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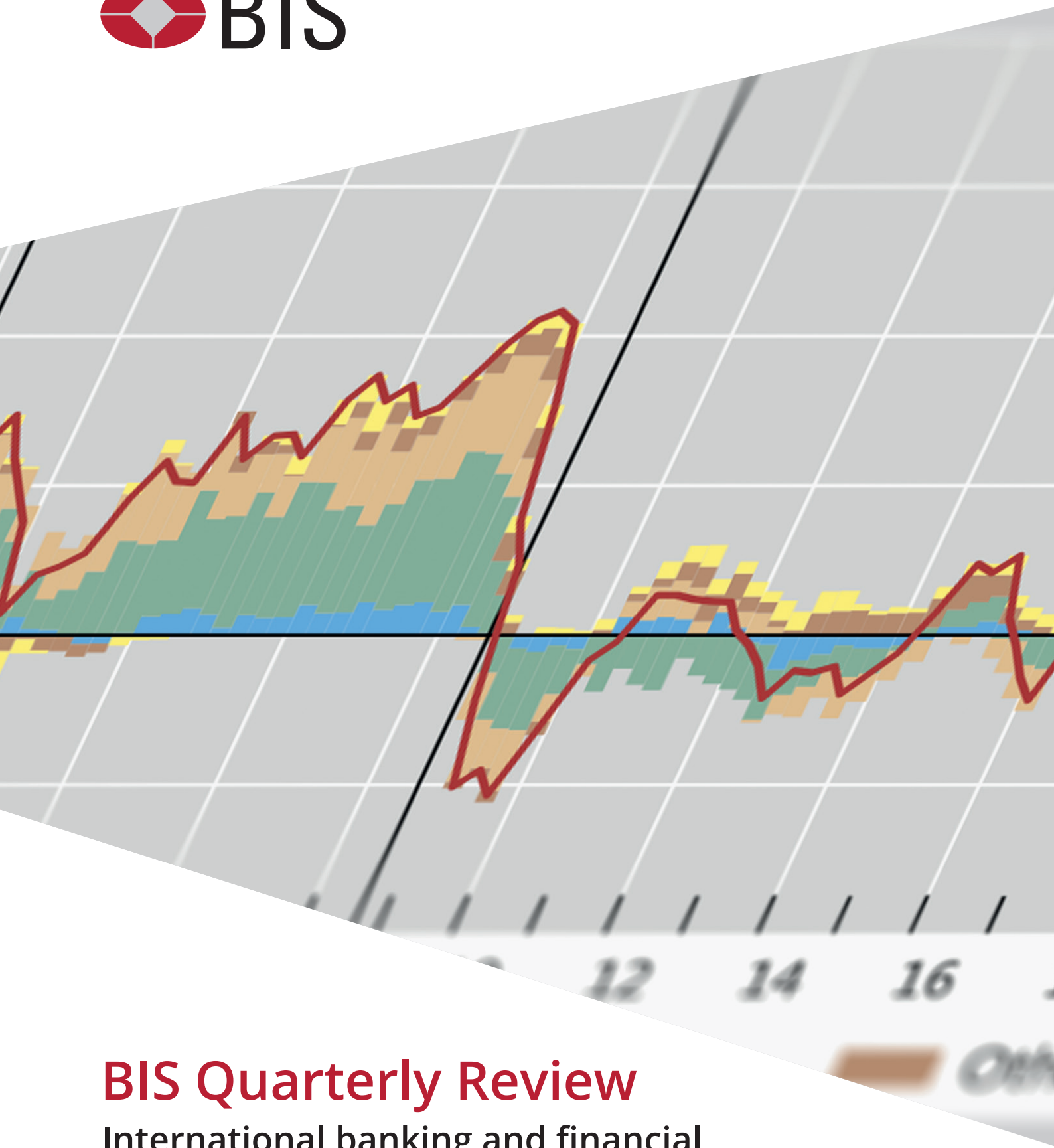

BIS Quarterly Review

International banking and financial market developments

September 2021

BANK FOR INTERNATIONAL SETTLEMENTS

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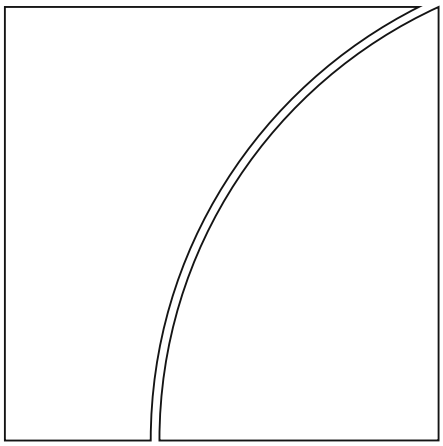

International banking and financial market developments

BIS Quarterly Review
Monetary and Economic Department

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Special features

Notations used in this Review

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

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

Abbreviations

Currencies

ALL	Albanian lek	MXN	Mexican peso
ARS	Argentine peso	MXV	Mexican unidad de inversión (UDI)
AUD	Australian dollar	MYR	Malaysian ringgit
BGN	Bulgarian lev	NAD	Namibian dollar
BHD	Bahraini dinar	NGN	Nigerian naira
BRL	Brazilian real	NOK	Norwegian krone
CAD	Canadian dollar	NZD	New Zealand dollar
CHF	Swiss franc	OTH	All other currencies
CLP	Chilean peso	PEN	Peruvian sol
CNY (RMB)	Chinese yuan (renminbi)	PHP	Philippine peso
COP	Colombian peso	PLN	Polish zloty
CZK	Czech koruna	RON	Romanian leu
DKK	Danish krone	RUB	Russian rouble
EUR	euro	SAR	Saudi riyal
GBP	pound sterling	SEK	Swedish krona
HKD	Hong Kong dollar	SGD	Singapore dollar
HUF	Hungarian forint	THB	Thai baht
IDR	Indonesian rupiah	TRY	Turkish lira
ILS	Israeli new shekel	TWD	New Taiwan dollar
INR	Indian rupee	USD	US dollar
ISK	Icelandic króna	VES	bolívar soberano
JPY	Japanese yen	VND	Vietnamese dong
KRW	Korean won	XOF	CFA franc (BCEAO)
MAD	Moroccan dirham	ZAR	South African rand

Countries

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

Countries (cont)

IN	India	MX	Mexico
IO	International organisations	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	UY	Uruguay
TO	Tonga	UZ	Uzbekistan
TR	Turkey	VC	St Vincent and the Grenadines
TT	Trinidad and Tobago	VE	Venezuela
TW	Chinese Taipei	VG	British Virgin Islands
TZ	Tanzania	VN	Vietnam
UA	Ukraine	ZA	South Africa
US	United States	ZM	Zambia

Markets send mixed signals

Risky asset and sovereign bond markets seemed to send mixed signals during the period under review.[1] Equity indices rose further globally, with emerging market economy (EME) stocks climbing in September. In conjunction with corporate spreads remaining extremely compressed, this underpinned exceptionally accommodative financial conditions in many jurisdictions. In sharp contrast, government bond yields declined steeply in advanced economies (AEs), even as the expected monetary policy stance tightened somewhat, thus hinting at a certain degree of investor unease about the economic outlook further down the road. Concurrently, the US dollar started appreciating, conceding some ground only later in the quarter.

Stock markets reflected cross-country differences in the strength of the recovery. Improvements in expected earnings boosted AE benchmarks. At the same time, an elevated cost of insurance against large drops in stock prices suggested a rise in investors' concerns about tail risk. A weakening of growth prospects and a tightening of regulatory measures drove a fall in Chinese equities for most of the review period, before a more recent recovery.

In corporate credit, risk appetite remained strong. Spreads stayed very tight by historical standards, although they widened noticeably but temporarily for the lowest-rated firms. Issuance was robust, especially for US high-yield borrowers.

Yield curves flattened in AEs. Following decade-high inflation readings, market-based expectations of future US policy rates rose, supporting the short end of the curve. Somewhat surprisingly, the long end fell sharply. The jury is still out on the underlying drivers. They probably have to do with government bond purchases by central banks and selected non-US investors, the unwinding of leveraged positions and perceived risks to the economic outlook.

EMEs continued to face challenges on various fronts. Besides uncertainty about the evolution of the Covid-19 pandemic, two issues stood out. First, rising expected policy rates in the United States blunted the traditionally positive effect of falling long-term US yields on portfolio flows. Second, investors were concerned about country-specific developments, including a softening growth outlook in China – where sovereign yields fell as a result – and high inflation readings in many jurisdictions – notably in Latin America, where currencies weakened markedly against the US dollar.

[1] 31 May to 13 September 2021.

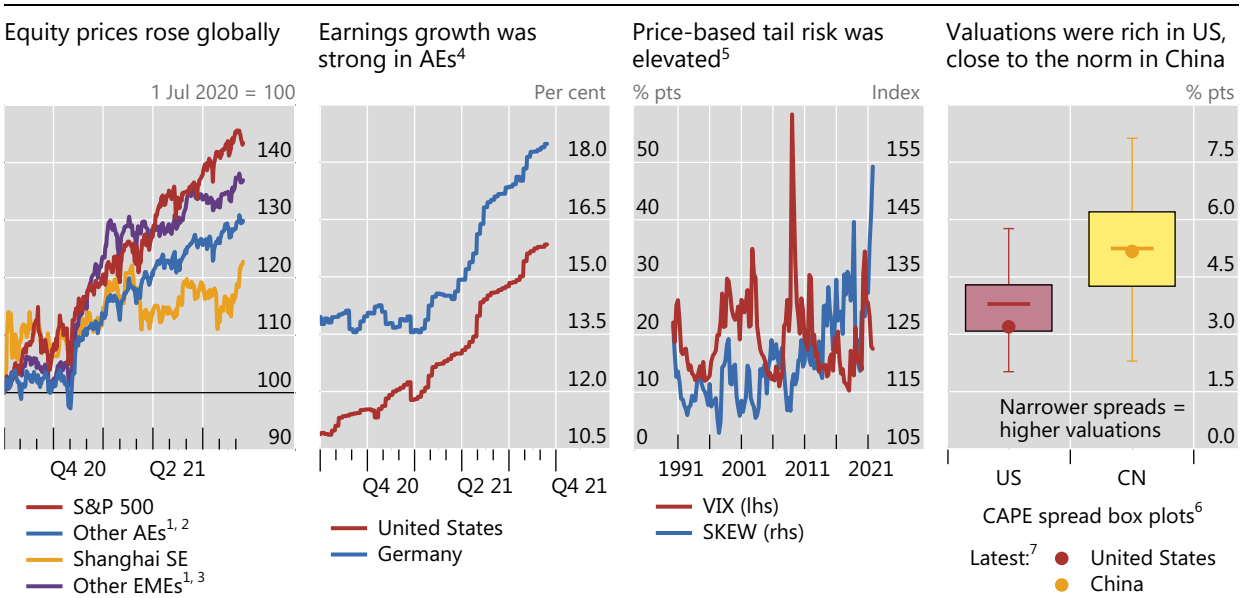
Key takeaways

- The mood in advanced economies' equity and corporate credit markets continued to be upbeat but government bond yields declined, even as investors perceived an increased likelihood of monetary policy tightening.
- Financial conditions remained extremely accommodative, especially in the United States.
- Challenges to emerging market economies surfaced as currency weakness and portfolio outflows despite declining long-term US yields.

Risky assets add to gains even as downside worries intensify

Equity markets proved resilient in AEs, although perceived tail risks increased. In the euro area, and especially in the United States, stock indices continued their upward trend on the back of brisk expected earnings growth (Graph 1, first and second panels). However, investors appeared concerned about several developments, including the prospect of less forceful US fiscal stimulus, the lingering effects of the pandemic on the services sector and persistent supply chain disruptions in manufacturing. As a result, even though option-implied volatility remained range-bound, a common market-based indicator of tail risk – reflecting the prices of options that provide a hedge against large equity declines – spiked to an all-time high during the review period (third panel).

Equity investors remained untroubled as perceived downside risk picked up — Graph 1



[1] GDP-weighted average. [2] AU, CA, CH, DK, GB, NO, NZ and SE. [3] BR, CL, CO, CZ, HK, HU, ID, IN, KR, MY, MX, PE, PH, PL, RU, SG, TH, TR and ZA. [4] Expected earnings per share growth between end-2020 and end-2023. [5] Quarterly averages. [6] Box plots show medians, interquartile ranges, and fifth and 95th percentiles; data starting in 2010. CAPE spreads are calculated by subtracting the real 10-year government bond yield from the inverse of the cyclically adjusted price/earnings (CAPE) ratio. [7] August 2021.

Sources: IMF; OECD; Barclays; Bloomberg; Datastream; BIS calculations.

The pandemic shaped stock market developments in EMEs, too. In China, the main index declined slightly early in the review period, as economic activity slowed, but posted gains overall owing to a surge in September. Besides a withdrawal of support measures, regulatory actions weighed on the country's large technology sector. In other EMEs, equity prices moved sideways before following AE benchmarks higher, buffeted by the cross-currents generated by strong export demand and by restrictions aimed at fighting the resurgent virus.

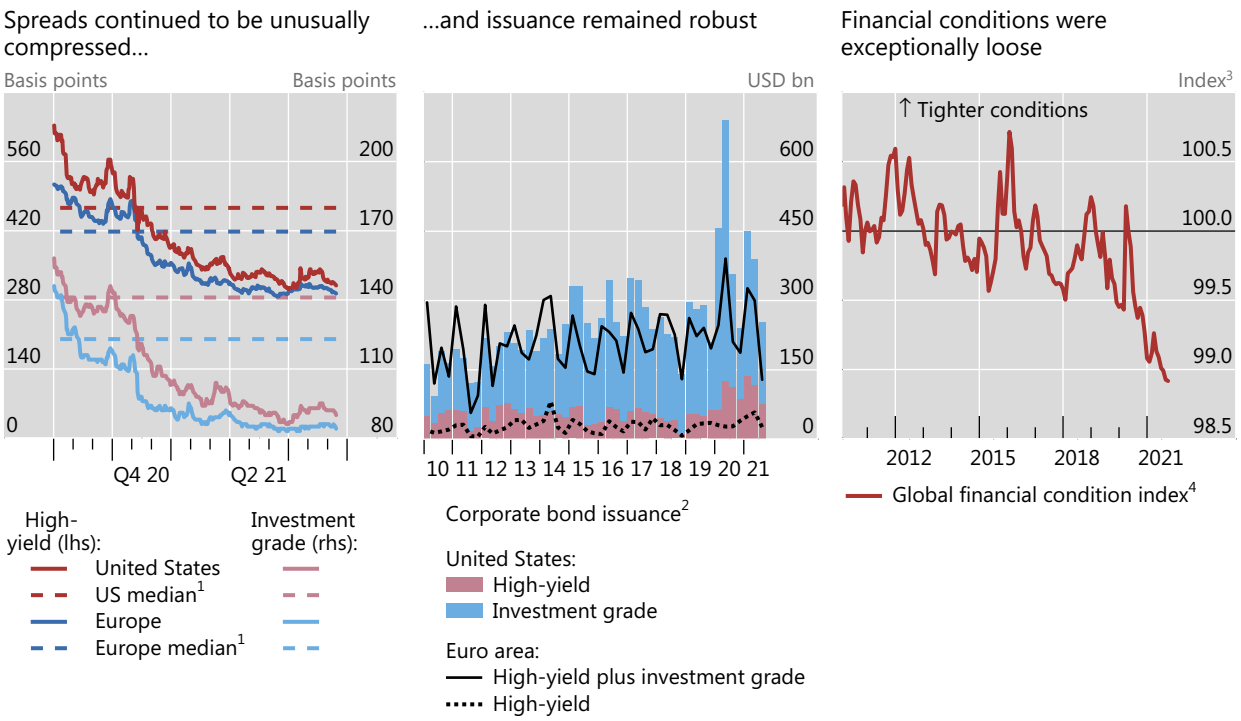
Stock valuations were quite rich in some jurisdictions and sectors. In the United States, they were above historical benchmarks even after accounting for very low interest rates (Graph 1, fourth panel). In China, they were close to their long-run norm. In general, valuations were particularly elevated in growth-oriented industries, such as technology, and in fast-developing market segments related to sustainable investing (Box A).

Market buoyancy was also visible in rising house prices. The pace of appreciation was strong in AEs, particularly in the United States. Monthly US housing price increases above 2% – exceptionally high in recent history – went hand in hand with shrinking available-for-sale inventories.

The corporate bond market signalled very easy credit conditions. Spreads did inch up early in the review period, but they narrowed again and remained well below historical medians in the euro area and the United States (Graph 2, left-hand panel). In parallel, third quarter issuance was resilient, especially in the US high-yield segment (centre panel). Once the growing volume of leveraged loans is factored in, credit to the riskiest US firms stood at $3 trillion in mid-2021, double the size in 2010.

Corporate credit markets remained buoyant, financial conditions accommodative

Graph 2



[1] 2010–current. [2] For Q3 2021, issuance data up to 13 September 2021, extrapolated to full quarter. [3] A value of 100 represents average conditions. [4] GDP-weighted average of the financial condition indexes of eight AEs and 13 EMEs. Monthly averages of daily values.

Sources: Bloomberg; Dealogic; Goldman Sachs, Marquee; ICE BofA indices; BIS calculations.

Box A

Sustainable finance: trends, valuations and exposures

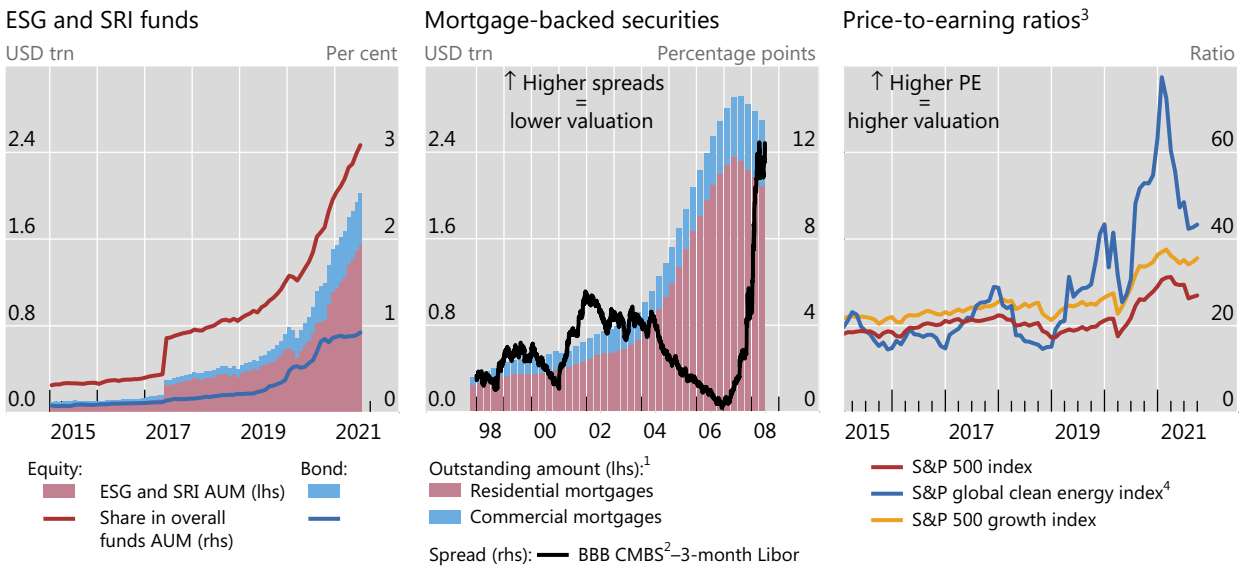
*Sirio Aramonte and Anna Zabai*①

Demand for investment products classified as delivering environmental, social and governance (ESG) benefits is booming. The growth of the overall ESG market rides mostly on investors' focus on environmental considerations, particularly in fixed income markets.② Both the general public and policymakers have encouraged market participants to support the transition to a low-carbon economy. At the same time, given the very fast growth of the new asset class, there are questions about the possibility that a bubble might develop unless market transparency can be ensured.③ Could a fundamentally welcome development – helping to finance the transition to a low-carbon world – generate significant financial imbalances? This box documents the pace of growth of ESG assets over recent years, considers their valuations, provides some indications of the size of investors' exposures, and sketches policy considerations relevant for the nascent regulatory framework.

While growth in ESG assets shows no signs of abating, lack of standardisation and the ensuing classification issues make it difficult to pin down precise amounts.④ One set of industry estimates relies on a broad definition that includes various approaches to integrating ESG criteria as well as "thematic", "impact" and "community" investing.⑤ On this basis, some estimates indicate that ESG assets rose by nearly one third between 2016 and 2020 to $35 trillion, or no less than 36% of total professionally managed assets.⑥ Another set of estimates – based on a narrower definition and including only mutual funds and exchange-traded funds (ETFs) that self-report as having ESG or socially responsible investment (SRI) mandates – shows even faster growth but at lower levels (Graph A1, left-hand panel). The assets managed by these funds have soared over the past five years, more than tenfold, and now stand at approximately $2 trillion. ESG/SRI equity funds account for about 3% of total mutual fund and ETF assets under management, and ESG/SRI bond funds for about 1%.

Sustainable finance's growth prompts parallels with past market developments

Graph A1



ESG = environmental, social and governance; SRI = socially responsible investing.

[1] Private label. [2] ICE Bank of America 0–10 year BBB US fixed rate commercial mortgage-backed securities index. [3] Monthly averages of daily values. [4] Includes firms that produce energy from solar, wind, hydro and other renewable sources, as well as those that supply clean technology. The top 10 constituents account for approximately 50% of total weight; no single stock's weight is higher than 8%.

Sources: Bloomberg; Datastream; EPFR; ICE BofA indices; authors' calculations.

Limited disclosure requirements result in an incomplete picture of which investors hold ESG assets, especially equity instruments. Current holdings of bonds with proceeds earmarked for environmental or social projects (ie bonds labelled as green, social or sustainable according to the International Capital Markets Association criteria) seem to amount to a small share of key financial intermediaries' balance sheets. They represent only about 1% of total bond portfolios for both US insurance companies and European banks (ECB, 2020).⑦ US pension funds stand out, with green bond holdings growing rapidly since 2017 and comprising about 4% of their current corporate credit exposure. By contrast, survey evidence indicates that these shares could be lower for hedge funds, as they lag behind other institutional investors in integrating ESG principles into their investment process.⑧ That said, bond holdings underestimate ultimate exposures, which would include stocks and other asset classes such as private equity, where ESG considerations are also increasingly relevant.

Historical lessons from the investment volume and price dynamics in rapidly growing asset classes could be relevant for ESG securities. Assets related to fundamental economic and social changes tend to undergo large price corrections after an initial investment boom. Railroad stocks in the mid-1800s, internet stocks during the dotcom bubble and mortgage-backed securities (MBS) in the Great Financial Crisis (GFC) are cases in point. It is thus noteworthy that the pre-GFC growth and size of the private label MBS market are comparable with those recently observed for ESG mutual funds and ETFs (Graph A1, centre vs left-hand panel).

There are signs that ESG assets' valuations may be stretched, although the available evidence stems from segments that are of indirect concern from a financial stability perspective. Even after a decline from their peak in January 2021, price-to-earnings ratios for clean energy companies are still well above those of already richly valued growth stocks (Graph A1, right-hand panel). Rich valuations in credit markets would be more relevant for assessing possible risks of financial distress, given the potential for defaults. More analysis would be needed to evaluate this possibility, including by estimating the size of any "greenium" or "socium" – ie the lower premium that market participants require for bearing financial risk when their investments support environmental or social causes – as it could signal market overheating.⑨

These considerations suggest that it is worth closely monitoring developments in the ESG market. If the market continues to grow at the current pace, and more elaborate instruments emerge (eg structured products), it will be important not only to assess the benefits of financing the transition to a low-carbon world, but also to identify and manage the financial risks that might arise from a shift in investors' portfolios. The widespread search for yield that has been under way in financial markets adds to the usefulness of such an exercise. Proceeding in this direction would involve the collection of adequate data on holders and exposures, with special attention to those that are leveraged and may reside in the less transparent segments of the financial system. In turn, all this puts a premium on adequate disclosure and reporting arrangements, including more reliable taxonomies.

① The views expressed are those of the authors and do not necessarily reflect the views of the BIS. ② IMF, "Sustainable finance", *Global Financial Stability Report*, October 2019. ③ A Carstens, "Transparency and market integrity in green finance", speech at the 2021 BIS Green Swan Conference, 2 June 2021. ④ F Berg, J Florian and R Rigobon, "Aggregate confusion: the divergence of ESG ratings", *MIT Sloan Working Paper*, 2020. ⑤ According to the Global Sustainable Investment Alliance (GSIA), thematic investing seeks exposure to sectors which will benefit from a greater focus on sustainability, such as efficient transportation. Impact investing finances specific projects that target environmental and/or social impacts. Community investing directs capital to traditionally underserved individuals or communities. See GSIA, *Global Sustainable Investment Review 2020*, 2021. ⑥ GSIA, ibid. ⑦ We use the BIS Sustainable Bonds Database to identify the green, social and sustainable bonds that are in the Refinitiv eMaxx database and are held by US insurance companies and corporate pension funds. Around 90% of these are green bonds. Data on euro area banks are from M Belloni, M Giuzio, S Kördel, P Radulova, D Salakhova and F Wicknig, "The performance and resilience of green finance instruments: ESG funds and green bonds", *ECB Financial Stability Review*, November 2020. ⑧ bfinance, *ESG asset owner survey: how are investors changing?*, February 2021. ⑨ For a discussion and references, see D Larcker and E Watts, "Where's the greenium?", *Journal of Accounting and Economics*, vol 69, issues 2–3, 2020. For the greenium on German green bonds, see L Pastor, R Stambaugh and L Taylor, "Dissecting green returns", *CEPR Discussion Paper*, no 16260, 2021. BoxFootnote.

While commonly used measures indicated that global conditions were at their loosest since the Great Financial Crisis (Graph 2, right-hand panel), there were some notable cross-country differences. In particular, the progressive loosening in the United States mainly reflected the long-lived strength of equity markets. China, where declining equity valuations and trade-weighted exchange rate appreciation contributed to tight conditions, stood out from the global picture. Other EMEs also faced certain headwinds (see below).

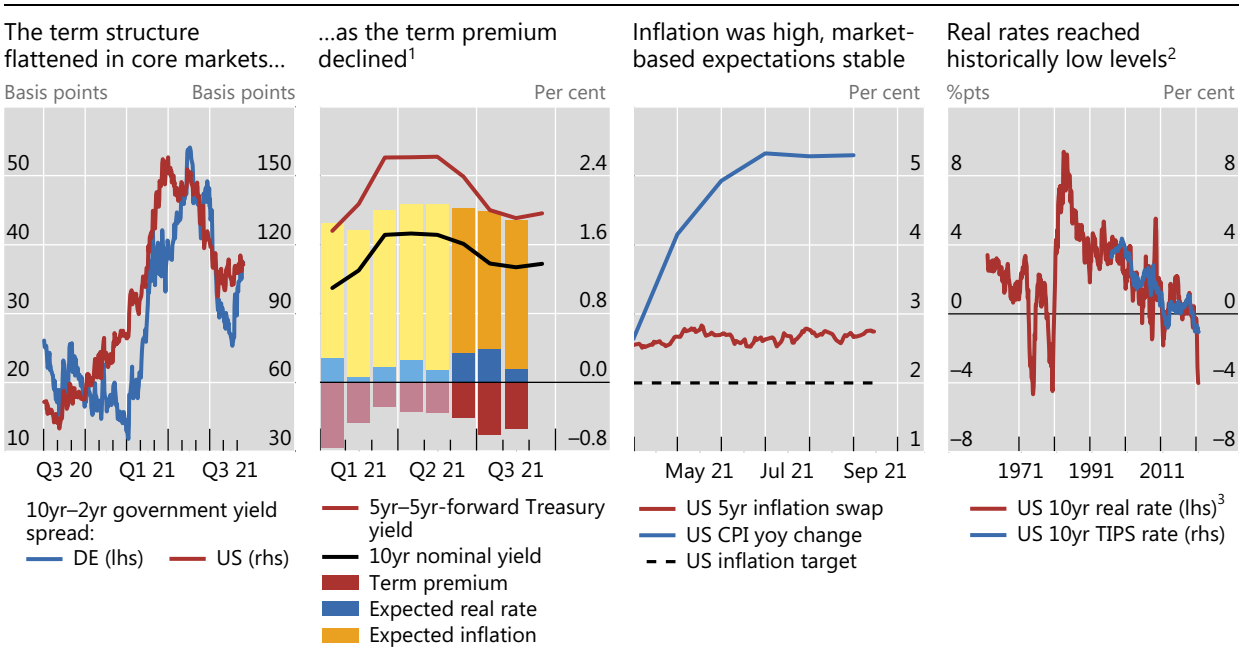
Long-term yields fall, but perceived snapback risk lingers

In the period under review, yield curves in AEs flattened significantly. By August, about half of the steepening that had taken place earlier in the year had reversed, both in Europe and the United States (Graph 3, first panel). These dynamics reflected an increase in front-end sovereign yields, but mostly a remarkable fall in longer-term ones. This decrease reflected perceptions that extend beyond the five-year horizon, as implied forward rates dropped in line with declines in estimated term premia (second panel). Yields fell in many AEs, including those that had made progress towards scaling back asset purchases, such as Australia and Canada.

