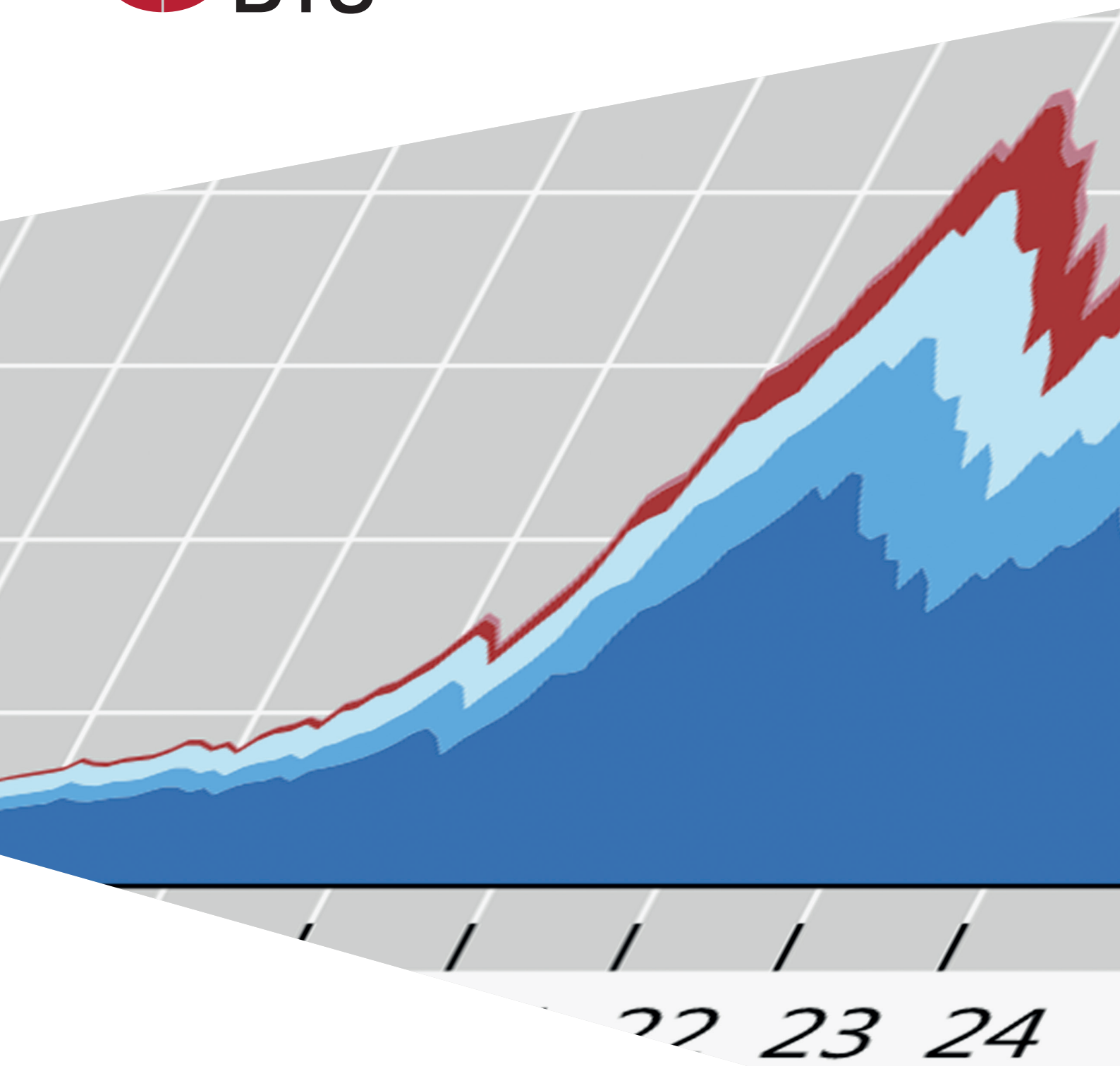
BIS



BIS Quarterly Review

International banking and financial market developments

March 2025

BIS Quarterly Review
Monetary and Economic Department

General queries concerning this commentary should be addressed to Andreas Schrimpf (tel +41 61 280 8942, e-mail: andreas.schrimpf@bis.org), queries concerning specific parts to the authors, whose details appear at the head of each section.

This publication is available on the BIS website (https://www.bis.org/publ/qtrpdf/r_qt2503.htm).

ISBN 978-92-9259-838-9 (online)
ISSN 1683-0121 (online)

BIS Quarterly Review

March 2025

International banking and financial market developments

Articles

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

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

Countries

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

Countries (cont)

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	SM	San Marino
ML	Mali	SR	Suriname
MM	Myanmar	SS	South Sudan
MN	Mongolia	ST	São Tomé and Príncipe
MO	Macao SAR	SV	El Salvador
MR	Mauritania	SZ	Eswatini
MT	Malta	TD	Chad
MU	Mauritius	TG	Togo
MV	Maldives	TH	Thailand
MW	Malawi	TJ	Tajikistan
MX	Mexico	TL	East Timor
MY	Malaysia	TM	Turkmenistan

Countries (cont)

TO	Tonga	UZ	Uzbekistan
TR	Türkiye	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
UY	Uruguay	1Z	British West Indies

Markets caught in cross-currents

Markets were pulled in different directions during the period under review.[1] Long-term government bond yields in core markets rose despite easing monetary policies, tightening financial conditions. In contrast, corporate credit remained buoyant, equity valuations stayed elevated and US dollar appreciation halted. This resulted in easier conditions despite the uncertain outlook, which seemed not fully priced in financial markets. Sentiment towards emerging market economies (EMEs) remained subdued, as investors struggled to ascertain their outlook amid diverse domestic conditions and global policy uncertainty.

While policy rates came down, long-term yields generally rose across major economies. The upward shift was initially driven by US yields and spilled over to other major markets. The moves went alongside large swings in real yields – spearheaded by term premia, shifts in market-based gauges of neutral rates and, in some jurisdictions, uncertainty about the fiscal outlook. Indeed, heightened investor unease with abundant bond supply seemed to add to the pressures of diminishing risk-insensitive demand, as quantitative tightening continued. Overall, yield curves in major economies thus steepened further and were solidly upward-sloping. Yet, although the rise in the 10-year US benchmark largely reversed late in the review period, long yields in other jurisdictions remained at significantly higher levels.

Irrespective of the bond market ebbs and flows, and brief episodes of heightened volatility, risky assets exhibited resilience across AEs. Risk-taking was especially pronounced in corporate credit markets, with credit spreads narrowing further, particularly in Europe. Leveraged loans and private credit continued to pick up pace on the back of resurgent leveraged buyout (LBO) and merger and acquisition (M&A) activity. Stock markets in most advanced economies (AEs) traded sideways but stayed at relatively high valuations. European stocks surprised with a vigorous rally, outperforming most other markets on the back of markedly improved sentiment. A few jitters in the wake of AI-related developments and key policy announcements, including on tariffs, were not enough to derail the predominantly positive sentiment.

Financial conditions were more mixed across EMEs, but the overall sentiment was subdued. Headwinds seemed to gather strength from a pause in the Federal Reserve's easing trajectory, uncertainty with regard to US trade policy and a still struggling Chinese economy. While the breather in the US dollar appreciation provided some relief, local currency government bond yields lingered at elevated levels. Yields rose sharply in some economies where fiscal concerns came into investors' focus. Conditions in stock markets differed across countries. Chinese equities staged a rally late in the review period, driven mainly by technology stocks, while others saw tepid performance, despite a few bright spots that emerged in regional stock markets. Sentiment was lukewarm, however, reflected in anaemic portfolio flows that essentially drew to a standstill.

[1] The period under review extends from 3 December 2024 through 28 February 2025.

Key takeaways

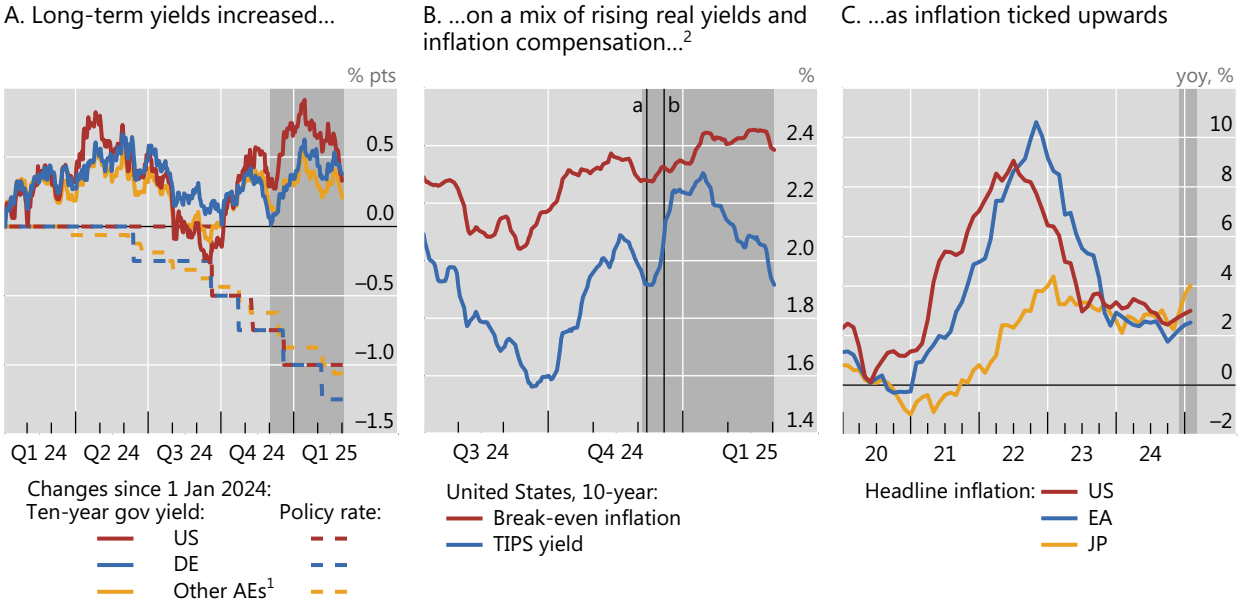
- *Despite policy easing, long-term government bond yields saw upward pressure across advanced economies, with fluctuations in real yields and term premia as the biggest drivers of yield moves.*
- *Risky assets exhibited resilience despite brief bouts of volatility and lingering concerns over tariffs, with robust risk-taking in corporate credit and European stocks.*
- *Sentiment was subdued in emerging market economies, as investors struggled to gauge the outlook for them amid varied domestic conditions and global policy uncertainty.*

Long-term yields rise amid wide fluctuations

Bond markets reflected most clearly the cross-currents of uncertainty. Long-term yields whipsawed in AEs but finished the review period higher despite policy easing by major central banks. The swings in bond yields largely owed to fluctuating real yields amid an upward drift in inflation compensation. In some countries, the upward move was bolstered by unfavourable market dynamics and heightened investor unease with fiscal outlooks.

Central banks in major economies continued on their path of policy easing during the review period, but with varying outlooks. The Federal Reserve cut its policy rate by 25 basis points in December but signalled fewer rate cuts in 2025, as the economy and labour market looked robust (Graph 1.A, dashed red line). Other central

Long-term yields rose across advanced economies as inflation ticked up — Graph 1



The shaded area indicates 3 December 2024–28 February 2025 (period under review).

[a] US jobs report (6 December 2024). [b] FOMC meeting (18 December 2024).

[1] Simple average of AU, CA, CH and GB. [2] Five-day moving average.

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

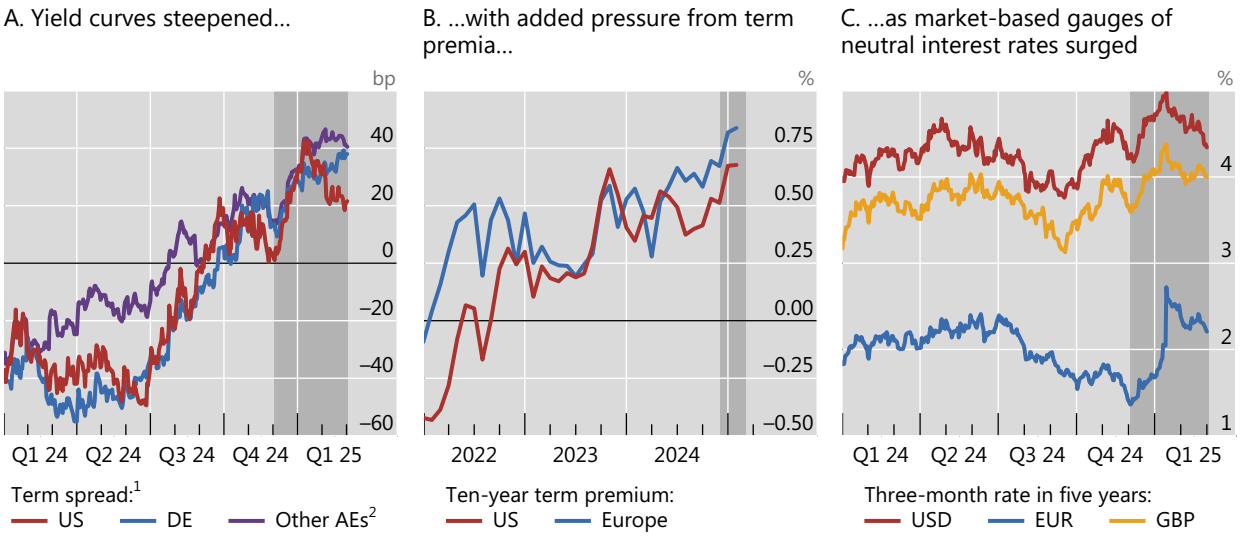
banks, including the Bank of England and Sveriges Riksbank, also hinted at a pause in policy easing. The ECB, however, lowered policy rates and indicated that further cuts might be needed in the light of slower than expected growth. In contrast, the Bank of Japan raised rates once again, as it continued with its process of policy normalisation. These policy moves, and expectations thereof, were reflected in a downward trend in short-term rates.

In contrast to short-term rates, long rates soared in December, initially boosted by strong macroeconomic data. In the United States, 10-year yields rose by more than 60 basis points before largely retracing that surge from mid-January onwards (Graph 1.A, solid red line). These swings in long-term rates were driven by real yields, while inflation compensation edged up during the period (Graph 1.B). Inflation readings across major economies stayed above target throughout 2024 and ticked up at year-end (Graph 1.C). The persistence of inflation, together with the resilience of labour markets, particularly in the United States, pushed rates higher as investors reassessed the prospects of a prolonged period of higher policy rates. In this market environment, the rise in US yields pulled up those in other major economies early in the review period (Box A). As US yields subsequently came down in February, rates in other major economies traded sideways.

The rise of long-term rates led to a material steepening of yield curves. Term spreads turned solidly positive in most AEs, particularly in non-US markets (Graph 2.A). The yield curve steepening was exacerbated by a notable increase in term premia (Graph 2.B), indicating that investors demanded greater compensation for holding long-term interest rate exposure. Moreover, market-based gauges of neutral interest rates also rose steadily throughout the review period, and especially sharply for the euro area (Graph 2.C).

The increase in term premia coincided with market signals of abundant government bond supply. For instance, interest rate swap spreads – the difference between the fixed rate leg of an interest rate swap and government bond yields of

Yield curves steepened as term premia and terminal rate gauges picked up — Graph 2



The shaded area indicates 3 December 2024–28 February 2025 (period under review).

[1] Ten-year minus two-year. [2] Simple average of AU, CA and GB.

Sources: P Hördahl and O Tristani, "Inflation risk premia in the euro area and the United States", *International Journal of Central Banking*, September 2014; Bloomberg; BIS.

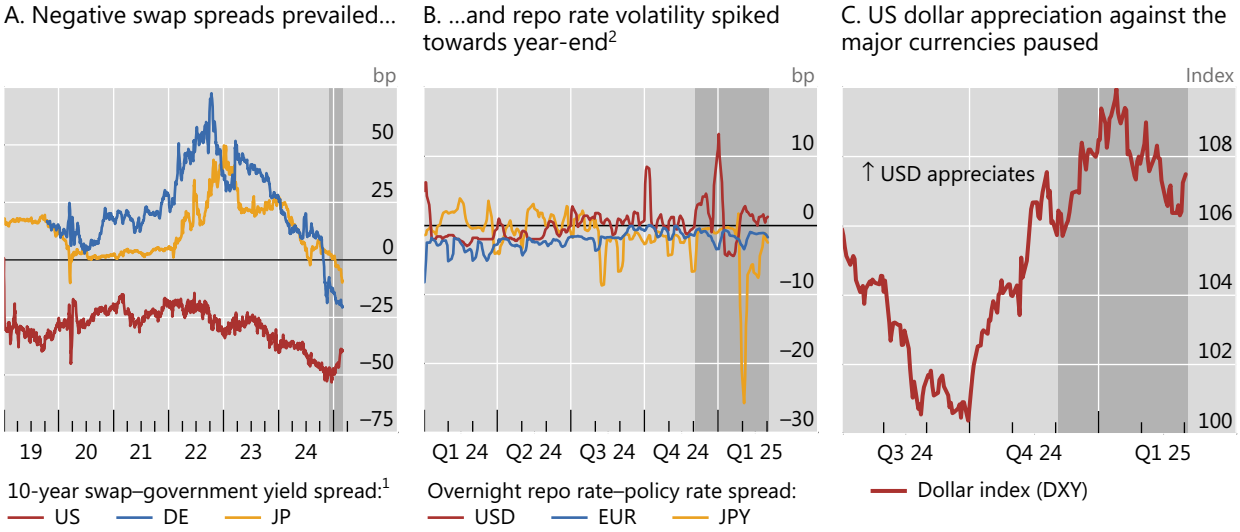
the same tenor – turned negative for Japanese yen swaps during the review period, joining comparable US and German instruments (Graph 3.A). Swap spreads have been negative in the United States for a prolonged time, but touched multi-year lows during the review period.[2]

Short-term funding markets in the United States also reflected the influence of more abundant bond collateral, in combination with typical year-end constraints on dealer intermediation. The spread between the US overnight repo rate and the effective federal funds rate experienced a significant spike towards the end of 2024 (Graph 3.B, red line). This spike appeared to reflect the heightened need for repo financing to accommodate large Treasury issuances and constraints on dealers' balance sheet space due to end-of-year regulatory reporting requirements. No such jumps were observed in Europe or Japan (blue and yellow lines, respectively), where bond collateral at this juncture seems relatively less abundant.

The appreciation of the US dollar peaked and then reversed during the review period. While the greenback gained some additional ground in December, reaching its highest parity since late 2022, it retraced its path from mid-January as doubts about the US growth outlook began to mount (Graph 3.C). This turnaround was not uniform across currencies, as some commodity currencies and the yen still depreciated further.

Market indicators suggest abundant supply of government bonds

Graph 3



The shaded area indicates 3 December 2024–28 February 2025 (period under review).

[1] Five-day moving average. [2] Five-day moving average, excluding end-of-quarter observations.

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

[2] It is noteworthy that these spreads are negative since private financial instruments typically carry higher risks (eg credit risk) such that corresponding yields should in principle be higher than those of government bonds. The uncommon sight of government bonds yielding more than private sector instruments suggests that investors and intermediaries are demanding higher compensation to absorb government debt supply, although to different degrees across countries. For a discussion of the drivers of interest rate swap spreads, see M Aquilina, A Schrimpf, V Sushko and D Xia , "Negative interest rate swap spreads signal pressure in government debt absorption", *BIS Quarterly Review*, December 2024.

Box A

US spillovers amid macroeconomic divergence

Fernando Avalos, Karamfil Todorov and Dora Xia ⓘ

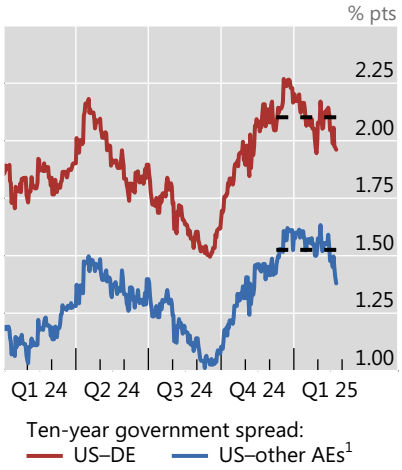
Core bond yields in advanced economies (AEs) moved up in tandem in the last few months, despite increased macroeconomic divergence. Since the start of the ongoing monetary policy cycle in early 2022, the US economy has been widely outperforming most of its AE peers, in terms of both realised growth and outlook. Under those conditions, interest rates would typically be expected to decouple, with US rates exhibiting more upward momentum than those of other AEs. Instead, US yields have been setting the tone for global yields, pulling up other AE yields, particularly in the second half of 2024. This box quantifies the extent of US rate spillovers to other AE rates and explores some of the potential drivers.

Long-term rates in major economies have been moving in lockstep in recent months, particularly since the fourth quarter of 2024. For instance, the spread between 10-year US Treasury notes and German bunds has fluctuated around 210 basis points since last October, which contrasted with a period of pronounced swings earlier in 2024 (Graph A1.A, red line). The picture for other AEs is broadly similar (blue line). Remarkably, growth in most AEs has generally trailed that of the US economy for most of the post-pandemic period, and uneven dynamism continued in the second half of 2024. Surveys indicate that economic forecasters do not expect AEs' growth to catch up with that of the United States in the near future.

US yields pulled those in other AEs as US spillovers intensified

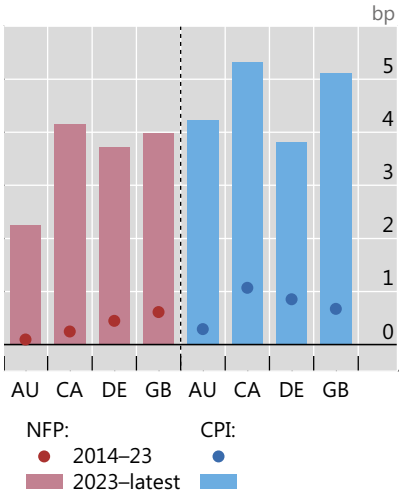
Graph A1

A. AE spreads to US remained roughly constant in recent months…



B. …as US yields pulled AE yields on the way up[2]

C. Macro news in the US has an increasing impact on other major AEs[3]



The dashed lines in panel A correspond to the averages over the period 2 December 2024–21 February 2025.

[1] Simple average of AU, CA, CH, DK, GB, NO and SE. [2] Spillovers between 10-year government bond yields of the United States, Germany, the United Kingdom, Canada and Australia. Estimation follows F Diebold and K Yilmaz, "Measuring financial asset return and volatility spillovers, with application to global equity markets", *Economic Journal*, vol 119, no 544, 2009. Spillover contributions are calculated from the one-month-ahead forecast error variance matrix inferred from generalised identification of shocks. [3] Non-farm payroll (NFP) and inflation surprises are the difference between the actual release and the Bloomberg mean forecast. The coefficients are estimated by linear regressions of 10-year yield changes to 100,000 surprises in NFP readings or a 1% surprise in month-on-month CPI inflation.

Sources: Bloomberg; Consensus Economics; S&P Global Market Intelligence; national data; authors' calculations.

The parallel upward shift in AE bond yields has been spearheaded by spillovers from US bond markets. The surge in US interest rates in the second half of 2024 has exerted a gravitational pull on the yields of other major economies. For instance, around a third of the variance of unexpected changes in the 10-year yields of Germany and the United Kingdom can be attributed to unexpected changes in US 10-year yields (Graph A1.B, red line).

The magnitude of the spillovers intensified quickly in the second half of 2024 and spiked at the beginning of 2025 as long-term rates in the US continued their upward march. In contrast, the spillovers from other major economies' yields to US rates receded gradually in 2024 and plummeted in the new year (blue line). In summary, US Treasuries have had much larger effects on AE bond markets than the other way around.

The larger spillovers from US bond markets seem related to the increasing impact of macroeconomic developments in the United States on bond yields of other major economies. Macroeconomic surprises in US economic data, ie the difference between actual release and consensus forecasts, are inducing larger market responses abroad. For instance, US labour market news during 2023–24 had an effect (Graph A1.C, red bars) about four times larger than the one typically observed in the previous decade (red dots). A similar pattern also holds for US inflation surprises (blue bars and dots), which had very little to no impact on AE yields before 2023 but have become very important since then as a driver of core bond yields.

This latest phase of highly synchronised increases in AE yields highlights the global influence of US yields. Several factors can be underlying these moves. First, adjustments in interest rates by the Federal Reserve have significant spillover effects on global financial markets by shaping investor expectations and sentiment globally.② Second, spillovers could stem from international portfolio flows as global investors rebalance their portfolio and transmit shocks of US yields to other AEs.③ US bond yields' disproportionate influence on other AEs, with limited reciprocal effects, further supports the notion of asymmetric spillovers and underscores the dominant role of the United States in global financial markets.④

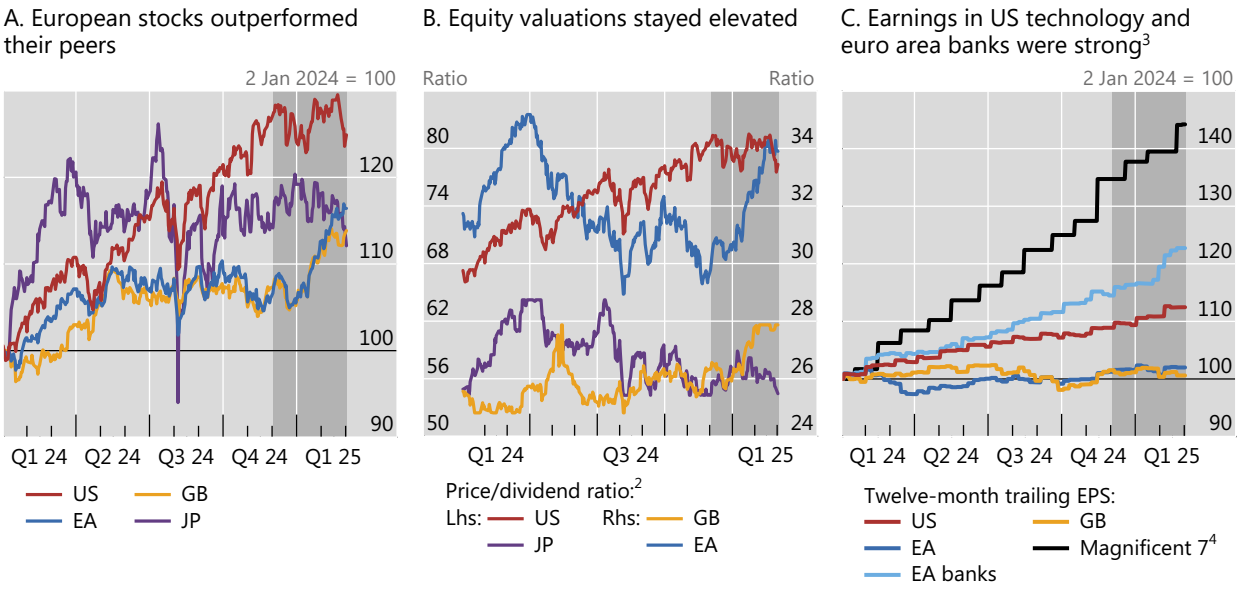
① The views expressed are those of the authors and do not necessarily reflect the views of the BIS. ② M Ehrmann and M Fratzscher, "Equal size, equal role? Interest rate interdependence between the euro area and the United States", *The Economic Journal*, vol 115, no 506, 2005, pp 928–48. ③ K Forbes and R Rigobon, "No contagion, only interdependence: Measuring stock market comovements", *The Journal of Finance*, vol 57, no 5, 2002, pp 2223–61. ④ H Rey, "Dilemma not trilemma: The global financial cycle and monetary policy independence", *NBER Working Papers*, no 21162, 2015.

Pricing of risky assets remains in hot territory

Risky asset markets remained resilient during the review period, shrugging off uncertainties about the outlook. Buoyant credit markets and elevated equity valuations countervailed the pressure from rising long-term bond yields, contributing to an easing of financial conditions in AEs.

Risk sentiment in equity markets remained largely intact, even though the performance of individual markets varied across major economies. European stocks surprised with a strong rally and outperformed US equities, which traded sideways like those of most other jurisdictions (Graph 4.A). Accordingly, valuations (as measured here by price/dividend ratios) remained elevated in the United States and increased materially in Europe (Graph 4.B). US market valuations were supported by strong earnings, particularly from technology firms (Graph 4.C). These companies performed well and sustained the US market, while the post-election surge in small cap stocks faded away. Across the Atlantic, investors shrugged off weaker than expected earnings, consistent with relatively weaker economies. The surge appeared driven by a large compression of the European equity risk premium and by the strong rally of banks – whose earnings continued showing strength – and other sectors that had been particularly shaken in the first quarter of 2022 (Box B).

Equity markets remained resilient, with a strong rally in European stocks[1] Graph 4



The shaded area indicates 3 December 2024–28 February 2025 (period under review).

[1] EA = EURO STOXX 50; GB = FTSE 100; JP = Nikkei 225; US = S&P 500. [2] Twelve-month trailing price/dividend. Data for GB and JP are winsorised at the 5th and 95th percentiles. [3] EA banks = EURO STOXX Banks. [4] Alphabet, Amazon, Apple, Meta, Microsoft, Nvidia and Tesla.

Sources: Bloomberg; LSEG Datastream; BIS.

Despite the solid equity performance in most AEs, bouts of volatility returned briefly during the period. The VIX spiked in the wake of the Federal Open Market Committee meeting in December, increasing by more than 70% on the day of the policy decision announcement. The substantial jump in volatility underscored the swift and pronounced market response to a reassessment of beliefs about the monetary policy path ahead. However, the increase was short-lived as contrarian investors and sellers of volatility presumably dampened the move. Markets were also jittery in late January on the back of risk-off sentiment related to artificial intelligence (AI) and in late February to early March on deteriorating investor confidence following a softening of growth signals and tariff-related news.

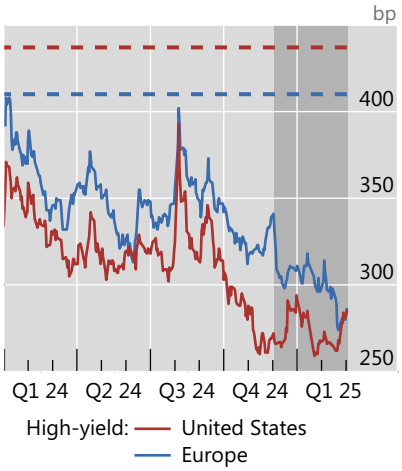
Corporate funding markets remained robust, with issuers taking advantage of the resilient risk sentiment. Credit spreads compressed further across the rating spectrum, particularly for European high-yield bonds, and stayed widely below historical watermarks (Graph 5.A). In this context, issuance remained strong even in the lower-grade segments. Leveraged loan issuance picked up pace (Graph 5.B, red line) amid the continued resurgence of LBO activity (Graph 5.C, blue line). Finally, the long dormant initial public offering (IPO) market extended its 2024 recovery (red line), with a sizeable number of firms brought public and strong first-day performance, particularly during the fourth quarter.

Other corners of private markets also benefited from the positive sentiment. Private credit continued to exhibit strong momentum and closed the year at strength, despite losing some ground to banks' leveraged lending. Venture capital funds saw strong fundraising given the sustained interest of investors in AI bets. The growth investment segment also saw a material improvement, amid a flurry of mergers and acquisitions.

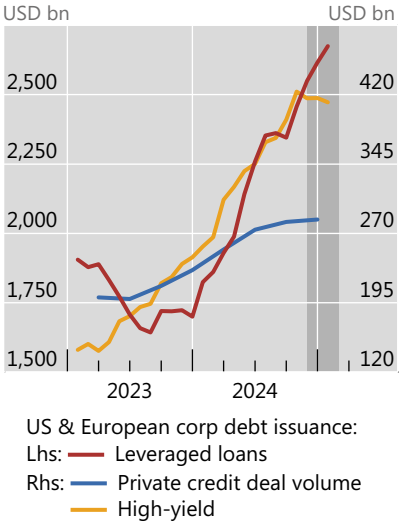
Corporate financing markets remained buoyant

Graph 5

A. Credit spreads narrowed further in Europe



B. Low-grade issuance remained strong across market segments…[1]



C. …in part buoyed by resurgent LBO and IPO activity[1]

The shaded area indicates 3 December 2024–28 February 2025 (period under review). The horizontal dashed lines in panel A indicate 2005–current medians.

[1] Twelve-month moving sum. IPO = initial public offering; LBO = leveraged buyout.

Sources: Bloomberg; Dealogic; ICE Data Indices; PitchBook Data Inc; BIS.

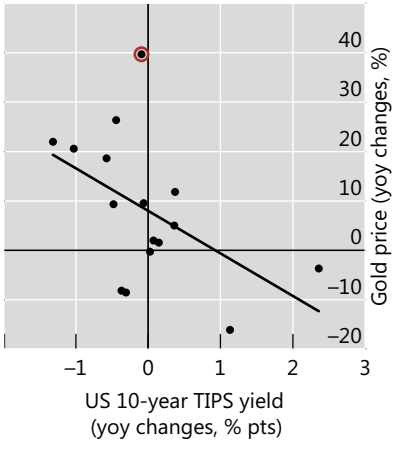
In contrast to the pressures faced by traditional safe havens, the price of gold sustained its strong upward momentum and gained pace during the review period – yet another case of markets being subject to cross-currents. Gold prices rose steadily during the period, irrespective of the wide fluctuations elsewhere (Graph 6.A). The 2024 rally in gold prices was unusual, as it coincided with a stronger US dollar and increasing real yields (Graph 6.B). In the crypto space, bitcoin lost momentum while ether plummeted (Graph 6.C).

Gold rally continues while cryptoassets plummet

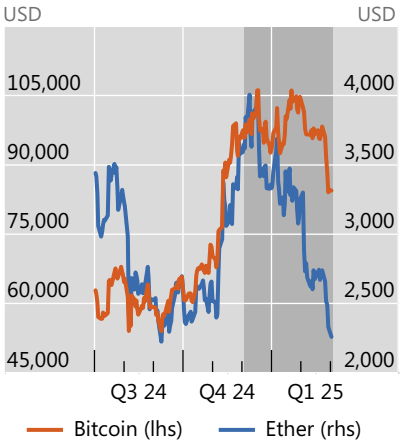
Graph 6

A. Gold rally accelerated…

B. …but was unusual with range-bound real yields



C. Cryptoassets plunged



The shaded area indicates 3 December 2024–28 February 2025 (period under review).

Sources: Bloomberg; LSEG Datastream; BIS.

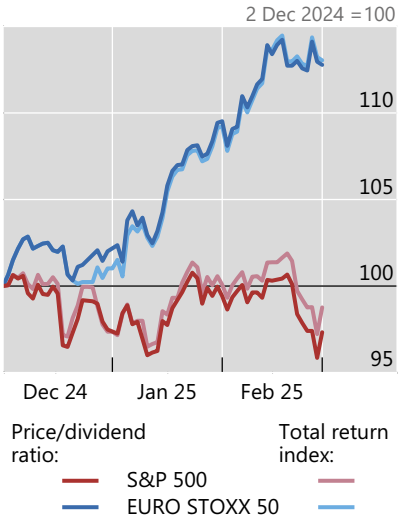
Why have European stocks recently outperformed their US peers?

*Fernando Avalos, Karamfil Todorov and Gabor Pinter*①

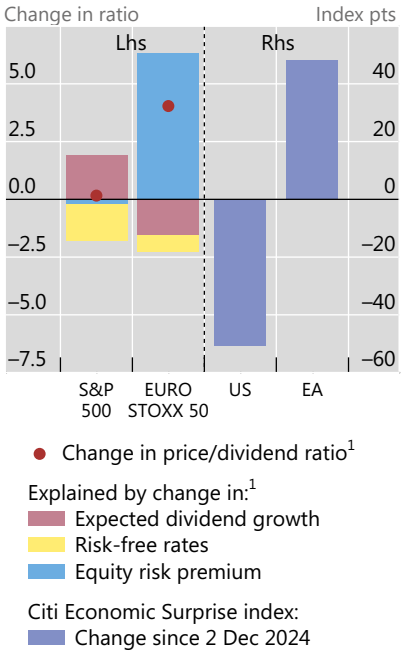
European stock markets outperformed their US peers, and most other global markets, in the new year. Despite the broad economic challenges faced by the region, including a tepid earnings outlook, high energy prices and the threat of tariffs, the EURO STOXX 50 index outstripped the S&P 500 by about 15 percentage points since early December (Graph B1.A). Other European indices in the United Kingdom and elsewhere also garnered strong gains. As a result, key valuation metrics in European equities, such as the price/dividend ratio, also improved by a similar margin versus the United States. In this box, we explore the drivers of this European outperformance and find that risk premium compression – investors' more benign sentiment regarding European stocks – has been the main driving force.

Risk premia compression drove the outperformance of European stocks — Graph B1

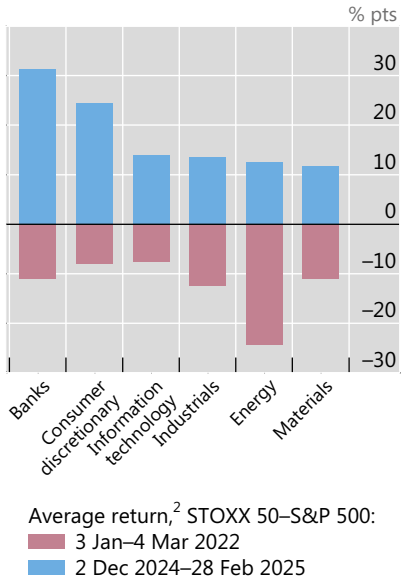
A. European stocks outperformed US stocks…



B. …driven by compressing equity risk premia…



C. …as cyclical sectors and those that underperformed at the start of the war in Ukraine rallied



[1] All changes computed between February 2025 and November 2024 from monthly averages of daily data. [2] For each sector, difference of the simple average of the respective index constituents' returns.

Sources: Bloomberg; Consensus Economics; LSEG Datastream; LSEG Workspace; Macrobond; national data; authors' calculations.

To understand the outperformance of European indices, it is useful to study the components of the price/dividend ratio.② Conceptually, the index price itself should be equal to the discounted value of future expected dividends. As a result, changes in the price/dividend ratio can be decomposed into three main parts, which reflect discount rates or cash flows: (i) changes in risk-free rates; (ii) changes in equity risk premia; and (iii) changes in expected dividend growth. A rise in the first two components reduces the price/dividend ratio as higher risk-free rates or risk premia cause future cash flows to be discounted more heavily. In contrast, a rise in the third component increases the price/dividend ratio as it signals higher future dividends (ie cash flows).③

A decomposition along the lines just discussed reveals that risk premium compression has been the main force driving the recent outperformance in European stocks. During the review period, the price/dividend ratio

for US stocks remained unchanged on average, while that of European stocks increased significantly (Graph B1.B, red dots). The rise in long-term rates put downward pressure on the price/dividend ratio in both the United States and Europe (yellow bars). An additional negative factor for European valuations was deteriorating expected dividend growth (red bars) in contrast to the improving figures for their US peers.④ On balance, the dominant factor that pulled up European stock market valuations despite the two countervailing headwinds was the large compression of the risk premia on European equities (blue bars).

Lower equity risk premia imply that investors demand less compensation for holding European stocks, increasing valuations. Several factors may underlie this more positive sentiment shift towards European stocks. First, high-frequency economic indicators have improved for Europe in recent months, in contrast to the United States (Graph B1.B, purple bars). Second, looser monetary policy in the short and medium term may shield some of these firms from threats like tariffs, not least by helping to keep exchange rates steady at current parities. Finally, the prospects of a more stable political situation in core European markets and perhaps even the potential easing of geopolitical conflicts in the region may have contributed to a general improvement in investors' sentiment towards European assets.

Consistent with improving sentiment and risk-taking in anticipation of an easing of geopolitical conflicts, most of the recent outperformance of European markets was driven by cyclical sectors. These sectors, such as consumer discretionary, banks and information technology, saw significant gains compared with their US counterparts during the review period (Graph B1.C, blue bars). Moreover, European sectors that could benefit from a sooner end to the war in Ukraine, via lower energy costs – such as energy, industrials and materials – also outperformed their US peers. These same sectors significantly underperformed during the period of rapid heightening of geopolitical uncertainty that surrounded Russia's invasion of Ukraine in February 2022 (red bars). Hence, the recent shift could at least partly reflect more positive sentiment and optimism about economic stability and growth in Europe in a context of de-escalating geopolitical tensions.

