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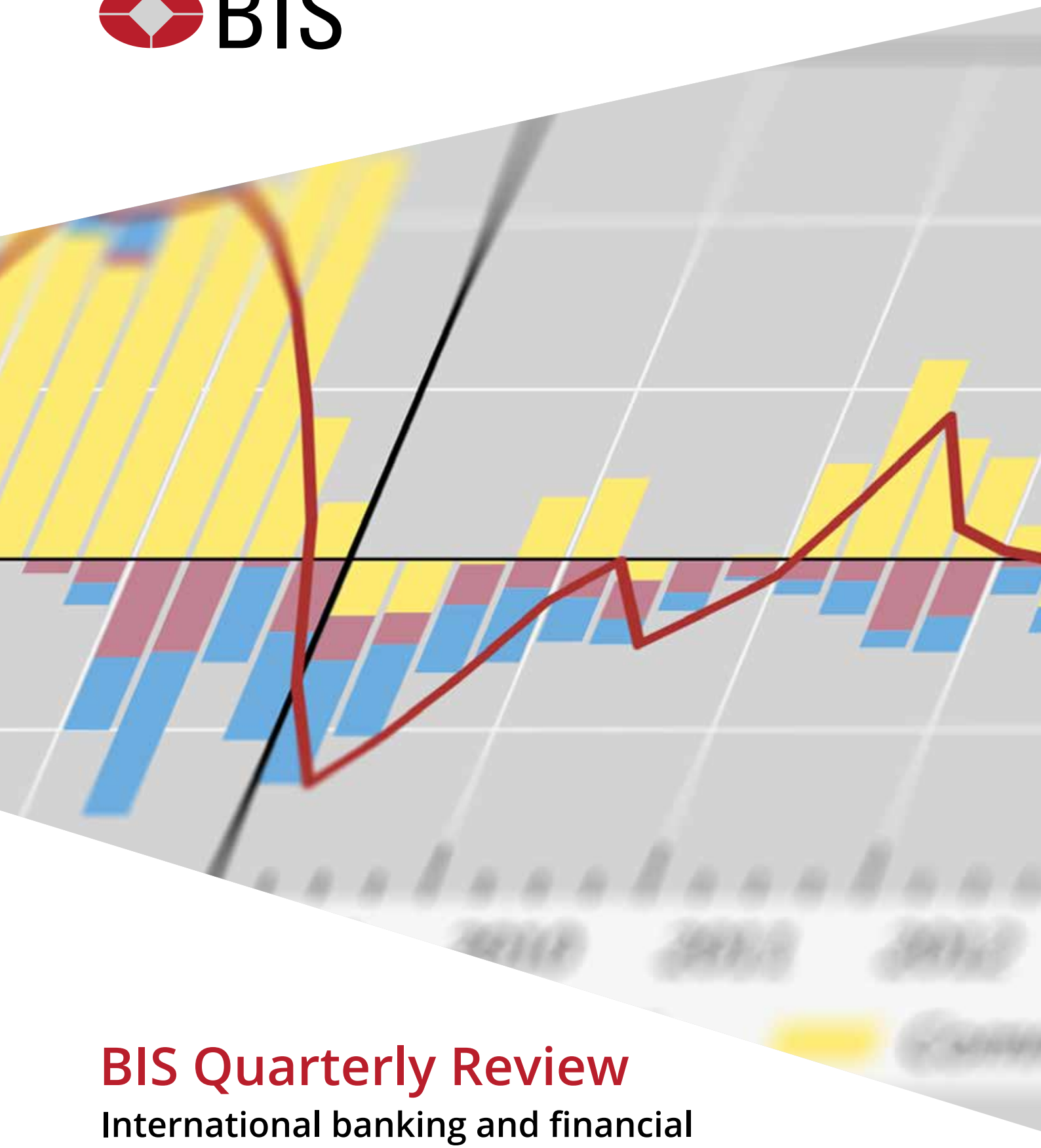

BIS Quarterly Review

International banking and financial market developments

December 2020

BIS Quarterly Review
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

ALL	Albanian lek	MXN	Mexican peso
ARS	Argentine peso	MXV	Mexican unidad de inversión (UDI)
AUD	Australian dollar	MYR	Malaysian ringgit
BGN	Bulgarian lev	NAD	Namibian dollar
BHD	Bahraini dinar	NGN	Nigerian naira
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 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
EUR	euro	SAR	Saudi riyal
GBP	pound sterling	SEK	Swedish krona
HKD	Hong Kong dollar	SGD	Singapore dollar
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
ISK	Icelandic króna	VES	bolívar soberano
JPY	Japanese yen	VND	Vietnamese dong
KRW	Korean won	XOF	CFA franc (BCEAO)
MAD	Moroccan dirham	ZAR	South African rand

Countries

AE	United Arab Emirates	CY	Cyprus
AF	Afghanistan	CZ	Czech Republic
AL	Albania	DE	Germany
AM	Armenia	DJ	Djibouti
AO	Angola	DK	Denmark
AR	Argentina	DM	Dominica
AT	Austria	DO	Dominican Republic
AU	Australia	DZ	Algeria
AZ	Azerbaijan	EA	euro area
BA	Bosnia and Herzegovina	EC	Ecuador
BD	Bangladesh	EE	Estonia
BE	Belgium	EG	Egypt
BF	Burkina Faso	ER	Eritrea
BG	Bulgaria	ES	Spain
BH	Bahrain	ET	Ethiopia
BI	Burundi	FI	Finland
BJ	Benin	FJ	Fiji
BM	Bermuda	FO	Faeroe Islands
BN	Brunei	FR	France
BO	Bolivia	GA	Gabon
BR	Brazil	GB	United Kingdom
BS	The Bahamas	GD	Grenada
BT	Bhutan	GE	Georgia
BY	Belarus	GH	Ghana
BZ	Belize	GN	Guinea
CA	Canada	GQ	Equatorial Guinea
CD	Democratic Republic of the Congo	GR	Greece
CF	Central African Republic	GT	Guatemala
CG	Republic of Congo	GW	Guinea-Bissau
CH	Switzerland	GY	Guyana
CI	Côte d'Ivoire	HN	Honduras
CL	Chile	HK	Hong Kong SAR
CM	Cameroon	HR	Croatia
CN	China	HT	Haiti
CO	Colombia	HU	Hungary
CR	Costa Rica	ID	Indonesia
CV	Cabo Verde	IE	Ireland

Countries (cont)

IL	Israel	MX	Mexico
IN	India	MY	Malaysia
IQ	Iraq	MZ	Mozambique
IR	Iran	NA	Namibia
IS	Iceland	NC	New Caledonia
IT	Italy	NG	Nigeria
JE	Jersey	NL	Netherlands
JM	Jamaica	NO	Norway
JO	Jordan	NR	Nauru
JP	Japan	NZ	New Zealand
KE	Kenya	OM	Oman
KG	Kyrgyz Republic	PA	Panama
KH	Cambodia	PE	Peru
KR	Korea	PG	Papua New Guinea
KW	Kuwait	PH	Philippines
KY	Cayman Islands	PK	Pakistan
KZ	Kazakhstan	PL	Poland
LA	Laos	PT	Portugal
LB	Lebanon	PY	Paraguay
LC	St Lucia	QA	Qatar
LK	Sri Lanka	RO	Romania
LR	Liberia	RS	Serbia
LS	Lesotho	RU	Russia
LT	Lithuania	RW	Rwanda
LU	Luxembourg	SA	Saudi Arabia
LV	Latvia	SC	Seychelles
LY	Libya	SD	Sudan
MA	Morocco	SE	Sweden
MD	Moldova	SG	Singapore
ME	Montenegro	SK	Slovakia
MH	Marshall Islands	SI	Slovenia
MK	North Macedonia	SR	Suriname
ML	Mali	SS	South Sudan
MM	Myanmar	ST	São Tomé and Príncipe
MN	Mongolia	SV	El Salvador
MO	Macao SAR	SZ	Eswatini
MR	Mauritania	TD	Chad
MT	Malta	TG	Togo
MU	Mauritius	TH	Thailand
MV	Maldives	TJ	Tajikistan
MW	Malawi	TL	East Timor

Countries (cont)

TM	Turkmenistan	VC	St Vincent and the Grenadines
TO	Tonga	VE	Venezuela
TR	Turkey	VG	British Virgin Islands
TT	Trinidad and Tobago	VN	Vietnam
TW	Chinese Taipei	XM	euro area
TZ	Tanzania	ZA	South Africa
UA	Ukraine	ZM	Zambia
US	United States	1C	International organisations
UY	Uruguay	1Z	British West Indies
UZ	Uzbekistan		

Search for yield sustains buoyant markets

Risky assets picked up momentum with positive vaccine news in early November, after remaining range-bound for most of the period under review.[1] Initially, an uncertain US election outcome and the second wave of Covid-19 kept valuations in check. Stock markets, particularly in the United States and China, alternated between brief rallies and sharp sell-offs. Subsequently, positive news on vaccine development boosted market sentiment and led investors to rotate towards sectors that had been severely hit by the pandemic outbreak. The overall market rise seemed to reflect the improved business conditions. However, concerns remained about the daylight between valuations, which are still above or near their already stretched pre-pandemic levels, and economic prospects, which are still uncertain.

A divergence in the assessments of corporate vulnerabilities may be emerging. Credit spreads in advanced economies saw some volatility but ultimately compressed further, approaching pre-pandemic lows. On the other hand, banks tightened lending standards throughout the review period. Investors' search for yield and the specifics of policy support appeared to underpin these contrasting developments.

Central banks maintained their accommodative stance as the second wave of Covid-19 arrived. In major jurisdictions, they kept their outstanding measures unchanged but emphasised their resolution to act in response to the economic fallout. In other advanced economies (AEs) and emerging market economies (EMEs), some central banks cut rates and/or scaled up asset purchases.

With continued central bank support, government bond yields in major AEs remained unusually low. Long-term US yields continued the upward trend started after the Treasury's August announcement of another increase in long-term bond issuances. That said, they experienced some volatility around election day. European sovereign yields trended down, as investors seemed to be expecting further policy easing on the back of low inflation and a weak economic outlook. This intensified search for yield, which led to further tightening of periphery sovereign spreads.

Sentiment towards EMEs improved. Attractive yields underpinned robust portfolio flows into China. For other EMEs, strong inflows to dollar-denominated bond funds continued and local currency bond funds began to see modest inflows in the course of November. Yields remained low in most cases, supported by domestic monetary policy and changing trade prospects.

The US dollar overall weakened in November, after trading sideways vis-à-vis both AE and EME currencies. The renminbi's appreciation was especially pronounced, as sentiment supporting Chinese assets strengthened. Some degree of differentiation in EMEs' currency strength appeared to be influenced by structural features of their economies. After the pandemic outbreak, and continuing during the review period, tech-heavy EMEs and those more deeply involved in manufacturing global value chains saw their currencies strengthen relative to those of commodity producers.

[1] 7 September to 30 November 2020.

Key takeaways

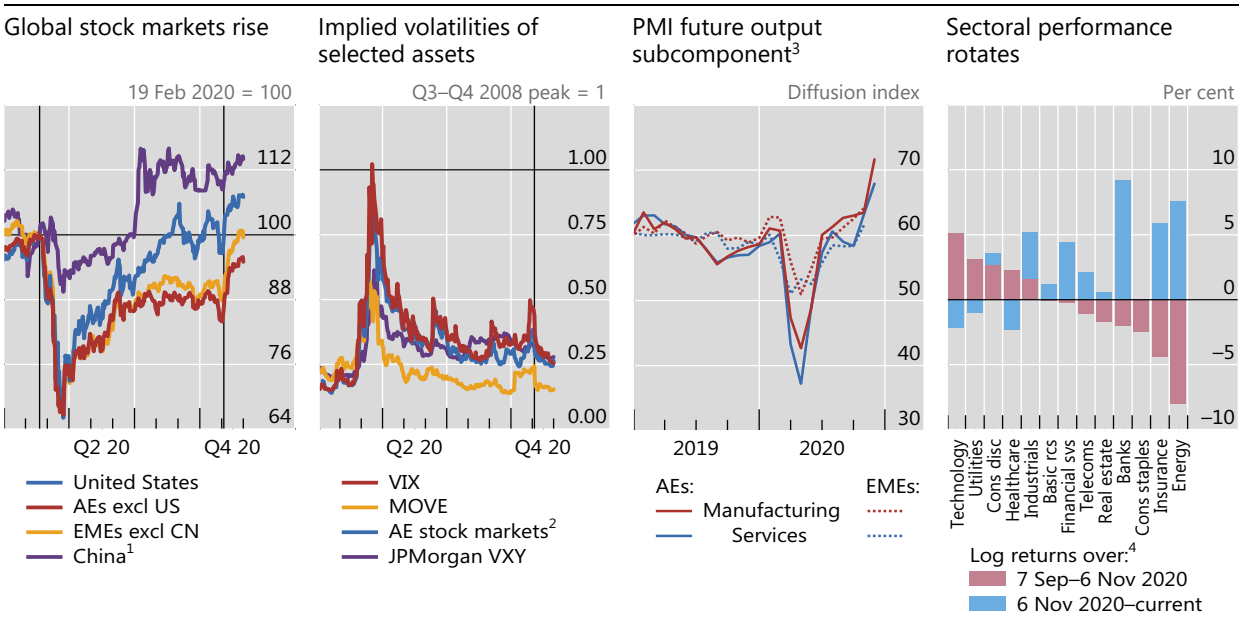
- Risky assets received a fillip from positive vaccine news and the US election, although concerns about the daylight between valuations and the still uncertain economic prospects persisted.
- Government bond yields remained unusually low on the back of supportive monetary policy, sustaining a search-for-yield environment.
- Currency strength differed across EMEs, reflecting in part the importance of technology and manufacturing in the respective economies.

Risky asset prices rise and rotate

Lacking clear direction in September and October, financial markets received a boost in early November from positive news on the development of Covid-19 vaccines. In equity markets, this mainly benefited sectors more vulnerable to the pandemic. In parallel, corporate spreads narrowed further, which contrasted with a certain tightening of banks' lending standards.

Going into the US election, the stock market had traded within a wide range after a sell-off at the beginning of the period under review (Graph 1, first panel). The correction in September was concentrated in technology stocks, which had experienced the largest gains beforehand. At the same time, contrasting with prevailing patterns in the past two decades, US Treasuries sold off (Box A). The outcome of the election triggered a swift rally in stock prices.

Stock markets rise and rotate — Graph 1



Basic rcs = basic resources; Cons disc = consumer-discretionary; Cons staples = consumer staples; Financial svs = financial services.

The vertical lines in the first panel indicate 19 February 2020 (S&P 500 pre-Covid-19 peak) and 3 November 2020 (US election day). The vertical line in the second panel indicates 3 November 2020.

[1] Shanghai composite equity index. [2] Implied volatility of the EURO STOXX 50 and Nikkei 225 indices; weighted average based on market capitalisation. [3] A value of 50 indicates that the number of firms reporting improvement is the same as the number reporting deterioration. Weighted average based on GDP and PPP exchange rate. [4] Log returns of the S&P 500 index over the two respective periods are subtracted from every corresponding return.

Sources: Bloomberg; Datastream; IHS Markit; BIS calculations.

Box A

US Treasuries and equity sell-offs: is the hedge faltering?

Fernando Avalos and Dora Xia[①]

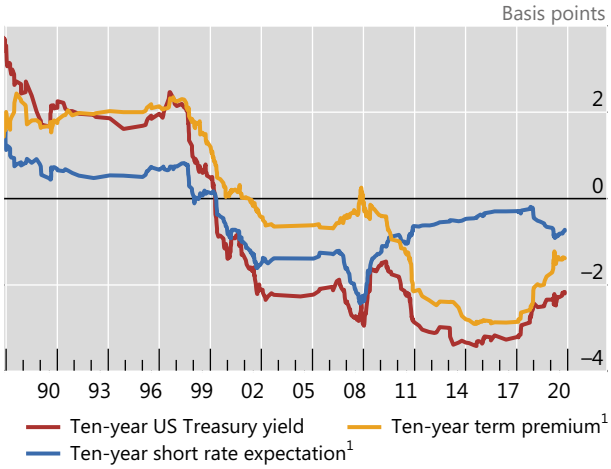
Over the past two decades, US Treasuries have served as a hedge against equity risk. However, this attribute has been called into question, as bond and equity markets have experienced simultaneous sell-offs in recent years. In this box, we focus on the hedging properties of US government bonds in the context of stock sell-offs, ie their status as safe haven assets. We find that this status has indeed weakened in recent years. Possible contributing factors are the Federal Reserve's limited easing space and bond dealers' reduced appetite to intermediate.

The turn of the century witnessed a marked change in the behaviour of US Treasuries during large equity sell-offs (corresponding to daily returns below the 5th percentile). Before the 2000s, 10-year US government bond yields tended to increase by 2 basis points when the S&P 500 index dropped by 1% (Graph A, left-hand panel, red line), which meant that bond and stock prices declined together. After that, US Treasuries became an effective hedge to stock market losses, as yields generally declined (and hence bond prices rose) during equity market downturns. The timing of the shift is in line with that found in the literature.②

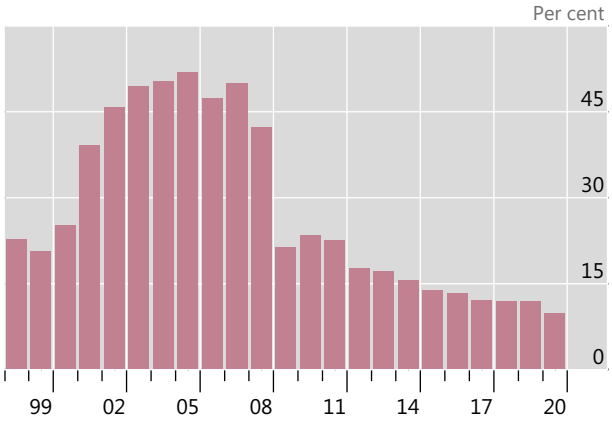
Time-varying relationship between bond and stock markets

Graph A

Response of 10-year Treasury yields to S&P 500 sell-offs



Volume of primary dealers' transaction of Treasuries[2]



[1] The decomposition is obtained from Adrian et al (2013). [2] Average yearly primary dealers' transaction data for coupons as percentage of total marketable outstanding debt.

Sources: T Adrian, R Crump and E Moench, "Pricing the term structure with linear regressions", *Journal of Financial Economics*, April 2013; Federal Reserve Bank of New York; Bloomberg; BIS calculations.

This shift reflects a change in the correlation between inflation and economic activity, which seems related to the changing interactions between monetary policy and the business cycle.③ Until the 1980s, recessions had been brought about mostly by central banks *tightening* in the face of inflationary pressures. Correspondingly, investors expected periods of low economic activity – and the attendant low stock prices – to go hand in hand with high inflation and/or high interest rates. This translated into higher Treasury yields and low bond prices. The interaction changed afterwards. Recessions became more likely to follow financial busts,④ to which authorities tended to respond by *loosening* monetary policy, and often persistently so.⑤ Eventually, falling stock prices started being associated with low interest rates and high bond prices, making Treasuries a hedge against downside risk in the equity market.

The key role of monetary policy expectations in those dynamics have affected, over time, different components of long-term Treasury yields. When interest rates were the primary monetary policy tool – that is, before the effective zero lower bound (ZLB) became a constraint – expectations of short-term rates drove the relationship between those yields and equity returns (Graph A, left-hand panel, blue line). Later, when the central bank resorted to asset purchases at the ZLB, term premia became the main driver of this relationship (left-hand panel, yellow line).

Signs have emerged that the effectiveness of US Treasuries as a hedge to large equity losses may have declined in recent years. The response of 10-year yields to S&P 500 sell-offs has become more muted since 2018 (Graph A, left-hand panel, red line), possibly reflecting the Federal Reserve's limited easing space. As Fed officials have consistently communicated their reluctance to introduce negative interest rates, this not only puts a floor under short-term rates but also limits the potential decline of long-term nominal yields, regardless of any additional easing measures considered.

The diminished effectiveness of the hedge could also reflect in part dealers' waning appetite to smooth transient supply or demand shocks in the US Treasury secondary market, even outside periods of generalised stress.⑥ As discussed elsewhere, their participation in this market has steadily receded since the Great Financial Crisis of 2007–09, while other market participants, such as hedge funds and principal trading firms, have emerged as liquidity providers (Graph A, right-hand panel).⑦ And these new participants have behaved in a more opportunistic manner, being less willing to step in when liquidity is most needed. All else equal, the resulting impairment of fair-weather liquidity conditions would increase liquidity premia and drive yields up (and prices down).

① The views expressed are those of the authors and do not necessarily reflect the views of the Bank for International Settlements. ② See R Clarida, "Monetary policy, price stability, and equilibrium bond yields: success and consequences", remarks at the High-level Conference on Global Risk, Uncertainty and Volatility, November 2019. ③ See J Campbell, C Pflueger and L Viceira, "Macroeconomic drivers of bond and equity risks", *Journal of Political Economy*, vol 128, no 8, August 2020. ④ See C Borio, M Drehmann and D Xia, "The financial cycle and recession risk", *BIS Quarterly Review*, December 2018. ⑤ See M Drehmann, C Borio and K Tsatsaronis, "Characterising the financial cycle: don't lose sight of the medium term!", *BIS Working Papers*, no 380, June 2012; and J Powell, "New economic challenges and the Fed's monetary policy review", remarks at the Jackson Hole Symposium, August 2020. ⑥ See Z He, S Nagel and Z Song, "Treasury inconvenience yields during the COVID-19 crisis", *NBER Working Papers*, no 27416, June 2020. ⑦ See T Adrian and J Kiff, "Market liquidity, leverage, and regulation ten years after the crisis", *World Economic Forum*, December 2018.

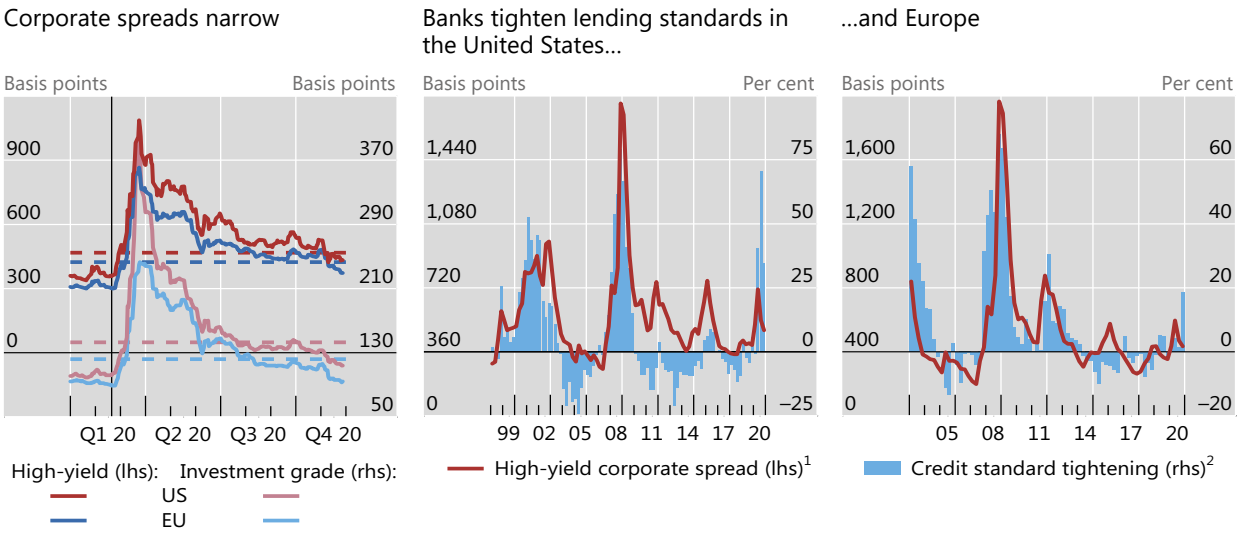
Forward-looking gauges of volatility reflected in part investors' perceived policy uncertainty. From early October, the implied volatility of major stock indices in AEs trended upwards, and the VIX jumped during the week before the US polls (Graph 1, second panel). The MOVE, which reflects the implied volatility of options on the main US Treasury benchmarks, also saw a material step-up as investors began to price in the possibility of a large fiscal expansion and the resulting higher supply of Treasuries. As the contours of the election outcome began to emerge midway through the first week of November, implied volatilities quickly fell back.

News on vaccine development boosted sentiment in November. Before the news, consistent with views prevailing earlier in the year, top outperformers included the technology and healthcare sectors, while financials and the energy sector underperformed (Graph 1, fourth panel, red bars). After the news, leading indicators of business conditions, which were already on the mend, turned sharply upwards (third panel). In consonance, stock markets rallied, benefiting sectors more vulnerable to the pandemic. Indeed, the rally generated a rotation towards the underperformers. In particular, firms within insurance, banking and energy saw the largest gains, while technology stocks lost some ground against the S&P 500 index (fourth panel, blue bars). This rapid rotation may have triggered the unwinding of highly leveraged positions on previous outperforming sectors, leading to extreme intraday price swings.

Corporate bond spreads tightened further, approaching pre-pandemic levels. The buoyancy of corporate bond markets contrasted with the uncertain medium-term global economic outlook, raising questions about the daylight in evidence between the underlying risks and spreads. The September equity sell-off had caused some short-lived volatility, particularly in the high-yield (HY) segment (Graph 2, left-hand panel). However, spreads narrowed soon afterwards and fell below their long-term averages. The spread compression was particularly noticeable in the investment grade (IG) segment.

Corporate spreads remain compressed while banks tighten standards

Graph 2



The vertical line in the left-hand panel indicates 19 February 2020 (S&P 500 pre-Covid-19 peak); the dashed lines indicate 2005–current medians.

[1] Option-adjusted spreads. [2] Net percentage of survey respondents who observed at least some tightening of credit standards.

Sources: ECB; Board of Governors of the Federal Reserve System; Bloomberg; ICE BoAML indices; BIS calculations.

Compressed credit spreads contrasted with banks' more cautious lending attitude. In the past, conditions in corporate credit and bank lending markets often moved in sync. This time around, though, banks in the United States and Europe continued to tighten their lending standards into October, while credit spreads have narrowed (Graph 2, centre and right-hand panels). The divergence is likely to have resulted from central banks' support in corporate bond markets. That said, the announcement by the US Treasury in late November regarding the discontinuation of the corporate credit facilities met a muted market response. Perhaps more importantly, investors' search for yield in a low interest rate environment contributed to credit spread narrowing. The same driver seemed to underpin the lengthening maturities of prime money market funds' portfolios (Graph 3, left-hand panel).

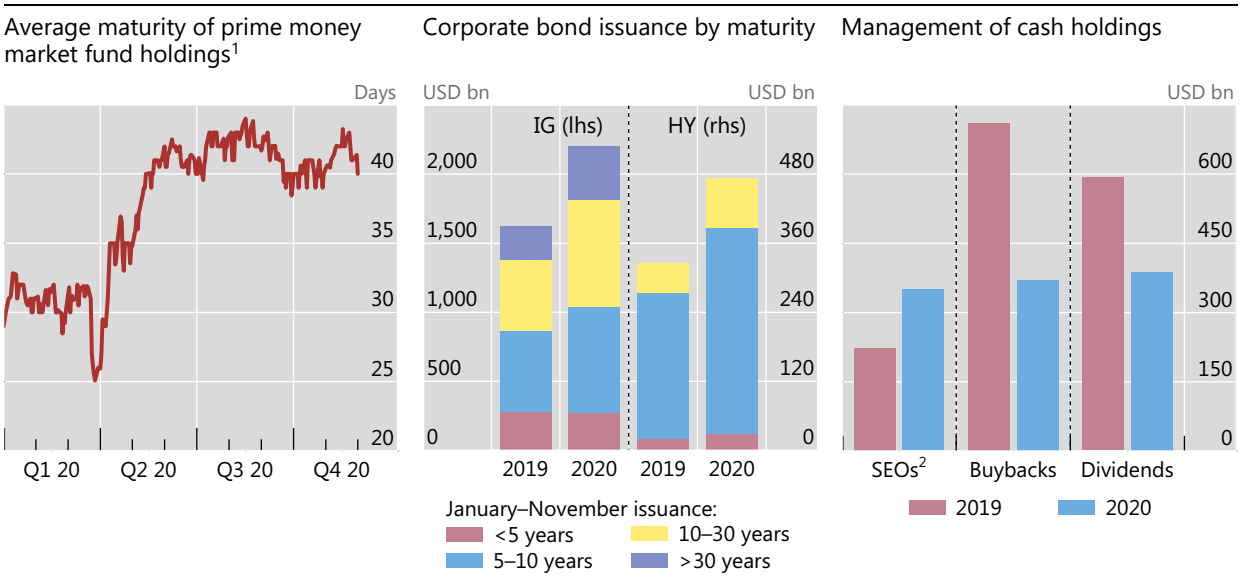
The very easy financial conditions in credit markets supported corporates' efforts to shield their balance sheets from liquidity stress. Corporates in AEs have issued bonds at record pace this year, almost entirely at the longest end of the maturity spectrum, within both the IG and HY segments. Issuance of securities with tenors of five years or less changed little from last year, but that of paper longer than 30 years (IG) or 10 years (HY) increased by more than 50% (Graph 3, centre panel).

In general, firms reduced their cash outlays. As buybacks dropped by more than half, dividends also saw double-digit reductions in comparison with 2019 (Graph 3, right-hand panel). Also, companies actively enhanced their cash positions through seasoned equity offerings to investors.

Such strategies, however, may offer only partial protection. The empirical evidence tends to suggest that cash holdings may mitigate liquidity risks, but they can do little to alleviate debt service burdens, which are key drivers of solvency problems. Moreover, when cash holdings are raised through debt issuance, they go hand in hand with higher debt service burdens, which can actually make firms more vulnerable to weak demand and financial shocks.[2]

[2] See the feature entitled "The financial vulnerabilities driving firms to the exit" in this issue.

Search for yield enables corporates to shield their balance sheets Graph 3



IG = investment grade; HY = high-yield.

[1] Median weighted average maturity calculated on a sample of 78 prime institutional and 64 prime retail money market funds as classified by CRANE. [2] Seasoned equity offerings.

Sources: Bloomberg; CRANE; Dealogic; BIS calculations.

Supportive monetary policies keep rates low

Government bond yields remained subdued during the period under review, on account of supportive monetary policies. Globally, negative-yielding debt climbed to $17.5 trillion, on a par with all-time highs. This pushed investors into riskier assets as they searched for yield, which broadened the range of low- or negative-yielding assets. That said, long-term yields in the United States and Germany decoupled, reflecting different economic and policy outlooks, and government bond supply.

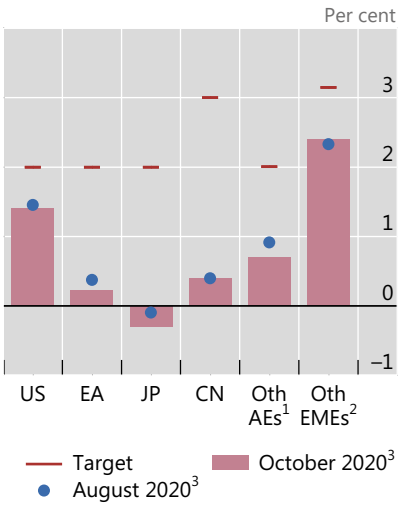
Across the globe, the actual and prospective monetary policy stance remained very accommodative. In fact, a number of central banks eased further or signalled that possibility, not least since in most jurisdictions inflation continued to undershoot targets, sometimes by a large margin (Graph 4, left-hand panel). Central banks in major economies kept their outstanding measures unchanged. And the Federal Reserve and the ECB adjusted their communications. Both of them emphasised continued vigilance regarding the economic developments, and qualified the scope of their outstanding actions.[3] Some central banks in other AEs, such as Australia and the United Kingdom, expanded their quantitative easing operations, while some EME central banks (eg Colombia, Indonesia and Mexico) cut their policy rates.

[3] In September, the Fed pointed out that its asset purchases would also aim to foster accommodative financial conditions, in addition to sustaining proper market functioning. In October, the ECB indicated that it expected to significantly recalibrate its policy settings in December, in response to the updated economic outlook.

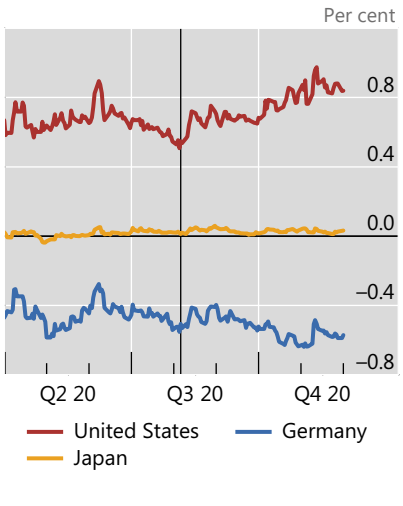
Government bond yields stay at low levels

Graph 4

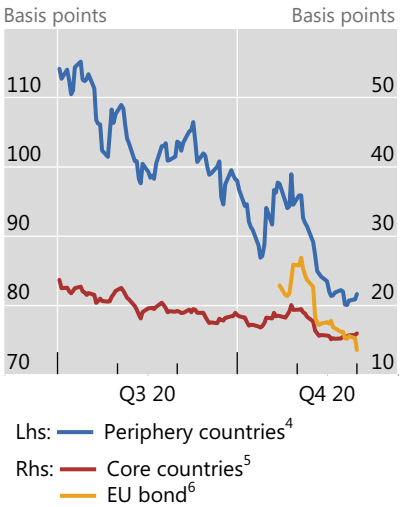
Inflation remains subdued



Ten-year government bond yields



Ten-year EU sovereign spreads vis-à-vis German bund



The vertical line in the centre panel indicates 5 August 2020 (US Treasury announcement of an increase in long-term bond issuance).

[1] Weighted average of AU, CA, CH, GB, NO, NZ and SE. [2] Weighted average of BR, CL, CO, CZ, HU, ID, KR, MX, PE, PH, PL. RU, TH and ZA. [3] Core inflation. [4] Simple average of ES, IT and PT. [5] Simple average of AT, FR and NL. [6] Ten-year EU bond issued under the SURE (Support to mitigate Unemployment Risk in an Emergency) programme.

Sources: Bloomberg; Datastream; BIS calculations.

On the back of central bank support, government bond yields in most major AEs remained generally contained. Yields trended downwards in Germany (Graph 4, centre panel), while remaining flat in Japan, on account of continued yield curve control policy. In the United States, yields had tended to increase after the US Treasury announced a material expansion in long-term debt issuance in August.

The divergence between the developments in long-term government bond yields in the United States and Germany seemed connected, in part, to the different economic outlooks. Europe's dimmer long-term prospects may have led investors to price in a more accommodative monetary policy stance. Moreover, Germany issued relatively less debt for investors to absorb than the United States (Box B).

Low, actually negative, yields in core European government bonds spilled over to other borrowers. The European Commission successfully placed two tranches of long-term bonds to fund the unemployment support scheme. The yield on the new bonds at issuance stood somewhat above that of core EU members, but still in negative territory. Moreover, the Chinese government issued its first negative-yielding euro-denominated bond in November. All these issues were massively oversubscribed. Finally, some corporate debt also traded with negative yields, to the tune of more than $2 trillion, towards the end of the review period.

Sovereign spreads of European periphery countries tightened further, partly reflecting investors' continued search for yield. Overall, the spreads on periphery long-term bonds tightened by over 15 basis points. For some countries, such as Portugal and Spain, 10-year yields approached zero. There was some volatility in late October as the European Recovery Fund faced some obstacles in its parliamentary confirmation (Graph 4, right-hand panel), but subsequently the spreads resumed their general downward trend.

Government bond yields and the dynamics of duration supply

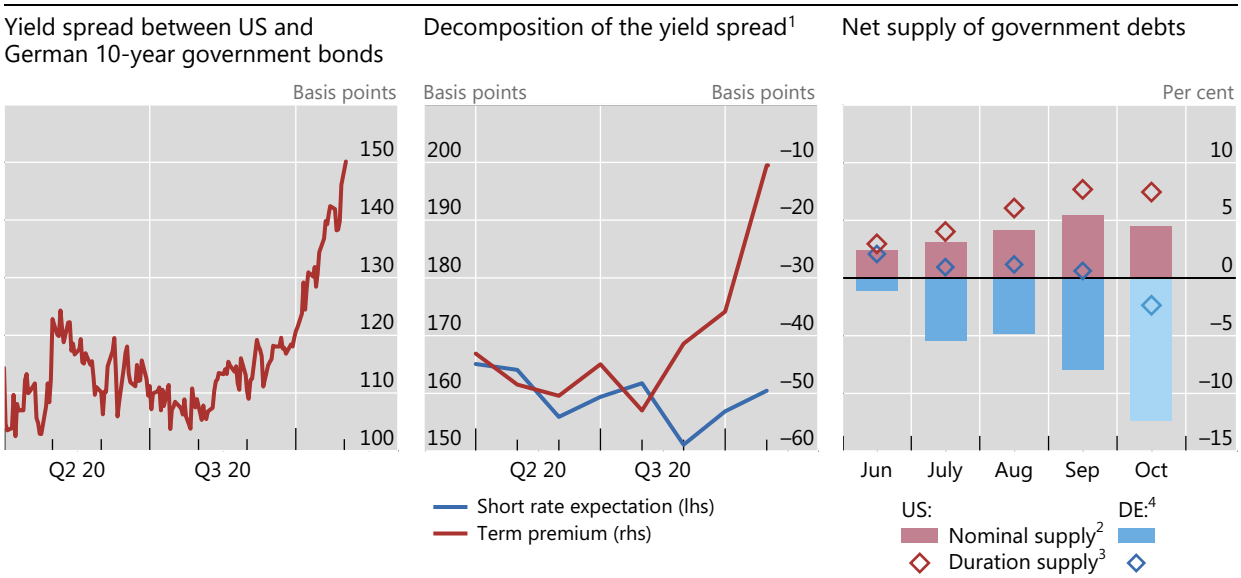
Fernando Avalos and Dora Xia[①]

US and German 10-year government bond yields have gradually diverged since August. While US rates stepped upwards, German rates trended downwards. As a result, the 10-year yield spread has widened by about 40 basis points (Graph B, left-hand panel). In this box, we break down long-term yields into their two main components: an expectation of future short-term rates and a term premium. Based on this decomposition, we find that the widening of the spread appears to have been largely driven by diverging term premia. We argue that this divergence is explained, in part, by opposing trends in the net government supply of long-term bonds (net of central bank purchases). In addition, differing economic outlooks may have played a role.

Diverging US and German yields can reflect shifting expectations about the relative path of short-term interest rates and/or term premia. To assess the relative importance of each component, we estimate them for US and German yields using a no-arbitrage model of the respective term structures of interest rates. Then, we calculate the spreads implied by each component. From August to October, the expected rate spread barely moved, while the term premia spread increased by about 40 basis points and thus accounted for most of the yield spread widening (Graph B, centre panel).②

Divergence between US and German 10-year government bond yields

Graph B



[1] The decomposition is based on the application of a no-arbitrage term structure model to interest rates in each jurisdiction. Based on Adrian et al (2013). [2] Nominal supply is calculated as the percentage change from May 2020 in the net debt outstanding (net of central bank's holdings). [3] Duration supply is calculated as the percentage change from May 2020 in the net 10-year equivalent debt outstanding (net of central bank's holdings). When calculating the 10-year equivalents, we approximate duration by the remaining time to maturity. [4] Nominal and duration supply for October (in lighter blue) have been computed using partially estimated central bank's holdings instead of official figures.

Sources: T Adrian, R Crump and E Moench, "Pricing the term structure with linear regressions", *Journal of Financial Economics*, April 2013; ECB; Federal Reserve Bank of New York; Bundesrepublik Deutschland Finanzagentur GmbH; US Department of the Treasury; Bloomberg; BIS calculations.

An important driver of term premia is the net supply of government debt, defined as the debt available to private investors once purchases from price-inelastic participants, such as central banks, have been removed.③ For example, the net nominal supply declined after the Great Financial Crisis of 2007–09 as a result of major central banks' asset purchases. This seemed to have compressed term premia and long-term yields in these countries.④ In addition to the supplied amount of debt, the supplied duration (specifically, long-term bonds) also matters for term premia.⑤ For instance, during 2011–12 the Federal Reserve purchased long-term bonds funded by sales of shorter bonds (Operation Twist). This operation shrank the duration supply, contributing to further compression of term premia.

Conversely, the recent widening of term premia spreads may have reflected to a considerable extent the relative increase of the net supply of long-term US sovereign bonds to the private sector. US Treasury ramped up the debt issuance after the Covid-19 outbreak. Thus, despite continued heavy purchases by the Fed, private investors had to absorb a growing amount of US government bond supply (Graph B, right-hand panel, red bars). By contrast, hefty purchases by the ECB through its own asset purchase programmes, together with contained issuance by the German government, reduced the outstanding stock of German sovereign bonds available to private investors (right-hand panel, blue bars). In fact, the euro area as a whole has seen a reduction in sovereign bond supply since June.

The US Treasury also lengthened the maturities of its debt issues. This led to an even larger increase of net supply, measured in duration terms (Graph B, right-hand panel, red diamonds). In contrast, the German government bond net duration supply has stayed relatively stable since May (right-hand panel, blue diamonds).

The expectation of heavier US government bond supply (and larger fiscal stimulus) from the next US administration may have further widened the spread before the election. As the election result made it more likely that the fiscal package would be smaller than initially expected, the yield spread saw a temporary compression before resuming its upward course.

① The views expressed are those of the authors and do not necessarily reflect the views of the Bank for International Settlements. ② As a robustness check, we replicated the analysis using survey data on short rate expectations. The result suggests an even larger role of the term premia spread as the expected rate spread narrowed between Q2 and Q3 2020. ③ Other factors affecting the term premia may include business cycle conditions, the uncertainty about the projected path of short rates, and the hedging property of bonds. For a review, see B Cohen, P Hördahl and D Xia, "Term premia: models and some stylised facts", *BIS Quarterly Review*, September 2018. ④ See eg B Bernanke, "Why are interest rates so low, part 4: term premiums", *Brookings Institution Blog*, April 2015. ⑤ See D Vayanos and J-L Vila, "A preferred habitat model of the term structure of interest rates", *NBER Working Papers*, no 15487, November 2009.

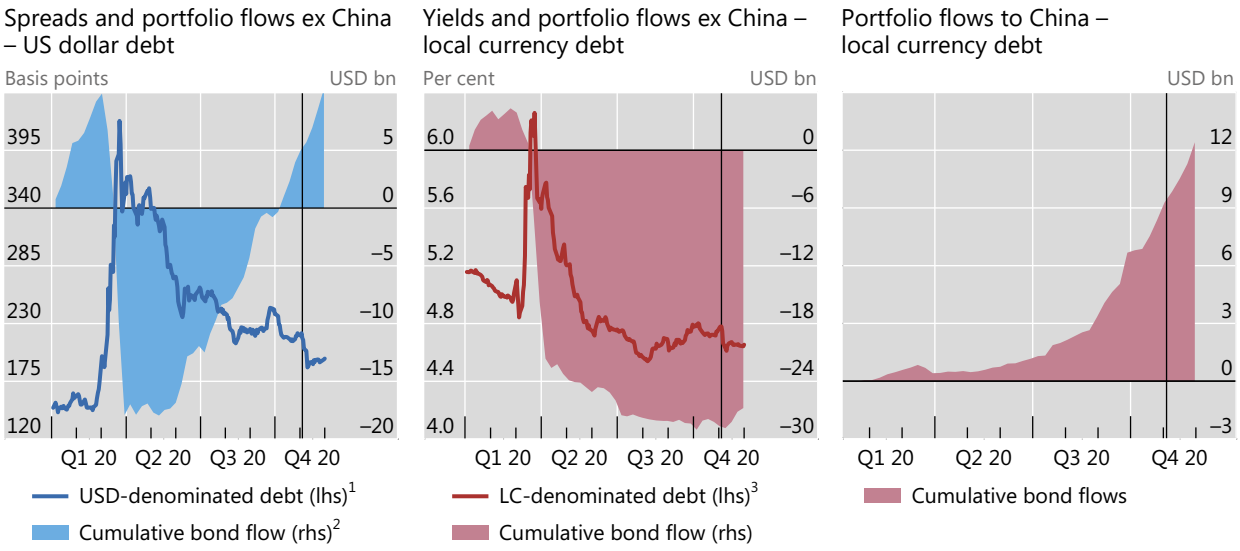
Sentiment towards EME fixed income markets improved after the US election. Portfolio inflows into funds investing in dollar-denominated fixed income assets from EMEs ex China continued to gain traction (Graph 5, left-hand panel). Their year-to-date cumulative amount turned positive again in September, and approached the pre-pandemic outbreak levels towards the end of the review period. Local currency EME funds ex China booked modest inflows in November, but the corresponding year-to-date cumulative portfolio flows remained deep in negative territory (centre panel). On the other hand, China saw robust inflows into local currency bond funds on the back of its relatively attractive yields and the announced inclusion of its government securities in a major bond index (right-hand panel).[4]

EME yields remained broadly stable in both the local currency and the dollar-denominated segments. In addition to the improved sentiment, this stemmed from EME central banks' accommodative monetary policy, which built upon the global easing environment and soft inflation numbers. The yields took a step down in the wake of the US election, probably reflecting investors' expectation of a more benign trade outlook.

[4] On 24 September 2020, FTSE Russell announced the inclusion of Chinese bonds in the World Government Bond Index over a period of 12 months, starting in October 2021.

EME bond markets remain resilient

Graph 5



LC = local currency. The vertical line in each panel indicates 3 November 2020 (US election day).

[1] Simple averages of JPMorgan Chase EMBI Global sub-indices, stripped spreads. [2] Flows to hard and blend currency bond funds. [3] Simple averages of JPMorgan Chase GBI Global sub-indices, traded yields.

Sources: EPFR; JPMorgan Chase; BIS calculations

EME currencies follow different paths

The US dollar weakened overall, particularly after the news on vaccine progress. EME currency strength varied, and the differentiation seemed to be related to the respective economies' technology intensity and/or involvement in global value chains.

The broad dollar performance largely mirrored changes in overall market sentiment during the review period. The greenback first appreciated as uncertainties around the US election and the second wave of Covid-19 built up, in a pattern common to risk-off environments. The gain then vanished after the preliminary election results and positive news on vaccine development. On balance, the dollar depreciated moderately vis-à-vis both EME and AE currencies, whereas the depreciation had been mostly against AE currencies in earlier quarters (Graph 6, left-hand panel).

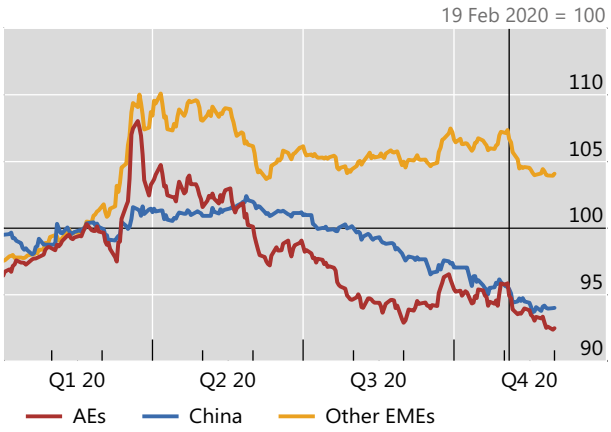
The US dollar depreciation was especially noticeable vis-à-vis the Chinese currency. The renminbi continued its trend appreciation that had begun in May. Its strong performance might reflect the more successful pandemic containment policies and the faster economic recovery in China. Moreover, the currency may have benefited from strong portfolio inflows, not only to bond funds (as discussed) but also to equity funds (Graph 6, right-hand panel). This stood in contrast to other EMEs, which as a group witnessed only a limited equity flow recovery. The renminbi experienced some volatility on the heels of the unexpected halting of the initial share offering of a fintech company, and defaults by several highly rated corporates.

Currency strength differed across EMEs during the review period, confirming a pattern already seen earlier in the year. The differentiation seemed to reflect, to a

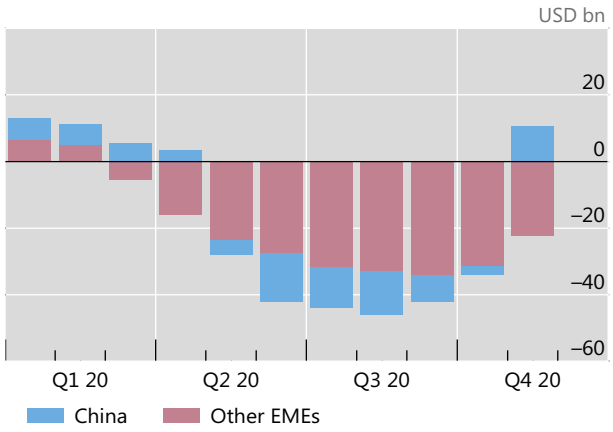
Amid overall dollar weakness, renminbi appreciates further with robust sentiment

Graph 6

US dollar exchange rates[1]



Cumulative net flows to Chinese equity funds turn positive



The vertical line in the left-hand panel indicates 3 November 2020 (US election day).

[1] Simple averages of regional economies. A decrease indicates a depreciation of the US dollar.

Sources: Bloomberg; EPFR; BIS calculations.

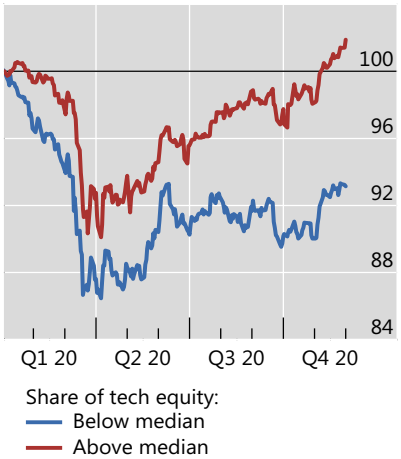
considerable extent, the sectoral composition of the respective economies. In part, this echoed the tech theme that had been driving equity valuations since the pandemic was declared. Currencies in jurisdictions with heavier weight on technology companies, eg Chinese Taipei and Korea, surpassed their pre-pandemic levels (Graph 7, left-hand panel). In addition, the currencies of EME jurisdictions more deeply embedded in global value chains also recouped their March losses, as the global manufacturing sector regained momentum (centre panel). In contrast, the currencies of countries more reliant on commodity exports, eg Russia and some Latin American countries, saw a limited rebound from the depths of the March turmoil (right-hand panel).

Economic fundamentals drive differing EME currency strength[1]

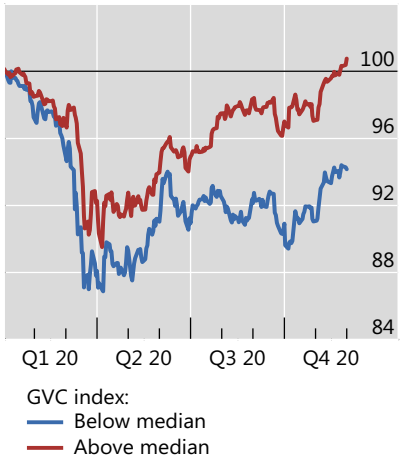
2 January 2020 = 100

Graph 7

Technology intensity



GVC participation[2]



Commodity exports

[1] An increase represents an appreciation of the US dollar. Grouping based on medians of each respective variable within a sample of 21 EMEs. [2] GVC = global value chain. Index calculated as the sum of added value and intermediate goods imports over the sum of total imports and exports.

Sources: IMF, *Directory of Trade*; OECD; WTO; Refinitiv Eikon; national data; BIS calculations.

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The broad dollar exchange rate as an EME risk factor[1]

US dollar appreciation is associated with a darkening of the economic outlook for emerging market economies (EMEs). Using data from 21 EMEs, we find that a 1 percentage point (ppt) appreciation shock to the dollar against a broad basket of currencies dampens the growth outlook by over 0.3 ppt and growth-at-risk (the lowest 5% of growth outcomes) by 0.6 ppt. Dollar appreciation adversely affects investment growth-at-risk in particular and even export growth-at-risk, indicating that global financial conditions play a key role. Indeed, the negative impact is significantly larger in countries with high dollar debt or high foreign presence in local currency bond markets.

JEL classification: F31, F34, F36, F41, F44.

The gyrations of the broad US dollar exchange rate over the past few decades have been linked to marked shifts in global economic activity. In particular, dollar strength has been systematically associated with worse economic performance in EMEs (Graph 1). There is a strong negative correlation between the value of the dollar and detrended EME output over time (left-hand panel). A stronger dollar is also associated with a larger frequency of particularly poor growth outcomes (blue distribution for strong dollar states versus overall red distribution, right-hand panel).

Against this background, this article aims to explore the link between the dollar and EME cyclical growth more systematically, abstracting from long-term trends. The literature on "growth-at-risk" (GaR) has established that tighter financial conditions and sustained high credit growth are key drivers of adverse real economy outcomes (eg Adrian et al (2018), Aikman et al (2019)). So far, this literature has not considered the dollar as a risk factor. At the same time, recent studies have found that the broad dollar exchange rate influences economic activity and financial conditions, in particular in EMEs (eg Avdjiev et al (2019a,b), Erik et al (2020), Shousha (2019)). These studies have focused on average outcomes. We bridge the gap between these two strands of the literature by analysing the impact of the dollar on both the average growth outlook and on GaR using data covering 21 EMEs from Q1 1990 to Q4 2019.

We focus on the link between EME cyclical growth and the broad dollar nominal effective exchange rate (as shown in Graph 1), not the bilateral exchange rates of EME

[1] The authors would like to thank Claudio Borio, Stijn Claessens, Catherine Koch, Aaron Mehrotra, Benoît Mojon, José María Serena, Hyun Song Shin, Vlad Sushko, Nikola Tarashev and Agustín Villar for helpful comments. The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

Key takeaways

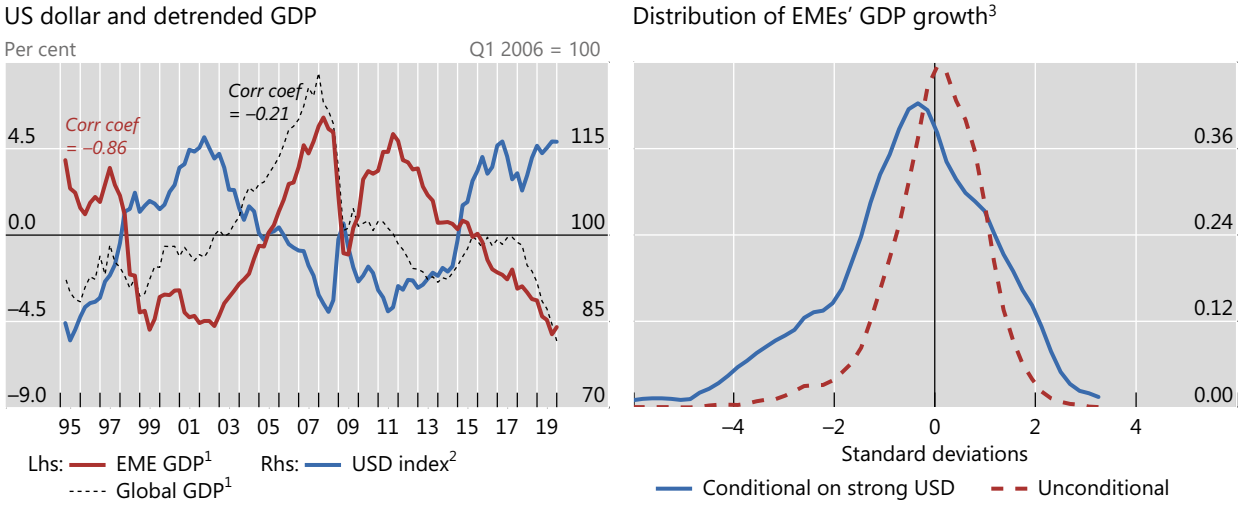
- A stronger dollar is followed by weaker growth in EMEs and a higher risk of deeper economic downturns.
- Dollar appreciation dampens in particular investment growth and even export growth.
- These negative effects are significantly larger in countries more exposed to changes in global credit conditions, because of high foreign investment in local currency bond markets or high dollar debt.

currencies against the dollar. This is for two main reasons. First, reflecting the dollar's role as a global risk factor, the effects of the broad dollar exchange rate on EME financial conditions have tended to outweigh those of the bilateral dollar exchange rates (Avdjiev et al (2019a), Shin (2019)). Second, the effects of the bilateral dollar exchange rate on growth are empirically more difficult to disentangle from causal effects in the other direction. Namely, a bilateral exchange rate could reflect perceptions of a country's current and future growth. This reverse causality is less of a concern in the case of the broad dollar index, which measures the value of the dollar against all major trading partners of the United States.

Our results suggest that broad dollar appreciation dampens real GDP growth on average and, in particular, lowers GaR, defined as the lowest 5% of real GDP growth realisations. We find that a stronger dollar has negative effects especially on real investment GaR and also dampens real export GaR. Moreover, we find that the dollar affects EMEs more strongly than small advanced economies (AEs) and that appreciations of other safe haven currencies do not have similar adverse effects on EME growth. These findings are consistent with the notion that the dollar influences

The broad dollar exchange rate is negatively linked to EMEs' economic performance

Graph 1



EMEs = AR, BR, CL, CN, CO, CZ, HK, HU, ID, IN, KR, MX, MY, PE, PH, PL, RU, SG, TH, TR and ZA. Correlation coefficients (Corr coef) are between GDP and the USD index.