In the United States, the evolution of nominal yields resulted in record low real interest rates. During the period under review, long-term market-based measures of inflation expectations remained stable, while realised inflation was consistently high (Graph 3, third panel). As a result, the fall in long-term nominal yields drove real rates into negative territory, to levels last seen during the Great Inflation era (fourth panel).

While actual or anticipated central bank actions underpinned near-term rates, there is no such clarity as regards the key drivers of long-term yields.

Yield curves flattened and real rates fell further into negative territory — Graph 3



[1] Decomposition of the 10-year nominal yield according to an estimated joint macroeconomic and term structure model; see P Hördahl and O Tristani, "Inflation risk premia in the euro area and the United States", *International Journal of Central Banking*, September 2014. Yields are expressed in zero coupon terms. The darker bars highlight the period under review (31 May–13 September 2021). [2] Monthly averages. [3] Calculated as the 10-year US Treasury constant maturity rate minus the year-on-year percentage change in the consumer price index for all urban consumers.

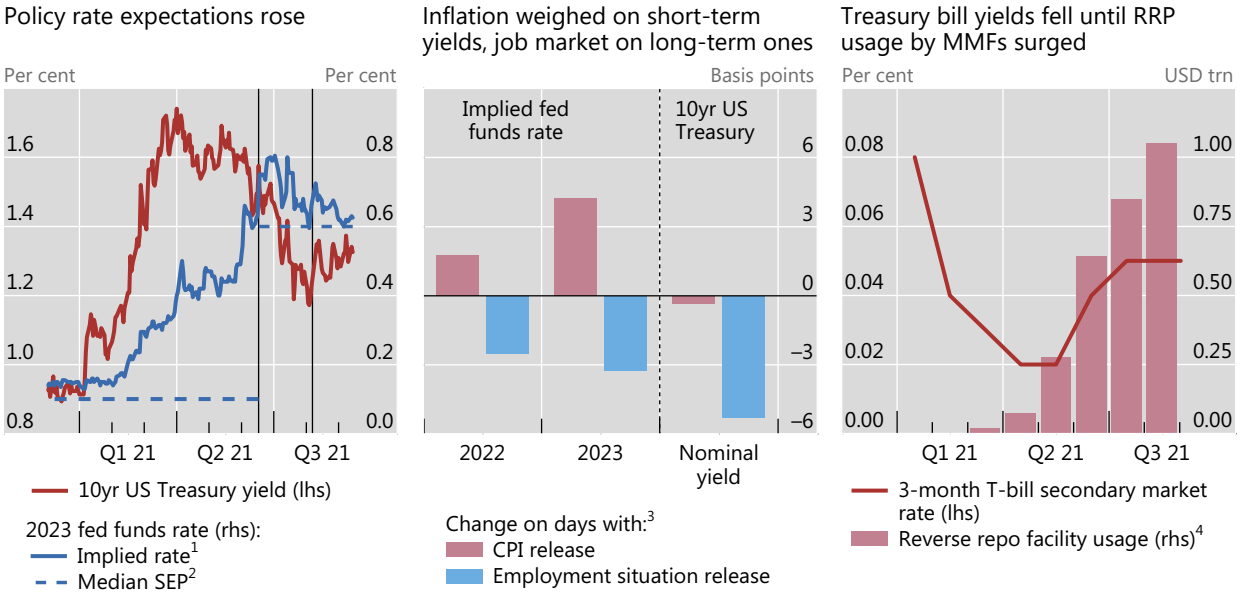
Sources: Federal Reserve Bank of St Louis, FRED; Bloomberg; BIS; BIS calculations.

Two developments supported short-term rates. First and foremost, there was an increase in expected policy rates. The perceived likelihood of a monetary policy tightening rose (Graph 4, left-hand panel), following higher than anticipated inflation releases (centre panel, first two red columns). Second, technical factors were also at work. After the Federal Reserve raised the interest rate paid on its overnight reverse repo facility (RRP) and eased participation limits, money market mutual funds[2] placed cash previously allocated to Treasury bills in the RRP, thus relieving downward pressure on front-end yields (right-hand panel).

Long-term US sovereign yields fell against the backdrop of large purchases by the Federal Reserve and certain private investors. The US central bank kept its substantial footprint in the markets for nominal and inflation-protected Treasuries (Graph 5, left-hand panel). In addition, yields on US sovereign bonds continued to entice foreign investors, notably those hedging their US dollar exposures into Japanese yen and euros (centre panel). And leveraged institutions reportedly unwound large short Treasury positions – de facto wrong-footed bets on rising rates.

US yields responded to a variety of factors

Graph 4



The vertical lines in the left-hand panel indicate 16 June 2021 (June 2021 FOMC meeting) and 6 August 2021 (July 2021 employment situation release).

[1] Federal funds rates implied by futures maturing in December 2023. [2] FOMC Summary of Economic Projections (SEP) median forecasts for 2023 federal funds rate. [3] Simple average of the changes in implied federal funds rates or 10-year Treasury yields calculated on 10 June 2021 and 13 July 2021 (red bars) and on 4 June 2021 and 2 July 2021 (blue bars). [4] Monthly average.

Sources: Board of Governors of the Federal Reserve System; Federal Reserve Bank of St Louis, FRED; Bloomberg; BIS calculations.

[2] The recent buoyancy of the money market mutual fund sector contrasts with the acute stress it suffered at the outbreak of the pandemic (Box B).

Box B

Stress in European money market funds at the outbreak of the pandemic

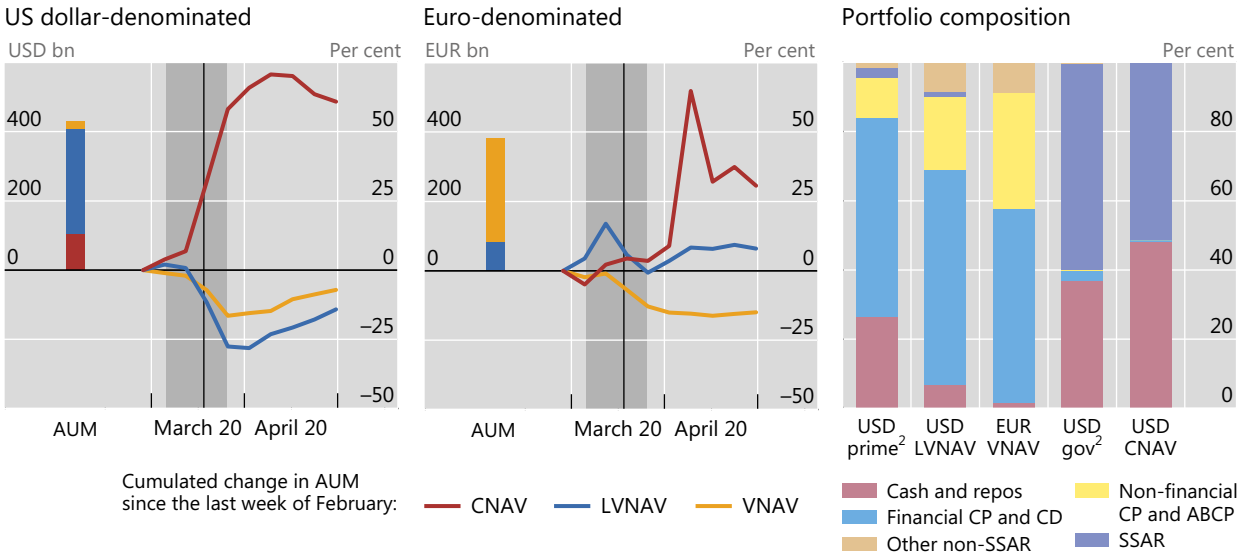
*Fernando Avalos and Dora Xia*①

European money market funds (EMMFs) were not immune to the acute stress that rocked their US counterparts in March 2020.② In several respects, the European developments echoed those in the United States. This box reviews the dynamics of EMMF outflows in the light of the US experience, including the role played by investors of different sizes and the importance of funds' liquidity.

EMMFs can be classified into three main groups: (i) constant net asset value (CNAV); (ii) low-volatility NAV (LVNAV); and (iii) variable NAV (VNAV). While CNAV funds price their portfolios at amortised nominal value, VNAV funds price them at market value. LVNAV funds stand in between: they normally price their portfolios like CNAV funds but must convert into VNAV funds if the volatility of their portfolios' market value exceeds certain thresholds. LVNAV and VNAV funds represent about 90% of EMMFs' overall assets under management (AUM), and they are mainly denominated in US dollars and euros, respectively (Graph B1, left-hand and centre panels, stacked bars). CNAV funds account for the remaining 10% of AUM and are almost entirely denominated in dollars.

Stress buffeted dollar LVNAV and euro VNAV money market funds[1]

Graph B1



The vertical lines in the left-hand and centre panels indicate 18 March 2020 (Federal Reserve unveils the MMLF programme and the ECB introduces the PEPP, which included non-financial commercial paper). The shaded areas indicate 6–26 March 2020 (period of consecutive outflows from US prime MMFs).

ABCP = asset-backed commercial paper; AUM = assets under management; CD = certificate of deposit; CP = commercial paper; CNAV = constant NAV; LVNAV = low-volatility NAV; SSAR = sovereign, supranational, agency and regional; VNAV = variable NAV.

[1] As classified by Informa iMoneyNet for USD-denominated funds and EPFR for EUR-denominated funds. [2] US domiciled funds.

Sources: Informa iMoneyNet; EPFR; authors' calculations.

The most stressed EMMFs, dollar-denominated LVNAV and euro-denominated VNAV funds, held predominantly non-government securities and had a similar experience to their US counterparts, prime institutional funds. A substantial share of these funds' assets consists of banks' commercial paper and certificates of deposit and, to a lesser extent, short-term debt of non-financial firms (Graph B1, right-hand panel). At the peak of the stress, the dollar LVNAV funds lost almost 30% of their February 2020 AUM (left-hand panel, blue line), representing almost $90 billion. In the euro-denominated segment, the losses of the VNAV funds by the end of March were higher than 15% of pre-stress AUM (centre panel, yellow line), or more than €50 billion. EMMF outflows started broadly at the same time as those in US prime MMFs (left-hand and centre panels, shaded areas). However, while outflows from US prime MMFs ebbed

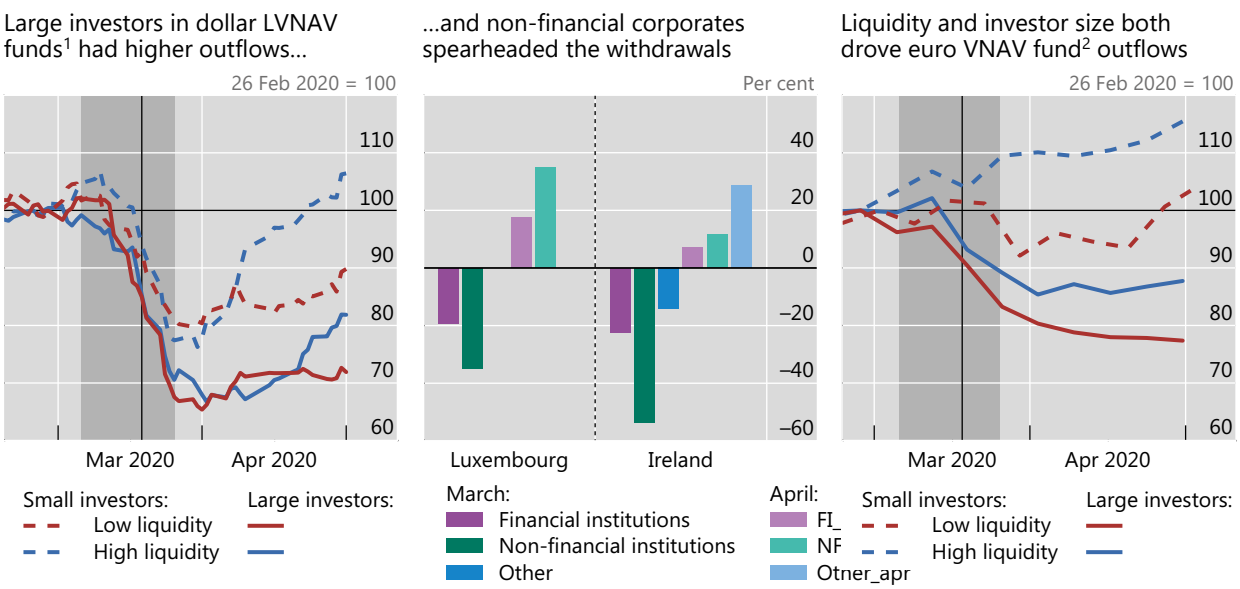
after the Federal Reserve introduced the Money Market Fund Liquidity Facility (MMLF) in late March 2020 (vertical lines), withdrawals from dollar-denominated EMMFs persisted through the end of the month.③ That probably reflected the fact that the Federal Reserve's liquidity support did not extend to EMMFs. In addition, redemptions continued to trickle out of euro VNAV funds through end-March and until mid-April, as the ECB's new Pandemic Emergency Purchase Programme (PEPP) was picking up momentum.④

As investors shifted away from riskier assets, MMFs investing mostly in government securities – CNAV funds in Europe, similar to government funds in the United States – received large inflows. While dollar CNAV funds gained more than 65% of their pre-Covid balances, this was still about $15 billion less than the outflows from other dollar-denominated EMMFs. Similarly, outflows from euro VNAV funds were only minimally captured by euro CNAVs or other euro-denominated EMMFs. All this suggests that a significant portion of EMMF losses may have turned into euro area overnight bank deposits, which saw unusual inflows of about €200 billion in March 2020, and possibly also flowed into US government MMFs, whose AUMs expanded much more than US prime MMFs contracted.

Did funds' investor size and liquidity positions play a role in EMMFs' experience, as was the case for US MMFs? We focus on dollar LVNAV and euro VNAV funds, the two types of EMMFs most affected by the stress, and partition the funds of each type into four groups using two criteria. First, we distinguish funds populated by large or small investors. We do this based on the funds' expense ratio – a common approach in the academic literature. The underlying idea is that MMFs catering to larger investors usually require larger minimum investments, and consequently tend to have lower expense ratios.⑤ Second, we differentiate high- from low-liquidity funds, using the portfolio share of their liquid assets in the last week of February 2020. Crossing the two features, we obtain four groups of funds, for which we document the flows in March and April 2020.⑥

The role of investor size and funds' liquidity during the March 2020 stress

Graph B2



The vertical lines in the left- and right-hand panels indicate 18 March 2020 (Federal Reserve unveils the MMLF programme and the ECB introduces the PEPP, which included non-financial commercial paper). The shaded area in the left- and right-hand panels indicates 6–26 March 2020 (period of consecutive outflows from US prime MMFs).

[1] As classified by Informa iMoneyNet. Funds are split into the low/high groups based on the average of their reported expense ratio and their reported weekly liquid assets during the last week of February 2020. [2] As classified by EPFR. Funds are split into the low/high groups based on their reported expense ratio and the composition of their asset holdings in February 2020.

Sources: IOSCO; Informa iMoneyNet; Refinitiv Lipper; EPFR; authors' calculations.

Large investors spearheaded the withdrawals from both European dollar LVNAV funds and US prime funds, although the main players were non-financial corporates in Europe and financial institutions in the United States. By end-March, EMMF withdrawals by large investors exceeded those by smaller investors by about 10% of the pre-shock AUM, irrespective of the funds' underlying liquidity conditions (Graph B2, left-hand panel). Non-financial institutions withdrew more than financial institutions from Luxembourg- and Ireland-domiciled funds.⑦ In fact, non-financial investors' redemptions represented between 35 and 53% of their holdings, as opposed to 19 to 22% of financial institutions' holdings (centre panel). This suggests that European outflows were mainly driven by precautionary motives – eg corporate treasurers securing dollar cash balances – in contrast to the need to cover margin calls by financial institutions in the United States.⑧

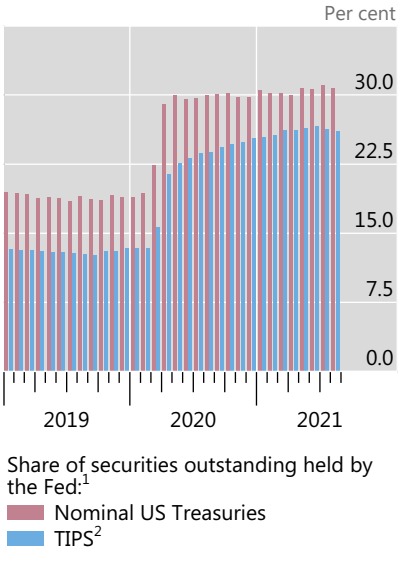
In April, the recovery of both European dollar LVNAV and US prime funds were led by small investors, although their liquidity preferences differed across jurisdictions: high-liquidity in Europe and low-liquidity in the United States. In Europe, high-liquidity funds with small investors saw a reversal of their entire March outflows by end-April (Graph B2, left-hand panel, dashed blue line). In the United States, by contrast, low-liquidity prime MMFs were the main recipients of inflows when small investors returned.⑨ Low-liquidity EMMFs recorded a relatively tepid recovery, with little regard for their typical investor's size (solid and dashed red lines). A possible reason is that, as already noted, dollar-denominated European funds did not benefit from the backing of the Federal Reserve's MMLF programme.

Turning to euro VNAV funds, large investors again spearheaded withdrawals, generally from less liquid funds, while small investors were quicker to return after the turmoil. Funds mostly serving large investors recorded withdrawals of between 20% (low liquidity) and 15% (high liquidity) of their pre-Covid AUM in March. At the same time, funds with small investors saw redemption of less than 10% of pre-shock AUM (low liquidity) or even recorded inflows (high liquidity). In April, funds serving larger investors did not see a noticeable rebound in their AUM, while less liquid funds catering to smaller investors fully recovered their losses.

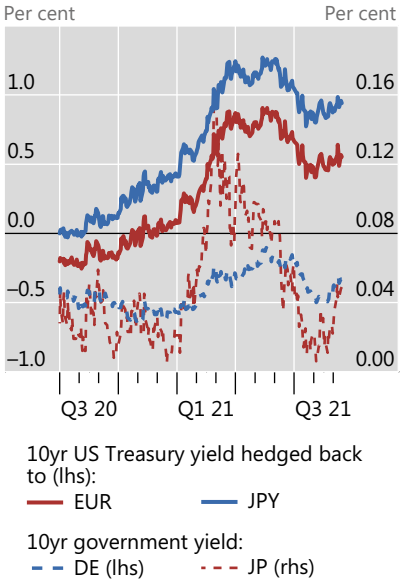
① The views expressed are those of the authors and do not necessarily reflect the views of the BIS. ② There are several studies of the March 2020 stress in US prime money market funds, eg F Avalos and D Xia, "Investor size, liquidity and prime money market fund stress", *BIS Quarterly Review*, March 2021; M Cipriani and G La Spada, "Sophisticated and unsophisticated runs", Federal Reserve Bank of New York, *Staff Reports*, no 956, December 2020; L Li, Y Li, M Macchiavelli and X Zhou, "Runs and interventions in the time of Covid-19: Evidence from money market funds", Federal Reserve Board, manuscript. ③ This programme allowed banks to borrow from the Federal Reserve by pledging a wide range of assets purchased from prime and tax-exempt MMFs. Eligible assets included the most distressed ones, such as commercial paper and certificates of deposit. The loans to the participating banks were given on a non-recourse basis (ie banks did not bear credit risk) and were exempt from regulatory capital requirements. The facility eased the stress by making banks willing buyers of illiquid assets, thus providing liquidity to MMFs to meet redemptions. In so doing, it reduced investors' pre-emptive withdrawals. ④ The PEPP was announced on 18 March 2020 and implemented on 24 March 2020, when the minimum remaining maturity of eligible non-financial commercial paper for both the PEPP and the Corporate Sector Purchase Programme was reduced from six months to 28 days. ⑤ L Schmidt, A Timmermann and R Wermers, "Runs on money markets mutual funds", *American Economic Review*, vol 106, no 9, 2016. The expense ratio measures the operational costs of an investment fund (eg management, shareholder services and other administrative fees). The investor pays these costs through a reduction in the investment's rate of return. ⑥ The four groups include a relatively balanced number of funds. In the euro VNAV segment, there are 51 funds managing $212 billion in the large investor-low liquidity group, 38 funds managing $13 billion in the small investor-low liquidity group, 37 funds managing $56 billion in the large investor-high liquidity group, and 49 funds managing $13 billion in the small investor-high liquidity group. The corresponding figures for the dollar LVNAV segment are 22 funds managing $92 billion, 30 funds managing $20 billion, 41 funds managing $73 billion, and 34 funds managing $79 billion. ⑦ Luxembourg and Ireland are the two major jurisdictions hosting dollar-denominated LVNAV funds. See IOSCO, "Money market funds during the March–April episode", *IOSCO Thematic Note*, November 2020. ⑧ For a description of the stress in US markets resulting from margin calls, see A Schrimpf, H S Shin and V Sushko, "Leverage and margin spirals in fixed income markets during the Covid-19 crisis", *BIS Bulletin*, no 2, April 2020. ⑨ See Avalos and Xia, ibid.

US Treasuries maintained their broad appeal; snapback risk seemed significant Graph 5

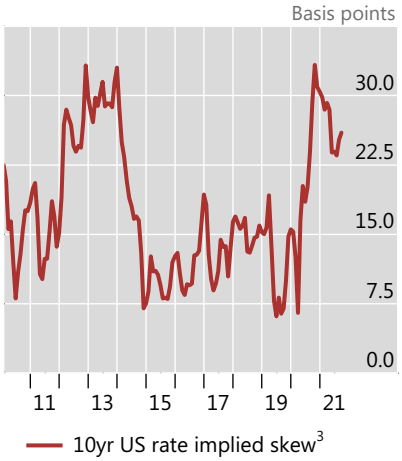
Fed had a large footprint in Treasury markets



Currency-hedged Treasury yields were attractive



Perceived snapback risk remained noteworthy



[1] Ten-year equivalent; ratio of Federal Reserve's System Open Market Account (SOMA) holdings to total outstanding value. [2] TIPS = Treasury Inflation-Protected Securities. [3] From USD swaptions with three-month maturity that give the right to enter a 10-year overnight indexed swap. The implied skew is calculated as the difference between the implied volatility of 100 bp out-of-the-money swaptions and the implied volatility of at-the-money swaptions; monthly average.

Sources: Board of Governors of the Federal Reserve System; Federal Reserve Bank of New York; Federal Reserve Bank of St Louis, FRED; US Treasury; Bloomberg; JPMorgan Chase; Refinitiv Eikon; BIS calculations.

Treasury investors also seemed attuned to developments in the US labour market. Yields proved sensitive to signs of slack, such as high long-term unemployment and low labour force participation. Early in the review period, 10-year yields fell after reports surprised markets by revealing that such slack persisted despite very high job opening numbers (Graph 4, centre panel, third blue column). Subsequently, labour market improvements in August and September first put a floor on rates and then contributed to a slight increase.

As long-term yields fell to very low levels, perceived snapback risk remained noteworthy. Derivatives prices indicated that market participants were willing to bear relatively high costs to hedge against a sharp rise in 10-year interest rates. A measure of option-implied tail risk stood somewhat below the high levels recorded in 2013 and 2020 (Graph 5, right-hand panel).

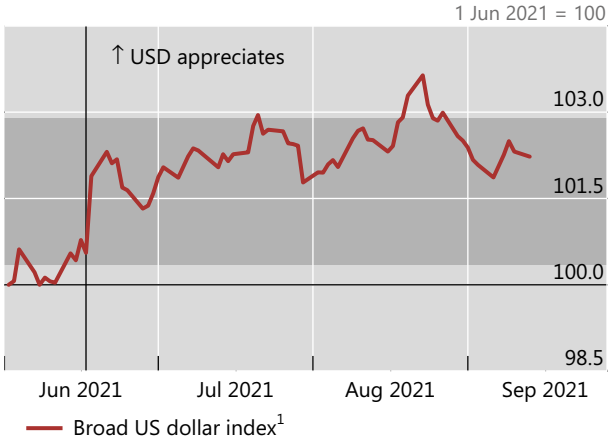
The dollar responds to expected policy and macro outlook

The US dollar appreciated over the period under review relative to a broad basket of trading partner currencies, with some volatility around the general trend. Early on, the strengthening reflected expectations of a tighter policy stance in the wake of the June Federal Open Market Committee (FOMC) meeting (Graph 6, left-hand panel, vertical line). Subsequently, it seemed to stem primarily from a rise in the appeal of safe assets, which confirmed the dollar's status as a risk barometer. Most recently, the US currency depreciated notably following the remarks of the Federal Reserve Chairman at the Jackson Hole conference in late August.

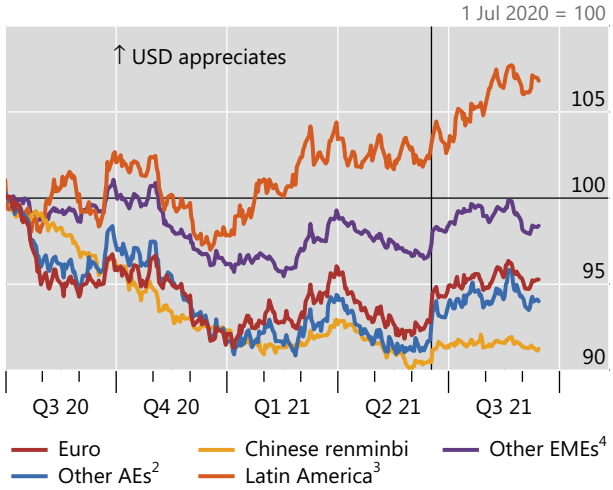
The US dollar appreciated broadly

Graph 6

The dollar strengthened on expected policy tightening in June, weakened in late August



The dollar appreciated most vis-à-vis Latin American EME currencies



The grey area in the left-hand panel indicates the 10th–90th percentile range calculated over 1 January 2021–30 May 2021. The vertical line in the left- and right-hand panels indicates 16 June 2021 (June 2021 FOMC meeting).

[1] Trade Weighted US Dollar Index: Broad, Goods and Services. An increase represents an appreciation of the US dollar. [2] AU, CA, CH, DK, GB, JP, NO, NZ and SE. [3] AR, BR, CL, CO, MX and PE. [4] CZ, HK, HU, ID, IL, IN, KR, MY, PH, PL, RU, SA, SG, TH, TR, TW and ZA.

Sources: Federal Reserve Bank of St Louis, FRED; Bloomberg; BIS calculations

The US dollar's strength over the period as a whole was broad-based. Exchange rates vis-à-vis other AE currencies largely reverted to levels prevailing at the end of the first quarter, when AE yields had peaked (Graph 6, right-hand panel). The dollar appreciated the most against Latin American currencies, partly due to the macroeconomic and financial headwinds they faced (see below).

The renminbi proved remarkably resilient in recent months. Earlier in 2021, its exchange rate vis-à-vis the dollar had co-moved closely with those of other AEs and EMEs. This pattern changed and the renminbi stayed flat even as other currencies depreciated, starting roughly when the People's Bank of China raised the required reserve ratio for foreign exchange deposits, for the first time since 2007.

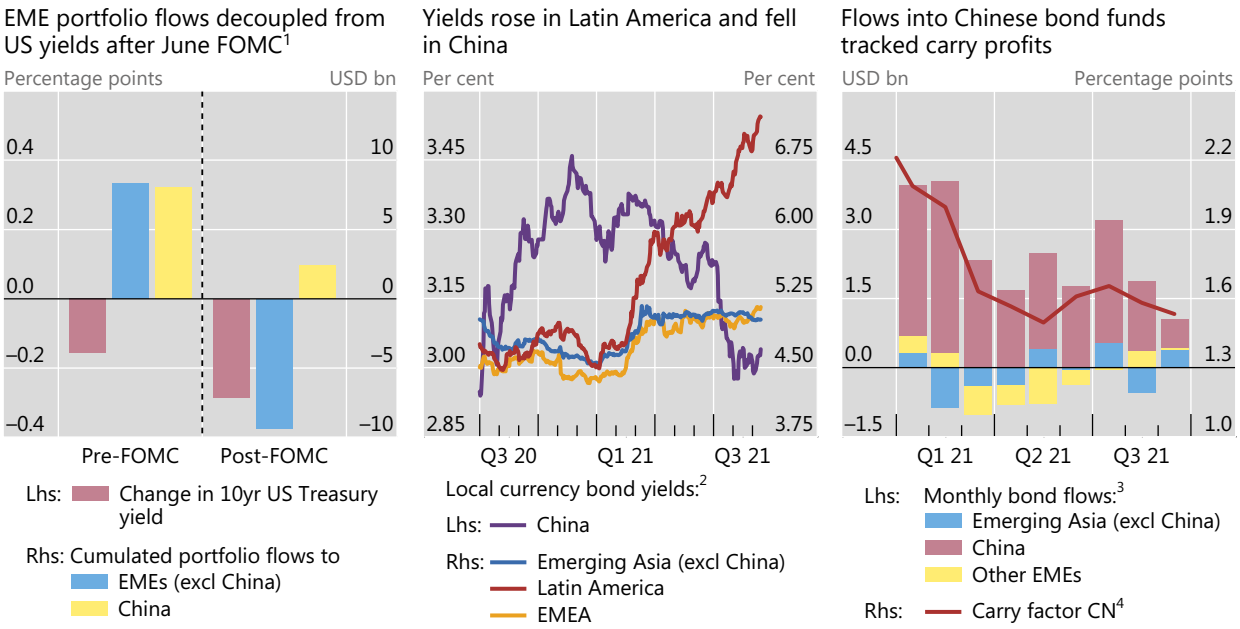
Headwinds grow for EMEs as the pandemic endures

Incipient recoveries in EMEs faced a variety of hurdles. On top of general concerns about the lingering pandemic and the spread of the Covid-19 Delta variant, two issues stood out. The first was the rise in expected US policy rates, which muted the traditionally beneficial effects of declining long-term US yields on portfolio flows. The second was a host of country-specific developments, including inflationary pressures, especially in Latin America, and a weaker growth outlook in China.