① The views expressed are those of the authors and do not necessarily reflect the views of the BIS. ② The dividend yield decomposition is based on the analysis of J Campbell and R Shiller, "The dividend-price ratio and expectations of future dividends and discount factors", *The Review of Financial Studies*, vol 1, no 3, 1988, pp 195–228. ③ Seminal papers in the large body of academic research on this matter are M Miller and F Modigliani, "Dividend policy, growth and the valuation of shares", *Journal of Business*, vol 34, no 4, 1961, pp 411–33; and T Marsh and R Merton (1987), "Dividend behavior for the aggregate stock market", *Journal of Business*, vol 60, 1987, pp 1–40. ④ In this application, we rely on dividend futures for both indices, which are available for the first five fiscal years. For the remaining horizon, we assume that dividends grow in line with long-term analyst expectations of earnings for each market, which implies a constant payout rate of dividends out of earnings.

Subdued sentiment towards EMEs

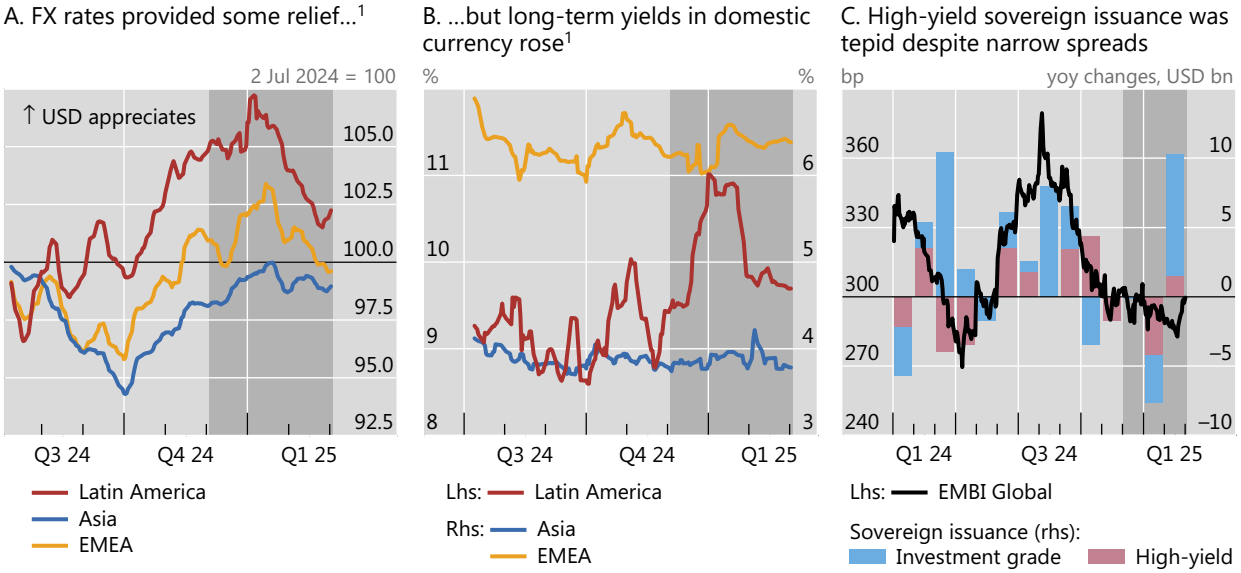
Financial conditions in EMEs generally tightened, but to differing degrees. The dollar provided mild relief as its appreciation against EME currencies took a breather. But headwinds gained strength amid generally mediocre macroeconomic conditions, the threat of tariffs and still sluggish growth in the Chinese economy.

Central banks' decisions reflected the diverse domestic conditions and constraints from the Federal Reserve pausing its easing. In Latin America, most central banks cut rates during the review period, as their easing cycle may not be completed yet. Brazil was the exception, hiking rates by 200 basis points in the midst of persistent inflationary pressures. In other parts of the world, notably in Europe and Asia, policy rate cuts were prevalent. In China, benchmark loan prime rates remained stable while the central bank ramped up measures to stabilise the renminbi exchange rate.

The appreciation of the US dollar stalled during this review period, and several EME currencies appreciated against the greenback. That was particularly the case of Latin American and EMEA (European, Middle Eastern and African) currencies, which largely rebounded from their pronounced Q4 2024 slide amid wide fluctuations

Financial conditions remained more subdued in EMEs as rates increased

Graph 7



The shaded area indicates 3 December 2024–28 February 2025 (period under review).

[1] Asia = CN, HK, ID, IN, KR, MY, SG and TH; EMEA = CZ, HU, IL, PL and ZA; Latin America = BR, CL, CO, MX and PE. Five-day moving average.

Sources: Bloomberg; Dealogic; JPMorgan Chase; national data; BIS.

(Graph 7.A, red and yellow lines). Asian EME currencies also saw ample swings in their parities, as US trade policy uncertainty mounted, and slightly depreciated over the review period (Graph 7.A, blue line). Carry trade activity, where investors borrow in low-yielding currencies to invest in higher-yielding ones, was likely limited as high volatility made the returns on such trades riskier and less attractive. That said, the conjuncture could quickly change, as evidenced by the August 2024 episode.[3]

Yields on government bonds in domestic currency generally saw upward pressure, tightening financial conditions. Yields whipsawed in Latin America and EMEA and stayed largely unchanged in Asia. The rise was particularly sharp at the long end of Brazil's term structure, as fiscal concerns took centre stage in investors' view. Other countries in Latin America saw more stable yields, in coincidence with developments in other regions (Graph 7.B).

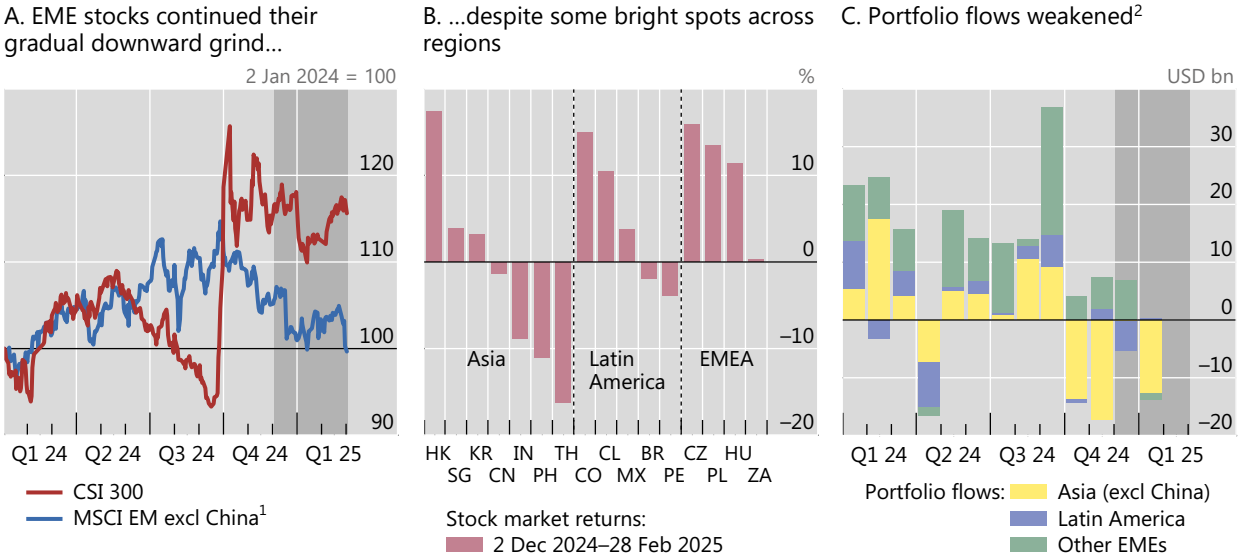
Issuance of dollar-denominated bonds was mixed despite falling spreads. The easier financial conditions of AE credit markets reflected more clearly on the spreads of dollar-denominated bonds, which compressed by about 20 basis points (Graph 7.C). Despite that compression, sovereign issuance remained generally circumspect, especially in the high-yield segment, although it gained some traction in February within the investment grade sovereign segment.

EME stock markets trended downwards on average, adding to the tightening pressure on financial conditions. Chinese equity markets saw a rebound in February after months-long weakness, and ended the period flat (Graph 8.A, red line) on the back of improving sentiment and optimism related to the outlook for AI. This sudden awakening of the continental market was also reflected in Hong Kong SAR equities, whose valuations soared. Additionally, there were bright spots in some small Latin

[3] See "Carry off, carry on", *BIS Quarterly Review*, September 2024.

EME stock markets broadly declined despite some bright spots

Graph 8



The shaded area indicates 3 December 2024–28 February 2025 (period under review).

[1] Based on the corresponding iShares ETF tracking the MSCI EM excluding China index. [2] See endnotes for details.

Sources: IIF; Bloomberg; BIS.

American markets and in EMEA, the latter seemingly pulled by the momentum of the major European exchanges (Graph 8.B). Moreover, India's IPO market continued its strong performance in the fourth quarter, having contributed a sizeable volume share to the global IPO market in 2024.

Overall, however, sentiment towards EMEs remained downcast. With attractive yields on safe debt of AEs, foreign investors in EME debt securities extended the caution that characterised the last quarter of 2024. Portfolio flows turned negative for emerging Asia, in line with the lacklustre stock performance and lower yields (Graph 8.C). Flows into other EMEs also weakened, reflecting the overall anaemic sentiment.

Endnotes

Graph 8.C: Emerging Asia = ID, IN, KR, LK, MN, MY, PH, PK, TH, TW and VN; Latin America = BR, CL, CO, and MX; other EMEs = BG, CZ, EE, GH, HU, KE, LB, LT, LV, MK, PL, QA, RO, RS, RU, SA, SI, TR, UA and ZA.

Fernando Avalos
Fernando.Avalos@bis.org

Sebastian Doerr
Sebastian.Doerr@bis.org

Gabor Pinter
Gabor.Pinter@bis.org

The global drivers of private credit[1]

Private credit has grown rapidly over the past two decades and expanded into more and more industries. Cross-country evidence shows that the footprint of private credit is larger in countries with lower policy rates, more stringent banking regulation and a less efficient banking sector. Examining the cost of capital of business development companies (BDCs), an important private credit investment vehicle, reveals that banks' initial funding advantage has substantially narrowed since 2010. The convergence in the cost of capital reflects a fall in BDCs' cost of equity relative to that of banks and a rise in BDCs' leverage. Private credit's growth has therefore been bolstered, at least in part, by a relative improvement in its funding cost.

JEL classification: G20, G23, G28.

Private credit funds have increased their assets under management (AUM) from about $0.2 billion in the early 2000s to over $2,500 billion today. As private credit's footprint in the financial system develops, interest is growing among regulators and in public policy circles in understanding its drivers and attendant financial stability implications.

This article explores global patterns in the growth of private credit and contributes to the literature by systematically studying its underlying drivers with detailed loan-level data. Moreover, it examines how changes in the cost of capital may have supported the growth of private credit vis-à-vis banks.

Three findings emerge from our analysis.

First, while private credit has grown rapidly and serves an increasing variety of industries, the loan portfolios of individual funds remain heavily concentrated. Portfolio specialisation in narrow industries can yield benefits through lenders' superior screening and monitoring capabilities – improving credit access for riskier and more opaque firms. However, a lack of diversification could expose funds to sector-specific downturns, which requires investors – up to now mostly institutional – to diversify their portfolios of private credit assets. The trade-off between specialisation and diversification is bound to gain prominence as AUM continue to

[1] The views expressed are not necessarily those of the Bank for International Settlements. We thank Giulio Cornelli and Rudraksh Kansal for excellent research assistance. For helpful comments, we are also grateful to Ryan Banerjee, Mathias Drehmann, Marc Farag, Gaston Gelos, Bryan Hardy, Wenqian Huang, Ulf Lewrick, Andreas Schrimpf, Hyun Song Shin and Frank Smets. All remaining errors are ours.

Key takeaways

- *Private credit has grown rapidly and broadly over the past two decades, while individual funds' loan portfolios remain concentrated in a handful of industries.*
- *The footprint of private credit is larger in countries with lower policy rates, less efficient banking systems and, to some extent, more stringent banking regulation.*
- *A fall in the cost of equity and a rise in the leverage of business development companies (BDCs), an important private credit investment vehicle, have narrowed the gap between the cost of capital for banks and BDCs. This suggests that the growth in private credit partly stems from declining funding costs.*

grow and fund managers seek avenues for greater participation by retail investors, who may be less aware of the concentration risks involved.

Second, the footprint of private credit is larger in countries with lower policy rates, less efficient banking systems and, to some extent, more stringent banking regulation. In a panel covering private credit loans for 45 countries between 2010 and 2019, all three variables have a statistically significant impact on loan originations by private credit funds. In terms of economic magnitude, the efficiency of the local banking system has the largest impact, followed by the level of the policy rate.

Third, the gap between the cost of capital of banks and business development companies (BDCs), an important private credit investment vehicle, has narrowed substantially since 2010. The spread between the cost of capital of publicly listed BDCs and that of banks has declined by around 200 basis points (bp) between the Great Financial Crisis (GFC) and 2019. The narrowing of the spread reflects a relative increase in banks' cost of equity in the aftermath of the GFC as well as a steady increase in BDC leverage. These patterns suggest that at least part of the rise of private credit has been supported by a relative improvement in its cost of funding.

The rest of the article is structured as follows. The first section provides a brief introduction to the features of private credit markets. The second examines global trends in private credit and its underlying country-specific drivers. Section three compares the cost of capital of BDCs with that of banks. The final section discusses the implications of our findings for the relationship between banks and private credit funds and the nature of financial intermediation going forward.

A primer on private credit

Private credit generally refers to non-bank credit extended by specialised investment vehicles ("funds") to small or medium-sized non-financial firms.[2] Deals are usually directly negotiated between borrowers and lenders, and the originator holds the loan on their balance sheet until maturity.

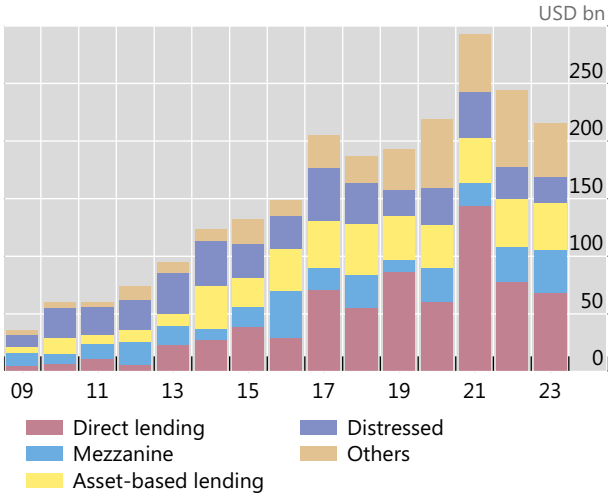
Most funds operate as closed-end structures that lock in capital for their life cycle, which typically ranges from five to eight years. They do not trade on exchanges and are not available to retail investors, which makes them illiquid and subject to

[2] For a general description of private markets, including private equity, see Aramonte and Avalos (2021). For a detailed description of private credit, including financial stability risks, see IMF (2024).

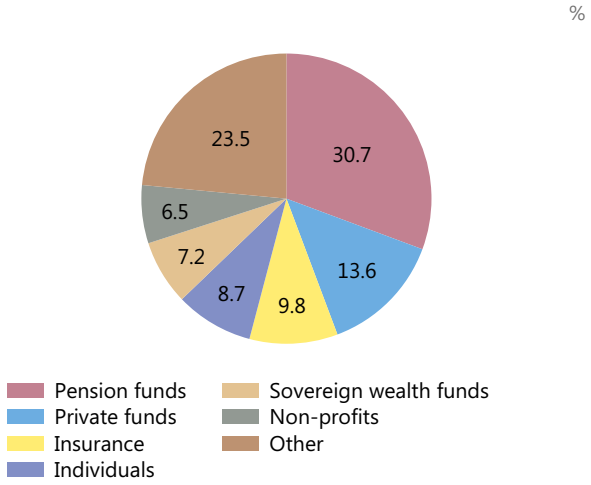
Private credit: fundraising by strategy type and composition of investor base

Graph 1

A. Direct lending has gained ground in raising funds in recent years, within an ecosystem of multiple strategies[1]



B. Large institutional investors dominate the investor base in private credit[2]



[1] Capital raised by private credit asset managers for funds focused on each respective strategy. Asset-based lending includes real estate, infrastructure, leasing, commodities and resources. Others include special situations, venture debt and multi-strategy. Data are available until June 2024. [2] Sample is based on private credit funds in the United States as of Q4 2021, the latest available date. See endnotes for details.

Sources: Board of Governors of the Federal Reserve System (2023); PitchBook Data Inc; authors' calculations.

lighter regulation. The life cycle of funds usually matches the average maturity of their loan portfolios, which mitigates liquidity and maturity transformation risks.

Some fund structures, however, offer investors more frequent redemption windows. An important example is BDCs in the United States, many of which list their shares on stock exchanges and are accessible to retail investors.[3] They are subject to federal regulation and have disclosure requirements similar to those of mutual funds, providing transparency and investor protection. With over $300 billion in AUM, BDCs represent 20% of the private credit market in the United States today.[4] Attempts to bring retail investors into the fold have been a general trend in the private credit space. To this end, fund managers are increasingly experimenting with structures that allow investors to regularly redeem a portion of their funds (eg "evergreen funds" or "interval funds").

On the asset side, funds usually specialise in certain strategies. Direct lending, which refers to funds extending covenant-heavy floating rate loans, has been the dominant strategy over the past decade (Graph 1.A, red bars). It relies on cash generation from firms' regular operations ("cash flow lending") instead of collateral. BDCs mostly engage in direct lending. Mezzanine lending is another common strategy, which consists of extending junior or subordinated debt to larger companies, often with equity participation rights (blue bars). These instruments

[3] BDCs are required to make at least 70% of their investments in private or public companies with equity values below $250 million and to pay out 90% of income as dividends, which are taxed as ordinary income to shareholders. For background on BDCs, see Davydiuk et al (2024).

[4] Collateralised loan obligations are another prominent segment of the private credit ecosystem. They do not originate loans to borrowers themselves but mainly invest in leveraged loans issued by banks or other private credit lenders to sub-investment grade firms. See Aramonte and Avalos (2019) for a detailed description.

bridge the gap between debt and equity. Asset-based lending (yellow bars) in turn requires hard assets as collateral, such as real estate, infrastructure or aircraft. The category "distressed" (purple bars) refers to funds that purchase troubled fixed income assets – such as non-performing loans – in the secondary markets at a significant discount to their intrinsic or fundamental value. To date, total AUM of private credit funds exceed $2.5 billion globally. In the United States, they exceed total outstanding leveraged loans or high-yield bonds (IMF (2024)).

The main sources of capital for private credit funds are institutional investors with long-term investment horizons and low liquidity needs. They include public and private pension funds, insurance companies and sovereign wealth funds (Graph 1.B). Insurance companies in particular have increased their asset allocations towards private credit.[5] Institutional investors primarily value seemingly attractive returns on their locked-up investments.[6] Retail investors make up a small but growing share.

Firms borrowing from private credit funds value flexible loan terms and are often underserved by banks. Surveys suggest that smaller and highly leveraged firms with scarce tangible collateral appreciate that deals are better tailored to their needs (Block et al (2024)). Compared with bank loans, firms also value the bespoke covenant structures and faster execution, as well as funds' readiness to renegotiate loan terms if needed. Reflecting these benefits, firms with negative earnings before interest, taxes, depreciation and amortisation (EBITDA), higher debt, lower accounting transparency and low tangible collateral value are more likely to borrow from private credit funds (Chernenko et al (2022), Jang (2024)).

Global patterns and drivers

This section first discusses global patterns in the development of private credit. It then systematically examines in a regression framework the drivers underlying its rise.

Aggregate patterns and concentration risks

To study global patterns in private credit, we rely on data from PitchBook Data Inc. The loan-level data provide information on direct and asset-based loans by private credit funds, including loan amounts, rate spreads, maturity, and borrower location and industry.

Private credit has seen spectacular growth in many jurisdictions. Global total outstanding loan volumes have increased from around $100 billion in 2010 to over $1.2 trillion today. The lion's share of credit is originated in the United States – over 87% of the total today, an increase from $90 billion in 2010 to over $1 trillion in 2024 (Graph 2.A, black line). Europe (excluding the United Kingdom) accounts for about

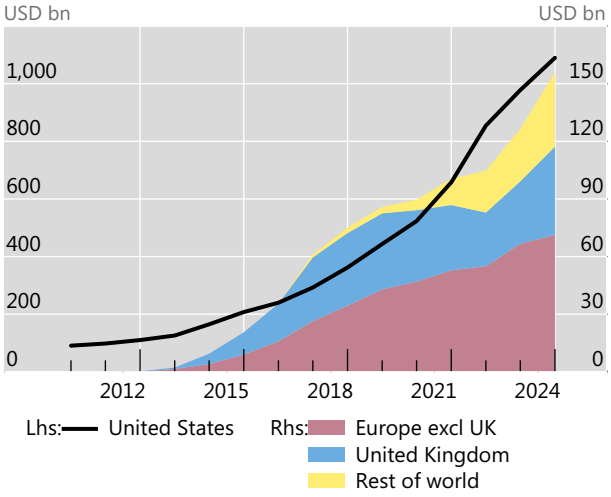
[5] Van Steenis (2025).

[6] Private credit funds yield high total returns compared with other debt instruments. For example, the rate spread (annual rate over Libor or SOFR) averages about 630 basis points (bp) on loans by private credit funds, exceeding that on leveraged loans by about 300 bp. However, Erel et al (2024) find that once one accounts for risk and fees, private credit does not provide abnormal returns.

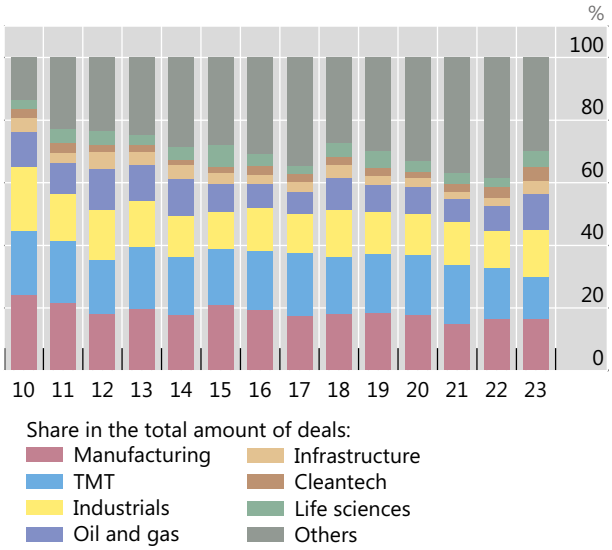
Private credit over time

Graph 2

A. Lending has grown rapidly in many jurisdictions…[1]



B. …and expanded into a broad set of industries[2]



TMT = technology, media and telecommunications.

[1] Total volume of outstanding direct and asset-based loans by region of the borrower. [2] As a share of total originated amounts. See endnotes for details.

Sources: PitchBook Data Inc; authors' calculations.

6% of the total in recent years (red bars) and the United Kingdom (blue bars) for about 3–4%. Canada accounts for most of the remainder.[7]

Private credit funds serve an increasingly wide variety of industries. Manufacturing, technology, media and telecommunications, and industrials used to account for over two thirds of all deals (Graph 2.B). Their share has shrunk to less than 40% today. Other industries, including cleantech and life sciences, make up an increasing share of the total.

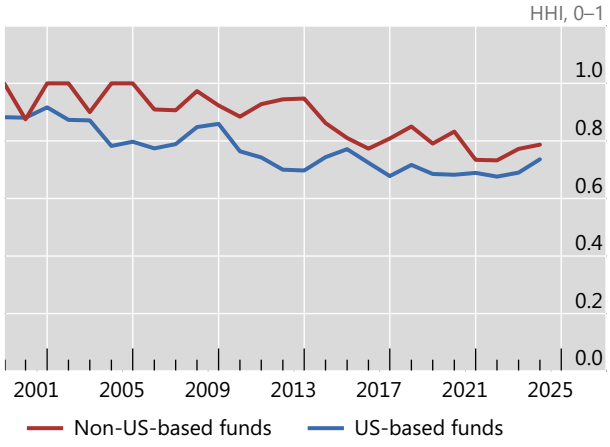
While the scale and scope of private credit has increased overall, loan originations by individual funds remain heavily concentrated in just a few industries (Graph 3.A). The Herfindahl-Hirschman index (HHI), a common metric of portfolio concentration that ranges from zero (low concentration) to one (high concentration), averages 0.74 and 0.81 for funds based in the United States and elsewhere (blue and red lines), respectively. This compares with banks' and non-banks' HHI in the syndicated loan market of 0.2 and 0.4, respectively (Aldasoro et al (2022)). Concentration ratios have fallen as average fund size rose. For a given fund size, portfolio concentration was similar before and after 2010 (Graph 3.B, red vs blue dots). However, fund size has increased markedly over time, and larger funds are more diversified in general.

Portfolio concentration yields benefits but also entails risks. Specialisation in narrow markets provides a deeper understanding of borrower characteristics and improves lenders' ability to monitor and manage loans. Specialised lenders can hence

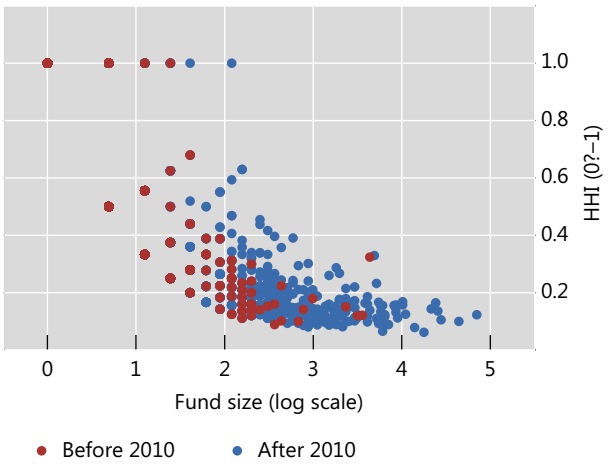
[7] For comparison, in the United States total commercial and industrial loans by banks grew from around $1.2 trillion in 2010 to $2.8 trillion in 2023. Bank loans to companies in the euro area averaged around €4.5 trillion to €5 trillion over the past two decades.

Fund portfolios remain highly concentrated in a few industries[1] Graph 3

A. Industry concentration in fund portfolios is declining but remains high



B. Concentration in loan portfolios is falling as funds get bigger[2]



[1] Herfindahl-Hirschman index (HHI) calculated for each lender across 40 industries. It ranges from zero (low portfolio concentration) to one (high concentration, with all loans concentrated in one industry). [2] Fund size measured as the natural logarithm of one plus the number of loans.

Sources: PitchBook Data Inc; authors' calculations.

offer more favourable loan terms, such as larger loans, lower risk-adjusted interest rates and longer maturities, and they are more willing to lend to smaller, opaque firms within their area of expertise. At the same time, greater diversification reduces exposure to region- or industry-specific shocks, mitigating credit risks.[8]

Should the share of retail investors rise, private credit funds may need to reassess the merits of specialisation. The purported advantages of funds relative to banks – superior screening and monitoring as well as bespoke loan terms – require some specialisation. But specialisation leaves funds exposed to idiosyncratic risks. As asset managers explore options to attract retail investors, who might have a limited understanding of the risks involved, funds may need to opt for greater portfolio diversification. Indeed, that may even become a regulatory requirement in some jurisdictions. But greater diversification could erode their competitive advantage of local expertise.

Drivers

We now study the factors underlying the rising footprint of private credit globally. Motivated by the literature, we examine four hypotheses.

The first hypothesis is that lower interest rates have contributed to the rise of private credit. They could have done this in several ways. For one, a low-for-long period might have induced institutional investors to search for yield and steer their portfolios towards private credit funds, lowering their funding costs. For another, a steady decline in policy rates could have eroded bank profitability. Low nominal

[8] For example, diversified banks are less risky (Goetz et al (2016)), which translates into lower funding costs (Levine et al (2021), Doerr (2024)) as well as better access to wholesale funding and more lending during crises (Doerr and Schaz (2021)).

interest rates mean a narrower spread between assets and liabilities because deposit rates adjust slowly to market rates (Drechsler et al (2017), Sarto and Wang (2023)). Bank profitability thus falls as policy rates trend downward, depressing banks' net worth and curtailing loan supply (Abadi et al (2023)). Private credit funds, which are wholesale financed at market rates and extend floating rate loans, face no such spread compression. Thus, they could have gained market share at the expense of banks during the low rate period.

The second hypothesis is that private credit fills unmet demand for credit in general. About 10% of all small and medium-sized firms in advanced economies (AEs) and over 20% in emerging market economies (EMEs) report being credit constrained, often due to a lack of collateral (Caballero et al (2025)). The growth of direct lending by private credit, providing uncollateralised loans with tailored covenants to small and medium-sized firms, could stem from the needs of firms underserved banks.

Third, stricter regulation for banks has spurred lending by private credit funds. Post-crisis banking regulation likely reduced banks' willingness to lend to risky firms.[9] Faced with an increase in the cost of bank credit, riskier firms may turn to non-bank lenders, including BDCs (Chernenko et al (2022), Davydiuk et al (2024)).

And fourth, rising leverage among non-financial corporations (NFCs) could have enlarged the footprint of private credit. Private credit funds are more willing to lend to highly leveraged borrowers. The substantial increase in NFC leverage in many countries over recent decades could therefore have coincided with increased lending by private credit funds.

To test these hypotheses, we assemble a quarterly data set on private credit loans for 45 countries between 2010 and 2019. By jointly considering different drivers in a cross-country regression setting, our work expands on existing studies that have predominately focused on individual countries, most notably the United States, or non-bank financial institutions more generally. We estimate the following regression:

$$\ln PC_{c,t} = \beta X_{c,t} + controls_{c,t} + \theta_c + \varepsilon_{c,t}. \quad (1)$$

The dependent variable $\ln PC_{c,t}$ is the natural logarithm of the total amount of newly originated private credit (*PC*) loans in country *c* and quarter *t*. The set of explanatory variables $X_{c,t}$ captures variables related to the four hypotheses laid out above. These include the policy rate; the International Monetary Fund's financial institutions (FI) index, which proxies banks' general ability to satisfy loan demand; the stringency of bank regulation; and NFC leverage. Annex A provides more details on data sources and variable definitions. The regressions include country fixed effects, θ_c, capturing time-invariant country-specific factors (eg country size and institutional features) as well as measures for economic development and business cycles.

[9] Cortés et al (2020) and Doerr (2021) show that post-crisis stress tests in the United States have reduced banks' credit supply to small and young firms in riskier markets. For Europe, Gropp et al (2019) show that an increase in capital requirements made banks reduce their risk-weighted assets, in particular loans to riskier corporations. For a discussion, see also Kashyap et al (2010). However, why banks have reduced their lending while more equity-dependent lenders have increased theirs remains an interesting question for future research.

Table 1 shows that originations of direct loans are higher when policy rates are lower, when the financial institutions index is lower – ie when banks are less capable to serve loan demand – and when the levels of bank regulatory stringency and total NFC leverage are higher.[10] These findings are consistent with the hypotheses laid out above. In terms of economic significance, a one standard deviation decrease in the policy rate (4.14%) is associated with an increase in private credit of about 12%. The average decline in policy rates observed between 2007 and 2017 in the median country in our sample is about 4 percentage points, which implies a significant impact on private credit. Similarly, a one standard deviation decrease in the FI index of 0.17 points is associated with an increase in private credit activity of about 33%. To put this into perspective, a difference of 0.17 points corresponds to roughly half the difference between AEs and EMEs in our sample.[11] The smallest effects are attributable to bank regulation stringency and NFC leverage, where a one standard deviation increase is associated with an increase in private credit activity of around 7%.

The drivers of private credit[1] Table 1

	(1)	(2)	(3)	(4)	(5)
Policy rate	–0.030***				–0.029***
	(–3.10)				(–3.27)
FI index		–1.679**			–1.906***
		(–2.14)			(–2.78)
Bank stringency			0.463		0.667*
			(1.42)		(2.00)
NFC debt				0.001	0.001
				(0.88)	(1.35)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
N	1523	1523	1523	1523	1523
R-squared	0.865	0.865	0.864	0.864	0.867
Within-R-squared	0.107	0.112	0.105	0.104	0.122

[1] The sample period covers Q1 2010 to Q4 2019. ***/**/* indicates statistical significance at the 1/5/10% level. Variable definitions are provided in Annex A. Control variables (not shown) include the logarithm of the total population, the logarithm of GDP per capita, GDP growth and quarterly inflation. T-statistics in parentheses are based on robust standard errors clustered at the quarter and country levels. The standard deviations of private credit, the policy rate, financial institutions index, bank regulation stringency and NFC debt-to-GDP are 1.35, 4.14, 0.174, 0.104 and 63.02, respectively.

Sources: IMF; World Bank; Pitchbook Data Inc; BIS; authors' calculations.

[10] Our results remain robust across various regression specifications that (i) exclude the US from our sample; (ii) include time fixed effects, thereby controlling for global factors; (iii) use alternative measures of banking sector developments; and (iv) exclude the bank stringency variable, allowing us to estimate the regressions on a longer sample (2001–21).

[11] The median values of the FI index in our sample of AEs and EMEs are 0.79 and 0.43, respectively. The FI index varies mainly across countries rather than over time, ie our estimate captures the tendency of countries with lower FI index values to have more private credit.

Box A

Demand versus supply drivers of private credit in the United States

The rise of private credit can be divided into demand and supply side drivers using statistical methods combined with price and quantity data. We estimate a bivariate structural vector autoregression model (SVAR) for the United States for the period Q1 2004 to Q3 2024. For prices, the SVAR includes the average interest rate on private credit deals over the policy rate. For quantities, it uses the natural logarithm of the total number of private credit deals.

We identify demand and supply shocks by imposing the following sign restrictions on the (within-quarter) impact responses of rates and deals to shocks (Uhlig (2005)): a demand shock has a positive effect on deals and rates, while a supply shock has a positive effect on deals but a negative effect on rates. We then decompose the evolution of private credit into two counterfactual series, one driven only by demand shocks (Graph A1.A) and another driven only by supply shocks (Graph A1.B). These time series illustrate periods in our sample when demand and supply shocks were important in driving the rise in private credit.

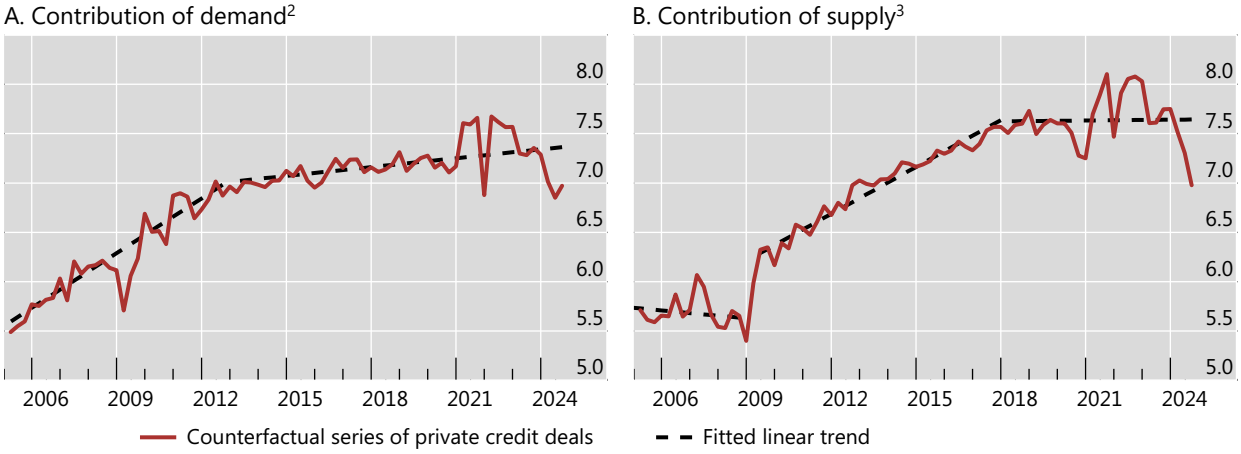
Demand shocks contributed relatively more to the overall growth in private credit between 2005 and 2012 (reflected by the steeper line in Graph A1.A). This may have been due to difficulties faced by small and medium-sized firms in accessing traditional bank credit. These underserved firms turned to private credit funds, which were able to meet their financing needs with more flexible and tailored lending solutions.

Supply shocks dominated from 2010 to 2019, when private credit grew rapidly (Graph A1.B). This period coincides with tighter banking regulation and historically low interest rates, when attractive yields started drawing institutional investors more broadly into private markets. These forces likely lowered credit funds' cost of capital, boosting their loan supply.

The period after 2020, dominated by the Covid-19 pandemic as well as steeply rising inflation and policy rates, is characterised by high volatility of supply and demand shocks, with no clear effect on the general trend.

Contribution of demand and supply shocks to the rise in private credit[1]

Number of deals, in logarithmic scale — Graph A1



[1] The graph shows the results from a historical decomposition applied to our SVAR(4) model with demand and supply shocks identified via sign restrictions. [2] The red solid line shows the counterfactual time series of the total number of private credit deals (in natural logarithm) explained by demand shocks identified via sign restrictions. The black dashed line shows a fitted linear trend over the pre-2012 and post-2012 periods. [3] The red solid line shows the counterfactual time series explained by supply shocks. The black dashed line shows a fitted linear trend over the pre-2009, 2009–18 and post-2018 periods.

Sources: PitchBook Data Inc; authors' calculations.

The rise of private credit is due to shifting demand and supply factors over different periods, with demand factors being more influential before the GFC and supply factors driving growth from 2010 onwards. To disentangle demand and supply factors, we apply statistical methods to the average interest rate on private credit deals over the policy rate and the total number of private credit deals in the United States (Box A). A historical decomposition suggests that demand factors were the dominant driver before the GFC, when private credit experienced modest growth in general. Demand factors might have dominated in that period due to a growing number of riskier firms or firms with few tangible assets that were underserved by traditional banks. Funds' credit supply, however, emerges as the more important driver from 2010 onwards, when private credit grew particularly strongly. Supply factors could be attributable to a decline in funding costs for private credit funds, possibly spurred by low policy rates. This finding is consistent with our hypothesis that the low-for-long period contributed to the rise of private credit.

Banks, private credit and the cost of capital

To better understand how private credit funds compete with banks, we examine their cost of capital. A lower cost of capital allows lenders to offer loans at lower rates, thereby attracting more borrowers and expanding their market share.

