size.

Finally, miners, ie those engaged in verifying transactions, are also affected by news events. In order to gauge this, we analyse a measure of profitability calculated as the revenue from block rewards and transaction fees minus the estimated cost of coming up with a proof-of-work. For all four cryptocurrencies with detailed data available, profitability declines strongly whenever regulation becomes tighter. Since profitability is likely to affect exit and entry of miners, this response ultimately can also affect the security of the various cryptocurrencies.

National regulation of global cryptocurrencies

Why do news events about national regulations have such a substantial impact on cryptoassets that have no formal legal homes and are traded internationally? Part of our interpretation is that cryptocurrencies rely on regulated institutions to convert regular currency into cryptocurrencies. Their cumbersome setup also means that many consumers hold and transact in cryptocurrencies through more interfaces, such as online crypto-wallets that are often regulated, or can be regulated in principle. And international arbitrage is still limited. Agents cannot easily access cryptocurrencies' markets offshore – because they may need to have a bank account in the foreign jurisdiction. Factors such as these create market segmentation and fragmentation, which currently make national regulatory actions bind to some degree.[18]

One example of likely market segmentation is the so-called "kimchi premium", the fact that the price of bitcoin in Korea regularly exceeds that in the United States, at times by over 50% (Graph 6, left-hand panel). This suggests limits to cross-border arbitrage. Similarly, news about cryptocurrency regulation by authorities in China has led at times to price differentials compared with the US market (Graph 6, centre panel).

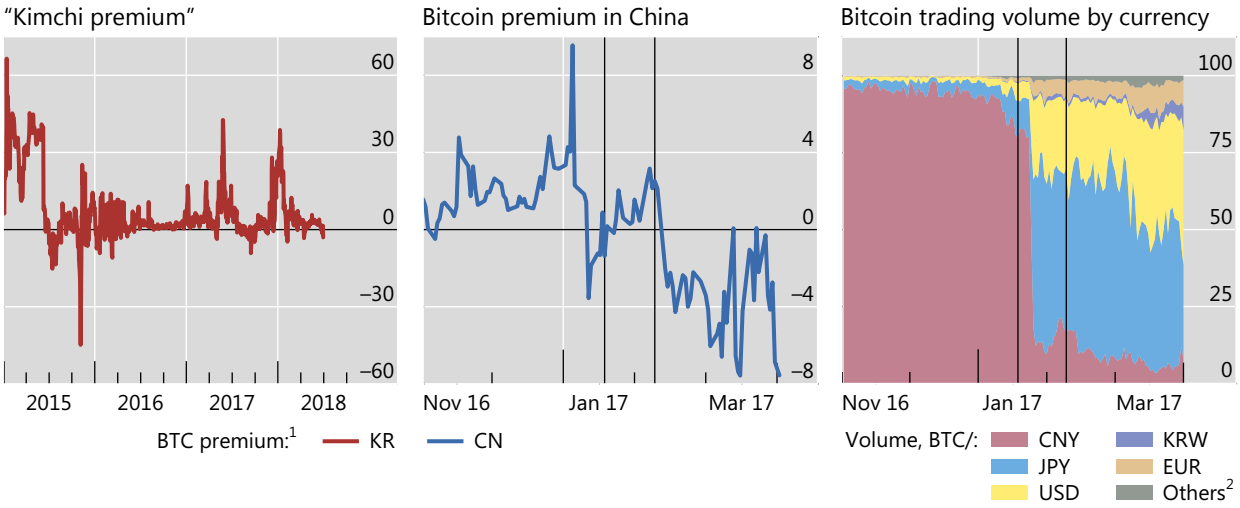
Yet national regulatory measures do spill across borders. For example, when China hinted at the possibility of strict regulation of Bitcoin around the end of January 2017, bitcoin trading shifted massively towards other Asian currencies (Graph 6, right-hand panel).

[18] Another channel would be the reputation effect: the possibility that a decision by one government could encourage other governments to adopt an "anti-crypto" mindset.

Premia and trading volume

In per cent

Graph 6



The vertical lines in the centre and right-hand panels indicate 19 January 2017 ("MEDIA-PBOC branch finds 'hidden risks' in bitcoin exchange BTCC-EID") and 9 February 2017 ("China central bank says warned bitcoin exchanges of closure risk on rule violations").

[1] Premium of local BTC price (in USD) compared with BTC price in the United States. [2] AUD, CHF, CAD, GBP, HKD, ILS, INR, PHP and SGD.

Sources: CryptoCompare.com; authors' calculations.

Conclusion

Our analysis shows that despite the entity-free and borderless nature of cryptocurrencies, regulatory actions as well as news regarding potential regulatory actions can have a strong impact on cryptocurrency markets, at least in terms of valuations and transaction volumes. This suggests that at the current juncture, authorities around the globe do have some scope to make regulation effective.

Looking ahead, there are three key challenges.

First, to effectively address regulatory concerns and achieve technology-neutral regulation, authorities will need to clarify cryptocurrency-related activities from legal and securities market perspectives, and to do so according to economic purpose rather than technology used. Related, the boundaries among national regulatory bodies may need to be redrawn to clarify responsibilities.

Second, although markets are currently somewhat segmented, cross-border spillovers can occur in response to regulatory events. As the market continues to evolve, and if more banks and funds engage in cross-country arbitrage, regulation and enforcement in one jurisdiction may lead activity to migrate to others with more lax approaches. Coordination has already been found to enhance the effectiveness of AML standards, with authorities seeking to treat similar products and services consistently according to their function and risk profile across jurisdictions (eg Financial Action Task Force (2015)). To maximise impact and avoid leakages, internationally consistent approaches should be used for cryptocurrencies as well.

Finally, while we did not analyse this in the current study, a number of observers have concluded that at the current stage of market development, cryptocurrencies do

not appear to present macroeconomic or financial stability issues (Carney (2018), FSB (2018)). And while illicit uses of course transcend borders, it seems hard to use cryptocurrencies to circumvent capital controls on a large scale. That said, new types of crypto-products, such as crypto-funds and derivatives on cryptocurrencies and cryptoassets, create additional linkages with the financial system. And cryptocurrencies and other cryptoassets can piggyback on the conventional financial system. A loss of public trust in cryptoasset markets could translate into distrust in the broader financial system and its regulators. While cryptoassets thus do not, at this point, pose a global financial stability risk, it is important to remain vigilant, monitor developments and respond to potential threats.

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The rise of zombie firms: causes and consequences[1]

The rising number of so-called zombie firms, defined as firms that are unable to cover debt servicing costs from current profits over an extended period, has attracted increasing attention in both academic and policy circles. Using firm-level data on listed firms in 14 advanced economies, we document a ratcheting-up in the prevalence of zombies since the late 1980s. Our analysis suggests that this increase is linked to reduced financial pressure, which in turn seems to reflect in part the effects of lower interest rates. We further find that zombies weigh on economic performance because they are less productive and because their presence lowers investment in and employment at more productive firms.

JEL classification: D22, D24, E43, G33.

Zombie firms, meaning firms that are unable to cover debt servicing costs from current profits over an extended period, have recently attracted increasing attention in both academic and policy circles. Caballero et al (2008) coined the term in their analysis of the Japanese "lost decade" of the 1990s. More recently, Adalet McGowan et al (2017) have shown that the prevalence of such companies as a share of the total population of non-financial companies (the zombie share) has increased significantly in the wake of the Great Financial Crisis (GFC) across advanced economies more generally.

In this special feature, we explore the rise of zombie companies and its causes and consequences. We take an international perspective that covers 14 countries and a much longer period than previous studies. The focus on listed companies allows us to consider two different ways of identifying zombie firms: a *broad* measure proposed by Adalet McGowan et al (2017), based on persistent lack of profitability in mature firms; and a *narrow* one proposed by Banerjee and Hofmann (2018), which additionally requires expectations of low future profitability inferred from a firm's stock market valuation.

Our analysis addresses three main questions:

First, are increases in the incidence of zombie firms just episodic, linked to major financial disruptions, or do they reflect a more general secular trend? Answering this question requires taking a sufficiently long perspective. Our database extends back to the 1980s and covers several business cycles. We find a ratcheting dynamic: the

[1] The authors would like to thank Claudio Borio, Stijn Claessens, Benjamin Cohen, Ingo Fender, Hyun Song Shin and Kostas Tsatsaronis for helpful comments and Yifan Ma for able research assistance. The views expressed are those of the authors and do not necessarily reflect those of the BIS.

Key takeaways

- The prevalence of zombie firms has ratcheted up since the late 1980s.
- This appears to be linked to reduced financial pressure, reflecting in part the effects of lower interest rates.
- Zombie firms are less productive and crowd out investment in and employment at more productive firms.
- When identifying zombie firms, it appears to be important to take into account expected future profitability in addition to weak past performance.

share of zombie companies has trended up over time through upward shifts in the wake of economic downturns that are not fully reversed in subsequent recoveries.

Second, what are the causes of the rise of zombie firms? Previous studies have focused on the role of weak banks that roll over loans to non-viable firms rather than writing them off (Storz et al (2017), Schivardi et al (2017)). This keeps zombie companies on life support. A related but less explored factor is the drop in interest rates since the 1980s. The ratcheting-down in the level of interest rates after each cycle has potentially reduced the financial pressure on zombies to restructure or exit (Borio and Hofmann (2017)). Our results indeed suggest that lower rates tend to push up zombie shares, even after accounting for the impact of other factors.

Third, what are the economic consequences of the rise of zombie companies? Previous studies have shown that zombies tend to be less productive (Caballero et al (2008), Adalet McGowan et al (2017)). Therefore, the higher share of zombie companies could be weighing on aggregate productivity. Moreover, the survival of zombie firms may crowd out investment in and employment at healthy firms. Our findings confirm these effects for more countries and a longer period. However, we find evidence of crowding-out only for the narrow measure of zombie firms. This suggests that it is important to consider expectations of future profitability in addition to current profitability when classifying firms as zombies.

The remainder of the special feature is organised as follows. The first section documents the upward trend in the share of zombie firms since the 1980s. The second assesses the causes of their rise. The third explores the consequences for productivity and the performance of non-zombie firms. We conclude by considering some policy implications.

The rise of zombie firms

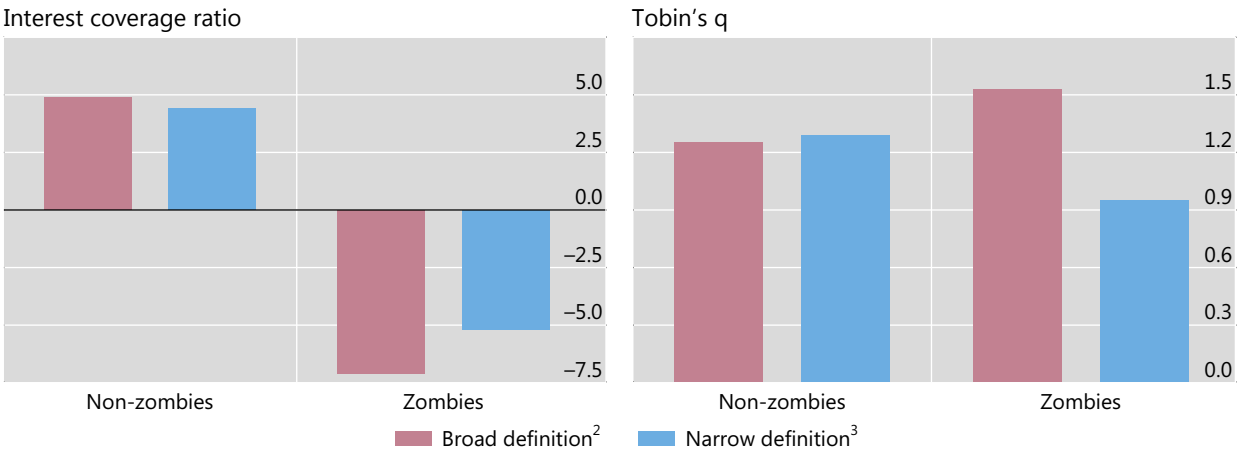
When is a company a zombie? Lack of profitability over an extended period is obviously an important criterion, especially if the company cannot service its debts. A second criterion is age: young companies may need more time for investment projects to deliver returns. Finally, low expected profitability should be important. Profitability today could be low because of a corporate restructuring or new investments that may eventually increase profitability.[2]

[2] Another criterion proposed in the literature is whether a firm is receiving "subsidised" credit. Caballero et al (2008) and Acharya et al (2018) identify zombie firms as companies that received

Here we apply two alternative zombie classifications to listed non-financial corporates in 14 advanced economies using the Worldscope database covering 32,000 companies.[3] The first, broader measure follows Adalet McGowan et al (2017) and identifies a firm as a zombie if its interest coverage ratio (ICR) has been less than one for at least three consecutive years and if it is at least 10 years old. The second measure is narrower. Following Banerjee and Hofmann (2018), and exploiting the fact that our database covers only listed companies for which we can observe stock market valuations, it adds the requirement that zombies should have comparatively low expected future growth potential. Specifically, zombies are required to have a ratio of their assets' market value to their replacement cost (Tobin's q) that is below the median within their sector in any given year.

The zombies under the two definitions are very similar with respect to their current profitability, but qualitatively different in their profitability prospects. Graph 1 shows that, for non-zombie firms, the median ICR is over four times earnings under both definitions. As the majority of zombie firms make losses, the median ICRs are below minus 7 under the broad measure and around minus 5 under the narrow one. A striking difference between the broad and narrow zombie measure emerges, however, with respect to expected future profitability, as measured by Tobin's q. Under the broad measure, the median Tobin's q of zombie firms is higher than that of non-zombies. Investors are therefore optimistic about the future prospects of

Interest coverage and Tobin's q of zombies and non-zombies[1] Graph 1



[1] Sample medians based on data for 14 advanced economies over the period 1987–2016. Interest coverage ratio = ratio of earnings before interest and taxation to interest paid; Tobin's q = the sum of the market value of equity and liabilities divided by the sum of the book value of equity and debt. [2] Firms with an interest coverage ratio less than one for three consecutive years and over 10 years old. [3] Broad zombies with a Tobin's q below the median firm in the sector in a given year.

Sources: Datastream Worldscope; authors' calculations.

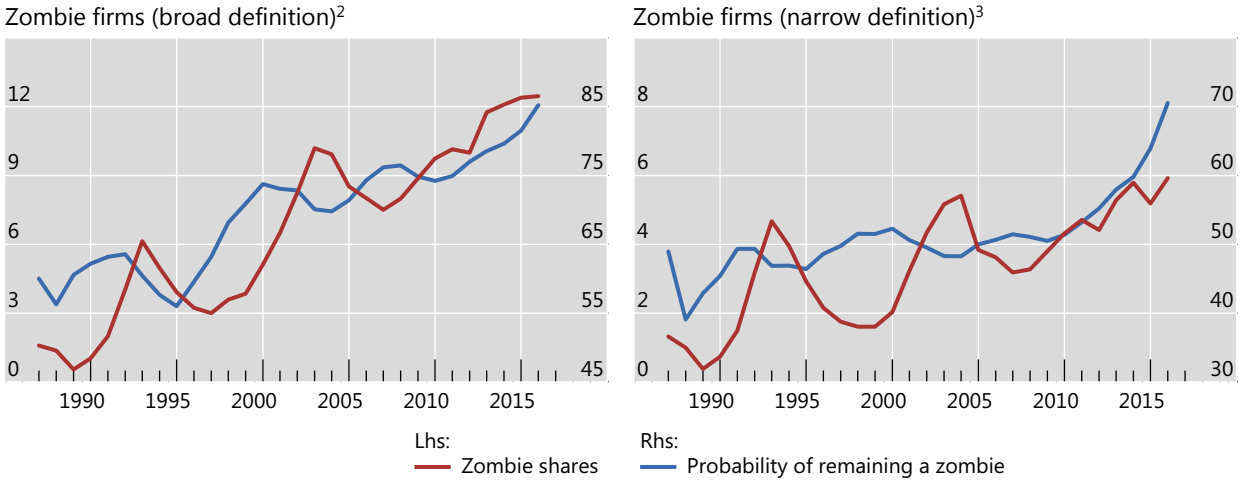
subsidised credit at rates below those for the most creditworthy companies. This identification has three potential drawbacks. First, identifying such credit with precision is difficult. Second, banks may grant subsidised credit for other reasons, such as long-standing relationships. Finally, when interest rates are very low for a long time, subsidised lending rates would have to be near zero or even negative. For these reasons, we adopt definitions that rest on the notion of persistent unprofitability, age and pessimistic market perceptions. In Banerjee and Hofmann (2018), we also assess the prevalence of subsidised credit and examine how the results based on such a definition would compare with those using the definitions adopted here.

[3] We include firms from Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Zombie firms are on the rise and survive for longer[1]

In per cent

Graph 2



[1] Simple averages of zombies as a share of all listed non-financial firms in the Worldscope database from Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom and the United States. [2] Firms with an interest coverage ratio less than one for three consecutive years and over 10 years old. [3] Broad zombies with a Tobin's q below the median firm in the sector in a given year.

Sources: Banerjee and Hofmann (2018); Datastream Worldscope; authors' calculations.

many of these zombie firms, more so than that for the non-zombies.[4] By definition the narrow measure, which is designed to purge the zombie measure from this anomaly, has a lower median Tobin's q, slightly below one.

Both zombie measures suggest that the prevalence of zombies has increased significantly since the 1980s (Graph 2, red lines). Across 14 advanced economies, their share rose, on average, from around 2% in the late 1980s to some 12% in 2016 under the broad definition (left-hand panel), and from 1% to about 6% according to the narrow measure (right-hand panel). The increase was not steady: upward shifts linked to economic downturns in the early 1990s, the early 2000s and 2008 were reversed only partly in subsequent years.

The rise of zombie firms has been driven by firms staying in the zombie state for longer, rather than recovering or exiting through bankruptcy (Graph 2, blue lines). Specifically, the probability of a zombie remaining a zombie in the following year rose from 60% in the late 1980s to 85% in 2016 (broad measure) and from 40% to 70% (narrow measure).

Causes

How can corporate zombies survive for longer than in the past? They seem to face less pressure to reduce debt and cut back activity. And in contrast to what might be expected, the main change does not coincide with the GFC, but occurred in the early 2000s. Regression estimates suggest that, pre-2000, zombies (broadly and narrowly

[4] Note that risk also affects Tobin's q. As equity can be viewed as a call option on the value of the firm, if zombies are inherently more risky this could also increase the Tobin's q of a firm.

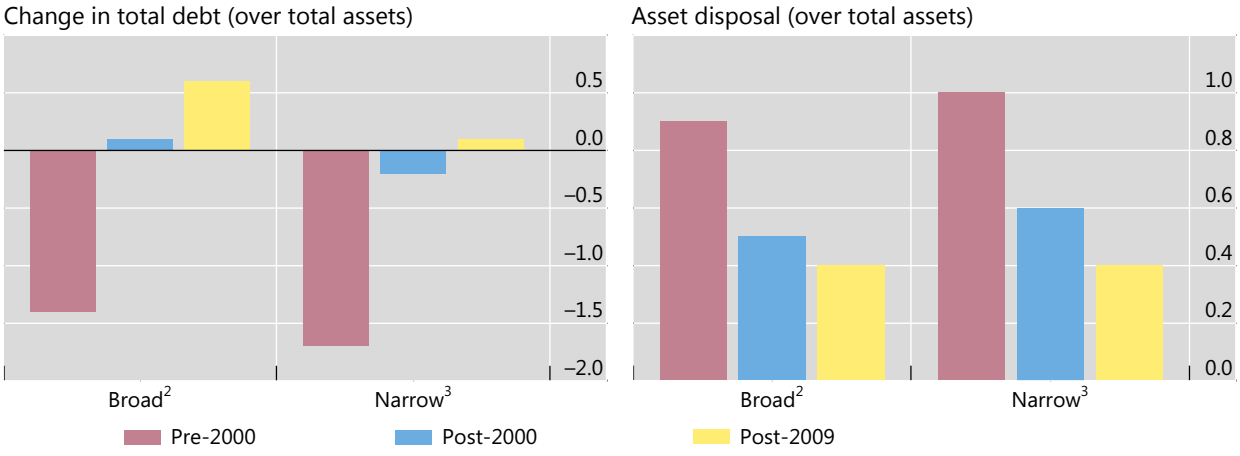
defined) cut debt at a rate of just under 2% of total assets a year relative to non-zombie firms. Post-2000, however, the two groups become indistinguishable, as the zombies' (relative) deleveraging speed has slowed down significantly (Graph 3, left-hand panel). There was a further mild slowdown post-2009, but it is not statistically significant. As deleveraging has slowed, zombies have been locking in more resources, hindering reallocation. Specifically, they have significantly slowed down their asset disposals relative to their more profitable peers (right-hand panel). The reduced pressure on zombies does not reflect a relative improvement in their profitability. There was no significant increase in zombies' earnings before interest payments and taxes (EBIT) relative to total assets compared with non-zombies, either since 2000 or since 2009.

Which factors explain this change in zombies' behaviour? The literature has identified weak banks as a potential key cause (Caballero et al (2008)). When their balance sheets are impaired, banks have incentives to roll over loans to non-viable firms rather than writing them off. Formal evidence suggests that weak banks indeed played a role in the wake of the GFC (Storz et al (2017), Schivardi et al (2017)). By inhibiting corporate restructuring, poorly designed insolvency regimes were also at work (Andrews and Petroulakis (2017)).

Another potential, more general factor is the downward trend in interest rates. Mechanically, lower rates should reduce our measure of zombie firms as they improve ICRs by reducing interest expenses, all else equal. However, low rates can also reduce the pressure on creditors to clean up their balance sheets and encourage them to "evergreen" loans to zombies (Borio and Hofmann (2017)). They do so by reducing

Zombie firm dynamics changed in the early 2000s[1]

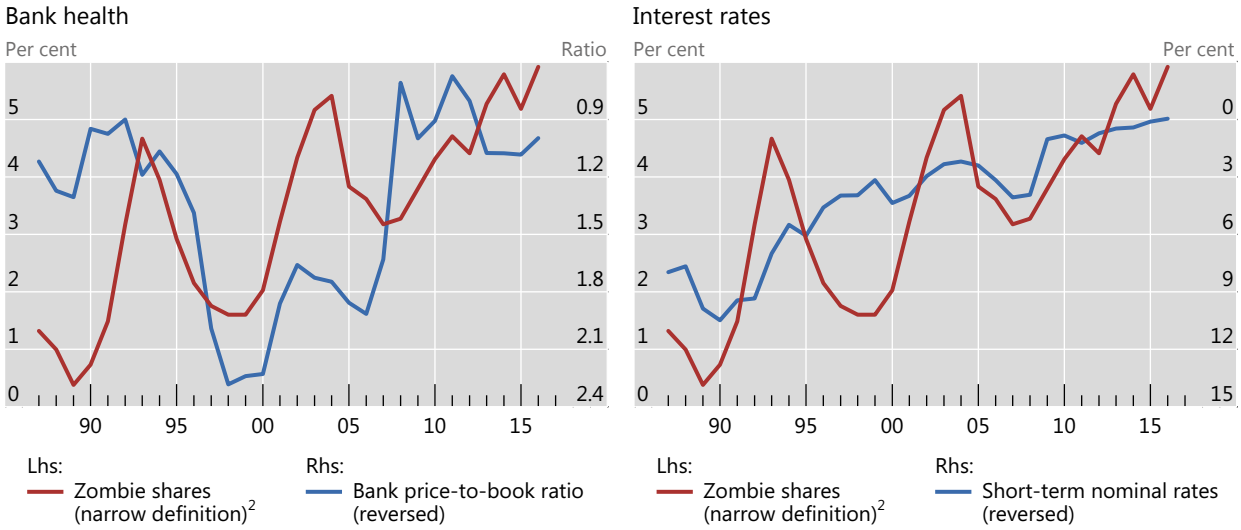
In per cent — Graph 3



[1] Estimates from the regression $y_{isct} = \beta_1 D(zombie_t) + \beta_2 D(zombie_t) * D(post\text{-}2000) + \beta_2 D(zombie_t) * D(post\text{-}2009) + \gamma Controls_{isct} + \alpha_{st} + \delta_{ct} + \varepsilon_{isct}$, where $D(zombie_t)$ is a dummy variable indicating whether firm i is classified as a zombie in period t, and $D(\text{post-}2000)$ takes a value of one for years after 2000 while $D(post\text{-}2009)$ takes a value of one for years after 2009. Control variables: ratio of fixed assets to total assets; market-to-book value; logarithm of total assets (TA) in constant 2010 US dollars; ratio of capital expenditures to total assets; ratio of R&D to sales; and dummy variable indicating whether the firm pays a dividend. α_{st} and δ_{ct} are sector-year and country-year dummy variables, respectively. [2] Firms with an interest coverage ratio less than one for three consecutive years and over 10 years old. [3] Broad zombies with a Tobin's q below that of the median firm in the sector in a given year.

Sources: Datastream Worldscope; authors' calculations.

Potential drivers of rising zombie shares[1] Graph 4



[1] Price-to-book ratios, policy rates and zombie shares are simple averages from Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom and the United States. [2] Firms with an interest coverage ratio less than one for three consecutive years, over 10 years old and with a Tobin's q below the median firm in the sector in a given year.

Sources: Datastream; Datastream Worldscope; national data; authors' calculations.

the opportunity cost of cleaning up (the return on alternative assets), cutting the funding cost of bad loans, and increasing the expected recovery rate on those loans.[5] More generally, lower rates may create incentives for risk-taking through the risk-taking channel of monetary policy. Since zombie companies are risky debtors and investments, more risk appetite should reduce financial pressure on them. These mechanisms could operate through nominal or inflation-adjusted (real) interest rates, but nominal ones might in practice be more relevant if there is money illusion.[6, 7]

Visual inspection suggests that the share of zombie firms is indeed negatively correlated with both bank health and interest rates. There is a rather weak negative correlation between the zombie share and bank health, proxied by banks' price-to-

[5] Specifically, the decision to charge off or roll over will depend on how the expected repayment from a loan compares with its liquidation value, which is typically its collateral value. So, for given collateral values, higher discounted repayments can induce more banks to roll over a larger part of their bad loans, in particular in crisis times when the market for collateral can be depressed and illiquid. See Lepetit et al (2011) for a formal analysis.

[6] There is evidence supporting such a link. Specifically, banks' loan charge-offs appear to rise with higher nominal rates (Lepetit et al (2011)) and the interest rate sensitivity of loan loss provisions to increases at low nominal rates (Borio et al (2017)). Moreover, banks enjoying capital gains on asset holdings owing to unconventional policy measures lowering nominal bond yields (specifically the ECB's Outright Monetary Transactions (OMT) programme) appear to have increased their supply of loans mainly to low-quality firms with which they had pre-existing lending relationships (Acharya et al (2018)).

[7] Yet another factor at work could be the rise of "superstar" firms that have skewed the profitability distribution towards the largest global firms (Autor et al (2017)). The rise of superstar firms may have lowered the profitability of non-superstars, contributing to a rising share of unprofitable firms and hence of zombies. But then the question is why these unprofitable firms have not exited the market.

book ratios (PBRs)[8] (Graph 4, left-hand panel). The link appears to be rather episodic, emerging in periods of economic downturn or financial stress, such as the early 1990s, the early 2000s and the GFC. But no link is apparent between the trends in these variables. The zombie share trends up, while the PBR does not display any trend from the late 1980s onwards. By contrast, there is a closer correlation between the rising zombie share and the fall in nominal interest rates (right-hand panel).[9] While one factor could indeed be less pressure to deleverage, the relationship might also reflect reverse causality: a higher share of zombie firms could depress productivity growth, which could in turn lower interest rate levels in the long run.[10] Alternatively, the co-movement could also reflect a common factor, such as a fall in aggregate productivity growth.[11]

A simple way to assess whether bank health and interest rates influence the incidence of zombie firms is to assess whether changes in the two variables predict future zombie shares. Technically, Granger causality tests are designed to do this (Granger (1969)). We implement them based on country panel data over the period 1987–2016. We do so by regressing the country zombie shares on their own lags as well as five lags of the bank price-to-book ratio, of the nominal interest rate and of labour productivity growth (Table 1). We include these variables to capture any common factor that might be at work.

The results suggest that lower nominal interest rates predict an increase in the zombie share, while the effect of bank health is less clear-cut. The level of interest rates over the previous five years is linked to higher zombie shares, and the link is

Zombie shares, interest rates and bank health: country-level evidence[1] Table 1

	(1) Granger causality test		(2) Long-run multipliers	
	Broad[2]	Narrow[3]	Broad[2]	Narrow[3]
Interest rate → zombie	10.20***	10.29***	–0.82***	–0.27***
Bank health → zombie	6.19***	9.41***	0.14	–0.58

[1] The table reports Granger causality tests (F-tests) with p-values in parentheses and long-run multipliers with t-statistics in parentheses. "Zombie" refers to the share of zombie firms in listed non-financial corporates; "interest rate" is the nominal short-term interest rate; and "bank health" is the banking sector price-to-book ratio. "→" indicates the direction of causality being tested. Estimates are based on a country panel covering 14 advanced economies over the period 1987–2016. The estimated panels include five lags of each variable as well as five lags of labour productivity growth and control for country fixed effects. Significance at the 1/5/10% level denoted by ***/**/*. All tests are based on cluster robust variance-covariance matrices. [2] Firms with an interest coverage ratio less than one for three consecutive years and over 10 years old. [3] Broad zombies with a Tobin's q below that of the median firm in the sector in a given year.

Sources: Datastream; Datastream Worldscope; authors' calculations.

[8] For a more detailed discussion of bank PBRs and why they are useful proxies for bank health, see Bogdanova et al (2018).

[9] This is also true for real rates. The correlation between the cross-country average zombie share and short-term ex post real interest rates is –0.75, compared with –0.76 for short-term nominal rates. In our baseline, we use nominal interest rates, but the results are almost identical if real interest rates are used.

[10] A standard explanation of the long-run level of nominal interest rates is that they are determined by the level of the "natural" real rate of interest and steady state inflation. The natural real interest rate is defined as the level that equates desired saving and investment at full employment. Standard theory postulates that this rate is closely linked to an economy's trend per capita growth and hence to productivity growth. See BIS (2018) for a discussion of the concept and further references.

[11] This explanation seems less plausible, as it would not explain why unproductive, loss-making firms continue to survive.

Cross-sectional test of the drivers of zombie shares[1] Table 2

	Broad[2]			Narrow[3]		
	(1)	(2)	(3)	(4)	(5)	(6)
*External finance dependence$_s$ * Interest rate*	–0.079***		–0.077***	–0.035***		–0.035**
*External finance dependence$_s$ * Bank health*		0.112	0.084		0.026	0.013
Fixed effects	Country* time, sector	Country* time, sector	Country* time, sector	Country* time, sector	Country* time, sector	Country* time, sector
Number of observations	13,593	13,593	13,593	13,593	13,593	13,593
R squared	0.088	0.088	0.088	0.077	0.077	0.077

[1] Estimates from regressions of the form: $Zombie\ share_{sct} = \beta_1(External\ finance\ dependence_s * Interest\ rate_{ct-1}) + \beta_2(External\ finance\ dependence_s * Bank\ health_{ct-1}) + \alpha_s + \gamma_{c,t} + \varepsilon_{sct}$. The dependent variable, $Zombie\ share_{sct}$ is the share of physical capital in zombie firms in sector s in country c in year t; $External\ finance\ dependence_s$ in sector s is measured as the median firm's share of capital expenditures that are not financed from operating income. "Interest rate" refers to the nominal short-term interest rate. "Bank health" is the banking sector price-to-book ratio in country c in year $t-1$. α_s and $\gamma_{c,t}$ are sector*year and country*year fixed effects, respectively. Significance at the 1/5/10% level denoted by ***/**/*; standard errors are clustered by sector-year and country-year. [2] Firms with an interest coverage ratio less than one for three consecutive years and over 10 years old. [3] Broad zombies with a Tobin's q below that of the median firm in the sector in a given year.

Sources: Datastream; Datastream Worldscope; authors' calculations.

statistically highly significant (Table 1, columns (1) and (2)). An improvement in bank health (an increase in the bank's average price-to-book ratio) also significantly affects the future zombie share (column (1)), but the direction of the effect is not clear and not statistically significant (column (2)). These results suggest that the link is indeed more episodic, associated with financial distress.