EMEs experienced strong portfolio outflows as markets reassessed the expected stance of US monetary policy. Throughout 2021, flows to these economies generally improved when US long-term rates declined. This pattern reversed sharply after the June FOMC meeting, as EMEs other than China saw outflows even when US yields fell (Graph 7, left-hand panel).

EME flows and yields reflected expected US policy path and regional headwinds

Graph 7



[1] Pre- and post-FOMC periods cover a time span of one month before and after 16 June 2021 (June 2021 FOMC meeting), respectively. [2] Simple averages of JPMorgan Chase GBI Global sub-indices, traded yields. [3] Flows to local currency bond funds. Data up to 13 September 2021. [4] Carry factor defined as the 10-year local currency sovereign bond yield minus the 10-year US Treasury yield; monthly average.

Sources: Institute of International Finance; Bloomberg; EPFR; JPMorgan Chase; BIS calculations.

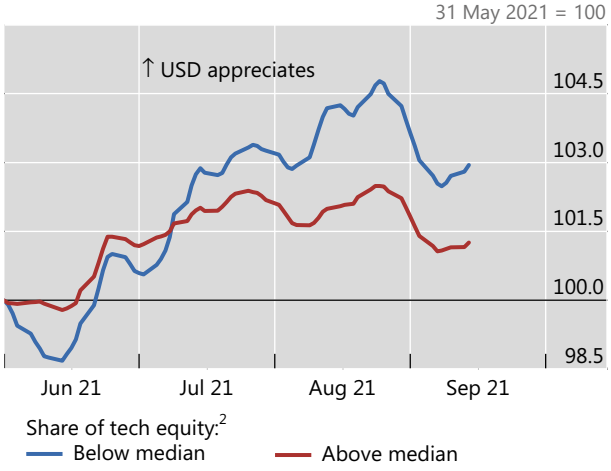
Country-specific challenges shaped diverging patterns in yields across EMEs. After rising together with AE rates earlier in the year, local yields continued to increase in Latin America as surging inflation prompted monetary policy tightening in most jurisdictions (Graph 7, centre panel). In other countries, such as Russia and South Africa, local yields remained largely flat despite rising inflation. By contrast, Chinese bond yields declined. This took place as a decelerating recovery prompted more accommodative policy and investors sought to profit from the positive yield differential between Chinese and US sovereign bonds (right-hand panel).

Patterns in foreign exchange markets also highlighted the predicament of some EMEs. The currencies of countries with a less developed technology sector depreciated more against the US dollar (Graph 8, left-hand panel). These countries could not benefit from strong international demand for high-technology products. In addition, in a sign that external funding pressures had built up, the exchange rates of commodity exporters were less responsive than usual to commodity prices (right-hand panel).

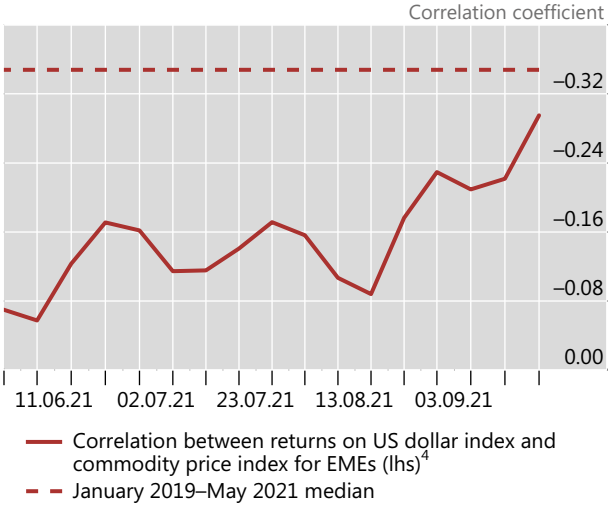
Foreign exchange markets pointed to headwinds for some EMEs

Graph 8

EMEs with a smaller tech sector saw stronger depreciations[1]



For commodity exporters, exchange rates responded less to commodity prices than in recent years[3]



[1] An increase represents an appreciation of the US dollar; five-day moving averages. The sample consists of 20 EMEs. [2] Share of tech equity in the main national stock market index. [3] Weekly averages. [4] Spearman rank correlation between daily log change in the US dollar index and the average of the daily log change on grains and industrial metals indices, 66-working day moving window. Correlation displayed on an inverted scale. The dollar index is the average of exchange rates for BR, CL, CO, ID, IN, MY, PE, RU and ZA.

Sources: IMF; WTO; Bloomberg; Refinitiv Eikon; BIS calculations.

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Monetary policy, relative prices and inflation control: flexibility born out of success[1]

The achievement of low and stable inflation on the back of credible monetary policy frameworks has coincided with a sharp and major drop in the co-movement of prices across finely disaggregated sectors of the economy. In other words, sector-specific price developments have become much more prominent in driving fluctuations in aggregate price indices. In addition, changes in the stance of monetary policy in this environment affect a rather narrow set of prices, limiting the policy's ability to steer inflation within tight ranges as well as the desirability of doing so. All told, this highlights the importance of flexibility in the pursuit of inflation targets within a credible policy regime.

JEL classification: E31, E52, E58

Ever since the Great Financial Crisis (GFC), central banks have struggled to bring inflation up towards targets, despite maintaining a highly accommodative policy stance for a long period of time. More recently, however, and partly on the back of a strong post-pandemic economic rebound underpinned by highly expansionary fiscal and monetary policies as well as supply bottlenecks, there have been widespread concerns that inflation may exceed those targets by an uncomfortably large margin (BIS (2021)). This evolving picture puts a premium on understanding inflation dynamics in an environment where inflation has been enduringly low and stable within a credible monetary policy regime.

Against this backdrop, this special feature addresses a number of questions. First, what are the relative contributions to inflation of generalised (ie common) and sector-specific (ie relative) price changes in high and low inflation environments, respectively? In answering this question, we use prices for very finely defined expenditure categories ("sectors") that underlie aggregate consumer price indices. Second, how broad across such sectors is the impact of changes in the monetary policy stance in a low and stable inflation regime? Finally, what are the implications for the conduct of monetary policy?

[1] We thank David Archer, Flora Budianto, Stijn Classsens, Benoit Mojon, Daniel Rees, Phurichai Rungcharoenkitkul, Hyun Song Shin and Nikola Tarashev for helpful comments and suggestions. We are also grateful to Alberto Americo for excellent research assistance. The views expressed are those of the authors and do not necessarily reflect the views of the Bank for International Settlements or the Bank of Thailand.

Key takeaways

- In a regime of low and stable inflation, sector-specific price changes across finely defined sectors, rather than generalised price co-movements, account for most of the fluctuations in aggregate price indices.
- At the same time, changes in the monetary policy stance affect a rather narrow set of prices, limiting the ability of monetary policy to steer inflation within narrow ranges.
- All told, the evidence puts a premium on flexibility in pursuing inflation targets within a credible policy regime.

Unsurprisingly, several of these questions have been asked before. The main contribution of our analysis is to adopt a holistic approach, connecting the various dots and employing more flexible and robust statistical techniques.

Three takeaways are worth highlighting.

First, once the economy settles into a low and stable inflation regime, the contribution of the common component of price changes to inflation drops substantially and becomes much smaller than that of the sector-specific components. This pattern also holds for the rates of price changes for broad sectors (ie durables, non-durables and services).

Second, within a credible policy regime, changes in the stance of monetary policy affect a remarkably narrow set of prices. Most of these are in the services sector, which, on balance, is more sensitive to economic fluctuations.

Finally, all told, these findings put a premium on flexibility in the pursuit of inflation targets. Since adjustments in the policy stance operate largely through aggregate demand – a common factor underlying all price changes – they may be less powerful once sector-specific price changes play a dominant role. When this factor affects a narrow set of prices, an overly forceful monetary policy action may be required to nudge overall inflation towards target, potentially causing undesirable shifts in relative prices. Flexibility can be especially important to reduce the potentially unwelcome side effects of the extraordinarily accommodative policy that may be needed to raise inflation back to narrowly defined targets.

Put differently: just like a *credible* conductor of a well-rehearsed orchestra can afford to lead with minimal gestures, so a *credible* central bank can afford to let inflation evolve within a wider range of its target without energetic adjustments to the policy stance.

The analysis is structured as follows. The first section examines the evolution of the contributions of common and sector-specific price changes to overall inflation. The second focuses on the impact of changes in the stance of monetary policy. The third draws implications for policy.

An inflation process in flux

The analysis is based on US data – specifically, on monthly (seasonally adjusted) price indices and the corresponding expenditure weights for 131 narrowly defined sectors of personal consumption expenditures (PCE) published by the US Bureau of Economic Analysis. The main reason for focusing on the United States is data availability, ie long,

granular and consistent price series, which makes it possible to go back to the high inflation era of the late 1960s and 1970s. To the extent that the forces we uncover for the inflation process in the United States are also operating in other economies, the results of our analysis would apply more broadly.[2]

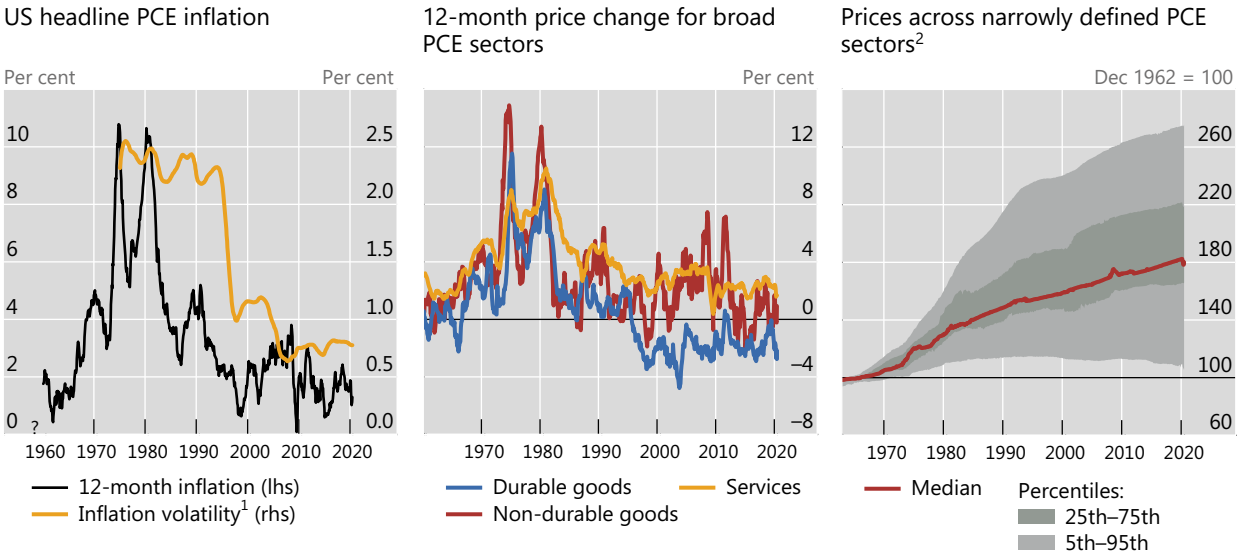
The basic features of the evolution of inflation at the aggregate level are very well documented by now (Graph 1). After being quite high and volatile during the Great Inflation era of the 1970s and early 1980s, inflation in the United States and in large parts of the world fell substantially and became much more stable starting around the mid-1980s (left-hand panel). The reduction in volatility is evident both in the trend – ie the more persistent movements that are the focus of policy – as well as in the more transitory components of inflation (not shown). At the same time, inflation has also become less persistent.[3]

Less well known and appreciated are the changes that took place "under the hood". Exploring them sheds important light on the aggregate behaviour of inflation.

A critical development is the striking drop in the importance of the common component of price changes relative to the sector-specific component once inflation has become low and stable.[4] The shift can be documented in several ways.

US headline PCE inflation and sectoral price changes

Graph 1



[1] 15-year moving standard deviation of 12-month headline personal consumption expenditures (PCE) inflation. [2] Weighted percentile measures using sector expenditure shares as weights. The narrowly defined sectors refer to the 131 categories based on a four-digit breakdown of PCE.

Sources: US Bureau of Economic Analysis; author's calculations.

[2] This is likely to be the case, as the broad evolution of inflation has been quite similar across many countries.

[3] The reduction in volatility for both trend and transitory components and the decline in inflation persistence at the disaggregated level is documented in Borio et al (2021). Our estimates of the trend and transitory components are based on a modified version of the Hamilton filter (Hamilton (2018)) proposed by Quast and Wolters (2020).

[4] In fact, the common component of price changes is arguably closer to the theoretical definition of inflation, which refers to a *generalised* increase in prices. Relatedly, in the context of US industrial production, Foerster et al (2011) document the fall in the importance of aggregate shocks and the concomitant rise in the role of sector-specific shocks since the mid-1980s.

First, the divergent rates of price changes point in this direction. While the average rates of price changes in three broad PCE sectors (durables, non-durables and services) moved roughly in sync prior to the mid-1980s, they have clearly become much more asynchronous since then (Graph 1, centre panel). In fact, they have diverged substantially since the mid-1980s, with the rate for the durable goods sector becoming markedly lower than that of services.[5] At a more granular level, strong trends in relative prices show up in an increasing dispersion of prices for the 131 narrowly defined sectors (right-hand panel).

Second, the drop in the importance of the common inflation component also emerges from a more formal statistical analysis using price data for the 131 sectors. Specifically, we compute the time-varying share of the total variance of the 12-month percentage change in prices for each broad sector explained by the first principal component – an estimate of the common inflation component – using a rolling 15-year window.[6] The fraction of the overall inflation variability attributable to the common inflation component drops sharply, from over 50% to between 15 and 30%, once the pre-1980 period of high and volatile inflation drops out of the estimation window (Graph 2, left-hand panel, black line). In fact, the decline is pervasive as it also applies to the rates of price changes measured at the level of the 131 expenditure sectors (middle panel). Moreover, the drop is also evident in both the trend and transitory components (not shown separately).

Finally, the footprint of the drop in the role of the common component is also visible in the smaller pass-through over time of "salient" price increases at the sector level into increases in core PCE inflation (ie inflation that excludes the volatile food and energy items). In other words, the so-called second-round effects, which would boost the importance of the common inflation component, appear to have become much smaller since the mid-1980s (see Box for details).

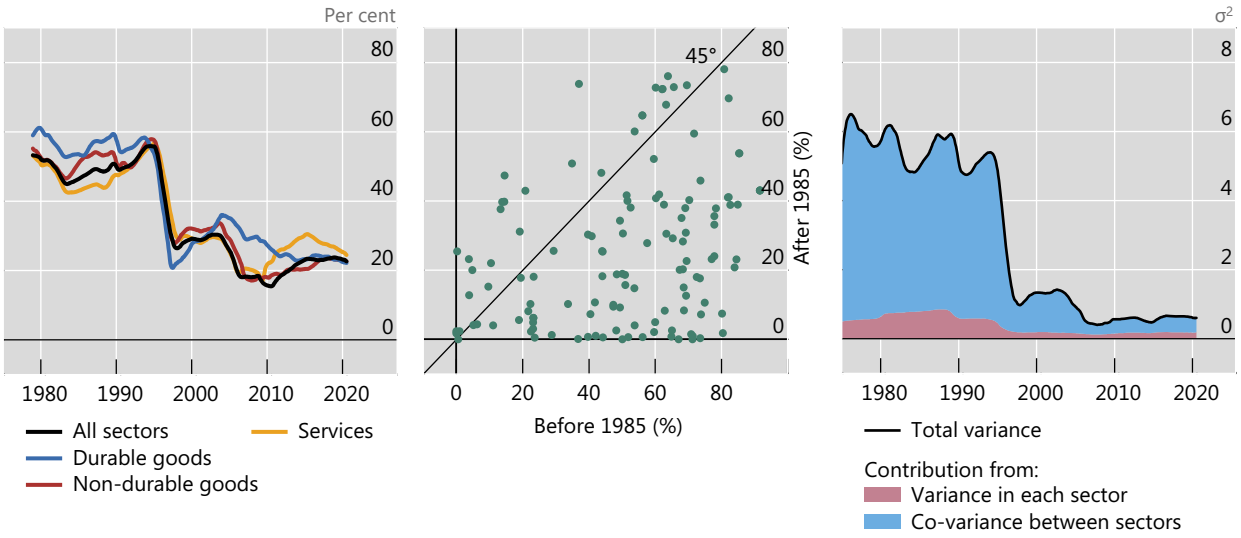
The striking decline in the importance of the common inflation component is largely responsible for another stylised fact: the significant reduction in the volatility of inflation documented previously. The bulk of the drop in the volatility of overall inflation does not reflect the decline in volatility within finely defined sectors but rather reflects the decline in the co-movement (covariance) of price changes across those sectors (Graph 2, right-hand panel).[7] This pattern is analogous to the behaviour of the volatility of the yield on a portfolio of securities, where the co-movement of

[5] Put differently, the well-known Balassa-Samuelson effect has become stronger.

[6] The first principal component is the linear combination of the underlying sectoral price changes that explains the highest fraction of the variance of overall inflation. It can be used as a proxy for the unobserved common component of all price changes. Dynamic factor model is another way to estimate the unobserved common inflation component (see Altissimo et al (2009) and Reis and Watson (2010)). Our more straightforward approach defines sector-specific price changes simply as idiosyncratic movements in sectoral prices that are unrelated to the common inflation component. Compared to dynamic factor models, our approach is easy to implement and computationally simple. As discussed in Stock and Watson (2002), the principal components consistently recover the space spanned by the factors when the cross-section is large, and the number of principal components used is at least as large as the true number of factors. Moreover, the principal component approach imposes fewer distributional assumptions on the data.

[7] During this period of falling co-movement, the average bilateral correlation between sectoral price changes – which strips out the impact of the variance of sectoral price changes from the covariance – dropped from 0.5 to 0.1. In other words, the decline in correlation alone accounts for roughly 80% of the reduction in the covariance between sectoral price changes.

The importance of the common factor underlying price changes has fallen sharply Graph 2



[1] The common component of 12-month percent changes in prices across all sectors and within each specified broad PCE sector is estimated using a 15-year moving window. [2] Each dot corresponds to one of the 131 narrowly defined PCE sectors. [3] Time-varying volatility of 12-month inflation is calculated using a 15-year moving window. The calculation of variance and co-variance contributions to the total variance of 12-month headline PCE inflation is based on the 131 narrowly defined PCE sectors.

Sources: US Bureau of Economic Analysis; authors' calculations.

yields matters much more than the volatility of yields on individual securities. The timing of the change in the volatility of inflation is equally noteworthy. Given the 15-year rolling window, the sharp drop around 1995 again reflects the effect of the pre-1980 data dropping out of the estimation window.[8]

The impact of changes in the monetary policy stance

What has the role of monetary policy been in the large drop in the importance of the common component of inflation? And what are the implications for the policy's ability to steer inflation once inflation is low and stable?

In answering these questions, it is essential to make a distinction between the monetary policy regime and changes in the stance of policy *within* the regime. The regime involves the more systematic aspects of the response of policy to economic conditions (the central bank's "reaction function"). Among other things, a well-understood and credible reaction function is important in shaping inflation expectations of workers, firms and other market participants. Changes in the policy stance, on the other hand, are better regarded as marginal adjustments to policy settings.

There is no doubt that the change in the policy regime has been *the* critical force bringing inflation down and hence reducing the importance of the common

[8] Eo et al (2020) document the divergent dynamics of goods and service prices in the United States, Australia and Canada, with the correlation between the two falling to essentially zero since the 1990s in all three countries. Moreover, they find that variations in trend inflation are now entirely dominated by fluctuations in trend prices in the service sector.

component, not least by mitigating second-round effects from sector-specific price shocks. The timing of the drop in its importance is quite telling: it coincides with the impact of the sharp monetary tightening in the late 1970s and early 1980s (the "Volcker shock"), in response to an inflation rate that was becoming increasingly unmoored.

What about the power of changes in the policy stance within a regime? To formally examine this issue, we first need to identify marginal adjustments in policy settings (or "shocks"). The idea is to capture shifts in the stance of policy that are both unforeseen by market participants and not due to the Fed's concerns about either current or anticipated economic conditions. We do so very precisely, using high-frequency minute-by-minute financial data, while controlling for the Fed's own assessment of the macroeconomic outlook, as summarised by "Greenbook/Tealbook" forecasts [9] The price to be paid for such finely calibrated analysis is that estimates of the shocks are only available from mid-1992, ie for the low inflation period.

Based on this identification strategy, we argue that monetary policy may face significant limitations when seeking to steer inflation within relatively narrow ranges in a low and stable inflation regime.[10] Two pieces of evidence justify this argument.

For one, given that monetary policy – as a tool influencing aggregate activity – transmits mainly through the common component of price changes, one possible implication of the observed decline in the importance of the common component is a diminished ability of marginal adjustments to the policy stance to steer inflation.[11] This would be so, for example, if the reduced role of the common component reflected more muted second-round effects.

In addition, armed with the measure of marginal adjustments in the policy stance, we consider their price impact on each of the 131 narrowly defined sectors over different horizons during the period July 1992–December 2018. Specifically, we use the standard local projections method proposed by Jordà (2005) and run the following regression for each sector i and horizon $h=1,\ldots,48$ months:

$$p_{i,t+h} - p_{i,t-1} = \alpha_{i,h} + \beta_{i,h} MP_t + \sum_{s=1}^{11} \rho_{i,h,s} \Delta p_{i,t-s} + \boldsymbol{\lambda}_{\boldsymbol{i,h}}^{'} \boldsymbol{x_t} + \epsilon_{i,t+h}$$

[9] These high-frequency monetary policy shocks are constructed using the methodology developed by Miranda-Agrippino and Ricco (2021). We are grateful to Andrea Ajello and Giovanni Favara for providing us with an updated series of the original shocks, using the Fed's publicly available forecasts through December 2014.

[10] Thus, the evidence in this section is consistent with the well known decline in the sensitivity of inflation to pressure on an economy's productive capacity, ie the so-called flattening of the Phillips curve.

[11] Our results (not shown) confirm the key role of the common component in the transmission of monetary policy. Using the empirical framework below, we separately examine the impact of marginal adjustments in the monetary policy stance on the common and sector-specific components of price fluctuations. We indeed find that the impact on the common component is economically and statistically significant. By contrast, the impact on the various sector-specific price fluctuations is largely insignificant; see Borio et al (2021). Moreover, an analysis therein based on a less satisfactory but standard identification strategy that covers a longer time span also suggests a reduction in the impact of monetary policy shocks across regimes.

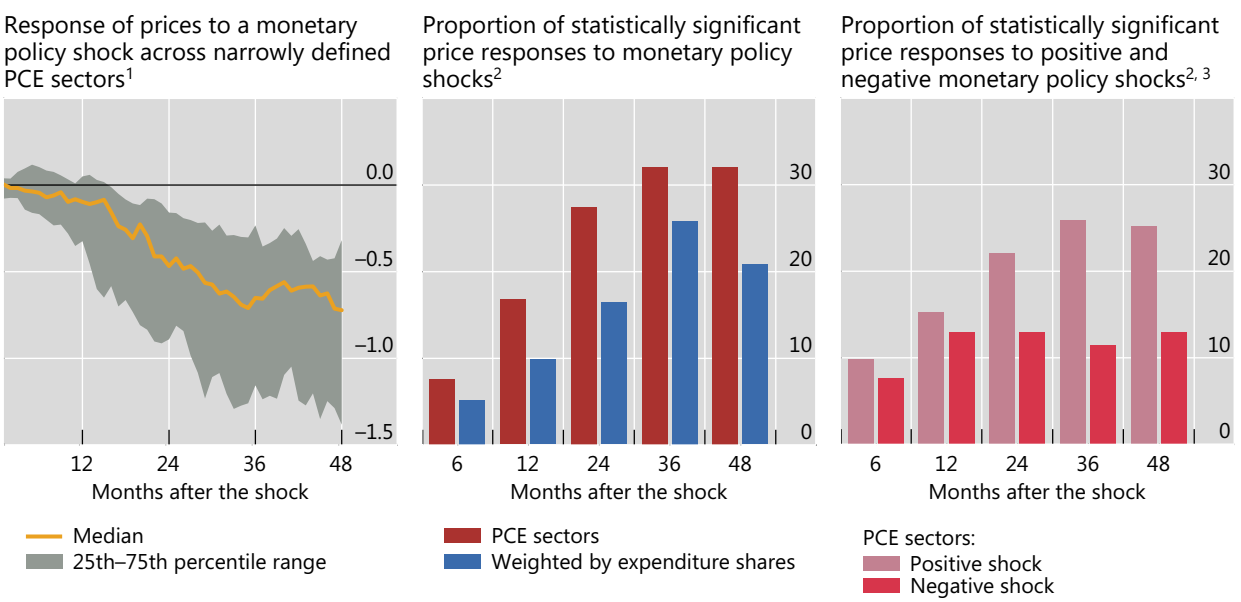
where $p_{i,t+h}$ is the log price level for sector i in month $t+h$, MP_t is the monetary policy shock in month t and $\boldsymbol{x_t}$ is a vector of aggregate controls included to filter out the impact of macroeconomic conditions on price changes within each sector.[12]

Over a period that witnessed a diminished role for the common component in price fluctuations, we find that the response of prices to monetary policy shocks appears limited to a few sectors (Graph 3).[13] This is so even if one allows for natural lags in the policy's impact, as shown by the increasing (absolute) size of the point estimates ($\beta_{i,h}$ in the equation above) as time unfolds (left-hand panel).[14]

Specifically, it is striking that the impact on prices is statistically significant at conventional levels for only a small fraction of narrowly defined sectors – less than 20% at the 10% significance level after 12 months (Graph 3, centre panel). Even after 36 months, the fraction of sectors for which the price response is statistically

The impact of monetary policy on prices varies across sectors

In per cent — Graph 3



[1] Weighted percentiles of the response of prices across 131 narrowly defined personal consumption expenditure (PCE) sectors to a monetary policy shock of 25 basis points. The weights are equal to the sector-specific average expenditure shares. [2] Significant at 10% level. [3] In this specification, positive (ie contractionary) and negative (ie expansionary) monetary policy shocks of 25 basis points are allowed to have differential effects on prices.

Sources: Board of Governors of the Federal Reserve System; US Bureau of Economic Analysis; authors' calculations.

[12] The set of control variables includes: a survey-based measure of long-term PCE inflation expectations; the unemployment gap; the 12-month log-difference in average hourly earnings; the 1-month log-difference in the WTI spot price; and the 1-month difference in the Baa-Aaa corporate bond credit spread.

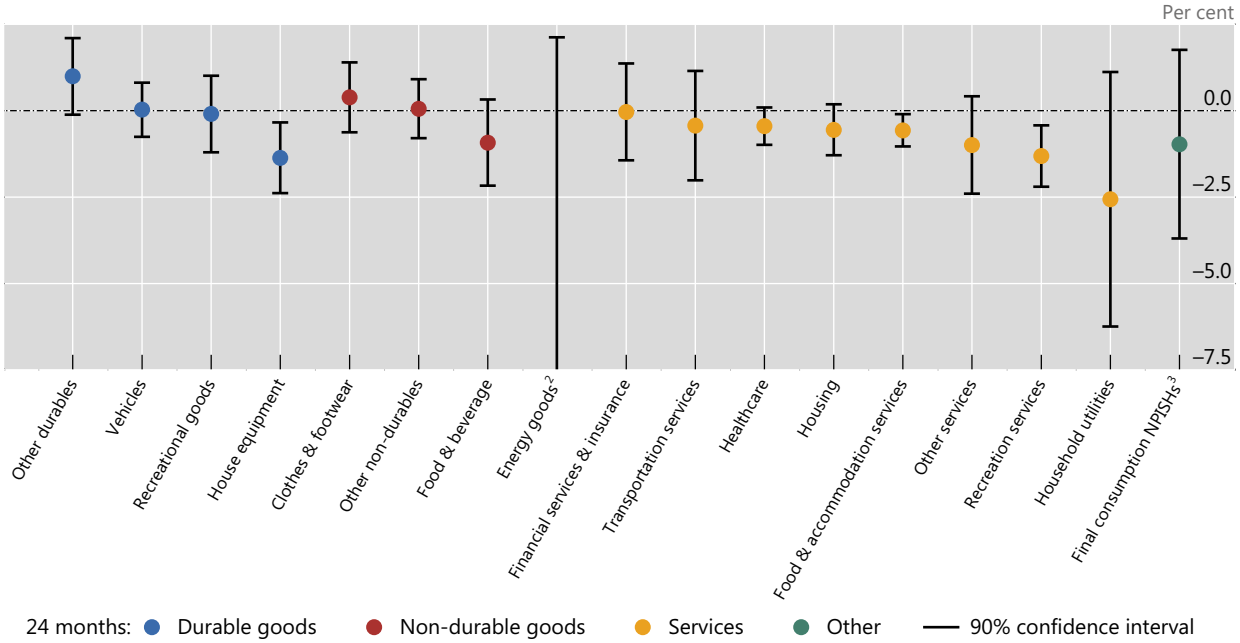
[13] Note that because of its wide reach, the effects of monetary policy shocks transmit mainly through the common component of price changes. That said, the importance of the common component ("factor loadings") varies across sectors. Hence monetary policy affects each sector differently despite its generalised impact.