[1] Percentage deviation from a long-term linear trend of the log median real GDP index within each region. Global GDP is based on the 21 EMEs and the 21 largest AEs excluding the United States. [2] Federal Reserve Nominal Broad Dollar Index. [3] Unconditional and conditional densities of real GDP growth, standardised within each country, based on the 21 EMEs during 1990–2019. "Strong USD" is defined as at least a 5% appreciation of the USD index within a quarter, which corresponds to the extent of US dollar appreciation during the first half of 2020; GDP growth refers to one-year-ahead outcomes after the appreciation. The densities are estimated using a kernel density estimator with an Epanechnikov kernel function.

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

global financial conditions, impacting EMEs in particular. This interpretation is supported by further empirical results, suggesting that dollar appreciation has a significantly larger effect on GaR in EMEs with high dollar debt and high foreign investor presence in local currency bond markets.

The remainder of the special feature is organised as follows. The first section reviews from a conceptual perspective the channels through which movements of the dollar can affect GDP growth (henceforth, "channels of dollar transmission"). The second estimates the effect of dollar fluctuations on GDP growth and on GaR in EMEs. The third section explores the nature of the dollar as a risk factor in EMEs, estimating GaR effects at the level of individual GDP components, juxtaposing the dollar impact on EMEs with that on small AEs and comparing its effect on EMEs with that of other safe haven currencies. The fourth section directly tests some of the channels of dollar transmission, assessing the role of foreign ownership, dollar debt and dollar trade invoicing in the transmission of dollar movements to EME GaR. The last section concludes.

Channels of dollar transmission

A negative correlation between broad-based dollar strength and global growth, as displayed in Graph 1, may arise through various channels.

First, the broad dollar exchange rate has attributes of a barometer of global investor risk appetite, over and above other gauges such as the VIX (Shin (2016)). When investor risk appetite dives, flight to safety may both push up the dollar and weaken global economic activity through capital outflows and tighter financial conditions as investors and lenders retrench from risky investments and borrowers.

Second, and relatedly, the broad dollar exchange rate could affect the global supply of dollar credit (Bruno and Shin (2015), Shin (2019)). When there is the potential for valuation mismatches on borrowers' balance sheets arising from exchange rate fluctuations, a stronger dollar weakens the balance sheets of those dollar borrowers whose liabilities rise relative to assets. From the standpoint of creditors with a diversified portfolio of borrowers, the weaker credit position of some borrowers increases tail risk in the overall credit portfolio, reducing the capacity for additional credit extension even with a fixed exposure limit as given by a value-at-risk (VaR) constraint or an economic capital constraint. The result would be a general tightening of global dollar credit supply, including for trade credit (Bruno et al (2018)). This *aggregate* credit supply channel would be in addition to a decline in dollar borrowing by entities with currency mismatches.

Third, similar dynamics may play out in local currency government bond markets if the tighter dollar credit conditions mentioned above are correlated with tighter risk constraints for global investors holding a diversified portfolio of local currency bonds. This can in turn lead to a general tightening of credit conditions in EME local currency bond markets as investors retrench across the board, including from countries whose bilateral exchange rates have not depreciated. Indeed, Hofmann et al (2020) find that broad dollar appreciation has larger adverse effects on bond flows and bond spreads in EME local currency sovereign bond markets than a depreciation of EME bilateral exchange rates against the dollar.

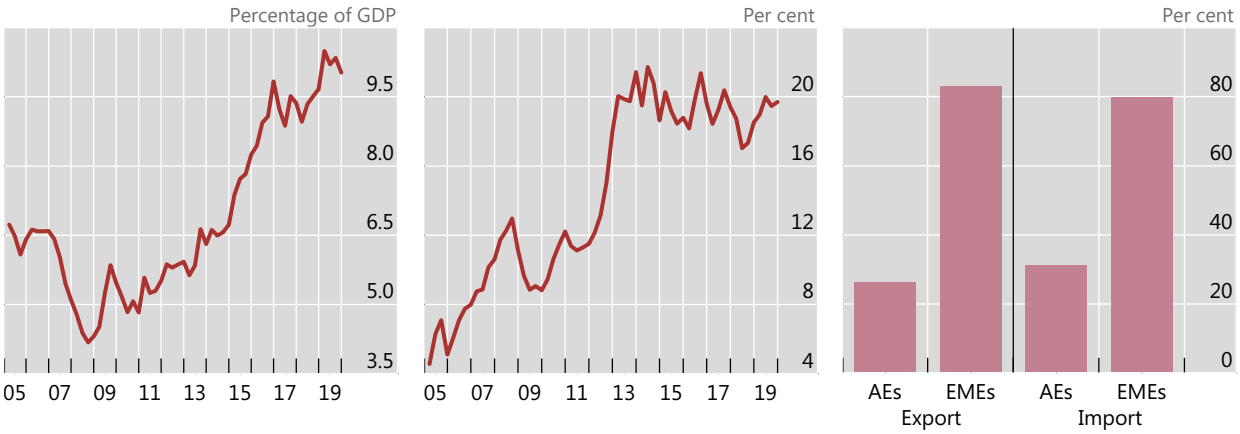
Fourth, the dollar can affect trade activity. A broad-based appreciation of the dollar could improve international price competitiveness of those countries whose

bilateral exchange rate depreciated against the dollar, boosting net exports and ultimately output. The conventional trade channel, however, rests on the assumption that export and import prices adjust in response to a change in the country's exchange rate. Over short horizons, this may not be the case if trade is invoiced in a foreign currency (Gopinath (2015), Gopinath et al (2020)). Such foreign currency invoicing weakens the link between exchange rates and price competitiveness, and hence the conventional trade channel. In particular, it means that a broad-based appreciation of the dollar may push up prices from the perspective of the importer and thus lead to a drop in trade.

EMEs are particularly vulnerable to changes in the value of the dollar through these channels, making the broad dollar exchange rate an EME-specific risk factor. While EMEs' financial deepening has progressed significantly over the past decades, in particular through the development of local currency bond markets, their financial systems still remain shallower than those of AEs. As a result, EMEs remain more dependent on foreign funding (CGFS (2019)). This is reflected in high dollar debt (Graph 2, left-hand panel) and large foreign investor holdings of EME local currency bonds (centre panel). On the back of thin hedging markets, these FX exposures of EME dollar borrowers and of foreign lenders in EME currencies are largely unhedged.[2] At the same time, US dollar invoicing is more widespread in EMEs than in AEs (right-hand panel).

Dollar debt, foreign investors and dollar trade invoicing in EMEs

Median values — Graph 2



AEs = AU, CA, CH, DE, DK, ES, FR, GB, IT, JP, NO, NZ and SE. For the list of EMEs, see Graph 1.

[1] Non-banks' total cross-border USD-denominated liabilities (bank loans and debt securities). [2] Excluding SG, HK and CZ due to lack of data availability. For KR, data are based on all listed bonds. [3] Latest available data. Due to lack of data availability, export for EMEs excludes CN, HK, MX, PE, PH and SG. Import for AEs excludes CA. Import for EMEs excludes CN, CO, HK, MX, PH, SG and ZA.

Sources: Arslanalp and Tsuda (2014); Boz et al (2020); national data; BIS locational banking statistics and global liquidity indicators; authors' calculations.

[2] The scope for hedging exchange rate risk through financial derivatives is much more limited in EMEs as FX derivatives markets in EME currencies are much smaller than those for AE currencies (Upper and Valli (2016), CGFS (2019)).

The impact of the dollar on EME growth and growth-at-risk

If dollar transmission takes place through the financial channels described above, the effects would be larger for GaR than for average growth outcomes. This is because financial constraints and frictions are usually more binding in bad states of the world.

In order to test this hypothesis, we estimate the dynamic impact of movements in the dollar on average growth and on GaR. Our estimates are from panel regressions, based on quarterly data for 21 EMEs over the period Q1 1990–Q4 2019.[3] The regression equations take the following form:[4]

$$\Delta^h y_{i,t+h} = \alpha_{i,t+h} + \beta_h \Delta dollar_t + \gamma_h \Delta y_{i,t-1} + \theta_h X_{i,t} + \varepsilon_{i,t+h} \qquad (1)$$

for horizons h={0, 1, …, 16} quarters, where $\Delta^h y_{i,t+h}$ stands for cumulative real GDP growth over horizon h and $\Delta dollar_t$ for the quarterly change in the Federal Reserve's broad dollar index. As we are aiming to identify the independent impact of the dollar on EME economic activity, the regressions further include a large set of variables $X_{i,t}$, which control for US factors that could affect both the dollar and EME growth: the VIX, quarterly real GDP growth, the purchasing managers' index (PMI) and quarterly CPI inflation as well as the change in one- and 10-year Treasury bond yields. To account for the historical negative correlation between the dollar and global commodity prices – which affect EME growth prospects – we also include the quarterly change in a global (dollar-based) commodity price index in $X_{i,t}$. Finally, we include a number of additional country-specific drivers of cyclical growth outcomes, as identified in the previous literature: stock market volatility as a measure of financial conditions, three-year non-financial private credit growth (relative to GDP), the current account balance (relative to GDP), the quarterly inflation rate and the change in the policy rate.[5]

Since we want to estimate the impact of the dollar on both average GDP growth and GaR, we estimate equation (1) in two ways. We first estimate a standard linear model. Then, we estimate a quantile regression for GaR, defined as the lowest 5% of growth outcomes over each regression horizon h.

The results suggest that an appreciation of the dollar has a quantitatively and statistically significant negative effect on GDP growth in EMEs, both for the average outcome and for GaR (Graph 3). In line with the conjecture derived from the conceptual considerations, the impact on GaR is quantitatively larger. Concretely, a 1 percentage point (ppt) appreciation shock to the broad dollar index is followed by a statistically significant cumulative decline of EME GDP growth by over 0.3 ppt after one year.[6] At about 0.6 ppt, the impact on GaR is almost twice as large, and is estimated with higher confidence in statistical terms. The effects of dollar appreciation on growth and on GaR are persistent, but start to fade and to become statistically insignificant after about six quarters.

[3] For the full list of EMEs, see Graph 1.

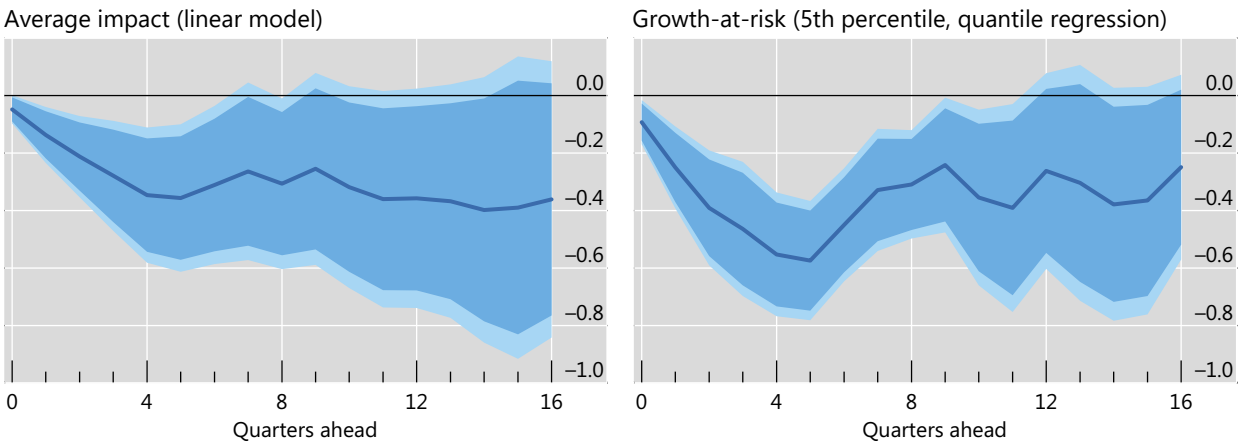
[4] The regressions are set up as local linear projections following Jordà (2005).

[5] Following Aikman et al (2019), we calculated stock market volatility as the quarterly average of the realised daily stock price volatility and three-year credit growth as the three-year change in the non-financial private sector debt-to-GDP ratio.

[6] The effects obtained for the linear model are similar to those found by Shousha (2019) based on a vector autoregression.

Dollar appreciation dampens EMEs' GDP growth and growth-at-risk

Impulse response to a 1 ppt appreciation shock to the dollar, in percentage points — Graph 3



For the list of EMEs, see Graph 1. Shaded areas indicate 90% (darker) and 95% (lighter) confidence intervals.

Based on data for 1990–2019. Cumulative impact on GDP growth estimated by fixed effects panel local projections. The set of regressors includes quarterly log change in the USD index, three-year change in non-financial private debt-to-GDP, log equity volatility, current account balance as a percentage of GDP, log VIX, quarterly change in 10-year Treasury yield, quarterly change in one-year Treasury yield, lagged quarterly US GDP growth, US PMI, lagged quarterly US inflation, quarterly change in policy rate, lagged quarterly change in the dependent variable, lagged quarterly inflation and quarterly log change in commodity prices. Confidence intervals were estimated by the Driscoll and Kraay (1998) method for the linear model and bootstrapping using country clusters for the quantile regression.

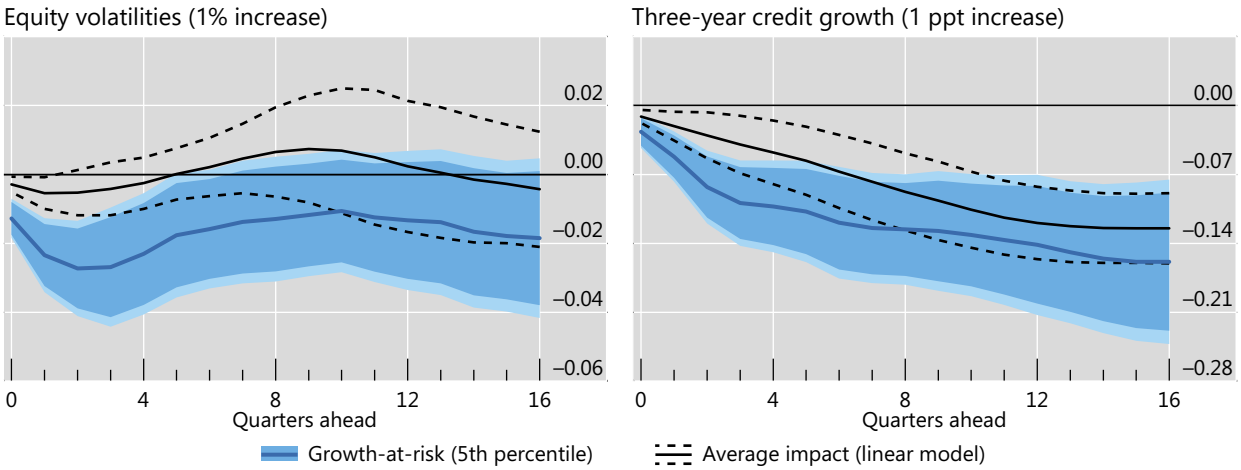
Sources: IMF; OECD; Bloomberg; Datastream; Institute for Supply Management; national data; BIS credit statistics; authors' calculations.

As a validation of the empirical model in equation (1), it is useful to consider the estimated impact of other prominent drivers of cyclical output growth, such as stock market volatility and three-year credit growth (relative to GDP), which were highlighted in the previous literature on GaR. In line with the existing literature, our estimates suggest that tighter financial conditions – captured by an increase in stock price volatility – dampen growth temporarily (Graph 4, left-hand panel), while higher indebtedness – captured by three-year credit growth – has a more persistent effect (right-hand panel). In either case, the effect on GaR is larger than that on average growth.

The above results indicate that the effect of the dollar on GaR is quite similar to that of stock market volatility and credit growth. A one standard deviation change of the broad dollar exchange rate over one quarter is 2.5 ppt. The corresponding numbers for stock price volatility and the three-year growth of private debt over GDP are 53% and 13.9 ppt, respectively. According to our empirical estimates, this would translate into respective cumulative impacts on GaR of –1.4, –1.2 and –1.4 ppt over a horizon of about one year.

Growth impact of stock price volatility and sustained credit growth

Impulse response of EMEs' GDP growth, in percentage points — Graph 4



For the list of EMEs, see Graph 1. Shaded areas indicate 90% (darker) and 95% (lighter) confidence intervals for the quantile regression. Dashed lines indicate 90% confidence intervals for the linear model.

Based on data for 1990–2019. Cumulative impact on GDP growth estimated by fixed effects panel local projections. The set of regressors includes quarterly log change in the USD index, three-year change in non-financial private debt-to-GDP, log equity volatility, current account balance as a percentage of GDP, log VIX, quarterly change in 10-year Treasury yield, quarterly change in one-year Treasury yield, lagged quarterly US GDP growth, US PMI, lagged quarterly US inflation, quarterly change in policy rate, lagged quarterly change in the dependent variable, lagged quarterly inflation and quarterly log change in commodity prices. Standard errors were estimated by the Driscoll and Kraay (1998) method for the linear model and bootstrapping using country clusters for the quantile regression.

Sources: IMF; OECD; Bloomberg; Datastream; Institute for Supply Management; national data; BIS credit statistics; authors' calculations.

Exploring the nature of the link

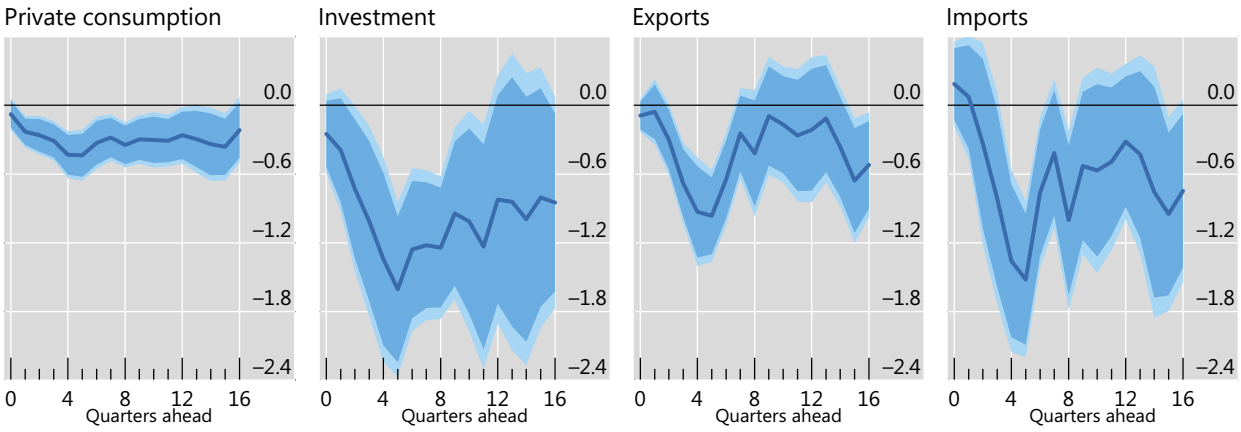
In this section, we further explore the broad dollar exchange rate as a risk factor for EME growth by considering a number of testable hypotheses. First, if dollar transmission occurs via financial channels, we would expect to see larger negative effects on investment than on other components of GDP as it is more sensitive to changes in financial conditions. Second, because of tighter trade-credit conditions and sticky export prices due to dollar invoicing, dollar appreciation need not be associated with higher export growth in EMEs. Third, on the basis of relative financial depth, we would expect to find that the dollar's impact on AEs is less pronounced than that on EMEs. Fourth, if the effects of the dollar reflect financial effects beyond the flight to safety, we would not see similar adverse effects on EMEs from appreciations of other safe haven currencies.

To test these hypotheses, in this section we explore variations of the previous empirical model. Specifically, we estimate the dollar's effect on the GaR for specific components of GDP, assess the impact of the dollar on small AEs – which resemble EMEs as regards exposure to global financial shocks – and compare the effects of the dollar with those of alternative safe haven currencies.

In order to assess the impact of the dollar on the GaR for different components of GDP, we re-estimate equation (1) for GaR using, sequentially, the cumulative growth rates of real consumption and real investment as well as real exports and real

Impact of dollar appreciation on EMEs' GDP components (at risk)

Impulse response to a 1 ppt appreciation shock to the dollar, in percentage points — Graph 5



For the list of EMEs, see Graph 1. Shaded areas indicate 90% (darker) and 95% (lighter) confidence intervals.

Based on data for 1990–2019. Cumulative impact on GDP components estimated by fixed effects panel local projections. The set of regressors includes quarterly log change in the USD index, three-year change in non-financial private debt-to-GDP, log equity volatility, current account balance as a percentage of GDP, log VIX, quarterly change in 10-year Treasury yield, quarterly change in one-year Treasury yield, lagged quarterly US GDP growth, US PMI, lagged quarterly US inflation, quarterly change in policy rate, lagged quarterly change in the dependent variable, lagged quarterly inflation and quarterly log change in commodity prices. Confidence intervals were estimated by bootstrapping using country clusters for the quantile regression.

Sources: IMF; OECD; Bloomberg; Datastream; Institute for Supply Management; national data; BIS credit statistics; authors' calculations.

imports as the dependent variable. We find that dollar appreciation negatively affects all private components of GDP. Nevertheless, there are notable quantitative differences in the estimated effects (Graph 5).

The effect of the dollar is strongest for investment, consistent with the notion of financial channels driving the effects of the dollar. Investment GaR declines in cumulative terms by as much as 1.6 ppt after five quarters after a 1 ppt appreciation shock to the dollar (second panel). This compares with a negative cumulative effect on consumption GaR of 0.4 ppt over the same horizon (first panel).

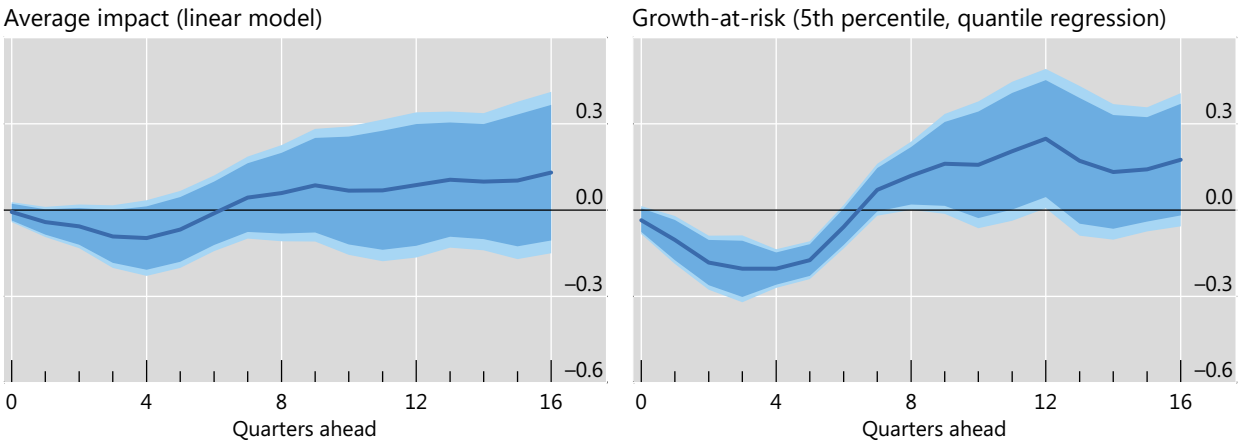
An appreciation of the dollar also has a *negative* impact on export GaR, triggering a cumulative contraction of up to 1 ppt after four and five quarters (Graph 5, third panel). This finding points to the relevance of financial channels through trade credit and dollar invoicing, counteracting the traditional expansionary effects on exports that would emanate from EME bilateral exchange rate depreciation.

In parallel, import GaR is negatively affected by a stronger dollar. The cumulative effect of a 1 ppt dollar appreciation shock reaches 1.5 ppt after five quarters, a result that is more in line with traditional trade channel effects. Since the impact of dollar appreciation on imports is larger than that on exports, the overall effect of the dollar on net export GaR is positive.

The effect of dollar appreciation on EMEs seems to be considerably stronger than that on small AEs, in line with the notion that EMEs are more vulnerable because of shallower financial systems. This result rests on data from Australia, Canada, Denmark, New Zealand, Norway, Sweden, Switzerland and the United Kingdom over the same sample period (Q1 1990–Q4 2019). In qualitative terms, the results are similar to those for EMEs: the dollar affects AEs' growth prospects and the negative effect of its appreciation on GaR is larger than that on average growth (Graph 6).

Impact of dollar appreciation on small AEs' GDP growth

Impulse response to a 1 ppt appreciation shock to the dollar, in percentage points — Graph 6



AEs = AU, CA, CH, DK, GB, NO, NZ and SE. Shaded areas indicate 90% (darker) and 95% (lighter) confidence intervals.

Based on data for 1990–2019. Cumulative impact on GDP growth estimated by fixed effects panel local projections. The set of regressors includes quarterly log change in the USD index, three-year change in non-financial private debt-to-GDP, log equity volatility, current account balance as a percentage of GDP, log VIX, quarterly change in 10-year Treasury yield, quarterly change in one-year Treasury yield, lagged US GDP growth, US PMI, lagged quarterly US inflation, quarterly change in policy rate, lagged quarterly change in the dependent variable, lagged quarterly inflation and quarterly log change in commodity prices. Confidence intervals were estimated by the Driscoll and Kraay (1998) method for the linear model and bootstrapping using country clusters for the quantile regression.

Sources: IMF; OECD; Bloomberg; Datastream; Institute for Supply Management; national data; BIS credit statistics; authors' calculations.

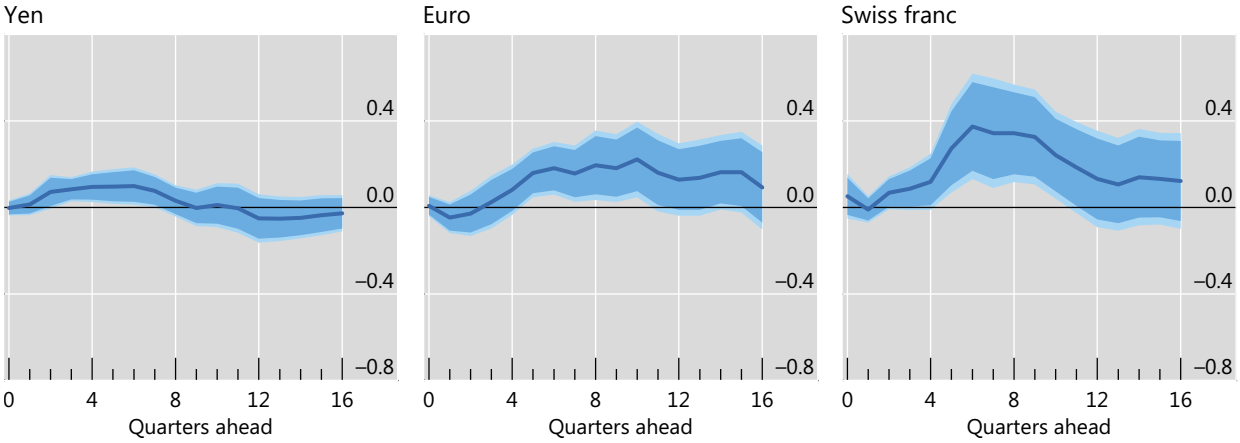
Quantitatively, however, these effects are much smaller than in the case of EMEs. A 1 ppt appreciation shock to the dollar dampens GaR in AEs by 0.2 ppt over one year (right-hand panel), which is one third of the impact we have estimated for EMEs. After about seven quarters, the effect even becomes positive, possibly reflecting the traditional trade channel.

The negative effect of dollar appreciation on EMEs does not merely reflect flight to safety effects. This is suggested by analyses in which we re-estimate equation (1) after replacing the dollar with other safe haven currencies: the yen, the euro and the Swiss franc.[7] The link between these alternative safe haven currencies and EME GaR is quite different from that of the dollar (Graph 7). A yen, euro and Swiss franc appreciation is not followed by lower EME GaR. Moreover, the effect is even significantly positive over medium-term horizons, possibly reflecting traditional trade channel effects.

[7] In order to control for macro-financial developments in the respective safe haven currency economy, we add the respective real GDP growth, inflation, business cycle indicator and changes in short- and long-term bond yields.

Impact of other safe haven currencies on EMEs' growth-at-risk

Impulse response to a 1 ppt appreciation shock to the JPY/EUR/CHF, in percentage points — Graph 7



For the list of EMEs, see Graph 1. Shaded areas indicate 90% (darker) and 95% (lighter) confidence intervals.

Based on data for 1990–2019. Cumulative impact on GDP growth estimated by fixed effects panel local projections at the 5th percentile. The set of regressors includes quarterly log change in the JPY/EUR/CHF index, three-year change in non-financial private debt-to-GDP, log equity volatility, current account balance as a percentage of GDP, log VIX, quarterly change in 10-year Treasury yield, 10-year JP/EA/CH government yields, quarterly change in one-year JP/DE/CH government yield, lagged quarterly US GDP growth, lagged quarterly JP/EA/CH GDP growth, US PMI, the JP/EA/CH composite leading indicator, lagged quarterly US inflation, lagged quarterly JP/EA/CH inflation, quarterly change in policy rate, lagged quarterly change in the dependent variable, lagged quarterly inflation and quarterly log change in commodity prices. Confidence intervals were estimated by bootstrapping using country clusters.

Sources: IMF; OECD; Bloomberg; Datastream; Institute for Supply Management; national data; BIS credit statistics; authors' calculations.

Exploring the channels of dollar transmission

In this section, we aim to directly explore some of the channels through which the broad dollar exchange rate may affect GaR. To this end, we exploit cross-country variation in financial and economic structure. Specifically, we estimate equations of the following form:

$$\Delta^h y_{i,t+h} = \alpha_{i,t+h} + \beta_h \Delta dollar_t + \beta_h^{FXD} \Delta dollar_t \cdot FXD_i +$$

$$\beta_h^{FOS} \Delta dollar_t \cdot FOS_i + \beta_h^{INV} \Delta dollar_t \cdot INV_i + \gamma_h \Delta y_{i,t-1} + \theta_h X_{i,t} + \varepsilon_{i,t+h} \qquad (2)$$

This is an augmented version of equation (1) that includes indicators of foreign ownership, dollar debt and dollar invoicing and their interactions with the change in the broad dollar exchange rate. Concretely, *FXD* refers to gross cross-border dollar debt as a percentage of GDP, *FOS* to the share of foreign ownership in local currency sovereign bond markets, and *INV* to the share of dollar invoicing in exports.[8] Each

[8] *FXD* is measured as non-banks' total cross-border US dollar-denominated liabilities (bank loans and debt securities) as a percentage of GDP taken from the BIS locational banking statistics and global liquidity indicators. *FOS* is the share of central government debt securities denominated in local currency held by foreign investors, estimated by Arslanalp and Tsuda (2014). *INV* is the percentage of exports invoiced in the US dollar (Boz et al (2020)). The variables that are interacting with the dollar in equation (2) are also included directly in the regressions in the set of control variables, so as to avoid the interaction terms picking up any direct effects of the variables.

structural indicator is measured in qualitative terms, separating the countries into two groups, with above- or below-average shares.[9]

Higher dollar debt and higher foreign ownership should increase the sensitivity of EMEs' GDP to global credit conditions and hence to the dollar, while greater dollar invoicing should weaken the trade channel. To the extent that these mechanisms are at play, the three indicators would strengthen the negative effect of dollar appreciation on GaR, implying that the coefficients on each interaction term would be negative. To test this hypothesis, we estimate equation (2) by first including the indicators separately and then jointly. For the sake of brevity and presentability, we report results only for GaR over four quarters (Table 1).

The estimation results underscore the importance of financial channels of dollar transmission. High foreign ownership is consistently associated with a significantly higher negative effect of dollar appreciation on GaR (second, fourth and fifth columns). Likewise, once the effect of foreign ownership is accounted for, high dollar debt is associated with a significantly higher negative impact of dollar appreciation on EME growth (fourth and fifth columns). By contrast, the extent of dollar invoicing does not appear to have a statistically significant effect (third and fifth columns), thus indicating that the role of the invoicing channel is small.

Channels of dollar transmission to four-quarter growth-at-risk Table 1

USD index	–0.382***	–0.333***	–0.482***	–0.190	–0.238
Interaction coefficients					
USD debt	–0.122			–0.280**	–0.366**
Foreign ownership of local currency govt bonds		–0.214*		–0.251**	–0.252**
USD invoicing for export			0.0907		0.168
Number of observations	1,382	1,382	1,151	1,074	1,074
Number of countries	18	18	15	14	14

Estimation results from equation (2) based on data for 2000–19 due to unavailability of data for most of the structural variables for the pre-2000 period. Coefficients of the interactions of structural variables and one-quarter change in the USD index, estimated by fixed effects panel local projections. The structural indicators are condensed into dummy variables constructed based on the average levels of the indicator variables across countries with available data over the period. The dummy variables take on the value 1 when the average value of the respective variable was equal to or higher than the cross-country median, and 0 otherwise. In addition to the structural variables and their interactions, the set of regressors includes quarterly log change in the USD index, three-year change in non-financial private debt-to-GDP, log equity volatility, current account balance as a percentage of GDP, log VIX, quarterly change in 10-year Treasury yield, quarterly change in one-year Treasury yield, lagged quarterly US GDP growth, US PMI, lagged quarterly US inflation, quarterly change in policy rate, lagged quarterly change in the dependent variable, lagged quarterly inflation and quarterly log change in commodity prices. ***/**/* indicates significance at the 1/5/10% level, based on bootstrap standard errors using country clusters.

Sources: Arslanalp and Tsuda (2014); Boz et al (2020); IMF; OECD; Bloomberg; Datastream; Institute for Supply Management; national data; BIS credit statistics, locational banking statistics and global liquidity indicators; authors' calculations.

[9] More precisely, each structural indicator is condensed into a dummy variable, reflecting the average levels of the indicator variables across countries with available data over the period. The dummy variables take on the value 1 when the average level over the sample period of the respective share in a country was equal to or higher than the cross-country median, and 0 otherwise.

Conclusions

Our analysis suggests that the broad dollar exchange rate is an important risk factor for EMEs' growth. Dollar strength is followed by significantly weaker EME growth on average and lower GaR. Our findings further suggest that the dollar affects EMEs through financial channels. This is linked to the shallowness of EME financial markets, as reflected in high dollar debt and high foreign ownership in local currency bond markets.

The role of the dollar as an EME risk factor has also been on display since the outbreak of the Covid-19 pandemic. In the wake of the first wave of the pandemic, the US dollar initially appreciated on a broad basis by almost 10% in the first three months of the year, accompanied by record bond portfolio outflows from EMEs and sharply widening EME bond spreads. Subsequently, when the pandemic situation eased in the summer, the dollar depreciated and bond portfolio flows and spreads normalised.

Going forward, the outlook of prolonged low interest rates across all major AEs implies an environment of ample global liquidity amid high economic uncertainty. This combination could also be associated with wide swings in the broad dollar exchange rate, with the potential to affect EMEs' GaR.

References

Adrian, T, F Grinberg, N Liang and S Malik (2018): "The term structure of growth-at-risk", *IMF Working Papers*, no 18/180, August.

Aikman, D, J Bridges, S Hoke, C O'Neill and A Raja (2019): "Credit, capital and crises: a GDP-at-risk approach", Bank of England, *Staff Working Papers,* no 824, September.

Arslanalp, S and T Tsuda (2014): "Tracking global demand for emerging market sovereign debt", *IMF Working Papers*, no 14/39, March.

Avdjiev, S, V Bruno, C Koch and H S Shin (2019a): "The dollar exchange rate as a global risk factor: evidence from investment", *BIS Working Papers*, no 695, January.

Avdjiev, S, W Du, C Koch and H S Shin (2019b): "The dollar, bank leverage, and deviations from covered interest parity", *American Economic Review: Insights*, vol 1, no 2, September, pp 193–208.

Boz, E, C Casas, G Georgiadis, G Gopinath, H Le Mezo, A Mehl and T Nguyen (2020): "Patterns in invoicing currency in global trade", *IMF Working Papers*, no 20/126, July.

Bruno, V, S-J Kim and H S Shin (2018): "Exchange rates and the working capital channel of trade fluctuations", *American Economic Review, Papers and Proceedings*, vol 108, May, pp 531–6.

Bruno, V and H S Shin (2015): "Cross-border banking and global liquidity", *Review of Economic Studies*, vol 82, no 2, April, pp 535–64.

Committee on the Global Financial System (2014): "Trade finance: developments and issues", *CGFS Papers*, no 50, January.

——— (2019): "Establishing viable capital markets", *CGFS Papers*, no 62, January.

Driscoll, J and A Kraay (1998): "Consistent covariance matrix estimation with spatially dependent panel data", *Review of Economics and Statistics*, vol 80, no 4, November, pp 549–60.

Erik, B, M Lombardi, D Mihaljek and H S Shin (2020): "The dollar, bank leverage and real economic activity: an evolving relationship", *BIS Working Papers*, no 847, March.

Gopinath, G (2015): "The international price system", in proceedings of the Federal Reserve Bank of Kansas City Jackson Hole Symposium, August.

Gopinath, G, E Boz, C Casas, F Diez, P-O Gourinchas and M Plagborg-Møller (2020): "Dominant currency paradigm", *American Economic Review*, vol 110, no 3, March, pp 677–719.

Hofmann, B, I Shim and H S Shin (2020): "EME bond markets and the dollar", Bank for International Settlements, mimeo.

Jordà, Ò (2005): "Estimation and inference of impulse responses by local projections", *American Economic Review*, vol 95, no 1, March, pp 161–82.

Shin, H S (2016): "The bank/capital markets nexus goes global", speech at the London School of Economics and Political Science, 15 November.

——— (2019): "In search of a global risk factor: case of the dollar index", speech at the ECB colloquium in honour of Benoît Cœuré, Frankfurt am Main, 18 December.

Shousha, S (2019): "The dollar and emerging market economies: financial vulnerabilities meet the international trade system", Board of Governors of the

Federal Reserve System, *International Finance Discussion Papers*, no 1258, October.

Upper, C and M Valli (2016): "Emerging derivatives markets?", *BIS Quarterly Review*, December, pp 67–80.

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Changes in monetary policy operating procedures over the last decade: insights from a new database[1]

We introduce a new interactive database that allows users to easily retrieve and customise detailed information on central banks' monetary policy operating procedures (MPOPs). These procedures govern the day-to-day implementation of monetary policy in markets. After a high-level conceptual overview of how MPOPs have evolved over the past decade, we showcase common trends and selected cross-country differences. We discuss, in particular, how the persistent environment of excess liquidity and the effective interest rate lower bound shaped MPOPs in the aftermath of the Great Financial Crisis of 2007–09.

JEL classification: E42, E43, E52, E58.

Central banks' monetary policy operating procedures (MPOPs) govern how monetary policy is implemented on a day-to-day basis in markets, and in particular how central banks actually set interest rates. To enhance the transparency and general understanding of this core aspect of central banking, the Markets Committee (MC) has been issuing a compendium on MPOPs since 2007 (MC (2019a)).[2] This special feature introduces a new interactive online tool based on the compendium which allows users to easily retrieve and customise detailed information.[3]

To set the stage, we start with a brief introduction of the main structure of the new online tool. We then turn to a bird's eye view of MPOPs. In this context, we provide a high-level conceptual overview of monetary policy implementation. We also highlight the profound changes in MPOPs due to the persistent environment of excess liquidity and the proximity to the effective interest rate lower bound (ELB) since the Great Financial Crisis (GFC) of 2007–09. We then distil some cross-country similarities and differences by drawing on the new database. Even though MPOPs

[1] The authors are grateful to Ulrich Bindseil, Claudio Borio, Paolo Cavallino, Stijn Claessens, Piti Disyatat, Benoît Mojon, Maik Schmeling, Hyun Song Shin, Olav Syrstad, and Nikola Tarashev for helpful comments. The views in this article are those of the authors and do not reflect those of the Bank for International Settlements.

[2] The Markets Committee is a central bank forum comprising senior officials with expertise in central bank operations and their interactions with financial markets. For further information on the MC, its current membership and work, see https://www.bis.org/about/factmktc.htm.

[3] The institutional details captured in the compendium are useful for practitioners and researchers interested in, for instance, optimal central bank design (eg Reiss (2013)), central bank communication (eg Blinder et al (2008)) and monetary policy operations (Borio (1997), Bindseil (2004, 2014)).

Key takeaways

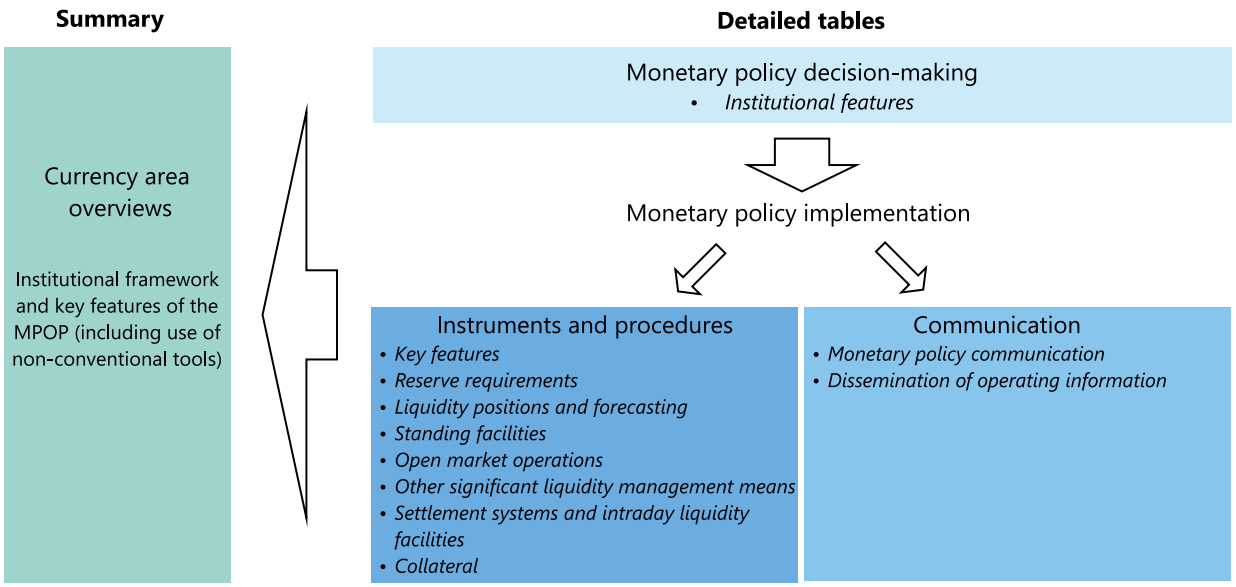
- A new interactive database allows users to easily retrieve and customise information on central banks' monetary policy operating procedures, covering the 15 largest currency areas.
- The database shows cross-country differences in the "nuts and bolts" of central banking since the Great Financial Crisis of 2007–09 and highlights several common trends.
- The expansion of central bank balance sheets and the effective lower bound led to the increased adoption of floor systems; increased use of multiple operating targets (beyond an overnight interbank rate); a lesser role for discretionary liquidity management; and more weight being placed on communication about monetary policy implementation.

share the same basic objective, there are notable differences across currency areas – for example, due to different market structures, players, practices and economic conditions.

The compendium on central bank operations in a nutshell

The MC Compendium, *Monetary policy frameworks and central bank market operations*, first published in 2007, captures the core features of the MPOPs of major advanced economy (AE) and emerging market economy (EME) central banks. At present, it covers the 15 currency areas around the globe whose currencies command the greatest international role. The information has been submitted by the respective central banks, all of which are represented on the Markets Committee (MC (2019a)). While the compendium reproduces or summarises information that is already publicly

Schematic overview of the information available in the MC Compendium — Graph 1



Items in italics indicate the features covered by the 15 tables in the MC Compendium.

Sources: Markets Committee Compendium; authors' elaboration.

available,[4] its value added mainly comes from providing a straightforward cross-country comparison of MPOPs. The latest instalment is from 2019.

The information in the compendium is structured along two dimensions (see Graph 1 for a schematic overview). First, a concise summary of MPOPs and their role in monetary policy implementation for each currency area. This description also provides the broader context, including a succinct discussion of central bank mandates, key objectives and other institutional features. Second, 15 tables (or "elements") that cover specific features of the MPOPs, with several subcomponents for each currency area (see Annex for an overview).

The main innovation of the online database is an interactive "Comparison" tool. It allows users to easily customise their queries to obtain a cross-country and/or a cross-table perspective on particular MPOP elements.

A bird's eye view of monetary policy operating procedures

The implementation of monetary policy has two core elements (eg Borio and Nelson (2008)).[5]

The first comprises mechanisms to *signal* the desired policy *stance*, eg is the central bank easing or tightening? These mechanisms involve variables that are fully under the central bank's control. Such variables can be policy interest rates, such as a lending rate or announced ranges for an overnight rate, or balance sheet quantities, such as announced large-scale purchases of government securities.

The second comprises *market* operations to implement the stance. In line with the type of signal, the operations may seek to influence a market interest rate, such as an overnight rate in the interbank market, or simply execute the announced adjustments in the central bank's balance sheet, such as the purchases noted above. If the central bank seeks to influence a market rate rather precisely, this is typically referred to as an "operational target".

The GFC has resulted in profound changes in operating procedures in many currency areas, especially in major AEs.

Pre-GFC, most central banks defined the policy stance and operational targets exclusively in terms of a short-term interest rate, most often an overnight interbank rate. In and of themselves, the transactions in the market to implement that stance *carried no signal*. Indeed, central banks went a long way to avoid any such impression so as not to confuse markets. The transactions were of a purely technical nature and were designed *not* to influence market prices beyond the operational target. They were carried out purely to adjust the amount of bank deposits with the central bank in order to control the overnight rate (see below). This "decoupling principle" ruled supreme.

[4] The original central bank publications remain the ultimate reference.

[5] For a detailed discussion on the analytical underpinnings of MPOPs, see Borio (1997) for an early review and Bindseil (2016) for a more recent and comprehensive assessment. See also Borio and Disyatat (2010) for an analysis of how balance sheet policies have profoundly influenced operating procedures. Disyatat (2008) discusses how misconceptions of MPOPs can compromise the understanding of the monetary transmission mechanism and other policy issues.

Post-GFC, as the policy rate neared the ELB in many currency areas, the respective central banks expanded their toolkit and followed a more multifaceted approach. Signals have included balance sheet quantities too. And they have not been limited to announcing some policy rate(s) or an adjustment in the central bank balance sheet *today*; they have sometimes also provided guidance about the *future path* of those variables ("forward guidance"). Moreover, operational targets have also gone beyond overnight or short-term rates and included long-term rates, such as benchmark 10-year bond yields. Put differently, the active use of adjustments in the size and composition of the balance sheet to change the policy stance ("balance sheet policies") has done away with the decoupling principle.

Despite these fundamental changes, the overnight interbank rate still plays a key role in day-to-day policy implementation. This is because it is the rate that the central bank controls most closely and, partly as a result, is the linchpin of the term structure of interest rates. This rate represents the marginal cost of funds for immediate liquidity purposes and is determined by the supply of, and demand for, bank deposits with the central bank, ie "bank reserves". It can be controlled most closely because the central bank is, by construction, the monopoly supplier of bank reserves. It changes the *supply* by lending/borrowing in the market (eg through repos and reverse repos) and by buying/selling assets.[6] Moreover, the central bank can also influence directly the *demand* for reserves through reserve requirements, which require banks to hold a minimum amount of deposits with the central bank.

While not affecting the significance of the interbank overnight rate, the growing reliance on balance sheet policies has had profound implications for *how* the central bank influences this rate. In general, there are two types of arrangement.

The first arrangement, which was the most common pre-GFC, is to adjust the amount of bank reserves rather precisely to meet banks' required demand. This precision is important, because the demand, which is ultimately determined by interbank settlement needs, is very interest-inelastic: failing to meet it would result in a very volatile overnight rate.[7] The central bank controls the supply of reserves through a combination of discretionary open market operations and standing (lending and borrowing) facilities that banks can tap on demand – together, so-called "liquidity management operations", which "drain" or add liquidity. In such a system, reserve requirements are a common tool that can allow banks to smooth their demand for reserves over given periods (ie requirements that have to be met only on average). This reduces the need for the central bank to forecast the demand for reserves precisely and/or to frequently fine-tune the supply of reserves.

Two terms are often used to describe this first arrangement. One, a "corridor" system, as the central bank steers the overnight rate within a range defined by the borrowing and lending rates on the standing facilities. Two, a "scarce reserves" system, because the central bank does *not* supply reserves over and above what is needed to meet day-to-day settlement needs.

The second arrangement, which has become common post-crisis, is often referred to as an "abundant reserves" or "floor" system. Here, the central bank tends

[6] For instance, "quantitative easing" (QE) is nothing but a purchase of government securities financed with bank reserves that are not subsequently withdrawn ("sterilised").

[7] In these approaches, excess reserves are remunerated, if at all, at a rate below the policy rate. Hence banks would typically be unwilling to hold more reserves than strictly needed. Conversely, being short of reserves would be very costly, as it would potentially lead to settlement problems.

not to offset the increase in the amount of reserves generated by its large-scale asset purchases.[8] In essence, the central bank floods the market by supplying banks with more reserves than needed for their settlement or liquidity management purposes more generally.[9] As a result, it pushes the overnight rate to that at which banks can deposit excess funds with the central bank – the deposit facility rate, which thus acts as a floor.

The specific details of MPOPs differ across currency areas, reflecting in part differences in market structures and institutions. With the expanded use of central bank balance sheets, these differences have grown further. The MC Compendium provides a window into many of these contrasting features, although it focuses primarily on the determination of the overnight rate. As the last instalment from the compendium is from 2019, the changes during the Covid-19 crisis are not covered. But these do not change the overarching narrative discussed next.

A cross-country perspective on monetary policy operations

The switch from "corridor" to "floor" systems

Many central banks, in particular in advanced economies, have shifted from a corridor to a floor system since the GFC. The AE central banks that have expanded their balance sheet most since the GFC currently use floor systems (Graph 2, left-hand panel).[10] This contrasts with the pre-GFC environment, when corridor systems were the norm, just like they still are among EME central banks. The general reluctance to operate a floor system at the time reflected concerns that interbank trading activity and market functioning might suffer in a regime of abundant reserves.

Virtually all of the central banks operating a floor system today have short-term interest rates that are close to zero, at zero or even negative. This reflects the fact that the adoption of the floor system has largely been a by-product of the ELB and the related use of central bank balance sheets as a policy tool and its subsequent expansion (MC (2019a)). Central banks have regarded the side effects of reduced interbank money market activity as largely second-order compared with the benefits of leveraging on central bank balance sheets to provide additional policy accommodation (MC (2019b)).

Large balance sheets per se are not a new phenomenon. In particular, many EMEs have had large balance sheets for quite some time, as they had built up precautionary buffers against potential currency crises. To that end, they have bought foreign

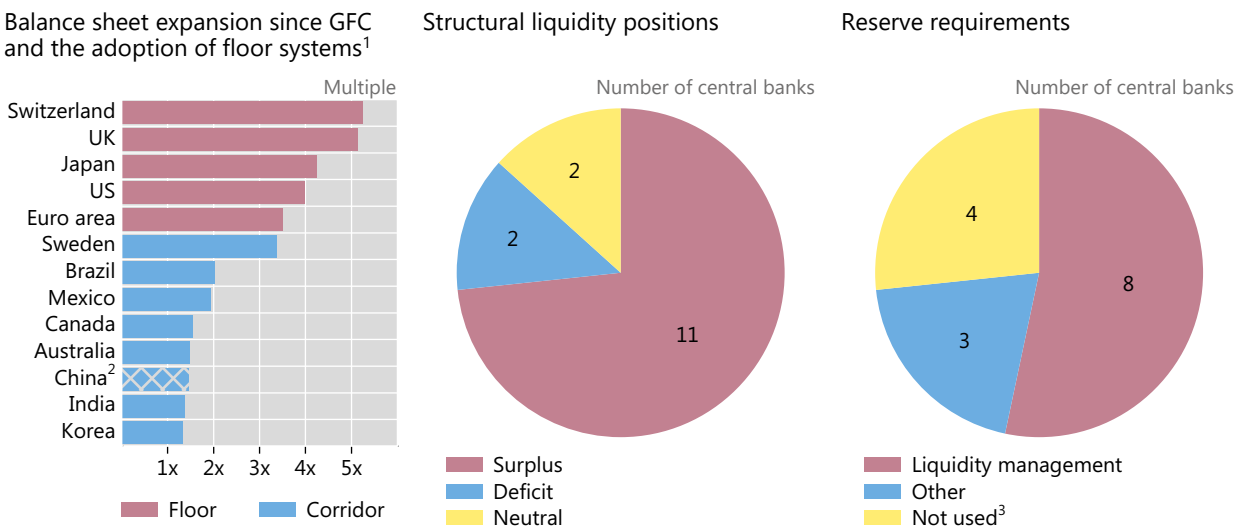
[8] More generally, of any increases in its balance sheet that would add to bank reserves, such as foreign exchange intervention (purchases of foreign currency assets) or large-scale lending to banks.

[9] Depending on their precise structure, prudential requirements can also influence the demand for bank reserves. This has been a factor complicating the identification of the demand for reserves post-GFC. See eg Kim et al (2018) and Corradin et al (2020).

[10] The main exception among AE central banks are Australia and Canada – two economies for which the effective ELB became a constraint only lately during the Covid-19 crisis. Another exception is Sveriges Riksbank, which, despite abundant reserves on the back of large-scale asset purchases, chose to absorb the excess liquidity daily via fine-tuning operations. The Central Bank of Norway (not covered in the compendium) abandoned its floor system in 2011 in favour of a novel quota-based system that incentivises banks to economise on their reserve holdings.

Corridor versus floor systems, reserve requirements and structural liquidity

As of September 2019 Graph 2



[1] Change in the size of central bank balance sheet as a share of GDP: peak level as a multiple of the pre-crisis average. Pre-crisis average calculated from Q1 2000 or earliest available to Q2 2007. [2] In the process of transitioning to a corridor system. [3] Canada, Hong Kong SAR, Sweden and the United Kingdom do not impose minimum reserve requirements.

Sources: Markets Committee Compendium; national data; authors' calculations.

currency (mostly dollars) financed with domestic currency in the form of bank reserves. As in a floor system, these central banks operate in an environment of a "structural liquidity surplus" (Graph 2, centre panel). A "structural liquidity surplus" means that the banking system in aggregate, and *absent* offsetting central bank operations, has more bank reserves than strictly needed for reserve requirement and/or settlement purposes. But in contrast to many of their AE peers, EME central banks reabsorb the excess reserves through a variety of tools – for instance, by issuing their own debt securities or offering time deposits. In so doing, they "sterilise" the FX interventions.

Reserve requirements

Reserve requirements have traditionally been an important part of MPOPs in scarce reserves regimes, but their role has dwindled with the adoption of floor systems. By construction, for reserves to be abundant, they must exceed reserve requirements by a sufficient margin. Several central banks do not impose such requirements at all at present (Graph 2, right-hand panel). This includes the Bank of Canada, Sveriges Riksbank and the Bank of England.

The majority of the central banks that have binding reserve requirements in place rely on them primarily for liquidity management purposes. A few also employ them for financial stability purposes – as a kind of "macroprudential tool" – and/or to affect bank credit for monetary policy purposes. In these two cases, the requirements simply act as a tax. Several EME central banks use them for such purposes, such as the Central Bank of Brazil and the People's Bank of China.[11]

[11] The advantage of reserve requirements (RRs) over changes in interest rates is their impact on capital flows. For example, an interest rate hike would tend to encourage inflows, as domestic interest rates

Liquidity management operations

Standing facilities

All central banks operate standing facilities. In an abundant reserves regime, the deposit facility is particularly important as it determines the interest rate floor. Almost all central banks offer a deposit facility, or reverse repos fulfilling a similar function. India, Japan and Korea adopted deposit facilities in 2007. The Federal Reserve started paying interest on reserves during the GFC in October 2008 to achieve the same objective.[12] Similarly, the Swiss National Bank moved away from non-interest-paying deposit accounts in 2015 so that it could implement negative interest rates.

All central banks have a lending facility, even though it is rarely used in currency areas that have moved to a floor system. In general, lending facilities perform a backup function, allowing banks in need to obtain reserves. When reserves are abundant, these facilities are essentially a safety valve to avoid excessive volatility at times of tensions in the market. Lending facilities most often take the form of an overnight repo or collateralised loan. The People's Bank of China is an exception, as it also offers loans with longer maturities of one week and one month.[13]

Depending on the design of their MPOPs, there are some notable differences across countries in terms of the width of the corridor – ie the difference between the interest rate charged on the lending facility and that paid on the deposit facility (Graph 3, left-hand panel). It ranges from 200 basis points for Korea to 40 bp for Japan. For most central banks, it has changed little since 2007. That said, with short-term rates approaching the ELB and with the move to an abundant reserves regime, the ECB and the Bank of England narrowed it significantly, from 200 bp to a mere 65 and 50 bp, respectively.

