

BIS Quarterly Review

International banking and financial
market developments

September 2020

BIS Quarterly Review
Monetary and Economic Department

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Markets rise despite subdued economic recovery	1
Stretched valuations in the aftermath of the pandemic	2
Lower bond yields on supportive policies.....	6
Headwinds build up against the US dollar.....	8
Box A: Banks through Covid-19.....	11
Box B: The short and long end of equity prices during the pandemic.....	13

Special features

Cross-border commercial real estate investment in Asia-Pacific	15
<i>Amanda Liu, Ilhyock Shim and Vladyslav Sushko</i>	
Definition of CRE and classification of investors	16
Asia-Pacific CRE markets and cross-border investment	18
Box A: Asia-Pacific regional REIT markets and their role in cross-border investment	21
Box B: Foreign currency funding of real investors in Asia-Pacific commercial real estate	22
Drivers of cross-border investment	23
Developments during Covid-19	25
Conclusions	27
Green bonds and carbon emissions: exploring the case for a rating system at the firm level	31
<i>Torsten Ehlers, Benoit Mojon and Frank Packer</i>	
Green bond issuers and carbon intensities.....	33
Box A: Carbon emissions data and firm disclosure.....	36
Desirable properties of a firm-level green rating system.....	39
A stylised example of a carbon intensity-based rating system.....	41
Box B: Rating uplifts to provide extra incentives for Paris-aligned emission reductions	44
Conclusions	45

Mind the buybacks, beware of the leverage	49
<i>Sirio Aramonte</i>	
The evolution of buybacks over time.....	50
Why do companies repurchase their own shares?	52
Buybacks or leverage? Evidence on risk drivers from the March 2020 shock	56
Conclusions.....	58
Cross-border links between banks and non-bank financial institutions.....	61
<i>Iñaki Aldasoro, Wenqian Huang and Esti Kemp</i>	
The growing importance of NBFIs as bank counterparties	62
Box A: The global picture of non-bank financial intermediation from FSB data	64
The network of cross-border links between banks and NBFIs	65
Vulnerabilities and the impact of the Covid-19 shock	68
Box B: Cross-border links with NBFIs from a bank nationality perspective	71
Conclusion.....	71
BIS statistics: charts	A1

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		

Markets rise despite subdued economic recovery

Financial markets recorded steady gains during the period under review,¹ after the acute stress in March. The rebound in valuations was underpinned by supportive monetary and fiscal policy, particularly in some advanced economies (AEs), as well as evidence that the plunge in economic activity had been arrested. Yet the economic upturn remained incomplete and fragile. Consensus forecasts indicated that a return to pre-crisis trend growth rates was unlikely. This raised questions about whether risky asset prices had disconnected from the underlying economic outlook.

There were clear signs of historically high valuations in equity and corporate credit markets. US and Chinese stock indices extended their April and May gains, surpassing in August the lofty early-year levels. In other equity markets, the upswing was more moderate. And the gains were restricted to a limited number of companies. Amid some recent volatility, technology and health care stocks globally outperformed while energy and financials lagged, possibly reflecting structural changes induced by the pandemic. In credit markets, spreads narrowed to long-term historical levels, despite evidence of deteriorating credit quality. Heavy issuance across the rating spectrum, especially in investment grade, though to a considerable extent precautionary in nature, added to the heavily indebted capital structure of many firms.

Central banks largely maintained their policy stance during the period under review. In late August, the Federal Reserve unveiled its new monetary policy framework, which market participants interpreted as heralding a more prolonged period of accommodation. Over the review period, interest rate levels and volatility compressed further, providing material support to risky asset prices. As inflation break-evens returned to pre-pandemic levels, real yields in AEs delved further into negative territory. In emerging market economies (EMEs), government bond yields retraced the March spike, despite a limited recovery in portfolio inflows.

In this context, a confluence of factors contributed to a depreciation of the US dollar, particularly vis-à-vis AE currencies. Notably, the rapid fall in US interest rates eroded the yield advantage of dollar assets. The dollar depreciated most sharply against the euro as market sentiment towards the common currency was buoyed by a more cohesive policymaking environment in the euro area. Overall, EME currencies remained range-bound, on the back of global investors' lukewarm appetite for local currency assets.

¹ 12 June to 7 September 2020.

Key takeaways

- Risky assets rose further despite the subdued economic outlook, raising concerns about a disconnection from economic prospects.
- Real yields in advanced economies fell deeper into negative territory as measures of inflation compensation returned to pre-pandemic levels.
- The dollar declined versus its advanced economy peers but was mixed against emerging market economy (EME) currencies amid lukewarm appetite for EME bonds and equities.

Stretched valuations in the aftermath of the Covid-19 outbreak

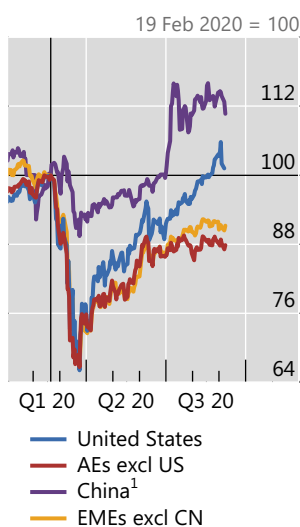
Financial markets recorded further gains during the review period, despite the challenging macroeconomic outlook. A divergence emerged between, on the one hand, elevated stock valuations and tightening credit spreads and, on the other, the reality of an economic recovery that looked incomplete and fragile. While investors did differentiate across sectors, rewarding technology stocks in particular, they seemed to be comforted overall by a stream of economic indicators that turned out better than feared. An accommodating monetary policy stance and news about new fiscal programmes in some jurisdictions also provided critical support for asset prices.

Stock markets overall saw a notable rise between July and early September. After recording strong returns in April and May, equity prices moved largely sideways in June but resumed their ascent thereafter. The gains were largest in the United States and China, whose main equity benchmarks by August had surpassed their pre-pandemic valuations, which had already carried signs of overheating (Graph 1, first panel). While other AE and EME stock indices recouped much of their March losses, they still remained some 10% below previous highs. A sell-off at the end of the review period cut some of the early gains, particularly in the technology sector.

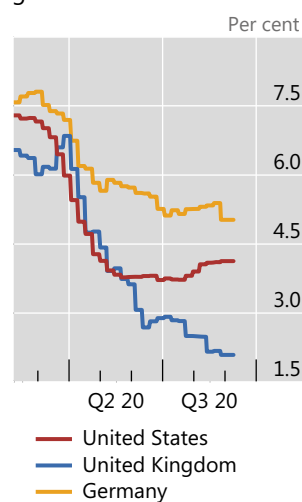
The evolution of aggregate valuations appeared to be somewhat at odds with the general economic outlook. The stream of macroeconomic news during the period was only moderately positive. Indices of economic surprises did turn increasingly positive, in particular as regards labour markets, manufacturing and investor sentiment. That said, despite some upward revisions, growth forecasts for the global economy remained generally tepid, anticipating that recent GDP losses would not be recouped before the end of 2021. Furthermore, corporate earnings expectations were revised downwards, sometimes significantly, in some of the largest AE markets (Graph 1, second panel).

That said, the bounceback rally in equity markets was highly heterogeneous at the sectoral, and even company, level. In the United States, for instance, less than half of the stocks included in the S&P 500 index had surpassed their February prices before the sell-off started. By that time, the top six technology firms had exceeded their mid-February prices by about 40%. Meanwhile, the rest of the index did not catch up, despite its components increasing by more than 50% from their deep trough (Graph 1, third panel).

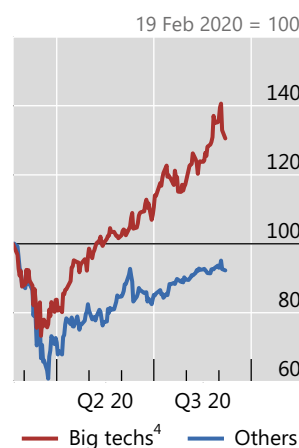
Stocks make up March losses...



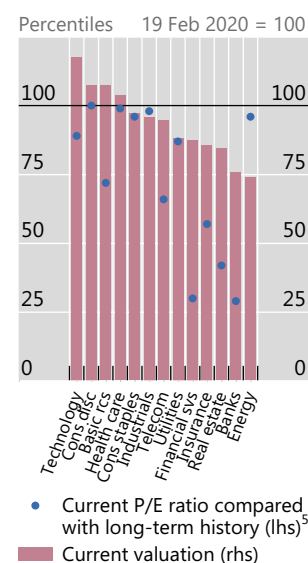
...despite downgraded expectations of EPS growth²



Most S&P 500 companies' equity prices have yet to recover³



Sectoral performance diverges



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

The vertical line in the left-hand panel indicates 19 February 2020 (S&P 500 pre-crisis peak).

¹ Shanghai composite equity index. ² Cumulative average growth rate of earnings per share (EPS), calculated between realised end-2019 and estimated end-2023. ³ S&P 500 constituents as of 18 August 2020, simple averages. ⁴ Amazon, Apple, Facebook, Google, Microsoft and Netflix. ⁵ Latest observation as percentile of long-term historical distribution, 1973–current.

Sources: Bloomberg; Datastream; Refinitiv; BIS calculations.

Investors' exuberant sentiment about specific stocks in the technology sector is likely to have fed on itself. Bets that the rally was set to continue led to heavy long positioning in call options. In such transactions, dealers typically seek to hedge their positions by purchasing the underlying stock, which boosts its price and validates the initial bets. As such self-fulfilling mechanisms also work in the downward direction, they tend to be destabilising.

Globally, the distribution of valuation changes across sectors was consistent with the uneven implications of Covid-19. Gains were stronger in sectors that would benefit more from the structural economic changes that the pandemic may induce – such as technology and health care. Highly cyclical sectors – such as basic materials and consumer discretionary – also outperformed, hinting at investors' belief in a swift recovery of the global economy (Graph 1, fourth panel, bars). In contrast, the stocks of financial, real estate and energy corporates lagged behind, as investors factored in the challenges ahead. For the banking sector in particular, the questions relate to chronically low profitability and the accumulation of assets of uncertain credit quality (Box A). In the case of real estate and oil, the concerns stem from the vast uncertainty about the shape of future demand. That said, confirming overall frothiness despite sectoral differentiation, most sector valuations remained stretched, sitting near the top of the historical distribution of price/earnings ratios (fourth panel, dots).

In this risk-on environment, corporate credit spreads tightened further, also suggesting some disconnection from underlying risks. During the review period, all spreads saw material drops, particularly for US high-yield credit (Graph 2, left-hand panel). Overall, the spreads on both investment grade (IG) and high-yield (HY) credit

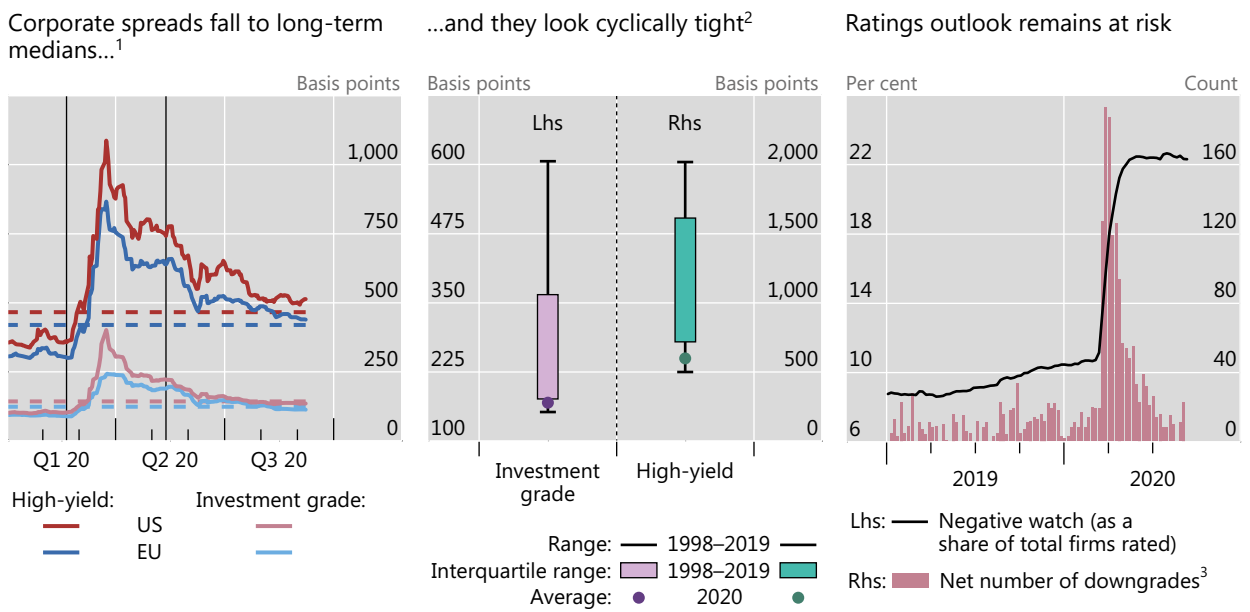
approached their respective long-term levels, on the back of direct and indirect policy support.

Similarly to aggregate stock market patterns, credit spreads looked remarkably tight when contrasted with subdued expectations for the real economy. Lower global activity means lower revenues and cash flows for firms to service their debts. Yet credit spreads in recent months have compressed to the low end of the historical distribution once the weak expected economic performance is taken into account (Graph 2, centre panel). This has taken place despite a persistent deterioration in issuers' credit quality: the share of firms on negative watch has not declined following the large spike in actual downgrades during Q2 (right-hand panel).

As indicated by credit spreads, credit markets seem to expect that corporate bankruptcy rates will continue to be low, even though this would be at odds with historical experience. Concretely, if historical relationships continued to hold, the 2020 GDP growth forecasts – ranging between –4.5 and –11% – would be consistent with bankruptcies increasing by 20–40% in 2020.² Yet, on the back of public support measures, most economies have witnessed a lower number of bankruptcies since the beginning of the year than over the equivalent period in the previous five years – this despite the pre-pandemic increase in the number of persistently unprofitable firms, so-called “zombies”, which are particularly vulnerable to economic downturns.³

Corporate spreads tighten despite indications of persistently high credit risk

Graph 2



The vertical lines indicate 19 February 2020 (S&P 500 pre-crisis peak) and 12 May 2020 (Fed starts purchasing corporate ETFs). The dashed lines indicate 2005–current medians.

¹ Option-adjusted spreads. ² Calculated on monthly averages of daily spread data, conditional on negative real GDP growth rate over the following two years. The sample includes corporate credit option-adjusted spread for the euro and the US dollar for the period 1998–current. Real GDP growth corresponds to the compounded annual growth rate calculated over the current- and next-year Consensus Economics forecast for real GDP growth. ³ Net downgrades count the number of downgrade actions taken minus the number of upgrade actions, which may include the same entity being downgraded more than once.

Sources: Consensus Economics; ICE BofAML indices; S&P Capital IQ; BIS calculations.

² See R Banerjee, G Cornelli and E Zakrajšek, “The outlook for corporate insolvencies”, mimeo, 2020.

³ For analyses of the factors behind zombie firms' existence and rise, see D Andrews and F Petroulakis, “Breaking the shackles: zombie firms, weak banks and depressed restructuring in Europe”, *OECD*

Banks through Covid-19

Bryan Hardy^①

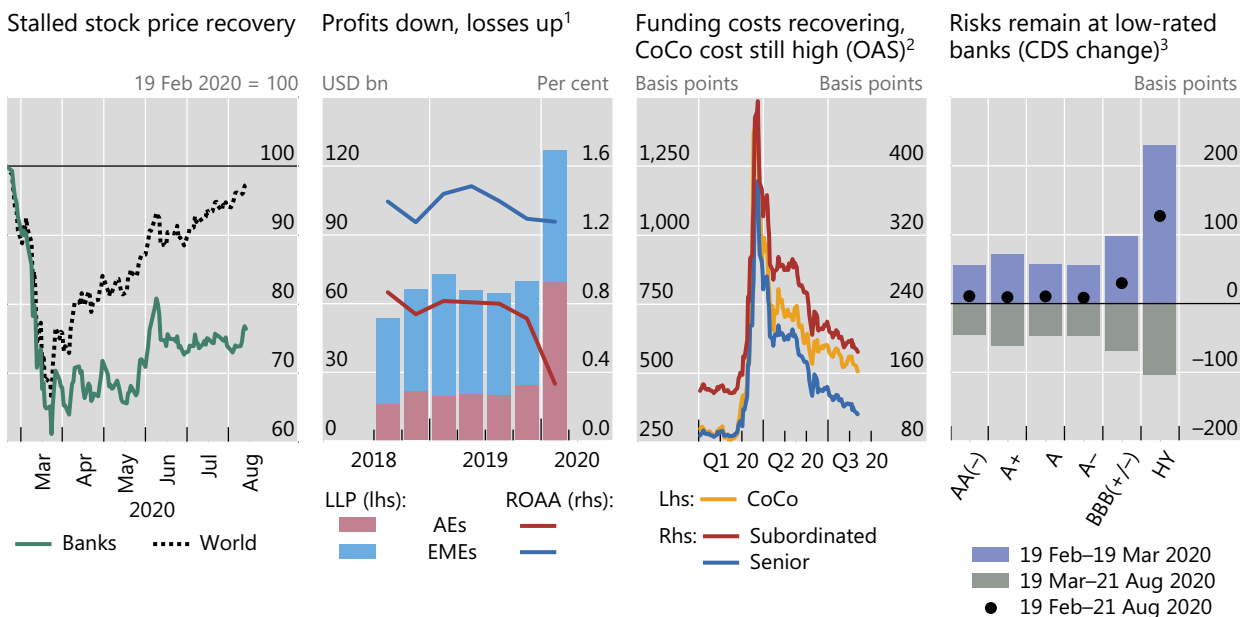
The Covid-19 crisis raised significant challenges for both banks and prudential authorities. There was high uncertainty about how economic activity would be affected and whether banks could weather the potential losses as businesses closed, either temporarily or permanently. Banks have so far proved to be a source of stability, remaining resilient while supporting the economy. Nevertheless, equity valuations remain depressed, credit rating outlooks are largely negative, and pockets of weakness and risk exist.

Bank stock prices plummeted along with those of other industries as the crisis unfolded.^② Thereafter, they largely moved sideways, remaining well below global stock prices and below their own pre-crisis levels (Graph A, first panel). Similarly, price-to-book ratios fell, stabilising around 1 on average for banks outside Europe. Less profitable banks in Europe and Japan had ratios below 1 pre-crisis and saw them deteriorate further thereafter.

Why have equity investors responded so negatively to banks? The sector has seen losses accumulate, with loan loss provisions for advanced economy banks increasing by \$45 billion (182%) between Q4 2019 and Q1 2020 (Graph A, second panel).^③ Consequently, their profits in Q1 2020 fell considerably, adding to the woes of many that were already suffering from low profitability. These trends are likely to have continued in Q2, in part owing to strong monetary policy accommodation that compressed net interest margins. Restrictions on capital payouts have further dampened investors' appetite for bank equity. Global banks have seen a recent spike in so-called level 3 assets, whose opaqueness is likely to be weighing down on valuations.^④

Banks face pressure but remain stable

Graph A



¹ LLP = loan loss provisions (annualised loan impairment charges, divided by 4); ROAA = return on average assets; AEs = AT, BE, CA, CH, DE, DK, ES, FI, FR, GB, IT, JP, NL, NO, NZ and US; EMEs = AR, BR, CN, ID, IN, MX, RU, SG, TR and ZA ² OAS = option-adjusted spreads for the following dollar indices: Markit iBoxx USD Contingent Convertible Liquid Developed Market AT1, iBoxx \$ Banks Subordinated and iBoxx \$ Banks Senior. ³ Ratings as of 10 August 2020, simple average of credit default swap (CDS) changes by group.

Sources: I Aldasoro, I Fender, B Hardy and N Tarashev, "Effects of Covid-19 on the banking sector: the markets assessment", *BIS Bulletin*, no 12, May 2020; Bloomberg; Datastream; Fitch; IHS Markit iBoxx; BIS calculations.

Economics Department Working Papers, no 1433, November 2017; R Banerjee and B Hofmann, "The rise of zombie firms: causes and consequences", *BIS Quarterly Review*, September 2018, pp 67–78; and R Banerjee and B Hofmann, "Corporate zombies: anatomy and life cycle", *BIS Working Papers*, no 882, September 2020.

Despite these stresses, banks have remained resilient so far. Basel regulations implemented since the 2008 crisis obliged banks to increase their capital considerably, with the average Common Equity Tier 1 ratio rising from 10% in Q4 2010 to 14% in Q4 2019. Banks thus entered the current crisis well positioned to absorb losses. Because of this strength, authorities turned to them as part of the solution to the economic downturn rather than as part of the problem. They reduced regulatory buffer requirements in some jurisdictions and, more generally, encouraged the use of liquidity and capital buffers to support the flow of credit.^① Efforts to preserve bank capital during the pandemic, eg capital distribution restrictions, while not welcomed by equity investors, were valued by debt investors for the safety provided. On the back of robust monetary policy support and a generally positive sentiment in debt markets, bank funding costs have largely recovered since late March, in contrast to the flagging stock price (Graph A, third panel). Spreads for Additional Tier 1 instruments, such as contingent convertible bonds (CoCos) used mainly by European banks, were an exception. They are still nearly double their pre-Covid levels, reflecting concerns over possible coupon cancellations from payout restrictions.

That said, vulnerabilities remain. Credit rating outlooks for banks are still generally negative.^② Credit default swap (CDS) spreads for BBB-rated and high-yield banks in particular have remained elevated, on average 30 and 127 basis points above their pre-Covid positions, respectively (Graph A, fourth panel). The concern in CDS markets over lower-rated banks underscores the value of a cautious approach to bank capital amid uncertainty about the evolution of the pandemic and the underlying quality of banks' assets. The full extent of economic damage from the pandemic will play out in the longer term, and losses may take time to fully materialise. These losses could be larger for more opaque assets, whose true value and risk are more uncertain.

^① The views expressed are those of the author and do not necessarily reflect the views of the Bank for International Settlements.
^② See I Aldasoro, I Fender, B Hardy and N Tarashev, "Effects of Covid-19 on the banking sector: the markets assessment", *BIS Bulletin*, no 12, May 2020. ^③ This is despite regulators encouraging banks to take a longer view when accounting for losses from the immediate stress. ^④ Level 3 assets are banks' most illiquid holdings, resulting in little market/external data to guide valuations and leaving banks to value them based on their own internal experience and methodology. See D Griffin and Y Onaran, "Big banks sit on \$250 billion of murkiest trades after Covid", Bloomberg, 19 August 2020. ^⑤ See C Borio, "The prudential response to the Covid-19 crisis", speech on the occasion of the BIS Annual General Meeting, 30 June 2020.

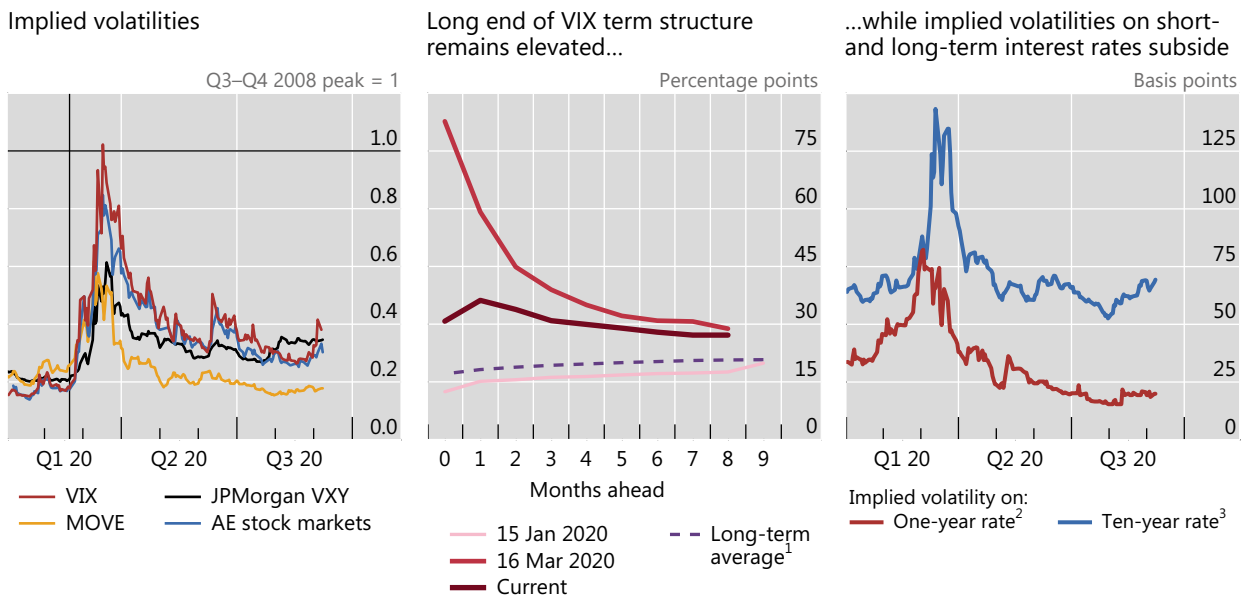
The narrowing of spreads occurred in the face of very strong supply. Corporate issuance through August in all categories outpaced the amounts of the corresponding period during 2019: IG corporates placed \$1.7 trillion of new debt through mid-August (versus \$1.1 trillion in 2019), while HY corporates issued \$322 billion (versus \$200 billion). In fact, the aggregate amounts over those eight months exceeded the total amounts for 2019 as a whole. As net leverage ratios⁴ continued to climb to all-time peaks, corporates' capital structure became increasingly reliant on debt and low interest rates.⁵

At the same time, option markets pointed to some lingering uncertainties among investors. The implied volatilities of several risky assets, including equities and currencies, remained materially above levels seen early in the year (Graph 3, left-hand panel). And while the call-option buying spree could explain some of these developments, it is remarkable that the long end of the VIX term structure was roughly twice the January marks (centre panel), which were close to the historical average.

In contrast, the implied volatilities of interest rates dropped below pre-pandemic levels. For most of the review period, the MOVE index, which captures the implied volatilities of US Treasury securities across the maturity spectrum, fluctuated around its all-time lows (Graph 3, left-hand panel, yellow line). Volatility compression was

⁴ Net leverage is defined as total debt minus cash holdings, as a share of 12-month trailing EBITDA.

⁵ See S Aramonte, "Mind the buybacks, beware of the leverage", *BIS Quarterly Review*, September 2020.



The vertical line indicates 19 February 2020 (S&P 500 pre-crisis peak).

¹ 22 August 2011–current average. ² USD swaption overnight index swap (OIS) 3m–1yr. ³ USD swaption OIS 3m–10yr.

Sources: Bloomberg; BIS calculations.

even stronger at the shorter end: during the review period, the price of insuring short-term interest rate risk had halved from January, oscillating near its historical minimum. Meanwhile, the price of insuring long-term interest rate risk was roughly back at January marks (Graph 3, right-hand panel).⁶ The compression of interest rate levels and volatility helped prop up risk-taking by curtailing funding risk, contributing also to the upswing in risky asset prices (Box B). Subdued volatility in fixed income markets reflected, in part, the impact of central bank actions and communication.

Lower bond yields on supportive policies

The stance of global monetary policy remained supportive as major central banks proceeded along the path set earlier in the year. After extraordinarily large purchases of US Treasury securities in March and April to smooth market functioning, the Federal Reserve could afford to scale down its monthly buying from about \$700 billion to around \$80 billion as market stress eased. In parallel, the ECB actually increased its asset purchases in the sovereign segment, tilting towards non-core securities. As a result, the balance sheet of the Fed and the ECB ballooned to about 30% and 50% of GDP, respectively. Separately, the central banks of some large EMEs cut policy rates, eg Brazil, Indonesia, Malaysia, Mexico and South Africa. Those of Chile and Indonesia announced asset purchase programmes to support market functioning.

Furthermore, in late August Chairman Powell unveiled changes to the Federal Reserve’s monetary policy framework. These included basing policy decisions on the

⁶ The price of insuring short-term (long-term) interest rate risk is reflected in the implied volatility of a three-month option to enter a one-year (10-year) interest rate swap, ie a one-year (10-year) swaption.

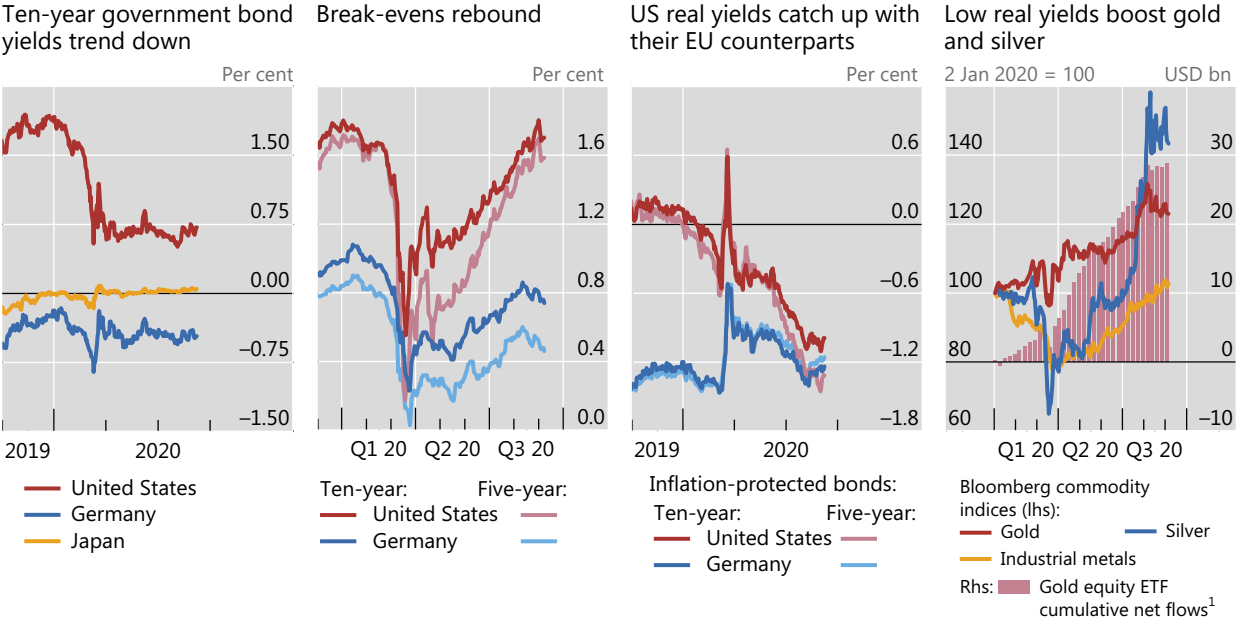
assessment of employment “shortfalls”, instead of deviations from target, and adopting a “flexible form of average inflation targeting”. The changes are intended to help the Fed achieve its dual mandate, in a context where the long-run growth rate and the general level of interest rates have declined, and a strong labour market has not triggered a significant rise in inflation. Given that the announcement was largely anticipated, it generated a limited market reaction: long-term Treasury yields dropped initially but rebounded quickly, ending slightly higher on the day.

Benefiting from the strong policy support, 10-year government bond yields in the United States and Germany trended down for most of the review period (Graph 4, first panel). In Japan, the bond rate remained anchored by yield curve control. Over the year, the decline in long-term US yields was more pronounced than elsewhere, leading to a substantial compression in the differentials vis-à-vis other global core safe assets. Despite the relative convergence at the long end, the US term structure remained steeper, possibly hinting at investors’ different expectations regarding the medium-term growth outlook for the three economies.

Inflation break-evens in major AEs rebounded from their March lows. In the United States, inflation compensation climbed back to pre-pandemic levels across the maturity spectrum (Graph 4, second panel). The increase was sharper at the short end, which caught up with the longer tenors. The rebound in US break-evens was more forceful than in other AEs, in part probably reflecting investors’ expectations of a larger fiscal stimulus in the United States. In addition to the fiscal package approved in March, there have been discussions since mid-year about new fiscal measures, which would reinforce the expansionary fiscal stance.

Real yields drop as inflation break-evens normalise

Graph 4



¹ Sum of net flows to SPDR Gold Trust and iShares Gold Trust, the top two gold ETFs as of 7 September 2020.

Sources: Bloomberg; BIS calculations.

The short and long end of equity prices during the pandemic

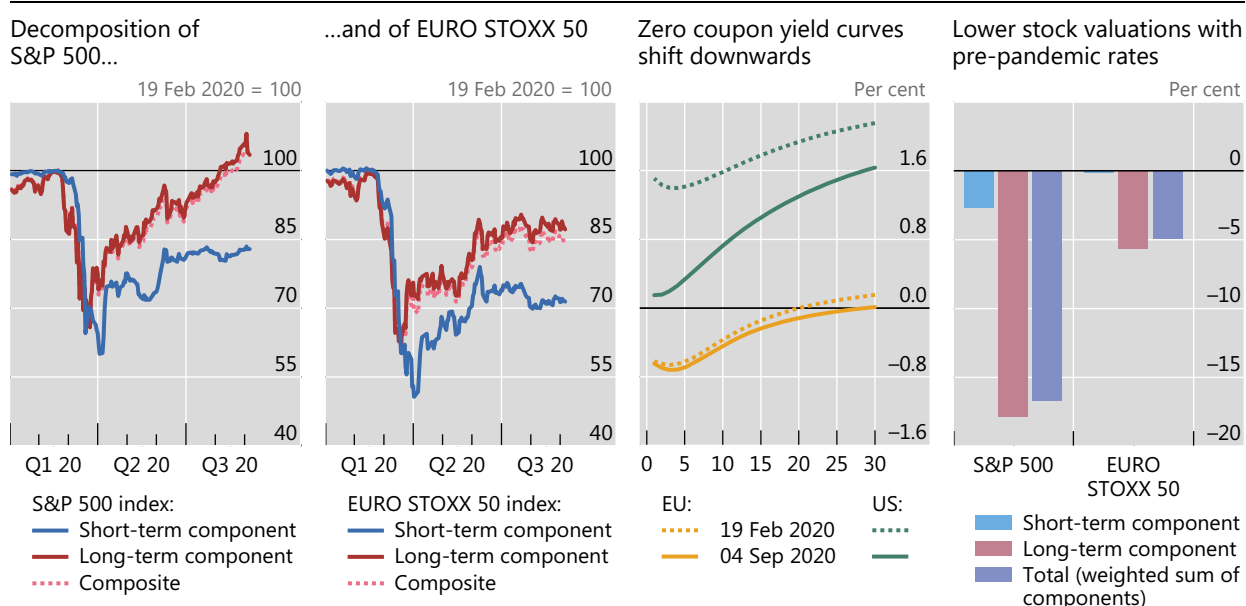
Valuations and the shift in interest rates

Fernando Avalos and Dora Xia

Stock markets price in long-term information, stretching far beyond the short-term cyclical fluctuation in the growth outlook.^① The recent rally in equity prices has attracted attention, among other reasons, for its possible disconnect from the underlying prospects of economies still reeling from the pandemic shock. In this box, we use dividend derivatives to decompose the US and European equity benchmarks into short- and long-term components, corresponding to the value of the short- and long-term dividend stream. Our main goal is to explore whether this dimension, together with depressed interest rates, sheds some light on the apparent disconnection. In line with the subdued short-term economic outlook mentioned above, we find that the short-term components of both indices have seen a limited recovery since March. The benchmarks' strong recent performance is thus predicated on steady gains in their long-term components. Moreover, these gains are related, to a large extent, to the drop in the term structure of interest rates that followed the policy response of central banks to the pandemic shock.

Stock indices pulled up by long-term components

Graph B



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

A stock's price can be seen as the sum of the present value of the stream of all expected future dividend payments.^② Our analysis draws on a variation of such a present value model. The discount rate for each expected future dividend comprises two parts. First, a risk-free rate reflecting the "value of time" and usually taken from the government bond market – we use the term structure of zero coupon yields for the United States and the euro area.^③ Second a risk premium, capturing the compensation that investors require for bearing the uncertainty surrounding future dividends.

We decompose the pricing of the S&P 500 and the EURO STOXX 50 into a short- and a long-term component. The threshold separating them marks the boundary of investors' cyclical considerations about dividend growth. Before that point in time, investors can form relatively detailed expectations about dividend growth, based on their expectations for the broader economy. Beyond that threshold, we assume that they take a long-term view of dividend

growth – a constant rate. For practical reasons, we choose that boundary to be five years, which coincides with the availability of reasonably liquid dividend futures contracts for both indices.^④ That is, contracts on the actual annual dividend payout of the firms included in the respective index. Those dividend futures prices provide a direct market assessment of the present value of those dividend coupons.^⑤

Thus, we construct the short-term component of both the S&P 500 and EURO STOXX 50 by adding up the futures prices of the respective annual dividends for 2020–24. The long-term component is obtained as a residual, as the difference between the full index price and the short-term component. After a parallel downward shift in late February that spanned most of March, the short-term components continued plunging into early April and subsequently displayed a tepid rebound (Graph B, first two panels). This path is consistent with survey data suggesting a subdued recovery of the real economy. In contrast, the long-term components reached a turning point in mid-March, followed by a relatively aggressive rally as the policy response gathered momentum.

The stock market rebound has been accompanied by an overall downward shift of yield curves, especially in the United States. Since the pandemic, the front end of the US zero coupon yield curve has declined by around 140 basis points (Graph B, third panel), while its euro area counterpart has barely moved. Long-term interest rates, as represented by 10-year tenor securities, have fallen by about 80 and 10 basis points in the United States and the euro area, respectively. In addition, long-run steady state interest rates have dropped by about 20 basis points in both.

In this context, a natural question concerns the relative contribution of lower interest rates to the rebound in equity prices. Using our simple model, we address that question empirically by recalculating the September prices of short- and long-term components after replacing the term structure of interest rates prevailing in early September with the term structure prevailing in February, before the outbreak of Covid. In addition, we keep unchanged the dividend growth rate and risk sentiment implicit in August prices. Notice that this *ceteris paribus* exercise does not imply any correlation between stock and bond returns, whose implications are at the centre of a lively debate.^⑥

The results suggest that the drop in interest rates has provided a significant boost to stock prices. Most gains were concentrated in the long-term components, which are naturally more sensitive to discount rate changes than their short-term counterparts. All else equal, in the absence of the fall in interest rates, the long-term components of US and European stock prices would have been roughly 18% and 6% lower than they were on 4 September, respectively (Graph B, fourth panel). The short-term components would have been only slightly lower. The estimated total impact – equal to the weighted average of the short- and long-term components – amounts to close to a half and a fifth of the rebound in the US and euro area equity prices, respectively.

^① See eg I Dew-Becker and S Giglio, “Asset pricing in the frequency domain: theory and empirics,” *The Review of Financial Studies*, vol 29, issue 8, August 2016, pp 2029–68 ^② Buybacks would affect the value of the stock only if they result in an increase in the dividend payout per share for the remaining shares. ^③ The zero coupon yield curves for the United States and the euro area are obtained from the Federal Reserve Board and the ECB, respectively. Both fit a Nelson-Siegel-Svensson model to observed interest rates. ^④ As of the time of writing, the futures contracts for the annual dividends for the period 2020–24 (five annual contracts) had relatively high open interest, suggesting adequate liquidity. ^⑤ See N Gormsen and R Kojien, “Coronavirus: impact on stock prices and growth expectations”, *University of Chicago, Becker Friedman Institute for Economics Working Paper*, March 2020, use dividend futures data to examine investors’ expectations about dividend growth. ^⑥ See eg 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, Zurich, November 2019.

With monetary policy keeping a lid on nominal yields, real yields dropped sharply as break-evens bounced back. In fact, yields on inflation-protected securities (so-called “real yields”) were pushed deep into negative territory, even for long-term securities. Once again, the shift was sharper for US securities. Long-term US real yields sank to all-time troughs in early September (Graph 4, third panel). In fact, short-term US real yields fell below their German equivalents for the first time since 2015. Record low US real yields coincided with the steep appreciation of precious metals, particularly gold and silver, as investors appeared to shift away from negative-yielding assets. Large inflows into gold ETFs supported the rally (fourth panel).

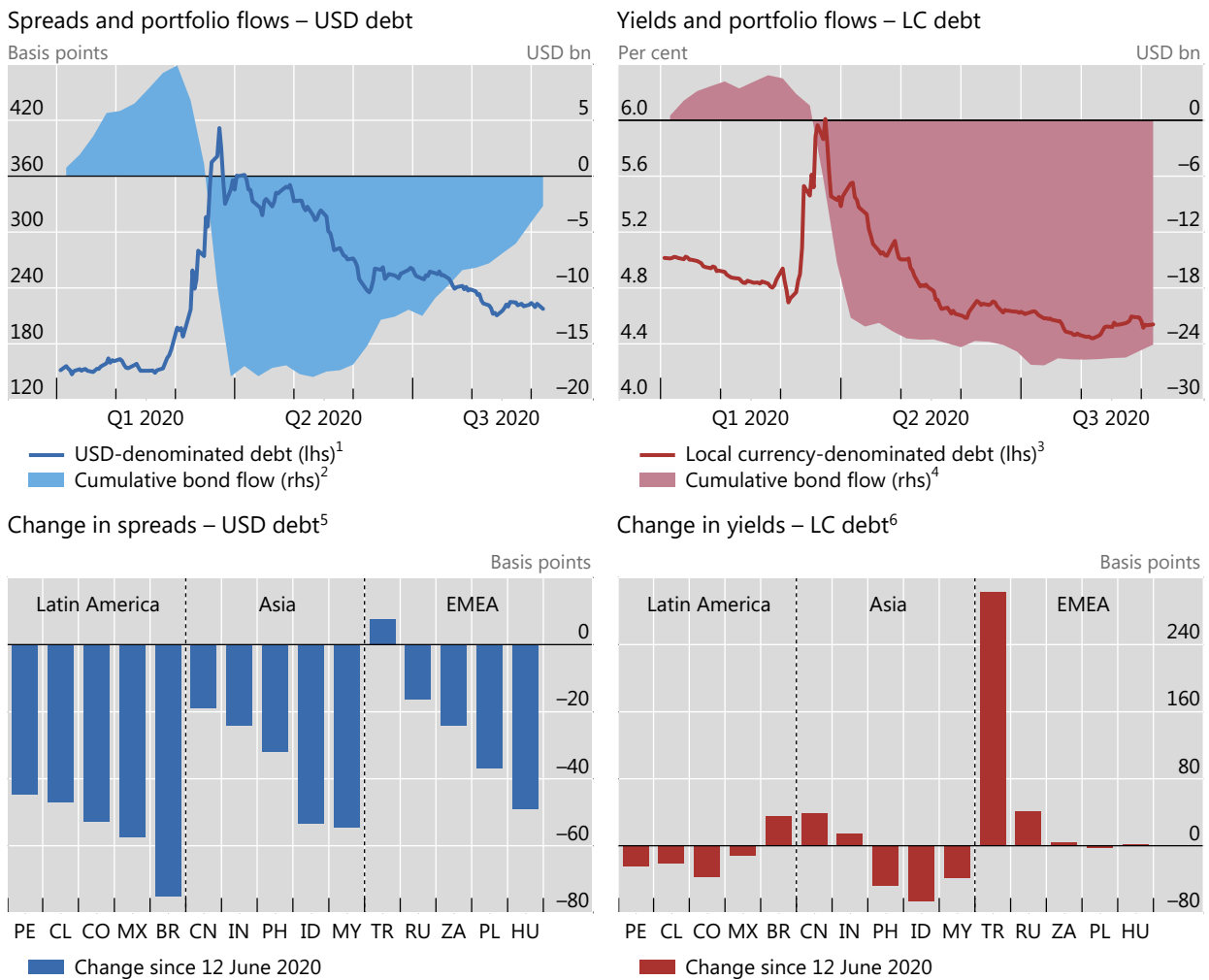
EME sovereign yields continued trending downwards, aided by their own supportive monetary policy. Monetary policy easing has been a significant departure from previous events of stress, when EMEs were often forced to ramp up rates to avoid currency meltdowns. The fall in AE yields contributed to creating monetary policy space for these countries. Overall, spreads on dollar-denominated debt

retrenched towards their long-term averages, even as they remained above the unusually compressed pre-pandemic levels (Graph 5, first panel, line).⁷ Moreover, yields on local currency-denominated bonds hit an all-time low (second panel, line). Turkey was a notable exception to these patterns, as the country came under severe currency pressure after mid-June (bottom panels).

However, the fall in sovereign funding costs was not matched by sizeable portfolio inflows. In the US dollar-denominated segment, the moderate net inflows during the review period partially compensated for the outflows in March (Graph 5, first panel, shaded area). In the local currency segment, in turn, essentially no net inflows took place (second panel, bars).

Funding costs drop for EME sovereigns, despite weak portfolio inflows

Graph 5



LC = local currency; EMEA = Europe, Middle East and Africa.

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. ⁴ Flows to local currency bond funds. ⁵ JPMorgan Chase EMBI Global sub-indices, stripped spreads. ⁶ JPMorgan Chase GBI Global sub-indices, traded yields.

Sources: EPFR; JPMorgan Chase; BIS calculations.

⁷ See "A rude awakening for investors", *BIS Quarterly Review*, March 2020.

Headwinds build up against the US dollar

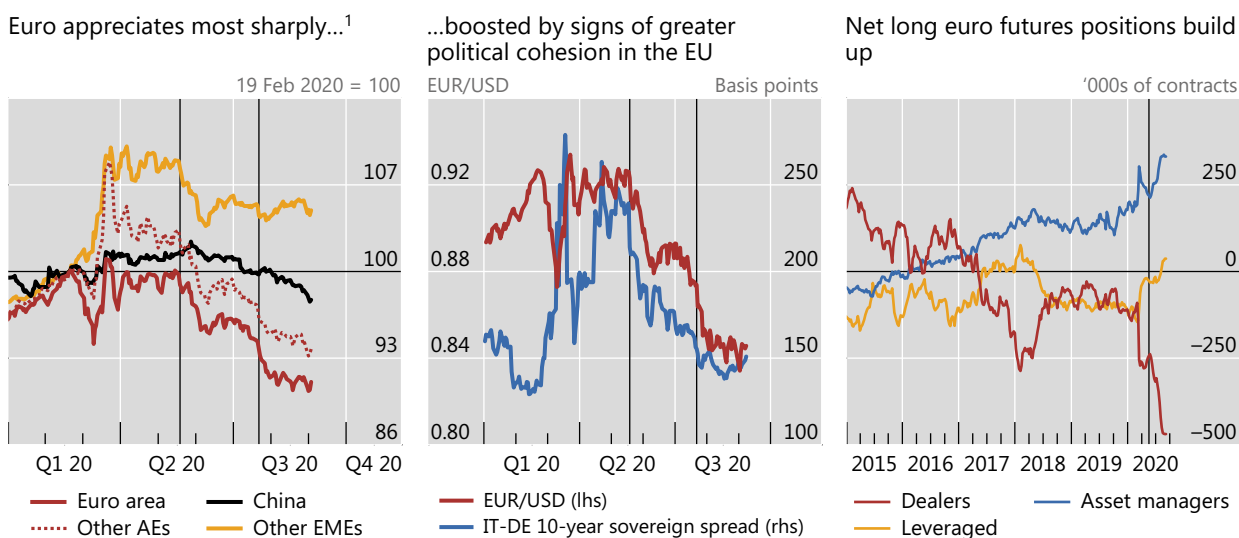
The US dollar depreciated sharply against AE currencies during the period under review. A confluence of factors, including financial and real, appear to have contributed to that outcome. In contrast, EME currencies remained range-bound on average, with a large degree of variation across countries as idiosyncratic factors weighed in.

The erosion of the dollar yield advantage is likely to have put pressure on the currency. On the back of the monetary policy response that followed the pandemic, the nominal “carry” of the dollar vis-à-vis other AE currencies dropped to multi-year lows. This was notably the case with the carry vis-à-vis the euro and the Japanese yen.

The dollar depreciated most vis-à-vis the euro, and somewhat less with respect to the other AE currencies (Graph 6, left-hand panel). The recent strengthening of the euro appears to reflect to a considerable extent investors’ positive response to signs of greater political cohesion in the euro area, which improved sentiment towards the bloc’s currency. The most recent turning point in euro/dollar exchange rate can be traced to mid-May, when Germany and France unveiled their proposal for a European Recovery Fund (ERF). Subsequently, the evolution of the euro/dollar exchange rate broadly tracked the compression of the Italian 10-year sovereign spread with German bunds (centre panel). Euro appreciation gathered pace in late July, when the European Council approved the ERF, broadly in line with the initial proposal.⁸

The dollar depreciates vis-à-vis AE currencies

Graph 6



The vertical lines in the left-hand and centre panels indicate 18 May 2020 (Germany and France propose recovery fund) and 21 July 2020 (European Council adopts conclusions on the recovery plan and multiannual financial framework). The vertical line in the right-hand panel indicates 18 May 2020.

