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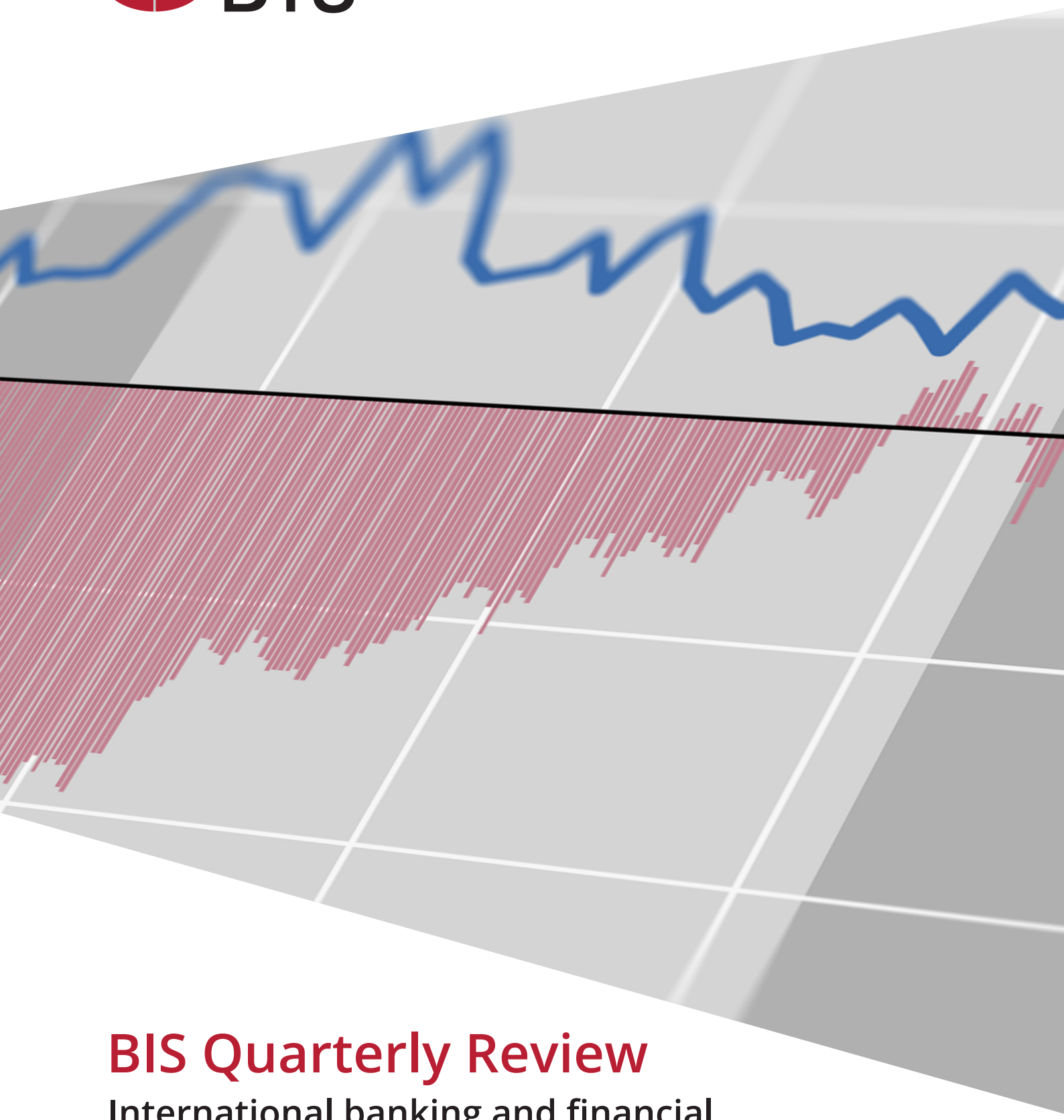

BIS Quarterly Review

International banking and financial market developments

December 2023

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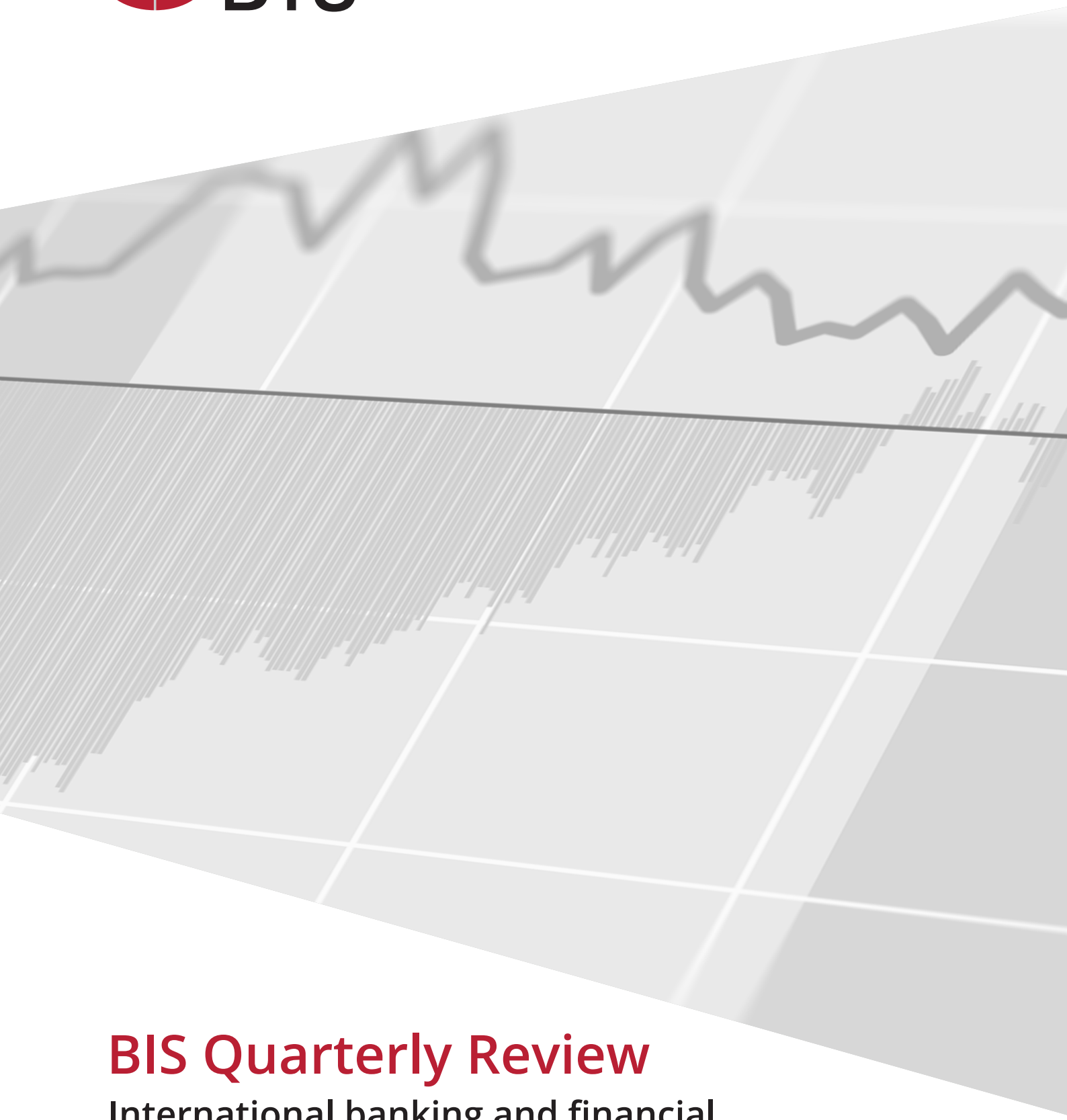

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BIS Quarterly Review
Monetary and Economic Department

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This publication is available on the BIS website (https://www.bis.org/publ/qtrpdf/r_qt2312.htm).

ISSN 1683-0121 (print)
ISSN 1683-013X (online)

ISBN 978-92-9259-713-9 (print)
ISBN 978-92-9259-714-6 (online)

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Special features

A technical annex containing detailed explanations for the graphs and tables is included at the end of each chapter.

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

Countries (cont)

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

Countries (cont)

TM	Turkmenistan	UY	Uruguay
TO	Tonga	UZ	Uzbekistan
TR	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

Markets adjust to "higher for longer"

Markets oscillated as monetary policy interest rate hikes appeared to be coming to an end. Long-term yields surged and then retreated on investors' evolving perceptions of future policy actions.[1] After reaching highs in some cases not seen since the run-up to the Great Financial Crisis (GFC), yields declined rapidly in November. Developments in risky asset markets, as well as exchange rates and capital flows in emerging market economies (EMEs), were closely intertwined with the evolution of core bond markets.

The path of long-term yields reflected market participants' strong reactions to statements by public authorities and news about the economic outlook. With inflation slowing, nominal and real yields followed similar paths in major advanced economies (AEs). Long-term yields started the review period under upward pressure from rising term premia, amid expectations of an increased supply of long-term debt, as announced earlier by the US Treasury. The rise in yields accelerated following the September Federal Open Market Committee (FOMC) meeting, as investors began to expect policy rates to stay high for longer than previously anticipated. Fixed income markets reversed course in November, when investors interpreted central bank communication and macroeconomic data releases as suggesting an earlier end to the hiking cycle. In addition, pressures on term premia eased on announcements of lower than expected issuance of long-dated Treasuries. Long-term yields in Japan reached highs not seen in a decade, with the central bank further relaxing its yield curve control (YCC) policy and the yen briefly depreciating to its lowest level since 1990. Bond spreads temporarily widened within the euro area on country-specific fiscal concerns.

Developments in risky asset markets were closely linked with those in fixed income markets. Stock prices declined for most of the review period and then rallied in November, in tandem with those of government bonds. The correlation between equity and government bond returns has remained positive since inflation took hold in 2021, thus weakening investor demand for bonds as a hedge and contributing to higher yields. Credit market conditions continued to be relatively benign, although credit spreads did widen temporarily. Fairly compressed credit spreads reflected relatively subdued corporate debt issuance, solid balance sheets for many corporates and possible lags in the transmission from higher policy rates to debt service burdens. Banks kept lending standards tight amid a pickup in default rates, while loan demand remained weak, especially in the euro area.

Emerging market economy (EME) financial markets continued to grapple with high US yields and the prospect of accelerating capital outflows, before getting some respite in November. Long-term local currency government bond yields increased, albeit less than in the United States, with term premia edging up, particularly in Latin America. EME portfolio flows were mostly negative, both in Asian and Latin American funds. While some EME currencies went through a short bout of depreciation against the US dollar, most ended up flat on net over the review period.

[1] The period under review is from 9 September through 24 November 2023.

Key takeaways

- *Bond markets remained volatile, with yields oscillating on evolving investor perceptions of the future path of policy interest rates; announcements of sovereign debt issuance also played a role.*
- *Risky asset markets lost ground before recovering, following the path set by bond yields, while conditions in credit markets remained benign.*
- *EME financial markets grappled with swings in US yields and changing pressures on domestic currencies. Portfolio outflows continued, reflecting a divergence in expected interest rate paths.*

US yields continued to set the tone for global bond markets

During the review period, developments in fixed income markets were underpinned by expectations of policy rate paths and sovereign debt issuance amid large fiscal deficits. The Federal Reserve and the ECB put policy rates on hold while reiterating their commitment to bring inflation back to target and re-affirming that rates may have to stay at higher levels than previously anticipated. Fixed income markets were volatile on the back of market participants' heightened sensitivity to central bank communications and macro news. Against the background of what they perceived to be data-dependent monetary policy, market participants kept revising their expectations, with yields rising through October and then declining in November. The effects of the outbreak of the war in the Middle East in early October were short-lived, and a flight to safety did not materialise.

By late October, yields on 10-year government bonds in major AEs reached levels not seen in more than a decade, and in some cases not since the run-up to the GFC. The rise in long-term yields accelerated following the 20 September FOMC meeting (Graph 1.A, line a), as market participants came to expect that policy rates would stay high for longer. With inflation receding, the paths of long-term government bond yields closely mirrored movements in inflation-adjusted, ie real, yields (Graph 1.B). In parallel, estimates of both the expectations and the term premium components of yields kept rising (Graph 1.C).[2] Estimates of the term premium began rising back in August, when the US Treasury surprised market participants with plans for a large increase in the supply of long-maturity securities.

Bond yields retreated in November, as investors revised down their expectations of future rate paths and pressures on term premia eased. Investors were reassured by the 1 November FOMC press statement (Graph 1.A, line b), which suggested that tighter financial conditions made further policy rate hikes less likely. And the US

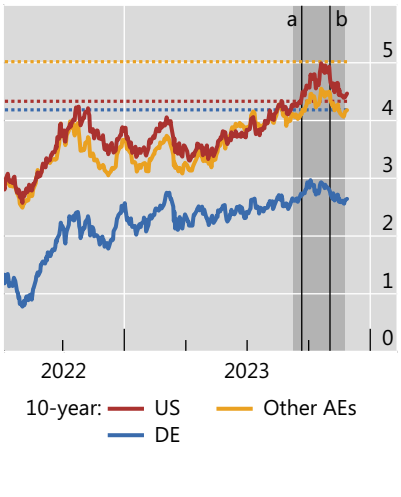
[2] The term premium is the excess return that investors demand for holding long-term bonds over short-term bonds. Estimates of term premia require the path of expected short-term rates to be stripped out from bond yields. Since the former are not unobservable, term premia are estimated with different econometric approaches. Some approaches rely only on the observed yield curve and model it through a set of common factors; others also include surveys and macroeconomic data. Results vary according to the different modelling assumptions, but a feature they all share is the wide uncertainty around the estimates. Still, different methods broadly agree that term premia have increased in recent months. For a review of methods and modes, see B Cohen, P Hördahl and D Xia, "Term premia: models and some stylised facts", *BIS Quarterly Review*, September 2018, pp 79–91.

US yields set the tone for global bond markets[1]

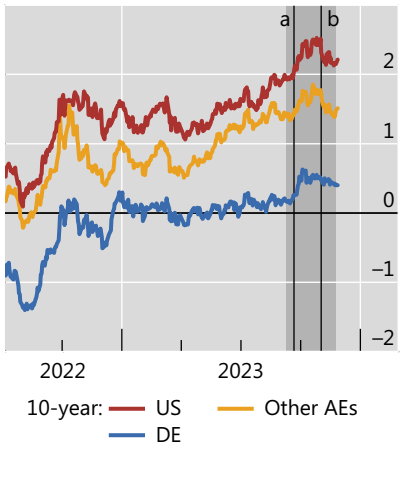
In per cent

Graph 1

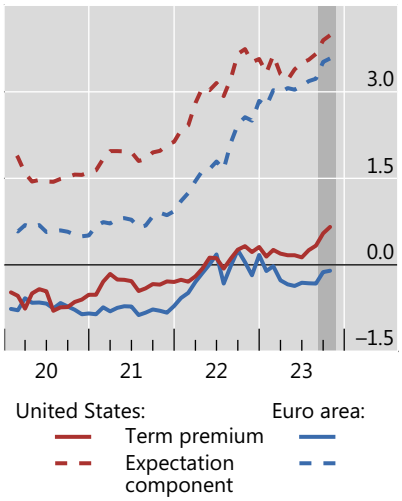
A. Nominal yields in AEs rose…



B. …in sync with real yields



C. …driven by expected futures rates and term premia



The shaded area indicates 9 September–24 November 2023 (period under review). The dotted horizontal lines indicate January 2007–June 2008 average.

[a] FOMC press conference (20 September 2023). [b] FOMC press conference and US Treasury quarterly refunding statement (1 November 2023).

[1] See technical annex for details.

Sources: Hördahl and Tristani (2014); Bloomberg; Datastream; BIS.

Treasury surprised market participants again, this time by announcing a lower than expected increase in issuance of long-term debt. Yields kept falling through November, as a string of macroeconomic data releases pointed to softer activity and faster than expected disinflation progress, lending further support to investors' revised perceptions of the future path of policy rates. Similar support came from the release of the November FOMC minutes. In Europe, even though the ECB communications kept stressing that the fight against inflation was not over, markets still priced in rate cuts as early as the second quarter of 2024 amid weak growth outlook in the euro area.

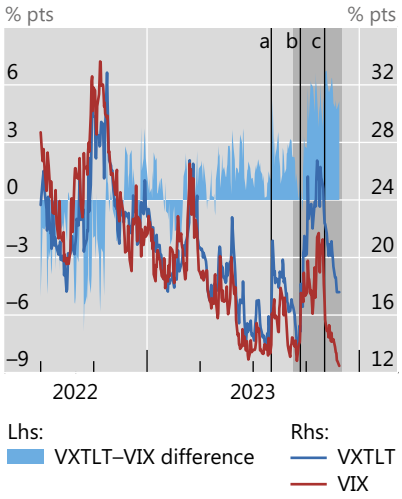
Volatility remained elevated amid rapidly changing conditions in fixed income markets. The option-implied gauge of US government bond return volatility increased after the September FOMC meeting, surpassing that of stock returns (Graph 2.A), although both metrics subsequently declined in November. The spike in volatility reflected the sensitivity of fixed income markets to US monetary and macro news.

Since high inflation took hold in mid-2021, the realised volatility of US government bond returns has hovered well above its average during the pre-pandemic decade of low inflation (Graph 2.B). When inflation surprises from a low level, it rarely prompts reassessments of possible monetary policy responses and, as a result, the volatility of bond returns does not co-move systematically with it (Graph 2.C, yellow dots and crosses). This changes at high levels of inflation: the bond volatility and inflation surprises were positively correlated in the recent period (red dots), similar to the 1980–94 period (blue dots). The co-movement is stronger when

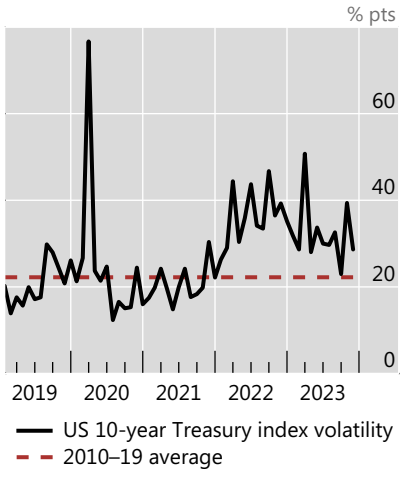
Fixed income markets remained volatile

Graph 2

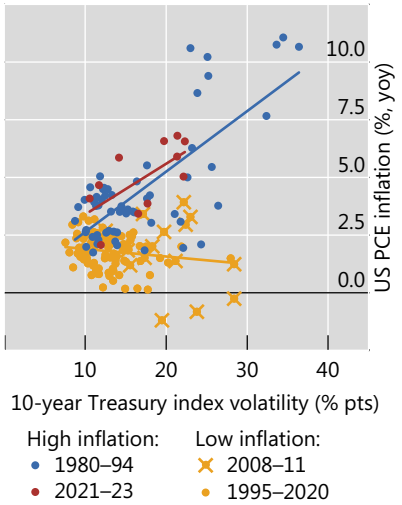
A. Implied volatility of bond returns well above that of equities



B. Realised volatility of bond returns well above the pre-Covid average[1]



C. Bond volatility is higher in periods of high inflation



The shaded area indicates 9 September–24 November 2023 (period under review).

[a] US Treasury announces increase in long-term securities issuance (2 August 2023). [b] FOMC press conference (20 September 2023). [c] FOMC press conference and US Treasury quarterly refunding statement (1 November 2023).

[1] See technical annex for details.

Sources: Bloomberg; Refinitiv; BIS.

inflation surprises on the upside, as the resulting decline in bond prices tends to raise volatility by more.[3]

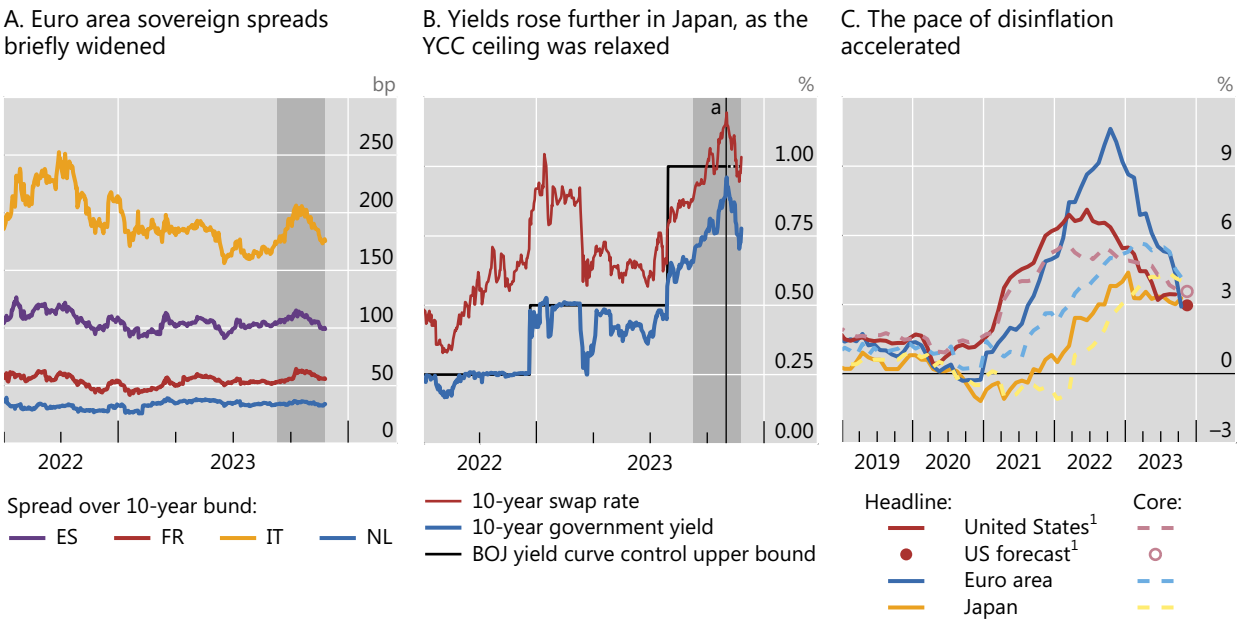
In some euro area economies, fiscal concerns pushed up government bond yields further. On the back of rising budget deficits, spreads of Spanish and especially Italian sovereign bonds over German bunds widened by up to 40 basis points during the review period (Graph 3.A). The Italian sovereign spread once again exceeded 200 basis points in October before compressing in November, amid the broad-based fall in government bond yields and as a major ratings agency reported an improvement to Italy's sovereign ratings outlook.

Japanese government bond (JGB) yields temporarily surged due to both domestic and external factors, reaching levels not seen in over a decade (Graph 3.B). This prompted the Bank of Japan to conduct an unscheduled bond operation in October to smooth market functioning. Part of the pressure on benchmark 10-year JGB yields came from higher expected future rates amid inflationary pressures (Graph 3.C). Domestic core CPI had exceeded the central bank's inflation target for sufficiently long to lead market participants to expect monetary policy tightening in the near future. Still, the YCC policy imposed limits on the 10-year yield, which led the yen to depreciate to multi-decade lows on widening yield differentials with US Treasuries. Following its late October monetary policy meeting, the Bank of Japan

[3] Inflation news also has a mechanical effect on bond prices: when the principal and coupons of outstanding bonds are fixed in nominal terms, a rise in inflation erodes bonds' real value.

Global yields fluctuated as inflation moderated

Graph 3



The shaded area indicates 9 September–24 November 2023 (period under review).

[a] BOJ modifies its yield curve control by redefining the 1% upper bound for 10-year JGB yields as "a reference" (31 October 2023).

[1] See technical annex for details.

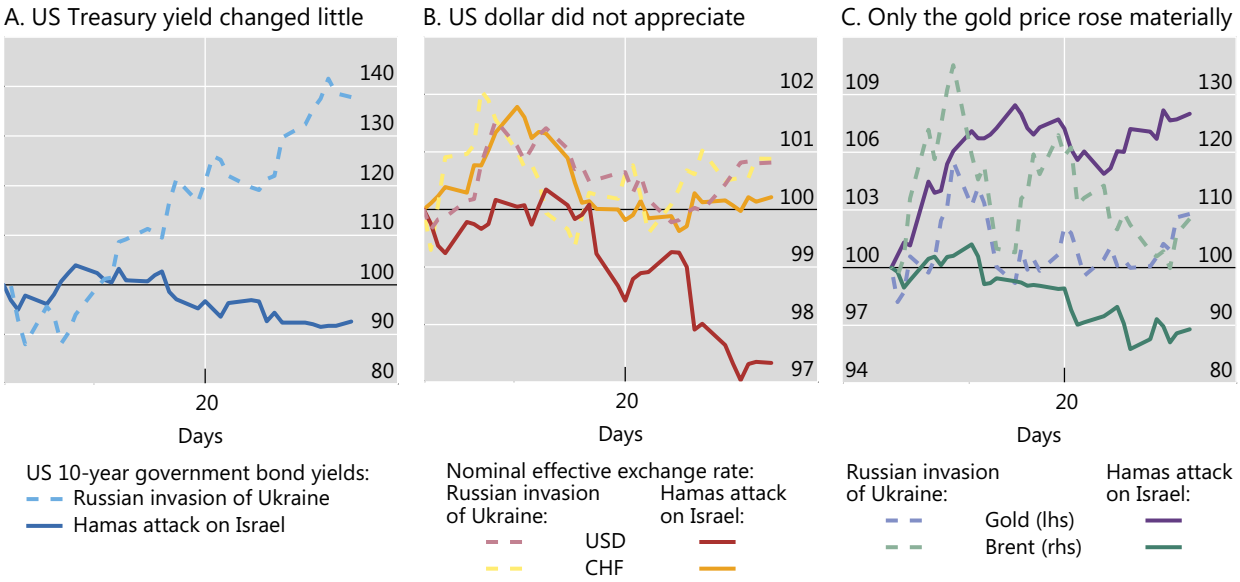
Sources: Federal Reserve Bank of Cleveland; Bloomberg; Datastream; BIS.

relaxed the YCC policy further, and revised upwards its inflation forecasts. In November, the yields on JGBs declined on reduced external pressures.