Open market operations and other liquidity management tools

Beyond standing facilities, central banks utilise open market operations (OMOs) to adjust bank reserves as needed. Discretionary OMOs remain a core part of the MPOP toolkit, even though the need to rely on them frequently is greatly reduced in a floor system. While the MC Compendium covers all OMO tools, the three most commonly used ones are repos and reverse repos, central bank bills and FX swaps. But some central banks have also engaged in longer-term lending operations stretching out to several years' maturity.[14]

rise relative to those on other currencies. But a tightening of RRs, because they are a tax, would make it less attractive for banks to encourage inflows and could reduce the interest rates on their liabilities.

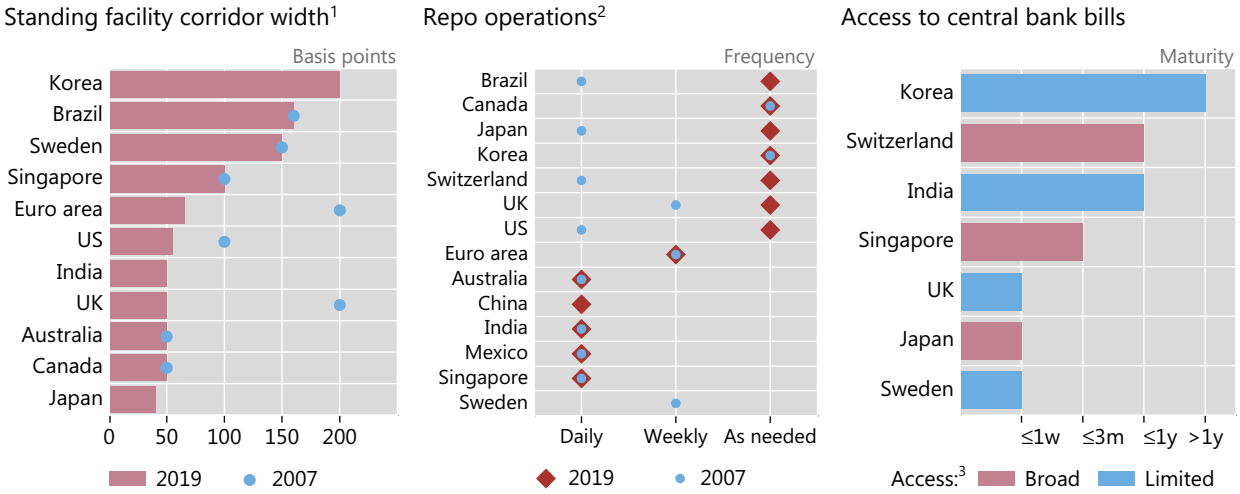
[12] Since 2014, the Federal Reserve has also had an overnight reverse repo facility (O/N RRP) as a supplementary tool, which is available to a different set of counterparties. In addition, the rate of remuneration on the deposit facility may not always act as a firm floor (as cash-rich government-sponsored entities are not entitled to earn interest on reserves). The O/N RRP facility, which is accessible to a broader set of institutions, ensures that the floor for market rates such as the effective federal funds rate and repo rates is not "leaky".

[13] There can be significant differences across currency areas regarding the extent to which banks actually tap lending facilities. A key consideration is stigma, which depends, inter alia, on how the facility is designed. See Borio (1997) for a cross-country analysis of this issue.

[14] Some of these long-term lending operations have embedded conditionality to foster lending to the real economy, also known as "funding for lending schemes".

Standing facilities and liquidity management tools

As of September 2019 Graph 3



[1] China, Hong Kong SAR and Switzerland do not operate a deposit facility. India, Japan and Korea introduced a deposit facility between 2007 and 2019. Mexico (not displayed) has a variable corridor, from 0% to twice the overnight interbank rate. [2] One main repo (liquidity-providing) operation selected for each central bank. Sweden does not conduct repo operations as of 2019. [3] Limited access = accessible only to the usual monetary policy counterparties; broad access = accessible to a wider range of (institutional) investors.

Sources: Markets Committee Compendium; authors' calculations.

Nearly all central banks use repos and reverse repos with eligible counterparties as the main tool. That said, instead of regular operations, many central banks now provide liquidity depending on market conditions. In particular, the central banks of five major AEs and the Central Bank of Brazil shifted from daily or weekly operations to operations that depend on market liquidity conditions (Graph 3, centre panel).

About two thirds of central banks can also issue debt securities – or central bank bills – in order to withdraw bank reserves from the system (or technically "drain liquidity"). But not all of them make use of that instrument. When employed, central bank bills come with a wide range of maturities (up to two years in the case of Korea). Another differentiating factor across central banks is the accessibility and marketability of such instruments. Some central banks (Japan, Singapore and Switzerland) allow a wide range of institutional investors to hold bills, rather than only the usual monetary policy counterparties (Graph 3, right-hand panel).

A single operating target no longer embodies the policy stance

As discussed, many central banks are no longer able to express the policy stance *exclusively* via short-term interest rates as their operational target. Short-term rates still continue to be one such target, not least because of their role in anchoring the yield curve. However, a richer set of tools are used to adjust the stance as rates have approached, or reached, the effective lower bound.

The most common operating target continues to be an interest rate with an overnight maturity.[15] Given its controllability, central banks most commonly target

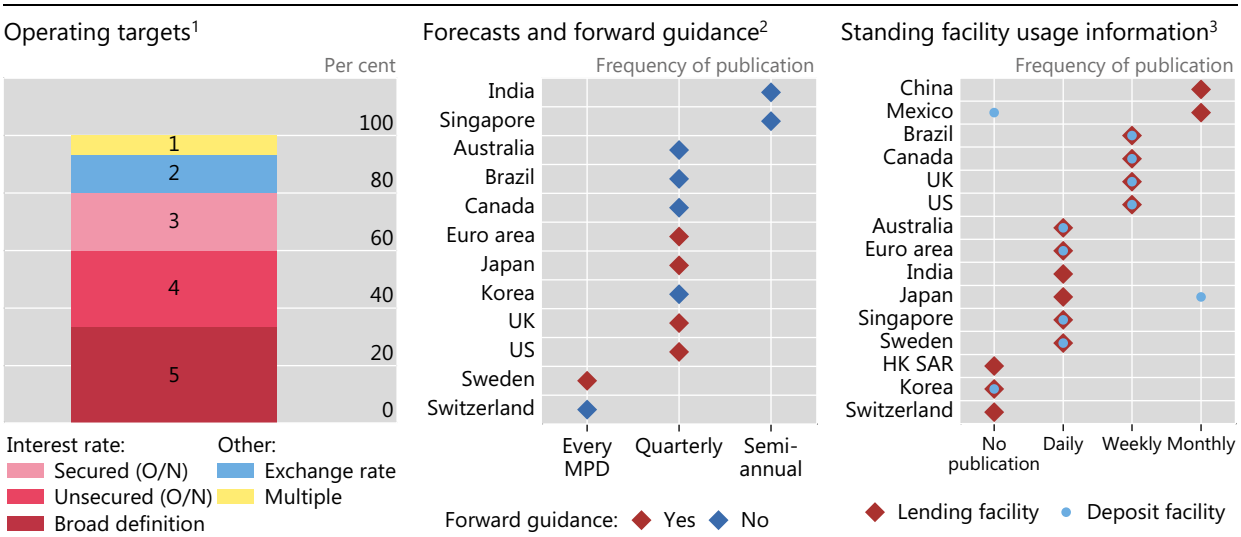
[15] Among currency areas in the compendium, Hong Kong SAR and Singapore are the major exception, as they explicitly target the exchange rate.

an unsecured overnight interbank rate (Graph 4, left-hand panel). A prominent example is the Federal Reserve, which defines a target range for the effective federal funds rate. That said, some central banks also target overnight secured (ie repo) rates (eg Brazil, Canada and Mexico).

The number of central banks with multiple operating targets has risen. In 2007, only the ECB considered an array of money market rates (even though EONIA was de facto the most relevant one). Now, the Riksbank and the Swiss National Bank also define their operational target more broadly. Most explicit about multiple operating targets is the Bank of Japan, which states that it targets the overnight rate as well as the yield on 10-year government bonds under its yield curve control framework.[16]

Central banks' operating targets and monetary policy communication

As of September 2019 Graph 4



[1] Number of central banks shown inside the bars. [2] China, Hong Kong SAR and Mexico (not shown) do not employ forward guidance or publish forecasts. Sweden and Switzerland publish forecasts following every monetary policy decision (MPD). [3] Some central banks publish the information with a lag. Australia publishes lending facility usage with a three-month delay. Canada and the United Kingdom publish both lending and deposit facility usage with a one-week and a three-week lag, respectively.

Sources: Markets Committee Compendium; authors' calculations.

[16] Since March 2020, the Reserve Bank of Australia has also set an operating target for the yield on three-year Australian government bonds, in addition to setting the target "cash rate".

The rising communication challenge

Given that the first element of monetary policy implementation is signals to express the desired policy stance, communication frameworks play a central role in MPOPs.[17] And communication has become increasingly important for ensuring the effectiveness of monetary policy implementation in recent years. At the same time, it has become more challenging, as the stance cannot be summarised by a single operating target once central banks also make active use of their balance sheets. The information in the MC Compendium reflects this evolution.

Guidance on the future path of operating interest rate targets and/or balance sheet operations – or forward guidance – has become a standard tool for shaping expectations, particularly for major AE central banks.[18] As of 2019, one third of central banks used forward guidance (Graph 4, centre panel).

The expansion of the toolkit and a more multifaceted approach to signal the stance have created communication challenges.[19] For example, consider the asset purchases by the Federal Reserve in three recent episodes, which were driven by different considerations: (i) in September 2019, to inject reserves to curb the upward spike in repo rates; (ii) in March 2020, to address market dysfunction in the Treasury market; and (iii) the subsequent continuation of asset purchases to ease financial conditions once the market stress had subsided (as recognised in the November 2020 Federal Open Market Committee statement). As this experience indicates, it has become harder to distinguish those operations that are done for purely technical reasons from those that are intended to implement the stance.

Also in response to the communication challenge, central banks have started to frequently inform market participants about operational results and facility usage. For instance, all central banks that employ open market operations publish the resulting volumes and prices, in most cases immediately after each operation. And, all but three publish information on the usage of their lending and deposit facilities, though some of them with a lag (Graph 4, right-hand panel).

[17] Just as in other areas, central banks have become more transparent. For example, until 1994 the Federal Reserve did *not* announce the fed funds rate. Rather, the stance was conveyed through subtle changes in its liquidity operations, which only a relatively small set of market participants could easily understand. See Borio (1997) for a cross-country analysis of the evolution of communication practice in this context.

[18] Forward guidance has been commonly viewed as an effective tool to provide monetary stimulus in a situation where policy rates are at the ELB (eg CGFS (2019); see also eg Filardo and Hofmann (2014)).

[19] The balance sheet unwinding implemented by the Federal Reserve between September 2017 and September 2019 illustrates such challenges. Communication by Fed officials at the time sought to emphasise that the fed funds rate target range was the key signal regarding the monetary policy stance. To facilitate this signalling, the Fed decided to put the balance sheet reduction "on autopilot", so as to minimise the risk that market participants could see it as a relevant factor in (co-)determining the monetary policy stance.

References

Bank for International Settlements (BIS) (2018): *Annual Economic Report 2018*, June.

Bindseil, U (2004): *Monetary policy implementation: theory, past, and present*, Oxford University Press.

——— (2014): *Monetary policy operations and the financial system*, Oxford University Press.

——— (2016): "Evaluating monetary policy operational frameworks", paper prepared for the Federal Reserve Bank of Kansas City's Jackson Hole Symposium, August.

Blinder, A, M Ehrmann, M Fratzscher, J de Haan and D-J Jansen (2008): "Central bank communication and monetary policy: a survey of theory and evidence", *Journal of Economic Literature*, vol 46, no 4, December.

Borio, C (1997): "The implementation of monetary policy in industrial countries: a survey", *BIS Economic Papers*, no 47, July.

Borio, C and P Disyatat (2009): "Unconventional monetary policies: an appraisal", *BIS Working Papers*, no 292, November.

Borio, C and W Nelson (2008): "Monetary operations and the financial turmoil", *BIS Quarterly Review*, March, pp 31–46.

Committee on the Global Financial System (CGFS) (2019): "Unconventional monetary policy tools: a cross-country analysis", *CGFS Papers*, no 63, October.

Corradin, S, J Eisenschmidt, M Hoerova, T Linzert, G Schepens and J-D Sigaux (2020): "Money markets, central bank balance sheet and regulation", *ECB Working Paper Series*, no 2483, October.

Disyatat, P (2008): "Monetary policy implementation: misconceptions and their consequences", *BIS Working Papers*, no 269, December.

Filardo, A and B Hofmann (2014): "Forward guidance at the zero lower bound", *BIS Quarterly Review*, March, pp 37–53.

Kim, K, A Martin and E Nosal (2018): "Can the US interbank market be revived?", Board of Governors of the Federal Reserve System, *Finance and Economic Discussions Series*, December.

Markets Committee (MC) (2019a): *MC Compendium: Monetary policy frameworks and central bank market operations*, October.

——— (2019b): *Large central bank balance sheets and market functioning*, October.

Reiss, R (2013): "Central bank design", *Journal of Economic Perspectives*, vol 27, no 4.

Annex

Overview of MC Compendium content

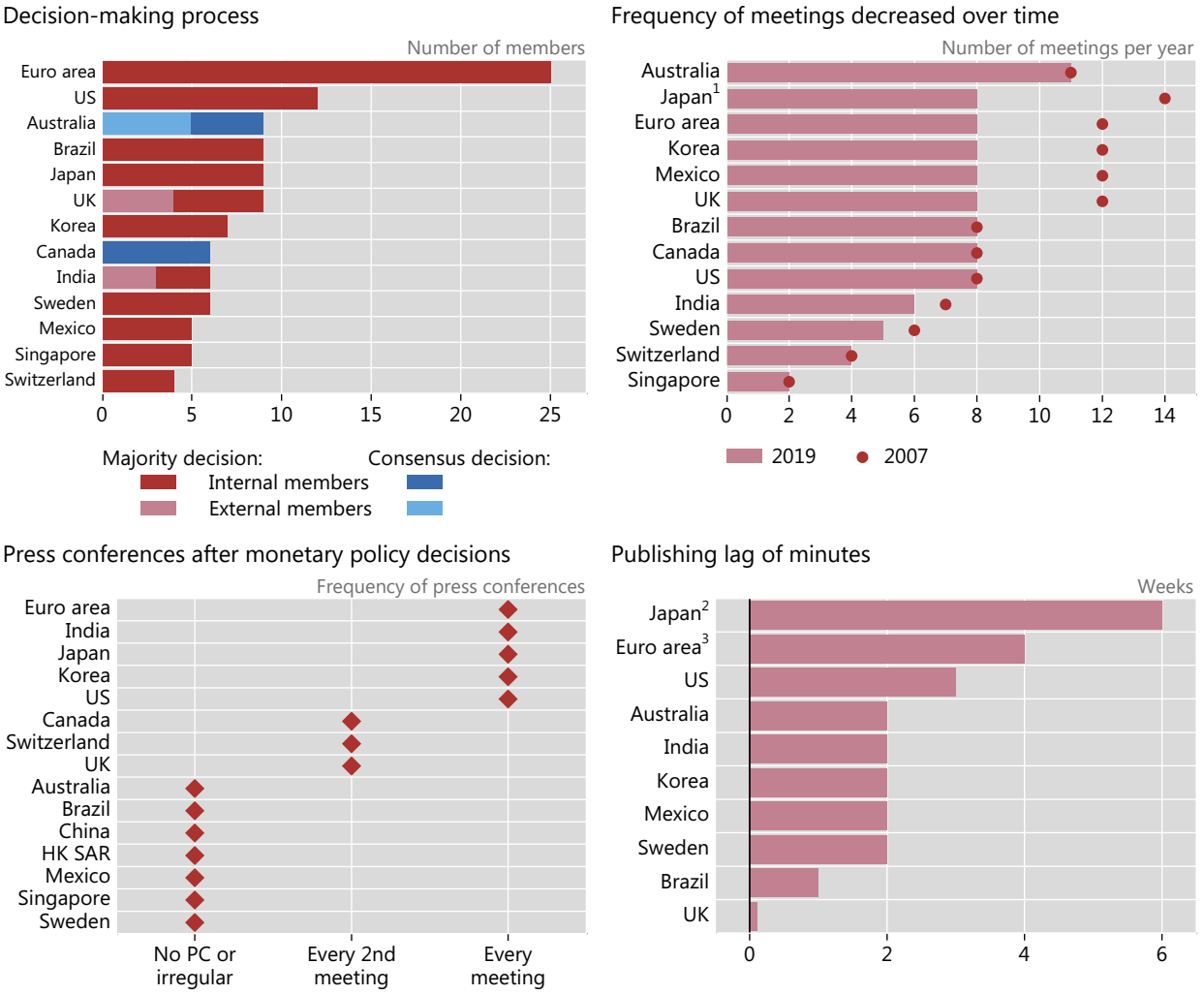
Table A1

Element	Title and content
1	**Institutional setup of monetary policy decisions and operations** • Summaries of main institutional features of monetary policy decisions (policy decision-making body, details about its composition, key parts of the mandate, and the nature of the decision-making process).
2	**Overview of key features** • Key features of MPOP (operating target and the tools used to achieve it).
3	**Monetary policy communication** • Details about: use of forward guidance, timing and distribution of policy announcements, communication explaining policy decisions, the dissemination and content of minutes, publication of forecasts and projected paths of policy rate.
4	**Reserve requirements: ratios and size** • Overview of reserve requirements imposed by central banks, including their function and the size of required and actual reserves.
5	**Main features of reserve requirements** • Details on how reserve requirements are implemented, including maintenance and calculation period length, averaging and remuneration.
6	**Liquidity position and forecasting** • Current liquidity position in each jurisdiction, and details on the central bank's liquidity forecast, including which autonomous factors are more volatile or unpredictable in each economy.
7	**Standing facilities** • Key characteristics of standing lending and deposit facilities, including their form, pricing, maturity, counterparty access and function.
7a	Lending / market ceiling
7b	Deposit / market floor
8	**Open market operations** • Details on central bank (reverse) repo agreements, central bank bill issuances and foreign exchange swap offerings; information includes their type, maturity, frequency, pricing, counterparty access and function.
8a	Repos or reverse repos
8b	Central bank bills
8c	FX swaps
9	**Other significant liquidity management means** • Overview of other tools (not listed in Tables 7–8) used to manage liquidity and the details of these operations.
10	**Settlement systems and intraday liquidity facilities**
11	**Collateral** • Assets admissible as collateral in open market operations and standing facilities.
12–15	**Dissemination of operational information** • Overview of the information central banks provide organised by type of operation, including the publication channels and timing of releases.
12	Liquidity forecast
13	Open market operations
14	Standing facilities
15	Other information dissemination

Sources: Markets Committee Compendium; authors' elaboration.

Institutional setup of monetary policy

Graph A1



[1] Until the end of 2015, Bank of Japan monetary policy meetings took place once or twice a month (with dates of semiannual meetings set in advance); typically, at least 14 meetings took place every year. [2] A high-level "summary of opinions" is released six business days after each monetary policy meeting. [3] The ECB has been publishing "monetary policy accounts" since January 2015.

Sources: Markets Committee Compendium; authors' calculations.

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Tools for managing banking distress: historical experience and lessons for today[1]

We analyse the effectiveness of policy tools for large-scale banking distress and draw lessons for today. The depth of recessions following banking distress depends both on the speed with which tools were deployed and their type and on the macro-financial vulnerabilities. While, in general, swifter and broader-ranging policy actions mitigate such recessions, central banks' asset purchases and lending are particularly effective when banks have been underperforming or when distress follows abnormally large asset price movements, such as those triggered by the Covid-19 crisis. Our analysis confirms that the recently employed policies have supported the real economy.

JEL classification: G01, G38, E60.

Banking distress and crises tend to be followed by deep recessions. The basic reason is the sharp contraction in lending following a breakdown in financial intermediation. Baron et al (2020) document that after episodes of large bank stock price declines and an abnormal number of bank failures – that is, after distress episodes – real GDP falls by 5.5% on average from peak to trough. Output losses are particularly large when distress morphs into a full-scale banking crisis (Laeven and Valencia (2013)). And they vary across countries. For example, during the Great Financial Crisis (GFC) output fell from peak to trough by 0.16% in Switzerland and by almost 30% in Greece.

There are two interrelated sets of explanations for such variations across countries and episodes. One relates to the initial economic conditions, notably the macro-financial imbalances with which countries enter a period of distress. For instance, banking distress associated with the unravelling of a domestic financial imbalance (eg a housing bubble) may have a very different impact than that stemming from an external event in the absence of such or similar imbalances (eg a crisis imported through cross-border exposures).[2] The other set of explanations relates to the policies employed. The timing and degree of policy activity and the specific tools deployed (eg central bank lending, separation of impaired assets) differ considerably across episodes. These choices will influence the severity of the recession, not least if the effectiveness of tools varies with the initial conditions.

[1] The authors thank Iñaki Aldasoro, Claudio Borio, Benoît Mojon, Vasily Pozdyshev, Hyun Song Shin, Nikola Tarashev and Christian Upper for helpful comments. The views expressed in this article are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

[2] The different impact of the GFC in Greece and Switzerland is a case in point.

Key takeaways

- Policy interventions that address banking distress also help support GDP growth.
- Central banks' asset purchases and lending have generally been effective in supporting growth when distress follows banks' poor performance, high private sector leverage or large asset price corrections.
- Central banks' swift response to the Covid-19 crisis has helped to support the economy, including by pre-emptively staving off banking distress.

While many studies document the economic consequences of banking distress, relatively few systematic cross-country analyses explore the effectiveness of mitigating policy tools.[3] Progress has been hamstrung by a lack of comprehensive data about these tools. Furthermore, it is inherently difficult to measure effectiveness. For example, larger-scale distress calls for stronger interventions, but also makes success less certain. This may lead to the spurious conclusion that interventions are less effective.

With this special feature, we make progress along three dimensions. First, we classify 62 banking distress episodes into five categories, on the basis of initial macro-financial vulnerabilities.[4] Second, using a new database by Adler and Boissay (2020) on the deployment of various distress mitigation tools, we assess empirically whether variations in the evolution of GDP across similar episodes can be explained by differences in the speed and type of policy interventions. Third, we draw policy lessons for today from our analysis.

We find that swifter and broader-ranging policy actions mitigate the impact of banking distress on economic activity. We refine this result in several ways. Central bank lending schemes are more effective in helping restore GDP growth when set up in the first year of distress, whereas impaired asset segregation schemes are more successful when used in the second. Asset purchase and – to a lesser degree – liability guarantee schemes are effective regardless of when they are deployed.

Our analysis of past experiences also suggests that certain tools are particularly effective under specific initial conditions. For example, we find that central bank lending schemes are most helpful when distress follows unusually large asset price corrections of the type triggered by the Covid-19 crisis. Our results confirm that the policy measures adopted since March 2020 have helped to support the economy, including by pre-emptively staving off banking distress.

The rest of this feature is structured as follows. The first section describes how we classify banking distress episodes and, in the process, documents their variety. The second describes the various policy interventions, and includes a box on their variation by time of use and across countries. The third section formally tests the effectiveness of various policy interventions depending on their speed and the type of episode. The fourth section applies these findings to the ongoing Covid-19 crisis. A final section concludes.

[3] In addition to country-specific case studies, the cross-country studies exploring the effects of crisis mitigation tools include Borio et al (2010), Cecchetti et al (2009), Claessens et al (2003, 2005), Detragiache and Ho (2010) and Laeven and Valencia (2013). For a general review of financial crises, see Claessens et al (2014).

[4] We use Baron et al's (2020) list of banking distress episodes for 29 countries since 1980.

Classifying banking distress episodes

Banking distress has various causes and can start from different initial conditions. Such differences must be accounted for when evaluating the effectiveness of policy interventions. Our approach consists of classifying past distress episodes into categories, based on the macro-financial vulnerabilities that preceded them.

We consider 62 past banking distress episodes from Baron et al (2020) for 29 countries over the period 1980–2016.[5] Baron et al define a distress episode as one in which bank equity prices fall by 30% year on year and there is a higher than normal number of bank failures. Their list differs from others' (eg Laeven and Valencia (2012, 2018)) in two ways. First, it features more episodes, including many distress episodes that did not end in crisis.[6] Second, the starting dates of the episodes are identified precisely by crashes in bank stock prices.

In order to classify banking distress episodes, we track the evolution of a large set of macro-financial variables in the run-up to these episodes. There are vulnerabilities when (some of) these variables take on abnormal values (Box A). We classify the episodes into five categories, corresponding to five broad vulnerability types: (V1) cross-border exposures; (V2) asset valuations; (V3) bank health; (V4) private non-financial sector (PNFS) leverage; and (V5) real economy performance (Graph 1, Box A and Adler and Boissay (2020)). Vulnerabilities of the first type, for example, typically stem from domestic residents' cross-border liabilities in foreign currencies and cross-border bank loans (Graph 1, left-hand panel). Those related to asset valuations show up as sharp drops in house and stock prices (eg following the bust of an asset price bubble). Vulnerabilities related to real economy performance manifest themselves most often through a prior severe recession, with pronounced falls in manufacturing PMIs and consumption growth.

Our classification highlights the variety of banking distress episodes. The right-hand panel of Graph 1 shows that in about 40% of the episodes, distress is preceded by excessive cross-border exposure, severe asset price corrections[7] or weak real economy performance. Weak bank performance only precedes 20% of the episodes.[8]

[5] Baron et al's (2020) list includes distress episodes for more countries over the period 1870–2016, but throughout this special feature we only consider those countries and years for which we also have information on policy interventions. These countries are: *Argentina*, Austria, Belgium, *Colombia*, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, *Indonesia*, Ireland, Italy, Japan, *Korea*, Luxembourg, *Malaysia*, the Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, *Thailand*, *Turkey*, the United Kingdom and the United States, with emerging market economies in italics.

[6] Baron et al (2020) contains about 50% more episodes than Laeven and Valencia (2018) for the same countries.

[7] These are price corrections other than of bank equity prices (which are part of Baron et al's (2020) definition of bank distress), such as those of non-financial corporations' equity prices and house prices.

[8] Episodes may not overlap. About one quarter of episodes feature only one type of vulnerability, and one quarter feature at least three types simultaneously. Most of the latter correspond to the GFC.

Box A

Definition of vulnerabilities and classification of distress episodes

This box describes how we identify the macro-financial vulnerabilities that manifest themselves in the run-up to banking distress episodes. We say that there is a (country-specific) vulnerability whenever a variable takes on an "abnormally" high or low value, ie when it falls in the upper or lower 10% tail of its distribution. Since the immediate lead-up and aftermath of the episode may distort the statistics, we follow Goldstein et al (2000) and consider the distribution only for "normal times", defined as the period that excludes the two years before and after the beginning of distress episodes. We then investigate which variables took on abnormal values in the distress episode's starting quarter (ie of the banks' stock price crash), as well as the first, third and fifth quarters before that.①

We consider a comprehensive quarterly data set of more than 70 macro-financial variables (in levels, growth rates, ratios to GDP) that the literature has identified as potential early warning indicators of banking distress (Table A).② We group these variables into five categories relating to different types of macro-financial vulnerabilities. This classification follows common practice and is consistent with central banks' financial stability monitoring frameworks.③ Altogether, taking into account the number of variables and quarters considered, the total number of potential vulnerabilities per category ranges from 48 to 72, depending on the category.

List of macro-financial variables used for the classification

Table A

Category of initial vulnerability / distress episode	Variables included in the category[1]
(V1) Cross-border exposures	Cross-border loans, bonds, short-term liabilities, foreign currency-denominated liabilities
(V2) Asset valuation	House price index, stock price index (overall, banks, financials, consumption sector, industrial sector)
(V3) Bank health	Bank assets, RoA, loans/assets, loans/deposits, deposit/assets, price-to-book value, leverage, interest rate margin, NPL/loans ratio
(V4) PNFS leverage	Credit to PNFS, HHs, NFCs, credit to HHs/credit to NFCs ratio, debt service ratio
(V5) Real economy performance	Real GDP, consumption, investment, unemployment, short-term rate, government bond yield, PMIs (composite, manufacturing), inflation

HHs = households; NFCs = non-financial corporations; NPL = non-performing loans; PMIs = purchasing managers' indices; PNFS = private non-financial sector; RoA = return on assets.

[1] All variables are de-trended. In addition, and depending on the variable, we consider up to three transformations: in log or level; in change or growth rate; and ratios to GDP.

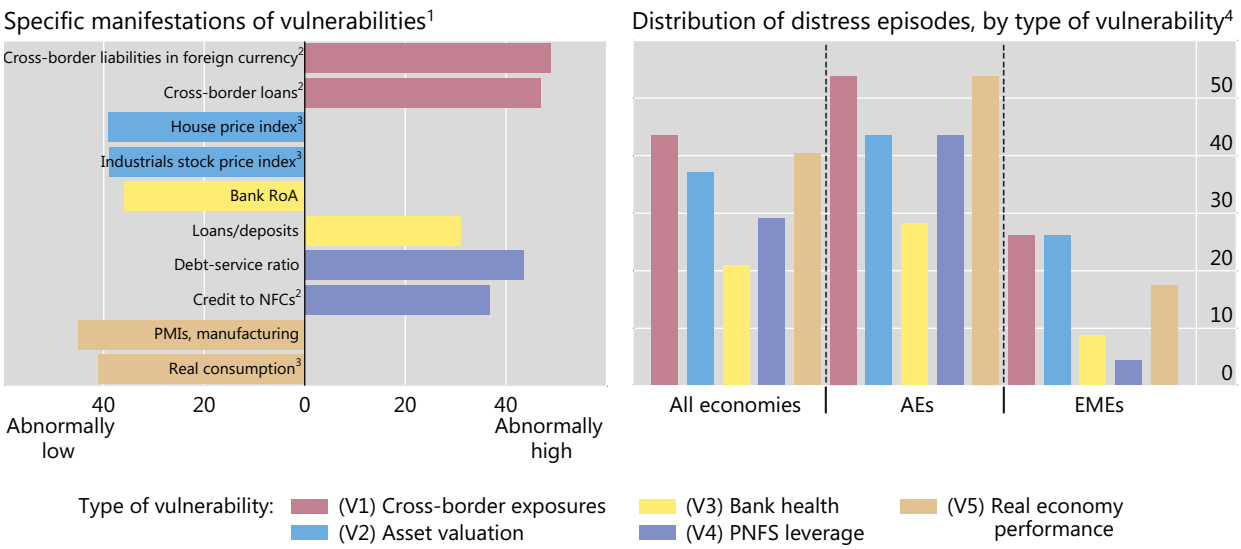
To classify a distress episode, we first calculate the percentage of "abnormal" variables within a category.④ Then we classify an episode into a specific category if this percentage is above a threshold of 25%. The classification is not mutually exclusive: a given distress episode may be classified in multiple categories. At the same time, the 25% threshold implies that three quarters of the episodes are classified in at least one category and one quarter of all episodes are classified as not preceded by any vulnerability.

① We experimented with different quarters up to the eighth quarter before the start of banking distress episodes, and our results did not change materially. ② See eg Borio and Lowe (2002), Borio and Drehmann (2009) and Aldasoro et al (2018). ③ For example, in its *Financial Stability Report* the US Federal Reserve Board emphasises four broad categories of vulnerability: valuation pressures; borrowing by businesses and households; leverage within the financial sector; and financial institutions' funding risks (FRB (2020)). Similarly, in its *Financial Stability Review* the ECB focuses on: macro-financial imbalances relating to the real economic outlook; leverage in the household and corporate sectors; financial market liquidity and asset valuations; and banks' financial health (ECB (2020)). ④ To reflect relevance, we weigh each vulnerability by how often it occurred before the distress episodes of Baron et al (2020)). For more details, see Adler and Boissay (2020).

Banking distress is preceded by different macro-financial vulnerabilities

In per cent

Graph 1



NFCs = non-financial corporations; PMIs = purchasing managers' indices; PNFS = private non-financial sector; RoA = return on assets.

[1] The bars indicate the frequency of abnormally low (left-hand side) or high (right-hand side) values in the quarter preceding banking distress episodes, during the whole history of such episodes since 1980. For the definition of abnormally low or high, see Box A. [2] Ratio to GDP. [3] Growth rate. [4] The bars indicate the frequency of initial vulnerabilities by category, in our sample of 62 banking distress episodes.

Sources: Baron et al (2020); IMF; Datastream; Fitch Connect; IHS Markit; national data; BIS; authors' calculations.

The data indicate some differences between advanced and emerging market economies (EMEs). In advanced economies (AEs), distress episodes tend to be preceded by widespread vulnerabilities, with notably excessive cross-border exposure and weak economic performance (55% of cases). In about 40% of the AE episodes, the initial conditions involve severe asset price corrections or high private sector leverage. In EMEs, it is harder to relate distress episodes to specific vulnerabilities. Just one in four episodes is preceded by excess cross-border exposure or a severe fall in asset prices, and few episodes by excess leverage, whether in the financial or non-financial sector. This suggests that banking distress in EMEs need not be the outcome of domestic imbalances, but could be triggered by external shocks.[9]

General patterns of policy interventions

For data on policy interventions, we draw on a new database on banking distress mitigation tools (Adler and Boissay (2020)). It contains information on more than 300 policy interventions deployed in 29 countries between 1980 and 2016. We divide policy tools into four broad types: (T1) central banks' lending schemes; (T2) bank liability guarantee schemes; (T3) impaired asset segregation (IAS) schemes; and (T4) bond and other asset purchase schemes (Box B). One advantage of the database is that it records interventions at their precise date (ie quarter) of

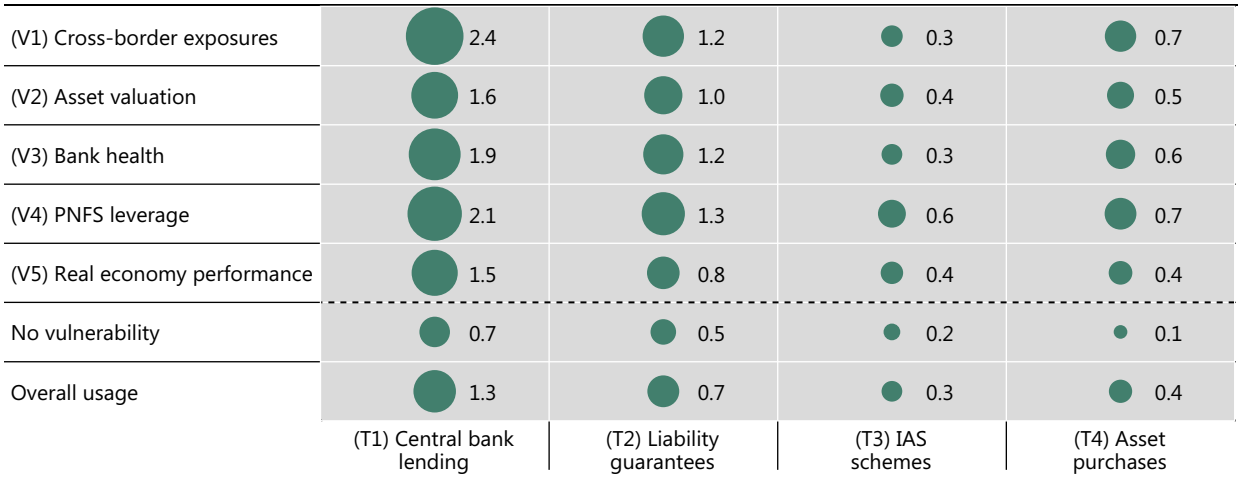
[9] This can also reflect the lack of data (notably cross-border borrowing data) before EMEs' distress episodes.

implementation.[10] Combining the databases of Baron et al (2020) and Adler and Boissay (2020) allows us to measure the lag between the beginning of a distress episode (ie when banks' stock prices crash) and specific policy interventions. This, in turn, allows us to evaluate whether the specific timing of a tool has different effects.[11]

A few general patterns emerge from the combination of the two databases. For each category of initial vulnerability (rows), Graph 2 shows the average number of tools of a specific type (columns) employed in the first two years of the banking distress episodes. Overall, central banks' lending schemes are used most often, followed by bank liability guarantees, asset purchases and IAS schemes. Policy interventions mostly take place in episodes associated with at least one macro-financial vulnerability (compare the row "No vulnerability" with the other rows). Relatedly, lending schemes and asset purchases are used the most in episodes associated with cross-border border vulnerability and high private sector leverage.

General patterns in the use of distress mitigation tools

Average number of tools used per distress episode[1] Graph 2



IAS = impaired asset segregation; PNFS = private non-financial sector.

[1] For our sample of 62 banking distress episodes.

Sources: Adler and Boissay (2020); Baron et al (2020); authors' calculations.

[10] Dates correspond to the actual implementation of the schemes, not to their announcement.

[11] A limitation of the Adler and Boissay (2020) database is that it does not contain information on the size of the policy interventions. Data on the size of banking distress mitigation schemes are often not available. And even when they are, many issues prevent comparability (eg facilities of the same size may be used to different degrees, with liability guarantees and liquidity facilities being cases in point). Similar caveats apply to studies on the effects of macroprudential tools (eg Boar et al (2017), Cerutti et al (2017)). All countries covered in Adler and Boissay (2020) are in the Baron et al (2020) database except Estonia, for which we use the bank distress episodes reported in Basten et al (2017).

A database on banking distress mitigation tools

Frederic Boissay, Stijn Claessens and Alan Villegas[①]

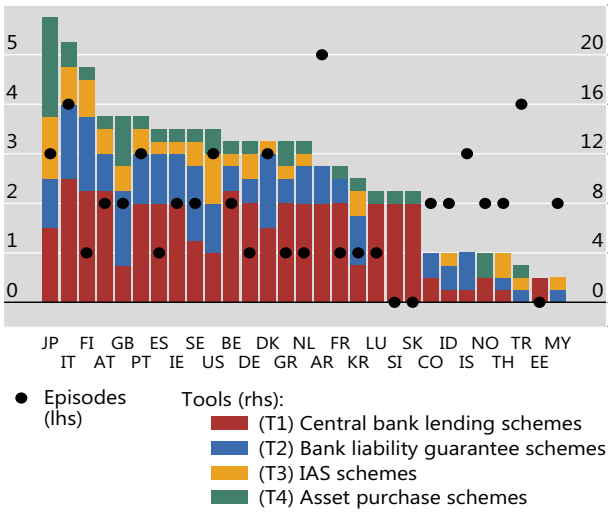
This box describes Adler and Boissay's (2020) new database on banking distress mitigation tools. The database contains information on more than 300 interventions in 29 countries between 1980 and 2016. It documents the tools' deployment dates (quarter) and key design features. The tools are divided into four broad types of schemes: (T1) central bank lending; (T2) bank liability guarantees; (T3) impaired asset segregation; and (T4) asset purchases.

Central bank lending schemes (T1) consist of interventions providing funding directly to banks and other financial intermediaries. These include outright liquidity provision, special (eg long-term) lending and changes in central banks' collateral eligibility rules (eg extension of collateral frameworks to more institutions or asset classes). Among these tools, the last one is the most frequently employed.

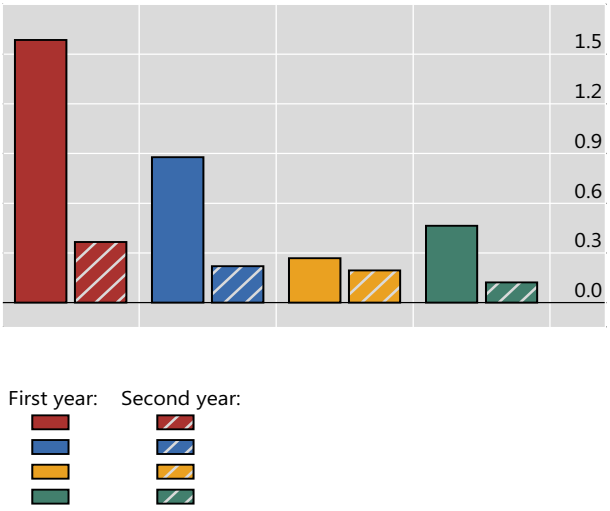
Number of banking distress mitigation tools in Adler and Boissay (2020)[1]

Graph B

Total number of banking distress episodes and mitigation tools recorded in the database, by country



Average number of tools used in the first and second year of a distress episode[2]



IAS = impaired asset segregation.

[1] For a sample of 29 countries between 1980 and 2016. [2] Conditional on at least one tool being used within the first two years of the distress episode.

Sources: Adler and Boissay (2020); Baron et al (2020); authors' calculations.

Bank liability guarantee schemes (T2) consist of fiscal authorities (partly) guaranteeing commercial banks' privately issued debts, sometimes in exchange for a guarantee fee. An example is an enhancement to an existing deposit insurance scheme. Most schemes are optional, and cover a relatively large array of debt instruments (eg senior debt instruments, interbank debts), but are restricted to newly issued (as opposed to legacy) liabilities.

The database records 40 ***impaired asset segregation schemes***, (T3) or so-called "bad banks". Most bad banks in the database have a limited lifetime. About half are set up for one specific bank. The other half are "centralised", ie they purchase assets on a voluntary basis from several banks, often with a limit on the amount purchased per bank. On average, the size of a bad bank amounts to 7% of GDP, and a haircut of 25% is applied on the assets purchased.

Asset purchase schemes (T4) consist of interventions where the central bank purchases specific assets on secondary markets (eg corporate bonds, asset-backed securities), or offers to banks to swap risky for safer assets (typically government bonds).

The intensity of interventions varies by country. Graph B (left-hand panel) shows that Japan, Italy and Finland record the most interventions overall. Finland has the most interventions per distress episode. When they take place, most interventions occur in the first year (right-hand panel). Central banks' lending schemes are the most prevalent type of intervention, with an average of 1.6 schemes set up in the first year, followed by bank liability guarantee schemes.

① The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements

Assessing the effectiveness of policy interventions

Our approach to evaluating empirically the effectiveness of policy interventions involves two steps. First, we seek to establish a causal relationship between the number of tools deployed and cumulative GDP growth throughout the distress episode.[12] Second, we test whether the various tools are more effective when deployed more swiftly or in particular types of distress episodes.

Baseline econometric model

Establishing a causal relationship between a given policy intervention and GDP growth is challenging. To keep "all else" equal, we focus on banking distress episodes that feature observationally similar initial macro-financial vulnerabilities. Our identification strategy rests on the assumption that similar vulnerabilities are the symptoms of similar underlying factors, and that the latter should have similar economic consequences unless they are addressed with different policies.[13]

Accordingly, the unit of analysis is a pair of similar episodes e and e',[14] and we are interested in whether the difference in the evolution of GDP throughout these episodes can be explained by differences in policy interventions. Our baseline econometric model is the following:

$$(1)\quad \Delta GDP_{e,e'} = \alpha + \beta_{(1)}\Delta T^{(1)}_{e,e'} + \cdots + \beta_{(4)}\Delta T^{(4)}_{e,e'} + \gamma \Delta Z_{e,e'} + \varepsilon_{e,e'}$$

The variable $\Delta GDP_{e,e'}$ is the difference in average annualised real GDP growth rates between episodes e and e'. To gauge post-crisis performance, we focus on GDP growth from two years before to three years after the episode starts.[15] Since different policy interventions often come together in a distress episode, we estimate the effects of the four types of distress mitigation tools simultaneously. Accordingly, variables $\Delta T^{(1)}_{e,e'}$ ...,$\Delta T^{(4)}_{e,e'}$ are the differences between the number of tools of type (T1), ..., (T4) deployed within the first two years of episode e versus episode e'. Of interest are the coefficients $\beta_{(1)}$, ...,$\beta_{(4)}$, which capture the effect of the corresponding tools on GDP growth. The regression features a set of additional control variables $\Delta Z_{e,e'}$ that account for drivers of GDP growth other than policy interventions. The controls notably include 0/1 dummies capturing differences between countries in terms of monetary policy rates, exchange rate regimes and central bank independence.[16]

[12] For a similar analysis with alternative metrics of success, see Adler and Boissay (2020).

[13] Ideally, one would compare episodes that differ *only* in terms of the scope and timeliness of policy interventions, eg where policymakers also face similar institutional constraints and fiscal space, and not only episodes with similar initial macro-financial vulnerabilities. These and other issues are admittedly limitations to comparing like with like. For example, one cannot exclude that even observationally similar vulnerabilities have different causes, and thus may call for different policies.

[14] Episodes e and e' feature the same type of initial vulnerabilities, ie both belong to at least one common category (V1), ..., or (V5). For our sample of 62 distress episodes, there are 1,891 (= 62 x 61 / 2) possible distinct pairs, of which only 385 are deemed to contain similar episodes. Thus, we work with a sample of 385 observations. For more details about the pairing, see Adler and Boissay (2020).

[15] We use GDP two years before the start of the episode because, closer to the start, GDP could be boosted by macro-financial imbalances. Part of the correction during a distress episode may then reflect a reversal to a normal growth path, for which policy interventions do not seek to correct.

[16] A reduction in the monetary policy rate can also be seen as a banking distress mitigation tool. Here, we use it as a control variable, as our focus is on the effectiveness of other measures.

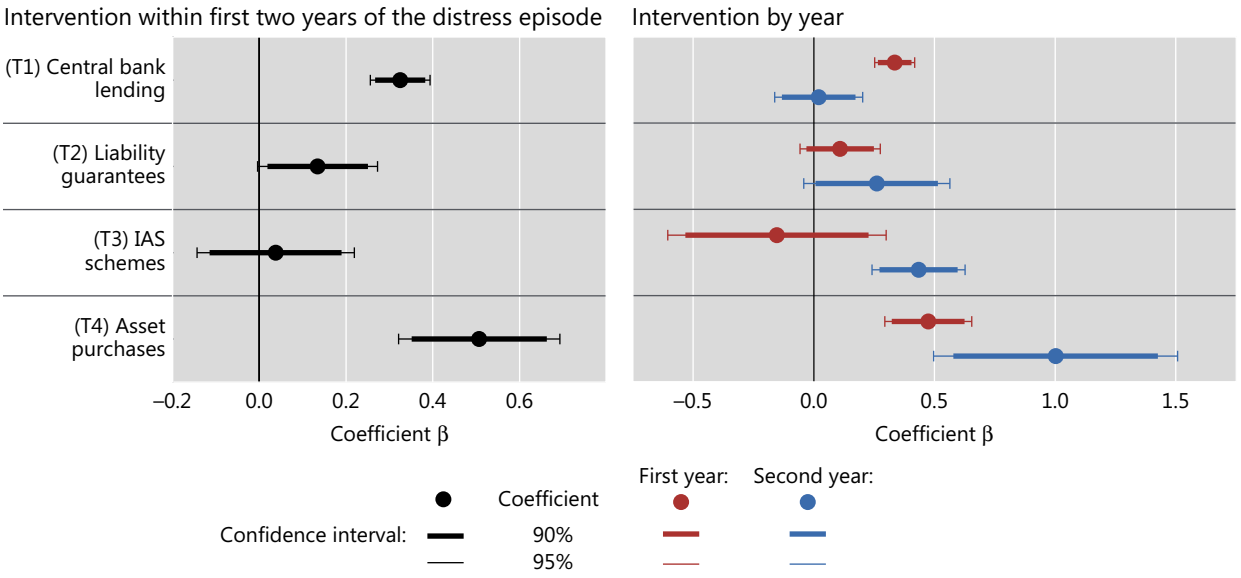
Results for general effectiveness and timing

The analysis points to differences in the tools' effectiveness. The estimates of the coefficients β in regression (1) are reported in Graph 3 (left-hand panel). We find that central banks' lending schemes and asset purchases have a statistically significant positive effect on post-crisis GDP growth. In particular, every additional asset purchase scheme augments the annualised GDP growth rate by 0.5 percentage points on average.[17] Additional bank liability guarantees also have a statistically significant positive effect, but marginally so. One reason could be that calibrating liability guarantee schemes (guarantee fee, requirements for participation, scope of the scheme) is challenging, and schemes may not initially be attractive to banks.[18]

Overall, our results are consistent with those using richer, micro data sets. Despite the usual limitations inherent to cross-country analyses employing coarse data, our findings concur with those of more granular case studies. For example, Eser and Schwaab (2016) and Andrade et al (2016) find that asset purchase schemes improve liquidity conditions, reduce risk premia and contribute to raising the equity price of

Effects of bank distress mitigation tools on GDP growth

Coefficient β, in percentage points[1] Graph 3



IAS = impaired asset segregation.

[1] Coefficients β from regression (1). Each coefficient measures the effect of using one more mitigation tool on annualised cumulated GDP growth from two years before, to three years after, the beginning of the distress episode, in percentage points. All coefficients are estimated using robust standard errors, in a sample of 385 observations.

Source: authors' calculations.

[17] There are several possible transmission channels of central bank asset purchases to the real economy. One is a portfolio rebalancing channel, whereby purchases of sovereign bonds induce a decline in their yields and give investors an incentive to invest in corporate bonds, thus supporting the real economy. Another is a capital relief channel, as the higher price of sovereign bonds induced by central banks' purchases benefits banks that hold such bonds.

[18] Banks may not participate if, for example, the scheme requires high regulatory capital ratios. Moreover, liability guarantee schemes can be dictated by urgency (eg a sudden depositor run), for which we do not fully control in our econometric analysis. This means their coefficient estimates could be biased downward due to reverse causality.

the banks holding the assets covered by the scheme. Andrade et al (2019) also find that, when central banks provide long-term liquidity to banks, the latter increase their loans to the real economy. And Laeven and Valencia (2008) find that extending blanket guarantees reduces banks' need for liquidity support from central banks.

The effectiveness of policy interventions varies depending on the phase of the distress episode (Graph 3, right-hand panel). This result is obtained from a richer version of regression (1) distinguishing between tools deployed in the first or second year of the distress episode. We find that liquidity provision by central banks is effective in the first year, reflecting its stabilisation role, but not in the second, when solvency issues tend to be more prominent. In contrast, impaired asset segregation is more effective in the second year, as non-performing assets are being recognised (Ari et al (2019)) and bank balance sheets must be repaired. Asset purchase schemes are effective whenever they are deployed, but more so in the second year.[19] Liability guarantees are the only exception, equally effective in the first or the second year.

Results for effectiveness by type of tool and category of banking distress

To test whether the effect of policy activity – defined as the number of tools deployed – varies with the category of distress episodes, we next estimate the following modification of regression (1):

$$(2)\quad \Delta GDP_{e,e'} = \alpha + \beta^{(1)}\Delta T_{e,e'} \times V^{(1)}_{e,e'} + \cdots + \beta^{(5)}\Delta T_{e,e'} \times V^{(5)}_{e,e'} + \gamma \Delta Z_{e,e'} + \varepsilon_{e,e'}$$

We interact the difference in the *total* number of tools deployed, denoted $\Delta T_{e,e'}$, with dummy variables $V^{(1)}_{e,e'}$, …, $V^{(5)}_{e,e'}$ equal to one if episodes e and e''s initial vulnerabilities both belong to categories (V1), …, or (V5). Accordingly, the coefficient β measures the effect of deploying one additional tool (of any type) during a distress episode that is preceded by a particular macro-financial vulnerability.

The results of estimating regression (2) are reported in the left-hand panel of Graph 4. All coefficients are statistically positive and of similar size at around 0.06. This means that using altogether more of the various available tools helps address banking distress.

Next, we examine whether the effectiveness of *individual* tools depends on the category of initial vulnerability. To this end, we modify regression (2) by interacting a given tool with each macro-financial vulnerability:

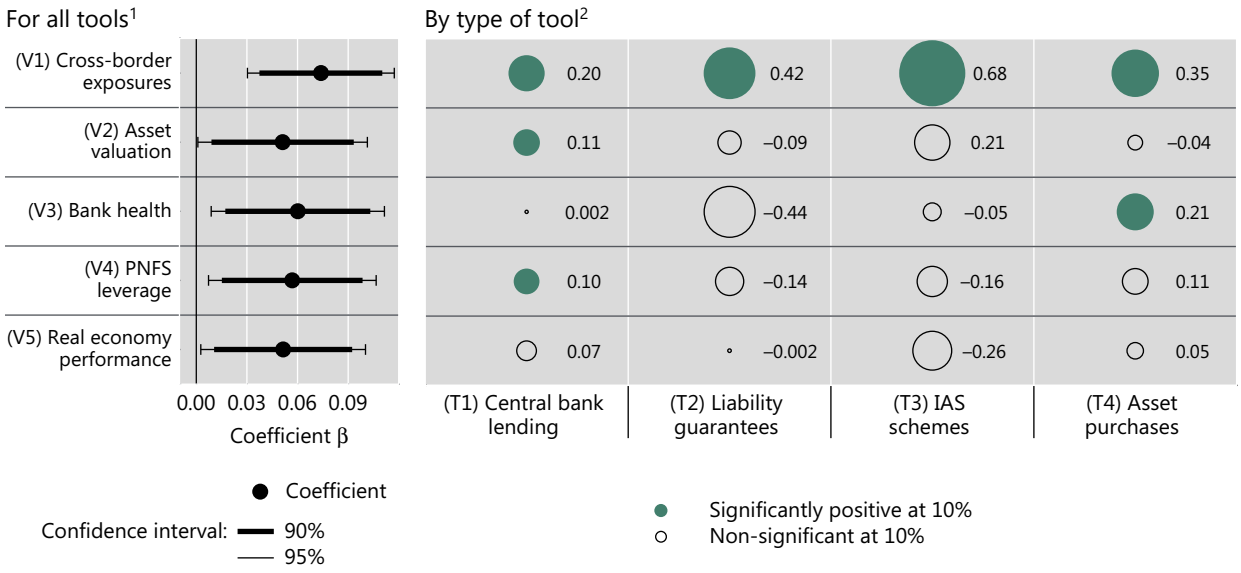
$$(3)\quad \Delta GDP_{e,e'} = \alpha + \beta^{(1)}_{(1)}\Delta T^{(1)}_{e,e'} \times V^{(1)}_{e,e'} + \cdots + \beta^{(5)}_{(1)}\Delta T^{(1)}_{e,e'} \times V^{(5)}_{e,e'} + \beta_{(2)}\Delta T^{(2)}_{e,e'} + \cdots + \beta_{(4)}\Delta T^{(4)}_{e,e'} + \gamma \Delta Z_{e,e'} + \varepsilon_{e,e'}$$

Of interest in regression (3) are the coefficients $\beta^{(1)}_{(1)}$, …,$\beta^{(5)}_{(1)}$, which capture the effects of deploying a tool of type (T1) during a distress episode preceded by macro-financial vulnerability of category (V1), …, or (V5). We estimate this model separately for each type of tool and obtain 20 (four tools times five vulnerabilities) distinct estimates. The right-hand panel of Graph 4 shows the effect on GDP growth (in percentage points) of deploying a given tool (columns) in a given type of distress (rows). The size of a dot reflects the size of the effect, and a green dot indicates that the effect is statistically significant.

[19] In all the cases above, the effects in the first and second year are statistically significantly different.

Effects of banking distress mitigation tools on GDP growth, by category of episode

Coefficient β, in percentage points — Graph 4



IAS = impaired asset segregation; PNFS = private non-financial sector.

[1] Coefficients β from regression (2) of the interaction of the total number of tools (whatever their type) with a dummy variable equal to one if both episodes e and e' belong to the category of distress considered (rows). [2] Coefficients β from regression (3) of the interaction of the number of tools of a particular type (columns) with a dummy variable equal to one for the particular category of distress episodes (rows). For liability guarantees and IAS schemes, we estimate the effect of tools deployed during the second year of distress only. The size of a dot reflects the size of the coefficient. All coefficients are estimated using robust standard errors, in a sample of 385 observations.

Source: authors' calculations.

While using more tools is beneficial regardless of specific initial conditions (Graph 4, left-hand panel), certain tools are especially effective under specific initial conditions (right-hand panel). For instance, we find that more lending schemes and asset purchases boost GDP growth – by 0.2 percentage points and 0.35 percentage points, respectively – when distress follows abnormally large cross-border exposure. Likewise, such interventions are effective on the heels of large asset price corrections, weak bank performance and excess private sector leverage. From the perspective of specific vulnerabilities, we find that all tools – and, especially, impaired asset segregation schemes – are effective in a context of excessive cross-border exposure. In contrast, no single tool is especially potent when a country enters a banking distress episode with weak economic performance. This could reflect the lack of direct central bank levers to address distress that originates in the real economy.[20] There are nonetheless complementarities between tools in the case of weak economic performance, because deploying multiple tools concomitantly helps to address distress (left-hand panel, last row).[21]

[20] Indeed, all the tools considered here work primarily through banks and to a lesser degree through various other segments of the financial sector.

[21] Unfortunately, the variation in the usage of tools is too limited and our sample too short to test explicitly for complementarities between the various tools.