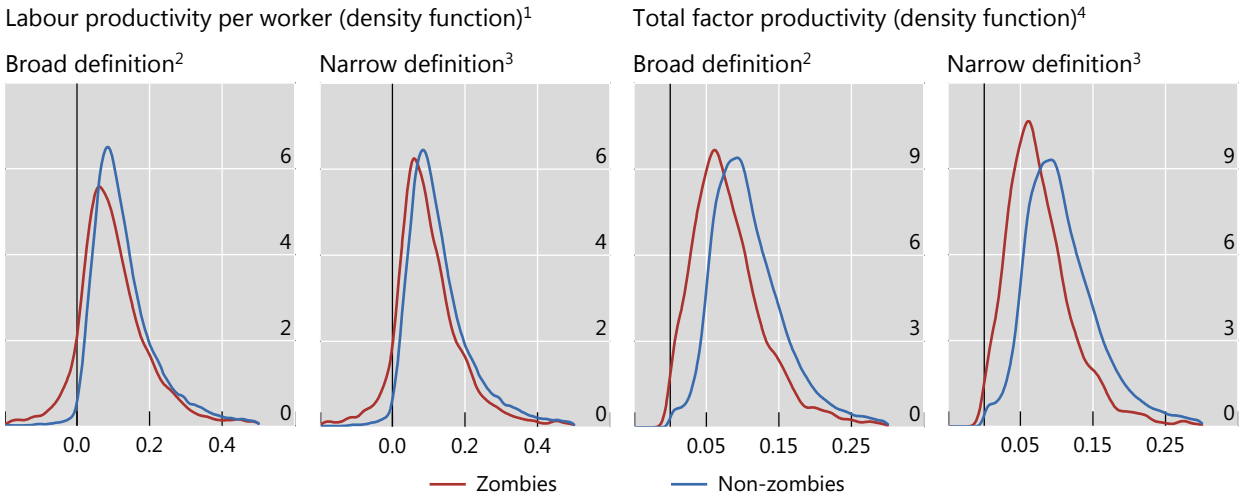
A more informative and more robust test of the drivers of the zombie share is to look at differences across sectors. We do so by assessing whether the effect of weaker bank health or lower interest rates is stronger in industries that are more dependent on external funding (considering 48 industries). The intuition is that firms in these industries are more sensitive to financial pressure.[12] These microdata-based tests are better able to address concerns about reverse causality as well as omitted common variables, as it is possible to fully control for the influence of unobserved macroeconomic factors at the country level in any year.

The results are consistent with a role for interest rates. Lower nominal interest rates push up zombie shares in those sectors where firms depend more heavily on external funding (Table 2). The relationship is statistically significant and the effects appear material.[13] Our estimates suggest that the 10 percentage point decline in nominal interest rates since the mid-1980s may account for around 17% of the rise in the zombie share in advanced economies when evaluated at the average industry external finance dependency ratio. Similar results obtain when we use the real, rather than nominal, interest rate (not reported). The role of bank health is not visible. The

[12] This is an application of the difference-in-difference method popularised by Rajan and Zingales (1998).

[13] These results are also robust to removal of the commodity sectors. Firms in this sector depend greatly on external funding, but may also experience swings in commodity prices related to global economic activity.

Zombie firms are less productive Graph 5



[1] Gross value added per worker, in constant 2010 US dollars. [2] Broad zombies defined as firms with an interest coverage ratio less than one for three consecutive years and over 10 years old. [3] Narrow zombies defined as broad zombies with a Tobin's q below the median firm in the sector in a given year. [4] In constant 2010 US dollars, based on Solow residuals from ordinary least squares regression estimates of sectoral production functions.

Sources: Datastream; Datastream Worldscope; authors' calculations.

interaction between external finance dependence and bank health is generally statistically insignificant (columns (2) and (5)), confirming the previous results.

Consequences

Previous studies have found that zombie companies may weaken economic performance (Caballero et al (2008), Adalet McGowan et al (2017)). Zombies are less productive and may crowd out growth of more productive firms by locking resources (so-called "congestion effects"). Specifically, they depress the prices of those firms' products, and raise their wages and their funding costs, by competing for resources.

Our findings are consistent with this hypothesis. On average, labour productivity and total factor productivity of zombie firms are lower than those of their peers (under both zombie definitions): the distribution of productivity of zombies is clearly shifted towards the lower end, ie to the left (Graph 5). This is especially evident for total factor productivity (third and fourth panels).

The more narrowly defined zombie firms also give rise to congestion effects, which are not visible in the case of the broader definition (Table 3). This is reflected in a negative and statistically significant coefficient for the interaction term between non-zombies and the zombie share. Specifically, the estimation results suggest that a 1 percentage point increase in the narrow zombie share in a sector lowers the capital expenditure (capex) rate of non-zombie firms by around 1 percentage point, a 17% reduction relative to the mean investment rate. Similarly, employment growth is 0.26 percentage points lower, an 8% reduction. However, under both definitions we find that non-zombie companies invest more and have higher employment growth (first row in Table 3). Ostensibly, it is the viable firms that expand more.

The zombie congestion effects on non-zombie firms[1]

Table 3

	Capex/Capital		Employment growth	
	Broad[2]	Narrow[3]	Broad[2]	Narrow[3]
D(Non-zombie firm)	0.453***	0.648***	0.074***	0.104***
*D(Non-zombie firm) * zombie share*	0.049	−0.996***	−0.113	−0.261***
Sector*year and country*year effects	Yes	Yes	Yes	Yes
Number of observations	261,555	261,555	236,728	236,728
R squared	0.206	0.206	0.069	0.069

[1] Estimates from the regression $y_{isct} = \beta_1 D(non\text{-}zombie\ firm)_{isct} + \beta_2 D(non\text{-}zombie\ firm)_{isct} * zombie\ share_{s,t-1} + \beta_3 \log(size_{isct}) + \beta_4 firm\ age_{isct} + \alpha_{s,t} + \gamma_{c,t} + \varepsilon_{isct}$. The dependent variable y_{isct} is either capital expenditures as a ratio of lagged physical capital or employment growth defined as $0.5 * \frac{employment_{it} - employment_{it-1}}{employment_{it} + employment_{it-1}}$ in firm i in sector s of country c in year t. $\alpha_{s,t}$ *and* $\gamma_{c,t}$ are sector*year and country*year fixed effects, respectively. The variable D(non-zombie firm) is a dummy variable taking the value of one if the firm is not classified as a zombie. "Zombie share" is the share of total assets in zombie firms in a given sector in a year. Significance at the 1/5/10% level denoted by ***/**/*; standard errors are double-clustered by country and sector. [2] Firms with an interest coverage ratio less than one for three consecutive years and over 10 years old. [3] Broad zombies with a Tobin's q below that of the median firm in the sector in a given year.

Sources: Datastream Worldscope; authors' calculations.

The economy-wide impact on productivity from the rise in zombie firms can be assessed by exploiting the global nature of the zombie phenomenon. In particular, to assess the productivity impact, we isolate the rise in a country's zombie share only due to the exposure of its capital stock to the global industry trends in zombification. We find that when the zombie share increases, productivity growth declines significantly, but only for the narrowly defined zombies (Table 4), consistent with our previous finding of a negative zombie congestion effect for this zombie measure (Table 3). This result is robust to controlling for lagged productivity growth and cyclical factors captured by the output gap. The estimates indicate that when the zombie share in an economy increases by 1%, productivity growth declines by around 0.3 percentage points.

Zombie firms push down aggregate productivity growth[1]

Table 4

	Broad[2]		Narrow[3]	
	(1)	(2)	(3)	(4)
Zombie share	–1.237	–1.347	–0.584**	–0.327**
Output gap and lagged productivity controls	No	Yes	No	Yes
Country/year fixed effects	Yes	Yes	Yes	Yes
Number of observations	409	383	409	383

[1] Estimates from the instrumental variable regression $Total\ factor\ productivity\ growth_{ct+1} = \beta_1 zombie\ share_{ct} + \beta_2 output\ gap_{ct} + \beta_3 Total\ factor\ productivity\ growth_{ct} + \alpha_c + \gamma_t + \varepsilon_{ct}$. The physical capital-weighted $zombie\ share_{ct}$ in country c in year t is instrumented with a shift-share instrument which measures zombie exposure of a country to the global zombie share, ie $\sum_{i=1}^{I} capitalshare_{ict} zombieshare_{it}$, where $capitalshare_{ict}$ is the share of capital in industry i in country c in year t and $zombieshare_{it}$ is the zombie share in industry i across all 14 economies in our sample in year t. α_c *and* γ_t are country and year fixed effects, respectively. Significance at the 1/5/10% level denoted by ***/**/*; standard errors are double-clustered by country and sector. [2] Firms with an interest coverage ratio less than one for three consecutive years and over 10 years old. [3] Broad zombies with a Tobin's q below that of the median firm in the sector in a given year.

Sources: OECD; Datastream Worldscope; Penn World Tables; authors' calculations.

Conclusions

What do our results mean for central bank policy? Among other things, they highlight a difficult trade-off (Haldane (2017)). Lower rates boost aggregate demand and raise employment and investment in the short run. But the higher prevalence of zombies they leave behind misallocate resources and weigh on productivity growth. Should this effect be strong enough to reduce growth, it could even depress interest rates further. Our study cannot answer this question. We leave the exploration of this trade-off to future research.

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Term premia: models and some stylised facts[1]

We review methods and models for estimating term premia on long-term government bonds. We then use these models to estimate term premia on US and euro area bonds and explore their recent behaviour. Although the models produce different estimates for the level of term premia, they largely concur on the trends and dynamics. While low (and sometimes negative) term premia have helped to keep yields unusually low, recent yield movements have tended to reflect shifts in expected short-term rates rather than in the premia. We find that co-movements in real term premia (rather than inflation risk premia or expected rates) have contributed to co-movements between yields in the United States and the euro area.

JEL classification: G10, G12.

Yields on long-dated bonds are made up of two parts: the returns expected from comparable, shorter-dated instruments over the same time period, and an additional component, or term premium. This term premium is normally thought of as the extra return (a risk premium) that investors demand to compensate them for the risk associated with a long-term bond. But it may also be influenced by supply and demand imbalances for a specific instrument, or several other factors. Typically, expected interest rates and term premia are extracted using models based on a small number of risk factors, under the assumption that consistency is maintained between yields at different maturities through the absence of arbitrage opportunities. The models are estimated from market data, in some cases supplemented by survey data and macroeconomic indicators.

In this Special Feature, we examine some methods and models used to distinguish these different bond yield components. We focus on benchmark government bonds for the United States and the euro area. Both of the corresponding yield curves benefit from deep, liquid markets with a broad range of maturities, and act as benchmarks for the pricing of many other assets worldwide.

We then make use of this decomposition to study recent drivers of US and euro area yields. In recent years, government bond yields have not always responded predictably to macroeconomic or monetary policy news. Long-term yields in the United States remained stubbornly low even as the Federal Reserve initiated a series of interest rate hikes away from zero starting in late 2015. From mid-2016, as growth prospects have picked up, yields in both the United States and in Europe have trended

[1] The authors would like to thank Claudio Borio, Phurichai Rungcharoenkitkul, Hyun Song Shin and Philip Wooldridge for comments and Bilyana Bogdanova and Nicholas LeMercier for research assistance. The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS.

Key takeaways

- We review various models that aim to separate the expectations and term-premium components of bond yields.
- Applied to 10-year government yields in the United States and euro area in recent years, the models produce different estimates for the levels of the term premia, but broadly agree on the trends and dynamics.
- Historically, term premia have tended to be more closely correlated across the two economies than are expectations of short-term rates.

higher, but long-term yields have not always kept up with those at the short-term end. Analysts have debated the causes and implications of a flat, or even downwards-sloping, term structure at a time of broadly robust growth.

The various models we study give different estimates for the *levels* of estimated term premia, but they tend to agree on the general *trend* and *dynamics*. In particular, all estimates point to an overall downward trend in term premia both in the United States and in the euro area since the 2007–09 Great Financial Crisis (GFC). Premia have increased somewhat recently, but are still well below pre-GFC levels. The models also tend to find that premia are highly correlated across currencies, while interest rate expectations are not. Changes in rate expectations, especially for real (inflation-adjusted) interest rates, have driven yields at times, including those of US Treasuries in the last year or two. But low term premia have also contributed to the recent puzzling behaviour in yields and the term structure, including through international spillovers.

The first section discusses the basics of term premia models and explores how they are used to separate the various components of market yields. The second and third apply these insights to benchmark 10-year government bond yields in the United States and the euro area. The fourth asks what correlations across the different estimated components can tell us about the drivers of US and euro area rates. The last section concludes.

Methods for estimating term premia

As mentioned above, long-term interest rates can be broken out into a part that reflects the expected path of short-term interest rates and a term premium.[2] In standard finance theories, the latter part represents the compensation, or risk premium, that risk-averse investors demand for holding long-term bonds. This compensation arises because the return earned over the short term from holding a long-term bond is risky, whereas it is certain in the short term for a bond that matures over the same short investment horizon. While some types of investor, such as pension funds, may consider long-term bonds less risky given their long-term liabilities, most other investors would tend to view them as more risky.

More generally, though, the term premium would reflect this type of compensation for risk only if markets were perfectly functioning and frictionless. In

[2] See also Kim and Orphanides (2007) for a review of key concepts and methods.

reality, a number of other influences may affect bond yields, and thus the estimated expectations and term premium components. One such influence is supply-demand imbalances, such as those brought on by outsize official sector purchases of government bonds in recent years. Such effects may be compounded by burgeoning demand for long-term bonds from insurance and pension funds, as they try to hedge duration risk, especially in an environment of falling yields (Domanski et al (2015)). Sometimes institutional factors might lead to outsize investor demand for specific maturities, creating a "preferred habitat" effect that will be reflected in term premia (Modigliani and Sutch (1966), Vayanos and Vila (2009)).

One simple way of estimating the term premium is to subtract a survey measure of the average expected short rate from the observed bond yield. There are some drawbacks with this approach, however. Survey data are not updated frequently and (typically) include only a limited set of forecast horizons. Surveys may not always represent actual expectations of market participants, for instance because forecasters compete for business or for influence through their calls or because one or more large players have a disproportionate impact on the market.

The modern term structure literature provides an alternative way of disentangling term premia and interest rate expectations.[3] The starting point is the assumption that bonds are priced in a way that precludes arbitrage opportunities across all maturities. In other words, the pricing is assumed to make it impossible to form a portfolio consisting of bonds with different maturities that generates a riskless profit.

Typically, these models represent the time-series dynamics of bond yields with simple vector autoregressions. Restrictions are then imposed to reflect the no-arbitrage assumption across the entire maturity spectrum, giving rise to alternative, risk-neutral dynamics for yields. The differences between the actual ("objective") and the risk-adjusted dynamics reflect market participants' risk preferences. By exploiting these two dynamics, it is possible to decompose yields into expectations of future interest rates and term premia.

Much of the term structure literature has relied on models where a small set of yield-based factors is assumed to drive bond yield movements. One example is the model proposed by Adrian et al (2013, henceforth ACM), which uses principal components of bond yields as pricing factors.[4] The factors are weighted sums of yields with weights derived through statistical techniques. These models are appealing for their simplicity. That said, the yields so derived are prone to overreacting to changes in the general level of interest rates because they rely only on yield information. In particular, they may tend to interpret a change in interest rates as evidence that the steady-state (long-run) interest rate has changed correspondingly. This leads to exaggerated movements in distant-horizon interest rate projections.

But there are alternative approaches. Precisely because term structure models try to capture the very high persistence of yields, ie their tendency to be highly correlated

[3] See eg Duffie and Kan (1996), Dai and Singleton (2000) and Joslin et al (2011).

[4] In principal components analysis, a set of time series (such as bond yields of different maturities observed over time) is used to generate a second set of series (principal components), which are not correlated with (orthogonal to) each other and which, as a group, capture a large share of the variation in the original series. The first principal component usually accounts for the most variation in the underlying variables; each additional principal component allows a more accurate rendering of the original series.

over time, some researchers have included interest rate survey data in the models, even as they recognise the shortcomings of such data.[5] Kim and Wright (2005, henceforth KW) use one such model to estimate US term structure dynamics based on survey data on future three-month interest rates. Just as in the previous set of models, however, the factors driving interest rates are derived only from interest rates themselves.

Other models include macroeconomic factors in addition to, or instead of, yield factors. These macroeconomic factors are motivated by what investors are likely to care about when pricing bonds. Typically, they include inflation and some measure of economic activity.[6] Whatever the choice of factors used, these typically also represent the risk factors in the pricing model, ie the factors that determine the size and the dynamics of risk premia. An example of such a model is the one used by Hördahl and Tristani (2014, henceforth HT), which includes data on nominal and real (index-linked) yields, inflation, and a measure of economic slack ("output gap"), as well as survey data on future short-term interest rates and future inflation rates.

With more data and assumptions, we can obtain still more detail about the components of long-term yields. Specifically, we can split the term premium into two parts: a real risk premium – the compensation required to bear risk associated with variable future short-term real interest rates – and an inflation risk premium, which is related to uncertain future inflation developments.[7] And one can separate the expectations component into a part that reflects average expected future short-term real interest rates, and another that captures expected average inflation until the bond matures.

As with any estimation exercise, there are important caveats. For one thing, all term premia estimates are model-dependent, and also subject to parameter uncertainty. Second, previously estimated term premia will change over time as the model parameters are updated, insofar as the most complete and up-to-date information is seen as useful in capturing earlier developments in model-implied expectations and premia. Third, macro data revisions will lead to changes in estimates based on models that use macro data. In some cases, such as with potential output series that are used to calculate the output gap, revisions can at times be substantial. Revisions of estimates therefore complicate the real-time performance of these models. And models that rely on unobserved variables such as the output gap are sensitive to the estimation of those variables, for instance, the measurement of trends as more data become available.

Moreover, any model should be seen as a useful simplifying tool, but one that does not necessarily capture various real-life influences. An example of the latter is the recent experience with policy rates stuck at the zero lower bound (ZLB) or, in some cases, below zero (see eg Wu and Xia (2016, 2018)). For a number of reasons, zero or negative interest rates are likely to behave differently from positive ones. Models that do not explicitly take into account the probability of hitting the ZLB are good approximations when interest rates are far away from it. But, when interest rates are

[5] See eg Kim and Orphanides (2012).

[6] Examples include Ang and Piazzesi (2003), Hördahl et al (2006), and Rudebusch and Wu (2008).

[7] Typically, this requires inflation data in addition to yields, in order to construct a real stochastic discount factor alongside the nominal one. Moreover, data on real (index-linked) bond yields are helpful to pin down the dynamics of real yields, but not strictly necessary. The Hördahl and Tristani (2014) model uses real yield data in addition to nominal yields, macro factors and survey information.

close to it, such models might generate interest rate forecasts below the bound as well as biased term premia estimates.

US term premia estimates and recent developments

We start off by comparing estimates of term premia on 10-year US Treasury bonds obtained from the three term structure models discussed above. These are the ACM yield-factor-only model, the KW yield-factor model with additional information from surveys, and the HT macro-finance factor model that also includes survey information.

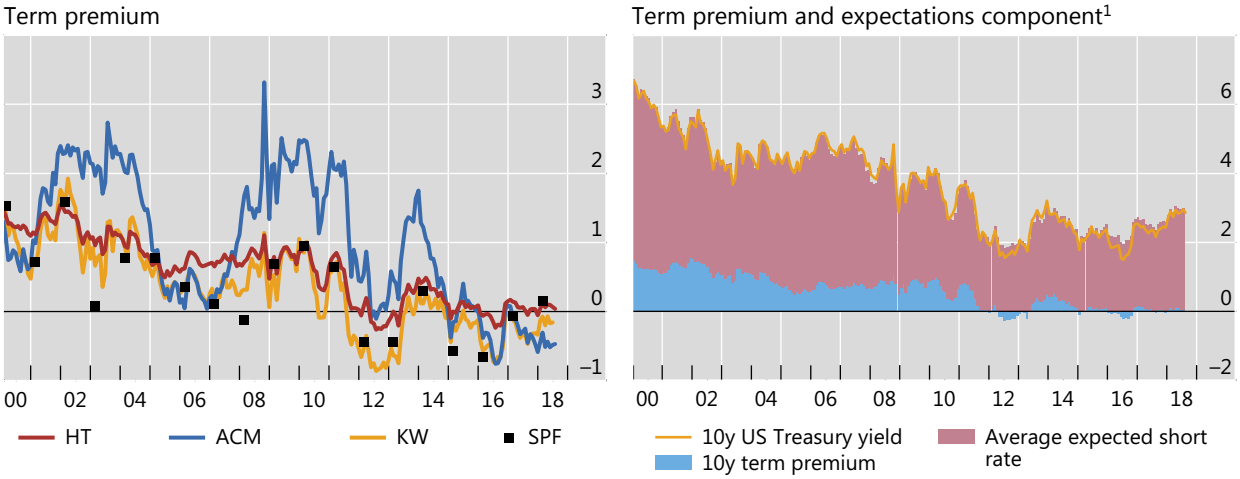
Graph 1 plots the premia estimates from each of these models. The left-hand panel also plots a model-free alternative estimate, calculated as the 10-year yield minus the corresponding 10-year average short-rate expectation, as reported once a year by the Survey of Professional Forecasters (SPF).

The graph illustrates how different methods can generate different levels of the term premia. Estimates derived from the ACM and the HT models can differ by as much as 200 bps. The discrepancy partly reflects the assumptions embedded in these estimates, as discussed above.[8]

Nonetheless, these models broadly agree on the trends and dynamics of premia. All estimates suggest a general downward trend since the GFC. The trend accounts for a large share of the overall evolution in the 10-year yield (Graph 1, right-hand

Ten-year US Treasury yields and term premium

In per cent — Graph 1



ACM = Adrian, Crump and Moench; HT = Hördahl and Tristani; KW = Kim and Wright; SPF = Survey of Professional Forecasters.

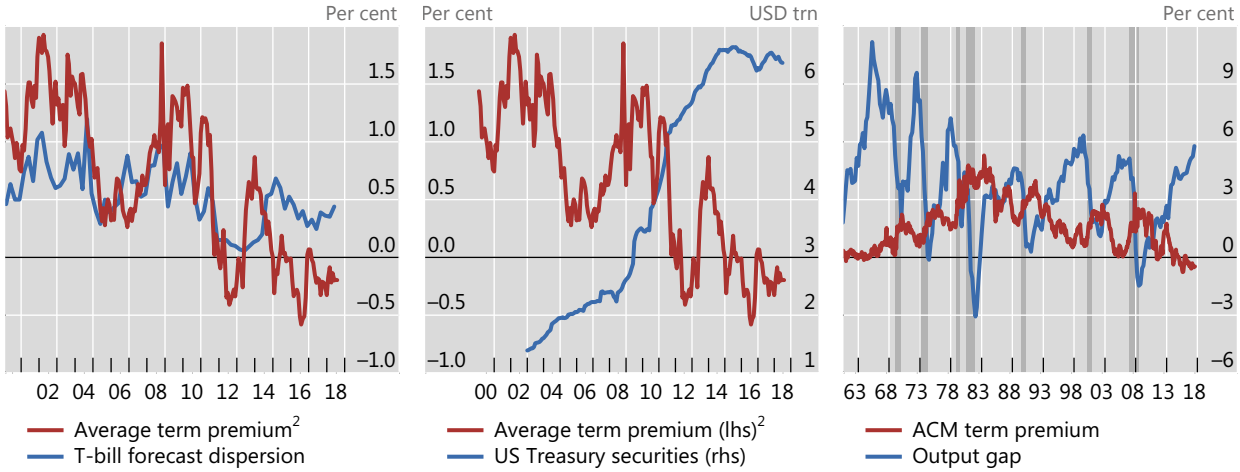
[1] Based on Hördahl and Tristani (2014). Decomposition of the 10-year nominal yield according to an estimated joint macroeconomic and term structure model; yields are expressed in zero coupon terms.

Sources: Adrian et al (2013); Hördahl and Tristani (2014); Kim and Wright (2005); Federal Reserve Bank of Philadelphia; authors' calculations.

[8] The discrepancies are not, however, explained by fitting errors implied by the models, as these models tend to fit the yield data very well. For example, the standard deviation of the residual between the observed 10-year yield and the corresponding yield from the HT model is below 9 basis points over the January 1981 to July 2018 sample period.

Ten-year US term premium and possible drivers

Graph 2



The shaded areas in the right-hand panel indicate recession periods as dated by NBER.

[1] Difference between 75th and 25th percentiles of one-year ahead three-month Treasury bill yield forecasts from the Survey of Professional Forecasters (SPF). [2] Average of Adrian, Crump and Moench (ACM), Hördahl and Tristani (HT) and Kim and Wright (KW) term premium estimates. [3] Sum of US Treasury securities holdings by the Federal Reserve and foreign officials. [4] Output gap estimate by CBO.

Sources: Adrian et al (2013); Hördahl and Tristani (2014); Kim and Wright (2005); Federal Reserve Bank of Philadelphia; Federal Reserve Bank of St Louis (FRED); Datastream; authors' calculations.

panel). All the models would agree that rising 10-year US Treasury yields in 2017–18 largely reflect an increase in the expected short rate over the subsequent 10 years. Correlations of monthly changes in premia estimates from different pairs of models range from 0.77 to 0.92.

What might explain the fall in term premia since the GFC? Two potential contributing factors could be declining uncertainty about the projected path of short rates, and demand pressures from central banks and other price-inelastic purchasers of Treasuries.

The general decline in the term premium during 2009–13 coincided with a smaller dispersion of survey expectations about future rates (Graph 2, left-hand panel). This reduced uncertainty may reflect forward guidance and other Fed communications policies. The fall in dispersion may also have reflected the smaller distance of short-term rates from zero, combined with the perception (reinforced by the Fed's forward guidance) that any rate increases were unlikely in the near term.[9] This pattern ended around the time of the 2013 "taper tantrum", when comments from Fed officials led the market to expect an imminent removal of monetary accommodation.

Purchases by the Fed and by the official sector outside the United States also played a role. The post-GFC downward trend in the term premium coincided with a sharp rise in the Fed's and foreign official holdings of Treasuries, in line with the notion that demand pressures from these sources helped to push down yields (Graph 2, centre panel).

[9] Towards the end of this period, policy rates and some bond yields did fall below zero in a few economies, including the euro area, although not in the United States.

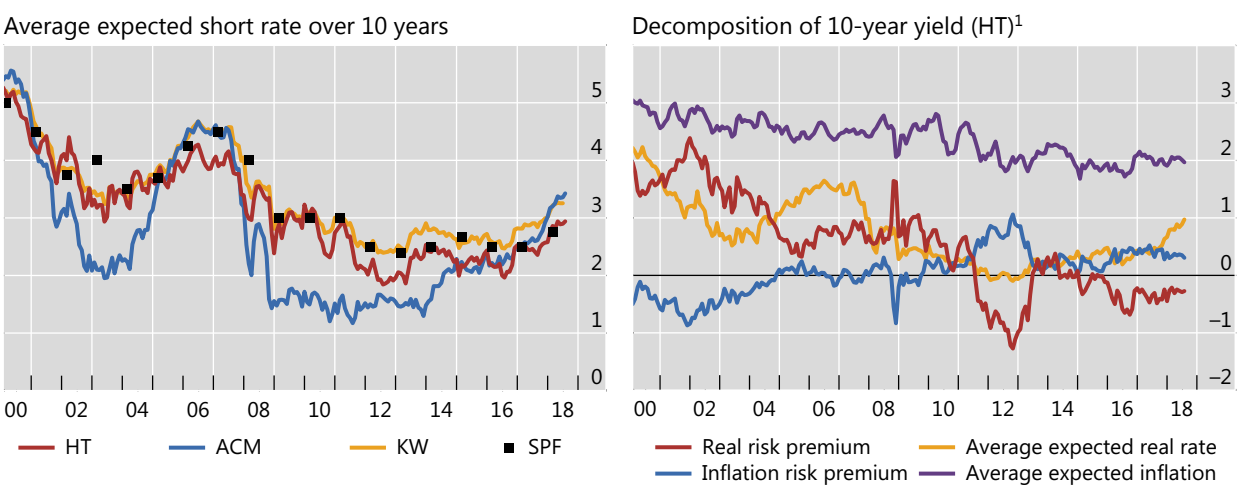
In addition, the downward trend of the term premium in the decade since the GFC may have been linked to the more appealing risk properties of bonds. Specifically, bond yields tended to fall in response to any sign of setbacks in the economic recovery as investors raised their expectations of further monetary stimulus or pushed back the expected start of policy normalisation. As often happens after a severe crisis, awareness of "tail risks" rose, and with it the desire to insure against such risks. Hence, in the GFC's aftermath, bonds took on some insurance-like properties. As a result, investors may have been willing to hold bonds even as the term premium fell towards zero or became negative. The resulting flight to safety boosted the demand for safe assets. Tighter regulatory requirements may also have played a role, such as for banks' holdings of liquid assets or collateralisation of derivatives positions.

We can uncover some further general properties of term premia when we look over a longer time span. For one thing, term premia are normally countercyclical – although, as discussed above, tail risk concerns helped keep term premia low after the GFC. In other words, they tend to rise when output is below potential or the economy is in recession, as investors seek higher compensation for being exposed to interest rate risk in bad times (Graph 2, right-hand panel). The fall in term premia during the current recovery represents a return to this pattern. And near-zero term premia are not unprecedented: for much of the 1960s, the premium hovered just above zero. From 1961 to 2018, however, the average according to the ACM model (which can be estimated over the longest time period) was around 160 basis points.

In addition to term premia, each modelling approach produces estimates of average expected short-term interest rate over any given horizon. All four measures discussed above show falling 10-year average expected short rates after the GFC (Graph 3, left-hand panel). The ACM model, which relies exclusively on yield information, displays a sharper initial decline, followed by an earlier rise. All four measures agree that the average expected short rate increased in 2017 and 2018.

Term premium and expectations components of US 10-year yield

In per cent — Graph 3



ACM = Adrian, Crump and Moench; HT = Hördahl and Tristani; KW = Kim and Wright; SPF = Survey of Professional Forecasters.

[1] Decomposition of the 10-year nominal yield according to an estimated joint macroeconomic and term structure model; yields are expressed in zero coupon terms.

Sources: Adrian et al (2013); Hördahl and Tristani (2014); Kim and Wright (2005); Federal Reserve Bank of Philadelphia; authors' calculations.

When we decompose the US 10-year yield further into real and inflation-linked components, we find that much of the initial decline in long-term yields during and after the GFC was due to a sharp drop in average expected real interest rates as the crisis unfolded. This was followed by a more gradual decline in expected real rates during the great recession that followed (Graph 3, right-hand panel). This observation is in line with the notion that investors' perception of the natural rate of interest may have fallen significantly during this time. Moreover, although the real risk premium remained elevated during and immediately after the Lehman collapse, it declined sharply as the Fed progressively eased monetary policy via unconventional measures. The decomposition also suggests that much of the rise in long-term yields in 2017–18 has been due to higher expected future real interest rates. By contrast, expected future inflation, the real risk premium and the inflation risk premium have changed little, with the real risk premium remaining unusually low.

Euro area estimates and recent developments

Similar to US Treasury yields, the euro area's benchmark long-term government bond yields declined more or less steadily during the GFC and its aftermath.[10] However, in 2014, euro area yields started to fall more rapidly than those in the United States. This was largely due to the market's anticipation of the ECB's asset-buying Public Sector Purchase Programme (PSPP) and its subsequent implementation (from early 2015). With a brief interruption, when they jumped in May–June 2015,[11] euro area yields continued to decline until the second half of 2016. Since then they have risen only modestly, even as US yields have increased more decisively.

To an even greater extent than for the United States, much of the decline in euro area yields up to mid-2016 reflected falling term premia (Graph 4, left-hand panel). The timing of this fall underscores the important role that supply-demand imbalances such as the ECB asset purchases (and the related market expectations) can play. Moreover, with economic growth weak, the hedging properties of core euro area sovereign bonds became particularly valuable to investors, leading them to tolerate even deeply negative term premia.

As for the United States, term premia estimates for the euro area differ depending on the model used, though they agree on the overall trend and dynamics. The centre panel of Graph 4 displays 10-year premia estimates calculated following the ACM methodology, alongside the HT model estimates and estimates from a model used by the Bank of France.[12] These estimates are less correlated than for US models. While the correlation of changes in premia between the HT and the ACM model is around 0.55, the premia estimated by the Bank of France are essentially uncorrelated with the other two. Apart from limited correlations, these estimates also differ in their overall levels. Towards the end of the sample period, the difference

[10] Benchmark government bond yields in the euro area are often proxied by government bond yields in France or Germany, as the credit risk of these bonds is deemed to be negligible.