The immediate market reaction to the escalation in geopolitical tensions in the Middle East was muted and short-lived. There were few, if any, discernible signs of a flight to safety. Following the 7 October attack by Hamas, US Treasury yields hardly moved, unlike in 2022, when Russia invaded Ukraine (Graph 4.A). Similarly, the US dollar did not significantly appreciate (Graph 4.B), although the Swiss franc, another safe haven currency, did appreciate for about two weeks. Among commodities, oil prices did not react and only gold prices rose substantially and remained persistently higher (Graph 4.C).

Limited signs of flight to safety amid escalation in geopolitical tensions

Beginning of the conflict[1] = 100 Graph 4



[1] 24 February 2022 and 7 October 2023, respectively.

Sources: Bloomberg; BIS.

Risky asset markets tied to the rates outlook

Prices of risky assets were closely tied to developments in fixed income markets, in particular to expectations about future rates. Both equity and credit market prices declined in the first part of the review period, only to recoup losses in November. Conditions in credit markets remained relatively benign, although credit spreads widened temporarily. Bank lending standards continued to tighten, especially in Europe.

Stock indices declined across the board early in the review period, in some cases losing more than 10% since their summer highs. The reasons differed across regions. In the United States, the enthusiasm that characterised some tech stocks earlier in the year fizzled out, and even the tech-heavy Nasdaq index posted losses (Graph 5.A). More broadly, higher discount rates weighed on US equity valuations, even as expected earnings per share actually rose (Graph 5.B) amid positive macroeconomic surprises on balance (Graph 5.C). In Europe, disappointing macroeconomic data (blue line) helped explain the negative price action. However, equity markets rapidly recouped losses in November when investors judged that the likelihood of additional rate rises had diminished significantly. Such an environment – in which bad news for the economy were interpreted in relation to the implications for monetary policy – reinforced the positive correlation between stock and sovereign bond returns. A positive correlation between these key asset classes may, in turn, adversely affect investors' risk diversification opportunities (Box A).

Box A

The correlation of equity and bond returns

*Marco Lombardi and Vladyslav Sushko*①

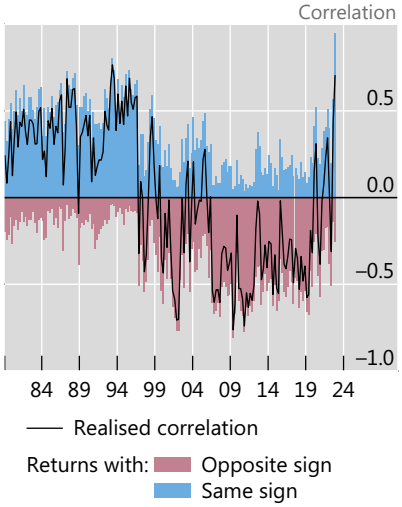
Amid a generalised increase in the volatility in fixed income markets and in sync with the inflation surge, the correlation between equity and bond returns has turned from negative to increasingly positive. A departure from the negative correlation between equity and bond returns, the typical configuration for the past two decades, weakens the diversification in the classical long-only asset allocation strategies of pension and investment funds. Specifically, it undermines the role of bonds as a hedge for the portfolio's equity portion. This box documents the recent persistence of positive correlations and explains it with reference to the inflation environment and the attendant uncertainty.

The correlation between US equity and government bond returns switched sign in mid-2021. Since then, the monthly realised correlation of the daily returns has become positive (Graph A1.A). One has to go back to the 1980s and the early 1990s to find a prolonged period with positive correlations.②

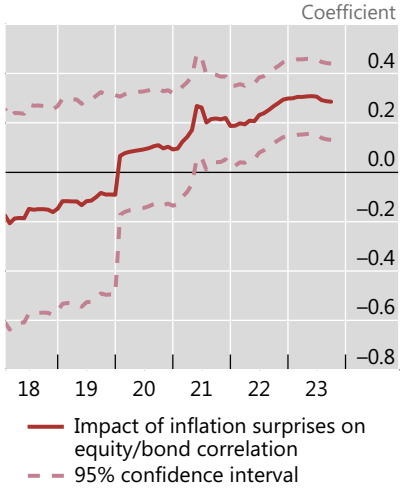
Positive equity/bond correlation goes hand in hand with prominent inflation

Graph A1

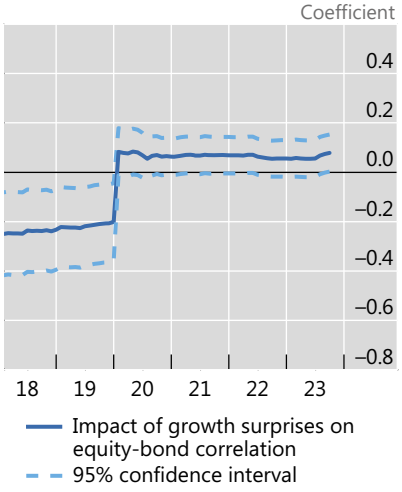
A. Correlation of S&P 500 and US Treasury returns: negative since mid-1990s[1]



B. The correlation became sensitive to inflation news…[2]



C. …and insensitive to growth-related news[2]



[1] Sum of the daily products of S&P 500 and US Treasury returns over the preceding quarter. [2] Estimated coefficients of a recursive regression of the monthly realised correlation of S&P 500 and US Treasury returns on the absolute values of the Citi indices of inflation and economic surprise; the first (last) estimate is based on data from January 2003 to January 2018 (January 2003 to September 2023).

Sources: Bloomberg; Macrobond; Refinitiv; authors' calculations.

The inflation environment plays a key role in shaping the correlation of equity and bond returns through the expected response of monetary policy to news.③ At times of low and stable inflation, market participants typically put more emphasis on growth-related news when forming expectations of monetary policy④ Growth surprising on the downside, for example, would depress equity prices due to lower expected earnings. Such a surprise would also raise expectations of a monetary policy easing, so that bond prices would be boosted by lower discount rates. Thus, in a low-inflation environment, a negative correlation between equity and bond returns prevails. By contrast, at times of high and volatile inflation, it is the inflation outlook that takes centre stage in shaping the expected path of monetary policy rates. Positive inflation surprises, for example, depress the price of outstanding bonds, since their principal and coupons are expressed in nominal terms. Positive inflation surprises also raise expectations of rate hikes and give central banks less scope to cut interest rates if growth falters. This depresses future earnings and equity prices. In such an environment, the correlation between equity and bond returns would thus be positive.

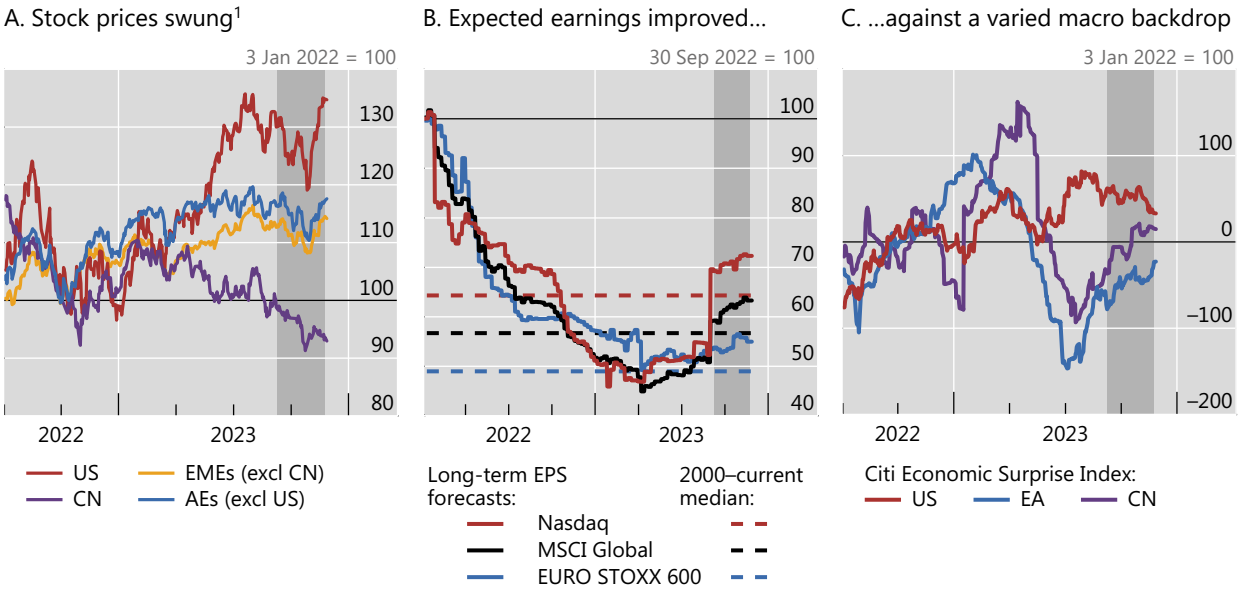
Empirical evidence confirms that the inflation environment affects the correlation of equity and bond returns. The coefficient on inflation surprises turned positive and statistically significant in mid-2021 (Graph A1.B). By contrast, the coefficient on growth news, while significant and negative in the period prior to mid-2021, has become statistically insignificant more recently (Graph A1.C).

A positive correlation between equity and bond returns can partly explain the increase in bond yields observed over the past months. The hallmark portfolio structure of passive investors includes government bonds as a hedge against the swings of riskier assets such as equities. However, if returns on bonds and equities are positively correlated, the former will no longer work as a hedge, and investors will require a higher term premium – ie compensation for undiversified risk in government bonds. Hence, the switch in the sign of correlations between equity and bond returns has contributed to the recent increase in bond yields by pushing up the term premium.⑤

① The views expressed are those of the authors and do not necessarily reflect the views of the BIS. ② The shift from a positive to a negative correlation in the late 1990s has been widely documented and researched. More specifically, it has been associated with phases of monetary tightening at times of low inflation (see for example L Beale and F Van Holle, "Stock-bond correlations, macroeconomic regimes and monetary policy", *SSRN Working Paper*, October 2017), or more broadly to a change in the relationship between monetary policy and the business cycle (see J Campbell, C Pflueger and L Viceira, "Macroeconomic drivers of bond and equity risks", *Journal of Political Economy*, vol 128, no 8, August 2020). ③ See also A Cieslak and A Schrimpf, "Non-monetary news in central bank communication", *Journal of International Economics*, vol 118, May 2019. ④ In a low-inflation environment, as inflation fluctuations around target are typically small and short-lived, they do not necessarily elicit a monetary policy response. In fact, inflation may be driven largely by relative price changes, which monetary policy could safely overlook; see C Borio, M Lombardi, E Zakrajšek and J Yetman, "The two-regime view of inflation", *BIS Papers*, no 133, March 2023. ⑤ The same point was made, in the context of low inflation, by R Clarida, "Monetary policy, price stability and equilibrium bond yields: success and consequences", speech at the *High-level conference on global risk, uncertainty and volatility*, Zurich, November 2019.

Global equity markets followed the path set by bond yields

Graph 5



The shaded area indicates 9 September–24 November 2023 (period under review).

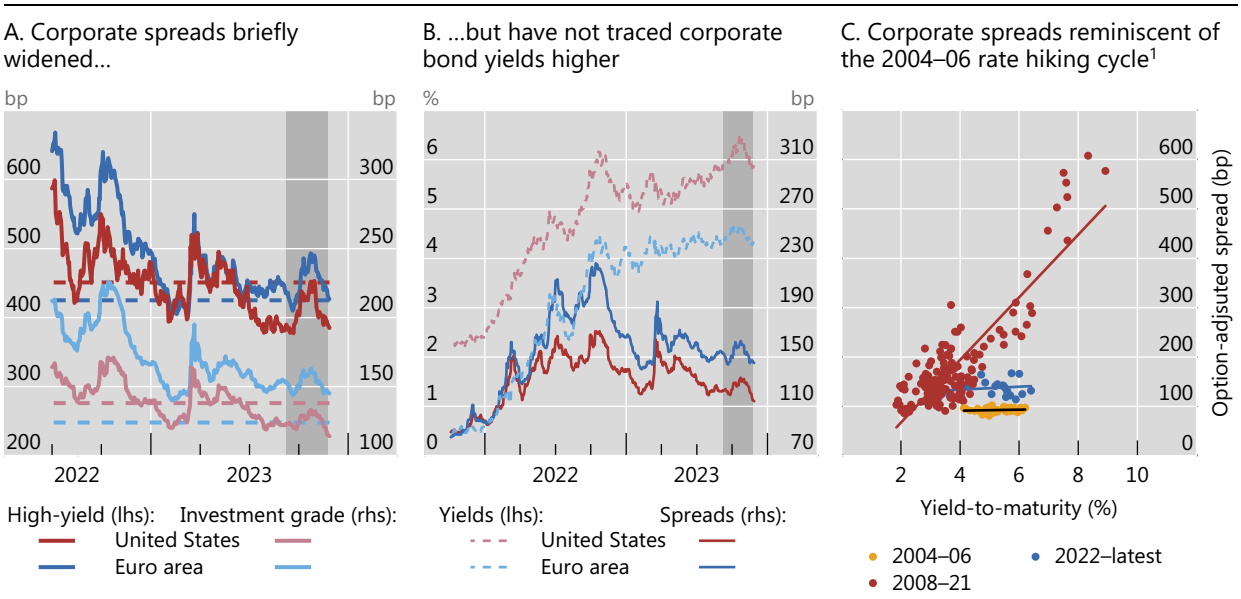
[1] See technical annex for details.

Sources: IMF; Bloomberg; Datastream; Macrobond; BIS.

Credit spreads remained compressed, despite the high level of yields. Spreads temporarily ticked up during the review period, and in the euro area were above their historical averages, both for investment grade and the high-yield segment (Graph 6.A). Still, even with their modest widening, credit spreads remained tight given the high level of corporate yields (Graph 6.B). This behaviour, visible in both the United States and the euro area, is uncharacteristic of the past decade and was last observed during the 2004–06 monetary policy tightening cycle (Graph 6.C).

Corporate issuers yet to feel the impact of higher funding costs

Graph 6



The shaded area indicates 9 September–24 November 2023 (period under review). The horizontal lines indicate 2005–current medians.

[1] Based on monthly averages.

Sources: ICE BoAML indices; BIS.

At least two factors may explain why credit spreads have not widened materially despite rising corporate funding costs. First, many corporates termed out their debt issuance profile in recent years and appear to still have large cash buffers (raised when interest rates were lower). This has allowed them to avoid refinancing at the current high borrowing rates (Graph 7.A). Second, the rise in corporate bond yields has coincided with an increase in the earnings outlook, a combination that has an ambiguous net effect on creditworthiness and, thus, credit spreads.

Nonetheless, tensions in corporate credit markets may lie ahead. A substantial amount of debt will become due in the next few years and will need to be refinanced at significantly higher rates. Small corporates are particularly vulnerable to such a scenario (Box B). The actual refinancing costs could increase further if credit spreads widen during a refinancing wave.

Box B

How does the rise in interest rates affect debt rollover across non-financial firms?

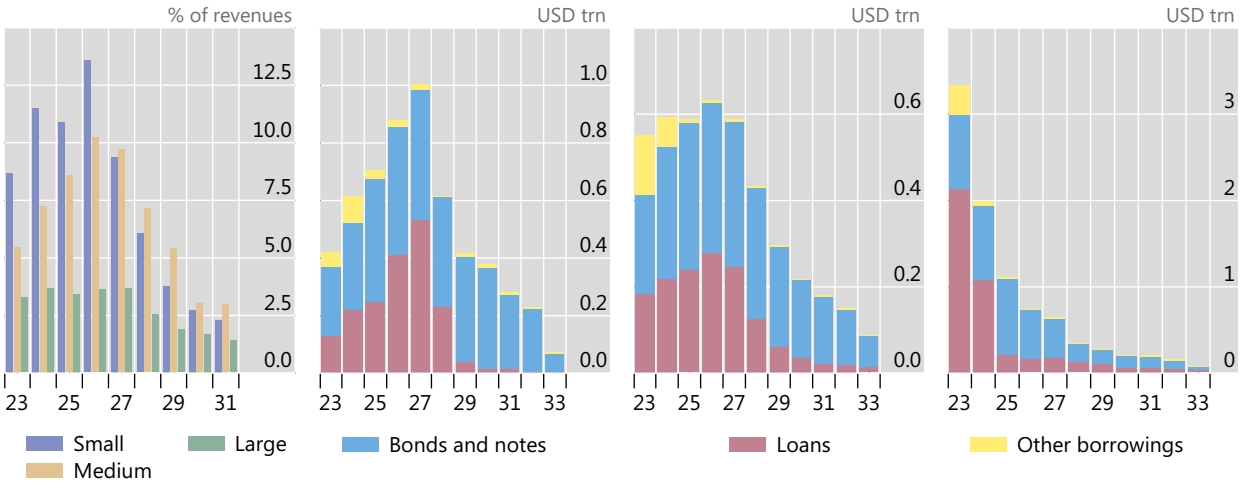
*Matteo Aquilina, Ryan Banerjee and Andreas Schrimpf*①

Non-financial firms took advantage of ample cheap credit in the low rate environment. Amid extraordinary policy stimulus, flat yield curves and low corporate spreads incentivised firms to lengthen the maturity of their debt and borrow at fixed interest rates.② However, the rapid rise in interest rates over the past 18 months has tightened financial conditions. This will adversely affect firms' ability to roll over maturing debt.

To assess debt rollover needs, we examine over 83,000 debt instruments that were outstanding as of 2023 and were issued by over 18,000 non-financial firms in 53 countries. Our sample extends to firms without credit ratings, thus broadening the canvas relative to that underpinning many other analyses. It also contains relatively small firms. For example, the smallest 5% of the firms in our sample have annual revenues of around $2 million – the threshold below which firms are commonly regarded as micro-sized in the United States and European Union. Nevertheless, our sample is tilted towards larger firms, which are more likely to disclose detailed information on debt liabilities.

Rollover needs loom larger for small firms and more bank-dependent systems

Graph B1



[1] Small/medium/large = in the bottom/middle/top tercile of 2022 revenues in the respective country.

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

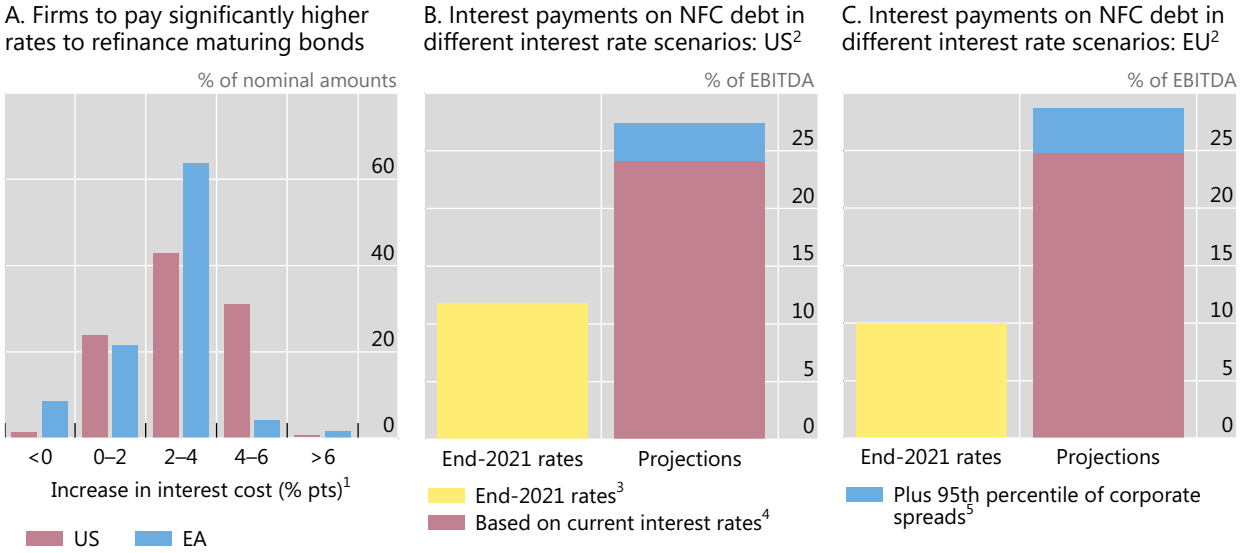
Differences in debt refinancing needs by firm size suggest that the current tightening episode will have highly uneven effects across firms. Smaller firms are likely to be subject to significantly larger refinancing pressures than larger ones. In each of the next four years, the bottom tercile of firms – as measured by revenues – has debt coming due in excess of 10% of total annual revenues (Graph B1.A) and over four times annual earnings before interest, taxes, depreciation and amortisation (EBITDA). Although the refinancing needs of medium-sized firms are relatively contained in the near term, they too will rise to around 10% of annual revenues and 40% of annual EBITDA by 2026. The refinancing needs of large firms are lower, at around 3% of annual revenues and only 20% of annual EBITDA. Relative to 2019, the debts coming due over the next two years are around 1 percentage point higher as a share of revenues for large firms but 2 percentage points higher for small and medium-sized firms.

The relative importance of bank and bond finance for non-financial corporates creates important cross-country differences. This is because bank loans tend to be of shorter maturity. In the United States, the greater use of corporate bonds suggests that immediate debt refinancing needs may be muted and will only grow gradually, peaking in around five years (Graph B1.B). By contrast, greater dependence on bank loans and other types of short-term borrowing will

front-load the refinancing needs of firms in other advanced economies and especially in EMEs (Graphs B1.C and B1.D). The refinancing wave has already started for firms in these jurisdictions.

Debt service burdens under different scenarios

Graph B2



[1] Difference between the current secondary market yield and the corresponding coupon on corporate bonds maturing within the next 24 months. [2] Based on total debt across firms in Q2 2022 relative to 2021 EBIDTA. [3] Interest payments on total debt. [4] Interest payments based on end-2021 rates plus additional interest payments, reflecting the change in the yield to maturity of the ICE Bank of America Merrill Lynch 10-year corporate bond index from end-2021 to September 2023. [5] Based on OAS historical distribution since 1997.

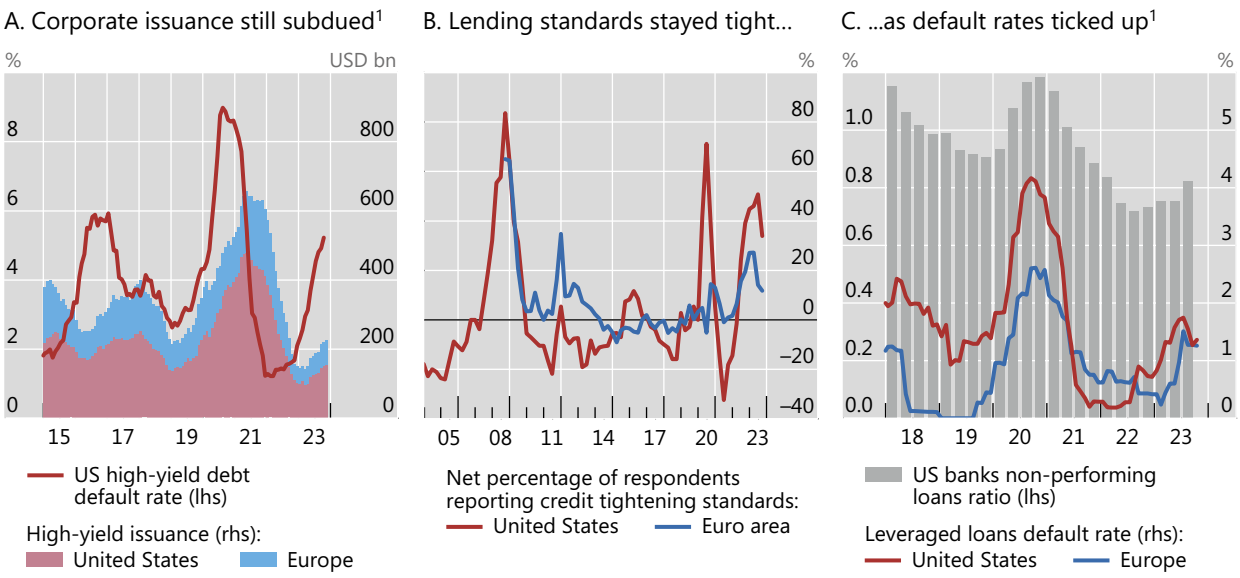
Sources: Bank of America Merrill Lynch; S&P Capital IQ; iBoxx; authors' calculations.