¹ Simple averages. A decrease indicates US dollar depreciation.

Sources: Bloomberg; national data; BIS calculations.

⁸ The agreement authorised the European Commission to borrow in the capital markets on the European Union’s behalf. The ERF will provide grants and loans to member states to fund the recovery from the pandemic, and seems to have been taken by investors as a meaningful first step towards a common EU fiscal policy

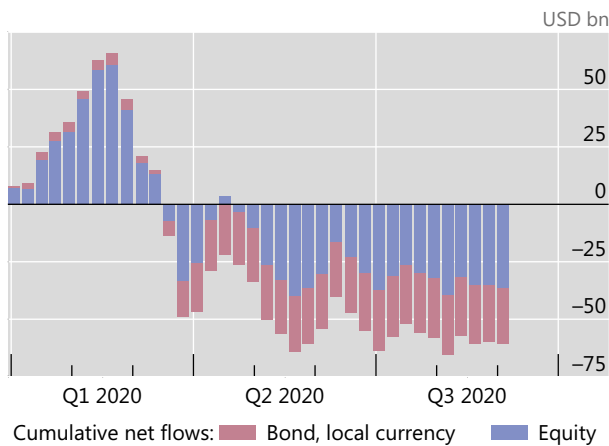
Positioning in the futures markets was not supportive of the dollar. Asset managers had started increasingly taking net long euro positions in December. These positions surged in the second half of May, after the French-German ERF proposal (Graph 6, right-hand panel, blue line). Echoing the behaviour of asset managers, leveraged funds active in futures shifted increasingly towards net long euro positions (yellow line). The net short euro position of currency dealers, who take the opposite side of all other investors, is at the most extreme level since the mid-2000s (red line). Generally speaking, this in itself can give rise to headwinds for the dollar, as dealers need to take a long euro position in the spot market to hedge their futures position.⁹

Despite its weakness against AE currencies, the dollar generally traded sideways against EME currencies. This seemingly reflected the lukewarm appetite for EME assets on the part of investors, mostly international. Portfolio flows to local currency-denominated assets, both equity and fixed income, did not see a bounceback from the sharp March outflows (Graph 7, left-hand panel). Several factors contributed to this unenthusiastic sentiment. On the financial side, the attractiveness of the EME carry trade has significantly diminished as interest rates have declined since the beginning of the pandemic. On the real economy side, currencies may reflect investors' concerns over a still deteriorating health situation in the short run, and the viability of some of these countries' growth models in the longer run. Notably, a post-pandemic backlash against globalisation would damage the prospects of key EME sectors that are part of long global value chains (GVCs). Moreover, traditional manufacturing industries may face persistent headwinds as a result of possible structural changes in the post-pandemic environment.

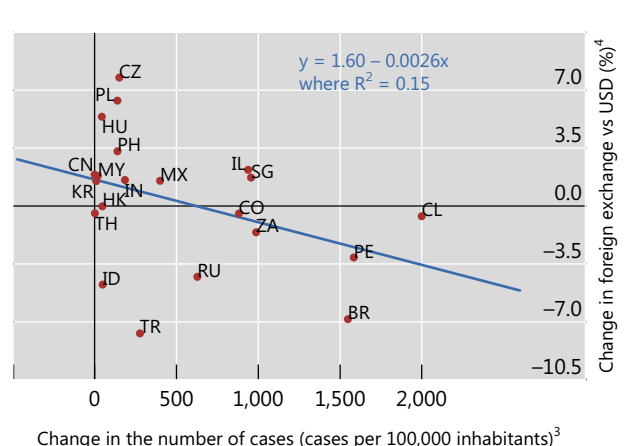
Mixed performance of EME currencies on the back of lukewarm investor appetite

Graph 7

Local currency portfolio flows remain subdued¹



Currencies swayed by the pandemic²



¹ Weekly data to 2 September 2020. ² The estimate of the slope coefficient is significant at the 10% level. ³ Change in the number of cases per 100,000 inhabitants between 1 April and 14 August 2020. ⁴ Change between 12 June and 14 August 2020.

Sources: World Bank; Johns Hopkins University; Bloomberg; EPFR; BIS calculations.

⁹ Futures markets represent only a small fraction of the FX market, but there is readily available data about investors' positioning. Moreover, those data are generally considered a useful barometer of market sentiment.

At the country level, the performance of EME currencies was mixed. That reflects, in part, the evolution of the pandemic (Graph 7, right-hand panel). Countries in Latin America tended to experience sharper depreciations as cases mounted with the arrival of the Southern Hemisphere's winter. Asian EMEs, on the other hand, actually saw modest appreciations, as the pandemic was better contained and currencies are likely to have benefited from China's recovery post-outbreak. In fact, the renminbi steadily appreciated during the review period, irrespective of occasional flare-ups of trade tensions. Eastern European currencies also strengthened on the back of a lower incidence of Covid-19 infections and the euro's pull. In some cases, other idiosyncratic factors appeared to have a larger imprint. The Turkish lira tumbled in August after two months of stability. The drop reflected concerns about depleted currency reserves amid a deteriorating growth outlook and runaway inflation. The Russian rouble slid back after a strong rebound in sync with oil prices in Q2 as geopolitical challenges intensified.

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Cross-border commercial real estate investment in Asia-Pacific¹

Cross-border investment in Asia-Pacific commercial real estate (CRE) has increased since the Great Financial Crisis. Amid low interest rates and ample liquidity, financial investors have sought higher returns from illiquid CRE assets. The search for yield has been particularly evident among investors from outside the Asia-Pacific region, who are almost exclusively portfolio investors and may constitute the marginal investor base. In response to the Covid-19 shock, these investors have withdrawn from certain Asia-Pacific CRE sectors, and some have flocked to regional property markets perceived to be safe. Authorities have introduced various policies to mitigate the effect of the pandemic on CRE markets.

JEL classification: F21, R33, R38.

Real estate is the world's single largest asset class, accounting for 60% of all global assets on some estimates.² Real estate is also widely used as collateral for borrowing from financial institutions. In this way, real estate markets can significantly affect the financial system and economy. For example, losses on commercial real estate (CRE) loans hit the banking systems of Australia and Japan in the early 1990s, and those of some Southeast Asian economies during the Asian financial crisis of 1997–98.

As an international asset class, real estate has gained further importance since the Great Financial Crisis (GFC). Commercial property prices have become more synchronised across countries (CGFS (2020)), while cross-border investment in CRE has surged, both in size and as a share of total real estate investment. One driver is low interest rates, which prompt search-for-yield behaviour on the part of the financial investors who account for most cross-border investment.

We track the evolution of cross-border investment in CRE markets in Asia-Pacific, focusing on the financial stability implications. We show that cross-border investment is dominated by vehicles that issue financial claims on CRE to their investors, as opposed to direct investor purchases of the properties themselves. Cross-border investors also generally take a portfolio approach to CRE investment, which can make

¹ The views expressed in this article are those of the authors and not necessarily those of the Bank for International Settlements. We thank Claudio Borio, Michael Chui, Stijn Claessens, Benoît Mojon, Andreas Schrimpf, Hyun Song Shin, Nikola Tarashev, Christian Upper and Philip Wooldridge for their helpful comments.

² Global assets are here defined as including equity, debt securities and gold. Savills (2016) considers as real estate the entire universe of developed property including residential real estate, high-quality or global commercial real estate and agricultural and forestry land in 2015.

Key takeaways

- Commercial real estate markets in Asia-Pacific offer attractive opportunities to cross-border investors searching for yield.
- Foreign investment vehicles dominate cross-border investment but their activity is also volatile as they are sensitive to global financial conditions and yield differentials.
- During the Covid-19 crisis, it was global financial investors who most drastically cut their activity in these markets, while some also shifted towards asset classes perceived as safe havens in the region.

local CRE markets overly sensitive to cyclical yield differentials and financial conditions outside the host economies. We show that, during the Covid-19 crisis, cross-border financial investors disproportionately reduced their CRE investment in Asia-Pacific, and shifted towards a few markets perceived as safe havens in the region. Hence, while important for international risk-sharing, cross-border financial investment can amplify volatility in CRE markets.³

This article starts by providing definitions and a taxonomy for the analysis of CRE investment, followed by a stocktake of developments in Asia-Pacific CRE markets. It then covers the drivers of cross-border CRE investment. After describing the impact of the Covid-19 pandemic on Asia-Pacific CRE investment, we conclude by discussing policy responses and challenges.

Definition of CRE and classification of investors

Our baseline measure of CRE includes office buildings, retail and industrial spaces and hotels as well as professionally managed residential real estate (RRE) properties, such as condominiums, because the latter are largely acquired for investment purposes.⁴

The main data source is Real Capital Analytics (RCA), which supplies data on property transactions in primary and secondary markets globally.⁵ In particular, RCA tracks both purchases and sales conducted by individual investors, making the detailed transaction record available via the RCA investor module. This record allows the quarterly volume of CRE transactions (a flow measure) to be constructed.

The location and type of entities engaged in CRE transactions constitute two key dimensions of analysis. We classify a CRE investor as a *cross-border investor* if the country location/domicile of the investor and the country location of the property are

³ CRE markets are more volatile than their RRE counterparts, because CRE properties are typically acquired for investment purposes rather than for direct use or operation (CGFS (2020)). Furthermore, long and lumpy construction lags can result in low supply elasticity and large and prolonged mismatches in demand and supply, which could in turn lead to sharp price corrections and depressed markets long after an economic downturn (Monetary Authority of Singapore (2016)). As such, the CRE market typically lags the macroeconomic cycle by several months, according to Berry (2020).

⁴ To be consistent with existing studies of cross-border CRE investment in the region (eg MAS (2016)), we do not include apartments, senior housing and development sites/land in the measure of CRE because these types of property are typically not acquired for financial investment purposes.

⁵ The RCA data for Asia and the Pacific capture transactions in all CRE projects and part of RRE projects including multi-family dwellings and condominium projects with a deal size of greater than USD 5 million for Australia, Hong Kong SAR, Japan, Korea and Singapore and those with a deal size of greater than USD 10 million for Indonesia, the Philippines and Thailand.

different, and as a *domestic investor* if they are the same. We further distinguish between cross-border investment from outside the Asia-Pacific region by *global investors* and cross-border investment from other jurisdictions inside the region by *regional investors*. The distinction is motivated by Portes and Rey (2005), who show that distance matters for equity flows, and by previous findings for banking flows (Remolona and Shim (2015)) and bond flows (Ng et al (2019)) to the effect that global investors cut investment in the Asia-Pacific region in times of financial stress but regional ones increased it.

We also categorise CRE investors according to two dimensions of their business model: whether their main objective is business use or financial return; and whether they buy properties directly or invest in financial claims on them. Table 1 shows the three resulting categories: (i) *direct real investors* (henceforth “real investors”), such as property developers, operators and users, who also tend to have a long-term horizon and local market knowledge; (ii) *direct financial investors*, such as sovereign wealth funds and high net worth individuals, who buy property for investment purposes (such as rental income), but are direct, long-term owners of the specific property itself; and (iii) *financial intermediaries* for indirect financial investors, such as property funds and real estate investment trusts (REITs). Intermediaries issue financial claims on CRE which are then held by indirect financial investors. Note that we do not observe the indirect investors who purchase financial claims, but only the transactions by the intermediaries investing on their behalf.

The financing model of intermediaries catering to indirect financial investors gives rise to funding risks, which may be relevant to financial stability. Some intermediaries are *less subject to funding risk* because they do not engage in liquidity or maturity transformation (eg insurance companies and pension funds) and thus can afford a long-term investment horizon. By contrast, other intermediaries, such as banks, finance companies, investment funds, REITs and investment managers, are *more subject to funding risk* because they offer redemption terms to investors that are shorter than those of the underlying assets, and hence engage in some form of liquidity or maturity transformation. As a consequence, they could be pressured to sell properties when financial market volatility rises or when investors redeem their stakes in the funds, thereby introducing procyclical behaviour (see eg Shek et al (2015)). For example, open-ended funds that invest in CRE promise daily liquidity while investing in illiquid assets. Concerns about this type of mismatch could trigger

Classification of commercial real estate (CRE) investors Table 1

Category	Type of entity	Select characteristics
Direct real investors	Developer/owner; real estate operating company	Owner/operator
	Corporate; government; educational; non-profit organisation; religious organisation	Real buyer/user
Direct financial investors	Sovereign wealth fund; high net worth individual; endowment	
Intermediaries for indirect financial investors	Insurance company; pension fund	Less subject to funding risk
	Bank; non-bank financial institution; open-ended fund; listed fund; equity fund; real estate investment trust; investment manager	More subject to funding risk

Source: Real Capital Analytics; authors' elaboration.

redemptions if market sentiment deteriorates.⁶ This would be compounded if funds are debt-financed and unable to roll over their funding. For example, REITs often use debt to finance their acquisitions subject to leverage limits and also expose investors to equity market risk.^{7, 8}

Asia-Pacific CRE markets and cross-border investment

Globally, the value of real estate managed professionally and held for investment purposes, as defined by the MSCI Real Estate Market Size Report, increased by 37% between 2014 and 2019, to \$9.6 trillion.⁹ In the 32 economies with the largest real estate markets, managed real estate assets amount to over 16% of the value of their equity markets. At end-2019, 11 Asia-Pacific economies accounted for \$2.6 trillion (or 27%) of the global stock (Graph 1, left-hand panel). Within Asia-Pacific, professionally managed real estate grew relatively rapidly in China and Japan. In some economies, the value of such real estate relative to GDP is large. For example, in 2019, it reached 103.3% in Hong Kong SAR and 47.3% in Singapore.

Cross-border investment is a significant part of the region's total CRE investment. The four-quarter moving average share of cross-border CRE investment was 36% in Q2 2020, when measured by the flow of acquisitions (Graph 1, centre panel). This is considerably higher than the comparable numbers for RRE, which range within single digits in many Asia-Pacific economies.¹⁰

Intraregional flows amount to approximately half of cross-border CRE flows in Asia-Pacific. In particular, Chinese investors have predominated among foreign property buyers, although their activity appears to have dropped from its peak in a number of markets. Still, investors located in China and Hong Kong SAR account for about half of all new intraregional cross-border CRE acquisitions, and those from Singapore for most of the rest. This largely reflects the roles of Hong Kong SAR and

⁶ Alternatively, funds can suspend redemptions, thereby locking in investors' money. For example, in 2015, Aviva Investors suspended redemptions from its GBP 159 million Asia-Pacific property fund, which invested mainly in prime CRE properties in Sydney and Tokyo. In 2016, seven major UK property funds were forced to suspend redemptions after experiencing more than GBP 1.5 billion in withdrawals around the time of the Brexit referendum. During the Covid-19 crisis, nine UK property funds and their feeder funds suspended trading within just a two-day period on 17–18 March 2020.

⁷ If a pension fund invests in REITs, then that part of indirect financial investment into CRE is considered to be more subject to funding risk than if the pension fund had invested in the properties themselves.

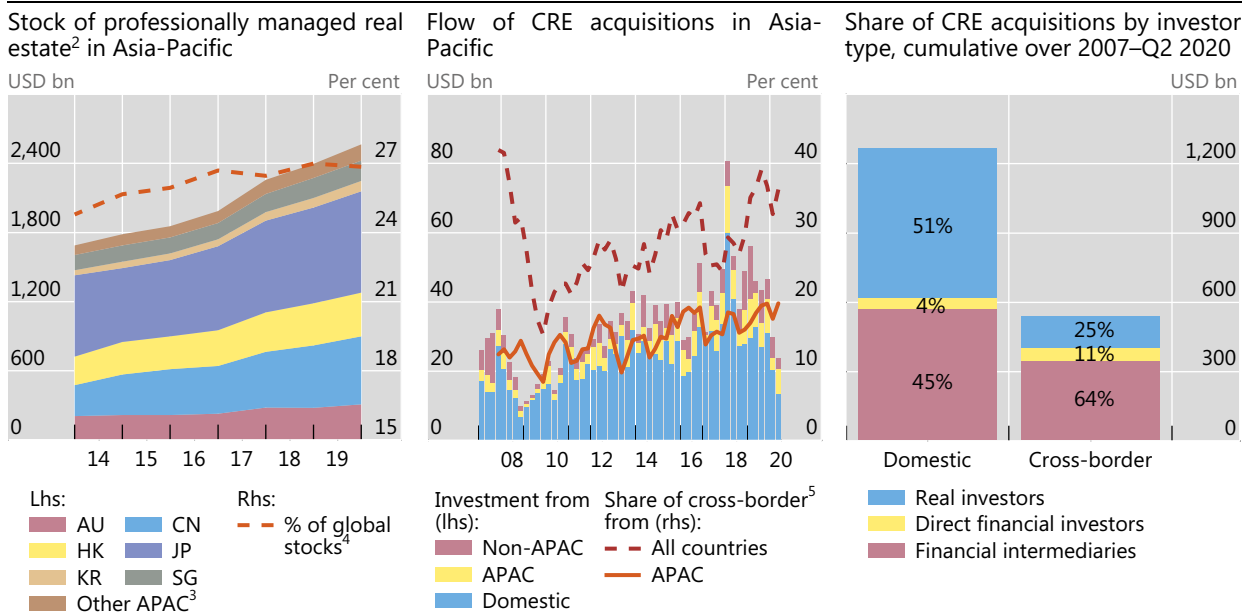
⁸ This is one reason that REITs have back-up credit lines from banks. For example, in response to the Covid-19 pandemic, US REITs drew down \$37 billion from their credit facilities in Q1 2020 according to S&P Global Market Intelligence.

⁹ Professionally managed real estate as defined by MSCI includes CRE and RRE such as condominiums which meet the following criteria: (i) held as investments for the purposes of delivering a mix of income and capital returns; (ii) professionally managed for these purposes, either by the beneficial owners or by third-party management entities; (iii) held by insurance companies, pension funds, sovereign wealth funds, unlisted funds (closed or open-ended), traditional estates and charities, listed funds, and large private landlords whose asset size is greater than \$100 million; and (iv) including leased office, retail, industrial, residential and investment property under development/construction.

¹⁰ For example, the share of overseas buyers in Hong Kong SAR ranged below 2.5% over the past seven years, and barely exceeded 10% during its peak. Similarly, the share of overseas buyers in Singapore's RRE ranged between 5% and 10% during most of the past decade (see CGFS (2020) for details).

Commercial real estate (CRE) markets in Asia-Pacific¹

Graph 1



¹ Asia-Pacific (APAC) includes Australia, China, Chinese Taipei, Hong Kong SAR, India, Indonesia, Japan, Macau SAR, Korea, Malaysia, New Zealand, the Philippines, Singapore, Thailand and Vietnam. Commercial real estate includes office, retail, industrial properties and hotels, but excludes apartments, senior housing and development sites/land. ² The aggregated value of real estate assets directly owned for investment purposes in each economy, ie delivering a mix of income and capital returns, and professionally managed either by the beneficial owners or by third-party management firms. ³ Includes Chinese Taipei, Indonesia, Malaysia, New Zealand and Thailand. ⁴ Thirty-two economies included in MSCI reports. ⁵ Share of cross-border investment over the total investment into Asia-Pacific, four-quarter moving average.

Sources: MSCI Real Estate Market Size Reports (all issues during 2014–19); Bloomberg; Real Capital Analytics; authors' calculations.

Singapore as major financial centres. Most cross-border CRE investment flows out of Singapore originate with entities headquartered there. By contrast, China-headquartered entities accounted for over half of cross-border real estate investment flows out of Hong Kong SAR.¹¹

Financial intermediaries for indirect financial investors accounted for the lion's share of cross-border acquisitions in Asia-Pacific, or 74% in the first half of 2019 (Table 2, third column, upper half). The share was much higher than that in domestic acquisitions, 46% (Table 2, first column). Those intermediaries consist mainly of funds, investment managers and REITs, which are more likely to be exposed to funding liquidity or market liquidity shocks (see Box A for REITs in Asia-Pacific).¹²

Importantly, cross-border investment is quite volatile during crises. For example, the share of cross-border investment in regional CRE markets declined from over 40% to less than 20% during the GFC (Graph 1, centre panel). It then gradually recovered, approaching its pre-GFC levels by 2019. Supplementary data also indicate that the share of cross-border CRE acquisitions in total gross capital flows rose from 2.1% in

¹¹ The estimates are based on the \$350 billion in cross-border real estate investment flows out of Hong Kong SAR by the top 20 largest investors in the five years to end-2019

¹² For example, purchases by pension funds and insurance companies accounted for just 6.5% of cross-border CRE investment by indirect financial investors in 2019, while non-bank financial intermediaries engaged in some form of liquidity or maturity transformation accounted for a 90% share.

Investor shares in the CRE investment flows to Asia-Pacific

Table 2

Share in <i>all</i> CRE acquisitions in the first half of each year (in per cent)								
Domestic investors		Cross-border investors						
		All		Global investors		Regional investors		
2019	2020	2019	2020	2019	2020	2019	2020	
Real investors	51.7	45.9	24.3	19.3	4.6	4.8	41.1	31.1
Direct financial investors	2.3	1.0	1.9	20.0	0.9	8.5	2.8	29.4
Financial intermediaries	46.0	53.1	73.8	60.7	94.6	86.7	56.0	39.5

Share in <i>portfolio</i> ¹ CRE acquisitions in the first half of each year (in per cent)								
Domestic investors		Cross-border investors						
		All		Global investors		Regional investors		
2019	2020	2019	2020	2019	2020	2019	2020	
Real investors	39.4	40.7	21.3	13.1	0.8	0.0	55.3	25.2
Direct financial investors	0.2	2.0	0.0	31.2	0.0	0.0	0.0	59.8
Financial intermediaries	60.5	57.3	78.7	55.7	99.2	100.0	44.7	14.9

¹ An investor can purchase either a portfolio of individual CRE properties or an individual property.

Sources: Real Capital Analytics; authors' calculations.

2009 to 4.2% in 2018. In the Asia-Pacific region, the top six investors in terms of the cumulative investment volume from 2007 to 2020 are either direct financial investors or financial intermediaries.¹³

Domestic investors, by contrast, include a much higher share of real investors, a 52% share in 2019, compared with a 24% share for cross-border investors. However, real investors are still subject to fluctuations in international funding market conditions. Both domestic and cross-border real investors in CRE markets have increased their reliance on international loan and bond markets. In particular, according to Chui et al (2018), property developers in several Asia-Pacific economies have been shifting away from domestic bank loans and choosing to issue debt securities, often in foreign currency. The latest data on loan and bond financing indeed show the trend continuing until the onset of the Covid-19 crisis (see Box B).

The differences in investor composition between domestic and cross-border CRE acquisitions are magnified when we focus on portfolio deals only. Portfolio CRE acquisitions accounted for 30% of domestic and 46% of cross-border CRE acquisitions in the first half of 2019, while individual property acquisitions accounted for the rest. Intermediation for indirect financial investors made up 79% of all cross-border portfolio investment (Table 2, third column, lower half). Moreover, this slice of the data makes it clear that the global cross-border investors purchasing Asia-Pacific CRE portfolios are almost exclusively financial intermediaries (fifth column).

¹³ Blackstone (US-headquartered equity fund; \$25.6 billion); GIC (Singapore-headquartered sovereign wealth fund, \$24.9 billion); Gaw Capital (Hong Kong SAR-headquartered equity fund, \$17.9 billion); Morgan Stanley (US-headquartered bank, \$17.4 billion); Hulic (Japan-headquartered real estate operating company, \$16.7 billion); and Charter Hall REIT (Australia-headquartered public REIT, \$16.0 billion).

Asia-Pacific regional REIT markets and their role in cross-border investment

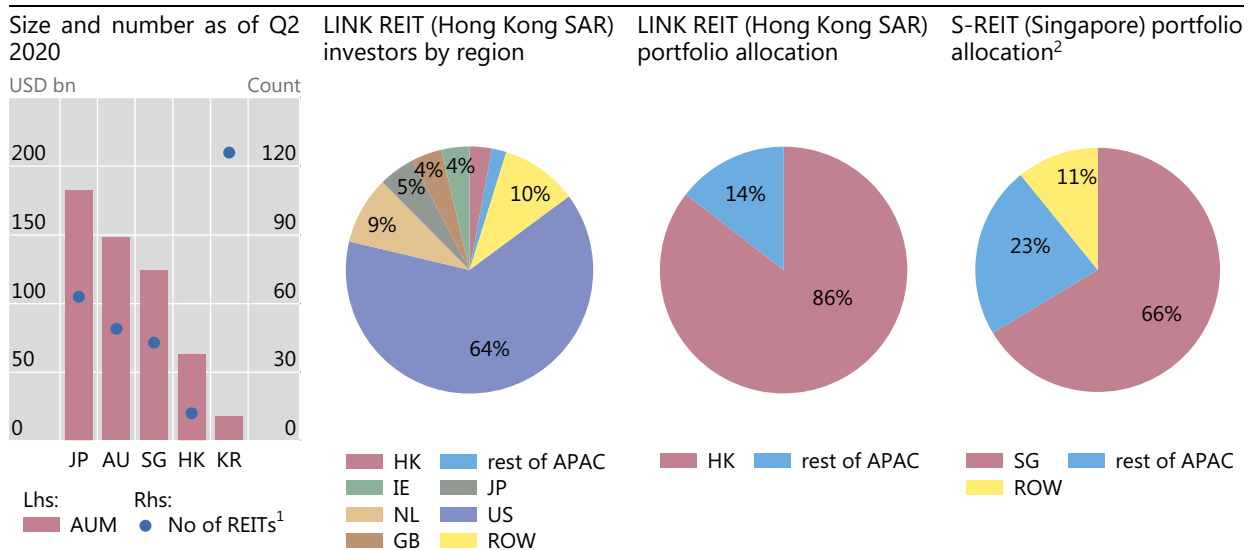
Investors can access Asia-Pacific property markets by investing in real estate investment trust (REIT) shares listed on major stock exchanges or non-listed REITs. Japan has the largest REIT market by market capitalisation, followed by Australia, Singapore, Hong Kong SAR and Korea (Graph A, first panel). Japan's and Australia's REITs tend to focus almost exclusively on domestic properties. By contrast, REITs listed on exchanges in Hong Kong SAR and Singapore make fairly sizeable allocations to other markets in the Asia-Pacific region. Hence, they play an outsized role in cross-border REIT investment.

Investors from outside Hong Kong SAR constitute the majority of the shareholders in the Hong Kong SAR-listed LINK REIT, the largest in the region (second panel). Asset management firms (such as BlackRock, State Street Global Advisors and Vanguard), custodian banks (such as Bank of New York Mellon) and global institutional investors (including pension and sovereign wealth funds) are the top holders.^① Moreover, 14% of LINK REIT portfolio holdings are properties outside Hong Kong SAR (third panel). Singapore also features a burgeoning REIT market (S-REITs) with a considerable allocation to commercial real estate in other jurisdictions in the region – amounting to some 23% of the portfolios (fourth panel).^② This reflects, in part, the preference for Singaporean real estate firms to spin off rental properties into REITs, thus generating capital from REIT offerings that can be redeployed.

Several other jurisdictions are in the process of developing the industry. The Philippines launched a coordinated set of rules on public listing of REITs earlier in 2020, which are also designed, in part, to make REITs more accessible to retail investors. China announced plans in April 2020 to create a public market for REITs, aiming to channel personal savings and private capital into infrastructure projects.

Asia-Pacific REITs and their role in cross-border investment

Graph A



¹ The number of REITs listed in each economy, ie J-REITs, A-REITs, S-REITs and property trusts and H-REITs; for Korea, listed and non-listed REITs are included. ² Based on 42 REITs and property trusts listed in SGX under the REITs category, excluding RHT Health Trust, which has become a cash trust. The shares are calculated as the average shares of all the REITs weighted by their asset size as of November 2019. Some REITs report the share of NCREIF Property Index (NPI) or total income in each region. If share data are unavailable, the portfolio is assumed to be evenly allocated to each region. The total asset size of the REITs in our sample is SGD 143.4 billion as of November 2019.

Sources: ASX; ARES; Bloomberg; LINK REIT Annual Report 2020; REITDATA.com; SGX; authors' calculations.

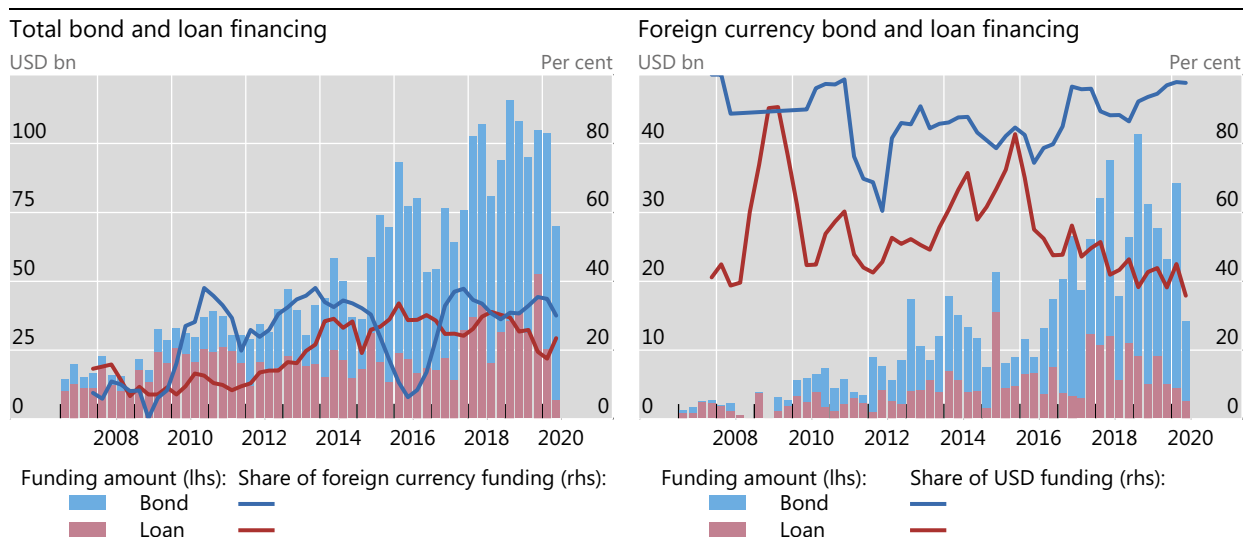
① According to Bloomberg, as of 11 February 2020, the top 20 investment funds held 70% of the outstanding LINK-REIT shares. Of these, asset management firms accounted for 53%, while bank custodians, sovereign wealth funds, pension funds and institutional portfolio managers for the rest. ② As of 2019, only six out of the 43 S-REITs invest solely in CRE in Singapore, while the other S-REITs invest either in Singapore and other jurisdictions or only in other jurisdictions.

Foreign currency funding of real investors in Asia-Pacific commercial real estate

Financial investors in commercial real estate (CRE) markets play a greater role than suggested by their share in cross-border or domestic deals. This is because even domestic real investors, eg property developers, fund a large share of their transactions in international financial markets. FX bank and bond financing by real CRE investors in Asia-Pacific rose to a third of their total funding in 2019, equivalent to \$30 billion per quarter (Graph B, left-hand panel).

Real CRE investors in Asia-Pacific tap the international funding market¹

Graph B



¹ Including the amount of new corporate bond issuances and the size of new loan deals (the amount authorised and available in loan deals) for real estate firms in the Asia-Pacific region.

Sources: Bloomberg; authors' calculations.

Real CRE investors in the Asia-Pacific region obtain most of their FX funding by issuing US dollar-denominated bonds (Graph B, right-hand panel). In particular, regional property developers have found it cheaper to borrow in US dollars in offshore bond markets. However, foreign currency funding can be fragile, as it is frequently of short duration. Indeed, the total amount of offshore US dollar bond issuances by Chinese property developers fell by 8.2% to \$25.8 billion in Q1 2020, as compared with Q1 2019, and further dropped to \$5.5 billion in Q2 2020, representing a year-on-year decrease of 74.8%. The number of new bond issuances also fell by 60.7% in Q2 2020 compared with Q2 2019. Finally, in the first half of 2020, Chinese property developers tended to issue offshore bonds with shorter tenors, suggesting that the drop in issuance was at least partly supply-driven due to tighter international funding conditions.

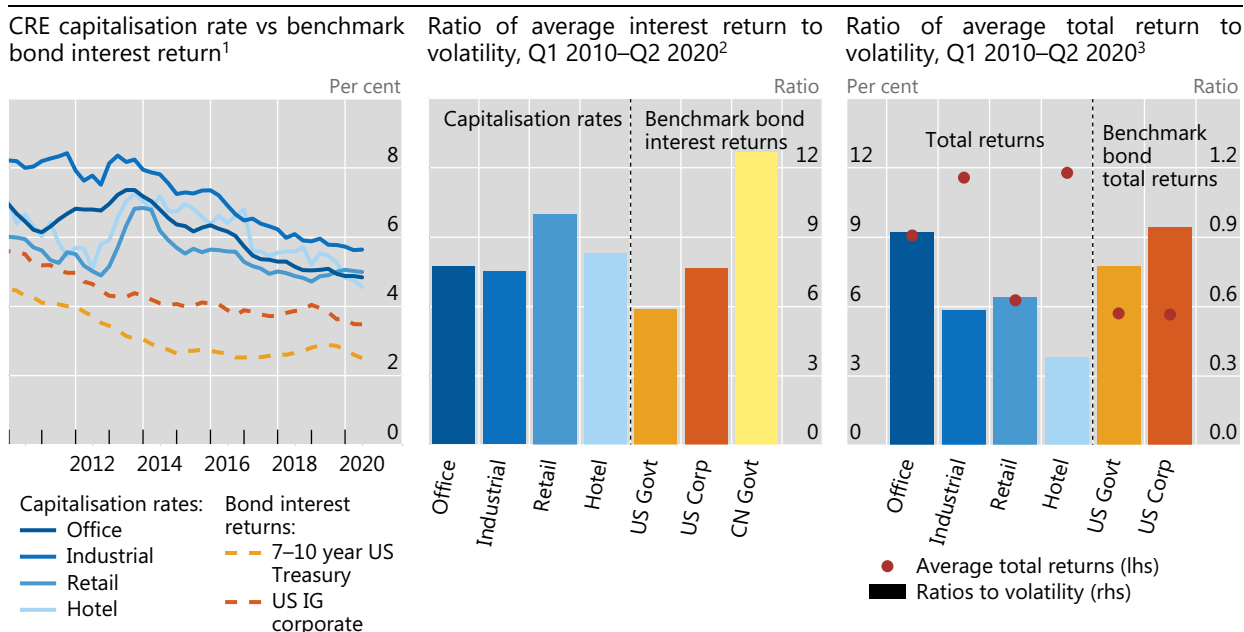
Drivers of cross-border investment

We now turn to a key driver of cross-border investments: the search for yield, ie investors' search for a relatively high and steady income stream, capital gains aside. Indeed, the average capitalisation rates of Asia-Pacific CRE investments (the ratio of net operating income to property value) exceed benchmark bond interest returns (the ratio of the coupon amount to bond value) by a significant margin (Graph 2, left-hand panel). This excess interest return on CRE investments may include any liquidity premium that investors demand for holding illiquid CRE assets.¹⁴ In turn, the low liquidity of CRE assets may be reflected in more volatile CRE price movements. When we adjust for historical volatility, however, we find that interest returns on CRE investments are greater than those on US government bonds, similar to those on US investment grade corporate bonds and smaller than those on Chinese government bonds (Graph 2, centre panel).

Investors who hold CRE claims on financial intermediaries, such as REITs or investment funds, may be interested in total returns, comprising both interest returns and capital gains (or price returns). Indeed, total returns on Asia-Pacific CRE have been higher on average than those on benchmark bonds over the past 10 years (Graph 2, right-hand panel, red dots). However, this has not been the case on a risk-adjusted basis (bars in the right-hand panel).

Relative rates of return on CRE in Asia-Pacific

Graph 2



¹ The capitalisation rate is the ratio of net operating income to property value. ² The benchmark bond interest returns are the coupon returns on seven- to 10-year government bonds in the United States and China and on US investment grade corporate bonds. ³ Total returns for CRE are calculated as the sum of capitalisation rate and price returns, and are the returns including interest returns and capital gains which are directly derived from the total return indices for bonds.

Sources: Bloomberg; ICE BofAML Indices; JPMorgan Chase; Real Capital Analytics; authors' calculations.

¹⁴ There is a long-standing academic literature on the relationship between return and liquidity in equity markets, most notably on the role of the illiquidity premium and stock returns (see a seminal paper by Amihud and Mendelson (1986)) and on the role of liquidity risk in the optimal portfolio choice for investors (see Acharya and Pedersen (2005)).

A regression analysis also suggests that search for yield represents an important driver of financial investors' behaviour. We obtain the results by regressing the share of cross-border investment on a set of standard pull and push factors, including the differential between CRE capitalisation rates and 10-year US Treasury interest returns. Each observation is a jurisdiction-quarter pair. We find that a wider differential between the average capitalisation rate of Asia-Pacific CRE and the 10-year US Treasury interest return is associated with a higher share of cross-border investment in the following quarter (Table 3, column (1)). This result is driven by global investors from outside the region, as revealed by columns (2) and (3). The underlying reason is that financial intermediaries predominate in global cross-border CRE deals, focusing almost exclusively on portfolio deals.

The results also point to the financial channel of exchange rates, whereby a general strengthening of the US dollar is associated with a diminished risk capacity on the part of global investors (see eg Bruno and Shin (2015), Avdjiev et al (2019) and Hofmann et al (2020)). Consistent with this channel, the broad dollar index enters with a highly significant negative coefficient, even after the bilateral dollar exchange rate is controlled for. This suggests that cross-border investment in CRE declines because a stronger US dollar reduces the supply of portfolio capital, in addition to any currency rebalancing motive. That the coefficient on the broad US dollar index returns is more negative in column (2) than in column (3) suggests that intraregional flows are affected more by dollar appreciation than global flows. In other words, Asia-Pacific investors seem more sensitive to fluctuations in dollar funding conditions than are US or European investors.¹⁵

Drivers of the cross-border investment share in Asia-Pacific CRE markets

Table 3

	(1)	(2)	(3)
	Cross-border share	Cross-border share from Asia-Pacific	Cross-border share from outside the region
Capitalisation rate – 10-year US Treasury interest return	2.533***	0.426	2.107***
CRE price growth	0.413	0.251	0.162
Bilateral US dollar exchange rate returns	-0.718***	-0.375	-0.343
Broad US dollar index return	-2.261***	-1.408***	-0.853***
GDP growth	0.929	1.266*	-0.338
Current account/GDP	-24.106	-24.736**	0.630
Acquisition volume growth	4.877***	1.455	3.422***
Constant	28.692***	22.422***	6.270***
Quarter fixed effect	Yes	Yes	Yes
Number of observations	270	270	270
R-squared	0.287	0.244	0.271

***/**/* indicates statistical significance at the 1/5/10% level, respectively; based on panel-corrected standard errors. Regression analysis uses a sample of observations in Australia, Hong Kong SAR, Japan, Korea, New Zealand and Singapore from Q1 2008 to Q1 2020. The explanatory variables other than acquisition volume growth are one-quarter lagged. The explanatory variables other than the broad US dollar return refer to Asia-Pacific economies as recipients of cross-border investment.

Sources: IMF; Bloomberg; Real Capital Analytics; BIS; authors' calculations.

¹⁵ There is also some evidence (albeit weak) that bilateral exchange rates affect the share of cross-border investors in CRE acquisitions. A negative coefficient on lagged bilateral US dollar exchange rate returns suggests that a local currency appreciation against the US dollar increases the cross-border share of CRE investment. This could be attributed to portfolio rebalancing effects that aim to

Finally, regression results indicate that foreign investors play a larger role in higher acquisition volumes. This is reflected in the positive coefficient on the total acquisition volume growth (columns (1) and (3)). This result suggests that cross-border investors constitute the marginal investor base in a similar manner to the long-standing results for the role of cross-border banking (Borio et al (2011)).

Developments during Covid-19

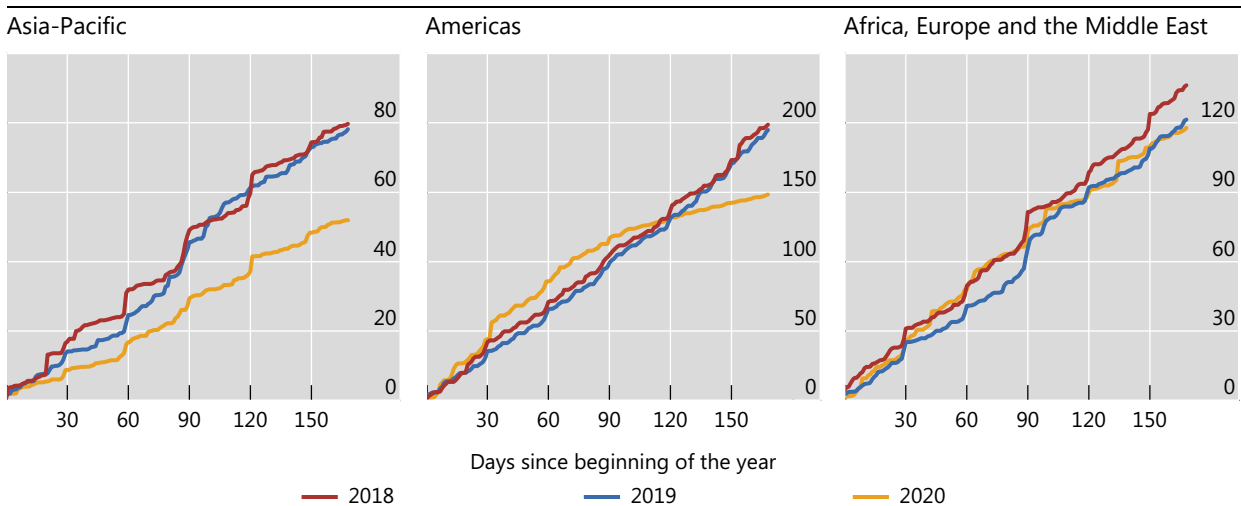
The Covid-19 shock exposed many of the CRE sector’s vulnerabilities. Its impact on CRE investment has been more immediate than that of previous downturns due to the unprecedented scale of the economic contraction. CRE purchases by financial investors also slowed due to increased uncertainty, as the lack of transactions made it difficult to ascertain true property values. Therefore, financial intermediaries investing cross-border on behalf of indirect financial investors disproportionately reduced their activity in regional CRE markets during the pandemic. This undercut the price of market-traded liquid claims on CRE properties, eg REIT shares, suggesting that investors saw a deterioration in the fundamental value of CRE property (BIS (2020)).

Asia-Pacific was the first region to experience the spread of Covid-19, and therefore felt its economic effects early in the year. The cumulative volume of Asia-Pacific CRE acquisitions over the first 170 days of 2020 was only around 65% of the corresponding volumes in either of the two previous years (Graph 3, left-hand panel). By contrast, the acquisition volume in the Americas was robust well into the first quarter of 2020, but has slowed rapidly thereafter, to reach a level about 25% lower over 170 days into 2020 than a year ago, as the pandemic spread to the continent (centre panel). Acquisition volumes in countries in Africa, Europe and the Middle East

Cumulative acquisition volume in commercial real estate markets in 2020

In billions of US dollars

Graph 3



Source: Real Capital Analytics.

keep constant portfolio shares in currencies. Portfolio rebalancing by unhedged global equity portfolio investors can also explain the negative relationship between equity market excess returns in local currency and FX returns (Hau and Rey (2006)).

have slowed only modestly since March 2020, thanks to some large deals (right-hand panel).

Cross-border investors may be particularly flighty when they face a large global shock, such as the Covid-19 pandemic. It is then that their impact as marginal investors makes itself felt. In fact, the higher the share of cross-border investment at end-2019, the greater the contraction in total CRE acquisition volumes over the first half of 2020 (Graph 4, left-hand panel).

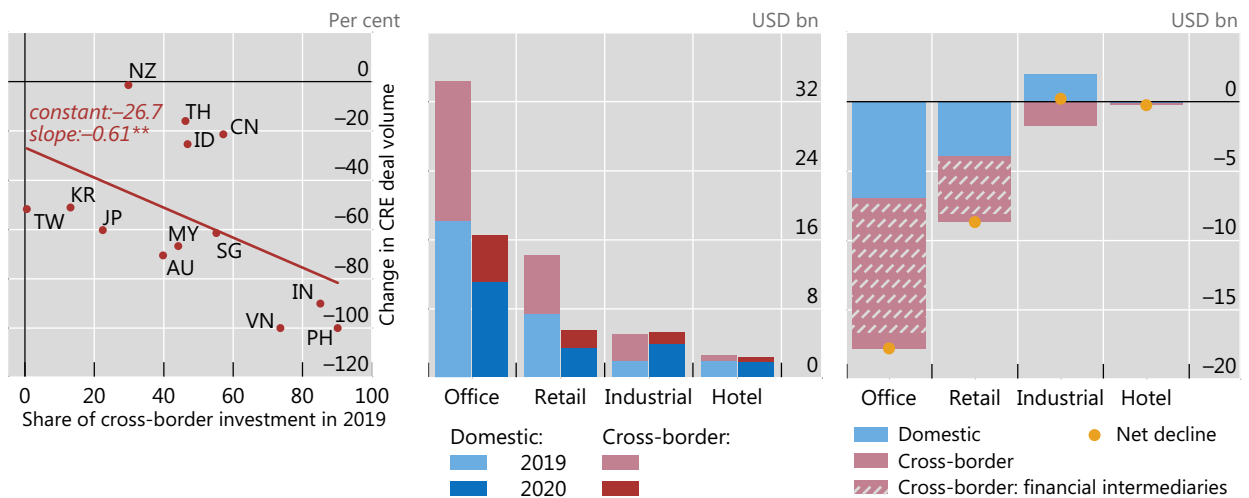
Cross-border financial intermediaries posted the largest decline in activity as the Covid-19 crisis reverberated through the region (Table 2, third and fourth columns, upper half). Their share in overall acquisitions declined from 74% to 61% between the first half of 2019 and the first half of 2020. The corresponding dollar amounts were \$29 billion and \$18 billion, respectively. By contrast, the share of direct financial investors in cross-border acquisitions increased from 2% to 20%, suggesting that they may be playing a stabilising role during market downturns. In terms of dollar amounts, their acquisitions increased from \$0.6 billion in the first half of 2019 to \$3 billion in the first half of 2020.

There are also notable differences in the behaviour of global cross-border financial investors, as compared with regional ones. This probably reflects the much larger role of financial intermediaries in the global category, compared with regional investors, who often buy the property directly (Table 2, fifth to eighth columns, upper half). As such, the pullback by global financial intermediaries outpaced the drop in the total volume of Asia-Pacific CRE acquisitions in the first half of 2020 from a year earlier. By contrast, regional investors reduced their investment at a slower pace, even exerting a stabilising influence by increasing their share of CRE portfolio acquisitions.

In terms of property types, office and retail CRE acquisition volumes fell sharply during the pandemic (Graph 4, centre panel). This was driven disproportionately by the pullback of cross-border financial intermediaries that invest in a portfolio of properties on behalf of indirect financial investors (Graph 4, right-hand panel).

CRE investments in Asia-Pacific before and during the Covid-19 pandemic Graph 4

Cross-border investors and changes in the CRE investment volume from Q4 2019 to Q2 2020 Investment in different types of CRE property from Q1 2019 to Q1 2020 Decline in CRE investment by investor type from Q1 2019 to Q1 2020

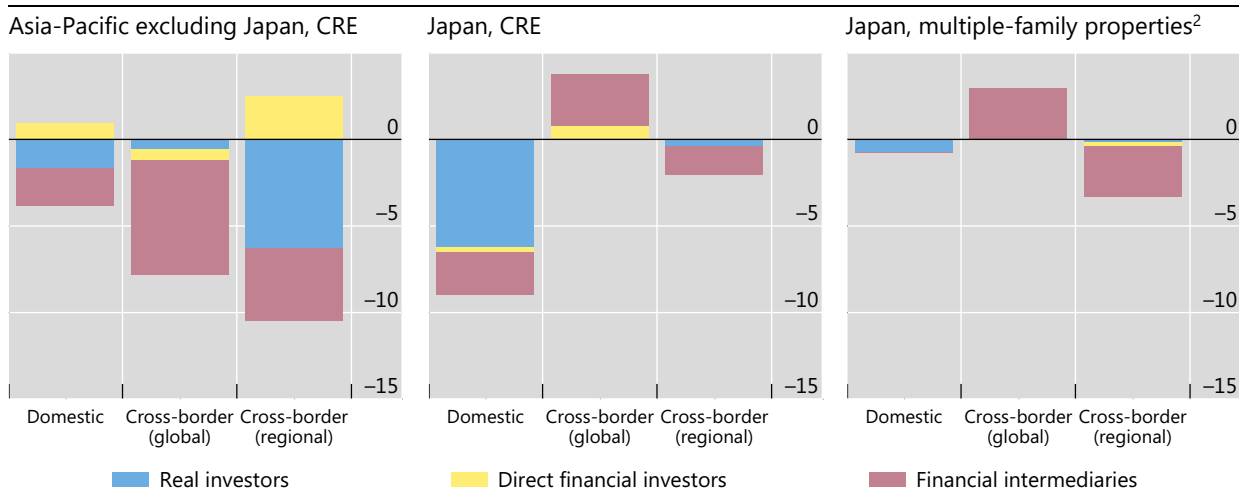


Sources: Real Capital Analytics; authors' calculations.