[14] The sluggish response of prices to a monetary policy shock is in line with those of Boivin et al (2009), who examine the impact of such shocks on disaggregated PCE sectors using a factor-augmented vector auto-regression (FAVAR) model. In their framework, monetary policy shocks are identified recursively, ie monetary policy is assumed to respond to contemporaneous fluctuations in the

significant rises to only about a third. Moreover, in terms of expenditure shares, the proportion is even lower across all horizons. In other words, the sectors whose prices are responsive to marginal adjustments in the stance of policy have a relatively small weight in the overall price index. Finally, the impact of monetary policy appears to be asymmetric: the fraction of sectors with statistically significant price responses is noticeably lower for expansionary monetary shocks across all horizons, compared with contractionary shocks (right-hand panel).

Which sectors are relatively more responsive to changes in the policy stance? Not surprisingly, the bulk are in services, which on balance tend to be more sensitive to economic fluctuations ("cyclically sensitive"). This is the message of an analysis based on 17 sectors and the cumulative price impact of monetary policy shocks after two years (Graph 4).[15]

The monetary policy impact is concentrated in the service sector[1] Graph 4



[1] The dots show the point estimates of the response of prices at the 24-month horizon to a 25 basis points monetary policy shock, while the black lines represent the associated 90% confidence intervals. [2] The point estimate of the impulse response of energy goods prices (not shown) is –14%, with a 90% confidence interval equal to [–30%, 2%]. [3] Non-profit institutions serving households.

Sources: Board of Governors of the Federal Reserve System; US Bureau of Economic Analysis; authors' calculations.

macroeconomic factors, whereas policy shocks are assumed to affect the economy with a lag. By comparison, our high-frequency identification approach, making use of movements in interest rates in a narrow window around policy meetings, is less prone to the endogeneity problem (see Miranda-Agrippino and Ricco *(2021)* for extensive discussion*)*.

[15] These sectors correspond to those that Stock and Watson (2019) use when considering whether the impact of monetary policy differs between cyclically sensitive and cyclically insensitive sectors. In fact, there is a reasonable correspondence between the sectors that they deem to be cyclically sensitive and those whose price responses are statistically significant in our analysis: across various horizons, around two thirds of the sectors for which we find significant responses are also cyclically sensitive according to their terminology.

Box

Second-round effects feature less prominently in inflation dynamics

*Claudio Borio, Piti Disyatat, Dora Xia, Egon Zakrajšek*①

This box empirically examines how the importance of relative price "shocks" has changed across high and low inflation regimes. It also notes what the analysis can say about current conditions, given questions about the implications of the recent spate of sizable price increases for future inflation.

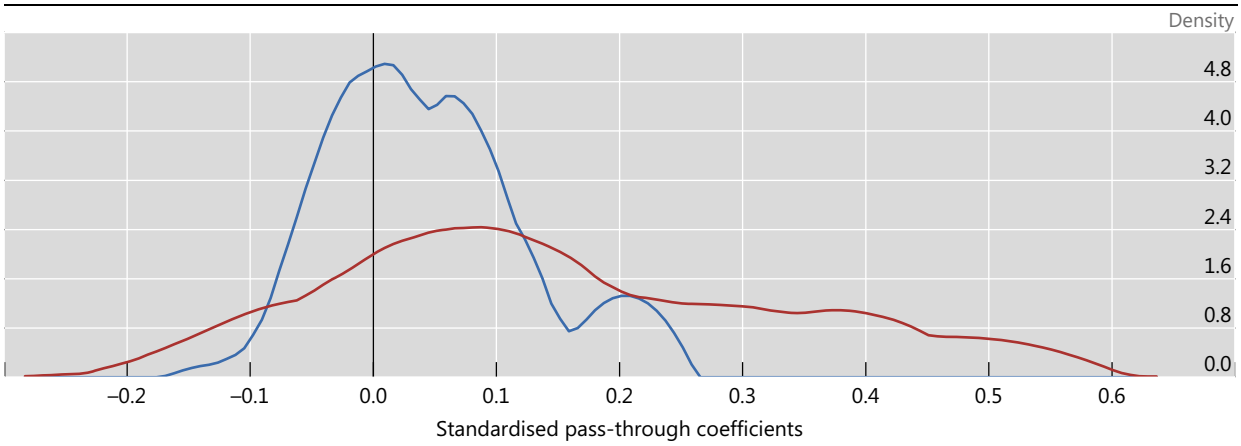
The construction of relative price shocks involves two steps. In the first step, we obtain relative price levels by estimating the following regression for each narrowly defined PCE sector:

$$\Delta p_{i,t} = \alpha_i + \lambda_i PC1_t + \epsilon_{i,t}$$

where $\Delta p_{i,t}$ denotes the monthly log-difference of the price index in sector i and $PC1_t$ is the first principal component of $\Delta p_{i,t}$ estimated across all 131 sectors. The above regression is estimated separately on two non-overlapping subsamples: January 1960–December 1985, a regime of high and volatile inflation; and January 1986–December 2019, a regime of low and stable inflation. To construct relative price levels for each subsample, we cumulate the estimated residuals $\hat{\epsilon}_{i,t}$ within each sector, thereby constructing (log) relative price levels, denoted by $rp_{i,t}$, which are unrelated to fluctuations in the regime-specific common inflation component.

In the second step, we analyse how the pass-through of "salient" and positive relative price shocks to core PCE inflation – the Fed's preferred inflation measure – varies across the two inflation regimes. All else equal, these changes are the most likely to pass through: being large, they are more noticeable; and being positive, they tend to constrain consumers more than decreases. Similar considerations may apply to the decisions of producers, which ultimately underlie changes in the prices of the consumer basket.

The pass-through of "salient" relative price increases to core PCE inflation has declined[1] Graph A1



[1] Each line shows the weighted kernel density estimate (ie a smoothed histogram) of the distribution of pass-through coefficients of "salient" relative price increases to 12-month ahead core personal consumption expenditure (PCE) inflation for the specified sample period. The weights are equal to the sector-specific average expenditure shares in each sample period.

Sources: US Bureau of Economic Analysis; authors' calculations.

We implement these ideas empirically using the non-linear transformation developed by Hamilton (2003) to analyse the impact of oil price shocks on the real economy. Specifically, we define a salient relative price increase in sector i in month t, denoted by $\Delta rp^{+}_{i,t}$, as

$$\Delta rp^{+}_{i,t} = max\{0, rp_{i,t} - rp^{*}_{i,t}\}$$

where, $rp^{*}_{i,t}$ is the largest (max) (log) relative price over the previous 12 months.

With these shocks in hand, we estimate the following "pass-through" regression:

$$\pi^{core,12m}_{t+12} = \mu + \beta_i \Delta rp^{+}_{i,t} + \gamma(u_t - u^{*}_t) + \sum_{s=0}^{11} \rho_s \, \pi^{core,1m}_{t-s} + \nu_t$$

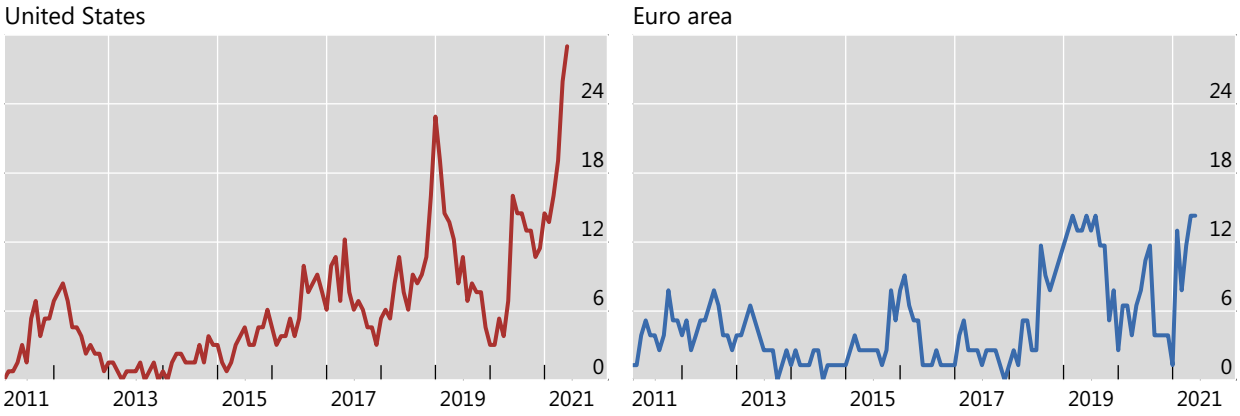
where $\pi_{t+12}^{core,12m}$ is the 12-month core PCE inflation recorded 12 months ahead. The coefficient of interest in this specification is β_i, which measures the extent to which a salient relative price increase in a narrowly defined sector in month t feeds into core PCE inflation over the subsequent 12 months. The pass-through estimates filter out the influence of business conditions, as proxied by the deviation of employment from an indicator of full employment $(u_t - u_t^*)$, and control for lagged core inflation dynamics.②

The results indicate that the pass-through of salient relative price increases has declined substantially with the transition to a low inflation regime (Graph A1). The distribution of pass-through estimates $\hat{\beta}_i$'s for the low inflation environment is much more concentrated around zero; in addition, the estimates are generally not statistically significant during this period. Put differently, the likelihood and size of second-round effects from relative price increases have diminished substantially.

To see how this analysis can shed light on the current outlook, we need to look at what is behind the recent elevated readings of overall inflation. These readings have been driven mainly by large hikes in the prices of a relatively small number of pandemic-affected goods and services.③ In the United States and euro area, for example, the share of narrowly defined expenditure categories that registered outsize price changes in recent months – most of which involve goods and services affected by the pandemic – has increased considerably relative to recent historical norms (Graph A2).

The share of sectors experiencing large positive price changes has risen recently[1]

In per cent — Graph A2



[1] Large positive price change is defined as a 12-month percent change in the sector-specific price index (131 sectors for the US and 77 sectors for the EA) that is more than 2 standard deviations above its average calculated over the past 5 years.

Sources: ECB; US Bureau of Economic Analysis, authors' calculation.

A key question then is whether these large price increases in a relatively small share of the consumption basket will feed into more generalised inflation. Indeed, the second-round effects from rising energy prices feature prominently in explanations of the rise in global inflation in the 1970s. However, we currently live in a different monetary policy regime.

All else equal, the analysis in this box stresses that the recently observed price increases could be transient. This is because, assuming that past patterns continue to prevail, the pass-through of relative price shocks into inflation would be small in the current environment in which inflation has been enduringly low and stable as part of a credible monetary policy regime. At the same time, the "all-else-equal" clause is important. In particular, the post-pandemic increase in inflation is rather unusual, having taken place as part of the post-Covid normalisation process and on the back of unprecedented fiscal and monetary stimulus. The analysis here is just one piece of the jigsaw puzzle, which requires a much more holistic assessment (eg BIS (2021)).

① The views expressed are those of the authors and do not necessarily reflect the views of the Bank for International Settlements or the Bank of Thailand. ② The unemployment gap is defined as the difference between the civilian unemployment rate and its estimate of the natural rate, where the latter is taken from the FRB/US model, a large-scale macroeconometric model of the US economy used by the Fed. ③ Admittedly, the rise in inflation is not entirely due to increases in the prices of pandemic-affected goods and services. Surging commodity prices have also contributed to higher inflation on the back of strong recoveries in China and in many advanced economies.

Monetary policy amidst sector-specific price changes

The previous empirical findings raise important considerations for the conduct of monetary policy. In particular, they favour flexibility in the pursuit of inflation targets within a credible policy regime. This may be especially so when inflation is hovering persistently below target, calling for a monetary easing.

There are two sets of reasons for this conclusion.

The first has to do with the central bank's *ability* to steer inflation. When sector-specific price changes account for the bulk of variations in the general price index, monetary policy may face headwinds in moving inflation in the desired direction. One reason is that idiosyncratic price changes are less responsive to fluctuations in aggregate demand. In addition, adjustments in the policy stance affect only a narrow set of prices that together have a relatively small weight in the overall index.[16] All told, this increases the need for large shifts in the stance to achieve a given target.

The second set of reasons has to do with the *desirability* of seeking to steer inflation precisely or the need to do so.

For one, not surprisingly, a substantial fraction of sector-specific price changes are *transitory*. Central banks can thus look through them. Responding to them can easily lead to an overreaction, as such changes are self-correcting. The justification for looking through such changes would be especially strong if their transitory nature reflected not just regime-induced well-anchored inflation expectations, but also, or even primarily, economic agents' "rational inattention";[17] ie their tendency to pay little attention to inflation when it is low and stable since it makes little difference to their well-being – a kind of self-correcting mechanism.

In addition, and arguably less prominent in the policy debate, the still important role of *trend* changes in sector-specific prices gives rise to tougher challenges. In a low and stable inflation environment, such changes in relative prices tend to reflect the fundamental evolution of demand patterns – preferences reflect income levels – and technology – productivity growth differs across sectors. As a result, they provide critical signals for the efficient allocation of resources and, short-term influences aside, are beyond monetary policy's reach.[18] Seeking to compensate for such changes in sector-specific prices to achieve a specific inflation target may be counterproductive.

To illustrate this more concretely, consider the economic environment that has emerged since the 1990s. Not least under the influence of globalisation, (eg Auer et

[16] Indeed, from this perspective, relying on US data would tend to *overestimate* the share of price categories over which monetary policy exerts influence. This is because the US economy is relatively closed, and the share of the service sector (60%) tends to be larger than elsewhere.

[17] See Maćkowiak et al (2021) for a review of the concept. Indeed, as noted by Greenspan (1994), price stability can be defined as an environment in which inflation does not materially influence the behaviour of economic agents.

[18] The importance of allowing for rich heterogeneity across sectors in assessing inflation outcomes is emphasised in Aoki (2001) and Wolman (2011), while Adam and Weber (2019) extend the analysis to consider firm heterogeneity. Conceptually, it would be optimal for monetary policy to target a narrower set of prices – namely those that display the highest degree of stickiness – than those contained in the CPI. In practice, communication challenges in doing so are formidable. The use of core inflation, eg excluding the change in especially volatile items such as food and energy, offers the simplest way of moving in this direction.

al (2017)), most economies have seen muted increases, if not declines, in the prices of many tradeable goods, especially durables (recall middle panel of Graph 1). These have kept a lid on overall inflation, which on average has hovered below central banks' objectives. The prices of these tradeable goods have also lagged behind those in the services sector, resulting in a large change in relative prices. To raise inflation in this environment, monetary policy would have to lean harder on those prices over which it has greater influence, largely those in the service sector, which also tend to be less flexible. All else equal, this would call for stronger and possibly more persistent easing.[19] In turn, this would increase the likelihood of hitting the effective lower bound for policy rates and exacerbate any potential side-effects of keeping interest rates low for long (eg BIS (2020), Borio (2021)).[20]

All told, the success of credible monetary frameworks in ushering in a low and stable inflation regime goes hand-in-hand with pervasive changes in price dynamics, which puts a premium on flexibility in the pursuit of narrowly defined inflation targets. This underlines the importance of a degree of tolerance for deviations of inflation from targets within certain ranges and of longer horizons to bring inflation back within those ranges. Such fluctuations, for example those that reflect fundamental sector-specific developments, may pose less of a concern, and offsetting them could require large policy adjustments that entail the risk of undesired side effects, notably when seeking to raise inflation. If so, the need for greater flexibility would be akin to a Goodhart's law: once inflation has been successfully anchored, its role as a gauge for policy action may be diminished.

Conclusion

This special feature has highlighted the importance of flexibility in the pursuit of narrowly defined inflation targets in an environment of low and stable inflation, owing to pervasive changes in the dynamics of price movements. Recent modifications to the monetary policy frameworks of the Federal Reserve and the ECB, albeit quite different, have moved in this direction. Our analysis suggests that, *all else equal*, such flexibility is especially warranted when inflation undershoots targets

If applied to the current context, in which inflation concerns have become more prominent, our analysis also speaks in favour of flexibility in the response. This is not least because a small number of sector-specific components of inflation have seen especially large increases in recent months. That said, the inference from our analysis is just one piece of information that needs to be part of a more holistic assessment examining the underlying forces at work (eg BIS (2021)). It is most critical to ensure – taking whatever actions are needed – that inflation remains low and stable, anchored to a credible monetary policy framework.

[19] The evidence that an easing of the policy stance impacts a narrower set of prices than a tightening strengthens this inference.

[20] Among the marginally statistically significant sectors, housing services have a particularly high weight (14%) in the total PCE basket, and this category contributes substantially to the shape of the overall price response. The sector is also by far the most cyclically sensitive. To the extent that monetary policy needs to lean heavily on the housing sector to move overall prices, aggressive policy actions may give rise to financial stability concerns, given that the sector is closely linked to asset prices and can also be highly leveraged. For current concerns in this respect, see BIS (2021).

At a more general level, the analysis highlights the merits of examining the inflation process at a disaggregated, granular level. Understanding the evolution of relative prices, particularly persistent ones, is key and is likely to be especially useful to policymakers. By the same token, inferences from economic models that eschew such considerations can be materially misleading.

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Funding for fintechs: patterns and drivers[1]

This special feature examines trends in equity funding for financial technology firms (fintechs) and the underlying country-specific drivers. Fintechs have raised over $1 trillion in equity globally since 2010. While the investment landscape was initially quite concentrated, it has become more diverse, both geographically and across market segments. Equity funding for fintechs is higher in countries with more innovation capacity and better regulatory quality. It also increases after the introduction of regulatory sandboxes. Early-stage venture capital investment is higher after merger and acquisition activity by large banks, but not after that by big techs.

JEL classification: E51, G23, O31.

New financial technology firms (fintechs) have proliferated over the past decade, reshaping the financial sector in economies around the world. Fintechs often target specific market segments in payments, credit, insurance or wealth management. In many cases, their growth is fuelled by risk-bearing capital.

This special feature explores patterns in fintechs' equity funding and contributes to the literature by systematically studying the underlying drivers. First, it provides an overview of investment in fintechs across time, regions, market segments and investment stages. Second, it analyses which factors are associated with differences in fintechs' capital-raising activity across countries. Third, it is among the first studies to address the questions: Can targeted policy measures, in particular regulatory sandboxes, improve fintechs' access to finance? How does venture capital (VC) investment in early-stage fintechs respond to mergers and acquisitions (M&As) involving fintechs and either large banks or large technology companies (big techs)?

The main findings are the following.

Equity investment in fintechs has expanded rapidly over the past decade, amounting to over $1 trillion in more than 35,000 deals since 2010. This growth, and especially that of VC investments, far outpaced the growth of non-fintech deals. By 2020, the capital raised by fintechs reached 5% of the value of global equity deals, up from less than 1% in 2010. This has gone hand in hand with greater geographical diversification of deals, even though the United States, the European Union (EU), the

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Key takeaways

- Investment in fintechs has grown rapidly since 2010 and has been higher in countries with more capacity for innovation and better regulations.
- Fintech capital-raising activity surges after the establishment of regulatory sandboxes, a widely adopted policy tool to spur innovation in the financial sector.
- Venture capital funding for early-stage fintechs rises after merger and acquisition activity in the sector by large banks, but not by big techs.

United Kingdom and China remain the main locations. A similar picture emerges in terms of market segments: while a few – such as "cryptocurrency and blockchain" and "big data, artificial intelligence (AI) and machine learning" – dominate the funding landscape, smaller segments are gaining ground.

Turning to potential drivers, we find that fintechs raise more capital in countries with better regulatory quality, higher financial development and, more specific to fintech, greater innovation capacity (see box). When we consider these factors together to parse their overall impact, it is especially innovation capacity and, to a lesser extent, regulatory quality that matter.

We also find that regulatory sandboxes – frameworks for testing financial products that use new technologies in a controlled environment – spur entry in the fintech sector.[2] Over the three years after their establishment, country-level investment in fintech nearly quadruples as a share of GDP. Sandboxes, which have been adopted in almost 60 countries, could thus help to foster financial innovation – but regulators should weigh their costs and the implications of innovation for financial stability and other regulatory mandates.

Finally, we show that VC funding for early-stage fintechs increases after mergers and acquisitions (M&As) in the fintech sector that involve large banks, but not after those involving big techs. This finding suggests that, by seeking often to exploit synergies with fintechs, banks could spur fintech formation. Big techs, by contrast, which are frequently in direct competition with fintechs, might thwart fintech entry by discouraging users from joining the networks of fledgling competitors (the so-called kill zone).

The rest of the special feature is organised as follows. The first section discusses investment patterns and how these have evolved over time and space. The second develops the empirical analysis of drivers of fintech investment. The third investigates the impact of regulatory sandboxes on fintech funding, and the fourth analyses how M&A activity by large banks and big techs affects VC deals.

How has investment in fintech evolved over time?

Data on investment deals in the fintech sector come from PitchBook Data Inc, a private data provider. The deal location is classified as that of the headquarters of the firm raising the capital. PitchBook also groups firms according to market segments offering similar products and services – so-called "verticals" (see box). Examples of

[2] See FSB (2017) and Cornelli et al (2020b).

market segments include "cryptocurrency and blockchain", "insurtech" and "real estate and mortgage tech". The data provider also distinguishes between investment types that correspond roughly to the stages of a firm's life cycle: in their standard sequence, VC, private equity (PE), M&As and public listing.[3]

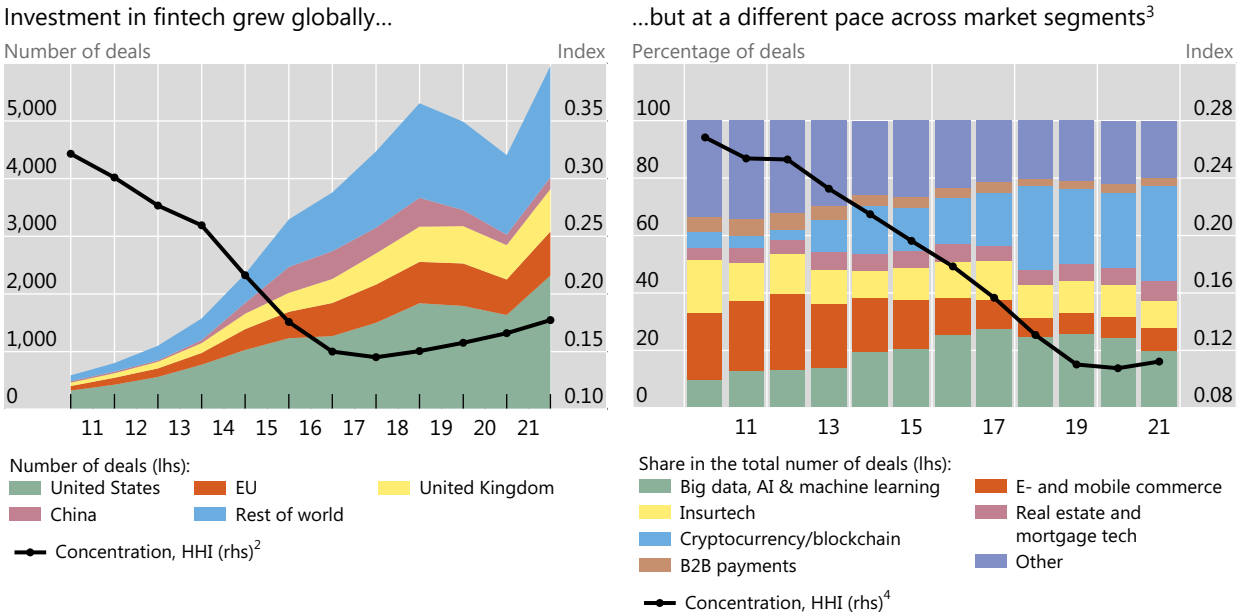
Investments in fintech have risen rapidly over the last decade, in terms of both number and value of deals. Meanwhile, investors have expanded across countries, market segments and deal stages. As in other sectors, there are many small deals in younger fintechs, and far fewer but larger deals in mature companies.

While total fintech deals numbered less than 600 in 2010, for a total value of around $11 billion, the total capital raised by fintechs in 2019 exceeded $218 billion, through almost 5,000 individual deals (Graph 1, left-hand panel). This trend reversed in 2020 during the Covid-19 pandemic, but investment has rebounded strongly in 2021. From a longer-term perspective, the average annual growth rate of equity raised in global fintech deals was 45% between 2010 and 2020 – much higher than the corresponding 8% growth rate for non-fintech deals. By 2020, capital raised by fintechs reached 5% of the total capital raised in global equity deals, up from less than 1% in 2010.

Capital-raising by fintechs has followed a similar upward trend in most regions. The largest market is the United States, accounting in recent years for almost 40% of the number of deals globally (and more than 50% of deal value). This is followed by the EU, the United Kingdom and China, which together account for 33% of the deals

The anatomy of fintech fundraising activity[1]

Graph 1



[1] Based on a sample of 78 countries from Q1 2010 to Q2 2021. Data for 2021 have been extrapolated based on observed data up to Q2 2021. [2] Herfindahl-Hirschman index (HHI) calculated across all countries in the sample. [3] Referred to as "verticals" by PitchBook Data Inc. In some cases, one deal is assigned to multiple verticals. [4] Across all verticals in the sample.

Sources: PitchBook Data Inc; authors' calculations.

[3] The typical life cycle of a fintech is similar to that of firms in other sectors. Startups typically rely on seed VC funding to develop a product. They use additional, early-stage VC and PE investment to scale up and serve a growing customer base. Once firms have achieved positive cash flow and profitability, VC and PE investors can sell their equity stake or "exit" through M&A, initial public offerings, etc. Our data set covers investment at each of these stages.

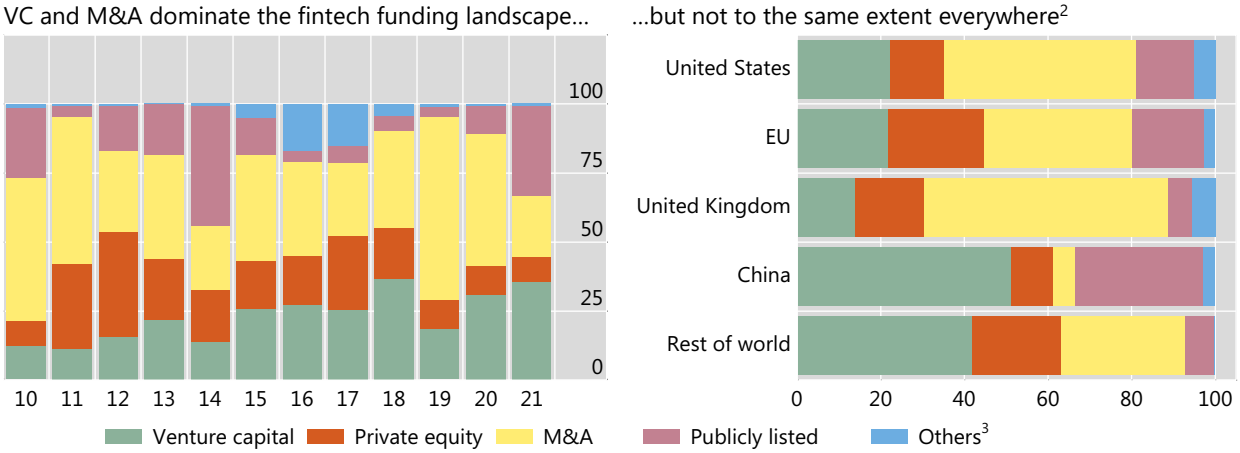
(and 35% by value). Yet the rest of the world – where India, Canada, Singapore and Australia take the lead – has increased its share over time. Calculated after grouping deals by country, the Herfindahl-Hirschman Index (HHI, a measure of concentration) declined by around 50% between 2010 and 2017, and it has shown only a modest increase since (Graph 1, left-hand panel, black line).

The relative importance of different market segments in the fintech sector has shifted over time (Graph 1, right-hand panel). Among major segments, the shares of deals by firms in "insurtech" and "real estate and mortgage tech" have remained relatively stable. By contrast, the shares of "big data, AI and machine learning" and especially "cryptocurrency and blockchain" have increased markedly. The growing importance of the latter could reflect investor interest in fintechs targeting innovations in wholesale and retail payments – such as the institutional use of blockchain, cryptoasset trading and stablecoins (BIS (2020)). The share of "e- and mobile commerce" and others has fallen. In parallel, the investment landscape has become less concentrated across market segments, as the HHI across segments has steadily declined (right-hand panel, black line). A similar decline in concentration is observed for deal values (not shown).

In terms of investments at different stages in fintechs' life cycle, VC and M&As dominate (Graph 2). The relative importance of VC funding – which usually targets younger companies – has increased over time (left-hand panel), mostly due to activity in China (right-hand panel). VC accounts for over a third of the value of all equity investment in 2021, up from 13% in 2010. The United States and United Kingdom have seen relatively more M&A investment in fintech (in line with their higher M&A activity overall). Globally, the share of M&A activity was particularly high in 2019 and 2020, amounting to 66% and 48%, respectively, of total investment values.[4]

Fintech equity investment by investment stage[1]

Percentage of deal value — Graph 2



[1] Based on a sample of 78 countries from Q1 2010 to Q2 2021. In some cases, one deal is assigned to multiple categories. [2] Averages over the period Q1 2010–Q2 2021. [3] Includes acquisition financing and asset acquisition deals.