Insights for today

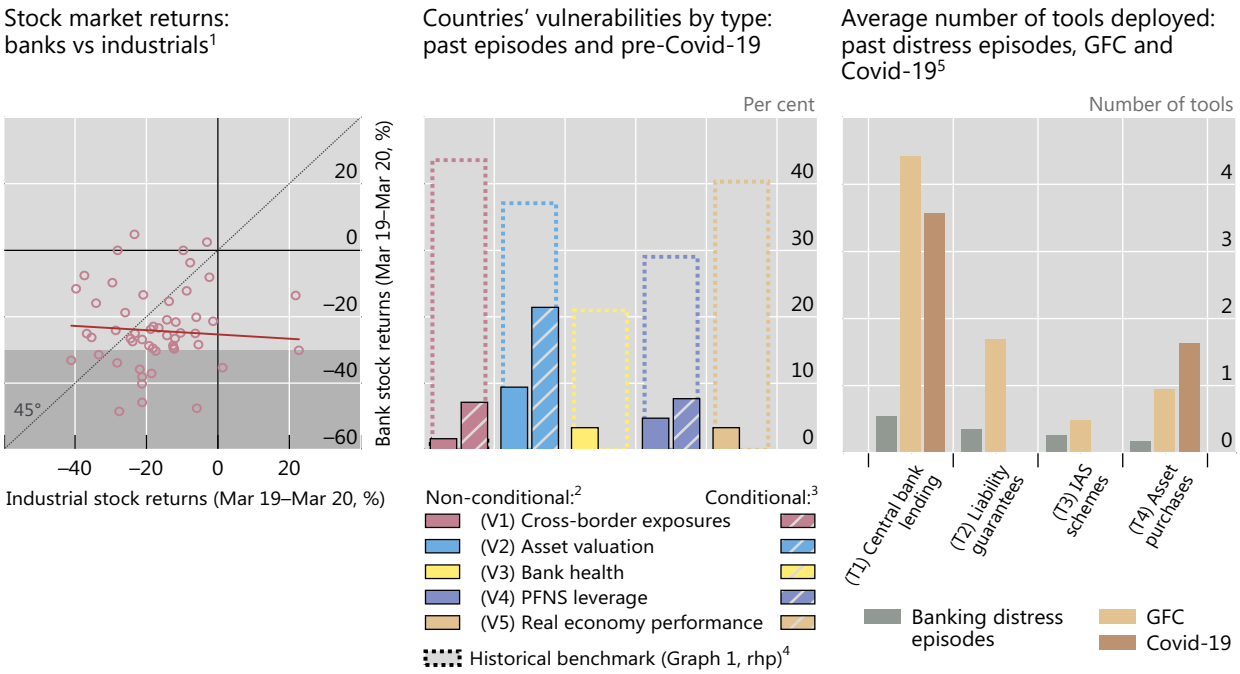
The Covid-19 economic shock is the largest and most singular global shock experienced in modern peacetime. It was triggered by a global pandemic and synchronised lockdowns, which resulted in inability to work, disruptions in global supply chains and an abrupt fall in aggregate demand, leading to a severe recession.

The financial sector has also been stressed by the shock. In many countries, banks' stock prices plummeted in the first quarter of 2020, even more so than those of other firms (Graph 5, left-hand panel), and are still well below their pre-crisis levels (Aldasoro et al (2020)). In some countries, the equity price drop was more than 30%, one of the two conditions for banking distress in Baron et al (2020).[22]

The fall in bank equity prices came on the back of overall relatively benign macro-financial conditions. Compared with past banking distress episodes, few countries entered the Covid-19 crisis with significant macro-financial vulnerabilities (Graph 5, centre panel: compare filled with unfilled bars). As of Q1 2020, the most frequent vulnerabilities related to asset valuations and PNFS leverage. Even these showed up,

The Q1 2020 bank stock price crash, deployment of mitigation tools and initial vulnerabilities

Graph 5



IAS = impaired asset segregation; PNFS = private non-financial sector.

[1] Based on 53 AEs and EMEs. The shaded area indicates a bank stock return lower than –30%, which corresponds to the Baron et al (2020) threshold for distress. [2] Percentages of countries, among 60, whose macro-financial conditions in Q1 2020 can be classified in the category of vulnerabilities considered. [3] Percentages of countries, among the 14 that experienced a fall in bank stock prices larger than 30% (shaded area in the left-hand panel), whose macro-financial conditions in Q1 2020 can be classified in the category of vulnerabilities considered. [4] Percentages of past distress episodes, among 62, whose initial macro-financial vulnerabilities are classified in the category considered. These percentages correspond to those reported in Graph 1 (right-hand panel). [5] Average number of tools deployed in the first two years of an episode, based on 43 distress episodes (outside the GFC), 19 countries during the GFC and 49 countries during the Covid-19 crisis.

Sources: Adler and Boissay (2020); Cantu et al (2020); Datastream; authors' calculations.

[22] To qualify as a banking distress episode according to Baron et al (2020), the Covid-19 crisis should also feature a higher than normal number of bank failures, which is not the case.

respectively, in only 10% and 5% of the countries (plain bars)[23] and only 20% and 10% of the countries where banks' stock prices fell by more than 30% (striped bars).

Central banks have responded swiftly and forcefully to the Covid-19 shock, with many interventions similar to those analysed in this special feature – notably targeted lending operations and asset purchases.[24] Responses so far closely match in number those taken during the GFC, and are substantially more than those in previous banking distress episodes (Graph 5, right-hand panel).

These interventions have helped banks remain resilient and support economic sectors affected adversely by the crisis. Lessons from our historical analysis underscore the benefits of a swift deployment of central banks' toolbox (see also CGFS (2019)). They also underscore that, in episodes preceded by bank underperformance or featuring abnormally large asset price corrections, central banks' targeted lending and asset purchases are particularly effective. As all this matches salient characteristics of the Covid-19 crisis and the attendant policy interventions, our analysis confirms that these interventions have helped to stave off banking distress and support growth.

Conclusion

The effectiveness of banking distress mitigation tools depends on both the speed and type of tools employed and the preceding financial and economic vulnerabilities. We find that greater and swifter overall policy activity reduces the adverse impact of banking distress on economic activity regardless of vulnerabilities. Central bank lending and asset purchase schemes are most effective in helping restore GDP growth in times of banking distress that follow low asset valuations, high bank leverage and weak bank performance.

Our analysis comes with many of the usual caveats. First, due to data limitations, we proxy policy intervention intensity by the number of tools used – not their size – and we do not capture all the institutional and other country differences that may affect economic outcomes. Second, we measure the effectiveness of policy interventions based on their short-term impact (within two years) on GDP growth. We ignore longer-term aspects, such as the potential effects on resource allocations, moral hazard or public finances, though the latter are an important consideration as public balance sheets are currently stretched in many economies.

Triggered by a global pandemic and synchronised lockdowns, the current recession greatly differs from those that typically follow banking crises. Still, bank valuations are under pressure, reflecting financial markets' stress and the effects of the recession. Our analysis suggests that central banks' swift response to the Covid-19 crisis, especially their large-scale lending and asset purchases, has helped – as in other instances – to stave off banking distress. Together with the regulatory capital and liquidity buffers built over the past decade, these policy interventions have helped banks weather the shock and be a source of stability, supporting the economy.

[23] In March, non-financial stock prices fell sharply but house prices did not.

[24] Fiscal authorities have responded to the economic disruptions too, with policy interventions of unprecedented scope and magnitude. Given the origin of the shock, many of these policies break new ground, notably the ample fiscal support to households and firms.

References

Adler, K and F Boissay (2020): "Dealing with bank distress: insights from a comprehensive database", *BIS Working Papers*, forthcoming.

Aldasoro, I, C Borio and M Drehmann (2018): "Early warning indicators of banking crises: expanding the family", *BIS Quarterly Review*, March, pp 29–45.

Aldasoro, I, I Fender, B Hardy and N Tarashev (2020): "Effects of Covid-19 on the banking sector: the market's assessment", *BIS Bulletin*, no 12, May.

Andrade, P, J Breckenfelder, F De Fiore, P Karadi and O Tristani (2016): "The ECB's asset purchase programme: An early assessment", *ECB Discussion Paper*, no 1956.

Andrade, P, C Cahn, H Fraisse and J-S Mésonnier (2019): "Can the provision of long-term liquidity help to avoid a credit crunch? Evidence from the Eurosystem's 3-year LTROs", *Journal of the European Economic Association*, vol 17, no 4.

Ari, A, S Chen and L Ratnovski (2019): "The dynamics of non-performing loans during banking crises: a new database", *IMF Working Papers*, no WP/19/272.

Baron, M, E Verner and W Xiong (2020): "Banking crises without panics", *Quarterly Journal of Economics*, forthcoming.

Basten, M, E Bengtsson, B Klaus, A Koban, P Kusmierczyk. J-H Lang and M Lo-Duca (2017): "A new database for financial crises in European countries: ECB/ESRB EU crises database", *ECB Occasional Papers*, no 194.

Boar, C, L Gambacorta, G Lombardo and L Awazu Pereira da Silva (2017): "What are the effects of macroprudential policies on macroeconomic performance?", *BIS Quarterly Review*, September, pp 71–88.

Borio, C and M Drehmann (2009): "Assessing the risk of banking crises – revisited", *BIS Quarterly Review*, March, pp 29–46.

Borio, C and P Lowe (2002): "Assessing the risk of banking crises", *BIS Quarterly Review*, December, pp 43–54.

Borio, C, B Vale and G von Peter (2010): "Resolving the financial crisis: are we heeding the lessons from the Nordics?", *BIS Working Papers*, no 311, June.

Cantu, C, P Cavallino, F De Fiore and J Yetman (2020): "A global database on central banks' response to Covid-19", *BIS Working Papers*, forthcoming.

Cecchetti, S, M Kohler and C Upper (2009): "Financial crises and economic activity", *NBER Working Papers*, no 15379.

Cerutti, E, S Claessens and L Laeven (2017): "The use and effectiveness of macroprudential policies: New evidence", *Journal of Financial Stability*, vol 28.

Claessens, S, D Klingebiel and L Laeven (2003): "Financial restructuring in banking and corporate sector crises: what policies to pursue?", in M Dooley and J Frankel (eds), *Managing currency crises in emerging markets*, University of Chicago Press, pp 147–80.

—— (2005): "Crisis resolution, policies, and institutions: empirical evidence", in P Honohan and L Laeven (eds), *Systemic financial crises: containment and resolution*, Cambridge University Press, pp 169–94.

Claessens, S, A Kose, L Laeven and F Valencia (2014): *Financial crises: causes, consequences, and policy responses*, International Monetary Fund.

Committee on the Global Financial System (2019): "Unconventional monetary policy tools: a cross-country analysis", *CGFS Papers*, no 63.

Detragiache, E and G Ho (2010): "Responding to banking crises: lessons from cross-country evidence", *IMF Working Paper*, no 10/18.

Eser, F and B Schwaab (2016): "Evaluating the impact of unconventional monetary policy measures: Empirical evidence from the ECB's Securities Markets Programme", *Journal of Financial Economics*, vol 119, no 1.

European Central Bank (2020): *Financial Stability Review*, May.

Federal Reserve Board (2020): *Financial Stability Report*, May.

Goldstein, M, G Kaminsky and C Reinhart (2000): "Assessing financial vulnerability: an early warning system for emerging markets", *Foreign Affairs*, vol 79.

Laeven, L and F Valencia (2008): "The use of blanket guarantees in banking crises", *IMF Working Paper*, no 08/250.

—— (2012): "Systemic banking crises: an update", *IMF Working Paper*, no 12/163.

—— (2013): "The real effects of financial sector interventions during crises", *Journal of Money, Credit and Banking*, vol 45, no 1.

—— (2018): "Systemic banking crises revisited", *IMF Working Paper*, no 18/206.

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The financial vulnerabilities driving firms to the exit[1]

This special feature investigates the influence of financial vulnerabilities on the likelihood that firms will exit the market. We fill a gap in the literature by analysing comprehensive data on firm exits together with data on the financial accounts of firms, both aggregated at the sector level. We find that high short-term debt and low earnings relative to interest expenses are the two most significant financial predictors of firm exits. Moreover, there is a two-year lag from a rise in vulnerabilities to the peak in exits. We also find evidence that sector-level vulnerabilities magnify the likelihood that weaker sales or tighter lending conditions tip firms over the brink. The unprecedented Covid-19 shock notwithstanding, our analysis suggests that while exits may remain contained in the near term, pressures to exit are likely to build up over time.

JEL classification: D22, E32, G32, G33.

The Covid-19 shock threatens the survival of many firms (Banerjee et al (2020b), Gourinchas et al (2020) and OECD (2020)). Whether firms will be able to maintain their operations or be forced to exit the market depends on many factors. Clearly, the length and depth of the shock are crucial. So too is the degree of policy support. Yet, unless policy support fully neutralises the shock, financial vulnerabilities could be the factor that determines which firms survive and which exit the market.

But which financial vulnerabilities are most relevant in pushing firms towards the exit? Surprisingly few studies look into the relationship between financial factors and economy-wide firm exits. A key limitation is data. Comprehensive data on firm exits do not typically include information on financial vulnerabilities. Conversely, analyses of firm vulnerabilities often focus on continuing firms; when they do consider exits, they cover only large publicly listed entities. Thus, the results of these analyses may be a poor guide for small- and medium-sized enterprises that constitute the majority of firms in the economy.

To study how financial vulnerabilities affect firm exits, we take a new approach by combining census data sets for seven European economies between 2008 and 2016. In particular, we merge sectoral data on gross entry and exits for the entire population of firms with harmonised company account data that provide key financial ratios evaluated at the median of each sector. In addition, we also include sales data

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Key takeaways

- High short-term debt and low earnings relative to interest expenses are the two most significant financial predictors of firms exiting the market.
- There is a lag between rising financial vulnerabilities and exits, with the peak effect materialising after two years.
- Financially vulnerable firms are more likely to exit the market when financial conditions are tight or economic activity is weak.

at the sector level and lending standards at the country level to control for the business cycle as well as lending conditions. While the data do not cover the Covid-19 crisis, our broad findings are informative about the types of financial vulnerability that could determine firm exits in current conditions.

Our empirical analysis produces three main findings:

First, financial vulnerabilities related to debt service have the strongest influence on firm exits. In particular, high short-term debt and low cash flow relative to interest payments are key drivers. By contrast, cash and holdings of liquid assets do not appear to provide much protection. Arguably, they may mitigate liquidity risks, but may be of little help in addressing solvency problems.

Second, the relationship between debt servicing vulnerabilities and firm exits is tighter during a period of relative calm than during the Great Financial Crisis (GFC) and the European sovereign debt crisis. The finding could reflect lags between the build-up of financial vulnerabilities during stressed periods and the realisation of firm exits once the stress has dissipated. Indeed, we find that it takes about two years before the full impact of higher financial vulnerabilities on exits is felt. Alternatively, loan evergreening by banks or very large aggregate shocks overwhelming even financially resilient firms would also be consistent with financial vulnerabilities being less of a driving factor in firm exits from 2008 to 2012.

Finally, financial vulnerabilities amplify the effect of weak activity and tight lending conditions on firm exits. Conversely, when financial vulnerabilities are low, this effect is negligible.

Despite the unprecedented Covid-19 shock, our analysis suggests that exits may remain contained in the short run, as pressure on firms may take time to build up. This is likely to be particularly true in the light of the unprecedented policy support in response to the pandemic, including highly accommodative monetary policy, public guarantees on loans, fiscal measures to bolster firms' cash flows, and moratoriums on certain credit obligations. Moreover, for the euro area economies in our study, financial vulnerabilities were lower at the onset of the Covid-19 recession compared with those before the GFC. Yet, to the extent that firms have borrowed to bridge the severe downturn, they may have become more vulnerable to future shocks, especially if they have built up high short-term debt and face low cash flows relative to interest expenses.

The remainder of this special feature is organised as follows. The first section documents trends in firm exits and financial vulnerabilities. The second compares how far different financial vulnerability metrics, on their own, help predict exit. The third analyses the time pattern of the impact of those vulnerabilities and how their relevance varies across sectors. The fourth evaluates how financial vulnerabilities interact with sales and lending conditions. Finally, we conclude with some broad implications for the current crisis.

Financial vulnerabilities and firm exits

Which financial vulnerabilities drive firms to exit the market? What matters more: is it overall indebtedness as a measure of insolvency risk, or is it short-term debt servicing needs, given that illiquidity can easily morph into solvency problems? Are liquid assets and cash balances sufficient to save an ailing firm? If not, does weak cash flow more clearly indicate difficulties in servicing debts and pressures to exit? The answers to these questions are critical if we are to identify the firms most at risk of failure in the Covid-19 crisis.

A vibrant literature studies the influence of financial vulnerabilities on firm defaults, following the seminal work of Altman (1968). But these analyses focus on the exit of large publicly listed firms. A literature examining firm exit (and entry) and its influence on firm productivity (eg Foster et al (2001)) is also well established. However, the business census data used in such studies do not include information from firm financial statements.[2] In addition, a new and growing literature links financial vulnerabilities to firm performance, including those of small firms (eg Duval et al (2020)). Unfortunately, these sources, although rich with financial information, record firm entry and exits only poorly. Thus, surprisingly few studies examine the relationship between financial factors and firm exits using comprehensive data that avoid biases in coverage. As such, policymakers have been left with little guidance on navigating the Covid-19 fallout on firm exits across the entire economy.[3]

A consequence of these limitations is that studies seeking to estimate the impact of Covid-19 on firm exits have had to rely on somewhat ad hoc assumptions about the key underlying drivers. For example, Banerjee et al (2020b) and Gourinchas et al (2020) simulate the impact of Covid-19 by assuming that it is the firms unable to cover short-term debt with cash holdings and cash flow which have to exit. By contrast, our analysis identifies empirically the factors that have triggered firm exits, thereby shedding light on the validity of these ad hoc assumptions.

Trends in exit rates and financial vulnerabilities

Firms exit when they permanently shutter their operations. The exit can be voluntary if an enterprise pays off all remaining liabilities at closure, or involuntarily if the firm is liquidated after failing to meet its liabilities.[4]

Looking at the data, we observe large differences in firm exit rates across the seven euro area economies in our sample, which covers the period 2008–16. In Portugal, the average annual exit rate stands at around 12% per year, while in Belgium it is as low as 3% (Graph 1, left-hand panel). The data also show that exits peaked around the European sovereign debt crisis in Austria, Italy, Spain and Portugal. By

[2] This has limited such studies to the analysis of broad financial conditions on firm entry and exit (eg Fort et al (2013) and Davis and Haltiwanger (2019)).

[3] One exception is Balcaen et al (2012), who study the influence of financial factors on economy-wide firm exits in Belgium using firm-level data. Contrasting different types of exit, they find that voluntary exits, as opposed to involuntary ones such as bankruptcies, are more likely in firms with lower leverage and higher levels of cash holdings.

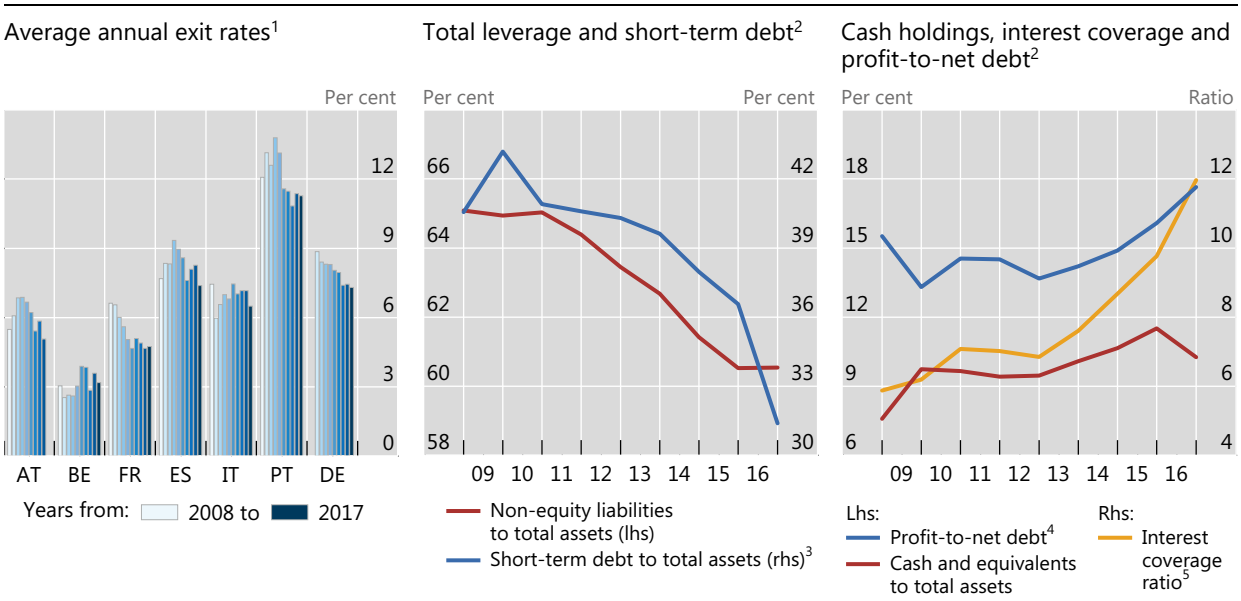
[4] See Box A for more details on the data and definitions. Note that mergers and acquisitions are not classified as exits. The OECD's *Structural Development and Business Statistics* database does not distinguish between voluntary and involuntary exits. However, firm bankruptcies range from around 10 to 50% of firm exits at the country level.

contrast in France and Germany, the average exit rate has fallen continuously since the GFC. As one would expect, exits rise in downturns and decline as economic conditions improve.

Firms' financial vulnerabilities are a natural driver of exits. These include insolvency cases, when firms' debts exceed their assets, as well as cases of illiquidity when debt servicing difficulties force firms into bankruptcy. In our sample, firms' financial vulnerabilities rather eased in the aggregate, particularly after 2013. Leverage, measured by the median non-equity liabilities-to-total asset ratio, declined by about 5 percentage points, from 65 to 60% between 2008 and 2016 (Graph 1, centre panel, red line). Similarly, the median ratio of short-term debt (ie debt maturing within one year) to total assets declined from around 40% to just above 30% over the same period (blue line). On the asset side, the median ratio of cash to total assets increased by around 2 percentage points between 2008 and 2016 (right-hand panel, red line). Over the same period, the median interest coverage ratio (ICR) – measured by the ratio of earnings before interest taxes and depreciation (EBITDA) to interest expenses – doubled as euro area economic activity recovered without a concomitant rise in interest rates (yellow line). Funding costs declined over this period for many firms. Last, consistent with the drop in leverage and the increase in the ICR, the median ratio of profits to net debt improved after 2013 (blue line), the order of magnitude being approximately the same as the increase in cash holdings.

Exit rates declined as financial vulnerabilities decreased

Graph 1



[1] The exit rate defined as the ratio of exiting to active firms for the whole business, non-agriculture economy sector, excluding utilities. [2] Financial indicators computed as averages for each year of the corresponding median indicator across all country-sector pairs. [3] Ratio of current debt to total assets. [4] Ratio of gross operating profit to total debt net of cash and equivalents. [5] Ratio of EBITDA (earnings before interest, taxes, depreciation and amortisation) to interest on financial debt.

Sources: OECD, *Structural and Demographic Business Statistics*; BACH database; authors' calculations.

Box A

A new data set to uncover the financial determinants of firm exits

To overcome the data limitations in existing studies described in this article, we take a sector-level approach. We merge three data sets at the sector level. The first, the OECD's *Structural and Demographic Business Statistics* database, provides annual information on firm entries and exits at the sector level based on business census data. Thus, it avoids bias in coverage, for example towards large firms. In these data, firm exit is defined as the dissolution of a combination of production factors with the restriction that no other enterprises are involved in the event. Mergers, takeovers, breakups or restructuring of a set of enterprises are not classified as exits. Neither are changes in activity nor firms that restart activity within two calendar years. Under this definition, it is important to highlight that exits may be voluntary, ie the enterprise paid off all remaining liabilities at closure, or involuntary, ie the firm was liquidated after failing to meet its liabilities eg in a bankruptcy.

The second data set is the Bank for the Accounts of Companies Harmonised (BACH) database from the European Committee of Central Balance Sheet Data Offices (ECCBSO). This database provides harmonised balance sheets and income statement information aggregated at the sector level. Importantly, this data set provides median financial ratios in each sector.① In contrast to using the mean, the median helps to prevent unrepresentative balance sheets, such as those of large firms, from distorting the sector-level measures of financial vulnerabilities. Third, we use the OECD *Structural Analysis* database of sectoral activity, which provides sector-level information on sales. We use this to control for the business cycle, which has been shown to have a strong influence on firm exits. Finally, we merge these three sector-level data sets with data from the ECB *Bank Lending Survey* to control for country-level lending conditions.

Sector-level data come with advantages and drawbacks. The census equivalent coverage of our data set is representative of all business activity within each sector and across the whole economy. However, the sectoral nature of the data comes at the cost of losing within-sector granularity. After merging the three underlying data sources, our data set covers seven euro area economies (Austria, Belgium, France, Germany, Italy, Portugal and Spain) and 34 underlying sectors from 2008 to 2016. On average, each economy has around 270 sector-year observations.

① To compute the median level of each financial indicator, firm-level observations are first sorted in ascending order. The middle value that cuts the data in half is the value for the median financial indicator. Thus, the median firm can differ across indicators. In addition, the BACH database provides other quantiles of financial ratios for each sector (in addition to weighted averages). Empirically, results using other quantiles are quantitatively similar.

The financial drivers of firm exits

Turning now to our empirical analysis, we investigate the financial determinants of firm exits, covering both voluntary and involuntary ones at the sector level. Following the existing literature, we link exits to three types of financial indicator. First, stock variables pertaining to the liability side of firms' balance sheets, eg total leverage or short-term debt. Second, stock variables from the asset side of the balance sheet, eg liquid assets and cash and equivalents. Last, we consider indicators of firms' cash flow vulnerability, eg the ICR or the ratio of profits to net debt.[5]

Our empirical evidence indicates that the two most significant financial predictors of sectoral firm exit rates are high levels of short-term debt and low earnings relative to interest expenses. Firms are more likely to exit when the median leverage ratio in the sector goes up (Table 1, first column).[6] However, this result is

[5] In addition to the financial vulnerabilities, our regression specification also controls for sectoral sales growth, sector entry and country-level lending conditions. See Box B for details on our empirical methodology.

[6] Median levels of financial indicators are computed by sorting firm-level observations in ascending order, dividing the sample into two halves and taking the middle value.

largely driven by firms' short-term debt. Once we split a firm's liabilities into those falling due within one year (second column), and longer-term debt (third column), only the coefficient on short-term debt is significant in predicting higher firm exits within the next year. This suggests that difficulty in rolling over short-term debt is a crucial factor pushing firms towards an exit.

Somewhat surprisingly, liquid assets do not appear to offer firms much protection from an exit. The insignificant (and positive) coefficients in the fourth and fifth columns of Table 1 indicate that neither high levels of current assets[7] nor high levels of cash holdings significantly affect the probability of an exit.

Several factors could account for this, at first sight, surprising result. For one, cash buffers may only determine *how* – and not necessarily *if* – a firm exits. For example, Balcaen et al (2012) find that firms with high cash buffers are more likely to exit voluntarily, while those with limited buffers tend to exit involuntarily through bankruptcies. A firm's decision to hold cash could also be driven by the riskiness of the firm. Hence, firms in riskier sectors could hold more cash *and* have a higher risk of exiting. Indeed, Opler et al (1999) show that firms with riskier cash flows tend to hold larger cash buffers as self-insurance. Our finding suggests that such precautionary cash buffers may be insufficient to fully offset higher exit risk. Indeed, Acharya et al (2012) document that, among large firms, those with higher cash holdings have higher bond spreads, also supporting the notion that cash holdings and risk are positively correlated. The limited impact could also reflect the fact that cash and liquid assets are held to hedge liquidity risks, but may be insufficient to address solvency problems. Finally, cash balances funded through credit lines and overdrafts do not improve a firm's net liquidity position.

The financial determinants of firm exits[1]

Dependent variable: sectoral exit rate — Table 1

	Liabilities			*Liquid assets*		*Cash flow ratios*	
	Leverage[2]	Short-term debt/ total assets	Long-term debt/ total assets	Current assets/total assets	Cash/ total assets	ICR[3]	Profits/ net debt
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Financial vulnerability measure$_{t-1}$	0.219	0.333**	–0.073	0.528	0.815	–0.773***	–0.258*
	(0.305)	(0.166)	(0.262)	(0.336)	(0.583)	(0.269)	(0.176)
Number of observations	1,894	1,894	1,894	1,894	1,894	1,894	1,894
R-squared	0.135	0.134	0.134	0.131	0.131	0.135	0.132

***/**/* indicates statistical significance at the 1/5/10% level, respectively.

[1] Estimates based on the regression specification described in Box B. Each column shows the regression estimates on the financial vulnerability measure, which is described in the column heading when each is included separately in the regression specification. All regressions include the following control variables: one-year lagged exit and entry rates, sector sales growth and lending conditions in period *t*. Robust standard errors are reported in parentheses. [2] Leverage = non-equity liabilities/total assets. [3] ICR is the interest coverage ratio defined as EBITDA (earnings before interest, taxes, depreciation and amortisation) to interest on financial debt.

Sources: OECD, *Structural and Demographic Business Statistics*; BACH database; authors' calculations.

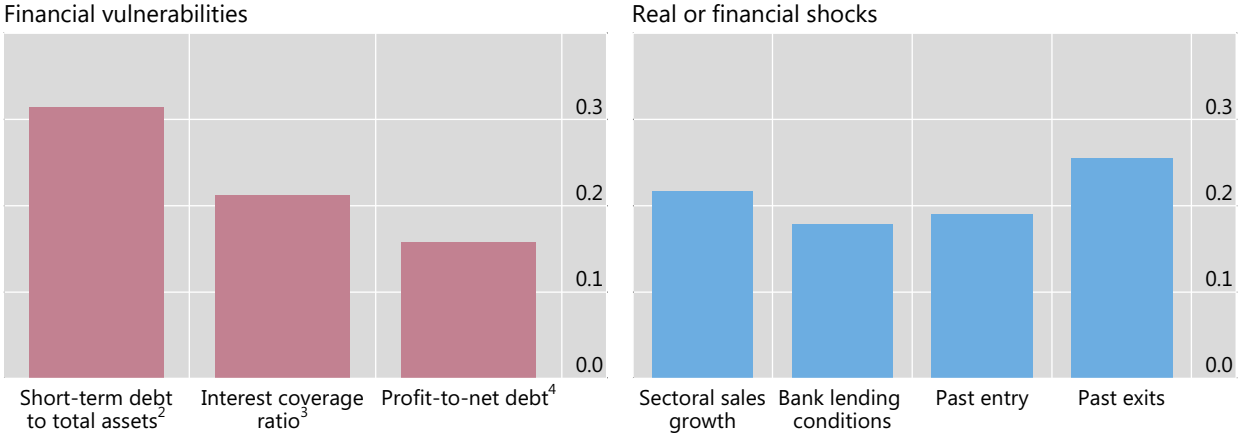
[7] Current assets include cash, cash equivalents, accounts receivable, stock inventory, marketable securities, pre-paid liabilities and other liquid assets.

By contrast, the fragility of cash flows plays a significant role in shaping firm exits. The ICR features strongly in credit rating models, which predict defaults in listed firms (eg Damodaran (2020)). Indeed, weaker ICRs are significantly correlated with higher firm exits in the following year (Table 1, sixth column). Over long horizons, profits relative to debt can also be viewed as an indicator of firm solvency.[8] Indeed, firms are more likely to exit when profits are low relative to net debt. That said, this effect is only marginally significant (seventh column).[9]

Shifting from statistical to economic significance, the short-term debt ratio has the greatest economic significance among our financial vulnerability metrics, followed by the ICR (Graph 2, left-hand panel). In particular, a one standard deviation[10] increase in the short-term debt ratio is associated with a 0.3 percentage point increase in the exit probability, amounting to a 4% increase over the mean exit rate. Somewhat smaller is the impact of a one standard deviation drop in the ICR, which is associated with a 0.2 percentage point increase in the exit rate. An equivalent drop in profits relative to net debt is associated with a 0.15 percent increase in the exit probability.[11]

Larger financial vulnerabilities and adverse shocks increase exits[1]

One-year ahead response, in percentage points — Graph 2



[1] Effect at a one-year horizon of a one standard deviation change in the variable named below each bar, estimated at the median of the dependent variable. For short-term debt to total assets, past entry and past exits, the change is an increase. For bank lending conditions, the change is a tightening and for other variables the change is a decrease. All estimated effects are statistically significant at standard confidence levels (5%), except that of the ratio of profit to net debt and past entry. See Box B for details. [2] Ratio of current debt to total assets. [3] Ratio of EBITDA (earnings before interest, taxes, depreciation and amortisation) to interest on financial debt. [4] Ratio of gross operating profit to total debt net of cash and equivalents.

Sources: ECB, *Bank Lending Survey*; OECD, *Structural and demographic business statistics*; BACH database; authors' calculations.

[8] A variant of this metrics featured in the US Interagency guidance on leveraged lending issued in 2013.

[9] Unfortunately, the European Committee of Central Balance Sheet Data Offices (ECCBSO) Bank for the Accounts of Companies Harmonised (BACH) database does not compute the ratio of profits to total debt. Such a metric would facilitate a more systematic analysis of cash buffers in preventing firm exits.

[10] Standard deviations are computed by stacking all country, sector and year observations.

[11] A simple horse race between the four statistically significant financial vulnerability measures identified in Table 1 shows that, while the ratio of short-term debt to assets remains significant once the ICR is included in the same regression, the leverage and ratio of operating profits to debt do not.

Box B

Assessing the financial determinants of firm exits

To assess the financial determinants of exits, we estimate the following empirical specification:

$$Exit_{s,c,t} = \beta_1 FinancialVulnerability_{s,c,t-1} + \beta_2 Exit_{s,c,t-1} + \beta_3 Entry_{s,c,t-1}$$

$$+\beta_4 Sales_{s,c,t} + \beta_5 LendingConditions_{c,t} + \alpha_{s,c} + \alpha_t + e_{s,c,t}$$

The dependent variable $Exit_{s,c,t}$ is the exit rate defined as the ratio of exiting to active firms in sector *s* in country *c* in year *t*.① The first set of explanatory variables, $FinancialVulnerability_{s,c,t-1}$, are measures of financial vulnerabilities for the median firm directly computed in the European Committee of Central Balance Sheet Data Offices (ECCBSO) Bank for the Accounts of Companies Harmonised (BACH) database: firm liabilities (leverage and short-term debt to assets), liquid assets (liquid asset holdings to assets and cash to assets) and cash flow (EBITDA to interest expenses and profits-to-net debt), considering each time the median value of each indicator in sector *s* in year *t*-1.② Our selection of financial vulnerability metrics is limited to those computed in the BACH database, which includes some of the most commonly used metrics of firm financial vulnerabilities found in other studies.

The additional regressors are as follows. We include the lagged dependent variable $Exit_{s,c,t-1}$ and the entry rate $Entry_{s,c,t-1}$, defined as the ratio of new entrants to active firms. The lagged dependent variable captures the staggered nature of exits, while the lagged entry variable captures creative destruction or churn, by which new entrants tend to displace some of the existing firms. The variable $Sales_{s,c,t}$ measures the growth rate of sales at the sector level to capture business cycle and sectoral demand fluctuations.③ We also include a measure of bank lending conditions at the country level $LendingConditions_{c,t}$, ie the change in the terms and conditions that banks apply on loans to firms. These data are taken from the ECB *Bank Lending Survey*. All our regressions include sector-country fixed effects $\alpha_{s,c}$, and time fixed effects α_t.

We examine four extensions to our baseline model. In the first, we estimate a local projection version of our baseline model by changing our dependent variable to $Exit_{s,c,t+h}$, where *h*=0,1,2,3 years as it may take several years before the full impact of financial vulnerabilities on firm exits is revealed. In the second extension, we interact our financial vulnerability measures with a time dummy variable that takes the value of one from 2013 onwards to measure if there has been a change in the sensitivity of exits over time. In the third, we allow financial vulnerabilities to have heterogeneous effects across sectors. In the fourth, we include interaction terms between our financial vulnerability metrics, on the one hand, and sector sales and aggregate lending conditions, on the other. This allows us to test whether depressed sales in a given sector or tighter lending conditions in the economy raise firm exits more strongly when firms' financial vulnerabilities are larger.

① As exit and entry rates are bounded between 0 and 1, we use a logistic transformation for these variables, ie log(y/1-y) where y is the exit or the entry rate. ② The BACH database provides the mean, median and the quartiles of financial ratios of firms for each sector, country-year triple. We use the median ratio, as opposed to the mean, to reduce the influence of outliers or of a specific group of firms. Our results are robust to using the quartiles of the distribution. ③ This specification implicitly assumes that changes to sales growth affect firm exits. However, the opposite could also be true because higher firm exits could also reduce production and hence sales growth. As a robustness test, in alternative regressions not reported we instead use *aggregate* sales growth instead of *sectoral* sales growth, which is less likely to suffer from this reverse causality. The results are very similar, both qualitatively and quantitatively, to those presented here.

Two findings related to other drivers of exits are also worth noting. First, our estimation results confirm the important impact of the business cycle and lending conditions on firm exits documented in previous studies (eg Dunne et al (1988)). Notably, declines in sectoral sales or tightening lending conditions at the country level are associated with higher exit probabilities (Graph 2, right-hand panel). Second, an increase in firm entry raises firm exits. This is suggestive of a creative destruction or churn channel whereby new entrants compete with incumbent firms, potentially driving out the most inefficient. Finally, we find that exit dynamics are persistent.

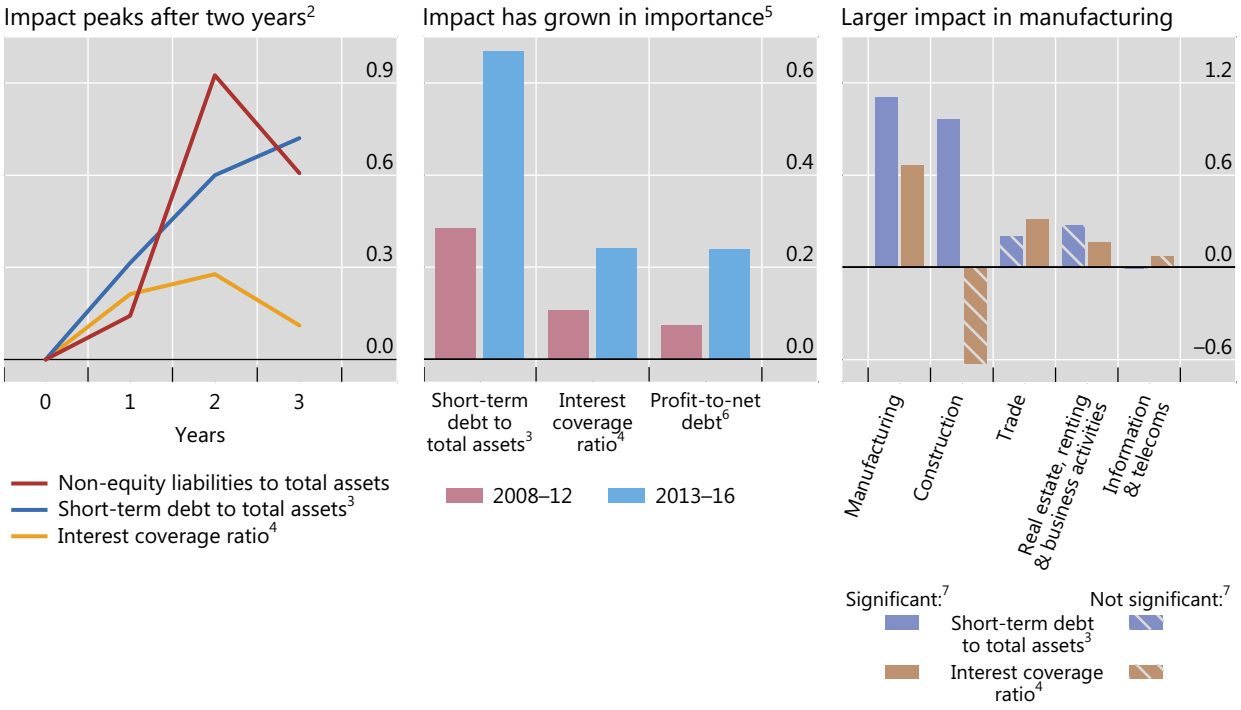
Financial vulnerabilities, persistence and sectoral differences in exits

It could arguably take several years before the full impact of financial vulnerabilities on firm exits is revealed. For instance, in the case of involuntary exits, there could be a long period between the point at which a firm defaults on its first debt payment and its final liquidation. For firms that levered up with long-term debt, pressures to exit may only materialise once large repayments start coming due. Moreover, for an entrepreneur deciding whether to wind down a firm voluntarily, it may take repeated evidence of poor performance before the firm finally exits.

Indeed, the effect of the financial vulnerabilities identified above takes about two years to peak (Graph 3, left-hand panel). The peak of the delayed effect is particularly noticeable for firm leverage (red line). For short-term debt, the effect does not peak before three years have elapsed (blue line). In this case, the steadily rising impact suggests that, while firms may be able to initially roll over their short-term debts, this

Financial vulnerabilities' impact comes with a lag, has increased over time and differs across sectors[1]

Change in exit rate, in percentage points — Graph 3



[1] Graphs show effect of a one standard deviation change in the named financial vulnerability variable on the exit rate, estimated at the median exit rate. For non-equity liabilities to total assets, short-term debt to total assets, the change is an increase. For interest coverage ratio and profit-to-net debt, the change is a decrease. See Box B for details. [2] Lines show point estimates for the response of exits to a one standard deviation change in the financial vulnerability variable reported in the legend on exit rates $Exit_{s,c,t+h}$ in sector s in country c for horizons $t+h$, for h=0, 1, 2, 3 years. See Box B for additional details. [3] Ratio of current debt to total asset. [4] Ratio of EBITDA (earnings before interest, taxes, depreciation and amortisation) to interest on financial debt. [5] Bars show the estimated response of exits at a one-year horizon to a one standard deviation change in the financial vulnerability variable, estimated using the same specification as in Box B, where we interact our financial vulnerability measures with a time dummy variable that takes the value of one from 2013 onwards. [6] Ratio of gross operating profit to total debt net of cash and equivalents. [7] Statistical significance at the 5% level.

Sources: ECB, *Bank Lending Survey*; OECD, *Structural and Demographic Business Statistics*; BACH database; authors' calculations.

may only delay the inevitable exit. Last, similar to the case of leverage, the full effect of a decline in the ICR takes two years to realise.[12]

While financial vulnerabilities trended downwards between 2008 and 2016 (Graph 1, centre and right-hand panels), their impact on exits appears to have increased during the latter part of our sample (Graph 3, centre panel). Estimates show that the coefficient on short-term debt, ICR and the profit-to-net debt ratio were all approximately twice as large during the period 2013–16 compared with that estimated during the more turbulent 2008–12 period. Importantly, both the ICR and the profit-to-net debt ratio were statistically insignificant in the pre-2013 period.

Thus, during periods of large aggregate shocks – ie the GFC and the European sovereign debt crisis – firm financial vulnerabilities appear less informative about the types of firm that exit. The finding could reflect loan evergreening by banks or higher uncertainty, raising the option value of delaying an exit during financial turmoil. Such factors would contribute to lags between the build-up of financial vulnerabilities and the realisation of firm exits. It is also possible that very large aggregate shocks can overwhelm even financially resilient firms, weakening the relationship between financial vulnerabilities and firm exits.

Moreover, the effect of financial vulnerabilities varies across sectors. In particular, the exits of firms in the capital-intensive manufacturing sector are more sensitive to financial vulnerabilities than those in the services sector (Graph 3, right-hand panel). There are also significant differences within the service sector, as financial vulnerabilities appear to be irrelevant for firms in information technology and communications. By contrast, in other types of service (eg trade, real estate, renting, business activities), some of which have been hit particularly hard by the Covid-19 shock, exits appear to be sensitive to the ICR.

The amplification effect of financial vulnerabilities

One would expect that financial vulnerabilities will amplify the impact of weaker economic activity or tightening lending conditions on firm exits. For instance, profits tend to move in tandem with sales. Therefore, downturns lead to a deterioration in firms' ability to cover interest payments. When firms already have weak ICRs, this can lead many of them to exit as they enter bankruptcy. A similar mechanism operates during periods of tight lending conditions. For instance, firms with low profits need to refinance more of their maturing debt than do more profitable firms. Thus, weaker firms with larger refinancing needs are more likely to be pushed over the brink when lending conditions tighten.

To assess the size of these effects, we extend our regression specification to include the interaction between sectoral sales and lending conditions on the one hand and financial vulnerabilities on the other. We then compare the effect of a contraction in sales or a tightening in lending conditions across three stylised cases. In one of these cases, the financial vulnerabilities are at a low level (Graph 4, left-hand panel, light blue bars). In the other two, it is at the median level (blue bars) or a high level (dark blue bars).[13]

[12] Interestingly, these results follow a similar pattern to the dynamic effects of GDP contractions on aggregate business bankruptcies (Banerjee et al (2020c)).

[13] Low (high) values for the metric correspond to the 10th percentile (90th percentile) of the distribution of the variable considered.

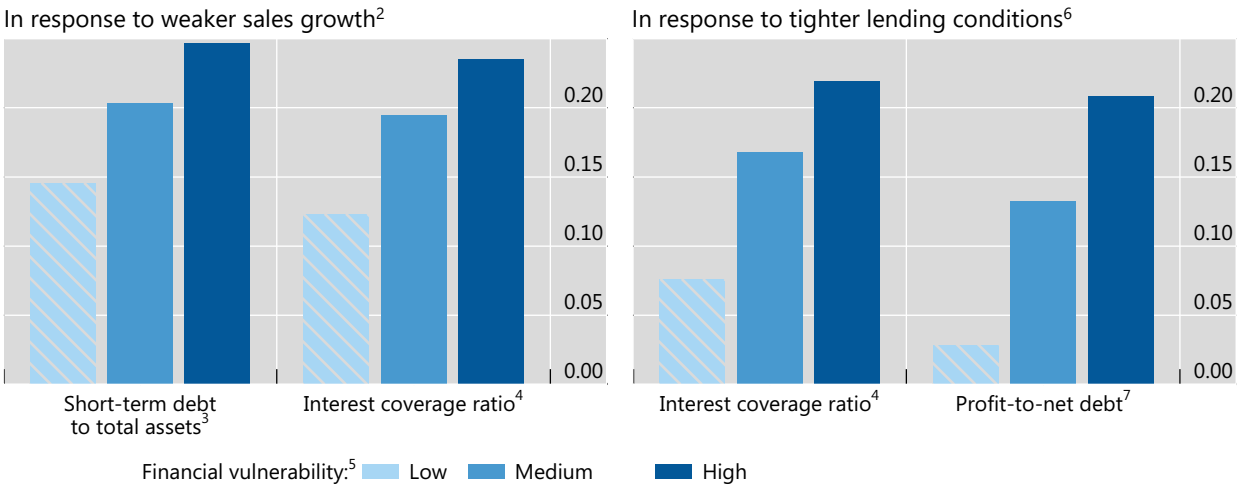
We find that the degree of financial vulnerabilities can sizeably change the impact of sectoral sales or lending condition shocks. Specifically, our estimates show that, for a given downturn in economic activity, a sector with a high level of short-term debt experiences an increase in firm exits that is some two thirds larger than is the case for a sector with low short-term debt (Graph 4, left-hand panel). Looking at the case of the ICR, the difference is even larger: in a sector where firms have low ICRs, a given drop in economic activity raises the exit rate twice as much as in a sector with high ICR firms.

A tightening of lending conditions also has a larger impact on sectors where firms are more financially vulnerable. These effects are particularly pronounced for cash flow vulnerabilities (Graph 4, right-hand panel). For example, in a sector where firms have low ICRs, a financial tightening delivers an increase in exits about three times higher than in a sector where firms have high ICRs. A similar difference holds for the profit-to-net debt ratio.

Conversely, low financial vulnerabilities can insulate firms from the fallout of weaker sales or tightening lending conditions. Indeed, our results indicate that, with low financial vulnerabilities, neither a drop in sectoral demand nor a tightening in lending conditions has a statistically significant effect on firm exits.

Financial vulnerabilities amplify the effect of real and financial shocks on exits[1]

Change in exit rate, in percentage points — Graph 4



[1] Dashed pattern bars are not significantly different from zero at the 10% level. [2] Effect of a one standard deviation drop in the growth rate of sectoral sales. [3] Ratio of current debt to total assets. [4] Ratio of EBITDA (earnings before interest, taxes, depreciation and amortisation) to interest on financial debt. [5] For short-term debt to total assets, low/medium/high financial vulnerabilities correspond to the 10/50/90th percentiles of the ratio, respectively. For interest coverage ratio and profits to net debt, low/medium/high financial vulnerabilities correspond to the 90/50/10th percentiles of the ratio, respectively. [6] Effect of a one standard deviation increase in the diffusion index for terms and conditions on bank loans to firms. [7] Ratio of gross operating profit to total debt net of cash and equivalents.

Sources: ECB, *Bank Lending Survey*; OECD, *Structural and Demographic Business Statistics*; BACH database; authors' calculations.

Conclusion

Systematic and comprehensive studies on the financial determinants of economy-wide firm exits have been a blind spot in the literature. We try to fill this gap by mobilising comprehensive data on firm demographics and harmonised company account data at the sector level. We find that high short-term debt relative to total assets and low earnings relative to interest expenses predict a significantly larger number of subsequent firm exits.

What do these results potentially imply for firm exits during the current Covid-19 crisis?

First, corporate earnings have collapsed for many firms, severely impairing their interest coverage ratios. Our results suggest that this will threaten the survival of many firms if earnings remain depressed for an extended period. Moreover, cash buffers may provide only limited protection. Second, the extent to which firms have been able to raise funding to cover losses and roll over existing short-term debt will be a decisive factor in preventing firm exits in the short run. However, as our results show, pressures to exit after a rise in indebtedness build up over time. Thus, firms' survival in the short term does not preclude a wave of exits later. Third, because of its sheer size, the Covid-19 shock may dwarf the impact of financial vulnerabilities on firm exits, as occurred during the GFC and the European sovereign debt crisis. That said, financial vulnerabilities may still matter because of their role as shock amplifiers. Finally, once the Covid-19 shock dissipates, it is likely that many sectors will be more financially vulnerable. Going forward, this greater fragility could keep exits high for some time.

Initial emergency measures have certainly been successful in containing the pandemic's fallout. Jobs and wages have been protected, while there have been fewer corporate bankruptcies in the first half of 2020 than in the previous five years (Banerjee et al (2020a)). Yet at least two major challenges loom (Carstens (2020)). First, businesses that can succeed in this new economy but are financially vulnerable may still need help as they undergo debt restructuring, repair their balance sheets and reduce their financial vulnerabilities. Second, there is a need to encourage and enable stakeholders of businesses involved in the most severely damaged sectors to reallocate their resources toward sectors that are more likely to thrive in the post-pandemic economy.

References

Acharya, V, A Davydenko and I Stebulaev (2012): "Cash holdings and credit risk", *Review of Financial Studies*, vol 25, no 12, pp 3572–609.

Altman, E (1968): "Financial ratios, discriminant analysis and the prediction of corporate bankruptcy", *Journal of Finance*, vol 23, no 4, pp 589–609.

Balcaen, S, S Manigart, J Buyze and H Ooghe (2012): "Firm exit after distress: differentiating between bankruptcy, voluntary liquidation and M&A", *Small Business Economics*, vol 39, no 4, pp 949–75.

Banerjee, R, G Cornelli and E Zakrajšek (2020a): "The outlook for business bankruptcies", *BIS Bulletin*, no 30, 12 October.

Banerjee, R, A Illes, E Kharroubi and J Serena (2020b): "Covid-19 and corporate sector liquidity", *BIS Bulletin*, no 10, 28 April.

Banerjee, R, E Kharroubi and U Lewrick (2020c): "Bankruptcies, unemployment and reallocation from Covid-19", *BIS Bulletin*, no 31, 13 October.

Carstens, A (2020): "The Great Reallocation", op-ed, *Project Syndicate*, 12 October.

Damodaran, A (2020): "Ratings, interest coverage ratios and default spread", http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ratings.htm.

Davis, S and J Haltiwanger (2019): "Dynamism diminished: The role of housing markets and credit conditions", *NBER Working Papers*, no 25466.

Dunne, T, M Roberts and L Samuelson (1988): "Patterns of firm entry and exit in US manufacturing industries", *RAND Journal of Economics*, vol 19, no 4, pp 495–515.

Duval, R, G Hong and Y Timmer (2020): "Financial frictions and the great productivity slowdown", *Review of Financial Studies*, vol 33, no 2, pp 475–503.

Foster, L, J Haltiwanger and C Krizan (2001): "Aggregate productivity growth: Lessons from microeconomic evidence" in "New developments in productivity analysis", *NBER Chapters*, pp 303–72.

Fort, T, J Haltiwanger, R Jarmin and J Miranda (2013): "How firms respond to business cycles: The role of firm age and firm size", *IMF Economic Review*, vol 61, no 3, pp 520–59.

Gourinchas, P, S Kalemli-Özcan, V Penciakova and N Sander (2020): "Covid-19 and SME failures", *NBER Working Papers*, no 27877.

OECD (2020): "Corporate sector vulnerabilities during the Covid-19 outbreak: assessment and policy responses", *Tackling Coronavirus*.

Opler, T, L Pinkowitz, R Stulz and R Williamson (1999): "The determinants and implications of corporate cash holdings", *Journal of Financial Economics*, vol 52, no 1, pp 3–49.

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Retail payments in Latin America and the Caribbean: present and future[1]

Retail payment services in Latin America and the Caribbean are characterised by high costs and insufficient access for large swathes of the region's population. To overcome these limitations, some of the larger central banks in the region have taken the lead to introduce fast retail payments and develop an open banking ecosystem. Several others have launched central bank digital currency pilots. The shift to digital payments, which is supported by these policy initiatives, is likely to receive further impetus from the Covid-19 pandemic.

JEL classification: E42, E58.

Despite the widespread adoption of mobile and internet technology, countries in Latin America and the Caribbean (LAC) have not been at the forefront of payment innovation. Relative to other regions, retail payment services in LAC continue to involve high costs for end users and be of subpar efficiency, partly reflecting low competition among financial institutions and limited compatibility among different payment solutions. Along with low income levels, high informality and low financial literacy, high costs contribute to limiting the access to electronic and digital payments for large swathes of the region's population.

However, conditions in LAC are ripe for a change. Central banks and other public authorities have recently launched important initiatives to improve national payment systems, which complement developments in the private sector. In recent years, the region has seen a sharp rise in the number of fintech firms offering more convenient ways to pay, and big tech firms have begun to integrate payment services into their e-commerce or social media platforms. However, private sector incentives are not always aligned with social goals. Central banks are the ultimate source of trust in money and payments and therefore play a key role in maintaining the safety and integrity of payment systems as well as ensuring that private sector innovation is channelled towards improving competition, consumer protection and financial inclusion, and preserving financial stability (BIS (2020)).

These efforts to improve payment services have received further impetus from the Covid-19 outbreak. Both the volume and value of digital payments have been rising faster than before the pandemic. Many individuals had a strong incentive or no alternative other than to use digital payments during lockdowns, and governments

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Key takeaways

- Limited access to retail payment services and their high costs are significant challenges in Latin America and the Caribbean.
- Central banks in the region have undertaken major initiatives aimed at promoting more efficient and inclusive payment systems.
- The Covid-19 pandemic should reinforce the momentum of these policy initiatives, as it has accelerated the shift to digital payments and underscored the need for more inclusive and lower-cost payments.

relied on them to disburse social benefits more rapidly and efficiently. Having become more familiar with digital payments, new users might continue to make frequent use of them once the pandemic ends.

This special feature first sets the stage by describing the key shortcomings of national retail payment services in LAC. It then turns to the main policy initiatives that aim to make domestic retail payments faster, more affordable and more inclusive. It finally documents how Covid-19 and the related mobility restrictions have accelerated the use of digital payments.

The main shortcomings of retail payment services in LAC

Retail payment systems share a number of features. They handle a large volume of low-value individual payments. But they have operational limits. In many countries, payment orders can be placed only on working days during certain hours, and their execution and finalisation normally takes one or more working days. In addition, even when retail payment systems are relatively fast, lack of competition between payment service providers and weak interoperability between existing retail payment mechanisms makes them costly for end users. Combined with other structural factors such as low income levels and poor financial literacy, the result is insufficient access by the population to payment instruments other than cash, which in turn severely restricts access to broader financial services such as credit and insurance. Despite some improvement over recent years, these issues continue to be particularly severe in LAC.

Weak interoperability and low competition drive high user costs

Interoperability is the technical or legal compatibility that enables a payment system or mechanism to be used in conjunction with other systems or mechanisms. It allows participants in different systems to conduct, clear and settle payments or financial transactions across those systems. In particular, interoperability does not require users and providers to participate in multiple systems (CPMI (2016a)).

In LAC, such compatibility is much more limited than in other regions. For example, full interoperability of automated teller machines (ATMs) and point of sale (POS) terminals is present in only a third of LAC countries, compared with 75% in Asian emerging market economies (EMEs) and 97% in advanced economies. Furthermore, interoperability in LAC has not kept pace with technological innovation. Only 10% of LAC jurisdictions offer full interoperability for mobile money services, compared with 75% in Asian EMEs and 25% of sub-Saharan African countries (Graph 1, left-hand panel). The boom of digital wallets, which has led to various

systems that do not communicate with each other (closed loop systems), has reinforced this effect.