The cost of capital comprises two primary components, the cost of equity (CoE) and the cost of debt (CoD). The CoE is the return shareholders expect for their investment in a company. It is often computed as an application of the capital asset pricing model by adding to the risk-free rate a risk premium that compensates the investor for the firm's exposure to market risk. The CoD is the effective interest rate a company pays on its borrowed funds, which include bonds, lines of credit or deposits, among others. The overall cost of capital, known as the weighted average cost of capital (WACC), combines these two components based on their respective proportions in the company's capital structure. We obtain information on the WACC, CoE and CoD from Bloomberg.[12]

To study the cost of capital, we focus on banks and BDCs in the United States. Detailed data on the funding of private credit funds are scarce. BDCs, as listed companies and major players in the private credit space, provide in their regulatory filings the information necessary to compute the costs of equity, debt and capital. In generalising our findings, however, it is important to keep in mind that BDCs differ from other debt funds in important ways.[13]

Banks' CoE was broadly similar to that of BDCs up until 2009 but has been higher since then (Graph 4.A, red line). It increased by substantially more than that of BDCs (blue line) during the GFC, likely reflecting the higher stock market variability of banks due to concerns about their health. Following the GFC, except for a brief period

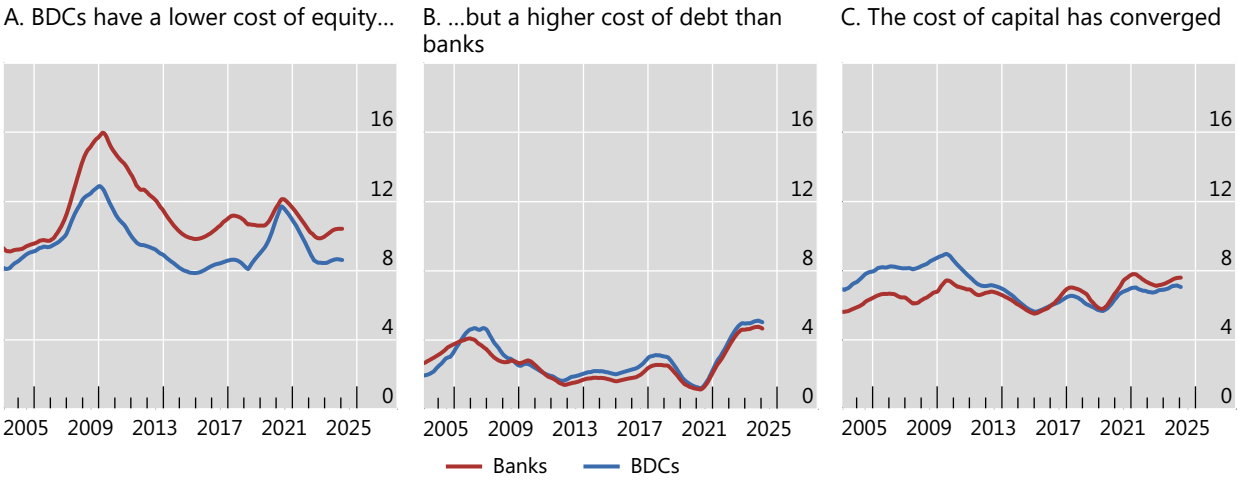
[12] For expositional clarity we have omitted the cost of preferred stock (CoP) from the discussion, as only a few companies have preferred stock and its share of total capital is typically small. Bloomberg computes the WACC according to the following formula: $WACC = [\ CoD \times (TD/V)\ ] + [\ CoP \times (P/V)\ ] + [\ CoE \times (E/V)\ ]$, where TD is total debt, V is total capital, P is preferred equity and E is equity capital.

[13] For example, BDCs depend primarily on equity as well as revolving credit and corporate debt, ie notes and bonds (Chernenko et al (2024)) and are open to retail investors. BDCs also face a regulatory limit on their debt-to-equity ratio of 2:1.

Cost of equity, debt and capital for banks and BDCs[1]

In per cent

Graph 4



BDC = business development company.

[1] Median values. See endnotes for details.

Sources: Bloomberg; authors' calculations.

during the Covid-19 pandemic, a sizeable gap persisted, in part reflecting the generally much higher leverage of banks.[14]

BDCs' CoD has been slightly higher than that of banks, and more so during periods of monetary tightening (Graph 4.B). During the three hiking cycles by the Federal Reserve starting in mid-2004, early 2016 and early 2022, BDCs' CoD increased by somewhat more than that of banks. These patterns reflect that BDCs are mostly wholesale financed at rates that move closely with the policy rate. Bank debt also comprises deposits with "sticky" rates that increase by less than the policy rate, implying an attenuated increase in funding costs when interest rates rise.[15]

Combining both series, we find that BDCs' cost of capital was relatively higher than that of banks in the pre-GFC period but that the series have converged since then (Graph 4.C). The WACC of BDCs (blue line) was around 200 bp higher than that of banks (red line) before the GFC, suggesting that banks enjoyed a material funding advantage at the time. Between 2010 and 2019, the spread declined by about 250 bp, with a pronounced drop during the GFC and in its immediate aftermath.[16]

[14] Another explanation for the persistent gap could be more stringent capital requirements, but the evidence is mixed. Baker and Wurgler (2015) show that capital regulation increases the cost of capital and loan rates by raising the cost of equity due to the so-called low-risk anomaly in equity markets. The anomaly refers to the counterintuitive observation that lower-risk stocks can generate higher risk-adjusted returns than higher-risk stocks. Using an alternative approach, Dick-Nielsen et al (2022) confirm the low-risk anomaly in equity markets but do not find evidence of regulation increasing the cost of capital for banks.

[15] Bloomberg's CoD measure likely overstates the cost of deposits for banks, as it assumes they pay the same rate as other short-term debt, potentially leading to an overestimation of the cost of debt and capital for banks. Adjusting the CoD for observed deposit rates leads to a level shift, reducing banks' CoD and WACC. However, dynamics relative to BDCs remain unaffected (see Annex A).

[16] For expositional clarity we omit the volatile period after 2019.

Further analysis indicates that the narrowing of the spread between the cost of capital of banks and BDCs is largely explained by a fall in BDCs' cost of equity and a material increase in their leverage. To establish this, we compute three counterfactual time series of the spread between the WACC of banks and that of BDCs. First, we allow only the cost of debt of banks and BDCs to vary over time, while holding their cost of equity and capital structure, ie the shares of debt and equity in total capital, constant at their respective pre-2007 averages. Second, we vary only the cost of equity but fix the cost of debt and the capital structure. Third, we allow only the capital structure to vary while keeping the cost of equity and debt fixed. The three series illustrate the relative contributions of changes in lenders' cost of debt, cost of equity and capital structure to changes in the spread between the WACC of banks and BDCs.

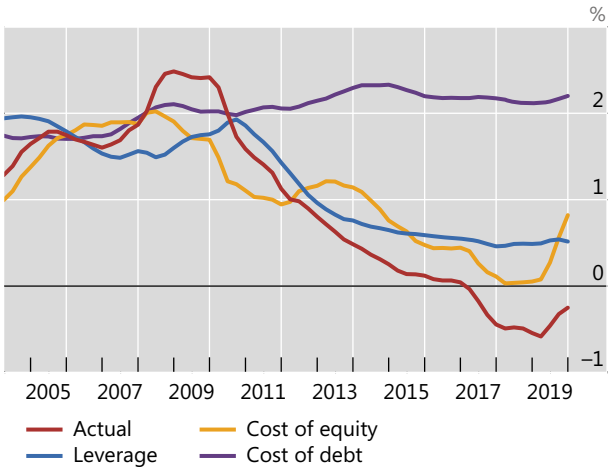
The cost of equity has contributed substantially to narrowing the WACC spread between banks and BDCs, particularly in the immediate aftermath of the GFC. The decline in BDCs' CoE relative to banks between 2009 and 2011 contributed almost 100 bp to the decline in the spread (Graph 5.A, yellow line), with subsequent changes being more gradual.

A steady increase in BDC leverage was the other main contributor to the narrowing of funding costs between banks and BDCs. Changes in the capital structure, ie shifts in the importance of equity vs debt, contributed about 150 bp to the decline in the spread after 2010 (Graph 5.A, blue line). The main driver was an increase in BDC leverage. Since 2011 BDCs' debt-to-equity ratio increased from around 0.4 to over 1 on average (Graph 5.B, blue line). Correspondingly, the share of debt in their WACC increased (red line).

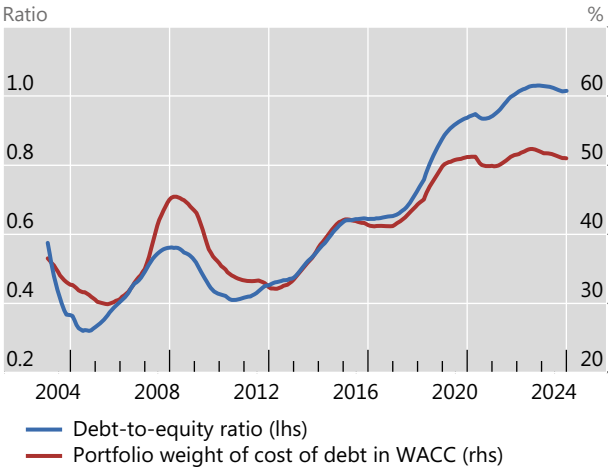
Finally, changes in the cost of debt had little impact on the cost of capital spread overall. If anything, the CoD of BDCs trended slightly upwards with respect to that of banks (Graph 5.A, purple line). This pattern likely reflects the relatively small difference between banks' and BDCs' cost of debt during the low rate period.

What is driving the convergence in the cost of capital between BDCs and banks? Graph 5

A. The narrowing of the spread reflects a relative increase in banks' cost of equity after the GFC…[1]



B. …as well as a steady increase in the importance of debt financing among BDCs[2]



BDC = business development company; WACC = weighted average cost of capital.

[1] The red line shows the difference ("spread") in the cost of capital (WACC) between BDCs and banks. The yellow line shows the spread when the cost of debt and portfolio weights are fixed at their pre-2007 average and only the cost of equity changes over time. The purple line fixes the cost of equity and portfolio weights but not the cost of debt. The blue line fixes the cost of equity and debt but not portfolio weights. All series are 12-month moving averages. [2] Twelve-month moving averages.

Sources: Bloomberg; authors' calculations.

The rise in leverage is potentially driven by BDCs' use of cheap debt during the low rate period. The attendant decline in the cost of capital despite rising leverage suggests that the benefits of cheaper debt financing outweigh the costs of increased risk to equity investors as BDCs levered up.[17] Additional research is warranted to understand the reasons for the substantial decline in BDCs' funding costs compared with those of banks.

Taken together, the evidence suggests that the growth of BDCs was driven, at least in part, by a decline in their cost of capital relative to that of banks. The patterns uncovered in this section are consistent with the broader finding that supply factors were the primary drivers of private credit's fast rise after 2011 (Box A). That said, BDCs have also experienced rapid growth in the years after 2020, although their cost of capital relative to that of banks has remained constant. This development could imply that some of the growth of BDC lending, or of private credit more generally, stems from its genuine ability to cater to the needs of firms underserved by banks.

Conclusion

This article has examined the growth and drivers of private credit. The footprint of private credit is larger in countries with lower policy rates, more stringent banking regulations and less efficient banking sectors. Moreover, evidence from the United States suggests that BDCs' cost of capital relative to that of banks has steadily declined over the past decade, eroding banks' initial funding advantage.

Our analysis informs the debate on how the relationship between banks and private credit could evolve and affect the nature of financial intermediation and financial stability going forward.

Private credit could complement the existing bank-based system and bring financial stability benefits. Banks are primarily financed via short-term deposits, and uninsured deposits are prone to runs. Private credit funds, with their closed-end structure and matched maturity of assets and liabilities, may be better positioned to hold long-term loans and attendant risks.

An open question is to what extent private credit funds are better at originating, screening and monitoring loans. Their specialisation in narrow market segments could provide informational advantages, and borrowers appear to value the flexible terms of private loans. It remains to be seen whether the expected returns of private credit are commensurate with the risk-taking involved or whether lending standards deteriorate in the face of continued credit expansion – in particular because private credit, being a fairly young asset class, has not yet gone through a full credit cycle. At the very least, the increasing prevalence of partnerships between private credit funds and banks suggests that banks, which have the customer relationships, loan officers and ability to provide liquidity through eg lines of credit, might still have an advantage in arranging loans.

Another question is whether private credit funds can maintain their comparative edge. As the leverage of BDCs – and private credit funds more generally – increases,

[17] One possibility is that with falling default probabilities and improving economic conditions after the height of the GFC and euro area sovereign debt crisis, BDCs were able to increase leverage without escalating their cost of debt and cost of equity, capitalising on enhanced creditworthiness and investor appetite for yield.

their advantage in holding risk may diminish. If private credit succeeds in attracting more retail investors, eg by migrating to more open-ended structures, liquidity mismatches between assets and liabilities would ultimately rise. Private credit would then be increasingly subject to similar vulnerabilities to banks. Relatedly, with the era of persistently low interest rates coming to an end, the fall in BDCs' cost of capital may reverse. In addition, as retail investors may have a limited understanding of funds' portfolio concentration, striking the right balance between specialisation and diversification within funds is bound to become more challenging. Indeed, funds may dilute their competitive advantage of local expertise if they diversify.

From a financial stability perspective, developments in funds' investor base, including the growing role of insurance companies and retail investors, as well as funds' leverage and degree of portfolio concentration warrant monitoring. This is especially relevant in light of growing interlinkages between banks and private credit.

References

Abadi, J, M Brunnermeier and Y Koby (2023): "The reversal interest rate", *American Economic Review*, vol 113, no 8, pp 2084–120.

Aldasoro, I, S Doerr and H Zhou (2022): "Non-bank lenders in the syndicated loan market", *BIS Quarterly Review*, March, pp 15–29.

Aramonte, S and F Avalos (2019): "Structured finance then and now: a comparison of CDOs and CLOs", *BIS Quarterly Review*, September, pp 11–14.

——— (2021): "The rise of private markets", *BIS Quarterly Review*, December, pp 69–82.

Baker, M and J Wurgler (2015): "Do strict capital requirements raise the cost of capital? Bank regulation, capital structure, and the low-risk anomaly", *American Economic Review*, vol 105, no 5, pp 315–20.

Block, J, Y S Jang, S Kaplan and A Schulze (2024): "A survey of private debt funds", *Review of Corporate Finance Studies*, vol 13, no 2, pp 335–83.

Board of Governors of the Federal Reserve System (2023): "Financial stability risks from private credit funds appear limited", *Financial Stability Report*, May.

Caballero, J, S Doerr, A Mehrotra and F Zampolli (2025): "How far can digital innovation improve credit to small firms in emerging market economies?", *BIS Bulletin*, no 99.

Chernenko, S, I Erel and R Prilmeier (2022): "Why do firms borrow directly from nonbanks?", *Review of Financial Studies*, vol 35, no 11, pp 4902–47.

Chernenko, S, R Ialenti and D Scharfstein (2024): "Bank capital and the growth of private credit", *Working Paper*.

Cortés, K, Y Demyanyk, L Li, E Loutskina and P Strahan (2020): "Stress tests and small business lending", *Journal of Financial Economics*, vol 136, no 1, pp 260–79.

Davydiuk, T, T Marchuk and S Rosen (2024): "Direct lenders in the US middle market", *Journal of Financial Economics*, vol 162, article 103946.

Dick-Nielsen, J, J Gyntelberg and C Thimsen (2022): "The cost of capital for banks: evidence from analyst earnings forecasts", *Journal of Finance*, vol 77, no 5, pp 2577–611.

Doerr, S (2021): "Stress tests, entrepreneurship and innovation", *Review of Finance*, vol 25, no 5, pp 1609–37.

——— (2024): "Bank geographic diversification and funding stability", *BIS Working Papers*, no 1221, October.

Doerr, S and P Schaz (2021): "Geographic diversification and bank lending during crises", *Journal of Financial Economics*, vol 140, no 3, pp 768–88.

Drechsler, I, A Savov and P Schnabl (2017): "The deposits channel of monetary policy", *Quarterly Journal of Economics*, vol 132, no 4, pp 1819–76.

Erel, I, T Flanagan and M Weisbach (2024): "Risk-adjusting the returns to private debt funds", *National Bureau of Economic Research Working Papers*, no 32278, March.

Goetz, M, L Laeven and R Levine (2016): "Does the geographic expansion of banks reduce risk?", *Journal of Financial Economics*, vol 120, no 2, pp 346–62.

Gropp, R, T Mosk, S Ongena and C Wix (2019): "Banks response to higher capital requirements: evidence from a quasi-natural experiment", *Review of Financial Studies,* vol 32, no 1, pp 266–99.

International Monetary Fund (IMF) (2024): "The rise and risks of private credit", *Global Financial Stability Report*, chapter 2, April, pp 53–76.

Jang, Y S (2024): "Are direct lenders more like banks or arm's-length investors?", *Working Paper*.

Kashyap, A, J Stein and S Hanson (2010): "An analysis of the impact of 'substantially heightened' capital requirements on large financial institutions", *Working Paper*.

Levine, R, C Lin and W Xie (2021): "Geographic diversification and banks' funding costs", *Management Science*, vol 67, no 5, pp 2657–78.

Sarto, A and O Wang (2023): "The secular decline in interest rates and the rise of shadow banks", *Working Paper*.

Uhlig H (2005): "What are the effects of monetary policy on output? Results from an agnostic identification procedure", *Journal of Monetary Economics*, vol 52, no 2, pp 381–419.

Van Steenis, H (2025): "The big new role for private credit", *Financial Times*, 10 January.

Annex A

Regarding the four main regressors in our econometric model, the policy rate varies at the quarterly level, whereas the stringency of capital regulation, the financial institutions index and the non-financial corporation (NFC) debt-to-GDP ratio are at yearly frequencies. A short description of the variables is as follows.

Policy rate: interest rate set by national central banks (or the European Central Bank in the case of euro zone countries) at the end of the quarter (source: BIS database).

Financial institutions (FI) index: an aggregate of (i) the financial institutions depth (FID) index, which uses data on bank credit to the private sector in per cent of GDP, pension fund and mutual fund assets to GDP, and insurance premiums to GDP; (ii) the financial institutions access (FIA) index, which uses data on bank branches per 100,000 adults and ATMs per 100,000 adults; (iii) the financial institutions efficiency (FIE) index, which uses data on banking sector profitability and cost measures and spreads (eg return on equity and net interest margin) (source: IMF Data Portal).

Bank stringency: the regulatory stringency variable is constructed as an index (normalised between zero and one) based on the World Bank's Bank Regulation and Supervision Survey. The index takes a value between zero (least stringent) and one (most stringent) based on questions about bank capital requirements, disclosure, the legal powers of supervisory agencies etc (source: World Bank).

NFC debt: debt of non-financial corporations (loans and debt securities) as a percentage of GDP (source: IMF Data Portal).

Graph A.1.A shows banks' cost of debt (CoD) in the original Bloomberg series as well as the CoD when we adjust the initial CoD for the cost and weight of deposits. To this end, we use data from the US call reports to compute the deposit rate as total deposit expense over lagged total deposits. We then recompute the CoD as (1 – deposits/assets) X CoD + deposits/assets X deposit rate for each bank.

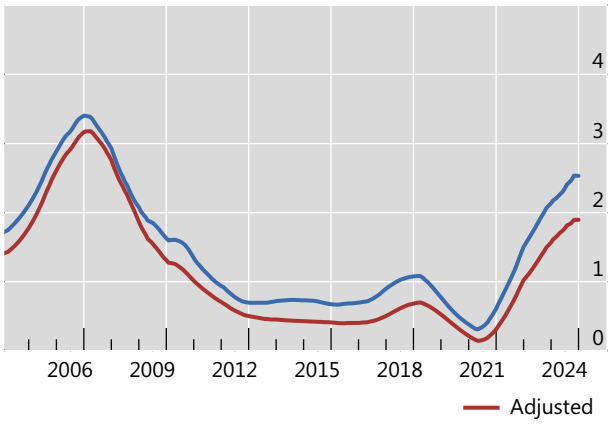
Graph A.1.B shows the spread between the weighted average cost of capital (WACC) of business development companies and that of banks, once without adjusting the WACC for the cost of deposits and once with adjustments. While the levels are different, the dynamics are nearly identical.

Accounting for the role of deposits in banks' cost of debt and capital

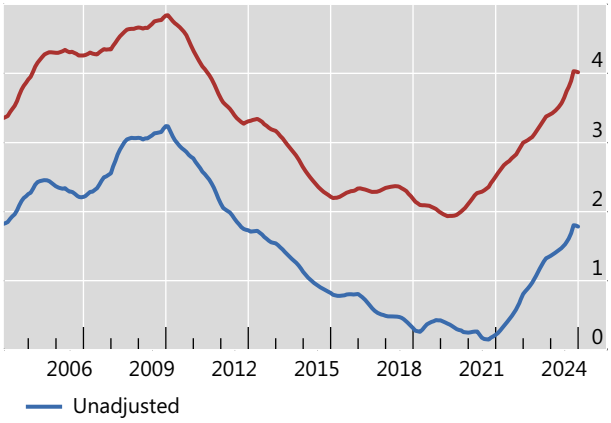
In per cent

Graph A.1

A. Banks' cost of debt adjusted for deposits



B. Spread in WACC between business development companies and banks, adjusted for deposits



WACC = weighted average cost of capital.

Sources: Bloomberg; authors' calculations.

Endnotes

Graph 1.B: Private funds: pooled investment vehicles not registered under the usual securities laws and regulations, such as hedge funds, private equity funds and venture capital funds. Non-profits: foundations, endowments and charitable organisations. Other: investors that do not fit traditional categories, such as foreign entities, special purpose vehicles, family offices, trusts, estates or other unconventional investment vehicles.

Graph 2.B: Cleantech: technologies aimed at reducing environmental impact. Industrials: production and distribution of goods and services for industrial use. Infrastructure: development and maintenance of physical systems like transportation, utilities and buildings. Life sciences: study and application of biology and related sciences to improve health. Manufacturing: production of goods using labour, machines and tools. Oil and gas: exploration, extraction, refining and distribution of oil and natural gas. Technology, media and telecommunications (TMT): industries focused on technological innovation, media content and communication services. Others: industries that do not fit in the aforementioned categories, such as financial technology, mobile, software as a service and other small industries.

Graph 4: The sample includes 11 banks and 55 business development companies. The cost of equity measures are taken from Bloomberg (mnemonic: WACC_COST_EQUITY) and are based on the capital asset pricing model (CAPM). The cost of debt is computed as the after-tax weighted average cost of debt (mnemonic: WACC_COST_DEBT), calculated using government bond rates, a debt adjustment factor, the proportions of short- and long-term debt to total debt and the stock's effective tax rate. The cost of capital is computed as the weighted average cost of capital, which includes the cost of debt, cost of preferred equity and cost of equity.

Claudio Borio
borio.cev@outlook.com

Matthieu Chavaz
matthieu.chavaz@bis.org

Moving targets? Inflation targeting frameworks, 1990–2025[1]

Recent and upcoming reviews of monetary policy frameworks have been putting the spotlight on the evolution of inflation targeting. This article provides context by using a new database of changes to the inflation targeting frameworks of 26 central banks since 1990. We use the data to track changes in the frameworks' flexibility in terms of the specification of the inflation target and the role of other objectives, ie employment (or output) and financial stability. While the specification of the numerical targets has become stricter (eg points rather than ranges), greater flexibility has taken the form of less strict / longer horizons to achieve them and more weight on other objectives, especially employment/output. These trends are typically more pronounced in advanced economies and have widened differences with their emerging market peers.

JEL classification: E12, E3, E52

Inflation targeting has turned 35. Since its birth, it has spread across the globe and proved remarkably durable.[2] Part of its appeal is to offer central banks a form of "constrained discretion" to pursue price stability (Bernanke and Mishkin (1999)). What is much less clear is where exactly to strike the balance between constraints and discretion. Policymakers and scholars have worried about both too little flexibility (eg Alan Greenspan)[3] and too much (eg Taylor (2022)). The close attention given to recent framework reviews confirms that the optimal specification remains up for debate (eg Eggertsson and Kohn (2023)).

This study aims to inform the debate. It develops a new database of changes to inflation targeting frameworks since the regime's adoption to document systematically how the flexibility of framework has evolved in a sample of 26 central banks from both advanced (AE) and emerging market economies (EMEs). Flexibility is here defined as the degree to which the framework tolerates fluctuations in (headline)

[1] The views expressed do not necessarily reflect those of the Bank for International Settlements. We thank Sarah Bell, Blaise Gadanecz, Gaston Gelos, Boris Hoffman, Benoît Mojon, Piti Disyatat, Tom Rosewall, Phurichai Rungcharoenkitkul, Andreas Schrimpf, Hyun Song Shin and Frank Smets for helpful comments and suggestions. We are also grateful to Albert Pierres Tejada for excellent research assistance, and for colleagues at several central banks for their help in locating sources.

[2] Inflation targeting – a price-stability-oriented monetary policy framework that sets specific and publicly known numerical targets – was first adopted in New Zealand in 1990. See Rose and Rose (2024) and Borio (2024).

[3] See eg Blinder (2006).

Key takeaways

- *The features shaping the flexibility of inflation targeting have evolved substantially since the inception of the regime in the early 1990s.*
- *While numerical targets have become stricter (eg points rather than ranges), greater flexibility has taken the form of less strict / longer horizons to achieve the targets and greater weight on other objectives, especially employment/output.*
- *These trends have typically been stronger in advanced economies, tending to widen differences with their emerging market peers.*

inflation and allows for the pursuit of other objectives, specifically employment (or output) and financial stability.[4]

To measure that flexibility, we construct a range of quantitative indicators for each central bank and year. The information is drawn *exclusively* from official documents laying out formal objectives and how to make them operational. The documents form a kind of "constitution" that guides policymaking. The analysis is similar in spirit to the construction of de jure indices of central bank independence or exchange rate flexibility (Romelli (2022); IMF (2004)). In particular, our analysis does not examine the actual *conduct* of the central bank within a given framework, such as by estimating central bank reaction functions (eg Taylor (1993)). Clearly, the de facto degree of flexibility could vary depending on circumstances.

Three key findings stand out. First, while the specification of the numerical targets has become stricter (eg points rather than ranges), the horizon over which to achieve them has become less strict, ie vaguer and longer. Second, objectives other than inflation, especially employment and output, have gained ground. Third, these trends are typically stronger in AEs and have tended to widen differences with their EME peers. Overall, the pattern is consistent with the idea that stronger confidence in hitting the inflation target and in the framework's credibility, as reflected in stricter numerical targets but longer horizons, has provided the leeway to pursue other objectives.

The rest of the article is organised as follows. The first section describes the basic concepts and lays out the methodology. The second considers the current state of play, comparing the flexibility of current frameworks across countries and focusing on the distinction between AEs and EMEs. The third examines the evolution of the degree of flexibility and provides some possible explanations, laying the ground for some final considerations.

Basic concepts and methodology

Constructing indicators of an inflation targeting framework's flexibility involves a number of steps: defining the object of analysis, ie the inflation targeting framework

[4] The present analysis complements other descriptive studies documenting the features of inflation targeting regimes but without focusing on flexibility (Mishkin and Schmidt-Hebbel (2007); Niedźwiedzińska (2021); Ciżkowicz-Pękała et al (2019); Unsal et al (2022)).

itself, defining flexibility and developing the measurement methodology. Consider each step in turn.

The object of analysis – inflation targeting – can be somewhat fuzzy. To varying degrees, all central banks seek to achieve price stability. And views can differ on whether a central bank is operating an inflation targeting regime or not, regardless of official statements (eg Buiter (2004)). For example, views might differ on the how specifically price stability must be defined and the permissible weight attached to the exchange rate and monetary aggregates. In what follows, we define inflation targeting broadly, as a framework that specifies and announces an explicit numerical objective for inflation to be reached over a certain horizon.

The resulting sample is representative of the set of inflation targeting frameworks in both AEs and EMEs. It covers 11 AE and 15 EME central banks.[5] Adoption dates range from 1990 (New Zealand) to 2016 (India). Given how infrequently regimes change, the indicators are annual.

We define *flexibility* as the degree to which the framework deviates from one in which the central bank's sole objective is to target a consumer price index over a short and numerically specified horizon – one to two years. In other words, this is the (theoretical) benchmark for *zero flexibility*. In this case, the policymaker has little discretion to tolerate fluctuations in inflation to pursue other objectives, such as employment or financial stability, and address the associated trade-offs.[6]

Greater flexibility has benefits as well as possible costs. It helps to reduce the economic costs of a strict pursuit of the inflation objective. The costs may be in terms of other objectives, such as output and financial stability, or the preservation of price stability itself on a more sustainable basis. To use King's famous expression, no central bank is an "inflation nutter" (King (1997)).[7] At some point, however, greater flexibility may also undermine the regime's credibility and raise its economic costs more generally. The trade-offs involved will depend on the workings of the economy, the forces driving it at any given point in time and the broader institutional context.

The construction of the flexibility indicators requires making several additional choices. Graph 1 outlines the structure; Box A delves into the details of the calibration.

The basic idea is to consider two key dimensions of flexibility (Graph 1, green boxes): (i) the flexibility of the *specification of the inflation target* itself; and (ii) the pursuit of *objectives other than price stability*. The specification of the target is what defines the tolerance for the dispersion of inflation outcomes and provides the leeway to pursue other objectives.

The next step in the quantification of flexibility is key (Graph 1, blue boxes). We consider two aspects of the specification of the target: (i) the definition of the

[5] We cover BIS member central banks only. The grouping follows BIS convention. AEs are Australia, Canada, the euro area, Iceland, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom and the United States. EMEs are Brazil, Chile, Czechia, Hungary, Indonesia, India, Israel, Korea, Mexico, Peru, Romania, the Philippines, South Africa and Thailand. See Annex C for additional details.

[6] In modern macroeconomic parlance, flexibility is key when the central bank faces shocks that create policy trade-offs. In this context, flexibility is not relevant when there is a "divine coincidence" between objectives, eg after a demand-driven inflation shock (Blanchard and Galí (2007)).

[7] For instance, flexibility allows policymakers to respond less strongly to supply-driven inflation "shocks", as AE central banks often do (Hofmann et al (2024)). See Svensson (1997) for an early elaboration of the concept of "flexible inflation targeting".

numerical target itself*;* and (ii) the *horizon* over which to achieve it. And we identify two objectives other than price stability: (iii) employment or output ("real economy"); and (iv) financial stability.[8] Importantly, we quantify *separately* the degree of flexibility for each of these four "sub-dimensions" of flexibility. The resulting *core indicators* are the main focus of the analysis.

To construct the four core indicators, we quantify and aggregate the impact on flexibility of a number of features of the framework that correspond to each sub-dimension (orange boxes). Consider the features related to the specification of the target and other objectives, in turn.

The specification of the target describes the level of ambition with respect to the inflation objective. Flexibility can be achieved in two non-mutually exclusive ways (left-hand side of Graph 1): through the specification of the numerical target or through the specification of the horizon over which the target is to be achieved. For instance, in the case of the numerical target, a range is less restrictive than a point. And a target defined in terms of headline inflation is more ambitious (less flexible) than one defined in terms of core inflation or with escape clauses (eg excluding changes due to taxes and volatile prices): headline is more volatile and hence harder to control. In the case of the horizon, the key distinction is between one that is short and quantitative versus one that is long and qualitative (eg "over the medium term").

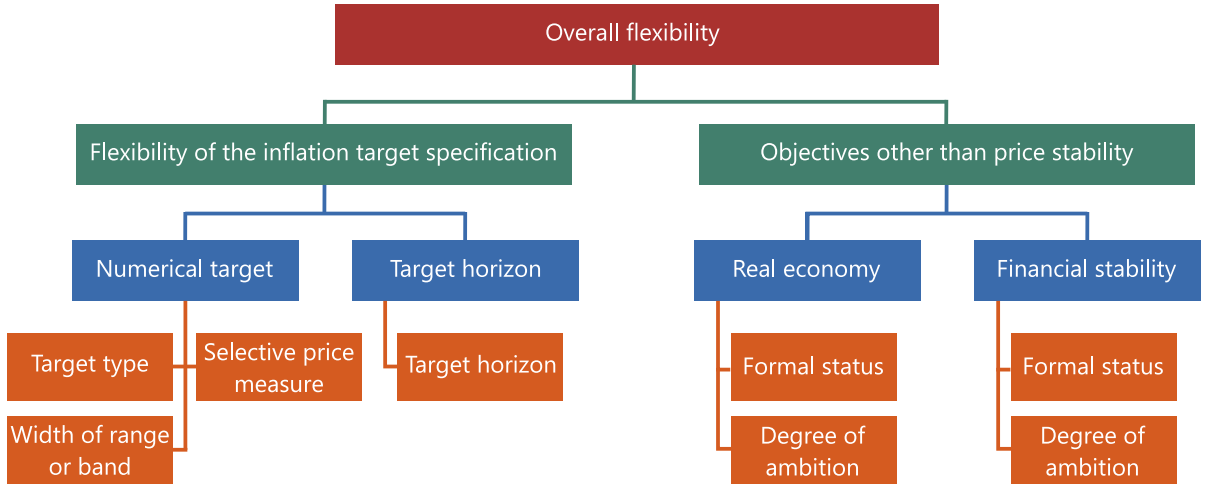
The required flexibility to pursue an objective other than price stability (right-hand side of Graph 1) depends on the weight attached to that objective. Thus, for each objective, we consider its status (eg primary, secondary or merely a consideration) and the level of ambition (eg just mitigating fluctuations in output or employment or achieving its maximum level).

Taken together, the four indicators provide a multifaceted picture of a given inflation targeting framework's degree of flexibility. With each core indicator ranging from 0 (minimum flexibility) to 1 (maximum), the most flexible central bank would be one that scored 1 for each of the four core indicators. Concretely, this would correspond to a central bank that: (i) targeted a wide range for core inflation over a qualitative long horizon; and (ii) considered real activity and financial stability as objectives on a par with price stability and had ambitious goals for both. This would be the case if the central bank aimed at maximum employment and used monetary policy explicitly to lean against the build-up of financial imbalances.

While, in principle, it would be possible to aggregate across sub-dimensions and construct a single indicator of flexibility, we regard this as a step too far. For one, focusing the discussion on the four indicators highlights the richness of the various facets of flexibility. In addition, the trade-offs between objectives and the interactions of the different dimensions are too dependent on specific views about the workings of the economy and on country-specific features. Aggregation would be too subjective and give a sense of false precision.

[8] We chose the two objectives at the heart of central bank functions. The real economy has been central to discussions of the merits of inflation targeting from the very beginning, as exemplified in the Taylor (1993) rule. Financial stability emerged around the early 2000s, linked to the possible build-up of financial imbalances (Borio and Lowe (2002); Cecchetti et al (2002)), and became more prominent in the debate following the Great Financial Crisis (eg Woodford (2012)). Objectives around eg climate and inequality have been discussed recently, but without affecting inflation targeting frameworks.

Taxonomy of inflation targeting frameworks Graph 1



Source: Authors' elaboration.

A couple of examples illustrate the point. Consider first the interaction between the numerical specification of the target and the horizon. How does overall flexibility change when the two move in opposite directions, eg the specification becomes tighter, but the horizon lengthens?[9] This requires taking a view on the effect on inflation expectations, the credibility of the regime and the economy more generally. Similarly, the trade-offs between inflation, output and financial stability depend crucially on how low inflation interacts with the build-up of financial imbalances and on the impact of monetary policy over different horizons. Views can differ substantially on *all* of these issues (eg Borio (2024); Svensson (2014)) as well as on which country-specific features matter most. And yet taking a stand on these issues would be critical to set the weights of the four indicators in an overall index.

Aggregation, by contrast, is more straightforward at the level of the features of each sub-dimension (eg the formal status and degree of ambition for an objective). To be sure, here, too, a degree of judgment is required to assign weights (Box A). But the features are more similar and can be more easily compared.

The final, more practical, issue concerns the choice of central bank documents used as a basis for constructing the indicators. We draw exclusively on official documents that describe the features of the regime – objectives and strategy. Objectives, which are often couched in high-level terms (eg "price stability"), are typically set in law. The strategy, which operationalises the objective(s), is more detailed and is typically contained in documents such as specific agreements with the government,[10] standalone statements (eg the Federal Reserve's Statement on Long-Term Objectives of Monetary Policy) and annual or inflation reports. We do not include speeches. While relevant, they often reflect individual policymakers' views, whereas strategy statements embody a broader consensus.

[9] Over a certain range, tightening the numerical target while lengthening the horizon can, on balance, *increase* flexibility, by better anchoring expectations while simultaneously making the target more achievable. But, after a point, the same shift could de-anchor expectations and *reduce* flexibility.

[10] See Box B for a discussion of the roles of the government and the central bank in shaping the strategy.

Box A

Measuring inflation targeting flexibility

This box explains the construction of core indicators for the four key sub-dimensions of flexibility (Graph 1, blue boxes). We first explain the scoring system for the (eight) features of inflation targeting frameworks (orange boxes). We then explain how they are combined to construct the core indicators. Annex C provides additional details about coding choices and data sources.

The explanation is organised around Table A1. The second column shows the four key sub-dimensions, ie the flexibility of (i) the numerical target and (ii) target horizon, and objectives for (iii) the real economy and (iv) financial stability.① The third column shows the eight features that can be adjusted to increase flexibility relative to the *no-flexibility* benchmark. In this (theoretical) benchmark, the policymaker's sole objective is to meet a point target for headline inflation over a specific (short) time horizon. The policymaker thus has few options in responding to policy trade-offs. For instance, if energy prices surge, policy rates must rise so that inflation gets back to target over the horizon. And the policymaker has no formal mandate to consider real economic costs to justify a more gradual response.

Measuring inflation targeting flexibility: scoring system

Table A1

(1) Dimension	(2) Sub-dimension	(3) Feature	(4) Scoring
A. Flexibility of the inflation target specification	A1. Numerical target	A1.1 How flexible is the type of target?	0 = point target
			0.5 = point target with tolerance interval (or range with midpoint)
			1 = range
		A1.2 How wide is the target range or interval?	0 = 1 percentage point
			0.5 = 2 percentage points
			1 = more than 2 percentage points
		A1.3 How selective is the price index?	0 = CPI inflation target (or equivalent)
			1 = core inflation target (or target with "escape clauses")
	A2. Target horizon	A2.1 How flexible is the target horizon?	0 = numerical horizon
			1 = qualitative (eg "over the medium term")
B. Objectives other than price stability	B1. Real economy	B1.1 What is the status of the objective?	0 = not an objective or consideration
			0.33 = only a consideration
			0.66 = secondary objective
			1 = primary objective
		B1.2 What is the degree of ambition?	0 = vague
			0.4 = dampen volatility
			0.8 = high/maximum level
			1 = shortfall from maximum level
	B2. Financial stability	B2.1 What is the status of the objective?	0 = not an objective or consideration
			0.33 = only a consideration
			0.66 = secondary objective
			1 = primary objective
		B2.2 What is the degree of ambition?	0 = vague
			0.5 = qualified leaning against the wind (LAW)
			1 = unqualified LAW

Source: Authors' elaboration based on central bank or government reports and statements (see Annex C)..

Flexibility of individual features

For each of the eight features of inflation targeting frameworks, we list the main specification options, rank these options by degree of flexibility and attribute a corresponding score (Table A1, final column). The least and most flexible options earn a value of 0 and 1, respectively. For options that fall in between, we generally give an intermediary score (eg 0.5 when there are three options, and 0.33 and 0.66 when there are four options).

To illustrate the approach, consider first the type of inflation target (A1.1). Following Ehrmann (2021), the three options are: a *point* target, a point target with a tolerance *interval* and a target *range*. A range provides more flexibility than a point because it allows for more inflation paths to fall within the target. Intervals also offer more flexibility than points because they imply greater tolerance for fluctuations in inflation, but they provide less flexibility than ranges because the point within the interval gives clearer guidance about the targeted inflation rate (Ehrmann (2021)). And if the central bank seeks to respect that guidance, this reduces flexibility. The next margin of adjustment is the width of the range or interval (A1.2). For simplicity, we consider three options: 1, 2 and more than 2 percentage points. The wider the range, the higher the flexibility and hence the score.②

The next feature is the target price measure (A1.3). The less flexible option is a CPI target, since the central bank must account for changes in all items of the consumption basket. The more flexible option is to use a core inflation target (which excludes particularly volatile items eg food and energy) or "escape clauses", ie a list of types of price changes that the central bank can ignore (eg administrative prices).

As regards the inflation target horizon (A2.1), we consider two options. When there is a numerical horizon, we assign a 0. In that case, the policymaker has less leeway to "look through" unwanted inflation outcomes to avoid abrupt changes in interest rates. For instance, the Bank of Israel aims to meet the target *within two years*. We give a 1 when the horizon is qualitative. For instance, the Central Bank of Norway says that it aims to achieve its target "in the medium term". In most cases, numerical horizons are one or two years. Qualitative horizons are thus also typically longer.

Consider next objectives for the real economy and financial stability. For each objective, we first assess its formal status (B1.1 and B2.1). The highest-scoring option is when the objective is on par with price stability. This gives policymakers the strongest mandate to deviate from strict inflation targeting. The other options are for the objective to be secondary to price stability, or to be a simple *consideration*, ie an indication in the strategy statement that the objective can be taken into account, but without being grounded in law.