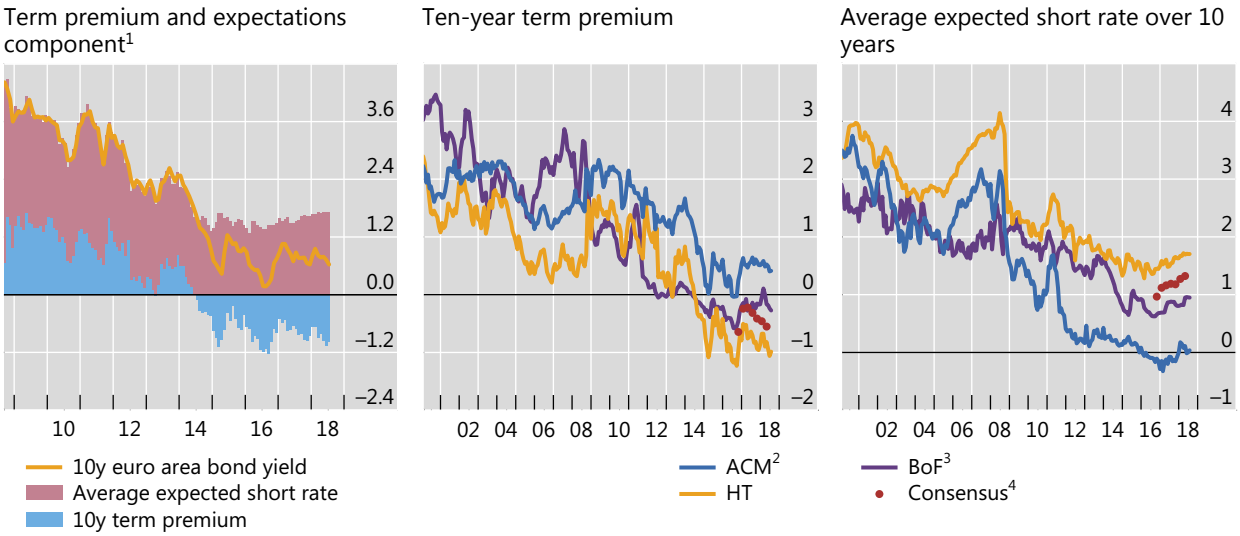
[11] This episode corresponded to a short-lived deterioration in market liquidity. See Riordan and Schrimpf (2015).

[12] These models make use of different euro area benchmark rates: the HT model uses 10-year French government bond yields, the ACM model 10-year German government bond yields and the Bank of France 10-year OIS rates on EONIA. However, these benchmark rates are very close to each other, with an average absolute difference of around 25 basis points.

Ten-year euro area government bond yield and term premium

In per cent

Graph 4



ACM = Adrian, Crump and Moench; BoF = Bank of France; HT = Hördahl and Tristani.

[1] Based on Hördahl and Tristani (2014). Decomposition of the 10-year nominal yield according to an estimated joint macroeconomic and term structure model; yields are expressed in zero coupon terms; French government bond data are used. [2] ACM estimates are calculated by applying the ACM model to the zero-coupon German government bond yields. The sample period spans from August 1997 to July 2018. [3] Based on Monfort et al (2017). [4] Based on the six-to-10 years ahead Consensus Economics forecast for the three-month interbank rate.

Sources: Hördahl and Tristani (2014); Monfort et al (2017); Consensus Economics; authors' calculations.

between the HT and ACM estimates is around 140 basis points. Since 2016, Consensus Economics has published quarterly long-term interest rate forecasts that can be used to back out model-free 10-year term premia estimates. These estimates (dots in Graph 4, centre panel) are closer to the HT premia and the Bank of France estimates, whereas the ACM estimates differ from the survey measure by around 100 basis points in recent quarters.

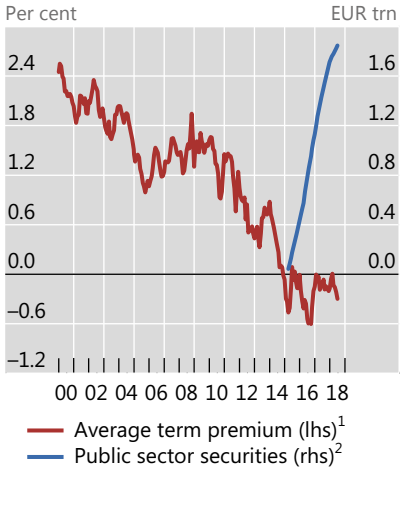
It is not clear exactly what lies behind the wide range in premium estimates across models. But one reason why the HT model tends to produce considerably lower estimates may be that it relies on an array of data types, whereas the ACM model uses only nominal yield data. As noted above, a model that relies only on yield information may be more prone to interpret the very low level of interest rates in the past few years as evidence that the steady-state interest rate level has fallen substantially due to the highly persistent nature of interest rates. The HT model, by contrast, is further disciplined by the inclusion of real yields, macroeconomic data and survey expectations. Consistent with this, as noted, the HT average expected short-term interest rate is closer to the expectations expressed by survey respondents (Graph 4, right-hand panel).

Just as in the United States, euro area term premia have been influenced by official sector asset purchases (Graph 5, left-hand panel) as well as the output gap (centre panel). A rise in official holdings likely helped to keep euro area bond yields low, but the steady (and clearly announced) pace of purchases makes it difficult to tie short-term fluctuations in the premia to these purchases. While weak macroeconomic performance may well have played a role after the GFC (for example, by pushing

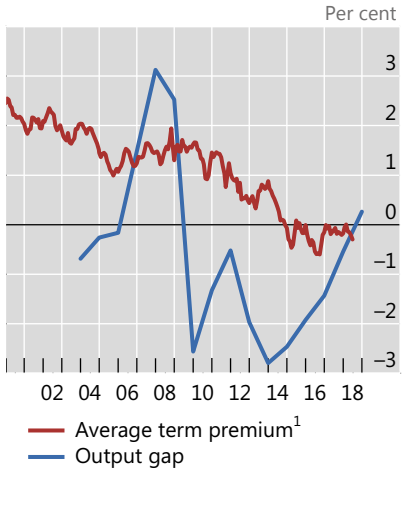
Ten-year euro area term premium and possible drivers

Graph 5

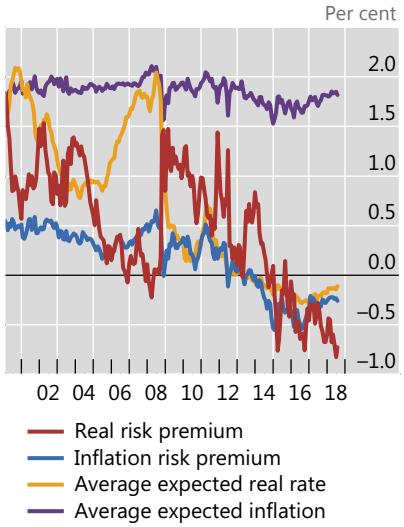
Term premium and domestic official holdings of government debt



Term premium and output gap[3]



Decomposition of 10-year yield (HT)[4]



[1] Average of Adrian, Crump and Moench (ACM), Bank of France (BoF) and Hördahl and Tristani (HT) term premium estimates. [2] Cumulative purchases under Eurosystem's Public Sector Purchase Programme; excluding debt securities issued by supranationals; book value. [3] For 2018, IMF WEO forecast. [4] Decomposition of the 10-year nominal yield according to an estimated joint macroeconomic and term structure model; yields are expressed in zero coupon terms; French government bond data are used.

Sources: Hördahl and Tristani (2014); Monfort et al (2017); ECB; IMF, *World Economic Outlook*; authors' calculations.

investors to safe assets), the steady narrowing in the euro area output gap since 2014 has been accompanied by a further drop in the term premium.

We can gain further insights into the movements of euro area bond yields by decomposing the 10-year yield into its four components (Graph 5, right-hand panel). According to the HT model, while the drop in the euro area yield during the GFC was mainly due to falling average expected real interest rates, much of the sharp drop in 2014–15 seems to have been due to a rapidly falling real term premium. In contrast to the United States, where (except for a spike in 2012) inflation risk premia were more or less stable after the GFC, the fall in euro area yields was reinforced by a drop in the inflation risk premium. In other words, insofar as the ECB PSPP placed downward pressure on yields, it did so by lowering term premia, and more so on nominal than on real bond yields. In 2017 and 2018, modest increases in expected interest rates and in the inflation risk premium component led to a moderate increase in bond yields, although a decline in the real term premium offset much of the effects of changes in the other components. For US yields, by contrast, rising expected real rates have been accompanied by relative stability in the other components and have been largely passed through into nominal yields.

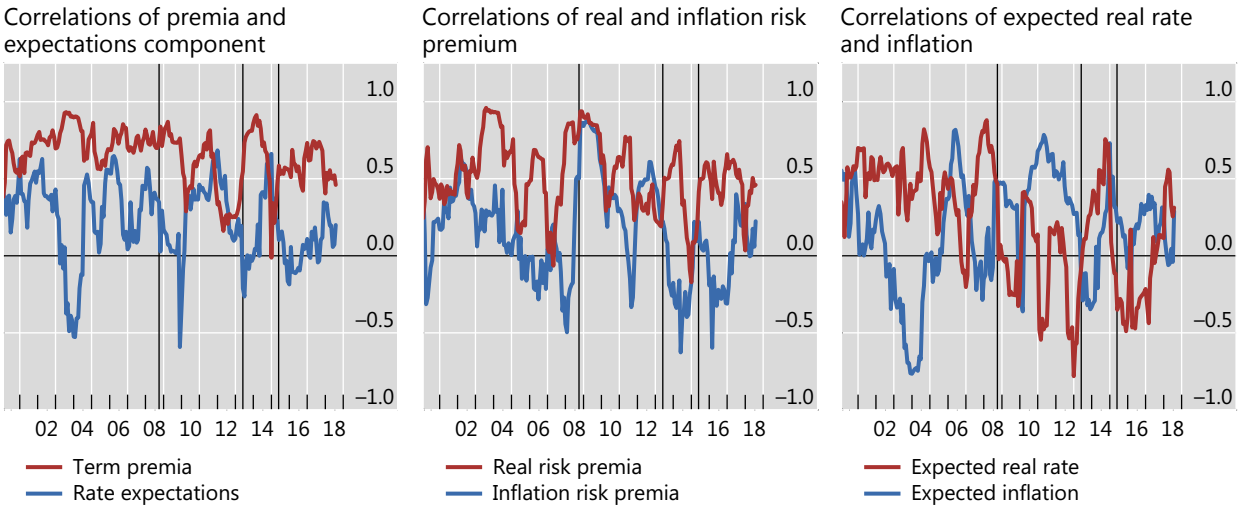
Cross-country correlations

Term premia are typically highly correlated across sovereign yields in different countries, contributing to significant co-movements in the yields.[13] Term premia in the euro area and the United States have indeed followed one another closely in recent years. The rolling one-year correlation between monthly changes in US and euro area term premia has typically hovered between 0.6 and 0.9, although it has displayed wider swings since the GFC (Graph 6, left-hand panel). In particular, the rolling correlation dropped markedly after the Lehman collapse in 2008, at the peak of the euro area sovereign debt crisis in 2012, and as the ECB launched its bond purchase programme in 2015. However, there was a clear surge in the correlation of term premia around the time of the taper tantrum in 2013, when rising global premia reflected declining global risk appetite as the outlook for US monetary policy became less certain. The high correlation is largely driven by the real components. Correlations of real risk premia tend to be much higher than those of inflation risk premia (centre panel).

Looking back further in time, US and euro area term premia typically tend to be more correlated than the respective expectations components (Graph 6, left-hand panel). Historically, the term premium correlation has generally been above 0.5, reaching at times up to 0.93. In contrast, the correlation of interest rate expectations between the United States and the euro area has fluctuated between 0 and 0.6. This correlation has even fallen below zero during some periods, including 2003–04, when

Co-movements of estimated components of US and euro area 10-year bond yields[1]

Correlation coefficients — Graph 6



The vertical lines indicate the Lehman Brothers bankruptcy (Oct 2008), Taper tantrum (May 2013) and Eurosystem's Public Sector Purchase Programme (Mar 2015).

[1] Twelve-month rolling correlation; based on monthly changes of the stated variables; based on Hördahl and Tristani (2014).

Sources: Hördahl and Tristani (2014); authors' calculations.

[13] See eg Jotikasthira et al (2015).

the fed funds rate was lowered to a then record-low 1%; the 2013 taper tantrum; and late 2015, when the Fed made its first post-GFC rate hike, with the ECB not moving in tandem. The low correlation of interest rate expectations reflects low correlations of both expected real rates and expected inflation (Graph 6, right-hand panel).

Conclusions

Yield curve models can offer a number of insights about the drivers of movements in US and euro area benchmark yields over the past several years. The estimated term premia can differ sharply depending on the model used but, in most cases, they have trended downwards since the GFC. While low term premia have helped to keep yields low, recent yield movements have tended to reflect shifts in expected short-term rates, particularly for the United States in 2017–18. Real risk premia, rather than premia for inflation risk, appear to have generally played an important role, while expected real rates have had a greater effect on expected short rates than expected inflation has.

What drives the term premia? We have identified a number of possible factors, including uncertainty, official sector purchases, the business cycle and regulation. But the relative impact of these factors can shift over time and is very hard to measure. Moreover, other factors may also be at work. Sound estimation methods for the bond yield components are an important first step in understanding how these factors play out in bond markets and the wider economy.

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Annexes

BIS Statistics: Charts

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

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

A Locational banking statistics

B Consolidated banking statistics

C Debt securities statistics

D Derivatives statistics

E Global liquidity indicators

F Statistics on total credit to the non-financial sector

G Debt service ratios for the private non-financial sector

H Property price statistics

I Effective and US dollar exchange rate statistics

J Credit-to-GDP gaps

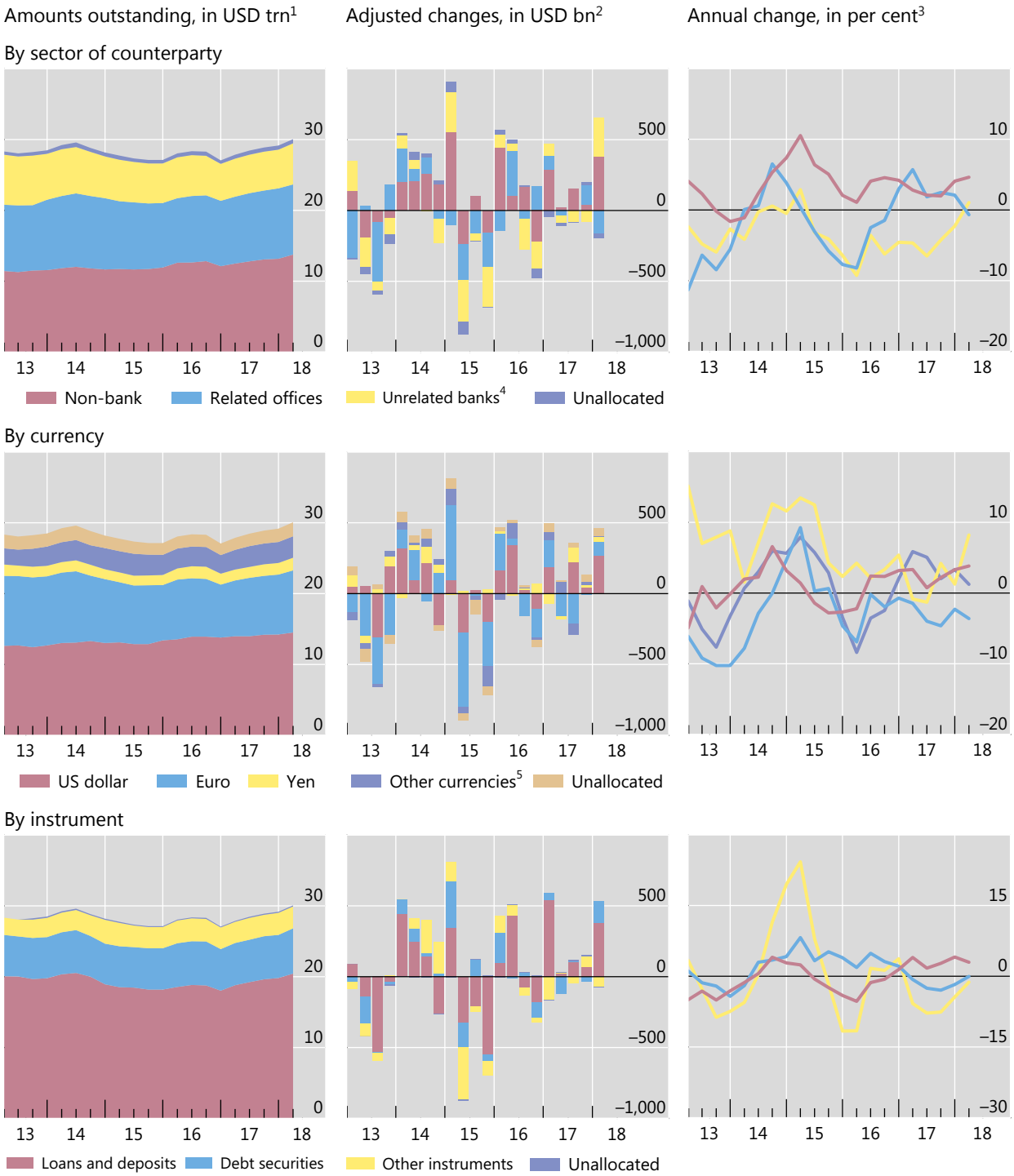
K Consumer price indices

L Central bank policy rates

A Locational banking statistics

Cross-border claims, by sector, currency and instrument

Graph A.1



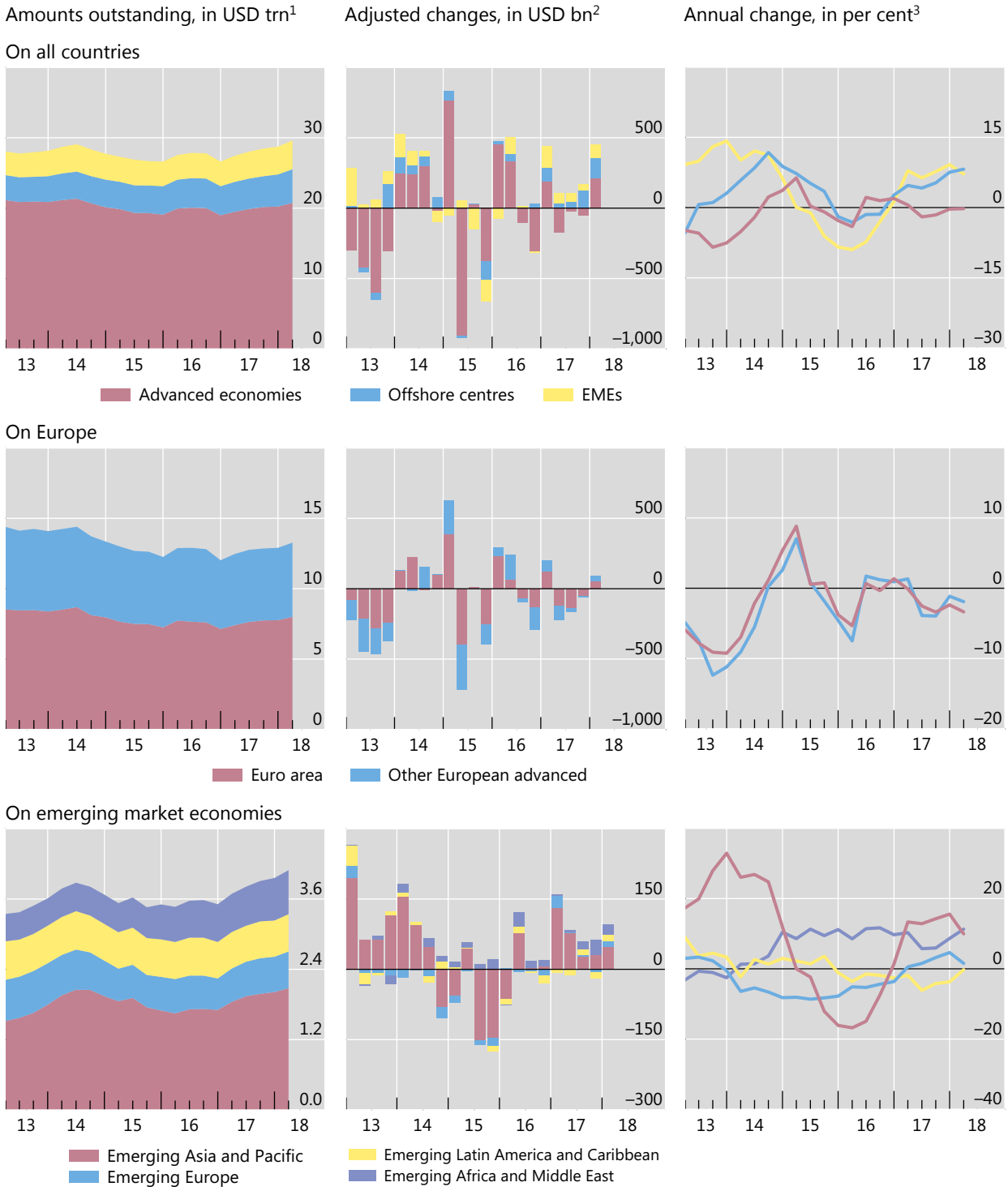
Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

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

Source: BIS locational banking statistics.

Cross-border claims, by borrowing region

Graph A.2



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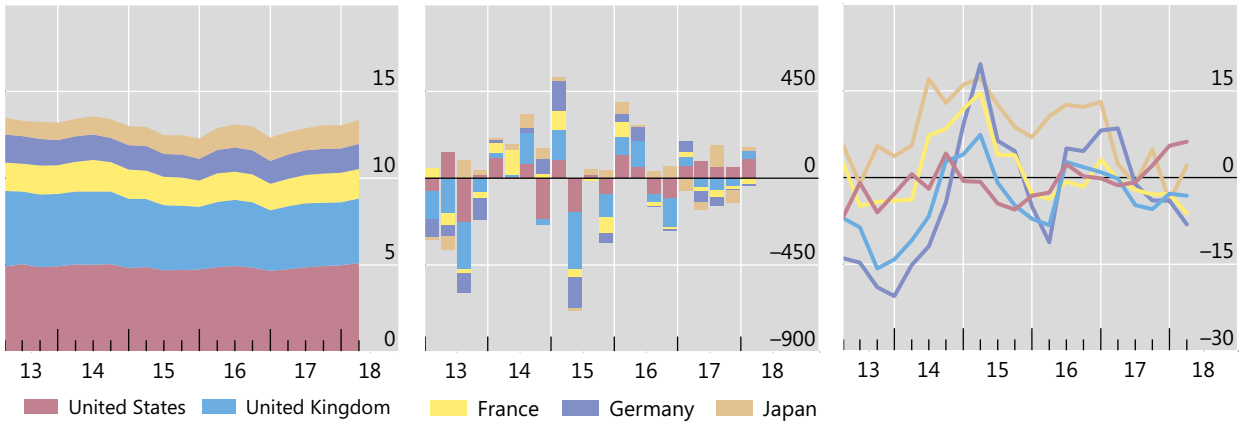
Source: BIS locational banking statistics.

Cross-border claims, by borrowing country

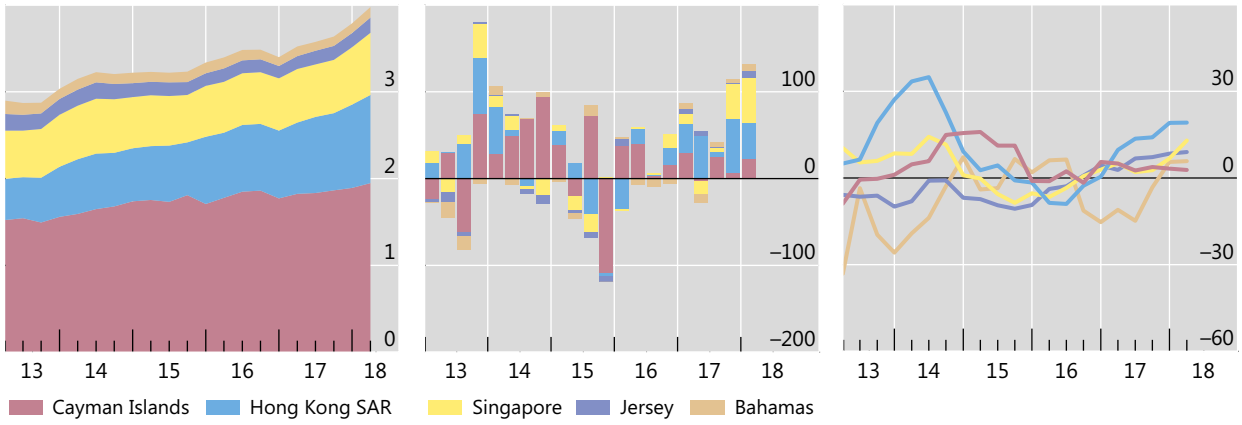
Graph A.3

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

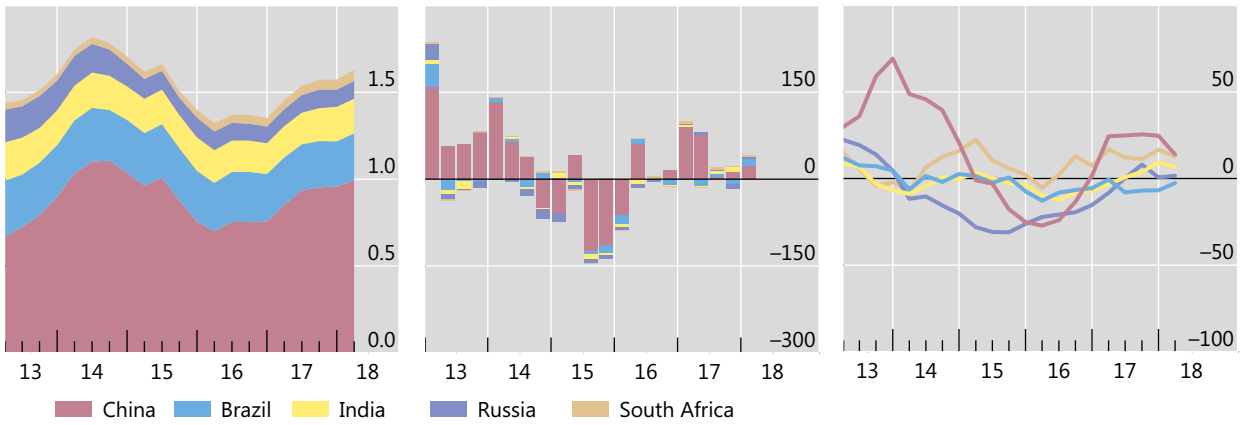
On selected advanced economies



On selected offshore centres



On selected emerging market economies



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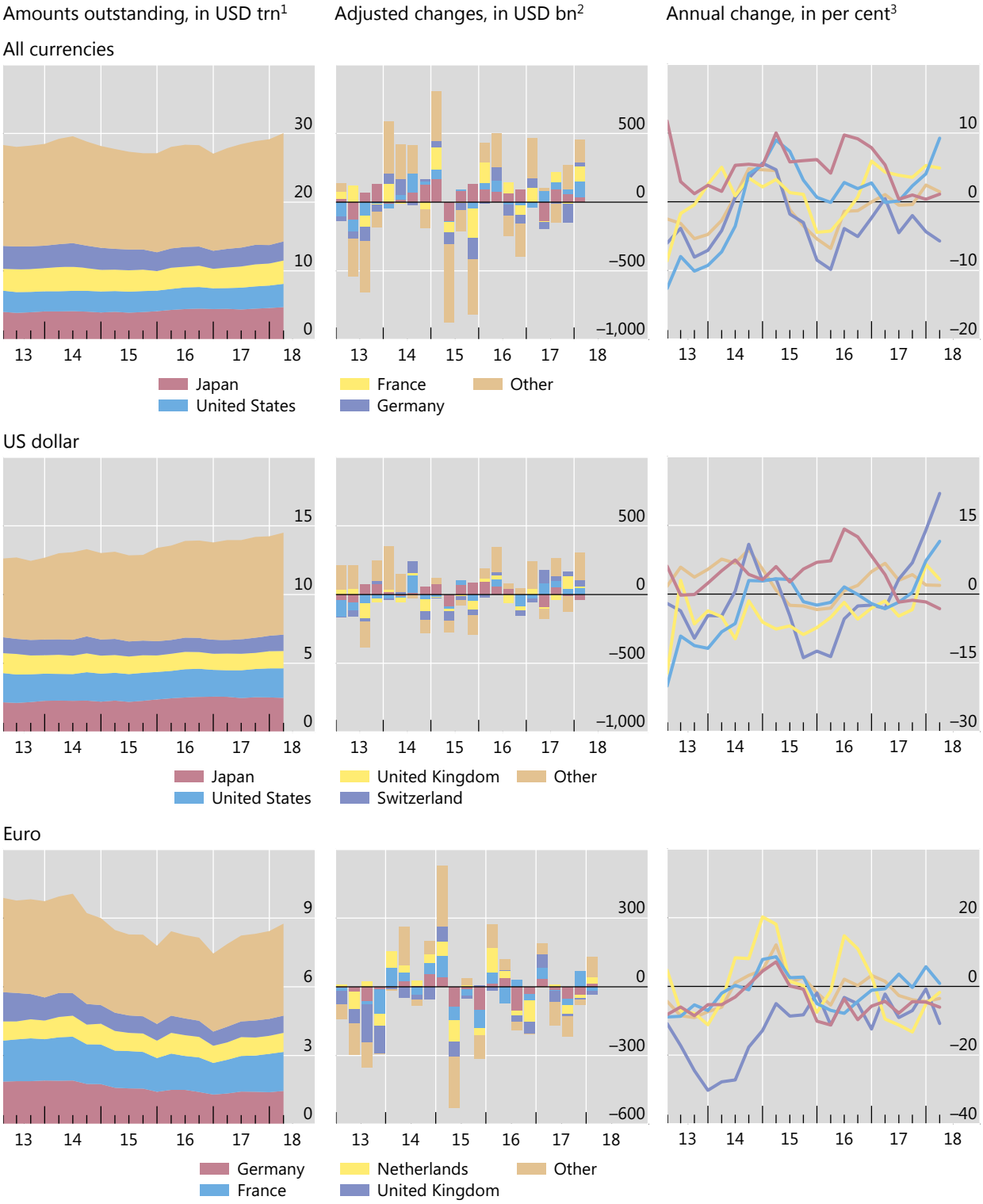
[1] At quarter-end. Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. [2] Quarterly changes in amounts outstanding, adjusted for the impact of exchange rate movements between quarter-ends and methodological breaks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

Source: BIS locational banking statistics.

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

Graph A.4



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

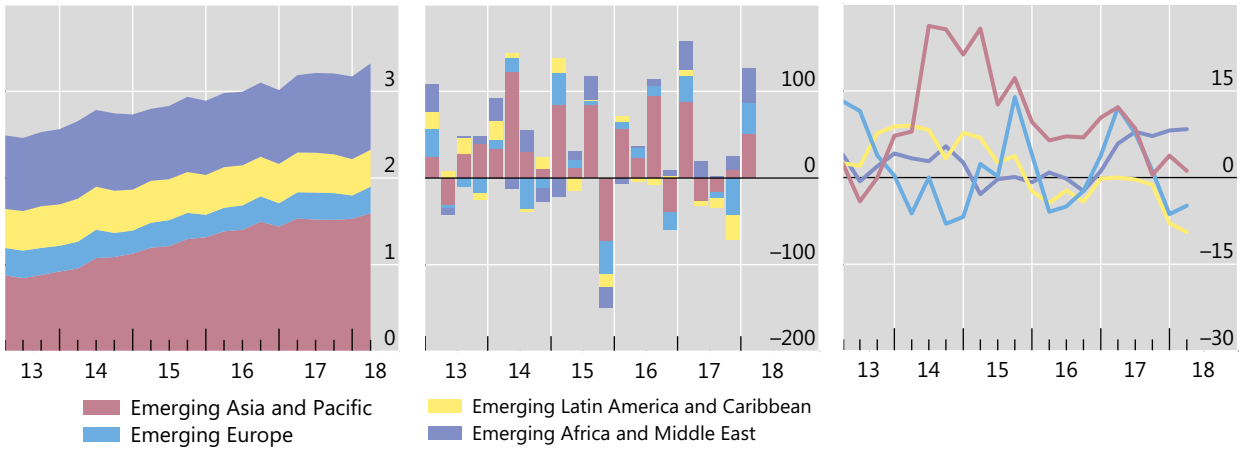
Source: BIS locational banking statistics.