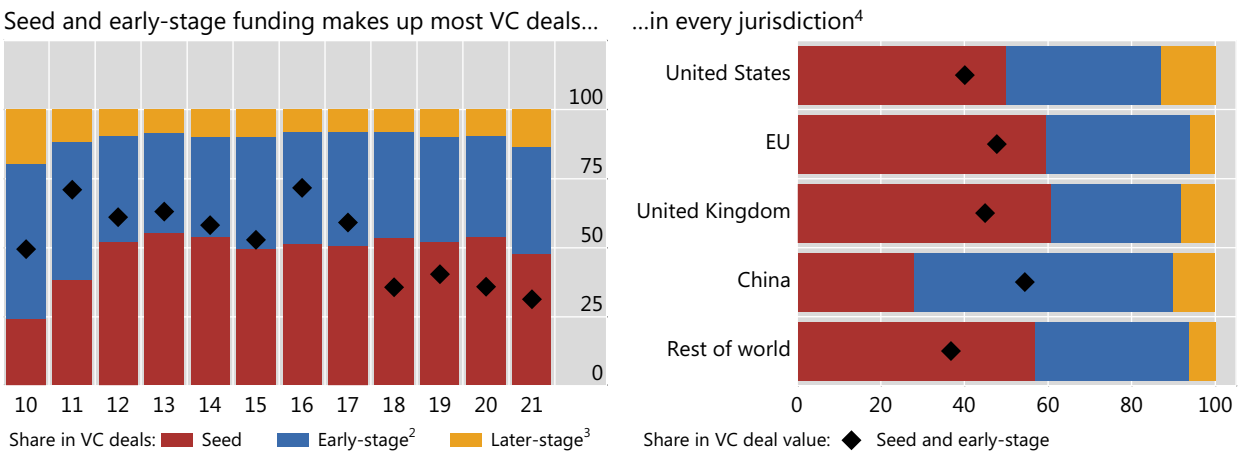
Sources: PitchBook Data Inc; authors' calculations.

[4] In 2021, meanwhile, there was relatively strong investment in publicly listed fintech companies, driven by a spate of large initial public offerings and special purpose acquisition companies.

VC funding: many small deals in young fintechs, and fewer large later-stage deals[1]

As a percentage of VC deals

Graph 3



[1] Based on a sample of 78 countries from Q1 2010 to Q2 2021. In some cases, one deal is assigned to multiple categories. [2] Includes series A, B and 1 funding rounds as classified by PitchBook. In the standard terminology of the VC industry, subsequent funding rounds are classified in either alphabetical or numerical order. [3] Includes series C, D, E, F, G, H, I, 2 and 3. [4] Averages over the period Q1 2010–Q2 2021.

Sources: PitchBook Data Inc; authors' calculations.

Zooming in on VC deals reveals many young companies that raise relatively small amounts of equity. Together, seed (or startup) and early-stage deals have made up roughly 90% of the total number of VC deals, both over time (Graph 3, left-hand panel) and across regions (right-hand panel). However, these deals – which are usually small in value – often account for half or less of the total value of VC investment, with a few later-stage deals accounting for the rest. The relative importance of seed and early-stage deals in the total deal value declined over time, probably reflecting the fintech sector's coming of age.

Beyond highlighting general trends, detailed and timely data on investment deals could allow public authorities to gauge investor expectations of future growth in novel financial services. Private data sources add substantial value, not least because of the paucity of regulatory reporting on fintech (FSB (2017); IFC (2020)). Thus, the full data set on the volume and number of fintech deals by country and year is available online along with this special feature.[5]

Drivers of fintech funding

Investments in fintech vary widely across countries. For instance, while investment in fintech was less than 0.01% of GDP in Russia and Saudi Arabia in 2019, it reached 0.06% of GDP in Switzerland and close to 2% in Singapore and the United Kingdom.

To investigate potential explanations for these cross-country differences, we consider structural features of national economies: countries' regulatory quality, the depth of domestic financial markets and their innovation capacity. The specific measures are outlined in the box. Previous work highlights the importance of the rule of law and the quality of legal and regulatory institutions for investments (La Porta et

[5] See https://www.bis.org/publ/qtrpdf/r_qt2109c_data.xlsx.

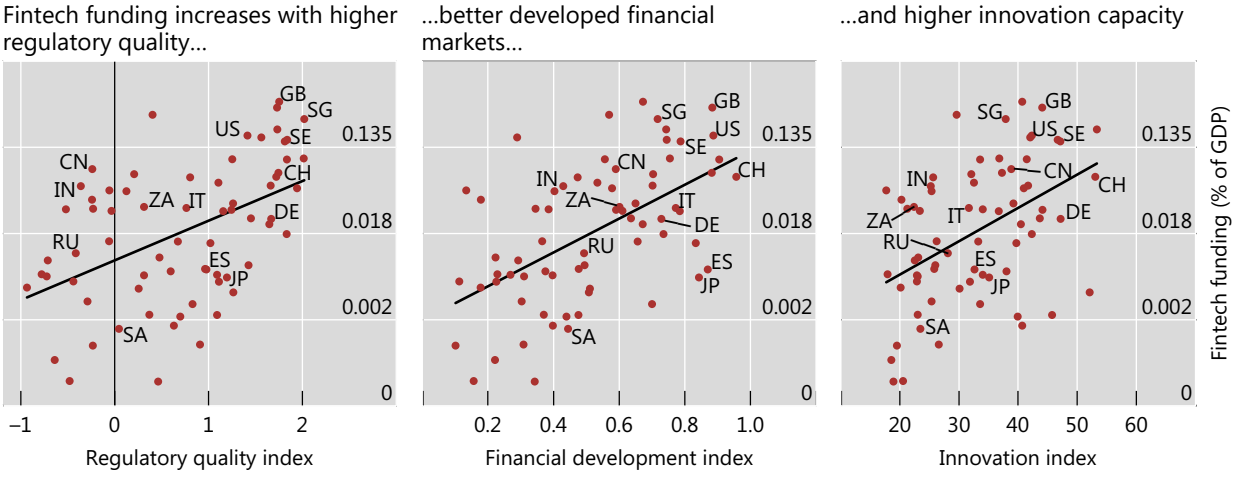
al (2008); Demirgüç-Kunt and Levine (2018)). As the fintech sector is relatively young and lacks established best practices, the regulatory environment could be particularly relevant (Barba Navaretti et al (2017); Cumming and Schwienbacher (2018)). In turn, the depth of financial markets, and access to finance in general, go together with higher capital-raising activity and firm formation (Ayyagari et al (2011); Doidge et al (2013)), and may benefit fintech activities (Claessens et al (2018); Haddad and Hornuf (2019); Rau (2020); Cornelli et al (2020a)). More developed financial markets facilitate a successful matching between investors and firms and are especially important for fast-growing sectors such as fintech. In addition, and more specific to fintechs, a more innovative environment is generally conducive to the financing of startups, as positive knowledge externalities increase the returns to firm formation and innovation (McCann and Ortega-Argilés (2013); Edler and Fagerberg (2017)). Since many fintech firms rely on new technologies, such as AI and mobile technologies, a domestic research capacity in these fields may be important.

When considered individually, regulatory quality (Graph 4, left-hand panel), the depth of domestic financial markets (centre panel) and a country's innovation capacity (right-hand panel) are positively correlated with investment in fintech. Among major markets, the United States and United Kingdom rank highly on regulatory quality and financial market development, while these countries as well as several European countries and China score relatively highly on innovation capacity.

The identified relationships are robust to controlling for other characteristics of national economies, ie GDP per capita, population and changes in global conditions (Table 1). In panel regressions at the country-year level, a stronger regulatory and institutional quality is linked to higher investment from 2010 to 2019 (first column). In particular, considering two countries that are 20 positions apart in the ranking of the 68 countries in our sample, the difference between the corresponding fintech investment-to-GDP ratios is roughly 60% of the average ratio (which is 0.06% of GDP). A similar improvement in ranks along the financial development index is associated with an increase in the funding-to-GDP ratio that amounts to one third of the average level (second column).

Fintech investment is correlated with institutional and financial development[1]

Graph 4



[1] Each dot corresponds to a country average over 2010–19 for 68 countries. Fintech funding to GDP is winsorised at the 1st and 99th percentiles. Fintech funding relative to GDP is shown on a logarithmic scale.

Sources: Svirydzenka (2016); IMF, *World Economic Outlook*; WIPO; World Bank; PitchBook Data Inc; authors' calculations.

Drivers of fintech funding[1] Table 1

	Fintech funding (% of GDP)[2]			
	(I)	(II)	(III)	(IV)
Regulatory quality	0.038***			0.025*
	(3.305)			(1.692)
Financial development index		0.021***		0.001
		(2.636)		(0.05)
Innovation index			0.049***	0.038**
			(3.433)	(2.418)
Controls[3]	Yes	Yes	Yes	Yes
Number of observations	546	546	546	546
R-squared	0.137	0.13	0.141	0.147

t-statistic calculated with robust standard errors in brackets; ***/**/* indicates statistical significance at the 1/5/10% level.

[1] The sample covers 68 countries for the period 2010–19. The dependent variable in all underlying regressions is the total amount of investments in fintech, scaled by GDP. The regressors, listed in the first column, are lagged by one year and standardised to a mean of zero and a standard deviation of one. [2] Winsorised at the 1st and 99th percentiles. [3] Dummies for GDP per capita terciles, year fixed effects and the natural logarithm of the total population.

Sources: Svirydzenka (2016); IMF, *World Economic Outlook;* World Bank; WIPO; PitchBook Data Inc; authors' calculations.

Finally, the corresponding rise in fintech funding in the context of the innovation index is 80% of the average (third column).[6]

Of course, countries with better regulatory frameworks usually also have more developed financial markets and a higher innovation capacity. This implies that the results discussed so far may overstate the impact of each individual driver taken in isolation. When we jointly investigate the impact of all three structural indicators, we find that regulatory quality and especially innovative capacity have a statistically significant effect even when the influence of other factors is controlled for (fourth column).

Regulatory sandboxes and investment in fintech

To complement the analysis of structural drivers, we now turn to the effects of regulatory sandboxes on fintech investment. To spur innovation in the financial sector in the near term, nearly 60 jurisdictions have introduced a sandbox as a targeted policy measure (World Bank (2020)).[7]

Sandboxes provide regulators and firms with a controlled testing environment for financial products using emerging technologies. Their goal is to nurture financial innovation and competition, and they often facilitate fintechs' access to capital. Firms

[6] Regression results are qualitatively similar when we use sub-indices of financial development that measure the development of financial markets vs financial institutions, scale the dependent variable by overall investment, or control for GDP growth or the log of mobile subscriptions. Moreover, similar results hold when we use the rule of law, bank credit to GDP and artificial intelligence conference papers per capita (Zhang et al (2021)) as alternative independent variables.

[7] Regulatory sandboxes are one form of innovation facilitators. Other forms include innovation hubs, which often involve dedicated support to supervised firms within existing regulatory frameworks, and accelerators, which may entail awarding grants to or buying services from innovative firms.

that enter the sandbox, and especially those that "graduate", have been judged by the regulator to offer innovative products and be able to comply with applicable rules. Sandboxes can thus improve the information available to investors and reduce regulatory uncertainty (Cornelli et al (2020b)). More generally, they can signal that authorities are inclined to support the entry of new players in the financial sector.

The establishment of a sandbox is a pivotal point for investments in the fintech sector (Graph 5, left-hand panel). Prior to the establishment of a sandbox, investments tend to be a small share of GDP. The picture changes drastically once the sandbox is in place, with the ratio of fintech investment to GDP picking up strongly already after one year. Over the three years after establishment, this ratio nearly quadruples on average, suggesting a sustained boost after initial cohorts graduate from the sandbox. This includes firms developing outside the sandbox, as investors might see greater regulatory certainty and higher growth prospects for fintechs in general.

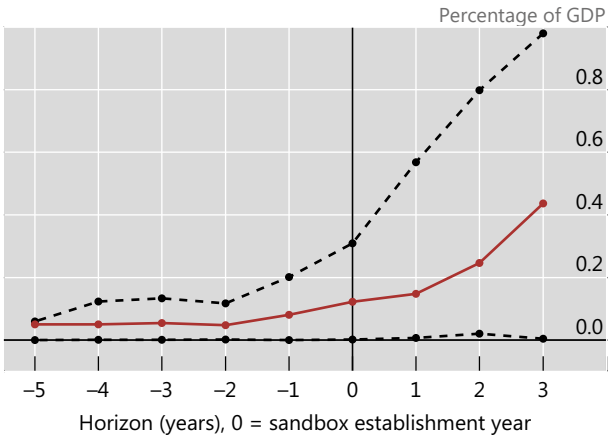
Sandboxes are associated with an economically large and statistically significant rise in investment in fintechs even after controlling for countries' level of development and other macroeconomic characteristics (Graph 5, right-hand panel). Investment as a share of GDP is, on average, around 75% higher in the years after the establishment of a sandbox than in the years before. Similarly, the number of deals per capita increases by almost a quarter.

Admittedly, higher investment in fintech does not always lead to improvements for consumers or society, and running a regulatory sandbox does entail costs for regulators (UNSGSA FWG and CCAF (2019)). Nonetheless, taken together, these findings suggest that sandboxes can support risk-bearing investment in new firms and could become a successful tool to foster innovation.

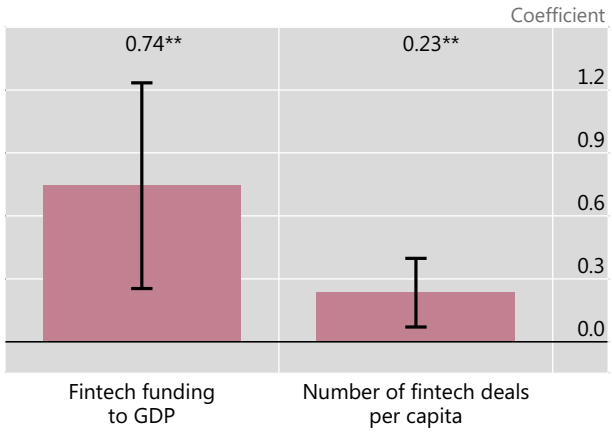
Regulatory sandboxes increase funding for fintechs[1]

Graph 5

In the average country, fintech funding increases after a sandbox is established…[2]



…in terms of amount raised and number of deals[3]



Fintech funding: Average 10th / 90th percentiles Coefficient estimate 90% confidence intervals

[1] The sample covers 68 countries for the period 2010–19. Of these, 33 have introduced sandboxes. Where a jurisdiction has more than one sandbox, we use the year of the first establishment. During our sample, no jurisdiction discontinued a regulatory sandbox. [2] For more details on the dates of sandbox establishment, see Key Data from Regulatory Sandboxes across the Globe (worldbank.org). [3] Based on country-level panel regressions. The dependent variable is the natural logarithm of the variable displayed on the x-axis. It is regressed against a dummy that takes on a value of one in each year from the establishment of a sandbox onward. Regressions include country and year fixed effects, as well as the natural logarithm of the total population lagged by one year as controls. Standard errors are clustered at the country level. ** indicates statistical significance at the 5% level.

Sources: IMF, *World Economic Outlook;* World Bank; World Bank (2020); PitchBook Data Inc; authors' calculations.

Box

Fintech "vertical" classification and other key variables

Fintechs offer a large variety of different products and services, including payment or wealth management apps, insurance solutions, cryptocurrency trading and credit scoring algorithms. As of now, there is no commonly agreed standard that classifies fintechs into different market segments. This box explains how Pitchbook classifies fintech market segments and the properties of other key variables in our analysis.

PitchBook offers its own classification of fintech companies into *industry verticals*, or segments. These comprise firms that offer similar products and services in a common specialised market. According to PitchBook, "Verticals are designed to slice across industries such that a single vertical may be comprised of companies that span multiple industries. A company is tagged to as many relevant verticals as possible and each vertical is given equal weight." In this special feature, we consider all investments that are classified as fintech. We use the additional vertical tags to assess the type of activity conducted by the funded fintech. These verticals allow us to track the evolution of funding deals in specific markets such as "insurtech", "cryptocurrency and blockchain" or "real estate and mortgage tech".

A key variable in our analysis is innovation capacity, which we measure with the *innovation output index* published by the World Intellectual Property Organization (WIPO), in partnership with Cornell University and INSEAD. This measures a country's creation and diffusion of knowledge (eg the number of scientific and technical publications in peer-reviewed journals, the share of high-tech net exports in total trade, computer software expenditure), patenting activity and the prevalence of intangible assets (eg trademark applications, top-level domains, mobile app development). One aspect to keep in mind is that the measurement of intangible assets includes activity in media and entertainment. Further, since the index is a broad-based measure of innovation, it also captures factors that might not be of direct relevance to innovation in the fintech sector (eg patents in biomedicine). Each country is assigned an output score between 1 and 100. A higher score implies higher innovation output. The highest-ranked countries include Switzerland, Sweden and the United States.

We also collect data on the *establishment date of regulatory sandboxes* for the financial sector (World Bank (2020)). Globally, 57 countries have established a regulatory sandbox, but in our sample of 68 countries, only 33 have one. Most sandboxes were established in or after 2016.

PitchBook provides data on fintech funding deals in 78 countries from Q1 2010 to Q2 2021. The empirical analysis is restricted to 68 countries over the period 2010–19, as not all control variables are available for the full sample, and it excludes the tumultuous Covid-19 period. Table A provides descriptive statistics for this sample.

Descriptive statistics[1]

Table A

	No obs	Median	Mean	Std dev	Min	Max
Fintech funding (USD mn)	546	28	1,330	7,040	0.01	114,000
Fintech funding (% of GDP)[2]	546	0.01	0.06	0.16	0	0.98
No of fintech deals	546	11	51.31	172.02	1	1,837
Regulatory quality[3]	546	0.95	0.80	0.86	–1.07	2.26
Financial development index[3]	546	0.58	0.56	0.22	0.10	0.98
Innovation index[3]	546	34.48	33.32	16.42	1.98	68.63
Population (mn)[3]	546	30	99	249	0.32	1,390
Regulatory sandbox dummy[4]	546	0	0.14	0.35	0	1
Large bank acquisition (USD mn)[5]	546	0	16	143	0	2,600
Big tech acquisition (USD mn)[5]	546	0	3	26	0	309

[1] The sample covers 68 countries for the period 2010–19. [2] Winsorised at the 1st and 99th percentiles. [3] Lagged by one year. [4] Country-level dummy that takes on a value of one in each year from the establishment of a sandbox onward. [5] For example, if M&A deals with a combined value of 100 involve global systemically important banks, or big techs, acquiring a fintech resident of country *C* in year *Y*, then the entry for country *C* is equal to 100 in years *Y*, *Y*+1 and *Y*+2. If subsequent deals take place during this three-year period, the time window is extended accordingly and the new deal value replaces the earlier one.

Sources: Svirydzenka (2016); IMF, *World Economic Outlook;* WIPO; World Bank; World Bank (2020); PitchBook Data Inc; authors' calculations.

M&A activity and VC funding

While fintech funding is growing rapidly, the innovation impetus may wane because of rising market concentration, particularly due to big techs' growth (Carstens et al (2021); Katz (2021)). If big techs acquire new entrants, this could slow innovation.

Usually, M&As by large firms spur firm entry, as acquisitions raise the potential return to entrepreneurs through higher firm valuations (Phillips and Zhdanov (2013)). In the digital economy, however, network effects imply that incumbents with a large user base have a head start over new entrants. In such markets, M&A activity could even reduce innovation. By acquiring entrants before their products reach sufficient scale, big techs can discourage users from joining these entrants' network, thereby reducing startups' growth prospects. For big techs in the US, this "kill zone" effect has been shown to make it harder for innovative firms to raise capital (Kamepalli et al (2020)). Relatedly, large firms may engage in "killer acquisitions" to discontinue a target firm's innovation projects (Cunningham et al (2021)). Whether acquisitions by large banks – which may see fintechs as complementing their existing services, rather than as direct competitors – have a different effect remains an open question.

We find a major difference between the effects of banks and big techs. M&As by large banks spur seed and early-stage VC investment in the fintech sector – the main source of funding for young firms – while M&As by big techs do not (Table 2). Acquisitions by large banks usher in significantly higher early-stage VC investment in the country of the acquired company (first column). In the three years after such acquisitions, early-stage VC investments as a share of GDP are 30% higher than their long-term average. Big tech acquisitions do not lead to similar effects (second column). The results are robust to considering large bank and big tech M&A activity simultaneously (third column) and to using the number of VC deals relative to the population as a measure of fintech investment (fourth to sixth columns).

This difference could reflect the relative importance of network effects for big techs, fintechs and banks. Both big tech and fintech business models depend on building up a large network of users through digital platforms. Big techs may thus see fintech entrants as direct competitors. Banks, by contrast, tend to have a more stable client base that is often based on long-term relationships, and may see fintech products and services as complementary to their existing offerings.

All said, these results suggest that authorities need to remain vigilant to competition in the fintech sector. Greater investment, and particularly early-stage VC investment, has been shown to foster firm creation and patent activity (Lerner and Nanda (2020)). This can, in turn, support innovation and competition, enhancing financial inclusion (Philippon (2017)). Yet abuse of market power could distort markets and slow beneficial innovation. It will be important to study further how M&A activity affects funding for new firms, and how financial regulation should interact with competition policy.

M&A activity and early-stage VC funding for fintechs[1] Table 2

	Early-stage VC fintech funding (relative to GDP)[2,3]			Early-stage VC fintech deal count (relative to the population)[2,3]		
	(I)	(II)	(III)	(IV)	(V)	(VI)
Large bank acquisition[3]	0.036**		0.039**	0.039***		0.039***
	(2.317)		(2.276)	(4.564)		(3.938)
Big tech acquisition[3]		0.011	0.017		–0.007	–0.001
		(0.429)	(0.676)		(–0.703)	(–0.051)
Controls[4]	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	546	546	546	546	546	546
R-squared	0.436	0.435	0.436	0.691	0.69	0.691

t-statistic calculated with standard errors clustered at the country level in brackets; ***/** indicates statistical significance at the 1/5% level.

[1] The sample covers 68 countries for the period 2010–19. For example, if M&A deals with a combined value of 100 involve global systemically important banks, or big techs, acquiring a fintech resident of country *C* in year *Y*, then the value of the regressor for country *C* is equal to 100 in years *Y*, *Y*+1 and *Y*+2. If subsequent deals take place during this three-year period, the time window is extended accordingly and the new deal value replaces the earlier one. [2] Refers to the sum of seed and early-stage deals (series A, B and 1). Variables winsorised at the 1st and 99th percentiles. [3] Standardised to a mean of zero and a standard deviation of one. [4] Country and year fixed effects, as well as the natural logarithm of the total population lagged by one year.

Sources: IMF, *World Economic Outlook;* World Bank; PitchBook Data Inc; authors' calculations.

Conclusion

Investors have ramped up their funding of fintechs since 2010, and VC funding in particular has grown. While overall investment was initially quite concentrated in a few large markets and segments, the funding landscape has become more diverse.

Investment in fintechs responds to structural features of national economies – such as higher innovation capacity and better regulatory quality – as well as targeted policy measures in the form of regulatory sandboxes. The results also suggest that M&As by large banks go hand in hand with more investment in young fintechs, while M&As by big techs do not.

Our analysis can help to inform policy on how to spur and monitor innovation in the financial sector. The positive impacts of the quality of regulation and of targeted initiatives like sandboxes suggest that policy can play a role to promote innovation. Yet regulators need to monitor developments to ensure that innovation in the financial sector serves the public interest.

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Covid-19 policy measures to support bank lending[1]

In the wake of the Covid-19 fallout, policymakers enacted a wide range of measures to support the flow of credit. Some measures strengthened banks' lending capacity by preserving their capital and encouraging flexibility in loss accounting. Others, such as state-backed loan guarantees or funding for lending programmes, incentivised banks to use their available capacity. We find evidence that both types of measures contributed to lending growth. Strong banks with ample balance sheet capacity could accommodate the large drawdown of corporate credit lines in the first months of the pandemic. Policy support appeared to foster further lending. Banks that increased their lending capacity increased their lending more than other banks. More generous guarantee programmes were associated with banks reporting looser lending standards and higher lending growth. Benefitting from such programmes, small and medium-sized enterprises expanded their borrowing, especially those in sectors hit hard by the pandemic.

JEL classification: E44, G21, G28

Covid-19 and its associated health measures brought economic activity to a sudden halt, requiring a swift and strong reaction by monetary, fiscal and prudential authorities. A key public objective was to ensure the continued flow of credit to the real economy, particularly bank credit.

This special feature informs the discussion of how Covid-19 policy measures supported the flow of bank credit via two main mechanisms: by enhancing bank lending *capacity* and by providing *incentives* for banks to lend. These measures directly targeted banks and their borrowers.[2] For example, balance sheet capacity was strengthened by preserving banks' capital and encouraging flexibility in loss accounting. Such prudential measures also sought to support bank resilience, an important foundation for lending. In turn, fiscal and monetary measures, such as loan guarantee programmes and funding for lending programmes, boosted incentives to lend by reducing banks' risks or funding costs. We stand out from the literature by

[1] The authors thank Patrizia Baudino, Claudio Borio, Stijn Claessens, Benjamin Cohen, Marc Farag, Ulf Lewrick, Benoit Mojon, Hyun Song Shin, Jean-Philippe Svoronos, Nikola Tarashev, Philip Wooldridge and Raihan Zamil for valuable comments and suggestions, and Anamaria Illes for excellent research assistance. All errors are our own. The views expressed in this article are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

[2] Chapter I of the BIS Annual Economic Report (2020) discusses a broad range of policy measures implemented in response to the pandemic and outlines remaining challenges. While this feature analyses the design and implications of some of the policy responses in more depth, important measures, such as monetary easing, remain out of scope.

Key takeaways

- Since the start of the Covid-19 pandemic, policy measures have supported lending by enhancing banks' balance sheet capacity and creating incentives for banks to use this capacity.
- Strong balance sheets allowed banks to accommodate credit line drawdowns at the start of the pandemic, while subsequent policy measures supported further lending.
- Small and medium-sized enterprises, particularly those in sectors hard hit by the pandemic, expanded their borrowing by more in countries with more generous guarantee programmes.

considering the two mechanisms side by side, adopting a global perspective and highlighting outcomes for small and medium-sized enterprises (SMEs), which were targeted by many of the measures we consider.

Both mechanisms supported bank credit. The initial increase in bank lending reflected the drawdown of pre-existing credit lines and was possible thanks to ample balance sheet capacity. Subsequently, capital preservation measures and guarantees appeared to further support lending in the second half of 2020 and into 2021. In particular, banks that increased their lending capacity increased their lending by more than other banks. More generous guarantee programmes were associated with larger increases in lending to SMEs in sectors particularly hard hit by Covid.

The remainder of this article proceeds as follows. The first section explains the mechanisms through which policy measures sought to support lending. The second documents the range of measures implemented across countries. The third analyses the impact of these measures on bank lending during the pandemic, and on credit to SMEs in particular. The concluding section outlines some trade-offs that policymakers face when unwinding the measures.

Through which mechanisms can policy support lending?

There are two complementary mechanisms by which policy measures can support bank lending in the face of a large but temporary shock. First, they can increase banks' *capacity to lend* by expanding their capital and by strengthening their liquidity positions. Second, they can *provide incentives* for banks to use this capacity by improving the risk-return trade-off for granting new credit.

Expand bank lending capacity

In order to increase lending, banks need to have the balance sheet capacity to make new loans. Public policy measures can enhance this capacity by boosting capital ratios, relaxing the requirements on these ratios or granting banks accounting flexibility. When it comes to liquidity constraints, swift central bank action can ensure that funding liquidity is not an issue for banks.

Policy measures can boost capital by supporting its growth. While regulators can, in principle, achieve this outcome by encouraging banks to raise new capital, this is rarely explored through market mechanisms amidst a crisis, when the cost of capital is particularly high. More effective are restrictions on capital payouts, which force banks to retain their earnings rather than distribute the capital to shareholders.

In parallel, policy measures can reduce constraints on lending capacity by reducing the measured riskiness of banks' balance sheets. Moratoriums on existing

loans keep risk weights from increasing by preventing borrowers' distress from surfacing as missed payments. Similar to this is the effect of encouraging banks to use the full flexibility of accounting rules like IFRS 9 in order to look beyond short-term uncertainty when accounting for expected losses.[3] In these cases, loss provisioning for the affected loans can decline.[4]

Authorities can also mobilise additional balance sheet capacity by loosening regulatory constraints themselves. The most straightforward way is by releasing buffers, such as the countercyclical capital buffer, which frees up capital at all banks in the releasing jurisdiction. Encouraging the use of other regulatory capital buffers can also generate capacity, especially in the absence of attendant regulatory restrictions.

Incentivise banks to increase lending

Banks use spare balance sheet capacity only if new lending offers a favourable risk-return balance, at interest rates that will not compromise borrowers' solvency. Public policy can influence this trade-off – and thus banks' lending incentives – by influencing the risk that banks bear and their cost of funding.

Several measures can reduce credit risk from banks' perspective. Loan guarantees provided by the public sector remove some or all credit risk from a loan, thus making it more attractive for banks to sustain their client relationships. That said, this effect could be reduced when guarantees come hand in hand with prescribed lending rates, thus keeping a lid on interest margins. Other fiscal measures primarily strengthen the creditworthiness of the borrower. They include, for instance, furlough schemes, direct transfers, tax deferrals or relief, grants and equity injections.[5]

Authorities can enhance the attractiveness of new loans by reducing their funding costs. An example, with additional incentives, is funding for lending programmes, which usually offer banks access to low-cost funding under certain conditions about how this funding is accessed and used. The Box explores how the structure of these programmes varies across countries.