Second, we assess the objective's degree of ambition. For the real economy, the score is lower when the goal is merely to dampen economic volatility, and higher when it is to reach full employment.③ For financial stability, we focus on the degree to which the central bank can act to prevent the build-up of financial imbalances – denoted as "lean against the wind" (LAW), for want of a better term. Since imbalances often develop in a phase of moderate inflation, such a scenario would generally imply a trade-off with price stability – unlike a scenario in which the economy is in freefall. We also consider whether the possibility to lean against the imbalances is qualified (less ambitious), such as through clauses stating "in exceptional circumstances" or that monetary policy is a "second line of defence" (relative to eg prudential policy).

Core indicators

To summarise the evolution of flexibility, we construct one core indicator for each sub-dimension in the second column of Table A1 (and blue boxes in Graph 1). How to best weigh different features requires judgment. For the numerical target, we use a simple average of the scores for the target type, width of range and price measure. For each objective, we give a 75% weight to the formal status, and 25% to the degree of ambition. This eg ensures that an objective gets an "uplift" if it is ambitiously worded, but without achieving a higher weight than having a formal status.④

① Governance and accountability mechanisms help to shape credibility. We exclude them from our indicators as they are typically covered in indices of central bank independence. For simplicity, we also ignore objectives for the exchange rate, which are relatively rare and should be best regarded as intermediate targets. We also ignore changes to the level of inflation targets, since this does not affect flexibility per se. ② We give no score when there is no band or range. Otherwise, much of the variation in criterion A2.2 would reflect variation between frameworks with and without bands, similarly to criterion A1.1. ③ We give the highest score for ambitions to minimise *shortfalls* from full employment (Federal Reserve). The Fed introduced this language following its 2020 strategy

review. It also specified that it aimed for inflation "that averages 2% over time". We ignore this change because its implications are ambiguous. On one hand, it reduces the flexibility associated with ignoring past inflation ("bygones"). On the other hand, it could be seen to increase the flexibility to tolerate higher inflation for some time given initial conditions – an important goal of the strategy and the only aspect explicitly mentioned in the statement (another element of asymmetry). ④ This eg means that the core indicator for real economy objectives is similar if there is a vaguely worded primary objective for the real economy or an ambitiously worded secondary objective.

The flexibility of current frameworks

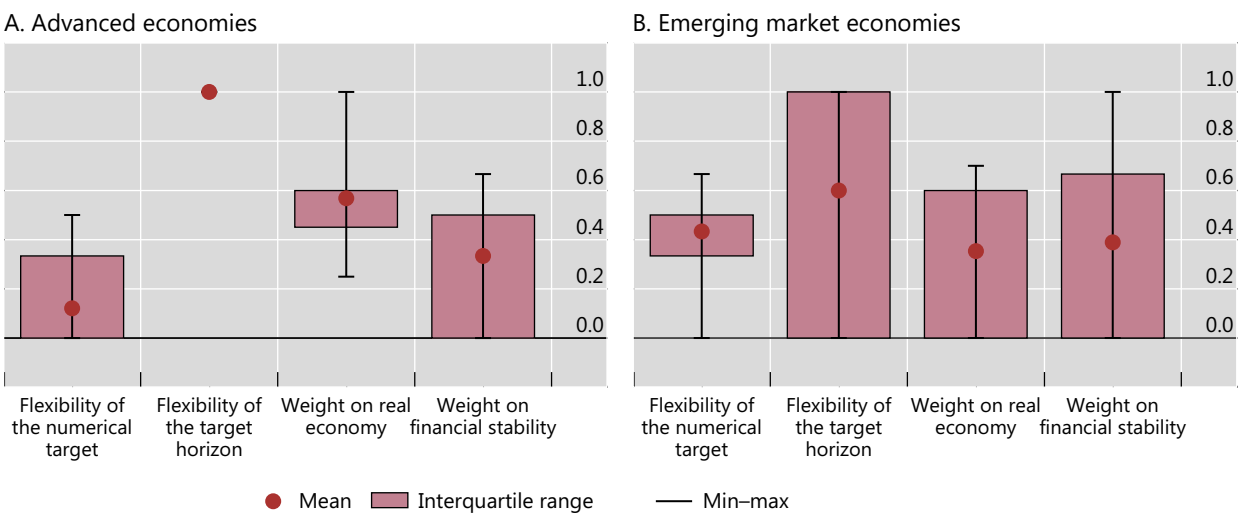
As a starting point, how do frameworks look as of end of 2024 based on the previous indicators? Table 1 lays out the cross-country average value for each of the four sub-dimensions and for the constituent features. Graph 2 portrays summary information of the cross-country dispersion.

AEs and EMEs differ systematically in terms of the specification of the target. AE central banks are significantly stricter in terms of the *numerical target*. More than half of AEs have the strictest specification, ie a point target for headline inflation and no escape clauses (the euro area, Iceland, Japan, the United Kingdom, Sweden, Norway and the United States). All AEs gain flexibility through the *horizon*, which is defined only in qualitative terms. By contrast, EMEs rely on more flexible numerical targets (eg ranges) and are more likely to have specific, shorter-term horizons. This may reflect the greater importance of highly volatile inflation components in EMEs (eg commodity and food prices) that may create large but less persistent deviations from target at any given time. It may also stem from the greater challenges faced in retaining credibility over longer horizons given the history of extended periods of higher inflation.

Another striking difference is the weight of real economy considerations. This weight is around 40% higher for AEs. In part, this is because two thirds of AE central

Inflation targeting flexibility indicators as of end-2024

Flexibility score, by sub-dimension — Graph 2



Source: Authors' calculations based on central bank or government reports and statements (see Box A and Annex C).

banks have real economy formal objectives, against only one third of their EME peers. At one end of the spectrum, in Australia and the United States, these formal objectives have the same status as price stability and are specified in terms of maximum (or full) employment rather than more vaguely (eg supporting the government's economic policy objectives). At the other end of the spectrum are several EMEs for which this objective does not figure at all (Czechia, Indonesia, Peru, the Philippines and Romania). One possible reason why AEs have broader real economy mandates is that this flexibility is seen as representing a smaller threat to the credibility of the target than in EMEs given the better inflation history.

By contrast, financial stability has a somewhat *lower* weight in AEs than in EMEs. One reason is that no AE central bank has a formal financial stability objective for monetary policy. Instead, AE central banks often simply have financial stability "clauses" in their strategy statement, around half of which refer to leaning against financial imbalances. In most cases, however, the clause includes significant caveats. This stands in sharp contrast to Korea, where monetary policy – not macroprudential policy – is explicitly stated as the first line of defence against such imbalances.[11]

The dispersion portrayed in Graph 2 shows that, across all facets of flexibility, AE frameworks tend to be more homogenous than those in EMEs. In particular, there is greater diversity across EMEs in terms of real economy and financial stability objectives and the flexibility of the target horizon. This coincides with EMEs being more diverse in terms of inflation histories.

Inflation targeting flexibility as of end-2024

Average scores across countries, 0 (least flexible)–1 (most flexible) Table 1

	Advanced economies	Emerging market economies
A. Flexibility of inflation target specification		
A.1 Numerical target	**0.12[1]**	**0.43[1]**
A1.1 How flexible is the type of target?	0.23	0.53
A1.2 How wide is the range or tolerance band?	0.38	0.62
A1.3 How selective is the price index?	0.00	0.21
A.2 Target horizon	**1.00**	**0.60**
A2.1 How flexible is the target?	1.00	0.60
B. Objectives other than price stability		
B.1 Real economy	**0.57[2]**	**0.35[2]**
B1.1 What status does the objective have?	0.61	0.36
B1.2 What is the degree of ambition?	0.45	0.35
B.2 Financial stability	**0.25[2]**	**0.29[2]**
B2.1 What status does the objective have?	0.24	0.36
B2.2 What is the degree of ambition?	0.32	0.10

[1] Simple average of features A1.1 to A1.3. [2] Weighted average of status (75%) and degree of ambition (25%).

Source: Authors' calculations based on central bank or government reports and statements (see Box A and Annex C).

[11] The financial stability weights are highest in Korea and Indonesia. The Bank of Korea has a statutory financial stability objective, but no formal macro- or microprudential responsibilities.

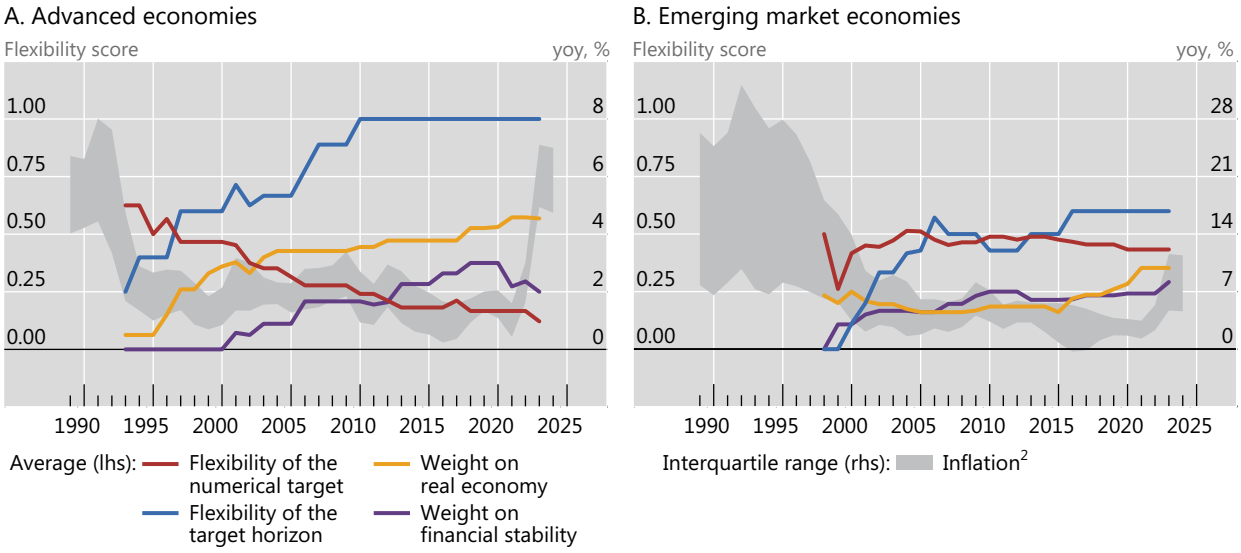
Evolution of the flexibility of the frameworks

While the previous section describes the most recent snapshot, how did the flexibility of the frameworks evolve to reach the current state? In the big picture, three stylised facts stand out. First, the flexibility of numerical targets has declined while that of the horizons has increased. Second, flexibility has grown with respect to objectives other than price stability – real economy and financial stability. Third, these trends are typically starker in AEs.

Delving further into the timing and nature of the changes holds clues about the possible driving forces. The pattern is generally consistent with the idea that stronger confidence in hitting the inflation target and in the framework's credibility, as reflected in stricter numerical targets and longer horizons, has provided more leeway to pursue other objectives and address trade-offs. In addition, the Great Financial Crisis (GFC) seems to have left a significant mark, at least in AEs, which bore the brunt of it. To illustrate these ideas, we inspect average indicator values over time (Graphs 3 and 4). To take into account the possible impact of changes in the composition of the sample, we also consider overall *changes* in core indicators since inflation targeting was adopted (Graph 5) and over subperiods (Annex Graph A.1).[12] Consider the specification of the target and objectives, in turn.

Growing confidence in the ability to control inflation and in the frameworks' credibility, as reflected in benign outcomes, was probably the main factor shaping changes in the target specification until at least the GFC. In AEs, by 2008 core inflation targets and escape clauses had largely been dispensed with, and less well

Inflation target flexibility over time[1] Graph 3



[1] The flexibility score ranges from 0 (least flexible) to 1 (most flexible); the series begin when each group includes at least four central banks. [2] Ten-year moving average.

Source: Authors' calculations based on central bank or government reports and statements (see Box A and Annex C).

[12] The composition of the sample changes over time as more jurisdictions adopt inflation targeting. By 2005, around 90% of central banks in the sample had adopted inflation targeting. The graphs indicate that compositional effects are generally not significant.

specified / longer-term horizons had been established (Graphs 4.C and 4.D). Moreover, if ranges or intervals applied at all, they had mostly become quite narrow (+/–1%) (Graph 4.B).[13] As a result, numerical targets had already lost significant flexibility pre-GFC. The picture is less stark in EMEs, where the decline in the level and volatility of inflation generally occurred later. On the eve of the GFC, several (but not all) EMEs had already done away with specific horizons (Graph 4.D), but looser target types (eg ranges) and selective price measures were still relatively common.

The post-GFC phase had a stronger impact on AEs, as policy frameworks adjusted with some delay to certain de facto changes in the conduct of policy. As central banks often struggled to push stubbornly low inflation back to target, the frameworks in AEs often sought to further emphasise a focal point for expectations. This is visible in the continuous fall in the flexibility of AE target types (Graph 4.A). Examples of this trend include dropping ranges (eg euro area) or tolerance intervals (eg Sweden) and adding midpoints (eg Australia). This is consistent with concerns about possible de-anchoring of expectations at a time of persistent shortfalls of inflation from target, including with the possibility of costly deflation.[14] Better anchoring could be seen as yielding greater leeway to put weight on real economy, at least in the near term. By contrast, in EMEs, while some further adjustment did take place, it was more muted and took place from a considerably more flexible score. This is consistent with the countries not having been at the heart of the GFC, having less concern about inflation shortfalls and, in some cases, having greater concerns about the longer-term implications of very low interest rates for financial stability.

The influence of confidence in inflation targeting frameworks' credibility and of the GFC is also visible in the growing weight of real economy considerations. As inflation performance improved, by the mid-2000s real economy concerns had already risen substantially (Graph 4.E). And the trend continued after the GFC. The set of central banks with formal real economy objectives (or assigning a higher standing to them) includes several AEs, such as Sweden (1997), the United Kingdom (1997), Switzerland (2004), New Zealand (2019) and Australia (2023), but also some EMEs – Thailand (2020) and Brazil (2021).[15] Moreover, in AEs the degree of ambition also increased markedly, with a greater concerns about *levels or rates of growth or employment* (rather than just volatility), eg in Australia, Canada and the United States (Graph 4.F). This is less the case for EMEs.

The evolution of the weight of financial stability follows a broadly similar pattern to that of the real economy. In this case, however, the upward trend and apparent impact of the GFC is more muted overall. Formal financial stability objectives are relatively common in Asia (eg Indonesia, Korea, the Philippines and Thailand), but only Indonesia added it post-GFC. The weight on financial stability among Asian central banks may reflect the experience with the Asian financial crisis in the mid-1990s. Some adjustments also included clauses explicitly mentioning the "leaning against financial imbalances" option (eg Thailand, joining Korea).

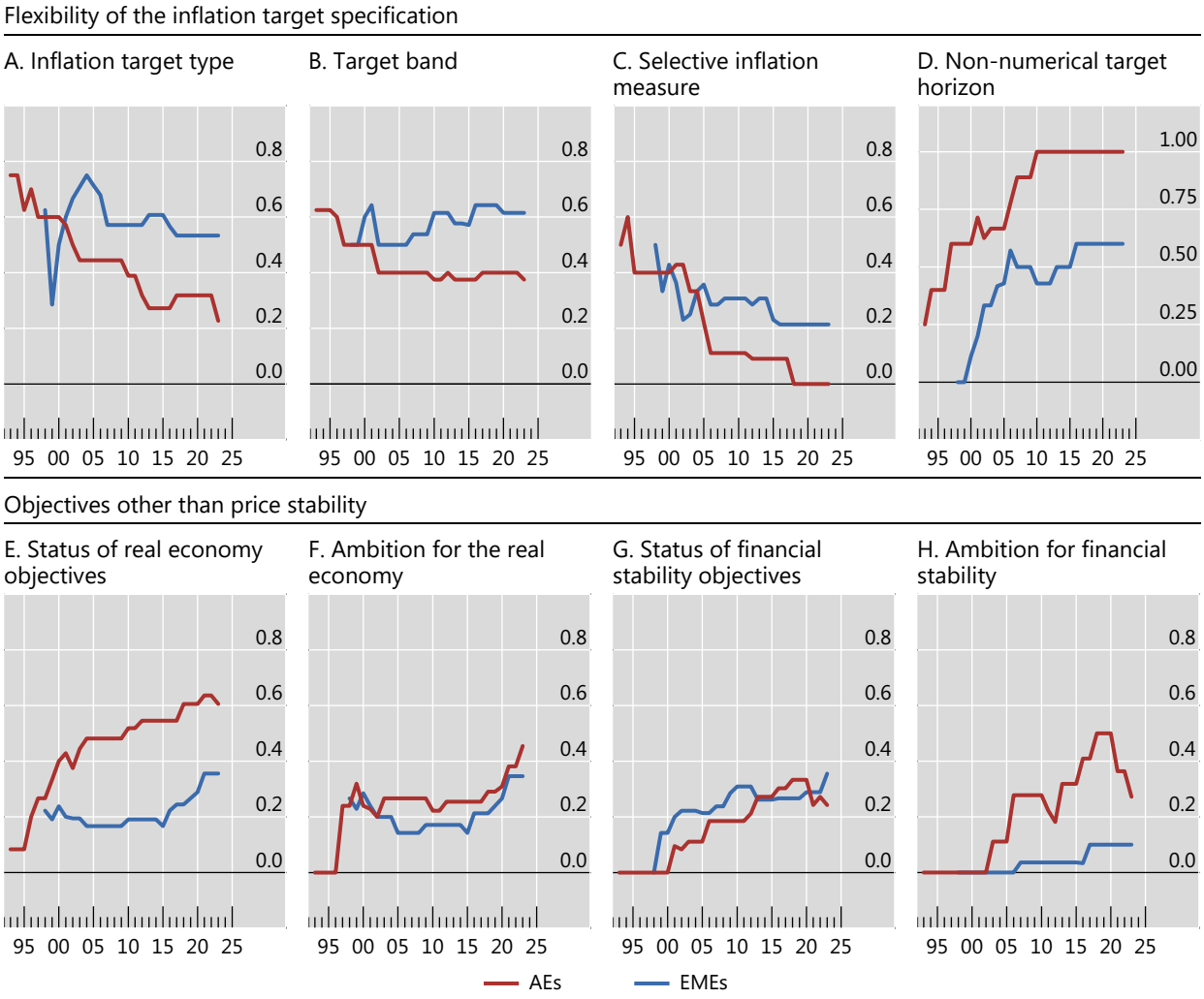
[13] The switch away from selective price measures might also have been relatively inconsequential, since in practice decision-making often puts significant weight on core inflation.

[14] See eg the 2023 review of the Reserve Bank of Australia.

[15] In 2023, however, upon the election of a new (conservative) government, the Reserve Bank of New Zealand lost the dual mandate it had been given in 2019 by the previous (Labour) government.

Flexibility of the inflation targeting framework

Flexibility score for each framework component, average of AE and EME central banks[1] Graph 4



[1] The flexibility score ranges from 0 (least flexible) to 1 (most flexible); the series begin when each group includes at least four central banks.

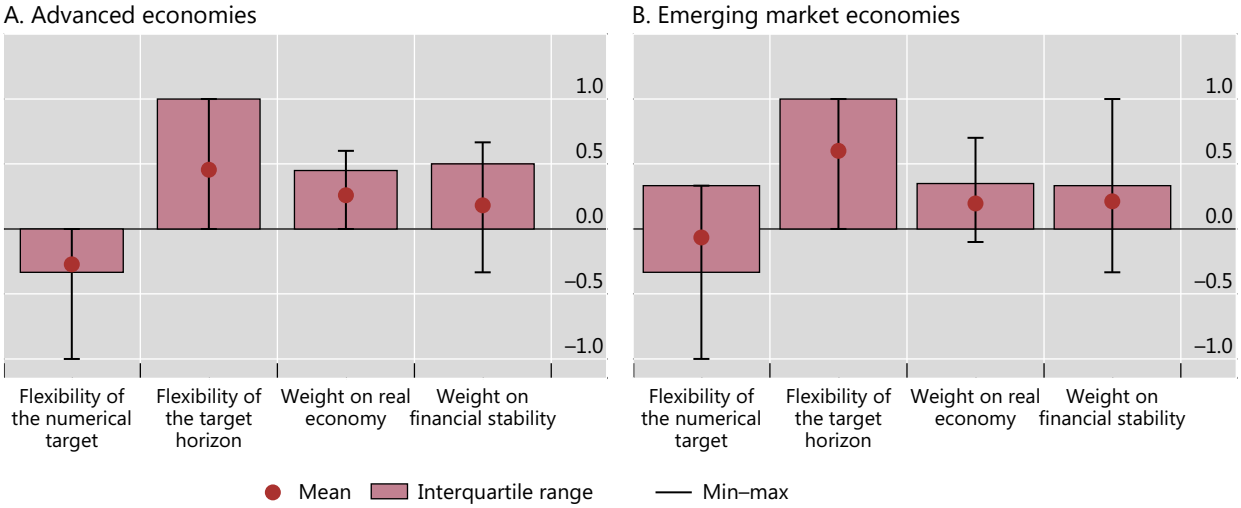
Source: Authors' calculations based on central bank or government reports and statements (see Box A and Annex C).

In AEs, no central bank in our sample took on a formal financial stability objective *for monetary policy* after the GFC. Instead, almost all AE central banks added financial stability "clauses" to their strategy statements. Pre-GFC, only Canada and Sweden had adopted such clauses (both in 2006), allowing for leaning against financial imbalances in both cases. In the mid-2010s, clauses spread to eg New Zealand, Norway and the United Kingdom. That said, such clauses lost bite as macroprudential instruments gained ground and became a key tool to fulfil central banks' growing financial stability responsibilities. In Australia, while such a clause was added in 2016, it was removed in 2023 following the Reserve Bank of Australia review.[16] Similarly, monetary policy in Iceland no longer has a financial stability mandate since 2022, perhaps reflecting in part the creation of a separate Financial Stability Committee two

[16] After the review, the joint agreement between the Australian government and the Reserve Bank of Australia still featured a section on financial stability objectives for the central bank, but financial stability was no longer mentioned in the monetary policy section of the agreement.

Changes in flexibility since adoption of inflation targeting

Flexibility score, net changes[1] Graph 5



[1] Changes based on the difference between 2023 and the first available year after adopting inflation targeting. Negative (positive) values indicate a change towards less (more) flexibility.

Source: Authors' calculations based on central bank or government reports and statements (see Box A and Annex C).

years earlier. This ebbing of financial stability concerns is visible in a decline in AE financial stability scores in the last part of the sample (Graphs 4.G and 4.H).

Conclusion

Inflation targeting has become the favoured global monetary framework and has proved remarkably durable (Rose (2020)). This study has documented a less well known fact. Under the surface, such frameworks' flexibility has evolved significantly. On the one hand, the explicit weight on objectives other than inflation – real economy objectives such as output and employment and, to a lesser extent, financial stability – has grown. On the other hand, the pursuit of those objectives has been facilitated through greater flexibility of the horizon over which the target is to be achieved even as the target itself has become less flexible. These developments, which are typically more marked among AEs, appear to reflect primarily a mix of considerations: greater confidence in the credibility of the frameworks; what, until recently, has been a benign inflation environment; and the impact of the GFC.

The adaptability of the inflation targeting framework has no doubt been one factor behind its durability. The changes have increased the regime's acceptability. Given past experience, it will be especially interesting to see how the recent surprising surge in inflation will influence the next adjustments. Forthcoming reviews offer a valuable opportunity to further refine the framework.[17]

The analysis of this study has been purely positive, not normative. The objective has simply been to document the evolution of the flexibility of the framework, not to

[17] The Federal Reserve and ECB are conducting monetary policy framework reviews in 2025.

assess the validity of the changes and their impact on the effectiveness of the regime.[18] At the same time, the analysis can inform such an evaluation by providing a systematic cross-country treatment. With that goal in mind, the indicators underlying the study are being made available on the BIS website.

References

Bernanke, B and F Mishkin (1997): "Inflation targeting: a new framework for monetary policy?", *Journal of Economic Perspectives*, vol 11, no 2, pp 97–116.

Bank for International Settlements (BIS) (2024): "Monetary policy in the 21st century: lessons learned and challenges ahead", *Annual Economic Report 2024*, June, Chapter II.

Blanchard, O and J Galí (2007): "Real wage rigidities and the New Keynesian model", *Journal of Money, Credit and Banking*, vol 39, pp 35–65.

Blinder, A (2006): "Commentary: inflation targeting for the United States – comments on Meyer", *Inflation targeting: problems and opportunities*, papers from a conference at the Bank of Canada, Ottawa, 1 February.

Borio, C (2024): "Whither inflation targeting as a global monetary standard?", *BIS Working Papers*, no 1230, December.

Borio, C and P Lowe (2002): "Asset prices, financial and monetary stability: exploring the nexus", *BIS Working Papers*, no 114.

Buiter, W (2004): "The elusive welfare economics of price stability as a monetary policy objective: Should new Keynesian central bankers pursue price stability?", *CEPR Discussion Paper*, no 4730.

Cecchetti, S, H Genberg and S Wadhwani (2002): "Asset prices in a flexible inflation targeting framework", *NBER Working Papers*, no 8970.

Ciżkowicz-Pękała, M, W Grostal, J Niedźwiedzińska, E Skrzeszewska-Paczek, E Stawasz-Grabowska, G Wesołowski P and Żuk (2019): *Three decades of inflation targeting,* Narodowy Bank Polski.

Eggertsson, G and D Kohn (2023): "The inflation surge of the 2020s: the role of monetary policy", presentation at Hutchins Center, Brookings Institution, 23 May.

Ehrmann, M (2021): "Point targets, tolerance bands or target ranges? Inflation target types and the anchoring of inflation expectations", *Journal of International Economics*, vol 132, p 103514.

Hofmann, B, C Manea and B Mojon (2024): "Targeted Taylor rules: monetary policy responses to demand-and supply-driven inflation", *BIS Quarterly Review*, December, pp 19–35.

International Monetary Fund (IMF) (2004) "Classification of exchange rate arrangements and monetary policy frameworks", www.imf.org/external/np/mfd/er/2004/eng/0604.htm.

[18] For two such recent assessments, see eg BIS (2024) and Borio (2024).

King, M (1997): "Changes in UK monetary policy: Rules and discretion in practice", *Journal of Monetary Economics*, vol 39, no 1, pp 81–97.

Mishkin, F and K Schmidt-Hebbel (2007): "A decade of inflation targeting in the world: what do we know and what do we need to know?", in F Mishkin (ed), *Monetary policy strategy*, MIT Press.

Niedźwiedzińska, J (2021): *Inflation targeting and central banks: institutional set-ups and monetary policy effectiveness*, Routledge.

Romelli, D (2022): "The political economy of reforms in Central Bank design: evidence from a new dataset", *Economic Policy*, vol 37, no 112, pp 641–88.

Rose, A (2020): "iPhones, iCrises and iTargets: inflation targeting is eradicating international financial crises in the iPhone era", CEPR *Policy Insights*, no 100.

Rose, A and A Rose (2024): "A presence of absence: The benign emergence of monetary stability", *Journal of International Money and Finance*, vol 146, p 103–25.

Svensson, L (1997): "Inflation targeting in an open economy: strict or flexible inflation targeting?", *Reserve Bank of New Zealand Working Paper*, no G97/8.

Svensson, L (2014): "Inflation targeting and "leaning against the wind"", *International Journal of Central Banking*, vol 10, no 2, pp 103–14.

Taylor, J (1993): "Discretion versus policy rules in practice", *Carnegie-Rochester Conference Series on Public Policy*, vol 39, pp 195–214.

Taylor, J (2022): "It's time to get back to rules-based monetary policy", *Hoover Economics Working Papers*, no 22111.

Unsal, D, C Papageorgiou and H Garbers (2022): "Monetary policy frameworks: an index and new evidence", IMF *Working Papers*, no 22/22.

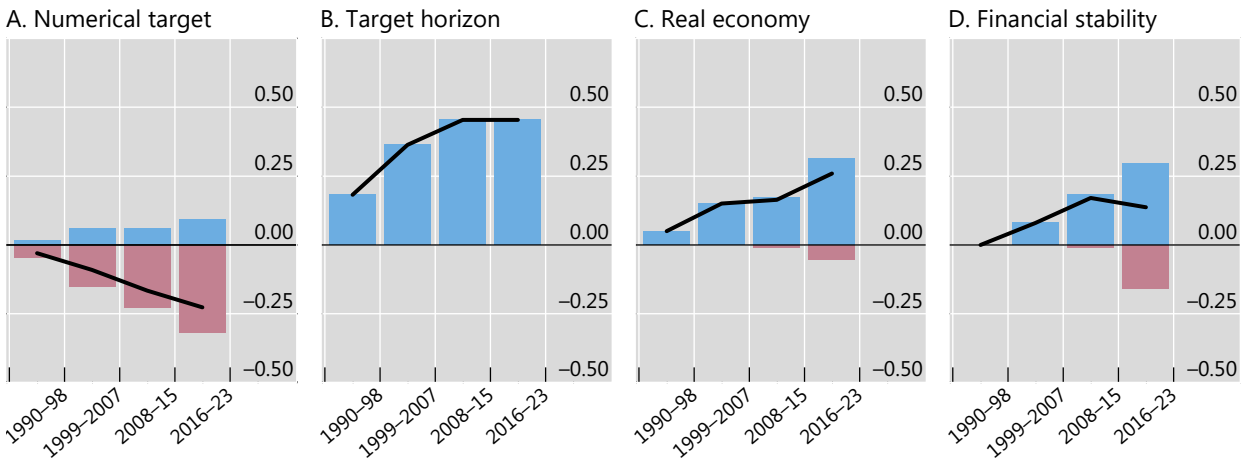
Woodford, M (2012): "Inflation targeting and financial stability", *NBER Working Papers*, no 17967.

Annex A

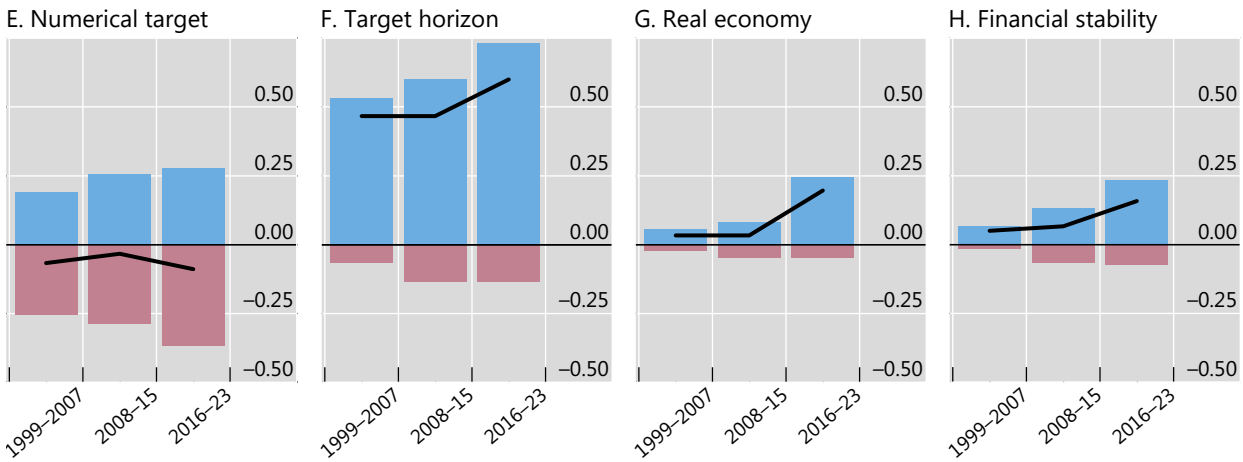
Cumulative changes in inflation targeting flexibility: subperiods

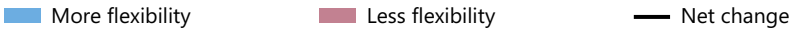
Flexibility scores, gross and net changes[1] Graph A.1

Advanced economies



Emerging market economies





[1] Cumulative changes in the value of the core indicators that increase flexibility (blue bars) and reduce it (red bars), divided by the number of central banks in the sample period.

Source: Authors' calculations based on central bank or government reports and statements (see Box A and Annex C).

Annex B: Changes in monetary policy frameworks: what, who and when

Whether and how changes to frameworks occur depends on the institutional context and the specific adjustment.

Objectives for monetary policy are often enshrined in law (or more rarely in constitution or treaty). Therefore, changing them is generally up to government or parliament. For the strategy (ie the operationalisation of the objectives), there are two main cases (first two rows of Table B.1). In the first group of jurisdictions, the central bank sets the strategy independently and can therefore take the initiative to make changes on its own. This was the case, for instance, of the recent changes to the strategies of the Federal Reserve (2020) and ECB (2021).

In the second group, the government is involved in setting key aspects of the strategy. Therefore, adjustments are initiated by the central bank alone or together with the government depending on the aspect in question. In Australia, Canada, Iceland and New Zealand, the government and central bank sign a joint agreement covering the numerical inflation target and other aspects (eg trade-offs between objectives). In the United Kingdom, the government sets the strategy independently. Among EMEs, when the government is involved, it typically focuses on setting the numerical inflation target (alone or jointly with the central bank).

Processes to set monetary policy strategy[1] Table B.1

Central bank sets strategy independently	AEs	5	CH, EA, JP, SE, US
	EMEs	7	CL, CO, CZ, HU, KR, MX, PE
Government is involved in setting the inflation target (and potentially other aspects of the strategy)	AEs	6	AU, CA, GB,[2] IS, NZ, NO
	EMEs	8	BR, IN, ID, IL, PH, RO, TH, ZA
Periodic public framework review	AEs	5	**AU**, CA, **EA**, **NZ**, **US**
	EMEs	0	

Underlined codes indicate jurisdictions where objectives are enshrined in constitution or treaty. Central banks in **red** have changed to periodic reviews during the past five years. Sample: 26 central banks with inflation targeting or closely related frameworks.

[1] This table only considers aspects of frameworks not set in law; this typically excludes objectives. [2] The Bank of England's Monetary Policy Committee's remit is renewed by the government, generally near the annual budget announcement; in 2013, the renewal was exceptionally backed by a full-fledged review.

Source: Authors' elaboration.

The frequency and incidence of changes also differ. Since changing objectives requires a parliamentary process, this happens relatively infrequently on an ad hoc basis. The strategy can potentially change more frequently and regularly. Recently, the Reserve Bank of Australia, ECB, Reserve Bank of New Zealand and Federal Reserve have announced the intention to review their strategy every five years. This follows the Canadian practice since 1998.[19] Other central banks have occasionally reviewed their strategy on an ad hoc basis (eg those of Chile, Japan, Norway, Switzerland and Thailand). Yet another case is for the government to set the inflation target on a

[19] Before then, the Reserve Bank of Australia and Reserve Bank of New Zealand renegotiations of the agreement typically coincided with new governments or Governor tenures.

regular basis – eg every year for Brazil, and every three years for Korea – typically without changing other aspects of the strategy.

The approach to conducting reviews also differs widely. In AEs, it has become commonplace for central banks and/or governments to conduct public framework reviews. These can cover a range of aspects, including objectives and/or the strategy. It is also frequent for reviews to be led by external experts, typically academics or ex-central bankers, especially when the government commissions the review. In EMEs, public reviews led by experts are rare (Chile and Thailand are two exceptions). In most cases, target changes happen without reviews.

Annex C: Data notes and sources

The data are collected manually from publicly available sources. Table C.1 lists the official sources used. Whenever available, we use the English language version of the source material. Central banks sometimes specify that English language material does not constitute official publications. In a handful of cases, we have used online tools to translate original language sources.

The codification of source material reflects the authors' judgment only and is done on a best efforts basis. Some codification choices are worth highlighting, even if they concern only a handful of observations.

When source material is unavailable for a given jurisdiction and year (or for a specific framework feature), we assume that the latest available source remains valid.

In a few cases, the central bank has both a short-term and a medium-term inflation target. We consider only the former. In terms of escape clauses, we only consider instances when specific items are explicitly excluded from the price measure targeted, or when the statement explicitly says that the central bank does not respond to some specific shocks. We ignore cases when the strategy statement merely specifies that the central bank responds *differently* to some shocks, or that it expects inflation to deviate from target in the short term.

In a few cases, there is a discrepancy between the horizon for the inflation target set out in the strategy statement and the formal announcement of the target (typically made by the government alone or jointly with the central bank). In such cases we consider the information in the strategy statement.

For the target price measure, for simplicity we also consider that the central bank targets CPI inflation when it uses a measure that strips out the direct effect of changes in policy rates.

We do not consider that the central bank has an objective for the real economy or financial stability when its strategy statement merely specifies that price stability is a precondition or key factor for eg growth or financial stability (or the reverse). We do not consider as a financial stability objective instances of objectives for eg development of the financial system or the functioning of the payment system. Even when the statement mentions a financial stability objective, it is not always clear to what extent it applies to monetary policy, as opposed to being only an institution-wide objective. In such cases, absent a clear indication that financial stability is relevant to monetary policy, we consider that the central bank has a consideration for financial stability rather than an objective.

In a few cases, the formulation of the central bank's objective for the real economy or financial stability differs from the formulation in law. In these cases, we use the strategy statement, since it is typically timelier. In the few cases of objectives to support economic growth, we give the same score as for objectives to dampen economic volatility. When the objective is for full potential growth, we give the same score as objectives for full employment.

When there are more than two options for one framework feature, we set scores so that there is an equal increment between each option. One exception is for the ambition for the real economy (B1.2). The highest-scoring option for that feature is an objective to miminise *shortfalls* from full employment. The second highest ranking option is to achieve full employment. These two options would differ when employment is above estimated full employment, but not when it is below. Therefore,

we set the increment between these two options to half of the increment between the other options for that feature.

Some choices about the sample are also worth discussing. In general, a central bank is included in the sample from the year when it adopts inflation targeting. In a few cases, however, there are missing data for some years after adoption. For instance, the Reserve Bank of Australia considers that it adopted inflation targeting "in the early 1990s". Until 1996, however, the inflation target was only set out in vague terms in the Governor's speeches. Therefore, Australia only enters the data set in 1996. The euro area counts as one observation. We include the ECB from 2003, when it clarified that it did not tolerate deflation.