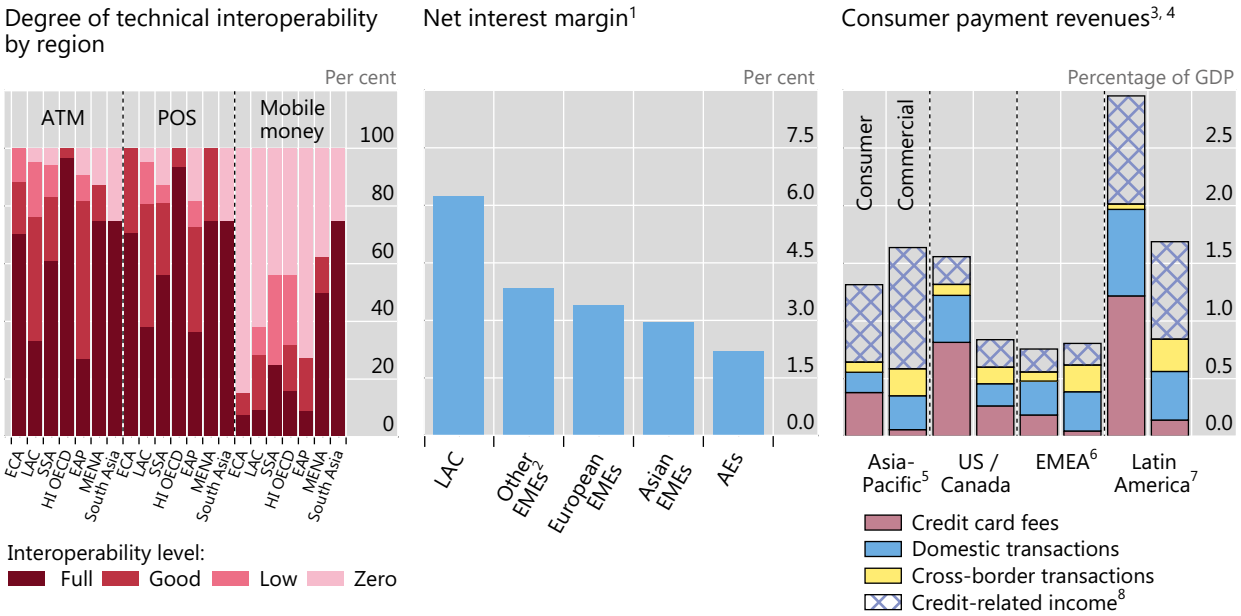
Lower levels of interoperability have important implications. They normally translate into higher costs to process a transaction and a longer time for the funds to reach the payee. Additionally, weak interoperability may limit competition among payment service providers (PSPs), mostly banks, thus helping keep high margins on the transactions they process. In LAC, banking competition – as proxied by net interest margins – is among the weakest across regions (Graph 1, centre panel). All of this translates into fees charged to final users that are the highest among EMEs. For example, total fees charged to consumers and merchants reached 4% of GDP in 2018 (right-hand panel). From this total, credit card fees – the most important source of LAC banks' payment revenues – amounted to over 1% of GDP, well above the 0.4% in Asia and 0.2% in Europe and some African countries. Similarly, the cost of domestic transactions for consumers was above 0.7% of GDP in the region, compared with 0.2% in Asia-Pacific.

True interoperability is unlikely to develop spontaneously. As it is a public good, private operators may not always have sufficient incentives to coordinate and invest in making their payment infrastructure more compatible. Besides, as noted above, incumbents and new players may not have the incentive to allow competing PSPs to interact in a way that is conducive to a competitive level playing field (BIS (2020)). Thus, unsurprisingly, interoperability tends to be strongly shaped by public policy.

In this regard, LAC countries have adopted three general models. The first – in Argentina, Brazil, Costa Rica, Mexico and Peru – is a market-wide approach requiring

Costs of payments in LAC are high, reflecting limited interoperability

Graph 1



EAP = East Asia and Pacific; ECA = Europe and Central Asia; EMEA = Europe, Middle East and Africa; HI OECD = high-income OECD; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; SSA = sub–Saharan Africa.

[1] Data for 2017. [2] Middle East, Russia and South Africa. [3] Data for 2018. [4] The regional GDP equals the sum of individual countries' GDP. [5] AU, CN, HK, IN, ID, JP, KR, MY, NZ, PH, RU, SG, TH and TW. [6] AT, BE, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LT, LU, LV, MT, NL, NO, PL, PT, SA, SE, SI, SK, TR and ZA. [7] AR, BR, CL, CO, MX and PE. [8] Credit-related income also counts some types of revenue that may be considered an ancillary service (credit) other than revenues from payment services, eg net interest income for revolving balances.

Sources: Beck et al (2000); McKinsey (2019b); World Bank, *Global Payment Systems Survey* (GPSS).

that most PSPs seamlessly transfer retail payments among themselves.[2] The second – adopted in Chile, Colombia and Paraguay – is a focused approach in which interoperability is required or encouraged, either for only a given set of payment types or for only some PSPs.[3] The third model – adopted in El Salvador, Guatemala and Nicaragua – is one with no specific requirement for interoperability, as it assumes that private initiatives should flourish first and then coordinate to become mutually compatible.

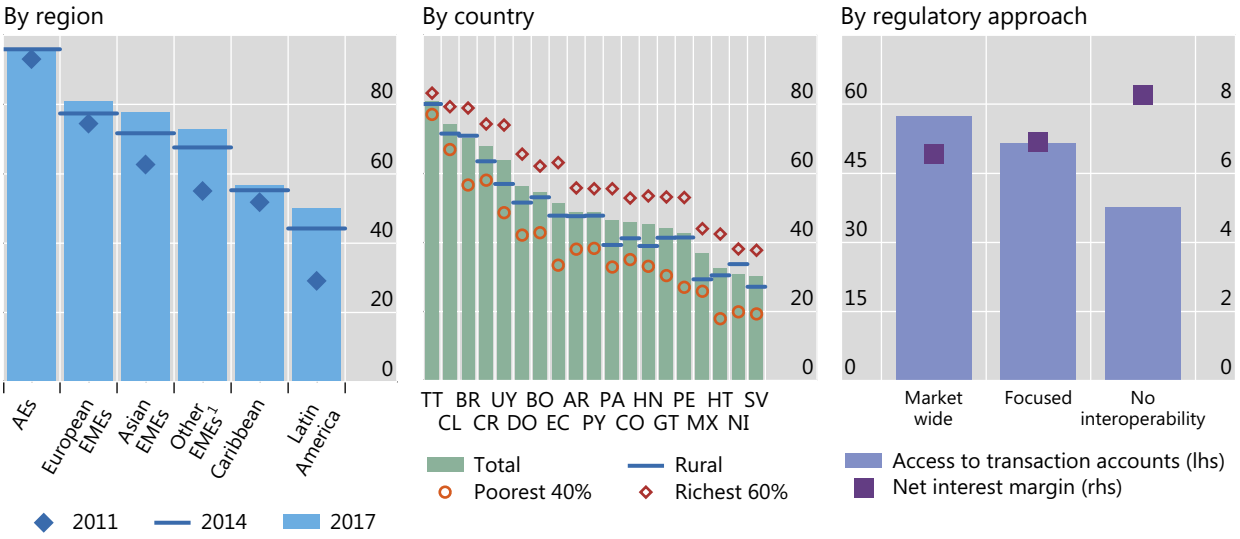
Low level of access to digital payments

As the world has transitioned to digital payments, LAC residents' access to payment services has lagged behind that of residents of other regions. In 2017, on average across LAC countries, only 49% of adults had access to transaction accounts to make

The share of adults with access to transaction accounts in LAC is relatively small

In per cent

Graph 2



[1] Middle East, Russia and South Africa.

Sources: World Bank, Findex; authors' calculations.

[2] In Brazil and Mexico, all major financial institutions must connect with each other with no (explicit) cost to individuals. In Argentina, the central bank has required interoperability between bank and digital accounts. In Costa Rica, the central bank has established an infrastructure that allows bank account holders to initiate payments through mobile phones. In Peru, the government has led a project to offer a fully interoperable mobile money service based on a single brand – BIM. Pagos Digitales Peruanos operates the brand and centralises all commercial, operating and marketing efforts for the wallet, while financial entities and mobile money issuers compete to attract users.

[3] In Paraguay, there is interoperability for person-to-person (P2P) and person-to-business (P2B) transactions across banks, but transfers from mobile money to bank accounts are not yet possible. In Chile, regulators have focused on opening up the market for new card transaction processors. In Colombia, there is interoperability among banks, but the recent regulation for non-bank PSPs does not include interoperability requirements.

and receive payments.[4] This compares with 92% in advanced economies, 80% in emerging Asia and 70% in other EMEs (Graph 2, left-hand panel).

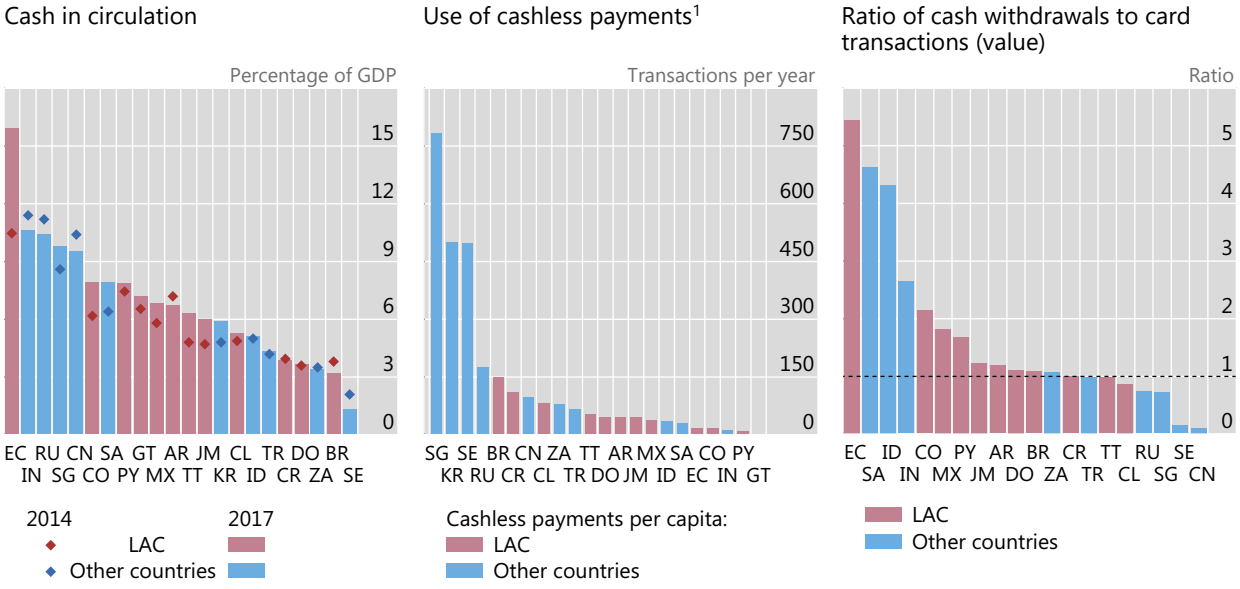
The average figures, however, mask great heterogeneity across LAC countries, as well as within countries. In Brazil and Costa Rica, the share of adults with access to transaction accounts is closer to that of EMEs in other parts of the world (70% and 68%, respectively), but in El Salvador, Haiti and Nicaragua, account ownership is a mere 30%. Within countries, access to transaction accounts is lower in rural areas, where infrastructure tends to be less developed and banks less present, and for low-income individuals, who are less likely to meet minimum fund requirements for opening a transaction account (Graph 2, centre panel). In all LAC countries but Trinidad and Tobago, the share of adults with access to transaction accounts is at least 16 percentage points higher among the richest 60% of the population relative to the poorest 40%.

Regulation concerning interoperability (see above) also seems to matter. Access to transaction accounts is, on average, highest among countries that have adopted a market-wide approach (57%), followed by those that have adopted the focused approach (52%). Unsurprisingly, it is the lowest in jurisdictions with no current requirements for interoperability (38%) (Graph 2, right-hand panel). In addition, net interest margins – our proxy for competition in the banking sector – tend to be higher in countries with no requirements for interoperability, highlighting the link between interoperability and competition in payment services (right-hand panel).

Access issues are also evident in cash and cashless payments in LAC. Cash in circulation is relatively high in most of the region's countries and has increased in some in the past few years (Graph 3, left-hand panel), although part of the rise may

Cash use in LAC prevails over cashless payments

Graph 3



[1] Data for 2017.

Sources: CEMLA, Yellow Book statistics; CPMI, Red Book statistics.

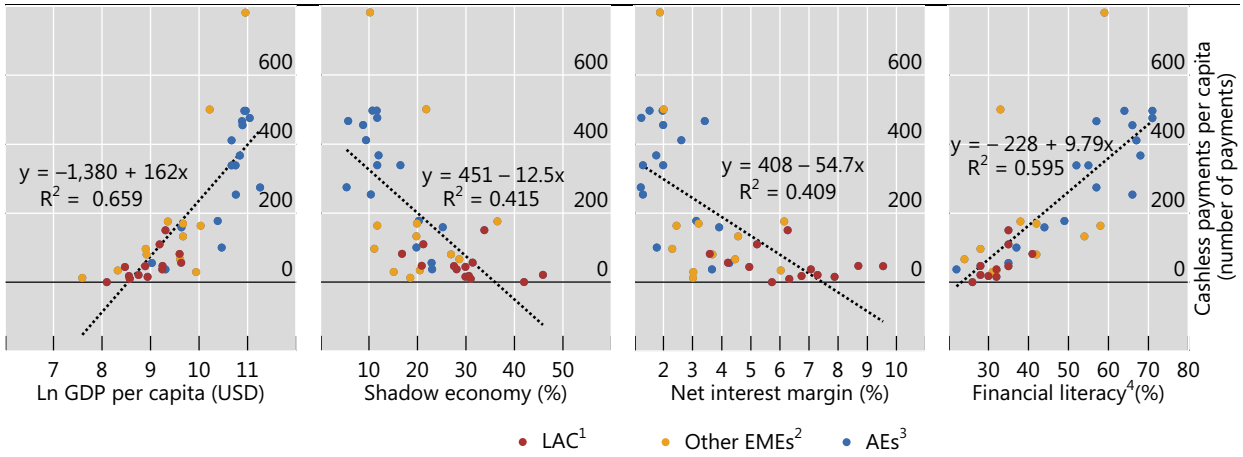
[4] Transaction accounts are defined as accounts (including e-money/prepaid accounts) held with banks or other authorised and/or regulated PSPs, which can be used to make and receive payments and to store value (CPMI-WB (2016)).

be due to store-of-value motives (Bech et al (2018)). High cash use, in turn, goes hand in hand with a low number of cashless payments. On average, people in LAC countries make 50 cashless payments a year, which is nine times lower than in advanced economies and almost a quarter lower than in other EMEs. Again, this average hides large variation across countries, from less than one payment per person per year in Guatemala to 149 in Brazil (centre panel). Preference for cash over cashless payments occurs even among banked users: the value of cash withdrawals at ATMs, a proxy for cash use by the banked, is systematically higher than card payments across the region (right-hand panel).

The limited use of non-cash payment instruments in the region can be explained by a number of broad factors. One is the lower level of per capita income relative to other regions, which is also typically associated with poorer internet, mobile and electricity infrastructure (Graph 4, first panel). A second factor is the larger shadow economy (second panel), which makes traceable payments less attractive. A third factor is the lower degree of competition – as proxied by high net interest margins – which drives up costs of payments for users (third panel) (BIS (2020)). Finally, a low level of financial literacy (fourth panel) also plays a role, as less informed potential users may perceive alternatives to cash as unsafe, unreliable or too complicated.

Factors explaining the lower use of cashless payments in LAC

Graph 4



[1] AR, BR, CL, CO, CR, DO, EC, GT, JM, MX PY, PE and TT. [2] CN, CZ, HU, ID, IN, KR, PL, RO, RU, SA, SG, TR and ZA. [3] AU, BE, BG, CA, CH, GB, HR, DK, FR, DE, IT, NL, ES, SE, and US. [4] Data not available for IN, JM, PY and TT.

Sources: Beck et al (2000); Klapper et al (2015); Medina and Schneider (2019); ECB; CEMLA Yellow Book statistics; World Bank; CPMI, Red Book Statistics.

Improving national retail payment services in LAC

Wider use of the internet and mobile phones, as well as the large margins earned by PSPs, have made LAC an attractive market for new firms and the adoption of innovative and more convenient payment methods. Indeed, in recent years the region has witnessed the rapid growth of fintech firms. The largest share – 25% of the total number in 2020 (according to Pitchbook Data) – are active in the area of payment services, offering, for example, payment gateways, aggregators, digital wallets and mobile POS.[5] In addition, some big techs have already entered the market or attempted to do so. For instance, in several countries Mercado Libre's Mercado Pago allows users to both pay for goods on its e-commerce platform and pay utility bills and for goods in some bricks-and-mortar stores. Notable also is Facebook's June 2020 attempt to launch a payment service associated with WhatsApp in Brazil. The central bank temporarily suspended this service in order to assess its risks to the domestic payment system and implications for competition (Central Bank of Brazil (2020b)).[6]

These private initiatives, however, do not necessarily guarantee the safety and integrity of payments, nor greater affordability and inclusiveness. While the private sector is in a better position to develop and adapt new technology to end users' needs, central banks and other public authorities play an essential role in ensuring adequate levels of safety and security, coverage and competition. Central banks and other authorities can impose common standards (on risk management, messaging formats, etc), promote competition, take the initiative to encourage and coordinate projects among multiple private sector operators, invest in building part or the entire basic infrastructure and/or directly operate it (BIS (2020), CPMI (2016b) and Carstens (2019)).

In LAC, there are three promising initiatives under the leadership of central banks and other public authorities. The first is the establishment of fast retail payment systems that are accessible at low or no cost to users. The second is providing a favourable environment for open banking. The third are pilot programmes for central bank digital currencies (CBDCs).

Fast retail payment systems

Fast retail payment systems (FRPS) have two essential characteristics. They are fast, allowing payments to be processed and made final – that is, irrevocable – in real or near real time (a few seconds at most). And they are available continuously, 24 hours a day, every day (Bech et al (2020) and CPMI (2016b)).

In the development of FRPS, the LAC region still lags behind other parts of the world, even though a few countries have made material progress. Some of the FRPS in use, for example in Colombia and Chile, lack extensive coverage and a wide range

[5] In 2019, payment fintechs received over $1 billion in investment. Major deals that year included a $725 million investment in Argentina's Prisma Medios de Pago, a $400 million in Brazil's Nubank, a $150 million investment in Argentina's Ualá and a $100 million investment in Mexican Clip (Cantú and Ulloa (2020)). Most firms are working closely with traditional actors such as banks, payment agencies and insurance firms.

[6] At the time of writing, Facebook was expected to soon be authorised to start P2P transfers in WhatsApp.

of use cases.[7] By contrast, Mexico and Brazil have recently completed ambitious projects that target both speed and availability of services. The two projects resulted in payment platforms that are regulated and operated by the respective central banks. In September 2019, the Bank of Mexico launched CoDi®, which builds on the infrastructure of SPEI, the Bank of Mexico's real-time gross settlement (RTGS) system, as well as on the existing mobile operators' networks. In turn, the Central Bank of Brazil made its platform, Pix, operational on 16 November 2020.

CoDi and Pix promise to offer attractive alternatives to traditional retail payment services in their respective jurisdictions. For one, they feature an option[8] that allows individuals to send and receive payments at no cost. Furthermore, merchants' cost to receive payments is lowered to zero in CoDi and significantly reduced in Pix,[9] with the additional advantage of settlement within 10 seconds. By contrast, merchants in Brazil may need to wait two days for funds from a traditional bank transfer. At the same time, CoDi and Pix promote better access by allowing simplified accounts – which are easier to open, do not require minimum holdings and charge lower or no fees – to also benefit from fast retail payments. The box summarises and compares the two platforms' main characteristics.[10]

Open banking

Open banking is the sharing through application programming interfaces (APIs) of data by bank and non-bank financial institutions with third parties. In turn, these third parties can leverage the data to improve the range and quality of financial services offered to consumers and businesses. The data shared could include individuals' and firms' personal and financial information (including that related to bank accounts), with their permission.

Open banking holds the promise of enhancing market competition for payment services, especially by easing access by new entrants that can apply their technological know-how and creativity to offer more convenient and lower-cost payment instruments. In particular, APIs may facilitate new ways of initiating payments, for example through better integration with e-commerce and social media platforms and specialised software. Combined with inexpensive fast payments, data-sharing can thus make digital payments even more attractive to larger parts of the

[7] In both Colombia and Chile, the systems are owned by groups of private commercial banks and operated by privately owned automated clearing houses (ACHs). However, these are limited in coverage and use cases. In Colombia, the Botón de Pagos PSE enables P2B online payments via bank accounts, and Transfiya offers instant payments for P2P transactions with only nine financial institutions as participants. In Chile, the Centro de Compensación Automatizado (CCA) currently conducts over one million transactions per day for most banks in the country in real time, but only for some use cases (P2B and P2P payments).

[8] Although CoDi and Pix will be available for consumers, regular bank transfers will be still in use. For example, users can still send money through TED in Brazil, although at a cost and with non-immediate settlement.

[9] Pix allows banks and other participants to charge merchants a fee for transactions, although it is expected that competition among PSPs will drive the fees down.

[10] Another promising initiative has been launched in Argentina. In close collaboration with the private sector, the central bank has issued new regulation, Transferencias 3.0, to make instant payments more affordable and widespread. It aims to allow all types of payments with full interoperability among banks and non-bank PSPs, at no cost for individuals and at very low cost for businesses. In the initial stage, starting in December 2020, users will be able to use a single QR code to initiate payments from any account, at either a bank or a non-bank PSP.

population. In addition to greater convenience, users can benefit from better transparency as third parties may offer portals or other services through which they can easily compare prices and conditions.

Open banking also makes it easier and less costly for both customers and financial institutions to open new transaction accounts. By streamlining processes that are usually slow and often entail a long paper trail, data-sharing among financial institutions could, for example, reduce the cost of complying with know-your-customer (KYC) procedures and anti-money laundering and combating the financing of terrorism (AML/CFT) regulations. The reduction in costs could, in turn, be passed on to users. Finally, by allowing for more personalised services, open banking could lead to transaction accounts better suited to the unbanked or underbanked.

To realise these benefits, open banking can benefit from active participation by central banks and other authorities as catalysts of private sector initiatives and overseers. Specifically, authorities may want to prevent network effects, as well as economies of scale and scope, from leading to the emergence of dominant players that would restrict competition and earn excessive rents. To promote competition, authorities therefore need to require or encourage APIs to share common standards and financial institutions to not impede data access (BIS (2019)). In addition, because open banking users' trust could easily be lost, authorities would need to put in place and monitor robust safeguards to protect personal and financial data against unauthorised use, hacking and fraud. In case data are stolen or misused, legal responsibilities and liabilities need be clearly specified and dispute settlement processes available to users.

In LAC, public initiatives to develop open banking are well advanced in Mexico and Brazil. In March 2018, Mexico published its Fintech Law, which requires banks and fintechs to develop APIs with common standards to enable registered third parties' access to information regarding product offers, aggregated data about their operations and, with clients' permission, individual transaction data (Diario Oficial de la Federación (2018)). However, to date the standards for such APIs are yet to be defined. Likewise, as part of its "competitiveness initiative" and jointly with the Pix project, in 2019 the Central Bank of Brazil launched its open banking model. It issued the regulation needed to enable sharing of registration and transaction data and has set up a gradual rollout plan.[11] At the same time, it asked industry participants to develop concrete proposals for the standardisation of APIs (Central Bank of Brazil (2020a)).[12] Other countries, eg Argentina and Peru, currently have no explicit rules or guidance that either require or prohibit the sharing of customer-permissioned data by banks with third parties (BCBS (2019)).

[11] Implementation will take place in four phases. Financial institutions should give access to: (i) information about their products by November 2020; (ii) customers' registry information and transactional data by May 2021; (iii) payment initiation services by August 2021; and (iv) information about their foreign exchange products, investments, insurance and open pension funds by October 2021 (Central Bank of Brazil (2020a)). In addition, the central bank is planning to start its first set of regulatory sandboxes in 2021 to promote innovative business models, competition, financial inclusion and enhanced supervision processes.

[12] Outside LAC, several countries had already introduced open banking regulations requiring banks to share customer-permissioned data and third parties to register with a particular regulatory or supervisory authority. Examples include: the EU's revised Payment Services Directive (PSD2), in force since 2016, which applies only to payment services; UK's Open Banking, in force since January 2018; and Australia's Consumer Data Right (CDR) bill, enacted in July 2020, which allows the largest banks' clients to securely share some of their banking data with other accredited banks and fintech firms.

CoDi and Pix

Viviana Alfonso, Alexandre Tombini and Fabrizio Zampolli[①]

CoDi in Mexico and Pix in Brazil are fast retail payment systems (FRPS) that allow users to execute and finalise payments in real time and are available 24 hours a day, every day of the year, through a platform operated by the respective central banks.

CoDi and Pix share many common features but also present some differences (Table 1). From the viewpoint of final users, coverage is identical. Both are available virtually to all transaction account holders for sending payments. However, some participating institutions cannot receive payments within CoDi.[②] By contrast, in Pix it is compulsory for all participating PSPs to provide their customers with all the functionalities for initiating and receiving instant payments in their mobile applications. As for access channels, both systems allow payments through mobile devices when a quick response (QR) code is scanned or by using near field communication (NFC) technology.[③] CoDi also incorporates push notifications, while Pix allows users to start a payment by using the payee's data.[④] Use cases currently vary, although they should ultimately converge. Specifically, CoDi is currently available only for payments between persons and businesses, while Pix also enables payments to the government. In 2021 Pix will also allow payments from government agencies to persons and businesses, and in Mexico some governmental agencies are presently working to develop use cases with CoDi.

Main differences between CoDi and Pix

Table 1

	CoDi	Pix
Coverage	Available virtually to all transaction account holders	Available virtually to all transaction account holders
Access channel	Mobile phone using QR code, NFC technology and push notifications	Mobile phone using QR code, NFC,[3] registered key of payee, manual input of payee's data, internet banking and in-person at bank branches
App	App provided by the central bank for request to pay functionality/embedded into some financial institutions' apps	Embedded into financial institution's app
Use cases[1]	P2P, P2B, B2P, B2B, G2P, P2G, G2B, B2G and G2G[2]	P2P, P2B, P2G,B2P, B2B, B2G, G2P,[3] G2B[3] and G2G[3]
Instrument	Credit transfer	Credit transfer
Cost for users	Free for individuals and merchants	Free for individuals. Charge for merchants in some use cases, although with not higher fees than credit or debit cards.
Interoperability	Full interoperability among participants	Full interoperability among participants
Openness of the system	Open only for SPEI-licenced participants. Third parties can develop applications to generate payment requests.	Open to financial institutions (eg banks, credit unions), payment institutions (e-money issuers and payment initiation providers[3]) and the Federal Treasury
Administrator of identification database	Each financial institution	Central Bank of Brazil
Type of settlement	Real-time	Real-time
Operator of settlement infrastructure	Bank of Mexico	Central Bank of Brazil

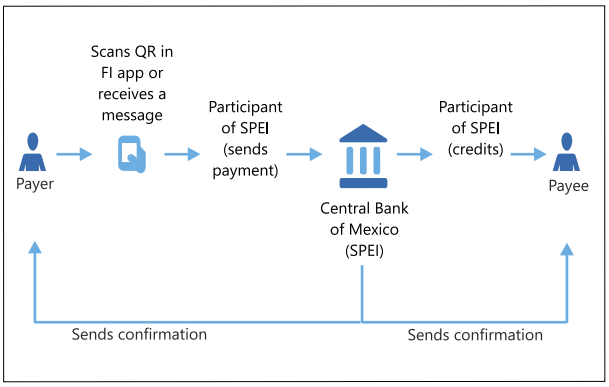
[1] B = business; G = government or public entity; P = person. [2] Although payments involving the government are not currently available, some local and federal agencies are working on the development of use cases with CoDi. [3] Available in 2021.

Sources: Central Bank of Brazil; Bank of Mexico.

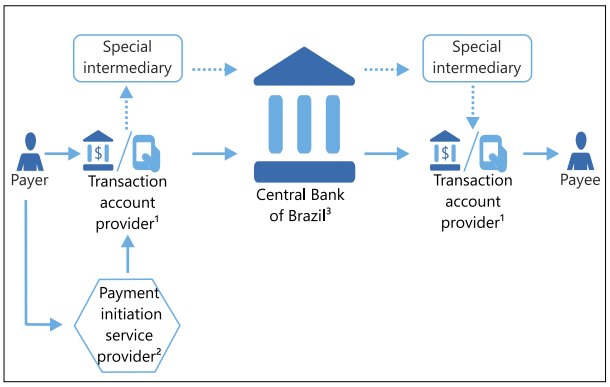
One important difference between CoDi and Pix concerns their openness (Figure A). CoDi allows participation by only financial institutions that are members of SPEI, the Bank of Mexico's real-time gross settlement (RTGS) system – but lets third parties develop applications that generate payment requests.[5] By contrast, Pix admits three types of institutions. First are payment initiation providers – the authorised third parties that carry out payment initiation at the request of a customer but do not participate in the financial settlement of the transaction.[6] Second are transaction account providers, or the financial institutions and PSPs that offer accounts – deposits, savings or prepaid accounts – to final users and can participate either directly or indirectly in the settlement infrastructure. Third are special intermediaries – direct participants that do not offer transactional accounts to end users but serve indirect members of Pix by connecting them to the central bank's settlement infrastructure.[7]

Payment platforms in Brazil and Mexico — Figure A

Functioning of CoDi in Mexico



Functioning of Pix in Brazil



FI = Financial institution.

[1] Can be direct or indirect participant. [2] Does not participate in settlement. [3] Provides settlement infrastructure and liquidity.

Sources: Central Bank of Brazil; Central Bank of Mexico.

① The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements. ② Some financial institutions do not offer CoDi for payments – that is, their clients cannot generate QR codes. In that case, payees can use a mobile application provided by the Bank of Mexico to create the QR code that initiates the payment. ③ QR codes are a type of matrix barcode that can store a larger volume of data, be scanned from either paper or a screen, be used even if partially damaged and encrypt information. NFC is a standards-based, short-range (a few centimetres) wireless connectivity technology that enables the wireless transfer of data. ④ The payee's data can be a key or the regular bank details. In Pix, the central bank also manages the unique database that stores the payee's key that identifies their transactional account. The key can be an email address, a mobile phone number, a tax payer number or a random number generated by the system. ⑤ The Bank of Mexico will submit a public consultation to allow indirect participants in SPEI to offer CoDi functionalities. ⑥ Online retailers, social media and fintechs including merchant acquirers and startups are examples of such companies. ⑦ Participation in CoDi is compulsory for banks that are members of SPEI, with more than 3,000 customer accounts. In Pix, participation is mandatory for all financial and payment institutions licensed by the Central Bank of Brazil with more than 500,000 active customer accounts.

The development of open banking more widely in LAC can benefit from international coordination and support. The BIS Representative Office for the Americas is currently coordinating joint efforts by BIS member central banks to build the necessary technical know-how.[13] In February 2020, these central banks agreed on setting up the Consultative Group on Innovation and the Digital Economy (CGIDE), tasked with proposing solutions to the technical hurdles involved in establishing a secure open banking environment. Given the sensitive nature of the data exchanged, the first problem tackled by the group was that of identifying and authenticating individuals' requests to initiate a payment or access other financial services online. The analysed solution is a scheme in which a central validator allows users to securely input their financial credentials through a mobile app.[14] The sharing of technical know-how on APIs could eventually be a basis for central banks to discuss how to improve cross-border payments in future joint initiatives (CPMI (2020)).

A complementary initiative that could make open banking more effective, especially in boosting financial inclusion, is the large-scale provision of a digital identity by either a trusted private or a public sector entity. Unlike traditional forms of identification such as passports, identity cards or driving licences, a digital ID can be authenticated remotely through digital channels, allowing the same individual to access a multitude of online services, including financial ones.[15] In particular, digital ID – along with open banking – can facilitate the opening of bank accounts and reduce the cost of KYC procedures. Most LAC countries have not yet embraced initiatives in this area, however. An exception is Argentina, where 98% of the population has a digital ID. Yet its adoption for accessing financial services is still very low.[16]

Experience from outside the region, in India, suggests that the combination of fast payment systems, open banking and a national digital ID system is indeed effective in improving the efficiency, convenience and inclusiveness of digital payments (D'Silva et al (2019)). India's FRPS, the Unified Payments Interface (UPI), relies on a national identity system provided as a public good and launched in 2010, Aadhaar. Thanks to this system, more than 1.2 billion Indian residents now have a unique digital identity. UPI leverages on Aadhaar to simplify the authentication process and make it more efficient. In a country where many people lack physical identity documents, Aadhaar led to a remarkable increase in the number of banked people as well as a sharp reduction in the exclusion of marginalised groups (D'Silva et al (2019)).

[13] BIS members in LAC are the central banks of Argentina, Brazil, Chile, Colombia, Mexico and Peru.

[14] The scheme's main features are presented in CGIDE (2020). Participating central banks are not necessarily endorsing open banking or the analysed scheme. The latter is only meant to serve as a general reference to help authorities develop their own country-specific solution.

[15] According to McKinsey (2019a), extending full digital ID coverage to all sectors of the economy could unlock economic value equivalent to 3–13% of GDP in 2030.

[16] To boost financial inclusion, two additional policies were adopted. First, as of January 2019 the presentation of the digital identity (DNI) is enough to physically or remotely open a universal free account, ie a general purpose transaction account without opening or maintenance costs offered by all banks. Second, as of October 2019 citizens can carry a copy of their national digital ID on their smartphones, which can be used as an authentication mechanism in financial institutions.

Central bank digital currencies

Central bank digital currency (CBDC) could become a new means of payment. Unlike the reserves held by commercial banks at the central bank, this form of safe digital money could be made available to individuals and businesses, complementing physical cash (ie retail CBDCs). As in other regions, many central banks in LAC are currently examining the design and technical characteristics of retail CBDCs that would provide the best balance between possible benefits and risks (see eg CPMI-MC (2018), Bank of Canada et al (2020), Auer and Böhme (2020) and Auer et al (2020b)).

In terms of benefits, retail CBDCs may help overcome the limitations of national payment systems in LAC in at least two ways. First, by offering a convenient and affordable payment instrument, CBDCs may promote financial inclusion and reduce the risk that users switch to less safe or transparent means of payments (eg stablecoins or cryptocurrencies). Second, they may provide a more affordable common means of transferring funds across accounts held at different PSPs domestically, thus reducing the costs associated with low interoperability. Additionally, if and when cash in circulation, cash access points or cash acceptance by payees decrease, CBDCs would guarantee that the public continues to have access to safe central bank money.

Assessment of these potential benefits needs to take into account that FRPS and open banking can offer similar advantages without some of the risks. These include the risk of disintermediation, accelerating bank runs at times of stress, and a potentially larger footprint of the central bank in the financial system. Such risks can, however, be mitigated by remunerating CBDC holdings at a lower rate than the rate paid on commercial bank reserves at central banks (hence at a lower rate than commercial bank deposits). Alternatively, central banks could impose limits on the amount of CBDC that individuals and firms can hold.

Over the past few years, a number of central banks in LAC have completed or are currently conducting pilot projects for the issuance of retail CBDCs. Ecuador was the first country in the world to issue a CBDC, named Dinero Electrónico, in 2014. The project was suspended in 2016. The digital currency had a low level of acceptance among users, especially in rural areas, meaning that access to payments was not materially improved. It was also criticised by commercial banks for not being backed by US dollar reserves at the central bank. In turn, Uruguay's experiment with the E-peso ran from November 2017 to April 2018. It allowed users to pay instantly at registered businesses and to conduct P2P transactions through digital wallets, with limits to the amount that could be stored and transferred. The initial assessment of the pilot project was positive. The E-peso had wider acceptance in the economic sectors that were more concerned with the costs of existing payment platforms. In addition, evidence suggests that the pilot CBDC reached some unbanked population in remote areas. That said, no decision has yet been taken to start a second pilot project, which would include the participation of banks and other financial institutions. Two projects currently in place are the Sand Dollar in the Bahamas, launched as a pilot in December 2019, and DCash in the Eastern Caribbean islands, launched in March 2019. Both aim at allowing individuals and businesses to transfer money and make payments free of charge through non-interest bearing digital wallets subject to transaction limits.

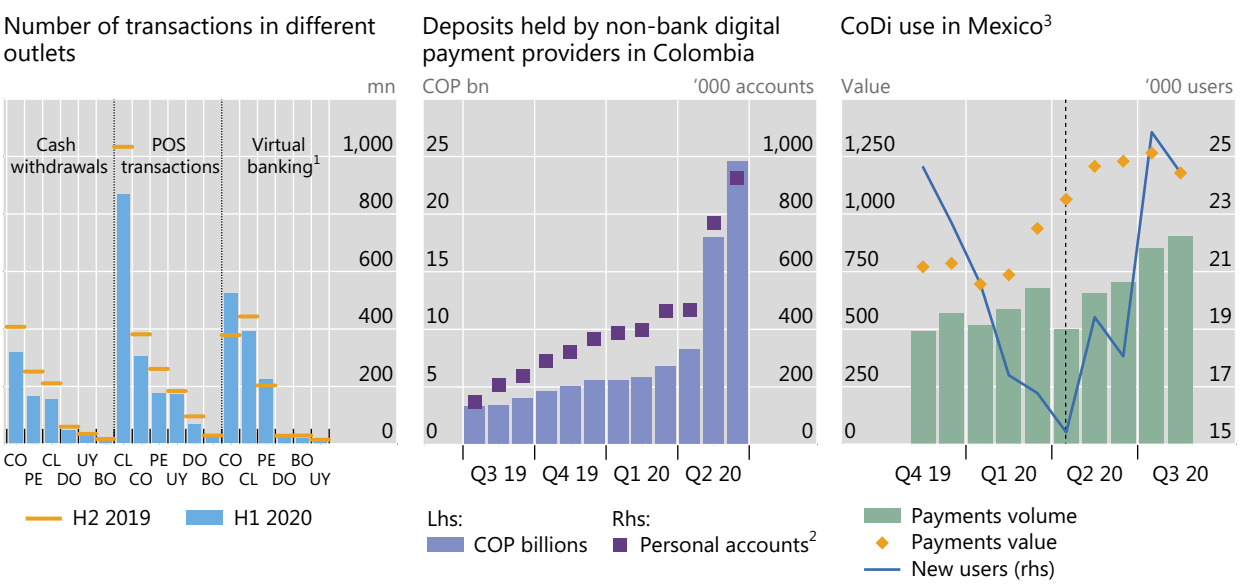
Payments during the pandemic

The adoption and development of digital payments have received a further impulse worldwide from the Covid-19 pandemic. Restrictions on bricks-and-mortar retailers and concerns about viral transmission via cash have given people a stronger incentive to purchase online and to use digital payments (Alfonso et al (2020) and Auer et al (2020a)). In addition, many governments supported the shift to cashless payments. First, they raised transaction limits for contactless payments (Auer, Frost, Lammer, Rice and Wadsworth (2020)) and reduced fees on debit and credit card payments as well as mobile money transactions (Allmen et al (2020)). Second, several governments used digital payments to distribute income support efficiently to those that needed rapid aid instead of relying on paper cheques or physical cash, which take longer to process (Gentilini et al (2020) and Auer, Frost, Lammer, Rice and Wadsworth (2020)). For example, in Colombia, Brazil and Chile, cash transfers to informal workers, heavily hit by the lockdowns, were partly disbursed through digital wallets or basic simplified bank accounts that beneficiaries could open remotely with a national ID document and at no cost.

In LAC, these changes resulted in a significant decline in cash withdrawals and POS transactions in the first half of 2020, matched by a significant expansion in the use of mobile, phone and internet banking (Graph 5, left-hand panel). In Colombia, customers' deposits at non-bank payment providers tripled between March, when the lockdown started, and June 2020 (centre panel). In Mexico, the Covid-19 pandemic gave a significant boost to CoDi use. The number of new customers sending payments through CoDi started to grow soon after lockdown had been announced, reversing the trend observed until then. The volume of transactions accelerated subsequently, and the average payment value increased by almost 35% relative to its pre-pandemic levels (right-hand panel).

Digital payments have soared since the start of the pandemic

Graph 5



[1] Includes mobile, internet and phone banking. [2] Excluding business accounts. [3] Dotted line represents the start of the Covid-19 lockdown in Mexico. The blue line represents the number of new users sending payments through CoDi. The trend for new users receiving payments through CoDi is the same.

Sources: Central Bank of Bolivia; Central Bank of Chile; Central Bank of Colombia; Central Bank of the Dominican Republic; Bank of Mexico; Central Reserve Bank of Peru; Central Bank of Uruguay; Financial Superintendence of Colombia.

Conclusion

The initiatives that central banks and other authorities are taking in a number of LAC countries to make payments more affordable, more convenient and more inclusive are proving very timely. The Covid-19 crisis has led to a sharp increase in the use of digital payments, prompting many new users to appreciate their convenience. For this reason, much of this increase may not be reversed after the pandemic ends. While this puts a premium on further improvements to payment systems, progress remains quite uneven in the region. Much progress is also needed to improve the efficiency of cross-border payments, which remain slow and expensive.

As LAC central banks strive to improve their payment systems, they can count on the BIS to provide support through its various committees and cooperative activities. In collaboration with the BIS Innovation Hub and the Committee on Payments and Market Infrastructures, the Consultative Group on Innovation and the Digital Economy (CGIDE) will play an important role in sharing technical know-how among BIS member central banks. In addition, through its regional office in Mexico City the Bank will disseminate best practices and standards to non-BIS member central banks in the region.

References

Alfonso, V, C Boar, J Frost, L Gambacorta and J Liu (2020): "E-commerce in the pandemic and beyond", *BIS Bulletin*, forthcoming.

Allmen, U, P Kehera, S Ogawa and R Sahay (2020): "Digital financial inclusion in the times of COVID-19", *IMFBlog*, July.

Auer, R and R Böhme (2020): "The technology of retail central bank digital currency", *BIS Quarterly Review*, March, pp 85–100.

Auer, R, G Cornelli and J Frost (2020a): "Covid-19, cash and the future of payments", *BIS Bulletin*, no 3, April.

——— (2020b): "Rise of the central bank digital currencies: drivers, approaches and technologies", *BIS Working Papers*, no 880, August.

Auer, R, J Frost, T Lammer, T Rice and A Wadsworth (2020): "Inclusive payments for the post-pandemic world", SUERF Policy Note, Issue n° 193, September.

Bank for International Settlements (2019): "Big tech in finance: opportunities and risks", *Annual Economic Report 2019*, June, Chapter III.

——— (2020): "Central banks and payments in the digital era", *Annual Economic Report 2020*, June, Chapter III.

Bank of Canada, European Central Bank, Bank of Japan, Sveriges Riksbank, Swiss National Bank, Bank of England, Board of Governors of the Federal Reserve and Bank for International Settlements (2020): *Central bank digital currencies: foundational principles and core features*, October.

Basel Committee on Banking Supervision (2019): *Report on open banking and application programming interfaces*, November.

Bech, M, U Faruqui, F Ougaard and S Picillo (2018): "Payments are a-changin' but cash still rules", *BIS Quarterly Review*, March, pp 67–80.

Bech, M, J Hancock and W Zhang (2020): "Fast retail payment systems", *BIS Quarterly Review*, March, pp 28–9.

Beck, T, A Demirgüç-Kunt and R Levine (2000): "A new database on financial development and structure", *World Bank Economic Review*, vol 14, pp 597–605, updated September 2019.

Cantú, C and B Ulloa (2020): "The dawn of fintech in Latin America: landscape, prospects and challenges", *BIS Papers*, no 112.

Carstens, A (2019): "The changing colour of money –new directions for payment systems and currencies", *The Business Times* (Singapore), 13 November, www.bis.org/speeches/sp191113.htm.

Central Bank of Brazil (2020a): "Resolução conjunta Nº 1. Dispõe sobre a implementação do Sistema Financeiro Aberto (Open Banking)", 4 May.

——— (2020b): "Nova solução de pagamentos depende de prévia autorização do BC", press release, www.bcb.gov.br/detalhenoticia/17108/nota.

Committee on Payments and Market Infrastructures (2016a): *Glossary of payments and market infrastructure terminology*, October

——— (2016b): *Fast payments – enhancing the speed and availability of retail payments*, November.

——— (2020): *Enhancing cross-border payments: building blocks of a global roadmap: stage 2 report to the G20*, July

Committee on Payments and Market Infrastructures and Markets Committee (2018): *Central bank digital currencies*, March.

Committee on Payments and Market Infrastructures and World Bank (2016): *Payment aspects of financial inclusion*, April.

Consultative Group on Innovation and the Digital Economy (2020): *Enabling open finance through APIs*, forthcoming.

D'Silva, D, Z Filková, F Packer and S Tiwari (2019): "The design of digital financial infrastructure: lessons from India", *BIS Papers*, no 106.

Diario Oficial de la Federación (2018): "Ley para regular las instituciones de tecnologia financiera", Nueva Ley DOF 09-03-2018, March, www.diputados.gob.mx/LeyesBiblio/pdf/LRITF_090318.pdf.

Gentilini, U, M Almenfi, P Dale, R Palacios, H Natarajan, R Galicia, A Guillermo, Y Okamura, J Blomquist, M Abels, G Demarco and I Santos (2020): "Social protection and jobs responses to COVID-19: a real-time review of country measures", World Bank Group.

Klapper, L, A Lusardi and P van Oudheusden (2015): *Financial literacy around the world: insights from the S&P Global FinLit Survey*.

McKinsey & Company (2019a): *Digital identification: a key to inclusive growth*, April.

——— (2019b): *Global Payments Report 2019: Amid sustained growth, accelerating challenges demand bold actions*, September.

Medina, L and F Schneider (2019): "Shedding light on the shadow economy: a global database and the interaction with the official one", *CESifo Working Paper*, no 7981.

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International banking amidst Covid-19: resilience and drivers[1]

The claims of international banks held up well during the Covid-19 crisis, although economic output fell by even more than during the Great Financial Crisis (GFC). Both cross-border and local claims were resilient, in advanced and emerging market economies alike. Looking at lending to the real economy, we examine how borrower and lender characteristics relate to the growth of claims on the private non-financial sector during the pandemic. We find that countries with stronger economic activity and smaller financial vulnerabilities borrowed more. Likewise, better capitalised banking systems lent more. The economic stress also led advanced economy borrowers to draw on pre-existing credit lines from foreign banks.

JEL classification: F34, G01, G21.

A decade after the Great Financial Crisis (GFC) a new, very different kind of crisis has hit us. The Covid-19 shock originated outside the financial sector. As it forced major economies into lockdown, economic activity contracted abruptly in the second quarter of 2020, undercutting output even more sharply than during the GFC. A strong policy response sought to contain the economic fallout. In line with these objectives, international banks' claims[2] have held up well, as reflected in the BIS international banking statistics (IBS).

This resilience was broad-based through the first months of the Covid-19 outbreak. It featured in both the cross-border and local claims of international banks. It also characterised their claims on both advanced and emerging market economies (EMEs). And it was seen in year-on-year growth rates, which address seasonality issues while taking into account all available data that reflect the pandemic.

Concretely, aggregate cross-border bank claims, on financial and non-financial borrowers combined, grew by 4.8% through mid-2020. This contrasts with a 5.2% decline in the year to end-2008, amidst the GFC. The most recent year-on-year growth was due mainly to a $2.7 trillion increase in Q1 2020, which prevailed over a

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[2] Claims include loans and deposits as well as holdings of debt securities and derivatives positions.

Key takeaways

- Banks' cross-border claims held up during the pandemic's first wave, growing by almost 5% year on year through mid-2020.
- Year on year, countries with stronger economies and smaller financial vulnerabilities borrowed more, and better capitalised international banks lent more.
- Funding stress also led borrowers to utilise pre-existing credit lines from banks, driving up claims.

$1.2 trillion decline in Q2 2020, both driven primarily by claims on advanced economy (AE) financial sector borrowers. Likewise, foreign banks' local claims in local currency grew by 8.6% year on year through mid-2020, driven largely by Q1 claims on AE central banks.

Foreign claims on the private non-financial sector – a gauge of direct lending to the "real economy" – also remained robust. Through mid-2020, they fell by 0.5% year on year. This decline pales in comparison with that at the onset of the GFC, when foreign claims on private non-banks fell by 11.8% year on year through end-2008.[3] This suggests that, in contrast to the GFC, banks served as a reliable first line of defence. Aided by swift policy action, they helped to mitigate economic stress in the pandemic's early stages (BIS (2020)).

To investigate the drivers of claims on the private non-financial sector, we look at characteristics of the borrower country and the lending banking system. We find that countries with stronger economic activity and smaller financial vulnerabilities borrowed more in the pandemic's opening months. In addition, better capitalised banking systems lent more. Despite the pandemic-related stress, banks accommodated the drawdown of pre-existing credit lines, thus supporting the flow of international credit, especially to non-financial entities in advanced economies.

The rest of this article is organised as follows. The first section documents how international banks' claims evolved, across regions and counterparty sectors. The second decomposes banks' claims on the private non-financial sector into borrower- and lender-related components. The final section concludes.

The resilience of international banks' claims

How did international banks' claims evolve amidst the pandemic? To answer this question, we compare year-on-year claims growth through mid-2020 (including the first full quarter after the initial Covid-19 shock, which is the most recent quarter in the current IBS) with that through end-2008 (that is, through the first full quarter of the GFC after the Lehman shock). We focus on year-on-year claims growth for two main reasons. First, to abstract from seasonality effects that are particularly strong around year-ends, in part due to window-dressing. Second, to capture all pandemic-related responses – such as quantitative easing, central bank swap lines and the drawdown of credit lines – that affected international banking and cut across both the first and second quarters of 2020.

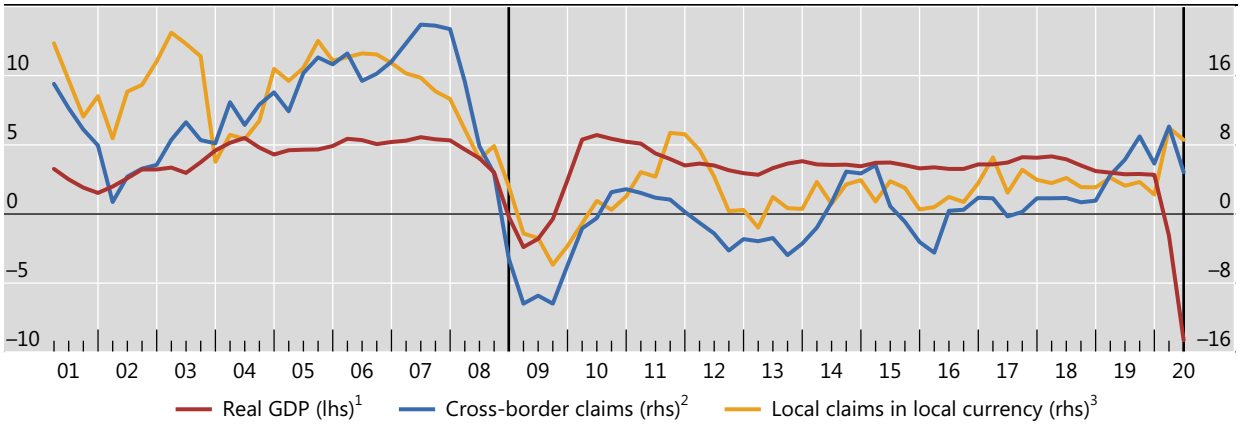
[3] Since a breakdown of foreign claims on the private non-financial sector is not available for the GFC period, reference to private non-banks provides the closest proxy. Claims on the private non-bank sector, comprising both non-bank financial and non-financial borrowers, grew by 0.4% in Q2 2020.

Overall, international banks' claims proved to be strikingly resilient when compared with the GFC (Graph 1). Year on year, the drop in global output was 9.1% through mid-2020, much larger than the 0.2% decline through end-2008 (red line). Yet, global cross-border claims grew by 4.8% through mid-2020 (blue line). Indeed, this marked one of the highest yearly growth rates since the GFC, in sharp contrast with the 5.2% decline through end-2008. Similarly, local claims in local currency also grew year on year at a historically high rate of 8.6% through mid-2020 (yellow line). Again, the contrast is sharp with the GFC: through end-2008, these claims grew by only 3.2%.[4] Besides banks' resilience, the recent strong growth also reflects high borrowing needs in the face of lockdowns.[5]

We next zoom in on cross-border bank claims in Q2 2020, which is the first full quarter of the pandemic and is less likely to be subject to seasonality effects than Q1 (Graph 2). Claims on AE borrowers declined by $0.8 trillion in Q2, or by 3.3% of the outstanding amount in Q1 (Graph 2, left-hand panel). This decline was driven entirely by claims on banks (red bars) – split roughly 60-40 between related and unrelated institutions – and, to a lesser extent, on non-bank financial borrowers (light blue bars). The large Q2 decline in inter-office positions vis-à-vis related banks came on the heels of an even bigger increase in Q1. Both moves reflect in part the use of AE central banks' swap lines (Aldasoro et al (2020)).[6] More generally, swings in interbank claims are consistent with adjustments for liquidity management purposes, which need not underpin new lending to the real economy.

International banks' claims hold up better in the pandemic than in the GFC

Year on year growth rate, in per cent — Graph 1



Vertical lines indicate end-2008 and end-June 2020.

[1] Weighted average based on rolling GDP and PPP exchange rates. Sample of 56 countries. [2] Compounded annual growth rate based on FX- and break-adjusted cross-border claims. [3] Consolidated claims, growth adjusted for breaks in series and exchange rate movements.

Sources: BIS consolidated banking statistics on an immediate counterparty basis; BIS locational banking statistics by residence; national data; BIS calculations.

[4] That said, local claims funded by local liabilities tended to be more stable than cross-border claims through the GFC (McGuire and von Peter (2016)).

[5] The consolidated banking statistics indicate that these banks' domestic claims (on borrowers in the home country) also increased sizeably in the first half of 2020.

[6] Banks in swap line recipient countries obtain currency through a claim on a bank located in the currency-issuing country. This claim is typically a deposit at an affiliated bank, ie an inter-office claim. When the swaps mature, the transaction reverses, resulting in a decline in such inter-office claims.

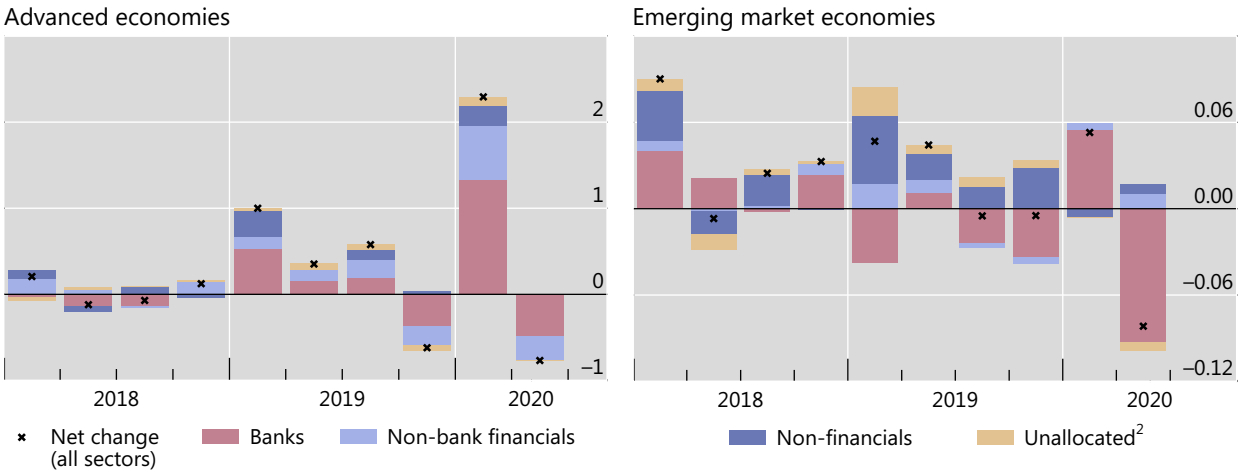
In EMEs, cross-border bank claims declined by $0.1 trillion in Q2 (or by 2% of the outstanding amount in Q1; Graph 2, right-hand panel). Claims on unrelated banks and central banks explain over two thirds of this decline. Claims on non-bank financial entities actually increased, but given the minor role of these institutions in EMEs, the change did not make a difference overall.

Cross-border claims on the non-financial sector remained largely unchanged for both AE and EME borrowers in Q2 2020 (Graph 2, dark blue bar). The non-financial sector includes a private component – lending to which may support consumption and real investment – and a public component – lending to which may also support real economic activity through fiscal spending or guarantees.

Local claims of foreign banks also held up in Q2 2020 (Graph 3).[7] In the case of AE borrowers, these claims declined by $0.1 trillion (or by about 1.6% of the outstanding amount in Q1), following a large Q1 increase (left-hand panel). This increase was due largely to unconventional monetary policy in AEs. Quantitative easing (QE) was financed with additional bank reserves in the financial system, which are included in reporting banks' local claims on the central bank (part of the red bar).[8] Turning to our sample of borrower EMEs,[9] foreign banks' local claims showed an increase in Q1 ($51 billion) and a decrease in Q2 ($18 billion; right-hand panel). Claims on central banks swung less in these countries, reflecting their more limited use of unconventional measures.