Cross-border liabilities of reporting banks

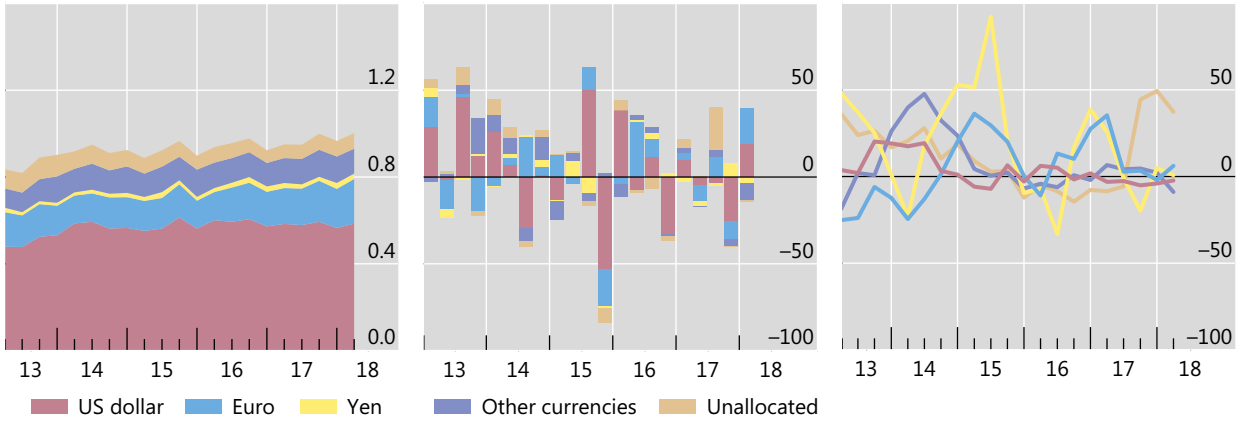
Graph A.5

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

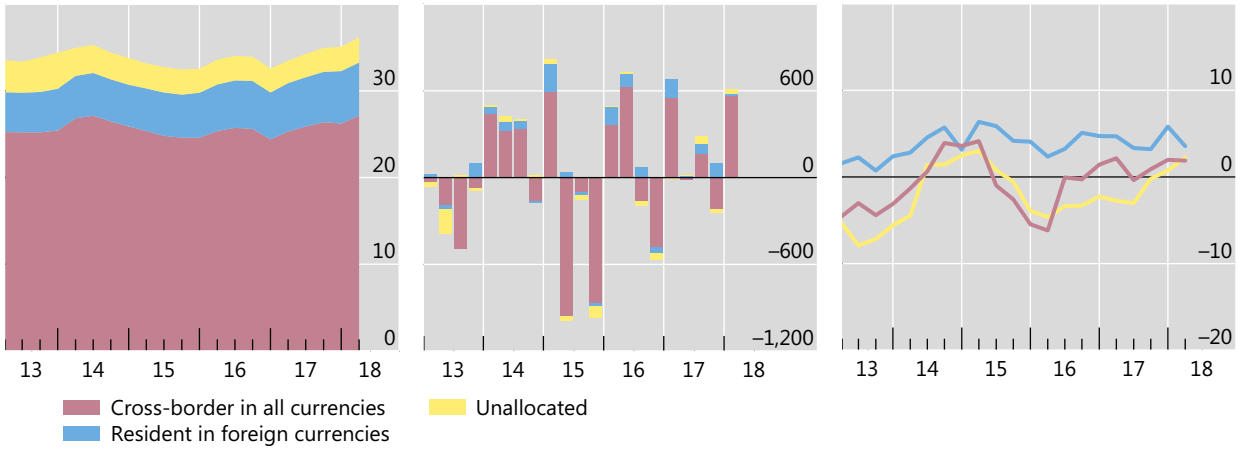
To emerging market economies



To central banks



By currency type and location



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

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

Source: BIS locational banking statistics.

B Consolidated banking statistics

Consolidated claims of reporting banks on advanced economies

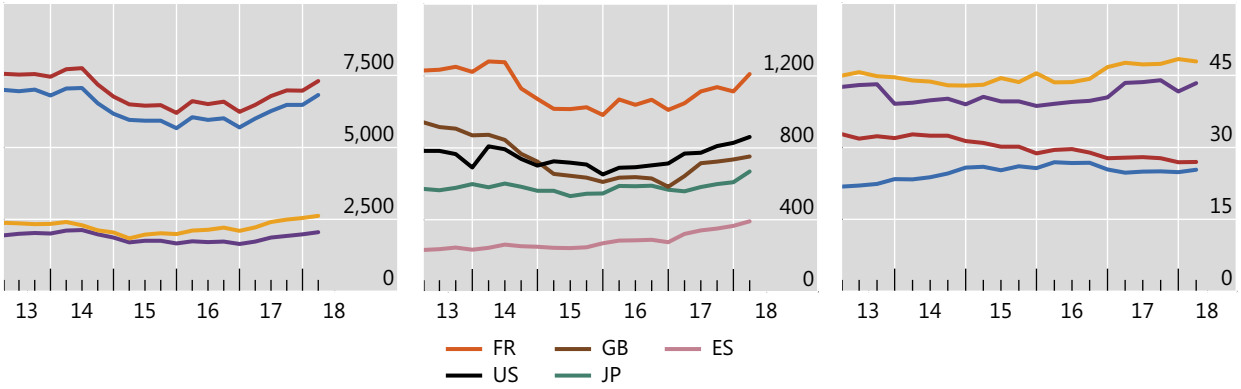
Graph B.1

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

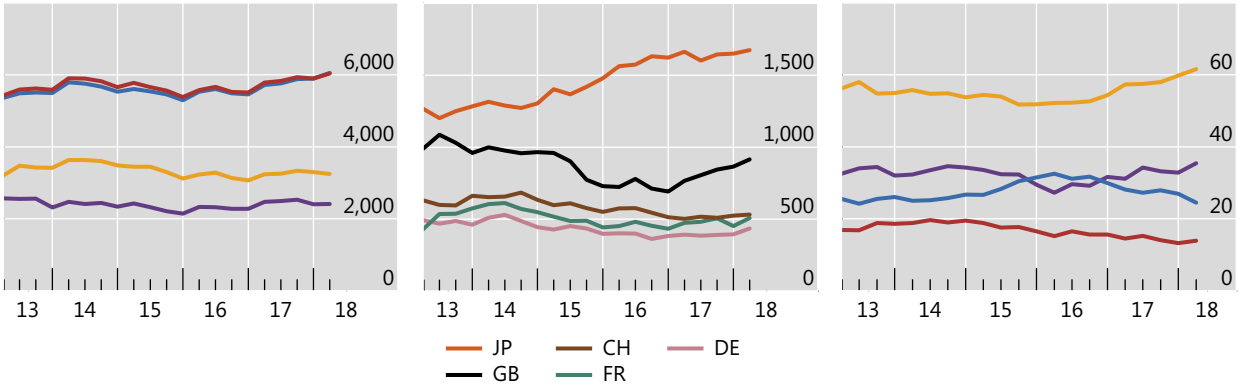
Foreign claims of selected creditors, in USD bn[1, 3]

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

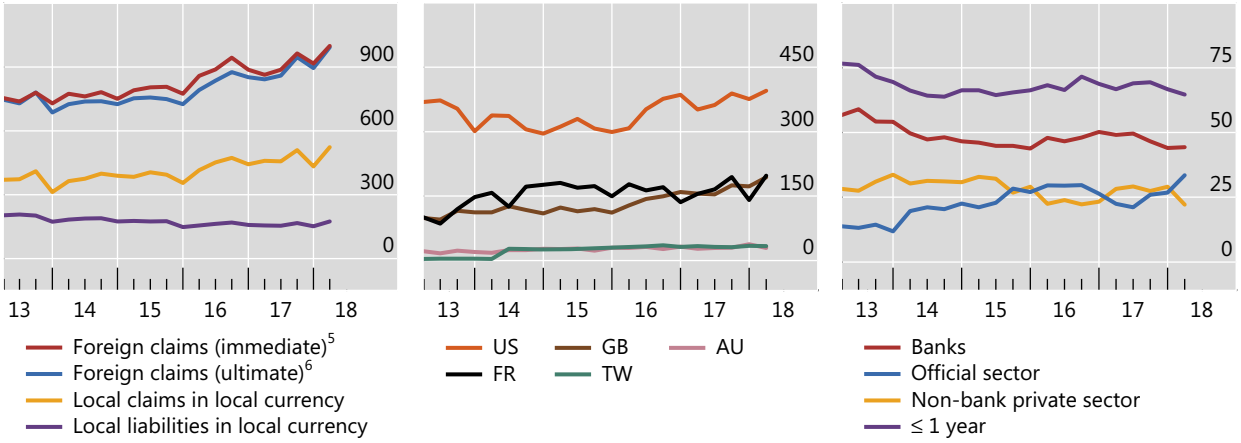
On the euro area



On the United States



On Japan



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

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

Source: BIS consolidated banking statistics (CBS).

Consolidated claims of reporting banks on emerging market economies

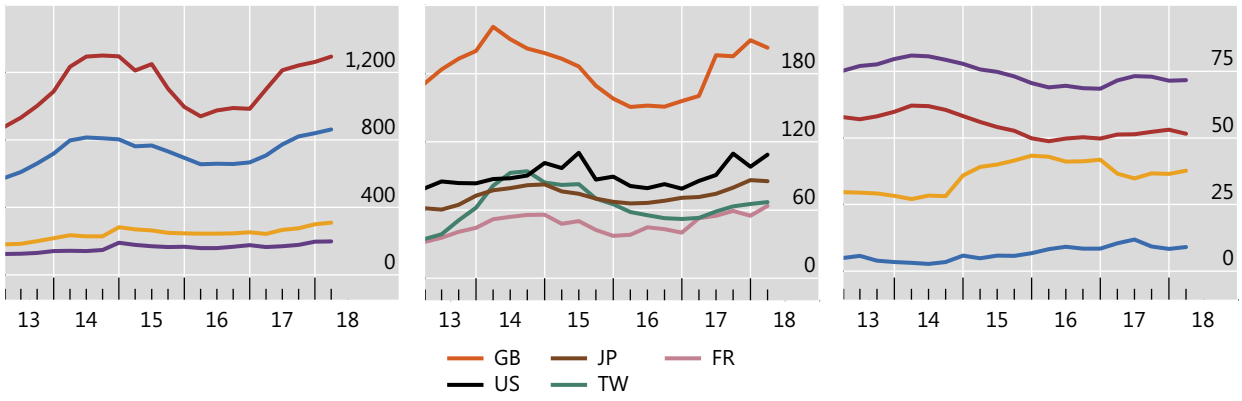
Graph B.2

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

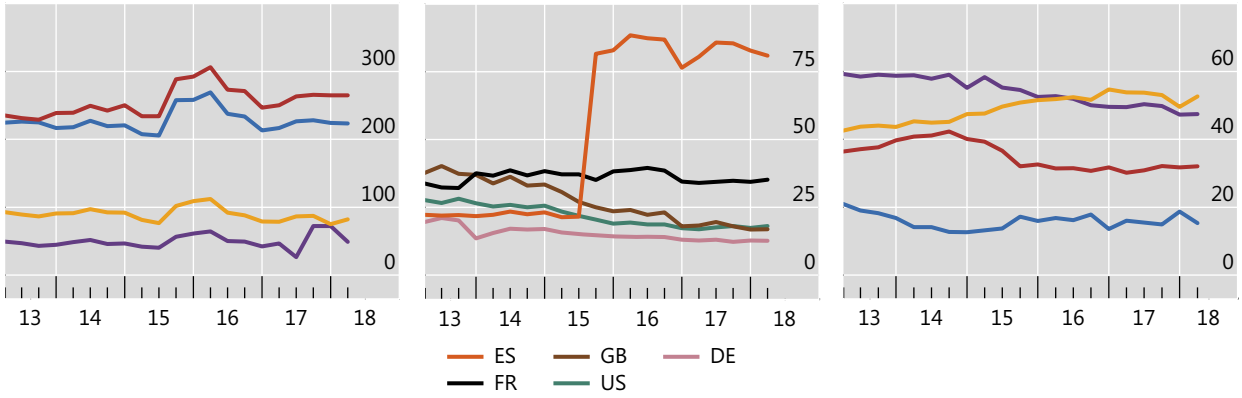
Foreign claims of selected creditors, in USD bn[1, 3]

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

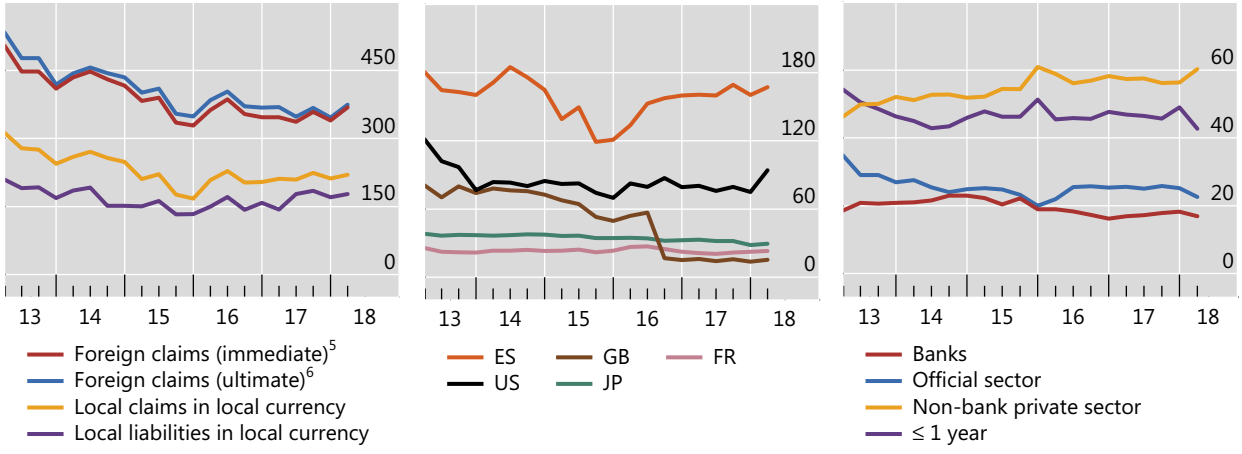
On China



On Turkey



On Brazil



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

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

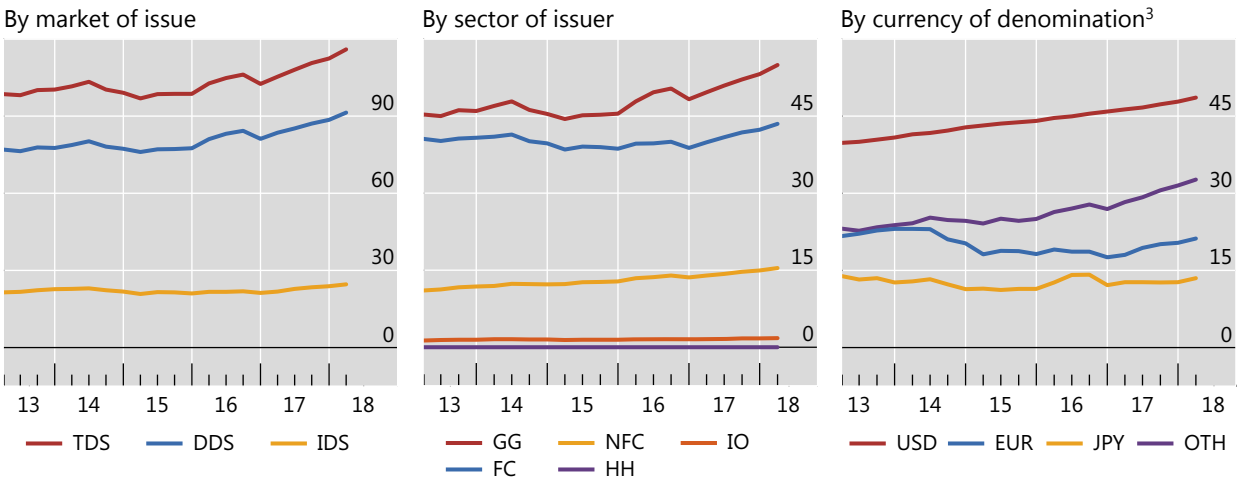
Source: BIS consolidated banking statistics (CBS).

C Debt securities statistics

Global debt securities markets[1]

Amounts outstanding, in trillions of US dollars[2]

Graph C.1



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

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

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

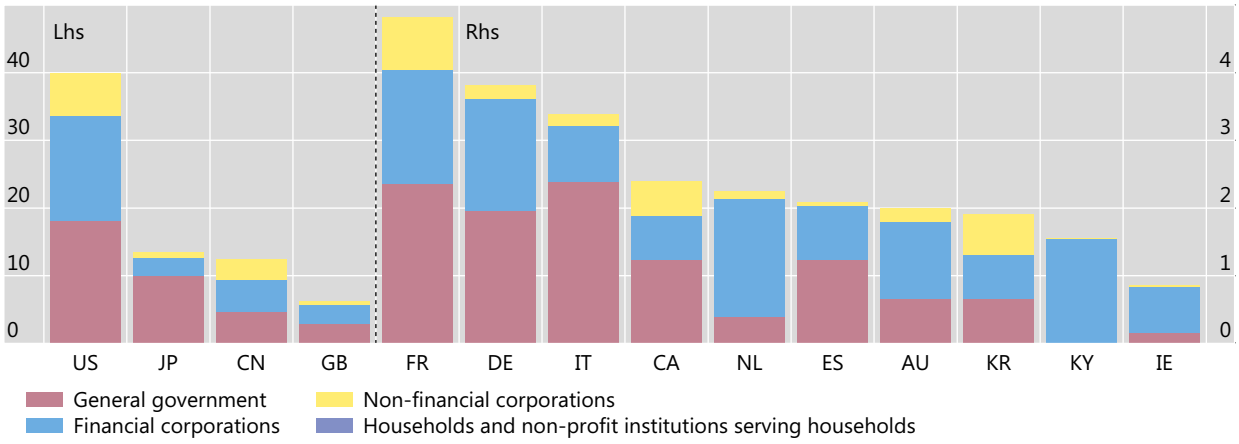
[1] Sample of countries varies across breakdowns shown. For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. For countries that do not report either TDS or DDS, data are estimated by the BIS as IDS. [2] At quarter-end. Amounts denominated in currencies other than the US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

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

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

Amounts outstanding for the latest available data, in trillions of US dollars[2]

Graph C.2



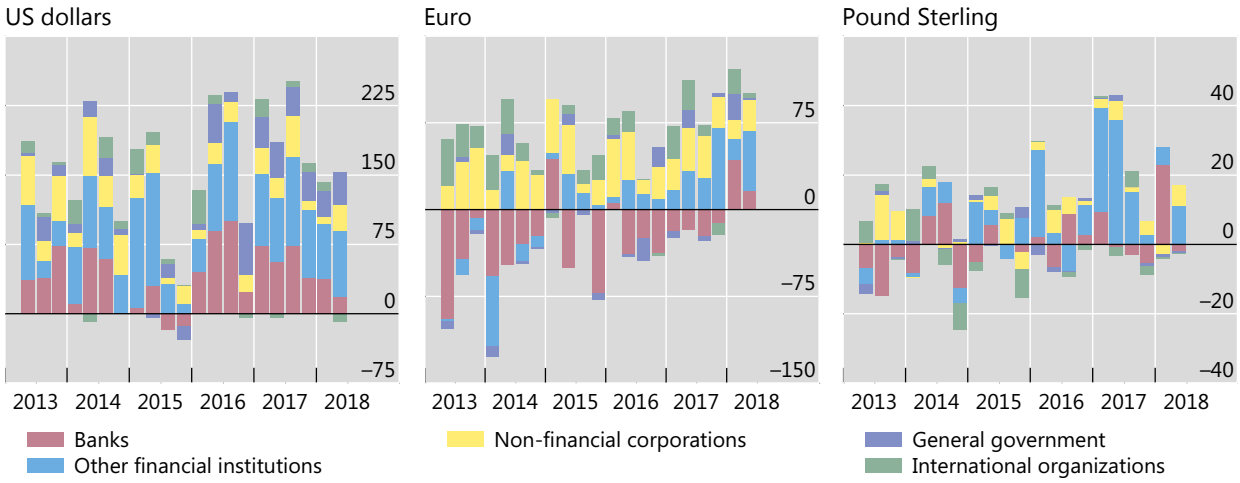
Further information on the BIS debt securities statistics is available at www.bis.org/statistics/secstats.htm.

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

Sources: National data; BIS debt securities statistics.

Net issuance of international debt securities

By issuer sector and currency of denomination, in billions of US dollars — Graph C.3

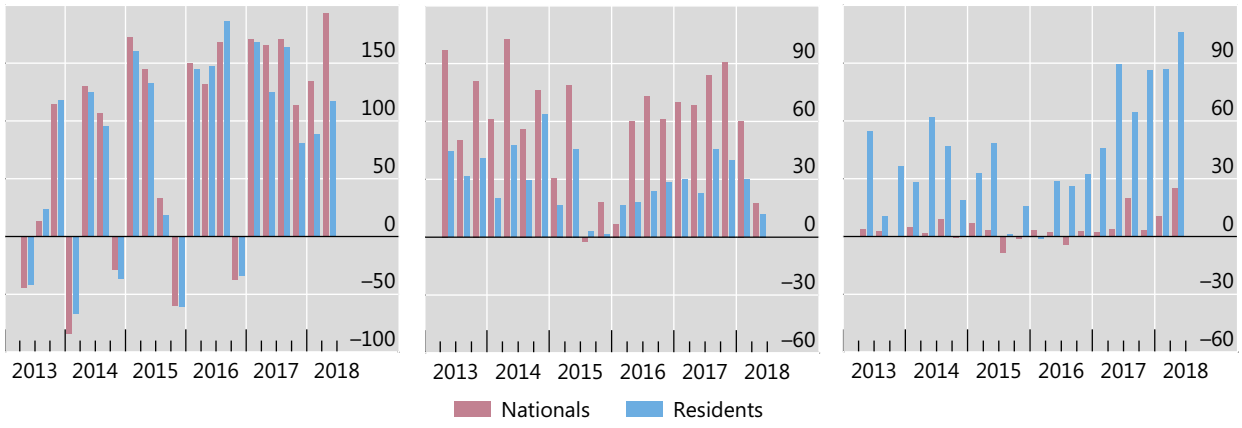


Further information is available at www.bis.org/statistics/secstats.htm.

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

International debt securities issued by financial and non-financial corporations[1]

Net issuance by region, in billions of US dollars[2] — Graph C.4



Further information is available at www.bis.org/statistics/secstats.htm.

[1] Excluding general government. [2] For a list of countries in each region, see Table C1 (http://stats.bis.org/statx/srs/table/c1).

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

D Derivatives statistics

Exchange-traded derivatives

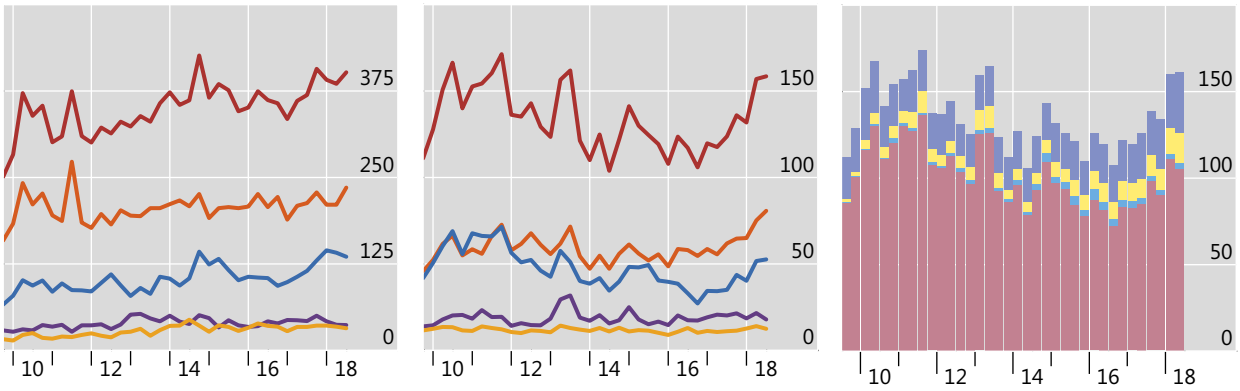
Graph D.1

Open interest, by currency[1]

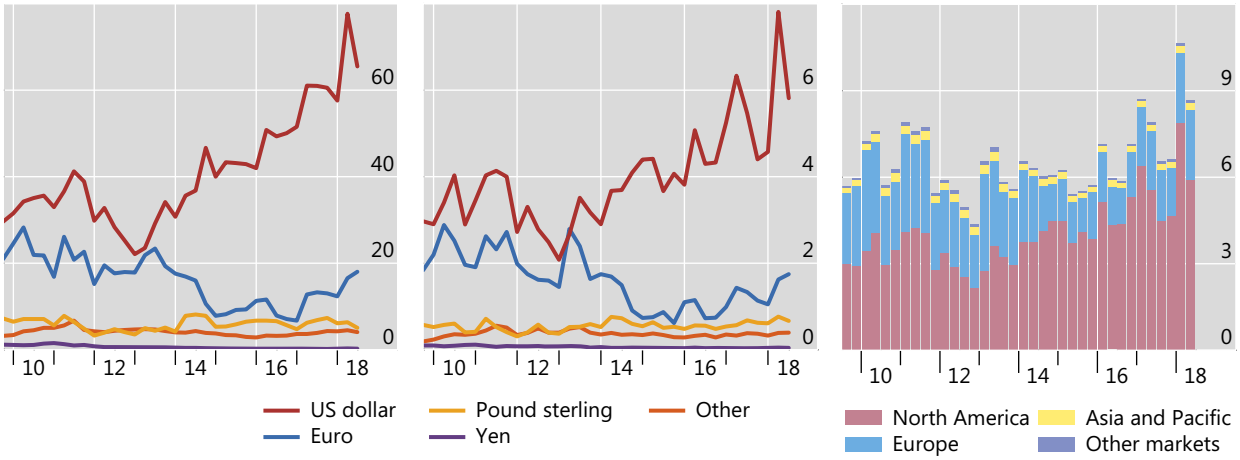
Daily average turnover, by currency[2]

Daily average turnover, by location of exchange[2]

Foreign exchange derivatives, USD bn[3]



Interest rate derivatives, USD trn[3]



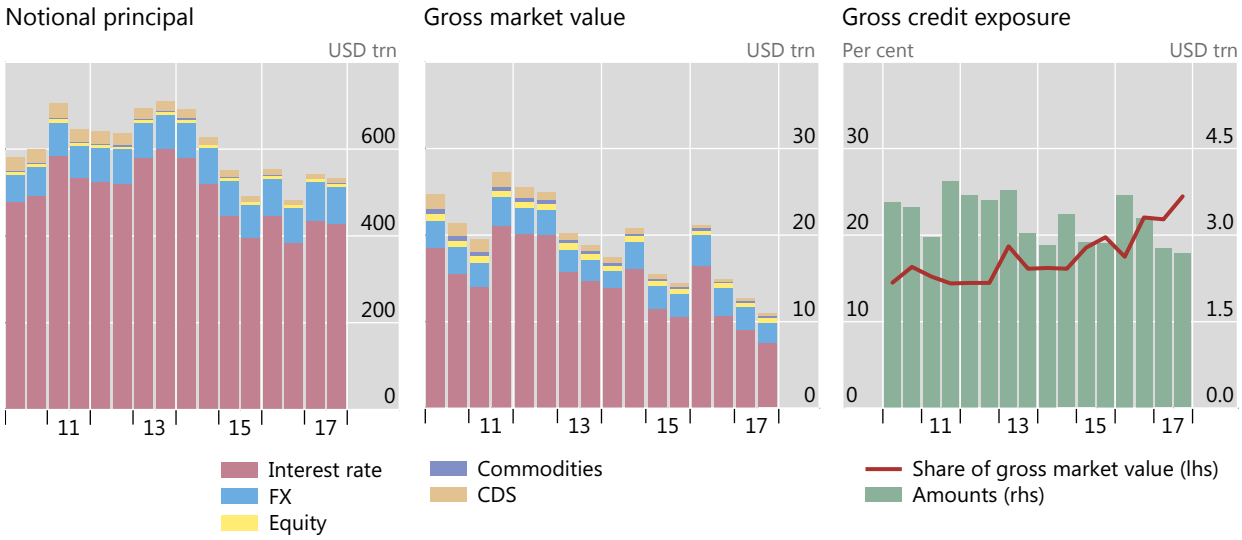
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/extderiv.htm.

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

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

Global OTC derivatives markets[1]

Graph D.2



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

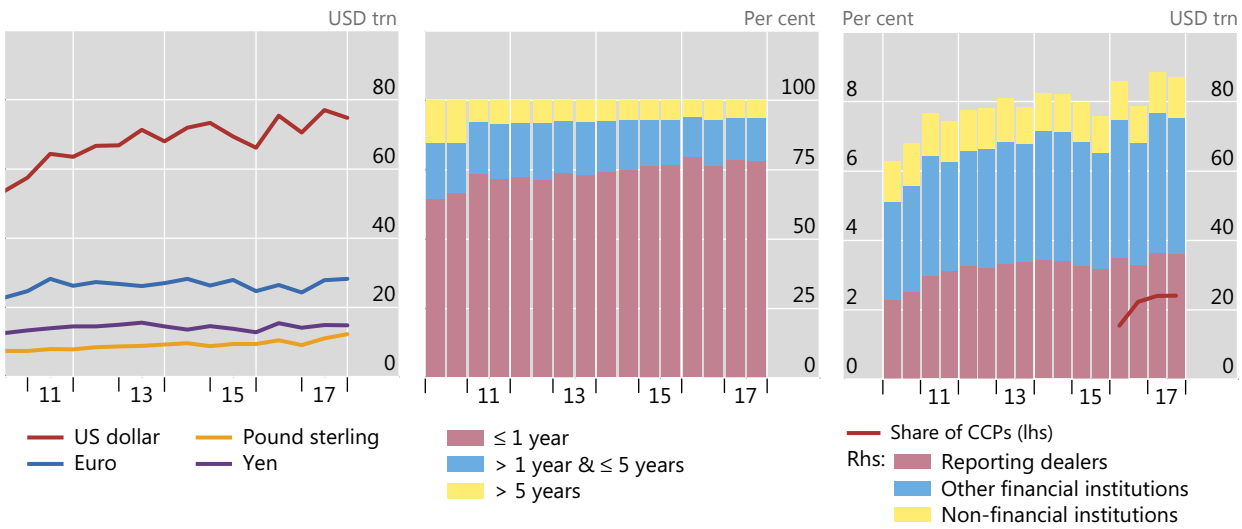
[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

OTC foreign exchange derivatives

Notional principal[1]

Graph D.3



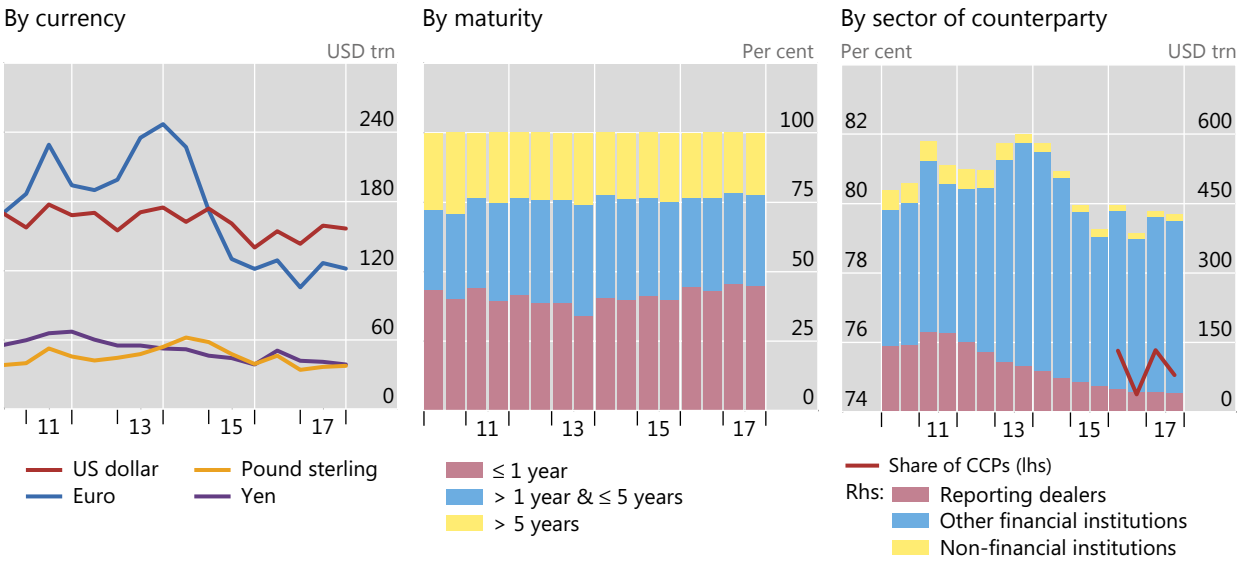
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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

Source: BIS derivatives statistics.