Cross-border net divestment¹ and safe haven flows during the first half of 2020

H1 2020 compared with H1 2019; in billions of US dollars

Graph 5



¹ Net investment is calculated as the difference between the total value of acquisitions and that of dispositions on commercial real estates. ² Includes apartment and senior housing properties.

Sources: Real Capital Analytics; authors' calculations.

A look at net flows (ie acquisitions minus dispositions) also shows that the search for yield by global financial investors can turn into a run for safety during a crisis. Graph 5 shows the change in net CRE investment by investor type in the first half of 2020 compared with 2019. Intermediaries, particularly for global investors, accounted for most of the decline (Graph 5, left-hand panel). Japan is an exception, as it saw acquisitions by global investors (Graph 5, centre panel), especially from the United States, who had pulled back from the rest of the region. Such a rotation recalls Japan's long-standing role as a safe haven for fixed income investors. In addition, global financial intermediaries increased their net purchases of multi-family dwellings in Japan, which are perceived as safer than CRE (Graph 5, right-hand panel).

Conclusions

This article focuses on vulnerabilities arising from cross-border investment in the Asia-Pacific CRE market. Prudential policy is the ideal tool for addressing such vulnerabilities. In particular, because cross-border CRE investment affects domestic CRE prices, policymakers may need to consider how to dampen the market volatility it generates.¹⁶

Some jurisdictions have placed direct limits on cross-border investments. While these restrictions do not necessarily target financial stability, they may still influence it. For example, Australia imposes quantitative and price restrictions on foreign owners, while other jurisdictions such as China and New Zealand impose restrictions on the types of commercial property that foreigners can buy and own (REIBC (2018)).

¹⁶ The financial stability monitoring of CRE markets is complicated by the fact that there are no officially sanctioned, internationally comparable property price statistics for CRE, as there are for RRE. As a result, central banks typically rely on data from private providers.

The CRE industry has also benefited from policy actions after the Covid-19 outbreak. For instance, in April 2020, the Monetary Authority of Singapore (MAS) announced measures to support individuals facing financial difficulties due to the pandemic, including a deferral of repayment for commercial and industrial property loans. MAS subsequently relaxed its rules on REIT dividends and debt-to-property value ratios. China, in turn, implemented a swift infrastructure investment drive in response to the Covid-19 outbreak, which seems to have helped property developers recover over the past few months. In August 2020, the Hong Kong Monetary Authority (HKMA) relaxed commercial property mortgage rules to boost the CRE market. In particular, the HKMA raised the cap on the loan-to-value ratio on mortgages for non-residential properties from 40% to 50% to make it easier for the CRE sector to obtain bank funding.

Despite rapid policy actions in several major jurisdictions, the Asia-Pacific CRE sector continues to face challenges from the pandemic. Over the medium term, if the pandemic lasts longer than expected and governments end their support for renters and landlords before the economy returns to strong growth, banks and other financial institutions may be hit by CRE loan delinquencies and a slowdown in activity. In addition, loans backed by CRE properties, direct land and construction loans and those in commercial mortgage-backed security pools will add to local banks' losses during market stresses.¹⁷ This puts a premium on advanced planning for the phasing out of support measures in the CRE sector.

Over the longer term, investors may face further difficulties if the pandemic fundamentally changes the demand for CRE (eg by sapping demand for retail, office and hotel space). In particular, this could put pressure on intermediaries catering to indirect financial investors and cross-border CRE investors who are exposed to additional funding and market liquidity risks.

¹⁷ CRE loans have historically posed a greater risk to bank balance sheets than have housing loans (RBA (2010)). Not only are CRE loans concentrated in riskier business activities, such as construction and development, but they also feature a high correlation between the property value as collateral and the rental income flows supporting loan repayments (Shim (2012)). A related aspect is the extent to which foreign investors rely on leverage from local sources. For example, local banks are allowed to lend to overseas buyers in Australia, Hong Kong SAR and Singapore.

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Green bonds and carbon emissions: exploring the case for a rating system at the firm level¹

Green bonds are debt instruments whose proceeds finance projects with various environmental benefits – including climate change mitigation. So far, however, green bond projects have not necessarily translated into comparatively low or falling carbon emissions at the firm level. We discuss the potential benefits of a firm-level rating based on carbon intensity (emissions relative to revenue) to complement existing project-based green labels. We argue that such a rating system could provide a useful signal to investors and encourage firms to reduce their carbon footprint.

JEL classification: Q53, G18, G24.

Interest in green bonds and green finance – commonly defined as the financing of investments that provide environmental benefits (G20 GFSG (2016)) – has been increasing rapidly. Financial instruments that contribute to environmental sustainability have become a priority for many issuers, asset managers and governments alike. In particular, the market for green bonds has been growing fast. Global issuance surpassed \$250 billion in 2019 – about 3.5% of total global bond issuance (\$7.15 trillion).²

Private institutions have developed green bond certifications and standards that grant issuers a green label if individual *projects* are deemed sufficiently in line with the Green Bond Principles (GBPs) of the International Capital Market Association (ICMA), and the use of proceeds can be ascertained.

A key issue for both policymakers and investors is whether existing certifications and standards result in the desired environmental impact (The Economist (2020)). While the GBPs define a broader range of environmental benefits, this special feature focuses on one particular aim: low and decreasing carbon emissions.

¹ The views expressed in this article are those of the authors and not necessarily those of the Bank for International Settlements. We thank Claudio Borio, Pierre Cardon, Stijn Claessens, Ulrike Elsenhuber, Ingo Fender, Jon Frost, Corrinne Ho, Kumar Jegarasasingam, Mike McMorrough, Luiz Pereira, Nikola Tarashev, Evertjan Veenendaal, Philip Wooldridge and Omar Zulaica for helpful comments. We thank Alan Villegas and Yifan Ma for excellent research assistance.

² Global green bond issuance as per the authors' calculations. Total global bond issuance from Dealogic DCM Research.

Key takeaways

- Current labels for green bonds do not necessarily signal that issuers have a lower or decreasing carbon intensity, measured as emissions relative to revenue.
- Rating firms, rather than bonds, on their carbon emissions could provide a useful signal to investors and encourage companies to increase their carbon efficiency.
- Such ratings, which could complement existing labelling systems, can be designed to provide extra incentives for large carbon emitters to help combat climate change.

Policymakers in many countries have committed themselves to achieving the Paris climate goals, including one of the three main objectives: “*making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development*” (United Nations (2015), article 2.1). On the investors’ side, an increasing number of private and public sector entities have explicit mandates for portfolio allocations to support the mitigation of climate change (Bolton et al (2020), Fender et al (2020), FT (2020)).³

The current system of green bond labels does not necessarily guarantee a material reduction in carbon emissions. Indeed, these labels would signal emission reductions only if the relevant projects were to transform the activities of the bond issuer radically enough for its carbon emissions to fall.⁴ But, as we show in the next section, green bond labels are not associated with falling or even comparatively low carbon emissions at the firm level.⁵

One approach to making progress in this respect would be to differentiate firms by their carbon emission outcomes. We explore the desirable properties of a highly stylised rating system that could provide investors, regulators and policymakers with firm-level information in a simplified, yet sufficiently granular way. Firm-level ratings of this nature could complement the current project-based green labels and provide a useful signal to investors.

An increased focus on firm-level carbon emissions is in large part enabled by improved data and disclosure, which are now published by a wide range of companies. Looking directly at emissions data provides a simple, transparent and cost-efficient way to verify whether corporates are on track to achieve any stated carbon emission goals. This could complement other efforts to require green bond issuers to publish standardised impact reports, which could include achieved (or expected) carbon reductions. New types of bonds, such as sustainability-linked bonds, climate-aligned or transition bonds, also focus on outcomes – including carbon emission reductions (CBI (2020), ICMA (2020)). But, the markets for such bonds are still in their infancy.

³ Another frequently cited question is whether standards and certification are consistent and sufficiently stringent across jurisdictions. The proposed EU green bond standard aims to address this problem (EU TEG (2019a)). Another important example is the mapping of taxonomies for two of the largest jurisdictions applying green finance, the European Union and China (EIB and China GFC (2018)).

⁴ Green bond labels can reward ways of contributing to sustainable growth other than reducing carbon emissions. Projects that are green without necessarily reducing carbon emissions include those that promote biodiversity or foster processes that reduce consumption of natural resources, for example.

⁵ In this feature, we focus on the carbon emissions related to activities of the corporate entity where the most disclosure of carbon emissions has occurred. At the level of the sovereign, setting outcome-based standards would require a different approach, which is beyond the scope of this article.

The roadmap to the rest of the feature is as follows. The next section reviews existing green bond standards and presents evidence on the correlation of existing green bond labels with both the level and change in firm-level carbon intensities. Then we explore the desirable properties for a green rating system for firms. The subsequent section provides a stylised example of what a carbon emission-based rating system fulfilling those properties might look like. In the conclusion, we note some unresolved issues and areas for further analysis and consultation.

Green bond issuers and carbon intensities

Current green bond certifications and emerging standards

Most green bond labels adhere to the GBPs. Developed by the private sector, these guidelines identify the key components of green bond issuance as (i) the *use of proceeds* for environmentally sustainable activities; (ii) *a process* for determining project eligibility; (iii) *management of the proceeds* in a transparent fashion that can be tracked and verified; and (iv) *annual reporting* on the use of proceeds (ICMA (2018)). Subsequent green bond certifications, such as the climate bond standards from the Climate Bonds Initiative (2019), provide more specificity within these components, including which investments qualify (eg renewable energy) or the accounting methodology for proceeds.⁶

A major development in setting official standards for green bonds is the proposed EU green bond standard (EU TEG (2019a)), based on the EU sustainable finance taxonomy (EU TEG (2019b)). Like the GBPs, the EU standards are based on the use of proceeds for environmentally beneficial projects. But in contrast to those high-level principles, the proposed EU standard entails detailed eligibility criteria for green projects and calls for official authorisation and supervision of third-party reviewers. In this way, they ensure a high level of consistency and credibility, which will likely spur demand from investors for green bonds compliant with the standard. While the EU standards are envisaged to be voluntary once they are adopted, they are likely to become a de facto requirement for issuers in the European market.

The project-based approach that underlies current green certifications as well as the EU standard has several advantages. It enables a wide range of firms to issue green bonds and incentivises them to initiate green projects. It is a forward-looking approach, as projects can cover investments in technologies that promise environmental benefits in the future. The rapid development of the green bond market shows that the project-based approach has met the demand from investors and issuers. Further, it has raised awareness of sustainable growth among all market players, and demonstrated that investor appetite for climate-related financial instruments is growing.

⁶ China's regulators have drafted for consultation a new green bond catalogue that aims to unify various national green bond and finance standards, further taking into account international standards (People's Bank of China, National Development and Reform Commission, and the China Securities Regulatory Commission (2020)). Certain categories (eg coal mining and oil extraction) have been removed, although some differences remain vis-à-vis the EU sustainable finance classification catalogue (Cui and Liu (2020)). For another example of standards established by a supranational regional body beyond Europe, see ASEAN Capital Markets Forum (2018).

A key question for investors in green bonds and similar instruments is how to verify that the promised environmental benefits are, in fact, delivered (Beschloss and Mashayeki (2019)). Savvy investors can perform due diligence and evaluate the (expected) environmental benefits of the underlying projects. Major investment managers can engage with issuers to provide impact reports – as they increasingly do (Climate Action 100+ (2019)). But not all investors have the capabilities and resources to follow suit.

Further, investors need to clearly understand what a green bond label can and cannot deliver. Investors may mistake green bond issuance as a signal for firms with low or decreasing carbon emissions. Because green labels apply to standalone projects rather than to the firm’s overall activities, projects promising carbon-reductions could be offset by carbon increases of the same firm elsewhere.

Data

A recent and significant development is that measures of carbon emissions have become available for most large firms across the world. Companies themselves calculate emissions on the basis of their economic activities and commonly accepted standards (The GHG (2004)) and disclose these data, or external parties provide estimates based on industry-specific models and companies’ annual financial and other reports. In some jurisdictions (eg the United Kingdom), disclosure of carbon emissions is mandatory for most larger firms. But even in jurisdictions where disclosure is not mandatory, corporates increasingly publish information on their carbon footprint. Third parties, including academic institutions, NGOs and rating agencies, have developed elaborate models for constructing and verifying firms’ carbon emissions.⁷ In this feature, we use annual data from S&P Trucost, whose assessments are available for listed firms that account for around 99% of global market capitalisation (see Box A for more details).

In our initial analysis, we consider both narrower and broader measures of carbon emissions. Carbon emission reporting currently distinguishes between three scopes. Scope 1 emissions cover emissions from owned or controlled resources of a firm. Scope 2 emissions are indirect emissions from the generation of purchased energy (eg electricity). Scope 3 emissions include all other indirect emissions that occur in a firm’s value chain (eg input products, employee travel, distribution etc). The broadest scope of a firm’s emissions is then the sum of Scopes 1, 2 and 3, which we denote as Scopes 1–3.⁸

Our preferred measure of firm “greenness” is carbon intensity, or the ratio of carbon emissions to revenue. Unlike a simple absolute measure of carbon emissions, it measures the firm’s carbon *efficiency*.⁹ A rating system that ranks firms according

⁷ Those include CDP, Four Twenty Seven (an affiliate of Moody’s), S&P Trucost, The 2° Investing Initiative, Transition Pathway Initiative and many others. In addition, a wide range of ESG data providers also cover carbon emissions data.

⁸ However, these scopes do not cover possible reductions in consumers’ carbon footprints (eg producing products with better energy efficiency). Such potential environmental benefits cannot be captured in our analysis.

⁹ High-carbon intensity firms produce by far the highest share of total emissions (see Graph 3, right-hand panel). Some very large firms could theoretically combine significant carbon emissions in some aspect of their business with low carbon intensity (and, in such cases, project-based green ratings would provide them with additional incentives to cut emissions). However, such cases are rare.

to carbon efficiency provides the right incentives for improvement at the firm level – firms that use greener technologies and energy can achieve lower carbon emissions at the same level of economic activity and size. Firms should not be considered greener simply because they produce less. And while revenues can be volatile (say over an economic cycle), as compared with other possible normalising variables such as assets, they do appear to be an excellent proxy for the carbon-producing economic activities of a firm – in particular for the higher emission scopes.¹⁰

We identify labelled green bonds as those classified as such by at least one of four main providers of green bond data: Bloomberg, Climate Bonds Initiative; Dealogic; and Environmental Finance Bond Database. This captures the universe of green bonds available to most investors, although it may underrepresent green bonds issued in China.¹¹

Green bond issuance and carbon emissions

A fact possibly underappreciated by investors is that green bonds do not necessarily emanate from more carbon-efficient firms. Graph 1 depicts the distribution of carbon emission intensities (tonnes of CO₂ per million US dollars of revenue) for a sample of around 16,000 listed firms in 2018 (end-financial year). Around 2% of these firms have issued green bonds.¹² Higher scopes include a wider range of carbon emissions and hence emission intensities must, by construction, be higher.

Naïve investors might expect firms with very high carbon intensities to be disqualified as issuers of green bonds. However, the graph indicates that, for Scope 1 and Scopes 1–2, a greater fraction of green bond issuers have carbon intensity above 100 tonnes of CO₂ per million dollars of revenue. While this is not the case for Scopes 1–3 carbon intensities (right-hand panel), firms with the highest carbon intensity comprise virtually equal shares of green bond issuers and others.

The type of firm matters. The majority of firms with very high carbon intensities across all scopes are power producers. By contrast, financial firms, notably banks, have been the most active users of green bonds and populate the group of least carbon-intensive firms.¹³

¹⁰ For firms in sectors with naturally less carbon-intensive business models (eg financials), revenue fluctuations do not necessarily translate into direct (Scope 1) emissions. For higher emission scopes, however, there is a very strong relationship between revenues and carbon emissions in our sample for all sectors. The correlation coefficient of year-on-year percentage changes in Scopes 1–2 and Scopes 1–3 emissions with year-on-year percentage changes in revenues are 0.8 and 0.95, respectively, in our sample (0.94 and 0.93 for financials). For higher scopes, changes in revenue hardly vary *without* causing changes in emissions. In fact, on average, they translate into greater relative changes in emissions: a 1% year-on-year change in revenues translates into a 1.1% change in Scopes 1–3 emissions on average in our sample (t-stat >800).

¹¹ For more details of the construction of comprehensive green bond issuance data and a discussion of the different types of green bond certification, see Ehlers and Packer (2017).

¹² For better comparability, we restrict the sample of green bond issuers and other firms to 2015–18, as there was no significant green corporate bond issuance before 2015.

¹³ Financial firms are a special case, as their business activities produce relatively few carbon emissions. Their investments, however, may be in carbon emission-intensive industries. But this is not reflected in current carbon emission scopes. A number of large banks and investors have begun to develop standards for financial institutions to better track the climate impact of their lending and investment portfolios (PCAF (2020)). Excluding financials as issuers of green bonds would push the carbon intensity distribution of green bond issuers to the right.

Carbon emissions data and firm disclosure

The Greenhouse Gas Protocol of the World Resource Institute recommends tracking three types of corporate carbon emission: Scope 1, comprising emissions made directly by the firm; Scope 2 emissions, which comprise the emissions of suppliers of energy; and Scope 3 emissions, which include all other emissions made along the value chain (see main article).^①

Scopes 1 and 2 emissions are easier for the firm to track and disclose. As a result, the data cover more firms but with some limitations. From the perspective of climate change, the carbon-related impact of the firm goes well beyond its direct emissions and energy consumption. Companies influence overall emissions by using carbon-intensive inputs in the production process, or by relying on downstream activities such as carbon-intensive transport and distribution.

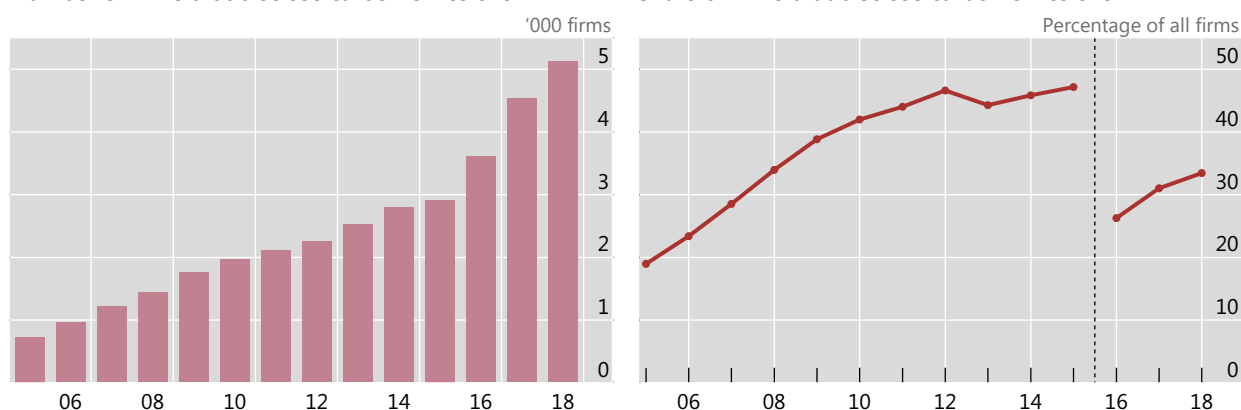
For this study, we obtained measures of carbon emissions at the firm level (across 42 countries) from S&P Trucost. The data are constructed from corporate annual reports and other disclosures, although the provider also uses models recommended by the Greenhouse Gas Protocol to fill in some missing data by estimating the emissions impact of disclosed activities and investments. Measurement difficulties, as well as the potentially incomplete or inconsistent reporting of all elements of Scope 3 emissions, have led researchers, asset managers and others to concentrate mostly on Scopes 1 and 2 emissions (Busch et al (2018)).^② Yet, the verification and estimation models used by our data provider aim to ensure a good level of consistency of Scope 3 emissions across firms (S&P Trucost (2019)). When we use both upstream and downstream Scope 3 emissions data, the time series start in 2017. If the analysis requires a longer time series, we switch to upstream emissions only.

Although Trucost provides carbon emissions measures back as far as 2006, the increasing number of firms they cover over time is testament to the improvement in disclosure over the years. From 730 firms reporting some form of carbon emission in 2006, this number had increased to 1,971 by 2011, 2,916 by 2016, and 5,118 by 2019 (Graph A, left-hand panel). After a one-time downward shift in the series due to a single outsized increase in the overall coverage, the percentage of covered firms has resumed its trend increase (Graph A, right-hand panel).

Increasing corporate disclosure of carbon emissions

Graph A

Number of firms that disclose carbon emissions

Share of firms that disclose carbon emissions¹

¹ Series underwent level shift in 2016 due to an outsized increase in S&P Trucost Limited © Trucost 2020's coverage of non-disclosing firms.

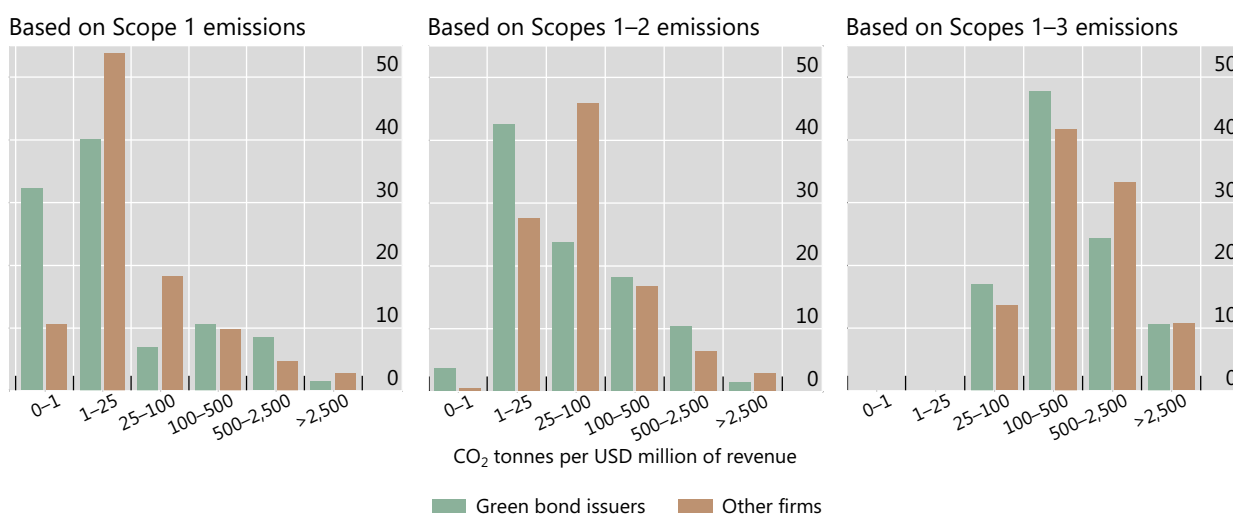
Sources: S&P Trucost Limited © Trucost 2020; authors' calculations.

① There are 15 approved categories of Scope 3 activities (Greenhouse Gas Protocol (2020)). ② Firms often use leeway in what they include in reported Scope 3 emissions. The data used in this feature, however, are constructed to ensure a high degree of consistency across firms. One caveat to the analysis – even when based on the broadest Scope 3 emissions – is that the various carbon emission scopes may not be broad enough to capture the entire environmental benefit (cost), in particular that of a potential reduction (increase) in the carbon footprints of consumers of the firm's products.

Distribution of carbon intensities – green bond issuers compared with other firms

Share of firms, in per cent; financial year 2018

Graph 1



Sources: Bloomberg; Climate Bonds Initiative; Dealogic; Environmental Finance Bond Database; S&P Trucost Limited © Trucost 2020; authors' calculations.

Comparing the carbon intensities of green bond issuers with those of other firms buttresses two important points previously made in Ehlers and Packer (2017). First, even if bond proceeds flow into green projects (eg renewable energy), issuers may be (and often are) heavily engaged in carbon-intensive activities elsewhere (eg coal power plants). Second, the wide range of varying green bond standards allows a very broad church of firms to issue green bonds, each deemed to be green for different reasons.

To assess how far green bonds may contribute to the transition to a low-carbon economy, we examine whether a firm reduces its carbon intensity after issuing green bonds.¹⁴ To achieve the Paris Climate goals, for instance, would imply a sharp reduction in emissions (IPCC (2018)).

Overall, there is no strong evidence that green bond issuance is associated with any reduction in carbon intensities over time *at the firm level*. The left-hand panel of Graph 2 shows the evolution of green bond issuers' carbon intensity before and after issuing their first green bond, both for Scope 1 and Scopes 1–3 emissions (changes in Scopes 1–2 emission intensities are almost identical to those for Scope 1). While carbon intensities fell on average in the two years after issuance, carbon intensities rose afterwards. Around 60% of green bond issuers in our sample show a reduction in Scope 1 carbon intensities after three years; and a fall of only about 30% when looking at broader Scopes 1–3 intensities. The median changes in carbon intensity across firms before and after green bond issuance are minimal. Moreover, as these results are not statistically significant, there is no clear pattern as to whether green bond issuance led to increases or decreases in the carbon intensities of their issuers.¹⁵

¹⁴ This is a simple benchmark; more sophisticated methods of assessing the climate-related impact of green bond issuance would require a full multivariate model to precisely lay out the counterfactual, ie the change in carbon emission intensity had a firm not issued green bonds.

¹⁵ The error bands are very wide, with a single standard error many times the absolute mean values at every horizon.

Comparing changes in carbon intensities of green bond issuers and other firms over a fixed period of time and across sectors (in the three years after 2015) points to a similarly mixed picture (Graph 2, right-hand panel). Sectors with very low average emission intensities, such as the financial sector, offer little scope for material carbon emission reduction. Hence, the difference between green bond issuers and other firms in this sector is bound to be minimal. In some sectors with typically higher carbon intensities, such as industrials and real estate, green bond issuers appear to have achieved lower carbon emissions than firms that did not issue green bonds. However, in the important utilities sector – which includes energy production and distribution – green bond issuers have, on average, achieved smaller reductions in carbon intensity.¹⁶

The results do not imply that projects financed by green bonds did not deliver their promised environmental benefits. They simply indicate that issuing green bonds has not resulted in a significantly lower level or significantly higher reductions in carbon intensity *at the firm level*. What might be the desirable properties of a complementary green rating scheme that could provide additional support to the reduction of carbon emissions? We discuss this next.

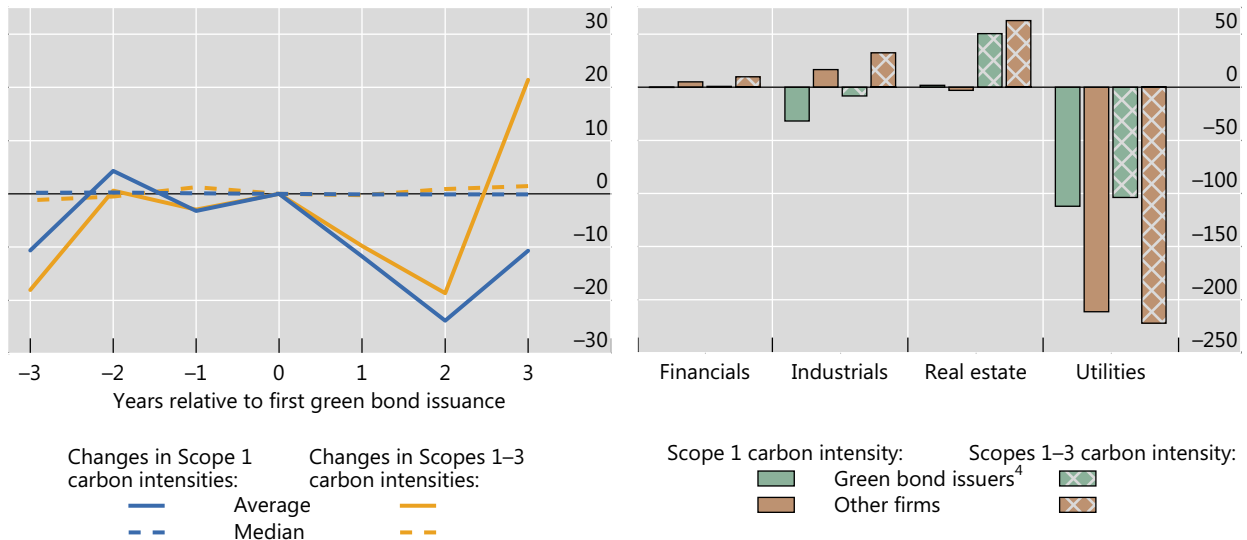
Green bond issuance and changes in issuers' carbon intensity¹

CO₂ tonnes per USD million of revenue

Graph 2

Total change in carbon intensity before and after green bond issuance at t=0²

2015–18 average changes in carbon intensity, by sector³



¹ All firms included, no correction for outliers. As the sample of firms for 2019 was limited, 2019 data are excluded to avoid potential sample bias. ² Based on 2015–18 data. Error bands are not reported as they are too wide to be shown. Changes in Scopes 1–2 carbon intensities are almost identical to those of Scope 1 intensities only. ³ For sectors with more than 10 firms that have issued green bonds. ⁴ Firms that have issued a green bond at least once since 2015.

Sources: Bloomberg; Climate Bonds Initiative; Dealogic; Environmental Finance Bond Database; S&P Trucost Limited © Trucost 2020; authors' calculations.

¹⁶ Several caveats apply. For one, depending on the type of project that green bond proceeds are financing, the environmental benefits may appear only far in the future, beyond the horizon of the current empirical analysis. In addition, other unobserved variables may differ between green and other issuers, confounding the comparison. That said, project-level green bond issuance is not associated with lower firm-level carbon intensity.

Desirable properties of a complementary green rating system

A firm-level green rating system should have three high-level objectives. For one, it should provide additional incentives for the rated companies to contribute to the attainment of climate goals such as those of the Paris Accord. Secondly, it should help investors in their decision-making processes – in particular investors without the resources to do their own “green” due diligence. Finally, the system should allow investors and other stakeholders (eg auditors, regulators and policymakers) to check firms’ improvements and verify that the desired climate mitigation effects are achieved.

Although there is no guarantee that any single rating system can achieve these high-level goals, we argue that there are a number of desirable properties that such a rating system should possess, at a minimum. We organise their discussion under each of the three objectives listed above. We provide some design suggestions to illustrate how a rating system can contribute to these high-level objectives. Obviously, further analysis and practical experience are necessary to ascertain the ability and feasibility of a rating system to deliver the intended results.

Importantly, the rating system that we explore is distinct both from the traditional ratings of creditworthiness as well as current green bond labels. It specifically aims at the CO₂ emission reduction of firms and does not take into account other relevant green objectives such as biodiversity, the mitigation of other greenhouse gases, more efficient water use, or climate adaptation.

The incentives of firms should be aligned with climate goals. We argue that a firm-level rating is better suited to deliver this property than a project-based classification. Indeed, the firm is the decision-making unit when it comes to the carbon footprint of economic activity: that is, the production process, choices of inputs, outputs and means of distribution. Ratings that are directly related to the company’s overall emissions should provide incentives for the firm to obtain a better rating by increasing the carbon efficiency of its production. The additional information also allows policymakers and investors to undertake actions affecting the firm that are more directly aligned with high-level climate goals.

Creating the right incentives crucially depends on choosing the right measures for constructing a rating. As discussed in the data section above, carbon intensity is a single measure that allows firms to show they have improved carbon efficiency at a given level of economic output or firm size. Therefore, rewarding a reduction in carbon intensity is an effective way to reduce firm-level carbon emissions, without incentivising firms to reduce economic activity or split up operations.

Rating buckets (eg similar to credit ratings) make firms easier to compare, and can motivate them to outperform their competitors. Rating buckets (and the achievement of a certain rating level) based on carbon intensity levels, constitute natural yardsticks for comparing firms’ performance in greening their activities (Shleifer (1985)). Assuming a growing preference of investors for “greener” business models, firms that adapt faster will eventually enjoy lower funding costs. Firms in a given sector can aim at improving their rating to show investors, especially the ones whose allocation follows a best-in-class approach, that they are greener than their direct competitors.

Ratings should be on a finer grid for firms with higher carbon intensity. This will provide stronger incentives for the highest emitters to improve. This matters because the distribution of carbon intensity is highly skewed. The firms with the highest carbon intensity are also the highest carbon emitters in absolute terms (Graph 3, right-hand panel). Indeed, the efforts these firms make to reduce their carbon footprint yield the largest social benefits.

A green rating should help investors make their investment decisions. At least three general features of a rating system can assist investors in their decision-making: (i) simplicity; (ii) sufficient granularity; and (iii) ratings stability.

A rating system with a limited number of buckets would be relatively simple to understand, as most investors are used to rating systems of this nature. The buckets also create a coordination device for investors – investor preferences or mandates could be straightforwardly related to rating buckets. Eligible securities could be defined as those with a given rating or better. Investment managers could easily communicate this to their clients.

Simplicity can also stem from the data used. Taking a factual backward-looking measure such as a firm's carbon intensity does not require forward-looking forecasts or potentially more complicated scoring methods.

A certain level of granularity helps investors identify firms that best fit into their investment strategy.¹⁷ Granularity in these respects is superior to merely identifying firms as either green or non-green.¹⁸ Yet, a system that is too granular – for instance reporting just the raw carbon intensity numbers – may be too complex. Ultimately, the most appropriate degree of granularity would require consultations and practical experience to establish, as it would be hard to pin down strictly on the basis of principles alone.

Investors prefer ratings to be stable over the short run as they want to form a view of a firm's likely performance over their investment horizon. While the ultimate aim of our rating system is to incentivise change, an improvement in carbon intensities will usually materialise over a longer time horizon.

Investors and other stakeholders should be able to verify firms' improvements. A green rating can only provide a useful signal for investors and other interested stakeholders if it is reliable. As data on firms' carbon intensity have become widely available for most listed firms, basing a rating directly on this measure ensures that a rating's content can be easily verified. Further, carbon intensity is an outcome-based measure that allows a direct assessment of whether or not firms have actually become more carbon-efficient.

From the perspective of verifying improvements, the rating would ideally be based on the broadest scope of emissions available. While conservative estimates of aggregate emissions across firms would rely on narrower measures to mitigate double-counting among listed firms, a firm-level analysis should capture a firm's

¹⁷ For instance, investors who diversify their portfolio across sectors, as do asset managers with a market-wide benchmark, could target firms with the lowest carbon intensity within each sector.

¹⁸ In particular, a binary system may not provide strong incentives for firms that are the largest emitters of carbon to improve, as it may not be possible to become green enough to cross the threshold. Conversely, if the threshold for a binary green rating were too loose, it would not only lose its signalling value but would provide only a limited incentive for firms to substantially improve.

entire value chain. This avoids loopholes as firms cannot improve their carbon efficiency simply by outsourcing carbon-intensive activities (Ben-David et al (2018)).

Rating system challenges – data quality and institutional considerations

The usefulness of a rating based on firms' carbon intensity depends on the quality of the available data. There are currently no mandatory audits of carbon emissions data. But a growing number of third parties already verify, disseminate and use such data, which makes for a certain level of consistency (see also Box A). Prominent private sector efforts to improve company disclosures are under way (FSB TCFD (2017), Ceres (2018)). Mandatory reporting based on legal standards and audits could further enhance data quality and consistency. Technological advances in measuring carbon emissions will further increase precision and reduce data collection costs.

Who pays for the green rating and who provides it are also important considerations. In the case of many conventional credit ratings, as well as a number of current green ratings, it is often the firms themselves that bear the costs. But the willingness to pay for such a rating may be limited – especially among carbon-intensive firms, whose coverage would be important to the rating system's effectiveness in helping to achieve higher-level climate goals. Alternative arrangements are feasible. A rating system based directly on the carbon emissions of a firm could be provided by any institution with access to such data on an unsolicited basis. The third parties that construct, collect, and verify carbon emissions data would perhaps be in prime position to supply such a rating at potentially very low cost. Official approval processes for rating providers – similar to the proposed third-party verification of green labels in the European Union – could furnish the ratings with additional credibility.

A stylised example of a carbon intensity-based rating system

There are many ways to construct rating schemes with the desired properties and design features outlined above. We provide one simple example and an enhancement (Box B) to illustrate our suggestions above. The key aspects of our example are open to choice, including the exact rating thresholds, the number and labelling of buckets, and the degree of emphasis on the level of carbon intensity, as compared with changes in carbon intensity.

In our example, we define rating thresholds as fixed levels of carbon intensity so that, over time, all firms can improve their rating by reducing their carbon intensity. This introduces a dynamic element into the rating, together with an incentive for firms to cut their carbon intensities. We start with the distribution of firms' carbon intensity at the end of their financial year 2018 (for most firms, the latest observation).

For simplicity, we assume a 10-bucket rating grid including five buckets for the 10% of firms with the highest carbon intensity, ie as many as for the other 90% of the firms. The labels start from GGGGG, which denotes the greenest firms covered in the data, and go down to PTTTT for the ones that pollute most (highest carbon intensity).

Green rating – carbon intensity cutoff points

Financial year 2018

Table 1

	Rating label									
	GGGGG	GGGG	GGG	GG	G	P	PP	PPP	PPPP	PPPPP
Percentile of carbon intensity distribution	5th	25th	50th	75th	85th	90th	95th	97.5th	99th	>99th
Threshold Scopes 1–3 carbon intensity ¹	50	133	401	985	1,847	3,112	6,293	9,128	16,812	>16,812
Rounded threshold Scopes 1–3 carbon intensity ¹	50	130	400	1,000	1,800	3,100	6,300	9,100	17,000	>17,000

¹ In tonnes of CO₂ per USD million of revenue. Includes both upstream and downstream Scope 3 data.

Sources: S&P Trucost Limited © Trucost 2020; authors' calculations.

Table 1 provides the relevant cutoff points based on firms' carbon intensity as of 2018 (the latest available data for most firms). As the exact carbon-intensity thresholds are arbitrary, we provide rounded numbers for simplicity (last row). Ten buckets afford sufficient granularity to illustrate the benefits of an asymmetric grid. A proper feasibility study, which would go well beyond the scope of this paper, would identify how fine the grid should optimally be.

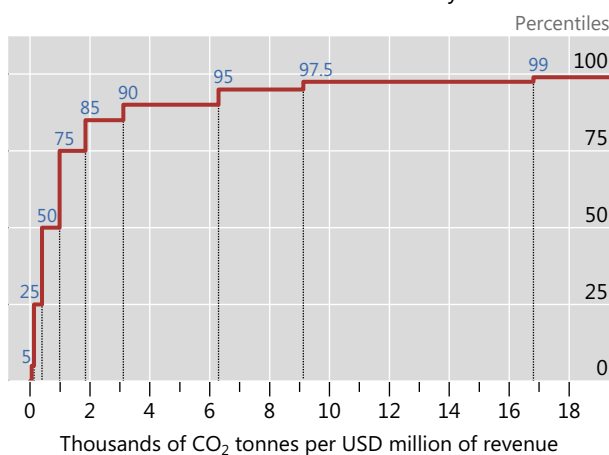
The thresholds point to a key issue in designing a rating system based on carbon emission intensities. The distribution of carbon intensities across firms is highly skewed (Graph 3, left-hand panel). Even when allocating half of the rating buckets to the top 10% of emitters, the distance between thresholds for these buckets is still high. The extreme skewness of the distribution reaffirms that it is crucial for any rating system aligned with climate goals to provide strong incentives for high emitters to improve. Even though our PPPPP rating bucket contains only the 1% of firms with the highest carbon intensities, these are responsible for close to 40% of total Scopes 1–3 emissions in 2018 in our sample of 16,000 firms (Graph 3, right-hand panel).

The distribution of carbon intensities and total emissions by rating bucket

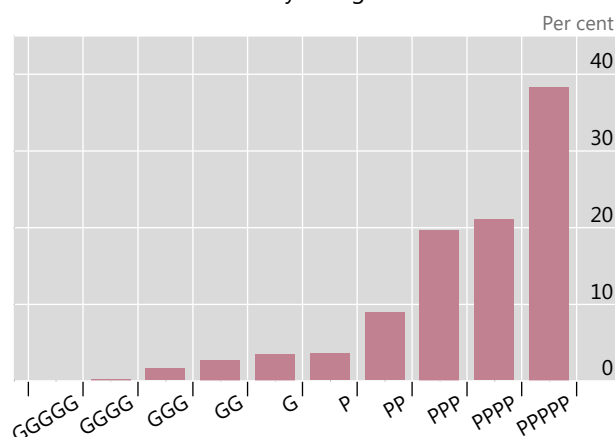
Based on Scopes 1–3 emissions, financial year 2018

Graph 3

Cumulative distribution of carbon intensity



Share of total emissions by rating



¹ The vertical lines indicate the cutoff points for the rating bins in the example green rating scheme at the stated percentiles (in blue). See Table 1 for the precise and rounded numbers.

Sources: S&P Trucost Limited © Trucost 2020; authors' calculations.

Our assumed grid can be used to test the stability (one-year-ahead) of firm ratings based on historical data (Table 2). The stability appears quite high. As expected, stability is lower for lower ratings – as they contain a smaller number of firms – but only slightly so. This degree of stability is no worse than that of credit ratings (Fitch (2020), Moody's (2020)), which should suffice for most fixed income investors.

Further incentives for firms to reduce emissions can be introduced by enhancing the rating system. For instance, a 10-year reduction of carbon emissions at 7% per annum (as, for instance, required in the proposed EU climate benchmarks (EU TEG (2019c)) would imply roughly a halving of emission intensities for given revenues. One way of generating additional incentives is to award rating uplifts to firms that fulfil or exceed the reduction target for carbon intensities.¹⁹ Box B outlines how such a rating system might work.

Transition matrix – green example rating¹

Transition probability from one year to the next, in per cent; 2006–18²

Table 2

		Rating in year $t+1$									
		GGGGG	GGGG	GGG	GG	G	P	PP	PPP	PPPP	PPPPP
Rating in year t	GGGGG	92	8	0	0	0	0	0	0	0	0
	GGGG	2	94	4	0	0	0	0	0	0	0
	GGG	0	3	92	5	0	0	0	0	0	0
	GG	0	0	3	91	5	0	0	0	0	0
	G	0	0	0	8	81	9	1	0	0	0
	P	0	0	0	1	11	71	15	1	0	0
	PP	0	0	0	1	1	10	77	10	0	0
	PPP	0	0	0	1	0	1	11	77	9	1
	PPPP	0	0	0	0	0	0	1	11	78	9
	PPPPP	0	0	0	0	1	0	0	1	13	84

¹ Does not include Scope 3 downstream due to unavailability of data before 2017. ² Weighted by the total number of observations in a given year to account for the expansion of the sample over time.

Sources: S&P Trucost Limited © Trucost 2020; authors' calculations.

¹⁹ A new "temperature rating" by CDP Worldwide and the WWF (2020) takes a different approach, calculating a temperature score for companies or asset portfolios based on the ambitiousness of companies' emission targets. A temperature score of 1.5°C or less indicates compliance with the Paris goals.

Rating uplifts to provide extra incentives for Paris-aligned emission reductions

Building on the green ratings system discussed in the main article, the enhancement described here shows how additional incentives for emission reductions might be created, through rating uplifts that occur if firms fulfil reduction targets implied by the Paris Accord.^① We use a 7% reduction per year as a benchmark – as in the proposed EU climate benchmarks (EU TEG (2019c)). Table B1 provides an example scheme of such uplifts. Using data for end-financial year 2018, the frequency of uplifts (or remaining in the same category) is presented in Table B2, as calculated based on two-year reductions in carbon intensity.

Example rating uplifts to incentivise carbon reductions consistent with and above those implied by the Paris Accord (7% reduction per year)

Table B1

Rating uplift – number of notches	1	2	3	4	5
Goal – multiple of reduction implied by the Paris Accord ¹	1	1.5	2	2.5	3
Implied two-year reduction in carbon intensity ²	-13.5%	-19.6%	-25.2%	-30.4%	-35.3%

¹ Speed of reduction = 1 implies the speed implied by the Paris Accord. A multiple of two means twice the speed of reduction (ie the implied reduction for four years is achieved in two years). ² Reduction thresholds are the compounded growth rates based on the 7% per annum reduction target (ie $-(1-0.93^2) = -13.5\%$ over two years). At twice the speed of reduction, the threshold is $-(1-0.93^4) = -25.2\%$.

Sources: EU TEG final report on climate benchmarks and benchmarks' ESG disclosures; authors' calculations.

A desirable feature of such a system is that firms with low green ratings can achieve substantial improvements. Uplifts are temporary by construction and are taken away if a firm does not achieve the same reduction in the following two-year period. Even though such a system is less stable by construction than one without uplifts, the degree of stability is not substantially lower. In our example, the probability of achieving the same rating in the next year ranges from 64% to 83% depending on the rating bucket. Stability can be increased, for instance, by lengthening the time horizon over which reductions are measured.

Frequencies of reaching a given rating after uplift¹

Financial year 2018, in per cent

Table B2

		Rating after uplift									
		GGGGG	GGGG	GGG	GG	G	P	PP	PPP	PPPP	PPPPP
Rating before uplift	GGGGG	100	0	0	0	0	0	0	0	0	0
	GGGG	9	91	0	0	0	0	0	0	0	0
	GGG	5	2	93	0	0	0	0	0	0	0
	GG	3	1	3	93	0	0	0	0	0	0
	G	2	1	2	2	93	0	0	0	0	0
	P	4	1	2	4	4	85	0	0	0	0
	PP	0	4	0	2	2	5	87	0	0	0
	PPP	0	0	4	1	3	3	7	83	0	0
	PPPP	0	0	0	5	1	3	6	8	78	0
	PPPPP	0	0	0	0	3	1	3	5	3	85

¹ Uplift calculated based on two-year changes in Scope 3 emission intensities excluding Scope 3 downstream emissions due to lack of data before 2017.

Sources: S&P Trucost Limited © Trucost 2020; authors' calculations.

① Even stronger incentives could be introduced by enforcing downgrades if reduction targets are not fulfilled or if carbon intensities increase over time.

Conclusions

The evidence that the current system of green bond finance is significantly accelerating the transition to a low-carbon economy is mixed. This feature explores the desirable properties of a complementary rating system that could further encourage firms to improve their carbon efficiency. We argue that such a system should deliver firm-level ratings based on carbon intensities. We illustrate in particular that sufficient granularity is desirable to distinguish among the heaviest carbon emitters for which progress is essential to mitigate climate change.

An additional benefit of firm-level ratings is that investors could also use them to rate any financial instruments issued by a firm, including stocks and not only bonds, which only a limited number of companies issue. The ratings could also be applied to firms' products: consumers might take an interest in such ratings if they prefer to buy from low-carbon firms, or from firms with better ratings than those of their industry peers.

Our analysis is merely laying out important considerations for ratings to foster carbon efficiency in economic activity. More analysis and experience will be needed before a practical green rating system can be implemented, to ensure that it will deliver the appropriate incentives.

While climate change mitigation is a key policy goal, this is not to say other environmental goals such as water security, biodiversity or climate adaptation are less important. We explore a rating system designed to help reduce firms' carbon emissions, but some of the principles – in particular the focus on simple outcome-based measures – may be applicable to other environmental goals as well.

Data on broader emission scopes would further help in assessing a firm's overall carbon footprint, making outcome-oriented standards even more meaningful. The currently broadest Scope 3 emission measures analysed in this feature are designed to take account of emissions along the entire production and distribution processes. To further improve this already broad-based measure, the relative environmental benefits (or costs) of the firm's final products might be included. Efforts are currently under way to include "avoided emissions" (dubbed Scope 4 emissions) to reflect the relative carbon emission impact of the goods a firm produces (Climate Disclosure Standards Board (2020)).

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Mind the buybacks, beware of the leverage¹

In the light of the economic toll of the Covid-19 pandemic, a natural question is whether the substantial amount of buybacks conducted in recent years has undermined corporate resilience and increased the need for public support. Buybacks are a means to distribute cash to shareholders. They are of concern for two reasons: first, managers could use them to artificially increase stock prices in order to boost performance pay; second, they could be a tool to raise leverage to excessive levels. There is some evidence that managers use buybacks opportunistically, but little indication of detrimental effects on long-term company value. However, buybacks appear instrumental in meeting leverage targets. Therefore, the main policy issue is leverage, and buybacks are of concern mostly in their role as leverage management tools.

JEL classification: G33, G35.