Removing regulatory penalties can play a similar role. Dipping into non-releasable regulatory buffers – eg the capital conservation buffer – can involve penalties, such as restrictions on capital payouts. Regulators can dampen the attendant market stigma by: explicitly suspending those penalties; implicitly removing them with payout restrictions for all banks; or actively encouraging buffer use.

[3] IFRS stands for International Financial Reporting Standards. IFRS 9 require banks to provision against expected credit losses, rather than provisioning only once evidence of losses arise. These standards are more flexible, allowing banks to account for the expected policy support over the medium term when determining expected losses. See Araujo et al (2021).

[4] By shifting all or part of the credit risk to the sovereign, guarantees on loans also expand capacity through lower risk weights and loss provisioning. In some cases, however, banks may need to assess if guaranteed loans would be non-performing. In addition, the loans typically remain on banks' balance sheet and affect the leverage ratio.

[5] These measures could also serve as a substitute for new loans, reducing loan demand.

Funding for lending programmes during Covid-19

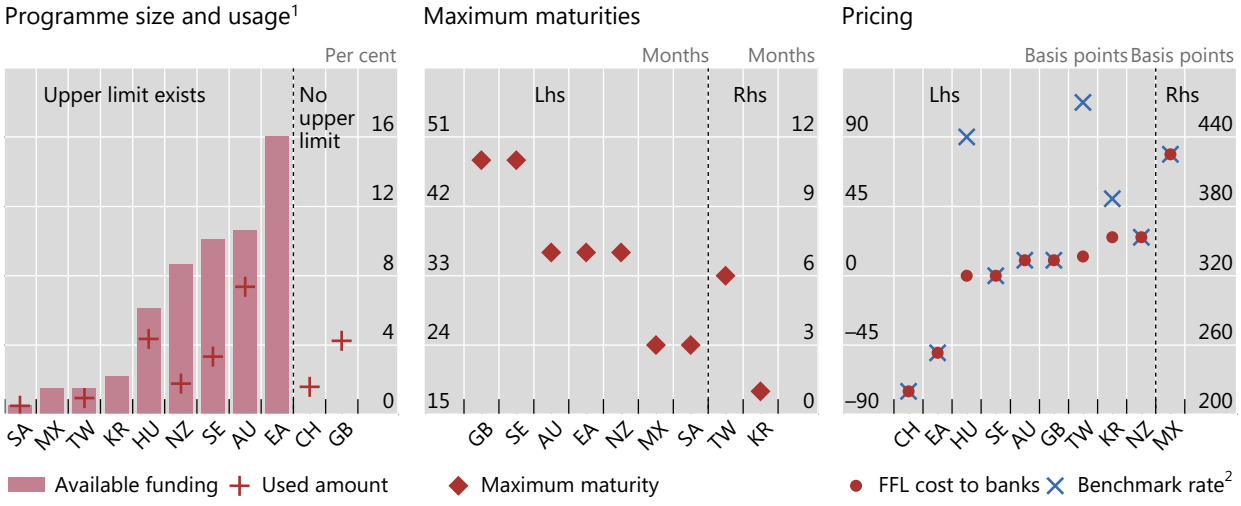
Catherine Casanova, Bryan Hardy and Mert Onen[ⓘ]

In response to the Covid crisis, central banks in various jurisdictions implemented "funding for lending" (FFL) programmes, which allow banks to access low-cost funding in order to lend to businesses in need. This type of measure had been introduced previously, such as by the Bank of England and the Magyar Nemzeti Bank in response to the euro area crisis in 2012. In 2020, several additional jurisdictions implemented similar programmes (including Australia, Mexico, New Zealand, Saudi Arabia, Sweden, Switzerland and Taiwan). Likewise, the European Central Bank (ECB) initiated the third phase of its Targeted Long-Term Refinancing Operations (TLTRO III), which aims to incentivise lending to households and corporations by providing low-cost financing to banks. To examine such programmes in detail, this box focuses on selected countries for which information is readily available.

FFL programmes typically have two main elements: the provision of low-cost funds; and conditions tied to the use of those funds and to additional access to funds. Such conditions differentiate FFL programmes from standard lending operations by central banks, such as standing or emergency lending facilities. The conditions usually require banks to use the funds to extend loans, often to SMEs or industries hard hit by Covid. In some cases, the funds are offered in tranches: banks can borrow a first tranche but need to extend new loans of a certain amount in order to access subsequent tranches of funds. For example, in Australia the amount of additional funding allowance is proportional to the increase in the bank's lending. In the United Kingdom, funds can be accessed if participating banks lend to the private non-financial sector in general, but total allowance increases are conditional on lending specifically to SMEs. Moreover, the cost of funding rises from 0.10% to 0.35% if the participating UK bank fails to increase its net lending.

Funding for lending terms, available funding and usage varied across jurisdictions

Graph A



[1] Expressed as a percentage of 2020 GDP. Values may correspond to different points in time, due to data availability. Used amount not available for EA, KR and MX. [2] Benchmark rates: AU = Cash Rate Target; CH = SNB Policy Rate; EA = Deposit Facility; GB = BoE Base Rate; HU = Central Bank Base Rate; KR = BoK Base Rate; MX = Benchmark Policy Rate; NZ = Official Cash Rate; SE = Riksbank Reference Rate; TW = Policy Rate.

Sources: Reserve Bank of Australia; European Central Bank; Bank of Korea; Reserve Bank of New Zealand; Yale COVID-19 Financial Response Tracker; national data; authors' calculations.

The size of these programmes varies considerably across countries (Graph A, left-hand panel). The largest programme in terms of total funding committed is the ECB's, at over 16% of the euro area's 2020 GDP. By contrast, Saudi Arabia has the smallest programme, amounting to 0.5% of its GDP. In the United Kingdom and Switzerland, there is no upper limit on available funding, hence resources channelled through the programme depend entirely on the demand from banks and the extent to which they satisfy the underlying conditions.

FFL programmes also vary in terms of loan maturities and pricing (Graph A, centre and right-hand panels). For example, the ECB's TLTRO III programme provides funding with a maturity of three years, while the repayment period is limited to six months in Chinese Taipei and just one month in South Korea. In most countries, interest charged on the funding to banks is set at a benchmark rate, such as the overnight interbank rate or the policy rate. In Hungary, Chinese Taipei and South Korea, the rate is actually set below the relevant benchmark to further encourage use.

The use of the FFL programme was also quite disparate. Among countries for which usage data are available, Australia had the highest take-up, reaching 7% of its 2020 GDP as of Q2 2021. Banks in the United Kingdom, Hungary and Sweden also utilised a sizeable amount of funds, at over 3% of the respective country's GDP.

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

Policy implementation and use across countries

Policymakers implemented many different measures in a very brief time span. We map these measures across countries and regions, focusing on implementations in the first half of 2020, which allows us to capture most of the policy response to the Covid-19 shock.

Which policies were implemented?

Policy actions varied across countries. Many measures consisted of relaxing existing policies, so countries with tighter ones in place had more scope for adjustment. In general, authorities in advanced economies had more fiscal space to fund costly measures than those in emerging market economies (EMEs).

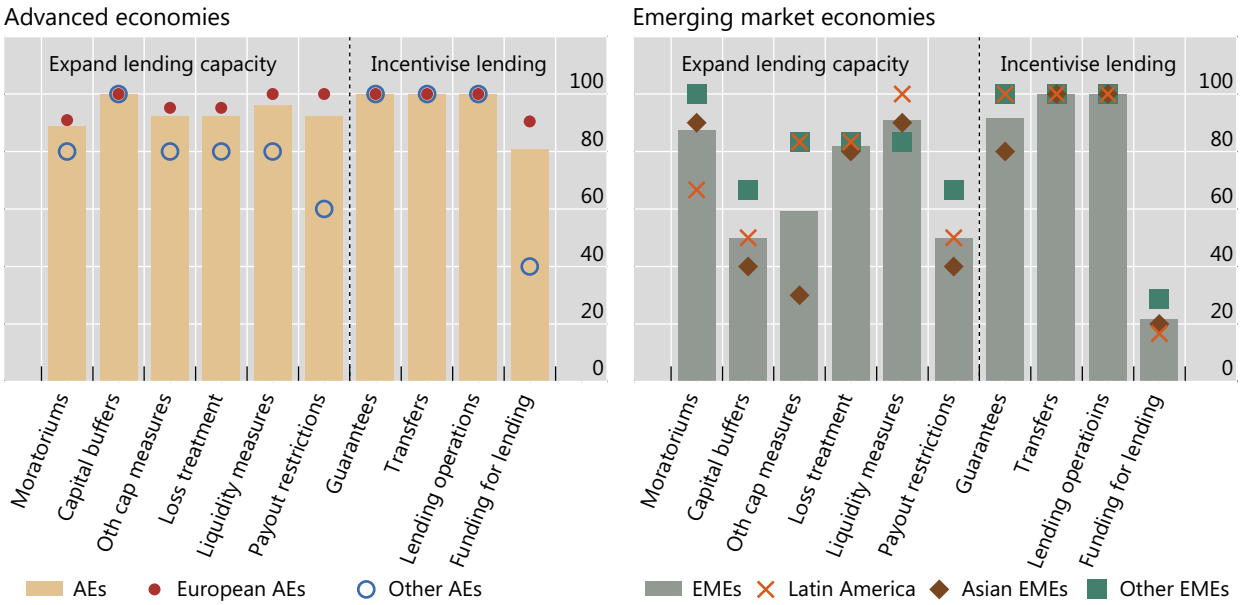
Advanced economies implemented a number of measures targeted at increasing banks' balance sheet capacity. Nearly all of them relaxed capital and liquidity requirements, and encouraged flexibility in the calculation of expected losses and the classification of non-performing loans (Graph 1, left-hand panel). Capital payout restrictions varied across regions: they were concentrated in Europe, where the European Central Bank (ECB) took the lead, and were implemented by only 60% of the non-European countries in our sample.

Measures to enhance banks' balance sheet capacity in emerging markets varied much more than in advanced economies. Most EMEs in our data implemented moratoriums on loan payments, provided relief from liquidity requirements and granted flexibility as regards the recognition of losses and the treatment of non-performing loans. That said, less than 60% of these EMEs used measures directly addressing capital requirements, buffers or payouts (Graph 1, right-hand panel). Asian EMEs resorted to such measures the least.

In turn, measures to incentivise lending were adopted by similar proportions of advanced and emerging market economies in our sample. Virtually all countries implemented loan guarantees and fiscal transfers, and expanded their lending operations. The notable exception has to do with funding for lending programmes, which were put in place across most European countries (many falling under the ECB programme) but only in around 20% of the EMEs in our database (Box).

Policy measures implemented during the Covid crisis to support bank lending[1]

Percentage of countries implementing within each region — Graph 1



Asian EMEs = CN, HK, ID, IN, KR, MY, PH, SG, TH and VN; European AEs = AT, BE, CH, DE, DK, EE, ES, FI, FR, GB, GR, IE, IS, IT, LT, LU, LV, NL, NO, PT, SE, and SK; Latin America = AR, BR, CL, CO, MX and PE; Other AEs= AU, CA, NZ, JP and US; Other EMEs = CZ, HU, IL, PL, RU, SA, TR and ZA.

[1] The sample covers 48 countries for prudential policies, 49 countries for monetary policies and 51 countries for fiscal or other policies. For prudential and monetary policies, European Union and euro area-level measures are also counted in individual countries. For instance, the ECB's TLTRO III programme is attributed to each country within the euro area, under funding for lending. The ECB's measures typically apply to the largest banks in the euro area. See Table 1 in the Annex for details on groupings of measures.

Sources: Cantu et al (2021); Asian Development Bank; FSB; IMF; OECD (2020); European Banking Authority; European Systemic Risk Board; national data; authors' calculations.

How did the size and terms of policies vary?

While the general policy types tended to be similar across countries, some of the specific features differed considerably. For instance, many jurisdictions implemented payout restrictions, but some only restricted share buybacks or executive bonuses (Canada and Singapore) while others froze dividend payments as well (euro area, Brazil, United Kingdom and South Africa; see Svoronos and Vrbaski (2020)). Similarly, the scope of loans that qualified for debt moratoriums varied significantly: some covered all types of existing loans, while others only covered loans to specific sectors or to SMEs. Moreover, in some countries such as Spain or the United States, debt repayment moratoriums were mandated by legislation, while in others, including Australia and South Africa, they were encouraged by policymakers and industry associations (Coelho and Zamil (2020)).

Details of guarantee programmes further underscore cross-country differences. Nearly every country in our sample implemented some sort of loan guarantee programme, but the ex ante (announced) sizes of these programmes varied greatly (Graph 2, left-hand panel). In advanced economies, it ranged from 32% of GDP in Italy and 25% in Germany, down to 1% in Australia. For emerging markets, the Czech Republic and Turkey top the list at 15% and 9% of GDP, respectively, while Russia sits below 0.5%. When expressed relative to the volume of outstanding bank loans, the announced guarantee programmes rank similarly across countries, ranging from

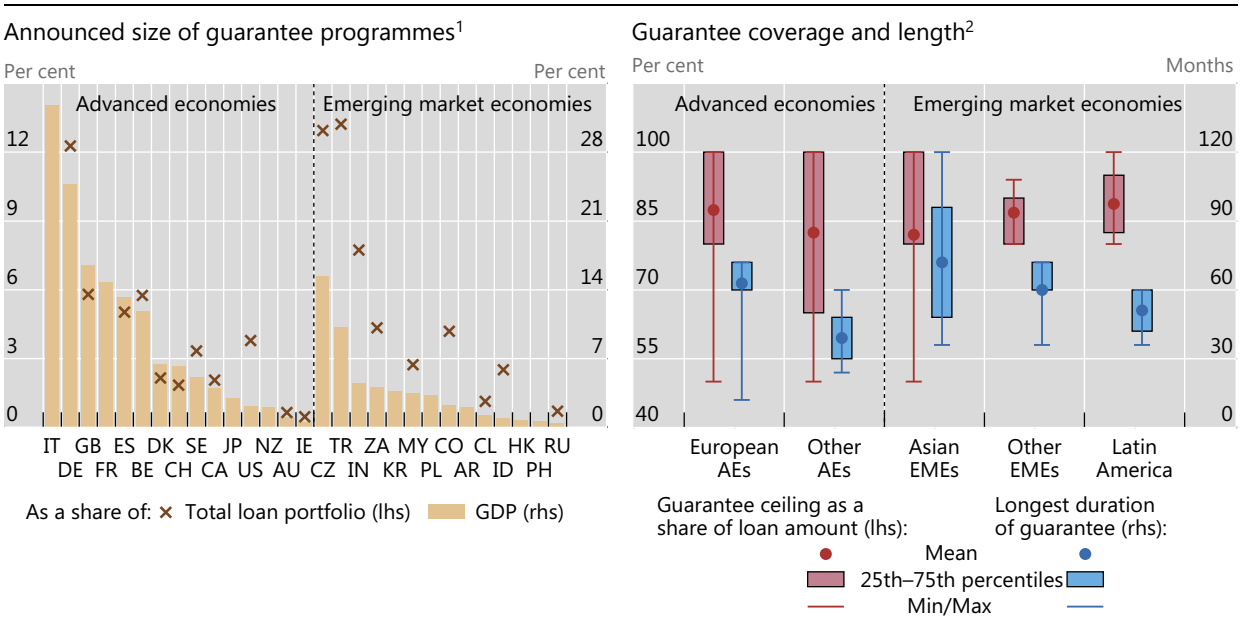
about 0.5% in Ireland to about 12% in the Czech Republic and Germany, and more than 13% in Turkey.

Different jurisdictions also imposed different terms for their guarantee programmes (Graph 2, right-hand panel). As of Q3 2020, the share of a given loan that was subject to guarantees was set at 100% in 14 countries but was as low as 50% in Australia and Latvia.[6] At the time of the programmes' announcements, the maximum maturity of eligible loans ranged from 12 months in Belgium to 10 years in Malaysia.

While programmes were almost always limited to corporate loans, sometimes they were further narrowed to SMEs (Hong Kong and Norway) or firms in sectors that were particularly hard hit by the pandemic (Portugal and Austria). Programmes also varied with respect to the pricing of guaranteed loans, the maximum loan amount per firm and the constraints on borrowers (in terms of disclosure and use of the proceeds).

Size and terms of loan guarantee programmes varied across countries

Graph 2



Asian EMEs = HK, ID, IN, MY and PH; European AEs = AT, BE, CH, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LT, LU, LV, NL, NO, PT, SE and SK; Latin America = BR, CL, CO and MX; Other AEs = AU, CA, NZ and US; Other EMEs = CZ, HU, PL, TR and ZA.

[1] Size as a share of gross loan portfolio value and GDP in each country. Data on the total loan portfolio were not available for some countries. [2] This panel reports the minimum, maximum, mean and the interquartile range. The left axis shows the maximum share of each loan covered by a guarantee and the right axis shows the maximum maturity of a guaranteed loan in months.

Sources: Asian Development Bank; IMF, *Financial Soundness* Indicators; IMF, *Fiscal Monitor Database,* October 2020; European Banking Authority; European Systemic Risk Board; national data; BIS; authors' calculations.

[6] These terms may have affected banks' use of guarantee programmes. For example, anecdotal evidence from Sweden suggested that banks were reluctant to take up guaranteed loans unless the guarantee covered 100% of the loan (Sveriges Riksbank (2020)). More generally, while the announced size of guaranteed loans in Europe reached 10% of existing loans in the region, the attendant take-up as of September 2020 was below 2.8% (ESRB (2021)).

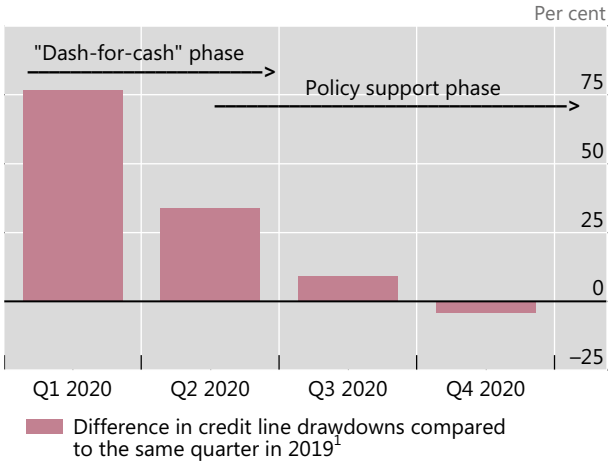
Policy measures and lending outcomes: empirical evidence

Broadly speaking, bank lending evolved over two phases after the Covid shock. The first phase was characterised by a "dash-for-cash" in Q1 2020 that spilt over into Q2. In this phase, firms drew down their available credit lines and raised other short-term borrowing, in part to bolster cash reserves (Graph 3, left-hand panel). This short-term borrowing gave rise to a sharp increase in credit to the private non-financial sector in Q1 (right-hand panel). Second came the policy support phase when measures were implemented en masse, mostly starting in Q2 2020. Initial balance sheet strength and new policy actions allowed banks to accommodate the sharp rise in corporate loan demand through both phases, even though the drawdown of credit lines consumed banks' lending capacity (Falagiarda and Köhler-Ulbrich (2021), Kapan and Minoiu (2021)).

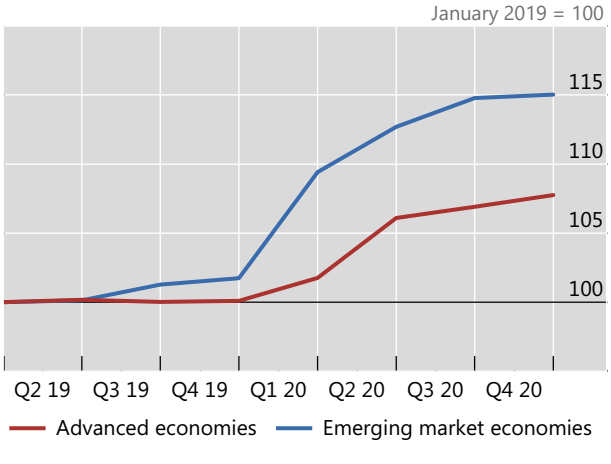
What role did policy measures play in the second phase, after the drawdown of credit lines? In particular, to what extent did capacity-enhancing measures affect bank lending? Did guarantees incentivise greater lending, in particular to SMEs, which are the corporate borrowers most likely to become credit constrained during crises (Chodorow-Reich (2014))? On these questions, we provide cross-country evidence that is consistent with, but does not necessarily imply, causal effects.

Drawdown of credit lines and policy support boost overall credit volumes — Graph 3

Firms drew their credit lines as first response



Bank lending to the private non-financial sector surged[2]



Advanced economies = AT, AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, JP, LU, NL, NO, PT, SE and US; Emerging market economies = AR, BR, CL, CN, CO, CZ, HK, HU, ID, IN, KR, MY, MX, PL, RU, SA, TH, TR and ZA.

[1] Sum of credit line drawdowns by public non-financial firms in CA, DE, FR, GB, IT, JP and US. Balanced sample of companies across quarters in 2019 and 2020. [2] Bank credit to the private non-financial sector, relative to GDP.

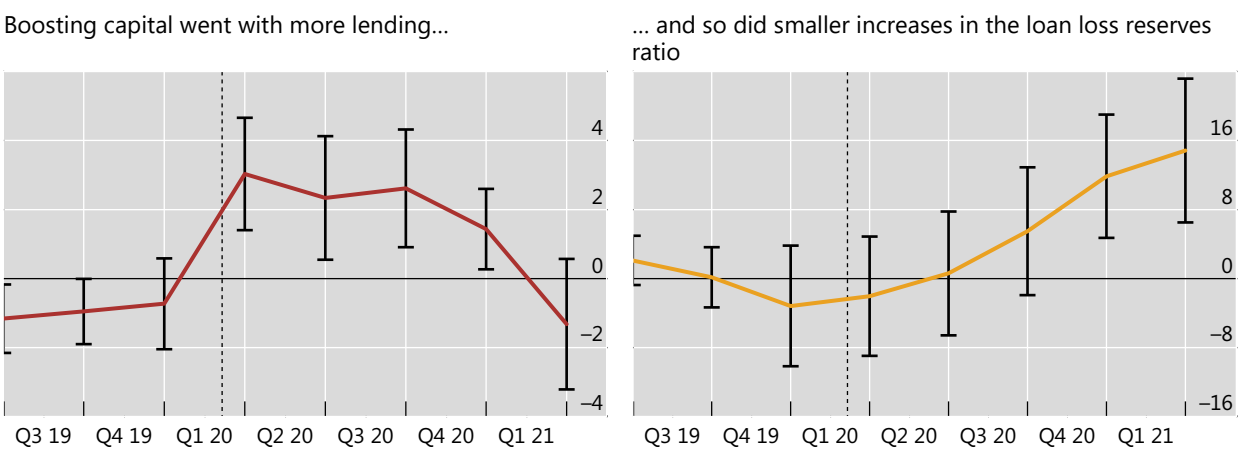
Sources: S&P Capital IQ; BIS; authors' calculations.

The role of bank balance sheet capacity

While changes to balance sheet capacity are typically difficult to attribute to specific policy measures or other drivers, it is straightforward to gauge the changes themselves and relate them to lending outcomes. In this section, we consider two changes to individual banks' consolidated balance sheets in the first half of 2020. The first is the change in capital, normalised by end-2019 risk-weighted assets (RWA). The second is the change in the ratio of loan loss reserves (LLR) to total assets.[7] We incorporate these variables jointly in a regression – together with other bank-level characteristics – to study how they relate to lending growth from Q1 2020 to Q1 2021. We also seek to rule out a scenario whereby our findings reflect the continuation of pre-existing lending growth or the effect of this growth on banks' balance sheets (Graph 4). Our key question is whether banks that expanded their balance sheet capacity by more than their peers – as measured by the capital and LLR variables – also experienced higher lending growth. An affirmative answer, especially if banks' pre-pandemic lending patterns were not different from their peers', would be indirect evidence that capacity enhancing measures might have supported lending during the pandemic.

Effect of increasing banks' lending capacity on loan growth[1]

Estimated impact on year-on-year loan growth, in per cent — Graph 4



The dotted vertical lines indicate 5 March 2020, which marks the initial market turmoil in response to Covid-19, followed by forceful policy actions.

[1] Lines plot the evolution of the estimates of β_t^j – where *t* indicates a quarter and *j* an explanatory variable – and whiskers the corresponding 95% confidence intervals stemming from the following regression: $[(LNS_{it} - LNS_{it-4})/LNS_{it-4}] * 100 = \alpha_i + T_t + \sum_{k=2019Q2}^{2021Q1} \sum_j \beta_k^j (T_k * X_i^j) + \varepsilon_{it}$, where *i* denotes the bank, *t* denotes a quarter from Q2 2019 to Q1 2021, α_i are bank fixed effects, T_t are time fixed effects and *j* indexes other explanatory variables. The left-hand side variable is the year-on-year growth in gross loans, winsorised at 1%. The explanatory variables X_i^j include the following: the normalised change in bank capital, $[(Cap_{2020Q2} - Cap_{2019Q4})/RWA_{2019Q4}] * 100$, where *Cap* stands for total capital and *RWA* for the risk weighted assets (left-hand panel); change in the ratio of loan loss reserves (LLR) to total assets (TA), $[(LLR_{2019Q4}/TA_{2019Q4}) - (LLR_{2020Q2}/TA_{2020Q2})] * 100$ (right-hand panel); as well as end-2019 bank-level characteristics, which serve as controls: cash share of assets, loan share of assets, average return on assets and total regulatory capital ratio. Sample of 112 large banks across 24 countries. Errors are clustered at the bank level.

Sources: FitchConnect; authors' calculations.

[7] Overall, bank capital ratios improved during 2020 in many jurisdictions (BCBS (2021)). See www.bis.org/frame for evidence across a number of studies showing increased capital ratios leading to higher lending growth. The increases in capital in 2020 were largely through retained earnings, in some cases compelled via payout restrictions, as few banks issued new capital on the market. The results reported in this section are robust to using balance sheet changes over all of 2020.

Banks that boosted their capital in the first half of 2020 by more than their peers, experienced comparatively higher lending growth throughout 2020 (Graph 4, left-hand panel). The effect arises in Q1, during the dash-for-cash phase when regulators stepped in to restrict capital payouts, but the comparatively higher lending persisted throughout the following quarters. The effect is economically significant: the median increase in capital across banks in the first half of 2020, of about 1.4% of 2019 RWA, is associated with a 3.3 percentage point higher year-on-year lending growth during 2020. This evidence is consistent with payout restrictions supporting lending by strengthening banks' capital base (see also Hardy (2021)).

Smaller increases in LLR in the first half of 2020 were also associated with expanded bank lending during, but not before, the pandemic. The increase in lending growth started in Q4 2020, well after the dash-for-cash phase (Graph 4, right-hand panel).[8] The results are economically significant, as we estimate that a bank with LLR changes at the cross-sectional median experienced loan growth 2.2 percentage points higher than a bank at the 75th percentile of LLR changes. This suggests an important countercyclical effect of flexibility in accounting for expected losses amidst an unprecedented crisis. While such flexibility backstopped unwelcome ballooning of loss provisions because of the unprecedented uncertainty, it is also important that these provisions accurately reflect expected losses once the dust settles.

Our data do not allow us to study, in any depth, macroprudential measures to boost lending capacity on the basis of capital buffers. Since only a few countries had implemented positive countercyclical capital buffers when the pandemic hit, releasable buffers accounted for a small fraction of bank capital. In addition, banks may have been reluctant to use non-releasable buffers because of non-regulatory constraints to maintain significant capital space above regulatory requirements. These constraints could stem from either internal risk-management considerations or market expectations. Whether or not buffer-based measures made a difference remains an open question, despite some evidence suggesting that banks which were closer to regulatory requirements constrained their lending by more (BCBS (2021), Berrospide et al (2021), Saporta (2021)).

The role of guarantees to incentivise lending

Government guarantee schemes seem to have been a major driver of bank lending during the second phase of post-outbreak lending. The attractive terms of such loans from the perspective of borrowers is likely to have boosted demand (Baudino (2020)), as banks reported higher demand in jurisdictions where the size of the guarantee programmes was larger (Graph 5, left-hand panel, red dots).[9] In addition, and less directly, these programmes dampened overall macroeconomic uncertainty, which is likely to have contributed to banks reporting looser lending standards (blue dots). Overall, aggregate bank lending to the private non-financial sector grew faster in countries with larger announced guarantee programmes (centre panel). This

[8] Since changes in provisions and changes in capital are both included in the regression, the results indicate that both factors played a role in our sample. In principle, government guarantees can improve borrowers' credit quality from banks' perspective, thus driving both a lower LLR-to-asset ratio and higher lending. Nevertheless, we find that the results are robust to including announced guarantee package size as an additional explanatory variable in the regression.

[9] The underlying surveys are administered to loan officers by banking supervisors in individual countries. The data are country aggregates and reflect these officers' opinions regarding changes in lending standards and demand conditions at their bank (IMF (2021b)).