OTC interest rate derivatives

Notional principal[1] Graph D.4



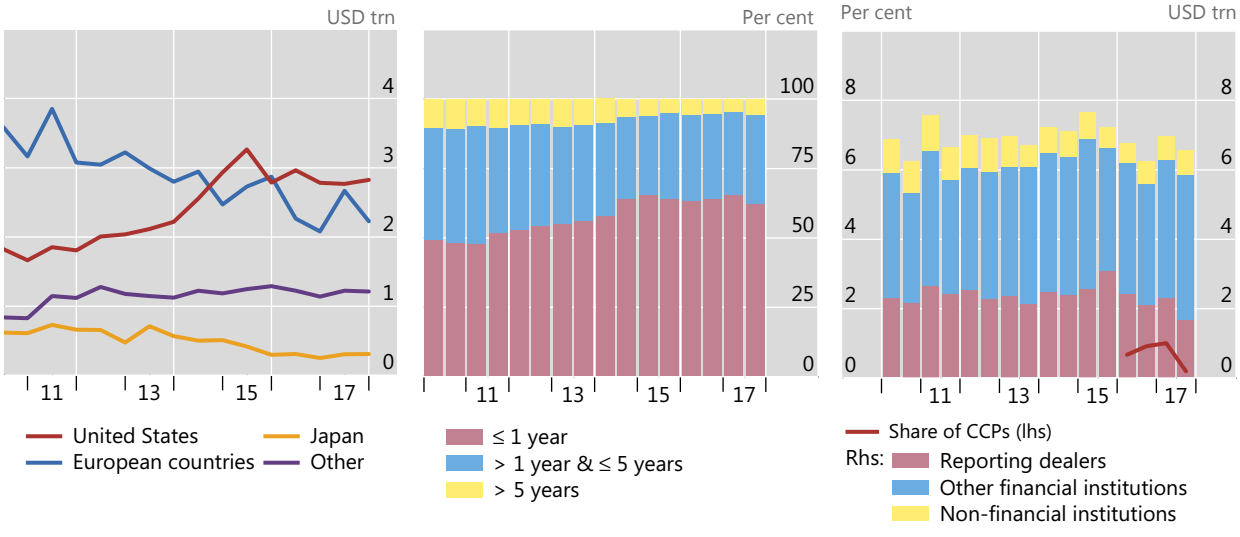
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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

Source: BIS derivatives statistics.

OTC equity-linked derivatives

Notional principal[1] Graph D.5



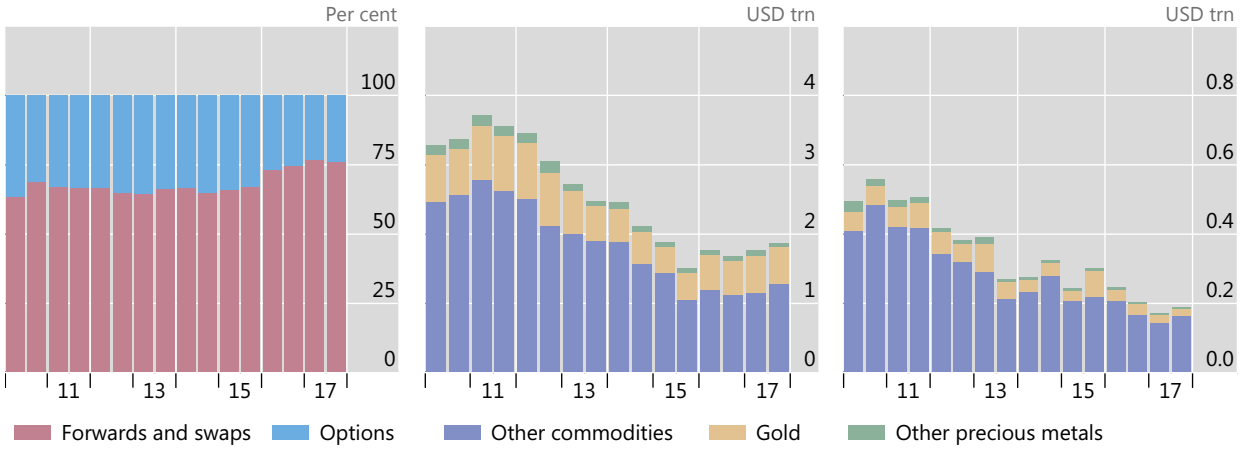
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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

Source: BIS derivatives statistics.

OTC commodity derivatives[1]

Graph D.6



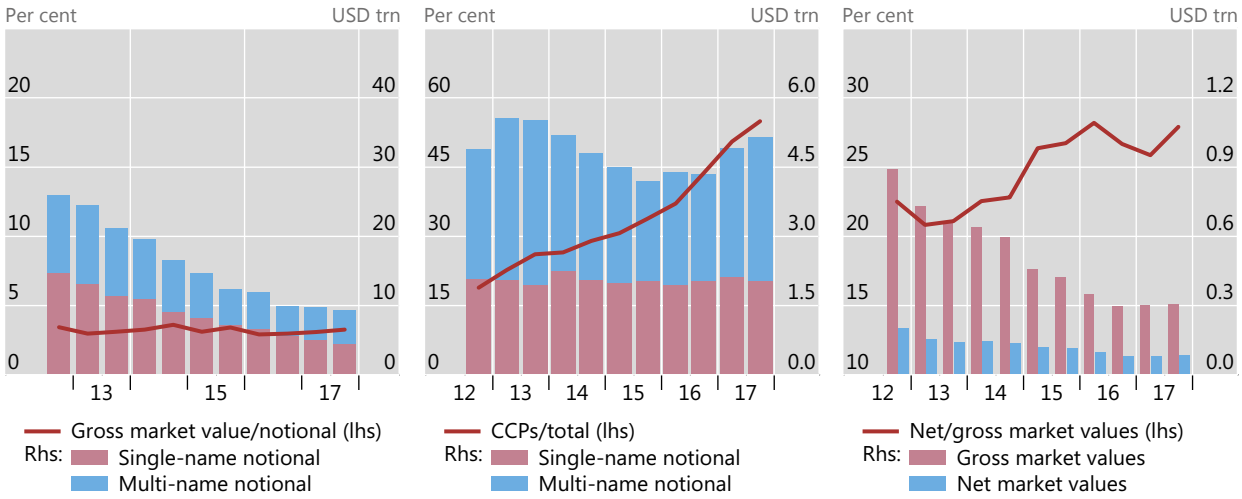
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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

Source: BIS derivatives statistics.

Credit default swaps[1]

Graph D.7



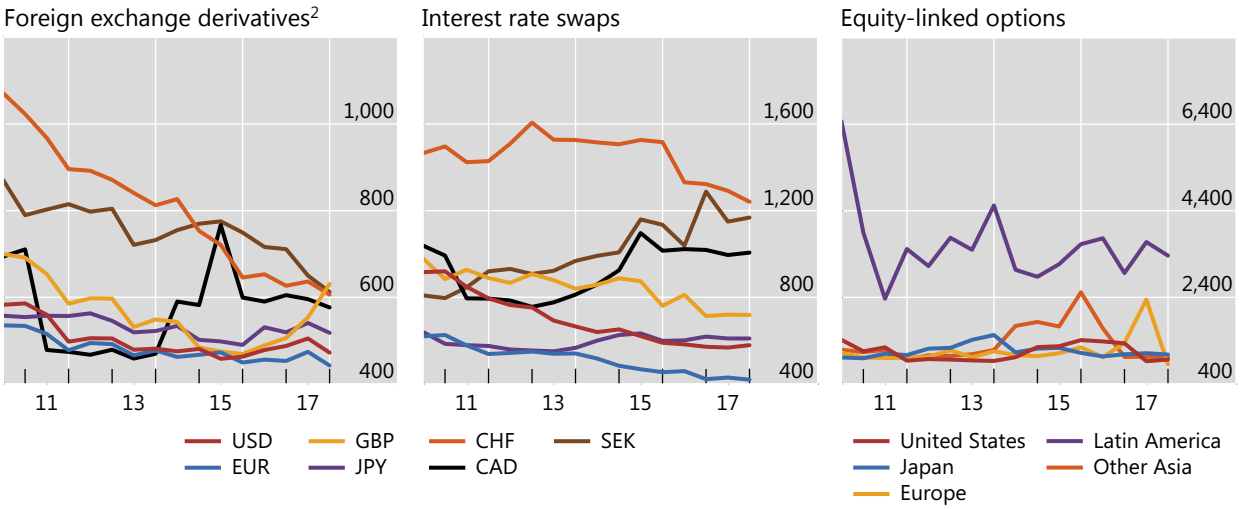
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm.

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

Source: BIS derivatives statistics.

Concentration in global OTC derivatives markets

Herfindahl index[1] Graph D.8



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

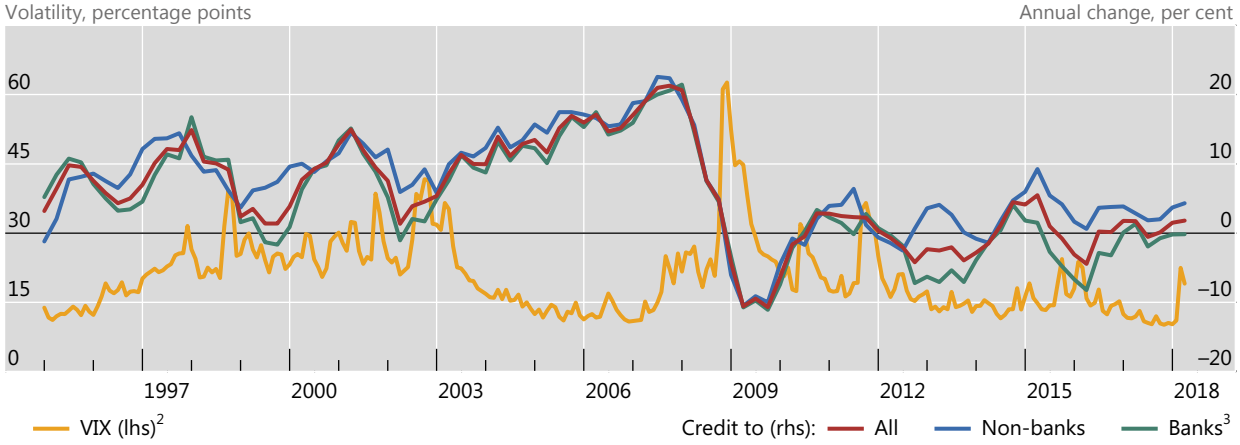
[1] The index ranges from 0 to 10,000, where a lower number indicates that there are many dealers with similar market shares (as measured by notional principal) and a higher number indicates that the market is dominated by a few reporting dealers. [2] Foreign exchange forwards, foreign exchange swaps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

Source: BIS derivatives statistics.

E Global liquidity indicators

Growth of international bank credit[1]

Graph E.1



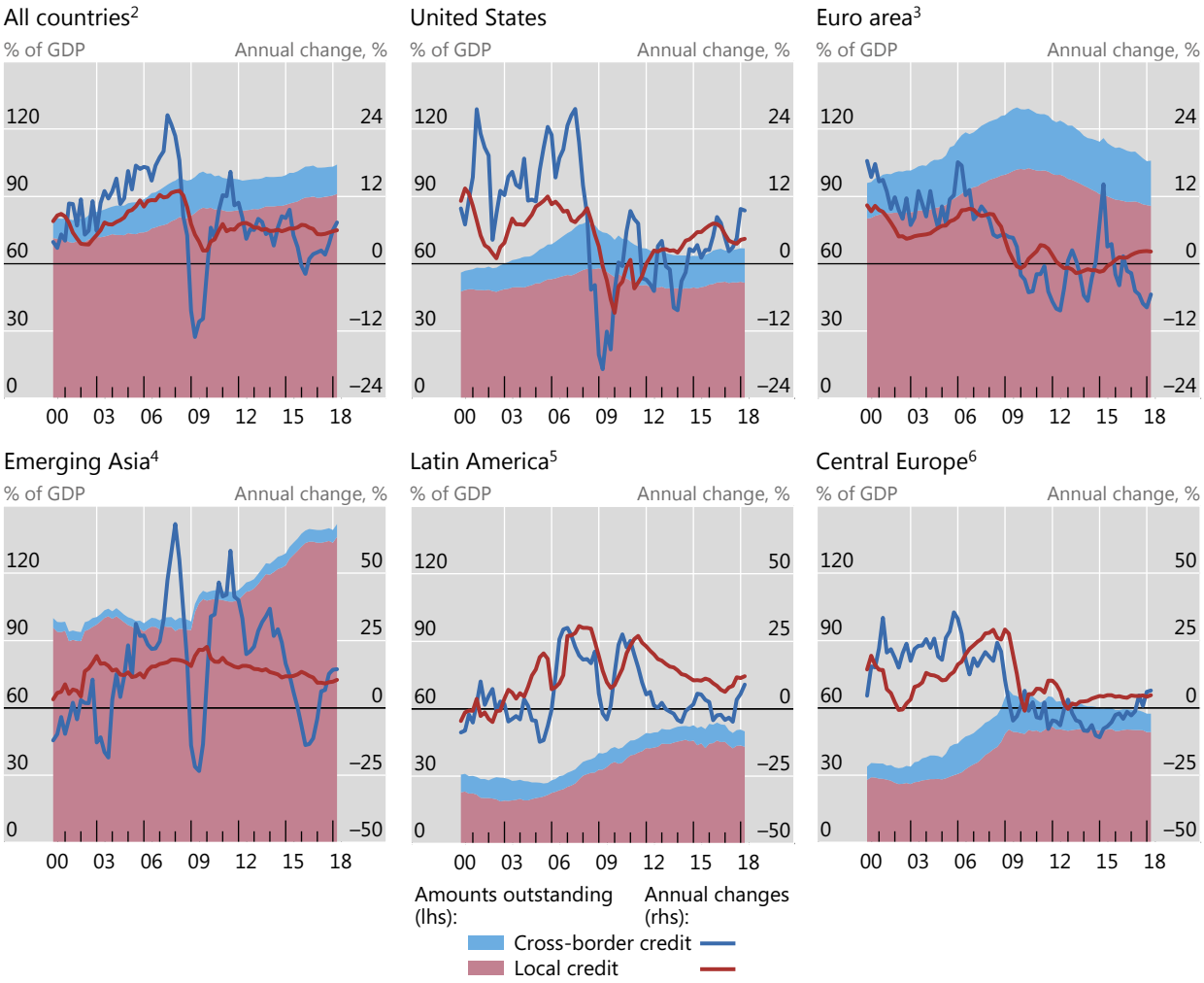
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[1] LBS-reporting banks' cross-border claims plus local claims in foreign currencies. [2] Chicago Board Options Exchange S&P 500 implied volatility index; standard deviation, in percentage points per annum. [3] Including intragroup transactions.

Sources: Bloomberg; BIS locational banking statistics.

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

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



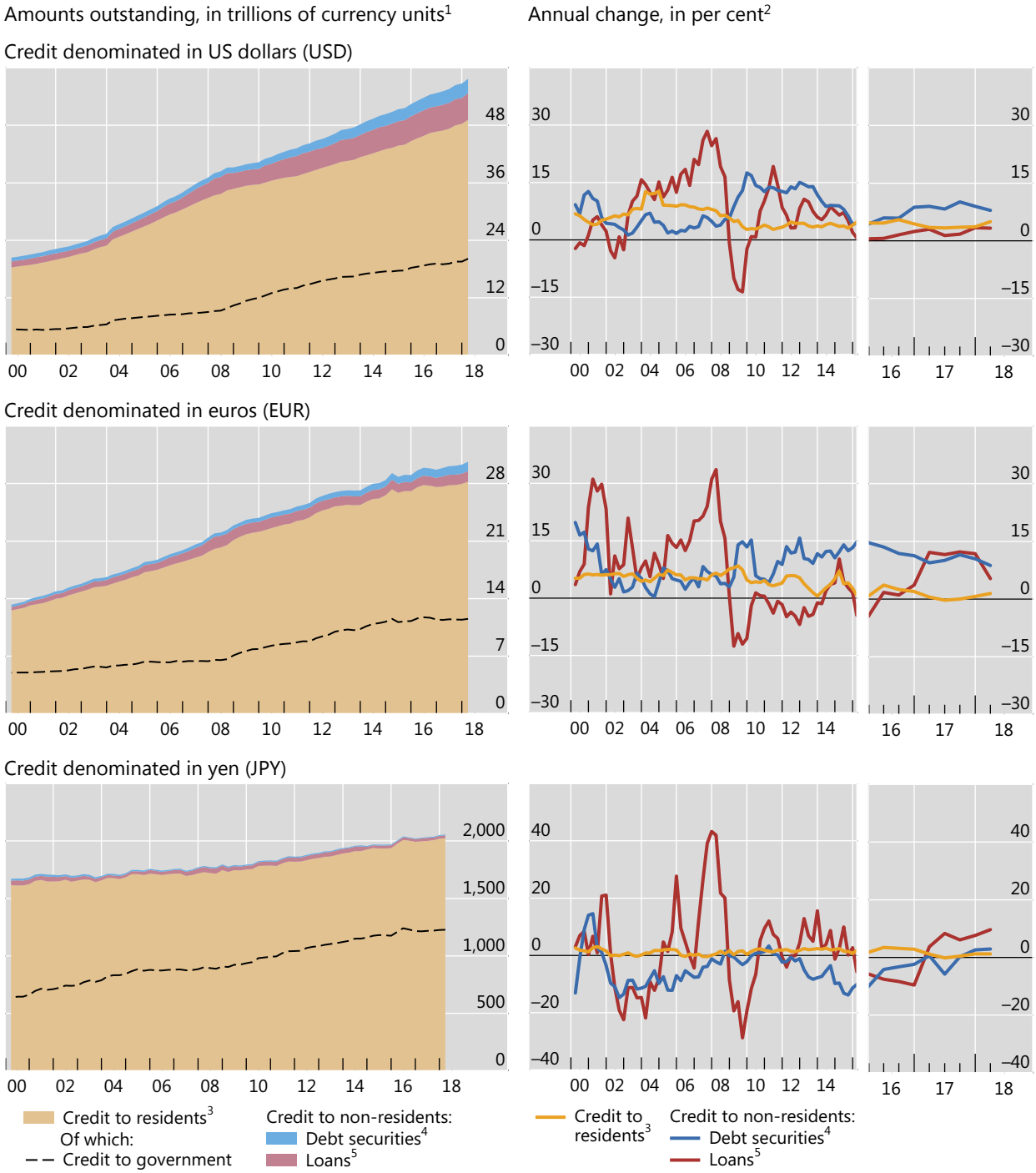
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

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

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

Global credit to the non-financial sector, by currency

Graph E.3



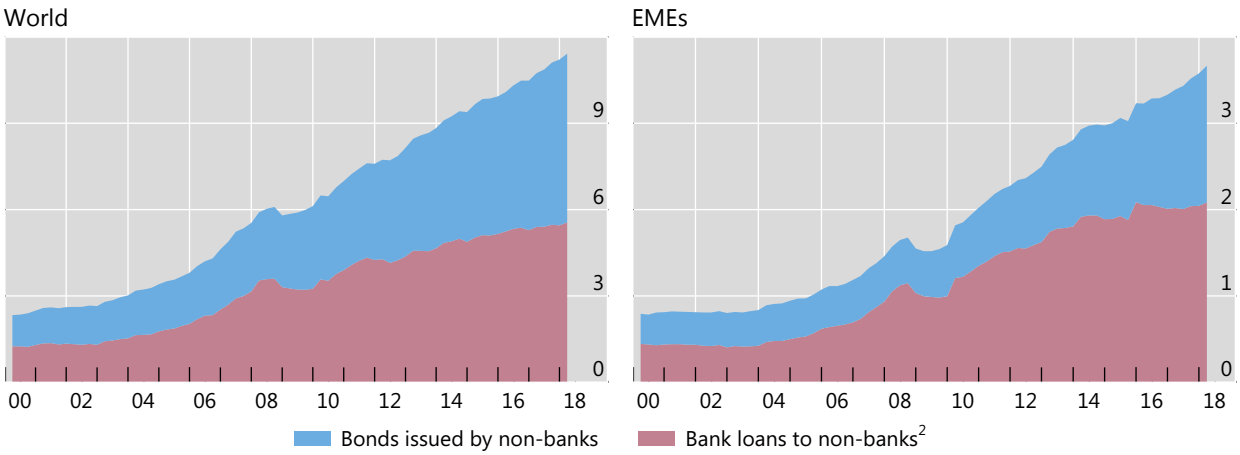
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[1] Amounts outstanding at quarter-end. [2] Based on quarterly break- and exchange rate-adjusted changes. [3] Credit to non-financial borrowers residing in the United States/euro area/Japan. National financial accounts are adjusted using BIS banking and securities statistics to exclude credit denominated in non-local currencies. [4] Excluding debt securities issued by special purpose vehicles and other financial entities controlled by non-financial parents. EUR-denominated debt securities exclude those issued by institutions of the European Union. [5] Loans by LBS-reporting banks to non-bank borrowers, including non-bank financial entities, comprise cross-border plus local loans.

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

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

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



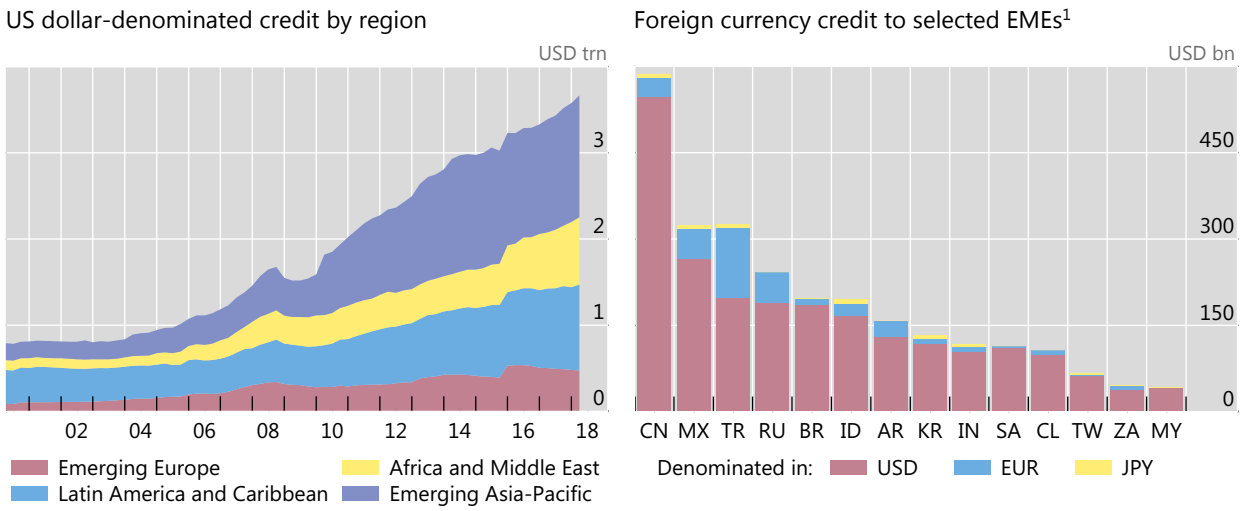
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[1] Non-banks comprise non-bank financial entities, non-financial corporations, governments, households and international organisations. [2] Loans by LBS-reporting banks to non-bank borrowers, including non-bank financial entities, comprise cross-border plus local loans.

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

Foreign currency credit to non-banks in EMEs

Graph E.5



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

[1] Amounts outstanding for the latest available data.

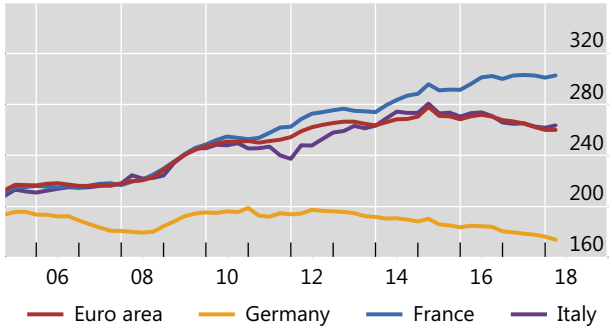
Sources: Datastream; Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; national data; BIS locational banking statistics (LBS); BIS calculations.

F Statistics on total credit to the non-financial sector

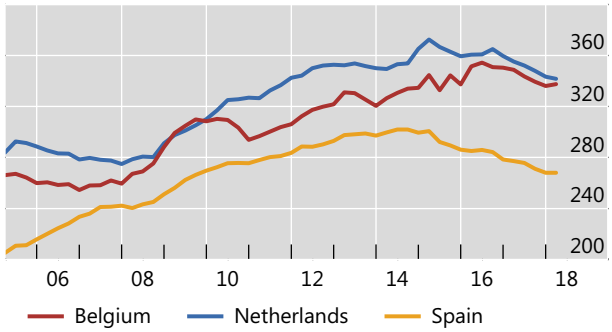
Total credit to the non-financial sector (core debt)

As a percentage of GDP — Graph F.1

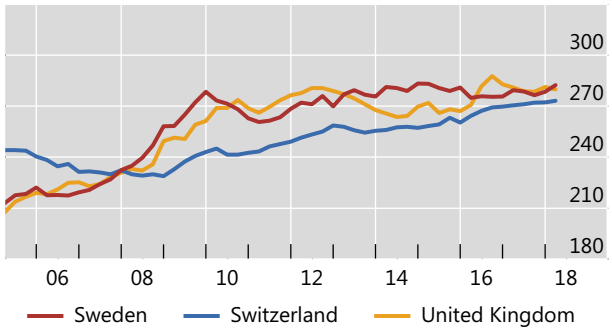
Euro area: aggregate and major countries



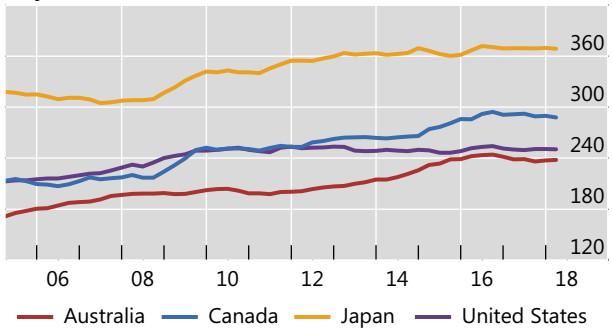
Euro area: other countries



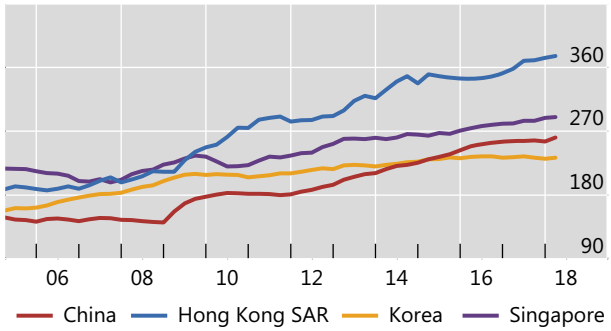
Other European countries



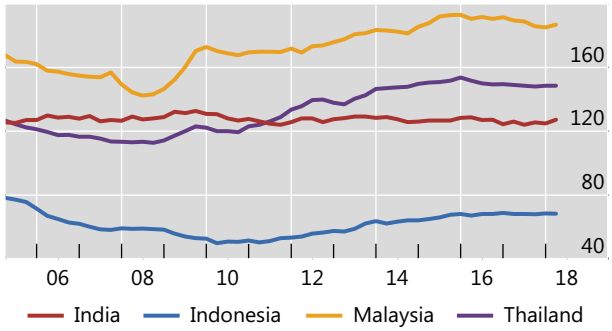
Major advanced economies



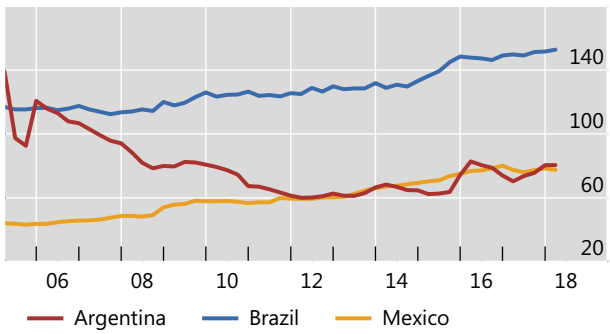
Emerging Asia



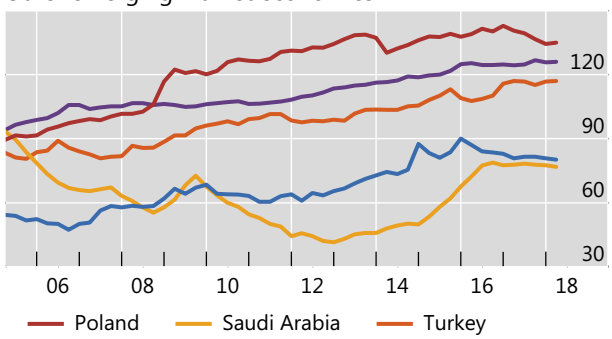
Other emerging Asia



Latin America



Other emerging market economies

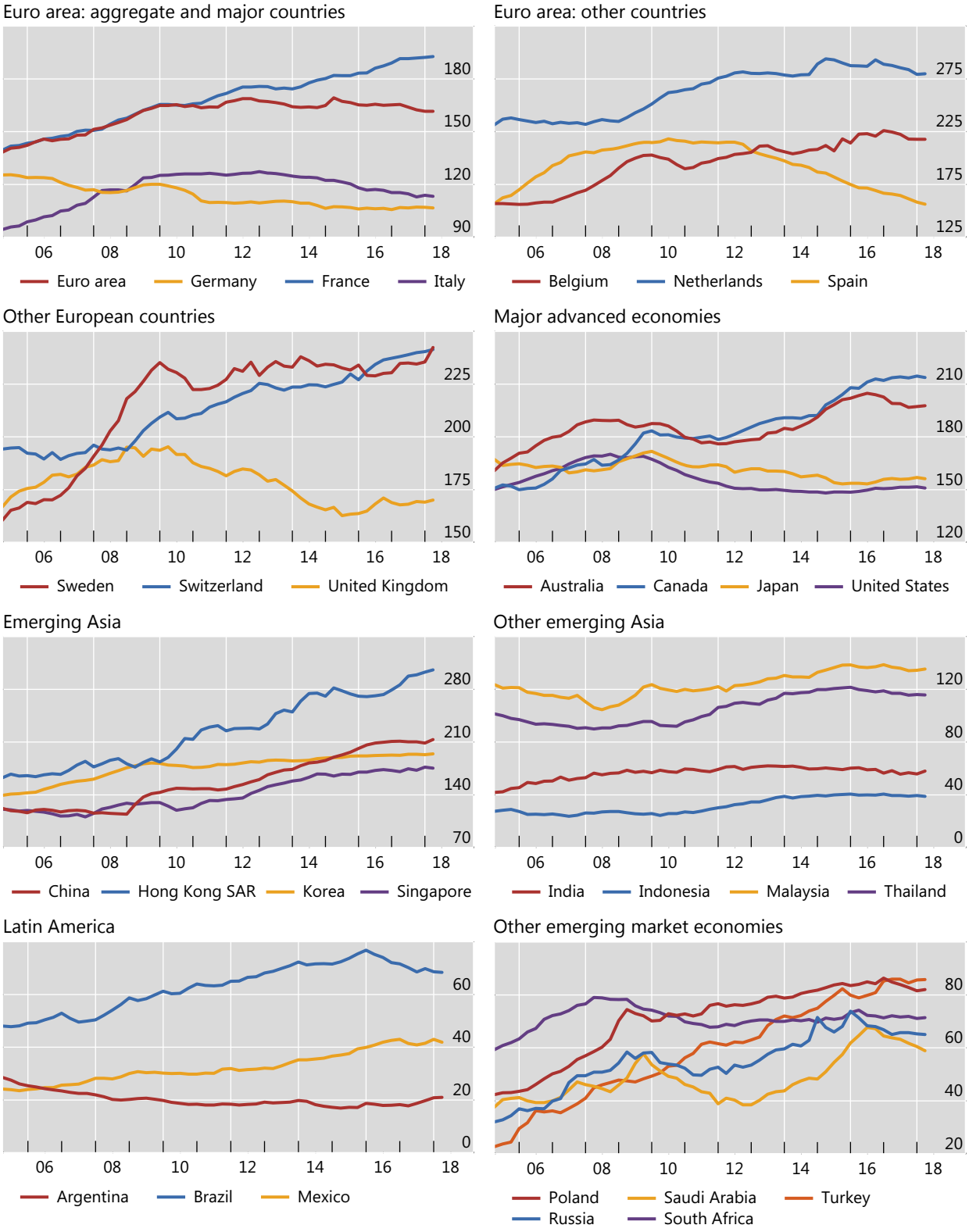


Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

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

As a percentage of GDP — Graph F.2



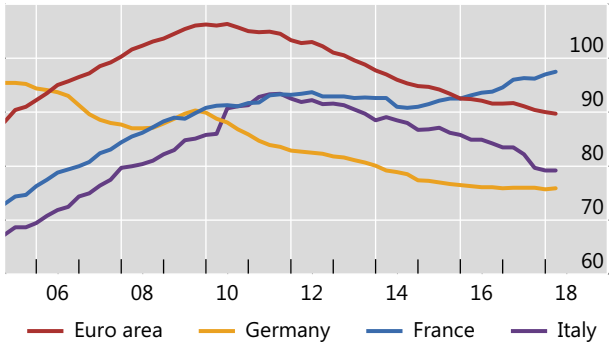
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