Finally, the extent of monetary tightening in specific jurisdictions could make a difference across firms. As the United States has experienced the largest increase in interest rates among the major advanced economies, the extra cost of rolling over maturing US dollar-denominated debt is likely to be higher than debt denominated in other major currencies. To give a sense of the potential upward pressure on refinancing costs, we compare current yields on corporate bonds in secondary markets with those prevailing at the time of issuance. This suggests that over 30% of the total amount of US dollar bonds maturing in 2024/25, if they are to be refinanced, will have interest rates that are 4 or more percentage points higher than what firms were paying in late 2021 (Graph B2.A). By contrast, the corresponding share for euro-denominated bonds is only 6%. Nevertheless, secondary market yields suggest that at least 60% of maturing euro-denominated corporate bonds will face interest rates that are between 2 and 4 percentage points higher than in late 2021 if they are refinanced (Graph B2.B).

Servicing existing debt at current interest rate levels could be challenging for many firms. Simulations suggest that debt servicing costs relative to earnings could more than double if yields remain at current levels and firms refinance the totality of their debt (Graphs B2.B and C, yellow and red bars). Moreover, should the currently compressed credit spreads widen, firms' debt servicing challenges would worsen. For instance, if credit spreads were to increase to the 95th percentile of the historical distribution, this could increase debt service-to-EBITDA ratios by an additional 3.5 percentage points, in both the United States and the European Union (Graph B2.C and D, blue bars).

① The views expressed are those of the authors and do not necessarily reflect the views of the BIS. ② See M Ampudia, E Eren and M Lombardi, "Non-financial corporates' balance sheets and monetary policy tightening, *BIS Quarterly Review,* September 2023, pp 9–10.

Corporate issuance remained subdued and bank lending restrained Graph 7



[1] See technical annex for details.

Sources: Board of Governors of the Federal Reserve System; BankRegData; Datastream; Dealogic; Moody's; PitchBook | LCD; BIS.

Bank lending remained subdued because of both supply and demand factors. Banks continued to extend credit with caution, keeping lending standards tight in both the United States and euro area (Graph 7.B). According to market sources, rising credit losses and funding pressures were recurring topics at recent earnings calls.[4] Indeed, the non-performing loan ratios of US banks ticked up in the third quarter (Graph 7.C), particularly for commercial real estate, credit cards and auto loans. At the same time, default rates on leveraged loans in both the United States and the euro area moderated. In addition, loan demand fell in both the United States and the euro area alike: 60% of US banks cited weaker demand for home mortgages in the third quarter, up from 43% in the previous quarter.

EMEs feel the effects of global conditions

Developments in EME financial markets were closely intertwined with the global environment. Portfolio outflows continued for most of the review period, exerting pressure on local currencies, bond and equity markets. In China, macroeconomic conditions remained fragile, with positive and negative macroeconomic surprises alternating. Similar to AEs, November brought some respite across EMEs, as US long-term yields declined and the US dollar depreciated.

EME currencies ended the review period broadly unchanged against the US dollar, but differed from each other in terms of the path they followed. Latin American currencies depreciated substantially in September and October (Graph 8.A), reflecting expectations of rate cuts and rising US yields. They recovered in November amid a robust domestic macro outlook and a rapid decline in US yields. Incentives for carry

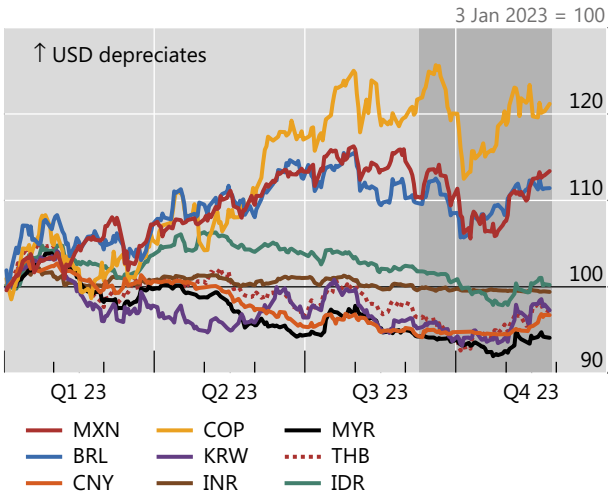
[4] For persistent headwinds in the life insurance sector, see Box C.

trades partly explain these exchange rate movements, as Latin America had received substantial inflows earlier in the year, but carry-to-risk ratios subsequently declined (Graph 8.B), prompting some outflows. Asian currencies, by contrast, were much more stable throughout, in part also due to foreign exchange interventions by central banks in the region (see below).

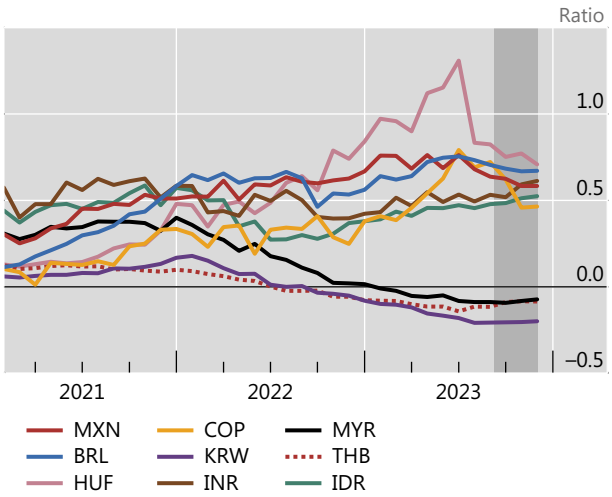
EME exchange rate movements followed changes in yields

Graph 8

A. Currencies more volatile in Latin America than in Asia



B. Carry-to-risk ratios declined[1]



The shaded area indicates 9 September–24 November 2023 (period under review).

[1] See technical annex for details.

Sources: Bloomberg; Datastream; JPMorgan; BIS.

Sovereign bond yields in a number of EMEs rose amid investor selling pressures and then declined. Yields on 10-year government bonds increased substantially in Latin America, and to a lesser extent in European and Asian EMEs before recovering some ground in November (Graph 9.A). Brazil also saw an increase in real yields, despite renewed policy rate cuts (Graph 9.B). Estimates of term premia widened in Latin America more generally (Graph 9.C), as investor demand for local currency bonds decreased.

Life insurance companies – the missing relief from rising interest rates

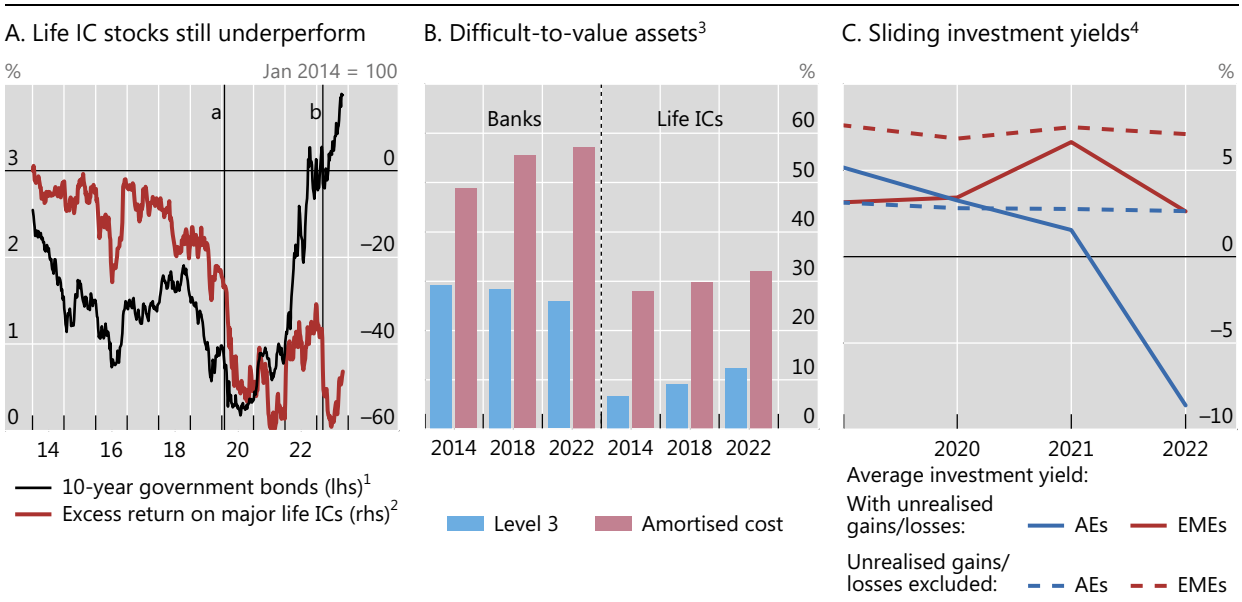
Bettina Farkas, Ulf Lewrick, Tomas Stastny and Nikola Tarashev ①

Given that life insurance companies' (ICs) valuations came under pressure during the low-for-long era, a natural question is whether the global monetary policy tightening has brought relief. Since life ICs' liabilities are generally of longer maturity than their assets, a decline in bond yields tends to make the discounted present value of these liabilities rise by more than that of the assets (a "negative duration gap"). To the extent that it remains unhedged, the negative duration gap would be an important headwind, thus helping to explain the underperformance of life ICs' stock prices relative to broader indices up to end-2020. However, this underperformance has not gone into reverse with the rise in yields as policy rates soared over the past two years (Graph C1.A).

In this box, we discuss potential reasons for the lack of relief for life ICs' stock prices. We point to the evolution of the shape of the yield curve and to the risk that – similar to banks' experience in March 2023 – liquidity needs force life ICs to recognise yet unrecognised losses. We conclude by highlighting challenges that life ICs may need to overcome as the effects of monetary tightening play out through the system.

Life insurance companies (ICs): valuation pressures despite rising rates

Graph C1



[a] World Health Organization declares an international public health emergency (30 January 2020). [b] Silicon Valley Bank fails (10 March 2023).

[1] Average across the same ICs' home jurisdictions, using the same weights as for excess returns. [2] Cumulative equity returns relative to the domestic stock market since January 2014; asset-weighted average across 14 large life ICs from eight AEs. [3] Asset-weighted average for a balanced sample of 33 life ICs and 601 banks from 40 countries. Level 3 assets are highly illiquid and their valuation relies on modelled estimates; amortised cost assets are reported at historical cost, abstracting from temporary valuation changes. [4] Investment income, divided by the sum of cash and invested assets; weighted averages across jurisdictions, with weights based on national insurance sectors' assets.

Sources: IAIS (SWM and IIM data); Bloomberg; S&P Capital IQ; national data; authors' calculations.

Our analysis draws on several data sources. Two come from the International Association of Insurance Supervisors (IAIS) and underpin its monitoring of risks in the global insurance sector.② The first data source, Sector-Wide Monitoring (SWM), is at the national insurance sector level. It covers 30 advanced economies (AEs) and 15 emerging market economies (EMEs), with life ICs accounting for over 70% of total assets in the median country.③ The second source, Individual Insurer Monitoring (IIM), is at the consolidated group level. From it, we obtain data on nearly 50 major life and composite ICs headquartered in 11 AEs and seven EMEs. We complement these yearly data sets, which extend from 2019 to 2022, with longer market and balance sheet data on life ICs and banks.

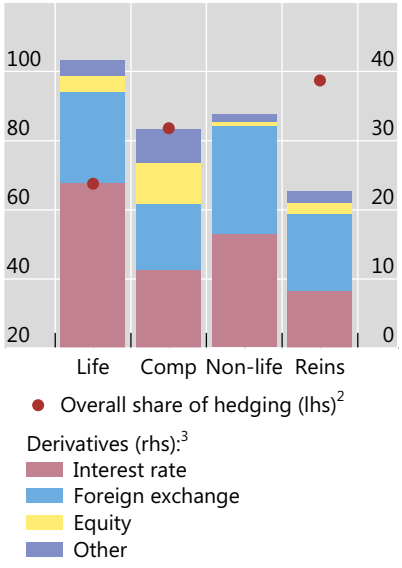
When it comes to the value of life ICs' equity, there are signs that the level and shape of the yield curve have been pulling in opposite directions. On the one hand, given generally negative duration gaps – two years on average across major life ICs – a parallel upward shift in the yield curve, as observed at the start of the monetary tightening cycle in early 2022, would have boosted the value of equity. On the other hand, the rise of yields at the shorter end of the curve *above* those at the longer end – ie the inversion of the curve as of late-2022 – could have partly offset this effect by imposing a higher discount rate for life ICs' fixed income assets than for their liabilities. Depending on the specific composition of individual ICs' balance sheets, the asset losses can even surpass benefits on the liability side.

With the surge in discount rates, the exposure of investors in life ICs' equity to *unrealised* losses – which accumulate on various assets not measured at fair value through profit or loss – has also gained in importance. The level of such losses is inherently difficult to assess for so-called Level 3 assets (ie complex or highly illiquid instruments), for which balance sheet values are typically based on model estimates. There are similar difficulties with assets held at amortised cost (typically loans and mortgages without an active market), which do not reflect changes in market valuations viewed as temporary. The shares of Level 3 and amortised cost assets on life ICs' balance sheets stood at 12% and 32% in 2022, respectively, compared with 26% and 57% for banks (Graph C1.B). By contrast, unrealised losses are known for those securities whose market value affects book equity but not accounting profits. For example, this is the case for parts of sovereign and corporate bond portfolios, with the overall size of these portfolios representing about half of the total investments covered by the IIM data set.④ Unrealised losses in such portfolios built up in the course of 2022 for life ICs, especially AE entities (Graph C1.C). In all these cases, the key underlying question is whether the accumulated losses may undermine life ICs' performance and capital positions if liquidity needs force them to sell the underlying assets.

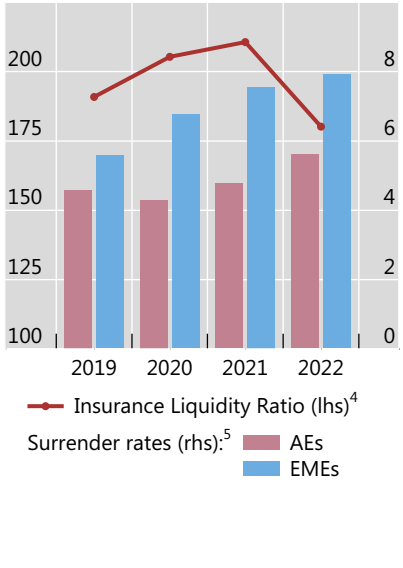
Sources of liquidity risk[1]

In per cent — Graph C2

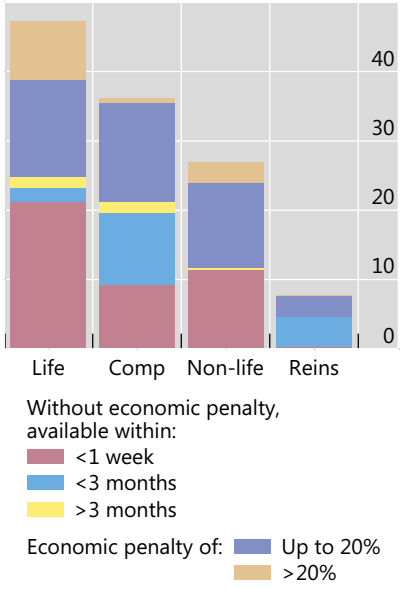
A. ICs' derivatives: mostly for hedging



B. Surrender rates have been rising while liquidity ratios have worsened



C. Surrender potential still high[5]



Comp = composite; Reins = reinsurance.

[1] The "life" and "non-life" designation is applied to companies with predominantly life and non-life lines of business, respectively. [2] In total gross notional amounts; not available for non-life ICs due to data gaps. [3] Gross notional amounts relative to total assets. [4] One-year Insurance Liquidity Ratio, which equals an IC's liquidity resources divided by its liquidity needs under stress over a one-year horizon. This ratio is one of several metrics that together constitute the IAIS's ancillary indicator for liquidity risk monitoring; weighted averages across a balanced sample of 38 life and composite ICs. [5] As a share of total assets including general and separate accounts.

Sources: IAIS (SWM and IIM data); authors' calculations.

One potential source of liquidity needs are derivatives-related margin calls. ICs in general, and life ICs in particular, hold material gross derivatives positions, mostly for hedging purposes (Graph C2.A). Given their negative duration gap, the risk of *falling* interest rates is one of the main risks that life ICs seek to hedge, at least partially – about half of their derivatives portfolio is comprised of interest rate derivatives, with a gross notional amount equivalent to about 20% of total assets on average. When interest rates *rise*, however, ICs incur losses on their derivatives' market value and have to post variation margins. High volatility can lead to additional, initial margin requirements. In each case, margins drain the entity's liquidity.

Liquidity pressure on life ICs could also arise from policy surrenders, which are on the increase. In 2022, the share of surrenders in outstanding life policies reached 5.5% in AEs and 8% in EMEs (Graph C2.B, bars). Policies with guaranteed but low rates, such as those issued during the low-for-long era, could prove particularly susceptible to surrenders, given the availability of alternative investments with higher returns (eg term deposits, investment funds). In the face of surrenders, ICs experience either a decline in liquid assets, if policies are not replaced, or a decline in profits, if policyholders switch to new policies that offer higher benefits.

Even though ICs generally have buffers to cushion an increase in liquidity needs, so that they can avoid realising losses on assets they do not intend to sell, there seem to be pockets of vulnerability. In 2022, a key measure of these buffers, the one-year Insurance Liquidity Ratio (ILR), averaged 180% across the life and composite ICs in the IIM (Graph C2.B, line). This is despite a sharp decline in that year, due to higher interest rates depressing the value of ICs' liquid assets (the ILR numerator) amid rising liquidity needs, eg because of surrenders (the ILR denominator). That said, four of these ICs reported an ILR of less than 100% at end-2022, indicating potential liquidity shortage under stress.

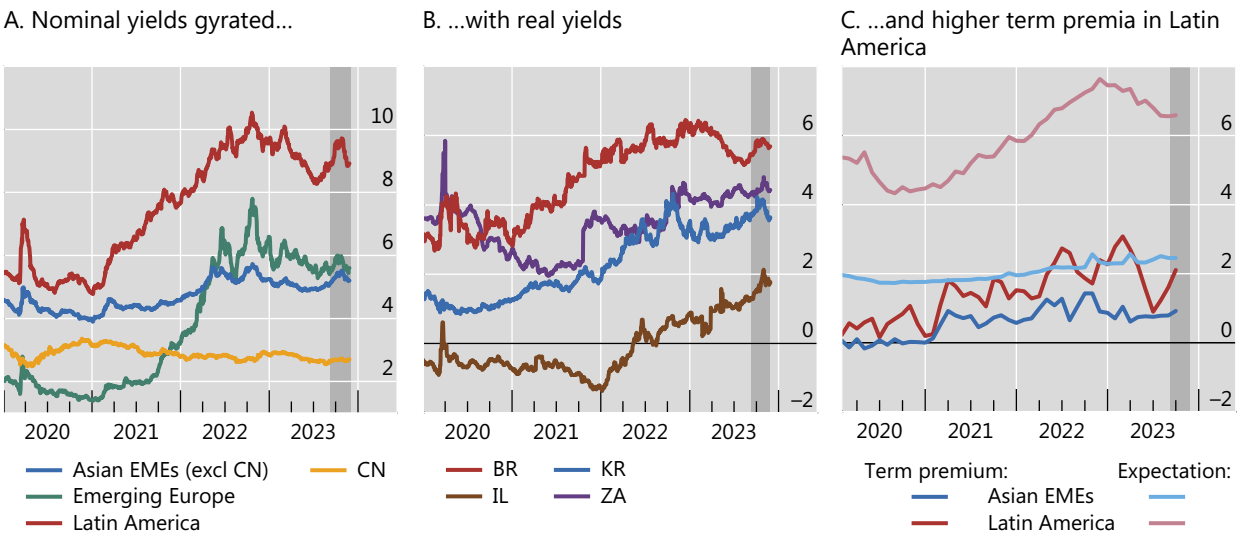
Going forward, the performance of life ICs will depend on how they manage liquidity as well as credit risks. Liquidity management would need to address the risk of margin calls, which are an inherent feature of derivatives positions, as well as surrender risk. For major life ICs, the policies that allow surrenders amount on average to nearly 50% of total assets, a higher share than for non-life and other ICs (Graph C2.C). For about half of these, contractual penalties on policyholders provide protection to the insurer against surrenders; for the other half, any protection stems mainly from tax treatments that raise the effective cost of surrenders. Alongside the risk of liquidity needs, credit risk has come to the fore, as debt servicing costs have increased for many borrowers on the back of soaring interest rates. While life ICs typically focus on highly rated securities, credit losses could emerge from exposure to real estate, a sector particularly hit by the pandemic and monetary policy tightening. Losses could also materialise in private credit, an opaque corner of the system where some life ICs sought to compensate for meagre interest income during the low-for-long era.⑤

① The views expressed are those of the authors and do not necessarily represent the views of the Bank for International Settlements or the International Association of Insurance Supervisors (IAIS). ② For a discussion of the IAIS's most recent Global Monitoring Exercise, see IAIS, *Global insurance market report 2023*, forthcoming. ③ Non-life ICs are as far as possible excluded from the analysis (they are not separated from life ICs only in Graph C1.C), as they are less exposed to the factors discussed in this box. Major non-life ICs report an average duration of liabilities of eight years and a duration gap of –1.5 years as of end-2022. These numbers are 11 and –2 years for major life ICs. ④ In principle, some sovereign or corporate bonds may be held at amortised cost, where unrealised losses affect neither accounting profits nor capital. However, this accounting treatment is reportedly less prevalent among life ICs than banks. ⑤ For a recent analysis of the decline in European ICs' credit quality, see J Brinkhoff and J Sole, "Did insurers become risk-loving during 'low-for-long'? The role of returns, ratings, and regulation", *IMF Working Papers*, no 2022/202, 2022.

Long-term yields in EMEs moved with real yields; term premia rose[1]

In per cent

Graph 9



The shaded area indicates 9 September–24 November 2023 (period under review).

[1] See technical annex for details.

Sources: S Joslin et al (2011); Bloomberg; Datastream; Refinitiv; BIS.

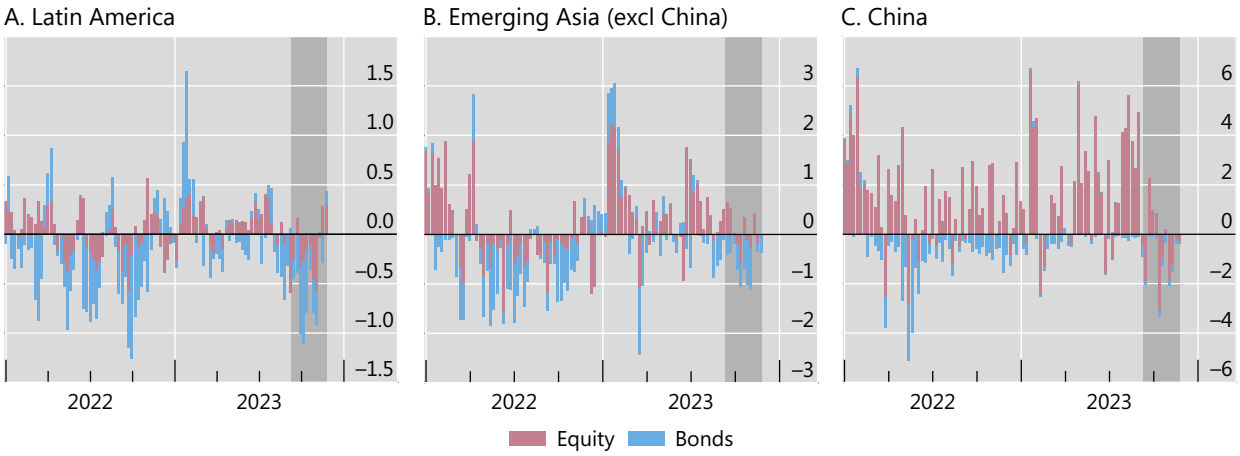
Fund flow data suggested that foreign investors' appetite for EME risk diminished. Portfolio outflows accelerated for most of the review period but have recently moderated in Asia and reversed in Latin America. Outflows in Latin America affected both bond and equity funds (Graph 10.A) continuing a trend since the summer. In Asia, outflows were concentrated in bond funds reflecting lower local yields than in the United States and other AEs (Graph 10.B).

Foreign investor retrenchment from China went hand in hand with the country's changing macroeconomic news. As positive surprises early and late in the review period were not sufficient to reassure investors, outflows from both bond and equity funds featured throughout the review period (Graph 10.C). Amid a generally weak growth outlook, local currency bond yields remained significantly below those in other major economies, as the central bank continued to stimulate the economy.

Most of the review period featured portfolio outflows from EMEs

In billions of US dollars

Graph 10



The shaded area indicates 9 September–24 November 2023 (period under review).

Sources: EPFR; BIS.

EME authorities have been actively managing exchange rate pressures. Some central banks reportedly intervened in FX markets, as suggested by declining FX reserves, to contain effects on local currencies. Others raised policy rates to help preserve external stability, notwithstanding a benign domestic inflation outlook. Authorities in a number of EME jurisdictions have drawn from a broad policy toolkit that includes interventions in currency spot, derivatives and local bond markets.