Data sources

Table C.1

	Adoption	Source
Australia	Early 1990s	Statements on the Conduct of Monetary Policy (from 1996).
Brazil	1999	• From 2016: introduction to end-of-year Central Bank of Brazil Inflation Reports • 1999–2015: annual inflation target decrees, available on Central Bank of Brazil website
Canada	1991	Agreements on the Inflation-Control Target between Bank of Canada and the Minister of Finance
Chile	1990	• From 2020: "Chile's monetary policy within an inflation-targeting framework" • 2007–20: "La política monetaria del Banco Central de Chile en el marco de metas de inflación" • 2000–06: "Monetary policy of the Central Bank of Chile: objectives and transmission" • 1991–99: "La política monetaria en Chile"; "Una década de metas de inflación en Chile: desarollos, lecciones y desafios"
Colombia	1999	• From 2006: introduction to Monetary Policy Reports • From 1999: Political Constitution of Colombia (1991), Article 373 and Decision C-481/99 of the Constitutional Court
Czechia	1998	• From 2010: "The CNB's new inflation target and changes in monetary policy" • 2004–10: "The CNB's inflation target from January 2006" • 2002–05: "The setting of the inflation target for 2002–2005" • 1999–2001: Czech National Bank Annual Report.
Euro area	2003	• From 2021: "The ECB's monetary policy strategy statement" • 2003–20: "The outcome of the ECB's evaluation of its monetary policy strategy"
Hungary	2001	• Introduction to end-of-year inflation reports • "Inflation targeting" (MNB.hu) • "The inflation targeting system in Hungary"
Iceland	2001	• From 2022: Monetary Policy Strategy • 2001–21: "Declaration on inflation target and a change in the exchange rate policy"
Indonesia	2005	• From 2016: introduction to end-of-year Bank Indonesia Monetary Policy Report • Regulation of the Minister of Finance No 124/PMK.010/2017

		• 2015–18: Decree of the Minister of Finance No 93/PMK.011/2014 • 2012–14: Regulation of the Minister of Finance of the Republic of Indonesia Number 66/MPK.011/2012 • 2010–12: Decree of the Minister of Finance No 143/PMK.011/2010. • 2008–09: Decree of the Minister of Finance No 1/KMK.011/2008 • 2005–07: Decree of the Minister of Finance No 399/KMK.011/2004 • "Towards inflation targeting: the case of Indonesia"
Israel	1997	• "Revisiting the inflation target" • Bank of Israel Annual Reports • 1997–98: Appendix to Inflation Report
Japan	2012	• From 2013: "The 'price stability target' under the Framework for the Conduct of Monetary Policy" • 2012: "The price stability goal in the medium to long term"
Korea	1999	• From 2016: introduction to Monetary Policy Reports • "Inflation Target for 2019 Onward" • "Inflation Target for 2016 Onward" • "Inflation Target for 2013 Onward" • "Inflation Target for 2010 Onward" • "Inflation Target for the Years 2007–09" • "Inflation Target for 2004–06" • "Inflation Target and Monetary Policy for 2003" • "The Inflation Target and Monetary Policy for 2002" • "The Inflation Target and Monetary Policy for 2001"
Mexico	1999	Annual Bank of Mexico Monetary Policy Programme
Norway	2002	• From 2003: introduction to Central Bank of Norway's Monetary Policy Report • 2021–22: Central Bank of Norway's monetary policy strategy statement
New Zealand	1990	Policy Targets Agreements
Peru	2002	Introduction to end-of-year Central Reserve Bank of Peru Inflation Reports
Philippines	2002	Introduction to end-of-year Bangko Sentral ng Pilipinas Monetary Policy Reports
Romania	2005	• 2005: National Bank of Romania Annual Report • "Direct inflation targeting: a new monetary policy strategy for Romania"
South Africa	2000	• From 2012: preface to end-of-year Monetary Policy Reviews • 2010: Minister of Finance letter to the South African Reserve Bank • 2000: South African Reserve Bank inflation target announcement; Minister of Finance budget speech
Sweden	1993	• From 2006: introduction to inflation report • 2007–10: Monetary policy in Sweden • 1999–2006: "The Riksbank's inflation target – clarification and appraisal" • 1993–98: "Monetary Policy in Sweden after the end of Bretton Woods"
Switzerland	2000	Swiss National Bank Annual Reports ("monetary policy concept" section)

Thailand	2001	Introduction to Bank of Thailand Monetary Policy Reports
United Kingdom	1992	• From 1997: annual Remit for the Monetary Policy Committee • 1995–1996: Chancellor's Mansion House speech • 1994: Chancellor's Mansion House Speech • 1993: Chancellor's Mansion House Speech • 1992: Chancellor letter from 8th October (kindly provided by Ryland Thomas)
United States	2012	Statements on Longer-Run Goals and Monetary Policy Strategy

Source: Authors' elaboration.

Jakub Demski
jakub.demski@bis.org

Yingwei Dong
yingwei.dong@bis.org

Patrick McGuire
patrick.mcguire@bis.org

Benoît Mojon
benoit.mojon@bis.org

Growth of the green bond market and greenhouse gas emissions[1]

This article examines whether stricter public policies to curb greenhouse gas emissions have spurred the development of green bond markets and whether the issuance of green bonds has been associated with a subsequent reduction in emissions. The findings indicate that green bond markets have grown the most in countries with stricter emissions targets. Green bond issuance increased especially in sectors with heavy emissions that have been subject to sectoral mitigation policies. Moreover, even though green bonds lack binding constraints on emissions reduction, green bond issuance in those sectors has been followed by a significant reduction in emissions.

JEL classification: F34, F36, G21, F23, F31, F36, G15.

Market capitalisation in the green bond market has reached $2.9 trillion, up nearly sixfold since 2018. Green bonds are intended to finance (a portion of) the investments needed to transition to sustainable economic development. These bonds, specifically earmarked to support initiatives to mitigate environmental impact, help channel funds into renewable energy, energy efficiency and other green projects.[2] However, promoters of green bonds initially tolerated a variety of standards for impact reporting (Ehlers and Packer (2017)). As a result, at least up to 2018, issuance of green bonds carried little information about the level or trajectory of issuers' greenhouse gas (GHG) emissions (Ehlers et al (2020)).

The green bond market has since matured, growing fast by attracting a variety of issuers within and across jurisdictions (Cheng et al (2024)). This article provides an updated assessment of these developments and whether public policies to lower carbon emissions are echoed in green bond volumes.

The article first documents the rapid growth in the green bond market. It provides stylised facts about the size, structure and growth of the green bond market,

[1] We thank Torsten Ehlers, Ingo Fender, Gaston Gelos, Corrinne Ho, Mike McMorrow Frank Packer, Andreas Schrimpf, Hyun Song Shin, Frank Smets, Dora Xia, Evertjan Veenendaal and Nertila Xhelili for their helpful comments, and Jimmy Shek for excellent research assistance. The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

[2] Cheng et al (2024) note that sustainable bond markets consist of two types of bonds. The funds raised through "use of proceeds" bonds are earmarked for climate and environmental projects in the case of green bonds; projects related to health and education, affordable housing or food security for social bonds; and a mixture of green and social projects in the case of sustainability bonds. A second type is "outcome-based" bonds where the coupon payment increases if contractually specified sustainability performance targets are not met.

Key takeaways

- *The green bond market has grown exponentially since the 2015 Paris Agreement, with a diverse set of issuers that includes sovereigns, municipalities, financial institutions and private corporations.*
- *Increased issuance of green bonds has followed stricter emissions policies aimed at reducing country-level emissions.*
- *Issuing a green bond has become a good indicator of reduced corporate emissions, notably for firms in carbon-intensive sectors or those that had been heavy emitters.*

against the backdrop of increasingly stringent environmental regulations and more transparent reporting of the impact of green bonds. Annual issuance reached $700 billion in 2024, a fraction of the estimated $2 trillion annual investment needed to tackle climate change (Ananthakrishnan et al (2023)).[3] The rise of environmental, social and governance (ESG) investing in the asset management industry reflects the growing demand for sustainable instruments. Some investors, including those in the reserve management community, favour those green bonds where the environmental impact can be certified.[4] On the supply side, green bond issuers have grown in number and now include a diverse group of sovereigns, municipalities, financial institutions and private corporations.

The article then empirically examines the relationship between climate abatement policies, green bond issuance and corporate GHG emissions. It does this by integrating firm-level data on emissions from S&P Trucost and issuance data from various financial databases.

In the second section, the article tackles two key empirical questions. The first is whether stricter regulatory frameworks have been effective in encouraging issuance of green bonds. The results suggest that regulatory stringency has a positive and statistically significant correlation with growth in the green bond market. In particular, policies that have targeted emissions in specific economic sectors have been followed by the largest increases in green bond issuance.

The second empirical question is whether the issuance of green bonds is followed by a future reduction in GHG emissions. Findings indicate that a firm's emissions decrease, and its carbon efficiency improves, following initial issuance of a green bond. This suggests that green bond financing strategies broadly defined, rather than the amounts associated with any specific green bond issue, can serve as a signal of firms' broader commitments to greening their operations. Further analysis reveals that this enhanced environmental performance is primarily achieved by firms in carbon-intensive sectors or those that were heavy emitters before issuing the green bond.

The final section concludes.

[3] Of course, green bonds are just one of many tools available to help corporations green their operations.

[4] The BIS's own green bond funds, for example, were developed in part to support the adoption of best practices, including impact reporting, in the green bond market (BIS (2019)).

Green bonds, GHG emissions and environmental policies

The market for green bonds has evolved rapidly in recent years, alongside greater awareness of the economic costs of climate change. These bonds earmark proceeds for investment and other projects designed to mitigate the impact of economic activity on the environment, although generally without binding constraints (see Box A). This section presents stylised facts on the growth of green bond markets, the trajectory of GHG emissions and changes in climate-related public policies. Such policies have, until recently, incentivised emissions reduction primarily by corporations.

The market for green bonds

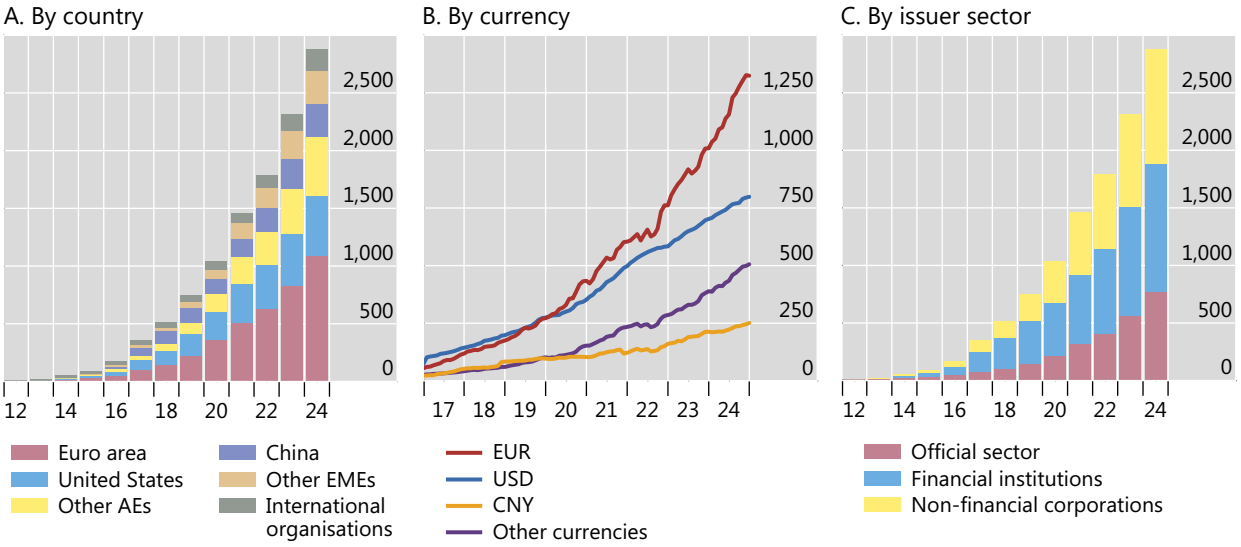
Since 2015 and the introduction of the International Capital Markets Association's Green Bond Principles (ICMA (2021)), the market for green bonds has ballooned. Amounts outstanding neared $3 trillion in 2024, up from roughly $500 billion as recently as 2018 (Graph 1.A).[5] While this is still small relative to corporate bond markets more broadly, green bonds are no longer a niche market. This growth has been underpinned by greater regulatory support across many jurisdictions and increased investor demand for green assets, reflecting growing awareness of the financial risks associated with climate change.

The exponential growth in the market is the result of greater issuance of green bonds in multiple jurisdictions. Advanced economies (AEs) have taken the lead, with

Green bond volumes have increased exponentially[1]

In billions of US dollars

Graph 1



[1] Amount outstanding is calculated using total cumulative issuance minus cumulative amount matured as of a given year.

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

[5] There are currently no binding international reporting standards for green bonds (see Box A). The data on green bonds are compiled from issuance data from three different vendors. A bond is classified as green if at least one vendor identifies it as such. This yields a comprehensive sample of 11,874 green bond issues in total by 3,352 different issuers from 2015–24.

member states from the euro area and the United States combined accounting for about half of the outstanding amounts (Graph 1.A). China stands out among emerging market economies (EMEs) with a significant market share as well. This geographic origin of issuers is reflected in the currency of outstanding green bonds. Bonds denominated in euros and US dollars are the most prevalent, but those in renminbi are also gaining ground (Graph 1.B).

Box A

The evolution of green bond standards

A green bond is a fixed income security that raises capital for projects related to limiting climate change or otherwise benefiting the environment. It is intended to support sustainable development by financing initiatives that mitigate or offset the environmental impact of economic activities. These include renewable energy, energy efficiency, clean transportation, sustainable water management and biodiversity conservation. Issuers claim to use, and are expected to use, the proceeds from green bonds exclusively for these green projects. However, whether that is truly the case is controversial.

There are several types of green bond, each tailored to different financing needs and project structures. The most common type is the "use of proceeds" bond. Another type is the revenue bond, which ties repayment directly to the revenue generated by the green project itself. Municipalities, local governments, utility companies and transportation authorities are frequent issuers of such bonds. Similarly, project bonds focus on specific projects and are secured by the assets and balance sheet of that project alone. This type is often used for large infrastructure projects (eg wind farms) and often in the context of public-private partnerships. Securitised bonds rely on securitisation to finance environmentally sustainable projects. An example is a bond issue backed by a pool of green assets (eg loans for energy-efficient buildings). Financial institutions (including commercial and investment banks, securitisation firms and government agencies) issue securitised bonds, often via special purpose vehicles (SPVs) to ensure that the credit risk is confined to the SPV rather than the parent company. Additionally, government-sponsored enterprises may issue these bonds to support specific policy objectives, eg promoting home ownership or financing sustainable infrastructure.

Investors in green bonds whose purpose is to have an environmental impact want to ensure that funds are not diverted to other uses. Transparency and adherence to established standards are thus crucial for maintaining integrity in the green bond market (Ehlers and Packer (2017)). However, issuers may engage in "greenwashing", ie marketing bonds as green without a commitment to environmental sustainability. Additionally, there is debate about whether green bonds finance projects that would not otherwise be funded. If such projects could be funded via conventional bonds, the additional benefit of green bonds may be limited. For any given issuer, the credit risk in a typical green bond (use of proceed bond) and a conventional bond is similar, since both are backed by the issuer's entire balance sheet. While this provides a broad guarantee of repayment of green bonds, it also undermines the authenticity of any split between specific green projects and other activities of the issuer.

These challenges can, in principle, be addressed with transparent reporting of the use of proceeds from green bonds and the environmental impact of projects they finance. Green bond standards, like the Green Bond Principles set forth by the International Capital Markets Association and the Climate Bonds Standard established by the Climate Bonds Initiative, provide frameworks for what and how to disclose information to investors. However, adherence to these standards is voluntary. Similarly, third-party certifications and second-party opinions (SPOs) can enhance credibility, but they too are not mandatory. Issuers that adhere to the standards aim to improve the attractiveness of their bonds, but some forgo these verification practices.

The lack of binding standards with clear, enforceable criteria has led to variability in practices among issuers (Ehlers and Packer (2017)) and has made it challenging for investors to compare bonds and assess their true environmental impact (Ehlers et al (2020)). Transparency and third-party verification have become more common (Cheng et al (2024)). However, smaller companies still tend to avoid SPOs and certifications due to cost concerns. For the same reason, these firms tend to produce lower-quality impact reports. Firms in EMEs also tend to avoid SPOs and certifications, and their impact reports are often limited. Regardless of the country of origin, firms issuing green bonds in smaller amounts often find the cost and effort of obtaining SPOs and certifications and of producing comprehensive impact reports outweigh the perceived benefits, especially if the bonds are targeted at investors already familiar with the issuer.

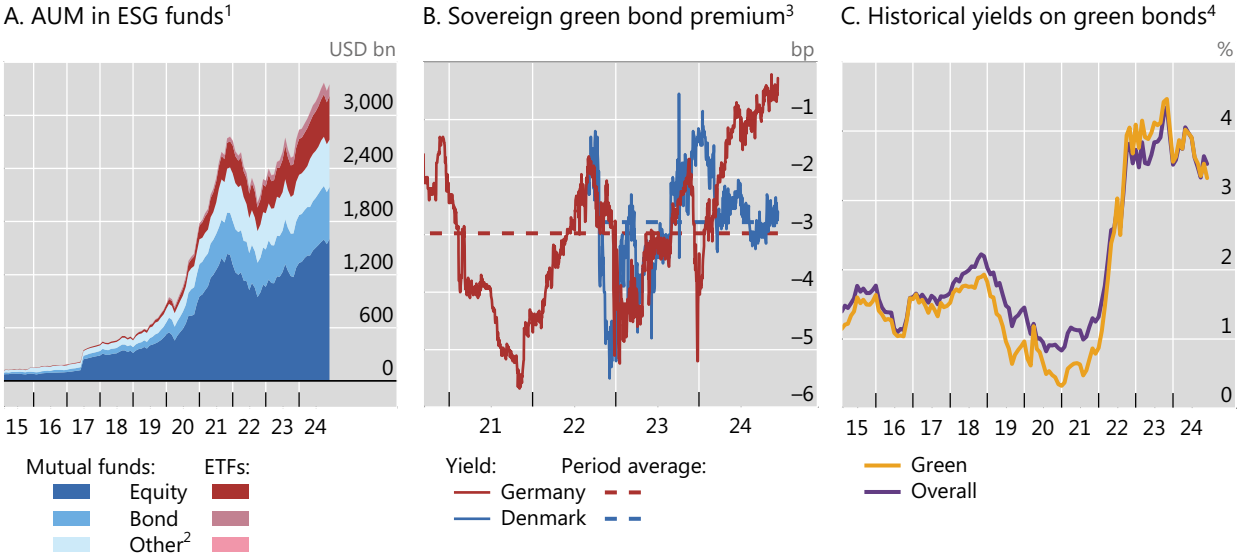
Issuers that are active in the green bond market include sovereigns, municipalities, financial institutions and non-financial corporations (Graph 1.C). Issuance by financial and non-financial corporations, especially in sectors with high emissions, has been particularly strong in recent years. The growing footprint of sovereign issuers has contributed to improvements in the quality and transparency of reporting standards. Because the use of proceeds type of green bond contradicts the principle of widespread fungibility of fiscal revenues, sovereign issuers of green bonds developed impact reporting and third-party certification (see Box A). Cheng et al (2024) show that non-sovereign issuers adopted these more stringent standards on green bonds as well.

Both demand- and supply-side factors have spurred growth in the green bond market. On the demand side, investors have increasingly prioritised sustainable investments, or the appearance thereof, driven by a societal shift towards environmental consciousness. Institutional investors have placed greater importance on green bonds in their long-term investment horizon for a variety of reasons, including the broad eligibility and diversification benefits of these bonds. Some now have stricter ESG mandates, some want to hedge carbon risk, and others may simply want to appear "green" (Krahnen et al (2023); NGFS (2024)). Adding to this, some central banks have adopted sustainability as a fourth reserve management objective in addition to the traditional goals of safety, liquidity and return (see Fender et al (2019, 2020, 2022)). Green investment funds and sustainability-focused indices have emerged to meet this growing demand (Graph 2.A).

Notably, this strong demand may have conferred a cost benefit to issuers. The so-called "greenium" is a trading premium on green bonds over traditional (ie non-

Some characteristics of green financial instruments

Graph 2



[1] Includes funds with socially responsible investment mandates, an older designation. AUM = assets under management; ESG = environmental, social and governance; ETFs = exchange-traded funds. [2] Includes multi-asset, money market and alternative funds. [3] The lines show the simple average of spreads on a green bond over a conventional sovereign bond with identical characteristics issued by Germany and Denmark. For Germany, bonds maturing in 2025, 2027, 2029, 2030, 2031, 2033, 2050 and 2053. For Denmark, bonds maturing in 2031 and 2033. Dashed lines show sample averages. [4] Global yield to maturity of overall global index (Bloomberg Global-Aggregate) and green bond global index (Bloomberg MSCI Global Green Bond Index).

Sources: Bloomberg; EPFR; authors' calculations.

green) bonds with otherwise identical characteristics (Graphs 2.B and 2.C). Empirical evidence on the size of the greenium has been mixed. But it could be linked to demand pressures at issuance that reflect the investor preferences discussed above. External review and certification may also play a role (Caramichael and Rapp (2024)). Investors' preference for more environmentally responsible firms to support sustainable growth (preference channel) and their perception that more carbon-intensive firms have higher probability for default (risk channel) can both contribute to explaining the greenium[6] (Xia and Zulaica (2022)). Flammer (2021) also documents that the issuance of green bonds triggers an increase in the equity price of the issuer, which could mean that green-oriented investors take it as a signal that the issuer will become more profitable, less risky or more attractive to other investors.

On the supply side, stricter environmental regulations and sustainability policies may have encouraged green financing, a point assessed below. The integration of ESG criteria into corporate strategies has prompted issuance, notably in the European Union (Caramichael and Rapp (2024)). More frequent issuance by sovereigns has also spurred development of green bond markets in their jurisdictions and raised green bond standards (Cheng et al (2024)). Finally, issuers seek the potential cost advantages (ie greenium) associated with green bonds.

Overall, the sixfold increase in market size since 2018 notwithstanding, green bonds are no panacea for funding the global energy transition. Issuers may be tempted to greenwash, improving their communication on sustainability without necessarily reducing their GHG emissions. The use of proceeds type of green bonds opens the door to such outcomes (Ehlers and Packer (2017); Scatigna et al (2021); Krahnen et al (2023)). In many jurisdictions, asset managers may also seek the label of green bonds exclusively for marketing purposes. In others, changes in the political arena may stigmatise green bonds and thus discourage asset managers from holding them.

GHG emissions of green bond issuers and mitigation policies

Which entities are responsible for the bulk of GHG emissions? And have they used green bonds to mitigate emissions? This section examines corporate GHG emissions and green bond issuance as a prelude to the empirical analysis that follows. Data from S&P Trucost track the scope 1, scope 2 and scope 3 GHG emissions of listed firms.[7] Since the data for *downstream* scope 3 emissions are incomplete, those for upstream scope 3 emissions, together with scope 1 and scope 2 emissions, are used.

Overall, the entities captured in S&P Trucost data account for roughly two thirds of global GHG emissions (Graph 3.A).[8] Among corporations, emissions are highly

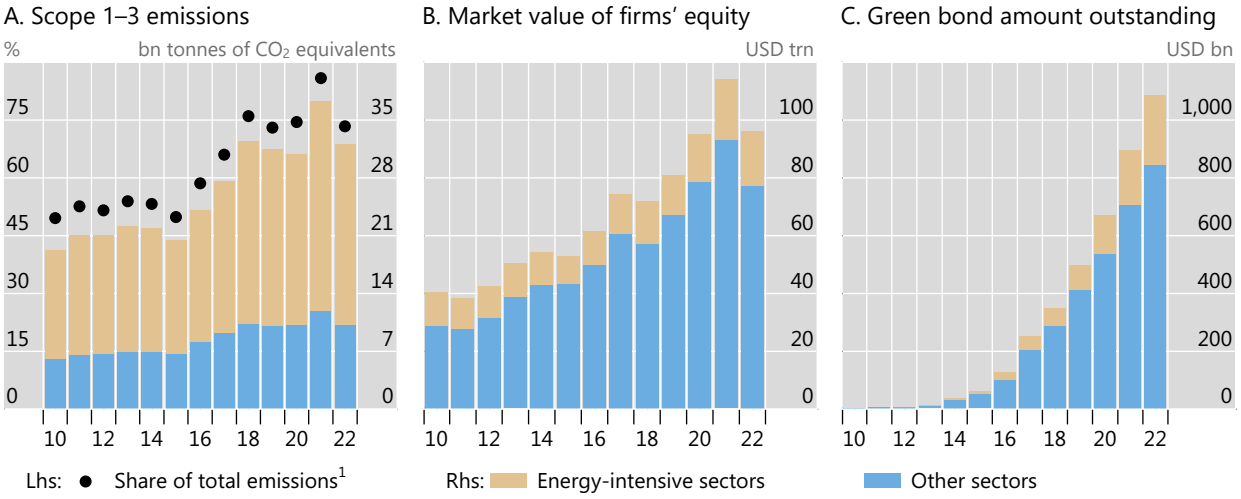
[6] The magnitude of the greenium differs across the term structure of bonds (Xia and Zulaica (2022)) and appears to be largest for bonds of large, investment-grade issuers (Caramichael and Rapp (2024)).

[7] The standards were developed as part of the Greenhouse Gas (GHG) Protocol, which provides guidelines for entities to quantify and report their direct and indirect emissions. Scope 1 covers direct emissions from owned or controlled sources, while scope 2 covers indirect emissions from electricity, heating, cooling etc consumed by the reporting entity. Scope 3 emissions refer to emissions by other entities in an entities' value chain, either upstream or downstream. Corporate issuers can influence their scope 3 emissions only indirectly, through the choice of their providers or customers.

[8] The data are compiled from corporate annual reports and other disclosures. Additionally, the provider employs models recommended by the GHG Protocol to estimate the emissions impact of disclosed

Heavy corporate GHG emitters account for small but growing share of green bonds

Graph 3



[1] Share of corporate greenhouse gas (GHG) emissions, according to Trucost data, in total global GHG emissions from all human activity, excluding land use change and forestry.

Sources: Climate Bonds Initiative; Climate Watch; Dealogic; Environmental Finance Bond Database; S&P Trucost; authors' calculations.

concentrated in a few sectors that account for a small share of market capitalisation but a high share of total emissions (Graphs 3.A and 3.B). This market capitalisation share for heavy emitters grew from 17% of outstanding green bonds in 2018 to 22% in 2022 (Graph 3.C).

GHG emissions exhibit large geographical variation, reflecting diverse industrial activities and energy consumption patterns (Graph 4). Emissions are predominantly concentrated in a handful of countries with extensive manufacturing and energy-intensive sectors, such as China, the United States, Japan, India and Korea. By contrast, countries with more service-oriented economies generally exhibit lower emissions. For instance, Germany and Japan, with their substantial automotive and heavy manufacturing sectors, show higher emissions than their European and Asian counterparts. This variation highlights the role of national policies and energy endowments (eg the share of nuclear or hydraulic electricity generation) in shaping corporate environmental performance that is likely to also be reflected among green bond issuers.

Since 2016, governments have generally tightened policies to mitigate GHG emissions, reflecting the growing urgency to address climate change (Graph 5.A). A major catalyst has been the Paris Agreement of December 2015, which prompted many jurisdictions to set more ambitious emissions reduction targets. These policy shifts have been complemented by enhanced reporting and transparency requirements for corporate emissions.

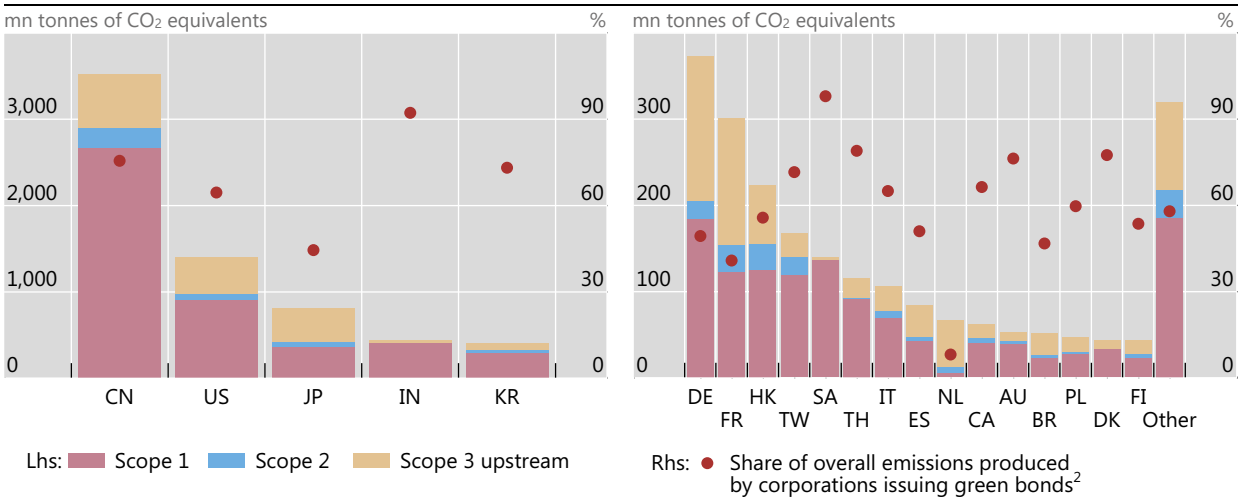
These mitigation policies differ by type and by how they incentivise GHG emissions reduction (see Table A.1 in Annex A). Sectoral policies target specific sources or economic sectors, such as electricity generation, transportation, agriculture and waste management. By contrast, cross-sectoral policies cut across multiple sources of emissions or sectors. For their part, international policies involve

activities and investments, filling in any gaps in the data. The global emissions not covered by Trucost are mostly due to consumption (eg transport or housing) and to agriculture.

commitments associated with international agreements and cooperation, such as participation in key climate treaties, international climate initiatives, international public finance measures (eg banning export credits for unabated coal plants) and comprehensive GHG emissions data and reporting.

GHG emitted by corporations in 2022, by headquarter country and type[1]

Graph 4



[1] Country-level greenhouse gas (GHG) emissions by type (scope 1, 2 and 3 upstream). [2] The dots account for scope 1 GHG emitted by corporations that are covered in the green bond database as a share of scope 1 GHG emissions of all corporations in that country (available in S&P Trucost data).

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

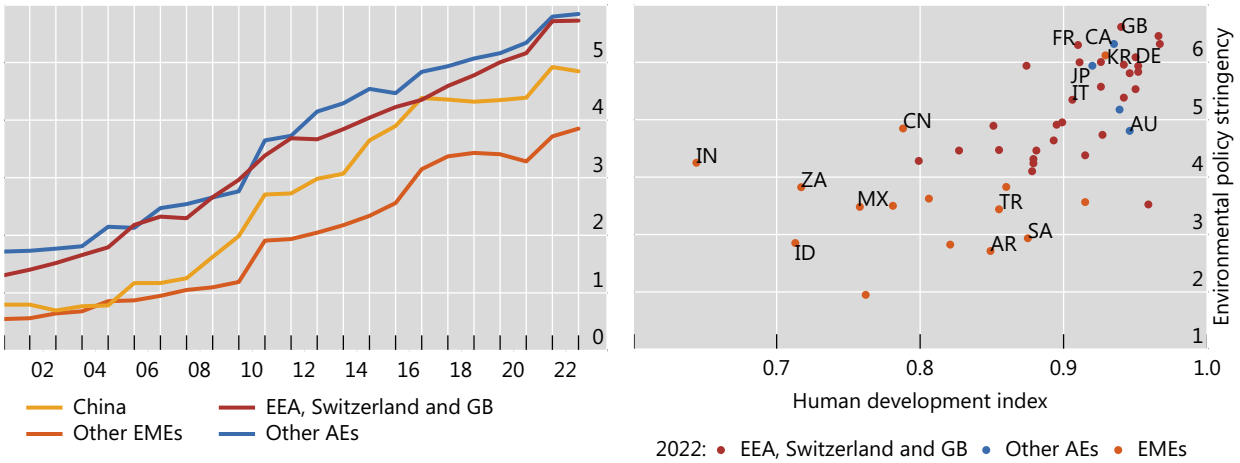
Policies to mitigate greenhouse gas emissions vary across jurisdictions

Index

Graph 5

A. Climate policy stringency, by region[1]

B. Climate policy stringency across countries



EEA = European Economic Area.

[1] The policy measures are weighted by population.

Sources: Nachtigall et al (2022); United Nations; authors' calculations.

These general shifts towards more stringent environmental policies notwithstanding, considerable cross-country differences remain. Across all countries, those with a higher level of economic development, proxied here by the human development index, tend to have more stringent policies (Graph 5.B).

Does issuance of green bonds link climate change policies and GHG emissions?

This section explores two key empirical questions. First, are differences in the stringency of public policies to mitigate GHG emissions across countries reflected in differences in the development of national green bond markets? Second, do corporations reduce their GHG emissions after issuing green bonds?

Policy stringency and the rise of green bond markets

Stricter climate policies may incentivise firms to green their operations and thus spur growth in green bond markets. This section investigates this formally using regressions on a sample of 39 countries from 2011 to 2022 (see Annex A).

The baseline empirical specification relates the size of countries' green bond markets to policy stringency. The size of countries' green bond markets is proxied by either total annual issuance (log-transformed) or the share of green bonds in total bond issuance.[9] The core explanatory variables include lagged standardised policy stringency indicators for the various policies described above. Other explanatory variables, such as GDP growth, GDP per capita, debt market size, market capitalisation and the share of renewable energy in electricity use, are also included as controls. Finally, country fixed effects are included to account for time-invariant differences across countries, and year fixed effects are included to capture time-specific shocks common to all countries.

The results show a positive correlation between policy stringency and the size of countries' green bond markets (Table 1). An increase in the aggregate policy stringency by one standard deviation is associated with around 2.4% higher annual issuance of green bonds (column 1). Not all types of policies have the same impact, however. Sectoral policies, ie those that apply to specific industrial sectors, appear to have a louder echo in green bond issuance (columns 2 and 3): a one standard deviation shift towards greater stringency is associated with nearly 3% more green bond issuance. This result remains consistent in alternative specifications, where the size of the green bond market is proxied by its share in total bond issuance (columns 4 to 6).

The design features of green bonds can vary across sectors, affecting the relationship between green bond issuance and policy stringency. Table 2 thus repeats the above regressions using issuance amounts in the financial sector (columns 1 to 3), non-financial sector (columns 4 to 6) and official sector (columns 7 to 9), respectively. For all three sectors, international policies such as participation in key international climate initiatives appear to coincide with greater issuance of green bonds. However, the story is different for cross-sectoral and sectoral policies. Cross-sectoral policies

[9] The total bond issuance of a country is the aggregate of all issues recorded in the Dealogic database.

significantly correlate with green bond issuance only for the official sector, while sectoral policies significantly relate to issuance only for the financial and non-financial sectors.

Stricter climate policies are correlated with larger green bond market growth Table 1

	Green bond gross issuance			Green bond issuance share		
	(1)	(2)	(3)	(4)	(5)	(6)
Aggregate policy	2.41***			2.50*		
International policy		0.58			–0.14	
Cross-sectoral policy		0.11			0.73	
Sectoral policy		2.94***			2.96**	
Sectoral policy: market-based			2.11***			3.06***
Sectoral policy: non-market-based			1.23**			0.42
Observations	420	420	420	420	420	420
Within R-squared	0.60	0.60	0.60	0.35	0.35	0.35
Overall R-squared	0.74	0.74	0.74	0.45	0.45	0.45

***/**/* indicate statistical significance at the 1/5/10% level. Regressions include country and year fixed effects. Green bond gross issuance is in logs. Policy variables are standardised to a normal distribution and lagged by one year. Control variables are GDP growth, GDP per capita, debt market size, market capitalisation and renewable energy share in electricity.

Source: Authors' calculations.

Correlations of climate policies and green bond issuance differ across sectors Table 2

	Green bond gross issuance: financial			Green bond gross issuance: non-financial			Green bond gross issuance: official		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Aggregate policy	2.59***			2.86***			1.04		
International policy		1.23**			0.93*			0.98*	
Cross-sectoral policy		0.17			0.21			1.17**	
Sectoral policy		2.90***			2.85***			1.03	
Sectoral policy: market-based			2.14***			2.39***			0.90
Sectoral policy: non-market-based			1.50**			1.24**			0.70
Observations	420	420	420	420	420	420	420	420	420
Within R-squared	0.50	0.50	0.50	0.54	0.54	0.54	0.27	0.27	0.27
Overall R-squared	0.71	0.71	0.71	0.69	0.69	0.69	0.52	0.52	0.52

***/**/* indicates statistical significance at the 1/5/10% level. The regression includes country and year fixed effects. Green bond gross issuance is in logs. Policy variables are standardised to a normal distribution and lagged by one year. Control variables include GDP growth, GDP per capita, debt market size, market capitalisation and the share of renewable energy in electricity use.

Source: Authors' calculations.

One possible reason for these sectoral differences is that cross-sectoral policies involve actions implemented at the regional or national level. Examples include setting GHG emissions targets (eg nationally determined contributions, a key element of the Paris Agreement) or public research and development expenditures. Regional or national policies may prompt the official sector to issue green bonds to finance

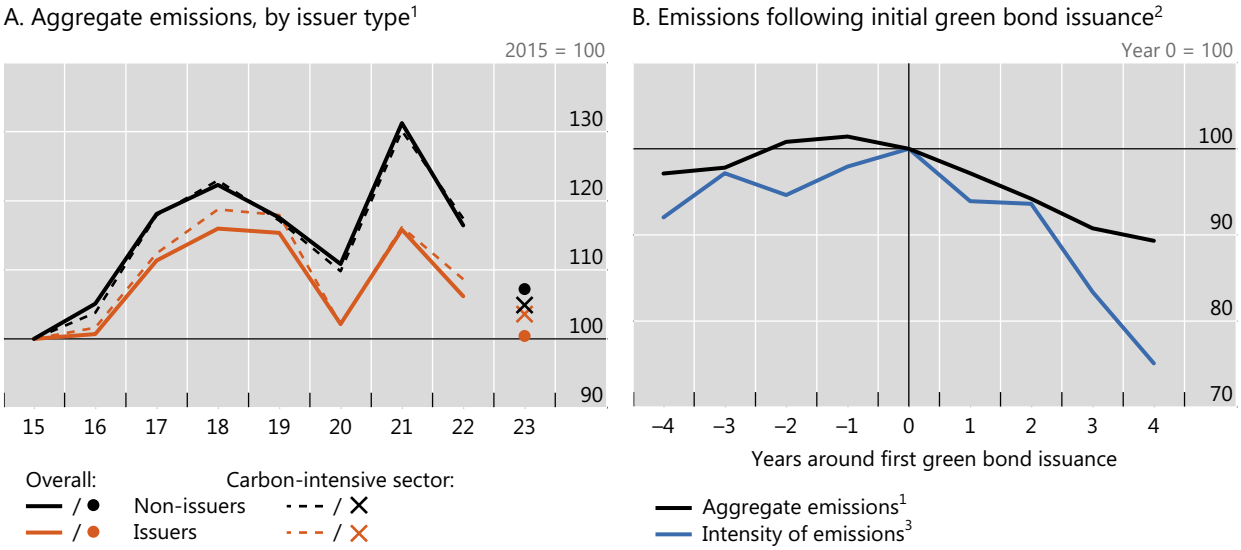
related projects. By contrast, sectoral policies tend to target specific sectors such as electricity, industry, transport and construction, making them more relevant for corporate issuance.

Green bond issuance and GHG emissions

The second important question is whether green bond issuance is also correlated with firms' actual GHG emissions. On this question, the results in the literature to date have been mixed (Ehlers et al (2020); Flammer (2020, 2021); Fatica and Panzica (2021)), potentially due to different data sources. With the surge in green bond issuance and improvements in emissions reporting in recent years, this section revisits this question using a data sample with more than double the outstanding amount of green bonds available previously.[10] This sample complements that in Cortina et al (2025), who focus on non-financial corporations and consider green bonds and green syndicated loans together.[11]

As a prelude to the regression analysis, Graph 6 presents a high-level view of how green bond issuance interacts with firms' GHG emissions. Between 2016 and 2022, firm-level GHG emissions experienced humped-shaped growth regardless of whether the firm issued green bonds (Graph 6.A), reflecting at least in part the reduction of activity due to Covid-related lockdowns in 2020 and 2021. However, for firms that did issue green bonds, their increase in emissions between 2015 and 2019

Corporate green bond issuance and greenhouse gas emissions — Graph 6



[1] Aggregate of scope 1 emissions of a consistent sample of firms. For 2023, data are extrapolated using the subset of firms whose emissions data are already available (dots and crosses). [2] Evolution of the aggregate of scope 1 emissions of a consistent sample of firms around their first year of green bond issuance. [3] Intensity of emissions as measured by the ratio of total scope 1 emissions to total revenue of firms in the consistent sample.

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

[10] The papers mentioned above rely on data available through 2018 or 2019.

[11] The data used here are sourced from different databases than those used by Cortina et al (2025).

was noticeably milder. This is evident in both the overall firm sample (solid lines) as well as in the subsample of carbon-intensive firms (dashed lines).

Green bond issuance also appears to be associated with a downward trajectory in firms' emissions (Graph 6.B). This can be seen in the drop in GHG emissions starting in the year of an initial issuance. In aggregate terms, the emissions of green bond issuers fell by more than 10% in the four years following issuance (black line). The profile of the carbon efficiency of these firms' operations suggests that this reflects changes in business practices beyond those stemming from pandemic-related lockdowns. Specifically, emissions per unit of firm revenue – a measure of emissions intensity (blue line) – shows an even starker drop following a green bond issuance. This metric dropped by nearly 30%, a faster pace than the one observed across the entire population of listed firms over the last decade (Jondeau et al (2021)).

Of course, green bond issuance alone may not explain these emissions trajectories. The green bond amounts seem to be small relative to the size of issuer firms (Flammer (2021)), and the impact they may have on the issuers' overall business model may be limited (Lam and Wurgler (2024)). In addition to any direct impact of climate-friendly projects financed by green bonds, the drop in emissions may also stem from firms' broader commitments to reduce emissions and green their operations. Green bonds may thus merely be a *signal* of such broader initiatives.