Policymakers across the world committed large sums to support private business through the Covid-19 pandemic. This came on the heels of a steady increase in buybacks, also known as share repurchases. Was there a link between substantial buybacks and the need for public assistance? This feature focuses mainly on US non-financial corporates and highlights that repurchases mostly served the purpose of leverage targeting. Thus, buybacks appear of concern to the extent that leverage is.

Overall corporate payouts rose substantially in recent years. Between 2010 and 2019, US firms distributed \$4 trillion in dividends and \$6 trillion in buybacks, or \$4 trillion net of equity issuance. Net repurchases amounted on average to about 1.5% of market capitalisation per year.

Stock buybacks can be a double-edged sword from investors' perspective. They can support a firm's market price by signalling undervaluation, achieving tax efficiency gains relative to dividends or helping avoid wasteful expenditures by managers. Still, they could be detrimental to longer-run firm value if executives use them simply to increase their performance pay. However, there is only limited evidence for this.

¹ The author thanks Claudio Borio, Stijn Claessens, Benoît Mojon, Andreas Schrimpf, José María Serena Garralda, Hyun Song Shin, Nikola Tarashev and Philip Wooldridge for valuable comments and suggestions, and Anamaria Illes and Jose María Vidal Pastor for excellent research assistance. The views expressed in this article are those of the author and do not necessarily reflect those of the Bank for International Settlements.

Key takeaways

- Corporate stock buybacks have roughly tripled in the last decade, often to attain desired leverage, or debt as a share of assets.
- Firms' desired leverage can be excessive if companies do not account for all financial distress costs, including those potentially shifted to the public purse as a result of bailouts.
- Policy discussions on financial stability should focus on leverage rather than buybacks.

In addition, buybacks are instrumental in meeting leverage targets. If investors failed to measure properly financial distress costs or shifted these costs to creditors or the public purse, these targets would be too high. Excessive leverage is a financial stability concern.

The remainder of the feature describes recent trends in buybacks, before exploring the reasons for repurchases. It then investigates how past buybacks affected returns during the initial pandemic shock, and links buybacks to the broader discussion on the financial stability implications of corporate leverage.

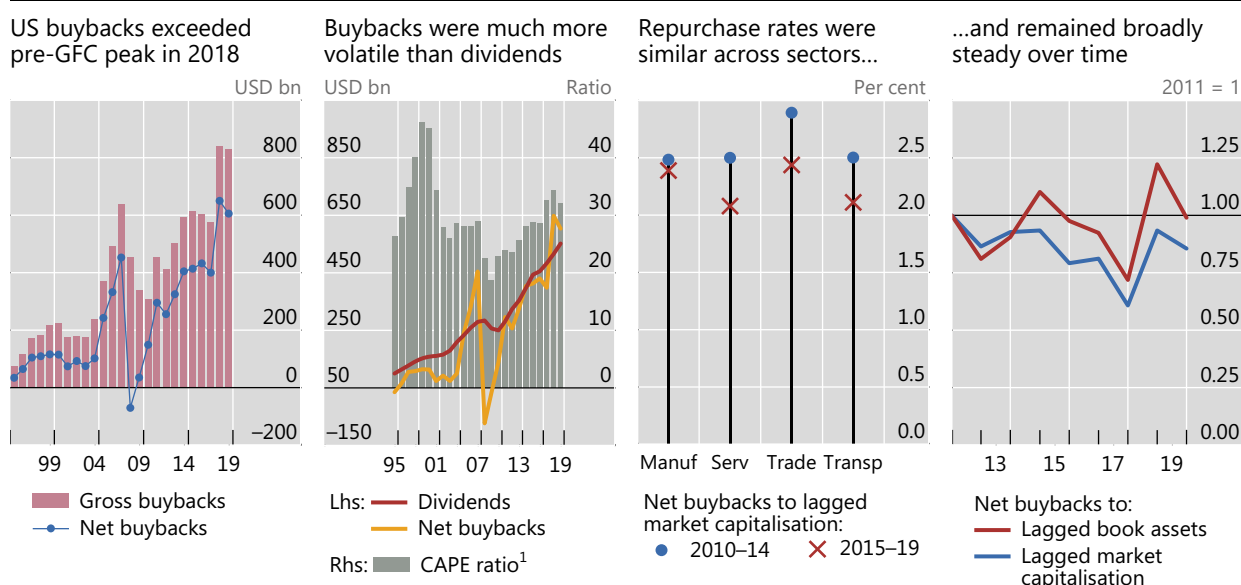
The evolution of buybacks over time

While share buybacks are conceptually similar to dividends, the two forms of disbursement to shareholders have evolved differently over time. As a powerful tool for leverage management, buybacks complement and reinforce the effect of debt issuance on firms' capital structure.

In a stock buyback, a company returns capital to shareholders by repurchasing its own shares. Equity decreases and leverage rises, more rapidly so when funds are obtained by issuing debt. As an example, a firm with \$100 in assets, \$30 in debt and \$70 in equity starts with leverage equal to 0.3 (\$30 debt divided by \$100 assets). A \$10 buyback financed by selling assets would raise leverage to 0.33 (\$30 debt over \$90 assets). Had the buyback been funded with \$10 of new debt, leverage would have climbed to 0.4 (\$40 debt relative to \$100 assets).

Like dividends, buybacks are a form of capital distribution. In the example above, the firm could also disburse funds through dividends, with similar effects on leverage. There are three important differences between dividends and buybacks. First, firms are reluctant to cut the former, because investors value smooth dependable income, but use the latter more flexibly, for instance to disburse one-off cash windfalls. Second, while managers could use buybacks to artificially inflate earnings per share (EPS) and stock prices, dividends have no effect on EPS and mechanically reduce stock prices on ex dividend dates. Third, dividends are paid mostly by mature firms, while buybacks are common among high-growth firms as well (Farre-Mensa et al (2014)).

Payouts to shareholders rose quickly in the aftermath of the Great Financial Crisis (GFC). In 2019, US firms repurchased own shares worth \$800 billion (Graph 1, first panel; all figures are in 2019 US dollars). Net of equity issuance, the 2019 tally reached \$600 billion. Net buybacks can turn negative, and they did during the GFC, as firms issued equity to shore up their balance sheets. Dividends had been somewhat higher than net buybacks until 2005, when the latter surged just before the GFC and dropped precipitously thereafter (second panel). Underscoring the structural differences between dividends and buybacks, the former were remarkably smooth, while the latter proved procyclical and co-moved with equity valuations (grey bars).



Manuf = manufacturing; Serv = services; Transp = transportation.

¹ Total return cyclically adjusted price/earnings ratio.

Sources: R Shiller, www.econ.yale.edu/~shiller/data.htm; Federal Reserve Bank of St Louis; S&P Capital IQ; author's calculations.

Similar trends could be observed globally. Aside from the United States, the five countries with the largest 2019 buyback amounts – Japan, the United Kingdom, France, Canada and China – recorded repurchases that were jointly worth \$130 billion in that year. While this total was only a fraction of US buybacks, it quadrupled relative to 2010. The country level increases were particularly pronounced in China, where repurchases rose tenfold to \$17 billion, and in Japan, where they added up to \$52 billion, for a fivefold rise, on the heels of stronger investor activism.

The rest of this feature zooms in on US data on non-financial corporates' buybacks. Given the substantial size and longer history of share repurchases in the United States, these data offer rich information on time trends and cross-company patterns. The determinants and effects of buybacks appear similar in most countries (Manconi et al (2019)).

While repurchases have risen in dollar terms, they have remained stable relative to company size. The repurchase rate – or net buybacks as a fraction of stock market capitalisation – was similar across sectors that represented the vast majority of non-financial buybacks conducted after 2010, and mostly hovered just above 2% (Graph 1, third panel). It was also broadly stable over time, albeit with some year-on-year variation (fourth panel). Scaling net buybacks by book assets yields similar patterns.

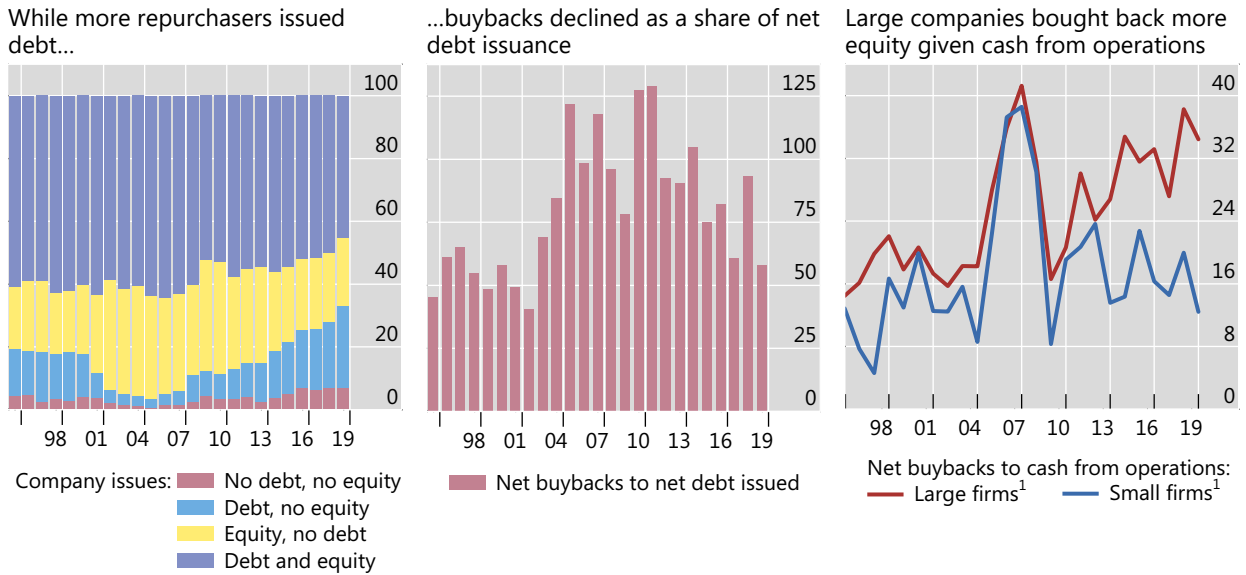
Repurchases were partly funded with external finance. Virtually all companies that undertook buybacks in a given year also raised funds from investors during the same period, often through a mix of equity and debt (Graph 2, left-hand panel). Repurchasing shares while also issuing equity might appear counterintuitive. However, it can occur when companies seek to offset the issuance of stock for employees' compensation. In addition, periodic equity issuance subjects firms to the scrutiny of financial markets, irrespective of planned buybacks.

While more repurchasers issued debt only, buybacks were not the main reason for rising debt issuance. About 25% of the companies that bought back stock issued

For large firms, buybacks rose relative to cash from core business

In per cent

Graph 2



¹ Large (small) firms are those with book assets above (below) the median in the previous year.

Sources: S&P Capital IQ; author's calculations.

debt but no equity in 2019 (Graph 2, left-hand panel). As illustrated in the example at the beginning of this section, this trend has contributed to a faster rise in leverage. However, starting in 2010 buybacks represented a progressively smaller share of debt issuance, trending down towards early 2000s levels (centre panel). This indicates that buybacks were not the main cause of the post-GFC rise in corporate debt.

After 2000, internally generated funds became more important in financing buybacks. For one, economic growth resulted in rising profitability. In addition, firms exhibited a higher propensity to distribute available income. Kahle and Stulz (2020) find that cumulative corporate payouts from 2000 to 2018 were higher than those from 1971 to 1999 and that two thirds of the increase was due to this higher propensity.

The propensity to distribute cash has differed across company size. For larger firms, repurchases as a fraction of cash from operations doubled between 2004 and 2019, to above 30%. For smaller firms, this fraction hovered around 15% with the brief exception of the GFC (Graph 2, right-hand panel).

Why do companies repurchase their own shares?

The decision to buy back equity can reflect a variety of motives, and an extensive academic literature allows us to classify these motives based on whether the likely effect on firm value is positive, negative or uncertain.

A classification of buyback based on their effects on firm value

In a number of cases, repurchases improve a firm's market value. For instance, if managers perceive equity as undervalued, they can credibly signal their assessment

to investors through buybacks. In addition, using repurchases to disburse funds when capital gains are taxed less than dividends increases net distributions, all else equal. Furthermore, by substituting equity with debt, firms can lower funding costs when debt risk premia are relatively low, especially in the presence of search for yield. And, by reducing funds that managers can invest at their discretion, repurchases lessen the risk of wasteful expenditures.

However, buybacks can be detrimental when they reflect conflicts of interest. Executive compensation linked to stock prices or EPS targets can lead managers to repurchase equity with the narrow objective of boosting their pay. Managers would not bear the full costs of this action: the resulting increase in leverage increases the likelihood of financial distress, but it is likely to materialise well after managers have received their compensation. Effectively, managers would shift risks to shareholders. In these circumstances, buybacks would be excessive from investors' longer-term perspective.

Finally, buybacks can be used to fine-tune the capital structure. Since repurchases always affect leverage, all else equal, they are a powerful tool to achieve a specific leverage target. Used for this purpose, they seek to bring in benefits for shareholders such as higher return-on-equity, but their net impact on long-term company value is not clear-cut. To assess this impact, it is necessary to also consider financial distress costs, such as weaker pricing power or higher bankruptcy risk.

Importantly, leverage can have positive effects on company value but still be excessive from the perspective of society as a whole. Such is the case when some financial distress costs are shifted to creditors or the public purse, with financial stability implications.

Limited scope for opportunistic buybacks

Findings in the academic literature suggest that misalignment of managers' and investors' incentives was not a major driver of buybacks.

One indication in this direction is that sub-par corporate governance appears to have limited effects on post-repurchase performance. Before 2000, opportunistic buybacks – in which managers repurchase stock largely for private benefit – were more likely in companies with poor corporate governance (Caton et al (2016)). These firms would experience weaker post-repurchase growth in terms of both stock returns and operating income. Studies indicate that the importance of governance for performance after buybacks decreased after 2000, probably due to enhanced regulations and disclosures.

In addition, incentives linked to executive pay seem to have had a weak influence on repurchase patterns. To be sure, available evidence suggests that companies prefer to pay out with buybacks, rather than with dividends, when managers hold more stock options (Fenn and Liang (2001)). The effect, however, is largely confined to the choice of capital distribution method, rather than the amount distributed (Kahle (2002)). That is, managers would decide to distribute persistent excess cash flows with buybacks, even if, in the absence of stock options, they would have used dividends. Importantly, they would generally not distribute more funds through buybacks than they would have through dividends.

Compensation practices have also evolved. Executive stock options have become relatively less popular, in favour of arrangements whereby executive performance pay is not negatively affected by dividend payments. As such, managers' incentive to

distribute capital with repurchases rather than dividends has weakened (Bonaimé et al (2019)). Still, bonuses linked to EPS, which increase with buybacks, increase the likelihood of repurchases when EPS targets are about to be missed by small amounts (Almeida et al (2016)).

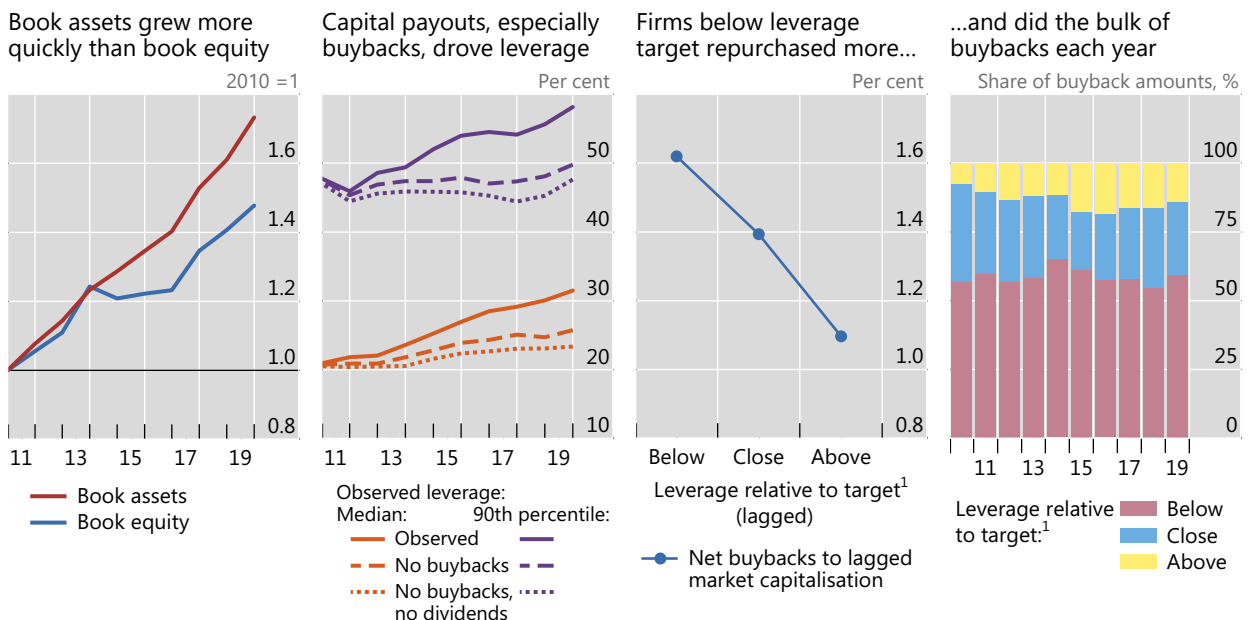
Ultimately, if repurchases mainly reflected managerial opportunism and were thus detrimental to investors, they would entice negative market reactions over the long run. There is little evidence that this has been the case. After accounting for broad risk factors, long-term stock returns are typically positive following buyback announcements and higher than for non-repurchasers (Peyer and Vermaelen (2009), Dittmar and Field (2015)). Similar patterns hold across most countries (Manconi et al (2019)). Even in the presence of substantial executive stock options, buybacks do not cause negative reactions (Kahle (2002)). Firms with executive bonuses tied to EPS targets also experience long-term returns in line with those of comparable firms that did not repurchase stock (Cheng et al (2015)).

Buybacks as a leverage management tool

Corporate assets grew faster than equity over the past decade. In the non-financial corporate sector, book assets expanded by 75% between 2010 and 2019. Book equity rose at a similar pace through 2013, before slowing and ultimately rising by 48% over the same period (Graph 3, first panel). The overall effect was a noticeable rise in median leverage, with debt climbing from 21% to 32% of book assets (second panel, solid yellow line). The increase in leverage was similar for the more leveraged firms, namely those at the 90th percentile of the cross-sectional distribution of leverage

Buybacks allowed firms to achieve desired leverage levels

Graph 3



¹ Leverage targets are fitted values from linear regressions of the logarithm of leverage (total debt over total assets) on the logarithm of size (total assets). Regressions are computed separately for each indicated year and industry. See Farre-Mansa et al (2018) for additional details. Firms below, close and above leverage target are those in the bottom, middle and top tertile of differences between observed leverage and predicted leverage, respectively. Tertiles are recomputed each year.

Sources: S&P Capital IQ; author's calculations.

ratios in a given year. For these companies, debt amounted to nearly 60% of book assets in 2019, up from 48% in 2010 (second panel, solid purple line).

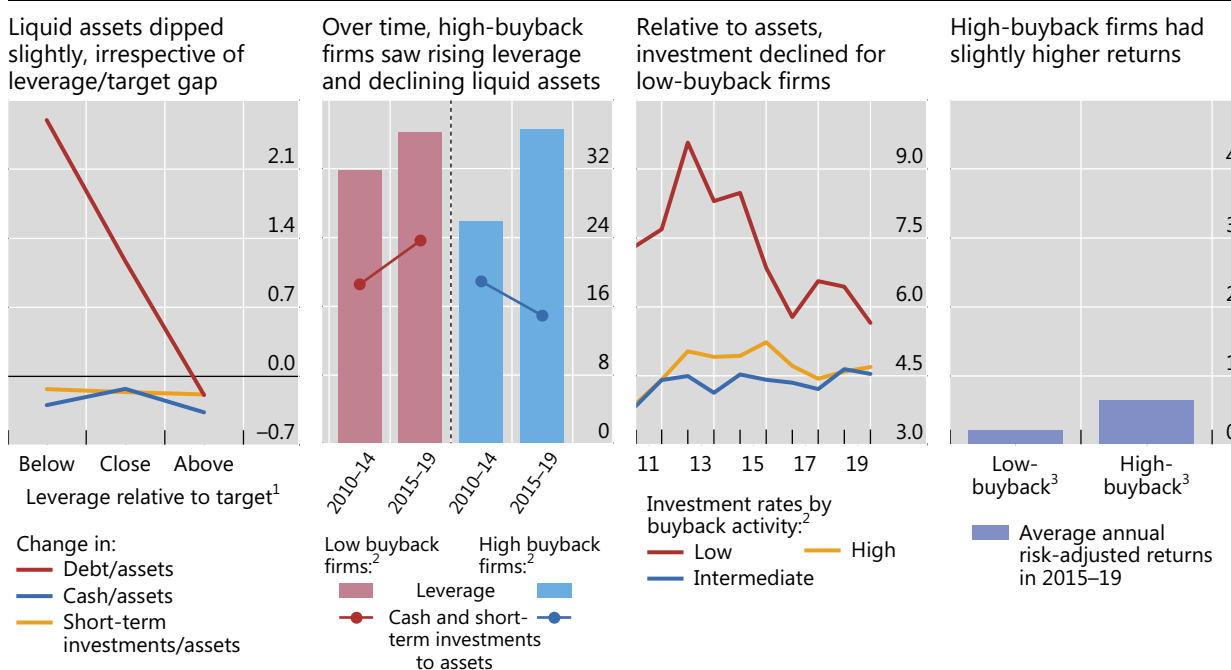
Capital distributions supported the increase in leverage. Given historical debt dynamics, adding repurchases and dividends back to company assets would have substantially dampened the increase in leverage (Graph 3, second panel, dotted lines). Importantly, the effect of adding back share repurchases (difference between solid and dashed lines) would have been much greater than that of adding back dividends (difference between dotted and dashed lines).²

Being an important leverage management tool, buybacks were concentrated in firms that sought to keep up with the leverage of their peers. Yearly repurchases were substantially higher for firms with leverage below the level prevalent in their main industry – henceforth “target leverage” (Graph 3, third panel; see also Farre-Mensa et al (2018)). Peer effects are important determinants of capital structure decisions, especially for smaller firms and in more concentrated industries, and can make leverage more procyclical in response to macroeconomic factors like the cost of capital (Leary and Roberts (2014)). In aggregate, companies below target leverage

Investment was stable but cash holdings dipped at high-buyback firms

In per cent

Graph 4



¹ Leverage targets are fitted values from linear regressions of the logarithm of leverage (total debt over total assets) on the logarithm of size (total assets). Regressions are computed separately for each indicated year and industry. See Farre-Mensa et al (2018) for additional details. Firms below, close and above leverage target are those in the bottom, middle and top tertile of differences between observed leverage and predicted leverage, respectively. Tertiles are recomputed each year. ² High (low, intermediate) buyback firms are those with average yearly buyback rate (net repurchases over lagged market capitalisation) in the fifth (first, third) quintile. ³ Average buyback rate calculated between 2010 and 2014.

Sources: S&P Capital IQ; author's calculations.

² The picture is different in countries where buybacks are considerably less prevalent than in the United States. Notably, in both Europe and Japan, the contribution of dividends to the evolution of leverage between 2010 and 2019 was roughly three times larger than that of buybacks.

accounted for around 60% of total buybacks each year, with limited annual variation (fourth panel).

As further proof that they were mostly used to manage leverage, buybacks appeared to have limited effects on other key ratios. In particular, leverage targeting was not strongly linked to changes in holdings of cash and short-term investments (Graph 4, first panel), even though high-buyback firms did see material declines in liquid assets relative to book assets over time (second panel).

In aggregate, buybacks also seemed to have limited bearing on investment. Investment rates dropped noticeably in time for low-buyback companies and were broadly stable for the rest (Graph 4, third panel). Low-buyback companies are relatively small, and their higher investment rates mirror faster asset growth.

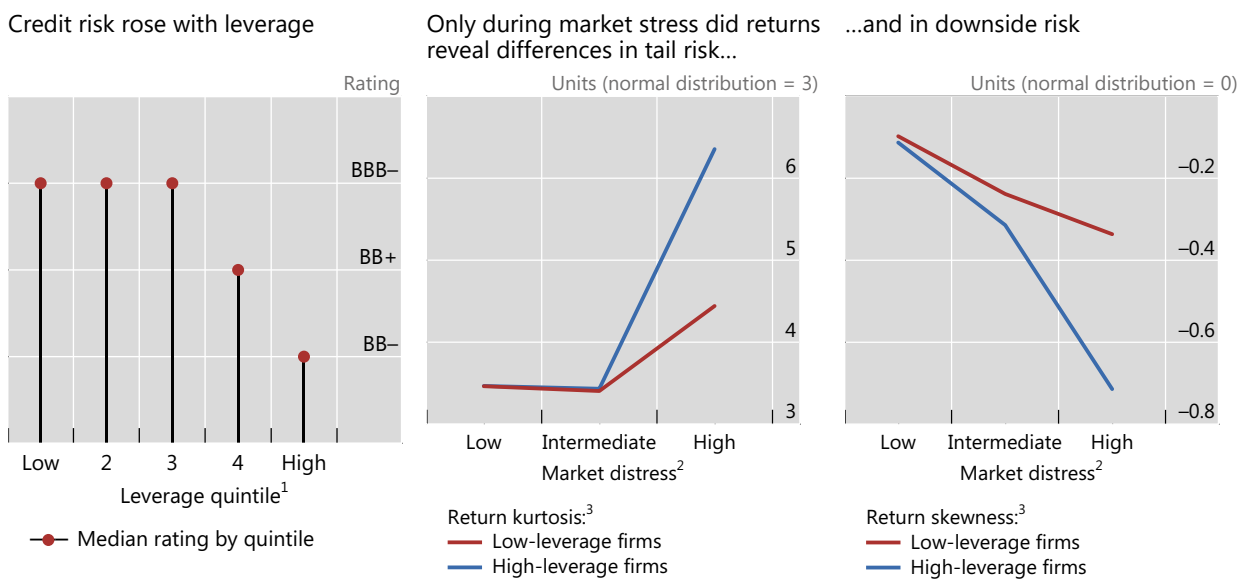
Likewise, repurchases have had a minor effect on risk-adjusted stock returns. In the five years before the Covid-19 pandemic, such returns were quite similar across repurchase levels (Graph 4, fourth panel). While high-buybacks firms did return more, their edge over low-buyback companies was small, 0.40% per year on average.

Buybacks or leverage? Evidence on risk drivers from the March 2020 shock

Gauging the effect of leverage on firms' performance is not straightforward, as it depends on market conditions. Admittedly, firms with higher leverage tend to have lower credit ratings, which signal higher default risk (Graph 5, left-hand panel). Stock returns, however, appear to reflect little of this higher default risk in normal times. Indeed, tail and downside risks were virtually identical for high- and low-leverage

Risks for leveraged firms surface clearly only during market stress

Graph 5



¹ Leverage quintiles are calculated on firm/year observations between 2010 and 2019. ² Low, "intermediate" and "high" market distress indicate the first, second-to-fourth and fifth quintile of monthly VIX values from 2010 to 2019, respectively. ³ Skewness and kurtosis are calculated using daily stock returns (Jan 2011–Mar 2020) for all firms in a given leverage quintile and for a given VIX level.

Sources: CBOE; S&P Capital IQ; author's calculations.

firms during periods of low and intermediate market stress between 2010 and 2019 (centre and right-hand panels).

The effect of leverage does become apparent during periods of pronounced market turmoil. In such instances, shocks are substantial enough to clearly reveal drivers of stock returns. During times of high market stress, tail and downside risks rose markedly for high-leverage firms (Graph 5, centre and right-hand panels).

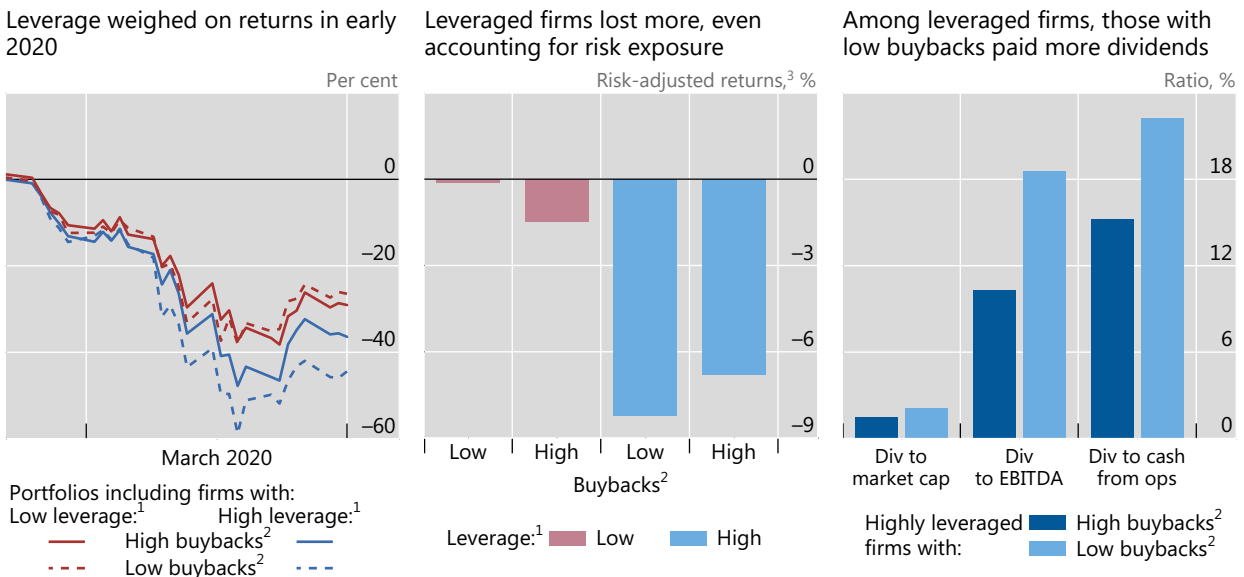
This evidence suggests that the initial pandemic shock in March 2020 can offer useful clues to understand the role of leverage for firms' performance and how it relates to that of buybacks. Concretely, if share buybacks drove company risk independently of leverage, firms with high buyback rates would have had lower returns after controlling for leverage. This argument suggests sorting firms into four investment portfolios with high/low leverage and high/low buyback propensity.

At the height of the pandemic shock, past repurchases adversely affected stock returns only through leverage. Between mid-February and end-March, high-leverage firms lost appreciably more than low-leverage firms (in line with the results of Ramelli and Wagner (2020)). Crucially, this pattern held irrespective of the amount of equity bought back during the previous three years (Graph 6, left-hand panel).

While the previous analysis treats leverage and buybacks as the only drivers of stock returns, taking into account other factors reinforces the message. Netting out the effect of such factors reveals limited implications of past buybacks, given leverage (Graph 6, centre panel). In fact, low-buyback/high-leverage companies actually experienced lower risk-adjusted returns than high-buyback/high-leverage companies. An important distinguishing feature of low-buyback firms is that they have tended to pay out more dividends (right-hand panel). Investors might have

Leverage, not buybacks, led losses in March 2020

Graph 6



Div to market cap = dividends to market capitalisation; Div to EBITDA = dividends to earnings before interest, taxes, depreciation and amortisation; Div to cash from ops = dividends to cash from operations.

¹ High- (low-) leverage firms are those in the fifth (first) quintile of average leverage (total debt over total assets) in 2017–2019. ² High- (low-) buyback firms are those in the fifth (first) quintile of average yearly buyback rates (net repurchases over lagged market capitalisation) in 2017–2019. ³ Residuals of regressions of stock returns on the market, value and book-to-market factors of Fama and French (1993) between 20 February 2020 and 17 March 2020.

Sources: S&P Capital IQ; author's calculations.

retrenched from them as the magnitude of the economic damage wrought by the pandemic increased the likelihood that dividends would be cut in the near future.

Conclusions

Buybacks are relevant for policy discussions, but largely as a leverage management tool. Policymakers' focus on leverage stems from the key role of capital structure dynamics in economic cycles, financial cycles and financial intermediation capacity. In general, a build-up in leverage precedes a decline in economic activity.

Companies can pursue excessively high leverage for a number of reasons. For one, opaqueness could blur the link between leverage and the likelihood and cost of financial distress. In this instance, more information may lead shareholders to target lower leverage. Alternatively, the focus on short-term results could lead managers and shareholders to largely disregard longer-term costs of distress, especially if these are borne by creditors, employees or the public sector. In this case, high leverage is part of a strategically chosen capital structure.

This article has argued that share buybacks affect firms' performance and financial resilience mostly through leverage. While there is some indication that managers use buybacks opportunistically to meet performance pay targets, this does not seem to adversely affect long-run company value. There is, however, clear evidence that companies make extensive use of share repurchases to meet leverage targets. The initial phase of the pandemic fallout in March 2020 put the spotlight on leverage: irrespective of past buyback activity, firms with high leverage saw considerably lower returns than their low-leverage peers. Thus, investors and policymakers should be mindful of buybacks as a leverage management tool, but they should particularly beware of leverage, as it ultimately matters for economic activity and financial stability.

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Cross-border links between banks and non-bank financial institutions¹

Cross-border links between banks and non-bank financial institutions (NBFIs) gained momentum in recent years. Banks' cross-border claims on NBFIs rose from \$4.6 trillion in Q1 2015 to \$7.5 trillion in Q1 2020, a faster increase than that of total cross-border claims. Financial centres and large advanced economies play a prominent role, as hosts of the largest and most interconnected NBFIs such as central counterparties, hedge funds and investment funds. The size of banks' cross-border links to NBFIs in emerging market economies has also been on the rise, albeit from a low base. The financial market turmoil triggered by Covid-19 revealed several vulnerabilities associated with cross-border linkages between banks and NBFIs.

JEL classification: G21, G23, L14.

You think that because you understand "one" that you must therefore understand "two" because one and one make two. But you forget that you must understand "and".

*Sufi teaching story, as cited in D Meadows, *Thinking in systems: a primer**

Non-bank financial institutions (NBFIs)² played an important role in transmitting shocks during the Great Financial Crisis (Gorton (2010), Claessens et al (2012)). Since then, NBFIs' assets under management have grown substantially, at even a faster pace than banks' (FSB (2020)). In tandem, national and international authorities have stepped up their efforts to quantify and understand NBFIs' activities and the attendant vulnerabilities (ESRB (2019)).

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² Non-bank financial institutions, comprise, inter alia, insurance companies and pension funds, finance companies, broker-dealers, special purpose vehicles, money market funds, hedge funds, other investment funds and central counterparties.

Key takeaways

- Cross-border bank claims on non-bank financial institutions (NBFIs), such as investment funds and central counterparties, have grown 63% in the last five years to \$7.5 trillion in Q1 2020.
- Financial links between banks and NBFIs are mainly denominated in US dollars and concentrated in financial centres and large advanced economies, but have also grown in emerging market economies.
- Vulnerabilities stemming from these growing interconnections were highlighted during the Covid-19 market turmoil, for example in fickle dollar funding from NBFIs and liquidity pressures from high central counterparty margins.

Of particular concern are links between banks and NBFIs, which, to echo the opening quote, are key “conjunctions” in the financial system. Both types of institutions can engage in credit, maturity and liquidity transformation, which could underpin the accumulation of imbalances in normal times and pockets of stress in a downturn. Thus, links between banks and NBFIs are behind particularly powerful transmission mechanisms, as demonstrated most recently by the pandemic-related market turmoil. This episode underscored that central counterparty (CCP) margins can be procyclical and drain banks’ liquidity at an inopportune time; that money market funds (MMFs) can be fickle funding providers to banks; and that banks’ positions vis-à-vis NBFIs can contribute to their net long currency positions. These lessons had an important cross-border dimension.

This article is a first attempt at a global mapping of the cross-border links between banks and NBFIs, using the BIS international banking statistics (IBS) and focusing mainly on the residence of counterparties.³ We use recent enhancements to these statistics that introduced a more granular breakdown of banks’ claims and liabilities vis-à-vis non-banks, in particular NBFIs (Avdjiev et al (2015)). Since analysis of cross-border links between NBFIs and non-banks is currently hampered by lack of data, we focus on the bank-NBFI nexus.

The rest of the article is organised as follows. The first section documents the continuous growth of NBFIs as bank counterparties in recent years. The second presents the network of cross-border links between banks and NBFIs,⁴ highlighting the systemic nodes through which shocks could propagate and the growing importance of NBFIs in emerging market economies (EMEs). The third section assesses vulnerabilities with a particular focus on how they materialised during the Covid-19 fallout in the first quarter of 2020.

The growing importance of NBFIs as bank counterparties

Banks’ cross-border claims on, and liabilities to, NBFIs grew strongly in recent years. The outstanding amount of cross-border claims increased from \$4.6 trillion in the first quarter of 2015 to \$7.5 trillion in the first quarter of 2020, a notable rise of six percentage points when scaled by total cross-border claims (Graph 1, left-hand

³ We use the locational banking statistics, most of which are published on the BIS website.

⁴ See the accompanying [interactive map](#) of cross-border links between banks and NBFIs.

panel).⁵ A similar increase is observed for banks' cross-border liabilities to NBFIs, from \$3.7 trillion to \$5.6 trillion over the same period.⁶ Box A puts the IBS in perspective by considering the overall size of NBFIs, using data collected under the Financial Stability Board's (FSB) annual global monitoring exercise on non-bank financial intermediation.

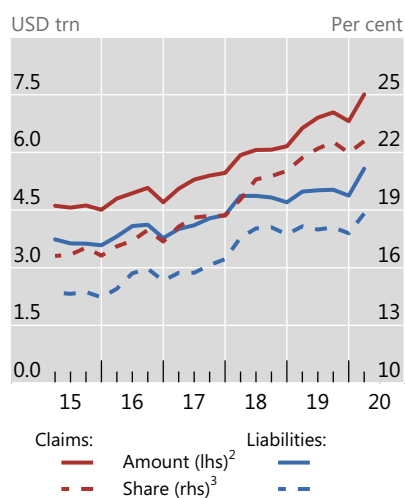
The US dollar dominates banks' cross-border positions with NBFIs. More than 50% of both claims and liabilities are denominated in US dollars (Graph 1, centre panel), a slightly higher share than that for interbank positions. The share of both US dollar claims and liabilities grew by 5 percentage points in the five years to Q1 2020, mostly at the expense of euro-denominated positions. This is in line with the growing international role of the US dollar documented in the literature (eg Aldasoro and Ehlers (2018), Maggiori et al (2020), Erik et al (2020)).

Cross-border links between banks and NBFIs exhibit a high degree of geographical concentration (García Luna and Hardy (2019)). Concentration is a feature of cross-border banking more broadly (Aldasoro and Ehlers (2019)), but it is particularly high – and rising – vis-à-vis NBFIs (Graph 1, right-hand panel). It also varies by currency. The top three counterparty countries respectively account for 39%, 74% and 86% of all euro-, dollar- and yen-denominated cross-border claims on NBFIs at end-March 2020.

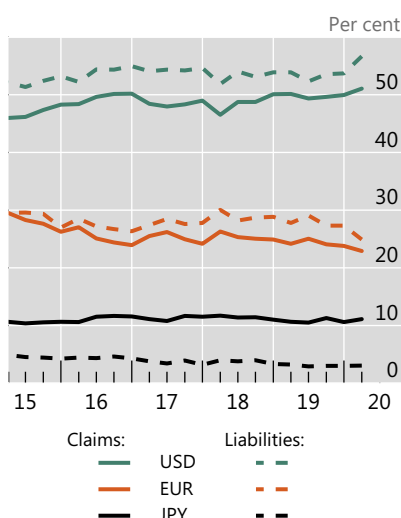
Banks' cross-border links with NBFIs grew substantially, with a rising USD share¹

Graph 1

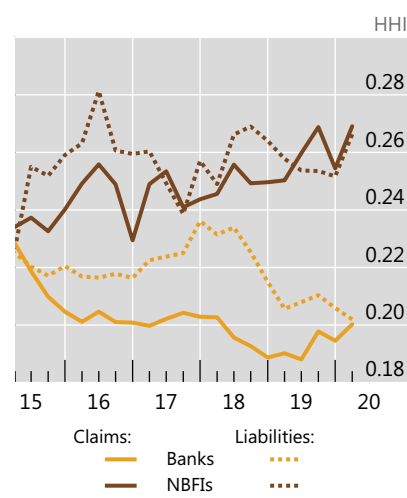
Cross-border links with NBFIs grew strongly in recent years



The US dollar makes up over half of claims and liabilities vis-à-vis NBFIs⁴



Links with NBFIs are more concentrated than interbank ones⁵



¹ Based on a varying number of reporting countries in respective quarters. ² Amount outstanding. ³ Share of NBFIs in total claims (liabilities) on all counterparty sectors. ⁴ Share of total claims (liabilities) on NBFIs. ⁵ Concentration is computed as a Herfindahl-Hirschman Index (HHI). The geographical concentration, in terms of counterparty countries, is computed for each reporting country and then averaged across reporting countries. A higher HHI implies higher concentration.

Sources: BIS locational banking statistics (by residence); authors' calculations.

⁵ The number of countries reporting positions vis-à-vis NBFIs has been continuously growing, from 27 in Q1 2015 to 40 since Q2 2019. The rising importance we document is not an artefact of this increase in the reporting population: we obtain notably similar figures if we consider a constant sample of reporting countries.

⁶ Data on liabilities may be underestimated. Debt securities issued by banks cannot be allocated to specific counterparties, as banks typically do not know who holds them after primary issuance.

The global picture of non-bank financial intermediation from FSB data

Iñaki Aldasoro, Wenqian Huang and Esti Kemp^①

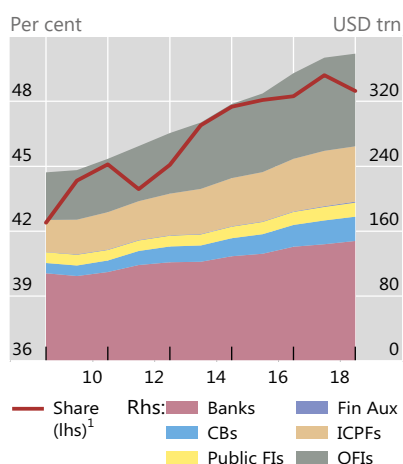
Non-bank financial intermediation provides additional sources of financing for households and corporates. But it can also contribute to systemic risks through links with the banking system. In the wake of the Great Financial Crisis, G20 leaders requested that the Financial Stability Board (FSB) develop recommendations to strengthen the oversight and regulation of “shadow banking”.^② The framework developed in response includes the monitoring of non-bank financial intermediation. Findings are reported annually to provide a global picture of the size and growth of non-bank financial institutions (NBFIs), as well as their links with other parts of the financial system.^③ Compared with the BIS international banking statistics, FSB data have a broader coverage of NBFIs’ domestic and cross-border counterparties – including non-banks – but cover fewer jurisdictions and have no counterparty country breakdown.

The growth of NBFI assets exceeded that of bank assets over the past decade, reaching 48% of total financial assets at end-2018, from 42% at end-2008 (Graph A, left-hand panel). As of end-2018, the combined assets of NBFIs – consisting mostly of insurance companies, pension funds and other financial intermediaries (OFIs)^④ – stood at \$184 trillion, versus \$148 trillion for banks.

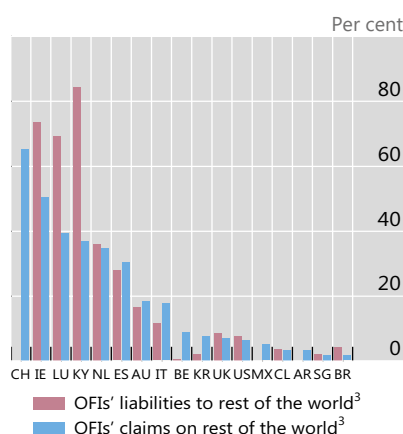
NBFIs’ global assets grew strongly over the past decade

Graph A

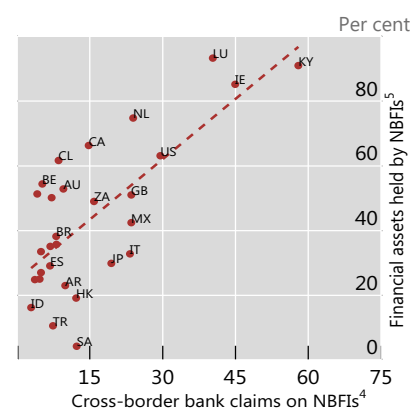
NBFI assets’ rising share in total financial assets



Cross-border positions are large for OFIs in financial centres²



Cross-border activity is linked to the local importance of NBFIs



CBs = central banks; Fin Aux = financial auxiliaries; ICPFs = insurance corporations and pension funds; OFIs = other financial institutions; public FIs = public financial institutions;

¹ Share of NBFI assets in total financial assets of financial institutions. NBFI = Fin Aux + ICPFs + OFIs. ² OFIs include all financial institutions that are not central banks, banks, financial auxiliaries, pension funds and insurance corporations; as of end-December 2018. ³ As a share of OFI assets. ⁴ BIS reporting banks’ claims on NBFIs vis-à-vis selected counterparty countries as a share of total cross-border claims on all sectors; as of end-December 2018. ⁵ Share of financial assets held by NBFIs in total financial assets; as of end-December 2018.

Sources: FSB, *Global monitoring report on non-bank financial intermediation 2019*; BIS locational banking statistics (by residence); authors’ calculations.

The importance of OFIs’ cross-border positions relative to local positions varies across jurisdictions. Although financial centres have larger cross-border links, OFIs in most jurisdictions report cross-border links representing less than 20% of their assets (Graph A, centre panel).

The bigger the role of NBFIs in the financial system of a given jurisdiction, the bigger their share in banks’ cross-border claims on that jurisdiction. The right-hand panel of Graph A illustrates this point by measuring the NBFIs’ role with the ratio of their financial assets under management to total financial assets within a jurisdiction. Financial centres stand out, with relatively large NBFI sectors that have strong cross-border links with banks (upper right-hand corner).

^① The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements. ^② FSB (2011). In October 2018, the FSB replaced the term “shadow banking” with “non-bank financial intermediation”. ^③ The 2019 report covers data up to end-2018 from 29 jurisdictions, which together represent over 80% of global GDP; see FSB (2020). ^④ OFIs include central counterparties, finance companies, hedge funds, money market funds and other investment funds.

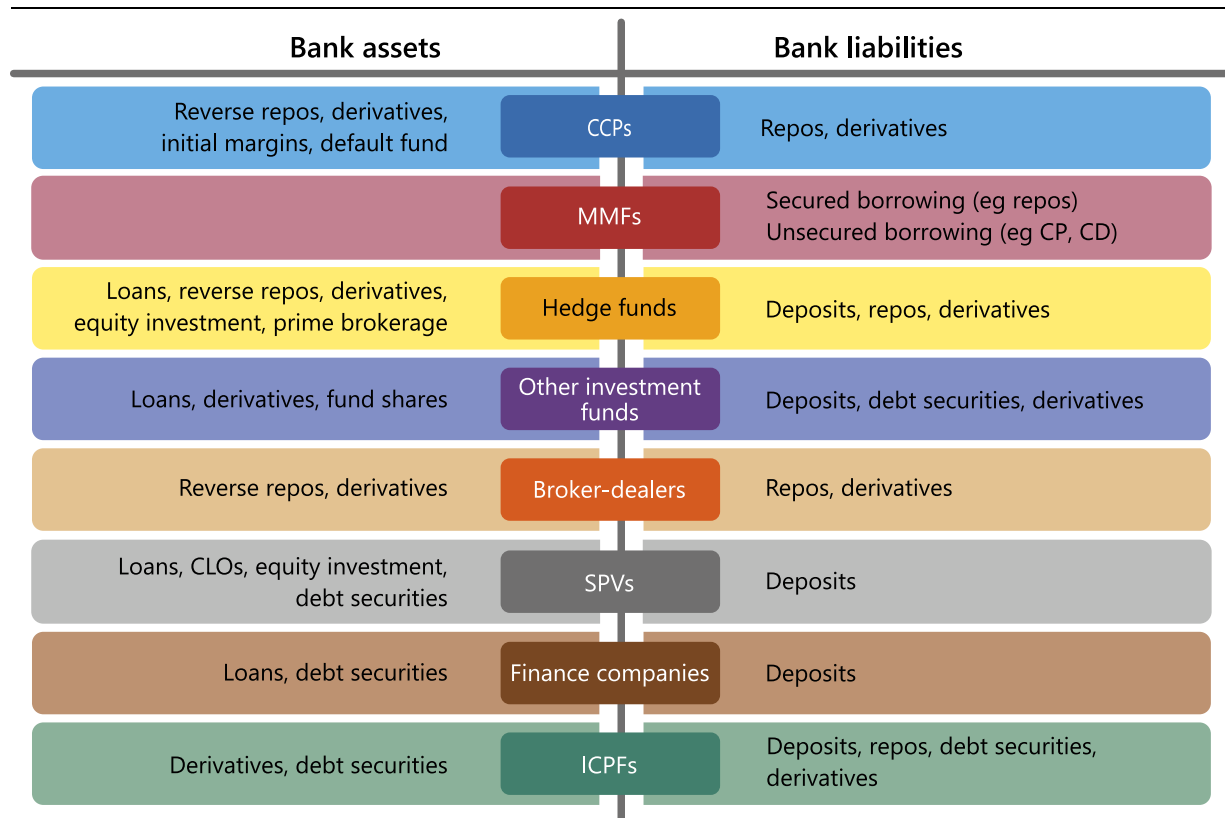
The network of cross-border links between banks and NBFIs

Banks and NBFIs are linked directly and indirectly.⁷ The IBS capture a subset of these linkages, namely banks' *direct* claims and liabilities vis-à-vis NBFIs. Graph 2 illustrates how such linkages could enter banks' balance sheets. For instance, if banks invest in collateralised loan obligations (CLOs) or extend loans to finance companies, these would show up on banks' asset side as claims on NBFIs. In turn, banks' liabilities could reflect funding from MMFs (eg via repos or commercial paper) or deposits from NBFIs, among others. Credit lines are off-balance sheet commitments that appear on balance sheets – as loans and the corresponding deposits – only when drawn.