Some EME central banks have been adding to or adjusting the set of tools they use. For example, Bank Indonesia started issuing securities with interest rates linked to US dollar rates to attract foreign investors and replenish foreign exchange reserves. In turn, the Bank of Mexico has reduced the size of its foreign exchange hedging programme, as conditions on the peso-dollar market stabilised.

Technical annex

Graph 1.A and 1.B: Other AEs based on simple average of AU, CA and GB.

Graph 1.C: Ten-year maturity. Monthly data up to end-October 2023. Estimates based on the joint macroeconomic and term structure model of P Hördahl and O Tristani, "Inflation risk premia in the euro area and the United States", *International Journal of Central Banking*, vol 10, no 3, September 2014.

Graph 2.B: Computed as the annualised monthly sum of daily squared returns on the Refinitiv 10-year government benchmark index. The monthly volatility for November 2023 was computed using data up to 24 November.

Graph 3.C: PCE for headline and PCE excluding food and energy for core. Forecasts from Cleveland Fed NowCast.

Graph 5.A: US = Nasdaq composite index; CN = Shanghai Shenzhen CSI 300 index. Country group aggregates based on GDP-weighted averages.

Graph 7.A: US high-yield default rate based on Moody's 12-month rolling US speculative grade default rates. High-yield issuance based on a 12-month rolling sum.

Graph 7.C: Twelve-month rolling leveraged loan default rates based, respectively, on Morningstar LSTA US Leveraged Loan Index (LLI) and Morningstar European Leveraged Loan Index (ELLI).

Graph 8.B: One-month interest rate differential divided by the implied volatility of one-month at-the-money currency options.

Graph 9.A: Ten-year maturity. Asian EMEs (excl CN) = simple average of ID, IN, MY and TH; emerging Europe = simple average of CZ, HU, PL, RO and SK; Latin America = simple average of BR, CL, CO, MX and PE.

Graph 9.B: Ten-year maturity.

Graph 9.C: Estimates based on the term structure model of S Joslin, K Singleton and H Zhu, "A new perspective on Gaussian dynamic term structure models", *Review of Financial Studies*, vol 24, no 3, 2011. Regional unweighted averages of estimated term premia and expectations components, estimated using zero coupon local currency bond yields for each market. Other AEs: AU, CA, CH, GB and SE; Asian EMEs: HK, ID, IN, KR, SG and TH; Latin America: BR, CL, CO, MX and PE.

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Global liquidity: a new phase?[1]

Foreign currency credit – a key aspect of global liquidity – has undergone distinct phases. The first phase recorded by the BIS global liquidity indicators (2003–09) featured soaring bank credit amid accommodative financial conditions in the run-up to the Great Financial Crisis (GFC). The second phase (2009–21) saw a shift towards bond markets and more dollar credit, especially to borrowers in emerging market economies (EMEs), on the back of tighter bank regulation and a loose monetary stance. Has the recent global surge in inflation and monetary tightening ushered in a new phase? Recent patterns point to a contraction in foreign currency credit, primarily in dollars, and particularly for EMEs.

JEL classification: E43, F34, G15.

Foreign currency credit – a key aspect of global liquidity – has grown and changed composition over the past two decades. These dynamics are important as they can reflect imbalances that exacerbate domestic financial cycles, with international spillovers (CGFS (2011)). Starting in 2000, the BIS global liquidity indicators (GLIs) track such dynamics, focusing on *non-bank* borrowers and credit denominated in dollars, euros and yen, as foreign currencies from the borrower's perspective.[2]

This special feature documents the evolution of the GLIs in terms of two phases and asks whether the recent shift in the macro-financial environment has ushered in a third phase. Several salient changes to trends in the GLIs help differentiate the phases (Table 1, coloured cells).

The first phase was driven by banks in the early 2000s.[3] Foreign currency credit expanded rapidly, primarily in the form of dollar- and euro-denominated loans, and mostly to borrowers in advanced economies. The bank-driven expansion ahead of the GFC saw the share of bonds fall (Table 1). Light regulation of banks' leverage and monetary policy behind the curve facilitated this expansion, thus contributing to the credit boom leading up to the Great Financial Crisis (GFC).

[1] The authors thank Iñaki Aldasoro, Stefan Avdjiev, Claudio Borio, Benjamin Cohen, Gaston Gelos, Patrick McGuire, Benoît Mojon, Andreas Schrimpf, Hyun Song Shin, Vlad Sushko and Nikola Tarashev for helpful comments, and Mert Onen, Swapan-Kumar Pradhan and Jhuvesh Sobrun for excellent research assistance. The views expressed in this article are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

[2] In other words, this is dollar, euro and yen credit to non-bank borrowers outside the United States, the euro area and Japan, respectively.

[3] The phases of global liquidity do not have exact start and end dates. For convenience, we delineate these phases as follows: Phase 1 from Q1 2003 to Q1 2009, phase 2 from Q2 2009 to Q2 2021 and a potential phase 3 from Q3 2021 onwards.

Key takeaways

- *The evolution of global liquidity over the past 20 years suggests distinct phases, marked by changes in the growth and composition of foreign currency credit following major shifts in the macro-financial environment.*
- *After a rapid expansion of foreign currency bank credit in the run-up to the Great Financial Crisis, there was a shift towards bond markets and more dollar credit, especially to borrowers in emerging market economies.*
- *Worldwide monetary tightening has curbed foreign currency credit, notably in dollars and to borrowers in emerging market economies, potentially heralding a new phase of global liquidity.*

A second phase began in the aftermath of the GFC and featured a shift to bond market credit.[4] Overall, foreign currency credit grew more moderately than in the first phase. The underlying shift to bond credit came as banks retrenched after the GFC and remained constrained by tighter regulation and the drag from the euro area debt crisis. Dollar credit expanded the most, particularly to borrowers in emerging market economies (EMEs).[5] The rising shares of bond finance, dollar credit and credit to EMEs became the distinguishing features of this phase. These developments reflected loose monetary policy and stronger incentives for investors to search for yield in EMEs, which had been largely left unscathed by the GFC.

The macro-financial environment has recently undergone another major shift, with implications for global liquidity. The global surge in inflation triggered a rapid and synchronised monetary tightening worldwide, which ended the "low-for-long" regime of phase 2. As US interest rates rose earlier and faster than those of other major currencies, the dollar reached new heights. The general tightening of financial

Global liquidity – markers and phases[1] Table 1

		Great Financial Crisis (GFC) ↓		Inflation surge and global tightening ↓
		Phase 1	**Phase 2**	**Phase 3?**
Main observable changes in:		Q1 2003–Q1 2009	Q2 2009–Q2 2021	Q3 2021–current
Aggregate	GLI stock (% of GDP)	Soaring	Rising	Falling
	GLI growth (%)	High	Positive	Negative/slowing
Composition	Bond share (%)	Falling	Rising	Rising
	Dollar share (%)	Rising	Rising	Falling
	EME share (%)	Falling	Rising	Falling

[1] Coloured cells mark salient developments in foreign currency credit that help distinguish one phase from another.

Source: Authors' elaboration.

[4] The terms bonds and bond markets in this feature refer to aggregates that comprise all debt securities included in the BIS IDS (Box A).

[5] In the GLIs, this aggregate includes all emerging and developing economies (BIS country grouping).

conditions made credit more expensive overall and may have reduced the incentives to search for yield in EMEs.

Did this shift in the macro-financial environment usher in a new phase of global liquidity? The latest data reveal several distinguishing patterns. First, foreign currency credit has contracted significantly as a share of global GDP. Second, this contraction was driven by a decline in dollar credit, matching the relatively tight stance in US monetary policy and driving down the share of the dollar in the total. While yen credit to non-bank borrowers outside Japan grew, as the central bank in the country kept policy rates low and the currency weakened, the small underlying volumes did not have a material impact on global liquidity. And third, EME borrowers faced a particularly steep credit contraction.

This article proceeds as follows. First, it steps through the first two phases in turn, pointing to their distinguishing features and the macro-financial environment that enabled them. It then lays out the recent change in the macro-financial environment and highlights the attendant changes in global liquidity. The final section concludes. A Box explains the BIS global liquidity indicators.

Phase 1: Bank-driven expansion

The first phase of global liquidity saw a large expansion in foreign currency credit, starting in the early 2000s and leading up to the GFC. During this period, the combined stock of foreign currency credit in dollars, euros and yen doubled, from $5 trillion in Q1 2003 to $10 trillion in Q1 2008 (Graph 1.A). As a share of world GDP, it rose from 13% to a peak of 17%.[6]

The rapid expansion in banks' international activity drove this dramatic growth and shifted the composition of credit. The share of foreign currency credit in the form of bonds fell by 10 percentage points as bank credit expanded (Graph 2.A).[7] Dollar credit grew rapidly even from a large base (Graph 1.A), with a year-on-year growth rate consistently above 10% and peaking at 24% in 2007 (Graph 1.B). During this phase, dollar credit rose as a share of overall credit, reaching 63% by Q1 2009 (Graph 2.B). This expansion came in the context of a broader build-up, centred on the United States and Europe, with European banks fuelling credit- and housing-market booms in advanced economies (Borio and Disyatat (2011), Shin (2011), Borio and McGuire (2004)).[8] Euro credit outside the euro area also saw brisk growth, averaging 10% over the phase. Starting from a small base, yen credit outside Japan caught the back end of the rising tide.

This boom in global liquidity occurred amid a permissive macro-financial and policy environment. Banks faced few regulatory limits on their leverage (Shin (2013), McCauley et al (2021)). This enabled a rapid expansion of bank credit, including to

[6] As a ratio to GDP, foreign currency credit may be lower than measures of external debt as it does not include local currency credit borrowed from abroad (eg US dollar external debt of US residents) and focuses only on the foreign currency debt of the non-bank sector (ie excluding banks).

[7] The bond share fell from 50% at end-2002 to 40% in Q2 2008 for dollar credit, from 57% to 48% for euro credit, and from 68% to 57% for yen credit.

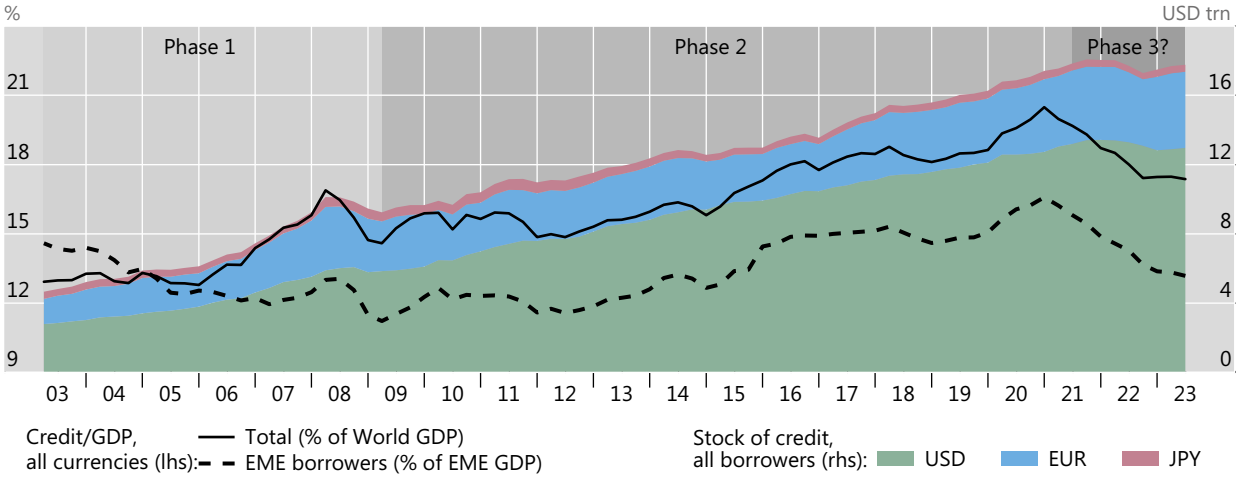
[8] The share of dollar credit to EME borrowers fell from 40% in 2000 to 30% in 2007. For overall foreign currency credit, this share dropped from 33% to 25% over that period (Graph 2.C). This trend towards advanced economy borrowers would be even more marked if dollar credit from European banks to US borrowers – a key development during this period – was included.

real estate, as lending standards declined. Banks headquartered in Europe led the expansion, pushing the year-on-year growth rate of international bank credit up to a peak of 20% (McCauley et al (2021)). Monetary policy remained behind the curve, with rates largely responding to but failing to stem the expansion of bank credit (Graph 3.A). Rapid foreign currency credit growth can be particularly concerning when it fuels domestic credit growth in the borrowing jurisdiction (Borio et al (2011), CGFS (2011)). It can exacerbate domestic credit cycles and create fertile ground for a crisis, as seen during the GFC.

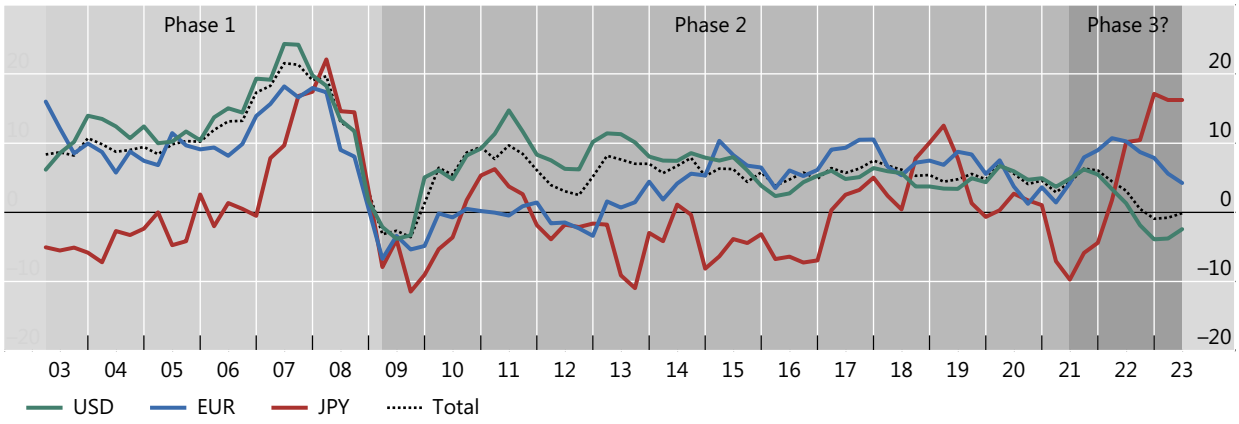
Foreign currency credit in the three major currencies[1]

Credit to non-bank borrowers — Graph 1

A. Credit stock[2]



B. Year-on-year growth, in per cent[3]



[1] Euro- and yen-denominated credit is converted to US dollars using the current exchange rate. [2] Stocks include statistical breaks. [3] Quarterly changes adjusted for breaks in series and exchange rate fluctuations. Total credit growth in US dollars at Q1 2009 exchange rates.

Sources: IMF, *World Economic Outlook*; BIS global liquidity indicators; authors' calculations.

Box A

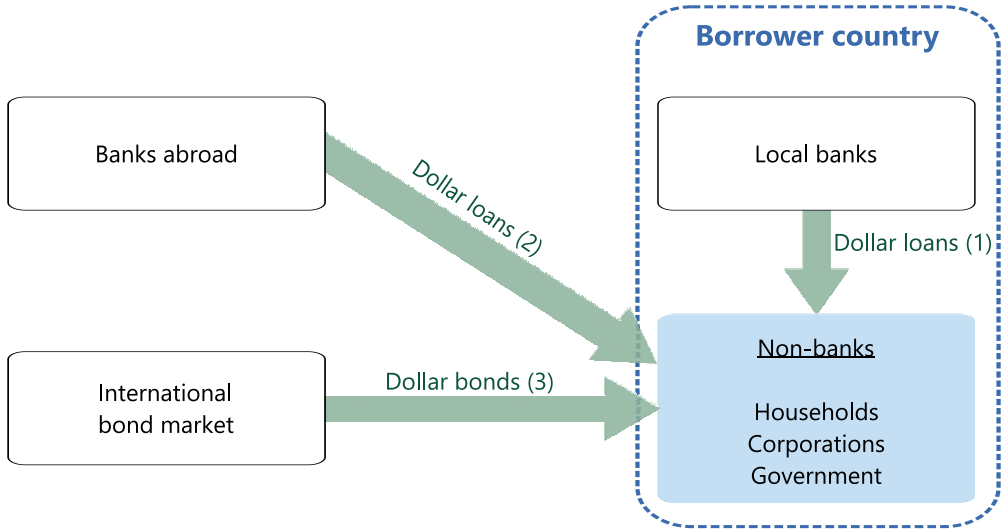
The BIS global liquidity indicators: a brief refresher

The term "global liquidity" refers to the ease of financing in global financial markets (CGFS (2011), Cohen et al (2017)). The concept has various price and non-price dimensions, with foreign currency credit (from the borrower's perspective) as a core indicator. The BIS global liquidity indicators (GLIs) track foreign-currency credit to *non-bank* borrowers on a quarterly basis. They start in 2000 and cover both loans extended by banks and funding from global bond markets through the issuance of international debt securities (IDS).① The main focus is on foreign currency credit denominated in three major reserve currencies (US dollars, euros and Japanese yen) to non-residents, ie borrowers outside the respective currency areas.②

The GLIs have three main components. Consider for example dollar credit to borrowers outside the United States (Graph A1). For a given borrower country, the GLIs measure the US dollar credit to residents by combining three series from BIS statistics: (1) dollar-denominated bank loans from local banks; (2) from banks abroad – where (1)+(2) are part of banks' "international claims"; and (3) dollars raised by issuing international bonds. Corresponding aggregates are compiled for euro- and yen-denominated lending to borrowers outside the euro area and Japan, respectively.

Global liquidity indicator components

Dollar credit to borrowers outside the United States — Graph A1



Source: Authors' elaboration.

The GLIs provide a more comprehensive view of foreign currency credit than most standard statistics. Other statistics more commonly track only a country's external liabilities, and generally do so for all borrowers in all currencies combined. The GLIs are similar to these data sets in that they capture cross-border foreign currency credit, but differ along a few dimensions: they capture locally extended foreign currency credit by banks (arrow 1); they focus on non-bank borrowers; and they separately capture credit denominated in dollars, euros and yen.

Like any measure, the GLIs have their shortcomings. The focus on international bonds (arrow 3) leaves out foreign currency bonds issued in the local market where the borrower resides (likely small and also missed by traditional statistics). From the perspective of specific countries or country groups, the GLIs are reported on a residence basis and thus can miss any bonds issued through affiliates located offshore.③ For example a dollar bond issued by a Brazilian firm's subsidiary in the Cayman Islands will be attributed to borrowers located in the

Cayman Islands and so captured in the global aggregate, but not reflected in the GLI figures for emerging market economies or Brazil (Aldasoro et al (2021)). More fundamentally, neither the GLIs nor any other statistics track the trillions in foreign currency debt that borrowers incur through FX swaps and forwards (Borio et al (2022)).

Table A1 quotes the main components of the GLIs as of Q2 2023. Across the three major currencies, the bulk of global liquidity is denominated in US dollars.

Q2 2023, in trillions of current US dollars — Table A1

	Global aggregate			EMEs		
	USD	EUR	JPY	USD	EUR	JPY
GLI foreign currency total	13.0	4.4	0.4	5.1	1.0	0.1
of which:						
International bonds	7.1	2.6	0.1	2.5	0.4	0.0
Bank loans	5.9	1.8	0.3	2.6	0.6	0.1

Source: BIS global liquidity indicators.

① International debt securities (IDS) include bonds issued outside the local market of the country where the borrower resides. Aldasoro et al (2021) explain what constitutes an IDS. ② For more information, see the GLI Methodology. ③ There are no comprehensive aggregate data sets for non-banks' foreign currency debt that are organised by the borrower's nationality.

Phase 2: The rise of bond markets

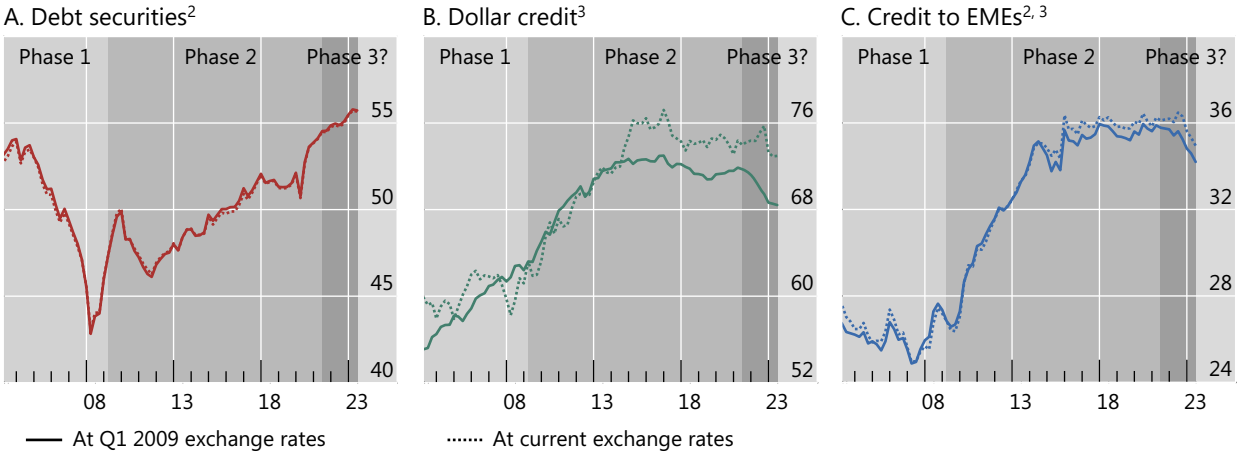
The end of the GFC ushered in a second phase of global liquidity. Foreign currency credit contracted for one to two years after the GFC, before returning to steady growth (Graph 1). This growth kept pace with GDP through 2012, when credit-to-GDP began to rise again, although more moderately than in phase 1.

The rise of bond markets is a defining feature of this phase (Shin (2013)), along with strong growth in dollar and EME credit. International bank lending collapsed and bond markets expanded in the GFC's wake. The share of foreign currency credit in the form of bonds rose from a trough of 43% in Q1 2008 to 55% by end-Q2 2021 (Graph 2.A). The dollar, already the dominant currency, saw a further rise in its share in global credit markets (CGFS (2020), Maggiori et al (2020)) (Graph 2.B).[9] Dollar credit growth remained above that of the euro through end-2014 (Graph 1.B). In contrast to the first phase, credit to EME borrowers took centre stage, with their share in foreign currency credit rising from 26% in Q2 2009 to 36% by end-2015 (Graph 2.C). This share would be larger still if the data included offshore issuance by EME firms issuing bonds via their subsidiaries located in advanced economies (Shin (2013), Aldasoro et al (2021), McCauley et al (2015a), Avdjiev et al (2020b)).

[9] The share of dollars in total foreign currency credit rose from about 63% in Q2 2009 to 73% by Q4 2016 (at fixed exchange rates).

Composition of global liquidity

As a percentage of total foreign currency credit[1] to non-bank borrowers — Graph 2

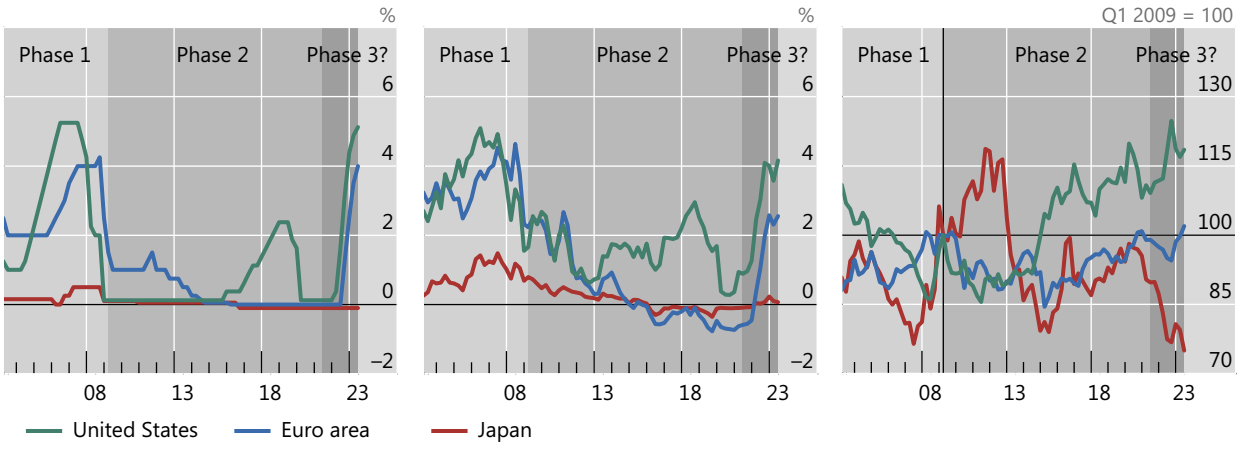


[1] Dollar, euro and yen credit. [2] All three currencies. [3] All instruments.

Sources: BIS global liquidity indicators; authors' calculations.

Interest rates and exchange rates in the major currency areas

Graph 3



[1] An increase indicates an appreciation of the currency against the main trade partners.

Sources: Bloomberg; national data.