Table 3 shows via regression analysis whether, as shown in Graph 6, issuers of green bonds reduce their GHG emissions.[12] The dependent variable is the GHG emissions intensity of a firm based on either scope 1 emissions or scope 1–3 emissions.[13] To capture the intertemporal impact of green bond issuance, each regression includes dummy variables that indicate the year a firm issued its first green bond, one year after the first issuance, two years after the first issuance and three or more years after. In addition, the regression includes firm-level fixed effects and a combination of industry-year and country-year fixed effects to control for time-varying factors (eg the effect of Covid-19 lockdowns) (see Annex A, Table A.3).

The results show that green bond issuance is associated with a significant reduction in firms' subsequent GHG emissions.[14] For scope 1 emissions (Table 3, column 1), firms' emissions intensity decreased by around 21%[15] on average one year after the firm first issued a green bond. Similar results emerge with the broader emissions metric (column 2, scope 1–3 emissions). Emissions intensity remains significantly lower for direct emissions even after three years. These results are

[12] The regression analysis is based on a panel data set of 736 green bond issuers (991 green bond issues) during the sample period of 2011–22.

[13] Scope 1–3 is the sum of scope 1, scope 2 and scope 3 upstream emissions. Scope 3 downstream emissions are not included because of measurement issues and incomplete data. The results based on scope 1–2 emissions alone are consistent with those using scope 1–3.

[14] These results are consistent with Cortina et al (2025) but differ from those of Guesmi et al (2025), whose estimates are based on a much smaller sample of green bonds compared with the sample in this article. Guesmi et al (2025) find that firms with high exposure to climate risks issue more green bonds.

[15] Given the average scope 1 emissions intensity before initial green bond issuance in the sample is about 739.8 tonnes of CO_2 equivalents per $1 million of revenue.

Firms' GHG emissions intensity declines following the issuance of green bonds Table 3

	Full sample scope 1	Full sample scope 1–3	Carbon-intensive sectors	Other sectors	GHG intensity in top 20%	GHG intensity in bottom 20%
	(1)	(2)	(3)	(4)	(5)	(6)
Green bond (issue year)	–85.4	–89.5	–358.2*	8.2	–492.6	–6.9
Green bond (1 year)	–154.5**	–152.5**	–630.6**	12.3	–779.2**	–2.6
Green bond (2 years)	–174.5**	–146.9	–728.5**	35.9	–903.1*	73.8
Green bond (3+ years)	–182.6*	–159.7	–928.8***	71.3**	–1,263.0**	26.6
Observations	6,174	6,174	1,816	4,288	1,205	1,171
Within R-squared	0.002	0.002	0.014	0.004	0.014	0.012
Overall R-squared	0.91	0.92	0.91	0.83	0.89	0.35

***/**/* indicates statistical significance at the 1/5/10% level. The regression also includes log firm asset, firm fixed effects, country-year and industry-year fixed effects. The dependent variable is emissions intensity of scope 1 emissions for column (1), and scope 1–3 emissions for other columns.

Source: Authors' calculations.

qualitatively consistent with those in previous studies based on narrower data samples.[16]

Finally, Table 3 also reveals that it is the heavy emitters that reduce their GHG emissions after issuing green bonds. Given the skewness of carbon emissions, this is critical in terms of societal "net zero" objectives. While firms in the carbon-intensive sectors achieve significantly lower emissions intensity, firms in other sectors do not (columns 3 and 4). Splitting the sample by emissions intensity before a firm's first green bond issuance shows consistent results (columns 5 and 6): firms in the highest emissions intensity quintile group reduce their emissions significantly, while those in the lowest intensity quintile group do not. Taken together, the results suggest that green bond issuance appears to signal deliberate changes in GHG emissions from sectors and by players that are the most relevant for aggregate GHG trajectories.

Conclusion

The rapid growth of the green bond market since the 2015 Paris Agreement highlights the increasing importance of green financial products in addressing climate change. The issuance of green bonds has proven to be a significant mechanism for channelling capital towards environmentally sustainable projects. The market now attracts a diverse array of issuers, including sovereigns, municipalities, financial institutions and, particularly, private corporations.

The empirical analysis presented above shows that green bond issuance has expanded the most in jurisdictions that have adopted stricter decarbonisation policies. Moreover, issuance has been followed by a fall in carbon emissions at the firm level.

[16] For example, Flammer (2021) finds improved environmental performance after the issuance of green bonds to be more significant when the bonds are certified by independent third parties. Fatica and Panzica (2021) find a similar effect when green bonds issued for refinancing purposes are excluded. Finally, Cortina et al (2025) find that green debt issuance tends to be followed by improvements in CO_2 efficiency among non-financial firms.

These results combined indicate that green bonds have emerged as a reliable signal of firms' overall commitment to improve environmental performance, at least in terms of GHG emissions. This seems to be the case particularly for heavy carbon emitters. By bridging the gap between environmental goals and financial markets, green bonds appear to contribute, perhaps only modestly considering their scale, to the global strategy to combat climate change.

Looking forward, issuers and promoters of green bonds should consider whether explicit binding constraints on GHG emissions at the issuer level could attract more demand for green bonds and thereby lower the funding costs of investments in more sustainable economic activities.

References

Ananthakrishnan, P, T Ehlers, C Gardes-Landolfini and F Natalucci (2023): "Emerging economies need much more private financing for climate transition", IMF Blog, 2 October.

Bank for International Settlements (BIS) (2019): "BIS launches green bond fund for central banks", press release, 26 September.

Caramichael, J and A Rapp (2024): "The green corporate bond issuance premium", *Journal of Banking & Finance*, vol 162, no 107126.

Cheng, G, T Ehlers, F Packer and Y Xiao (2024): "Sovereign green bonds: a catalyst for sustainable debt market development?", *BIS Working Papers,* no 1198, July.

Cortina, J, C Raddatz, S Schmukler and T Williams (2025): "Green debt transition: from issuances to emissions", presentation at the HKIMR-ECB-BOFIT Joint Conference, Hong Kong SAR, 14–15 January.

Ehlers, T, B Mojon and F Packer (2020): "Green bonds and carbon emissions: exploring the case for a rating system at the firm level", *BIS Quarterly Review*, September, pp 31–47.

Ehlers, T and F Packer (2017): "Green bond finance and certification", *BIS Quarterly Review*, September, pp 89–104.

Fatica, S and R Panzica (2021): "Green bonds as a tool against climate change?", *Business Strategy and the Environment*, vol 30, no 5, pp 2688–701.

Fender, I, M McMorrow, V Sahakyan and O Zulaica (2019): "Green bonds: the reserve management perspective", *BIS Quarterly Review*, September, pp 49–63.

——— (2020): "Reserve management and sustainability: the case for green bonds?", *BIS Working Papers,* no 849, March.

Fender, I, M McMorrow and O Zulaica (2022): "Sustainable management of central banks' foreign exchange reserves", Grantham Institute, *Policy Briefing Papers*, no 6, July.

Flammer, C (2020): "Green bonds: effectiveness and implications for public policy", *Environmental and Energy Policy and the Economy*, vol 1, no 1, pp 95–128.

——— (2021): "Corporate green bonds", *Journal of Financial Economics*, vol 142, no 2, pp 499–516.

Guesmi, K, P Makrychoriti and E Pyrgiotakis (2025): "Climate change exposure and green bonds issuance", *Journal of International Money and Finance*, vol 152, no 103281.

International Capital Markets Association (ICMA) (2021): *Green bond principles: voluntary process guidelines for issuing green bonds*, June.

Jondeau, E, B Mojon and L Pereira da Silva (2021): "Building benchmark portfolios with decreasing carbon footprints", *BIS Working Papers,* no 985, December.

Krahnen, J, J Rocholl and M Thum (2023): "A primer on green finance: from wishful thinking to marginal impact", *Review of Economics*, vol 74, no 1, pp 1–19.

Lam, P and J Wurgler (2024): "Green bonds: new label, same projects", *National Bureau of Economic Research Working Papers*, no w32960, September.

Nachtigall, D, L Lutz, M Cárdenas Rodríguez, I Haščič and R Pizarro (2022): "The climate actions and policies measurement framework: a structured and harmonised

climate policy database to monitor countries' mitigation action", *OECD Environment Working Papers*, no 203, November.

Network for Greening the Financial System (NGFS) (2024): *Sustainable and responsible investment in central banks' portfolio management: practices and recommendations*, May.

Scatigna, M, D Xia, A Zabai and O Zulaica (2021): "Achievements and challenges in ESG markets", *BIS Quarterly Review*, December, pp 83–97.

Stechemesser, A, N Koch, E Mark, E Dilger, P Klösel, L Menicacci, D Nachtigall, F Pretis, N Ritter, M Schwarz, H Vossen and A Wenzel (2024): "Climate policies that achieved major emission reductions: global evidence from two decades", *Science*, vol 385, no 6711, pp 884–92.

United Nations Development Programme (UNDP) (2024): *Human development report 2023–24: breaking the gridlock: reimagining cooperation in a polarized world*, March.

Xia, D and O Zulaica (2022): "The term structure of carbon premia", *BIS Working Papers,* no 1045, October.

Annex A

Countries covered in the empirical analysis

Argentina, Australia, Austria, Belgium, Canada, Chile, China, Colombia, Czechia, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Malta, Mexico, the Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Romania, Russia, Saudi Arabia, Slovenia, South Africa, Spain, Switzerland, Türkiye, the United Kingdom and the United States.

Climate mitigation policies

The Climate Actions and Policies Measurement Framework (CAPMF) is a database developed under the International Programme for Action on Climate to track and evaluate climate mitigation policies across 52 countries from 2000 to 2022. The CAPMF measures the adoption and stringency of market-based instruments (eg carbon taxes, emissions trading schemes), non-market-based instruments (eg standards, bans) and other climate actions (eg emissions targets, climate governance). It includes 128 policy variables grouped into 56 policy instruments and other climate actions, covering sectoral, cross-sectoral and international policies. The measure for the US used in the econometric analysis is based on Stechemesser et al (2024), which rely on a similar methodology.

Types of climate abatement policies

Table A.1

Sectoral policies			Cross-sectoral policies	International policies
Sector	**Market-based instruments**	**Non-market-based instruments**	**GHG emissions targets:** - Net zero target - NDC target	**International cooperation:** - Climate treaties - Climate initiatives - Emissions pricing from aviation or shipping
Electricity	- Carbon pricing - RES support	- Bans and phase-outs of coal power plants - Air pollution standards for coal plants - Planning for renewables	**Public RD&D expenditure:** - Six categories (energy efficiency, renewables, etc)	**International public finance:** - Banning export credits for unabated coal plants - Banning public finance of fossil fuels abroad
Transport	- Carbon pricing - Congestion charge	- Fuel economy standards - Energy labels - Bans and phase-outs of ICE - Public rail investment - Motorway speed limits	**Fossil fuel production policies:** - FFS reform for fossil fuel production - Bans and phase-outs of fossil fuel extraction - Policies to reduce fugitive methane emissions	**GHG emissions and data reporting:** - Reporting and accounting - UNFCCC evaluation of biennial reports - Submissions of key UNFCCC documents
Industry	- Carbon pricing - Financing mechanism for EE	- MEPS appliances - Energy labels - Building energy codes - Bans and phase-outs of fossil-based heating	**Climate governance:** - Independent climate advisory body	
Buildings	- Carbon pricing - Financing mechanism for EE	- MEPS industrial motors - Energy efficiency mandates		

EE = energy efficiency; FFS = fossil fuel support; GHG = greenhouse gas; ICE = internal combustion engine; MEPS = minimum energy performance standards; NDC = nationally determined contribution; RD&D = research, development and demonstration; RES = renewable energy source; UNFCCC = United Nations Framework Convention on Climate Change.

Source: Nachtigall et al (2022).

Overview of data sources: country-level data

Table A.2

	Unit	Source
Climate actions and policies measurement framework (CAPMF)[1]	Standardised to mean of zero and standard deviation of one	OECD
Debt securities	USD	Dealogic
Green bonds	USD	Climate Bonds Initiative, Environmental Finance, Dealogic
Annual percentages of constant price GDP, year-on-year changes	Values between 0 and 1	IMF
GDP per capita, current prices	PPP dollars	IMF
Market capitalisation of listed domestic companies	Current USD	World Bank
Share of electricity production from renewables	Values between 0 and 1	Statistical Review of World Energy

[1] Data for the United States are not available in the CAPMF. This article therefore uses the US series in Stechemesser et al (2024).

Source: Authors' elaboration.

Overview of data sources: firm-level data

Table A.3

	Unit	Source
Greenhouse gas emissions	CO_2 equivalents	S&P Trucost
Debt securities	USD	BIS
Green bonds	USD	Climate Bonds Initiative, Environmental Finance, Dealogic
Company total assets	USD	S&P Global Market Intelligence
Company total revenue	USD	S&P Global Market Intelligence

Source: Authors' elaboration.

Matteo Aquilina
Matteo.Aquilina@bis.org

Giulio Cornelli
Giulio.Cornelli@bis.org

Nikola Tarashev
Nikola.Tarashev@bis.org

Commonality under pressure: banks and funds[1]

We study the joint evolution of financial strain at banks and investment funds. When market pressure on banks intensifies from an elevated level, net flows decline at open-ended corporate bond mutual funds (MFs), corporate bond exchange-traded funds (ETFs) and prime money market funds alike. This commonality has risen materially over time for all three fund types. That said, bond ETFs can be a stabilising force, as salient features of their business model help attract investor inflows in times of stress. By contrast, outflows from bond MFs tend to contribute to a tightening of market conditions when banks are already under pressure.

JEL classification: G21, G22, G23

Over the past two decades, the heft of non-bank financial intermediaries (NBFIs) has grown and so has their interdependence with banks. NBFIs provide funding to banks and count on banks to make markets. In addition, NBFIs and banks might have similar investors and may be active in similar asset classes (Acharya et al (2024), Aradillas Fernandez et al (2024)). This interdependence has an international dimension (Aldasoro et al (2020)).

We study a specific channel through which bank-NBFI interdependence may affect financial stability. In particular, we seek to shed light on whether strain at investment funds tends to contribute to a tightening of market conditions when market pressure on banks intensifies from an already elevated level. Such joint dynamics would have adverse system-wide effects.

Our analysis relies on readily available data. We use credit default swap (CDS) spreads to identify episodes of low and high market pressure in the banking sector, as well as to capture how pressure evolves within such an episode. In turn, we measure strain in investment funds with net flows relative to assets under management (AUM). We are agnostic as to what drives the joint evolution of bank CDS spreads and net fund flows – that is, establishing causal effects is out of scope.

We focus on prime money market funds (MMFs), corporate bond exchange-traded funds (ETFs) and open-ended corporate bond mutual funds (MFs). Each of

[1] The views expressed in this article are those of the authors, not necessarily those of the Bank for International Settlements. For helpful comments, we are grateful to Iñaki Aldasoro, Mathias Drehmann, Bryan Hardy, Gaston Gelos, Ulf Lewrick, Benoit Mojon, Gabor Pinter, Hyun Song Shin, Andreas Schrimpf and Karamfil Todorov.

Key takeaways

- *When elevated market pressure in the banking sector intensifies, net flows decline at several investment fund sectors engaging in liquidity transformation. This relationship has strengthened greatly over time.*
- *In episodes of high market pressure on banks, exchange traded funds specialising in corporate bonds can be a stabilising force, as their business model helps attract investor inflows.*
- *By contrast, investor outflows from open-ended corporate bond mutual funds may contribute to a tightening of market conditions when banks are already under high pressure.*

these investment fund sectors comprises homogeneous entities, which allows us to conduct the analysis at the fund-type level. In addition, because of liquidity transformation, the funds are vulnerable to investor flows that force fire sales. Such fire sales can be triggered by a common investor base in the fund and banking sectors and can influence the market conditions in which banks operate.

The focus of our analysis is inspired by, but distinct from, the standard one in the literature on systemic risk. In the spirit of the so-called SRISK measure (Acharya et al (2017), Brownlees and Engle (2017)), our main interest is in episodes of high market pressure in the banking sector. We stand apart, however, by not exclusively focusing on extreme stress. The high-pressure episodes in this article also include more benign spells that only hold the *potential* to affect financial stability. It is during such episodes that liquidity management tools or structural disincentives to investor outflows would make a big difference. Furthermore, whereas the broad-based stress in a financial crisis makes financial intermediaries look alike, the episodes we consider are more likely to reveal any structural heterogeneity across NBFI types.

When market pressure on banks intensifies from a high level, we find the following about investment funds. First, net flows decline at bond MFs, bond ETFs and prime MMFs alike. This commonality with banks has strengthened materially over time. Second, despite their decline, net flows at bond ETFs remain in *inflow* territory, probably reflecting salient features of these funds' business model that attract investors at times of stress. Third, by contrast, the bond MF sector faces material investor *outflows*, similar in magnitude to those experienced during the initial phase of the Covid-19 pandemic. A key driver of this finding is the behaviour of bond MFs that face outflows with initially low cash buffers – such funds respond by hoarding cash. Since cash hoarding is the flip side of illiquid asset sales, bond MFs tend to tighten market conditions at an unfavourable time for banks.

This article proceeds as follows. The first section discusses the growth of the three investment fund sectors and their interdependence with banks. The second describes our empirical approach. The third studies the joint evolution of fund flows and market pressure in the banking sector. The fourth section and an accompanying box analyse the economic significance of this evolution. The final section concludes.

Systemic relevance of investment funds

The past 20 years have witnessed strong growth of NBFIs and of investment funds in particular. While the banking sector grew threefold from 2002 to 2023, reaching $189 trillion in total assets, NBFIs roughly quadrupled over the same period, reaching $239

trillion in assets (FSB (2024)). Among NBFIs, bond and money market funds – including the corporate bond ETFs, open-ended corporate bond MFs and prime MMFs that this article focuses on – grew nearly fivefold as a group, from $11 trillion to $52 trillion.[2] They are currently by far the largest component of NBFIs involved in bank-like activities.

NBFIs and banks – direct and indirect links

As NBFIs grew, they became increasingly intertwined with banks. This is a key conclusion of Acharya et al (2024), who gauge the contribution of banks and NBFIs to systemic risk by studying the evolution of their stock returns in times of extreme stress. The increased interdependence has an international dimension, as cross-border links between banks and NBFIs – notably investment funds – rose by more than 60% between 2015 and 2020 (Aldasoro et al (2020), FSB (2024)).

Some of the links between the three investment fund types we study and banks relate to debt funding. MMFs hold bank commercial paper and certificates of deposit, and ETFs and MFs invest in bonds issued by banks. Focusing on European entities, Franceschi et al (2023) find that MMFs hold about 40% of bank debt with maturities shorter than six months, whereas MFs account for 10% of such debt with maturities longer than three years. In the United States, MMFs are a key source of dollar funding for non-US banks (Aldasoro et al (2020), Aldasoro, Balke, Barth and Eren (2022)).[3] The funding links also go in the other direction. Banks provide investment funds – as well as other NBFIs – with short-term loans and credit lines. And in times of stress, funds rely on repo borrowing from banks (Bank of England (2024)).

Other links stem from shared ownership, market making activity and common asset exposures. For one, fund managers rely on support from banks belonging to the same holding company (Bagattini et al (2023)). In addition, prime MMFs typically interact with one bank dealer and rely on this dealer if they need to sell any of their illiquid assets (Novick et al (2020), FSB (2021)). Furthermore, corporate bond ETFs, corporate bond MFs and prime MMFs trade and invest in similar assets as banks. Consistent with these funds' capacity to influence conditions in markets where banks operate, Cetorelli et al (2023) find that bond funds play the largest role among NBFIs in the propagation of price shocks that ultimately hit bank capital.

A common investor base can create important indirect links between banks and funds. For instance, US data reveal that the "real" sector – which includes households and non-financial businesses – held approximately 60% of banks' liabilities as well as between 60 and 80% of MFs' and MMFs' shares in 2023.[4] A retrenchment by these investors from both banks and investment funds would have systemic consequences. Relatedly, Acharya and Rajan (2024) highlight that, while the large post-Great Financial Crisis (GFC) expansion in the Federal Reserve's balance sheets generated

[2] There is no official estimate of the global size of these three fund sectors. That said, available data suggest that their US segments accounted for about 20% of the size of US NBFIs with bank-like activities (the FSB's "narrow measure") in 2023 (FSB (2024), Kuong et al (2024)).

[3] From banks' perspective, the importance of this link with prime MMFs has decreased since the 2016 US MMF reform. This reform led to mass conversions from the prime to the non-prime category (Aldasoro, Ehlers and Eren (2022)). Non-prime funds invest in short-term government securities or repos backed by such securities while prime funds can also hold commercial paper of both non-financial and financial entities (including banks) and certificates of deposit.

[4] Less comprehensive data indicate that pension funds and insurance companies are also part of banks' and funds' common investor base.

flighty claims on commercial banks, these claims did not decline with the subsequent balance sheet contraction. Flush with liquidity, the holders of these claims are also likely to seek exposure to investment funds for a yield pickup.

Investors' behaviour in times of stress – differences across fund types

When investment flows force funds to sell illiquid assets, they contribute to a tightening of market conditions. The systemic effects of such fire sales are stronger if they coincide with elevated market pressure elsewhere in the financial system.

The *potential* for disruptive fire sales in a risk-off environment is a feature of the fund types we study because they all engage in pronounced liquidity transformation.[5] Prime MMFs promise same day liquidity to their investors, and redemptions at bond MFs and ETFs are typically executed one day after investors request them. At the same time, the assets in these funds' portfolios trade in illiquid secondary markets.

That said, there are important differences across these fund types. The exposures of prime MMFs are of shorter maturity and typically to higher-quality borrowers than those of bond MFs or bond ETFs. Thus, prime MMFs may actually benefit from a flight to liquidity when investors' risk appetite declines. Of course, in systemic events such as the GFC and the pandemic-related crisis – when investors sought refuge in government MMFs – the prime MMF sector may be at the epicentre of the stress.

In turn, the business model of bond ETFs is less prone to destabilising dynamics. Authorised participants (APs) – the only entities that can create or redeem ETF shares in primary markets – and bargain hunting end investors step in to put a lid on discrepancies between the share price of the actively traded bond ETFs and the value of the underlying illiquid portfolio (Aquilina et al (2023), Aramonte and Avalos (2020), Gorbatikov and Sikorskaya (2022)). Such stabilising behaviour is viable because of bond ETF design features that reduce the risk of runs. For one, because there is a small number of APs in each ETF, they take into account the adverse price impact that redemptions would have on their holdings. Furthermore – in contrast to MFs – it is standard practice to redeem bond ETF shares in exchange for securities, rather than cash. This in-kind redemption allows ETF sponsors to strategically choose the composition of "redemption baskets" in stress, so that the attractiveness of redemptions declines (Todorov (2021), Shim and Todorov (2021)). All this mitigates the likelihood that – in a risk-off environment – outflows from bond ETFs would necessitate fire sales.

Empirical approach

We now describe our empirical approach to studying the joint evolution of strain in the banking and investment fund sectors. In the first subsection, we describe how we identify episodes of high market pressure on banks. In the second subsection, we explain how we measure sector-level strain within such an episode.

[5] This is only one of the main propagation channels involving NBFIs. Another channel stems from fluctuations in leverage due to changes in margin requirements (Aramonte et al (2023)).

Market pressure in the banking sector

We use CDS spreads to differentiate between low and high market pressure in the banking sector. These spreads capture the premium that creditors demand for their exposure to an entity. Accordingly, they have been used as indicators of banking sector stress (Avino et al (2019), Knaup and Wagner (2012), Indergand et al (2022)).[6]

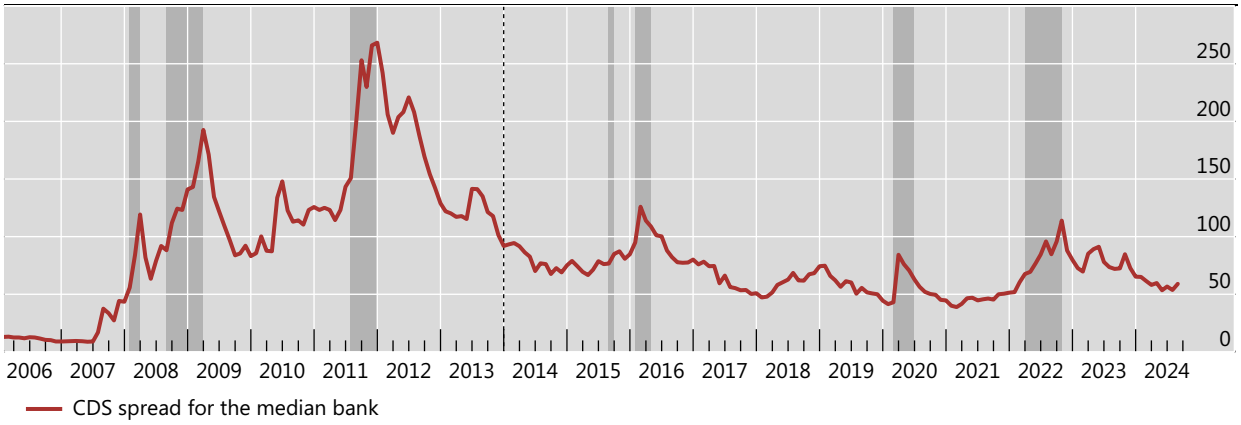
We define high market pressure in the banking sector as sustained increases in CDS spreads relative to a threshold. Specifically, we work with almost 20 years of monthly data with global coverage: 53 large banks from 15 jurisdictions. We study two subperiods – from January 2006 to December 2013 and from January 2014 to August 2024. Within each subperiod, "high-pressure" episodes include months that witness the top 10% of four-month changes in the median CDS spread (Graph 1, shaded areas).[7] The remaining months are "low pressure".

We chose the two subperiods and the definition of high market pressure for a number of reasons. First, the earlier subperiod roughly coincides with strong growth in the overall NBFI sector, whereas the size of this sector is stable at a high level during the later subperiod (FSB (2024)). Second, the high-pressure episodes capture well known systemic events, such as the GFC (2008–09), part of the European sovereign debt crisis (2010–12) and the initial fallout of the Covid-19 shock (2020). Third, the number and length of high-pressure episodes are roughly the same in the two subperiods. Fourth, by featuring only sustained increases in CDS spreads, high-pressure episodes indicate increases in banks' funding costs. By contrast, if CDS spreads spike abruptly and then quickly revert to low levels, banks would be able to reduce the attendant impact on their funding expenses by slightly delaying some of

High vs low market pressure episodes in the banking sector

In basis points

Graph 1



The shaded areas indicate high market pressure episodes, including all observations for which the change in CDS spread from month *t*–4 to *t* is above the 90th percentile within each of the two subperiods delineated by the dashed line at end-2013.

Sources: S&P Global Market Intelligence; authors' calculations.

[6] Since identifying causality is out of scope, we will *not* try to establish whether the evolution of CDS spreads is due to issues in the banking sector itself, originates in another sector or is the outcome of a market-wide risk-off environment.

[7] If a gap between such months is up to two-months long, we also treat it as high pressure.

their new debt issuance. This is why, for instance, the severe but very short-lived banking stress in March–April 2023 is not among the high-pressure episodes.

Ultimately, the high-pressure episodes in Graph 1 are not confined to systemic events. Such events affect a critical mass of financial entities and have macroeconomic repercussions – they are thus "deep in the tail". In addition, we include episodes of banking sector fragility that could have evolved into a crisis but did not.[8] The latter episodes could be a result of banks succeeding in overcoming their difficulties and reassuring markets, the public sector coming to the rescue (implicitly or explicitly) or NBFIs acting in a way that mitigates the pressure on banks. Below, we shed light on the relevance of the latter explanation for specific fund types.

Strain at investment funds and banks

When we condition on low or high market pressure episodes in the banking sector (per Graph 1), we track the evolution of strain in this sector as well as that in the three investment fund types. We say that strain in the banking sector increases when the median CDS spread rises month to month – that is, when market pressure in the banking sector intensifies (from either low or high levels). In turn, strain in a fund sector increases when there is a decline in net investor flows – defined as inflows minus outflows. We focus on sector-level strain, ie the aggregate net flow across all constituent entities over a month, divided by aggregate AUM at the beginning of the same month.

We work with monthly data on open-ended bond MFs, bond ETFs and prime MMFs from January 2006 to August 2024.[9] Seeking to include a representative set of entities that hold global asset portfolios, we draw from the top 500 funds worldwide by AUM within each of the first two sectors. In a slight departure from this principle, we draw only from the top 500 US-domiciled prime MMFs, as the identification of similar MMFs domiciled elsewhere is not clear-cut. Our sample covers about 50% of bond MFs', 70% of bond ETFs' and nearly two thirds of US-domiciled MMFs' total AUM as of December 2005. The findings below are robust to separately studying funds domiciled in specific jurisdictions.

Fund flows and market pressure on banks

We first measure the commonality of strain at investment funds and banks. Then we look into whether net fund inflows or outflows underpin this commonality.

[8] The increase in CDS spreads in early-2016 was likely driven by the near failure of a global systemically important bank (G-SIB). In turn, 2022 witnessed bouts of investor concern about credit risk in general and the CDS spreads of another G-SIB came under intense upward pressure.

[9] Working with monthly data prevents us from detecting outsize investor swings that reverse within a calendar month. However, it avoids the noise in higher frequency data. Conducting the analysis with weekly data confirms our findings in qualitative terms but lowers their statistical significance.

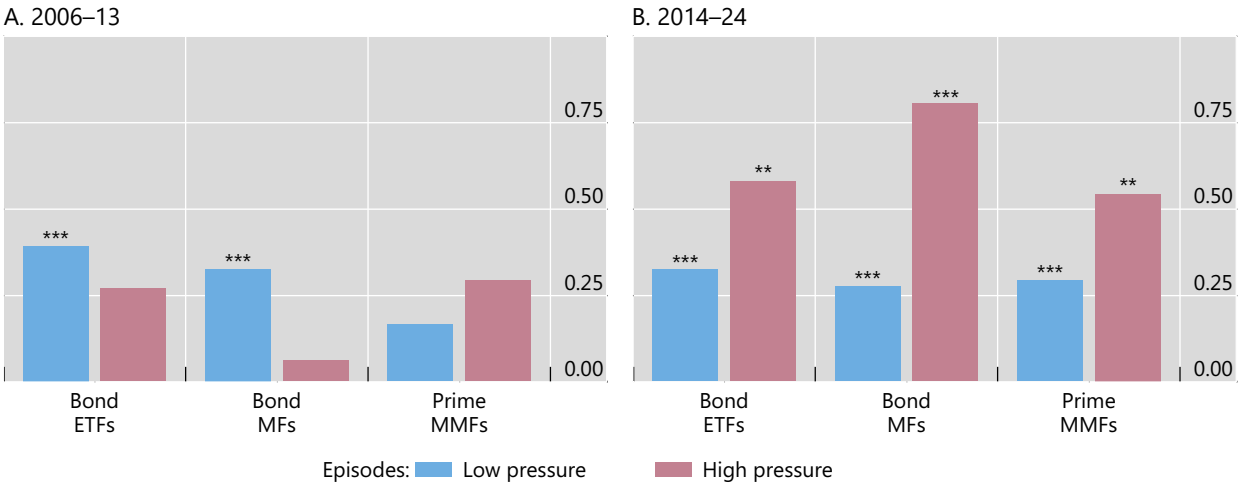
Commonality of strain at investment funds and banks

Strain commonality with the banking sector evolved similarly across investment fund sectors, increasing materially from the earlier to the later subperiod only within episodes of high market pressure.[10,11] We see this by comparing bars of the same colour across the panels in Graph 2, where we calculate the correlation between CDS spread changes and the *negative* of net fund flows – thus, a higher correlation implies stronger commonality. While the correlations were below 30% (and statistically insignificant) in high-pressure episodes during the earlier subperiod, they rose to above 50% (and became statistically significant) in the later subperiod. By contrast, the corresponding correlations in low-pressure episodes barely moved (blue bars). The phenomenon is starkest in the bond MF sector, in which the low-pressure correlation declined slightly but the high-pressure correlation shot up from effectively zero to about 80%.

The correlations in the later subperiod (Graph 2.B) are consistent with investors perceiving that the similarity between bank and fund sectors rises in high-pressure episodes. When market pressure is low, a common investor base would exploit

Commonality of strain across banking and investment fund sectors[1]

Correlation coefficients between bank CDS spread changes and the negative of net fund flows — Graph 2



[1] Episodes of low/high market pressure, as identified in Graph 1. ***/** indicates statistical significance at the 1/5% level. The change in high-pressure (low-pressure) correlations between the two subperiods is statistically significant at the 1% level (insignificant). See endnotes for details.

Sources: iMoneyNet; Lipper; S&P Global Market Intelligence; authors' calculations.

[10] Loretan and English (2000) and Forbes and Rigobon (2002) warn that an increase in the correlation between two variables can be the "mechanical" outcome of higher volatility. The volatility of flows in the bond MF and prime MMF sectors did increase from the earlier to the later subperiod in our sample but that of flows in the bond ETF sector and of monthly changes in bank CDS spreads declined. In the Annex A, we illustrate that the link between volatilities and correlations can be driven by fundamentally different but observationally indistinguishable mechanisms. Since we are agnostic about the drivers of correlation changes, either mechanism could be behind our findings.

[11] This echoes a finding in Acharya et al (2024) on commonalities between the banking and the broad NBFI sectors. Using stock price data, they find that: (i) the systemic risk contributions of these two sectors have become more correlated since the GFC; and (ii) returns in each of the sectors cause – in a statistical sense – returns in the other.

diversification benefits by rebalancing its positions across sectors. In such episodes, there is thus a relatively high likelihood that, for example, an increase in banks' CDS spreads would occur together with fund inflows. By contrast, common risk factors come to the fore in episodes of high market pressure in the banking sector. In such circumstances, investors both demand higher compensation for credit exposure to banks and retrench from investment funds.

For market conditions, it is crucial whether the above correlations reflect the evolution of inflows or outflows. While inflows would not force fire sales of fund assets, outflows may have the opposite effect. For this reason, we next consider the *level* of investor net flows in episodes of low and high market pressure.

Distribution of fund flows

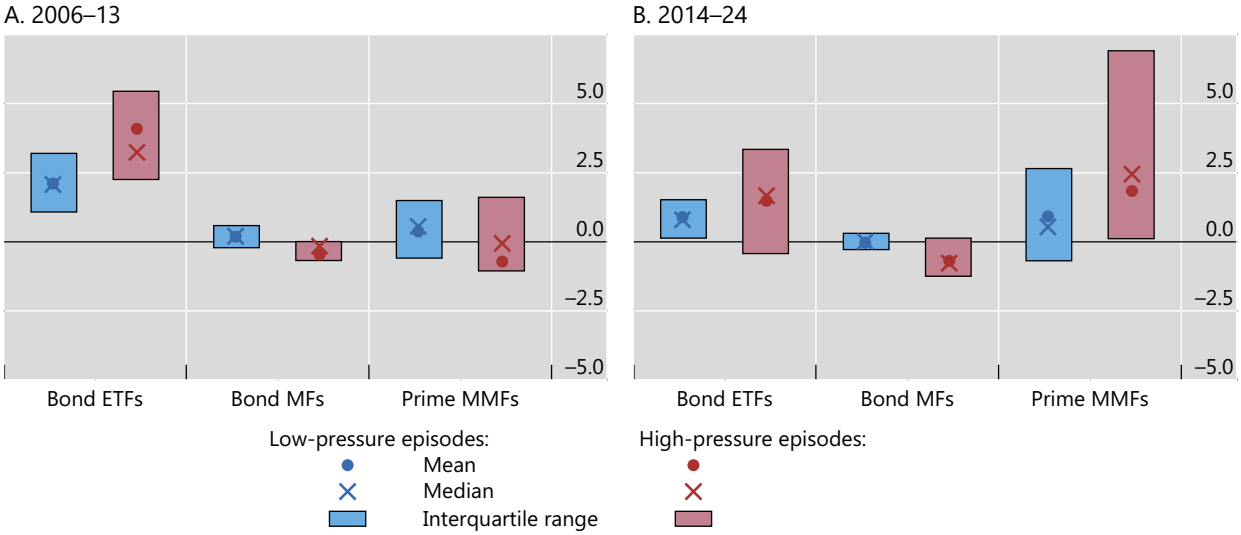
The distribution of net investor flows remains largely similar between the two subperiods but differs markedly across sectors (Graph 3).

The picture is rather benign for bond ETFs and prime MMFs. In each subperiod, bond ETFs tend to face *higher* net flows – mostly inflows – when banks are under strong market pressure (Graph 3, red vs blue bars). This finding squares with contrarian behaviour by bond ETF investors, supported by these funds' business models (as noted above). The experience of prime MMFs is similar, especially over the later subperiod, probably as a result of the relative safety of these funds' portfolios.

The picture is much less benign in the case of bond MFs. Here, higher market pressure on the banking system tends to go together with lower net flows. While inflows and outflows are roughly equally likely in low-pressure episodes, outflows occur 75% of the time in high-pressure episodes. Again, this pattern persisted through both subperiods, consistent with strong incentives for a run to occur on bond

Strain distribution across investment fund sectors[1]

Monthly net flows, as a percentage of assets under management — Graph 3



[1] Episodes of low/high market pressure, as identified in Graph 1.

Sources: iMoneyNet; Lipper; S&P Global Market Intelligence; authors' calculations.

MFs in a risk-off episode, as they hold riskier assets than prime MMFs and engage in greater liquidity transformation than bond ETFs.

The heterogeneity of flow distributions across fund types (Graph 3) helps refine the interpretation of the correlation results (Graph 2). In high-pressure episodes in the later subperiod, for instance, an intensification of market pressure in the banking sector tends to go together with declining *inflows* to bond ETFs and prime MMFs but with rising *outflows* from bond MFs (Graphs 2.B and 3.B, red bars).

Economic significance of bank-fund commonality

We now study the *magnitude* by which net fund flows evolve when pressure in the banking sector intensifies. Focusing on one fund sector at a time, we verify whether this relationship differs between episodes of low and high market pressure. In addition, further narrowing our focus to high-pressure episodes, we assess whether asset fire sales are likely to result from net fund flows that tend to go hand in hand with a standard adverse shock to bank CDS spreads. The latter sheds light on the economic significance of bank-fund commonality.

We proceed as follows, focusing on the later subperiod, as it reflects structural features of the financial system that are currently in place. We first estimate the relationship between (de-meaned) changes in the median CDS spreads in the banking sector and net fund flow (NFF) relative to AUM in an investment fund sector.[12] We do so separately for low- and high-pressure episodes:

$$NFF_t^k = \alpha^k + \beta^k \Delta CDS_{t:t-1}^{bank} + \varepsilon_t^k, \qquad (1)$$

where k stands for bond ETFs, open-ended bond MFs or prime MMFs. Second, focusing on high-pressure episodes, we simulate a "shocked" net flow for each sector by replacing $\Delta CDS_{t:t-1}^{bank}$ with its standard deviation and setting ε_t^k to zero.[13] As a benchmark for the shocked net flow in fund sector k, we use the maximum net outflow from this sector during the initial three months of the Covid-19 pandemic. These outflows were particularly disruptive, forcing central banks to intervene in order to restore orderly market functioning (Avdjiev et al (2020), Schrimpf et al (2020)).

The regression estimates (Graph 4.A) add to the information about strain commonality that episode-dependent correlations revealed above (Graph 2.B). Consistent with the earlier findings, a higher rise in bank CDS spreads goes hand in hand with a lower net flow at each investment fund sector. However, only for bond MFs is this relationship materially stronger (with marginal statistical significance) in episodes of high pressure than in low-pressure episodes (Graph 4.A, blue vs red bars). Within high-pressure episodes, it is statistically significant only for bond ETFs and bond MFs. We thus focus on these two sectors in the rest of the section.