BIS cross-border banking statistics capture the links between banks located in a given jurisdiction and the NBFIs in another. The left-hand panel of Graph 3 plots the network of banks' cross-border *claims* on NBFIs as of Q1 2020. The size of the nodes is proportional to the total value of cross-border links. The colour of the links shows the location (legal residence) of the bank that holds the claim, and the width

Asset and liability links between banks and NBFIs: illustrative examples¹

Graph 2



CCPs = central counterparties; CD = certificates of deposit; CLOs = collateralised loan obligations; CP = commercial paper; ICPFs = insurance companies and pension funds; MMFs = money market funds; SPVs = special purpose vehicles.

¹ The diagram does not aim to be comprehensive but to give a high-level overview of the main types of connections to NBFIs on bank balance sheets. Note that credit lines, if not drawn, do not appear on balance sheets.

Source: Authors' elaboration.

⁷ Examples of indirect links include those arising from being part of the same conglomerate (including implicit or explicit support from banks to affiliated funds), or from having exposures to the same counterparty (eg overlapping portfolios).

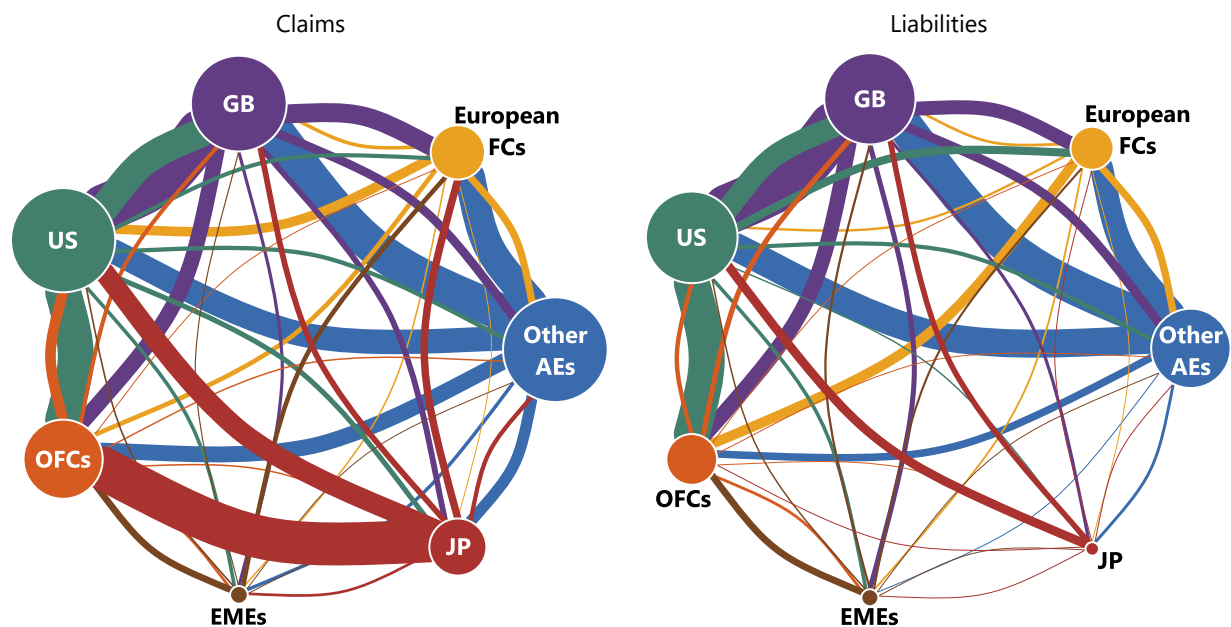
is proportional to the value of the claim. For example, claims of banks located in the United States on NBFIs in the United Kingdom are captured by the green link between the green and purple nodes. In turn, the purple link between these two nodes denotes claims of banks in the United Kingdom on NBFIs located in the United States. The same logic applies to the network of banks' cross-border liabilities (right-hand panel). For example, the green link between the same two nodes denotes the liabilities of banks in the United States to NBFIs in the United Kingdom.

The patterns across claims and liabilities, and across counterparty countries, shed light on the types of NBFIs with which banks have cross-border positions.⁸ Banks in Japan, for instance, have sizeable claims on NBFIs in offshore financial centres (mainly in the Cayman Islands). This probably reflects banks' holdings of securities, such as CLOs, issued by securitisation vehicles, such as special purpose vehicles (SPVs) (Aramonte and Avalos (2019), SNP Global (2020)).⁹ The claims of banks in the US on

Network of banks' cross-border claims and liabilities vis-à-vis NBFIs

As of end-March 2020

Graph 3



Link colours are based on the residence of the bank having the claim (left-hand panel) or liability (right-hand panel). For example, green links in the left-hand panel are claims of banks located in the United States on NBFIs in the respective counterparty countries/regions. In the same panel, the purple link connecting the United Kingdom with the United States represents claims of banks in the former on NBFIs in the latter. Due to data confidentiality constraints, some reporting jurisdictions' positions are grouped with other jurisdictions. Links between jurisdictions belonging to an aggregate (ie between EMEs) are not considered. The composition of countries in a customised aggregate differs for reporting location and counterparty location. EMEs = emerging market economies (out of 14 reporting countries, 11 report claims/liabilities vis-à-vis NBFIs and three are BR, CL and MX; there are about 150 EME counterparty countries). European FCs (financial centres) = IE, LU, NL and CH. Other AEs = other advanced economies, comprising euro area countries (excluding IE, LU and NL; 13 euro area reporting countries provide positions vis-à-vis NBFIs), AU, CA, DK, NO and SE. OFCs = offshore financial centres, as per the BIS classification (out of 12 reporting offshore centres, five do not report positions vis-à-vis NBFIs: BH, CW, JE, PA and SG). For confidentiality reasons, the underlying data are not available. The dynamic version shows a slightly different aggregation and the underlying data are available.

Sources: BIS locational banking statistics (by residence); authors' calculations.

⁸ While BIS data do not present a breakdown of NBFIs (eg CCP or broker-dealer) or instruments (eg repo or debt security), other publicly available data and research can indicate the types of NBFIs to which banks have exposures.

⁹ As of end-2018, Japanese banks held CLOs worth \$107 billion (FSB (2019)).

NBFIs in offshore financial centres also probably reflect such activities (DeMarco et al (2020)), as well as prime brokerage business with hedge funds (Fichtner (2014)). It is likely that central clearing contributes to strong links between the United States and the United Kingdom, as both host internationally active CCPs (Benos et al (2019)). Banks in the euro area and in other advanced economies such as Canada and Australia (Graph 3, blue nodes) have substantial claims on NBFIs in European financial centres – ie Ireland, Luxembourg, the Netherlands and Switzerland.¹⁰ These may arise from banks’ exposures to investment funds and other asset managers, such as hedge funds. European banks have large claims on NBFIs in the United States, reflecting exposure to US finance companies and US SPVs (Abad et al (2017)).

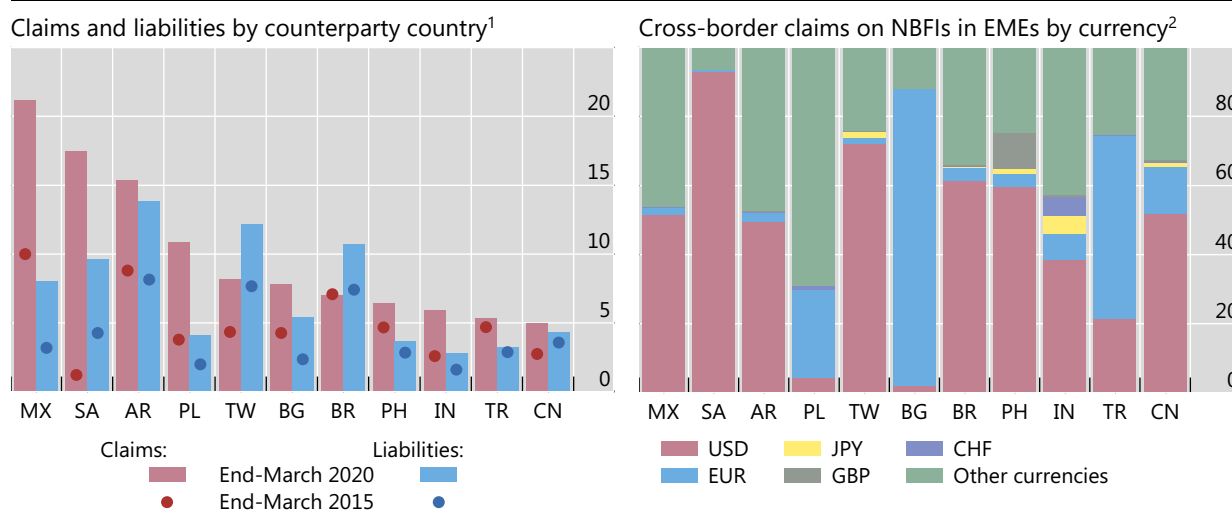
Turning to the network of cross-border liabilities, a similarly prominent role is played by certain financial centres and large advanced economies (Graph 3, right-hand panel). Again, this is likely to reflect the location of large CCPs that clear derivatives (eg the United Kingdom) and of NBFIs that are an important funding source for banks, such as MMFs (eg in the United States and Cayman Islands). That said, there are also some differences relative to the network of cross-border claims. Notably, offshore financial centres play a less prominent role as counterparties (size of links into orange node). Furthermore, the cross-border liabilities to NBFIs of banks in Japan are significantly smaller than their cross-border claims as of end-March 2020 (red node).

Banks’ cross-border claims on and liabilities to NBFIs have also become more important for EMEs. While EMEs play a small role in the overall bank-NBFI cross-border network (Graph 3), the role of NBFIs is non-negligible from EMEs’ perspective (Graph 4, left-hand panel). Furthermore, this role grew substantially for some

Cross-border linkages between banks and NBFIs are large for some EMEs

In per cent

Graph 4



¹ Share of NBFIs in the total cross-border claims (liabilities) of banks in all reporting countries vis-à-vis respective counterparty countries on x-axis. ² Share of currency denomination in the total cross-border claims on NBFIs in the respective borrower countries; as of end-March 2020.

Sources: BIS locational banking statistics (by residence); authors’ calculations.

¹⁰ We define European financial centres as those European jurisdictions with large bank and NBFI activity relative to the size of the economy.

countries in recent years, in terms of both claims (red bars vs dots) and liabilities (blue bars vs dots). As of Q1 2020, over 15% of the total cross-border bank claims on Mexico, Saudi Arabia and Argentina are vis-à-vis NBFIs. The US dollar also looms large for some EMEs: more than 60% of the cross-border claims on NBFIs in Brazil, Chinese Taipei and Saudi Arabia are denominated in US dollars (right-hand panel).

Vulnerabilities and the impact of the Covid-19 shock

Vulnerabilities associated with bank-NBFI links surfaced amid the Covid-19 market turbulence in March. On the one hand, banks' claims on certain NBFIs such as hedge funds increase financial leverage. During the severe financial stress caused by the pandemic's fallout, the unwinding of the leveraged positions exacerbated fire sales and drained market liquidity (Schrimpf et al (2020)). In addition, banks' links with CCPs (the "CCP-bank nexus" in Faruqui et al (2018)) can transform banks' counterparty credit risk into liquidity risk. On the other hand, banks increasingly rely on NBFIs such as MMFs for short-term funding. Such funding can suddenly dry up, causing market disruptions (Eren et al (2020)). More broadly, cross-border links between banks and NBFIs tend to underpin FX positions that generate liquidity and maturity mismatches. The IBS shed light on these vulnerabilities and their evolution during the initial phase of the Covid-19 crisis.

Banks' cross-border claims on NBFIs saw a significant spike in Q1 2020 (\$797 billion), in line with that observed for cross-border claims more broadly (BIS (2020)). The large expansion could be the result of NBFIs' drawdown of credit lines from banks (Glancy et al (2020)). NBFIs located in the United States, United Kingdom and Cayman Islands accounted for much of this expansion, most of which was US dollar-denominated (Graph 5, first panel). Banks' claims on NBFIs in Japan, mostly yen-denominated, also saw a significant rise.¹¹

Increases in banks' cross-border claims on NBFIs in the United Kingdom and Japan probably also reflected, in part, gains on banks' centrally cleared derivatives positions with, and initial margin calls by, CCPs located there. Historically, changes in cross-border bank claims on NBFIs in the United Kingdom and Japan have tended to correlate positively with changes in CCPs' initial margins in the same jurisdictions (Graph 5, second panel). The market turbulence in the first quarter of 2020 gave rise to a substantial increase in clearing volume by CCPs, as well as exceptionally large margin calls as CCPs stepped up their protection from counterparty risk (upper right-hand corner). Such a sudden and massive increase of margins generates liquidity strains for clearing member banks (Huang and Takáts (2020)).¹²

Banks' cross-border liabilities to NBFIs were also heavily affected by the March turmoil. The increase of \$779 billion in Q1 2020 was exceptional, three times as large as the typical (average) first quarter increase since 2015 (Graph 5, third panel).¹³ Just

¹¹ In contrast, cross-border claims on the non-financial sector in Japan declined slightly in Q1 2020.

¹² This underscores the importance of CCP members understanding how margin calls could evolve in stressed markets and remaining prepared to manage liquidity strains. To achieve that, members could benefit from transparency in CCPs' credit risk management, eg margin methodology and practices.

¹³ The seasonal pattern of first quarter increases is liable to arise from the year-end contraction in banks' balance sheets occurring mostly via derivatives and repos (BIS (2018)).

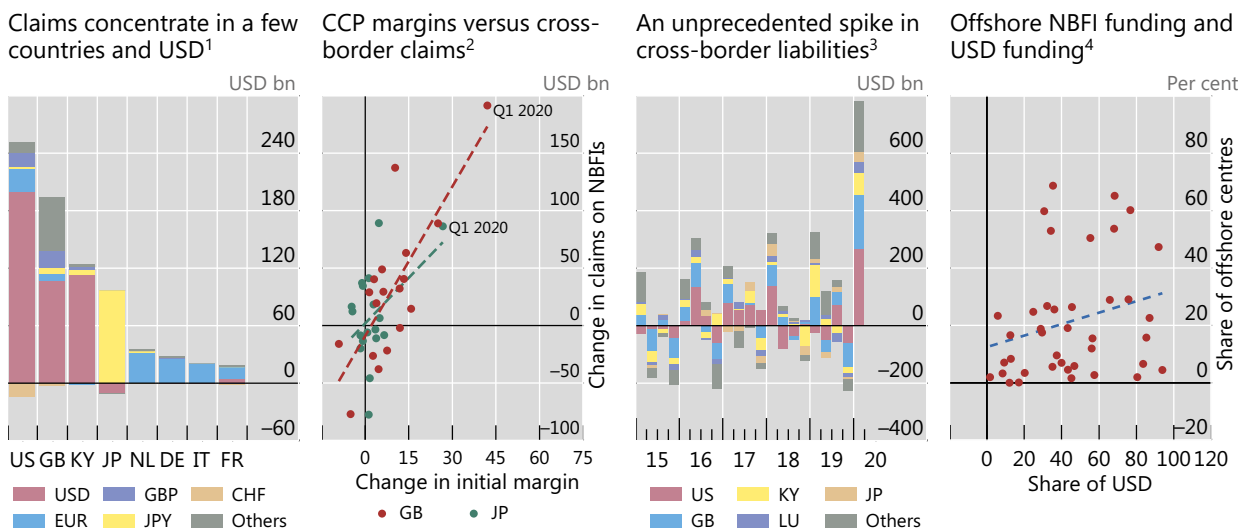
as with changes in claims, NBFIs' drawdown of credit lines from banks plays a role: as the credit lines are drawn, they generate a corresponding increase in deposits at banks. As of end-December 2019, banks in the United States had almost a trillion dollars of committed credit lines to NBFIs (Federal Reserve Board (2020)). Furthermore, to the extent that CCPs intermediate between banks that are on opposite sides of derivatives contracts, gains on such contracts for some banks (ie claims on NBFIs) would go hand in hand with losses for other banks (ie liabilities to NBFIs). This could partly explain the increases in banks' liabilities vis-à-vis NBFIs in the United States and the United Kingdom.

The expansion of banks' liabilities to NBFIs in the first quarter of 2020 masks the underlying vulnerability stemming from some fickle funding sources. An example is the funding to banks provided by US MMFs. Portfolio holding data reported by MMFs reveal that the level of this funding rose from December 2019 to March 2020, in line with the overall direction of banks' liabilities vis-à-vis NBFIs in the United States. However, there was a significant decline from February to March 2020, underscoring that, despite reforms, MMFs can still be an unreliable source of funding (Eren et al (2020)).¹⁴

Banks also rely on offshore financial centres for their US dollar funding from NBFIs. The importance of these centres in banks' cross-border liabilities to NBFIs coincides with that of the US dollar (Graph 5, fourth panel). As the NBFIs in offshore

Changes in banks' cross-border positions vis-à-vis NBFIs

Graph 5



¹ FX- and break-adjusted changes in stocks as of end-March 2020; counterparty countries are shown on x-axis. ² Each dot represents changes during a quarter for the period from end-December 2015 to end-March 2020; cross-border claims are adjusted for FX movements and breaks in series, whereas initial margin are changes in stocks from the preceding quarter. UK CCPs = LCH, LME and ICEU; JP CCP = JSCC. ³ Cross-border liabilities in all currencies by counterparty country; FX- and break-adjusted changes in stocks. ⁴ As of end-March 2020; banks in 40 reporting locations (BH, BR, CL, CW, JE, MX, PA and SG do not report these data). The x-axis shows the USD-denominated cross-border NBFi liabilities of banks in individual reporting countries divided by these banks' total cross-border NBFi. The y-axis shows the cross-border liabilities of banks in the same reporting countries to NBFIs in offshore financial centres divided by these banks' total cross-border NBFi liabilities. For confidentiality reasons, the underlying data are not available.

Sources: Clarus FT; BIS locational banking statistics (by residence); authors' calculations.

¹⁴ Previous disruptions to the US dollar funding provided by US MMFs to non-US banks have been highly consequential for banks and their borrowers, as shown in the context of the euro zone crisis of 2011 (Ivashina et al (2015)) or the US MMF reform (Aldasoro et al (2019)).

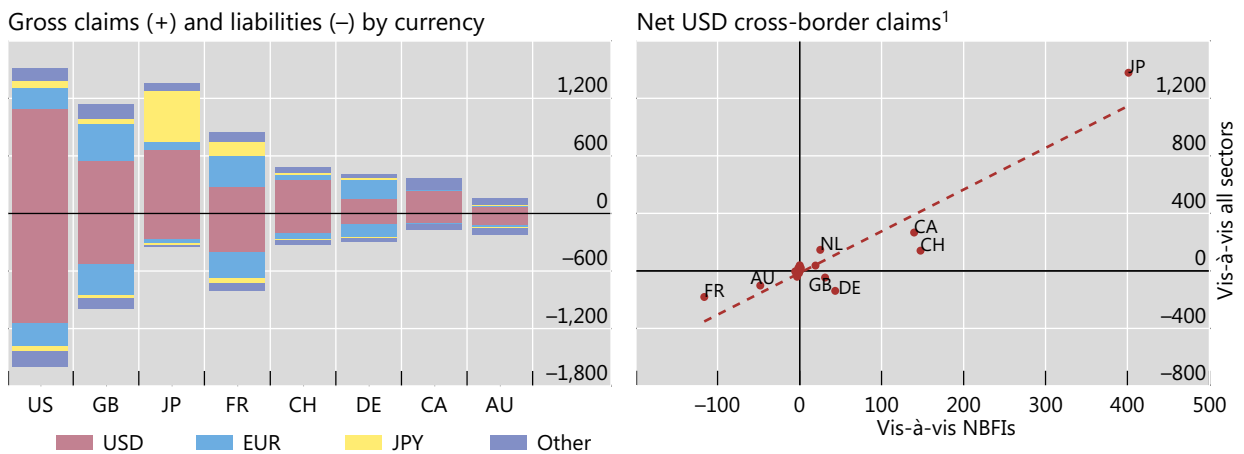
financial centres (eg hedge funds, MMFs and other investment funds) tend to have a short investment horizon, they can amplify US dollar funding stress.

To look further into the role of NBFIs in banks' vulnerability to US dollar funding shortages, we consider statistics aggregated by bank *nationality* (see Box B for a discussion of this aggregation). In other words, we shift focus away from banks' *residence* and to their home countries. The data reveal apparent net long positions in US dollars vis-à-vis NBFIs (Graph 6, left-hand panel), which tend to contribute to apparent net long positions vis-à-vis all counterparties (right-hand panel).¹⁵ While banks typically hedge such positions via FX swaps – thus reducing or eliminating any currency mismatches – the short maturity of these instruments generates liquidity mismatches, leaving banks vulnerable to US dollar funding shortages. Such shortages took centre stage during the Covid-19 crisis, prompting authorities to swiftly re-establish central bank swap lines to quell the storm (Aldasoro et al (2020)).

Apparent net currency positions vis-à-vis NBFIs and all counterparties

By bank nationality; amounts outstanding as of end-March 2020, in billions of US dollars

Graph 6



¹ USD cross-border claims minus USD cross-border liabilities, for 21 bank nationalities. Trustee positions of Japanese banks are included. The upward sloping fitted line has an R-squared of 0.86 when including Japanese banks, and of 0.60 when excluding them.

Sources: BIS locational banking statistics (by nationality); authors' calculations.

¹⁵ Data for Japanese banks include trustee positions, leading to an overestimation of net US dollar claims.

Cross-border links with NBFIs from a bank nationality perspective

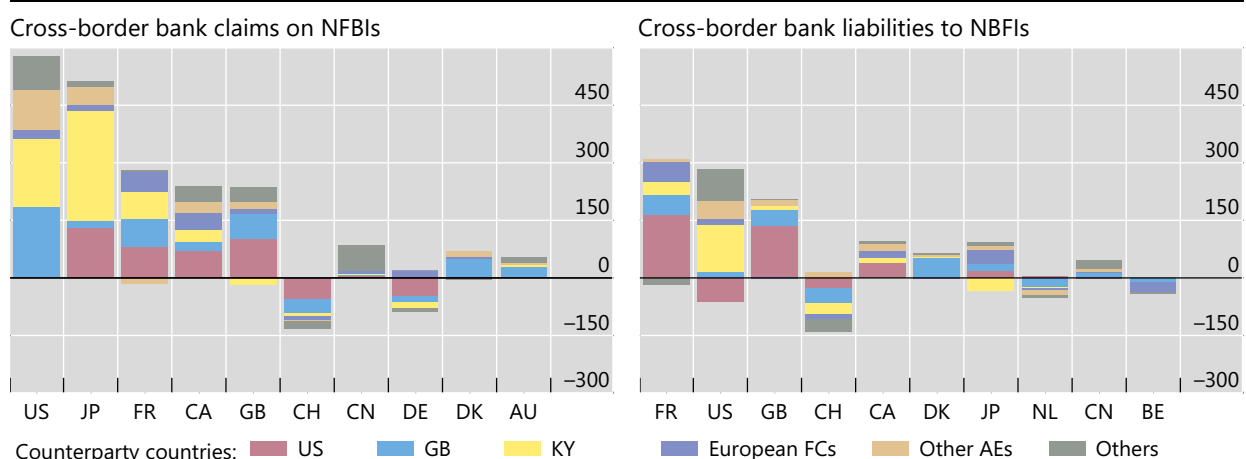
The BIS locational banking statistics (LBS) by *nationality* aggregate cross-border positions based on where reporting banks are headquartered. For example, they identify the claims held by the London offices (branches or subsidiaries) of German banks, ie those headquartered in Germany.^① By contrast, the LBS by *residence* – used in most of this article – treat all offices of the banks located in the United Kingdom in the same way, regardless of their nationality.

Banks headquartered in a handful of jurisdictions account for the lion's share of the changes in cross-border positions vis-à-vis non-bank financial institutions (NBFIs) between Q1 2015 and the eve of the Covid-19 crisis (end-2019). US banks are behind the largest increase: \$576 billion, of which 32% (\$185 billion) was vis-à-vis NBFIs in the United Kingdom, with an additional 30% (\$175 billion) vis-à-vis those in the Cayman Islands (Graph B, left-hand panel). Japanese banks have also increased their claims on NBFIs in the Cayman Islands, by \$287 billion over the same period. On the liability side, French and UK banks accumulated substantial cross-border liabilities with NBFIs in recent years, especially those located in the United States (right-hand panel). Similarly, US banks increased their cross-border liabilities with NBFIs, especially in the Cayman Islands. Banks headquartered in these jurisdictions are also the ones who saw the largest changes in claims and liabilities during the Covid-19 period.

Cumulated change in cross-border links with NBFIs ahead of the Covid-19 shock¹

By bank nationality; Q1 2015–Q4 2019 cumulative change, in billions of US dollars

Graph B



European FCs = European financial centres (IE, LU, NL and CH); other AEs = advanced economies excluding US, GB and European FCs; others = all other counterparty countries.

¹ FX- and break-adjusted changes.

Sources: BIS locational banking statistics (by nationality); authors' calculations.

^① The LBS by nationality allow for a split of cross-border assets *and* liabilities vis-à-vis NBFIs. An alternative – that does not allow for such split – is the consolidated banking statistics (CBS). They provide a similar nationality view, but from a worldwide consolidated perspective (ie net of intragroup positions). The top nationalities using the CBS are very similar to those using the LBS by nationality; see García Luna and Hardy (2019).

Conclusion

Banks' cross-border links with NBFIs grew substantially in recent years, in tandem with the increase in the size of the NBFIs sector around the globe. Such linkages are highly concentrated along multiple dimensions. The market turmoil unleashed by the Covid-19 shock brought to the fore vulnerabilities associated with these links.

While adding to the understanding of the bank-NBFI nexus, our article also points to important data gaps. Enhancing the available data along four dimensions would help give a fuller picture of financial vulnerabilities and the attendant transmission channels. These dimensions are: the domestic exposures between banks and NBFIs, the specific types of NBFIs that banks have as counterparties, the exposures within the NBFI sector, and the financial instruments underpinning all exposures.

The sheer size of NBFIs, as well as their growing interconnectedness with banks, warrants continued monitoring by authorities. The fact that some NBFIs face a substantially different regulatory environment compared with banks – as well as no or limited formal access to central bank liquidity or public sector credit guarantees – only heightens this need.

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Annexes

BIS Statistics: Charts

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

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

A Locational banking statistics

A.1 Cross-border claims, by sector, currency and instrument.....	A4
A.2 Cross-border claims, by borrowing region.....	A5
A.3 Cross-border claims, by borrowing country	A6
A.4 Cross-border claims, by nationality of reporting bank and currency of denomination.....	A7
A.5 Cross-border liabilities of reporting banks.....	A8

B Consolidated banking statistics

B.1 Consolidated claims of reporting banks on advanced economies.....	A9
B.2 Consolidated claims of reporting banks on emerging market economies.....	A10

C Debt securities statistics

C.1 Global debt securities markets.....	A11
C.2 Total debt securities, by sector of issuer	A11
C.3 Net issuance of international debt securities	A12
C.4 International debt securities issued by financial and non-financial corporations.....	A12

D Derivatives statistics

D.1 Exchange-traded derivatives.....	A13
--------------------------------------	-----

D.2 Global OTC derivatives markets	A14
D.3 OTC foreign exchange derivatives.....	A14
D.4 OTC interest rate derivatives.....	A15
D.5 OTC equity-linked derivatives	A15
D.6 OTC commodity derivatives.....	A16
D.7 Credit default swaps.....	A16
D.8 Concentration in global OTC derivatives markets.....	A17
D.9 Growth of central clearing	A17

E Global liquidity indicators

E.1 Growth of international bank credit.....	A18
E.2 Global bank credit to the private non-financial sector, by residence of borrower	A19
E.3 Global credit to the non-financial sector, by currency	A20
E.4 US dollar-denominated credit to non-banks outside the United States	A21
E.5 Foreign currency credit to non-banks in EMDEs	A21

F Statistics on total credit to the non-financial sector

F.1 Total credit to the non-financial sector (core debt)	A22
F.2 Total credit to the private non-financial sector (core debt)	A23
F.3 Bank credit to the private non-financial sector (core debt)	A24
F.4 Total credit to households (core debt)	A25
F.5 Total credit to non-financial corporations (core debt).....	A26
F.6 Total credit to the government sector at market value (core debt).....	A27
F.7 Total credit to the government sector at nominal value (core debt)	A28

G Debt service ratios for the private non-financial sector

G.1 Debt service ratios of the private non-financial sector	A29
G.2 Debt service ratios of households	A30
G.3 Debt service ratios of non-financial corporations.....	A31

H	Property price statistics	
H.1	Real residential property prices	A32
I	Effective and US dollar exchange rate statistics	
I.1	Real effective exchange rates	A33
I.2	US dollar exchange rates	A34
J	Credit-to-GDP gaps	
J.1	Credit-to-GDP gaps	A35
K	Consumer price indices	
K.1	Consumer prices	A36
L	Central bank policy rates	
L.1	Central bank policy or representative rates	A37

A Locational banking statistics

Cross-border claims, by sector, currency and instrument

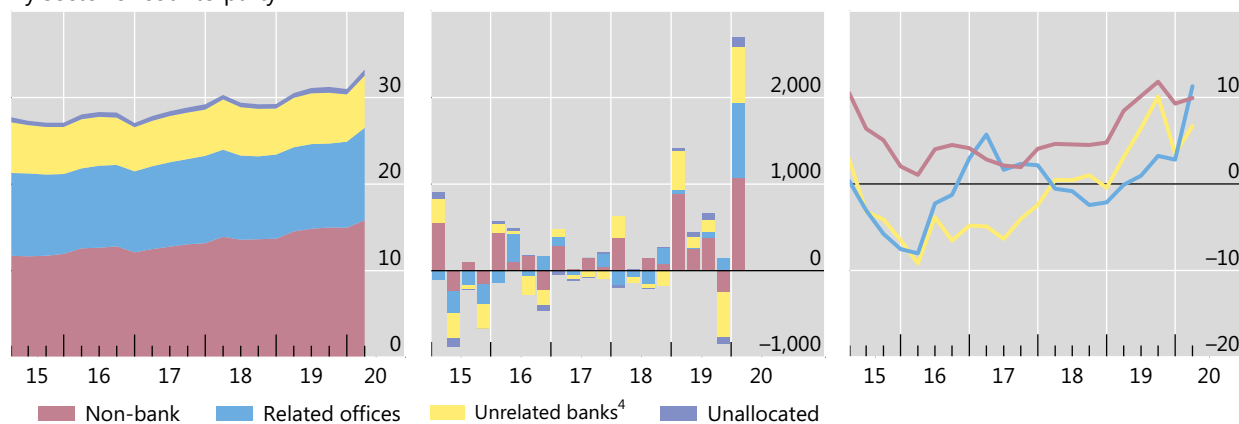
Graph A.1

Amounts outstanding, in USD trn¹

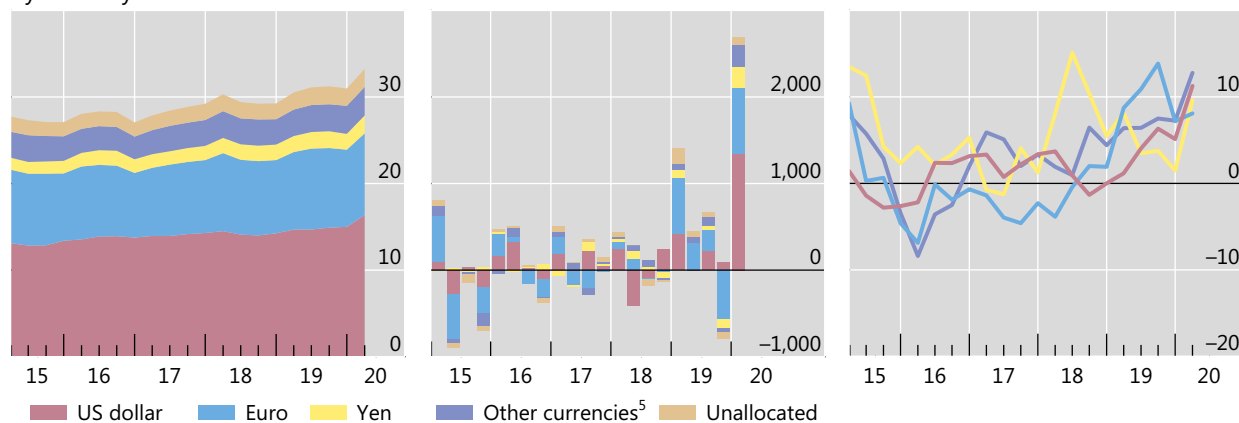
Adjusted changes, in USD bn²

Annual change, in per cent³

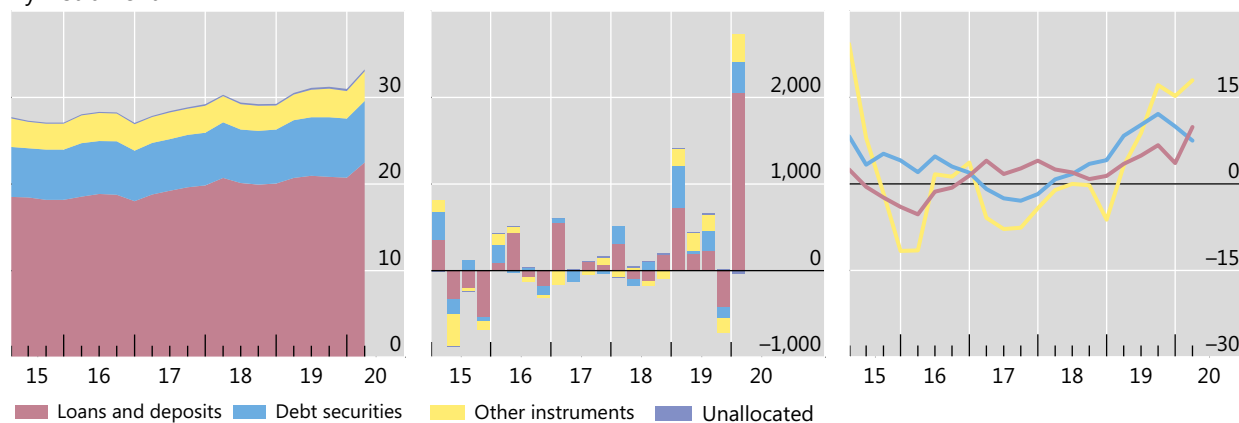
By sector of counterparty



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

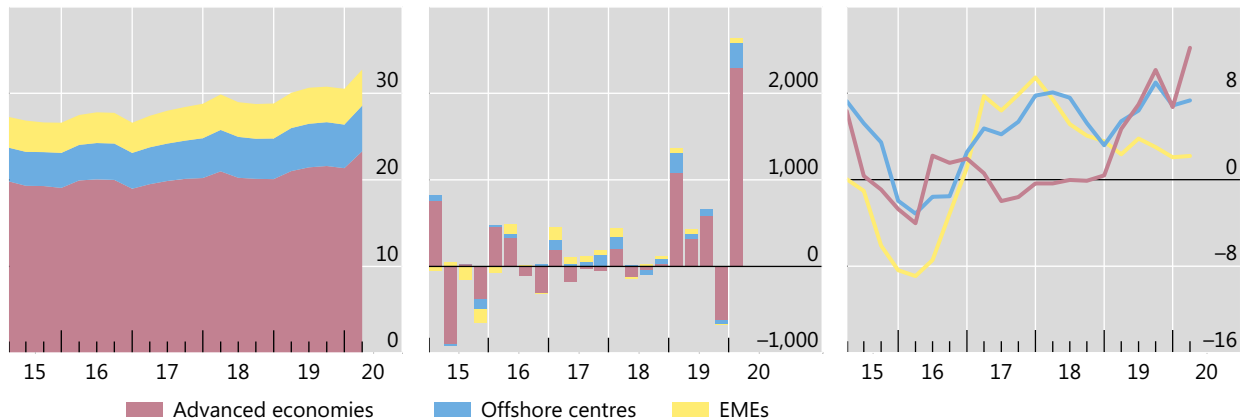
Graph A.2

Amounts outstanding, in USD trn¹

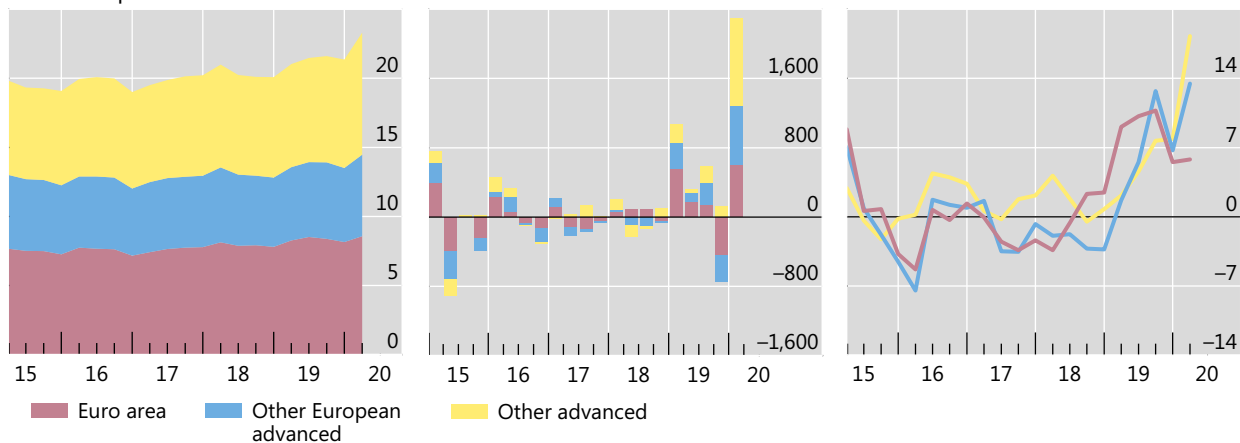
Adjusted changes, in USD bn²

Annual change, in per cent³

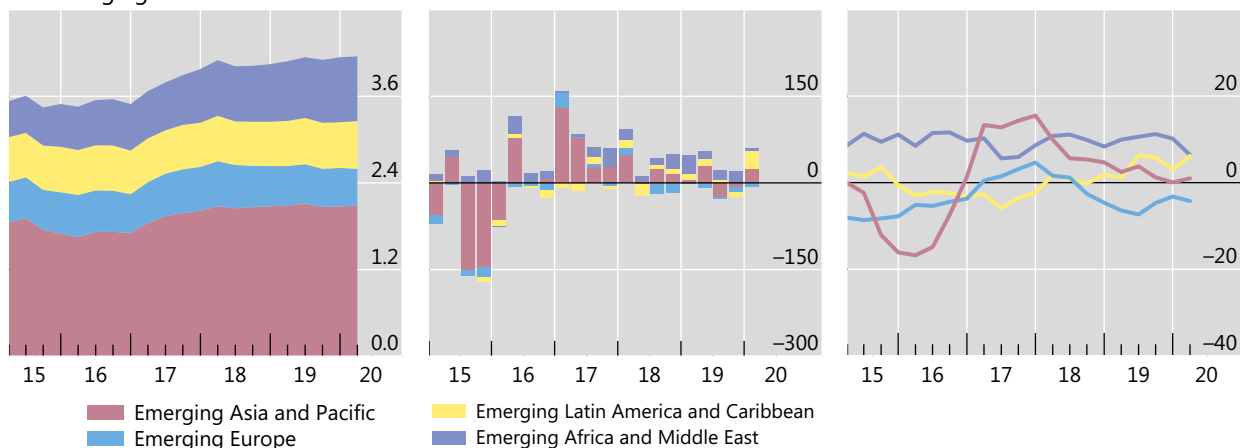
On all countries



On developed countries



On emerging market economies



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

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

Source: BIS locational banking statistics.

Cross-border claims, by borrowing country

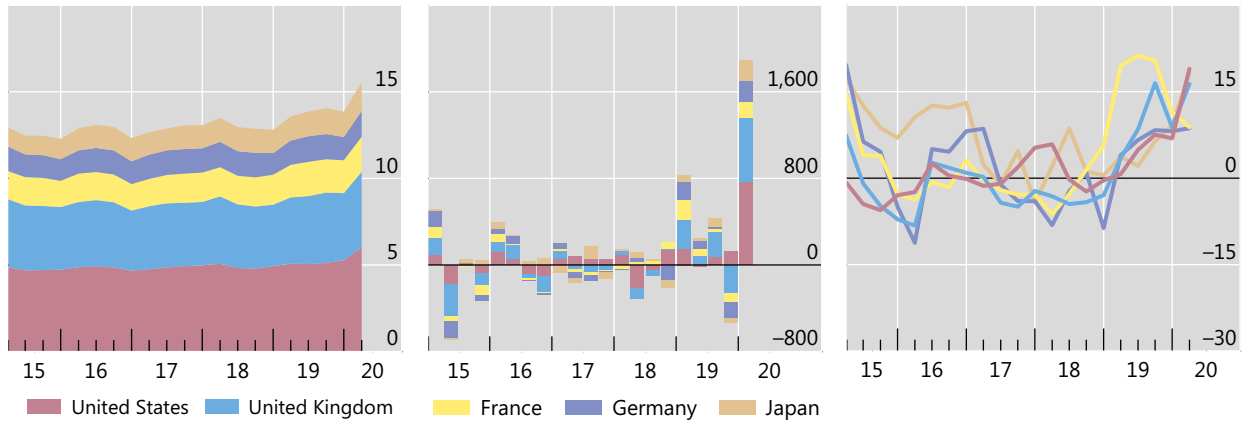
Graph A.3

Amounts outstanding, in USD trn¹

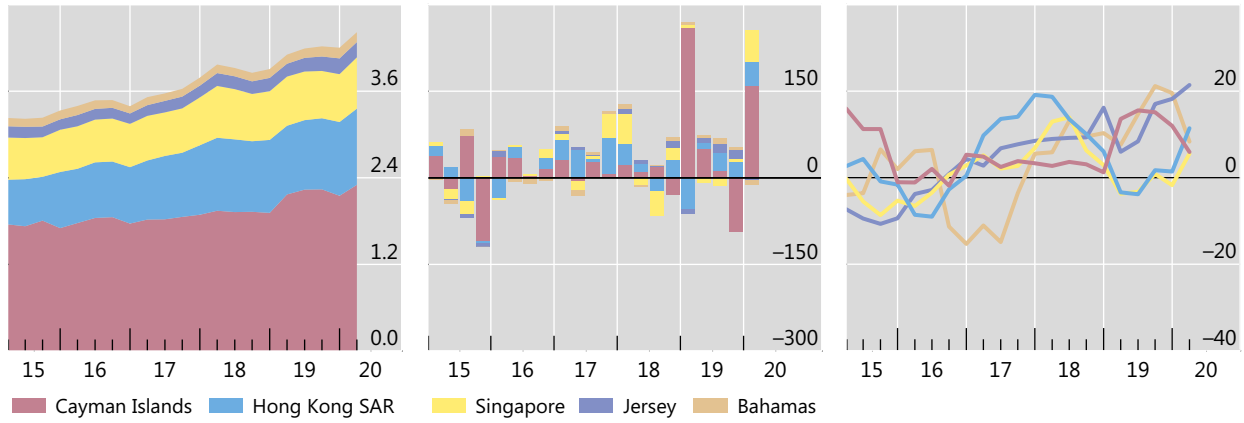
Adjusted changes, in USD bn²

Annual change, in per cent³

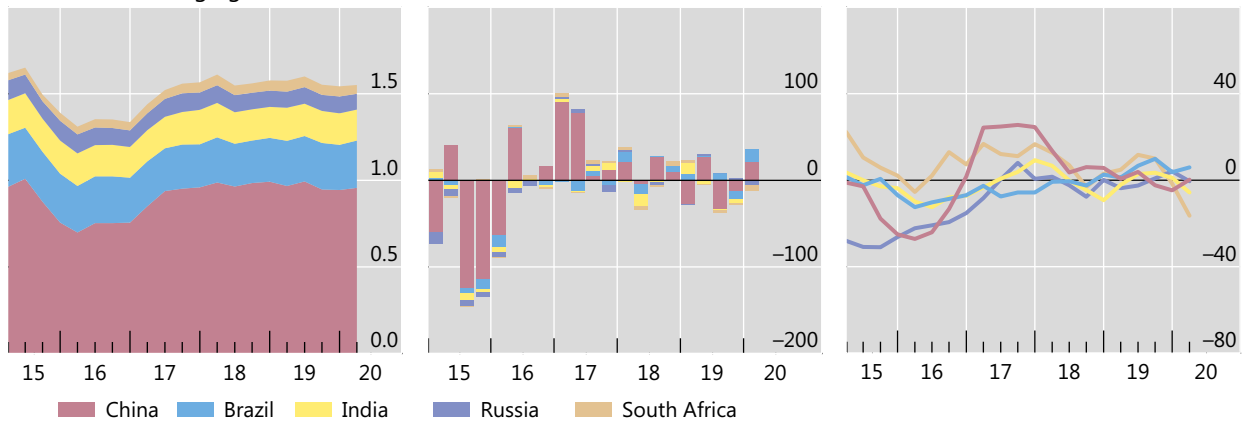
On selected advanced economies



On selected offshore centres



On selected emerging market economies

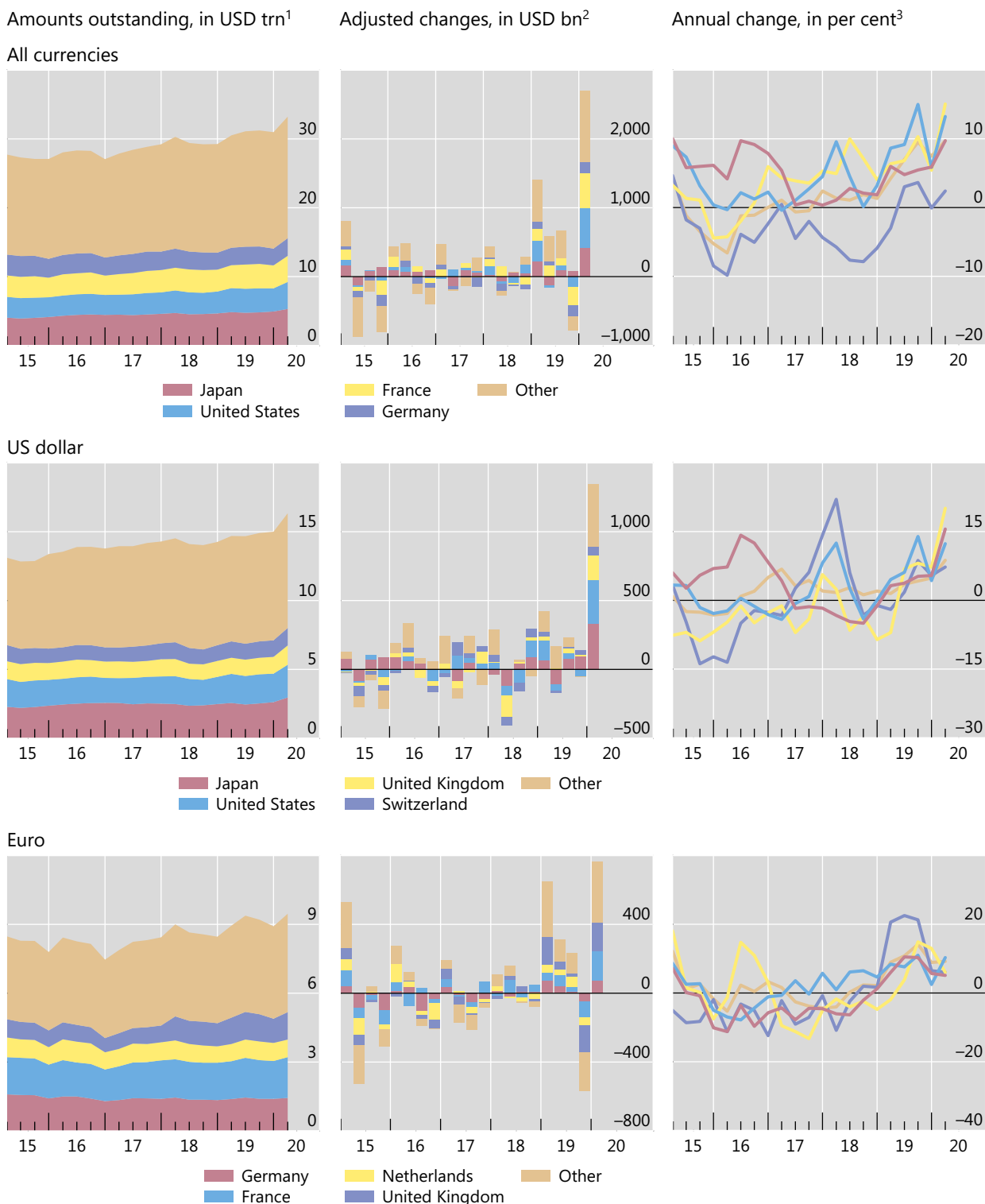


Further information on the BIS locational banking statistics is available at www.bis.org/statistics/bankstats.htm.