These patterns reflected a new macro-financial and policy environment. Tighter regulation and supervision constrained banks (Ichiue and Lambert (2016)), and many banks adopted more conservative business models. At the same time, the Federal Reserve pushed its policy rate to zero, kept it there and engaged in quantitative easing (QE), thus flattening the yield curve and weakening the US dollar early in phase 2 (Graph 3). The upshot of these developments was a boost in US dollar-denominated bond issuance on the back of low borrowing costs. Euro policy rates also fell but initially lagged behind dollar rates in the first half of this phase (Graph 3.A). Combined with a retrenchment by European banks in the aftermath of the euro area crisis (McCauley et al (2019)), this kept growth in euro credit subdued

while dollar credit expanded.[10] Compressed yields (Graph 3.B), particularly at longer maturities, drove investors to search for yield by investing dollars in EMEs, especially via bonds (McCauley et al (2015b)).[11]

A new phase? Dollar tightening

The events of the past few years represent a seismic shift in the macro-financial environment. Monetary easing in response to the Covid-19 pandemic prolonged the accommodative stance. When inflation surged in 2021 against a backdrop of disrupted supply chains and rising geopolitical tensions, central banks embarked on the most rapid and synchronised worldwide tightening in decades, leaving behind the "low-for-long" regime associated with phase 2 (Graph 3.A). US policy rates rose earlier and, in 2022, faster than those in the euro area and Japan.[12] Central banks also began to unwind QE, contributing to the rise in long-term bond yields (Graph 3.B).

Does the sharp turn in economic conditions and associated policies herald a new phase of global liquidity? One would expect credit to shrink in response to the tighter monetary stance. One would also expect dollar credit to fall by more, given the relatively fast rise and high levels of dollar-denominated rates as well as a strengthening dollar (Graph 3.C). Furthermore, a relative retreat from EMEs may occur, as rising rates across advanced economies could obviate the need to search for yield in EMEs.

We see growing evidence for these shifts in the data since mid-2021.

Foreign currency credit has begun to contract in aggregate. The overall stock of foreign currency credit stood 2% lower at mid-2023 than at its peak two years earlier (Graph 1.A). The contraction is more evident when credit is scaled by GDP – from 20% at end-Q2 2021 to 17% at end-Q2 2023 (solid line).

While the relative pace of bond credit was a key factor separating the first two phases, it does not seem to mark the transition to a potential third phase. From mid-2021, the growth of credit from bond markets slowed to a standstill but its share kept rising because bank lending declined. Banks of various nationalities drove the decline in lending, with the drop in EME banks' dollar lending being particularly sharp.

Dollar-denominated credit witnessed a steeper contraction, matching the tighter stance of US monetary policy compared with that of the euro area and Japan. Year-on-year growth in dollar credit fell from 6% in Q3 2021 to negative 4% at end-2022, staying negative for the latest four quarters in the data (Graph 1.B).[13] By contrast, euro credit growth merely slowed, and yen growth even accelerated over the same period. As a result, the dollar share in foreign currency credit declined from 72% in mid-2021 to 68% by mid-2023 (evaluated at constant exchange rates) (Graph 2.B). The divergence in credit growth across the dollar, euro and yen reflects their

[10] Yen rates remained low throughout all phases.

[11] This phase also saw the development of local currency EME government bonds as a distinct asset class. If the rising share of *local currency* bonds held by foreigners were included in our calculations, the increasing trend of international credit to EMEs would be steeper (Du and Schreger (2022), Onen et al (2023)).

[12] A number of EMEs raised rates earlier and faster than advanced economies.

[13] The other major contraction of year-on-year USD credit growth in the data, immediately following the GFC, similarly reached a low point of –4%, and lasted three quarters.

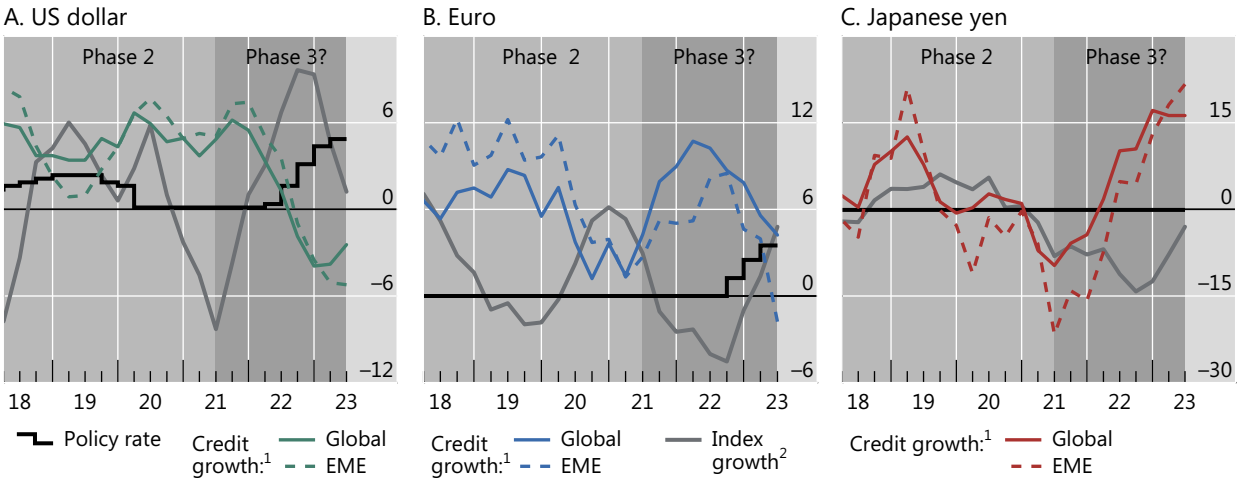
respective policy rates and exchange rates, with these variables moving in lockstep (Graph 4).[14]

Credit to EME borrowers has seen an even steeper decline than overall credit. Euro credit to these borrowers shrank by 2% year on year at end-Q2 2023, even as euro credit overall continued to expand.[15] Dollar credit – the predominant foreign funding currency for most EMEs – shrank by 5% year on year by mid-2023 (Graph 4.A). The largest drops – two quarterly declines by more than $100 billion each – occurred in the second half of 2022, when US rates rose sharply and the US dollar reached the highest level since the 1980s. Time and again, dollar strength has been associated with tighter global financial conditions, especially for EMEs (Bruno and Shin (2015), Avdjiev et al (2019), Obstfeld and Zhou (2023)).

Foreign currency credit growth, exchange rates and policy rates

In per cent

Graph 4



[1] Credit to non-bank borrowers. Year-on-year growth rates, adjusted for breaks in series and exchange rate effects. [2] Year-on-year growth rate of nominal effective exchange rate index (NEER). An increase indicates appreciation of the currency.

Sources: BIS global liquidity indicators; national data; authors' calculations.

Conclusion

The tightening in foreign currency credit since 2021 is a departure from pre-pandemic trends. Whether this marks a new phase of global liquidity would depend on the persistence of the prevailing macro-financial environment. Both dollar and euro policy rates have risen further since the latest data points (Q2 2023), and central banks remain committed to the higher rates in order to tame inflation. Continued geopolitical uncertainty and fragmentation could additionally tighten credit conditions, thus furthering the current trends in global liquidity.

[14] Growth in yen credit exceeded 16% year on year driven by brisk bank lending. This growth is from a much smaller base and does not materially affect global liquidity overall.

[15] Growth of yen credit to EMEs (22%) outpaced yen credit growth overall (16%) at end-Q2 2023. One third of the increase in yen credit went to EME borrowers, two thirds of which are in emerging Asia.

A sustained tightening of credit conditions could expose financial vulnerabilities that had built up during the second phase, particularly for EMEs heavily reliant on foreign currency debt. A key question is whether the contraction in dollar credit, a staple of EME finances, will continue and at what pace. More generally, high interest rates put upward pressure on the cost of credit, typically a harbinger of credit losses that the financial system will need to absorb.

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Liquid assets at CCPs and systemic liquidity risks[1]

Central counterparties (CCPs) are key players in financial markets, holding $1.3 trillion in liquid assets as of June 2023. The holdings are highly concentrated in the eight largest CCPs, mainly based in Europe and the United States. Most of these liquid assets are "cash" – ie deposits at central banks, reverse repos and unsecured bank deposits – and government bonds, which CCPs receive as collateral for the transactions they clear. This collateral improves systemic resilience by shielding CCPs from counterparty risk. But it also imposes liquidity demands on market participants that, occasionally, could worsen financial stress during flight-to-safety episodes or lead to destabilising margin spirals. The dual role of government bonds as both collateral and underlying assets for CCP-cleared derivatives introduces "wrong-way" risk that can exacerbate these spirals.

JEL classification: G10, G23, G28.

The introduction of central clearing mandates in 2012 has considerably expanded the use of collateral as a risk mitigant. While the management of counterparty risk in bilaterally cleared transactions depends, in part, on long-standing business relationships, assessments of counterparties' creditworthiness are less prominent in centrally cleared trades. Instead, central counterparties (CCPs) rely mainly on the collateralisation of transactions. For one, they require initial margin (IM) from their counterparties: clearing members need to post low-risk and liquid assets to CCPs before trades can be settled. In addition, to mutualise potential default losses in excess of IM, CCPs also require their members to contribute to a default fund (DF). As a result, CCPs are in command of large pools of liquid assets (which we refer to as "collateral" for simplicity).

This special feature analyses the size and composition of CCP collateral, as well as the implications of its management for the broader financial system. We rely on data from public quantitative disclosures by CCPs and focus on three questions. First, from a bird's eye view: how do CCPs obtain and allocate their liquid assets? Second, turning to collateral composition: how does it vary across regions, currencies and asset classes? Third, from a financial stability perspective: how do shifts in the allocation of CCPs' liquidity holdings affect systemic liquidity risk?

Three main findings emerge from our analysis. First, total collateral posted with CCPs stands at $1.3 trillion and is predominantly comprised of cash – ie deposits at

[1] We thank Claudio Borio, Sebastian Doerr, Gastón Gelos, David MacDonald, Benoît Mojon, Hyun Song Shin, Takeshi Shirakami, Nikola Tarashev and Kevin Tracol for helpful comments and suggestions and Nicolas Lemercier and Ilaria Mattei for research assistance. The views expressed are those of the authors and do not necessarily reflect those of the BIS.

Key takeaways

- *Liquid assets held by CCPs stood at $1.3 trillion at mid-2023, mostly consisting of government bonds and "cash", ie deposits at central banks, reverse repos and unsecured deposits at banks.*
- *Collateral composition varies across regions: CCPs in Europe and the Americas predominantly hold government bonds, whereas cash dominates in CCPs domiciled in Asia-Pacific.*
- *Shifts in the composition of CCP liquid assets can amplify liquidity shortages in times of stress or contribute to downward price spirals for government bonds.*

central banks, reverse repos and unsecured deposits at banks – and government bonds. This amount is roughly equal to 10% of the high-quality liquid assets held by global systemically important banks. More than 85% of CCP liquid assets originate from the posted IM (where government bonds dominate) and the rest from the DF (where cash dominates). These liquid assets are concentrated at eight CCP conglomerates, which account for over 80% of the total in our data.

Second, the composition of liquid assets varies markedly across regions. CCPs in Europe and the Americas (mostly the United States) maintain high shares of their portfolios in government bonds, whereas cash prevails in Asia-Pacific CCPs. Within cash, American CCPs prefer deposits at central banks, European CCPs favour reverse repos and Asia-Pacific CCPs feature a balanced mix.

Third, while CCPs' loss-absorbing buffers support financial stability by protecting them from counterparty risk, they increase liquidity risk for market participants. During flight-to-safety episodes, for instance, some CCPs may place more cash with central banks rather than recycling it through reverse repos, thus removing liquid resources when they are in high demand. Alternatively, sudden and large IM hikes force deleveraging by derivative counterparties and can precipitate fire sales that lead to higher volatility and additional IM hikes, in so-called margin spirals. Moreover, the dual role of government bonds as collateral and underlying assets in some derivatives contracts introduces a form of "wrong-way" risk. That is, heightened volatility in the cash market for government bonds may raise collateral demand in derivative markets precisely when government bond prices are falling and the value of existing IM is thus eroding. Ultimately, this would increase the appeal of cash collateral and may contribute to a downward price spiral in government bonds.

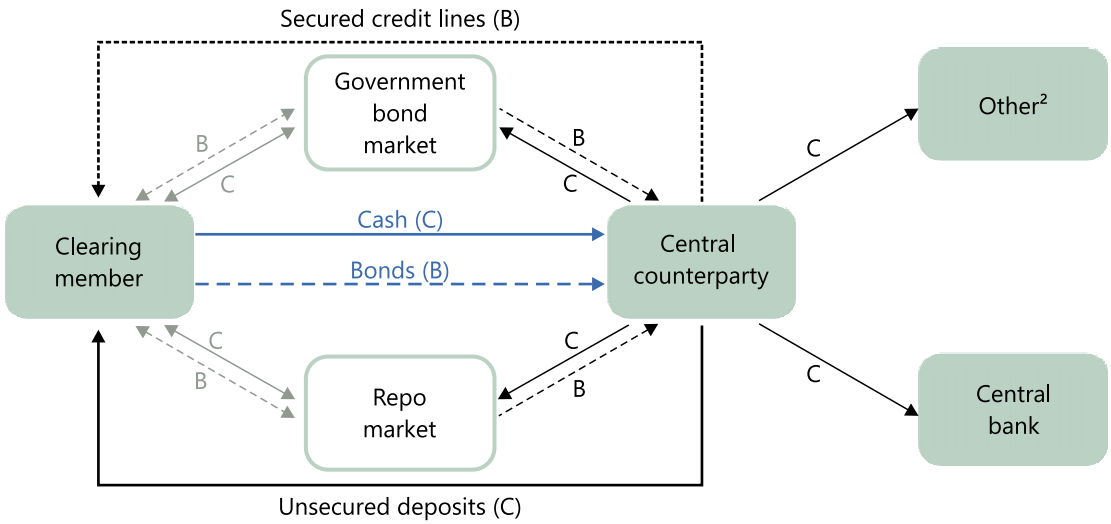
The rest of this article is structured as follows. The first section sets the stage with a brief conceptual discussion of how CCPs obtain and allocate their liquid assets. The second section reviews the landscape of liquid assets held by CCPs, focusing on their geographic, currency and asset class distribution. The third section analyses the potential impact of shifts in the allocation of CCPs' liquidity holdings on systemic liquidity risk. A final section concludes with policy implications. Box A describes the CCP disclosure data used throughout the article.

A bird's eye view of CCP collateral management

CCPs' soundness, critical for the resilience and stability of the financial system, rests on a well defined risk management framework.[2] As part of this framework, the loss-absorbing buffers available to CCPs mainly include clearing members' IM and their contributions to the DF (Faruqui et al (2018)).[3] Graph 1 presents a stylised map of collateral flows related to a CCP. To meet the CCP's IM and DF requirements, clearing members post liquid assets, usually in the form of cash (C, solid blue arrow) and government bonds (B, dashed blue arrow).

A CCP has various options to allocate the cash collateral received from members (Graph 1, solid black arrows).[4] The safest option is to deposit cash with central banks, which is free from credit and liquidity risks (Borio et al (2023)). This option, however, is available only to CCPs with central bank accounts, and may deliver relatively low yields. A second possibility is to lend cash via reverse repos or in unsecured deposits at banks – some of which may be clearing members. Cash lent in reverse repos is

Liquid assets in central counterparties: a stylised map[1] Graph 1



[1] Blue arrows denote collateral inflows to central counterparties (CCPs). Black arrows denote the subsequent allocation of liquid assets by CCPs. See technical annex for further details. [2] Includes gold, equity, mutual funds, other bonds and other liquid assets.

Source: Authors' elaboration.

[2] At the core of this framework is the "default waterfall", which specifies the order of loss absorption by the resources available to CCPs in the event of a clearing member's default. When a clearing member defaults, its IM is the first buffer to absorb the resulting losses. The DF absorbs any losses in excess of this IM, mutualising them across the surviving members.

[3] CCP capital is also part of the risk management framework, but its size is small relative to IM and DF (Huang and Takáts (2023)). In turn, CCPs' committed loss-absorbing resources are called upon only when the IM of a defaulting counterparty and the DF are depleted. Thus, they do not count as liquid assets from a CCP's standpoint. In addition, the cash that CCPs typically use to transfer variation margin between counterparties is also not part of liquidity holdings.

[4] In doing so, CCPs must always stay within the realm of high-quality, low-risk liquid assets and are subject to strict investment policies. Specific requirements for the type and amounts of liquid assets (and the allocation thereof) vary by jurisdiction and are subject to regulatory oversight.

secured with high-quality collateral (typically government bonds), mitigating counterparty risk. Alternatively, CCPs' unsecured bank deposits carry more risk but receive higher interest rates. A third option is to invest the cash in other low-risk, easily marketable financial instruments ("other" in Graph 1).

CCPs also receive non-cash collateral from clearing members, typically government bonds. CCPs can use this non-cash collateral, together with any other high-quality liquid securities, in order to arrange secured credit lines with banks – a way of monetising these assets.[5] The rest of the non-cash collateral received typically comprises highly marketable assets that should be easy to convert into cash without material market price impact.

The landscape of liquid assets held by CCPs

We use CCP quantitative disclosure data to study how CCPs allocate the collateral obtained from clearing members across different types of liquid assets. Our sample has 31 CCP groups in total, encompassing 184 clearing services. To ensure our sample is representative and consistent, we use data from Q1 2018 to Q2 2023 (Box A).

Overview of collateral origination

IM accounts for the bulk of the collateral held by CCPs (about 85%), with the rest coming from members' DF. IM increased from $670 billion in March 2018 to $1.14 trillion in June 2023, ie about 70% (Graph 2.A). This growth reflects, in part, the trend towards a higher use of collateral in financial markets (Borio et al (2023)). DF also increased steadily during our sample period, from $120 billion to $160 billion.

IM saw pronounced spikes in our sample. Most notably, these occurred in early 2020 (Covid-19) and 2022 (invasion of Ukraine), reflecting the risk-sensitive nature of IM models as well as shifts in risk perceptions. Sharp shifts in those perceptions sometimes lead to large adjustments in IM that may substantially affect the leverage embedded in derivatives transactions (Avalos et al (2023)). In comparison, DF is less responsive to short-run market developments.

Central clearing is highly concentrated. Eight CCP groups[6] with a global reach account for over 80% of total IM and 90% of total DF in our sample (Graph 2.B), for a combined amount of about $1.1 trillion as of June 2023. Concentration is partly a structural feature of cleared markets, as multilateral netting benefits for traders are greater when their positions are distributed across a smaller number of CCPs (Duffie and Zhu (2011)). In addition, concentration can rise sharply when markets become

[5] To finance their liquidity needs, CCPs may also have access to unsecured credit lines.

[6] The eight CCP groups are the largest CCPs in terms of activity across regions and asset classes. They correspond to the "MajorCCP" flag in Box A.

Box A

Inside central clearing: decoding CCP public quantitative disclosures

As part of the CPMI-IOSCO *Principles for financial market infrastructures*, CCPs are required to publish information on their balance sheets and operations at a quarterly frequency.① These so-called public quantitative disclosures (PQDs) aim to provide information such that stakeholders (including authorities, market participants and the public) can: (i) assess and compare CCP risk controls; (ii) have a clear and accurate understanding of a CCP's risks; (iii) assess CCPs' importance and impact on systemic risk; and (iv) understand and assess the risks of participating in a CCP.

We source quantitative disclosure data from ClarusFT, a commercial data provider that aggregates the dispersed and heterogenous data published by individual CCPs. Disclosure data began in Q3 2015, but many CCPs only started reporting consistently from 2018 – we hence only use data from Q1 2018 to Q2 2023 to ensure sample consistency. Moreover, we select CCP groups that have at least 20 quarters of data. Our sample thus comprises 184 CCP clearing services② (out of a total of 219 that publish disclosures) belonging to 31 CCP groups. Table A1 allocates the CCP groups to countries and regions, and "MajorCCP" flags the largest eight CCP groups.

As we capture the largest CCPs, our sample is representative of the aggregate. For example, our cleaned data set accounts for over 93% of total reported initial margins in the ClarusFT database. Moreover, our data exhibit similar trends and levels as those revealed by CCP Global (previously known as CCP12), a CCP industry association.③

CCP mappings in the cleaned data set

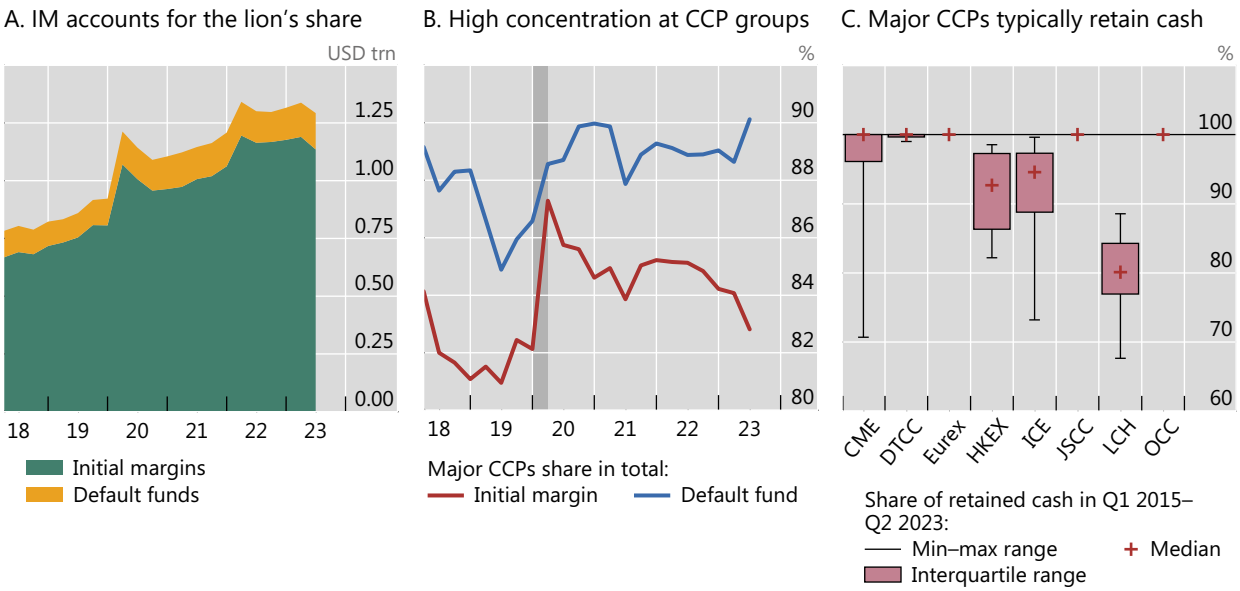
Table A1

Group	Subgroup	Country	Region	MajorCCP	Group	Subgroup	Country	Region	MajorCCP
ASXCLF	ASXCLF	AU	Asia-Pacific	0	JSCC	JSCC	JP	Asia-Pacific	1
ATHEXClear	ATHEXClear	GR	Europe	0	KDWP	KDWP	PL	Europe	0
B3	B3	BR	Americas	0	KELER	KELER	HU	Europe	0
BMEC	BMEC	ES	Europe	0	LCH	LCH SA	FR	Europe	1
Euronext	Euronext	IT	Europe	0	LCH	LCH LTD	GB	Europe	1
CCIL	CCIL	IN	Asia-Pacific	0	LME	LME	GB	Europe	0
CCPA	CCPA	AT	Europe	0	Nasdaq	Nasdaq	SE	Europe	0
CDCC	CDCC	CL	Americas	0	Nodal	Nodal	US	Americas	0
CME	CME	US	Americas	1	OCC	OCC	US	Americas	1
DTCC	DTCC	US	Americas	1	OMIClear	OMIClear	PT	Europe	0
Eurex	Eurex	DE	Europe	1	SCH	SCH	CN	Asia-Pacific	0
EuroCCP	EuroCCP	NL	Europe	0	SGX-CDP	SGX-CDP	SG	Asia-Pacific	0
HKEX	HKEX	HK	Asia-Pacific	1	SIX	SIX	CH	Europe	0
ICE	ICE US	US	Americas	1	TAIFEX	TAIFEX	TW	Asia-Pacific	0
ICE	ICE NGX	CA	Americas	1	TFX	TFX	JP	Asia-Pacific	0
ICE	ICE EU	GB	Europe	1					

Source: ClarusFT.

① BIS Committee on Payments and Market Infrastructures-International Organization of Securities Commissions, *Public quantitative disclosure standards for central counterparties*, 2015. ② A CCP group typically provides several clearing services for different asset classes, sometimes in different regions. ③ CCP Global, *Public quantitative disclosure – PQD quarterly trends report*, 2023.

Landscape of liquid assets held by CCPs[1] Graph 2



[1] See Table 1 for information on major CCPs.

Sources: ClarusFT; authors' calculations.

stressed, as revealed by the surge in the share of DF and especially IM held by the eight global CCP groups at the start of the pandemic.

The collateral received by CCPs is intended to be available at short notice in case of defaults, so its liquidity is key to ensuring CCP resilience. To minimise liquidity risk, most CCPs keep the cash collateral they receive from clearing members rather than investing it in other assets with higher returns. Four of the eight global CCPs consistently follow this practice (Graph 2.C). The other four occasionally allocate a limited fraction – typically less than 25% – to other high-quality liquid assets.