Cross-border lending slips only slightly in Q2 in AEs and EMEs alike[1]

Quarterly changes, in trillions of US dollars — Graph 2



[1] Quarterly changes are adjusted for breaks in series and exchange rate fluctuations. [2] Includes unallocated by non-bank subsector and unidentified positions.

Sources: BIS locational banking statistics by residence; BIS calculations.

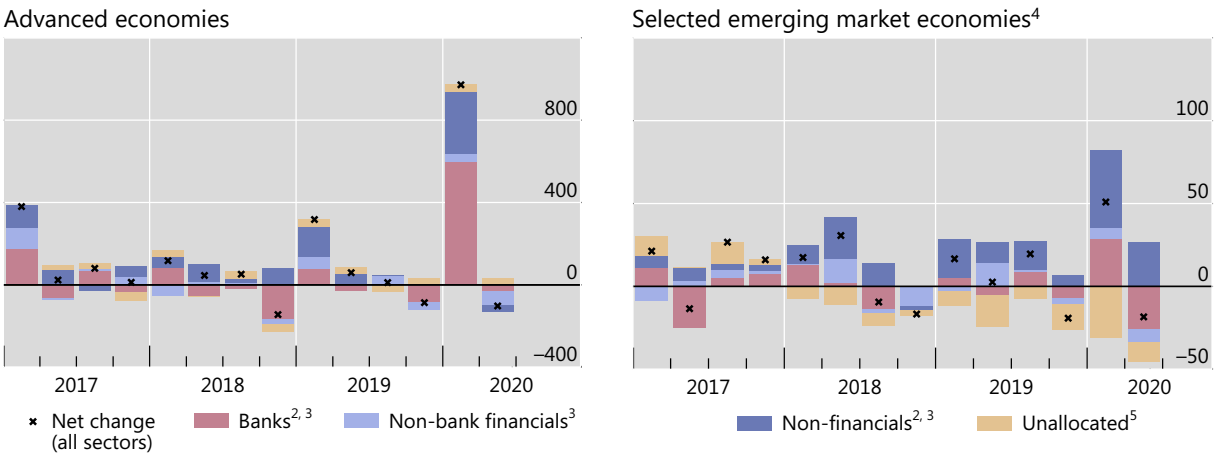
[7] In all currencies, excluding confidential data. Local positions are not fully reported in the LBS by some countries. Notably, we need to estimate positions for the United States using the CBS and Federal Reserve data.

[8] Federal Reserve data show that non-US banks' branches and agencies in the United States increased their reserves held at the Federal Reserve by $0.32 trillion during Q1 2020, but reduced them by $0.23 trillion in Q2. Claims on the central bank in other reporting AEs expanded in both Q1 and Q2.

[9] Our coverage is limited only to those EMEs that report to the LBS, provide data for local positions and have the needed sector breakdowns. Nevertheless, the overall patterns are confirmed by a similar

Local claims of foreign banks held steady in AEs and increased in EMEs

Quarterly changes, in billions of US dollars[1] Graph 3



[1] Adjusted for breaks in series and exchange rate fluctuations. [2] Includes estimates of claims on the US central bank from *Table 4.3* of the Federal Reserve (under "Banks") and on the government sector from CBS (under "Non-financials"). [3] Includes CBS-based estimates of claims on unrelated banks, non-bank financials and non-financials in the United States. [4] The selected countries are the ones for which local claims data are available for the sectors shown: Chinese Taipei, Indonesia, Korea, Malaysia, the Philippines, Saudi Arabia, South Africa and Turkey. [5] Calculated as the difference between claims on all sectors and the sum of claims on the bank, non-bank financial and non-financial sectors.

Sources: Board of Governors of the Federal Reserve System, *Table 4.3*; BIS consolidated banking statistics on an immediate counterparty basis; BIS consolidated banking statistics on a guarantor basis; BIS locational banking statistics by nationality; BIS calculations.

Local claims on the non-financial sector were sustained in the first months of the pandemic (Graph 3, dark blue bar). These claims – funding both private and government activities – fell in AEs (by $33 billion) and expanded in our sample of EMEs (by $27 billion) in Q2 2020. Together with similar findings above on cross-border claims, this suggests that stronger post-GFC balance sheets have allowed banks to mitigate the pandemic shock and shield non-financial borrowers to a significant extent.

Drivers of foreign banks' claims on the private non-financial sector

To investigate borrower- and lender-specific drivers of direct lending to the real economy, we focus on international banks' claims on the private non-financial sector.[10] For this, we use the consolidated banking statistics (CBS), which group lender banks according to nationality, thus allowing us to study how features of national banking systems – in addition to borrowing country characteristics – could have influenced foreign credit. As above, we examine year-on-year growth through mid-2020.

exercise using CBS – which are not adjusted for exchange rate movements but have a much broader coverage of local claims in local currency for EMEs.

[10] While claims on the government can also support real economic activity, the CBS we employ do not allow us to separate them from claims on central banks.

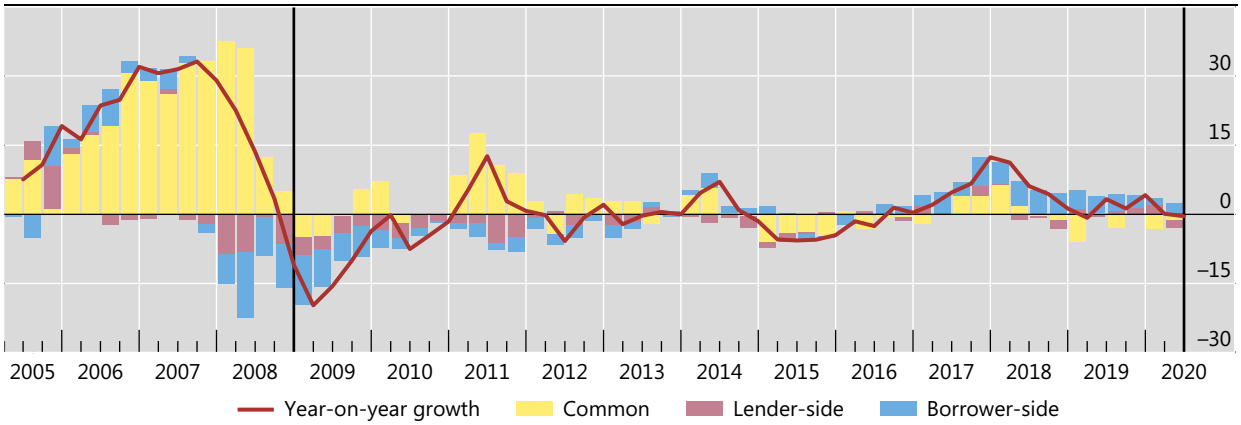
The characteristics of borrowers or lenders can help explain a change in claims only to the extent that this change can be attributed to the respective counterparty. We thus rely on a methodology that delivers a specific (purely accounting) attribution, decomposing claim flows into three mutually exclusive parts: a borrower country-specific component (hereafter, "borrower-side"), a lending banking system-specific component ("lender-side"), and a common component (see box).[11] In our context, the first two components capture, respectively, the extent to which a country stands out relative to other borrowers and the extent to which a lender stands out relative to other banking systems; the common component is, by construction, uniform across both lenders and borrowers and cannot be attributed.

Borrower- and lender-side components are likely to reflect borrowing country and lending banking system characteristics that influence claims growth. However, they need not correspond exactly to demand or supply factors, respectively. For instance, government guarantees in a borrowing country can support credit supply by reducing risks to the lender. Alternatively, any pre-existing credit lines of a banking system may accommodate credit demand in borrowing countries.

Our decomposition offers a new angle on how claims on the private non-financial sector during the initial phase of the Covid-19 pandemic differed from those in the GFC (Graph 4). The borrower-side component contributed 2.5 percentage points to the overall growth rate through mid-2020 (blue bar). At the same time, the common component (yellow bar) and the lender-side component (red bar) were negative, subtracting 1.2 and 1.6 percentage points, respectively. By contrast, both lender- and borrower-side components were negative at the outset of the GFC, with the borrower-side component contributing 9.5 percentage points to the decline in foreign claims on the private non-bank sector through end-2008 and the lender-side another 6.4 percentage points.[12]

Borrower-side factors drove claims on the private non-financial sector[1]

Year on year growth, in per cent — Graph 4



[1] Based on Amiti et al (2017). Up to Q4 2018, foreign claims on the private non-bank sector. Year-on-year growth adjusted for breaks in series. Vertical lines indicate end-2008 and end-June 2020.

Sources: BIS consolidated banking statistics on a guarantor basis; BIS calculations.

[11] Amiti and Weinstein (2018) developed the underlying methodology, and Amiti et al (2017) and Avdjiev et al (2020) have applied it to the BIS international banking statistics.

[12] Detailed sectoral breakdowns, distinguishing the private non-financial sector, are only available after 2014, with coverage becoming nearly complete only by 2018. See Garcia Luna and Hardy (2019) for further discussion on the sectoral breakdowns available in the data.

Decomposing lending growth into common, lender- and borrower-side components

We decompose growth in international banks' claims into three non-overlapping and exhaustive components: a lending banking system-specific (henceforth lender-side) component, a borrower country-specific (henceforth borrower-side) component, and a common component. To this end, we follow the methodology in Amiti and Weinstein (2018) as applied to the BIS international banking statistics (IBS) in Amiti et al (2017).①

The methodology attributes claims growth to lenders and borrowers. To fix ideas, consider the year-on-year growth in the claims of lending banking system l on borrowers in country $(L_{l,b,t})$, as shown in the left-hand side of equation (1). For each quarter t, we construct lender-side components specific to each lending banking system $(\widehat{\alpha_{l,t}})$ and borrower-side components specific to each borrower country $(\widehat{\beta_{b,t}})$. This construction is based on regressions with fixed effects for each lender banking system in each quarter and for each borrower country in each quarter. From these, we extract a common component γ_t, which equals the median of all $\hat{\alpha}$'s and $\hat{\beta}$'s in quarter t, and is thus constant in the cross section. We then remove the common component from the computed supply- and demand-side components to obtain $\alpha_{l,t} = \widehat{\alpha_{l,t}} - \gamma_t$ and $\beta_{b,t} = \widehat{\beta_{b,t}} - \gamma_t$, yielding the decomposition seen on the right-hand side of equation (1):

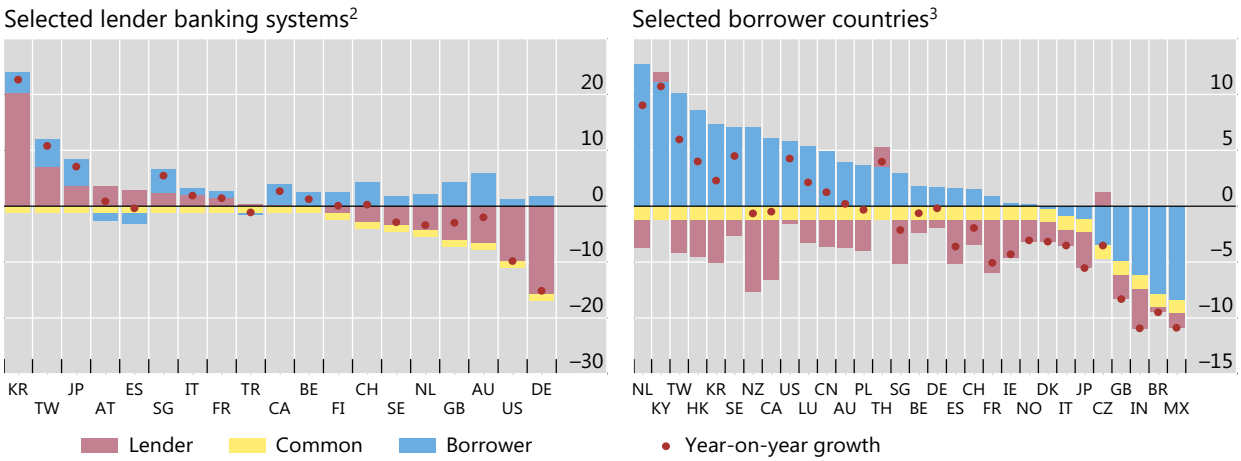
$$\frac{L_{l,b,t} - L_{l,b,t-4}}{L_{l,b,t-4}} = \gamma_t + \alpha_{l,t} + \beta_{b,t} \qquad (1)$$

To aggregate this decomposition at the lender banking system or borrower country level, we weight the bilateral growth observations according to the corresponding stock of claims at the beginning of the quarter. This gives more weight to large observations, which are more important in explaining the overall lending growth for a given lender or borrower. With these weights, the three components sum exactly to the aggregate growth for a given lending banking system or borrower country.

The lender- and borrower-side components differ substantially across countries (Graph A). For instance, the borrower-side components in Q2 2020 range from 12.7 percentage points in the case of the Netherlands to –8.4 percentage points in that of Mexico (right-hand panel).

Lender- and borrower-side components of foreign claims on the private non-financial sector[1]

Year on year growth through mid-2020, in per cent — Graph A



[1] Growth decomposition using methodology of Amiti et al (2017). [2] Top 19 lending banking systems by outstanding claims on the private non-financial sector in Q2 2020, excluding confidential observations. [3] Top 30 borrowing countries by outstanding claims on the private non-financial sector in Q2 2020.

Sources: BIS consolidated banking statistics on a guarantor basis; BIS calculations.

① For a complete discussion of the underlying method, see M Amiti and D Weinstein, "How much do idiosyncratic bank shocks affect investment? Evidence from matched bank-firm loan data", *Journal of Political Economy*, vol 126, no 2, 2018 and M Amiti, P McGuire and D Weinstein, "Supply- and demand-side components in global banking", *BIS Working Papers*, no 639, 2017. Also published as "International bank flows and the global financial cycle", *IMF Economic Review*, vol 67, no 1, March, 2018, pp 61–108.

Before delving into borrower- and lender-side components, we stress that the common component is likely to reflect global factors. A key example of such factors is the large and synchronised strengthening of liquidity and capital positions across most banking systems, due to the post-GFC regulatory reform (Lewrick et al (2020)). This reform has likely contributed to dampening the decline of the common component through the Covid-19 shock.

Borrower-side factors

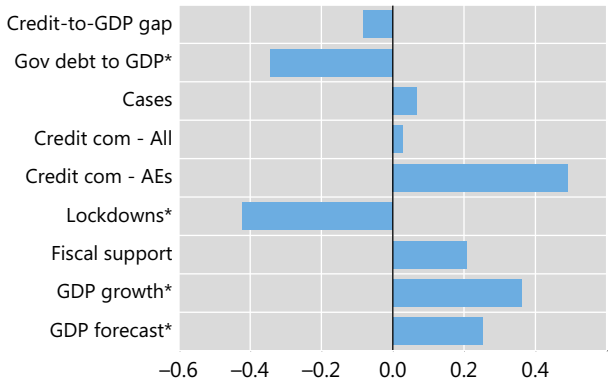
Since the Covid-19 shock originated outside the financial system, we might expect borrower-side factors to be the main drivers of claims growth. To capture such factors, we examine such characteristics of the borrower countries as their pre-existing financial vulnerabilities and measures of the pandemic's severity, together with their policy responses and pre-existing credit commitments. We then examine whether these characteristics may explain cross-country differences in the borrower-side component in the year-on year growth of foreign claims on the private non-financial sector through mid-2020.[13]

Pre-existing vulnerabilities – in the public or private sectors – seem to have reduced the borrower-side component (Graph 5, left-hand panel). Concretely, high government debt is strongly associated with a decline in this component. One potential reason is that lenders might perceive less indebted countries, and borrowers

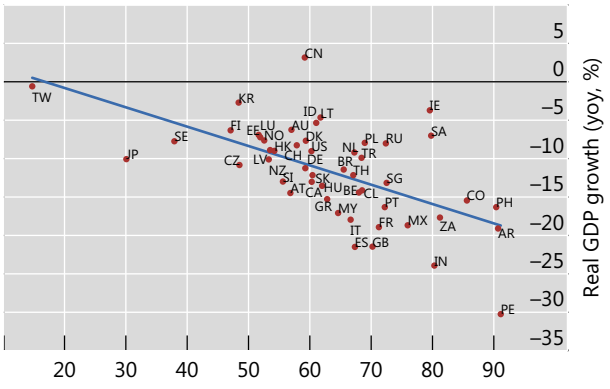
International banks' foreign claims tracked growth

Year on year growth through mid-2020 — Graph 5

Correlation of borrower-side component with borrower country characteristics[1]



Stricter lockdowns, lower realised economic growth[2]



[1] Borrower-side component of growth in foreign claims on the private non-financial sector (guarantor basis), extracted using methodology of Amiti et al (2017). Excludes observations with growth larger than +/–30% and offshore centres. * indicates significance at the 10% level. "Credit-to-GDP gap" is as of end-2019, observations larger than 50% are dropped. "Gov debt to GDP" is as of end-2019. "Cases" are cumulative Covid-19 cases per capita as of 30 June 2020, with large outliers dropped. "Credit com" is the ratio of credit commitments to foreign claims on the private non-financial sector at end-2019. "Lockdowns" is the stringency of Covid-19 containment policies, proxied by the Q2 2020 average of eight Oxford University indicators of government responses for each country (no restrictions = 0; maximal restrictions = 100). "Fiscal support" is the pledged fiscal support for Covid-19 as of June 2020, as a percent of GDP. "GDP growth" is annual real GDP growth between Q2 2019 and Q2 2020. "GDP forecast" is the consensus forecast made in June 2020 for 2021 GDP growth. [2] Real GDP growth is year on year growth through mid-2020. Lockdown stringency as defined in footnote 1.

Sources: Aldasoro et al (2018); Drehmann et al (2011); IMF, *Fiscal Monitor*; World Health Organization; Oxford University; Consensus Economics; national data; BIS consolidated banking statistics on a guarantor basis; BIS calculations.

[13] The box quantifies these differences.

resident there, as more creditworthy. Likewise, overheating in markets for private sector debt, as proxied by a higher credit-to-GDP gap,[14] is associated with a decline in claims growth, although to a lesser extent.

The pandemic's severity and the policy countermeasures relate to the borrower-side component to a varying extent. On the one hand, Covid-19 cases per capita may not accurately capture the state of the economy, as they correlate only weakly with this component.[15] Policy responses to the pandemic, on the other hand, show far stronger relationships. Public health measures, such as stricter lockdowns, have a strong negative correlation with the borrower component. In the short run, a stricter lockdown weighed on economic activity (Graph 5, right-hand panel), which in turn lowered claims growth.[16] Economic policies, such as fiscal support measures, correlate positively with the borrower-side component, suggesting that they support borrowers' creditworthiness and lift aggregate demand.

Turning to more direct measures of economic growth, we find that they are positively associated with the borrower-side component. This is the case for both measures of realised GDP growth and forecasts of future growth.

In parallel, the growth in claims on AE private non-financial borrowers reflected drawdowns of existing credit lines. While the borrower-side component shows no relationship with pre-existing (ie undrawn) credit commitments in general, this relationship is positive for AE countries. Non-financial borrowers seem to have taken advantage of these facilities to anticipate future needs, boosting claims reflected in the borrower component.[17]

Lender-side factors

Despite the sharp output decline in Q2 2020 and weaker profits, banks themselves have proved to be stable so far. Still, the lender-side component of foreign claims on the private non-financial sector differs significantly across banking systems (see box). We relate this component to characteristics of the lending banking system at the national level, ie bank capitalisation and credit commitments.

Claims growth exhibits a positive relationship with bank capitalisation and with credit commitments extended prior to the pandemic. Indeed, the lender-side component is higher for banking systems featuring higher risk-based capital ratios or, especially, leverage ratios (Graph 6, left-hand panel). Better capitalised banking systems also tended to increase their domestic claims more (right-hand panel). And similarly to what we saw on the borrower-side, banking systems with greater credit commitments at end-2019 lent more through mid-2020 (left-hand panel).

[14] The credit-to-GDP gap compares the actual credit-to-GDP ratio with its long-term trend (Drehmann et al (2011)).

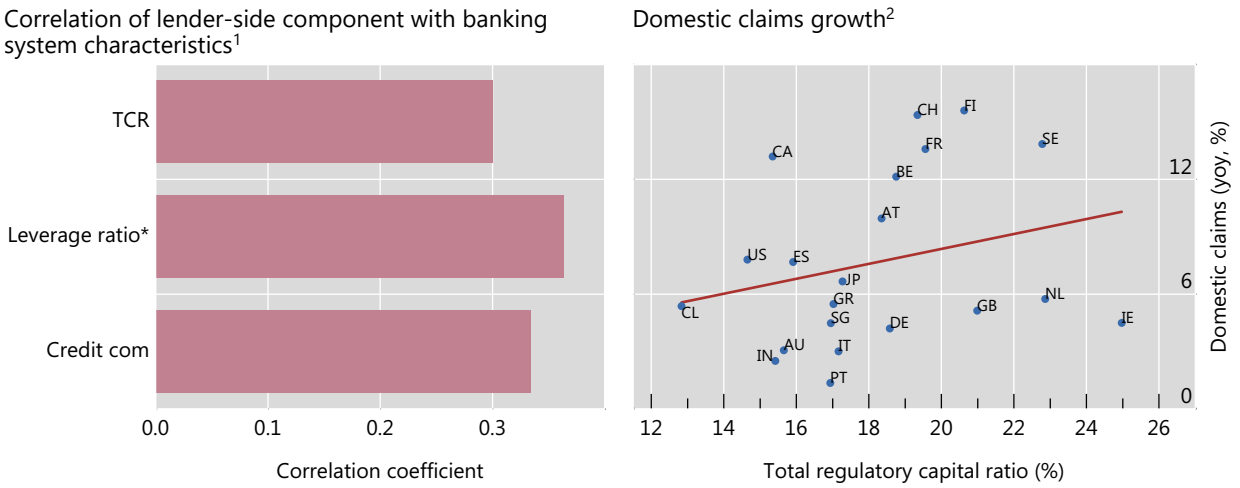
[15] Covid-19 deaths per capita show a similar correlation.

[16] A priori, the short-term lockdown impact is ambiguous. On the one hand, a stricter lockdown implies weaker economic activity (at least in the short run). On the other hand, it might increase demand for credit to bridge the cash flow shortfall.

[17] Credit commitments in the CBS dropped from $4.9 trillion to $4.6 trillion in Q1 2020.

Healthier banking systems extended more credit

Year on year claims growth through mid-2020 — Graph 6



[1] Lender-side component of growth in foreign claims on the private non-financial sector (guarantor basis), extracted using the methodology of Amiti et al (2017). Excludes observations with growth larger than +/–30% and offshore financial centres. * indicates significance at the 10% level. "TCR" is the total regulatory capital ratio as of end-2019, or Q3 2019 if the former is unavailable (consolidation perimeter may not match that of the CBS). "Leverage ratio" is defined as equity divided by assets. "Credit com" is the ratio of credit commitments to foreign claims on the private non-financial sector. [2] Domestic claims growth through mid-2020 not adjusted for exchange rate movements.

Sources: IMF, Financial Soundness Indicators; FitchConnect; BIS consolidated banking statistics on a guarantor basis; BIS calculations.

Conclusion

As the Covid-19 pandemic forced major economies into lockdown, global economic activity dropped suddenly in the second quarter. Yet in contrast to the GFC, international banks' claims held up well. Banks appear to have acted as the first line of defence against the shock by providing credit to stressed borrowers. Cross-border and local claims remained resilient, across both AEs and EMEs. So did claims on the private non-financial sector, closely capturing direct lending to the real economy.

A decomposition of foreign claims on the private non-financial sector allows us to study the underlying borrower- and lender-side drivers. The borrower-side component was positively related to indicators of lower vulnerabilities (such as lower government debt or a lower credit-to-GDP gap) and stronger economic activity in borrower countries (such as higher output growth or weaker lockdowns). The lender-side component was positively related to better capitalisation in lending banking systems (in terms of risk-based capital and leverage ratios). Both the borrower- and lender-side components were positively related to the size of pre-existing credit lines. Banks were thus in a position to accommodate the large drawdown of credit lines, along with the other funding needs of stressed borrowers.

The experience with international bank lending during the first phase of the pandemic is no reason for complacency. A second wave of infection is triggering additional lockdowns and likely output declines. Economic weakness might persist until vaccines are widely available. Continued monitoring, and if necessary, support is critical to maintain lending to the real economy as the Covid-19 crisis unfolds.

References

Aldasoro, I, C Cabanilla, P Disyatat, T Ehlers, P McGuire and G von Peter (2020): "Central bank swap lines and cross-border banking flows", *BIS Bulletin*, (forthcoming).

Aldasoro, I, C Borio and M Drehmann (2018): "Early warning indicators of banking crises: expanding the family", *BIS Quarterly Review*, March, pp 29–45.

Amiti, M, P McGuire and D Weinstein (2017): "Supply- and demand-side factors in global banking", *BIS Working Papers*, no 639. Published as "International bank flows and the global financial cycle", *IMF Economic Review*, vol 67, no 1, pp 61–108, March, 2018.

Amiti, M and D Weinstein (2018): "How much do idiosyncratic bank shocks affect investment? Evidence from matched bank-firm loan data", *Journal of Political Economy*, vol 126, no 2.

Avdjiev, S, B Hardy, P McGuire and G von Peter (2020): "Home sweet host: Prudential and monetary spillovers through global banks", *BIS Working Papers*, no 853. Forthcoming in *Review of International Economics*.

Bank for International Settlements (2020): *Annual Economic Report*, Chapter 1, "A global sudden stop".

Drehmann, M, C Borio and K Tsatsaronis (2011): "Anchoring countercyclical capital buffers: the role of credit aggregates", *International Journal of Central Banking*, vol 7, no 4, pp 189–240. Also published as *BIS Working Papers*, no 355.

Garcia Luna, P and B Hardy (2019): "Non-bank counterparties in international banking", *BIS Quarterly Review*, September, pp 15–31.

Lewrick, U, C Schmieder, J Sobrun and E Takáts (2020): "Releasing bank buffers to cushion the crisis – a quantitative assessment", *BIS Bulletin*, no 11.

McGuire, P and G von Peter (2016): "The resilience of banks' international operations", *BIS Quarterly Review*, March, pp 65–78.

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

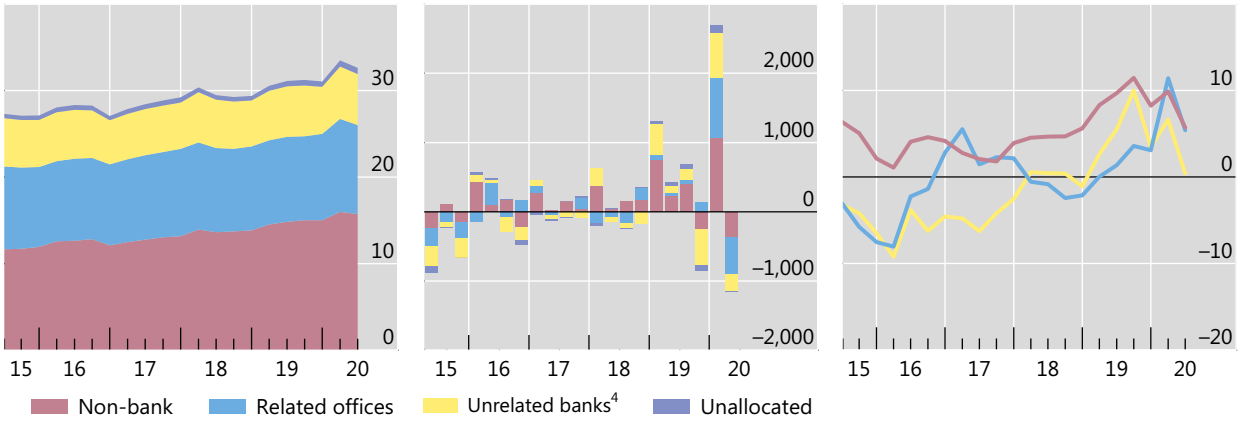
A Locational banking statistics

Cross-border claims, by sector, currency and instrument

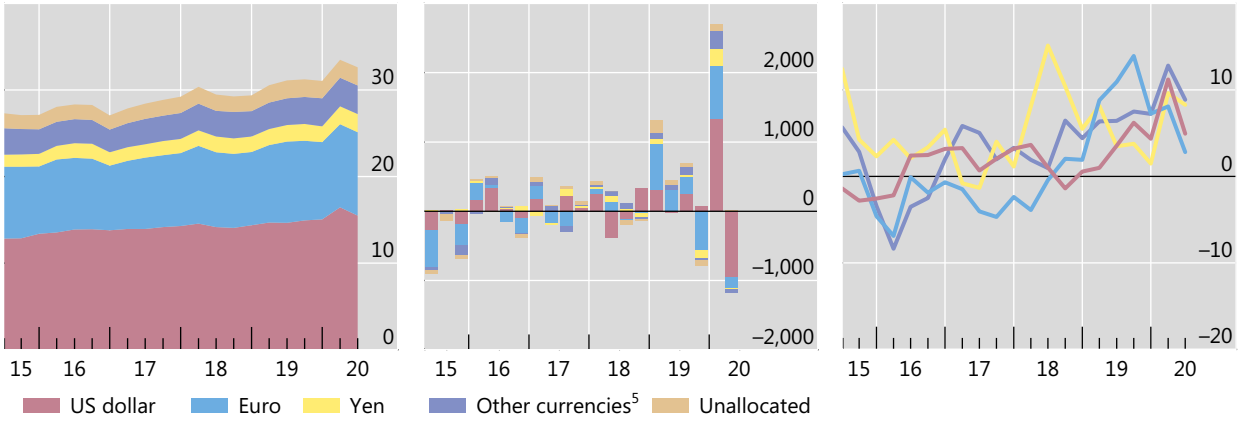
Graph A.1

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

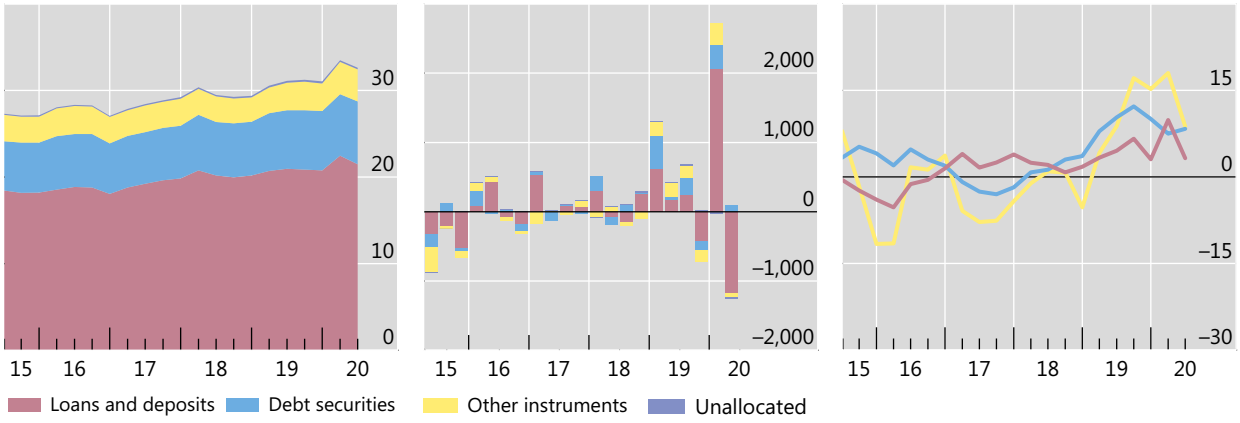
By sector of counterparty



By currency



By instrument



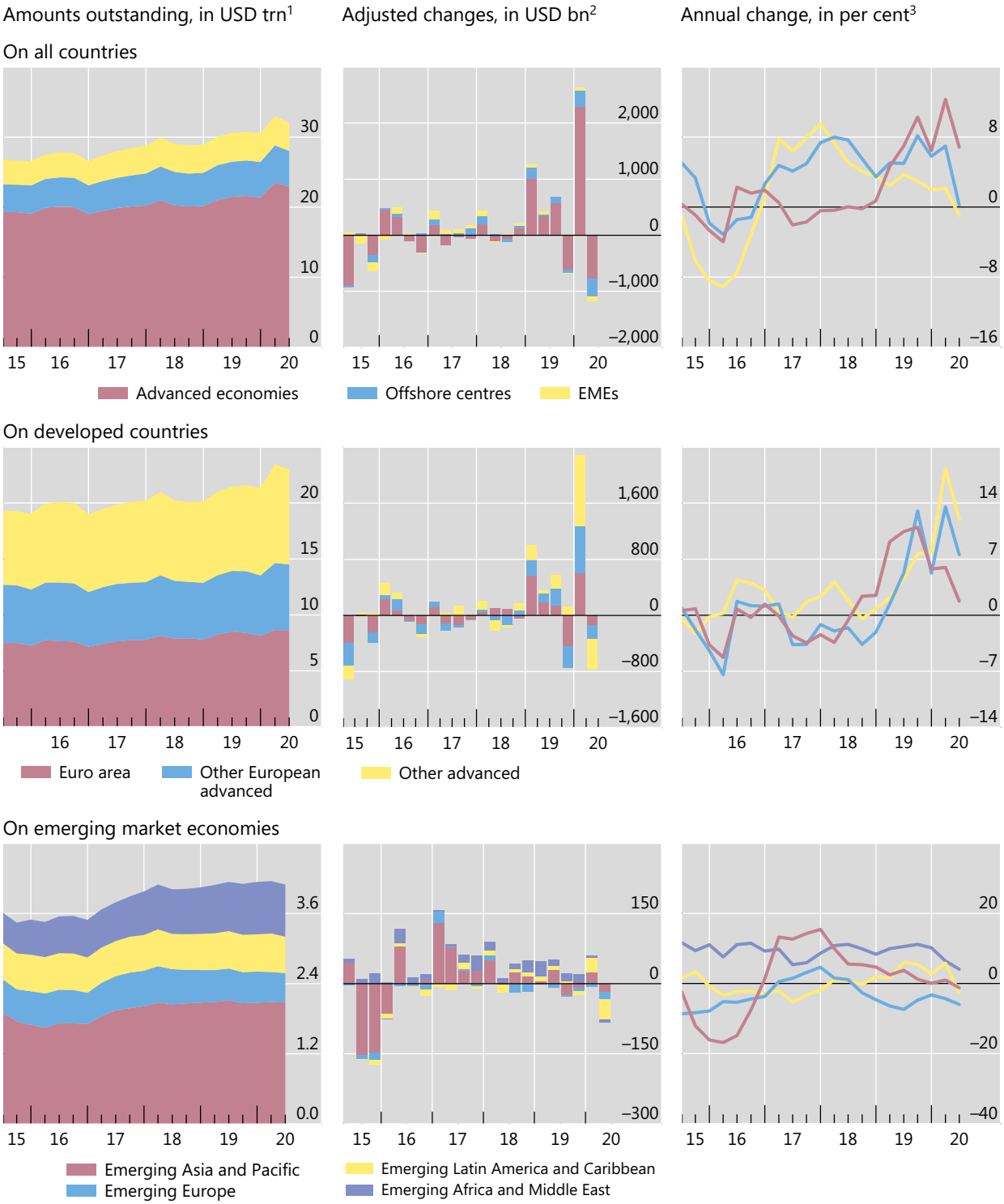
Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

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

Source: BIS locational banking statistics.

Cross-border claims, by borrowing region

Graph A.2



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

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

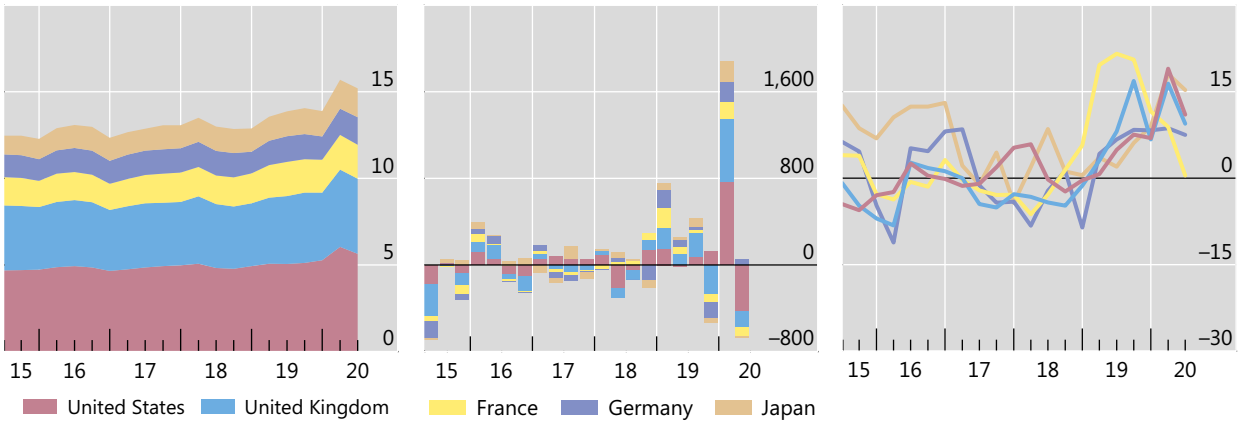
Source: BIS locational banking statistics.

Cross-border claims, by borrowing country

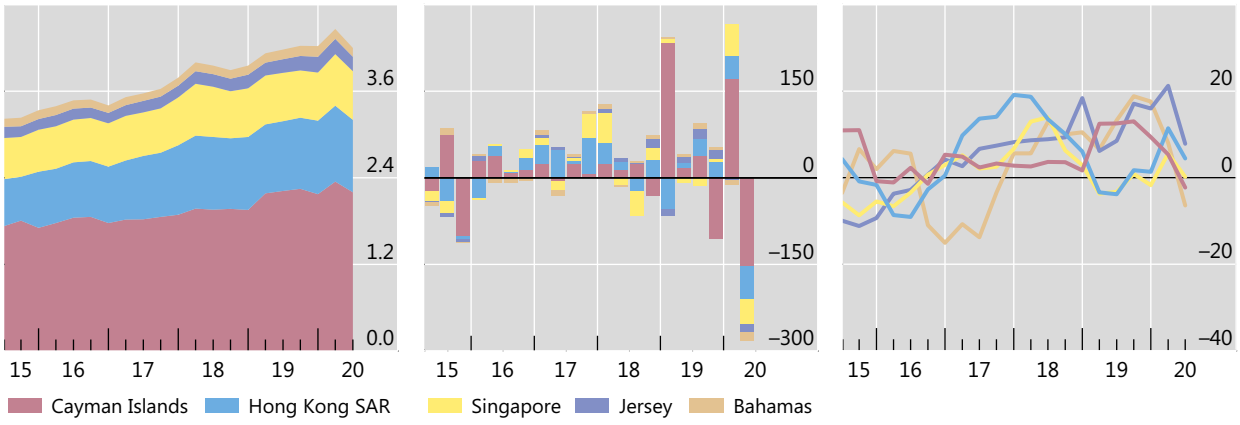
Graph A.3

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

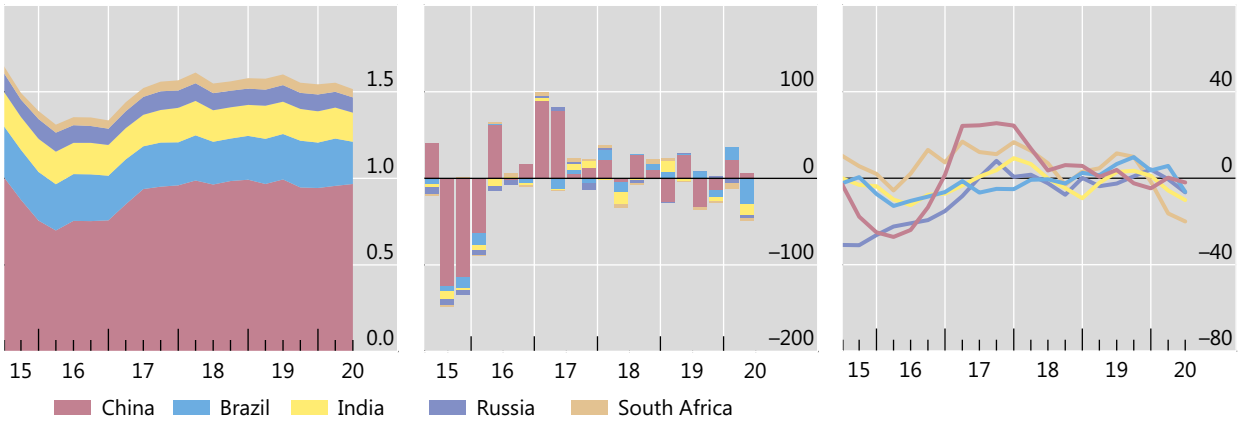
On selected advanced economies



On selected offshore centres



On selected emerging market economies



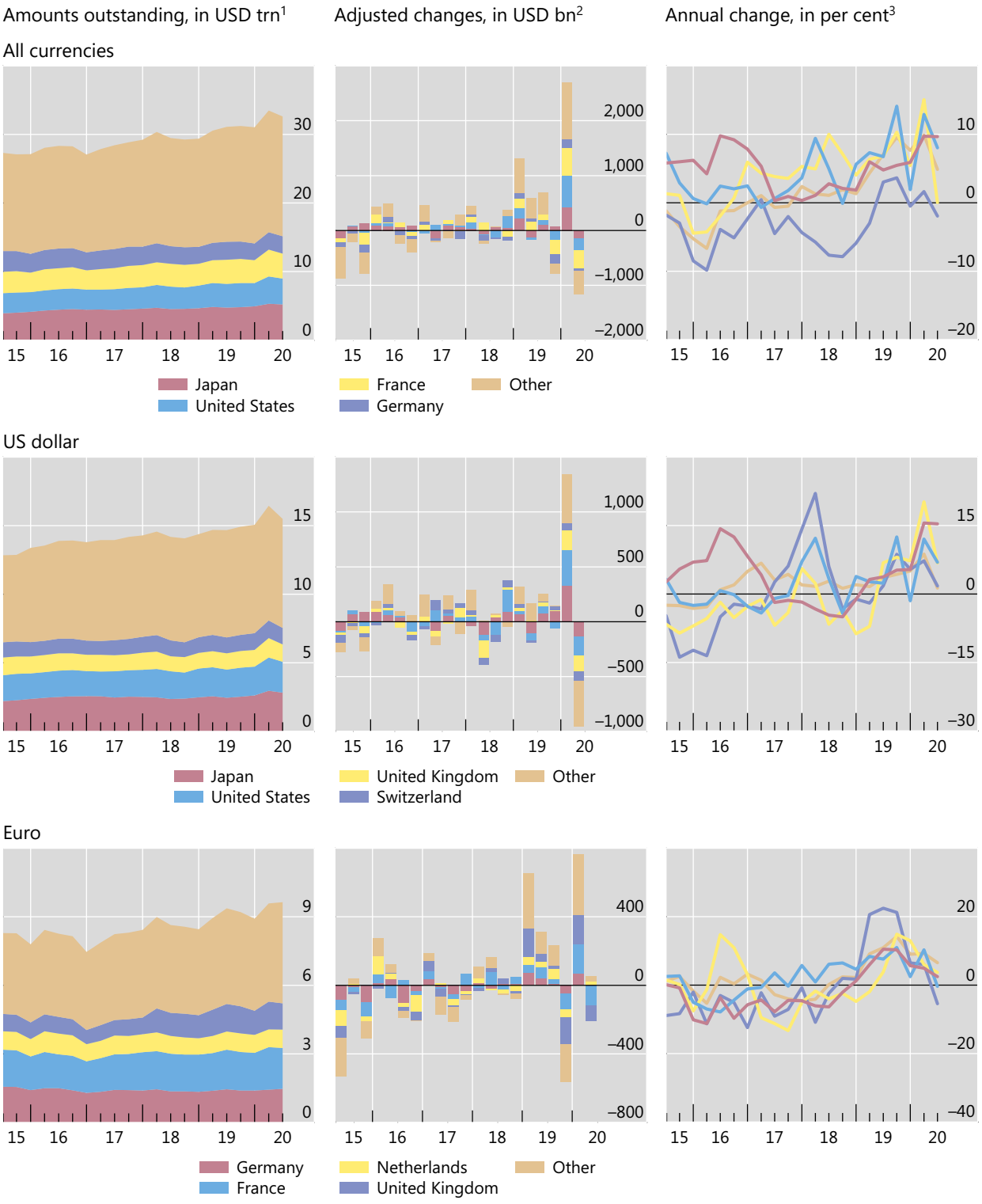
Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

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

Source: BIS locational banking statistics.

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

Graph A.4



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

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

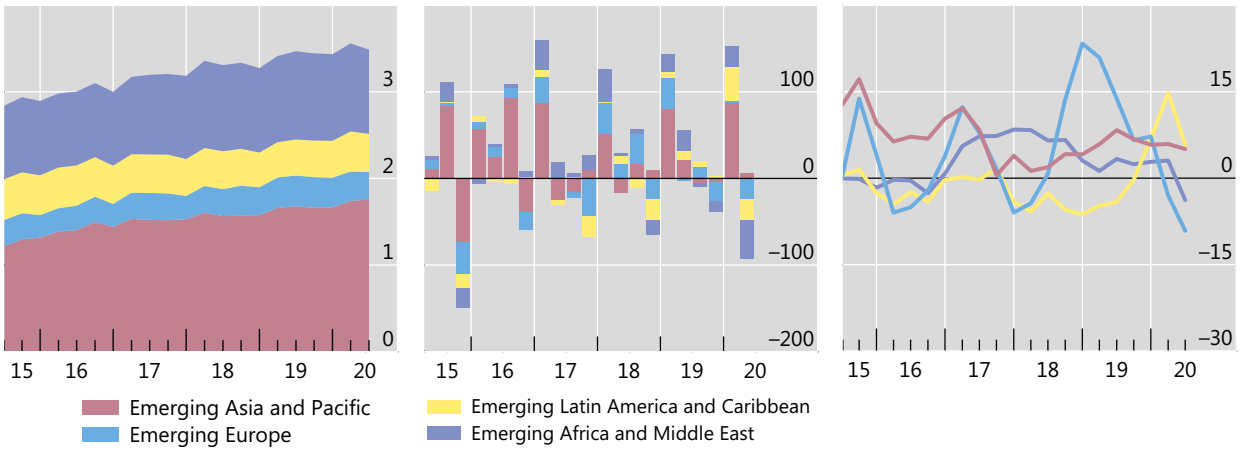
Source: BIS locational banking statistics.

Cross-border liabilities of reporting banks

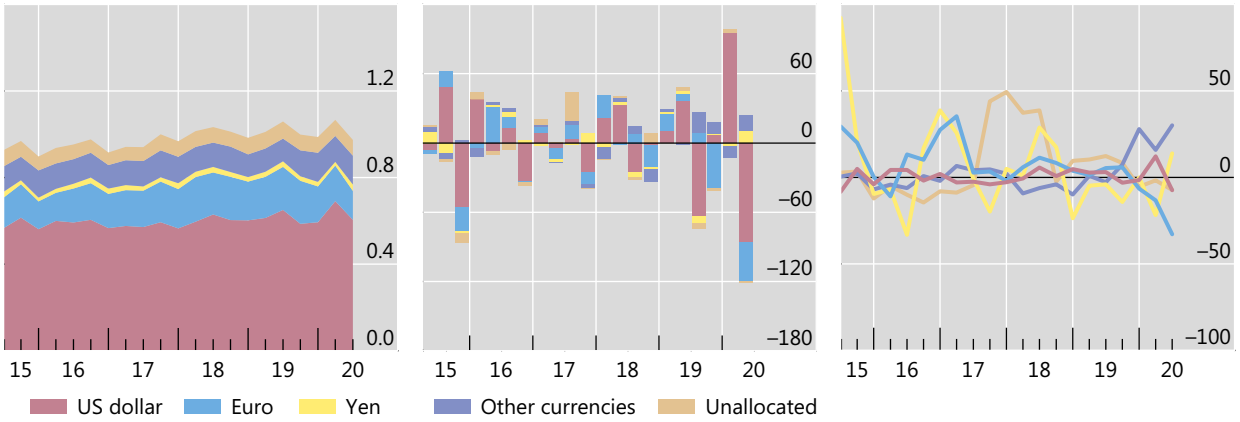
Graph A.5

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

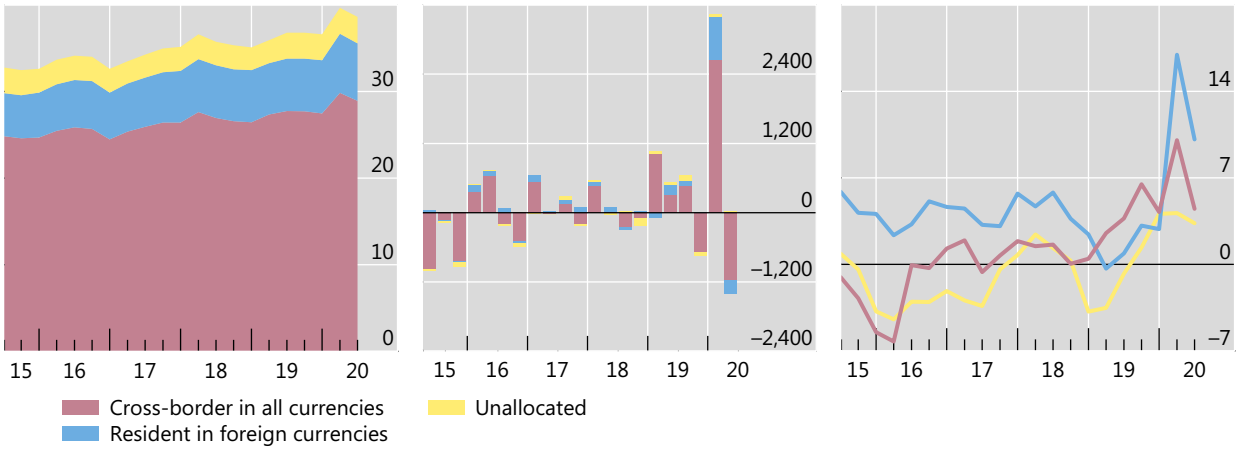
To emerging market economies



To central banks



By currency type and location



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

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

Source: BIS locational banking statistics.

B Consolidated banking statistics

Consolidated claims of reporting banks on advanced economies

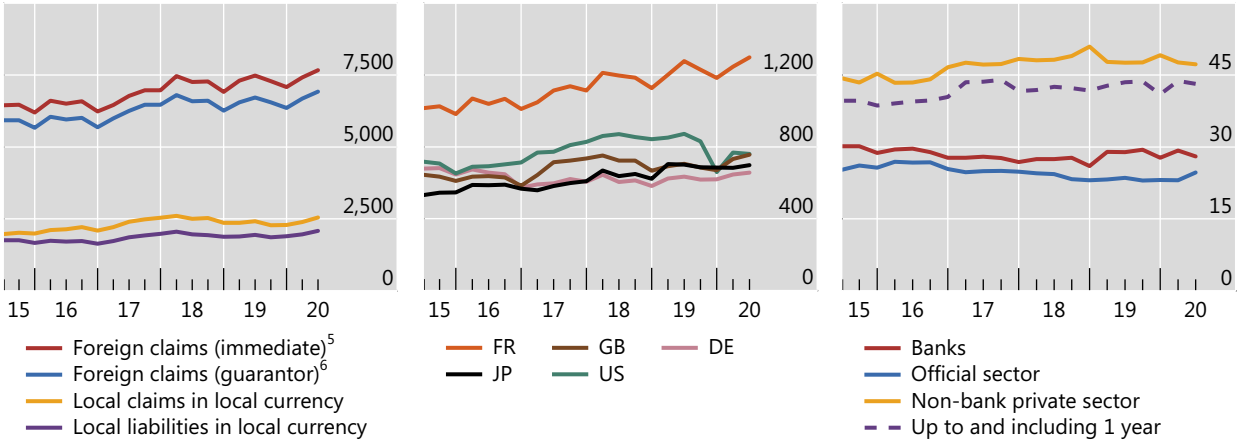
Graph B.1

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

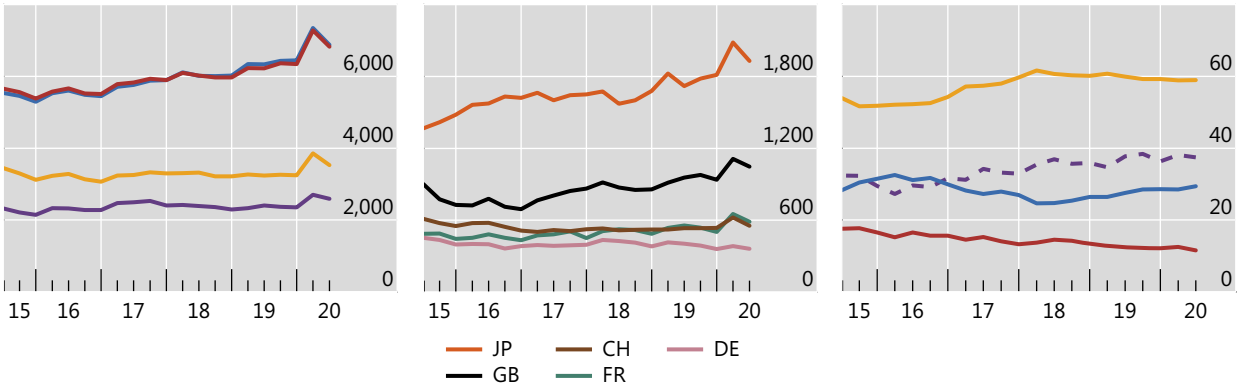
Foreign claims of selected creditors, in USD bn[1, 3]

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

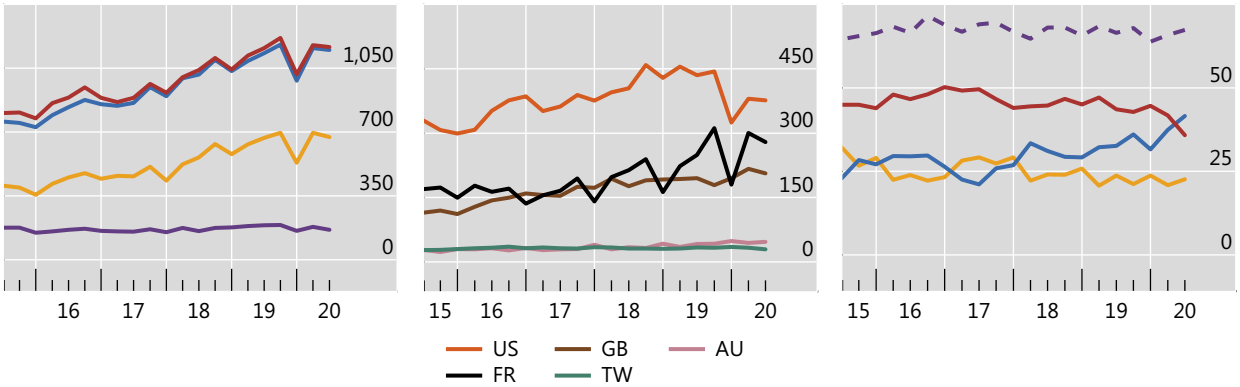
On the euro area



On the United States



On Japan



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 a guarantor 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 a guarantor basis.

Source: BIS consolidated banking statistics (CBS).