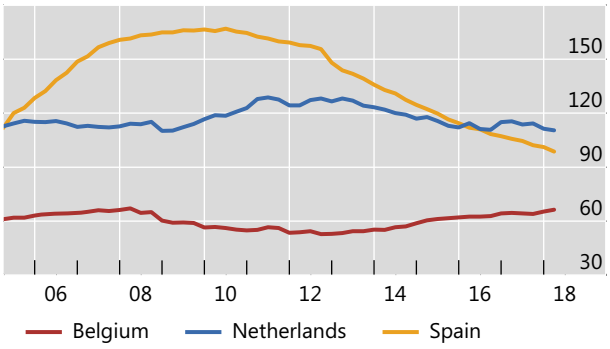
Bank credit to the private non-financial sector (core debt)

As a percentage of GDP — Graph F.3

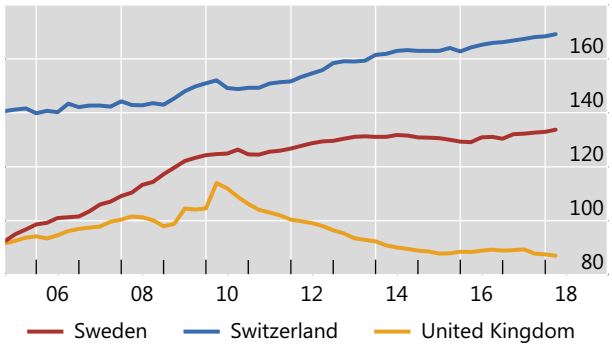
Euro area: aggregate and major countries



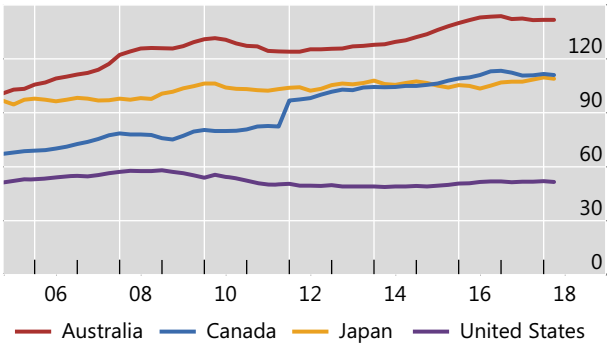
Euro area: other countries



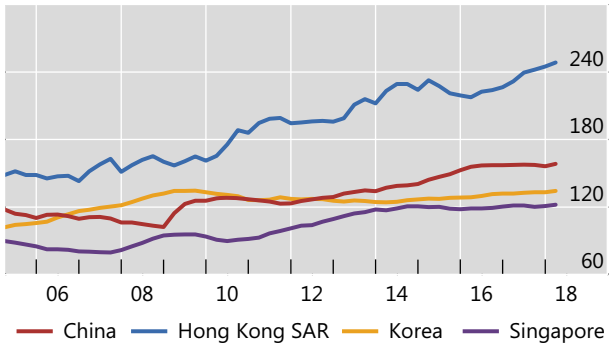
Other European countries



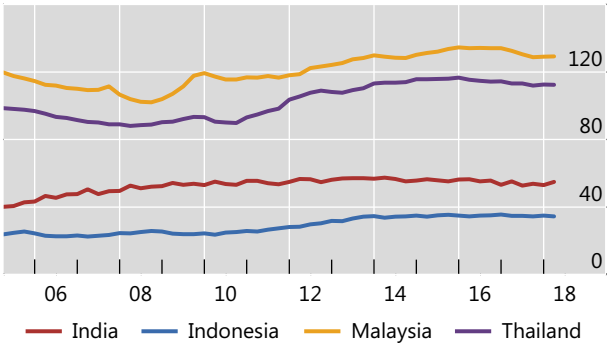
Major advanced economies



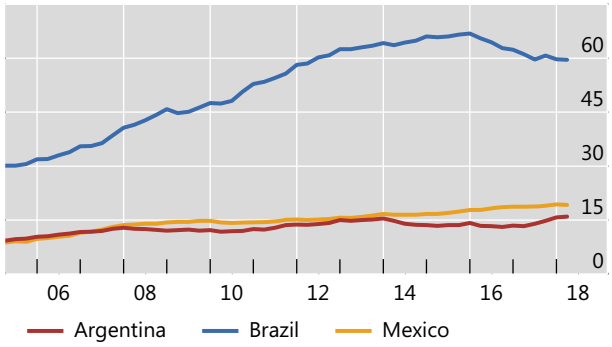
Emerging Asia



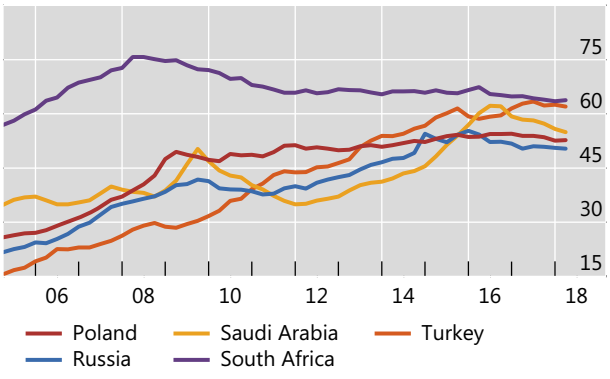
Other emerging Asia



Latin America



Other emerging market economies



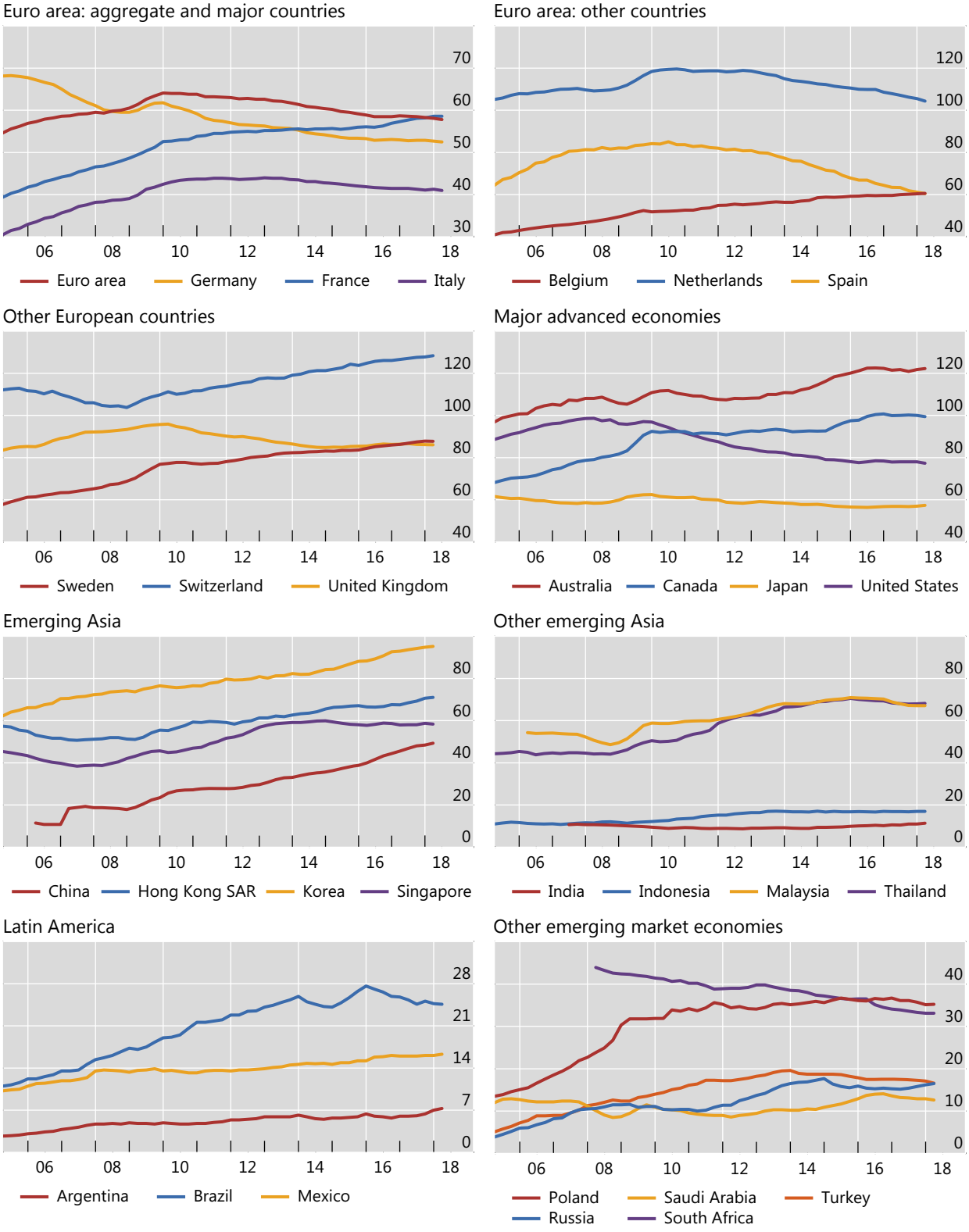
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

Total credit to households (core debt)

As a percentage of GDP

Graph F.4



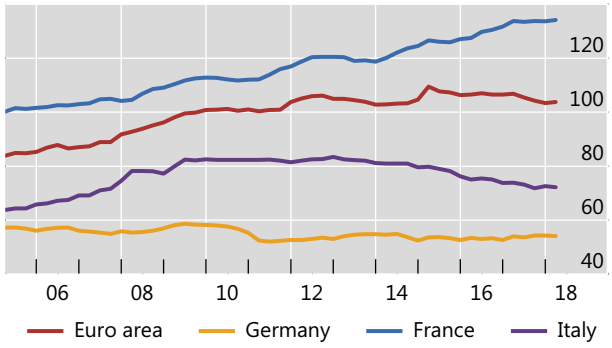
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

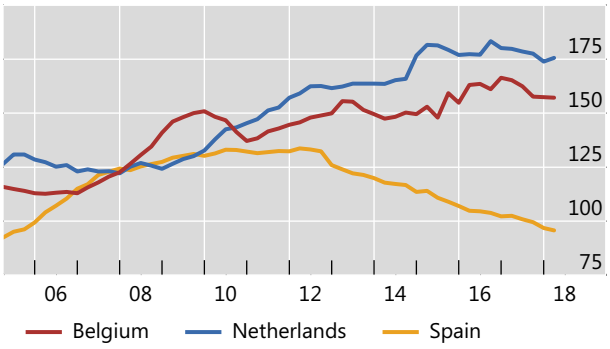
Total credit to non-financial corporations (core debt)

As a percentage of GDP — Graph F.5

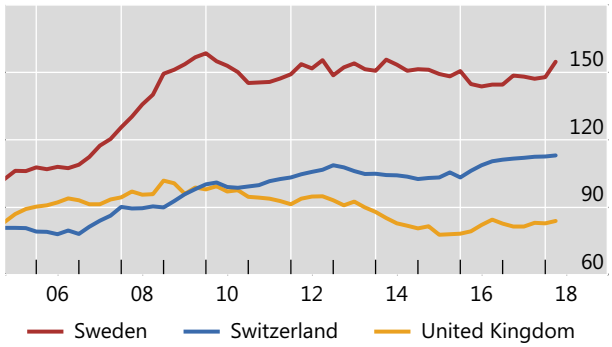
Euro area: aggregate and major countries



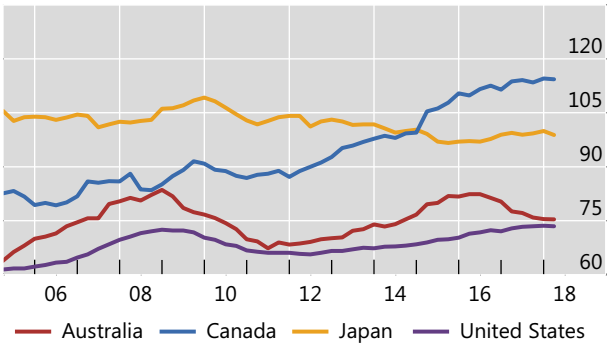
Euro area: other countries



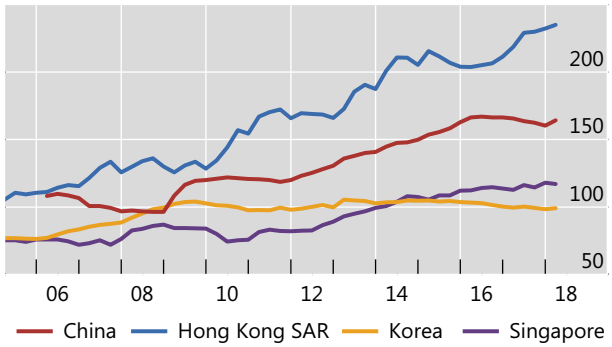
Other European countries



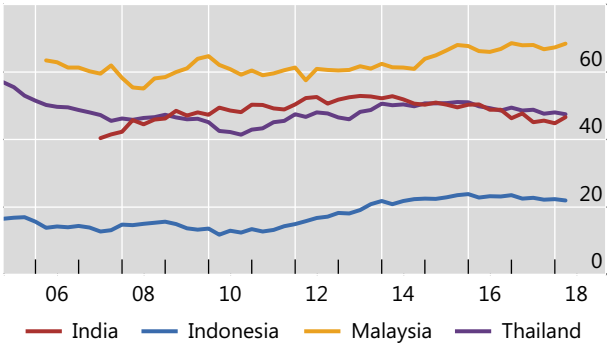
Major advanced economies



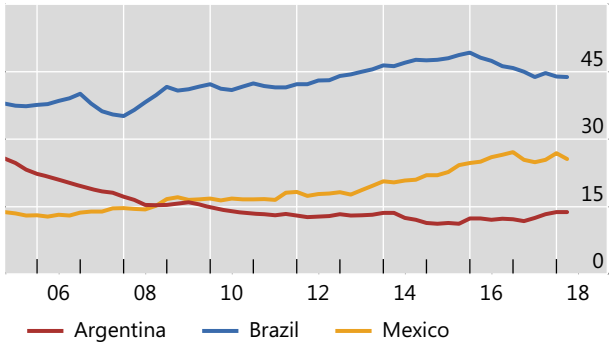
Emerging Asia



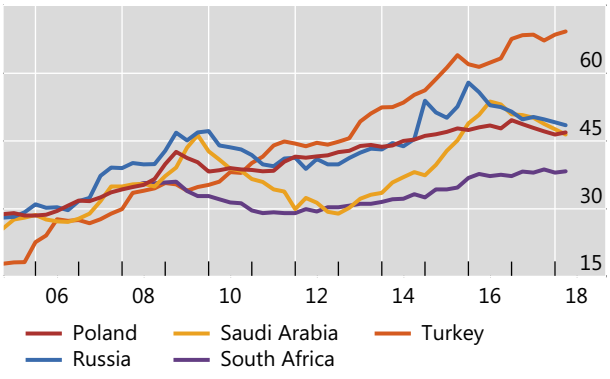
Other emerging Asia



Latin America



Other emerging market economies



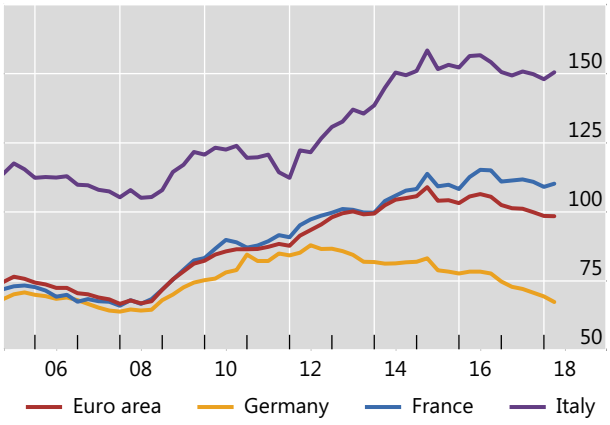
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

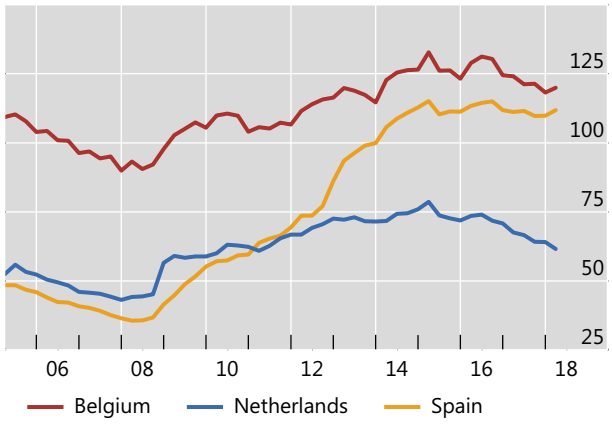
Total credit to the government sector at market value (core debt)[1]

As a percentage of GDP — Graph F.6

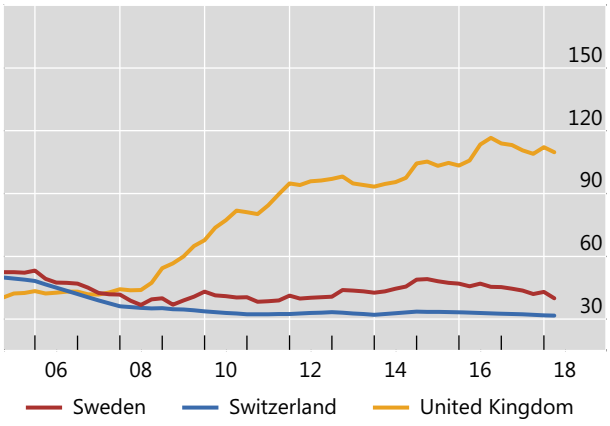
Euro area: aggregate and major countries



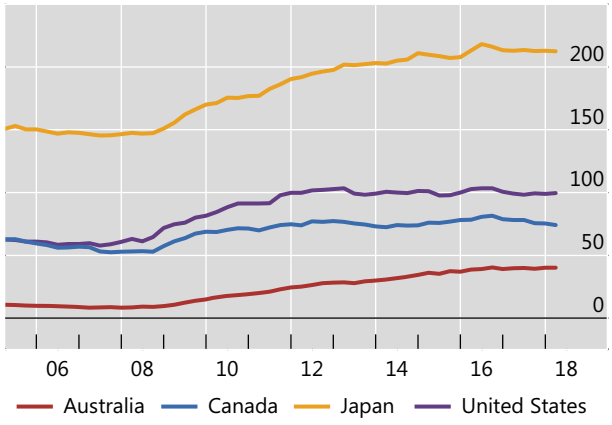
Euro area: other countries



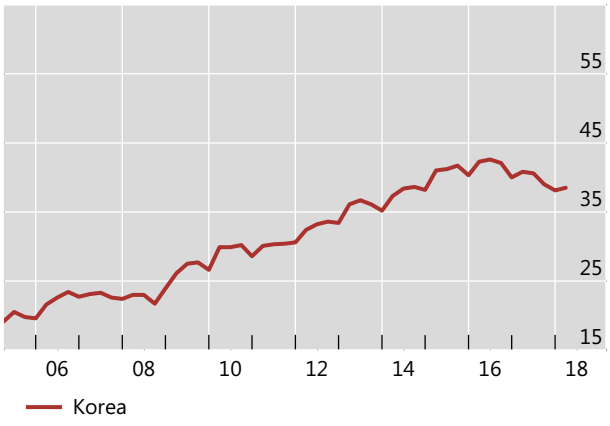
Other European countries



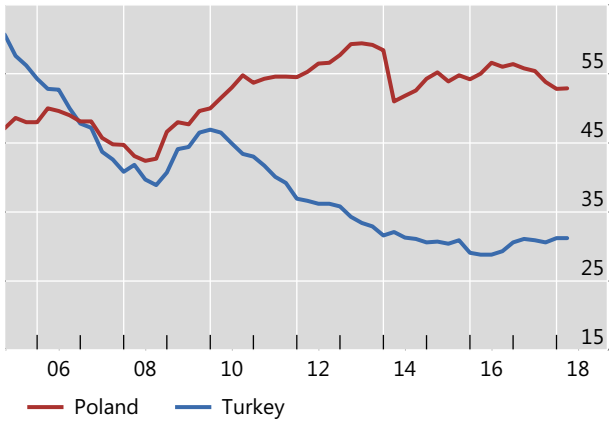
Major advanced economies



Emerging Asia



Other emerging market economies



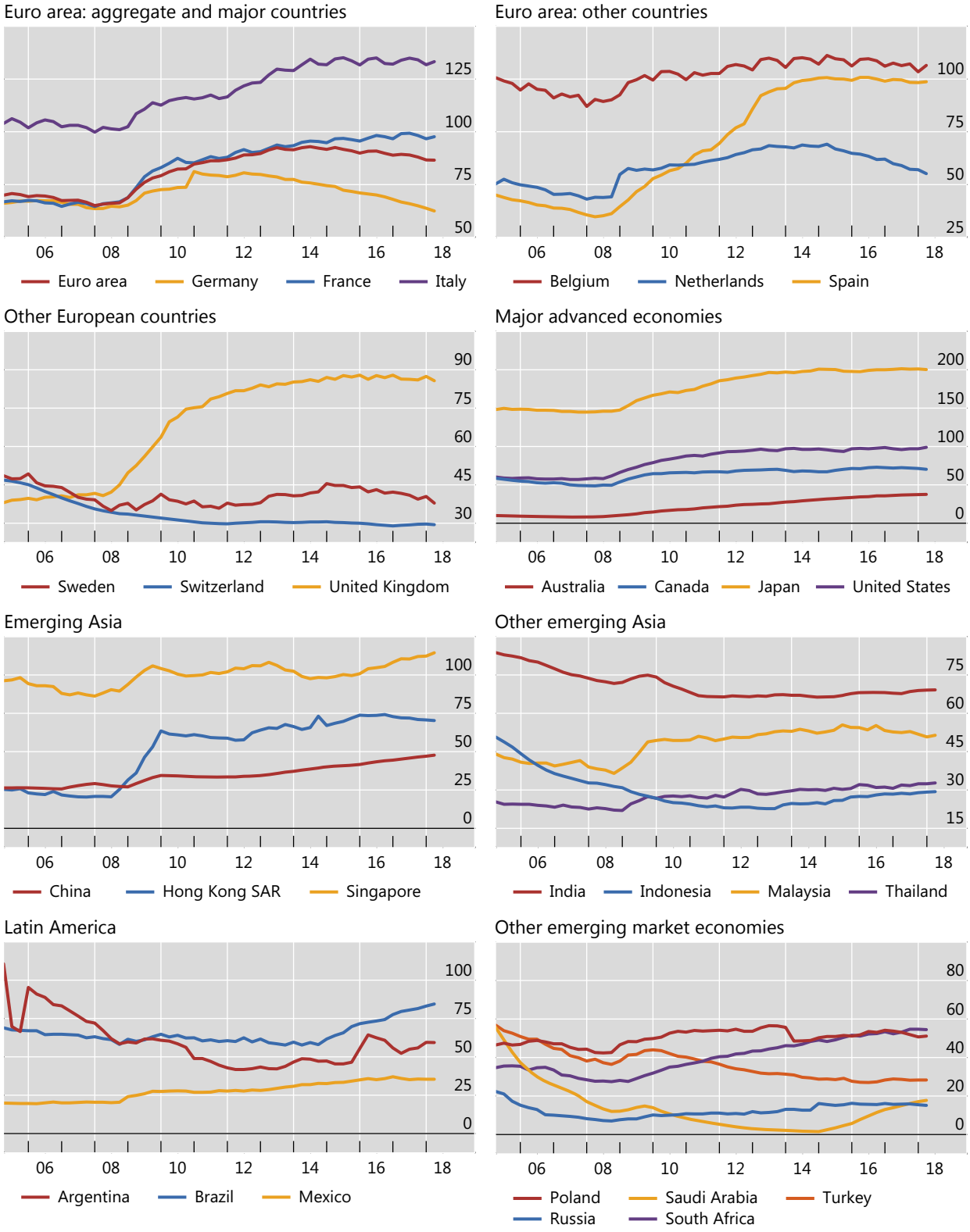
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

[1] Consolidated data for the general government sector.

Source: BIS total credit statistics.

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

As a percentage of GDP — Graph F.7



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

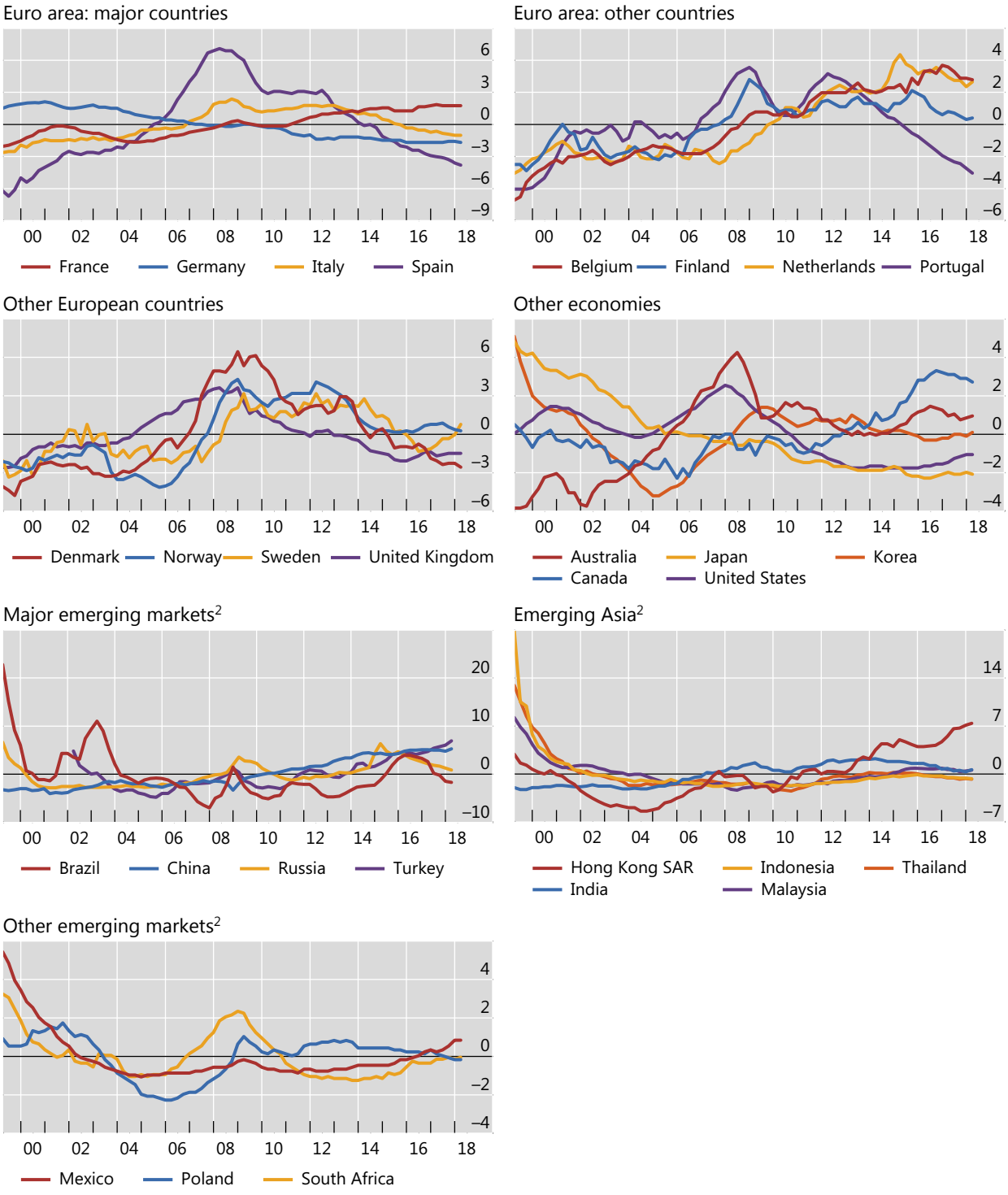
[1] Consolidated data for the general government sector; central government for Argentina, Indonesia, Malaysia, Mexico, Saudi Arabia and Thailand.

Source: BIS total credit statistics.

G Debt service ratios for the private non-financial sector

Debt service ratios of the private non-financial sector

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



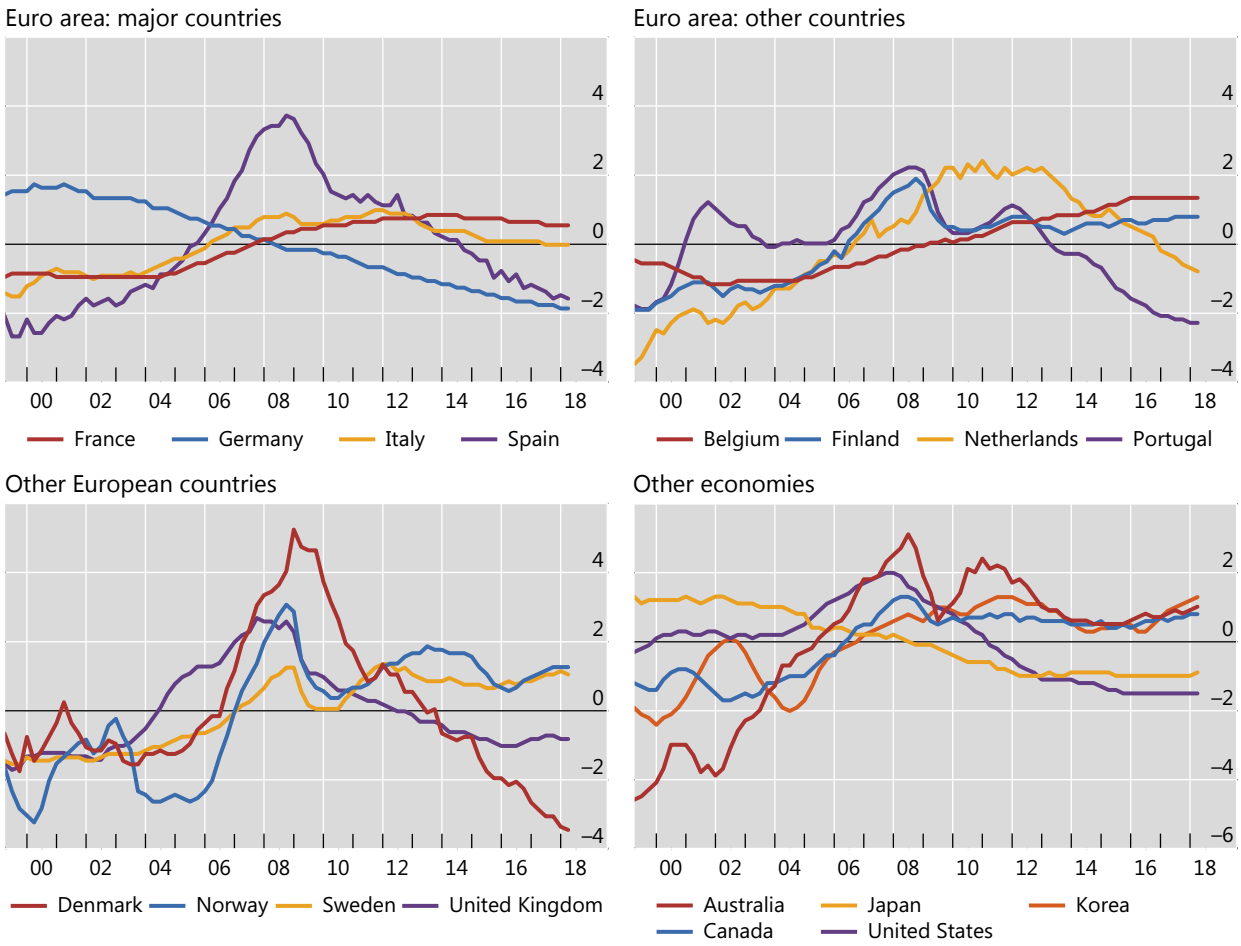
Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

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

Source: BIS debt service ratios statistics.