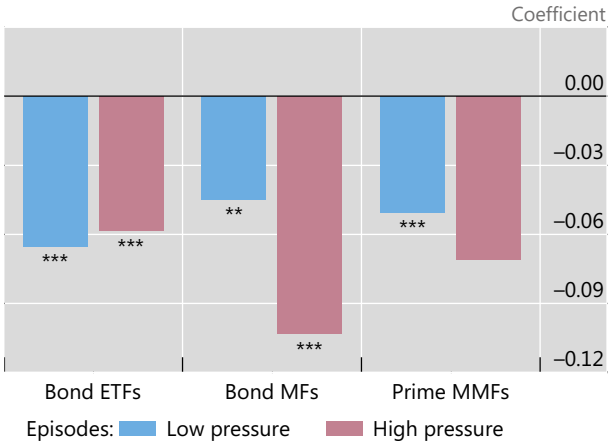
[12] By de-meaning the right-hand side variable, we set the intercept equal to the average NFF.

[13] Since we condition on high market pressure episodes, this typical shock is in the "tail".

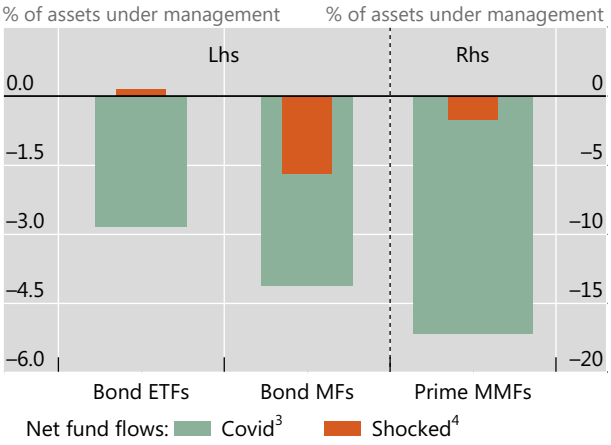
Economic significance of strain commonality at banks and investment funds[1]

Graph 4

A. Slope coefficient, by fund type[2]



B. Simulated net flows vs Covid-19 experience, conditional on high-pressure episodes



[1] Based on regressing monthly net fund flows (NFFs) in a fund sector on (de-meaned) changes of bank CDS spreads, conditional on an episode category from January 2014 to August 2024. [2] *** indicates statistical significance at the 1% level. The estimates are scaled by the unconditional standard deviation of the NFF in the respective fund sector between January 2014 and August 2024. [3] Maximum NFF during the initial month of the Covid-19 pandemic (ie March 2020). [4] Associated with an adverse one standard deviation shock of banking sector strain, per equation (1).

Sources: iMoneyNet; Lipper; S&P Global Market Intelligence; authors' calculations.

We again find a benign picture for bond ETFs. Echoing earlier results, when the market pressure on the banking sector intensifies from a high level by a typical increment, net flows at bond ETFs decline but remain in *inflow* territory (Graph 4.B, first orange bar). Since such an outcome would lead these funds to purchase assets, it would contribute to a normalisation of market conditions.

In the case of bond MFs, the shocked net flows are *outflows* and of high economic significance. The ratio of these outflows to the maximum ones during the pandemic-related crisis is at nearly one half (Graph 4.B, second orange bar relative to green bar). Such a large magnitude of shocked outflows suggests that it is likely to contribute to a tightening of market conditions by necessitating sales of illiquid assets.

Additional analysis, exploiting heterogeneity across individual funds, provides further evidence that the outflows from bond MFs in high-pressure episodes can be expected to generate material sales of illiquid assets. In Box A, we differentiate funds according to the share of highly liquid assets in their investment portfolio, while also accounting for the riskiness of this portfolio. We find that, when market pressure on banks intensifies from a high level, sector-level outflows are driven by funds with relatively low liquidity buffers. Focusing on the bond MF sector – and in line with Morris et al (2017) – we also find that low-liquidity funds are more likely to *increase* their cash buffers in the face of outflows. Since cash hoarding is the flip side of illiquid asset sales, such fund behaviour would tighten market conditions at an unfavourable time for banks.

Box A

The interplay of fund liquidity and high market pressure

*Matteo Aquilina, Giulio Cornelli and Nikola Tarashev*①

Previous studies have found that investment funds can mitigate redemption risk by building liquidity buffers.② In this box, we add to this evidence by studying net flows at individual funds in three sectors – open-ended corporate bond mutual funds (MFs), corporate bond exchange-traded funds (ETFs) and US prime money market funds (MMFs). We find that at times of high market pressure in the banking sector, funds with low liquidity buffers tend to experience stronger outflows and hoard cash.

Our empirical setup incorporates monthly data from January 2014 to August 2024. Within this period, we focus on months of high market pressure, ie those witnessing the top 10% of four-month changes in the median credit default swap (CDS) spread across 53 large banks. We draw our sample from the top 500 funds in each sector, working with those for which there are data on cash holdings (bond MFs and bond ETFs) or the holdings of (liquid) assets maturing within a week (prime MMFs). For each sector, a dummy variable "liquidity," indicates which funds are in the top quartile with respect to the average ratio of cash or liquid assets to total assets under management (AUM). Then, denoting by *NFF* the ratio of net fund lows relative to AUM, and by $\Delta CDS^{bank}_{t:t-1}$ the one-month change in the median CDS spread in the banking sector, we estimate the following regression equation:

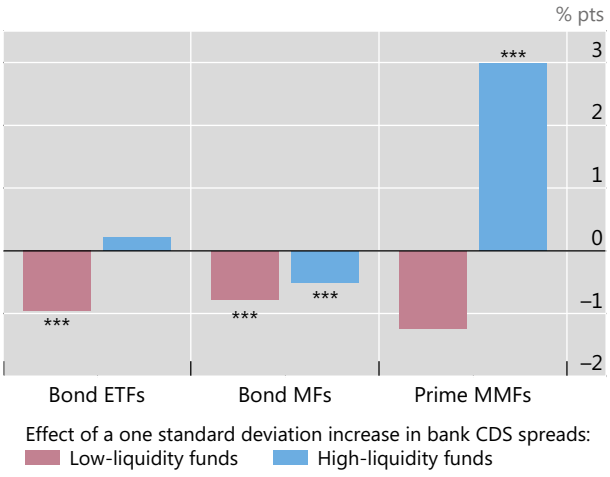
$$NFF^{k}_{i,t} = \beta^{k}\Delta CDS^{bank}_{t:t-1} + \lambda^{k}\Delta CDS^{bank}_{t:t-1} * liquidity^{k}_{i} + \mu^{k} riskiness^{k}_{i} + \theta^{k}_{i} + \varepsilon^{k}_{i,t} \qquad \text{(A1)}$$

Here, i denotes funds, k a fund sector, t time and *riskiness* a control variable that is equal to the share of fixed income securities with a rating below investment grade in the total AUM.③

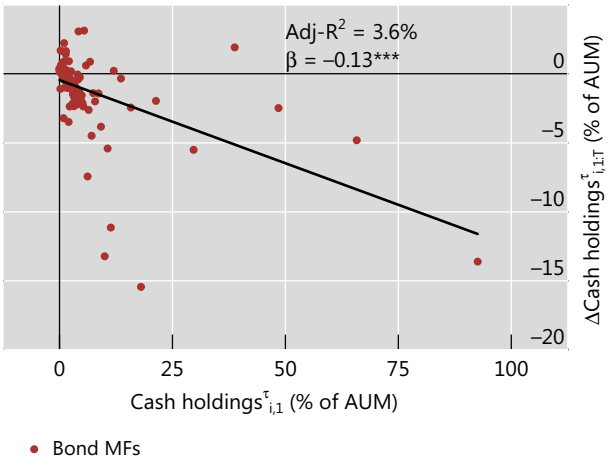
The evolution of strain and cash buffers at investment funds

Episodes of high market pressure on banks — Graph A1

A. Change in net fund flows, given a standard adverse shock to market pressure on banks[1]



B. Funds with low cash buffers hoard more cash[2]



*** indicates statistical significance of the associated coefficient at the 1% level.

[1] Total estimated effect, per equation (A1). The dependent variables correspond to the entity-level strain (ELS) measures for each sector and are winsorised at the 1st and 99th percentiles. $\Delta CDS_{t:t-1}$ is the one-month change in the CDS spreads for the median bank; for bond ETFs and MFs, liquidity corresponds to a dummy variable taking the value 1 for funds for which the average percentage allocation to cash over the post-2014 subperiod is in the top quartile of the respective distribution; for prime MMFs, the dummy variable is based on the percentage of assets maturing within one week. For bond ETFs and MFs, riskiness is the percentage of the fixed income allocation invested in securities with ratings below BBB; this measure is not available for prime MMFs. [2] Binned scatter plot. AUM = assets under management. Based on episodes of high market pressure in the 2014–24 subperiod (see Graph 1). Each dot of the binned scatter plot corresponds to the cash holdings of fund i at the beginning of an episode of high market pressure (x-axis) vs the change in cash holdings for the same fund i from the last to the first period of the same episode of high market pressure.

Sources: iMoneyNet; Lipper; S&P Global Market Intelligence; authors' calculations.

We find that, all else equal, funds come under greater strain when their liquidity position is weaker (Graph A1.A). In the bond MF sector, the average net flow – a 1% outflow – tends to decline by 0.5 percentage points for high-liquidity funds when the banking sector CDS spread increases by one standard deviation. At 0.8 percentage points, the corresponding decline at low-liquidity bond MFs – from an average 0.8% outflow – is larger in statistical terms. The results are qualitatively the same for bond ETFs and prime MMFs. That said, the estimated effects on these funds are statistically significant only for one of the subgroups, and neither effect results in an outflow when applied to the corresponding average net flow.

Given the high incidence of outflows from bond MFs, we also investigate the evolution of cash buffers in that sector at the level of individual funds, again focusing on episodes of high market pressure on banks. For each of the four such episodes from 2014 to 2024, we use the initial cash buffer of a bond MF and the change of this buffer over the episode. This leads to the binned scatter plot in Graph A1.B. Consistent with previous research (Morris et al (2017)), funds with lower cash buffers tend to reduce these buffers by less, or even expand them.④ Thus, such funds not only face larger outflows – as implied by the estimate of equation (1) – but are also more likely to sell illiquid assets, which would contribute to a tightening of market conditions.

① The views expressed are those of the authors and do not necessarily reflect the views of the BIS. ② See U Lewrick and S Claessens, "Open-ended bond funds: systemic risks and policy implications", *BIS Quarterly Review,* December 2021; and S Morris, I Shim and H S Shin, "Redemption risk and cash hoarding by asset managers", *Journal of Monetary Economics,* vol 89, pp 71–87, 2017. ③ We are unable to measure the riskiness of prime MMFs because of a lack of data. ④ See A Schrimpf, I Shim and H S Shin, "Liquidity management and asset sales by bond funds in the face of investor redemptions in March 2020", *BIS Bulletin*, no 39, March 2021.

Conclusion

Investor flows that lead funds to fire sales of assets would be of greater systemic relevance if they occur when market pressure on banks is already high. This is the case irrespective of whether the fund flows contribute to, or are a consequence of, the pressure on banks, or whether the two developments are the joint manifestation of external risk factors. Either way, financial stability is jeopardised.

We find that investment fund sectors differ in their tendency to experience such destabilising flows. Thanks to salient features of their business models, bond ETFs tend to actually attract investors under stress. By contrast, the bond MF sector would face large outflows when market pressure on banks escalates. This underscores the macroprudential value of containing disruptive redemptions in this sector via reforms that reduce the appeal of procyclical redemptions or via liquidity management tools that reduce investors' first-mover advantage (Lewrick and Claessens (2021)). Indeed, the Financial Stability Board and the International Organization of Securities Commissions have recently published recommendations on this topic (FSB (2023), IOSCO (2024)).

Our findings also suggest important avenues for further research. Notably, they only indirectly reveal the actual evolution of funds' sales of risky assets. The impact of investor redemptions on the volume of such sales and ultimately on market prices may be unstable or highly non-linear. Analyses of this relationship would arise naturally in system-wide stress tests (Bank of England (2024)) and would allow for more definitive conclusions about the financial stability implications of fund flows.

References

Acharya, V, N Cetorelli and B Tuckman (2024): "Where do banks end and NBFIs begin?", *NBER Working Paper*, no 32316, April.

Acharya, V, L Pedersen, T Philippon and M Richardson (2017): "Measuring systemic risk", *Review of Financial Studies*, vol 30, no 1, pp 2–47.

Acharya, V and R Rajan (2024): "Liquidity, liquidity everywhere, not a drop to use: why flooding banks with central bank reserves may not expand liquidity", *Journal of Finance*, vol 79, no 5.

Aldasoro, I, F Balke, A Barth and E Eren (2022): "Spillovers of funding dry-ups", *Journal of International Economics*, vol 137, article 103622.

Aldasoro, I, T Ehlers and E Eren (2022): "Global banks, dollar funding and regulation", *Journal of International Economics*, vol 137, article 103609.

Aldasoro, I, W Huang and E Kemp (2020): "Cross-border links between banks and non-bank financial institutions", *BIS Quarterly Review*, September, pp 61–74.

Aquilina, M, K Croxson, G Valentini and Z Sun (2023): "Authorised participants as shock absorbers in fixed-income ETFs", *Finance Research Letters*, vol 55, part A, article 103897.

Aradillas Fernandez, A, M Hiti and A Sarkar (2024): "Are nonbank financial institutions systemic?", *Liberty Street Economics*, October.

Aramonte, S and F Avalos (2020): "The recent distress in corporate bond markets: cues from ETFs", *BIS Bulletin*, no 6, April.

Aramonte, S, A Schrimpf and H S Shin (2023): "Non-bank financial intermediaries and financial stability", in R Gürkaynak and J Wright (eds), *Research Handbook of Financial Markets*, Edward Elgar Publishing, pp 147–70.

Avdjiev, S, E Eren and P McGuire (2020): "Dollar funding costs during the Covid-19 crisis through the lens of the FX swap market", *BIS Bulletin*, no 1, April.

Avino, D, T Conlon and J Cotter (2019): "Credit default swaps as indicators of bank financial distress", *Journal of International Money and Finance*, volume 94, pp 132–39.

Bagattini, G, F Fecht and A Maddaloni (2023): "Liquidity support and distress resilience in bank-affiliated mutual funds", *ECB Working Paper*, no 2799.

Bank of England (2024): *The Bank of England's system-wide exploratory scenario exercise final report*, December.

Brownlees, C and R Engle (2017): "SRISK: a conditional capital shortfall measure of systemic risk", *Review of Financial Studies*, volume 30, no 1, pp 48–79.

Cetorelli, N, M Landoni and L Lu (2023): "Non-bank financial institutions and banks' fire sale vulnerabilities", *Federal Reserve Bank of New York Staff Reports,* no 1057.

Financial Stability Board (FSB) (2021): *Policy proposals to enhance money market fund resilience: final report*, October.

——— (2023): *Revised policy recommendations to address structural vulnerabilities from liquidity mismatch in open-ended funds*, December.

——— (2024): *Global monitoring report on non-bank financial intermediation*, December.

Forbes, K and R Rigobon (2002): "No contagion, only interdependence: measuring stock market co-movements", *Journal of Finance*, vol 57, no 5, pp 2223–61.

Franceschi, E, M Grodzicki, B Kagerer, C Kaufmann, F Lenoci, L Mingarelli, C Pancaro and R Senner (2023): "Key linkages between banks and the non-bank financial sector", *European Central Bank Financial Stability Review,* May.

Gorbatikov, E and T Sikorskaya (2022): "Two APs are better than one: ETF mispricing and primary market participation", mimeo.

Indergand, M, E Jondeau and A Fuster (2022): "Measuring and stress-testing market-implied bank capital", *SNB Working Papers*, no 2, February.

International Organization of Securities Commissions (IOSCO) (2024), *Revised recommendations for liquidity risk management for collective investment schemes*, November.

Knaup, M and W Wagner (2012): "A market-based measure of credit portfolio quality and banks' performance during the subprime crisis", *Management Science*, volume 58, no 8, pp 1423–37.

Kuong, J, J O'Donovan and J Zhang (2024): "Monetary policy and fragility in corporate bond mutual funds", *Journal of Financial Economics*, vol 161, article 103931.

Lewrick, U and S Claessens (2021): "Open-ended bond funds: systemic risks and policy implications", *BIS Quarterly Review*, December, pp 37–51.

Loretan, M and W English (2000): "Evaluating changes in correlations during periods of high market volatility", *BIS Quarterly Review*, June, pp 29–36.

Morris, S, I Shim and H S Shin (2017): "Redemption risk and cash hoarding by asset managers", *Journal of Monetary Economics*, vol 89, pp 71–87.

Novick, B, D Veiner, H De Jesus, D Mayston, J Pucci, E Kiely, S Fisher and S DeZur (2020): *Lessons from Covid-19: US short-term money markets*, BlackRock.

Schrimpf, A, H S Shin and V Sushko (2020): "Leverage and margin spirals in fixed income markets during the Covid-19 crisis", *BIS Bulletin*, no 2, April.

Shim, J and K Todorov (2021): "ETFs, illiquid assets and fire sales", *BIS Working Papers*, no 975, November.

Todorov, K (2021): "The anatomy of bond ETF arbitrage", *BIS Quarterly Review*, March, pp 41–53.

Annex A: Elusive common drivers of volatility and correlation

When the volatility of two observable variables – eg changes to bank credit default swap spreads and net investment fund flows – increases, their correlation may also increase. This would happen if a common risk factor became more volatile – eg a common investor base approached financial constraints. Alternatively, the correlation would rise if the reliance on the common investor base intensified or other contagion channels between banks and investment funds strengthened. The latter is the scenario that Loretan and English (2000) and Forbes and Rigobon (2002) are interested in. By generalising an argument in these papers, this annex explains why the two alternative scenarios would drive observationally indistinguishable outcomes.

Denote the two observable variables by x and y. Suppose that these variables are driven by uncorrelated and unobservable risk factors – u, ε and v, where the first is common to the two variables and the other two are variable-specifc. The factors stem from generic probability distributions, with mean zero and some variances: $u \sim (0, \sigma^2_{u,r})$, $\varepsilon \sim (0, \sigma^2_{\varepsilon,r})$ and $v \sim (0, \sigma^2_{v,r})$. Ultimately, these risk factors enter the observable variables via the loading coefficients $\rho_{x,r} \in (0,1)$ and $\rho_{y,r} \in (0,1)$:

$x = \rho_{x,r}u + \sqrt{1-\rho^2_{x,r}}\varepsilon$, with variance $V_r(x) = \rho^2_{x,r}\sigma^2_{u,r} + (1-\rho^2_{x,r})\sigma^2_{\varepsilon,r}$ and

$y = \rho_{y,r}u + \sqrt{1-\rho^2_{y,r}}v$, with variance $V_r(y) = \rho^2_{y,r}\sigma^2_{u,r} + (1-\rho^2_{y,r})\sigma^2_{v,r}$.

The r subscript stands for an episode category, eg episodes with high (H) or low (L) market pressure in the banking sector.

The correlation of x and y in episode r is:

$$corr_r(x,y) = \left(\sqrt{1 + \frac{1-\rho^2_{x,r}}{\rho^2_{x,r}}\frac{\sigma^2_{\varepsilon,r}}{\sigma^2_{u,r}}}\sqrt{1 + \frac{1-\rho^2_{y,r}}{\rho^2_{y,r}}\frac{\sigma^2_{v,r}}{\sigma^2_{u,r}}}\right)^{-1}$$

Suppose that the variances and the correlation rise with market pressure in the banking sector: $V_H(x) > V_L(x)$, $V_H(y) > V_L(y)$ and $corr_H(x,y) > corr_L(x,y)$. Either of the following two scenarios could be behind this observation. While the rise in correlation stems entirely from the volatility of the common factor in the first scenario, the corresponding rise is independent of this volatility in the second scenario.

1. The volatility of the common factor increases and all else stays the same. Concretely: $\rho_{x,A} = \rho_{x,\tilde{A}}$, $\rho_{y,A} = \rho_{y,\tilde{A}}$, $\sigma^2_{\varepsilon,A} = \sigma^2_{\varepsilon,\tilde{A}}$, $\sigma^2_{v,A} = \sigma^2_{v,\tilde{A}}$ and $\sigma^2_{u,A} > \sigma^2_{u,\tilde{A}}$.
2. At least one of the common factor loadings increases and the volatilities of *all* risk factors rise proportionately. Concretely: $\rho_{x,A} \geq \rho_{x,\tilde{A}}$ and $\rho_{y,A} \geq \rho_{y,\tilde{A}}$ (with at least one strict inequality), $\sigma^2_{\varepsilon,A} = \kappa\sigma^2_{\varepsilon,\tilde{A}}$, $\sigma^2_{v,A} = \kappa\sigma^2_{v,\tilde{A}}$ and $\sigma^2_{u,A} = \kappa\sigma^2_{u,\tilde{A}}$, where $\kappa > 1$.

If one seeks to disentangle these two scenarios, it is not enough to simply observe that both the volatilities and the correlation rise in high-pressure episodes. Some identification assumptions are necessary, such as those imposed in Loretan and English (2000) and Forbes and Rigobon (2002).

Endnotes

Graph 2: For each sector, the data are for the top 500 entities by assets under management as of December 2005 (only US domiciled MMFs); for ETFs, the data also refer to the top 500 entities as of December 2011. The MMF series do not include observations for the period around the 2016 MMF reform, ie May to October 2016. Each series is winsorised at the 1st and 99th percentiles.

Torsten Ehlers
torsten.ehlers@bis.org

Bryan Hardy
bryan.hardy@bis.org

Patrick McGuire
patrick.mcguire@bis.org

International finance through the lens of BIS statistics: the international dimensions of credit[1]

International sources of credit can be a boon to borrower countries in need of capital. But they can also be destabilising by enabling domestic credit booms. Before the global financial crisis (GFC), internationally active banks drove credit growth by lending both across borders as well as locally in the host countries where they operated. Since the GFC, borrowers have increasingly turned to international bond markets. This article shows how BIS statistics can help disentangle the various international dimensions of credit to borrower economies and describes the role of foreign banks and international bond markets in the credit provision process.

JEL classification: F34, F36, G21, F23, F31, F36, G15.

In the last half century, borrower countries have been repeatedly rocked by swings in international capital flows. The ebb and flow of cross-border credit, often driven by changes in investor risk appetite, can expose vulnerabilities and thus be destabilising. Before the Great Financial Crisis (GFC) of 2007–09, for example, international *banks* fuelled domestic credit booms in advanced economies (AEs) and emerging market economies (EMEs) alike. In the post-GFC low rate environment, many corporate borrowers bulked up on foreign currency *bonds*, mainly denominated in the US dollar. Rising dollar borrowing costs since 2020 have curtailed this somewhat, but continued dollar appreciation and geopolitical uncertainty have brought questions of debt sustainability to the fore yet again.

This article is a primer on how BIS statistics shed light on various international dimensions of credit and their impact on financial stability in borrower economies. The first dimension is the funding source. Cross-border credit can be *direct*, such as a cross-border loan to a non-bank borrower, or *indirect*, such as a loan extended by a local (ie resident) bank but that is funded by cross-border borrowing. In both cases, the funding for this credit is sourced from abroad. A second dimension is the currency of denomination, which can be the borrower's domestic currency or a foreign currency. A third dimension is the mix of creditors and their structures: they can be banks or non-banks, foreign or domestic, and extend credit locally or across borders.

[1] This is the fifth article in a series showcasing the BIS international banking and financial statistics, following McGuire et al (2024a, 2024b) and Hardy et al (2024a, 2024b). We thank Stefan Avdjiev, Gaston Gelos, Benoît Mojon, Swapan-Kumar Pradhan, Andreas Schrimpf, Ilhyock Shim, Hyun Song Shin, Goetz von Peter and Sonya Zhu for their helpful comments, and Jhuvesh Sobrun for excellent research assistance. The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

Key takeaways

- *Rapid international credit growth can enable domestic credit booms, posing risks to financial stability. Both direct cross-border credit and indirect cross-border credit bear watching.*
- *Foreign banks operating in domestic markets may enhance credit provision in local credit markets, but their cross-border credit tends to dry up first when financial volatility arises.*
- *Foreign currency credit is increasingly intermediated through capital markets rather than through banks, which diversifies the sources of credit but also alters the risks.*

International credit bears watching, in particular when it grows faster than domestic credit. This can enable domestic credit booms, as happened in many countries in the run up to the GFC (CGFS (2011)). Direct cross-border credit fuelled by a search for yield inflated asset prices, and the resulting rise in collateral values further amplified credit growth. Indirect cross-border credit also played a key role in many economies by allowing local banks to extend credit in excess of what would be sustainable by the domestic deposit base alone.

Borrowing during such boom periods is often denominated in a foreign currency, mainly the US dollar. This enables borrowers to take advantage of lower funding costs or access larger pools of capital. However, it also creates risk when the borrower's local currency depreciates: higher debt burdens beget higher repayment costs and potential defaults. For example, mortgages denominated in low interest rate foreign currencies (eg the Swiss franc) were popular in some eastern European countries ahead of the GFC. But in its wake, the debt burden ballooned in local currency terms. After the GFC, borrowers increasingly took advantage of low long-term rates in bond markets. This helped diversify and deepen their access to capital, but also exposed them to changes in the risk appetite of international bond investors.

Dynamics in the growth of cross-border credit in part reflect conditions in global wholesale funding markets. This makes it important to also consider the composition of creditors, how they fund their credit and thus how flighty the credit is. For banks, BIS statistics provide useful measures of how much credit is provided by foreign banks versus home banks, and how much of the credit is funded and extended locally versus across borders. Short-term wholesale funding, which proved to be unstable in the GFC (Bruno and Shin (2015), Ivashina and Scharfstein (2010)), is often used to fund cross-border credit. Consequently, during periods of financial stress, foreign banks tend to withdraw cross-border credit more rapidly than do domestic banks or foreign banks operating locally in the country.

The international dimensions of credit growth pose policy challenges (Borio et al (2011)). In economies experiencing booms, international credit complicates the job of domestic authorities who seek to constrain credit. They have several tools to slow the growth of domestic credit but only limited tools to control credit extended by institutions abroad. In addition, borrowers may shift from local to foreign currency liabilities if local currency rates rise. This can reduce the efficacy of domestic monetary policy and ties the economy to interest rate conditions set elsewhere – including in international bond markets.

This article first describes the international dimensions of credit and how they are reflected in BIS statistics. It then discusses the implications of such credit for financial stability. The final section concludes.

International dimensions of credit

International credit can help economies grow, but a rapid expansion in such credit can be destabilising. The BIS international banking statistics (IBS) and global liquidity indicators (GLIs) are key resources that provide visibility on *three dimensions* of credit to non-bank borrowers in a particular economy (see Box A): the source of funding (ie cross-border or local), the currency of denomination and the identity of the creditor (eg a foreign bank, domestic bank or non-bank creditor).

Direct and indirect cross-border credit and foreign currency credit

One key aspect of financial stability analysis is the extent to which credit to non-banks in a particular economy is supported by funding from abroad. Zeroing in on non-bank borrowers – ie non-bank financial institutions, non-financial corporations, households and governments – puts the focus on the real economy. Cross-border credit can take various forms. The most common is direct borrowing by non-banks from non-resident creditors, either bank or non-bank creditors. Such *direct cross-border credit* is the standard metric used in assessing reliance on international credit.

However, international credit can also be indirect. Creditors located in a particular country may finance a large share of their own locally extended credit to non-banks (ie domestic credit[2]) with net borrowing from non-residents (from other banks or non-banks). Importantly, this *indirect cross-border credit* allows credit growth to outrun domestic deposit growth. This component is often ignored in empirical analysis of credit booms, but as discussed below, it has been the marginal source of credit in many economies (Ehlers and McGuire (2017), Avdjiev et al (2020)).

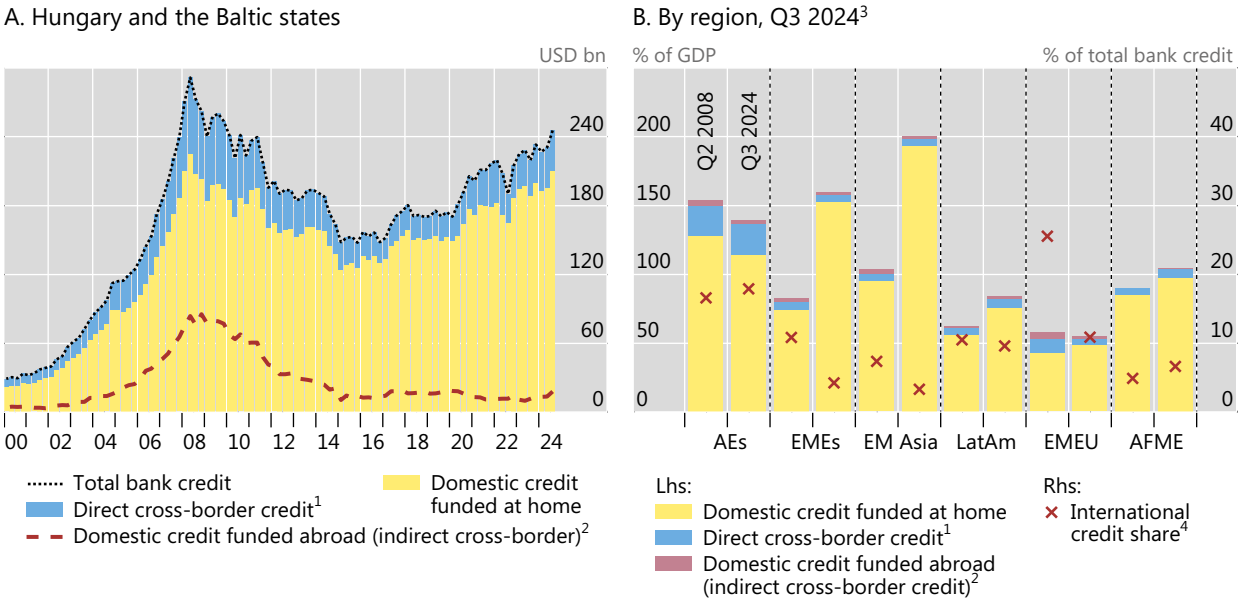
Several European cases highlight the roles of direct and indirect cross-border bank credit during the global credit boom ahead of the GFC. Direct cross-border credit to non-banks in Hungary and the Baltic states, for example, grew at roughly 34% year on year in the six years prior to Q1 2009 (Graph 1.A), about three percentage points above the rate for domestic bank credit. In addition, banks in these countries drew on indirect cross-border credit to support their domestic lending (dashed red line). Combined, these two cross-border components accounted for more than half of the stock of total bank credit to non-banks in these countries by 2008.

Since the GFC, direct and indirect bank credit have grown in importance in some regions but not in others (Graph 1.B). For AE borrowers, total bank credit has fallen somewhat relative to the scale of economic activity (stacked bars). But the combined share of direct and indirect bank credit rose modestly, to reach 18% of total bank credit (red x). For EME borrowers, by contrast, international bank credit has fallen as a share of total bank credit. This mainly reflected significant growth in domestic credit funded with local deposits (yellow bars) in the Asia-Pacific region and to a lesser extent Latin America. Emerging Europe, where international credit had surged leading up to the GFC, saw the largest declines in its share.

[2] Domestic credit, as usually measured, captures only loans or securities booked at banks in a given jurisdiction vis-à-vis residents of that jurisdiction. The addition of cross-border bank credit (from the IBS) yields a measure of the total credit provided by banks to non-banks in a particular country.

Direct and indirect bank credit to non-banks

Graph 1



AEs = advanced economies; AFME = Africa and Middle East; EM Asia = emerging Asia; EMEs = all emerging market economies; EMEU = emerging Europe; LatAm = Latin America.

[1] BIS reporting banks' cross-border claims on resident non-banks. [2] For BIS reporting countries, net cross-border borrowing (liabilities minus claims) by banks resident in the country; for non-BIS reporting countries (eg Hungary and Baltic states), BIS reporting banks' net cross-border claims on banks in the country. Net cross-border positions of countries with banks that export capital (ie with positions below zero) are excluded. [3] See endnotes for details. [4] Sum of direct and indirect cross-border credit.

Sources: IMF; LSEG Datastream; national data; BIS international banking statistics; authors' calculations.

International credit is often denominated in a currency that is foreign to the borrower. The *currency of denomination* of credit, regardless of whether this credit is extended by banks inside or outside the country, is of particular concern to policymakers since sudden moves in the exchange rate can significantly increase the debt burden expressed in local currency terms. As of end-Q3 2024, 90% of the total direct cross-border bank credit was denominated in five major currencies (USD, EUR, JPY, GBP, CHF). As discussed below, borrowing via bond issuance in international markets, mainly in US dollars, in part replaced bank borrowing in foreign currencies.

Policy measures such as capital controls and financial regulation can affect the channels through which international credit flows. Some of these measures focus on direct cross-border credit, while leaving a banks' intragroup funding alone. Ultimately, the mix of direct versus indirect international credit is shaped by policy and by the organisation of globally active banks (Hardy et al (2024b)). Thus, focusing on only one type of international credit (eg direct cross-border) risks missing important developments in other forms (eg indirect cross-border).

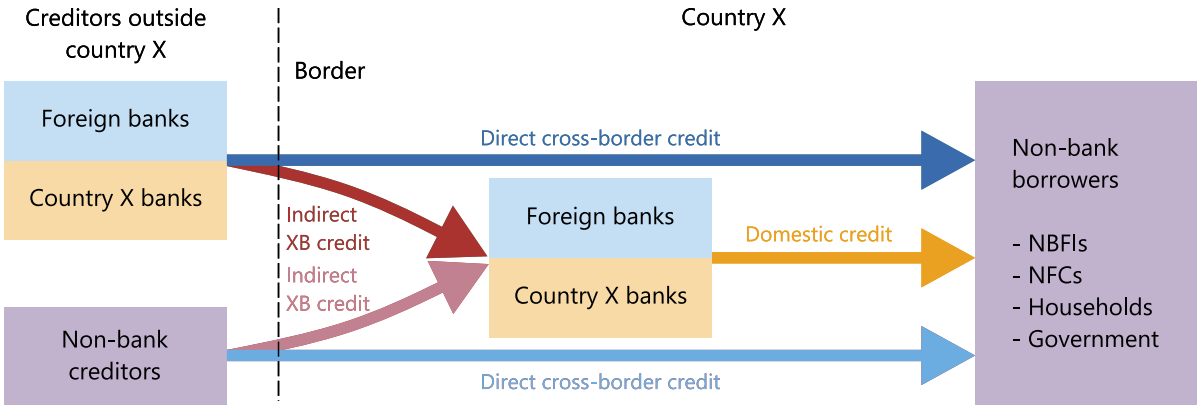
Box A

Tracking international credit with BIS statistics

BIS statistics provide several complementary perspectives on international credit. This box shows how the international banking statistics (IBS) shed light on bank credit to non-bank borrowers in a given country.

International credit reaches borrowers through several channels (Graph A1). It can be extended across borders directly from banks or non-banks abroad. It can also come indirectly through banks in the borrowing country that fund themselves from abroad, either through intragroup positions or with funding from unrelated parties (banks or non-banks). Both direct and indirect cross-border credit are often supported by wholesale funding (Bruno and Shin (2015)). For its part, domestic credit (locally extended) can come from foreign-owned banks or from domestic banks, regardless of the funding source. The IBS cover direct and indirect credit provided by banks quite well (dark arrows). However, BIS statistics only partially cover such credit provided by non-banks (light arrows). Specifically, indirect cross-border credit is well captured for countries that report to the IBS, but it must be estimated for those that do not (see endnotes). Borrowing via international bonds is tracked in the BIS international debt securities (IDS) statistics and the global liquidity indicators (GLIs), but the identity of the holders of these bonds is not known.

Credit to non-bank borrowers in country X — Graph A1



NBFIs = non-bank financial institutions; NFCs = non-financial corporations; XB = cross-border.

Source: Authors' elaboration.

The IBS contain various breakdowns that are not generally available in banks' public financial data sources. Banks' claim (ie asset) positions can be broken down by the location (country) and sector of the counterparty, as well as by booking location. For example, a French bank can extend a loan to a non-bank borrower in Brazil, either from an office outside of Brazil (a cross-border claim) or from an affiliate in Brazil (a local claim, part of domestic credit in Graph A1). This breakdown, combined with the breakdown by currency, yields several useful ratios:

Direct cross-border bank credit share: share of cross-border credit to non-banks in total bank credit to non-banks. The denominator is domestic credit (DC), as reported in the *IMF International Financial Statistics*, plus total cross-border (XB) credit to non-banks in the country from the IBS.

$$\text{Direct XB share} = XB / (DC + XB).$$

Direct plus indirect cross-border bank credit share: the direct XB share, adding to the numerator the net cross-border borrowing by banks in the country (net XB bank bor). This *additional* piece is the amount of domestic credit extended by banks in the country that is *financed by cross-border liabilities*. It enters the numerator only when net cross-border borrowing by local banks is positive.

Direct and indirect XB share = (XB + max(0, net XB bank bor)) / (DC + XB)

Foreign currency share: the share of total bank credit that is denominated in currencies other than the currency of the borrowing country. Estimates of cross-border bank credit in foreign currency are constructed from the IBS. The construction of domestic bank credit in foreign currency varies by country (see endnotes).

Foreign currency share = (DC in FX + XB FX credit) / (DC + XB)

Foreign bank participation rate (FBP rate): share of total bank credit to non-banks that is provided by foreign banks. The numerator includes foreign banks' international claims on non-banks (INTC) on an immediate counterparty basis, comprising cross-border claims (in all currencies) plus claims extended by bank affiliates inside the borrower country and denominated in non-local currencies, as well as these affiliates' locally extended claims on non-banks in the local currency (LCLC). For this latter piece, LCLC is not broken down by counterparty sector in the data. Rather, the parameter α denotes the estimated share of LCLC to the non-bank sector, computed as the share of overall foreign claims on the non-bank sector (guarantor basis).

FBP rate = (INTC + α*LCLC)/(DC + XB)

Credit providers: nationality and location

Cross-border bank credit can, but need not, give foreign-owned banks an outsize role in domestic credit markets. Such non-domestic banks loom large in economies where direct cross-border bank credit is a large part of overall credit. But even in economies with relatively little cross-border credit, foreign banks can play a pivotal role via their local presence in the domestic banking system. While some operate like domestic banks, raising deposits in the country to lend locally, others fund their local lending with cross-border liabilities. These can take a variety of forms, including interoffice funding, wholesale funding or cross-border deposits (Hardy et al (2024b).

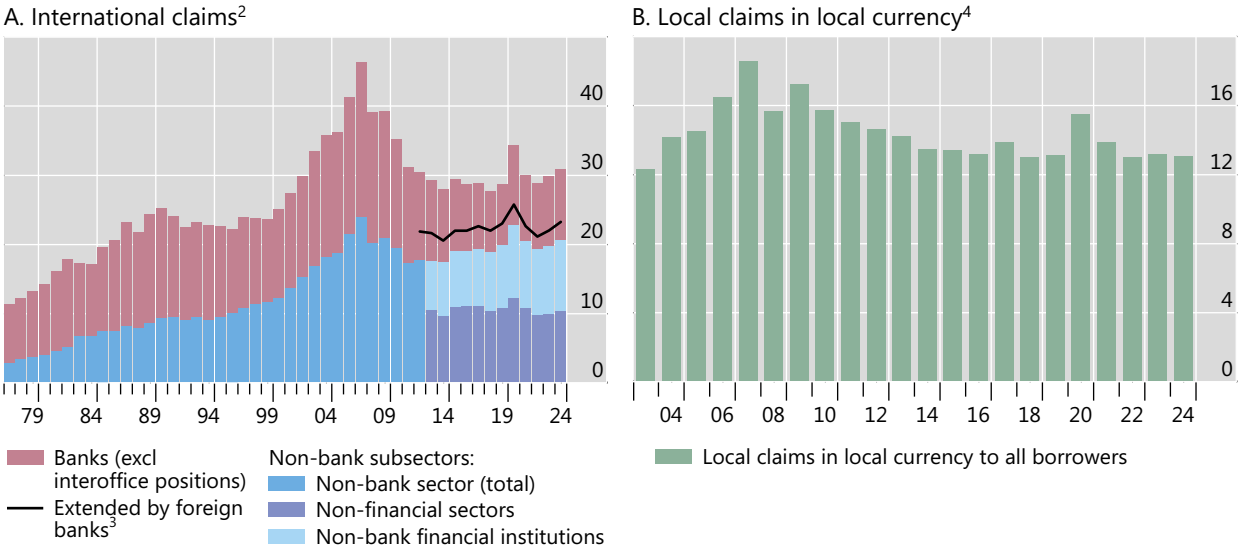
The role of foreign banks as credit providers has evolved over the decades. International claims (comprising all cross-border lending and local lending in foreign currency) expanded through the 1970s and 1980s (Graph 2.A), fuelled by regulatory arbitrage, financial innovation and financial liberalisation (McCauley et al (2021)). A second wave of expansion preceded the GFC, after which many banks – in particular European banks (IMF (2015), McCauley et al (2019)) – retrenched their overseas operations. Of the total international bank credit outstanding at end-Q3 2024, an estimated 75% was extended by a bank that is foreign to the borrower (black line).