Consolidated claims of reporting banks on emerging market economies

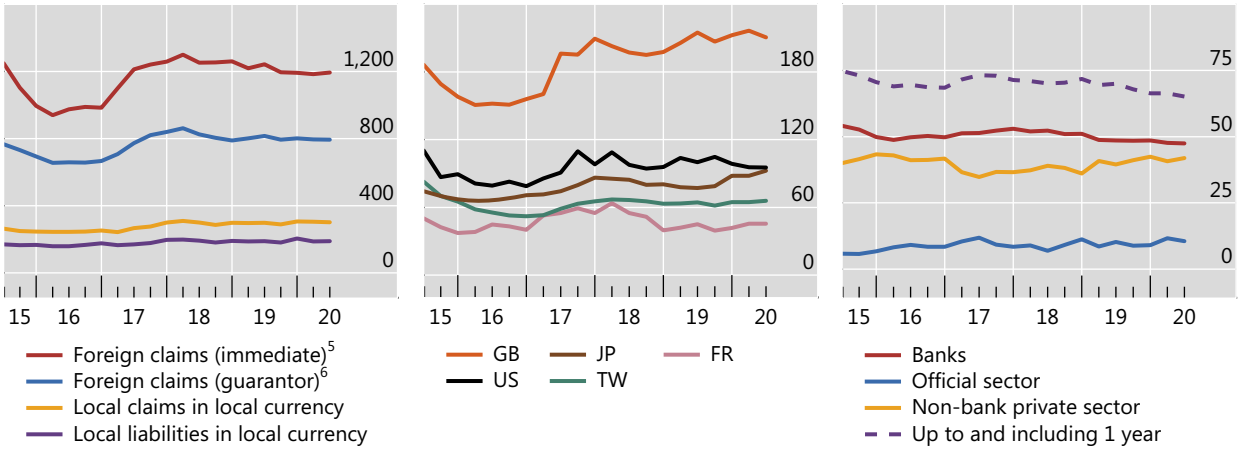
Graph B.2

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

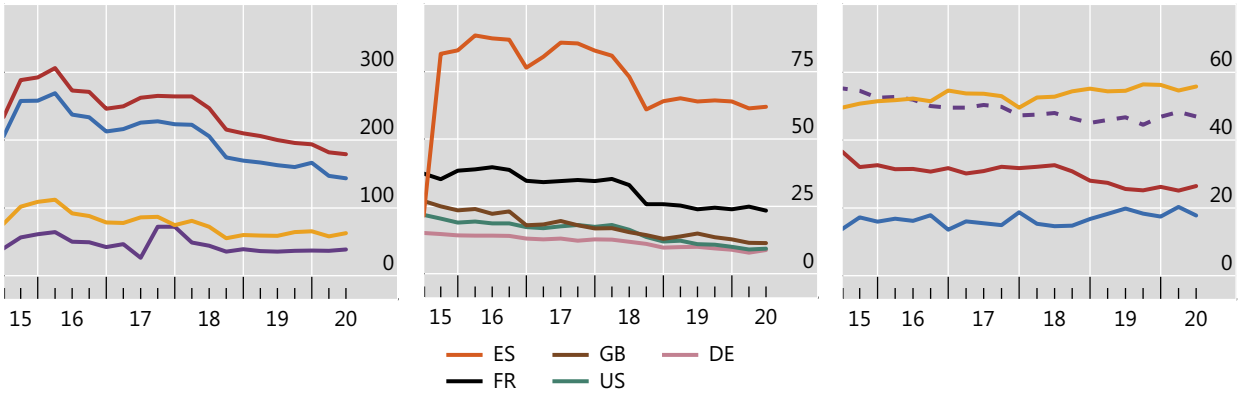
Foreign claims of selected creditors, in USD bn[1, 3]

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

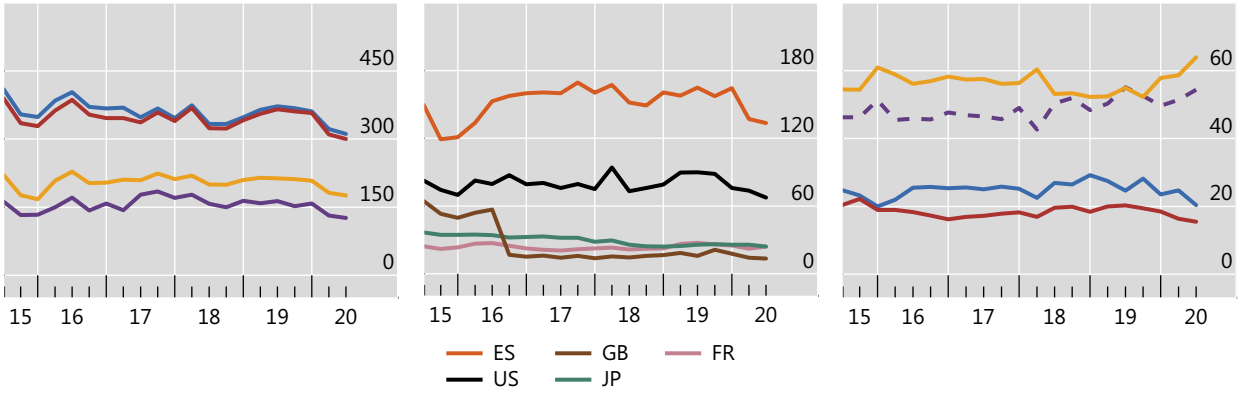
On China



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 a guarantor 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 a guarantor basis .

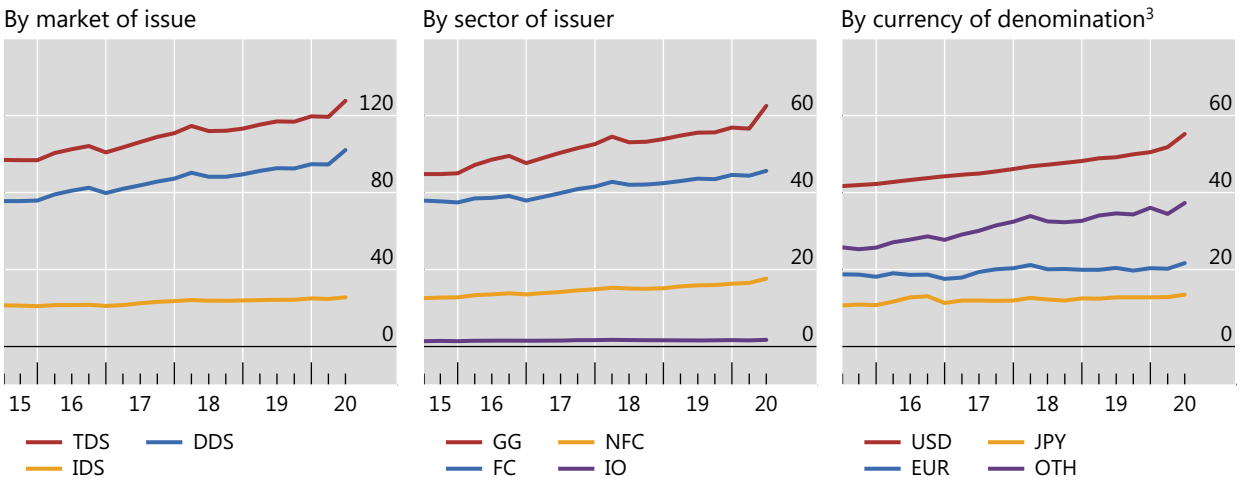
Source: BIS consolidated banking statistics (CBS).

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.

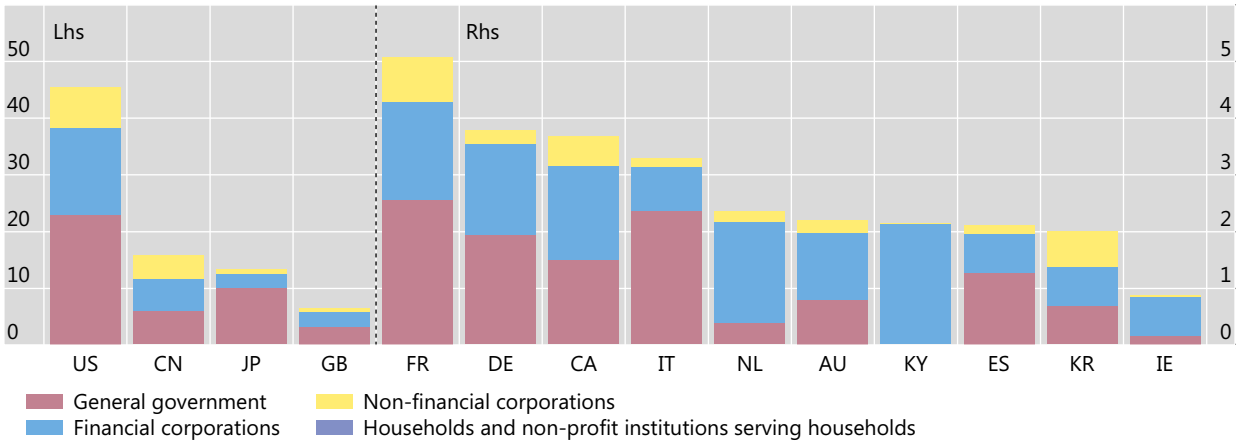
[1] Sample of countries varies across breakdowns shown. For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. For countries that do not report either TDS or DDS, data are estimated by the BIS as IDS. [2] At quarter-end. Amounts denominated in currencies other than the US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



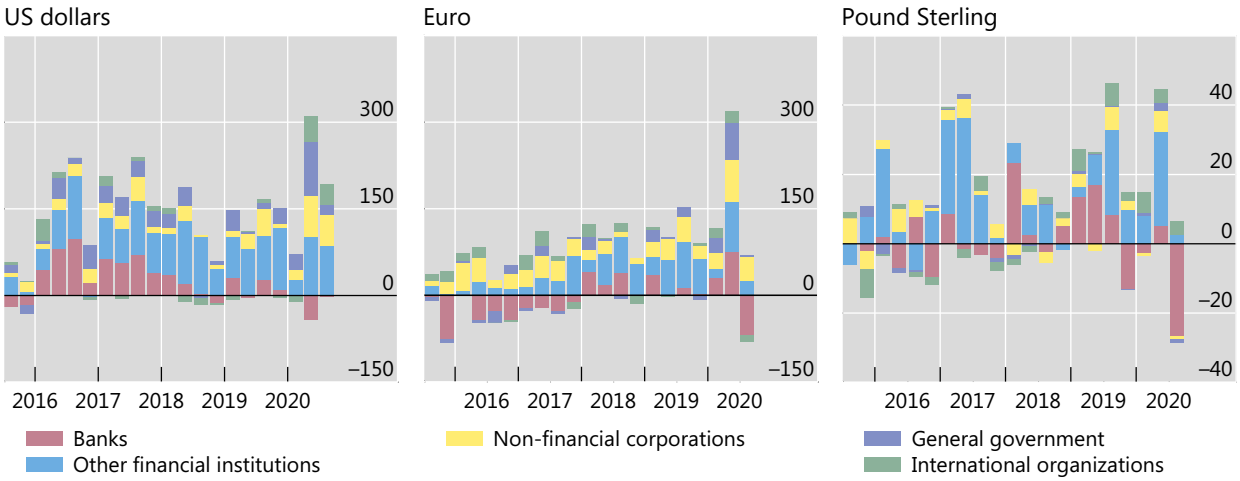
Further information on the BIS debt securities statistics is available at www.bis.org/statistics/secstats.htm.

[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

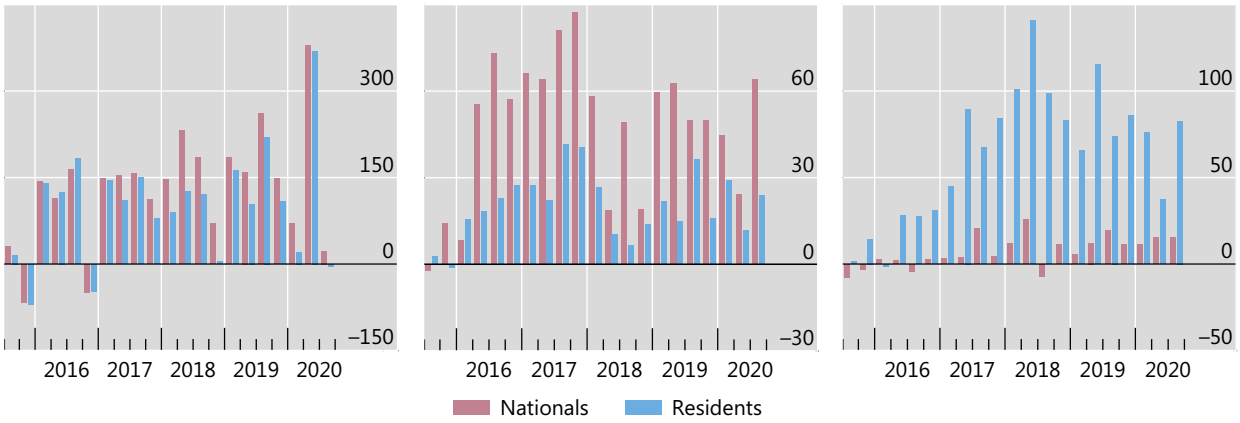


Further information is available at www.bis.org/statistics/secstats.htm.

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

D Derivatives statistics

Exchange-traded derivatives

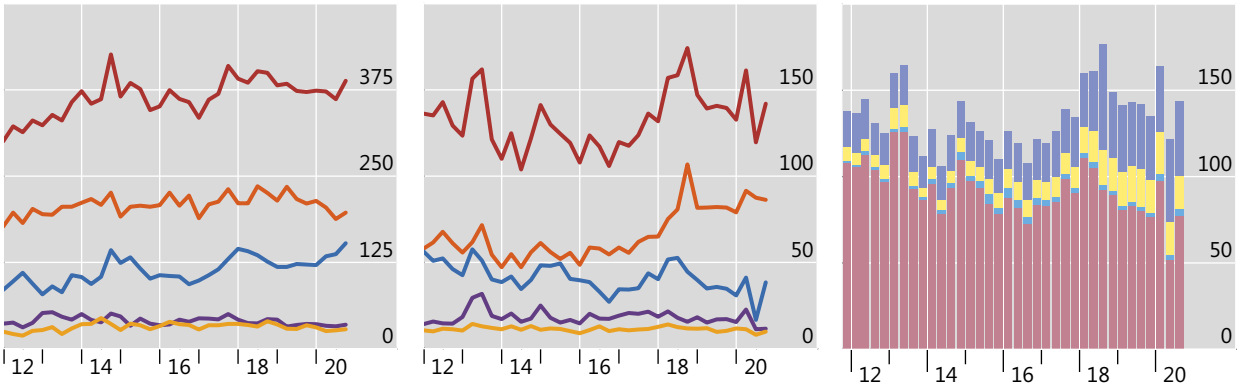
Graph D.1

Open interest, by currency[1]

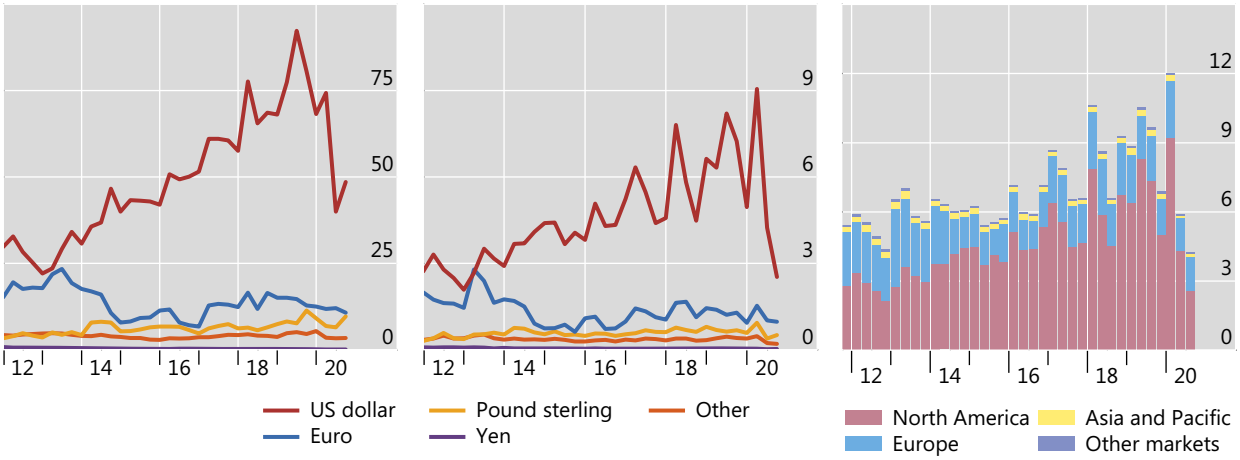
Daily average turnover, by currency[2]

Daily average turnover, by location of exchange[2]

Foreign exchange derivatives, USD bn[3]



Interest rate derivatives, USD trn[3]



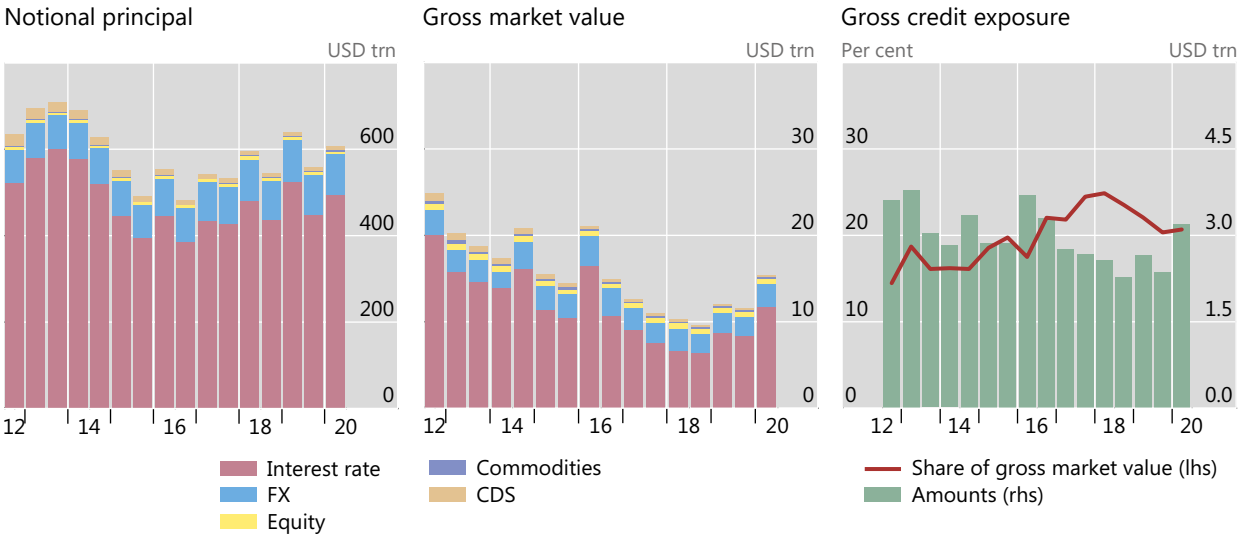
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/extderiv.htm. For definitions, see the online glossary.

[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. For definitions, see the online glossary.

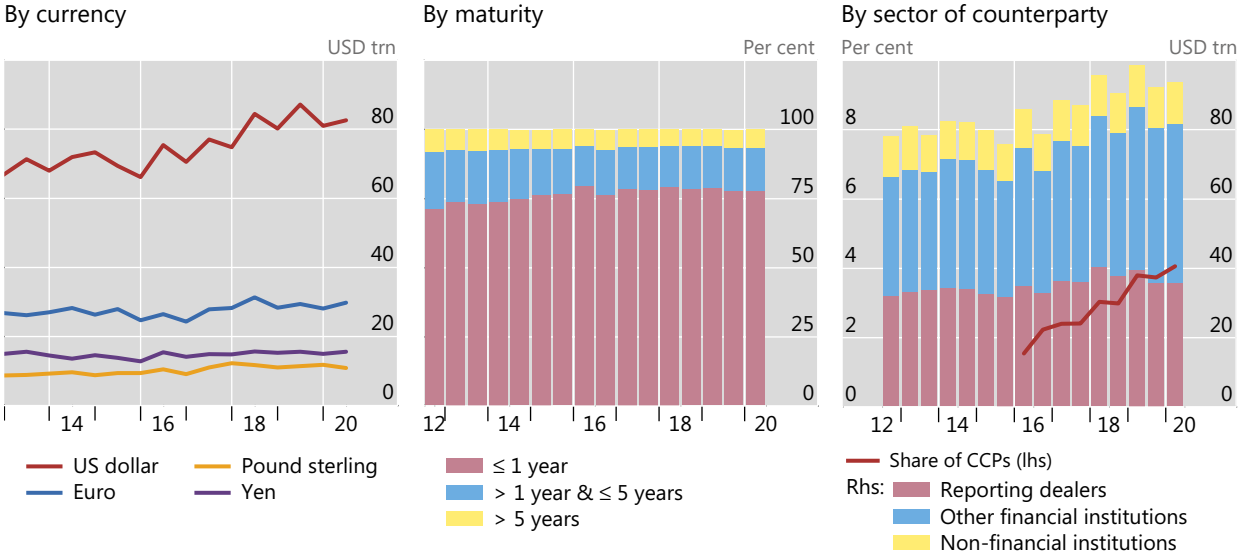
[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

OTC foreign exchange derivatives

Notional principal[1]

Graph D.3



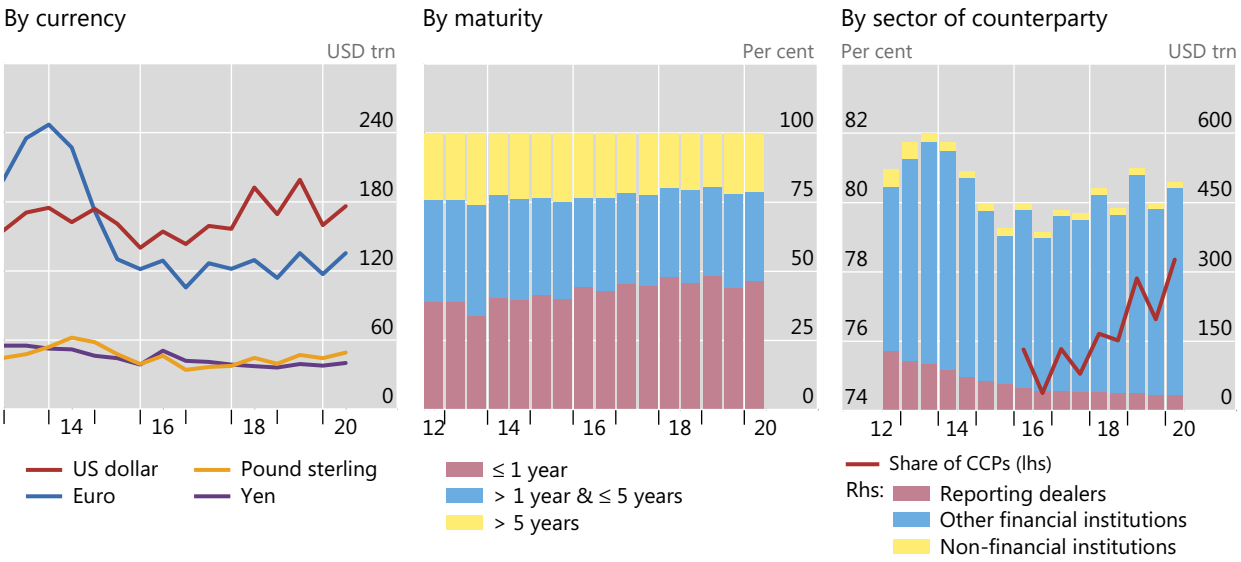
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm. For definitions, see the online glossary.

[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



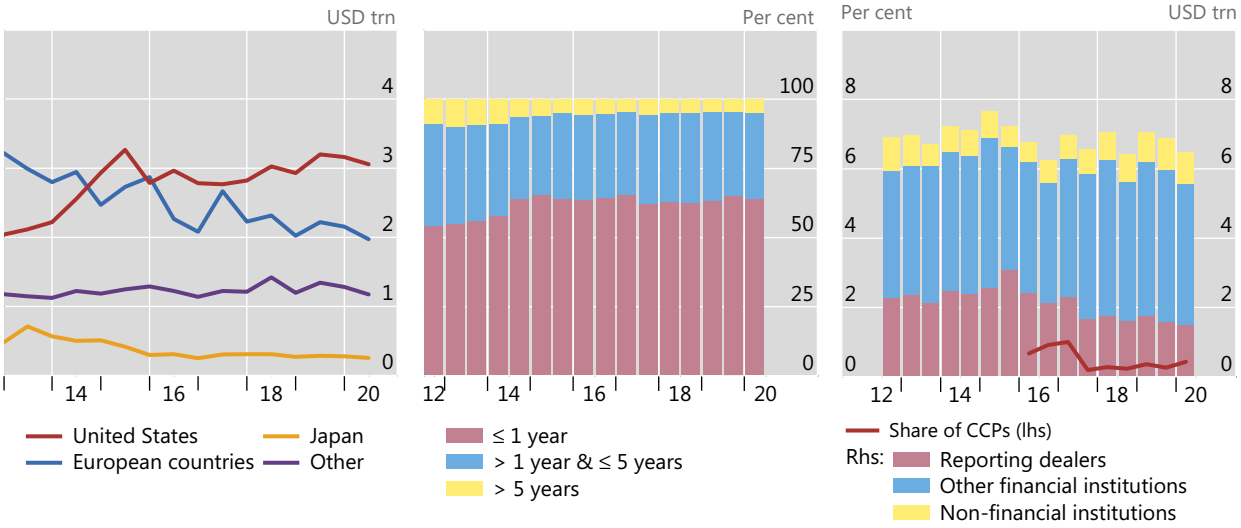
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm. For definitions, see the online glossary.

[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. For definitions, see the online glossary.

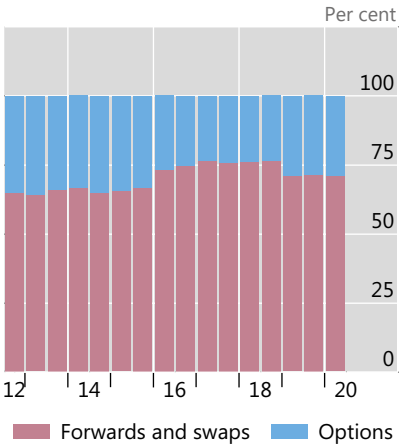
[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

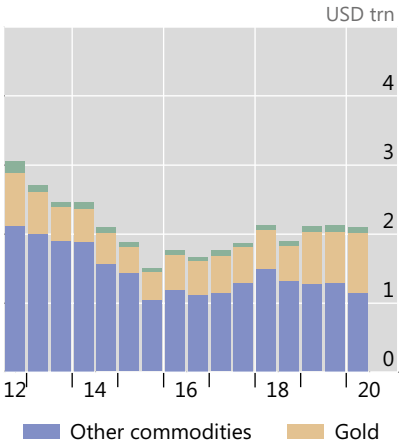
OTC commodity derivatives[1]

Graph D.6

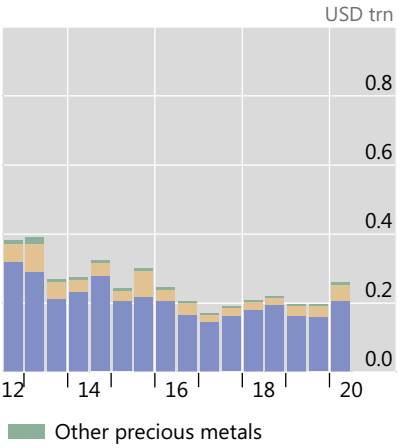
Notional principal, by instrument



Notional principal, by commodity



Gross market value, by commodity



Forwards and swaps | Options | Other commodities | Gold | Other precious metals

Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm. For definitions, see the online glossary.

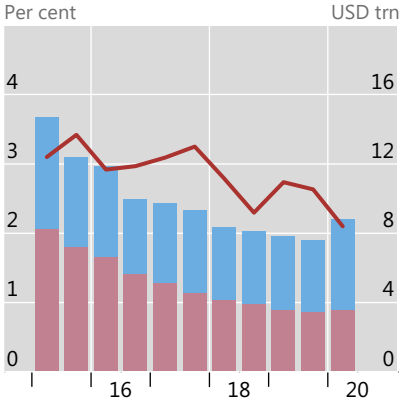
[1] At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

Credit default swaps[1]

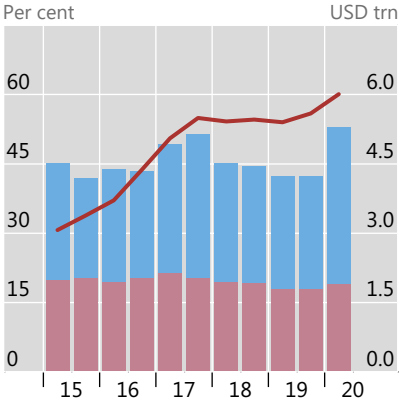
Graph D.7

Notional principal



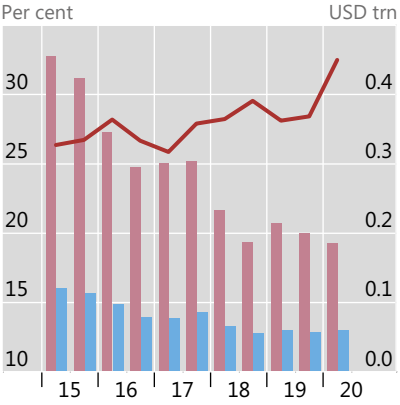
Gross market value/notional (lhs)
Rhs: Single-name notional | Multi-name notional

Notional principal with central counterparties (CCPs)



CCPs/total (lhs)
Rhs: Single-name notional | Multi-name notional

Impact of netting



Net/gross market values (lhs)
Rhs: Gross market values | Net market values

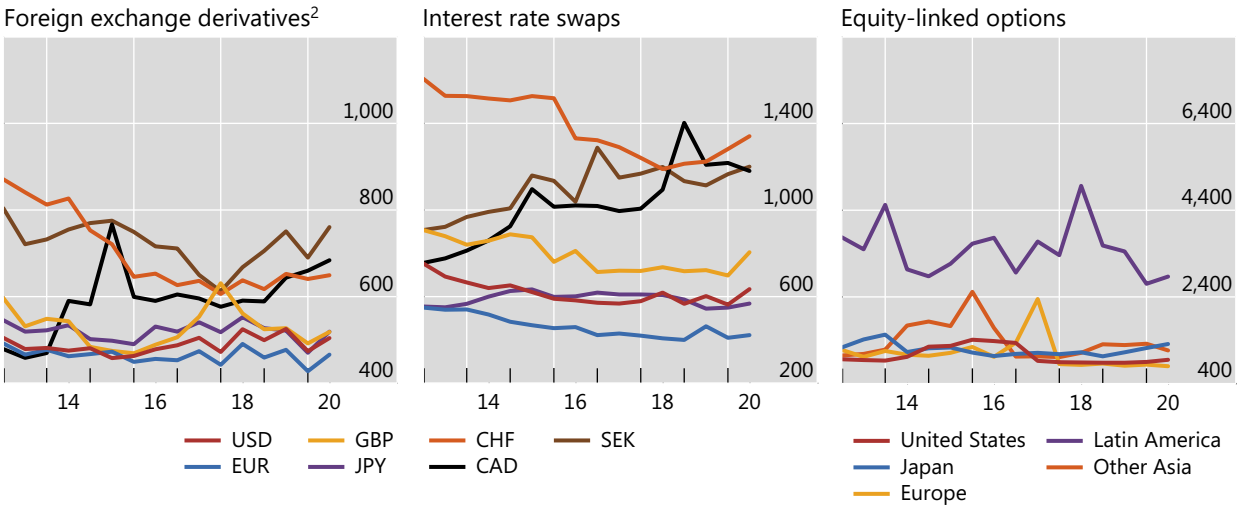
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm. For definitions, see the online glossary.

[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



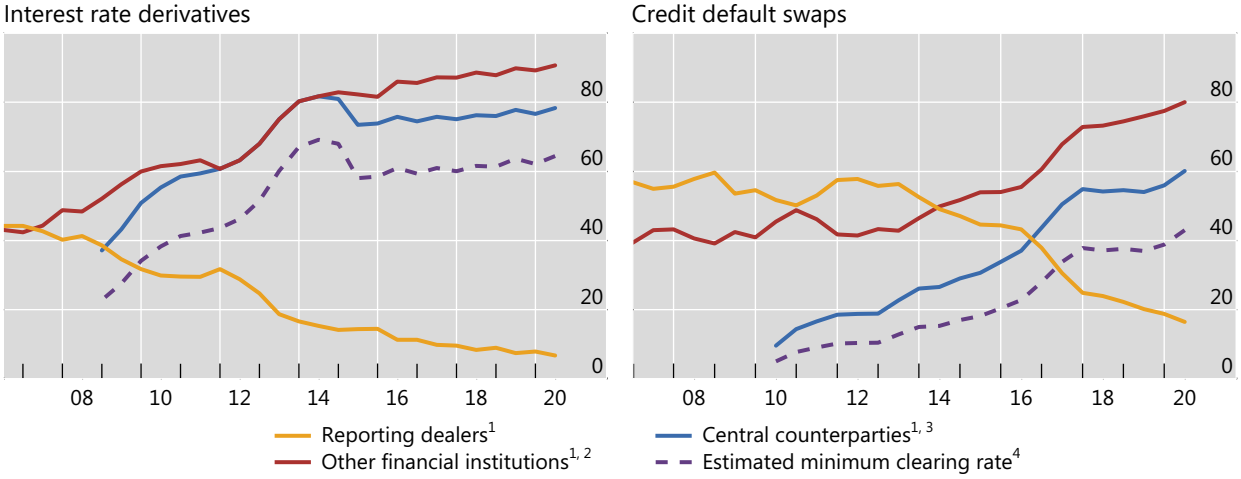
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm. For definitions, see the online glossary.

[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.

Growth of central clearing

Notional amounts outstanding by counterparty, in per cent Graph D.9



Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm. For definitions, see the online glossary.

[1] As a percentage of notional amounts outstanding against all counterparties. [2] Including central counterparties but excluding reporting dealers. [3] For interest rate derivatives, data for CCPs prior to end-June 2016 are estimated by indexing the amounts reported at end-June 2016 to the growth since 2008 of notional amounts outstanding cleared through LCH's SwapClear service. [4] Proportion of trades that are cleared, estimated as (CCP / 2) / (1 – (CCP / 2)), where CCP represents the share of notional amounts outstanding that dealers report against CCPs. CCPs' share is halved to adjust for the potential double-counting of inter-dealer trades novated to CCPs.

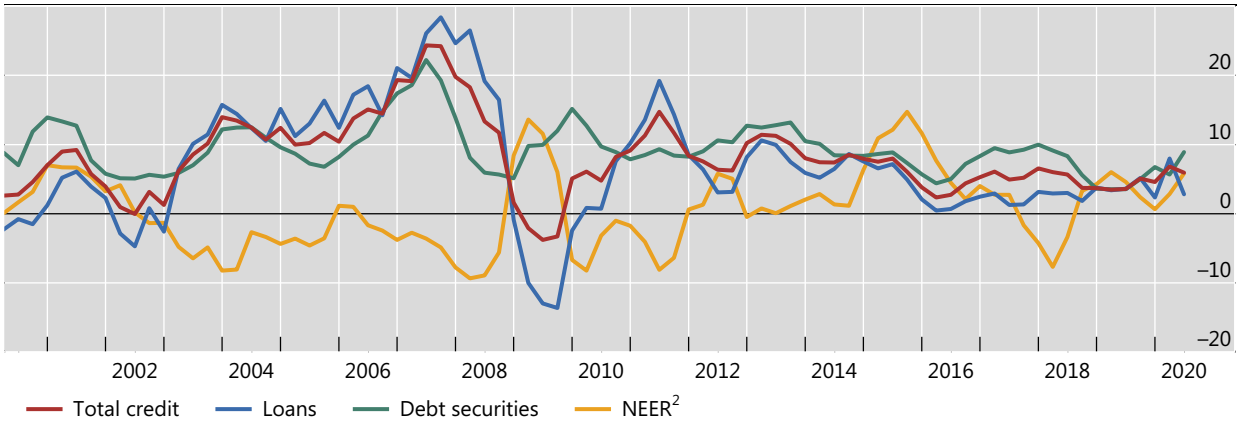
Sources: LCH.Clearnet Group Ltd; BIS OTC derivatives statistics (Table D7 and Table D10.1); BIS calculations.

E Global liquidity indicators

US dollar credit outside the United States[1]

Annual change, in per cent

Graph E.1



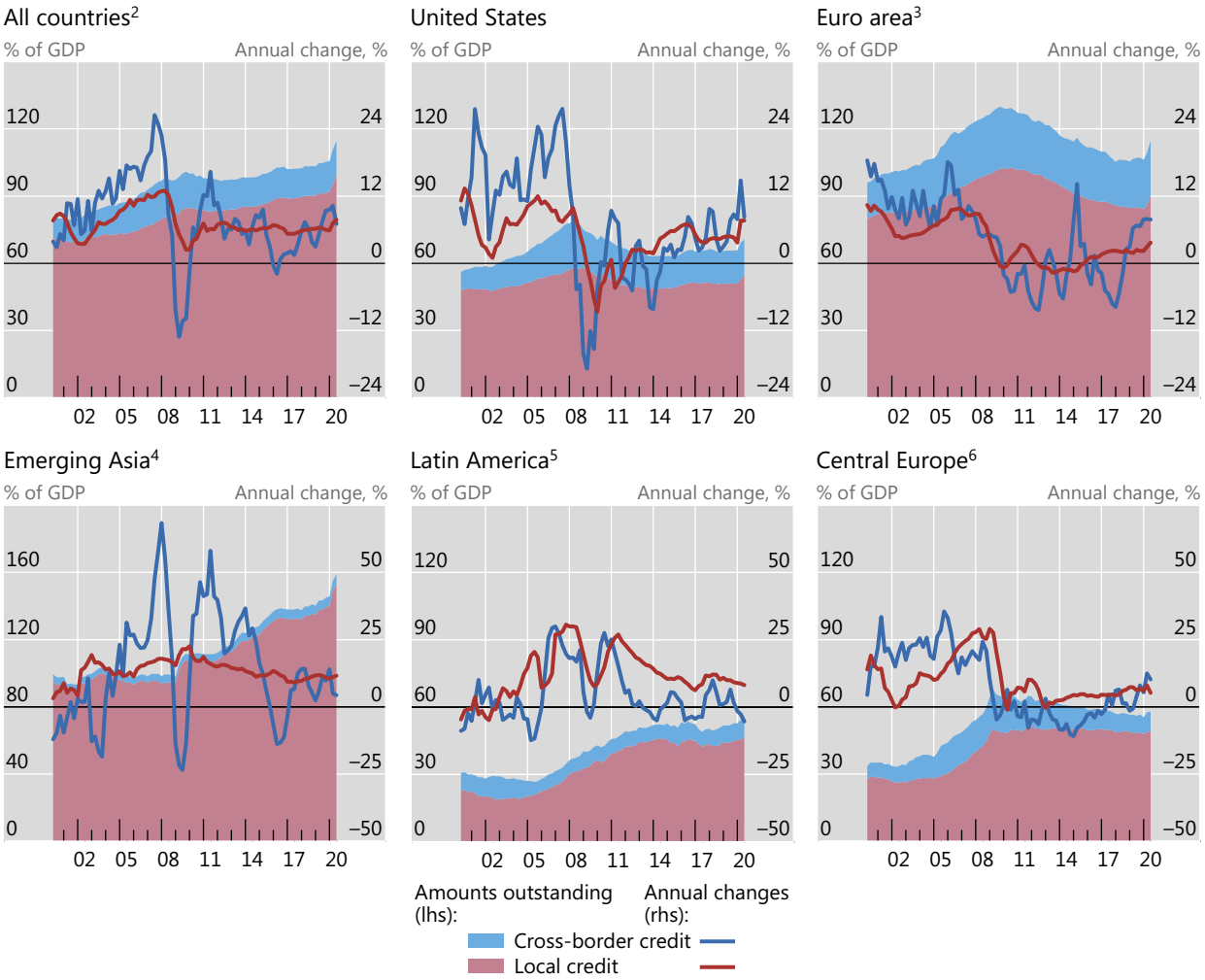
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[1] Annual growth of US dollar-denominated credit to non-banks outside the United States. [2] Annual growth of the US dollar nominal effective exchange rate.

Sources: Datastream; Dealogic; Euroclear; Refinitiv; Xtrakter Ltd; national data; BIS locational banking statistics; BIS effective exchange rate statistics; BIS calculations.

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.

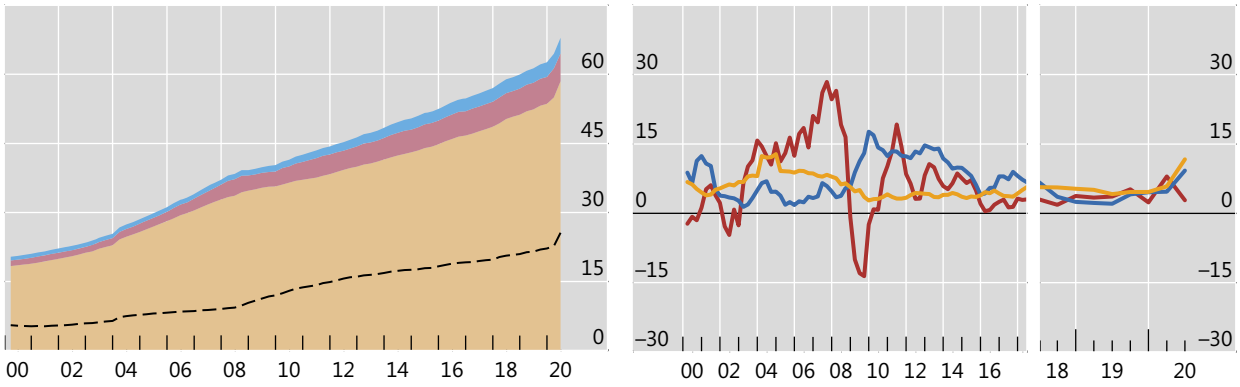
Global credit to the non-financial sector, by currency

Graph E.3

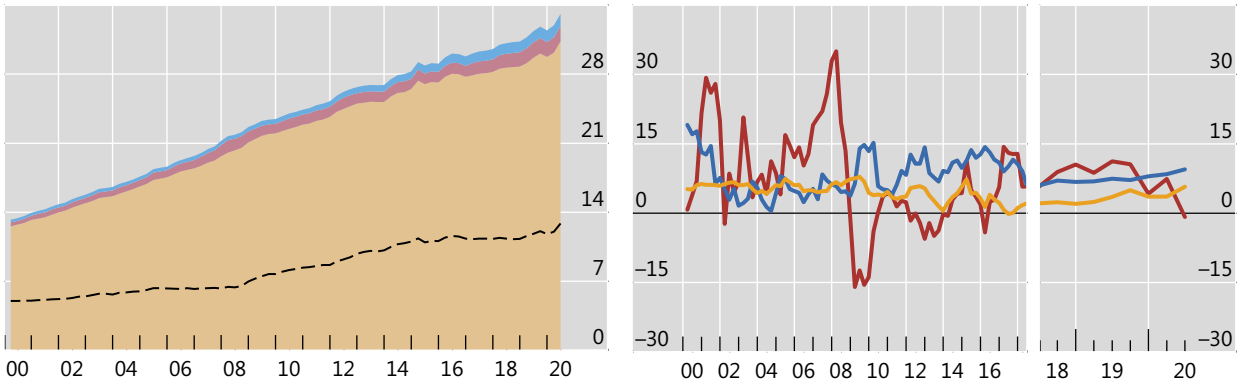
Amounts outstanding, in trillions of currency units[1]

Annual change, in per cent[2]

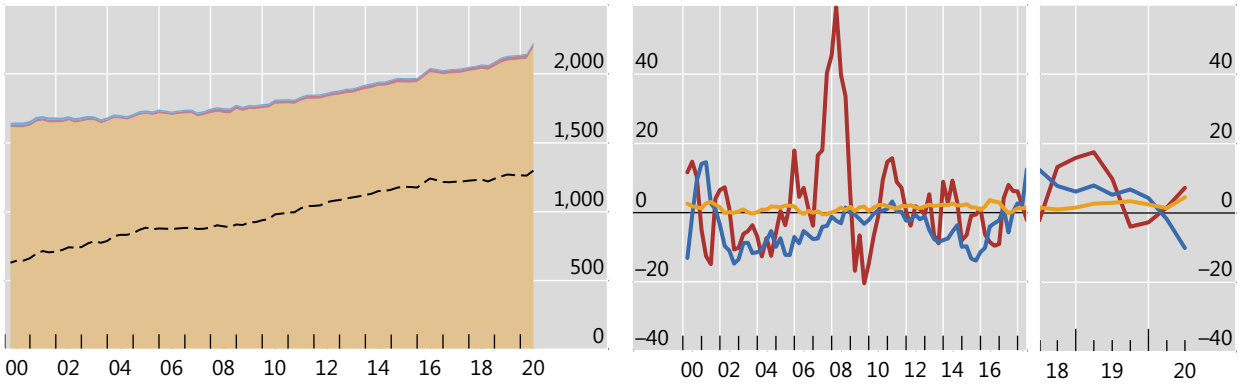
Credit denominated in US dollars (USD)



Credit denominated in euros (EUR)



Credit denominated in yen (JPY)



Credit to residents[3]
Of which:
Credit to government
Credit to non-residents:
Debt securities[4]
Bank loans[5]

Credit to residents[3]
Credit to non-residents:
Debt securities[4]
Bank loans[5]

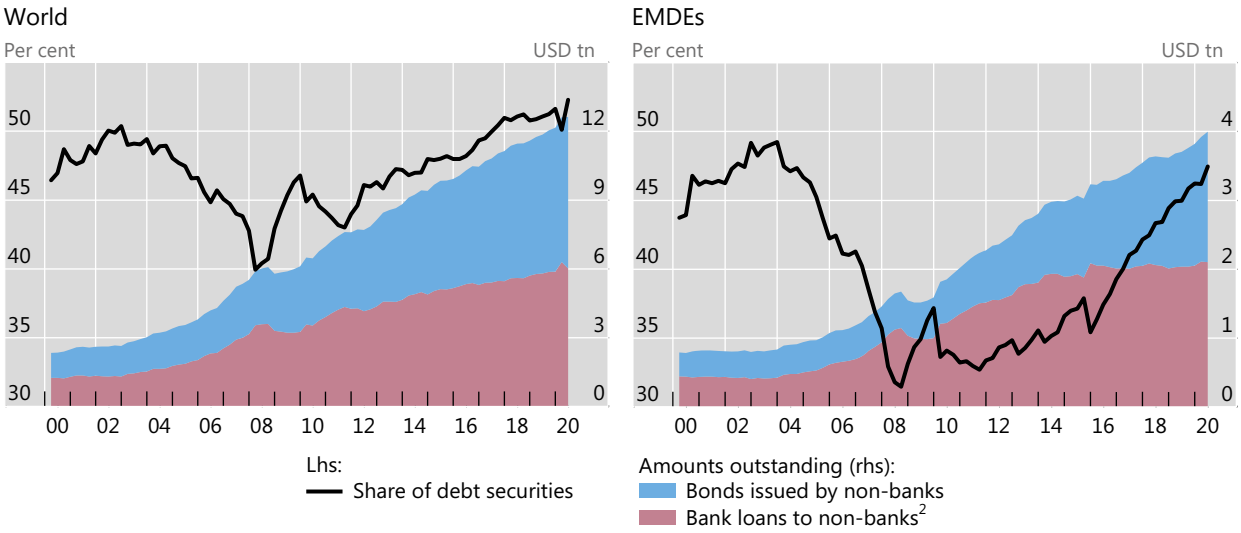
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[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; Refinitiv; Xtrakter Ltd; national data; BIS locational banking statistics (LBS); BIS calculations.

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

Graph E.4



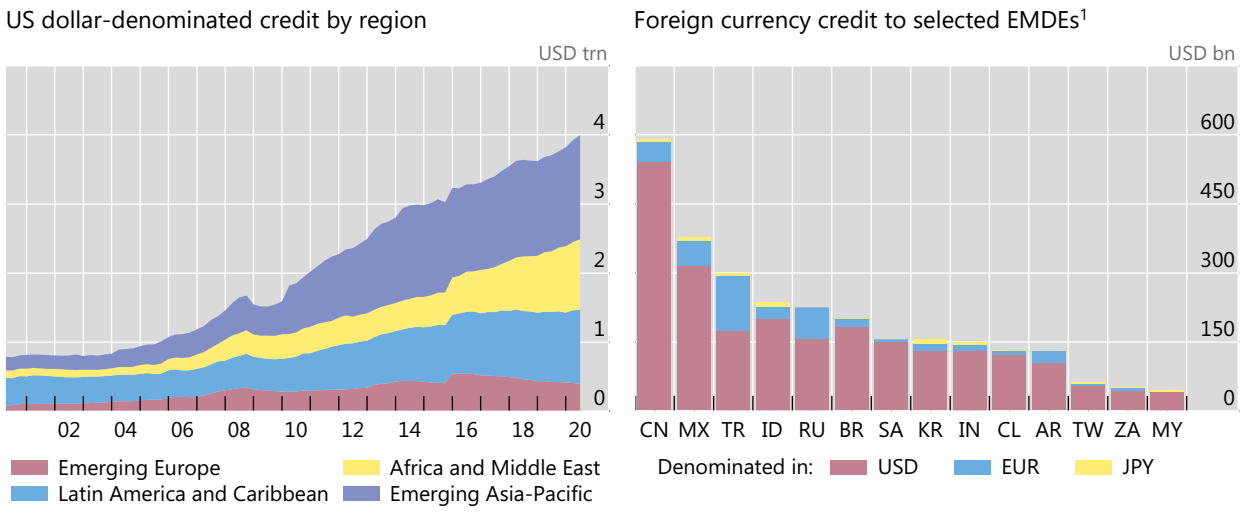
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[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; Refinitiv; Xtrakter Ltd; national data; BIS locational banking statistics (LBS); BIS calculations.

Foreign currency credit to non-banks in EMDEs

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.

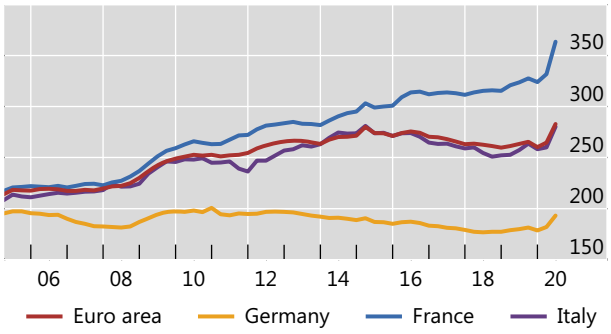
Sources: Datastream; Dealogic; Euroclear; Refinitiv; Xtrakter Ltd; national data; BIS locational banking statistics (LBS); BIS calculations.