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

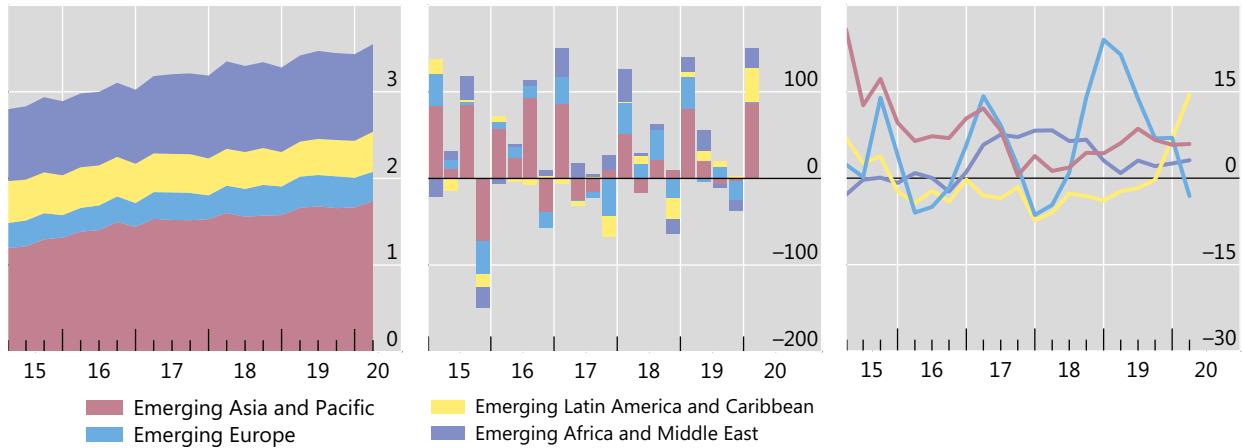
Graph A.5

Amounts outstanding, in USD trn¹

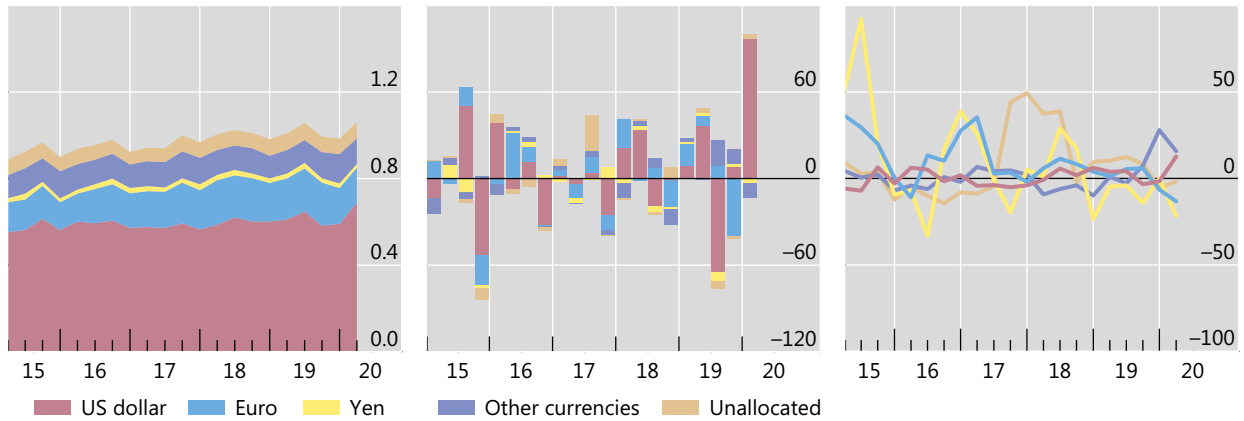
Adjusted changes, in USD bn²

Annual change, in per cent³

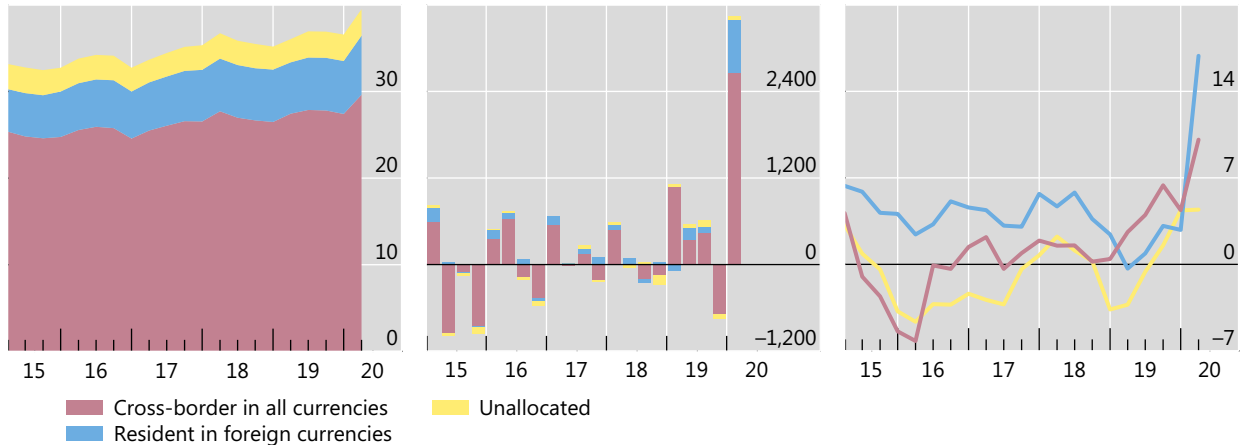
To emerging market economies



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

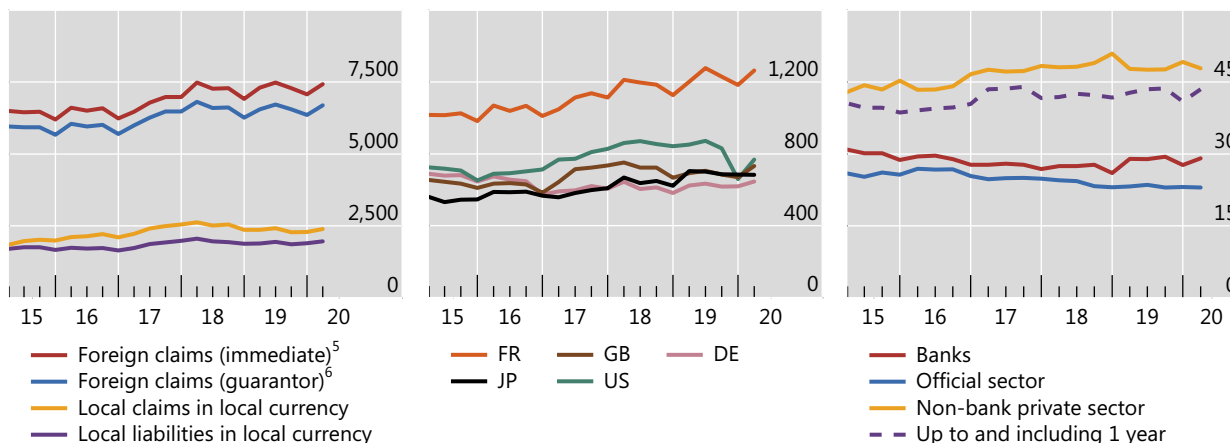
Graph B.1

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

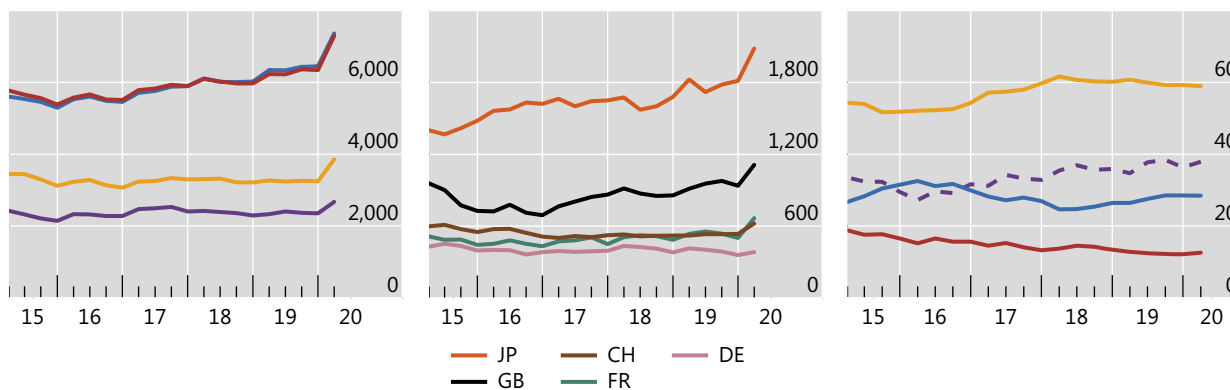
Foreign claims of selected creditors, in USD bn^{1,3}

International claims, by sector and maturity, in per cent⁴

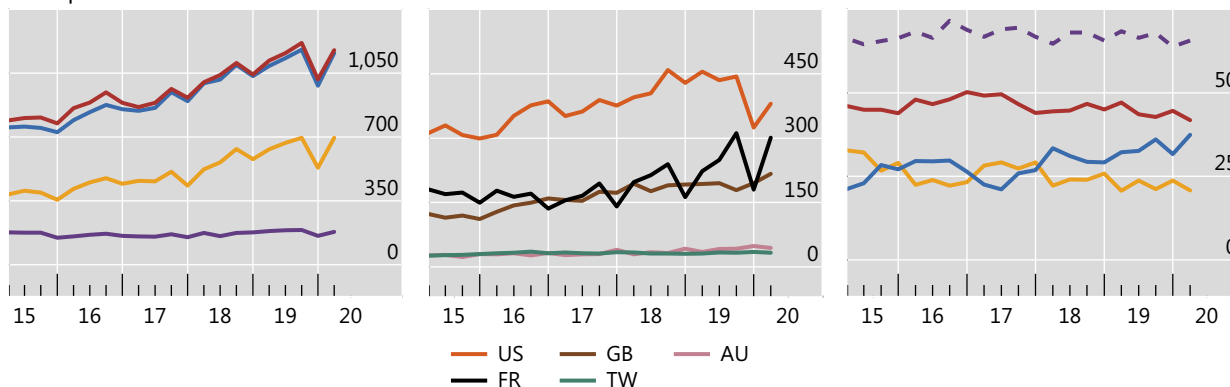
On the euro area



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

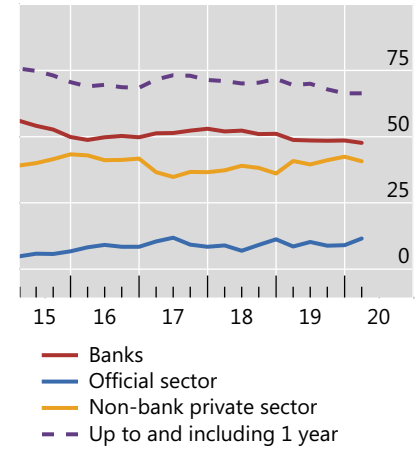
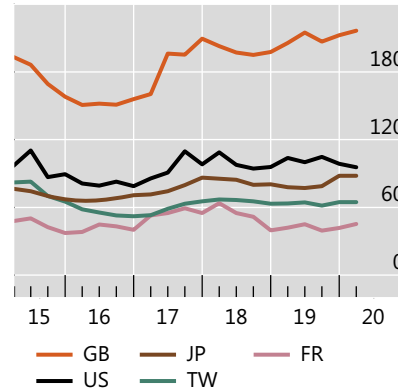
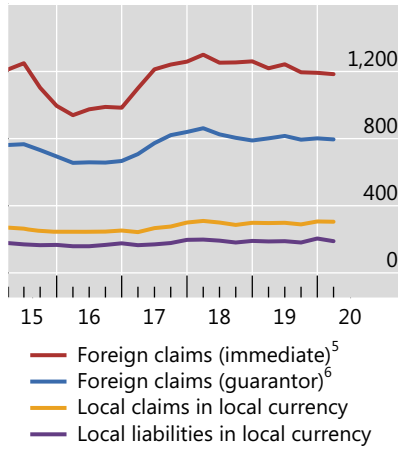
Graph B.2

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

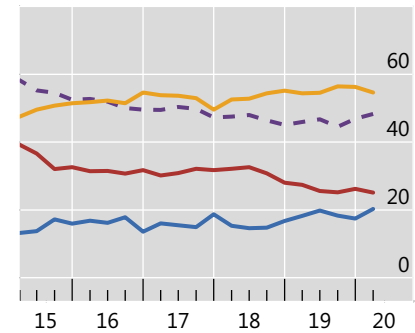
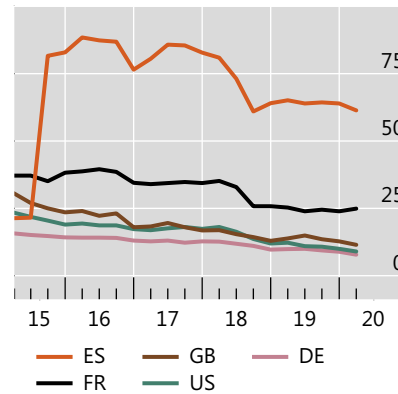
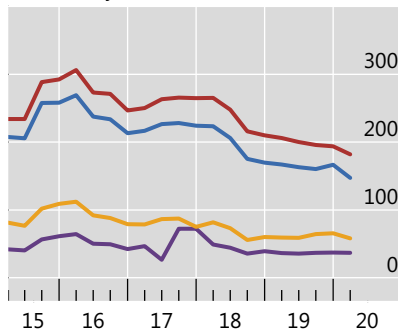
Foreign claims of selected creditors, in USD bn^{1,3}

International claims, by sector and maturity, in per cent⁴

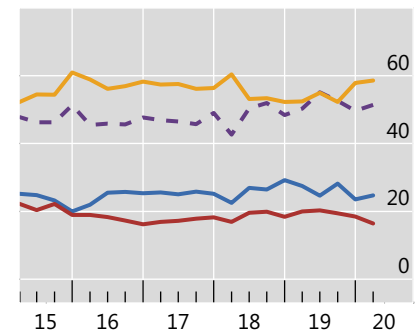
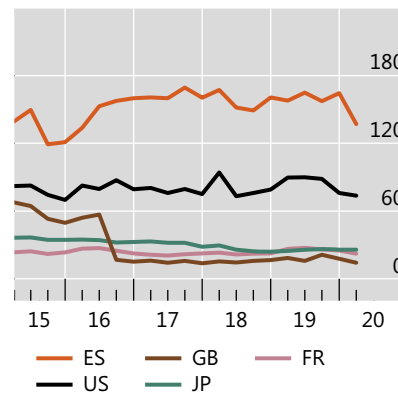
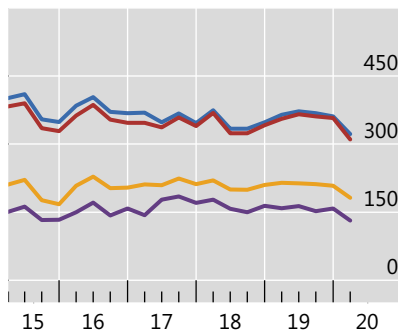
On China



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.

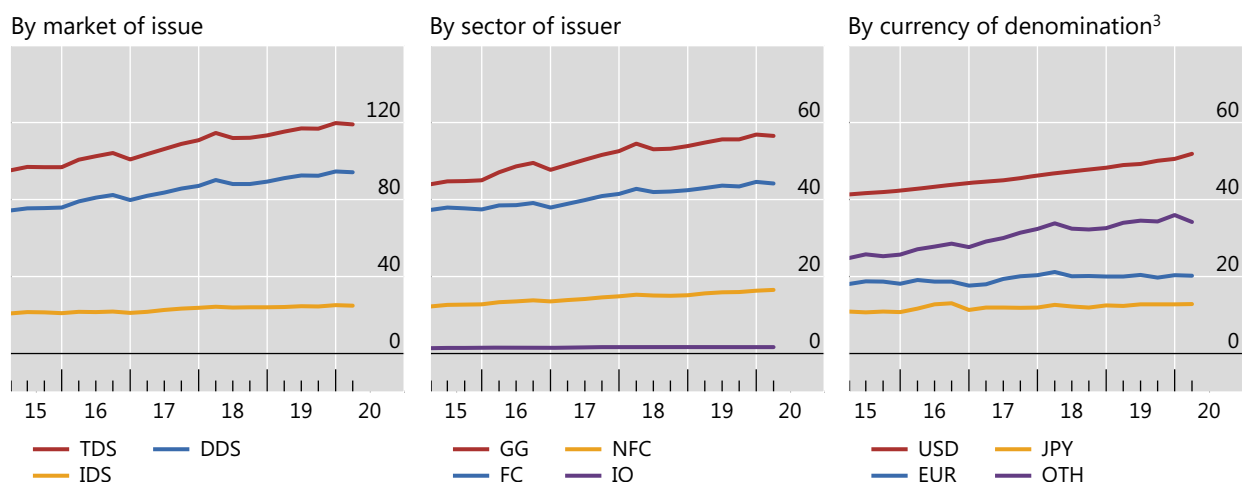
Source: BIS consolidated banking statistics (CBS).

C Debt securities statistics

Global debt securities markets¹

Amounts outstanding, in trillions of US dollars²

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.

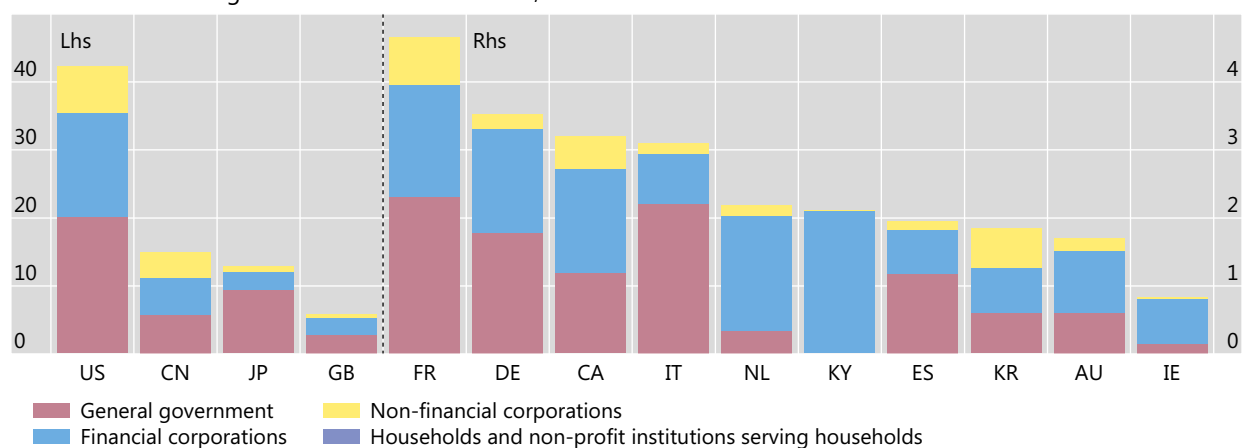
¹ Sample of countries varies across breakdowns shown. For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. For countries that do not report either TDS or DDS, data are estimated by the BIS as IDS. ² At quarter-end. Amounts denominated in currencies other than the US dollar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

Amounts outstanding for the latest available data, in trillions of US dollars²

Graph C.2



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

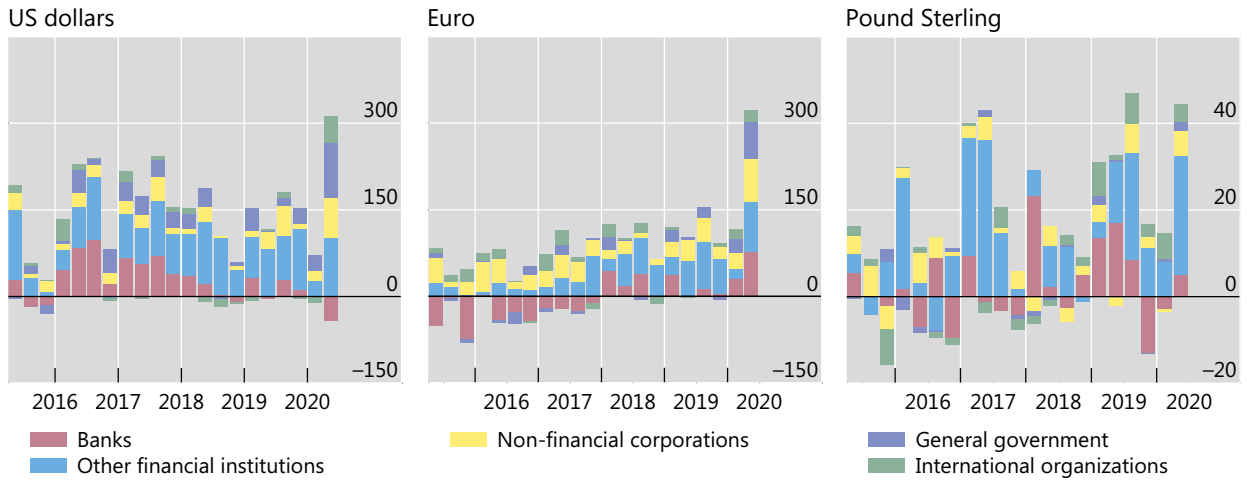
¹ For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. ² Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

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



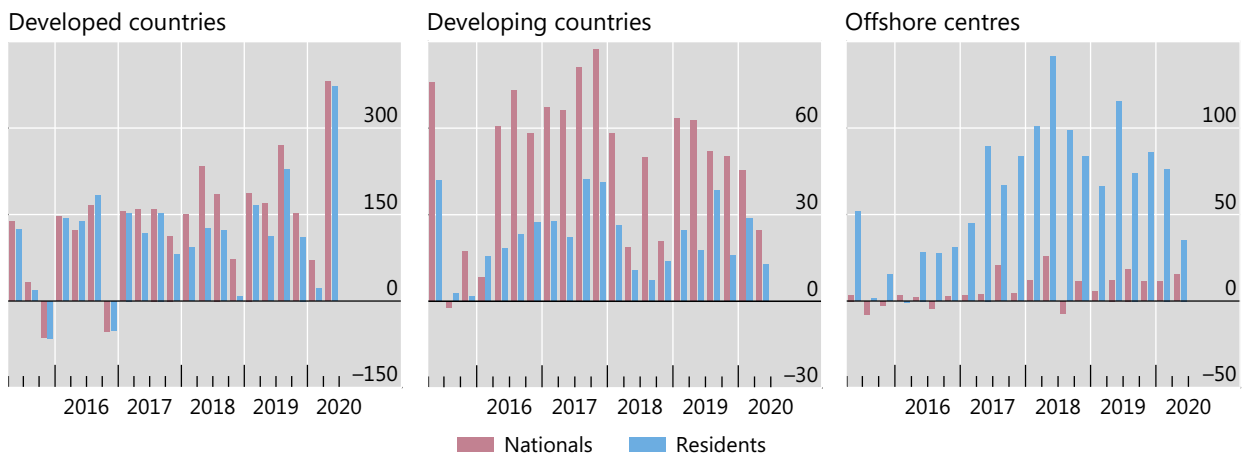
Further information is available at www.bis.org/statistics/secstats.htm.

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

International debt securities issued by financial and non-financial corporations¹

Net issuance by region, in billions of US dollars²

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

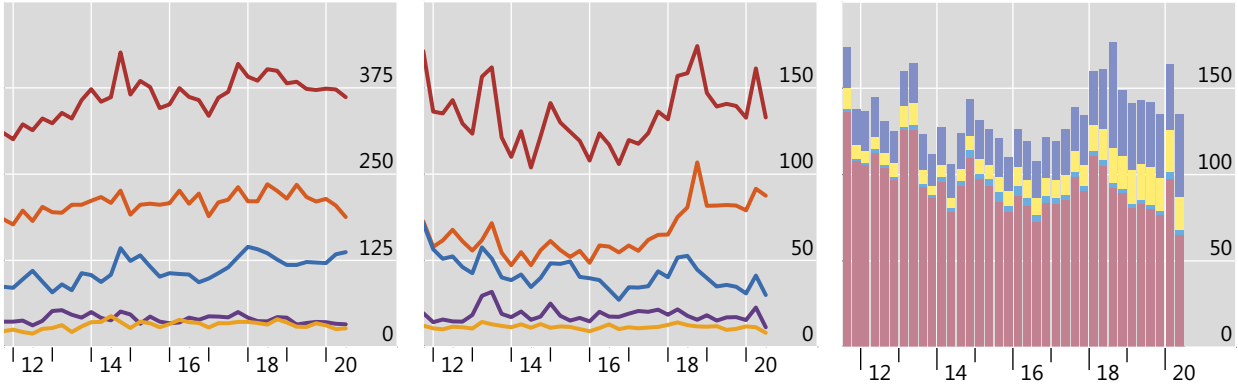
Graph D.1

Open interest, by currency¹

Daily average turnover, by currency²

Daily average turnover, by location of exchange²

Foreign exchange derivatives, USD bn³



Interest rate derivatives, USD trn³



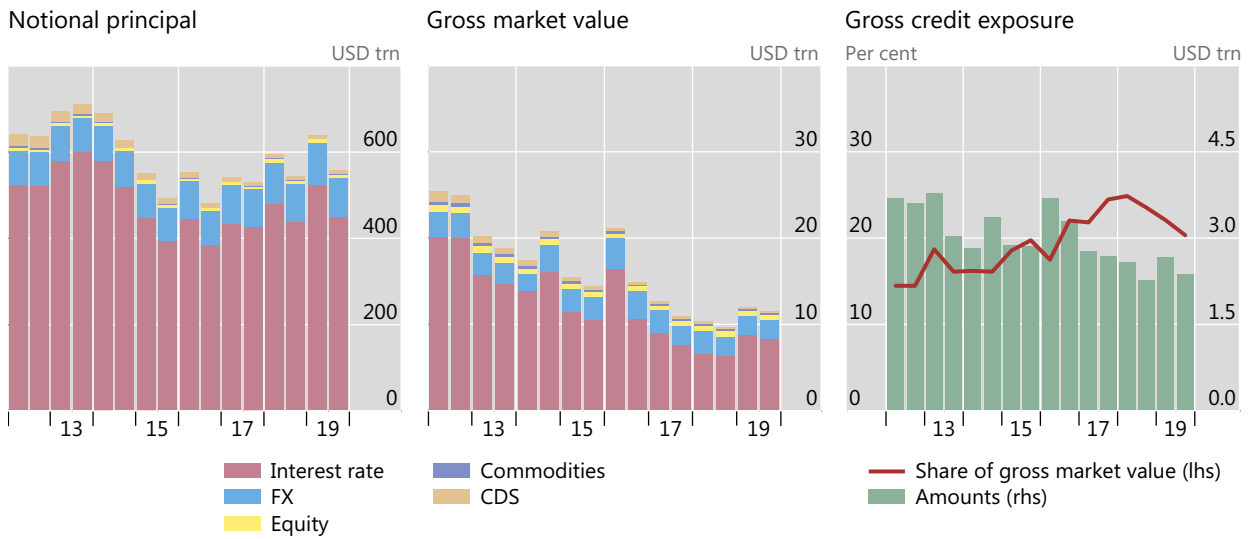
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/extderiv.htm. For definitions, see the [online glossary](#).

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 markets¹

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.

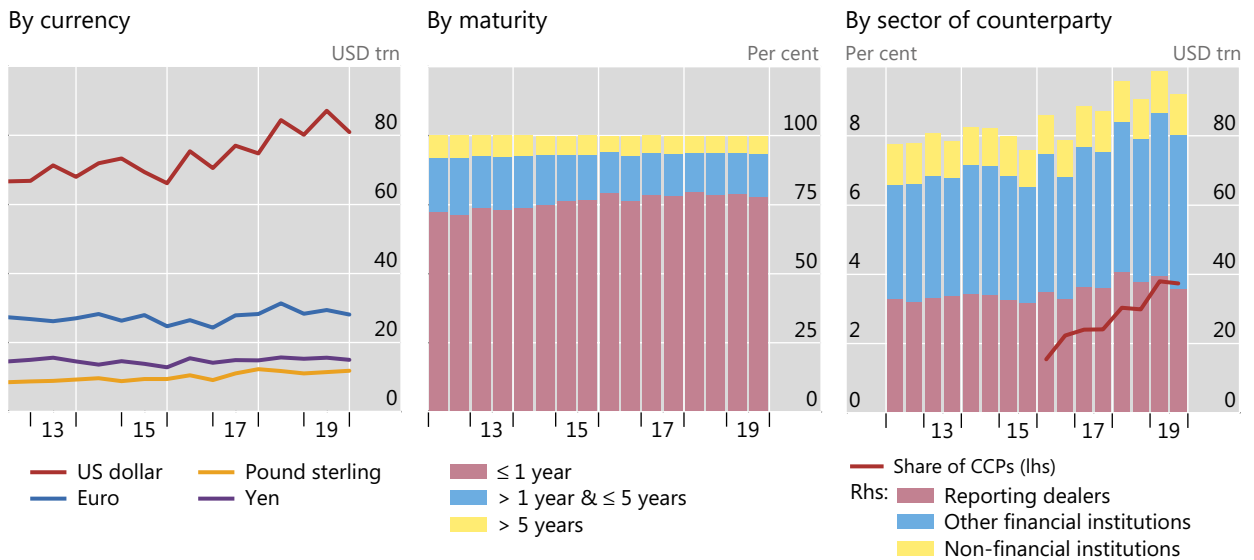
¹ At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

OTC foreign exchange derivatives

Notional principal¹

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.

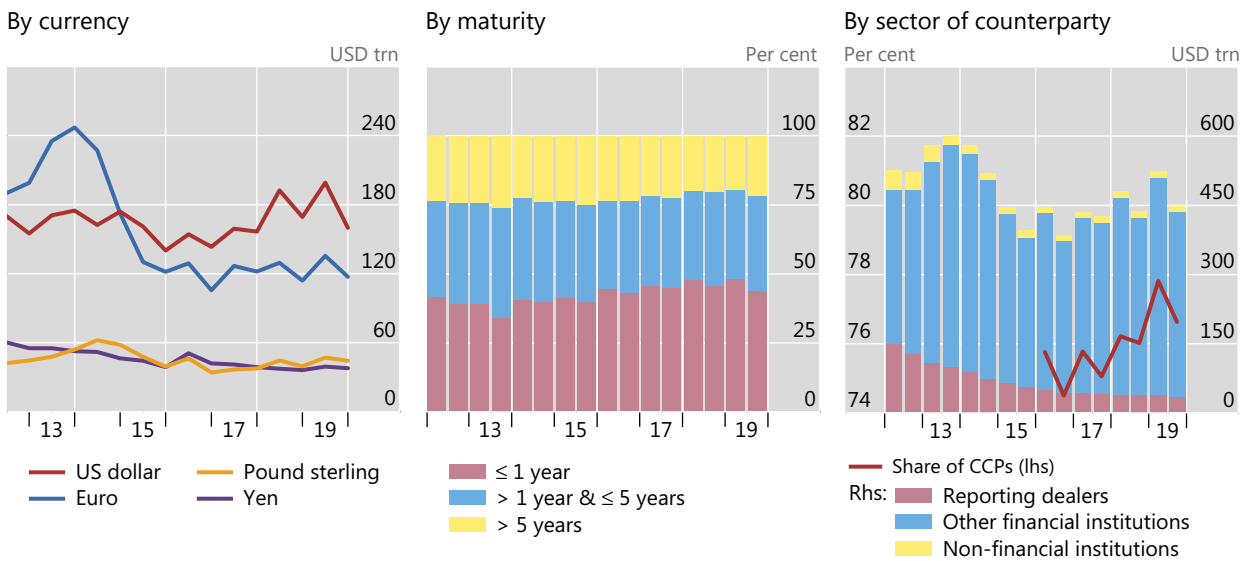
¹ At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

OTC interest rate derivatives

Notional principal¹

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](#).

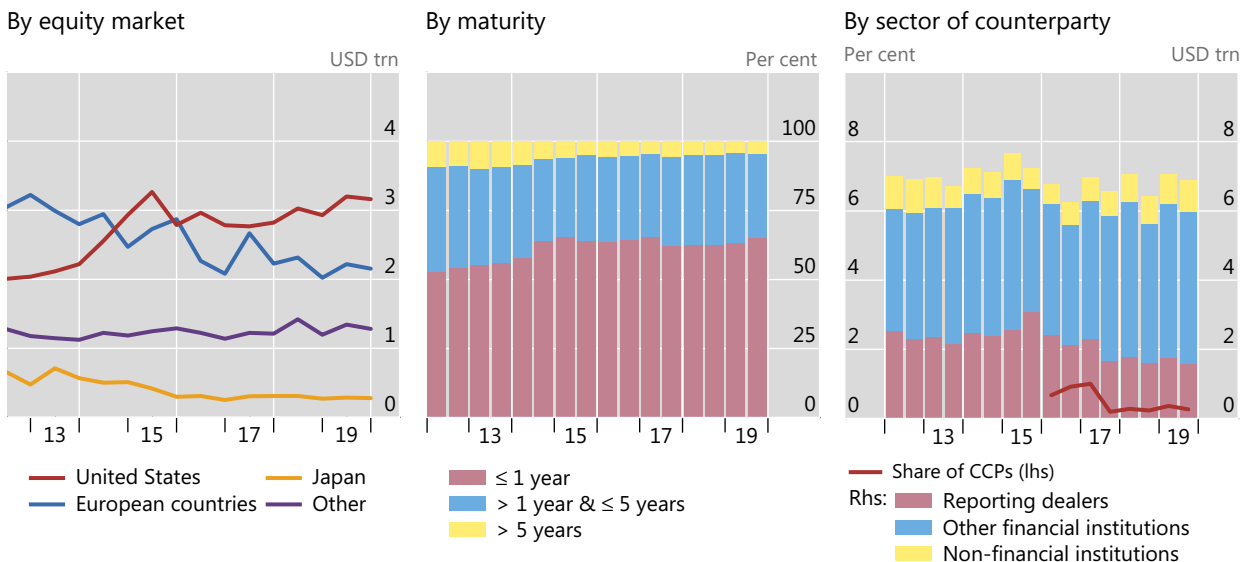
¹ At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

OTC equity-linked derivatives

Notional principal¹

Graph D.5



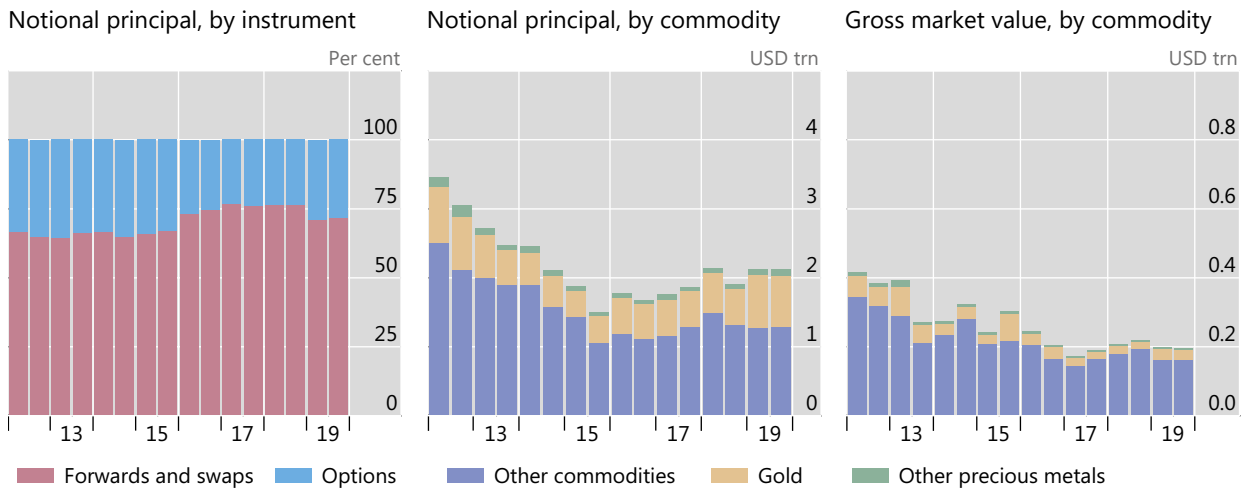
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm. For definitions, see the [online glossary](#).

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 derivatives¹

Graph D.6



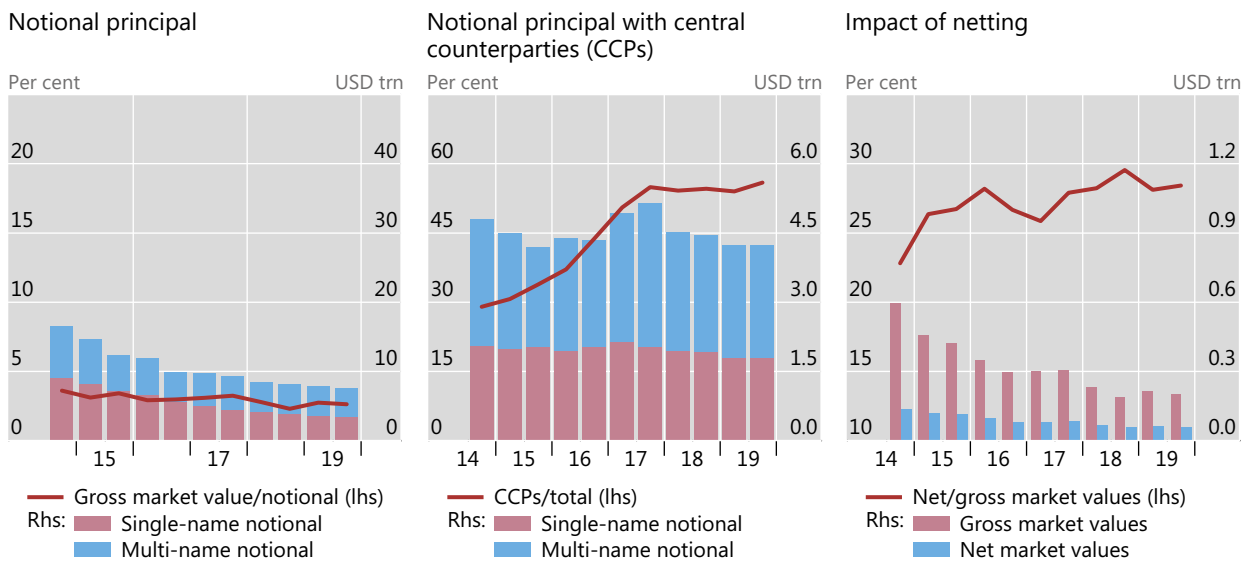
Further information on the BIS derivatives statistics is available at www.bis.org/statistics/derstats.htm. For definitions, see the [online glossary](#).

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 swaps¹

Graph D.7



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

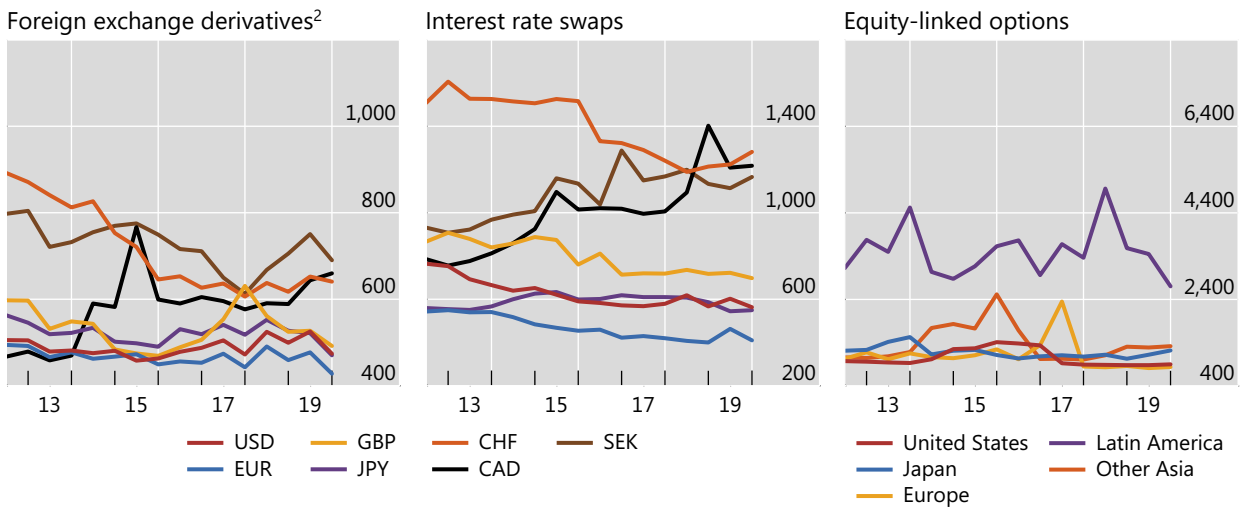
¹ At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: BIS derivatives statistics.

Concentration in global OTC derivatives markets

Herfindahl index¹

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](#).

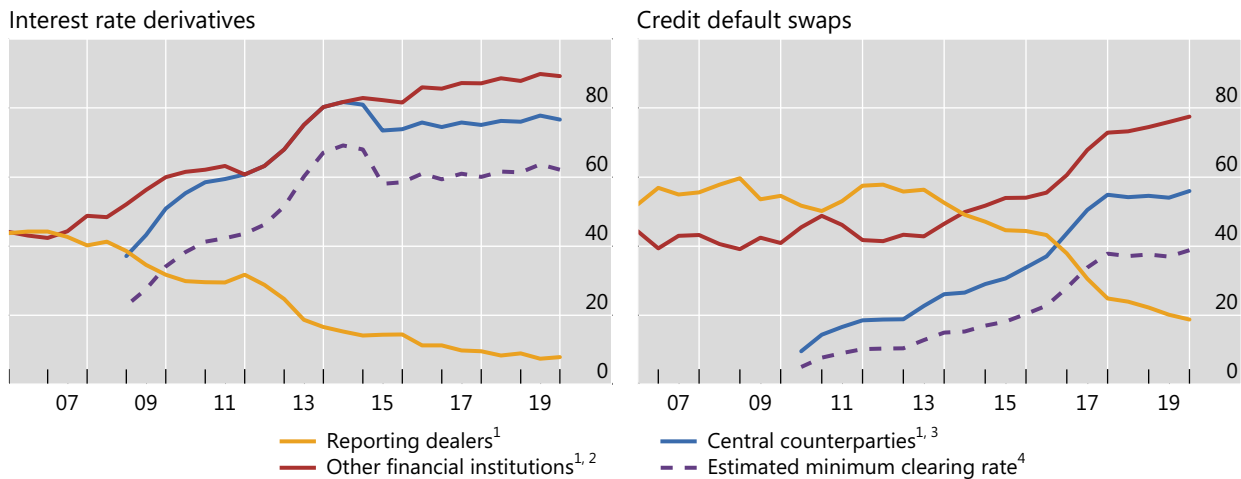
¹ The index ranges from 0 to 10,000, where a lower number indicates that there are many dealers with similar market shares (as measured by notional principal) and a higher number indicates that the market is dominated by a few reporting dealers. ² Foreign exchange forwards, foreign exchange swaps and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

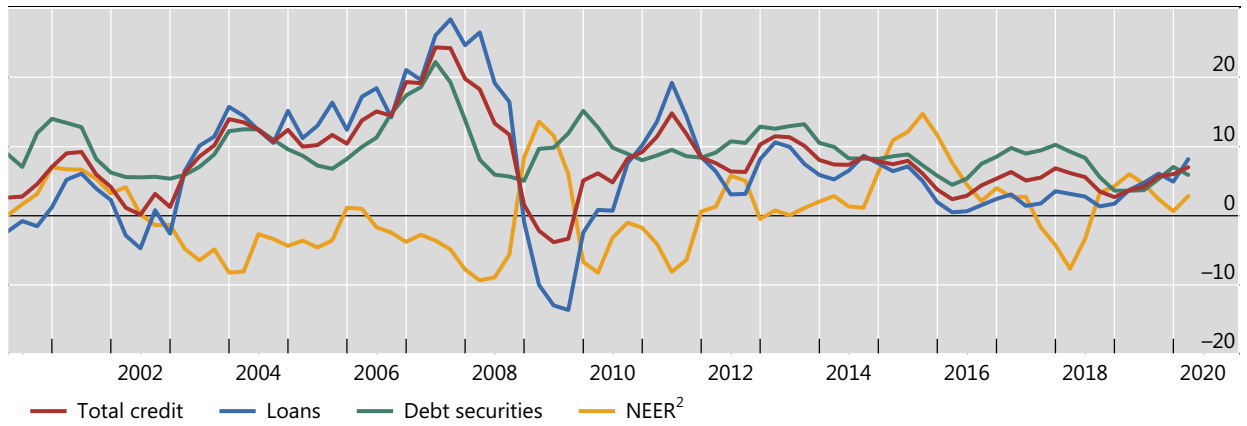
Sources: LCH.Clearnet Group Ltd; BIS OTC derivatives statistics (Table D7 and Table D10.1); BIS calculations.

E Global liquidity indicators

US dollar credit outside the United States¹

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.

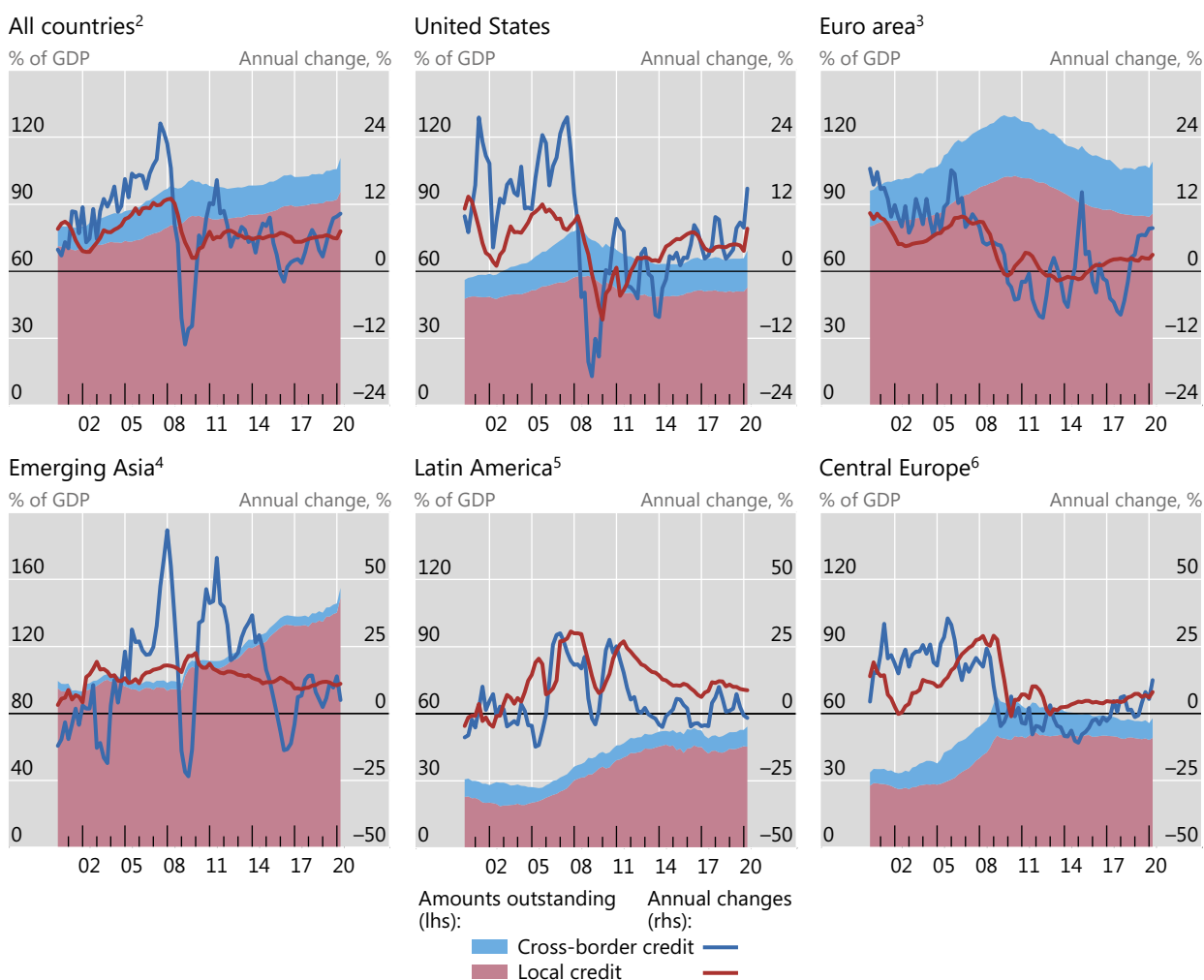
¹ Annual growth of US dollar-denominated credit to non-banks outside the United States. ² Annual growth of the US dollar nominal effective exchange rate.