But foreign banks also have local operations in the borrower countries, much of which are denominated in the borrower's local currency (Graph 2.B). Combining these claims with their international claims provides a measure of foreign banks' share in total bank credit to non-bank borrowers – ie the *foreign bank participation (FBP) rate* (Ehlers and McGuire (2017); see Box A).

Since the GFC, foreign banks have accounted for a decreasing share of total bank credit to EMEs as domestic financial systems have grown. For EMEs as a group, their FBP rate fell from over 20% in 2008 to 7% in 2024 (Graph 3.A, blue line). While foreign bank credit rose faster than economic activity for much of this period, it was overshadowed by the dramatic expansion in credit from domestic banks (Avdjiev et al (2024), Hardy (2019)). By contrast, the FBP rate for advanced economies (red line) has continued to rise after the GFC.

Bank claims by borrower and type[1]

Claims scaled by world GDP; in per cent — Graph 2



[1] See endnotes for details. [2] International claims comprise cross-border claims in all currencies plus local claims in foreign currencies from the BIS locational banking statistics; end-year, except for Q3 2024. [3] Lower bound estimate of international bank claims where the creditor bank is foreign to the borrower. [4] Local claims in local currency for a constant sample of reporting countries in the BIS consolidated banking statistics from 2003 onwards.

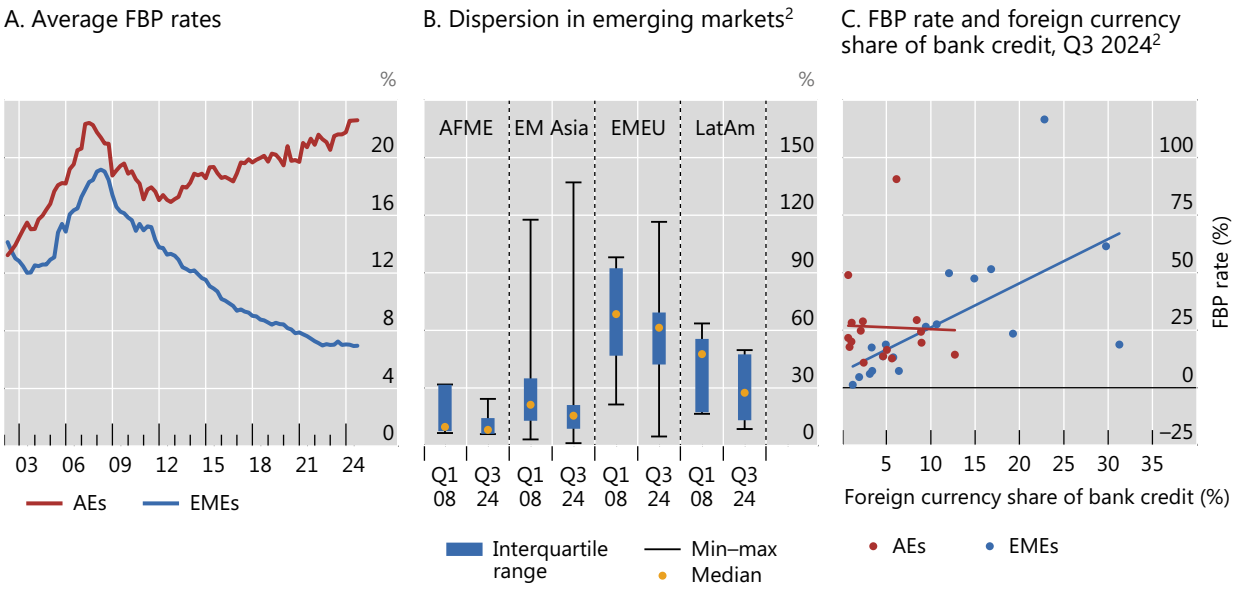
Sources: IMF; World Bank; BIS international banking statistics; authors' calculations.

Foreign bank participation rates varied markedly both across and within EME regions in mid-2024. Asia-Pacific EMEs stood out with relatively low FBP rates (Graph 3.B). For instance, the rate for China was close to 1% in Q2 2024, falling from an already low 3% a decade earlier. Similarly, both India and Korea have had FBP rates below 15% for the last two decades. FBPs in Latin America and other EMEs have been consistently higher than in Asia but have shifted down since the GFC.

Foreign banks often, but not always, bring foreign currency credit to borrower economies. Their access to foreign currency funding sources makes them a natural conduit. They tend to transact much more in foreign currencies than do domestic banks (Aldasoro et al (2022)), and their lending can be linked to borrowing costs in their home currency (Morais et al (2019)). EMEs with relatively higher FBP rates also tend to have a higher share of bank credit denominated in foreign currencies (Graph 3.C).[3] No such correlation is evident for AE borrowers, which tend to borrow primarily in domestic currency regardless of the banks' ownership. Moreover, many domestic banks in AEs are well integrated in the global financial system and thus can access foreign currency funds themselves directly or via affiliates abroad.

[3] The declining FBP rates are thus consistent with the declining reliance on foreign currency credit in general (Avdjiev et al (2024), Gelos et al (2024)).

Foreign bank participation (FBP) in domestic banking markets[1] Graph 3



AFME = Africa and Middle East; EM Asia = emerging Asia; EMEU = emerging Europe; LatAm = Latin America.

[1] FBP rate is the estimated claims by BIS reporting foreign banks on non-bank borrowers of the domestic economy, divided by the sum of cross-border claims on non-bank borrowers and domestic bank credit to non-banks. See endnotes for details. [2] The foreign currency share is calculated for total bank credit to non-banks.

Sources: IMF; LSEG Datastream; national data; BIS international banking statistics; authors' calculations.

Capital markets as a rising force in global finance

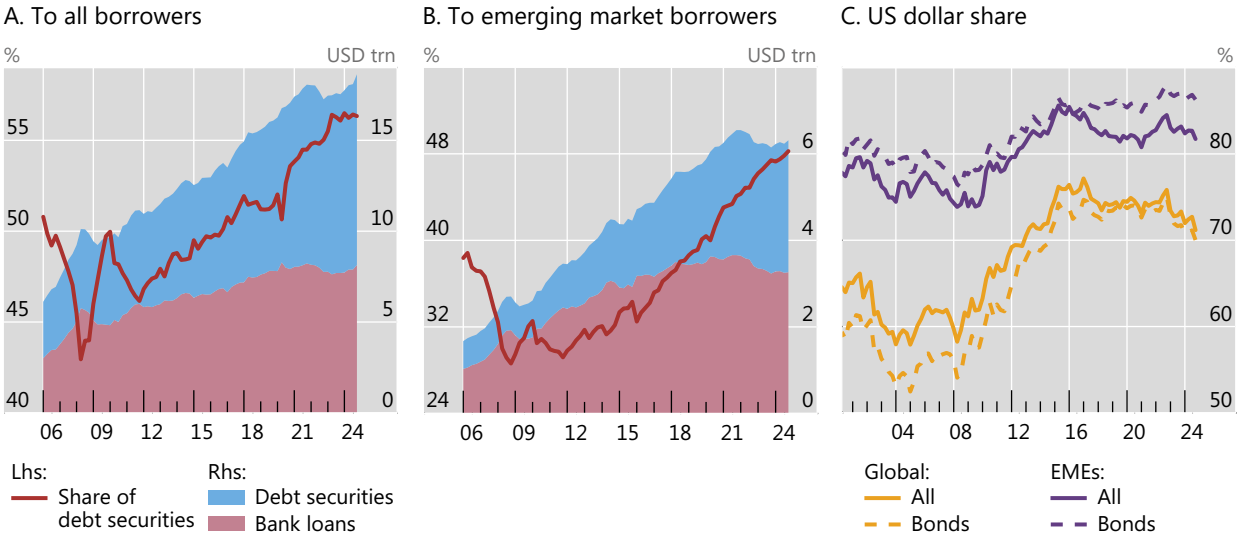
While banks remain key providers of foreign currency credit, international capital markets have become increasingly important since the GFC (Hardy and von Peter (2023)). This development is reflected in the BIS GLIs, which track credit denominated in US dollars, euros and yen to non-bank borrowers outside the respective currency-issuing jurisdictions (Graph 4.A). The major share of credit captured in the GLIs is to private sector firms.[4] The rise in credit through debt securities occurred as bank creditors stepped out after the GFC and non-bank investors stepped in (McCauley et al (2015), Shin (2012)). The shift has been particularly stark in EMEs, where the bond share rose from almost a third at end-2008 to almost a half in mid-2024 (Graph 4.B). The shift towards capital market financing is likely to be even starker if growth of domestic capital markets is factored in.[5]

Greater reliance on capital markets has both pros and cons for borrowers. Debt securities allow EME borrowers to tap larger investment pools, which in turn helps diversify risks away from banks and across a broader set of investors. Further, EME borrowers have been able to obtain credit at tenors that can exceed those generally offered by banks. On the other hand, capital markets can be more prone to swings in

[4] See BIS, "BIS global liquidity indicators: methodology", December 2022, at www.bis.org/statistics/gli/gli_methodology.pdf, for the GLI compilation methodology.

[5] International investors also hold local currency bonds issued in domestic markets, but these are not captured in the GLIs (Gelos et al (2024)).

The rising bond share in foreign currency credit and the dominant US dollar[1] Graph 4



[1] US dollar-, euro- and yen-denominated credit to non-bank borrowers outside the respective currency areas (non-residents).

Sources: BIS global liquidity indicators; authors' calculations.

global risk sentiment, which in turn can affect exchange rates and thereby the ability to repay foreign currency credit (Koepke (2019), Hofmann et al (2022)).

The dollar remains EMEs' foreign currency of choice in both bank and bond credit (Graph 4.C). Countries with exports denominated in dollars (eg commodities producers) have a natural hedge. But those without such a hedge face both balance sheet and rollover risk when the dollar appreciates or when borrowing costs rise. As discussed below, the recent dollar appreciation and rising dollar borrowing costs make EMEs more vulnerable to sudden changes in investor sentiment.

Implications of international credit for domestic policy

International credit bears watching by policymakers. For one, international credit is often the marginal source of credit and can be subject to destabilising reversals. For another, the modes of credit extension and funding (ie cross-border vs local) by foreign banks affect the stability of their lending (Hardy et al (2024b)). The following subsections discuss cases that illustrate these points.

International credit and domestic credit booms

Rapid expansion in international credit can be an enabler of domestic credit booms (Domanski et al (2011), Aldasoro et al (2023), Borio et al (2011)). In the run-up to the GFC, for example, international credit was the marginal source for borrowers in many countries, fuelling a rise in ratios of bank credit to GDP. As the crisis unfolded, countries that had relied heavily on such credit saw the largest credit contractions.

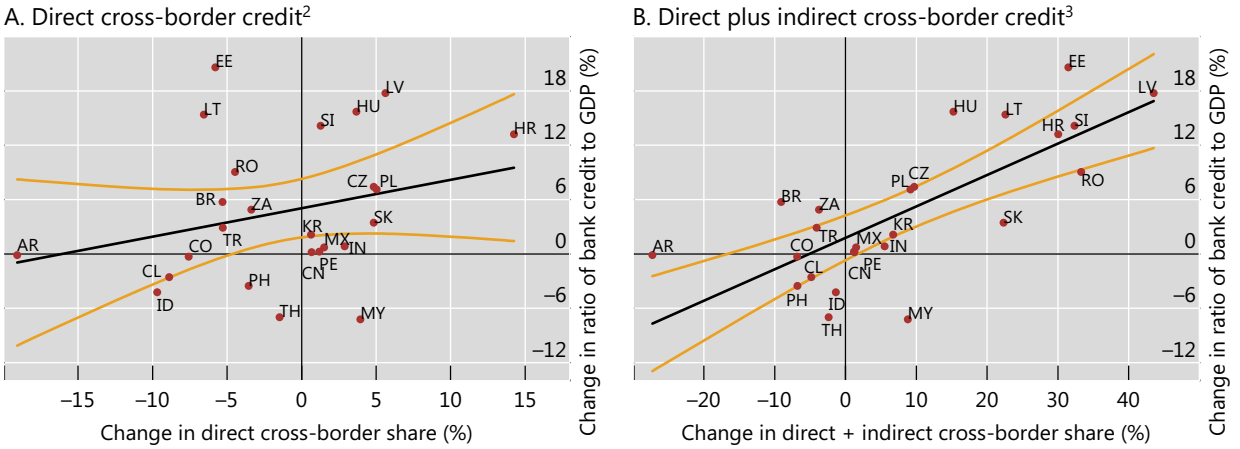
The *type* of international credit matters in these boom-bust episodes. In a sample of EME borrower countries, there is a statistically significant relationship between the change in the share of *direct* cross-border bank credit between 2002 and 2008 and

the change in the ratio of bank credit to GDP (Graph 5.A). Importantly, the relationship is more pronounced when the more comprehensive measure of international credit is used. That is, the rise in the ratio of bank credit to GDP is more tightly related to the change in the *combined* share of direct cross-border credit and *indirect* cross-border credit (Graph 5.B). This is seen in the steeper slope of the regression line and the much narrower confidence bands for the estimated regression line (yellow lines).

Such indirect cross-border credit can come in different forms. In several eastern European countries, foreign banks advanced euros or Swiss francs to their local affiliates, which in turn extended foreign currency mortgages to households. Indeed, these countries experienced big credit booms with a high share of foreign currency credit in mid-2008. By contrast, in Korea, foreign banks advanced dollars to banks in the country, but those were not used to fund dollar-denominated assets. Rather, banks in Korea bought won-denominated investments that were hedged back into dollars using FX forwards (McCauley and Zukunft (2008)). The forward counterparties, mostly Korean exporters such as shipbuilders, in effect borrowed dollars by contracting to sell future dollar revenues.

As in the boom period, so too in the bust period: international credit drove larger swings in activity (Graph 6). Note that here the focus is on the cumulative contraction in output (real GDP) during the GFC rather than the change in the ratio of bank credit to GDP. Those EMEs most dependent on international credit before the Lehman Brothers collapse tended to suffer sharper downturns.[6] The share of direct cross-border credit on the eve of the GFC is only loosely related to GDP growth in the following years (Graph 6.A). But once again, the combined (direct plus indirect) share of cross-border credit (Graph 6.B) and foreign currency credit (Graph 6.C) are more tightly associated with the severity of the downturn.

International credit in EMEs during the pre-GFC boom (Q1 2002–Q2 2008)[1] Graph 5

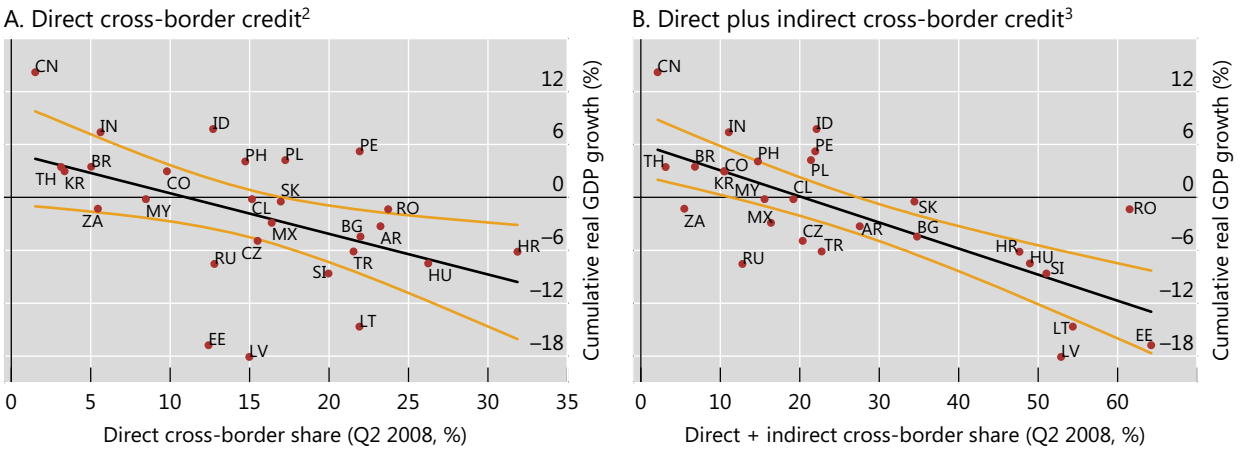


[1] The y-axes show the change in the ratio of total bank credit (including credit to governments) to GDP over the Q1 2002–Q2 2008 period. Total bank credit is the sum of domestic credit and cross-border bank credit to non-banks in the country. The black lines indicate OLS predicted values, and the yellow lines indicate the 95% confidence bands for these regression lines. [2] The x-axis shows the change in the ratio of direct cross-border credit over total bank credit to non-banks (including governments). [3] The x-axis shows the change in the ratio of direct cross-border credit plus net cross-border borrowing by banks in the country (if positive) to total bank credit to non-banks.

Sources: IMF; national data; BIS international banking statistics; authors' calculations.

[6] Berkmen et al (2012) show that financial factors were key in determining the size of the growth impact of the GFC. Leverage and the share of short-term debt in GDP are significant explanatory variables in various regression specifications. Lending from advanced economies also factors in significantly.

International credit and GDP in EMEs in the post-GFC bust (Q2 2008–Q4 2009)[1] Graph 6



[1] The y-axes show the cumulative growth in GDP in the six quarters between end-Q2 2008 and end-Q4 2009. The black lines indicate OLS predicted values, and the yellow lines indicate the 95% confidence bands for these regression lines. [2] The x-axis shows the ratio of direct cross-border credit to total bank credit to non-banks (excluding governments) at end-Q2 2008. [3] The x-axis shows the ratio of direct cross-border credit plus net cross-border borrowing by banks in the country (if positive) to total bank credit to non-banks, at end-Q2 2008.

Sources: IMF; national data; BIS international banking statistics; authors' calculations.

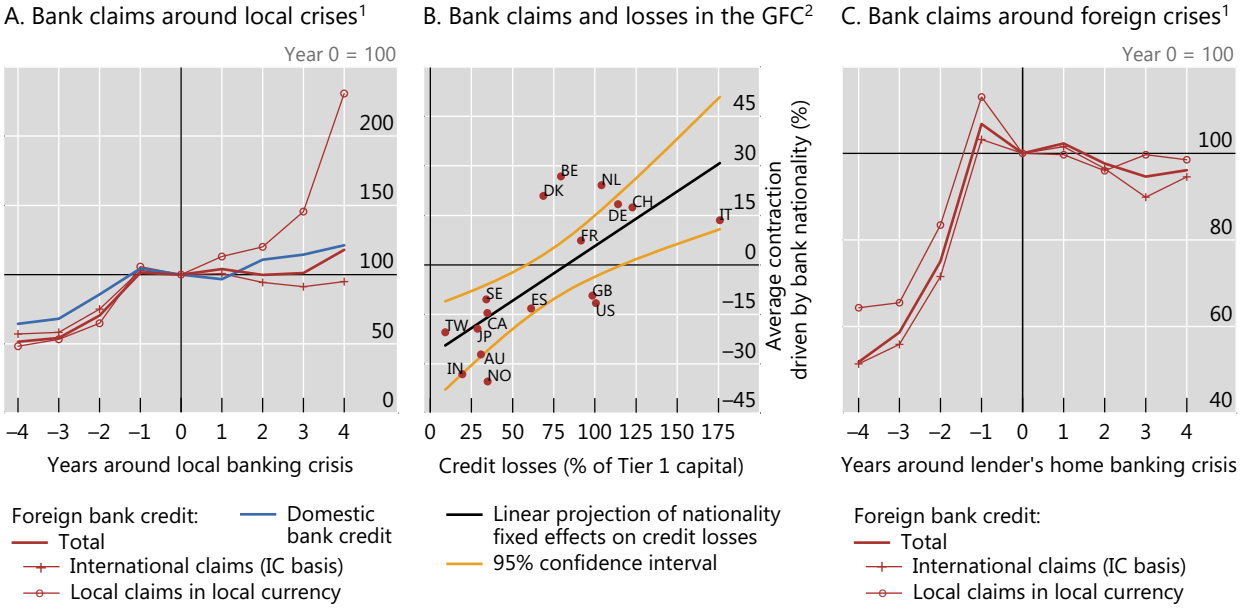
The trade-offs of greater foreign bank participation

The identity of the lender is another key dimension of international credit. A greater share of credit from foreign banks brings both benefits and risks for the borrower. Foreign banks, which typically enjoy a broader intragroup support network and funding mix, can both bring best practice to domestic markets and increase competition that drives cost reductions at domestic banks (Caparusso and Hardy (2022), Claessens and van Horen (2014)).

However, for the stability of credit in borrower countries, the source of funding matters more than the ownership of the bank (Ehlers and McGuire (2017), Ongena et al (2015)). For example, foreign banks operating locally can often rely on support from their parent bank (De Haas and van Lelyveld (2010)). In such cases, they can be better equipped than domestic banks to handle economic shocks originating in the borrower country (Cull et al (2017)). BIS statistics show that, following a local banking crisis, local credit extended by foreign banks expands strongly in subsequent years (Graph 7.A). Indeed, it is more resilient than local lending by domestic banks (blue line). By contrast, foreign banks' international claims are fickle and tend to disappear.

This ordering of resilience stems mainly from the funding source. International credit is more likely to be funded by wholesale funding, which is subject to periodic squeezes (Bruno and Shin (2015), Ivashina and Scharfstein (2010)). By contrast, local credit, particularly if denominated in the local currency, is often funded by local liabilities (eg stable domestic deposits) in the local currency. This matching of currencies across the assets and liabilities sides of the balance sheet helps insulate creditors from movements in exchange rates (IMF (2015), McGuire and von Peter (2016)) and thus tends to be a stabilising force.

Foreign banks and lending responses to shocks Graph 7



[1] Years before and after the start of a banking crisis, as defined by Laeven and Valencia (2020) for 27 borrower countries (panel A) and 18 lender countries (panel C). [2] The y-axis is a nationality fixed effect from a regression on peak-to-trough contractions in credit around the GFC. Taken from McCauley et al (2019). See endnotes for details.

Sources: Laeven and Valencia (2020); McCauley et al (2019); national data; BIS international banking statistics; authors' calculations.

However, in the case of global shocks or shocks in a bank's home country, foreign banks can be transmitters of risk to local economies. For instance, a bank that faces a shock in one location may adjust its globally consolidated balance sheet, leading to credit contractions in other locations (Adams-Kane et al (2017), Peek and Rosengren (1997)). During the GFC, banks that racked up larger credit losses saw larger peak-to-trough contractions in their foreign claims (Graph 7.B) after accounting for borrower- and location-specific factors (see endnotes). More generally, banking crises in the foreign bank's home country are followed by a decline in lending abroad, mainly due to lower international claims (Graph 7.C).

Dollar debt, dollar appreciation and rising dollar rates

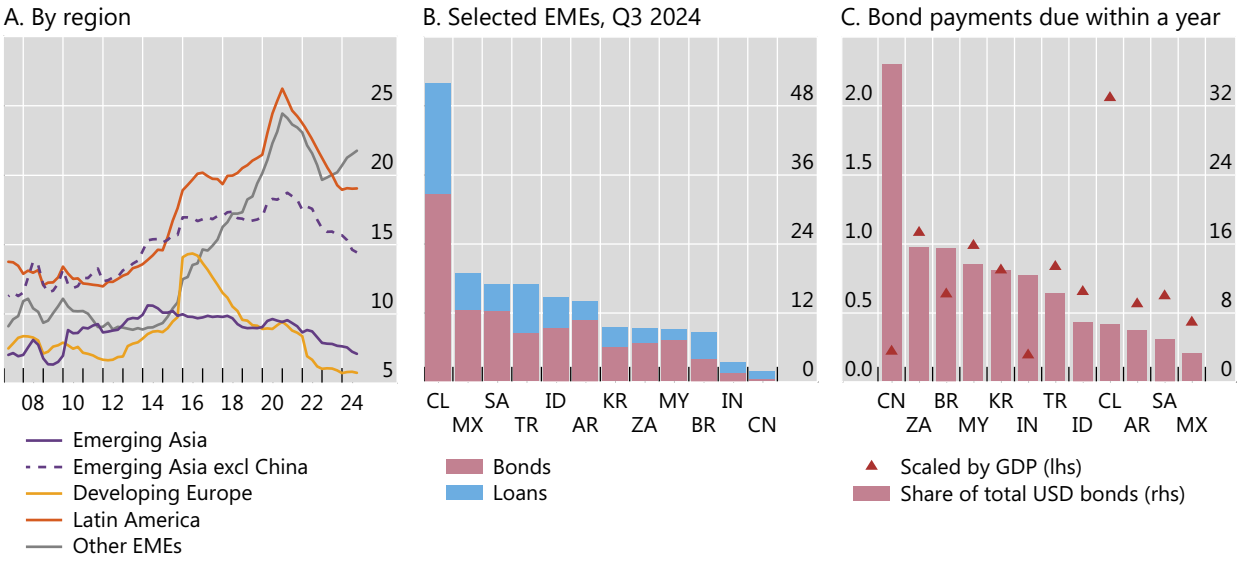
Low long-term borrowing costs in the major currencies after the GFC led to a nearly decade-long rise in foreign currency borrowing by EMEs (Graph 8.A). However, the rise in dollar policy rates and sustained dollar appreciation since 2020 have led to a steepening of the dollar yield curve, which, in turn, has curtailed this borrowing.

Despite this decline, dollar repayment obligations remain a concern in the current environment (Graph 8.C). Changes in policies that affect trade (eg tariffs) – and any further appreciation of the US dollar – could put additional pressure on EMEs' ability to repay. Many EMEs are exporters of commodities, goods and services priced and traded in dollars. The associated dollar revenue has served as a natural hedge against currency mismatches. However, falling sales and commodity prices can foreshadow difficulties in servicing their international debt. This debt bears watching as trade policies evolve and their impact on the global economy is felt.

Dollar credit to EME non-bank borrowers, scaled by GDP[1]

In per cent

Graph 8



[1] US dollar-denominated credit to non-bank borrowers outside the respective currency areas (non-residents).

Sources: IMF; BIS global liquidity indicators; BIS international debt securities statistics; authors' calculations.

Conclusions

The international dimensions of credit growth pose various policy challenges.[7]

First, in economies experiencing booms, international credit often complicates the job of domestic authorities who seek to monitor and constrain credit. For example, domestic authorities have several tools to slow the growth of credit extended by banks within their jurisdiction. But short of capital controls, the tools to measure, much less control, credit extended by institutions outside the country are limited. BIS work on the early warning properties of various "gap" variables, in particular the credit-to-GDP gap, has proven quite useful in this regard (Borio and Lowe (2002, 2004), Borio and Drehmann (2009), Aldasoro et al (2018)).[8]

Second, the post-GFC push in several jurisdictions for local capital requirements and "ring-fencing" of banks' operations presents its own trade-offs. The longer-term implications of such a move are widely debated. While such regulatory changes may make banks more stable in the near term, they do so by possibly hampering cross-border transfers of capital. Policymakers should continue to examine these trade-offs.

[7] See, inter alia, IMF (2018), Albertazzi and Bottero (2014), Kim and Mitra (2014), Popov and Udell (2012), Borio et al (2011), CGFS (2011), Espinosa-Vega et al (2010).

[8] In addition, some provisions in the Basel III framework may help policymakers dampen unwanted credit flows. "Jurisdictional reciprocity", as detailed in BCBS (2010), should help promote supervisory coordination across jurisdictions. Supervisors in a jurisdiction seeking to dampen cross-border bank credit in that jurisdiction can coordinate with supervisory authorities abroad in setting buffer requirements on the creditor banks' cross-border positions.

Finally, policymakers should not lose sight of other challenges that have emerged since the GFC. Cross-border bank credit has taken a back seat to bond issuance, much of which was absorbed by non-bank creditors (McCauley et al (2015)). Such "non-bank to non-bank credit" remains opaque because of a lack of data on the consolidated holders of the claims. Moreover, it has been less affected by many of the post-GFC regulatory initiatives that targeted the banking sector.

References

Adams-Kane, J, J Caballero and J J Lim (2017): "Foreign bank behavior during financial crises", *Journal of Money, Credit and Banking*, vol 49, no 2/3, pp 351–92.

Albertazzi, U and M Bottero (2014): "Foreign bank lending: evidence from the global financial crisis", *Journal of International Economics,* vol 92, supplement 1: pp S22–S35.

Aldasoro, I, S Avdjiev, C Borio and P Disyatat (2023): "Global and domestic financial cycles: variations on a theme", *International Journal of Central Banking*, vol 19, no 5, pp 49–98.

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

Avdjiev, S, J Burger and B Hardy (2024): "New spare tires: local currency credit as a global shock absorber", *BIS Working Papers*, no 1199, July.

Avdjiev, S, P McGuire and G von Peter (2020): "International dimensions of EME corporate debt", *BIS Quarterly Review*, June, pp 1–13.

Basel Committee on Banking Supervision (BCBS) (2010): "Basel III: A global regulatory framework for more resilient banks and banking systems", December.

Berkmen, S P, G Gelos, R Rennhack and J Walsh (2012): "The global financial crisis: explaining cross-country differences in the output impact", *Journal of International Money and Finance*, vol 31, no 1, pp 42–59.

Borio, C, R McCauley and P McGuire (2011): "Global credit and domestic credit booms", *BIS Quarterly Review*, September, pp 43–57.

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

Caparusso, J and B Hardy (2022): "Bank funding: evolution, stability and the role of foreign offices", *BIS Quarterly Review*, September, pp 67–78.

Claessens, S and N van Horen (2014): "Foreign banks: trends and impact", *Journal of Money, Credit and Banking*, vol 46, no 1, pp 295–326.

Committee on the Global Financial System (CGFS) (2011): "Global liquidity – concept, measurement and policy implications", *CGFS Papers*, no 45, November.

Cull, R, M S Martinez Peria and J Verrier (2017): "Bank ownership: trends and implications", *IMF Working Papers,* no 17/60, March.

De Haas, R and I van Lelyveld (2010): "Internal capital markets and lending by multinational bank subsidiaries", *Journal of Financial Intermediation*, vol 19, no 1, pp 1–25.

Ehlers, T and P McGuire (2017): "Foreign banks and credit conditions in EMEs", *BIS Papers*, no 91.

Espinosa-Vega, M, C Kahn and J Sole (2010): "Systemic risk and the redesign of financial regulation", *IMF Global Financial Stability Report*, chapter 2, April.

Gelos, G, P Patelli and I Shim (2024): "The US dollar and capital flows to EMEs", *BIS Quarterly Review*, September, pp 51–67.

Hardy, B (2019): "Emerging markets' reliance on foreign bank credit", *BIS Quarterly Review*, March, pp 15–28.

Hardy, B, P McGuire and G von Peter (2024a): "International finance through the lens of BIS statistics: bank exposures and country risk", *BIS Quarterly Review*, September, pp 69–86.

——— (2024b): "International finance through the lens of BIS statistics: the geography of banks' operations", *BIS Quarterly Review*, December, pp 69–86.

Hardy, B and G von Peter (2023): "Global liquidity: a new phase?", *BIS Quarterly Review*, December, pp 21–31.

Hofmann, B, A Mehrota and D Sandri (2022): "Global exchange rate adjustments: drivers, impacts and policy implications", *BIS Bulletin,* no 62, November.

International Monetary Fund (IMF) (2015): "International Banking after the Crisis: Increasingly Local and Safer?", *Global Financial Stability Report*, chapter 2, April, pp 55–91.

——— (2018): "Regulatory reform 10 years after the global financial crisis: looking back, looking forward", *IMF Global Financial Stability Report*, chapter 2, October, pp 55–81.

Ivashina, V and D Scharfstein (2010): "Bank lending during the financial crisis of 2008", *Journal of Financial Economics*, vol 97, no 3, pp 319–38.

Kim, K and S Mitra (2014): "Real and financial vulnerabilities from crossborder banking linkages", *IMF Working Papers,* no 14/136, July.

Koepke, R (2019): "What drives capital flows to emerging markets? A survey of the empirical literature", *Journal of Economic Surveys*, vol 33, no 2, pp 516–40.

Laeven, L and F Valencia (2020): "Systemic banking crises database II", *IMF Economic Review*, vol 68, pp 307–61.

McCauley, R, Bénétrix A, P McGuire and G von Peter (2019): "Financial deglobalisation in banking?", *Journal of International Money and Finance*, vol 94, June, pp 116–31.

McCauley, R, P McGuire and V Sushko (2015): "Dollar credit to emerging market economies", *BIS Quarterly Review*, December, pp 27–41.

McCauley, R, P McGuire and P Wooldridge (2021): "Seven decades of international banking", *BIS Quarterly Review*, September, pp 61–75.

McCauley, R and J Zukunft (2008): "Asian banks and the international interbank market", *BIS Quarterly Review*, June, pp 67–79.

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

McGuire, P, G von Peter and S Zhu (2024a): "International finance through the lens of BIS statistics: residence vs nationality", *BIS Quarterly Review*, March, pp 73–88.

——— (2024b): "International finance through the lens of BIS statistics: the global reach of currencies", *BIS Quarterly Review*, June, pp 1–16.

Morais, B, J-L Peydró, J Roldán-Peña and C Ruiz-Ortega (2019): "The international bank lending channel of monetary policy rates and QE: credit supply, reach for yield, and real effects", *Journal of Finance*, vol 74, no 1, pp 55–90.

Ongena, S, J-L Peydró and N van Horen (2015): "Shocks abroad, pain at home? Bank-firm-level evidence of the international transmission of financial shocks", *IMF Economic Review*, vol 63, pp 698–750.

Peek, J and E Rosengren (1997): "The international transmission of financial shocks: the case of Japan", *American Economic Review*, vol 87, no 4, pp 495–505.

Popov, A and G Udell (2012): "Cross-border banking, credit access, and the financial crisis", *Journal of International Economics*, vol 87, no 1, pp 147–61.

Shin, H S (2012): "Global banking glut and loan risk premium", *IMF Economic Review*, vol 60, no 2, pp 155–92.

Annex A: Sources of credit

This annex defines key terms and concepts used throughout the feature, based on the BIS Glossary and the Box in a previous feature in this series (Hardy et al (2024a)).

1. **Domestic positions:** claims[9] or liabilities of a domestic bank vis-à-vis residents of the bank's home country. They are not usually covered in the IBS.
2. **Cross-border positions:** positions on a non-resident – for example, a claim on or liability to a counterparty located in a country other than the country where the banking office that books the position is located.
3. **Local positions:** claims on or liabilities to a counterparty located in the same country as the office that books the positions (the opposite of "cross-border positions"). Local positions in the home country are domestic positions (→1).
4. **International positions:** positions on a non-resident or denominated in a foreign currency. International claims comprise cross-border claims in any currency plus local claims of foreign affiliates in non-local (foreign) currencies.
5. **Foreign position:** claims on, or liabilities to, residents of countries other than the country where the controlling parent is located. Foreign claims comprise positions 2 + 3 above, ie local claims of the bank's offices abroad as well as cross-border claims of the bank's offices worldwide.

Endnotes

AFME = Africa and Middle East; EM Asia = emerging Asia; EMEU = emerging Europe; LatAm = Latin America. All graphs are based on data from the locational banking statistics (LBS) and the consolidated banking statistics (CBS). China does not report to the CBS.

"Emerging market economies (EMEs)" is used as a short form for *emerging market and developing economies*, the set of economies not classified as advanced economies (AEs) in the BIS country grouping convention. The names of jurisdictions corresponding to ISO codes are provided under the abbreviations on pages iv–vii.

Graph 1.B: The number of countries in each region are: AEs (24), AFME (4), EM Asia (10), EMEs (32), EMEU (12) and LatAm (6).

Graph 2.A: International claims extended by foreign banks are derived as the sum of all parent bank nationalities in the BIS consolidated banking statistics on an immediate counterparty basis and estimated international claims of nine parent bank nationalities that do not report to the CBS (from the BIS locational banking statistics by nationality). Interoffice claims are included in "Banks" (red bars) prior to 1983.

Graph 2.B: The following reporting countries are excluded due to data unavailability or because they started reporting later than 2003: AT, CL, HK, KR, LU, MX and PA.

Graph 3: The numerator of the FBP rate is the sum of international claims (IC) and local claims in local currency (LCLC) on non-bank borrowers, on an immediate counterparty basis. IC consist of cross-border claims of foreign banks plus local claims

[9] In the BIS LBS, bank claims comprise: (i) loans and deposits; (ii) holdings of debt securities; and (iii) derivatives with a positive market value and other residual instruments (combined). Credit is defined as the sum of (i) and (ii). In the BIS LBS, derivatives are broken out from claims, see Hardy et al (2024a).

extended in foreign currency by hosted foreign banks (in domestic economy). LCLC are claims made by foreign banks resident in the domestic economy to domestic non-bank borrowers in the domestic currency; LCLC to non-bank borrowers are calculated by multiplying LCLC on all sectors (on an immediate counterparty basis) by the share of non-banks in total foreign claims (on a guarantor basis). Since most countries started reporting claims on an guarantor basis around end-2004, the Q1 2005 figures are used for the shares between 2000 and 2004.

Graph 3.A: The regional aggregates are made up of 23 AEs and 31 EMEs.

Graph 3.B: The number of countries in each region are: AFME (7), EM Asia (8), EMEU (9) and LatAm (7).

Graph 3.C: The regional aggregates are made up of 16 AEs and 18 EMEs. Foreign currency share of bank credit: the currency composition of banks' cross-border claims on non-banks in a country is captured in the BIS LBS, which break down cross-border claims into five major currencies (USD, EUR, JPY, GBP and CHF). The method for obtaining the currency breakdown of domestic credit to non-banks depends on the country. In the LBS, reporting countries provide the same breakdown for banks' local positions in foreign currencies, and thus the difference between this total and domestic credit is the amount in domestic currency. This yields the estimates for EMEs that themselves report to the LBS (ie BR, CL, MX, KR, TR and ZA). For other EMEs, the share of local claims in foreign currency of domestic credit is estimated as the difference between BIS reporting banks consolidated cross-border claims (guarantor basis) and their international claims (IC basis) (ie local claims in non-local currencies booked by foreign banks). Thus, the figures are incomplete for these countries because (a) there is no explicit currency breakdown for this piece, and thus assumptions are required to determine the USD, EUR, JPY, GBP and CHF shares; and (b) the positions of domestic banks' local foreign currency positions are not known. For (b), we assume for most countries that these banks' local positions are all in domestic currency.

Graph 7B: "Average contraction driven by bank nationality" is derived from a nationality fixed effect σ_n derived from the following regression equation in McCauley et al (2019):

$$-\frac{\Delta A_{in}}{A_{in}} = \alpha \log(A_{in}) + \delta \log(d_{in}) + \sum_r (\beta^r * R_{in}^r) + \lambda_i + \sigma_n + \epsilon_{in} ,$$

where ΔA_{in} is the peak-to-trough contraction in foreign claims A_{in} of bank nationality n on borrowers in country i. d_{in} is the geographic distance between home and borrower countries, R_{in}^r are the values of various balance sheet variables of the foreign affiliate measured at the peak of A_{in}. These include balance sheet size, peak-to-trough contraction (of the affiliate), local intermediation share, interbank funding ratio, foreign currency funding ratio, cross-border funding ratio, cross-border excluding intragroup ratio, net intragroup funding, intragroup funding received, pre-crisis expansion (log) and a post-crisis recovery dummy. λ_i is a borrower country fixed effect. Credit losses for each nationality are the maximum credit losses on securities (from Bloomberg-reported company statements) and non-performing loans (from S&P CapitalIQ) expressed as a share of Tier 1 capital in 2008.