Collateral composition

CCPs' collateral composition differs along at least three dimensions: (i) IM versus DF; (ii) regions and associated currencies; and (iii) types of contract cleared by the eight global CCPs.

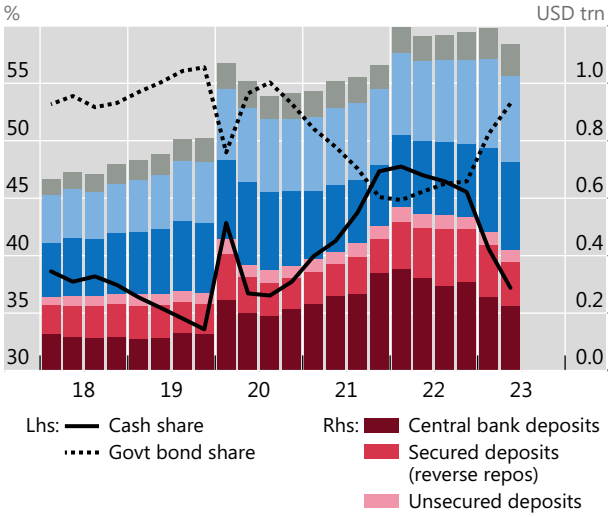
Government bonds dominate cash in IM. As of end-June 2023, CCPs in our sample held around $600 billion in government bonds, equally split between foreign and domestic. The share of such bonds in IM was usually above 50% during our sample period (Graph 3.A, dotted black line). The predominance of government bonds in total IM partly reflects their "quasi-money" nature, given their wide acceptability and high liquidity (BIS (2023)). In parallel, the share of cash in IM oscillated between 33 and 48% (solid black line). As the safest option, central bank deposits account for the lion's share of cash in IM.

In contrast, cash in various forms represents the majority of DF. The share of cash in DF has typically hovered around 60%, mostly in the form of central bank deposits (Graph 3.B). Such a high share of the most liquid assets presumably reflects the high

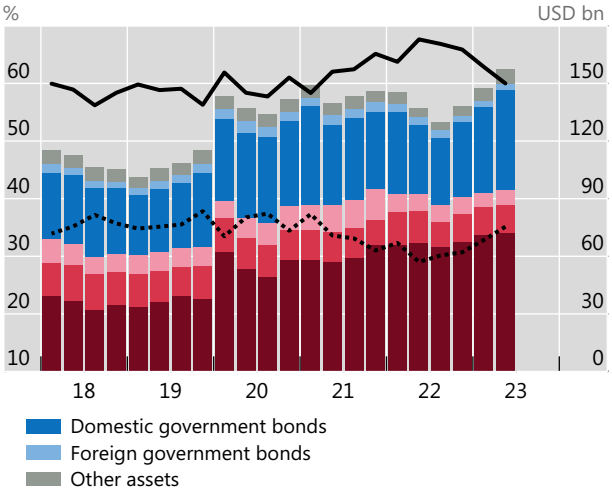
Collateral composition of IM and DF

Graph 3

A. The majority of IM is government bonds, followed by cash



B. DF comprises mainly cash, especially central bank deposits



Sources: ClarusFT; authors' calculations.

likelihood that, if a DF is called upon to cover losses from defaulting members, the prevailing environment will be one of financial stress.

Collateral composition varies greatly across regions. CCPs located in Europe and the Americas (mostly the United States) have relatively high shares of government bonds in total collateral (Graph 4.A, blue areas). In the case of European CCPs, it is foreign bonds that dominate, whereas for CCPs in the Americas it is domestic bonds – most likely US Treasuries. In contrast, cash holdings dominate in Asia-Pacific CCPs, representing about 80% of all collateral held. The allocation to various types of cash also differs across regions (red areas). CCPs in the Americas predominantly rely on central bank deposits, those in Europe place more cash in reverse repos, and Asia-Pacific CCPs have a rather even split across central bank deposits, reverse repos and, notably, unsecured deposits.[7]

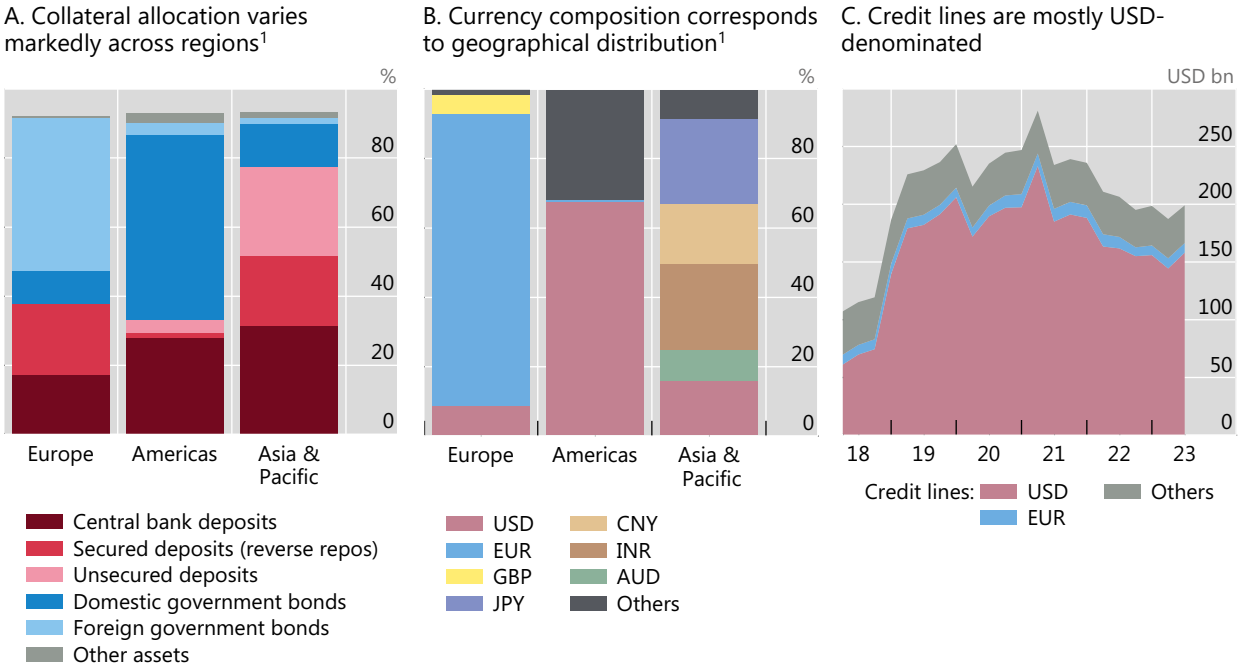
In terms of currencies, the US dollar and euro dominate the overall pool of liquid resources, as the largest global CCPs are domiciled in the United States and Europe. As of end-June 2023, over 80% of European CCPs' liquid resources were denominated in euros (Graph 4.B). Likewise, for CCPs in the Americas, 67% of the liquid assets are in US dollars. For Asia-Pacific CCPs, the picture is more mixed, as they are domiciled in jurisdictions with various currencies. The top three currencies are the Japanese yen, Indian rupee and the renminbi, accounting for 25%, 25% and 17% of liquid resources, respectively. With a share of 16%, the dollar has a large heft in this region as well.

Credit lines are mostly denominated in US dollars and typically secured by the non-cash collateral CCPs receive.[8] Dollar credit lines expanded from $60 billion in March 2018 to $160 billion in June 2023 (Graph 4.C, red area). In contrast, euro-

[7] The small share of unsecured deposits in European CCPs – less than 0.1% – is consistent with the European Market Infrastructure Regulation (EMIR), which caps them at 5% of IM.

[8] Credit lines are sometimes extended by clearing members (BCBS-CPMI-FSB-IOSCO (2018)).

Geographical variation of collateral composition Graph 4



[1] Based on June 2023 data.

Sources: ClarusFT; authors' calculations.

denominated credit lines remained largely below $10 billion (blue area). Overall, about 80% of outstanding credit lines, as of June 2023, are denominated in US dollars.

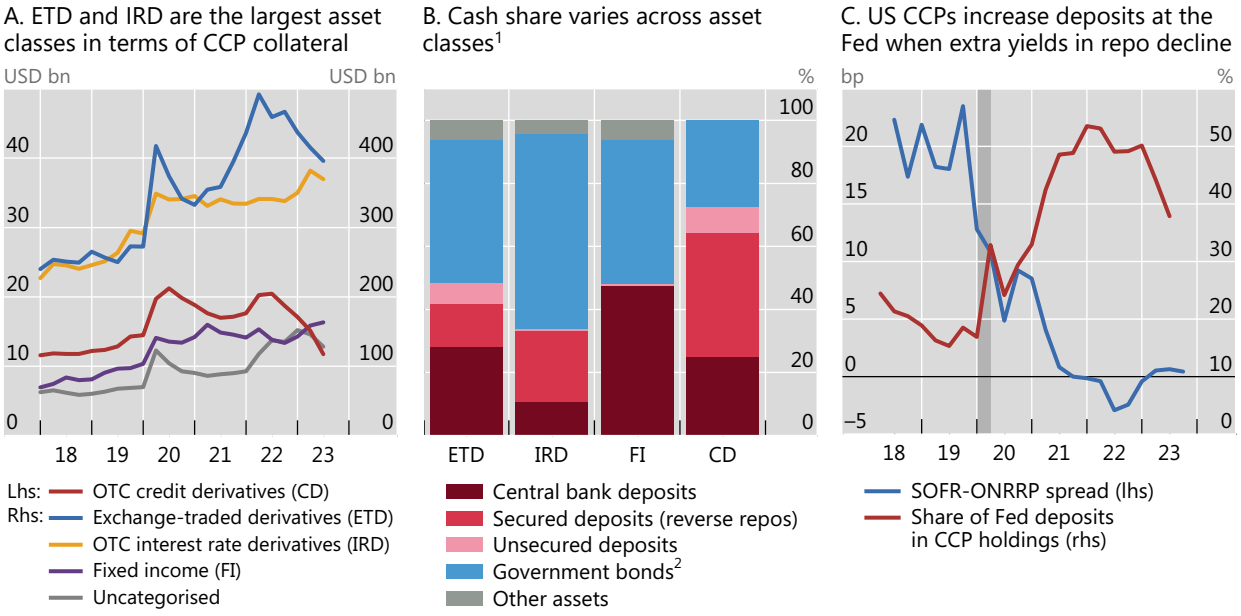
Our data reveal that collateral allocation across the eight global CCP groups also varies with the type of contract they clear. Three types stand out: (i) exchange-traded derivatives, mainly futures and options; (ii) over-the-counter (OTC) derivatives subject to central clearing mandates, including interest rate derivatives – mostly swaps – and credit derivatives – mostly credit default swaps; and (iii) other fixed income instruments, mainly repo and mortgage-backed securities lending. Exchange-traded derivatives contracts are the largest source of collateral, with $400 billion or 37% of the global total, as of June 2023. OTC interest rate derivatives contracts are a close runner-up at $370 billion, or 35% of total global collateral (Graph 5.A). Government bonds account for at least half of the collateral held by CCPs clearing OTC interest rate derivatives (Graph 5.B, blue areas), whereas cash dominates in CCPs clearing OTC credit derivatives (red areas). The collateral mix is more balanced for exchange-traded derivatives and fixed income instruments.

CCP liquidity holdings and market dynamics

We study two main channels through which CCP collateral composition and changes thereof can affect systemic liquidity.[9] The first is CCPs' shifts in cash allocation during "flight-to-safety" episodes. The second relates to changes in IM requirements, which

[9] For a recent review of other channels through which CCPs' operations may affect liquidity in the broader financial system, see King et al (2023).

Liquid assets concentrated in exchange-traded and OTC interest rate derivatives Graph 5



SOFR = secured overnight financing rate; ONRRP = Federal Reserve overnight reverse repurchase rate

The shaded area indicates Q1 2020.

[1] Based on Q2 2023 data. [2] Domestic and foreign currency-denominated bonds.

Sources: Federal Reserve Bank of St Louis, FRED; Bloomberg; ClarusFT; authors' calculations.

can lead to margin spirals, potentially exacerbated by the dual role of government bonds as collateral and as the underlying asset in derivatives.

CCP cash allocation and potential flight to safety

Differences in the cash composition across asset classes are relevant from a systemic liquidity perspective. For example, CCPs clearing fixed income instruments typically park a large share of the cash received from members in central bank deposits (Graph 5.B, dark red areas). This tightens liquidity conditions unless the central bank reinjects the reserves into the banking system. In contrast, CCPs clearing OTC interest rate and credit derivatives are more involved in repo markets, lending out 23% and 40% of their cash collateral through reverse repos, respectively. This recycles liquidity back into the financial system, lowering repo rates and easing funding conditions (Benos et al (2023)).

The differences in cash allocation across CCPs can relate to institutional constraints as well as CCP price sensitivity. For one, only some CCPs have access to deposit accounts at central banks – this is typically not the case for foreign-domiciled CCP entities.[10] Moreover, CCPs can be price-sensitive in the allocation of their cash holdings. For instance, major US CCPs ramped up their deposits at the Federal Reserve as the spread between the secured overnight financing rate and the Federal

[10] Central banks typically offer accounts to domestic banks, and in some cases domestic CCPs for financial stability and settlement efficiency reasons.

Reserve overnight reverse repurchase rate narrowed during 2020–21, that is, when the extra yields offered by repo markets shrank (Graph 5.C).

Beyond institutional constraints and price incentives, CCPs are not immune to "flight-to-safety" behaviour. Much like other market participants, they may protect themselves under stress by rushing to the most liquid and safest form of money available. Consistent with this, US CCPs' deposits with the Federal Reserve doubled in Q1 2020 (Covid-19 global outbreak), taking their share in total collateral from 17% to 33% (Graph 5.C, red line, greyed period). Both a response and a contributor to the dash for cash, CCP deposits at the central bank increased from 2.4% to 5.6% as a ratio to total bank reserves held at the central bank in Q1 2020 (Graph 6.A). A similar, even if more modest, spike occurred at the beginning of the war in Ukraine, when this share jumped from 4.4% to 5.2%.

Margin spirals and wrong-way risk

CCPs' adjustment of IM requirements can exacerbate systemic liquidity stress in some circumstances. This is because an increase in IM, ie a decrease in allowed leverage, tends to occur in times of stress.[11] Occasionally, this may lead to fire sales in cash and derivative markets, increasing volatility further, and triggering additional rounds of IM calls – ie a margin spiral (eg Brunnermeier and Pedersen (2009)).[12]

There is some evidence lending support to this conjecture. Using US Treasury futures data, we document that open interest (ie the notional value of futures contracts held by market participants) co-moves with the leverage allowed by IM requirements: as leverage fell, so did open interest (Graph 6.B). Moreover, using a vector autoregression (VAR) model that controls for the incidence of several contemporaneous factors, we also find that deleveraging leads to lower open interest in US Treasury futures (Graph 6.C). In other words, IM surges (ie cuts in permitted leverage) result in the closing of outstanding positions. In certain contexts, this could lead to market stress, consistent with documented margin spirals in recent episodes such as the March 2020 "dash for cash" and the September 2022 UK gilt market turmoil (Schrimpf et al (2020) and Breeden (2022)).

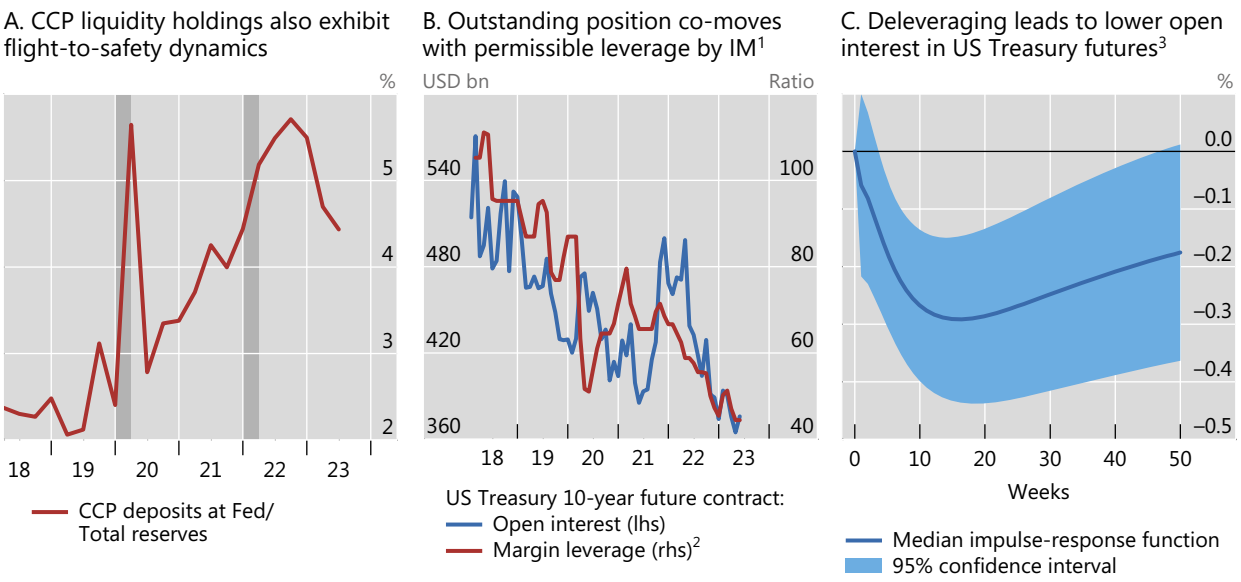
The dual role of government bonds as collateral and underlying assets in derivatives contracts can introduce "wrong-way" risk – ie the risk that collateral loses value precisely when counterparty risk increases. When volatility increases in government bond markets, CCPs demand more IM to counteract the heightened counterparty risk. If government bond prices are simultaneously falling, the value of existing collateral drops – effectively requiring even more collateral to maintain the positions. This increases the appeal of cash collateral and may exacerbate the downward pressure on government bond prices, reinforcing the spiral.

[11] This results from the combination of two features. First, IM requirements in derivatives markets (like haircuts in repo markets) mechanically limit the leverage of market participants. Second, IM requirements increase when market volatility rises, in order to mitigate counterparty credit risk (Murphy et al (2014) and Gurrola-Perez (2023)).

[12] In stress times with large price changes, variation margin calls that settle marked-to-market profits and losses could also lead to "loss spirals", which can be significant in size (FSB (2021)). However, this is out of this article's scope, given the focus on liquid assets actually held by CCPs.

CCP liquidity holdings and market dynamics

Graph 6



The shaded areas indicate Q1 2020 and Q1 2022.

[1] Monthly average. [2] Contract price over initial margin requested per contract. [3] The impulse-response function shows the response of US Treasury futures' open interest (in per cent) to a one standard deviation decrease in leverage (in per cent). Based on weekly data from January 20218 through June 2023. See technical annex for details.

Sources: Federal Reserve of St Louis, FRED; Bloomberg; ClarusFT; CME; authors' calculations.

Wrong-way risk dynamics appeared to play a role during the 2010–11 Irish sovereign debt crisis. At that time, investors liquidated their positions in Irish government bonds after a CCP raised the haircuts on such bonds when used as collateral. This led to lower prices of Irish government bonds, ie a widening of their spread vis-à-vis the yield on German bunds, triggering further haircuts, further position closures and ultimately a downward price spiral. From late 2010 to mid-2011, Irish yield spreads to German bunds rose from 40 to almost 120 basis points, while CCP haircuts on Irish government bonds increased from 0% to 80% (Altenhofen and Lohff (2013)).

While the size of CCP government bond holdings remains relatively small, the potential for self-reinforcing spirals should not be underestimated. In our data, the share of CCP holdings in total government debt securities outstanding as of end-2022 is highest for Brazilian, Chilean and Swedish government bond markets: 6.1%, 3.6% and 3.1%, respectively. The government bond holdings of the largest CCPs – typically active in the United States, the United Kingdom, Germany and France – account for even smaller shares of the respective markets. That said, recent stress in the UK gilt market serves as a stark reminder that self-reinforcing spirals originating in a relatively small market segment can potentially threaten the stability of the broader financial system.

Conclusion

CCPs currently manage a large pool of liquid assets, which supports financial stability by safeguarding them from counterparty risk. At the same time, risk does not disappear but morphs into systemic liquidity risk, especially in a context of margin spirals (Aramonte et al (2023)). After surveying the global landscape of CCP liquid assets and their allocation, we argue that under certain circumstances shifts in CCP collateral composition may contribute to the propagation of systemic liquidity stress.

Our findings underscore the importance of ongoing international policy work on CCP margining practices. The public quantitative disclosure data used above are an outcome of the CPMI-IOSCO Principles for Financial Market Infrastructures, which seek to enhance the monitoring of CCP-related risks. Further improving the quality and reliability of these disclosures would be of much value. For example, expanding the availability of granular data on the currency and maturity composition of CCP non-cash collateral could help to better assess wrong-way risk. In addition, our results complement existing work on margining procyclicality (eg BCBS-CPMI-IOSCO (2022) and FSB (2023)), as we quantify the size and composition of CCP liquidity holdings from a global perspective. Taken together, the findings of existing studies highlight the importance of striking a careful balance between ensuring CCP resilience, on the one hand, and avoiding systemic liquidity shortages, on the other.

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Technical annex

Throughout the special feature, we refer only to the post-haircut values of collateral held by CCPs.

Graph 1: For simplicity, the graph assumes that unsecured deposits and secured credit lines are with clearing member banks. In practice, they can be with any bank.

Graph 2.C: Based on the percentage of total participant cash held as cash deposits (including through reverse repos) reported by individual entities of the major CCP groups. The group-level total participant cash held as cash deposits (including through reverse repos) is computed as the weighted average of the entity-level share, using total cash received by the respective entities as the weights. For DTCC, the simple average is applied for the three entities as total cash received is not available in ClarusFT.

Graph 4.B: The very large share of the euro in the currency composition of CCPs in Europe may be due to data reporting issues.

Graph 6.C: The variables in the vector autoregression model include (in order): log(price), volatility, log(allowed leverage) and log(open interest) – all referring to 10-year US Treasury futures. Volatility is defined as the 30-day moving standard deviation of the US Treasury 10-year bond future price daily change, annualised. Allowed leverage is defined as the price of a contract divided by initial margin in US dollars. The model is identified using a Cholesky decomposition, such that the order of variables determines the temporal sequence of how innovations in one variable affect the others, eg innovations in log(price) contemporaneously affect all other variables, whereas it is not itself contemporaneously affected by innovations in other variables. The estimation is based on weekly data, specifically using the Friday observation of each week.

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Who borrows from money market funds?[1]

Classifying all borrowers in about two thirds of the $9 trillion global money market fund (MMF) market, we document that MMFs extend funding primarily to banks and governments. Funding to other non-bank financial institutions (NBFIs) and non-financial corporates is a much smaller fraction of MMFs' assets. When monetary policy tightens, MMF assets increase by about 34 cents for every dollar of bank deposit contraction. MMFs allocate most of this increase to either governments or banks, and only a marginal share to other NBFIs, likely funding arbitrage trades by hedge funds. These findings cast doubt on the assumption, prevalent in the literature, that MMF funding enables other NBFIs to offset a material portion of the contraction in banks' credit supply when rates rise.

JEL classification: E52, G15, G21, G23.

Money market funds (MMFs) play a key role in short-term funding markets – with over $9 trillion in assets under management (AUM) globally as of end-2021 (FSB (2022)). Recurrent episodes of stress in the sector have underscored liquidity risks of systemic importance. At the same time, the attractive returns offered by MMFs have sparked concerns about the stability of banks' deposit funding when interest rates rise. Addressing risks emanating from MMFs requires a clear understanding of who borrows from them, and how their assets and investments change with policy rates.

This special feature provides a taxonomy of MMF investments and analyses how they respond to monetary policy tightening. We draw on detailed and up-to-date information on around two thirds of the global MMF market. Using entity-level information, we classify borrowers into governments, banks, other non-bank financial institutions (NBFIs) and non-financial corporations (NFCs). We contribute to the literature by clearly identifying the instruments through which specific borrower types obtain funding. Zooming in on the US segment of the market, we then show how MMF investments change with monetary policy. We investigate the common narrative that, when policy rates rise, the funding provided by MMFs to other NBFIs is sufficient to materially dent the transmission of monetary policy to the real economy.

Three findings emerge from our analysis. First, the size of the MMF industry is at record levels and the dollar looms large in AUM. As of September 2023, US MMF –

[1] We thank Douglas Araujo, Claudio Borio, Gaston Gelos, Bryan Hardy, Peter Hoerdahl, Benoit Mojon, Andreas Schrimpf, Hyun Song Shin, Nikola Tarashev and Kevin Tracol for helpful comments and suggestions, and Albert Pierres Tejada and Henry Williams for outstanding research assistance. The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

Key takeaways

- *With more than $9 trillion in assets under management (AUM) globally, money market funds (MMFs) are key players in short-term funding markets, especially in US dollars.*
- *Other than to governments, MMFs primarily lend to banks, while their lending to other non-bank financial institutions (NBFIs) and non-financial corporates is an order of magnitude smaller.*
- *When monetary policy tightens, MMFs deploy almost the entire increase in their AUM as funding to governments and banks and do not finance any material credit expansion by other NBFIs.*

which can only lend in dollars – held $6.1 trillion in AUM. By comparison, total commercial bank assets in the United States stood at $23 trillion. MMFs domiciled outside the United States ("non-US MMFs") held an additional $1.2 trillion in AUM, with 60% in US dollars and the rest mostly in euros and pounds.