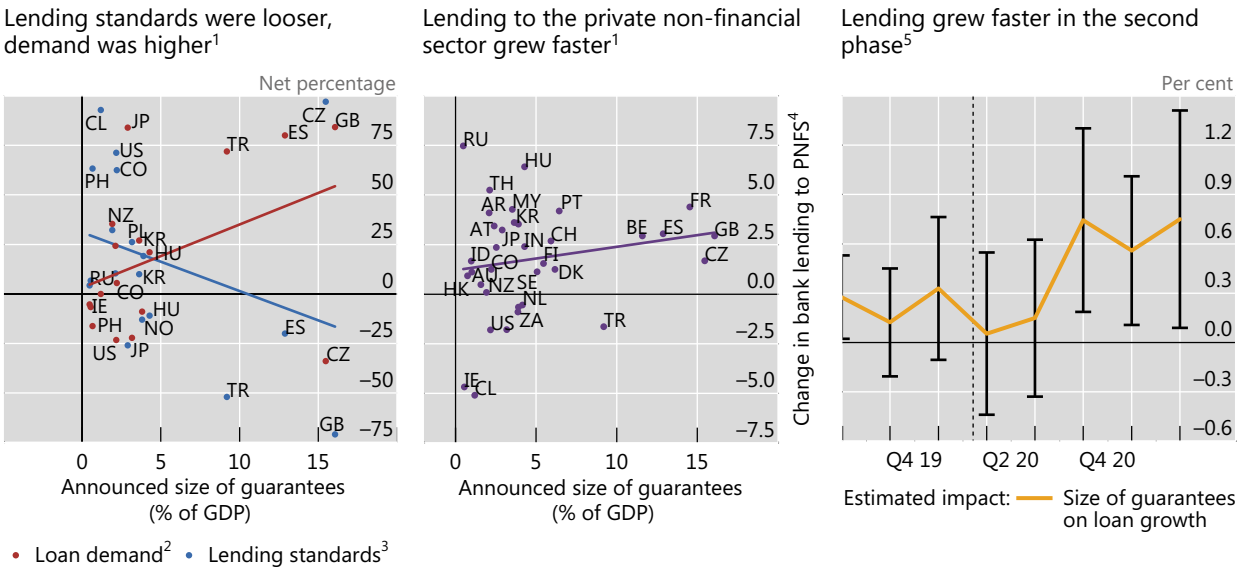
differentiation was most pronounced in the second phase of lending, from Q3 2020 to Q1 2021 (Graph 5, right-hand panel).

Next, we study whether guarantee programmes benefited borrowers that needed support. For this, we need to abstract from the drawdown of credit lines, as these reflect predetermined credit access as opposed to the effect of guarantees. Indeed, there is evidence that the drawdown of credit lines was more intense in countries that imposed stricter lockdowns during the early stages of the pandemic (Graph 6, left-hand panel). To look through such developments, which reflect mostly short-term instruments, we consider "long-term" borrowing – with remaining maturity longer than one year. In particular, we consider such borrowing by SMEs,[10] which were a key target of guarantee programmes in many countries. Further, we highlight firms in sectors that were hard hit by Covid restrictions, and so may have been in greater need of funds.[11]

Our results suggest that SMEs, particularly those in sectors hard hit by Covid, were more likely to expand their "long-term" borrowing in countries with more generous guarantee programmes. Firms in such sectors increased their long-term

More generous guarantee programmes seemed to support lending

Graph 5



The dotted vertical line in the right-hand panel indicates 5 March 2020, which marks the initial market turmoil in response to Covid-19, followed by forceful policy actions.

[1] DE and IT are excluded as outliers. Their inclusion would not change the direction of the fitted lines. [2] Based on banks' responses to surveys on demand for loans from non-financial corporates between 31 March and 30 June 2020. Net percentage of banks indicating an increase vs a decrease; smaller values indicate weaker demand. [3] Based on banks' responses to surveys on their lending standards for loans to non-financial corporates between 31 March and 30 June 2020. Net percentage of banks indicating that they tightened their standards vs loosened them; negative values indicate a loosening and positive values indicate a tightening. [4] Growth rate of bank lending to the private non-financial sector (households and non-financial corporations) as a percentage of GDP from end-Q2 to end-Q4 2020. [5] For an interpretation of the panel, see Graph 4. In the underlying regression, the announced size of the guarantee package in the country of the bank's headquarters replaces the capacity change measures.

Sources: ECB; IMF, *Fiscal Monitor Database*, October 2020; IMF, *Lending Surveys Monitor,* June 2021; FitchConnect; BIS; authors' calculations.

[10] We define SMEs as firms with total assets on balance-sheets not exceeding USD 50 million. SMEs generally do not issue significant amounts of debt securities, so their debt liabilities should largely comprise bank loans.

[11] Sectors hard hit by Covid include airlines, hotel, restaurants and leisure, entertainment, textiles, apparel and luxury goods, as in Banerjee et al (2021).

debt by 3% of assets in countries where the announced guarantees amounted to 10% of GDP or more (Graph 6, centre panel). There was no such increase where the guarantee packages were smaller. Firms in other sectors seemed to benefit from larger guarantee programmes as well, but to a lesser degree.

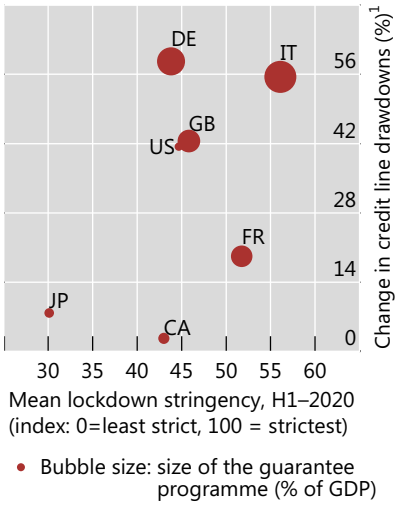
We also find that the set of SMEs accessing bank credit expanded in countries with more generous guarantee terms. The share of firms that obtained new debt in 2020 and which had not raised any debt over the previous two years was substantially higher in hard-hit sectors, and was even higher in jurisdictions in which guarantees covered 100% of the loan. This share was 2.5% in hard-hit sectors, but only 1% in other sectors (Graph 6, right-hand panel, black dots). In hard-hit sectors, it was 2.3% when guarantees did not cover the full amount of the loan but rose to 2.8% with full coverage (bars). These results are consistent with evidence from Switzerland, where many SMEs without pre-existing bank debt are likely to have participated in the guaranteed loan programme (Fuhrer et al (2020)).

Admittedly, the data underpinning the analysis in this section do not allow us to identify what part of the lending during the pandemic was actually subject to guarantees. Regardless, the results suggest that guarantees – likely to have been supported by other fiscal support measures, such as furlough schemes, tax relief or direct subsidies (IMF (2021a)) – encouraged banks to lend by providing reassurance that credit risks had been contained and a self-reinforcing credit crunch had been avoided.

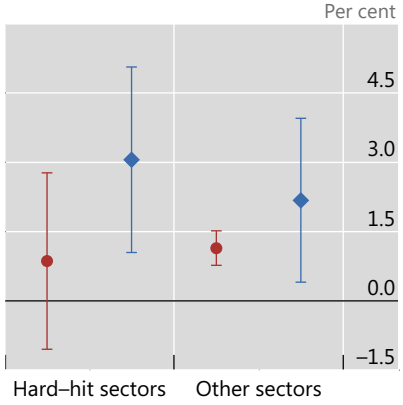
Larger guarantee programmes led to an increase in long-term SME debt

Graph 6

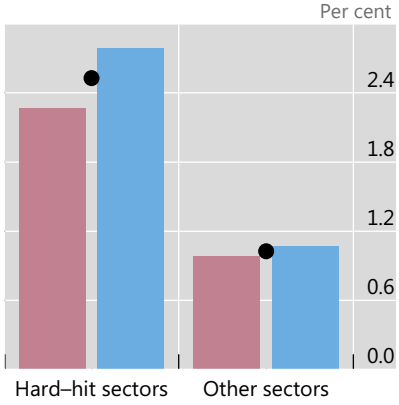
More credit-line drawdowns and larger guarantee programmes accompanied stricter lockdowns



SMEs in hard-hit sectors increased long-term debt by more where guarantee programmes were larger[2]



Full guarantees were associated with a higher share of borrowers without recent credit history[3]



[1] Change between Q2 2019 and Q2 2020. [2] Point estimates of the change in long-term debt relative to total assets (dots and diamonds) on long-term borrowing in 2020, and the attendant 95% confidence intervals (whiskers), stem from the following weighted panel regression: $(\Delta LTDebt_{ijct}/TotalAssets_{ijc,2019}) * 100 = \alpha_j + \alpha_c + T_t + \beta_1 HardHit_{j,t} + \beta_2 Guarantee_{c,t} + \beta_3 HardHit_{j,t} * Guarantee_{c,t} + \varepsilon_{ijct}$, where c denotes a country, t a year, j an industry, *HardHit* is equal to 1 for hard-hit industries and 0 otherwise, and *Guarantee* is equal to 1 for countries where the guarantee package amounted to 10% or more of GDP and to 0 otherwise. Weights are inversely proportional to the number of observations from a country. The firms in the sample have average total assets below $50 million from 2018 to 2020. The data panel comprises more than 1.35 million SMEs in 13 countries from 2018 to 2020. Standard errors of the regressions are two-way clustered at the country and industry level. [3] Share of first-time borrowers based on a simple average for 2020 after aggregating the underlying sample at the country level with a split into hard-hit and other sectors, as well as the guarantee coverage. Black dots represent the average share of first-time borrowers in each sector, irrespective of guarantees.

Sources: IMF, *Fiscal Monitor Database*, October 2020; Oxford University, Blavatnik School of Government; S&P Capital IQ; BIS; authors' calculations.

Moving forward: trade-offs and unwinding

Policy measures that helped expand bank lending capacity and provided incentives for banks to lend seemed to support lending through the Covid-19 pandemic. Existing capacity accommodated the sudden drawdown of pre-negotiated credit lines. Once the Covid-19 crisis set in, backstopping the erosion of bank capital was essential for supporting the further flow of credit. In turn, there needed to be incentives for banks to utilise that capacity for lending to new or existing borrowers. Loan guarantees provided such incentives. In sum, measures targeting banks and their borrowers directly appeared to be effective at cushioning the pandemic's fallout and prevented a simultaneous credit crunch across banks.

Looking forward, policymakers face the challenge of appropriately timing the phasing out of support measures. On the one hand, withdrawing guarantees too early might cause an abrupt credit crunch where collateral values are low, making it impossible for firms, especially SMEs, to roll over their debt. This in turn could generate a wave of defaults (Juselius and Tarashev (2021)). On the other hand, keeping guarantees for too long creates moral hazard by encouraging banks to lend to non-viable, over-indebted firms, with the risk of zombification and evergreening these loans (Borio and Restoy (2020)). Further, the larger the volume of guaranteed debt, the bigger the potential dent in sovereign budgets.

The sequence and speed of withdrawing the different policy measures is also key. It is important that banks maintain sufficient capacity to absorb any additional losses that may materialise when fiscal support and guarantees are withdrawn (Drehmann et al (2020)). It is with these losses in mind that supervisors will need to assess the adequacy of banks' capitalisation.

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Annex

Definitions of policy measures in the article — Table 1

Policy type	Primary mechanism	Policy category	Definition
Moratoriums	Expand capacity	Fiscal	Deferral of loan repayments. Includes both corporate and household loans. Includes both the principal-only and full debt-service moratoriums.
Capital buffers	Expand capacity	Prudential	Includes changes to the counter-cyclical capital buffer, capital conversation buffer, DSIB buffer, GSIB buffer, and other jurisdiction-specific buffers. Also includes encouragement from supervisory authorities to use these buffers if needed.
Other capital measures	Expand capacity	Prudential	Risk weights and leverage ratio.
Loss treatment	Expand capacity	Prudential	Treatment of expected losses, treatment of non-performing loans or assets.
Liquidity measures	Expand capacity	Prudential	Liquidity coverage ratio, liquidity management terms, loan-to-deposit limits, reserve requirements, jurisdiction-specific liquidity buffers, encouragement to use liquidity buffers.
Payouts	Expand capacity	Prudential	Restriction on capital distributions. This could include dividends, share buybacks or executive bonuses.
Guarantees	Incentivise lending	Fiscal	State-backed guarantees on loans.
Transfers	Incentivise lending	Fiscal	Fiscal measures such as direct spending, tax cuts, unemployment programmes, social security, grants and subsidies.
Lending operations	Incentivise lending	Monetary	All tools involving central banks' lending to the private and public sectors.
Funding for lending	Incentivise lending	Monetary	Programmes that provide low-cost funding to banks, strictly conditional on increased lending to corporates (and/or households). Subset of lending operations.

Sources: Reserve Bank of Australia; ECB; Bank of Korea; Board of Governors of the Federal Reserve; Asian Development Bank; FSB; IMF; OECD; European Banking Authority; European Systemic Risk Board; Yale COVID-19 Financial Response Tracker; national data; BIS; authors' elaboration.

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Seven decades of international banking[1]

International banking grew rapidly from the 1950s to the 2000s, propelled by banks avoiding regulations that burdened their domestic funding, by financial liberalisation that expanded investment opportunities, and by financial innovation that offered new tools to manage risks. The core of the market is offshore, where lenders and borrowers transact in currencies foreign to them both. Competition among banks for market share contributed to surges in international lending that amplified credit booms preceding major financial crises. Losses during the Great Financial Crisis, and regulatory reforms in its wake, have constrained banks' expansion, making way for non-bank financial institutions to step in as major international creditors.

JEL classification: F33, F34, G01, G15, G21

From the ashes of the Second World War, international banking re-emerged starting in the 1950s. In 1963, when the BIS started to collect data, banks' outstanding international claims amounted to less than 2% of world GDP. They grew rapidly in the following decades, peaking above 60% in 2007 before retreating to near 40% in early 2021 (Graph 1, left-hand panel). As the market expanded, the early predominance of interbank activity in a few major currencies gave way to business with non-bank financial and non-financial counterparties in a multitude of currencies. This feature explains the structural and cyclical factors behind these developments.

Regulatory arbitrage, financial innovation and financial liberalisation were key drivers. Regulations that raised the costs of domestic intermediation made it attractive for banks to borrow and lend abroad. The development of new financial products, including syndicated loans and derivatives, altered the way that banks managed risks in their international portfolios. The transition of the broader international financial system from a tightly managed one with extensive exchange controls and capital account restrictions to today's market-driven, integrated system was both a cause and a symptom of international banking's growth.

Alongside these structural factors, global financial imbalances have shaped and been shaped by international banking. Cross-border lending enabled the credit booms at the heart of several international financial crises, notably the Latin American debt crisis in the early 1980s, the Asian financial crisis in the late 1990s and the Great Financial Crisis (GFC) of 2007–09. Ahead of each crisis, competition among banks for market share contributed to surges in international credit.

[1] The authors thank Iñaki Aldasoro, Claudio Borio, Stijn Claessens, Bryan Hardy, Wenqian Huang, Benoit Mojon, Hyun Song Shin, Nikola Tarashev and Goetz von Peter for helpful comments and discussion, and Swapan-Kumar Pradhan for excellent research assistance. The views expressed in this article are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

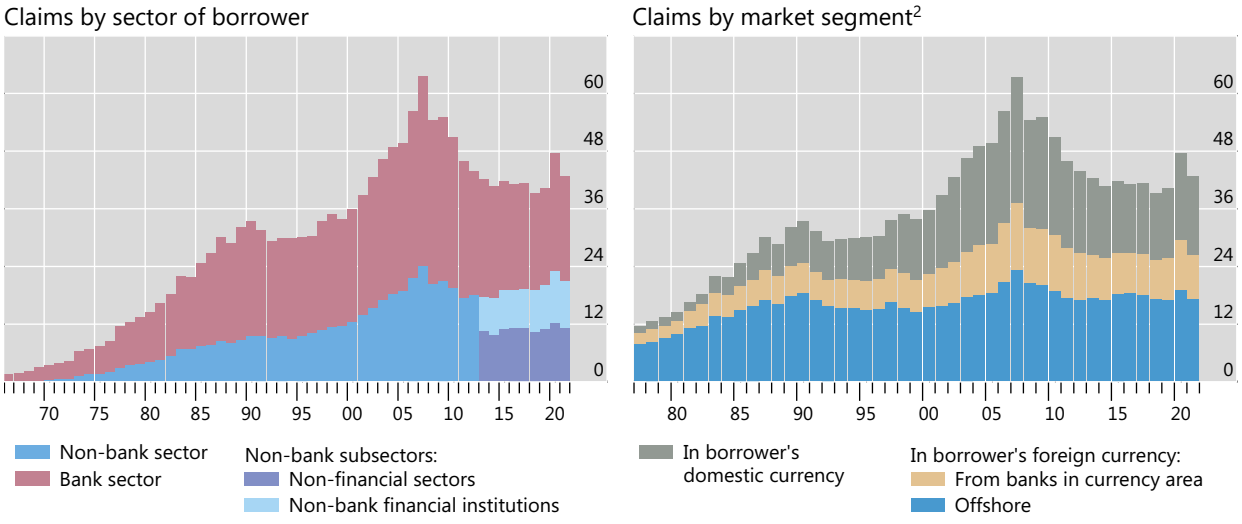
Key takeaways

- International banking since the 1950s has taken place mainly offshore, where lenders and borrowers transact in currencies foreign to them both.
- Regulatory arbitrage, financial liberalisation and financial innovation drove a multi-decade expansion of international banking, which peaked at over 60% of world GDP on the eve of the Great Financial Crisis.
- Competition among banks for market share contributed to surges in international lending that amplified credit booms preceding major financial crises.
- Losses during the Great Financial Crisis, and regulatory reforms in its wake, constrained banks' expansion and accelerated the rise of non-bank financial institutions as international creditors.

The rest of this feature is organised as follows. The next section describes how segments of the international banking market have evolved since the 1950s; Box A defines those segments and Box B describes the available data. The following sections analyse how regulatory arbitrage and financial innovation shaped the market's development. The penultimate section assesses how international credit enabled booms ahead of financial crises, and the final section outlines policymakers' response to the challenges posed by international banking.

International banking outpaced world GDP until the GFC

Outstanding international claims of banks in BIS reporting countries, as a percentage of world GDP[1] Graph 1



[1] International claims comprise cross-border claims in all currencies plus local claims in foreign currencies; end-year, except end-March 2021. Data completeness improves over time; for breaks in series, see Box B. [2] For definitions of market segments, see Box A.

Sources: IMF, *World Economic Outlook*; World Bank; BIS locational banking statistics; authors' calculations.

Box A

What constitutes international banking?

*Robert McCauley, Patrick McGuire and Philip Wooldridge*①

International banking comprises cross-border business in any currency and local business in foreign currencies. It consists of three market segments, which are distinguished principally by whether a transaction is denominated in a currency that is foreign to the borrower, the lender or both of them (Table A1, coloured areas).

The first two segments constitute traditional international banking, where the currency is foreign to either the lender or the borrower but not both. One segment is cross-border lending by residents of a given jurisdiction in their domestic currency (Graph 1, right-hand panel, brown area). For example, a bank in New York might lend US dollars to a borrower in London or Tokyo (Table A1, brown area). The other segment is also cross-border but involves residents borrowing in their domestic currency from a bank abroad (Graph 1, right-hand panel, grey area). For example, a company in New York might borrow US dollars from a bank in London or Tokyo (Table A1, grey area). Both of these examples involve a counterparty that is a non-US resident and thus transacts in a foreign currency. For ease of interpretation, in this feature we define the currency from the borrower's perspective and thus refer to the first transaction as foreign currency (because the borrower is a non-US resident) and the second as domestic currency (because the borrower is a US resident).②

The third segment is the offshore market, which was historically known as the "eurocurrency" market because it developed first in Europe (Graph 1, right-hand panel, blue area). The defining characteristic of this market is that business is denominated in a currency that is foreign to both parties. For example, a bank in Tokyo might lend US dollars to a bank in London, which might then onlend the dollars to another borrower in London (Table A1, blue area). While the first is a cross-border transaction and the second a local one, both are denominated in a currency that is foreign to the parties involved because all are non-US residents. Likewise, euro-denominated transactions between parties outside the euro area, and yen ones between parties outside Japan, are offshore.

The three segments are closely linked. Banks inside a currency area with surplus funding can channel it to the offshore market, and vice versa. Each segment is represented on major banks' balance sheets. For instance, reserves held by banks at the central bank (a domestic claim) can be used to settle domestic, international or offshore claims in the relevant currency (Aliber (1980)).

Segments of international banking: example for a US dollar loan[1]

Table A1

Lending bank \ Borrower		Residents of currency area	Non-residents of currency area	
		Borrower in US	Borrower in GB	Borrower in JP
Residents of currency area	Bank in US	Domestic claim	**Cross-border claim in borrower's foreign currency**	
Non-residents of currency area	Bank in GB	**Cross-border claim in borrower's domestic currency**	**Offshore claim[2]**	
	Bank in JP			

[1] This example applies to any currency area that corresponds to a country. The euro adds complexity because euro transactions between euro area countries are cross-border but denominated in the domestic currency of both the borrower and lender. Based on the borrower's perspective, such transactions are classified as cross-border claims in the borrower's domestic currency (grey area). [2] Includes local business between residents of the same country denominated in a foreign currency (eg US dollar credit from a bank in GB to a borrower in GB).

① The views expressed in this article are those of the authors and do not necessarily reflect those of the Bank for International Settlements. ② This contrasts with the usual perspective in the BIS international banking statistics, where the currency is defined as domestic or foreign depending on the residence of the reporting bank.

The offshore core of international banking

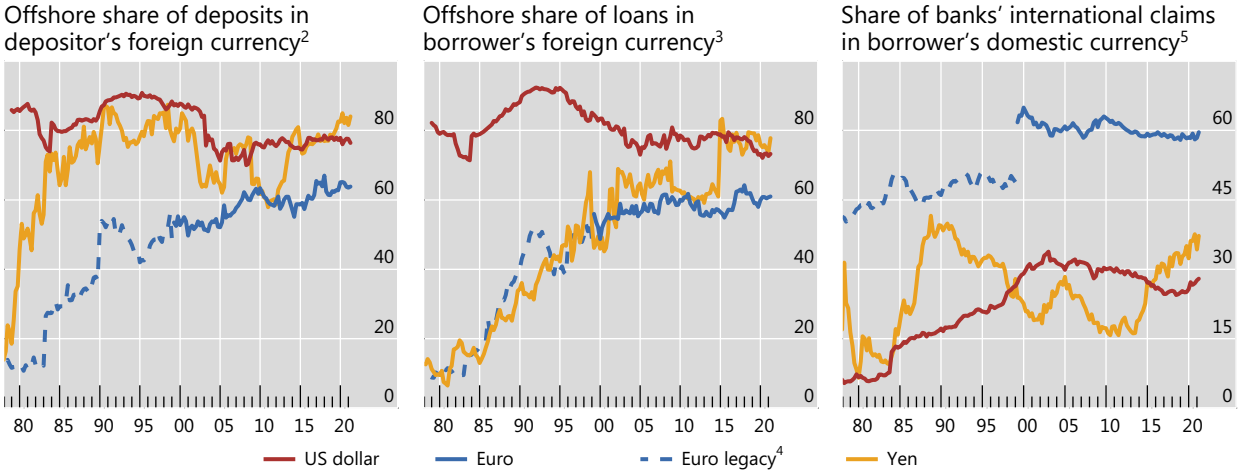
International banking is an amalgamation of cross-border and foreign currency business. It consists of three segments (Box A). The first two encompass traditional international banking: cross-border transactions in the domestic currency of either the lender or the borrower. For example, a US dollar loan from a bank in the United States to a borrower abroad (Graph 1, right-hand panel, brown area), or a dollar loan from a bank outside the United States to a borrower inside (grey area). The third segment is the offshore market (blue area), where business is denominated in a currency that is foreign to both the lender and the borrower.

After the Second World War, the offshore segment emerged as the core of international banking. For many centuries banks had used funds raised in their home country to finance international trade and extend loans to foreign kings and governments. In the 1950s, this traditional model started to give way to one where banks funded their international business from abroad. By the mid-1970s, the offshore market constituted the bulk of international claims (Graph 1, right-hand panel, blue area).

Lenders and borrowers have opted overwhelmingly to conduct their foreign currency business in the offshore market. For example, non-banks outside the United States place only a small fraction of their US dollar deposits with banks in the United States. The share of their dollar deposits in banks outside the United States was as high as 90% in the early 1990s and averaged 77% over the 2000–21 period (Graph 2, left-hand panel). Similarly, they borrow US dollars mainly from banks outside the United States (centre panel). For the euro too, the offshore market is where non-banks outside the euro area prefer to transact – to a lesser degree than for the dollar but to a greater degree than for euro legacy currencies. And non-banks outside Japan have deposited their yen mainly in banks outside Japan since the mid-1980s. Their borrowing of yen from banks outside Japan gained ground more slowly but is now mostly offshore too.

Foreign currency activity is mainly offshore[1]

In per cent — Graph 2



[1] For definitions of the market segments shown in each panel, see Box A. [2] Deposits held by non-bank depositors. [3] Loans to non-bank borrowers. [4] Sum of ATS, BEF, DEM, ESP, FIP, FRF, IEP, ITL, LUF, NLG, PTE and XEU. [5] Claims on all sectors.

Sources: BIS locational banking statistics; authors' calculations.

The significance of offshore banking is reflected in London's premiere position in international banking. Even though the US dollar has been the leading currency during the post-war era (Graph 3, right-hand panel), New York's pre-eminence in international banking was short-lived (Kindleberger (1974)). London came to the fore already in the 1960s, where it has remained in most years despite sterling's small share of international claims. In the 1970s, more than a quarter of international claims were booked at banks in the United Kingdom, mainly in London (left-hand panel). In the late 1980s, Japanese banks' attachment to the traditional cross-border banking model briefly put Tokyo ahead. London's share rebounded during the decade before the GFC and, while subsequently losing ground to Asian financial centres, it remained on top at end-March 2021 with a 16% share.

Origins in regulatory arbitrage

From the outset, offshore banking attracted business by avoiding some regulations that applied to domestic banking. Differences in the regulatory treatment of banks' domestic and offshore funding created the equivalent of a tax wedge, which enabled banks abroad to offer higher interest rates to depositors and lower ones to borrowers. US regulations had the greatest impact, given the dollar's dominant role in international banking. Regulations in other countries also created opportunities for the offshore market in the Deutsche mark, yen and other currencies to grow.

The most relevant regulations included ceilings on deposit rates, reserve requirements and deposit insurance premiums. As early as 1955, a London bank priced US dollar deposits at yields above the US deposit rate ceiling (Schenk (1998)). In 1966, when the deposit rate ceiling bound in the United States, the big US banks turned to their London offices to replace lost domestic deposits (Klopstock (1968)). Without the costs on intermediation imposed by reserve requirements and deposit insurance, banks outside the United States regularly offered higher rates than banks inside, and Europeans, especially central banks, quickly accepted the novelty of offshore dollar deposits (BIS (1964)). US multinationals too deposited dollars abroad, and from the 1970s US money market funds channelled US households' and corporates' dollars into offshore accounts.

Regulations incentivised banks not only to raise dollar funding outside the United States but also to lend dollars from abroad, including to US residents (Graph 1, right-hand panel, grey area). After the US Federal Reserve extended reserve requirements to cover banks' net dollar funding from abroad in 1969, foreign banks avoided them by booking loans to US firms at affiliates outside the United States (McCauley and Seth (1992)). In 1970, with credit ceilings and reserve requirements restricting lending in much of Europe, European corporates borrowed substantial amounts of dollars offshore for the first time (BIS (1971)).

Over time, the easing of national regulations has reduced opportunities for arbitrage. For example, the United States removed the interest rate ceiling on large deposits in 1970. Also, as yields fell in the 1980s, reserve requirements imposed smaller opportunity costs, and the Fed set them to zero in 1990. However, US deposit insurance still confers an advantage on offshore dollar deposits (Kreicher et al (2014)).

More generally, financial liberalisation resulted in a gradual shift in the composition of international banking away from the offshore market. The opening of capital accounts and deregulation of financial systems by many advanced and

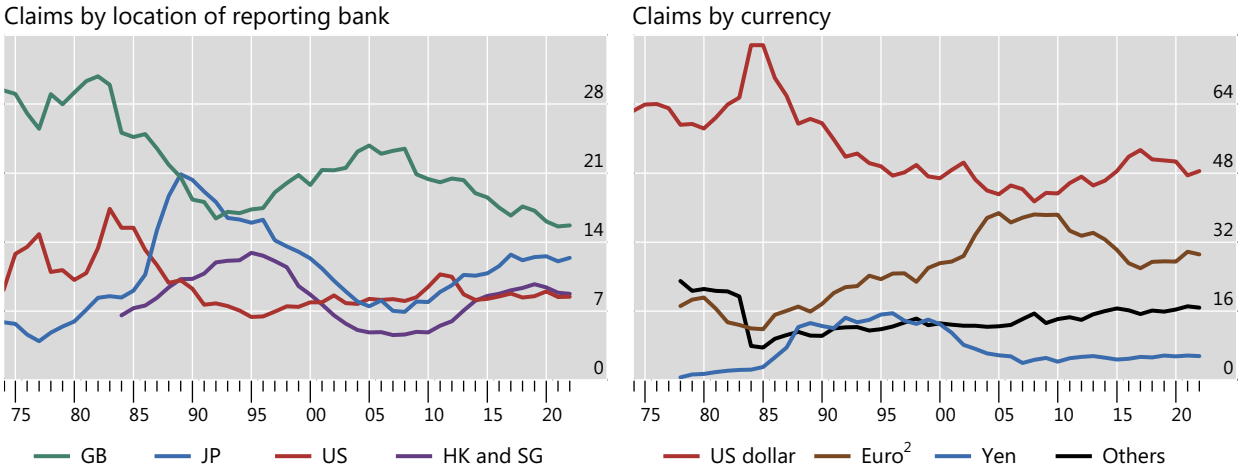
emerging market economies (EMEs) starting in the 1980s spurred growth in other segments. The offshore segment's share thus declined from close to 70% in the late 1970s to around 40% in 2021.