Debt service ratios of households

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



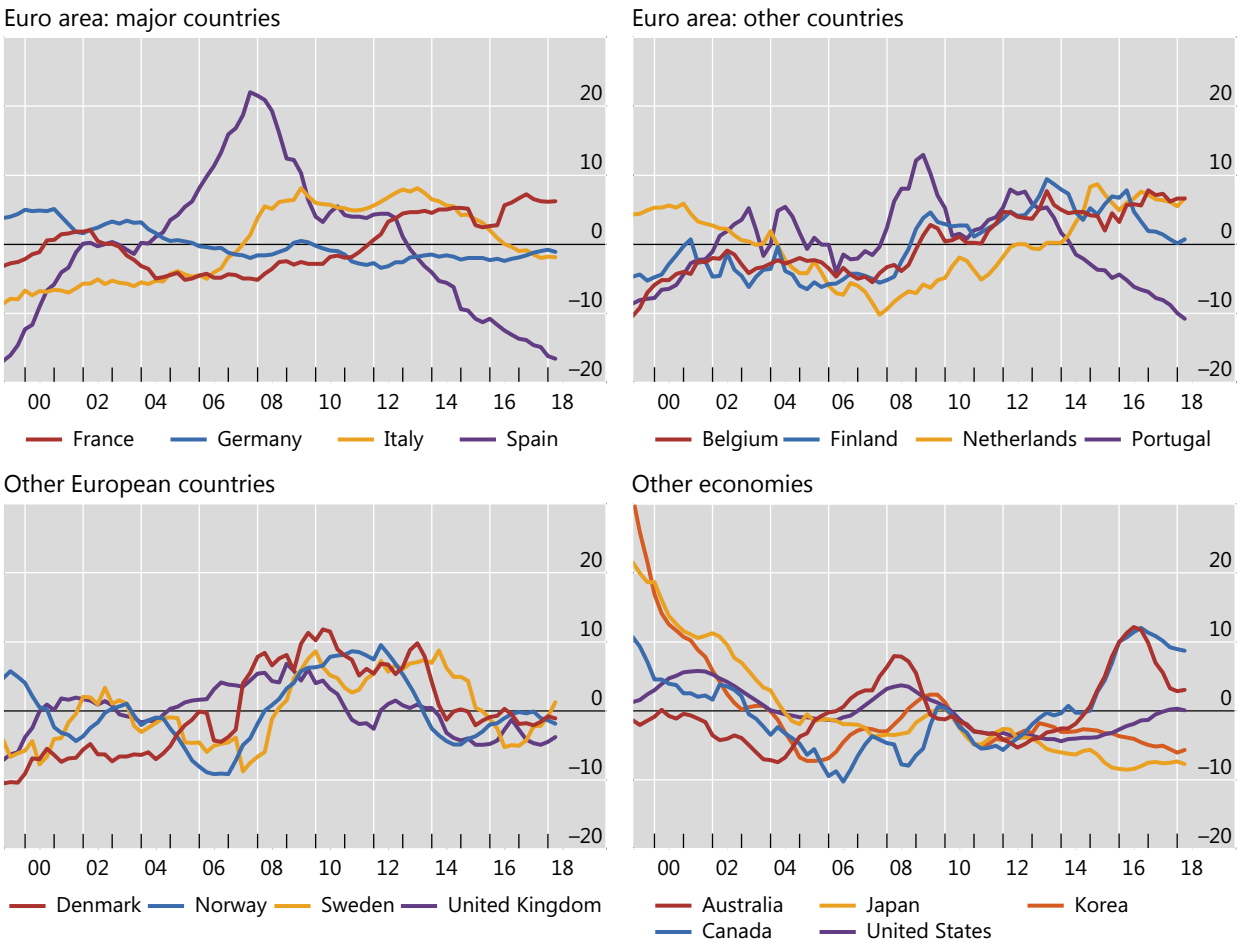
Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

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

Source: BIS debt service ratios statistics.

Debt service ratios of non-financial corporations

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



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

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

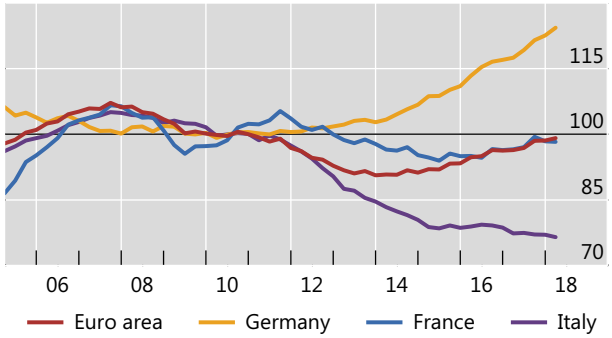
Source: BIS debt service ratios statistics.

H Property price statistics

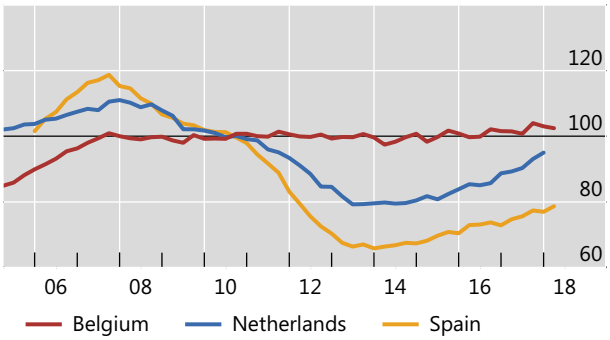
Real residential property prices

CPI-deflated, 2010 = 100 Graph H.1

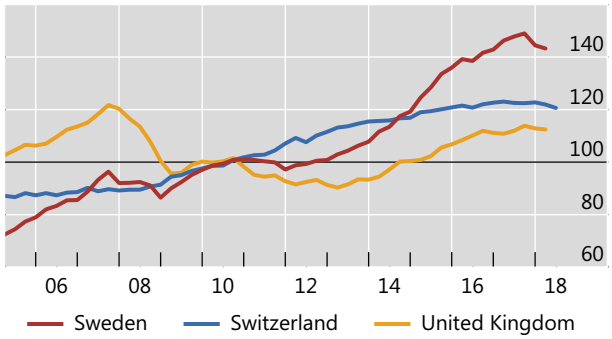
Euro area: aggregate and major countries



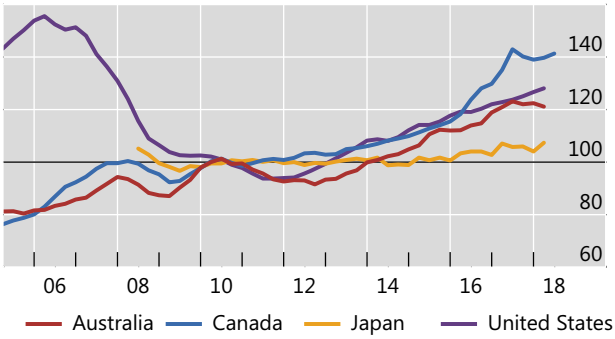
Euro area: other countries



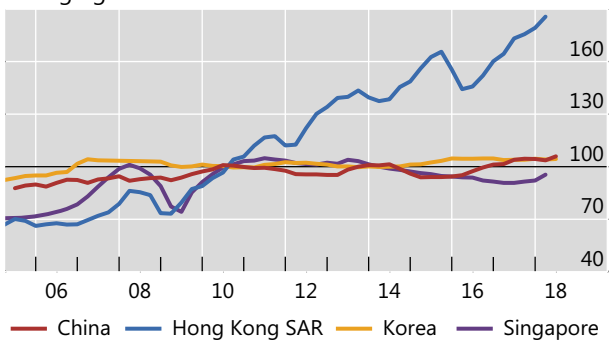
Other European countries



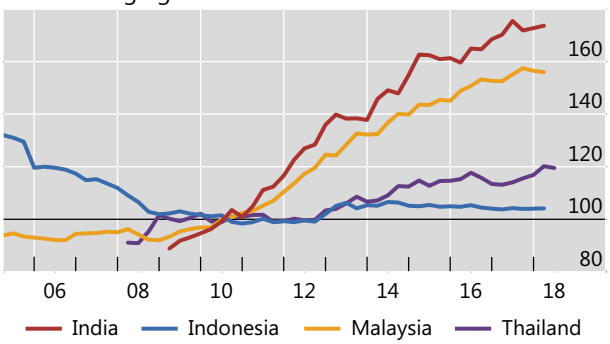
Major advanced economies



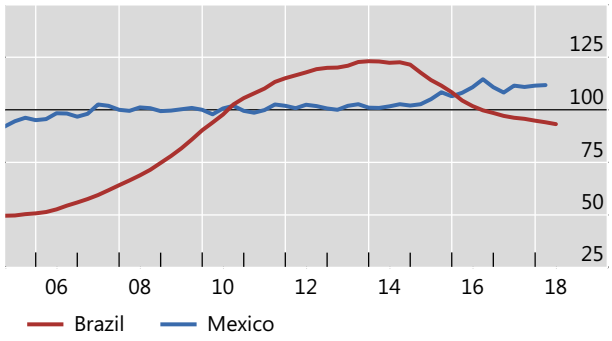
Emerging Asia



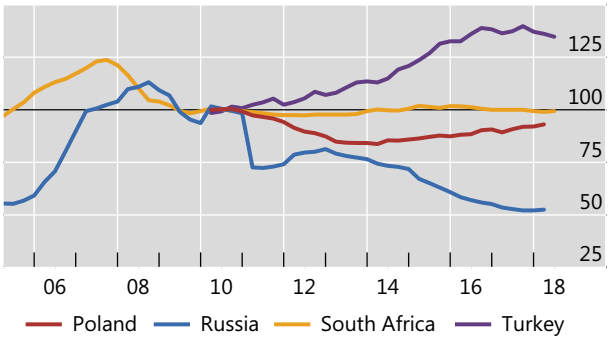
Other emerging Asia



Latin America



Other emerging market economies



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

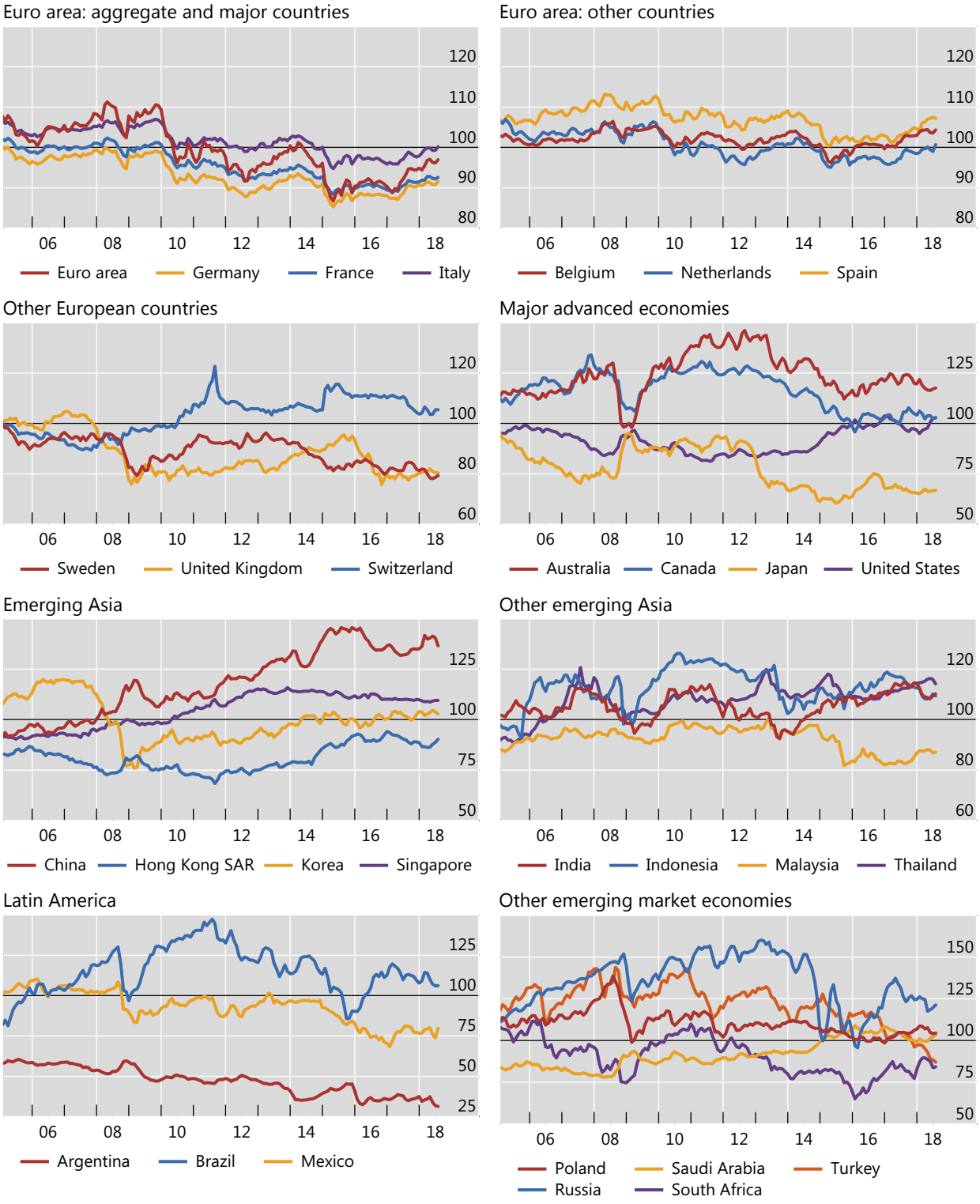
Source: BIS property prices statistics.

I Effective and US dollar exchange rate statistics

Real effective exchange rates

CPI-based, 1995–2005 = 100[1]

Graph I.1



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

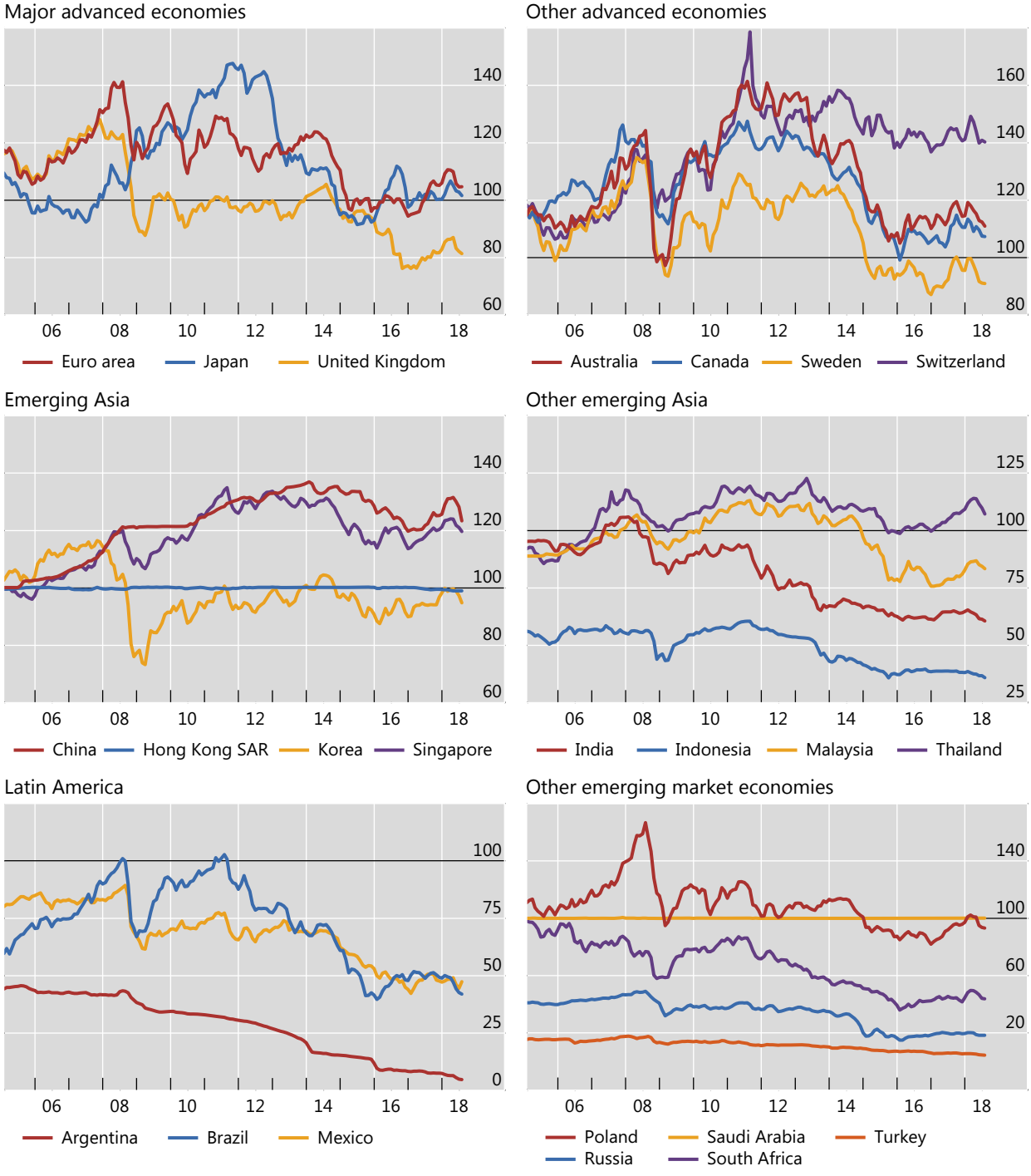
[1] An increase indicates a real-term appreciation of the local currency against a broad basket of currencies.

Source: BIS effective exchange rates statistics.

US dollar exchange rates

Indices, 1995–2005 = 100[1]

Graph I.2



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

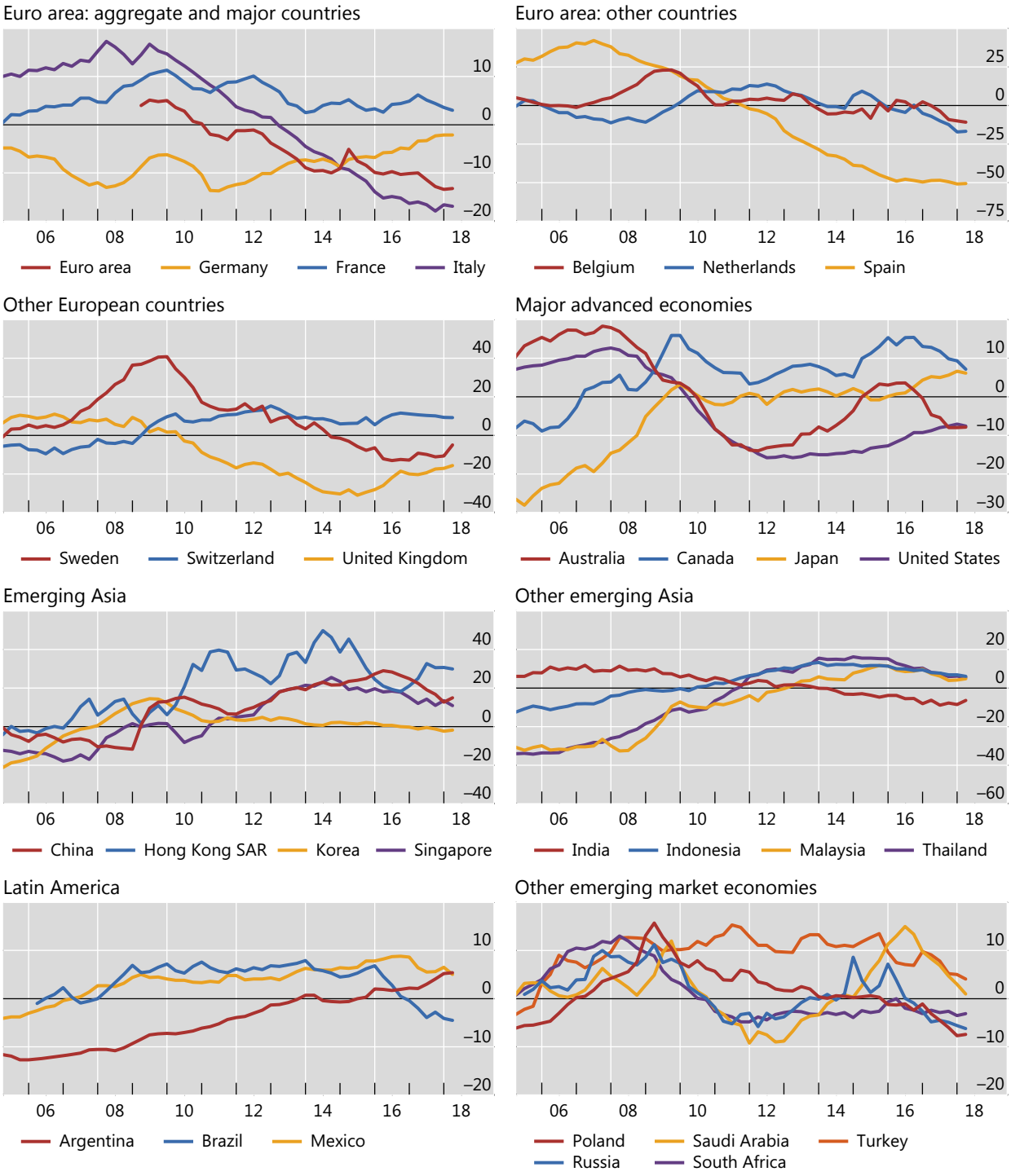
[1] An increase indicates an appreciation of the local currency against the US dollar.

Source: BIS US dollar exchange rates statistics.

J Credit-to-GDP gaps

Credit-to-GDP gaps

In percentage points of GDP — Graph J.1



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

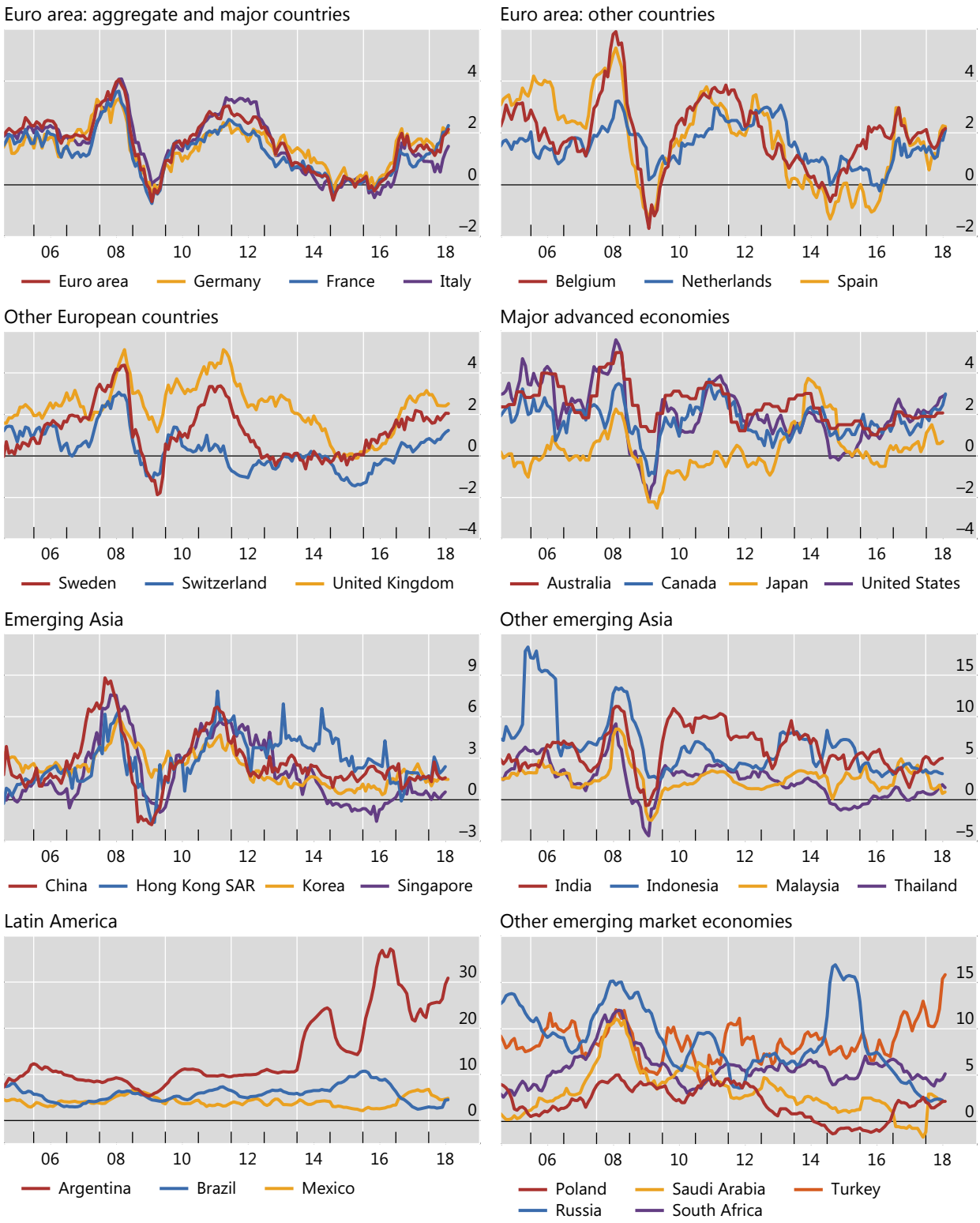
Source: BIS credit-to-GDP gaps statistics.

K Consumer prices

Consumer prices

Year-on-year percentage changes

Graph K.1



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

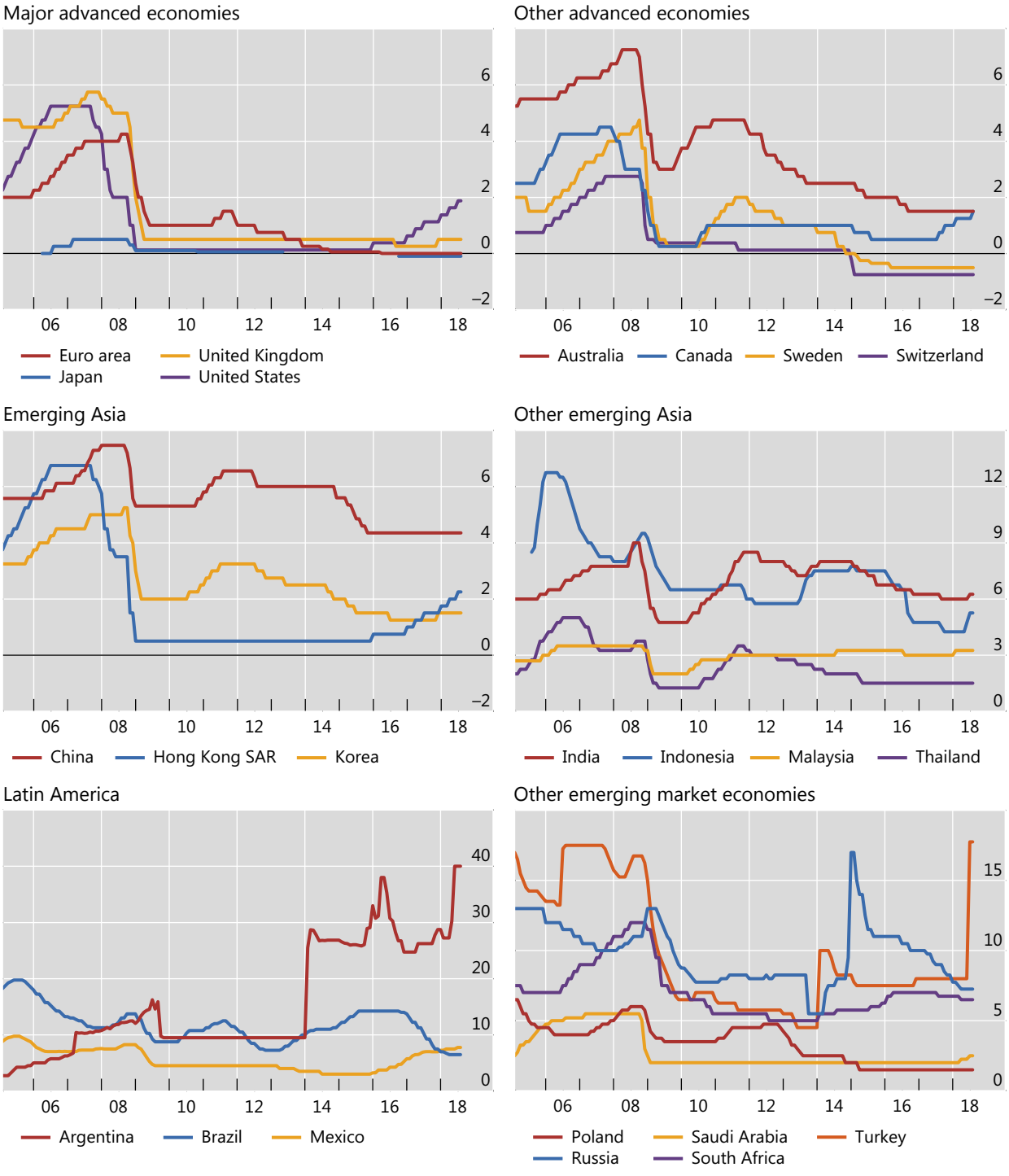
Source: BIS consumer price statistics.

L Central bank policy rates

Central bank policy or representative rates

Month-end; in per cent

Graph L.1



Further information on the policy rates is available at www.bis.org/statistics/cbpol.htm.

Source: BIS policy rates statistics.

Special features in the BIS Quarterly Review

March 2018	Early warning indicators of banking crises: expanding the family	Iñaki Aldasoro, Claudio Borio & Mathias Drehmann
March 2018	Tracking the international footprints of global firms	Stefan Avdjiev, Mary Everett, Philip R Lane & Hyun Song Shin
March 2018	Payments are a-changin' but cash still rules	Morten Bech, Umar Faruqui, Frederik Ougaard & Cristina Picillo
March 2018	The ABCs of bank PBRs: What drives bank price-to-book ratios?	Bilyana Bogdanova, Ingo Fender & Előd Takáts
March 2018	Mortgages, developers and property prices	Michael Chui, Anamaria Illes & Christian Uppe
March 2018	The implications of passive investing for securities markets	Vladyslav Sushko & Grant Turner
December 2017	Is there a debt service channel of monetary transmission?	Boris Hofmann & Gert Peersman
December 2017	Household debt: recent developments and challenges	Anna Zabai
September 2017	FX swaps and forwards: missing global debt?	Claudio Borio, Robert McCauley & Patrick McGuire
September 2017	Central bank cryptocurrencies	Morten Bech & Rodney Garratt
September 2017	What are the effects of macroprudential policies on macroeconomic performance?	Codruta Boar, Leonardo Gambacorta, Giovanni Lombardo & Luiz Pereira da Silva
September 2017	Green bond finance and certification	Torsten Ehlers & Frank Packer

Recent BIS publications[1]

BIS Papers

Low for long or turning point?
BIS Papers No 98, July 2018

The 16th BIS Annual Conference took place in Lucerne, Switzerland, on 23 June 2017. The event brought together a distinguished group of central bank Governors, leading academics and former public officials to exchange views on the topic "Low for long or turning point?". The papers presented at the conference and the discussants' comments are released as BIS Working Papers.

BIS Papers no 98 contains the opening address by Jaime Caruana (Former General Manager, BIS) and remarks by Alan Blinder (Princeton University) and Philip Lowe (Reserve Bank of Australia).