Second, besides governments, banks are MMFs' main borrowers by a wide margin. In an average month, over half of all US MMF lending is to the private sector ($1.8 trillion), of which 90% goes to banks, only 7% to other NBFIs and 3% to NFCs. Non-US MMF lending is even more skewed towards banks. In terms of instruments, repurchase agreements (repos) have become the primary means of bank and NBFI borrowing from MMFs. NFCs borrow almost exclusively through commercial paper (CP). Box A explores borrowing by Federal Home Loan Banks (FHLBs), which provide a roundabout way for MMFs to fund other banks when funding conditions are tight. Box B examines the role of the Fixed Income Clearing Corporation (FICC), which does not fund NFCs but supports arbitrage trades by leveraged funds.

Third, the AUM of MMFs increase during episodes of monetary policy tightening and banks absorb significantly more of these MMF inflows than NBFIs. Focusing on the United States, we find that when policy rates rise, AUM increases by about 34 cents for every dollar decline in bank deposits. More than half of this increase in AUM is allocated to governments, nearly 40% is absorbed by banks and only 3–4% by other NBFIs. Thus, while NBFIs may counteract some of the contraction in bank lending to the real economy during monetary tightening, our findings imply that the offset is not financed by MMFs, contrary to what is assumed in the literature.[2]

The rest of the article is structured as follows. The first section provides background on MMFs and their borrowers. The second section discusses patterns in borrowing from MMFs by governments, banks, NBFIs and NFCs. The third section explores the link between policy rates and borrowing from MMFs. The conclusion discusses policy implications.

Background on MMFs and their borrowers

MMFs are open-ended collective investment funds that invest in short-term instruments and seek to maintain stable share prices.[3] MMFs provide investors with

[2] For evidence on expanding NBFI lending to the real economy during monetary tightening, see Elliott, Meisenzahl, Peydro and Turner (2022) and Cucic and Gorea (2022). For arguments on MMFs financing other NBFIs' credit expansion, see Xiao (2020), Allen and Walther (2021), Elliott, Meisenzahl, Peydro and Turner (2022) and Elliott, Meisenzahl and Peydro (2023), among others.

[3] See Bouveret et al (2022) and Avalos and Xia (2021a,b) for background on MMFs.

a money-like asset while offering funding to governments (by purchasing securities) and the private sector (largely through repos, certificates of deposit (CD) and CP). What all borrowers have in common is a high credit standing, as regulation requires MMFs to invest in high-quality and low-risk instruments. Data from the Financial Stability Board (FSB (2022)) show that global MMF AUM stood at around $9 trillion as of end-2021 (Graph 1.A, brown line).

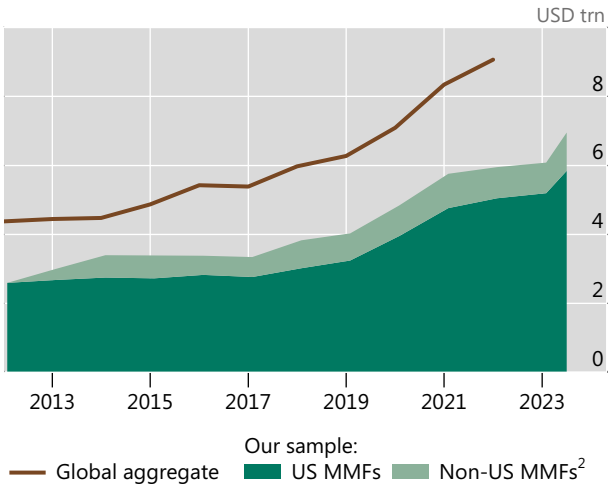
Our analysis draws on two data sets on the portfolio holdings of MMFs, offering up-to-date coverage of around two thirds of the global market.[4] The first, Crane, encompasses US MMFs' monthly investments from February 2011 to September 2023 (Graph 1.A, dark green area). The second, iMoneyNet, includes the monthly investments of non-US MMFs from January 2013 to September 2023 (light green area).[5] We observe the identity of lending funds and borrowers as well as information on amounts and instruments used. The AUM of US and non-US MMFs amount to $6.1 trillion and $1.2 trillion, respectively, as of September 2023. Together they represent, on average, about 67% of the global total when the series overlap.

Long-run aggregate data help to put MMFs' importance into perspective over the past decades (Graph 1.B). Relative to total US commercial bank assets, US MMFs' AUM increased from less than 10% in the 1980s to about 25% today (red line). Globally, the ratio of MMF to bank assets hovered around 4% (blue line).

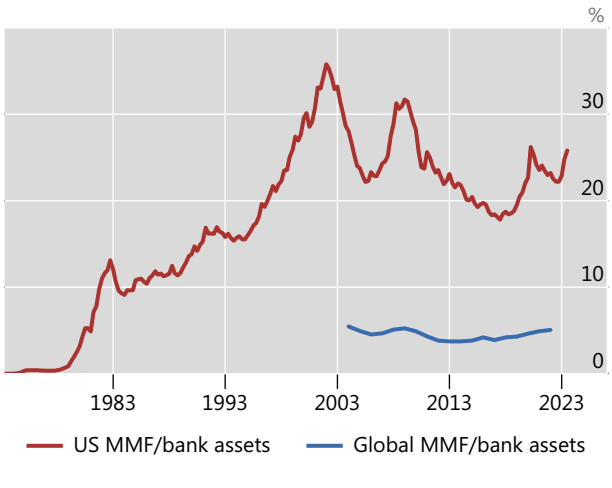
The MMF industry played a prominent role in, and was reshaped by, the Great Financial Crisis (Kacperczyk and Schnabl (2013)). In response to the crisis, regulatory reforms were introduced to enhance the stability of MMFs while maintaining funds'

MMF assets over time[1] Graph 1

A. MMF assets have seen remarkable growth



B. MMF assets relative to total bank assets



[1] See technical annex for details. [2] MMFs domiciled in AU, BM, CH, FR, GB, IE, KY and LU.

Sources: Crane; FRED; FSB; Informa iMoneyNet; authors' calculations.

[4] The remainder is, to a large extent, accounted for by local currency-denominated MMFs located outside the United States, which have grown substantially in recent years (FSB (2022)).

[5] Funds in Ireland, Luxembourg and the Cayman Islands have the highest AUM shares (54%, 31% and 14%, respectively).

flexibility to meet investor needs. In particular, the 2016 US MMF reform reduced the scope of MMFs to provide unsecured funding.[6]

We use our data on borrower entities to classify all MMF counterparties into four groups: government entities, banks, other NBFIs and NFCs. Government entities are mostly treasury departments (most notably the United States Department of the Treasury). In the United States, the central bank also borrows through its overnight reverse repo facility (ON RRP).[7] Banks are mostly large and highly rated bank holding companies. NBFIs include a clearing house (FICC), insurance companies, asset managers and special purpose vehicles that specialise in securitisation and asset-backed commercial paper (ABCP).[8] Finally, NFCs are large global companies from various industries.[9]

Who borrows from MMFs and how?

In the United States, MMFs – which hold their AUM only in US dollars – mostly fund banks and governments (Graph 2.A). Banks are the largest borrowers on average – accounting for around two thirds of the total – and the rest goes mostly to governments. Investments in government securities grew sharply with the outbreak of Covid-19 (Eren et al (2020)) and positions at the ON RRP gained prominence starting in 2021 (Morgan et al (2022), Doerr et al (2023)). In turn, borrowing by NBFIs and NFCs together accounted for around 5% on average.

Outside the United States, MMF investments are even more tilted towards banks. Among non-US MMFs, banks account on average for over 70% of total borrowing (Graph 2.B). NBFIs and NFCs again account for only a small share. Virtually all lending by non-US MMFs is done in pounds, euros and dollars, with the latter accounting for 60% on average (Graph 2.C).

Banks, NBFIs and NFCs differ markedly in the instruments they use to borrow from US MMFs. The composition of bank borrowing has shifted from unsecured (ie CP and CD) borrowing towards repos (Graph 3.A), especially after the October 2016 reform. Borrowing through short-term debt instruments by FHLBs (part of "other" in Graph 3) can at times be substantial (Box A). For NBFIs, ABCP conduits were the main instrument of borrowing up until 2017 but have since been replaced by repo (Graph 3.B). The lion's share of NBFI repo borrowing is explained by the FICC, which

[6] The reform led to the conversion of some prime funds, which can extend unsecured lending to firms, into government funds, which can extend lending to firms only via repos with high-quality collateral (Bouveret et al (2022)).

[7] The ON RRP offers money market lenders (primary dealers, banks, MMFs and government sponsored entities) the possibility to invest cash overnight on a collateralised basis (against Treasury collateral). In practice, however, it is mostly used by MMFs (Afonso et al (2022)).

[8] Insurance companies include Prudential plc and MetLife, asset managers include Federated and BlackRock, and ABCP conduits include Antalis US Funding Co, among many others.

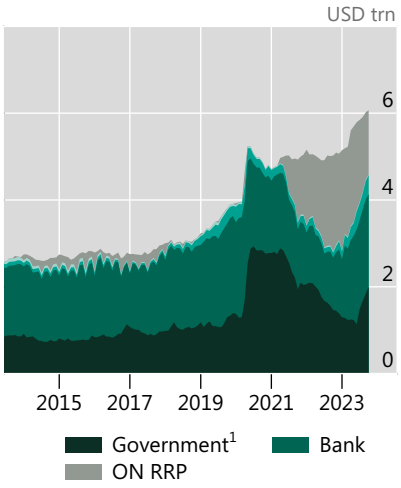
[9] For example conglomerates (eg Procter and Gamble and Unilever), automotive companies (eg Toyota and BMW), energy companies (eg ExxonMobil and Chevron), pharmaceutical companies (eg Novartis and Pfizer) and retailers (eg Walmart).

likely funds arbitrage trades by leveraged funds (Box B). Finally, NFCs borrow almost exclusively through CP (Graph 3.C).[10]

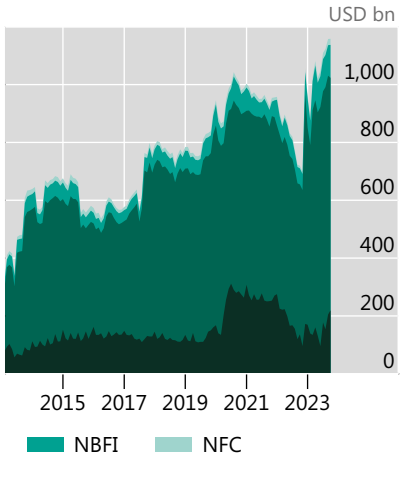
Who borrows from money market funds? The aggregate view

Graph 2

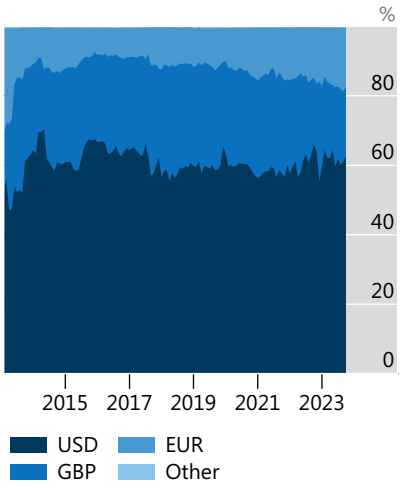
A. US MMFs largely lend to banks and governments



B. Non-US MMF lending is more tilted towards banks[2]



C. Non-US MMFs mostly lend in USD



NBFI = non-bank financial institutions; NFC = non-financial corporations; ON RRP = overnight reverse repurchase facility.

[1] Includes Treasury, municipal and other securities. [2] MMFs domiciled in AU, BM, CH, FR, GB, IE, KY and LU.

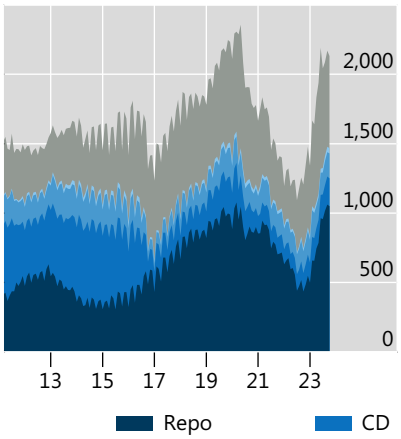
Sources: Crane; Informa iMoneyNet; authors' calculations.

Borrowing from US MMFs: counterparty and instrument splits

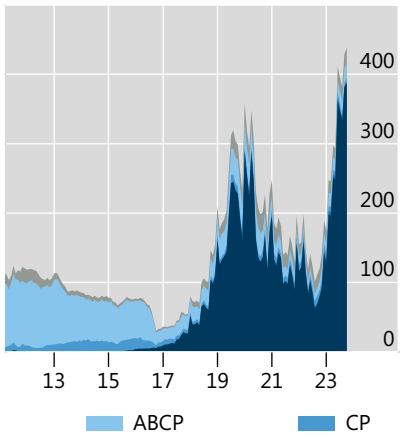
In billions of US dollars

Graph 3

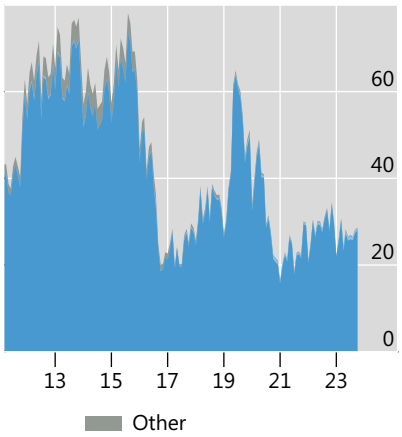
A. Bank borrowing from MMFs is near historical highs



B. Recent NBFI borrowing is dominated by repos



C. NFCs borrow through CP, but well below pre-MMF reform levels



ABCP = asset-backed commercial paper; CD = certificates of deposit; CP = commercial paper; repo = repurchase agreements. For banks, "other" includes borrowing through short-term debt instruments by Federal Home Loan Banks.

Sources: Crane; authors' calculations.

[10] For non-US MMFs patterns differ somewhat. For banks, CP and CD have consistently played a large role, accounting for close to two thirds of the total. For NBFIs, repo borrowing has increased in importance, but ABCP remains the main funding instrument.

Box A

Money market fund lending to Federal Home Loan Banks

Iñaki Aldasoro and Sebastian Doerr ①

Federal Home Loan Banks (FHLBs) are large borrowers from money market funds (MMFs) through short-term debt instruments. Their borrowing increases markedly when funding conditions tighten (Anadu and Baklanova (2017)). This box documents how such borrowing supports relatively long-term lending by FHLBs to their member banks.

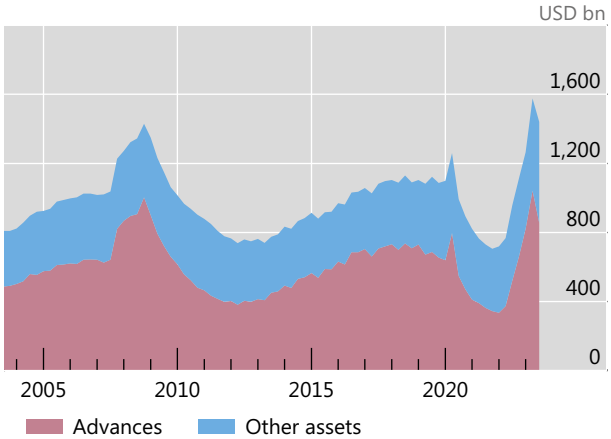
The FHLBs are a system of regional banks in the United States. They were created in 1932 to support the housing finance and community lending needs of their member financial institutions (thrifts, insurance companies and banks). They enjoy relatively low funding costs as they are perceived to have an implicit government guarantee. Members, in turn, obtain over-collateralised wholesale funding from FHLBs for their mortgages and mortgage-related investments (so-called advances).② Advances are a substantial component of total FHLB assets, and tend to grow when member banks' funding conditions are tighter (Graph A1.A). Due to their role as providers of liquidity during funding stress episodes, FHLBs are sometimes referred to as lenders of second-to-last resort (Ashcraft et al (2010)).

MMFs are instrumental to FHLBs' role as lenders of second-to-last resort, sparking concerns that MMFs are again "underwriting the US housing market".③ FHLB borrowing from MMFs grows considerably during episodes of funding stress (Graph A1.B). It jumped around the September 2019 repo market stress and spiked to over $800 billion with the global Covid-19 outbreak in March 2020 (a 32% monthly increase). Another sharp increase began with the start of the recent US interest rate hiking cycle, peaking with the bank stresses in March and April 2023. For example, the failed Silicon Valley Bank (SVB) had outstanding advances with the FHLB of San Francisco of $15 billion as of end-2022 (just before its collapse), up from zero one year before.④

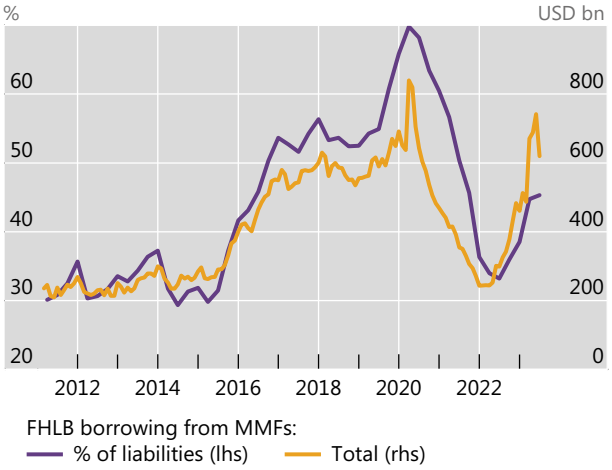
FHLBs as lenders of second-to-last resort and the role of MMFs

Graph A1

A. FHLB total assets ebb and flow with advances to members, which rise during periods of stress



B. FHLBs are heavily reliant on funding from MMFs, which also rises during periods of stress



Sources: Crane; FRED; Informa iMoneyNet; authors' calculations.

① The views expressed are those of the authors and do not necessarily represent the views of the Bank for International Settlements. ② For background on FHLBs and related financial stability risks, see Gissler and Narajabad (2017) and Gissler et al (2023). ③ See Dunbar (2023). ④ See the financial reports of SVB and FHLBs for 2021 and 2022.

Money market funds, other non-bank financial institutions and sponsored cleared repo

*Iñaki Aldasoro and Sebastian Doerr*①

Non-bank financial institutions' (NBFI) borrowing from money market funds (MMFs) is predominately done through "sponsored cleared repo" with the Fixed Income Clearing Corporation (FICC). This box explains how sponsored repo connects MMFs and hedge funds (HFs), and how the link grows stronger when HFs bet on Treasuries (funded by repo). Such bets, or arbitrage trades, have recently caught the attention of regulators and the financial press.②

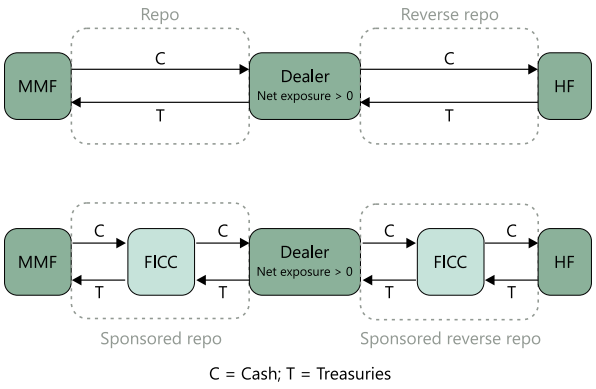
Sponsored repo is a financial transaction in which a dealer facilitates non-dealer counterparties' access to the FICC cleared repo platform. In a standard matched-book repo trade, a dealer borrows money from a cash lender (eg an MMF) and then lends these funds to a cash borrower (eg a hedge fund) in exchange for collateral (Graph B1.A, upper part). This process requires the dealer to allocate capital against the repo exposure. In sponsored repo, on the other hand, FICC intermediates both sides of the trade between the counterparties that the dealer "sponsors". While the dealer still provides a guarantee to FICC in respect of all obligations of the sponsored counterparties, it offsets the multiple transactions on its balance sheet (Graph B1.A, lower part). This allows dealers to economise on capital, thus building larger leveraged exposures.

MMF reverse repos with FICC have risen substantially over the past five years, ebbing and flowing with interest rates (Graph B1.B). When interest rates rise, asset managers' demand for hedging interest rate risk leads them to take long positions in Treasury futures. In turn, the resulting price discrepancies between these futures and the underlying cash bonds (the "cash-futures basis") incentivise leveraged funds to engage in relative value trades that involve short positions in the futures and require repo funding (Avalos and Sushko (2023), Barth et al (2023)).③ Dealers provide this funding but – to the extent that the higher interest rates have tightened funding conditions – also seek to reduce the footprint of repo on their balance sheet through, for example, clearing. Consistent with this, MMF reverse repos with FICC grow during periods of rising rates, just as net short positions on US Treasury futures by leveraged funds build up.

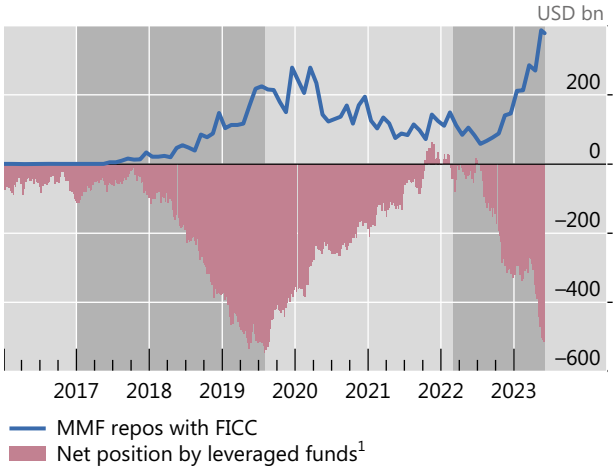
MMF repos with FICC are at record levels and mirror basis trades by hedge funds

Graph B1

A. Sponsored cleared repo: netting benefits for dealers and indirect links between MMFs and hedge funds



B. MMF repos with FICC grow when rates rise and hedge funds engage in the Treasury futures basis trade



Shaded areas in the right-hand panel denote periods of rising rates.

[1] The sum of net positions in two-, five- and 10-year US Treasury futures.

Sources: Commodity Futures Trading Commission; Crane; Informa iMoneyNet; JPMorgan; authors' calculations.

① The views expressed are those of the authors and do not necessarily represent the views of the Bank for International Settlements. ② See Duguid et al (2023). ③ The cash-futures basis trade is an arbitrage strategy whereby investors go long cash Treasuries and short Treasury futures. Borrowing in the repo market to finance the trade and build leverage is key for this strategy, as the basis is generally narrow.

Monetary policy transmission through NBFIs revisited

We now explore the link between monetary policy and borrowing from MMFs. Seminal work on the United States shows that monetary policy tightening leads to deposit outflows (in particular of checking and savings account deposits) and a contraction in bank lending to the real economy (Drechsler et al (2017)). Meanwhile, money flows into MMFs (Xiao (2020)). Follow-up work argues that, during tightening cycles, MMFs increase their lending to other NBFIs (such as mortgage companies, fintech lenders, hedge funds or investment companies), which in turn lend more to the real economy. Because of this supposedly increased funding through MMFs, the argument goes, other NBFIs offset the reduction in banks' credit supply to a significant extent when monetary policy tightens. Yet previous work categorised MMF borrowers (ie banks, NBFIs or NFCs) on the basis of the funding instruments, as it drew on data that did not reveal the actual borrowing entity. This left untested the crucial assumption that MMFs finance the credit expansion by other NBFIs during monetary tightening.[11]

To investigate whether MMFs actually increase lending to other NBFIs when monetary policy tightens, we proceed in two steps. First, we estimate how much bank deposits and MMF AUM change during a typical tightening cycle. Second, we calculate the extent to which different counterparties absorb the overall increase in AUM. The analysis uses aggregate US data provided by FRED and US MMF data by Crane.

Graph 4 provides a first glance at the relationship between policy rates, bank deposits and MMF AUM. It shows a negative correlation between the federal funds rate (FFR) and checking and savings account deposit growth (Graph 4.A) and a positive correlation between the FFR and AUM growth (Graph 4.B). These patterns are consistent with liquid deposits moving out of banks and into MMFs during tightening cycles.[12]

To estimate the sensitivity of deposits and AUM to changes in the FFR, we follow Xiao (2020) and estimate the following regression at the quarterly frequency:

$$\Delta y_t = \beta\, \Delta FFR_t + controls_t + \varepsilon_t \qquad (1)$$

The dependent variable Δy_t is the year-on-year growth rate of either total checkable and savings deposits at commercial banks or of total MMF AUM in quarter t. The explanatory variable ΔFFR_t is the cumulative three-year change in the federal funds rate. To account for macroeconomic developments, the regression controls for GDP growth, inflation and the growth in corporate cash holdings. The sample period is Q1 1990–Q3 2023. Based on Drechsler et al (2017) and Xiao (2020) we expect $\beta_{deposits} < 0$ and $\beta_{AUM} > 0$.