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 currencies¹

Graph E.2



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

¹ Cross-border claims of LBS reporting banks 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.

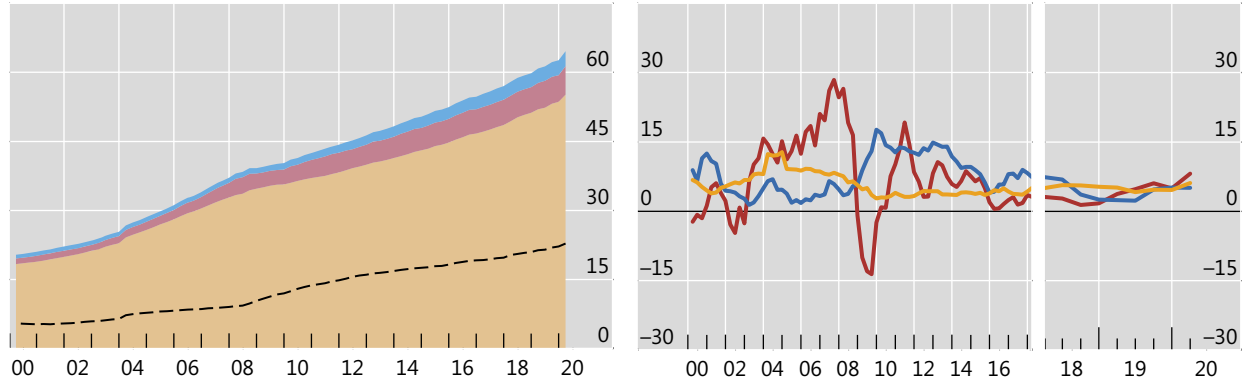
Global credit to the non-financial sector, by currency

Graph E.3

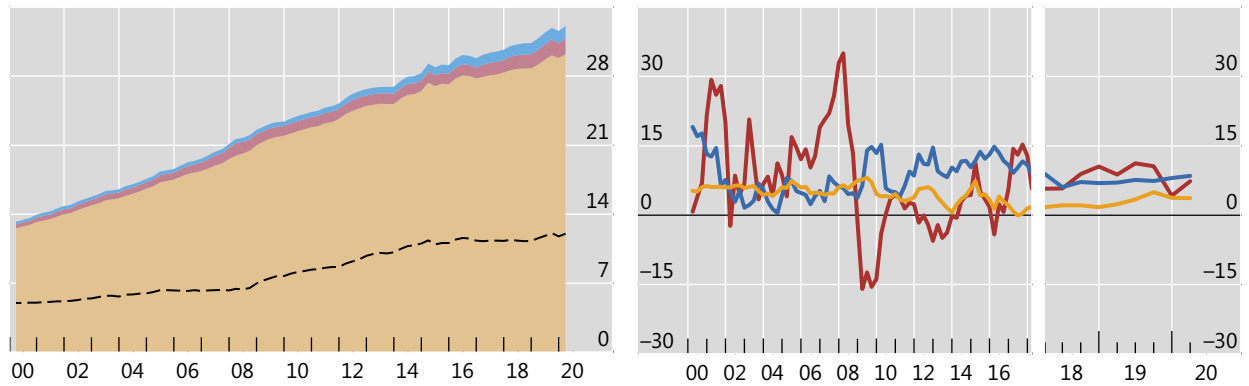
Amounts outstanding, in trillions of currency units¹

Annual change, in per cent²

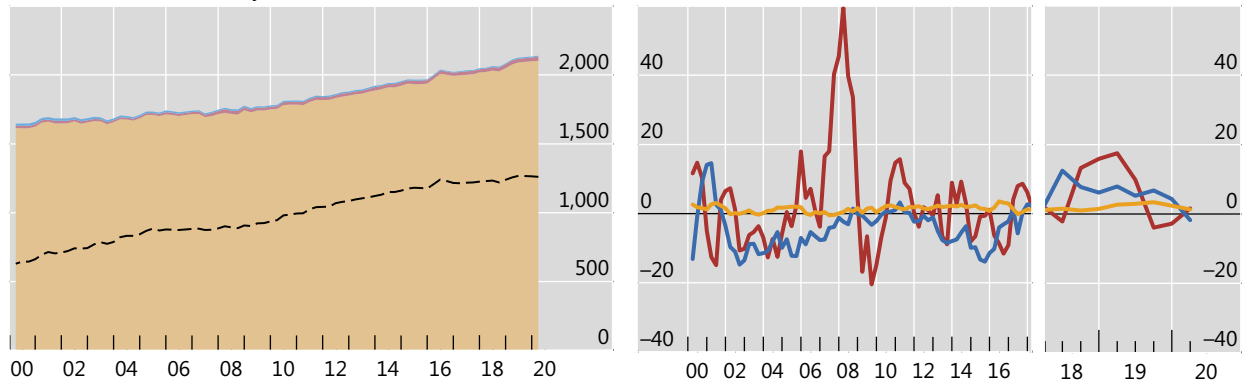
Credit denominated in US dollars (USD)



Credit denominated in euros (EUR)



Credit denominated in yen (JPY)



Credit to residents³
 Credit to non-residents:
 Of which:
 Credit to government
 Bank loans⁵

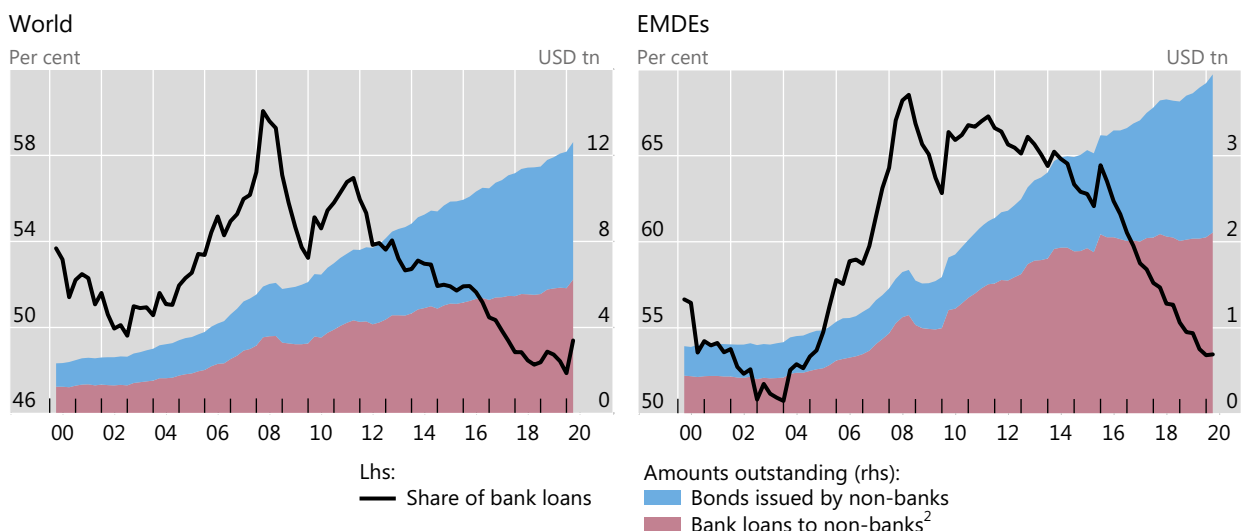
Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

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 States¹

Graph E.4



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

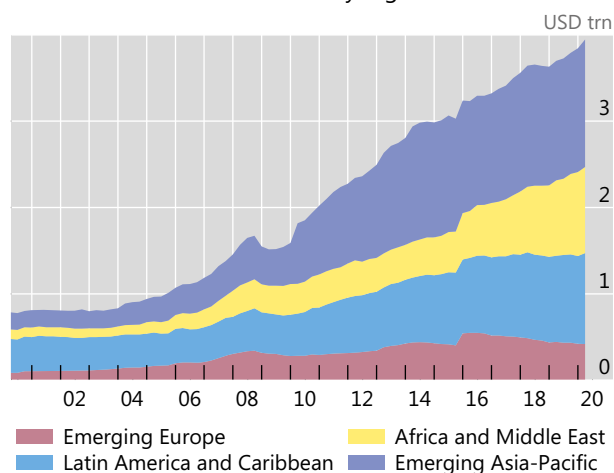
¹ Non-banks comprise non-bank financial entities, non-financial corporations, governments, households and international organisations. ² Loans by LBS-reporting banks to non-bank borrowers, including non-bank financial entities, comprise cross-border plus local loans.

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

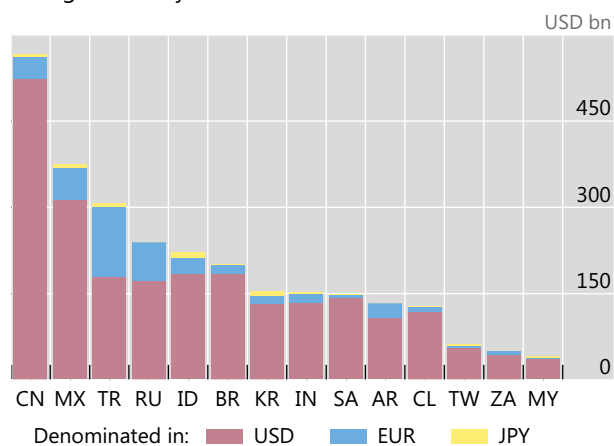
Foreign currency credit to non-banks in EMDEs

Graph E.5

US dollar-denominated credit by region



Foreign currency credit to selected EMDEs¹



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.

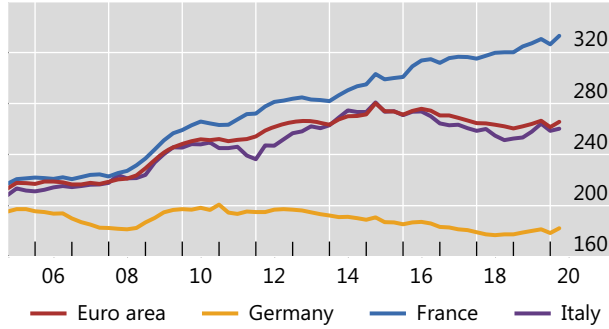
F Statistics on total credit to the non-financial sector

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

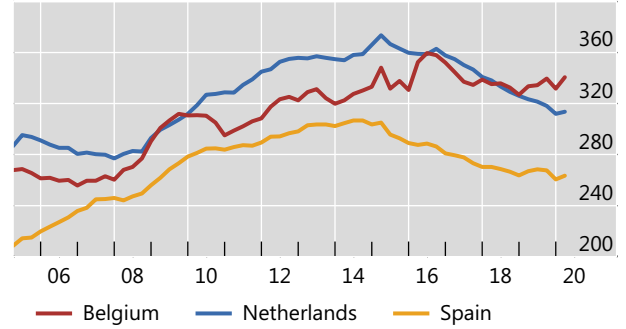
As a percentage of GDP

Graph F.1

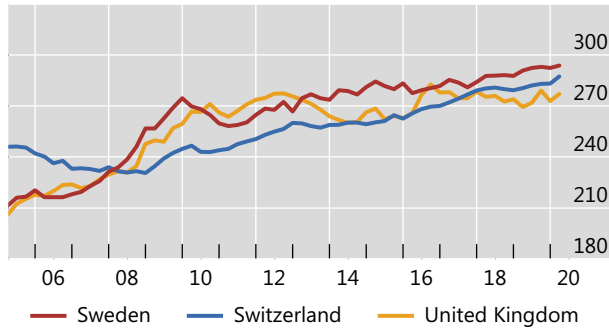
Euro area: aggregate and major countries



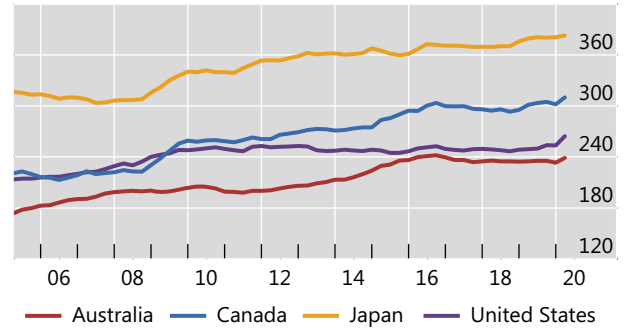
Euro area: other countries



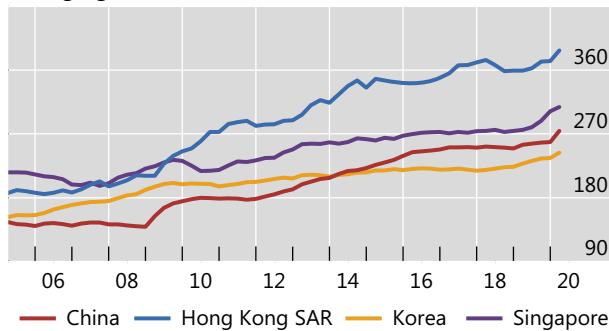
Other European countries



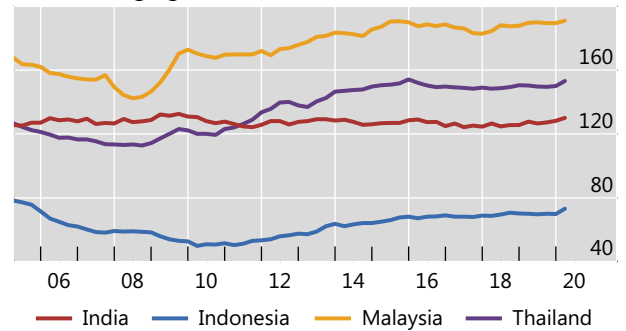
Major advanced economies



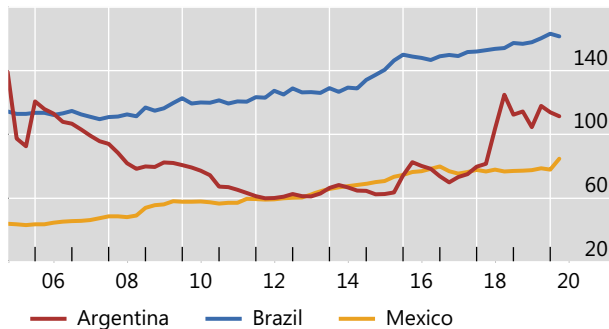
Emerging Asia



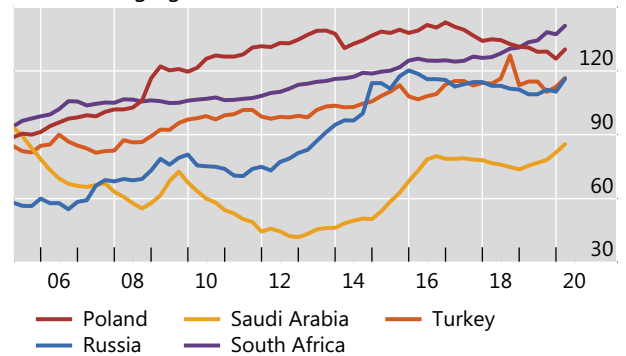
Other emerging Asia



Latin America



Other emerging market economies



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

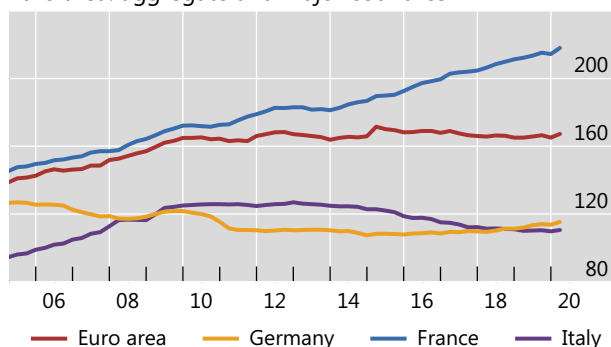
Source: BIS total credit statistics.

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

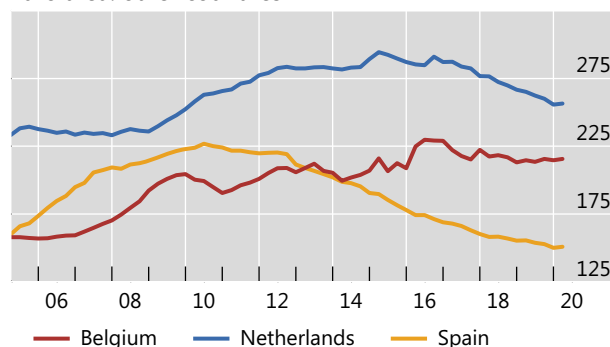
As a percentage of GDP

Graph F.2

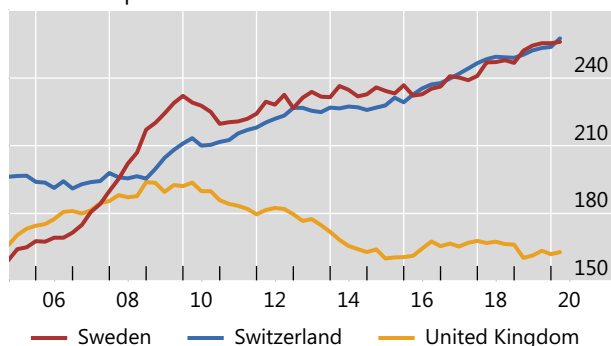
Euro area: aggregate and major countries



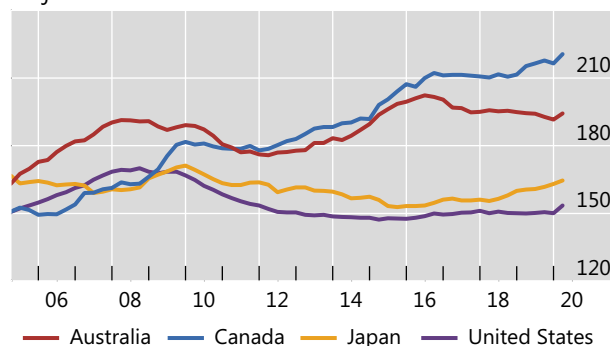
Euro area: other countries



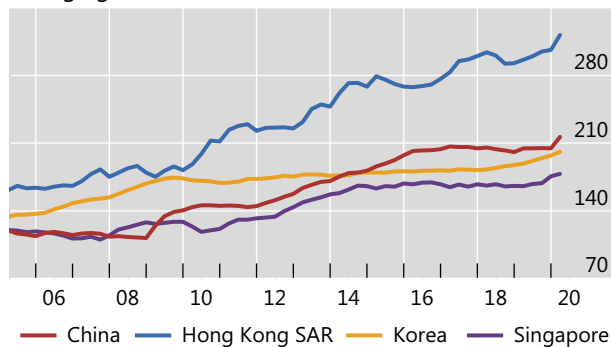
Other European countries



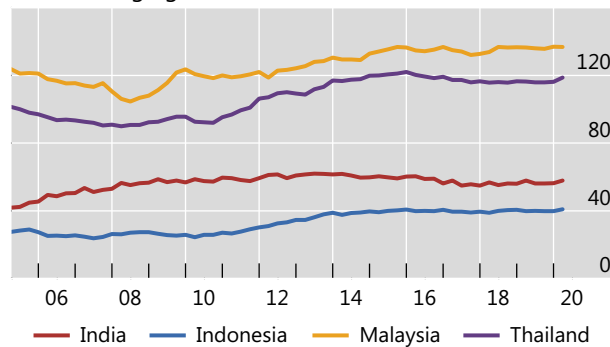
Major advanced economies



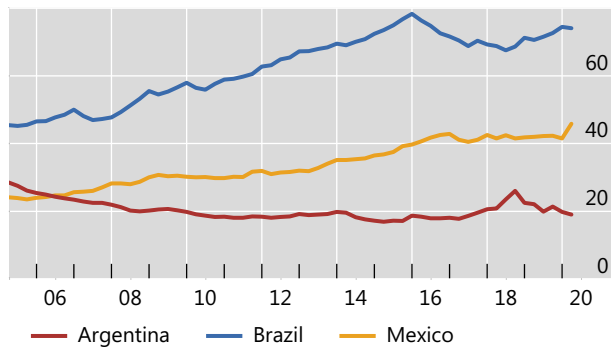
Emerging Asia



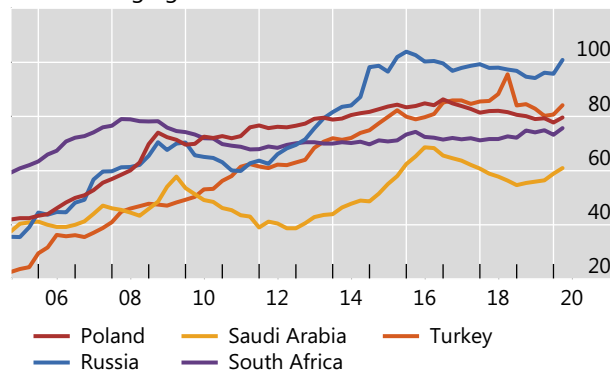
Other emerging Asia



Latin America



Other emerging market economies



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

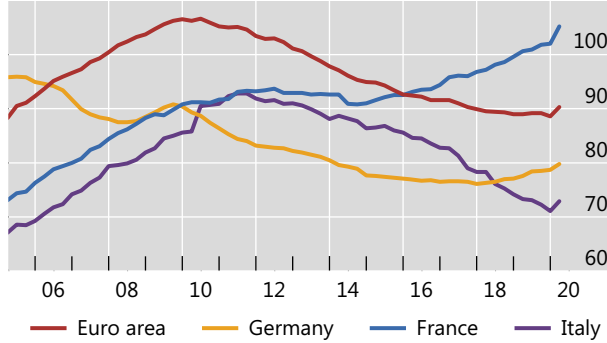
Source: BIS total credit statistics.

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

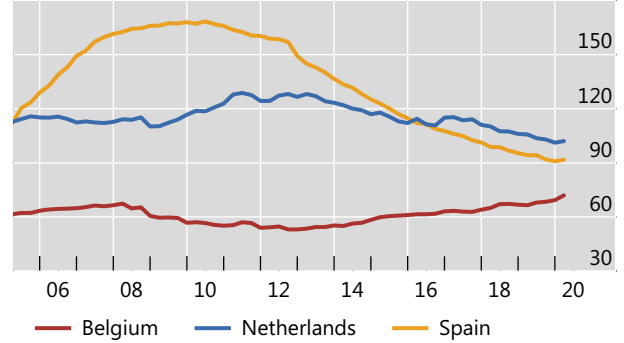
As a percentage of GDP

Graph F.3

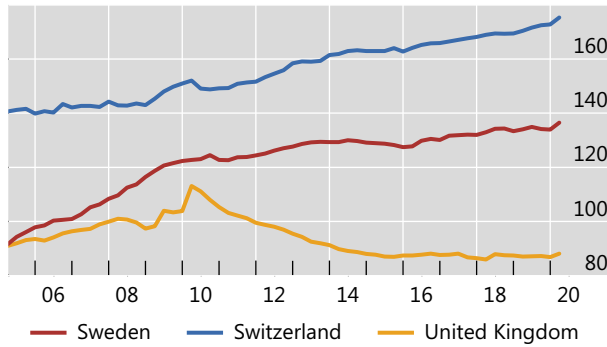
Euro area: aggregate and major countries



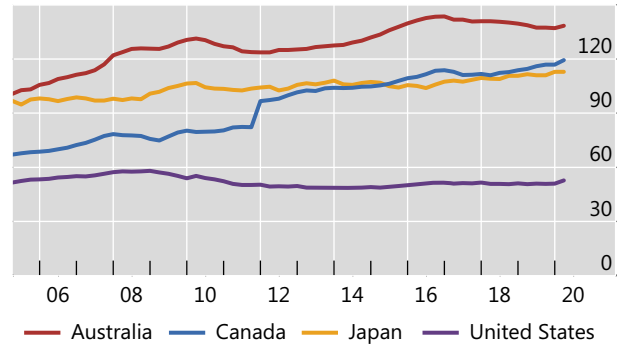
Euro area: other countries



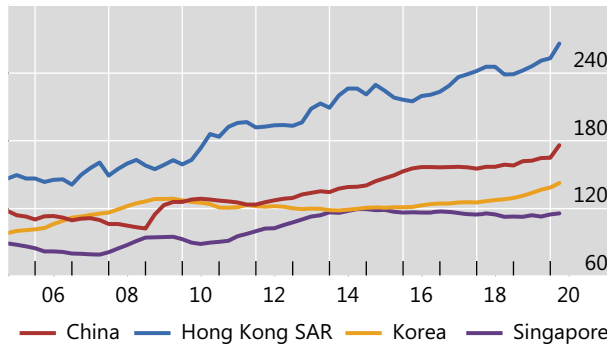
Other European countries



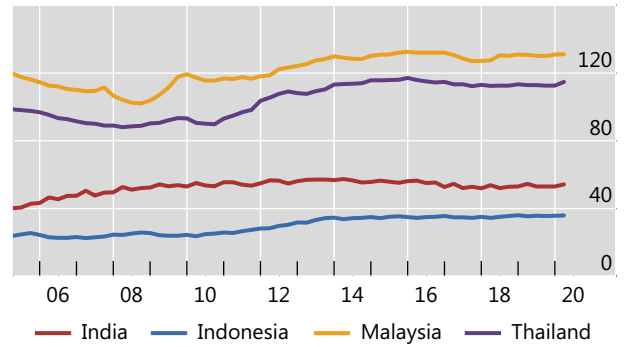
Major advanced economies



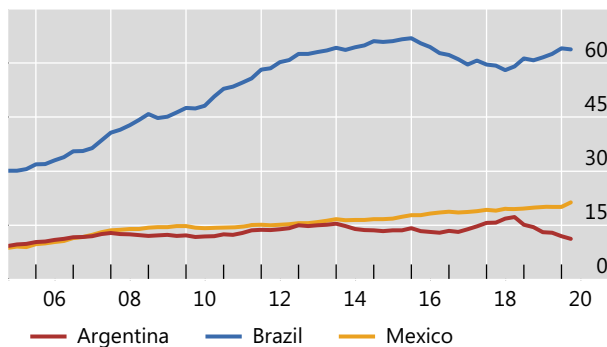
Emerging Asia



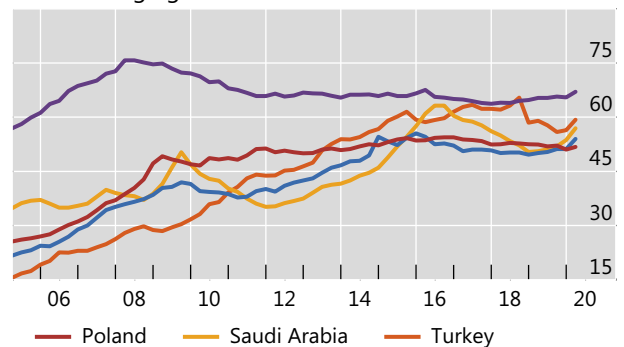
Other emerging Asia



Latin America



Other emerging market economies



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

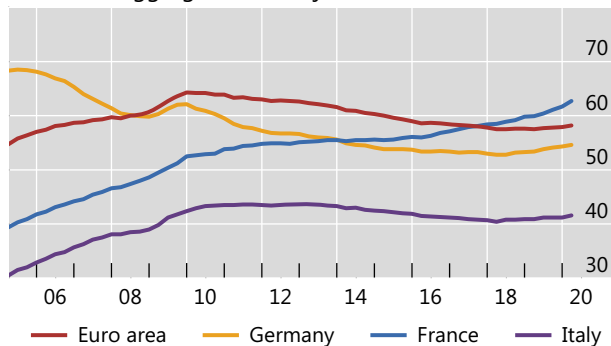
Source: BIS total credit statistics.

Total credit to households (core debt)

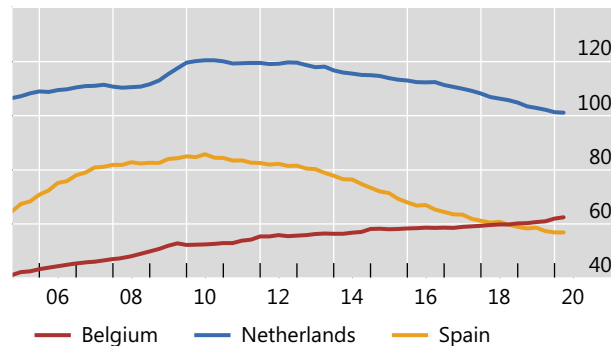
As a percentage of GDP

Graph F.4

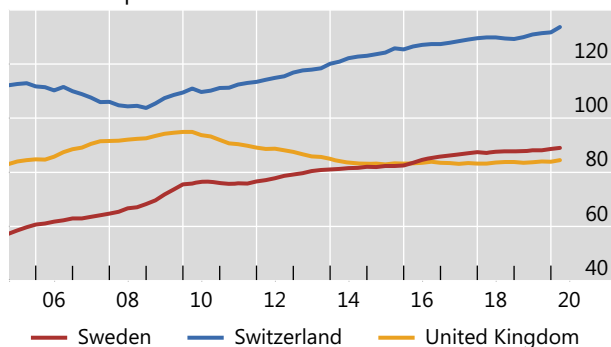
Euro area: aggregate and major countries



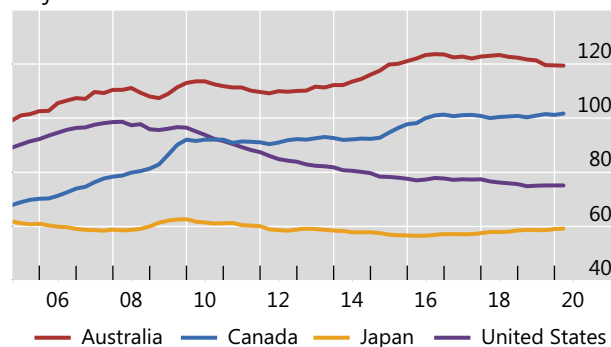
Euro area: other countries



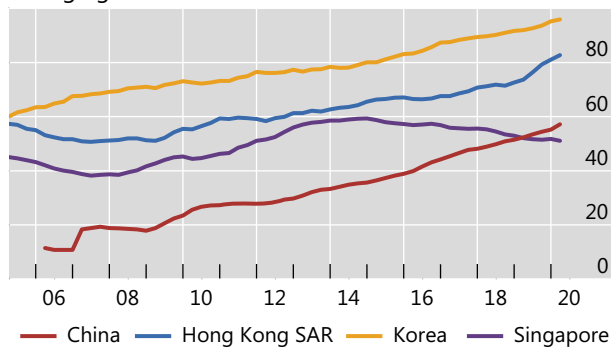
Other European countries



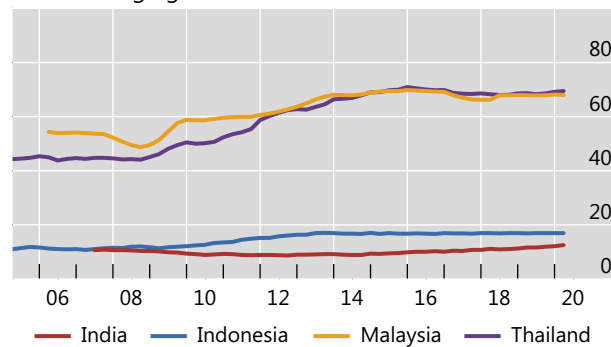
Major advanced economies



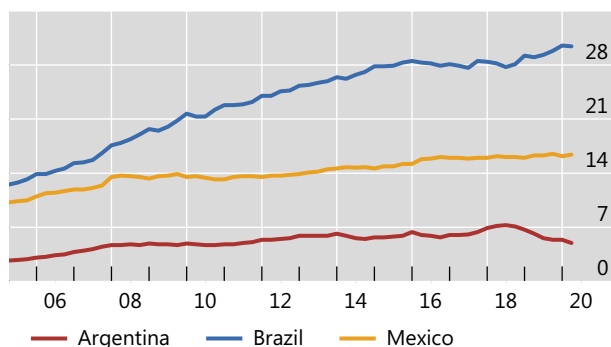
Emerging Asia



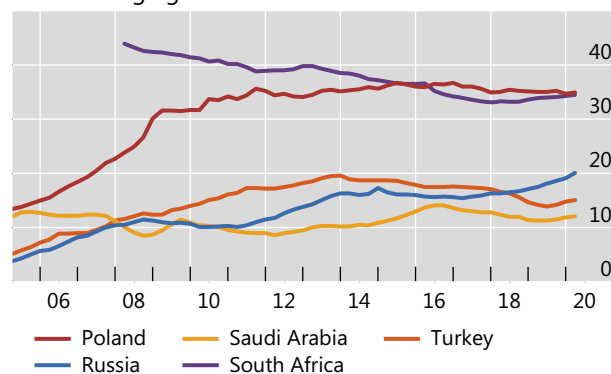
Other emerging Asia



Latin America



Other emerging market economies



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

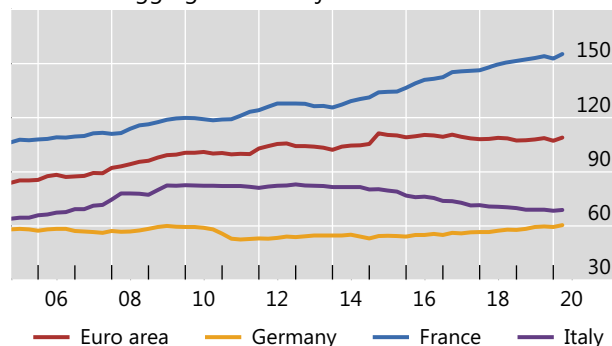
Source: BIS total credit statistics.

Total credit to non-financial corporations (core debt)

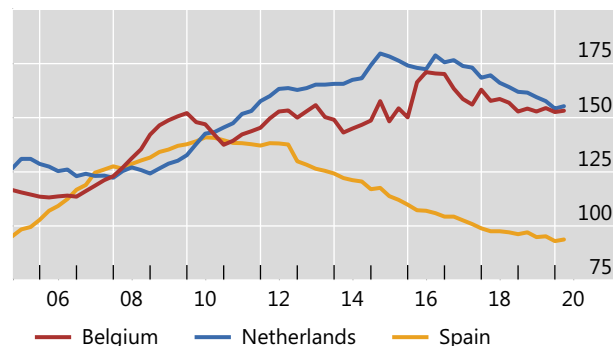
As a percentage of GDP

Graph F.5

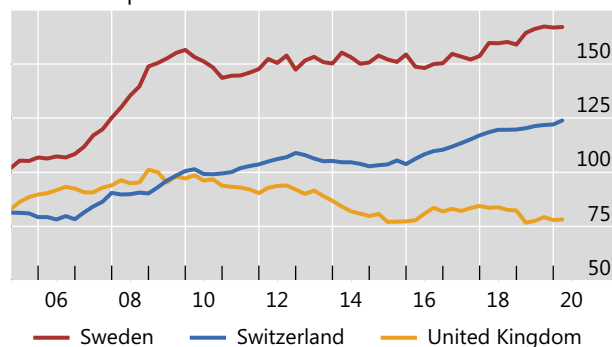
Euro area: aggregate and major countries



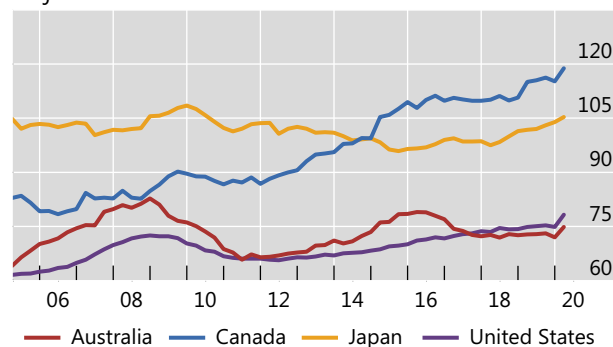
Euro area: other countries



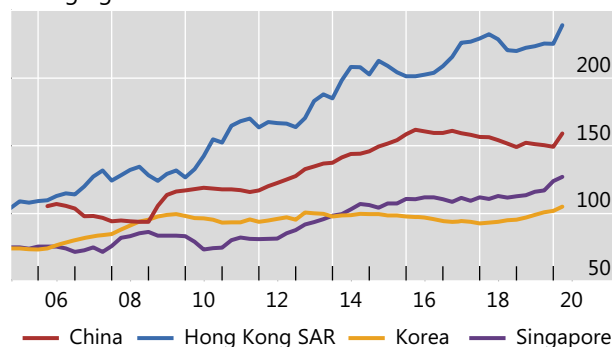
Other European countries



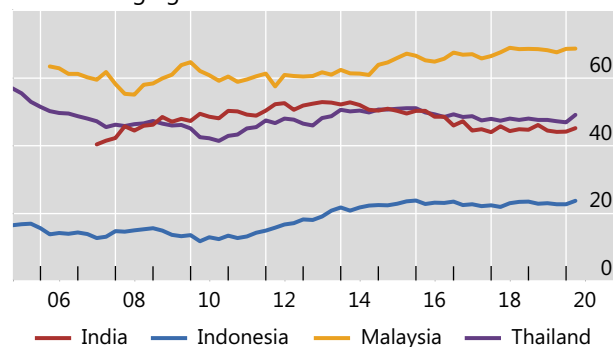
Major advanced economies



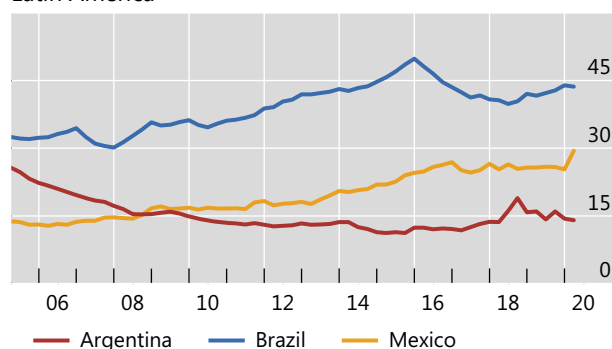
Emerging Asia



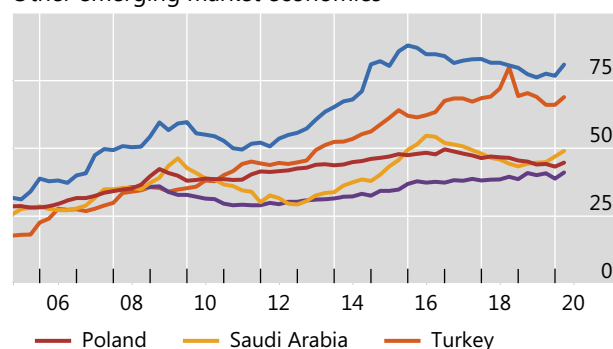
Other emerging Asia



Latin America



Other emerging market economies



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

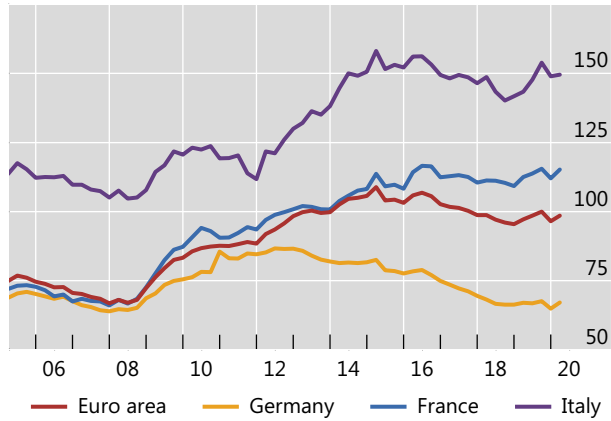
Source: BIS total credit statistics.

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

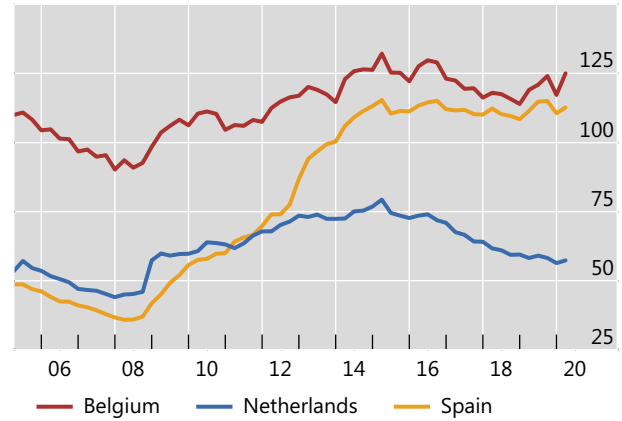
As a percentage of GDP

Graph F.6

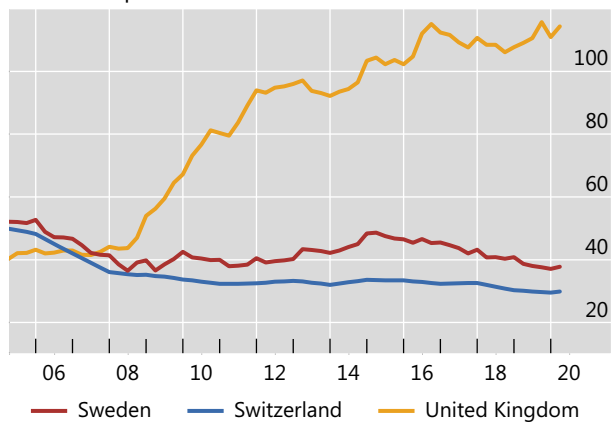
Euro area: aggregate and major countries



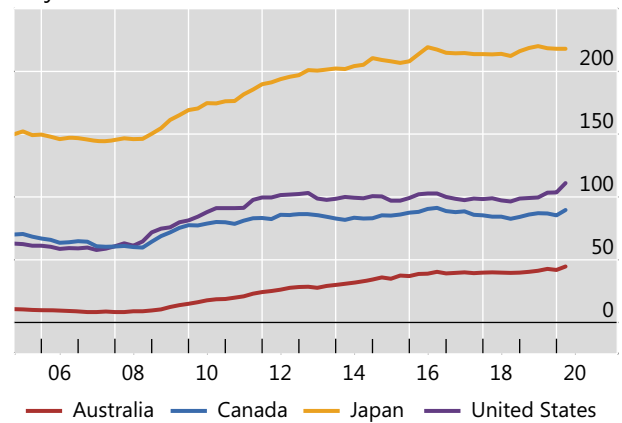
Euro area: other countries



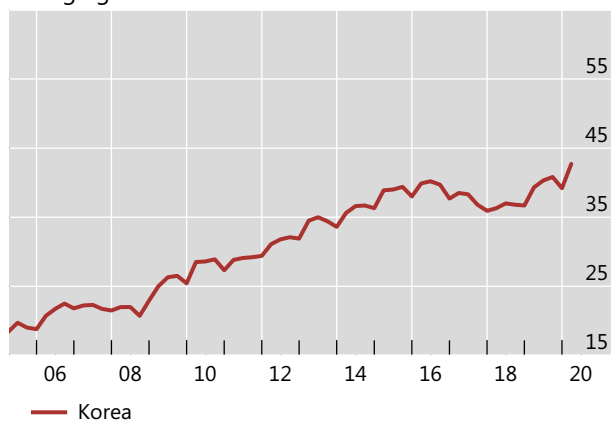
Other European countries



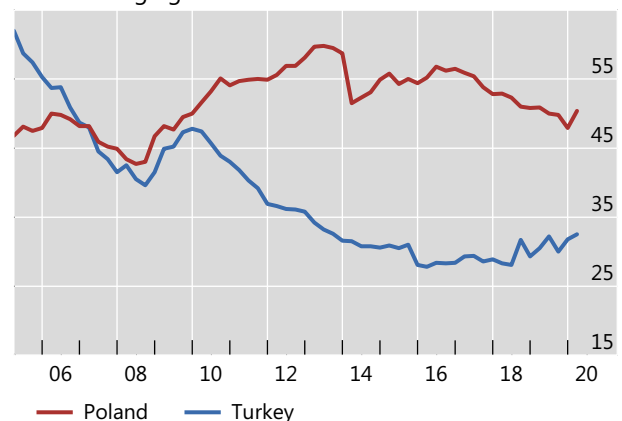
Major advanced economies



Emerging Asia



Other emerging market economies



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

¹ Consolidated data for the general government sector.

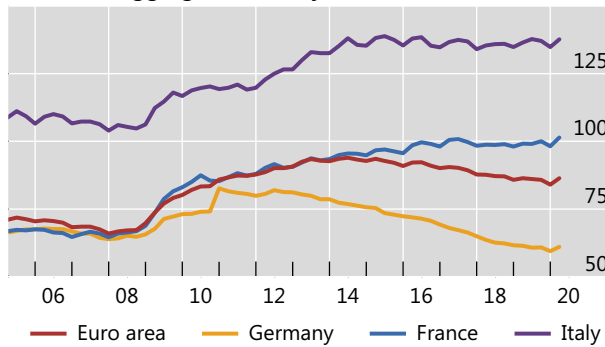
Source: BIS total credit statistics.