BIS Working Papers

Why you should use the Hodrick-Prescott filter - at least to generate credit gaps
Mathias Drehmann and James Yetman
September 2018, No 744

The credit gap, defined as the deviation of the credit-to-GPD ratio from a Hodrick-Prescott (HP) filtered trend, is a powerful early warning indicator for predicting crises. Basel III therefore suggests that policymakers should use it as part of their countercyclical capital buffer frameworks. Hamilton (2017), however, argues that you should never use an HP filter as it results in spurious dynamics, has end-point problems and its typical implementation is at odds with its statistical foundations. Instead he proposes the use of linear projections. Some have also criticised the normalisation by GDP, since gaps will be negatively correlated with output. We agree with these criticisms. Yet, in the absence of clear theoretical foundations, all proposed gaps are but indicators. It is therefore an empirical question which measure performs best as an early warning indicator for crises - the question we address in this paper. We run a horse race using quarterly data from 1970 to 2017 for 42 economies. We find that no other gap outperforms the baseline credit-to-GDP gap. By contrast, credit gaps based on linear projections in real time perform poorly.

An intermediation-based model of exchange rates
Semyon Malamud and Andreas Schrimpf
September 2018, No 743

We develop a general equilibrium model with intermediaries at the heart of international financial markets. In our model, intermediaries bargain with their customers and extract rents for providing access to foreign claims. The behavior of intermediaries, by tilting state prices, generates an explicit, non-linear risk structure in exchange rates. We show how this endogenous risk structure helps explain a number of anomalies in foreign exchange and

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

international capital markets, including the safe haven properties of exchange rates and the breakdown of covered interest parity.

Quantitative or qualitative forward guidance: Does it matter?
Gunda-Alexandra Detmers, Özer Karagedikli and Richhild Moessner
August 2018, No 742

Every monetary policy decision by the Reserve Bank of New Zealand (RBNZ) is accompanied by a written statement about the state of the economy and the policy outlook, but only every second decision by a published interest rate forecast. We exploit this difference to study the relative influences of qualitative and quantitative forward guidance. We find that announcements that include an interest rate forecast lead to very similar market reactions across the yield curve as announcements that only include written statements. We interpret our results as implying that central bank communication is important, but that the exact form of that communication is less critical. Our results are also consistent with market participants understanding the conditional nature of the RBNZ interest rate forecasts.

Reserve requirements and capital flows in Latin America
Michael Brei and Ramon Moreno
August 2018, No 741

The experience of a number of central banks in emerging economies indicates that capital flows can pose a dilemma. For example, raising policy rates can attract more capital inflows by raising deposit rates. It has been suggested, however, that raising reserve requirements instead of the policy rate can address this dilemma, as deposit rates will not necessarily increase, even if lending rates rise. To investigate this possibility, this paper examines how banks adjust loan and deposit rates in response to changes in reserve requirements. We use data on 128 banks from seven Latin American countries over the period 2000-14. Our results indicate that higher reserve requirements are associated with higher loan rates, whereas deposit rates remain unchanged during normal times and decrease during periods of large capital inflows. Reserve requirements may therefore be a way to mitigate the dilemma posed by capital inflows in some Latin American economies.

The macroeconomic effects of macroprudential policy
Michael Brei and Ramon Moreno
August 2018, No 740

Central banks increasingly rely on macroprudential measures to manage the financial cycle, but the effects of such policies on the core objectives of monetary policy to stabilise output and inflation are largely unknown. In this paper, we quantify the effects of changes in maximum loan-to-value (LTV) ratios on output and inflation. We rely on a narrative identification approach based on detailed reading of policymakers' objectives when implementing the measures. We find that over a four-year horizon, a 10 percentage point decrease in the maximum LTV ratio leads to a 1.1% reduction in output. As a rule of thumb, the impact of a 10 percentage point LTV tightening can be viewed as roughly comparable to that of a 25 basis point increase in the policy rate. However, the effects are imprecisely estimated and the effect is only present in emerging market economies. We also find that tightening LTV limits has larger economic effects than loosening them. At the same time, we show that changes in maximum LTV ratios have substantial effects on credit and house price growth. Using inverse propensity weights to re-randomise LTV actions, we show that these effects are likely causal.

The economics of revoking NAFTA
Raphael Auer, Barthélémy Bonadio and Andrei A Levchenko
August 2018, No 739

In a world economy interconnected by global value chains (GVCs), domestic productivity depends on the availability of imported inputs and the vast majority of workers stands to lose from protectionism. To exemplify this, we provide a quantitative assessment of the aggregate and distributional effects of one hypothetical protectionist measure - the case of revoking the North American Free Trade Agreement (NAFTA). Using a multi-country, multi-sector, quantitative model of global production, we show that a full revocation extending to both tariffs and non-tariff trade barriers would result in a real annual GDP loss of US$ 37 billion in

Canada, US$ 22 billion in Mexico, and US$ 40 billion in the USA. In contrast, annual combined losses would amount to less than US$ 5 billion if only tariff rates were to be increased. For both counterfactuals, the distributional impacts across sectors would be an order of magnitude larger than the aggregate effects. Combining these results with information on the geographic distribution of sectoral employment, we show that almost all regions in North America would record reductions in their average real wage.

Bank solvency risk and funding cost interactions in a small open economy: evidence from Korea
Iñaki Aldasoro and Kyounghoon Park
August 2018, No 738

Using proprietary balance sheet data for Korean banks and a simultaneous equation model, we document that increased marginal funding costs lead to larger solvency risk (as measured by the Tier 1 regulatory capital ratio), which, in turn, leads to larger marginal funding costs. A 100 bp increase in marginal funding costs (solvency risk) is associated with a 155 (77) bp increase in solvency risk (marginal funding costs). The findings of an economically and statistically significant relationship are robust to considering different proxies for solvency risk, types of banks, interest rate regimes, and interest margin management strategies. They also hold irrespective of the funding profile considered. FX-related macroprudential policies can affect the negative feedback loop by muting the effect of marginal funding costs on solvency risk. Our findings can inform the calibration of macroprudential stress tests.

Transmission of monetary policy through global banks: whose policy matters?
Stefan Avdjiev, Catherine Koch, Patrick McGuire and Goetz von Peter
August 2018, No 737

This paper explores the basic question of whose monetary policy matters for banks' international lending. In the international context, monetary policies from several countries could come into play: the lender's, the borrower's, and that of a third country, the issuer of the currency in which cross-border lending is denominated. Using the rich dimensionality of the BIS international banking statistics, we find significant effects for all three policies. US monetary easing fuels cross-border lending in US dollars, as befits a global funding currency. At the same time, a tightening in the lender or the borrower country reinforces international dollar lending as global banks turn to the greenback for cheaper funding and toward borrowers abroad. Our results also show that stronger capitalization and better access to funding sources mitigate the frictions underpinning the transmission channels. Analogous results for euro-denominated lending confirm that global funding currencies play a key role in international monetary policy transmission.

The role of household debt heterogeneity on consumption: Evidence from Japanese household data
Jouchi Nakajima
July 2018, No 736

This paper estimates the impact of household debt on consumption behaviour using data from the Japanese Preference Parameters Study. Covering the 2005–13 period, the survey is the first of its kind for Japan. It features responses to forward-looking questions about key risks to income, shedding light on the motives for household savings behaviour. The analysis finds that household marginal propensities to consume (MPCs) were significantly higher for highly-indebted Japanese households than for those with little-to-no debt - a type of variation that is consistent with findings for other countries. The evidence points to a significant precautionary saving motive by Japanese households, with savers particularly concerned about (unlikely) future unemployment spells and longevity risks.

Gauging procyclicality and financial vulnerability in Asia through the BIS banking and financial statistics
Stefan Avdjiev, Bat-el Berger and Hyun Song Shin
July 2018, No 735

We look back at past episodes of financial stress in Asia with a forward-looking perspective. We put ourselves in the shoes of a contemporary observer with the data at hand and ask what evidence was available on the systematic build-up of vulnerabilities. We reconstruct a

graphical narrative of banking and financial developments at the time. Our exercise showcases the usefulness of the BIS international banking and financial statistics as a window on the financial system's procyclicality. We conclude with a real-time forward-looking survey of current financial vulnerabilities, focusing on the implications of the shift in the pattern of credit intermediation from banks to bond markets.

Payments, credit and asset prices
Monika Piazzesi and Martin Schneider
July 2018, No 734

This paper studies a modern monetary economy: trade in both goods and securities relies on money provided by intermediaries. While money is valued for its liquidity, its creation requires costly leverage. In ation, security prices and the transmission of monetary policy then depend on the institutional details of the payment system. The price of a security is higher if it helps back inside money, and lower if more inside money is used to trade it. In ation can be low in security market busts if bank portfolios suffer, but also in booms if trading absorbs more money. The government has multiple policy tools: in addition to the return on outside money, it affects the mix of securities used to back inside money.

A risk-centric model of demand recessions and macroprudential policy
Ricardo Caballero and Alp Simsek
July 2018, No 733

When investors are unwilling to hold the economy's risk, a decline in the interest rate increases the Sharpe ratio of the market and equilibrates the risk markets. If the interest rate is constrained from below, risk markets are instead equilibrated via a decline in asset prices. However, the latter drags down aggregate demand, which further drags prices down, and so on. If investors are pessimistic about the recovery, the economy becomes highly susceptible to downward spirals due to dynamic feedbacks between asset prices, aggregate demand, and potential growth. In this context, belief disagreements generate highly destabilizing speculation that motivates macroprudential policy.

The global factor in neutral policy rates: Some implications for exchange rates, monetary policy, and policy coordination
Richard Clarida
July 2018, No 732

This paper highlights some of the theoretical and practical implications for monetary policy and exchange rates that derive specifically from the presence of a global general equilibrium factor embedded in neutral real policy rates in open economies. Using a standard two country DSGE model, we derive a structural decomposition in which the nominal exchange rate is a function of the expected present value of future neutral real interest rate differentials plus a business cycle factor and a PPP factor. Country specific "r*" shocks in general require optimal monetary policy to pass these through to the policy rate, but such shocks will also have exchange rate implications, with an expected decline in the path of the real neutral policy rate reflected in a depreciation of the nominal exchange rate. We document a novel empirical regularity between the equilibrium error in the VECM representation of the empirical Holston Laubach Williams (2017) four country r* model and the value of the nominal trade weighted dollar. In fact, the correlation between the dollar and the 12 quarter lag of the HLW equilibrium error is estimated to be 0.7. Global shocks to r* under optimal policy require no exchange rate adjustment because passing though r* shocks to policy rates 'does all the work' of maintaining global equilibrium. We also study a richer model with international spill overs so that in theory there can be gains to international policy cooperation. In this richer model we obtain a similar decomposition for the nominal exchange rate, but with the added feature that r* in each country is a function global productivity and business cycle factors even if these factors are themselves independent across countries. We argue that in practice, there could well be significant costs to central bank communication and credibility under a regime formal policy cooperation, but that gains to policy coordination could be substantial given that r*'s are unobserved but are correlated across countries.

The likelihood of effective lower bound events
Michal Franta
June 2018, No 731

This paper provides estimates of the probability of an economy hitting its effective lower bound (ELB) on the nominal interest rate and of the expected duration of such an event for eight advanced economies. To that end, a mean-adjusted panel vector autoregression with static interdependencies and the possibility of regime change is estimated. The simulation procedure produces ELB risk estimates for both the short term, where the current phase of the business cycle plays an important role, and the medium term, where the occurrence of an ELB situation is determined mainly by the equilibrium values of macroeconomic variables. The paper also discusses the ELB event probability estimates with respect to previous approaches used in the literature.

US monetary policy and fluctuations of international bank lending
Stefan Avdjiev and Galina Hale
June 2018, No 730

There is no consensus in the empirical literature on the direction in which U.S. monetary policy affects cross-border bank lending. We find robust evidence that the impact of the U.S. federal funds rate on cross-border bank lending in a given period depends on the prevailing international capital flows regime and on the level of the two main components of the federal funds rate: macroeconomic fundamentals and the monetary policy stance. During episodes in which bank lending from advanced to emerging economies is booming, the relationship between the federal funds rate and cross-border bank lending is positive and mostly driven by the macroeconomic fundamentals component, which is consistent with a search-for-yield behavior on the part of internationally-active banks. In contrast, during episodes of stagnant growth in bank lending from advanced to emerging economies, the relationship between the federal funds rate and bank lending is negative, mainly due to the monetary policy stance component of the federal funds rate. The latter set of results is most pronounced for lending to emerging markets, which is consistent with the international bank-lending channel and flight-to-quality behavior of internationally-active banks.

Has inflation targeting become less credible?
Nathan Sussman and Osnat Zohar
June 2018, No 729

Beginning with the global financial crisis (2008) the correlation between crude oil prices and medium-term and forward inflation expectations increased leading to fears of their un-anchoring. Using the first principal component of commodity prices as a measure for global aggregate demand, we decompose nominal oil prices to a global demand factor and remaining factors. Using a Phillips Curve framework we find a structural change after the collapse of Lehman Brothers when inflation expectations reacted more strongly to global aggregate demand conditions embedded in oil prices. Within this framework we cannot reject the hypothesis that expectations remained anchored.

Accumulation of foreign currency reserves and risk-taking
Rasmus Fatum and James Yetman
June 2018, No 728

We assess whether the accumulation of foreign currency reserves in the Asia-Pacific region may have unintended consequences in the form of increased private sector risk-taking. To do so we carry out a country-specific daily data event study analysis of the relationship between official announcements of reserves stocks and various proxy measures of risk-taking. Overall, our results suggest that reserves accumulation exerts no significant influence on risk-taking.

Recent RMB policy and currency co-movements
Robert N McCauley and Chang Shu
June 2018, No 727

This study investigates how variation in the determinants of the renminbi's daily fixing since the August 2015 exchange rate reform maps on to variation in the co- movement of the renminbi with regional and other emerging market currencies. We first identify three post-reform periods of RMB management: transition, basket management and countercyclical

management. The co-movement with regional and Latin American currencies peaked in the basket period, when the daily fixing was most predictable and multilateral. By contrast, the decline in co-movement in the countercyclical management period between May and July 2017 leaves it premature to speak of a renminbi zone. The dependence of the co-movements on renminbi management has important implications for renminbi internationalisation.

Residential investment and economic activity: evidence from the past five decades
Emanuel Kohlscheen, Aaron Mehrotra and Dubravko Mihaljek
June 2018, No 726

We analyse the evolution and main drivers of residential investment, using a panel with quarterly data for 15 advanced economies since the 1970s. Residential investment is a notably volatile component of real GDP in all countries in the sample. We find real house price growth, net migration inflows and the size of the existing housing stock to be significant drivers of residential investment across various model specifications. We also detect important asymmetries: interest rate increases affect residential investment more than interest rate cuts, and interest rate changes have larger effects on residential investment when its share in overall GDP is rising. Finally, we show that adding information on residential investment significantly improves the performance of standard recession prediction models.

Basel Committee on Banking Supervision

Pillar 3 disclosure requirements - regulatory treatment of accounting provisions
August 2018

The Committee today released a technical amendment on additional Pillar 3 disclosure requirements for those jurisdictions implementing an expected credit loss (ECL) accounting model as well as for those adopting transitional arrangements for the regulatory treatment of accounting provisions. The amendment is intended to provide users with disclosures that fully reflect any transitional effects for the impact of expected credit loss accounting on regulatory capital, as well as to provide further information on the allocation of accounting provisions in the regulatory categories of general and specific provisions for standardised exposures during the interim period.

Technical amendments are defined as changes in standards that are not substantial in nature but that cannot be unambiguously resolved based on the current text.

Incentives to centrally clear over-the-counter (OTC) derivatives - A post-implementation evaluation of the effects of the G20 financial regulatory reforms
August 2018

TheThe report concludes that the reforms - particularly capital requirements, clearing mandates and margin requirements for non-centrally cleared derivatives - are achieving their goals of promoting central clearing, especially for the most systemic market participants. This is consistent with the goal of reducing complexity and improving transparency and standardisation in the OTC derivatives markets. Beyond the systemic core of the derivatives network of CCPs, dealers/clearing service providers and larger, more active clients, the incentives are less strong.

The report identifies reform areas that may merit consideration by the relevant standard-setting bodies (SSBs). The findings from the report will inform relevant SSBs regarding any subsequent policy efforts and potential adjustments, bearing in mind the original objectives of the reforms. This does not imply a scaling back of those reforms or an undermining of members' commitment to implement them.

Survey on the interaction of regulatory instruments: results and analysis
July 2018

This report aims to summarise and analyse the results of the second-wave of the survey conducted by the Basel Committee's Research Task Force on the role of multiple regulatory constraints in the Basel III framework. The results of the first wave (reporting date 30 June

2016) were published in February 2017 and invited additional survey questions as well as more in-depth interpretations of banks' answers.

Some aggregate results are broken down by bank groups and geography. To provide additional insights (and check data quality), banks' answers from this survey are merged to banks' information on the other topics collected through the Basel III monitoring exercise. We find that there is a great degree of consistency across topics and, also, between the two survey waves.

Global systemically important banks: revised assessment methodology and the higher loss absorbency requirement
July 2018

The Basel Committee on Banking Supervision published today the Global systemically important banks: revised assessment methodology and the higher loss absorbency requirement. The revised methodology is expected to be implemented in member jurisdictions by 2021. Building on member jurisdictions' experience and the feedback received during the public consultation concluded in June 2017, the Committee has reconfirmed the fundamental structure of the global systemically important bank (G-SIB) framework. There is general recognition that the framework is meeting its primary objective of requiring G-SIBs to hold higher capital buffers and providing incentives for such firms to reduce their systemic importance.

The decision to maintain the core elements of the G-SIB framework will further contribute to the stability of the regulatory environment after the recent finalisation of the Basel IIII post-crisis reforms.

The Committee agreed to the following enhancements to the G-SIB framework:

•Amending the definition of cross-jurisdictional indicators consistent with the definition of BIS consolidated statistics;

•Introducing a trading volume indicator and modifying the weights in the substitutability category;

•Extending the scope of consolidation to insurance subsidiaries;

•Revising the disclosure requirements;

•Providing further guidance on bucket migration and associated higher loss absorbency (HLA) surcharge when a G-SIB moves to a lower bucket; and

•Adopting a transitional schedule for the implementation of these enhancements to the G-SIB framework.

When the G-SIB framework was first published, the Committee agreed to review the framework every three years to allow for the opportunity to enhance the framework, as needed. The Committee also reconfirmed the importance of the three-year review cycle. In particular, the Committee will pay attention to alternative methodologies for the substitutability category, so as to allow the cap to be removed at that time.

Treatment of extraordinary monetary policy operations in the Net Stable Funding Ratio
June 2018

The Basel Committee on Banking Supervision has approved a technical amendment which is related to the treatment of extraordinary monetary policy operations in the Net Stable Funding Ratio (NFSR).

Effective immediately, this amendment to the NSFR standard allows reduced required stable funding factors for central bank claims with a maturity of more than six months, subject to a floor of 5%. This amendment aims to provide greater flexibility in the treatment of extraordinary central bank liquidity-absorbing monetary policy operations.

The Basel Committee wishes to thank all those who contributed time and effort to express their views during the December 2017 consultation process.

Progress in adopting the "Principles for effective risk data aggregation and risk reporting"
June 2018

The Basel Committee on Banking Supervision today published its latest progress report on banks' implementation of the Principles for effective risk data aggregation and reporting. The Principles, issued in January 2013, aim to strengthen banks' risk data aggregation and risk reporting with a view to improving their risk management, decision-making processes and resolvability.

The progress report is based on the results of a self-assessment survey completed by authorities with supervisory responsibility for global systemically important banks (G-SIBs). The report reviews G-SIBs' progress in implementing the Principles in 2017. A previous progress report, published in March 2017, assessed implementation during 2016.

The assessment covered 30 G-SIBs designated in 2011-12 that were required to adopt the Principles by January 2016. It notes that in 2017 most G-SIBs made, at best, marginal progress in implementing the Principles. G-SIBs have found it challenging to comply with the Principles, due mainly to the complexity and interdependence of IT improvement projects. As a result, the expected date of compliance has slipped back for many banks.

In view of this outcome, and to promote further adoption of the Principles, the Basel Committee has made the following recommendations:

•Banks should continue to implement the Principles according to the roadmaps agreed with their supervisors and consider how implementation would benefit other data-related initiatives and requirements; and

•Supervisors should maintain their emphasis on ensuring that banks fully implement the Principles. This includes meeting with banks' boards of directors and/or senior management in 2018 to receive updates on implementation progress. Supervisors should also continue to promote home-host cooperation in relation to the implementation of the Principles by global banking groups.

The Committee will continue to monitor G-SIBs' progress in adopting the Principles and plans to conduct the next assessment in 2019.

Committee on the Global Financial System

Financial stability implications of a prolonged period of low interest rates
July 2018 No 61

The decade following the Great Financial Crisis (GFC) has been marked by historically low interest rates. An environment characterised by "low-for-long" interest rates may dampen the profitability and strength of financial firms and thus become a source of vulnerability for the financial system. In addition, low rates could change firms' incentives to take risks, which could engender additional financial sector vulnerabilities.

This report identifies and provides evidence for the channels through which a "low-for-long" scenario might affect financial stability, focusing on the impact of low rates on banks and on insurance companies and private pension funds (ICPFs). For banks, low rates might reduce resilience by lowering profitability, and thus the ability of banks to replenish capital after a negative shock, and by encouraging risk-taking. For ICPFs, falling interest rates cause the present value of liabilities to rise more than that of assets, affecting solvency. In addition, the scope for claimholders to terminate life insurance contracts early can become a source of liquidity vulnerability for insurance companies if a period of low interest rates ends with a sudden snapback in rates.

The report finds that while banks should generally be able to cope with solvency challenges in a low-for-long scenario, ICPFs would do less well. Even though the Working Group identified only a relatively limited amount of additional risk-taking by banks and ICPFs in response to low rates, a low-for-long scenario could still engender material risks to financial

stability. For example, even in the absence of greater risk-taking, a future snapback in interest rates could be challenging for financial institutions. Banks without sufficient capital buffers could face solvency issues, driven by both valuation and credit losses. ICPFs, instead, could face liquidity problems, driven either by additional collateral demands linked to losses on derivative positions or by spikes in early liquidations.

Committee on Payments and Market Infrastructure

Governance arrangements for critical OTC derivatives data elements (other than UTI and UPI) - consultative report
August 2018 No 182

The CPMI and IOSCO seek public comment on possible governance arrangements for critical OTC derivatives data elements other than the Unique Transaction Identifier (UTI), and the Unique Product Identifier (UPI) (CDE). CDE are the key data elements for reporting over-the-counter (OTC) derivatives transactions, in addition to the UTI and the UPI.

Analysis of Central Clearing Interdependencies
August 2018 No 181

This report by the Financial Stability Board, the Committee on Payments and Market Infrastructures, the International Organization of Securities Commissions and the Basel Committee on Banking Supervision maps interdependencies between central counterparties (CCPs) and clearing members and other financial service providers. The international standard-setters published a first report on central clearing interdependencies in July 2017.

To assess whether the findings of the July 2017 report were stable over time, the international standard-setters conducted another more streamlined data collection (as of October 2017) from the same 26 CCPs. The results are broadly consistent with the previous analysis with the data as of September 2016 and show that:

•Prefunded financial resources are concentrated at a small number of CCPs.

•Exposures to CCPs are concentrated among a small number of entities.

•The relationships mapped are characterised, to varying degrees, by a core of highly connected CCPs and entities and a periphery of less highly connected CCPs and entities.

•A small number of entities tend to dominate the provision of each of the critical services required by CCPs.

•Clearing members and clearing member affiliates are also important providers of other critical services required by CCPs and can maintain several types of relationships with multiple CCPs simultaneously.

There are, however, some changes to highlight in the interdependencies in central clearing. For instance, the concentration of client clearing activity has decreased. Compared with the last report, initial margins from clients are now concentrated in two CCPs, compared to only one with the data as of September 2016.

The analysis of interdependencies in central clearing is intended to provide useful inputs for designing supervisory stress tests and has informed the policy work as set out in the joint CCP workplan to promote CCP resilience, recovery and resolvability. The standard-setters published a report on the implementation of the workplan in July 2017.

Implementation monitoring of PFMI: Level 2 assessment report for Canada
August 2018 No 180

This report presents the CPMI's and IOSCO's conclusions on the Level 2 assessment of the Principles across all FMI types in Canada. The assessment reflects the status of Canada's legal, regulatory and oversight framework as of 30 June 2017. This assessment was conducted as a

peer review from August 2017 to April 2018.12 Accordingly, the assessment ratings reflect the implementation measures in place as of 30 June 2017.

This assessment is part of the IMSG's effort to conduct Level 2 assessments of the legal, regulatory and oversight frameworks implementing the Principles for all FMI types in the 28 jurisdictions participating in the PFMI implementation monitoring exercise. For practical reasons, the Level 2 assessments are being carried out sequentially for groups of jurisdictions that have reported that final implementation measures for the Principles are in force, corresponding to the highest rating in the Level 1 assessments.13

The counterparts for this assessment were the BoC, the federal Department of Finance, and certain provincial securities regulators that are members of the CSA, as these are the authorities responsible for the regulation, supervision and oversight of FMIs in Canada.

Implementation monitoring of PFMI: Fifth update to Level 1 assessment report
July 2018 No 179

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

This report provides jurisdictions' self-assessments of their progress, as of 1 January 2018, towards adopting the legislation, regulations and other policies that will enable them to implement the 24 Principles for FMIs and four of the five Responsibilities for authorities included in the PFMI. It shows that progress continues to be made by the 28 participating jurisdictions since the previous update in July 2017. This report is the last published L1 report.

Speeches

Rising to the occasion: central banking in a financially integrated world

Opening remarks by Mr Agustín Carstens, General Manager of the BIS, at the joint Danmarks Nationalbank-BIS conference on "Monetary policy spillovers in a financially integrated world" to mark the 200th anniversary of Danmarks Nationalbank, Copenhagen, 7 September 2018.

Are post-crisis statistical initiatives completed? Taking stock

Opening remarks by Mr Agustín Carstens, General Manager of the BIS, at the Ninth Irving Fisher Committee (IFC) Conference, Basel, 30 August 2018.

Global market structures and the high price of protectionism

Overview panel remarks by Mr Agustín Carstens, General Manager of the BIS, at the □Federal Reserve Bank of Kansas City's 42nd Economic Policy Symposium, Jackson Hole, Wyoming, 25 August 2018.

The level of global debt concerns me

Translation of an interview with Mr Claudio Borio, Head of the Monetary and Economic Department of the BIS, with □Portafolio, conducted by Mr Ricardo Ávila on 9 July 2018.

Keeping a close watch

Interview with Mr Agustín Carstens, General Manager of the BIS, in LatinFinance, conducted by Mr Kevin Gray and published online and in print format on 2 August 2018.

Low inflation and rising global debt: just a coincidence?

Article by Mr Claudio Borio, Head of the Monetary and Economic Department of the BIS, for the 70th anniversary of Zeitschrift für das gesamte Kreditwesen, published on 1 August 2018.

Proportionality in banking regulation

Speech by Mr Fernando Restoy, Chairman, Financial Stability Institute, Bank for International Settlements, at the Westminster Business Forum Keynote Seminar: "Building a resilient UK financial sector - next steps for prudential regulation, structural reform and mitigating risks", London, United Kingdom, 4 July 2018.*

"My message to young people: stop trying to create money"

Translation of an interview with Mr Agustín Carstens, General Manager of the BIS, in the Basler Zeitung, 25 June 2018.

The banks' bank is looking to open up

Translation of an interview with Mr Agustín Carstens, General Manager of the BIS, in the Basler Zeitung, 25 June 2018.

It's when markets are running hot that flags need raising

Overview Column by Mr Agustín Carstens, General Manager of the BIS, in the Financial Times, 25 June 2018. Read the original on the Financial Times website.

The Per Jacobsson Foundation Lecture, 2018

Per Jacobsson Lecture and panel discussion on the occasion of the Bank's Annual General Meeting, Basel, 24 June 2018.

Sustaining the momentum

Speech by Mr Agustín Carstens, General Manager of the BIS, on the occasion of the Bank's Annual General Meeting, Basel, 24 June 2018.

Macroprudential frameworks: experience, prospects and a way forward

Speech by Mr Claudio Borio, Head of the Monetary and Economic Department of the BIS, on the occasion of the Bank's Annual General Meeting, Basel, 24 June 2018.

Cryptocurrencies and the economics of money

Speech by Mr Hyun Song Shin, Economic Adviser and Head of Research of the BIS, on the occasion of the Bank's Annual General Meeting, Basel, 24 June 2018.

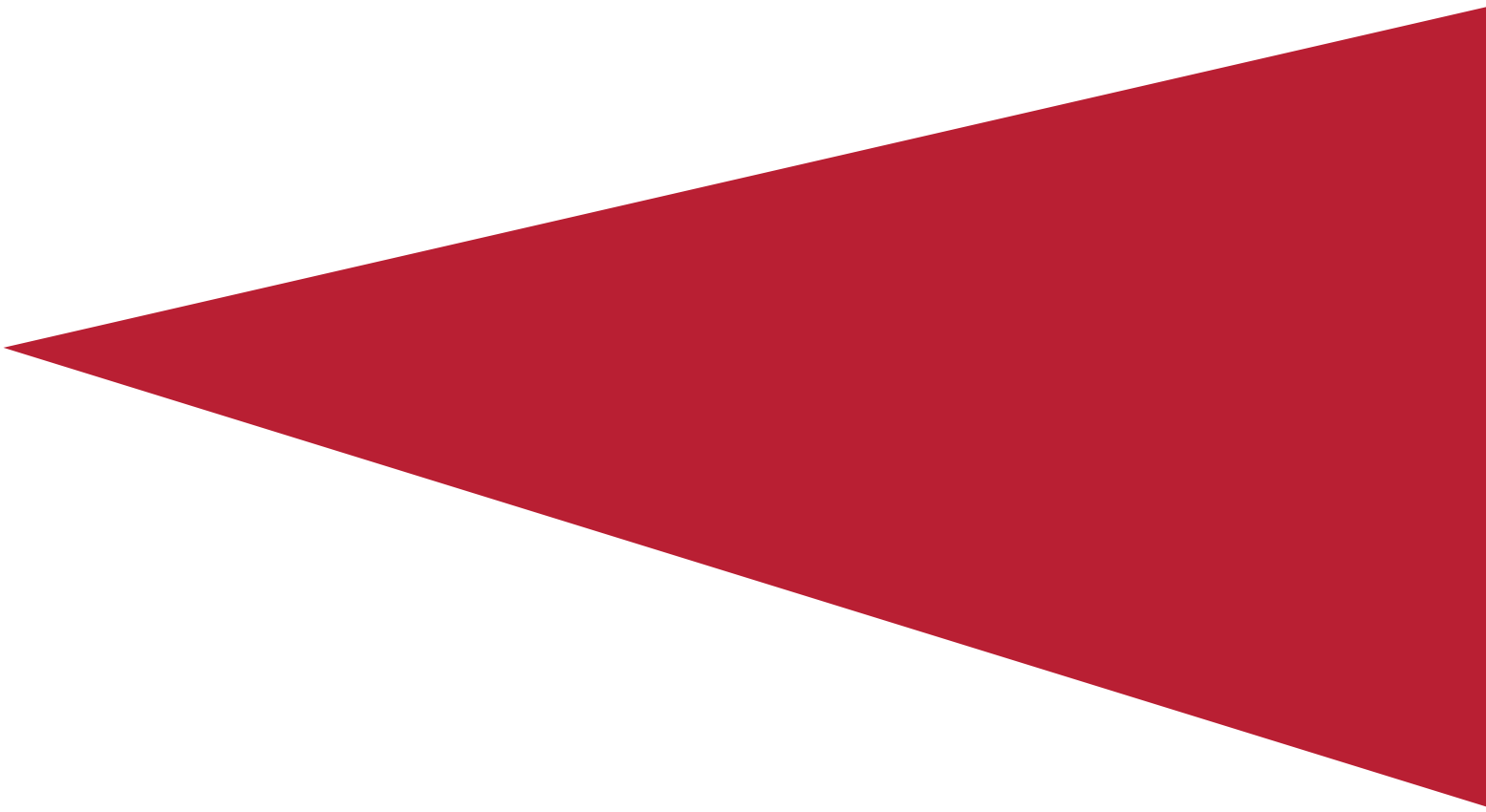
Fintech in EMEs: blessing or curse?

Panel remarks by Mr Luiz Awazu Pereira da Silva, Deputy General Manager of the BIS, at the CV Meeting of Central Bank Governors of CEMLA - Asuncion, Paraguay, 5 June 2018.*

Central banks and financial oversight

Speech by Mr Fernando Restoy, Chairman, Financial Stability Institute, Bank for International Settlements, at the Fundación Ramón Areces, Madrid, Spain, 4 June 2018.*

Promoting global monetary and financial stability



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