What displaced offshore banking was cross-border business in the borrower's domestic currency. Whereas such activity accounted for slightly more than 10% of international claims in the late 1970s, it accounted for almost 40% in early 2021 (Graph 1, right-hand panel, grey area). For the US dollar, cross-border claims on US residents expanded more rapidly than those on non-US residents until the mid-2000s (Graph 2, right-hand panel). For the euro, cross-border claims on euro area residents – which account for a majority of euro-denominated claims – rose rapidly after the currency's launch. Their growth propelled the euro's share of international claims to nearly 40% in the mid-2000s, although it then fell in the wake of the GFC and European sovereign debt crisis of 2010–12 (Graph 3, right-hand panel).

In effect, financial liberalisation reduced the scope for regulatory arbitrage and broadened investment opportunities. Whereas in the 1960s and 1970s banks had mainly extended foreign currency credit to other banks that subsequently onlent the funds, starting in the 1980s they increasingly extended credit directly to the final borrower in the borrower's currency. The share of international credit denominated in a currency other than the US dollar, yen or euro has risen steadily since the mid-1980s, from 10% to 17% at end-March 2021 (Graph 3, right-hand panel). Moreover, financial liberalisation led to an expansion of multinational banking, where banks fund their activities locally in the currency of the country where their affiliates operate (McCauley et al (2010)). In early 2021, foreign banks' local claims in EMEs were almost as large as their international claims, and globally their local claims were about three quarters as large (Graph 4, left-hand panel).

Declining but still pre-eminent role of London and the US dollar

As a percentage of outstanding international claims of banks in BIS reporting countries[1] Graph 3



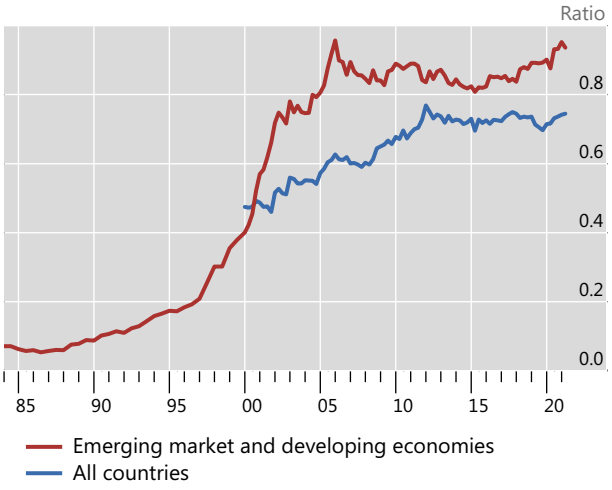
[1] End-year, except end-March 2021. Data completeness improves over time; for breaks in series, see Box B. [2] Prior to Q1 1999, sum of euro legacy currencies.

Sources: BIS locational banking statistics; authors' calculations.

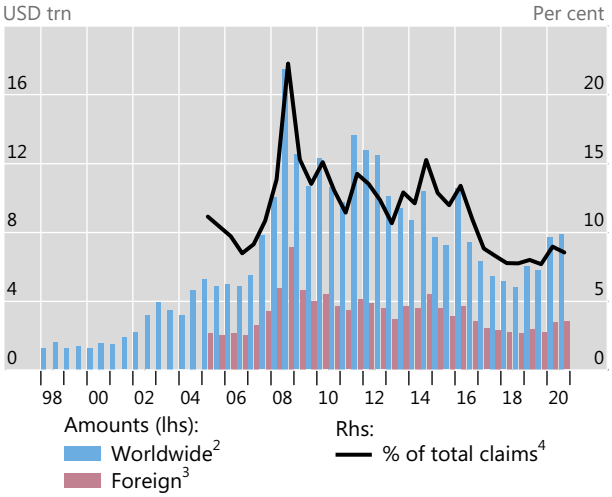
Diversification into local currency assets and derivatives

Outstanding claims of banks in BIS reporting countries, on a consolidated basis — Graph 4

Local claims denominated in local currencies as a ratio of international claims[1]



Derivatives with a positive fair market value



[1] Local claims refer to claims of banks' foreign affiliates on residents of their host countries. [2] Over-the-counter derivative claims on counterparties worldwide. [3] All derivative claims on counterparties outside the bank's home country. [4] Derivative claims as a percentage of total claims (inclusive of derivatives) on counterparties outside the bank's home country, including claims of banks' foreign affiliates on residents of their host countries.

Sources: BIS consolidated banking statistics; BIS OTC derivatives statistics; authors' calculations.

Propagator of financial innovation

International banking was sometimes an incubator and more often a propagator of financial innovation. New or enhanced financial products, notably syndicated loans and derivatives, significantly altered the way that banks managed the risks associated with their international portfolios.

The development in the late 1960s of syndicated loans made it easier for banks to manage their credit risk exposures. The syndication process enabled smaller banks to participate in international loans and facilitated the trading of loans in the secondary market. It also increased the size of loans available, which attracted a wider range of borrowers, including sovereigns, who might otherwise have tapped bond markets. Syndicated loans typically took the form of medium-term floating rate loans, with interest rate risk that matched banks' short-term deposits. Owing to London's pre-eminent role in the offshore market, the London interbank offered rate (Libor) emerged in the 1970s as the standard reference rate for floating rate contracts.

Innovations in derivatives markets further reshaped banks' international business. Prior to the 1980s, banks had hedged risks or taken positions by transacting in the interbank market at different maturities and in different currencies (CGFS (1986)). This had inflated interbank positions on their balance sheet. The development of interest rate, foreign exchange (FX) and credit derivatives enabled banks to shift risk management activities off their balance sheets. In effect, derivatives made it easier for banks to decouple the risk profile of their portfolios from their

origination business. Banks' worldwide derivative assets increased from about $1 trillion in the late 1990s to $8 trillion at end-2020, with considerable variation during the intervening period (Graph 4, right-hand panel, blue bars). Over one third of their derivative assets have been with foreign counterparties (red bars), and at end-2020 these assets accounted for around 8% of total foreign exposures (black line).

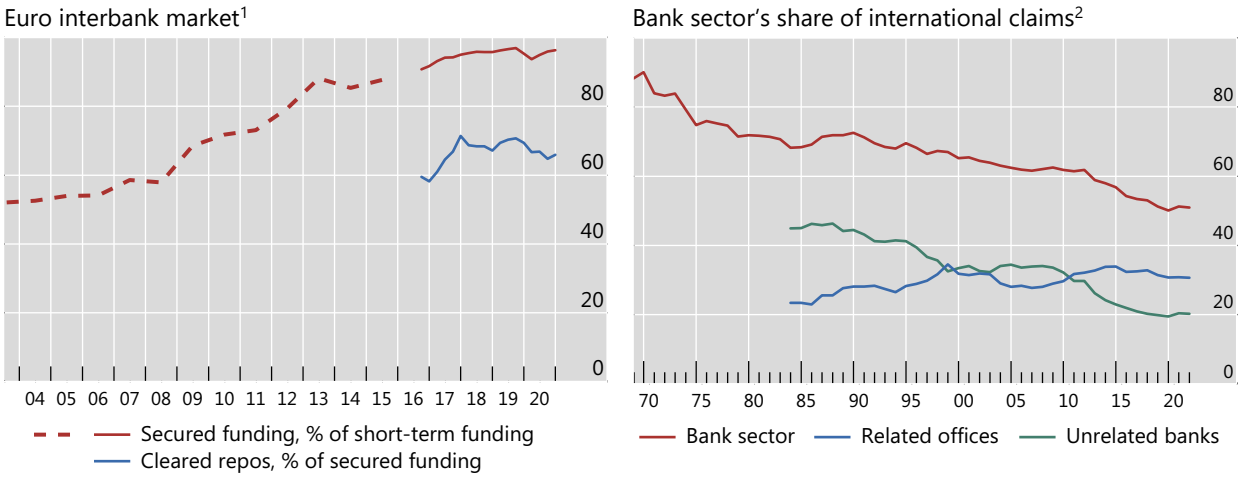
The expansion of secured funding markets also changed banks' management of credit exposures. As well as broadening banks' access to money market investors, repos further reduced their interbank exposures, albeit by increasing exposures to central counterparties. For example, in the euro money market, unsecured funding dwindled to a small fraction of short-term funding after the GFC (Graph 5, left-hand panel). In turn, the growing share of repos backed by high-quality collateral underpinned higher standardisation and thus greater use of central clearing.

The expansion of derivatives and cleared repos has made interbank links more complex and opaque. Specifically, while transactions among banks remain an integral part of international banking, fewer of them appear as such on banks' balance sheets than in the past.[2] The BIS locational banking statistics, which track on-balance sheet positions, indicate that interbank assets peaked in 1989 at 73% of international claims, but had fallen to around 50% by early 2021 (Graph 5, right-hand panel). Excluding intragroup positions – ie business between offices of the same banking group – the decline is even more pronounced, from 44% in 1989 to 20% in 2021.

Interbank activity receded and shifted to secured funding

In per cent

Graph 5



[1] Based on average daily turnover of secured and unsecured funding in the euro money market, excluding commercial paper, certificates of deposit, overnight index swaps and FX swaps. Ratio of cleared repos to secured funding refers to all sectors. Data for 2016–21 are quarterly averages from the ECB's money market statistical reporting (MMSR); data prior to 2016 refer to the second quarter of each year and are from the ECB's money market survey, adjusted for comparability with MMSR. [2] Sectoral shares are partly estimated from reported data.

Sources: ECB (2021); BIS locational banking statistics; authors' calculations.

[2] One example is the clearing of derivatives and repos, which replaces a position between two banks with a position between each bank and a central counterparty. Another is FX swaps, which are a key funding tool although their principal value does not appear on-balance sheet (Borio et al (2017)).

Competition for market share and credit booms

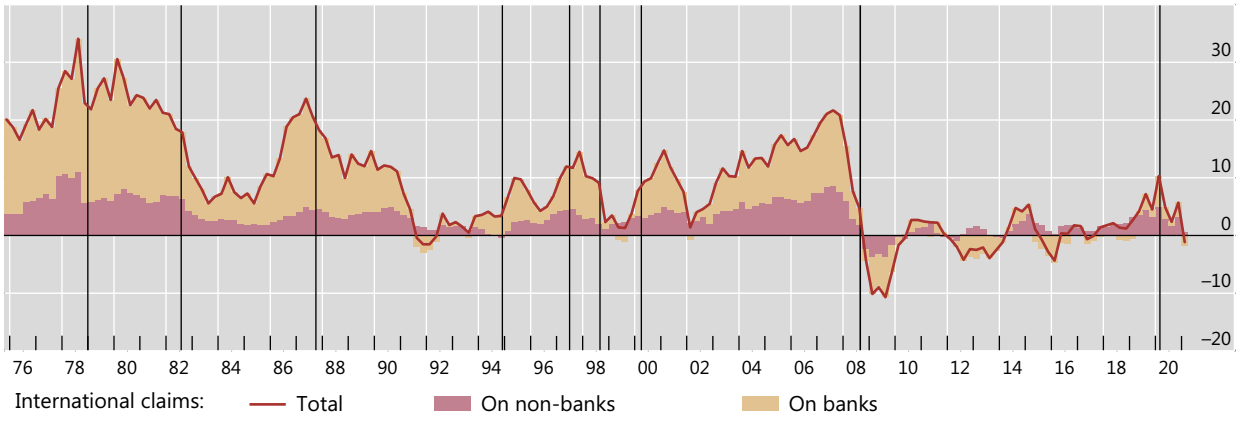
The combination of regulatory arbitrage and financial innovation had, by the 1970s, transformed international banking into a powerful machine to extend credit. Financial liberalisation and competition among banks for market share fuelled the machine and provided a further impetus to growth. US banks were the dominant international lenders in the 1970s. Japanese banks replaced them in the 1980s (Graph 6, bottom panel). Throughout the 1990s and 2000s, European banks gained market share, which they then ceded after the GFC.

International bank credit has tended to grow faster than domestic credit, driving the build-up of financial imbalances during booms in borrower countries (CGFS (2011); Borio et al (2011)). Its interbank component is especially volatile, swinging in sync with global booms and busts (Graph 6, top panel). Indeed, financial crises became more frequent after the 1970s owing in part to the credit excesses enabled by international banking. Three peaks in the growth of international claims after 1980 coincided with post-war crises: the Latin American debt crisis in 1982, the Asian financial crisis in 1997, and the GFC in 2007–09 (top panel). The ascendant national banking systems of the day played a key role (bottom panel).

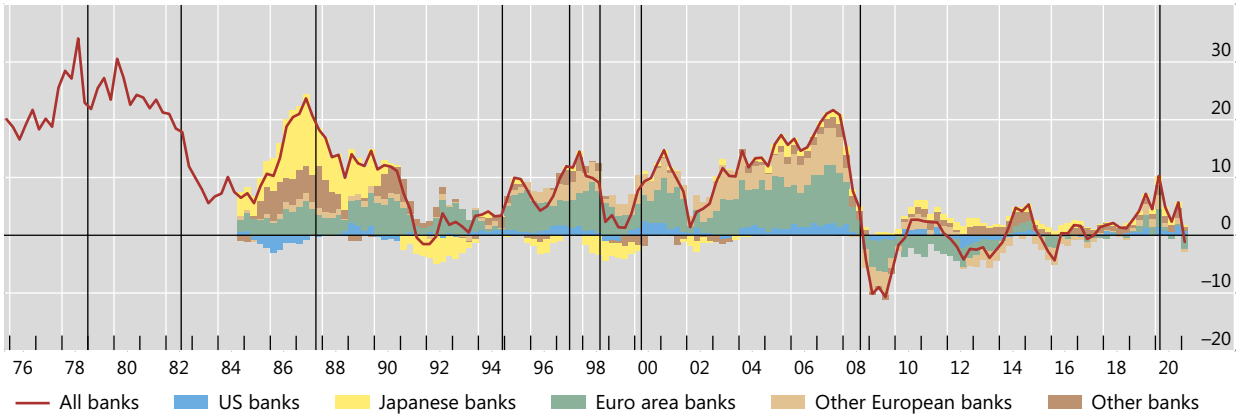
Competition for market share drives booms in international banking

Contributions to year-on-year changes in international claims, in per cent — Graph 6

By sector of counterparty



By nationality of reporting banks



The vertical lines indicate: January 1979 (oil shock); August 1982 (Mexican default); October 1987 (US stock market correction); December 1994 (Mexican peso devaluation); July 1997 (Asian financial crisis); September 1998 (LTCM collapse); April 2000 (Nasdaq peak), September 2008 (collapse of Lehman Brothers); March 2020 (Covid-19 crisis).

Sources: BIS locational banking statistics; authors' calculations.

The 1982 crisis came on the back of a decade-long expansion in international bank credit to EMEs. By the late 1960s, competition among banks had driven down margins on cross-border loans to advanced economies. Seeking higher returns, banks expanded their lending to EMEs, mainly to sovereign borrowers. While US banks dominated lending to EMEs in the early 1970s, Japanese and European banks made inroads as the decade wore on (Devlin (1989)).[3] Following the 1973 rise in oil prices, deposits from oil-producing states further boosted lending to EMEs by easing banks' funding conditions, especially for banks outside the United States.

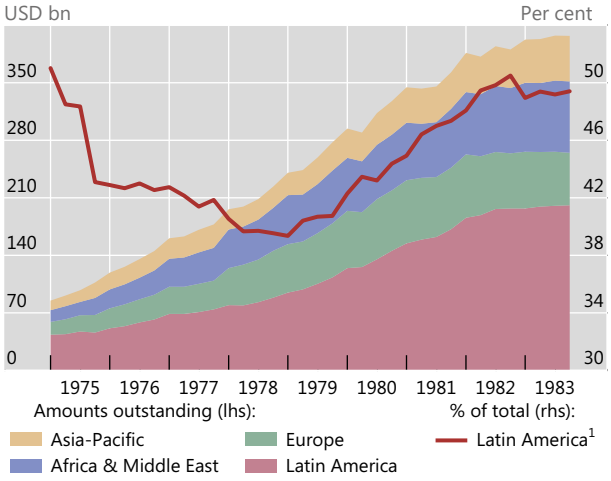
Banks found eager borrowers in Latin America, who initially sought financing for industrialisation and imports and later borrowed to cover the costs of servicing their growing debts. Competition to meet this demand, coupled with a perception that sovereign borrowers were low-risk, resulted in an easing of lending terms amid high volumes (BIS (1979)). Banks' cross-border claims on the region more than quadrupled between end-1974 and mid-1982, from $43 billion to $197 billion, far outpacing the growth of international bank credit to other regions (Graph 7, left-hand panel). However, after Mexico announced in August 1982 that it could not meet its foreign currency debt obligations, international banks found that interest and exchange rate risks, which syndicated loans had in the first instance transferred to borrowers, ultimately emerged as higher credit risk on their own balance sheets.

Competition for market share also featured in the run-up to the Asian financial crisis in 1997. In the 1980s, low capital costs enabled Japanese banks to lever up and expand internationally (Graph 6, bottom panel). In particular, they drove a boom in interbank lending in the second half of the 1980s (top panel). Concerns that Japanese banks were undercapitalised during this period were an impetus for the first Basel capital accord in 1988 (Ito and Hoshi (2020)).

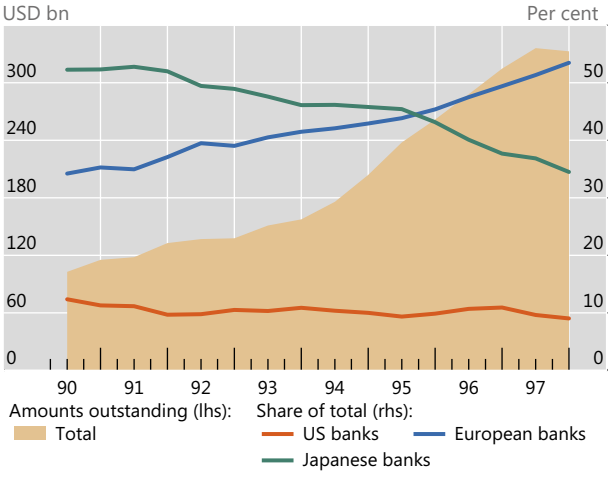
International credit fuelled booms in Latin America and emerging Asia

Graph 7

Cross-border claims on EMEs in the run-up to the Latin American debt crisis, by region of borrowers[1]



International claims on emerging Asia in the run-up to the Asian financial crisis, by nationality of banks[2]



[1] Claims on EMEs are underestimated because they exclude loans channelled through Carribbean financial centres. In Q4 1983, Carribbean centres joined the countries reporting the LBS; their joining boosted claims on EMEs by over 25%. [2] International claims comprise cross-border claims and local claims in foreign currencies.

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

[3] According to the BIS consolidated statistics, at end-1984 US banks accounted for 41% of the $227 billion stock of international claims on Latin America, Japanese banks 18%, UK banks 10% and French banks 8%. Comparable data are not available for earlier years.

The bursting of Japan's asset price bubble starting in 1990 ushered in an extended period of retrenchment for Japanese banks, but not from everywhere. Japanese banks' claims on emerging Asia doubled between end-1990 and mid-1997, from $60 billion to $124 billion. They were by far the largest foreign creditors to the region, accounting for about one third of international credit on the eve of the Asian financial crisis (Graph 7, right-hand panel). The credit boom in emerging Asia also brought in European banks, whose combined share of claims on the region rose from 35% at end-1990 to 51% in mid-1997.

Thailand's abandonment of its currency peg in July 1997 triggered a pullback by banks, initially from Asia but by 1998 globally. The growth of international bank claims slowed from 15% in late 1997 to 10% in mid-1998 and, following the collapse of the hedge fund Long-Term Capital Management in October 1998, to 1% in mid-1999 (Graph 6, top panel).

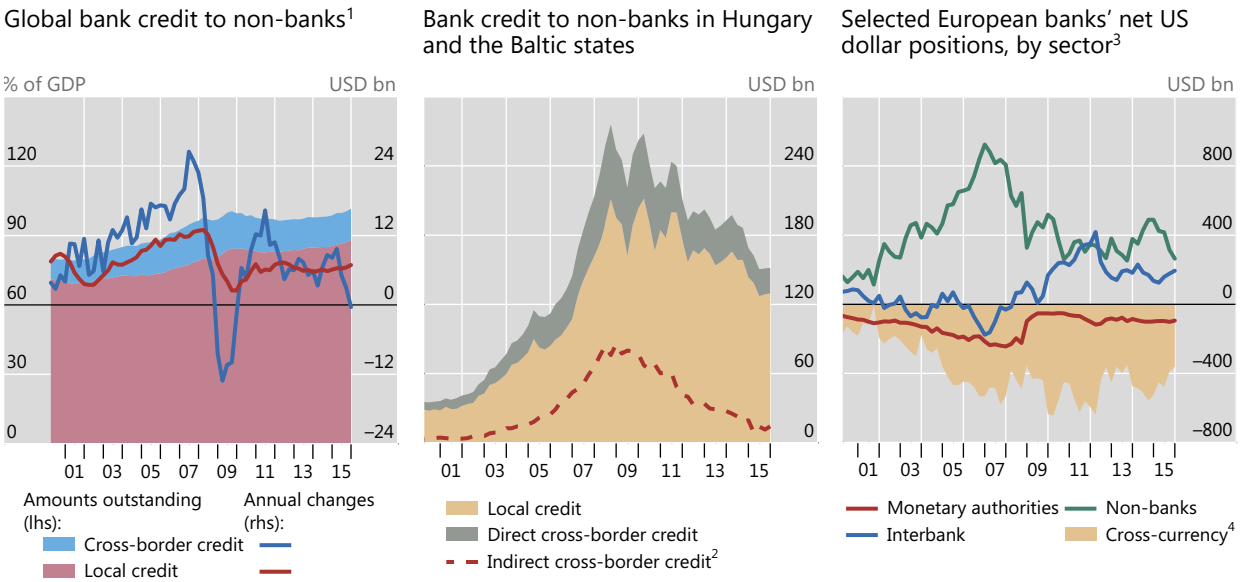
Competition for market share and the resultant lowering of credit standards again came into play in the build-up to the GFC. With few regulatory limits on overall leverage, European banks, in particular Belgian, Dutch, German, Swiss and UK institutions, as well as US investment banks geared up their balance sheets. In doing so, they drove the growth of international bank credit above 20% in mid-2007 (Graph 6, bottom panel).

The accelerating growth in international credit during this period enabled – both directly and indirectly – credit booms in many borrower countries, advanced economies and EMEs alike. Banks' *direct* cross-border credit to non-banks grew at a much faster clip in the run-up to the GFC than did local bank credit (Graph 8, left-hand panel) (CGFS (2011)). Banks also lent cross-border to local banks that then channelled the funds to resident non-bank borrowers. This *indirect* channel allows credit growth to outrun domestic deposit growth. As cases in point, direct and indirect cross-border credit to non-banks in Hungary and the Baltic states grew rapidly in the years preceding the GFC, and by 2008 accounted for more than half of the outstanding bank credit in those countries (centre panel).

The development of collateralised debt obligations and credit derivatives linked to them enabled European banks to participate in the US housing boom in the mid-2000s even in the absence of any US mortgage origination business. Their dollar assets increased more quickly than their dollar liabilities, leaving them with a large funding gap – an excess of dollar assets over dollar liabilities – that is typically hedged through FX swaps (Graph 8, right-hand panel, shaded area). The bursting of the US house price bubble in 2008 and the seizing-up of dollar funding markets following the collapse of Lehman Brothers compelled banks to deleverage, which pushed the growth in international claims far into negative territory in 2009 (Graph 6, top panel).

Following the GFC, the growth in international banking has been subdued. After suffering big losses, European banks shrank their balance sheets by retreating from international markets. At the same time, the Canadian, Chinese, Japanese and several smaller banking systems have expanded their global reach. Nevertheless, since 2008 banks' international claims have not kept pace with global economic activity (Graph 1, left-hand panel). International banking has been constrained in part by the post-GFC reforms in bank regulation, which raised banks' risk-based capital requirements, tightened leverage limits, and placed controls on the mix of funding instruments to contain liquidity risk. These measures have increased banks' shock-absorbing capacity but have also raised the cost of balance sheet space (Borio et al (2020)).

Credit boomed and funding gaps built up ahead of the GFC Graph 8



[1] Cross-border claims on the non-bank sector plus local claims on the private non-financial sector. [2] Net cross-border interbank claims (claims minus liabilities). [3] Swiss, German and UK banks; estimated following methodology in McGuire and von Peter (2009). [4] Implied cross-currency funding that equates gross US dollar assets and liabilities.

Sources: IMF, *International Financial Statistics*; BIS global liquidity indicators; BIS locational banking statistics; authors' calculations.

In banks' place, non-bank creditors have stepped in. The BIS global liquidity indicators show that outstanding dollar credit to non-bank borrowers outside the United States more than doubled between mid-2008 and end-March 2021 to $13 trillion. Yet over this period the share of bank loans fell from 60% to only 47%. Non-bank borrowers have increasingly turned to bond markets for foreign currency funding instead of banks, giving a more prominent role to asset managers and other non-bank financial institutions as suppliers of credit (McCauley et al (2015)).

Policy responses

Policymakers responded to the challenges posed by international banking in three ways. First, they shone a spotlight on them. Improvements in BIS international banking and financial statistics followed each crisis (Box B). International banking has been a regular topic of discussion at BIS meetings, notably at the Eurocurrency Standing Committee established in 1971 (later renamed the Committee on the Global Financial System). Discussions in the 1960s and 1970s focused on the implications for monetary stability, while later ones turned to financial stability.

The second response was to strengthen international supervisory and regulatory standards for banks. The Basel Committee on Banking Supervision, formed in 1974, promoted consolidated supervision of banks' worldwide operations and, following the 1982 crisis, agreed on a framework for minimum capital adequacy. The framework has been expanded and revised over the years, most recently following the GFC, when Basel III not only tightened capital constraints but also provided for tightening them further in a boom.

The third response was to set up central bank swap lines to backstop funding liquidity during periods of turmoil. Already in the 1960s, central banks had coordinated injections of dollar funding to reduce strains in offshore markets (McCauley and Schenk (2020)). These operations anticipated the use of central bank swap lines during the GFC and the Covid-19 crisis to alleviate pressures arising from non-US banks' short-term dollar funding needs (Aldasoro et al (2020)).

The shift to non-bank finance in recent years brings its own challenges, but the responses under discussion are similar in form: more transparency about non-bank finance, revised regulation and liquidity backstops (FSB (2020)). While today banks are perceived as a source of strength for the financial system, past episodes of turmoil demonstrate how the troubles of non-bank financial institutions can spill over to banks in unforeseen ways.

Box B

Historical data on international banking

Swapan-Kumar Pradhan and Philip Wooldridge

The BIS, in cooperation with central banks, started to collect statistics about international banking in 1963. The locational banking statistics (LBS) provide information about the geographical and currency composition of banks' assets and liabilities, including their intragroup business. The consolidated banking statistics (CBS) measure banks' country risk exposures on a worldwide consolidated basis. Both sets have been enhanced over the decades, often following financial crises (BIS (2019)). Reasonably complete LBS and CBS are available from 1977 and 1983, respectively, on the BIS website.

This feature also uses less-complete LBS published prior to 1977. Data collected starting in 1963 capture only cross-border claims in currencies other than the domestic currency of the reporting country. These were first reported by banks in 11 countries: Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Sweden, Switzerland and the United Kingdom. From end-1966, the data were expanded to cover cross-border claims in all currencies. The next major expansion occurred at end-1973, when the United States and Singapore became reporting countries. From end-1974, local claims in foreign currencies were added, allowing the calculation of international claims. Since then, the number of reporting countries has expanded to 48, including the addition of Caribbean and Asian financial centres from end-1983 and many EMEs since 2000.

Historically, the currency breakdown in the LBS focused on the major currencies (eg USD, EUR, JPY, GBP, CHF) plus the domestic currency of the reporting country; all other currencies were lumped together. This complicates the decomposition of international banking into the three segments explained in Box A and shown in Graph 1. The segments were estimated as follows:

- Cross-border claims denominated in the borrower's domestic currency were calculated as cross-border claims in USD on residents of the United States, EUR (or EUR legacy currencies) on the euro area, JPY on Japan, GBP on the United Kingdom (including Guernsey, Isle of Man and Jersey) and CHF on Switzerland, plus cross-border interbank liabilities of banks in reporting countries other than the aforementioned five denominated in the reporting country's currency.
- Cross-border claims denominated in the borrower's foreign currency from banks in the relevant currency area were calculated as cross-border claims of banks in reporting countries in their respective domestic currencies (ie currencies foreign to the borrower) minus, from 1999 onwards, intra-euro area claims in EUR and, from end-2001, cross-border claims among Guernsey, the Isle of Man, Jersey and the United Kingdom in GBP.
- Offshore claims were calculated as a residual: international claims minus the above two segments. Offshore claims may be overestimated by as much as 8% over the 2010–20 period (less in earlier periods) because they include small amounts of cross-border claims that may be denominated in the borrower's domestic currency but are not reported with a full currency breakdown.

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