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

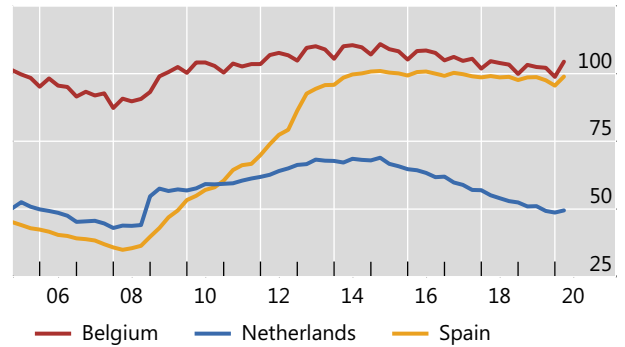
As a percentage of GDP

Graph F.7

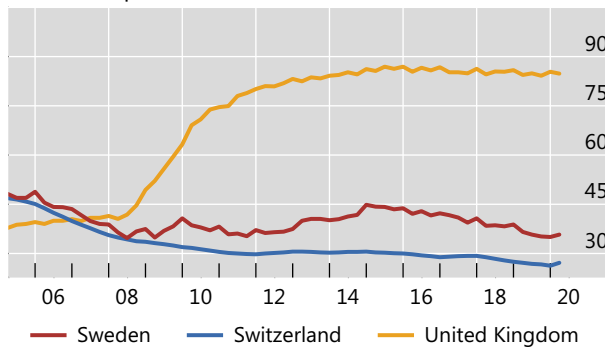
Euro area: aggregate and major countries



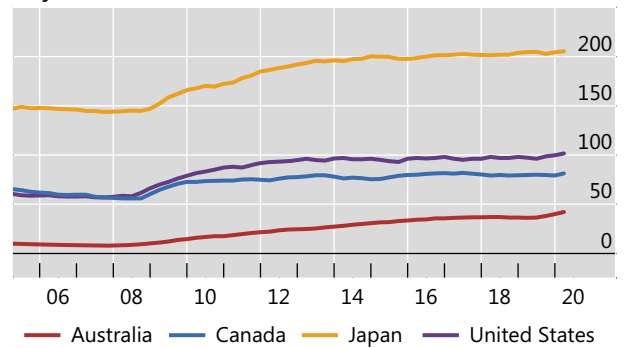
Euro area: other countries



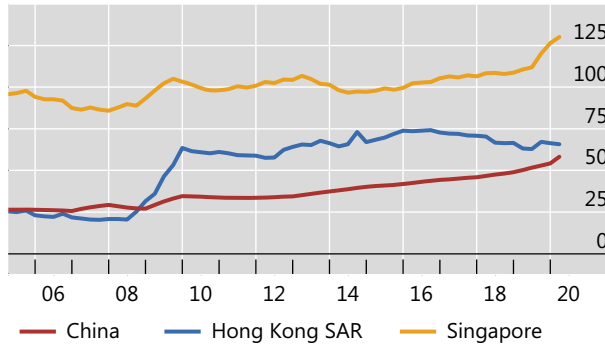
Other European countries



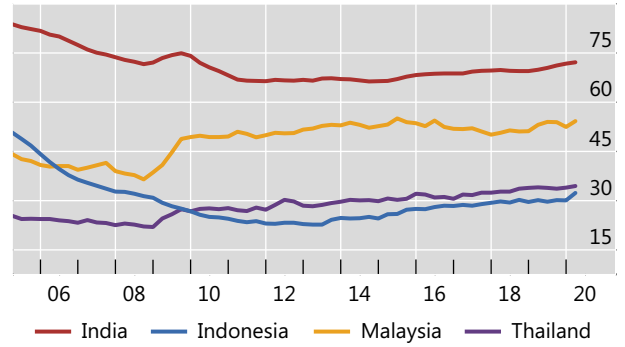
Major advanced economies



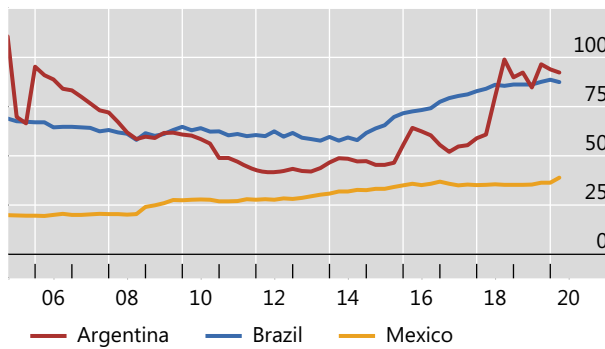
Emerging Asia



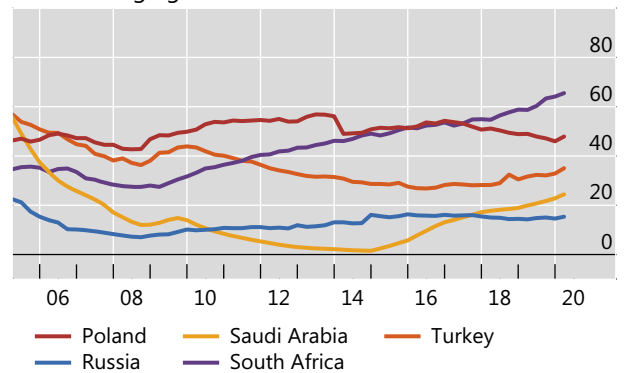
Other emerging Asia



Latin America



Other emerging market economies



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

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

Source: BIS total credit statistics.

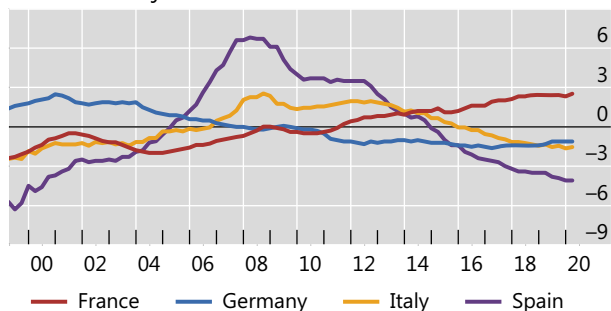
G Debt service ratios for the private non-financial sector

Debt service ratios of the private non-financial sector

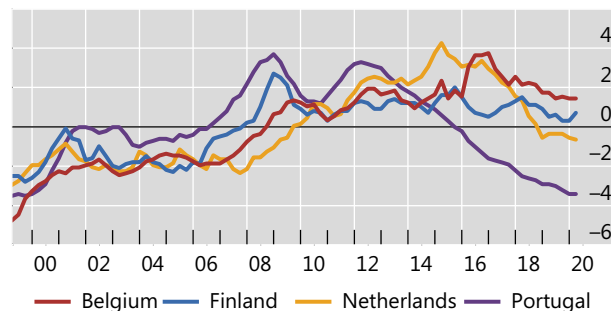
Deviation from country-specific mean, in percentage points¹

Graph G.1

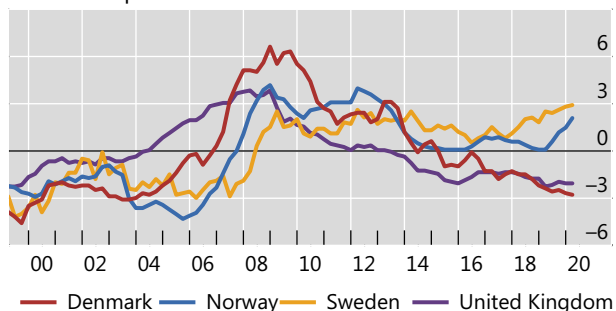
Euro area: major countries



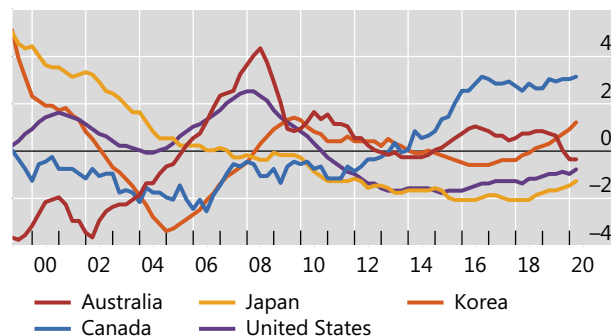
Euro area: other countries



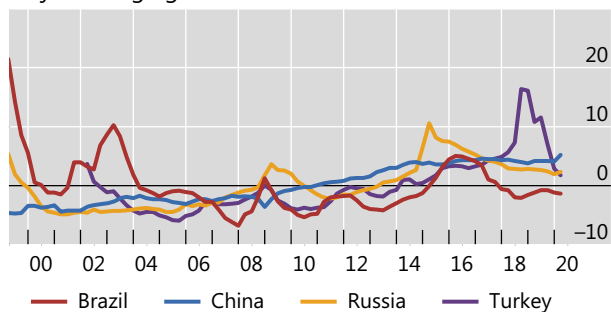
Other European countries



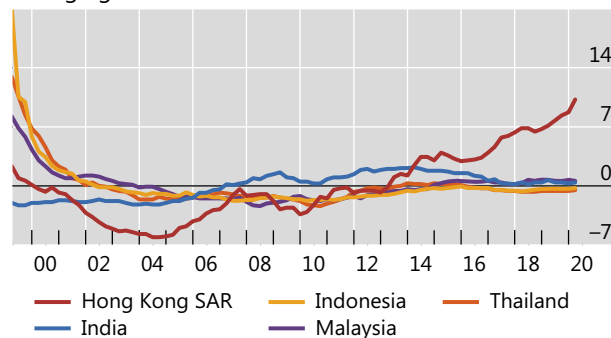
Other economies



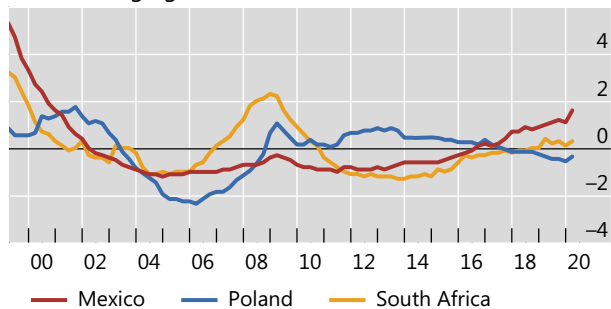
Major emerging markets²



Emerging Asia²



Other emerging markets²



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

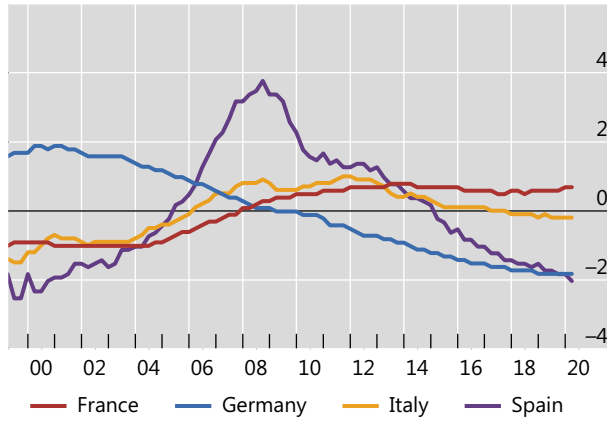
Source: BIS debt service ratios statistics.

Debt service ratios of households

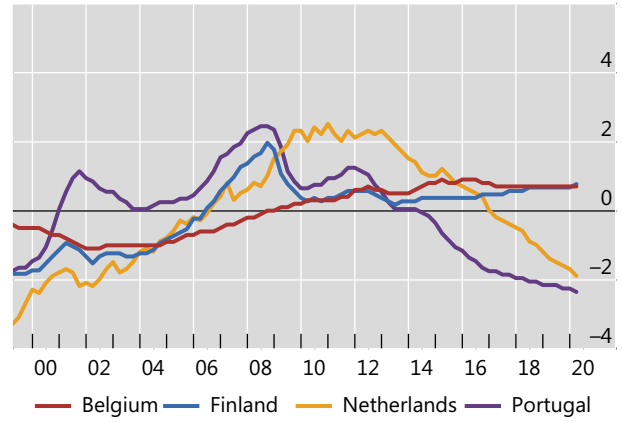
Deviation from country-specific mean, in percentage points¹

Graph G.2

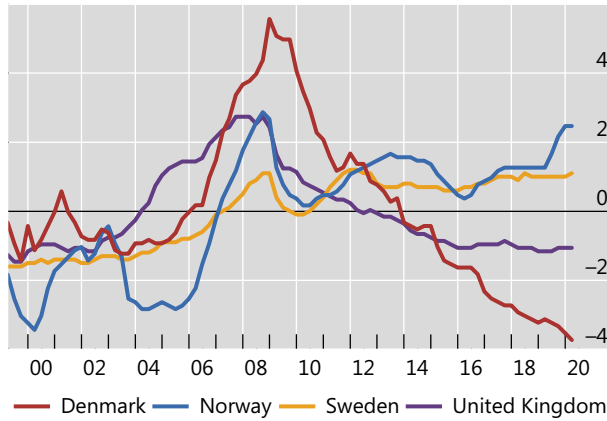
Euro area: major countries



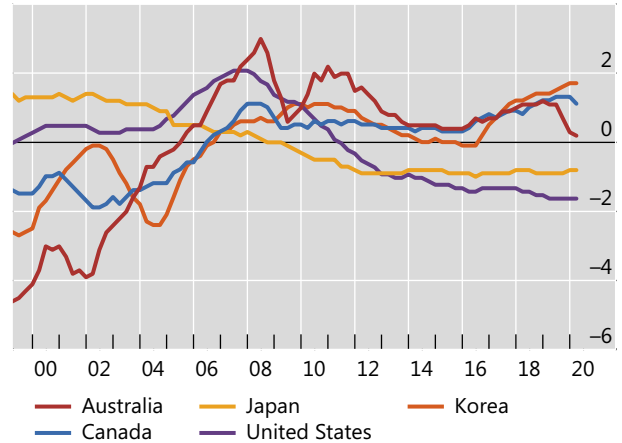
Euro area: other countries



Other European countries



Other economies



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

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

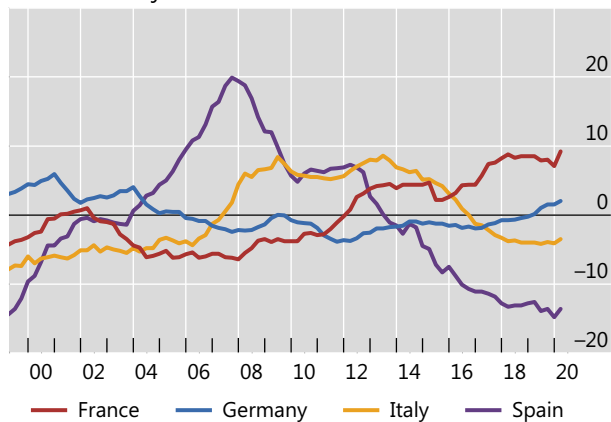
Source: BIS debt service ratios statistics.

Debt service ratios of non-financial corporations

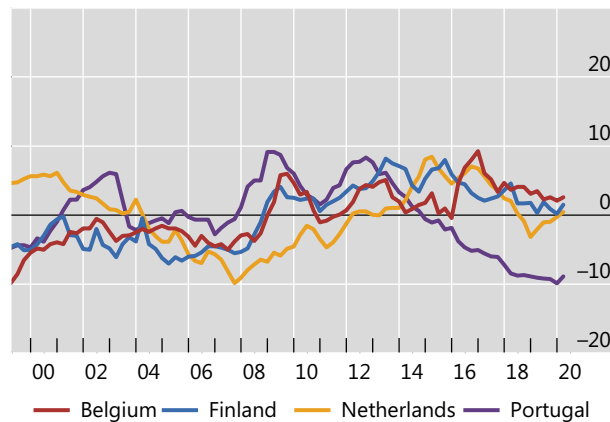
Deviation from country-specific mean, in percentage points¹

Graph G.3

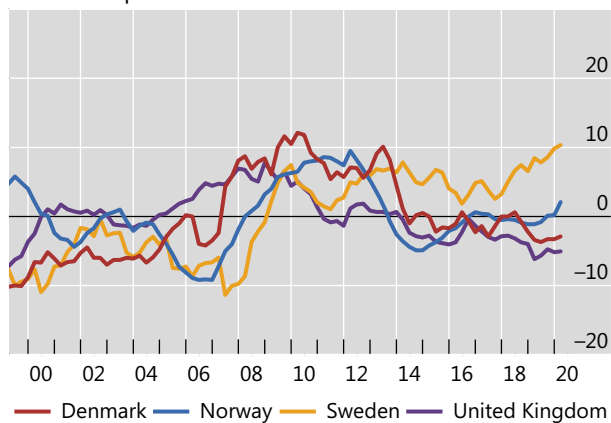
Euro area: major countries



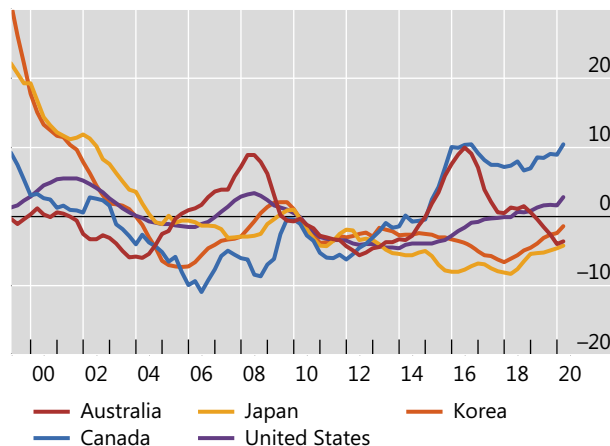
Euro area: other countries



Other European countries



Other economies



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

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

Source: BIS debt service ratios statistics.

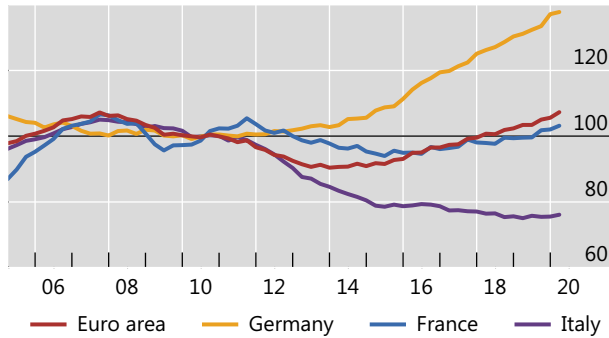
H Property price statistics

Real residential property prices

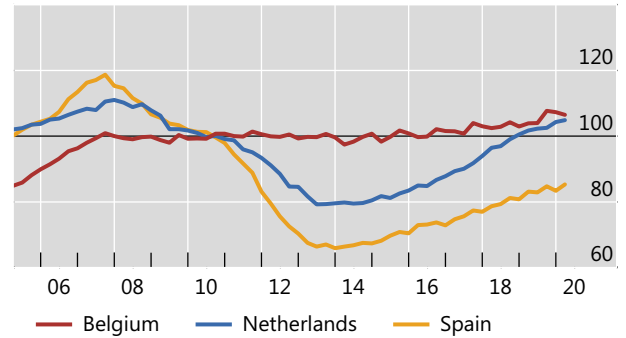
CPI-deflated, 2010 = 100

Graph H.1

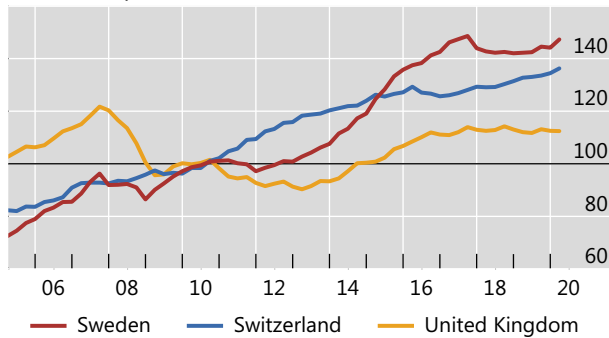
Euro area: aggregate and major countries



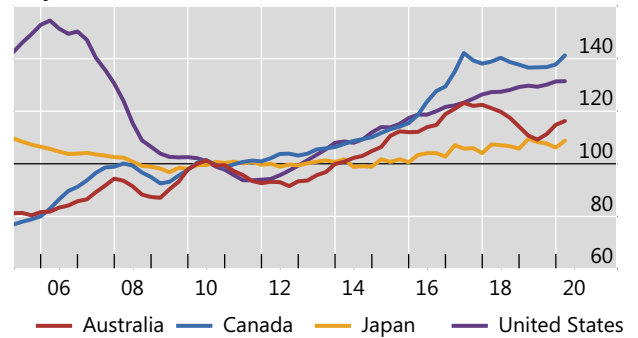
Euro area: other countries



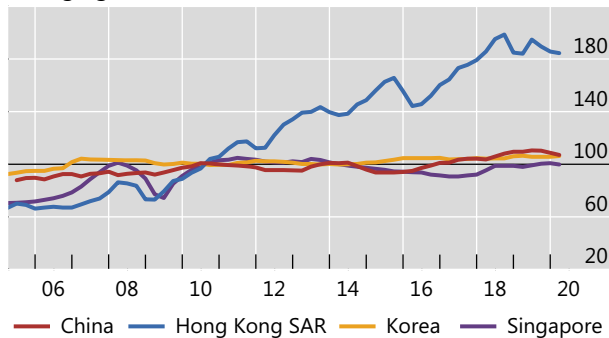
Other European countries



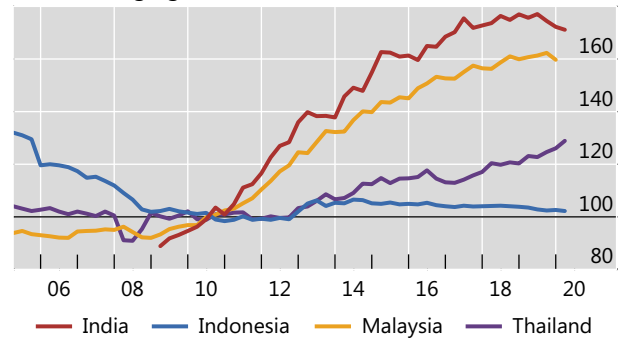
Major advanced economies



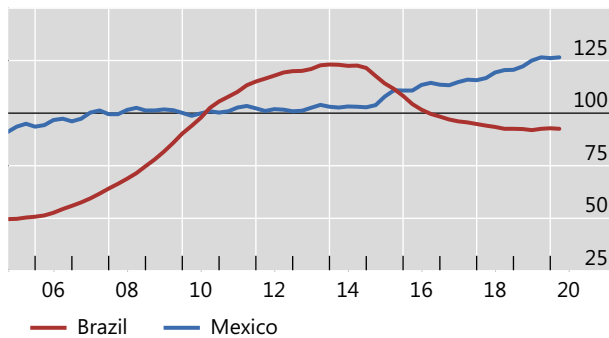
Emerging Asia



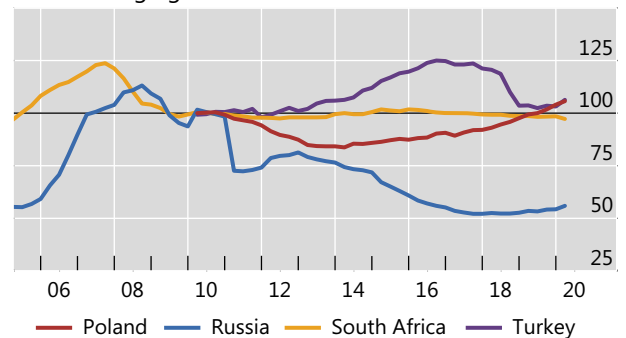
Other emerging Asia



Latin America



Other emerging market economies



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

Source: BIS property prices statistics.

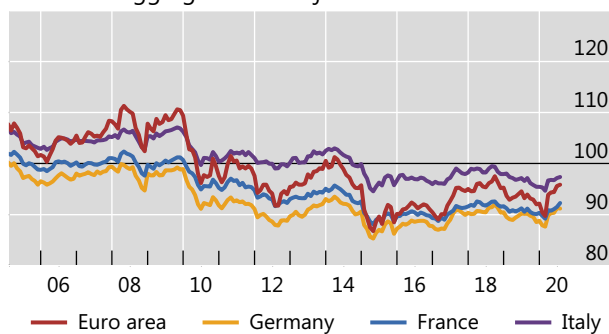
I Effective and US dollar exchange rate statistics

Real effective exchange rates

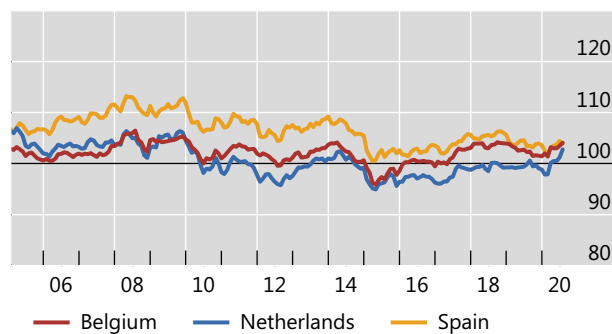
CPI-based, 1995–2005 = 100¹

Graph I.1

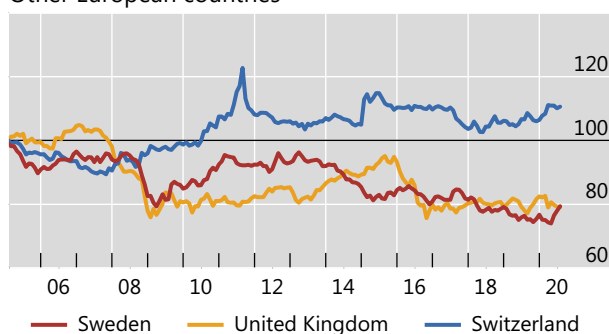
Euro area: aggregate and major countries



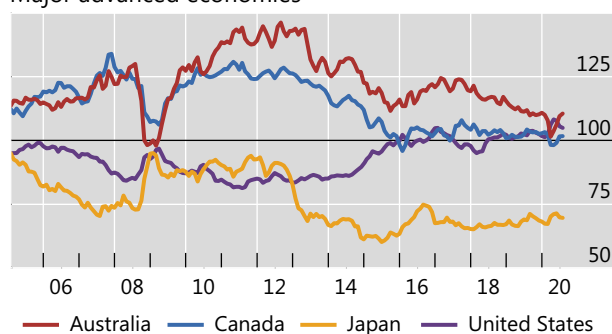
Euro area: other countries



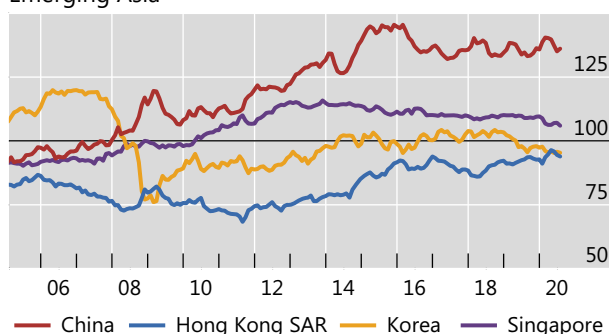
Other European countries



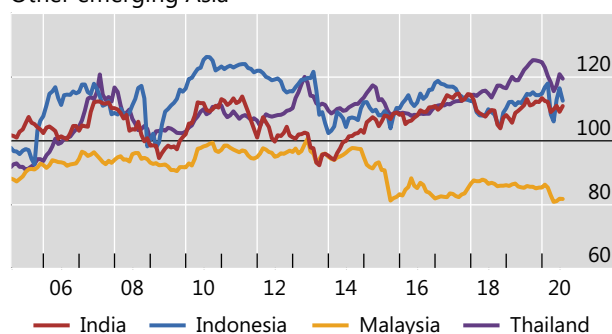
Major advanced economies



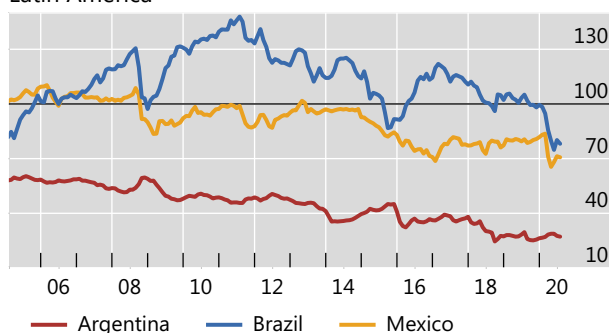
Emerging Asia



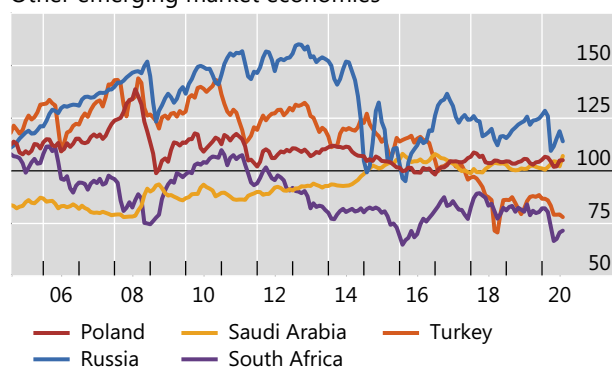
Other emerging Asia



Latin America



Other emerging market economies



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

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

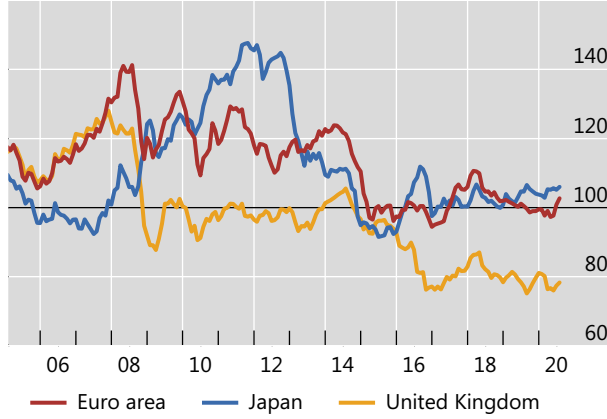
Source: BIS effective exchange rates statistics.

US dollar exchange rates

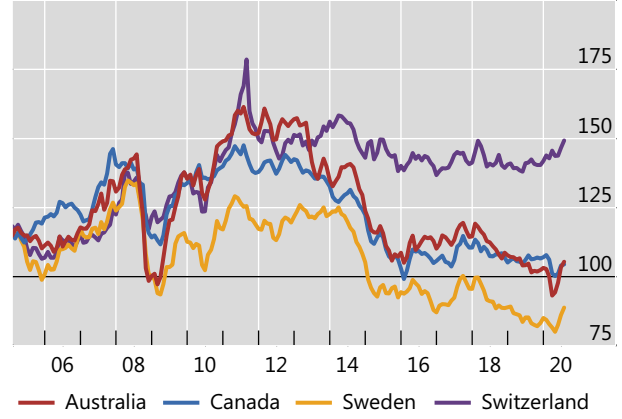
Indices, 1995–2005 = 100¹

Graph I.2

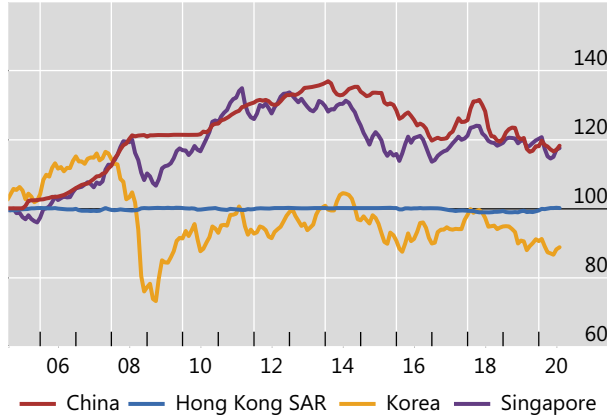
Major advanced economies



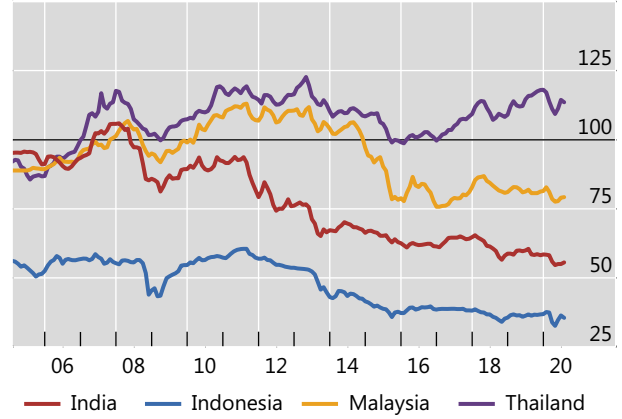
Other advanced economies



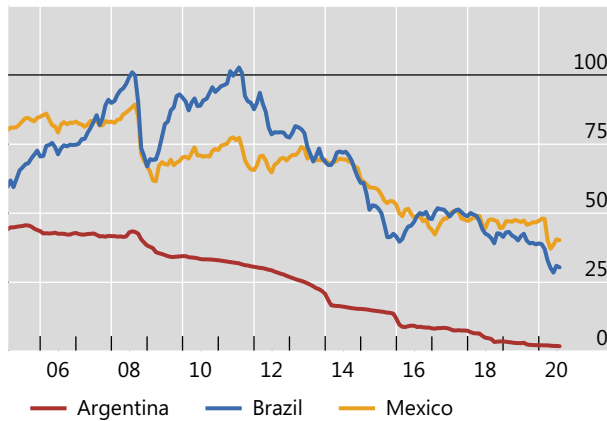
Emerging Asia



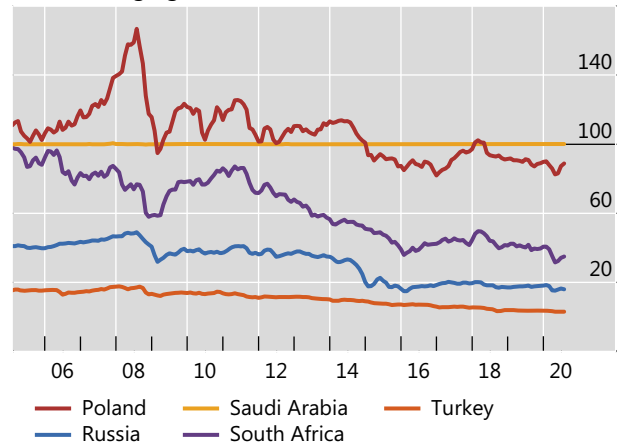
Other emerging Asia



Latin America



Other emerging market economies



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.

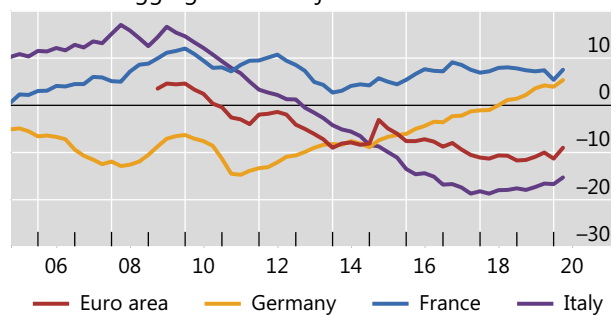
J Credit-to-GDP gaps

Credit-to-GDP gaps

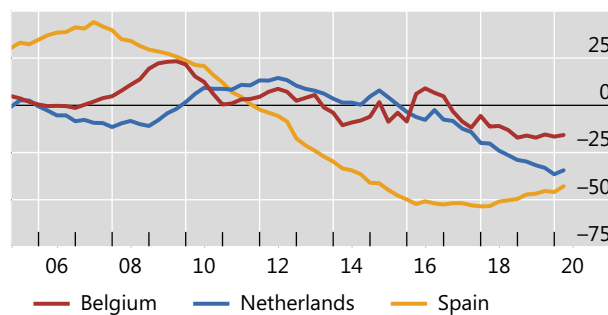
In percentage points of GDP

Graph J.1

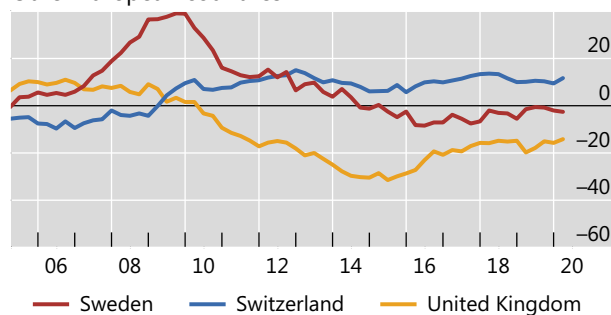
Euro area: aggregate and major countries



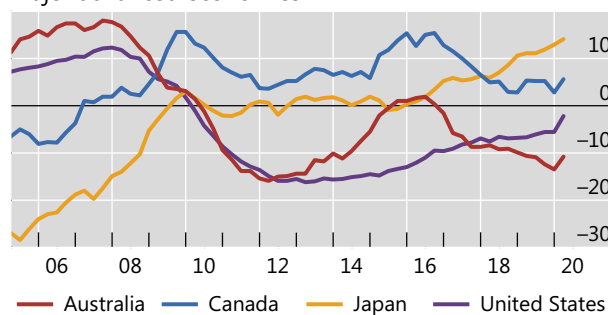
Euro area: other countries



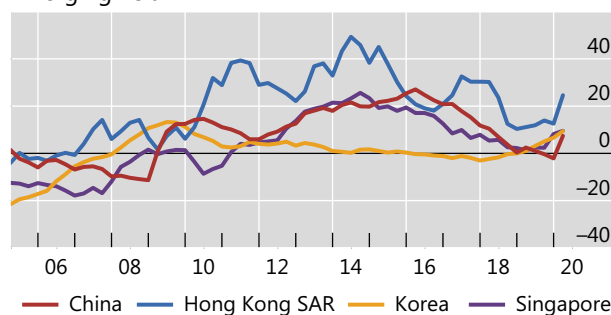
Other European countries



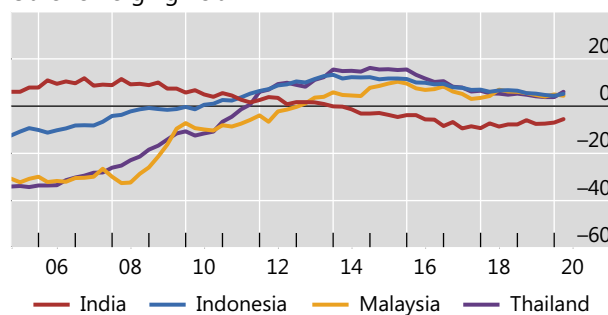
Major advanced economies



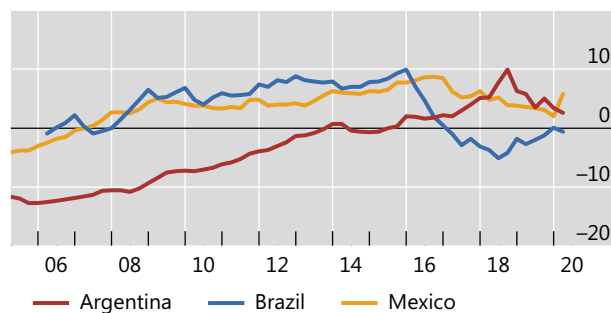
Emerging Asia



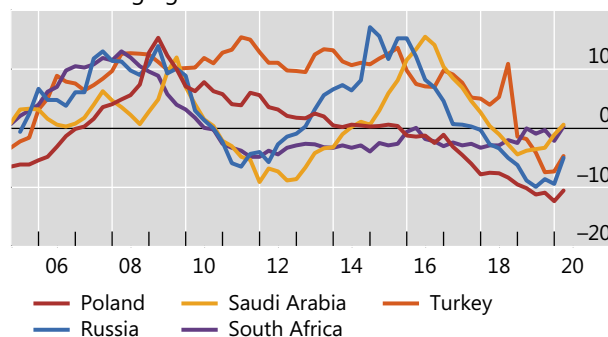
Other emerging Asia



Latin America



Other emerging market economies



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.

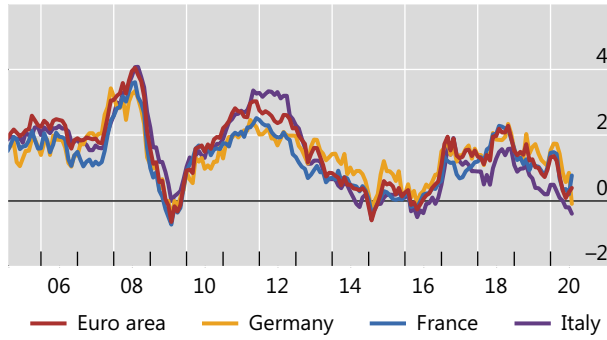
K Consumer prices

Consumer prices

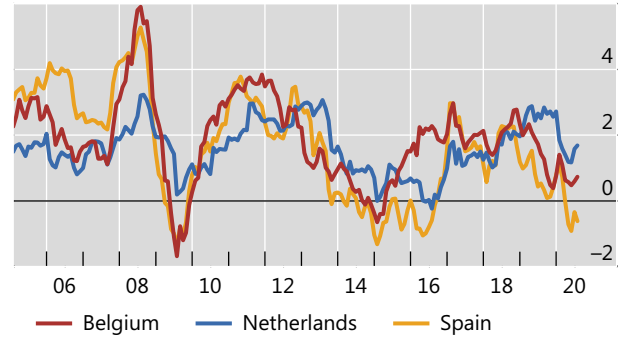
Year-on-year percentage changes

Graph K.1

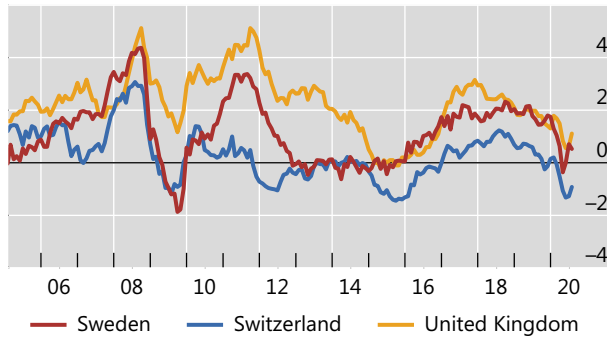
Euro area: aggregate and major countries



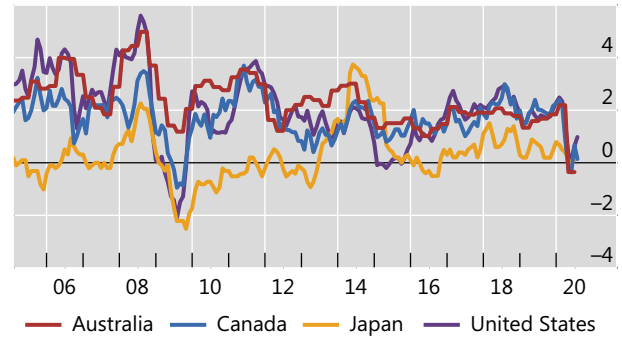
Euro area: other countries



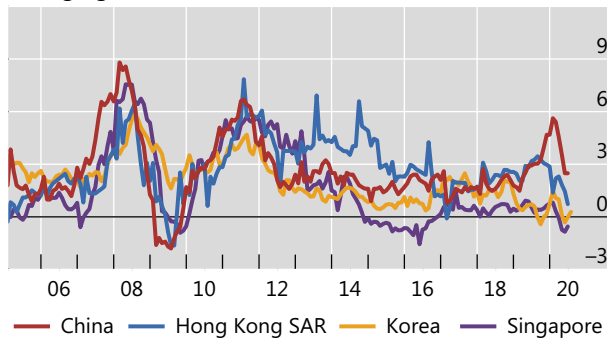
Other European countries



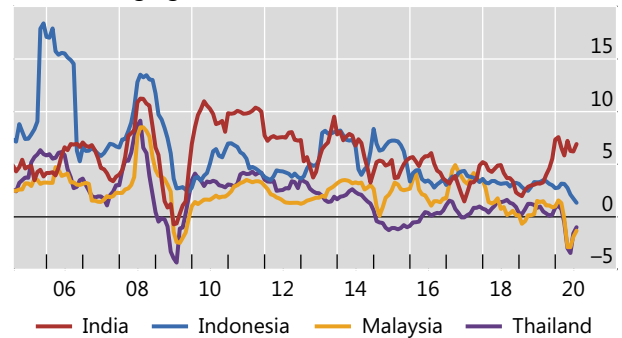
Major advanced economies



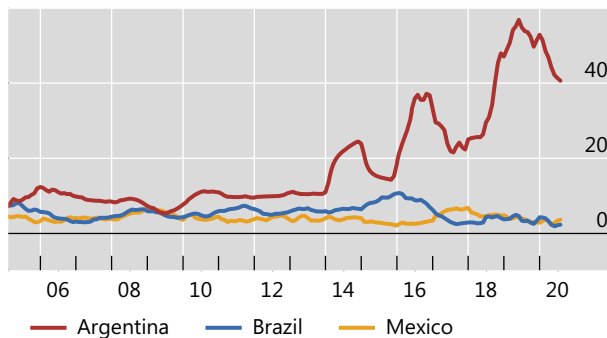
Emerging Asia



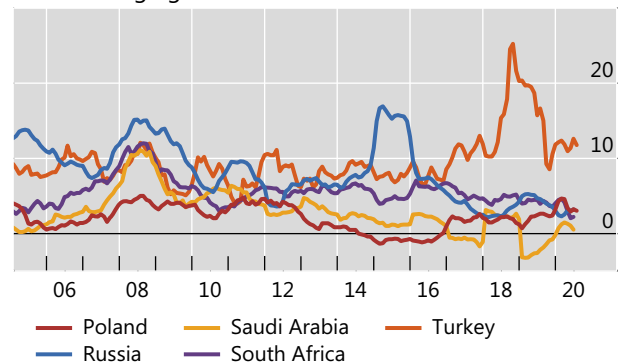
Other emerging Asia



Latin America



Other emerging market economies



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

Source: BIS consumer price statistics.

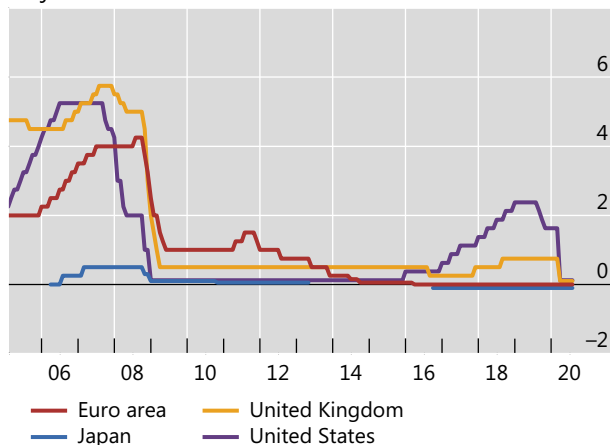
L Central bank policy rates

Central bank policy or representative rates

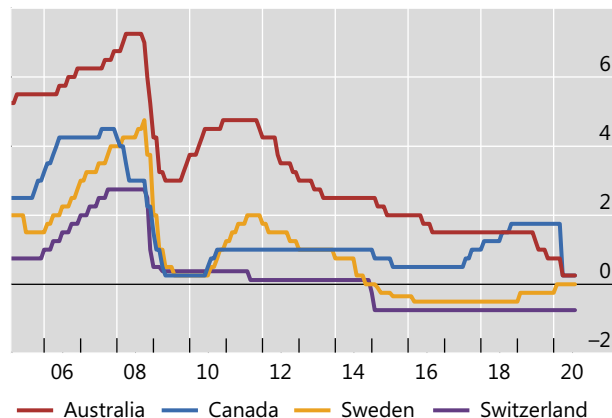
Month-end; in per cent

Graph L.1

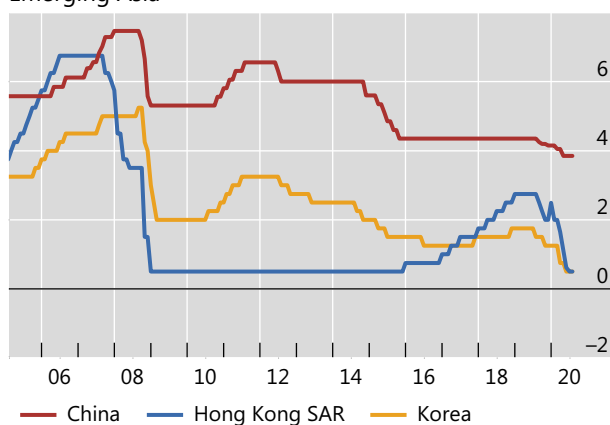
Major advanced economies



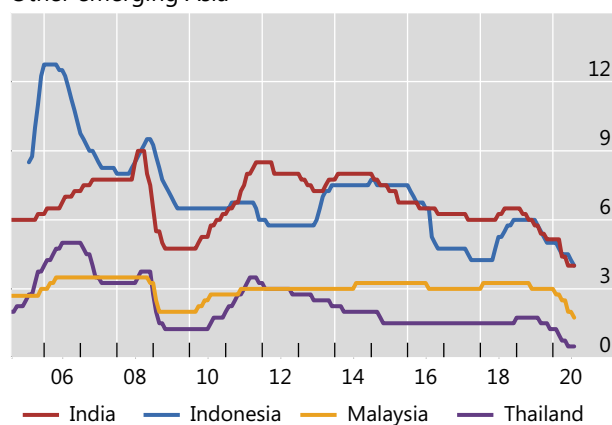
Other advanced economies



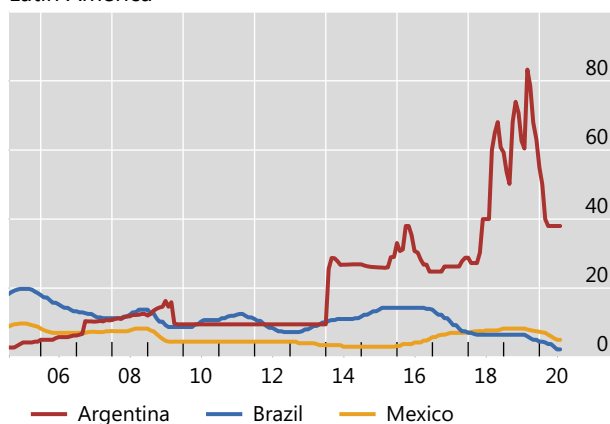
Emerging Asia



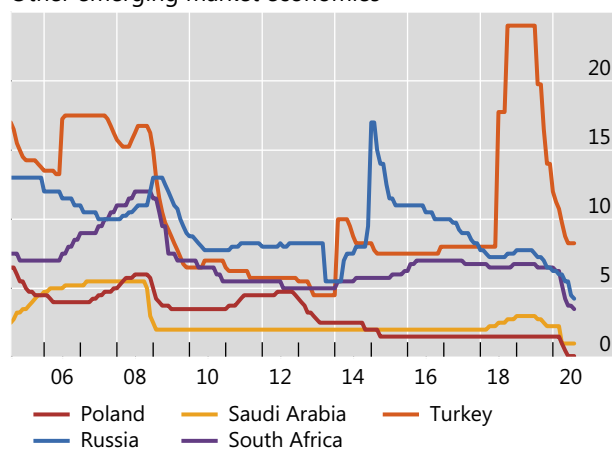
Other emerging Asia



Latin America



Other emerging market economies



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

Source: BIS policy rates statistics.