F Statistics on total credit to the non-financial sector

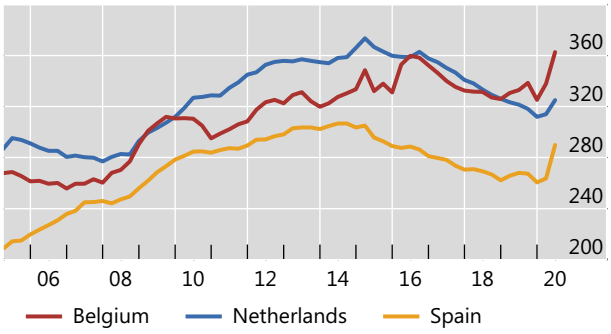
Total credit to the non-financial sector (core debt)

As a percentage of GDP — Graph F.1

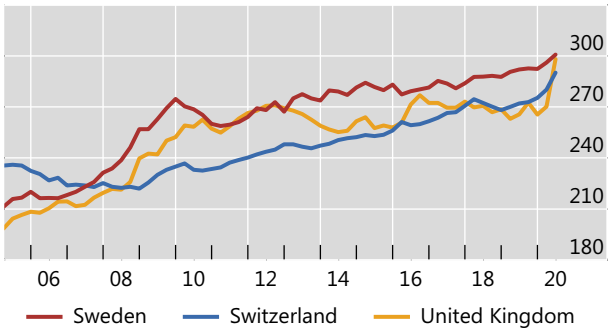
Euro area: aggregate and major countries



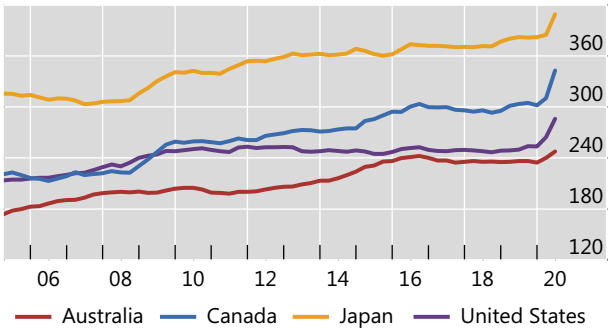
Euro area: other countries



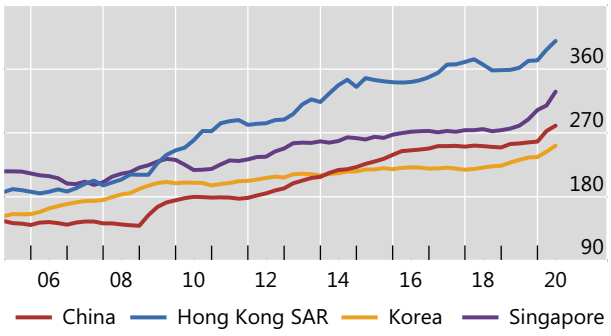
Other European countries



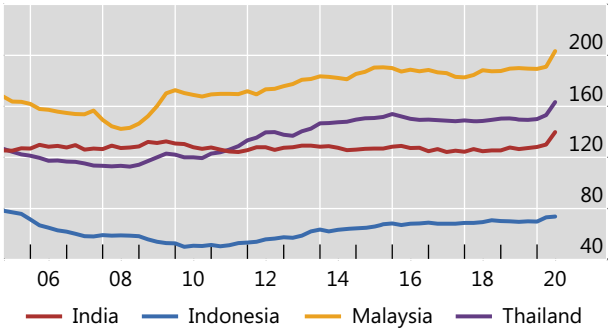
Major advanced economies



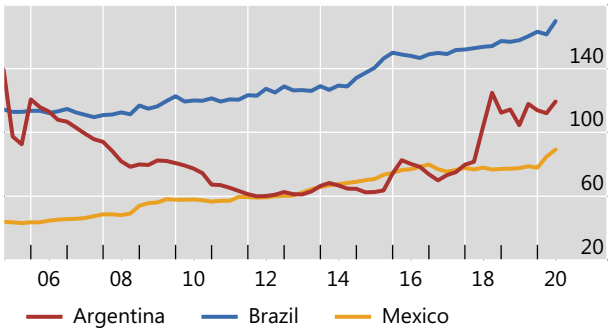
Emerging Asia



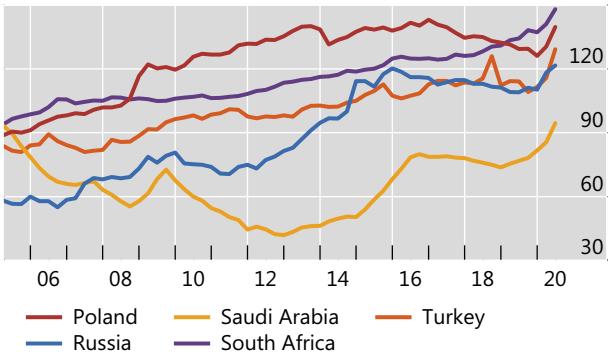
Other emerging Asia



Latin America



Other emerging market economies

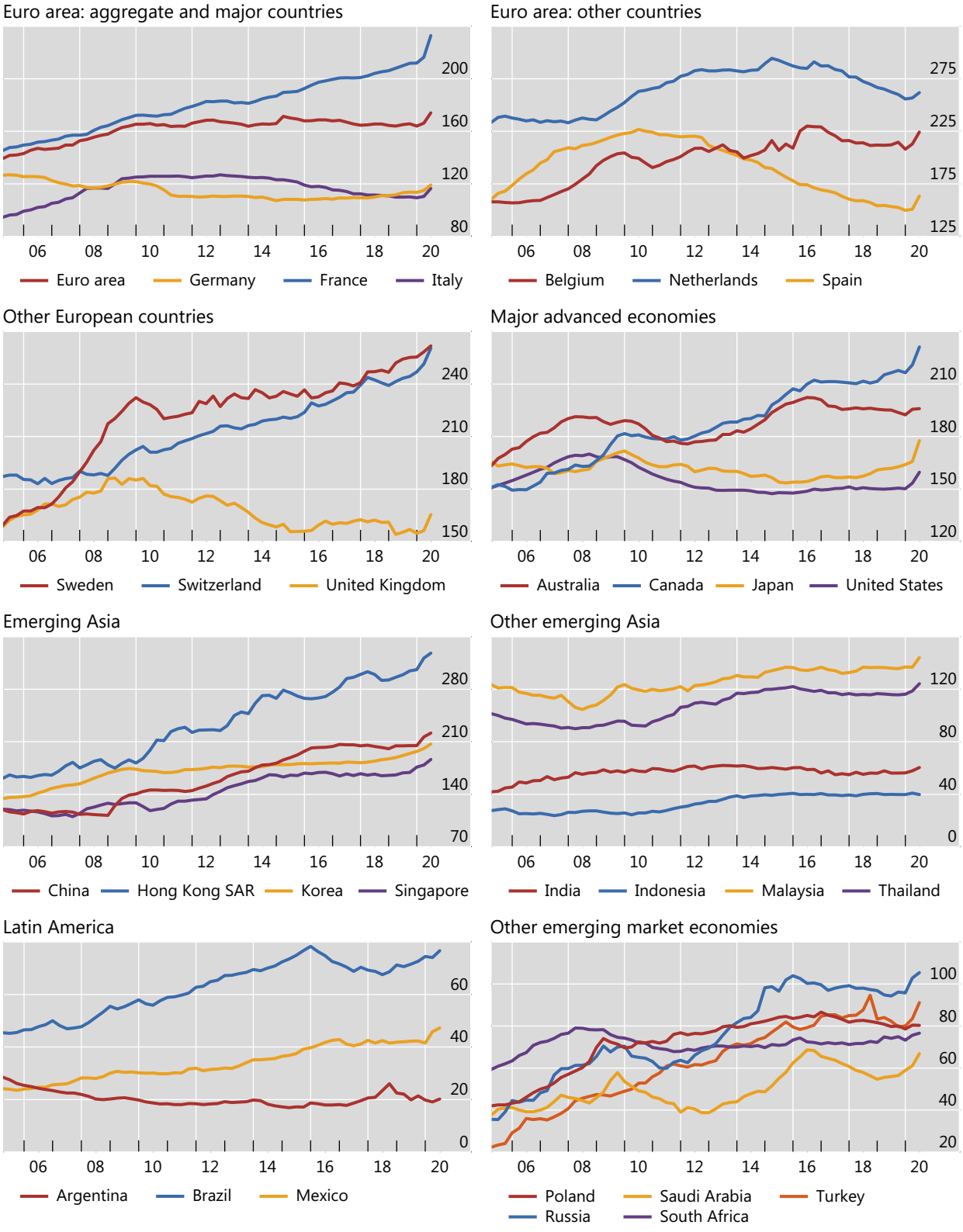


Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

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

As a percentage of GDP — Graph F.2



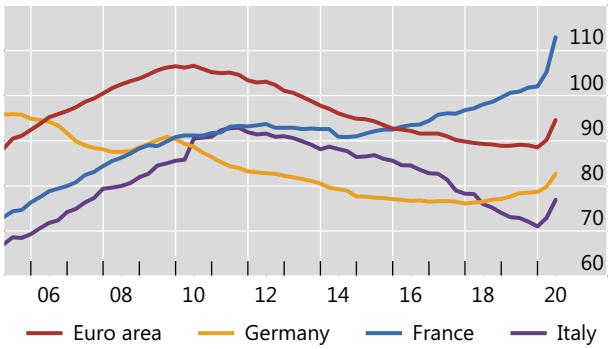
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

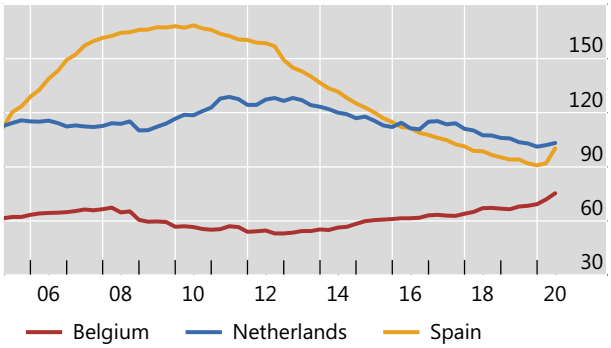
Bank credit to the private non-financial sector (core debt)

As a percentage of GDP — Graph F.3

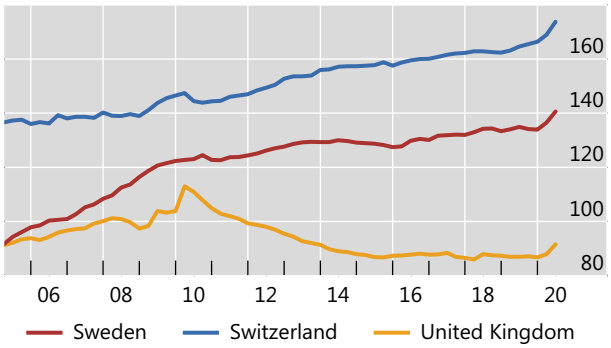
Euro area: aggregate and major countries



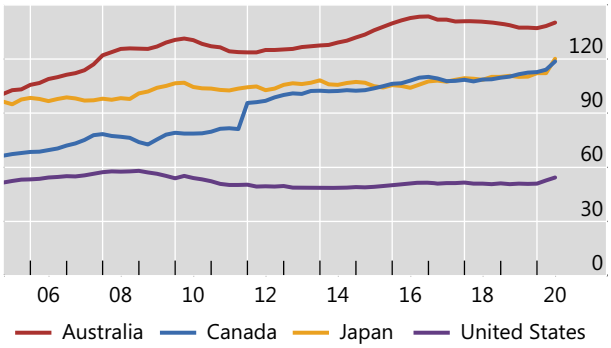
Euro area: other countries



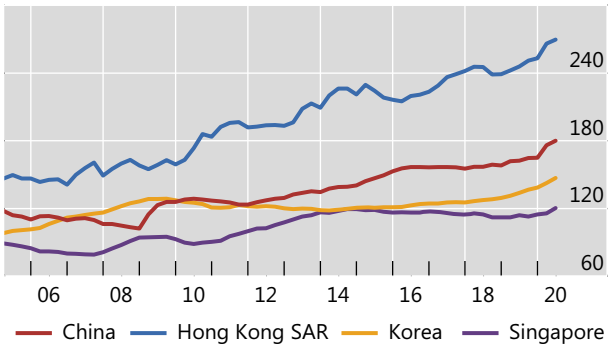
Other European countries



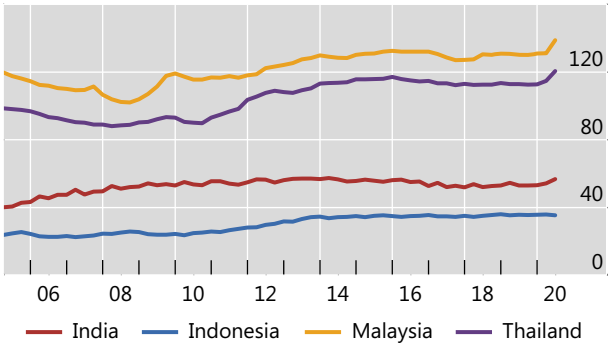
Major advanced economies



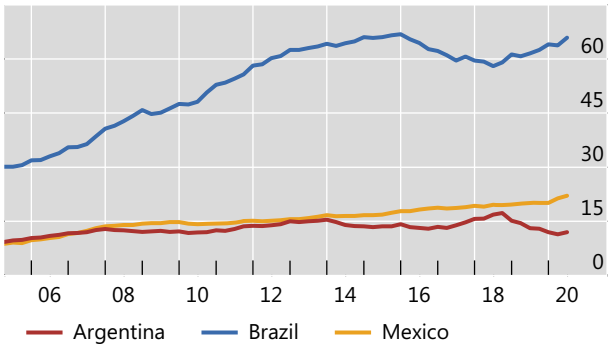
Emerging Asia



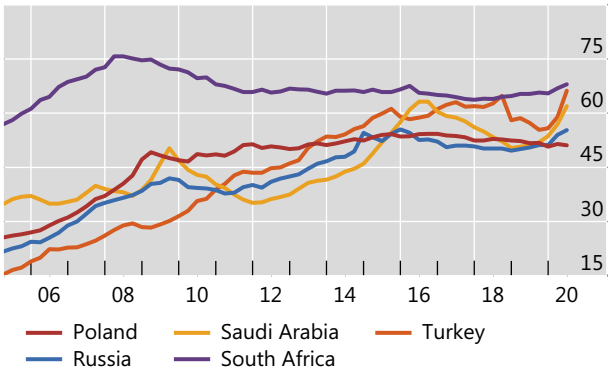
Other emerging Asia



Latin America



Other emerging market economies



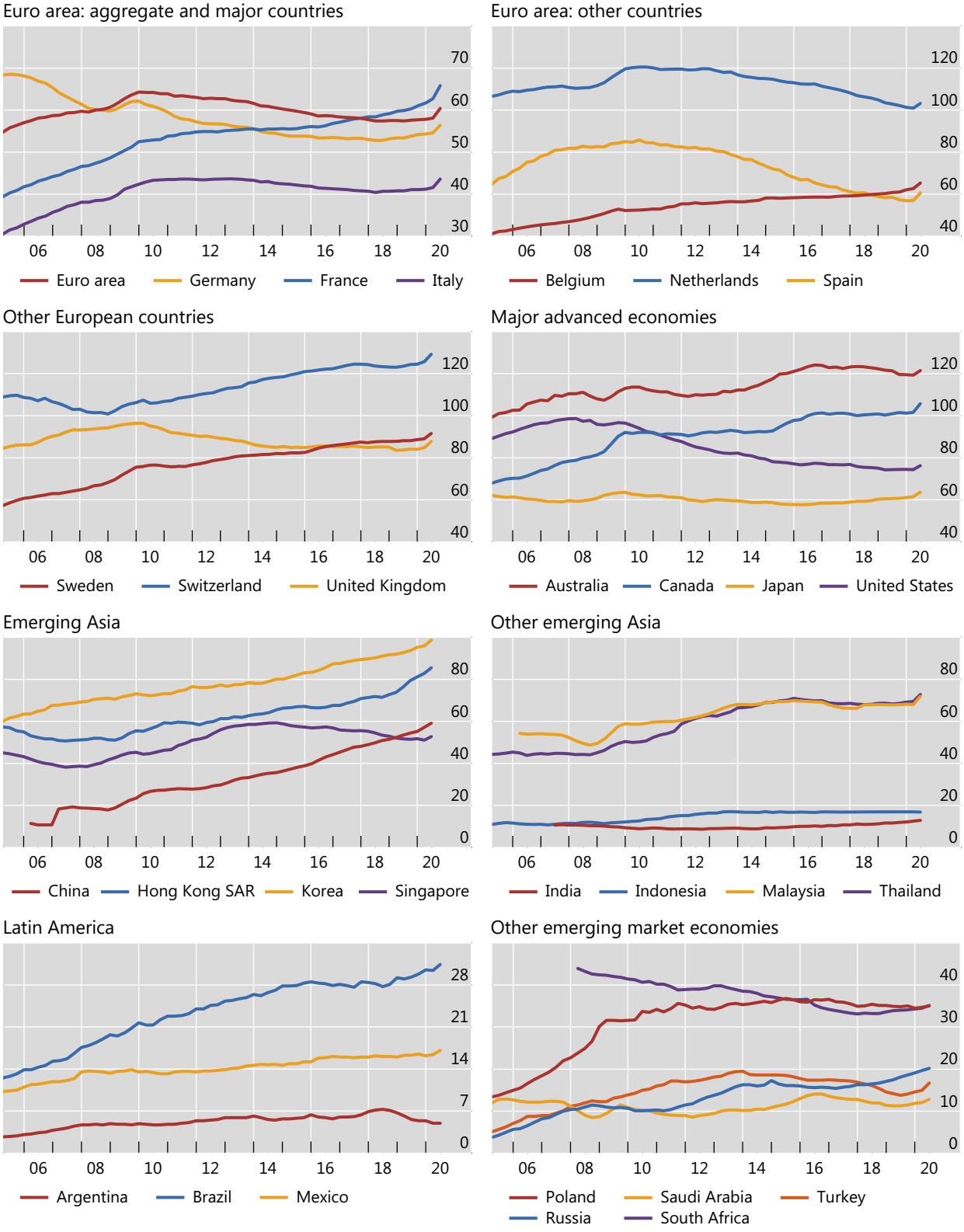
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

Total credit to households (core debt)

As a percentage of GDP

Graph F.4



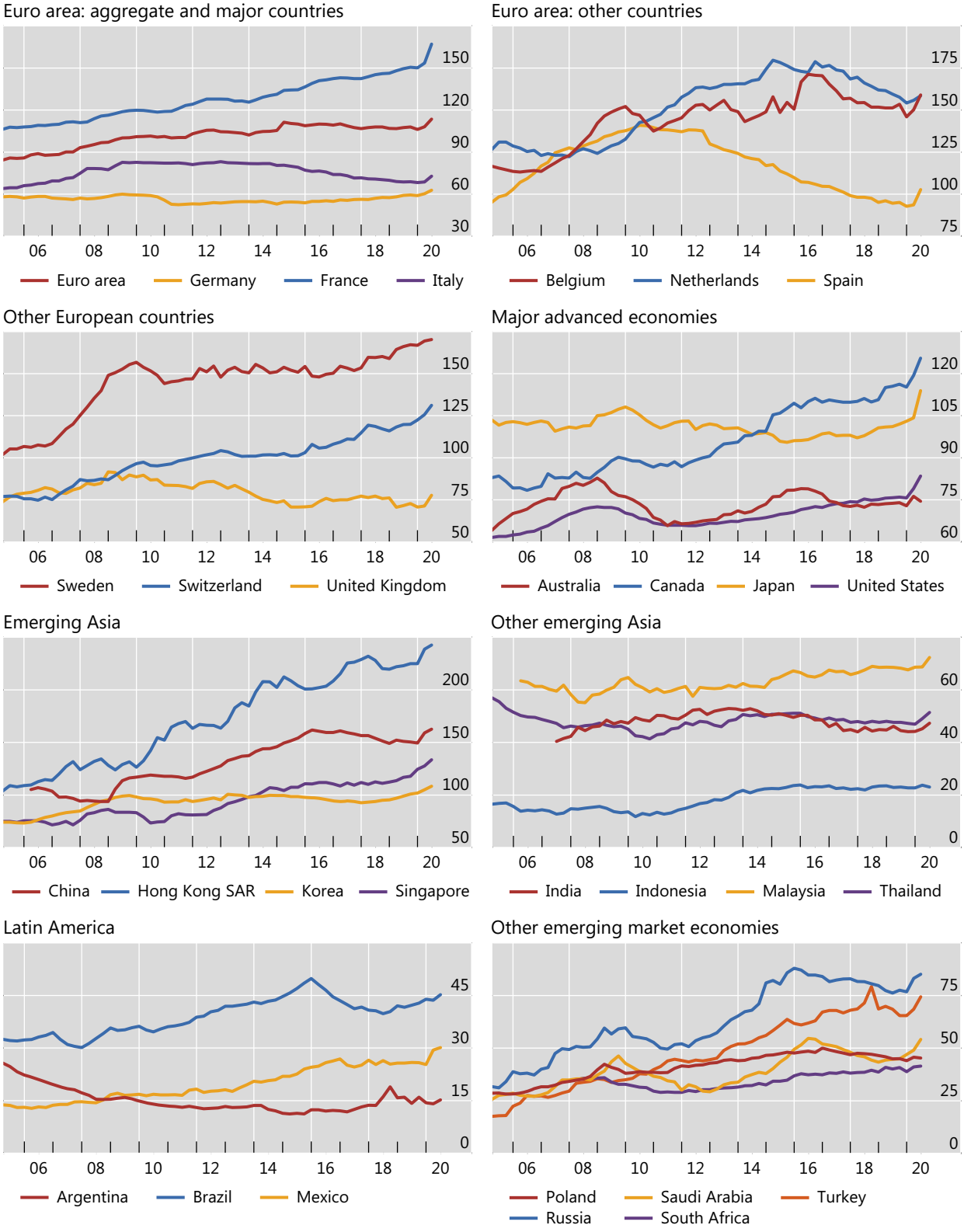
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

Total credit to non-financial corporations (core debt)

As a percentage of GDP

Graph F.5



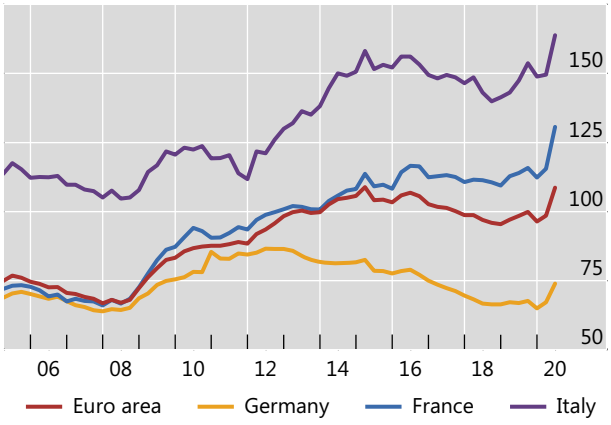
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

Source: BIS total credit statistics.

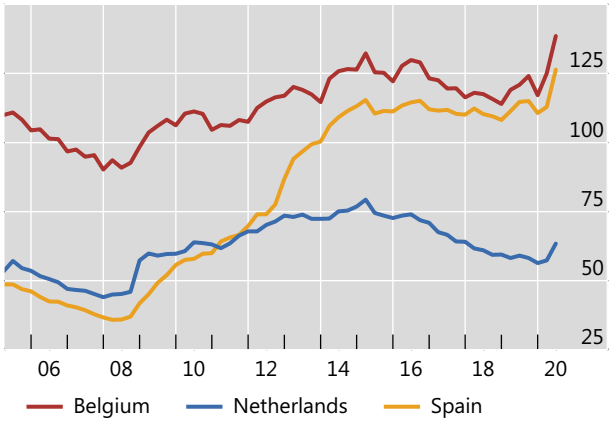
Total credit to the government sector at market value (core debt)[1]

As a percentage of GDP — Graph F.6

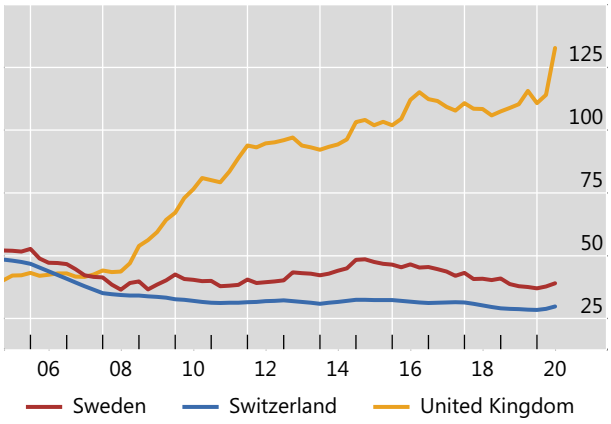
Euro area: aggregate and major countries



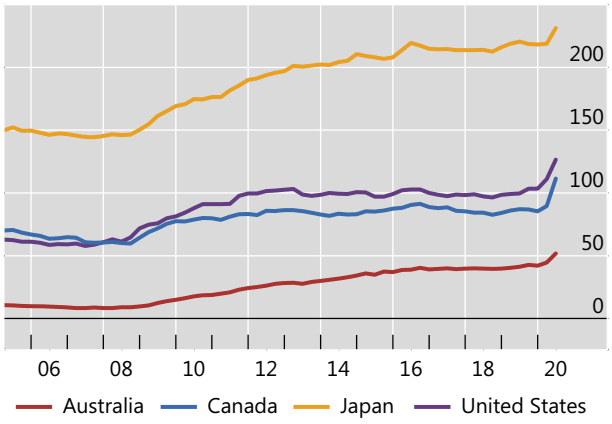
Euro area: other countries



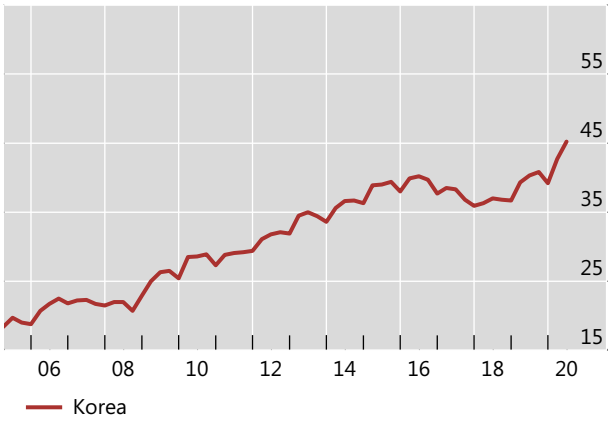
Other European countries



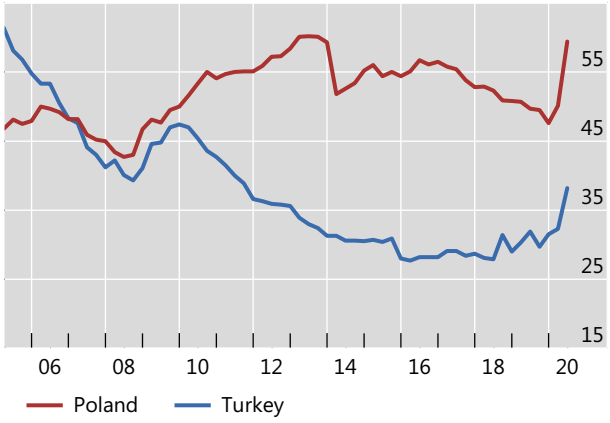
Major advanced economies



Emerging Asia



Other emerging market economies



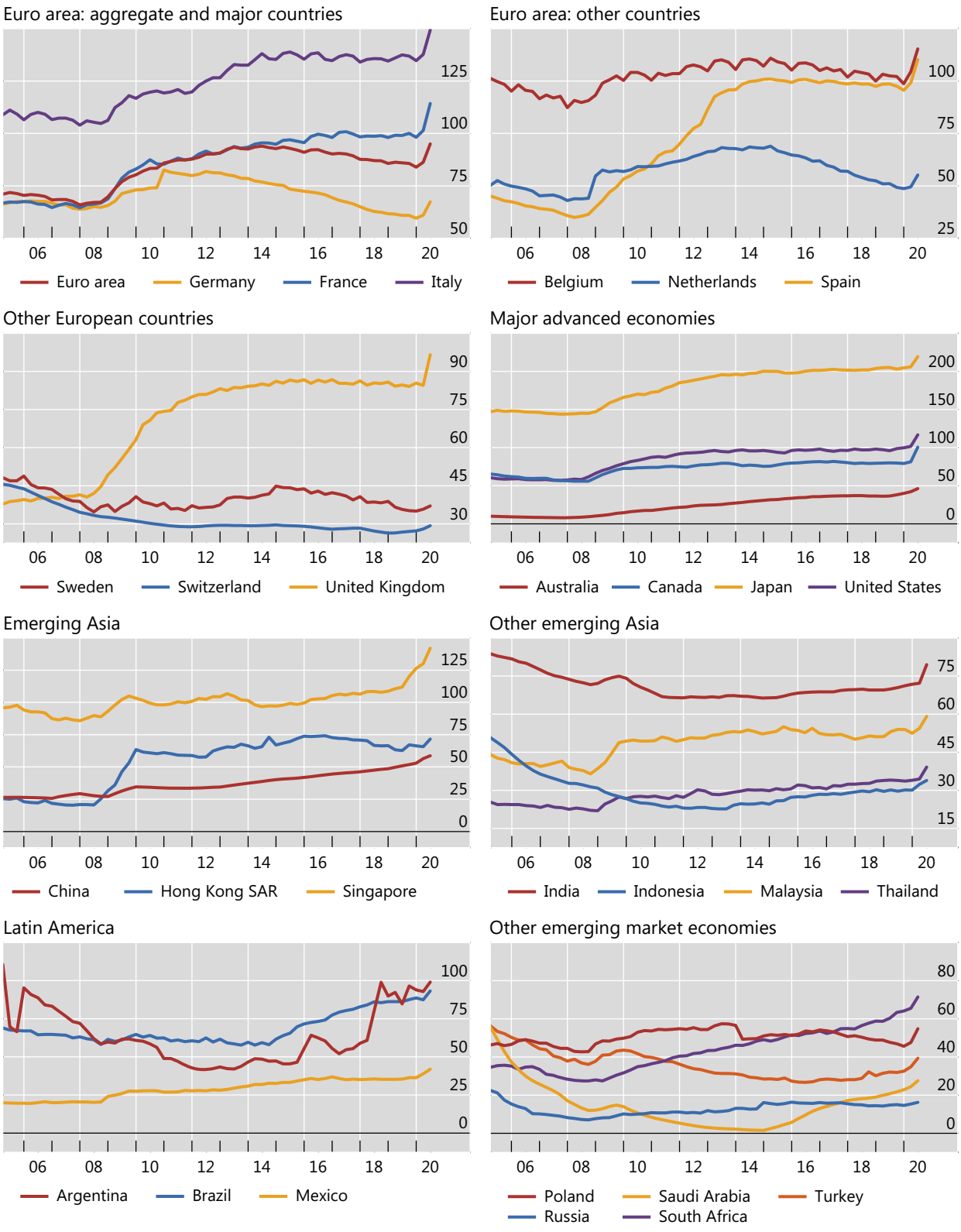
Further information on the BIS credit statistics is available at www.bis.org/statistics/totcredit.htm.

[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.

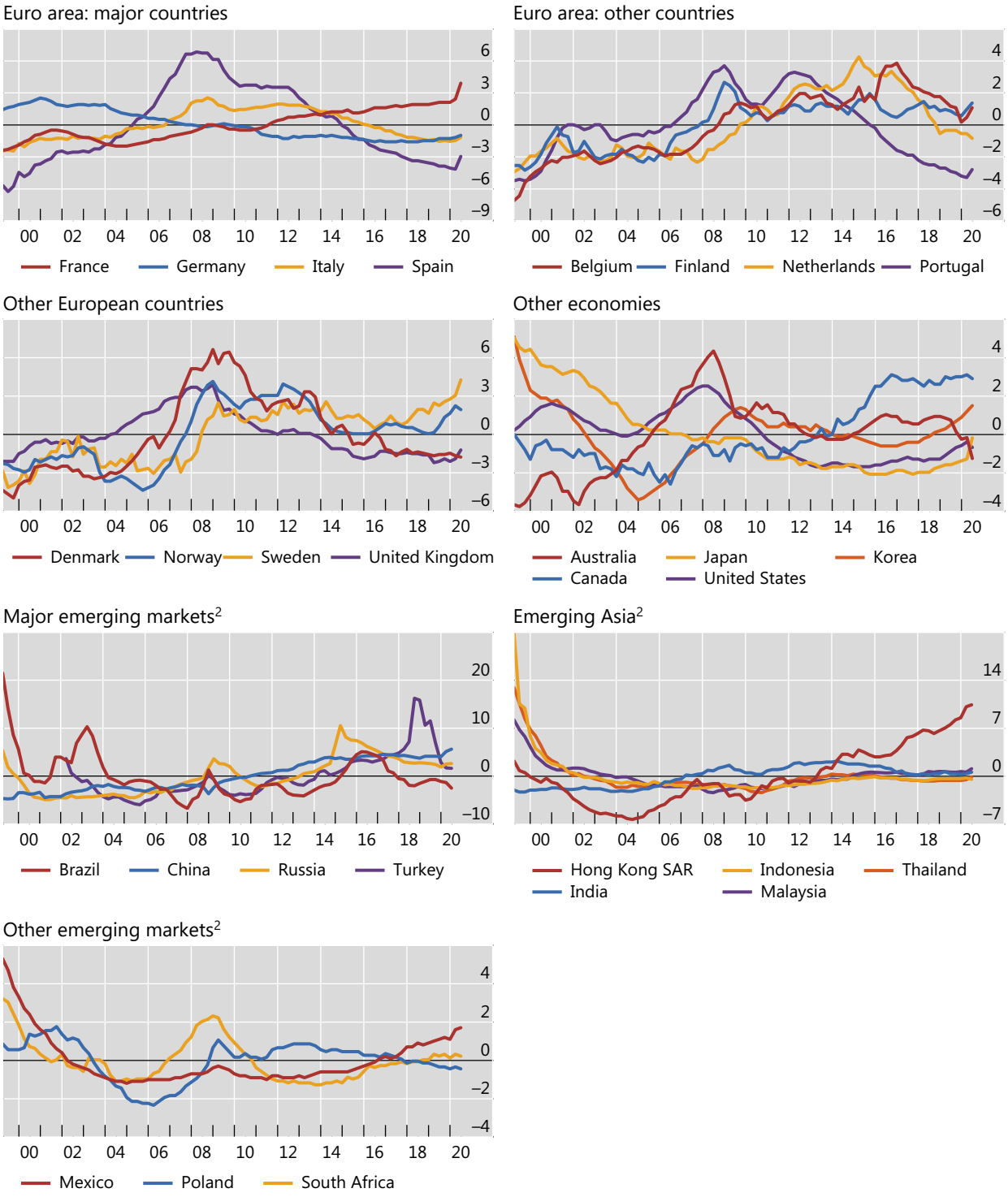
[1] Consolidated data for the general government sector; central government for Argentina, Indonesia, Malaysia, Mexico, Saudi Arabia and Thailand.

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



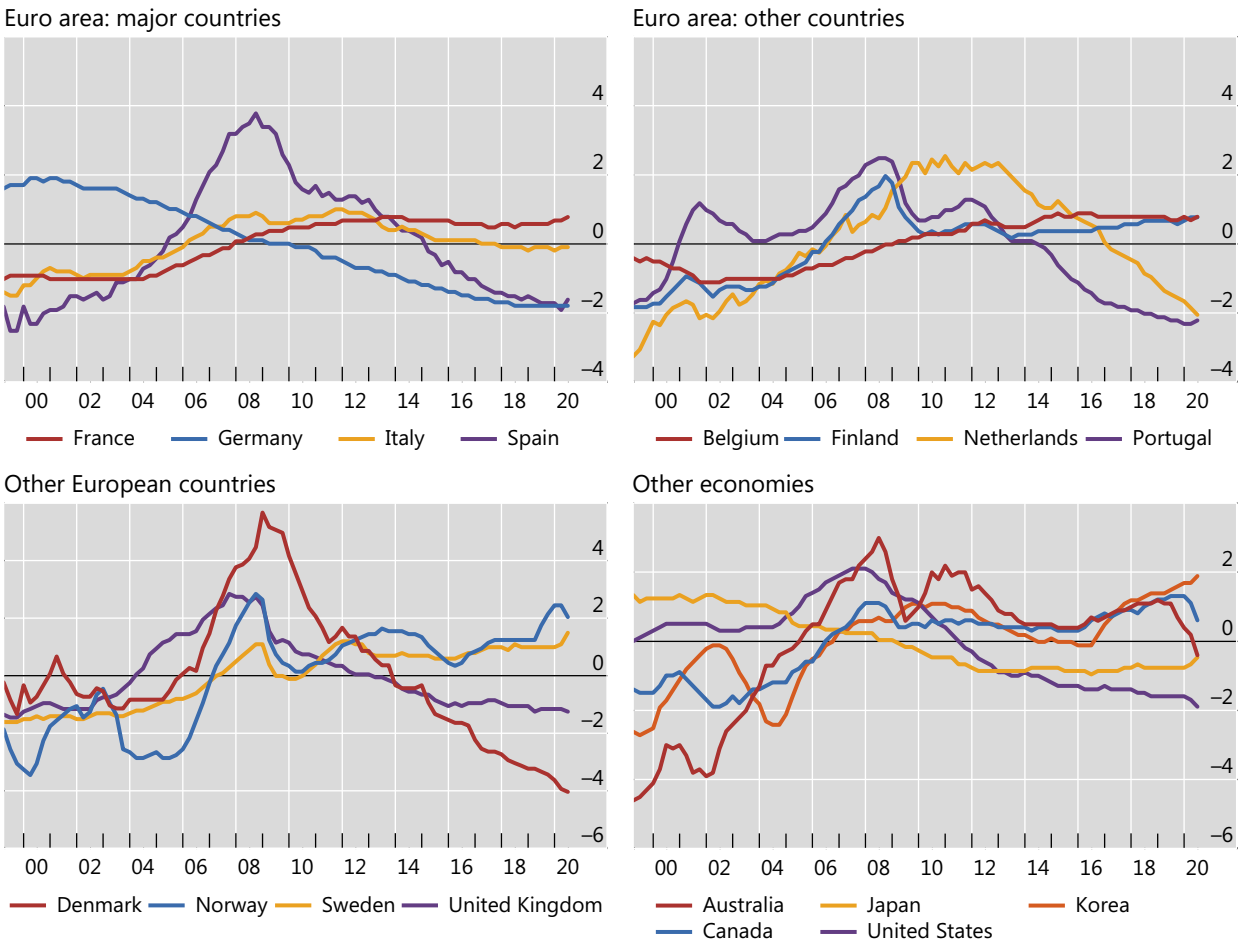
Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

[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



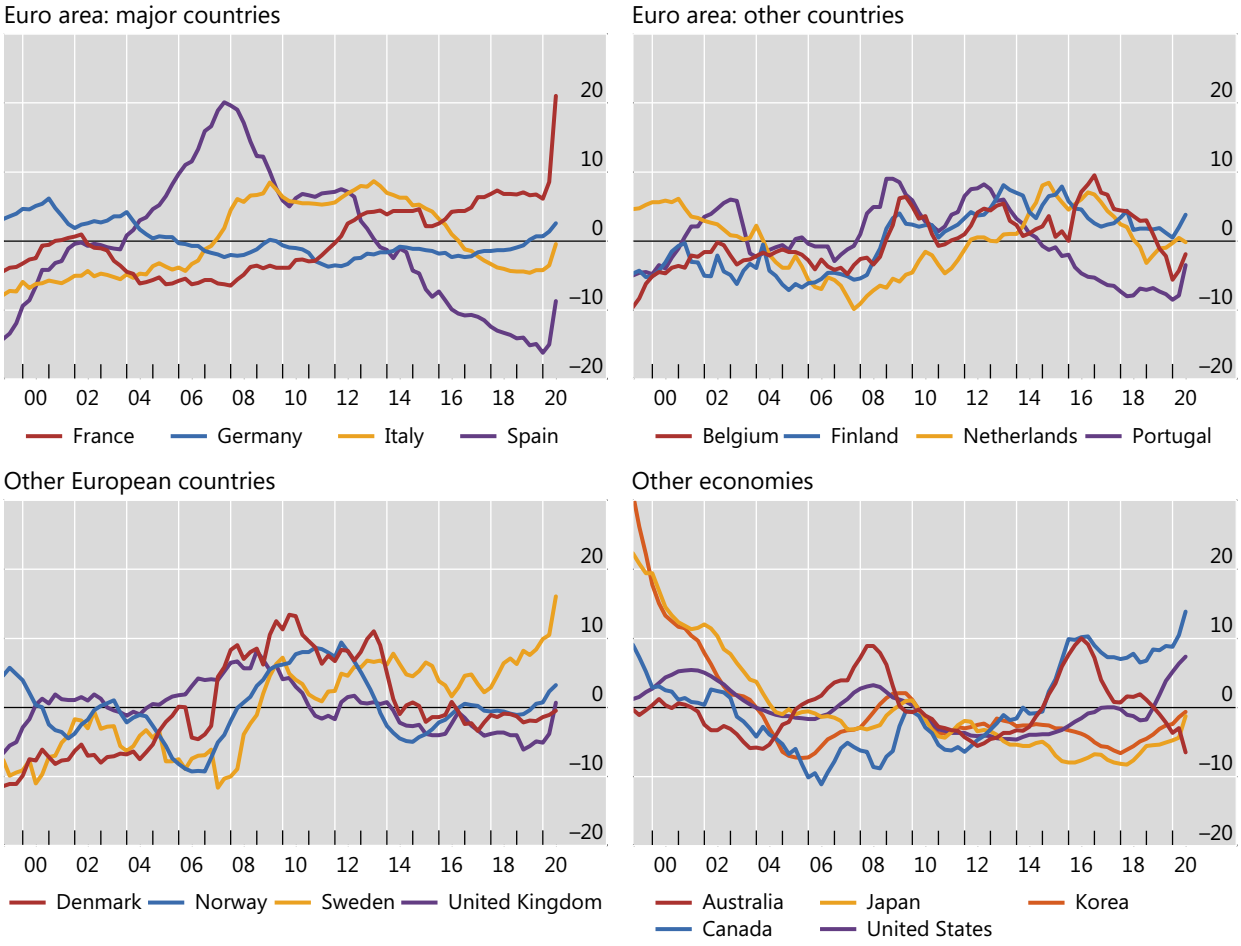
Further information on the BIS debt service ratio statistics is available at www.bis.org/statistics/dsr.htm.

[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.

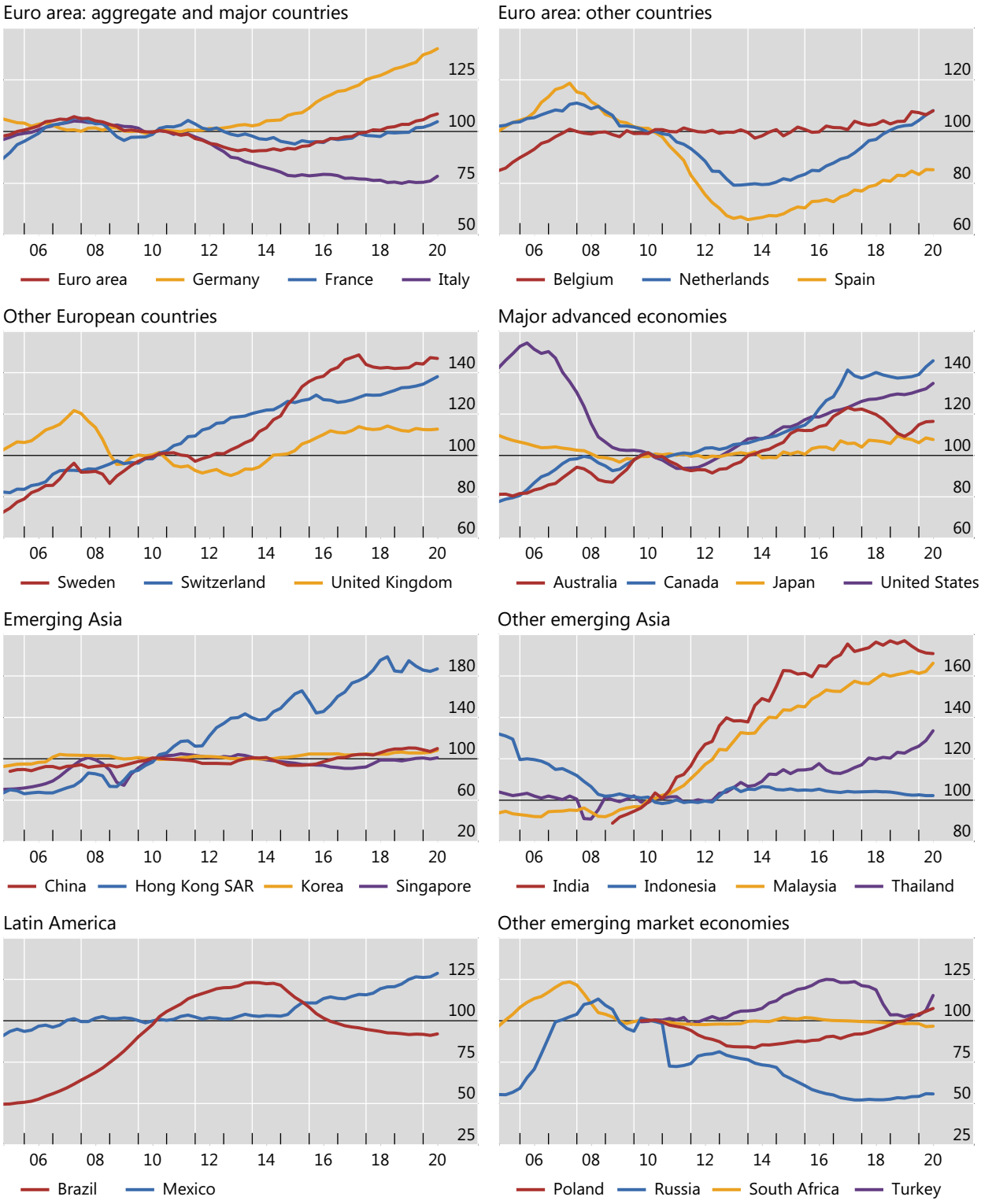
[1] Country-specific means are based on all available data from 1999 onwards.

Source: BIS debt service ratios statistics.

H Property price statistics

Real residential property prices

CPI-deflated, 2010 = 100 Graph H.1



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

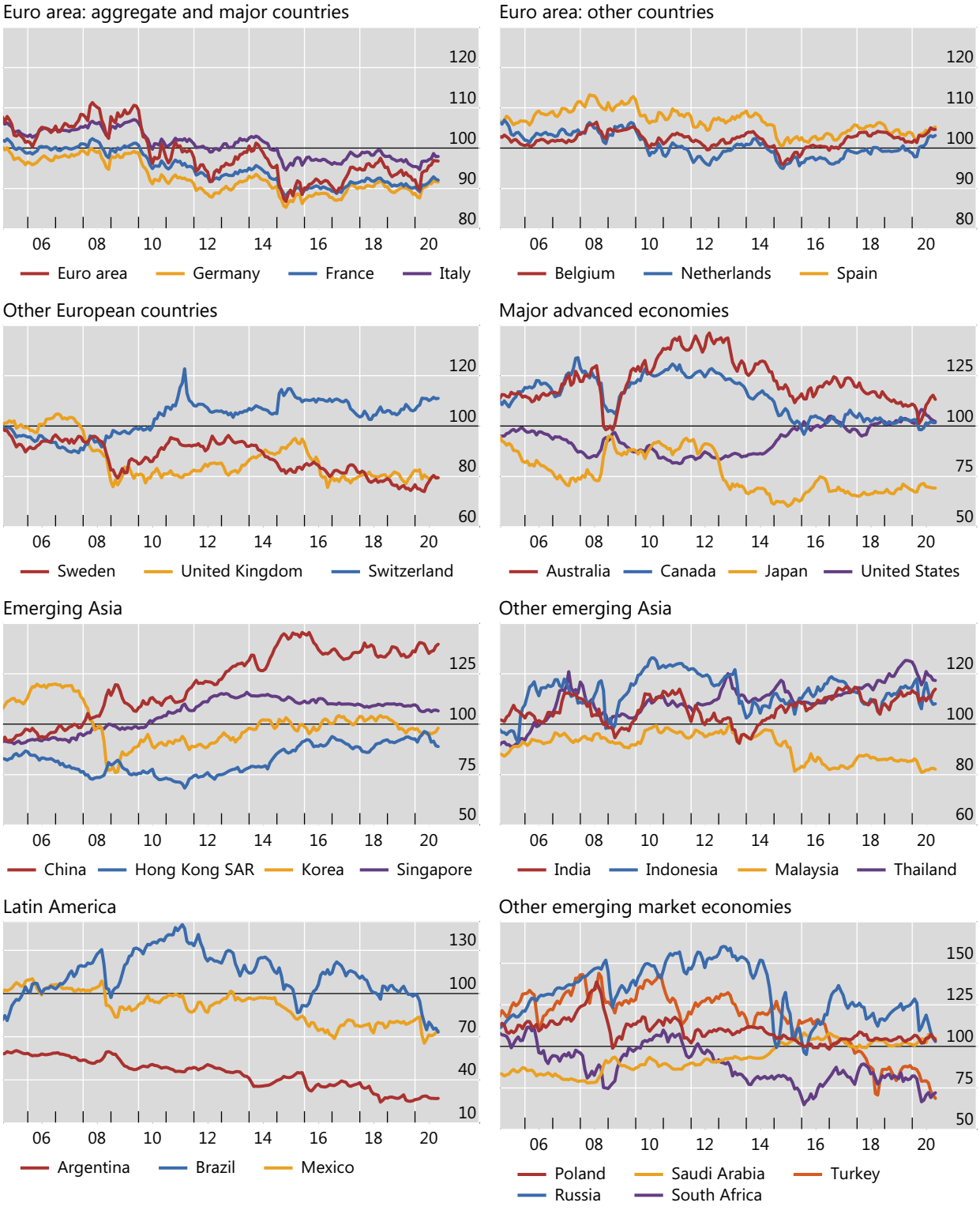
Source: BIS property prices statistics.

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.

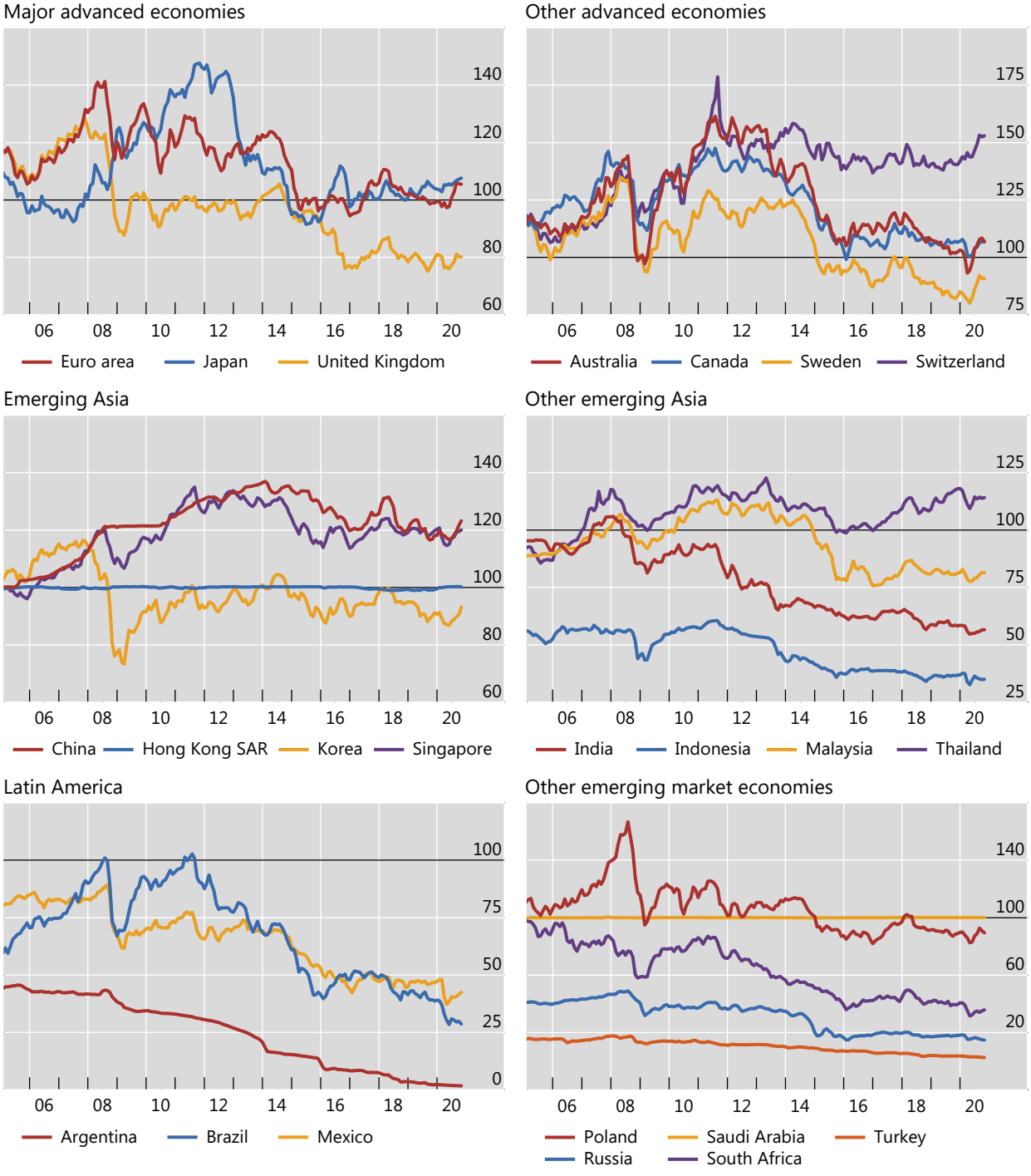
[1] An increase indicates a real-term appreciation of the local currency against a broad basket of currencies.

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.

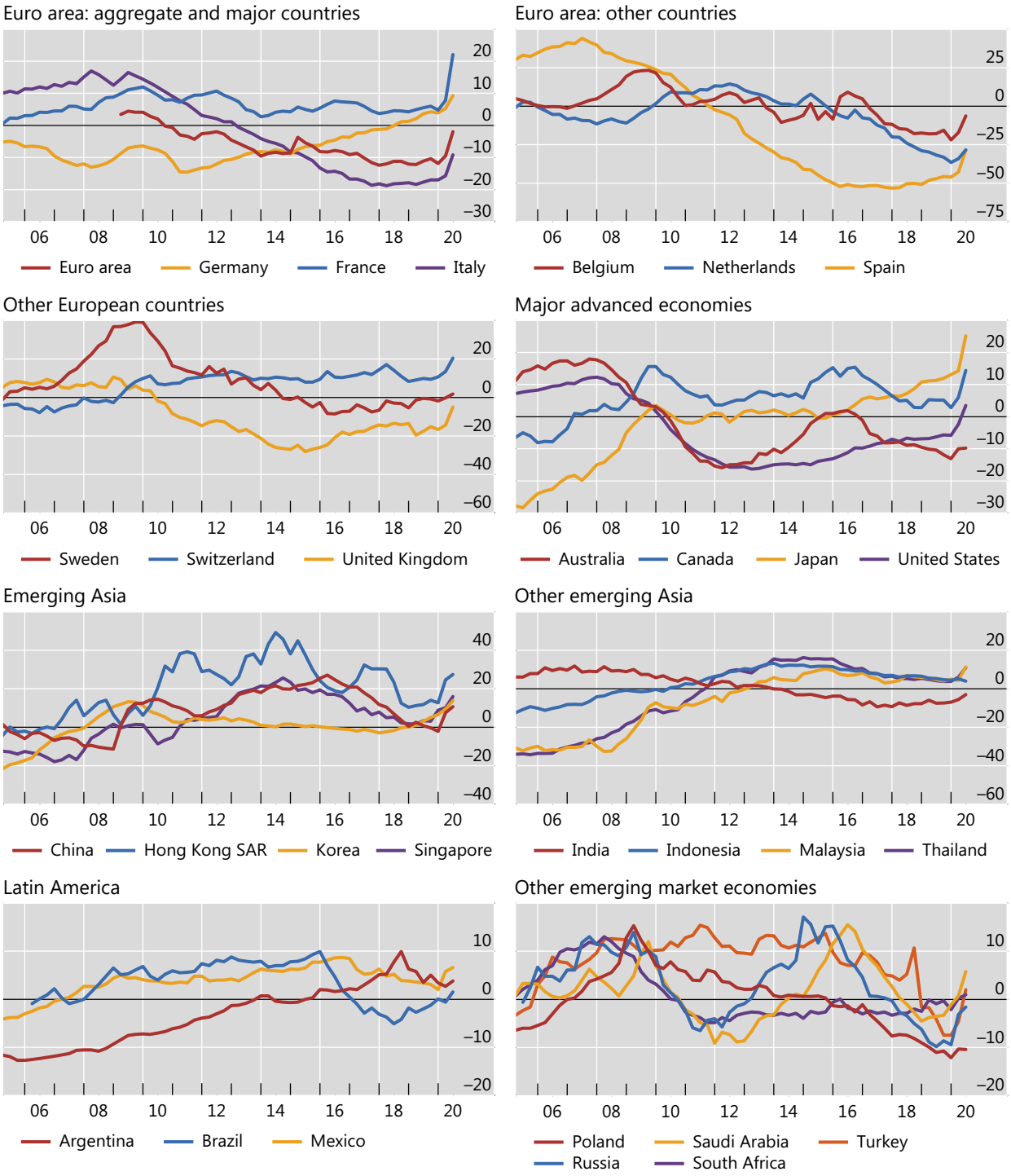
[1] An increase indicates an appreciation of the local currency against the US dollar.

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.

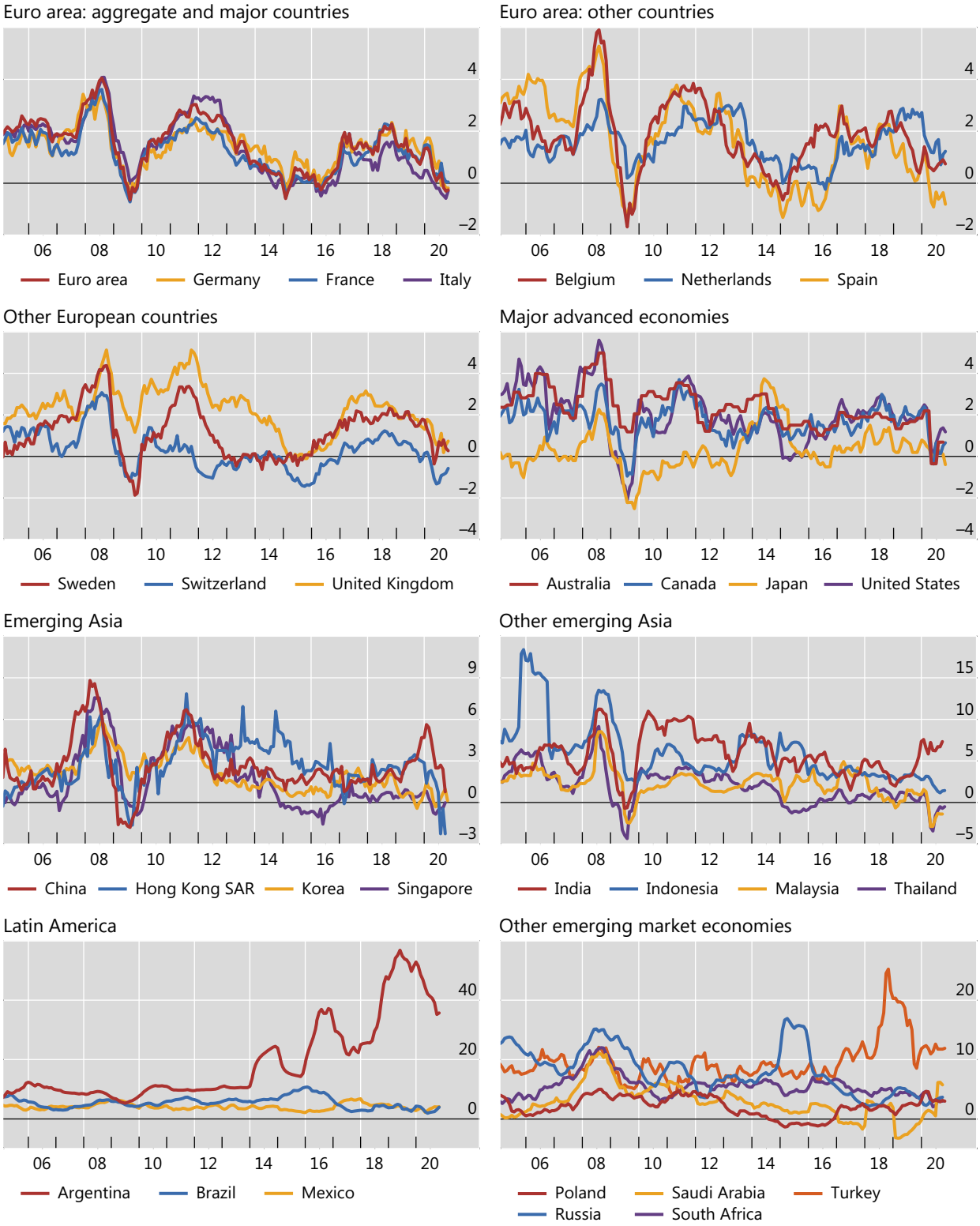
Source: BIS credit-to-GDP gaps statistics.

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.

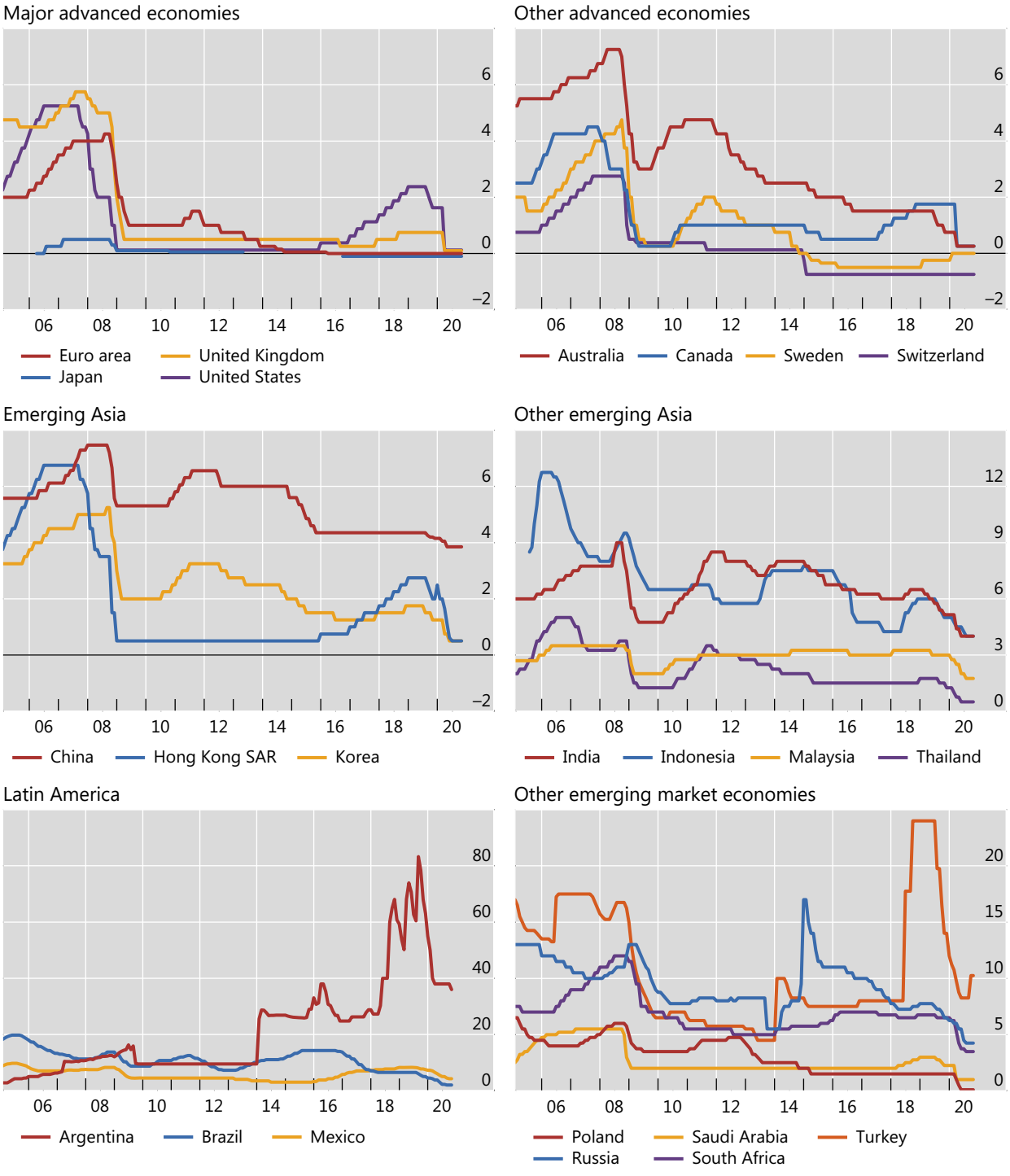
Source: BIS consumer price statistics.

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.