[11] Using a structural model, Xiao (2020) argues that for every dollar of reduced bank lending when the FFR rises, other NBFIs increase lending by 33 cents because they receive more funding from MMFs. To quantify MMF lending to other NBFIs, the analysis adds up CP, ABCP, repos and short-term notes to argue that 62% of MMFs' portfolio can be attributed to lending to these NBFIs. Elliott, Meisenzahl, Peydro and Turner (2022) and Elliott, Meisenzahl and Peydro (2023) provide US and international evidence that NBFIs expand relative to banks during tightening cycles. To explain their findings they also refer to MMF funding.

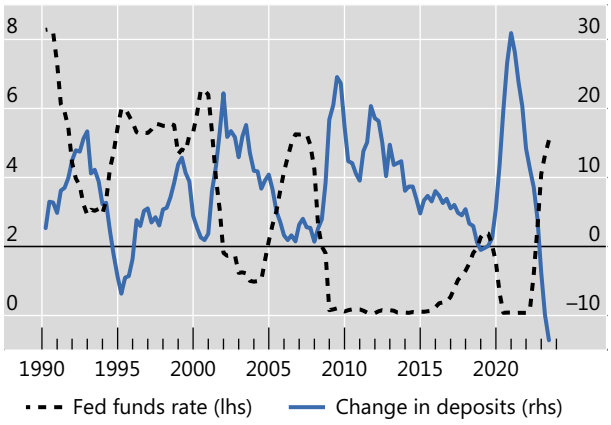
[12] The decline in checking and savings account deposits can reflect various factors, such as loan repayments, reduced credit demand or a change from retail deposits to other types of wholesale funding.

The deposits and AUM channel of monetary policy[1]

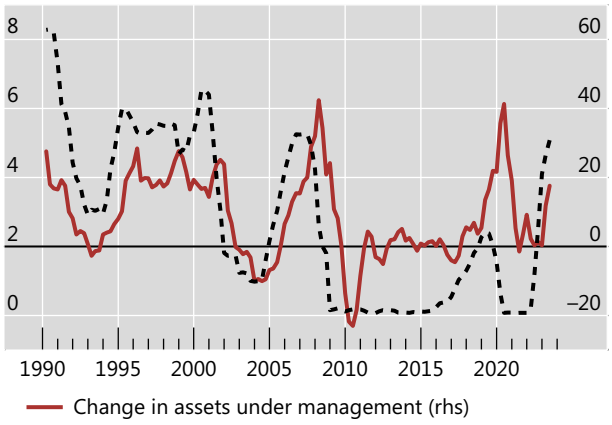
In per cent

Graph 4

A. When the FFR rises, bank deposit growth declines…



B. …whereas MMF assets increase



[1] See technical annex for details.

Sources: FRED; authors' calculations.

Table 1 reports results in line with expectations. For a 100 basis point (bp) cumulative increase in the FFR, deposits decline by 192 bp (column (1)).[13] As shown in Drechsler et al (2017), banks' credit supply declines by about two thirds of the decline in deposits. The link between deposits and loan growth echoes findings in a long-established literature and reflects the unique role of deposits as a cheap source of funding that cannot be easily substituted with wholesale financing (Kashyap et al (2002), Gatev and Strahan (2006), Hanson et al (2015)). Column (2) shows that AUM increase by 187 bp when the FFR increases by 100 bp. As argued by Xiao (2020) among others, MMFs supposedly pass this funding on to other NBFIs.

But do MMFs use their additional funds to finance other NBFIs, and if so, at what scale? To understand how MMF funding of different counterparty sectors (banks, NBFIs, NFCs and governments) moves with changes in AUM, we investigate who the marginal borrowers are. We follow Fang et al (2023) and regress a standardised change in MMF funding to sector *s* on the percentage change in total AUM:

$$\frac{Inv_{s,t}-Inv_{s,t-1}}{AUM_{t-1}} = \alpha_s \frac{AUM_t-AUM_{t-1}}{AUM_{t-1}} + \varepsilon_t \qquad (2)$$

Since total AUM must be absorbed by some counterparty sector, the estimated coefficients α_s in equation (2) sum to one. Each coefficient hence reflects the allocation of a marginal change in total AUM to counterparty sector s.

Banks are much more important "absorbers" of AUM than NBFIs and NFCs. For every additional dollar of AUM, on average 38 cents are absorbed by banks (Table 1, column (3)). NBFIs and NFCs absorb an order of magnitude less, 3.9 cents and 1 cent, respectively (columns (4) and (5)). For NFCs, the effect is statistically insignificant. The large remainder, or 57 cents of every additional dollar of AUM, is invested in Treasuries or the ON RRP (column (6)).[14]

[13] More specifically, we assume that the FFR transitions from an initial period of no change to a cumulative increase of 100 bp.

[14] Excluding 2020–23 from the sample, the respective numbers in columns (3)–(6) are 64%, 3%, 2% and 31%. For non-US MMFs' lending in US dollars, the numbers are 72%, 4%, 3% and 21%.

Tightening cycles and marginal borrowers[1] Table 1

	(1)	(2)	(3)	(4)	(5)	(6)
			Banks	NBFIs	NFCs	Gov
Variables	Δ deposits	Δ AUM	Δ inv/AUM	Δ inv/AUM	Δ inv/AUM	Δ inv/AUM
FFR	−1.765***	2.282***				
	(0.497)	(0.628)				
%Δ AUM			0.380**	0.039***	0.010	0.571***
			(0.166)	(0.009)	(0.006)	(0.174)
Observations	133	133	147	147	147	147

[1] Results for equation (1) are columns (1) and (2) and equation (2) are columns (3)–(6). The sample periods are Q1 1990–Q2 2023 and February 2011–June 2023, respectively. ***/**/* denote statistical significance at the 1/5/10% level. See technical annex for details.

Source: Authors' calculations.

We can combine the estimates in Table 1 to obtain aggregate changes in deposits and AUM. First, our estimates imply that a typical 400 bp tightening cycle reduces deposits by about 770 bp. In 2022, checkable and savings (total) deposits stood at $14 ($18) trillion, so our estimates imply a reduction of about $1.1 trillion ($1.4 trillion).[15] For MMFs, AUM stood at $5 trillion in 2022. Our estimates imply an increase in AUM of about 750 bp, or $375 billion, of which about $142 billion (38%) goes to banks. In addition, only $15 billion (4%) flows to NBFIs, much less than a typical decline in bank credit supply during a tightening cycle, which averages about two thirds of the $1.1 trillion deposit decline (Drechsler et al (2017)).

These findings have implications for the interpretation of previous studies on how NBFIs affect monetary policy transmission. To the extent that other NBFIs offset some of the reduction in banks' credit supply during monetary tightening (thereby weakening monetary policy transmission), our results suggest that this is not because of increased borrowing from MMFs. Instead, we find that banks partly offset the reduction in relatively cheap deposits with – typically costlier – short-term funding from MMFs, consistent with Choi and Choi (2020). However, as higher funding costs stymie bank lending (Bernanke and Blinder (1988), Gertler and Gilchrist (1994)), the partial substitution in banks' funding mix is unlikely to fully offset the decline in their credit supply during monetary tightening.

Conclusion

This article documents that MMFs, a key player in short-term funding markets, primarily fund banks and governments. Moreover, within the private sector, banks are the main absorbers of increases in MMFs' AUM when policy rates rise. These stylised facts have implications for the academic literature and for policy.

First, recent academic work has studied the role of NBFIs in monetary policy transmission. This work has established that NBFIs other than MMFs offset part of the contraction in bank lending to the real economy when policy rates rise. Our findings reveal one purported underlying channel to be negligible – namely, that these NBFIs

[15] Estimates are similar in Xiao (2020) and Drechsler et al (2017)

finance their credit expansion with credit from MMFs. There is therefore a need to revisit the interpretation of previous results, especially with regard to the role of the MMF sector in affecting the transmission of monetary policy.

Second, the banking turmoil of March 2023 has once again turned attention to the stability of deposit funding in a context of sharp monetary tightening. Our findings suggest that banks with access to MMFs, ie mostly larger banks, would tend to counteract some of the decline in deposits during tightening cycles.

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Technical annex

Graph 1.A: Global aggregate based on total financial assets of money market funds across a global sample of 29 jurisdictions covering about 90% of global GDP, as collected in FSB (2022).

Graph 1.B: US MMF/bank assets based on aggregate data for US domiciled MMFs and banks, sourced respectively from FRED Table Z1 in Financial Accounts of the United States and Table H8 Assets and Liabilities of Commercial Banks in the United States. Global MMF/bank assets based on the global aggregate of MMF assets provided by the FSB (see the note to Graph 1.A) and the corresponding number for total global bank assets (obtained from the same source).

Graph 4.A: Federal funds rate based on the effective federal funds rate, sourced from FRED Table H15 Selected Interest Rates. Change in deposits based on the sum of total savings and checkable deposits, sourced from FRED Tables H6 and Z1 in the Financial Accounts of the United States.

Graph 4.B: Federal funds rate as in the note to Graph 4.A. Change in assets under management based on aggregate data for US-domiciled MMFs, sourced from FRED Table Z1 in the Financial Accounts of the United States.

Table 1: Estimations in columns (3)–(6) are based on the methodology of Fang et al (2023). Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with a lag structure of 12 months.

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Buy now, pay later: a cross-country analysis[1]

Buy now, pay later (BNPL) schemes let consumers spread their spending over a number of interest-free instalments, which are typically unreported to credit bureaus. BNPL is growing strongly, especially in countries with strong e-commerce, higher inflation, inefficient banking systems and less stringent regulations. Used to a greater extent by young adults, who are typically heavily indebted and have low credit scores, BNPL schemes suffer higher delinquency rates than traditional consumer credit.

JEL classification: D12, G40, G50, G51.

Buy now, pay later (BNPL) schemes have surged in popularity, allowing consumers to divide their spending into interest-free instalments. The cost of the platform-based BNPL service is borne primarily by merchants. Thus, consumers can manage their expenses while incurring only small fees or none. However, imprudent spending or a poor understanding of BNPL terms can lead to overindebtedness.

This special feature reviews BNPL payment schemes. First, it provides an overview of the BNPL business model, discussing the benefits and costs for each agent (merchant, user and platform). Second, it documents the global diffusion of BNPL services, mapping users' gender, age, education and risk profiles. Third, it asks why the adoption of BNPL services has varied widely across countries.[2]

The main findings are as follows. First, merchants pay high fees to transfer credit risk to the platforms and broaden the customer base. BNPL schemes are accessible even to consumers without a credit history or stable income and do not typically affect their credit scores. Relying primarily on fee revenues, platforms have faced profitability challenges due to high operating costs and rising credit losses.

Second, BNPL users tend to have a riskier credit profile than those of traditional consumer credit products. BNPL users are typically younger, with less education, higher debt burdens and lower credit scores. Accordingly, late payments and losses for BNPL in the United States are higher than in the case of credit cards.

[1] We thank Douglas Araujo, Claudio Borio, Johannes Ehrentraud, Jon Frost, Gaston Gelos, Jan Keil, Benoît Mojon, Han Qiu, Andreas Schrimpf, Hyun Song Shin, Nikola Tarashev, Karamfil Todorov, Raihan Zamil and Sonya Zhu for comments. The views expressed in this article are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

[2] Our empirical analysis focuses on firms whose core business is BNPL, thus excluding firms that offer BNPL solutions as part of their diverse payment options (eg PayPal). Thus, the data reported below are likely to understate actual BNPL uptake and volumes.

Key takeaways

- *Buy now, pay later (BNPL) customers pay interest-free instalments, which are typically not reported to credit bureaus, while merchants pay fees to increase sales and shift credit risk to BNPL platforms.*
- *Compared with traditional consumer credit, BNPL users are typically younger, with less education, more debt, lower credit scores and higher delinquency rates.*
- *BNPL is more widespread in countries with greater e-commerce penetration, higher inflation, more inefficient banking systems, and looser financial and consumer protection regulation.*

Third, BNPL uptake varies widely around the world. Adoption is stronger in countries with a robust e-commerce base, higher inflation and less stringent regulation. Our findings also reveal higher BNPL usage in countries with a higher level of household debt and banking inefficiencies.

The rest of the special feature is organised as follows. The first section discusses the characteristics of BNPL and how it differs from more traditional forms of consumer credit. The second section analyses users' characteristics and how BNPL use has evolved worldwide. The third section investigates the economic and institutional drivers of BNPL. The last section concludes.

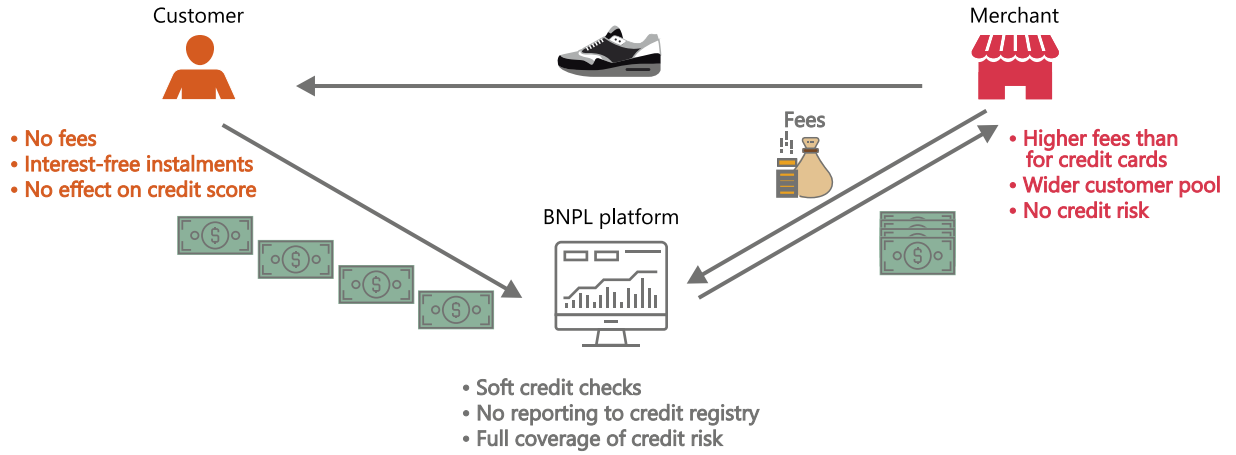
BNPL: what it is and how it works

BNPL payment schemes let customers pay for their purchases with interest-free instalments rather than paying the full amount at checkout. They are widely used by consumers for online purchases on e-commerce platforms. BNPL is rapidly expanding in physical stores too, facilitated by the use of scannable barcodes and QR codes.

With some simplification, a BNPL transaction involves three agents: a merchant, a customer, and a BNPL platform (Graph 1).[3] When customers decide on a purchase and select the BNPL option at checkout, the platform approves a credit line (see below). Upon approval, the platform pays the merchant the full amount of the goods purchased and takes on the customer's credit risk. Customers pay the first instalment upfront to the platform, while the residual amount is typically due in weekly instalments. The most common form of payment is "pay-in-four," ie repayment within four weeks, although options with longer repayment horizons are also available (Di Maggio et al (2023)). Popular BNPL services support borrowing up to $1,000 and are interest-free if instalments are paid on time. Otherwise, late fees or interest apply to missed payments, much as in the case of a credit card (see Table 1).

[3] The example describes the typical features of a BNPL transaction within a "merchant partner acquisition model". An alternative strategy is the "app-driven acquisition model" where BNPL providers pre-approve consumers' credit applications within their proprietary apps (Consumer Financial Protection Bureau (CFPB) (2022)).

BNPL payment scheme: a highly stylised example Graph 1



Source: Authors' elaboration.

BNPL vs credit cards: typical features Table 1

	Buy now, pay later	Credit card
Nature of credit	Typically, short-term credit for a specific purchase and limited amounts.	Revolving line that can be used for multiple transactions up to a limit.
Credit checks	Usually, "soft" credit checks. Late payments do not affect credit score; severe delinquencies may.	"Hard" credit check. Repayment history affects the credit score.
Instalments	Depending on the platform and the purchase amount: eg 4, 6 or 12.	Monthly minimum, full balance or any amount in between.
Fees and interest	Generally, interest-free instalments for the set repayment period. Late fees and interest apply.	Interest on carried balances after the grace period. Also: annual fees, cash advance fees etc.

Source: Authors' elaboration.

Compared with traditional consumer credit, BNPL credit is extended on the basis of less information.[4] "Soft" credit checks by BNPL platforms are less intrusive than the "hard" ones performed by credit card companies or banks. In contrast to traditional consumer credit, BNPL credit is typically not communicated to credit bureaus and, consequently, does not affect a consumer's credit score. While late payments are often not recorded on the credit file, severe delinquencies (missing multiple payments) are likely to be (Center for Responsible Lending (2022)).[5]

Credit that circumvents credit bureaus is nothing new. For instance, payday loans, a type of unsecured credit that is typically repaid by the borrower's subsequent pay cheque, also fall in this category. However, payday loans charge very high interest rates and may come with additional fees that generate substantial borrowing costs (Carrell and Zinman (2014); Gathergood et al (2018)). Thus, these loans tend to be for

[4] While soft checks refer to income and *recent* payment history, a hard check is a thorough examination of the *full* credit history, financial behaviour and outstanding debts (Di Maggio et al (2023)).

[5] The reporting of severe delinquencies for BNPL to credit registries varies by jurisdiction and is also influenced by the specific terms and conditions of the BNPL service user agreement.

emergency financial needs rather than for the purchase of goods or services (Morse (2011); Zinman (2010)).

Merchants benefit from offering BNPL payment options in several ways. First, credit and fraud risks are transferred from the merchant to the platform. Second, offering BNPL options allows merchants to reach customers who lack immediate financial means. In some cases, merchants also benefit from non-payment services such as marketing and the data analytics provided by BNPL platforms. This results in a higher share of website visitors who finalise a purchase and an increase in both the number and value of sales (Lux and Epps (2022)).

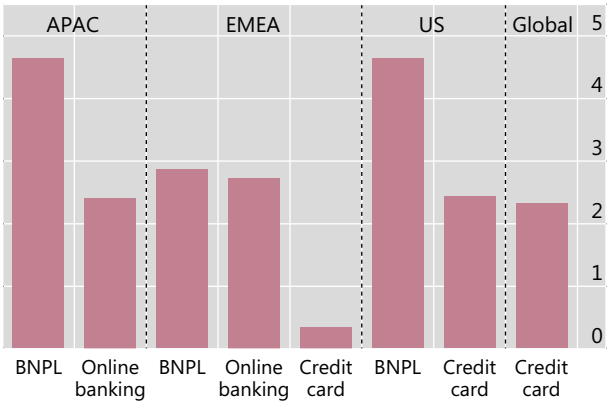
At the same time, merchants incur high costs when offering a BNPL option. Graph 2.A reports the percentage cost borne by the average merchant across selected platforms and jurisdictions. These variable costs are consistently – and several percentage points – higher for BNPL than for online banking credit or credit cards. In addition to these costs, merchants using BNPL also incur a fixed membership fee to join the platform's network and may also pay a fixed fee per transaction. Despite these costs, as of August 2023, a significant proportion of merchants in many jurisdictions offer BNPL payment options on their websites (Graph 2.B). According to Berg et al (2023), e-commerce merchants who offer BNPL as a payment option benefit from expanding sales, as some customers make purchases they might otherwise not have made, while others spend more than they had initially planned.

Despite the high costs, merchants widely adopt BNPL solutions[1]

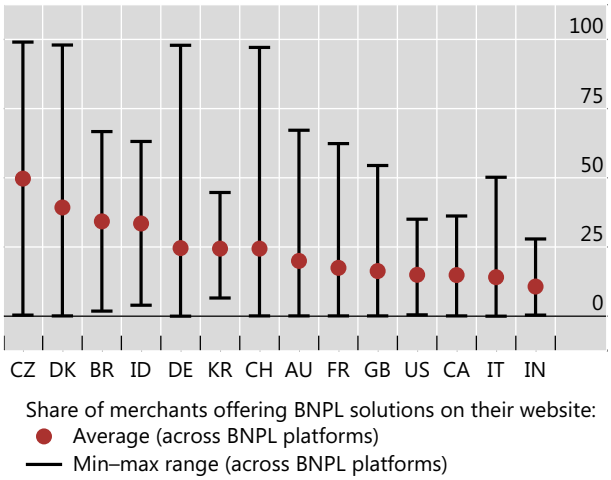
In per cent

Graph 2

A. Despite higher costs than for other consumer credit…



B. …BNPL adoption is strong among merchants



[1] See technical annex for details.

Sources: Adyen; Statista; authors' calculations.

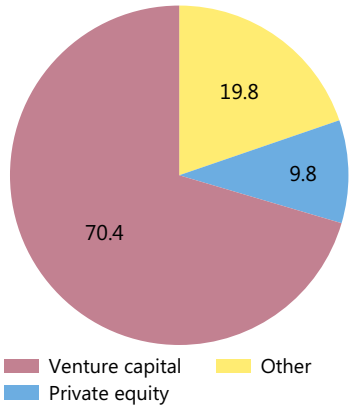
BNPL platforms are financed mainly through private markets. Exceptions to this pattern are Affirm and Sezzle, for example, which have tapped public equity markets. Among private investors, venture capital fund managers dominate (Graph 3.A). As is typical in private markets, BNPL firms are financed primarily through co-investment deals in which fund managers act as general partners and attract limited partners (LPs) (Aramonte and Avalos (2021)). Between January 2015 and November 2023, pension funds alone accounted for more than one third of these LPs, while financial companies accounted for an additional quarter (Graph 3.B).

BNPL platforms are financed mainly by venture capital, and their liabilities are mixed[1]

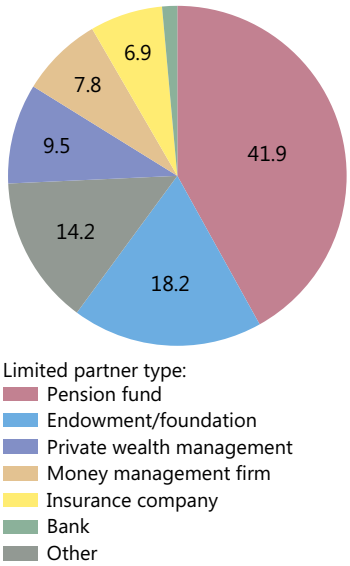
In per cent

Graph 3

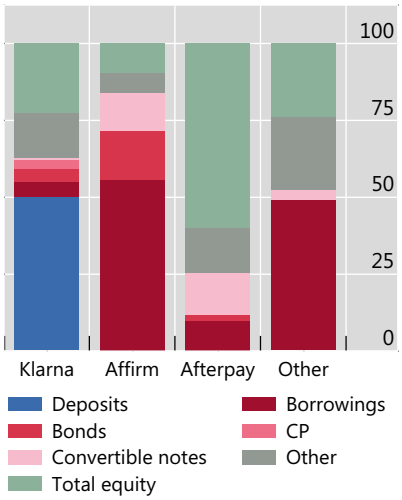
A. Venture capitalists account for the lion's share of investors[2]



B. Many pension funds invest in BNPL deals[3]



C. The composition of liabilities varies widely



[1] See technical annex for details. [2] Based on the number of deals involving a BNPL firm, 556 fund management companies, 2015–November 2023. [3] Based on the number of limited partners commitments, 273 limited partners, 2015–November 2023.

Sources: PitchBook Data Inc; authors' calculations.

The composition of non-equity liabilities varies considerably across BNPL providers (Graph 3.C). Klarna, which has a banking licence, is reliant mostly on deposits. By contrast, "borrowing" – represented mainly by bank credit lines – amounts to more than half of total assets for Affirm and Zip.

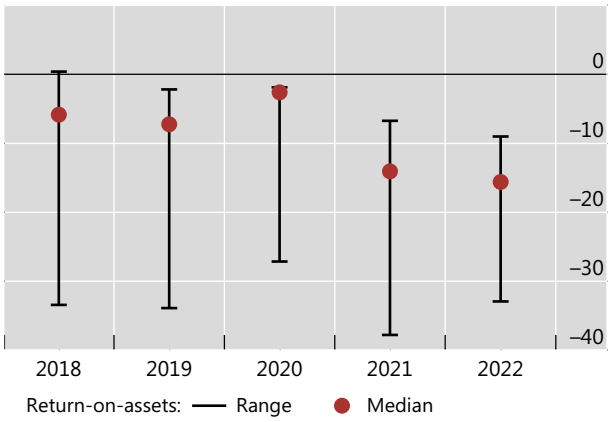
Major BNPL platforms, including Affirm, Afterpay and Klarna, face profitability challenges (Graph 4.A). High operating costs, for marketing, administrative and technology expenses among others (Graph 4.B), have prevented these platforms from breaking even since 2018 (Payments Dive (2022)). In addition, the return on assets for BNPL platforms was notably low in 2021–22 due to rising credit losses, and intensified competition from neo-banks and big techs entering the BNPL market (Fitch (2022)). In response, BNPL platforms are broadening their services to include interest-bearing loans in partnership with sponsor banks (Wang and Mason (2023)) and are leveraging advanced technologies, such as artificial intelligence (AI), to enhance customers' experience and reduce personnel costs.

High fixed costs erode the profitability of BNPL platforms[1]

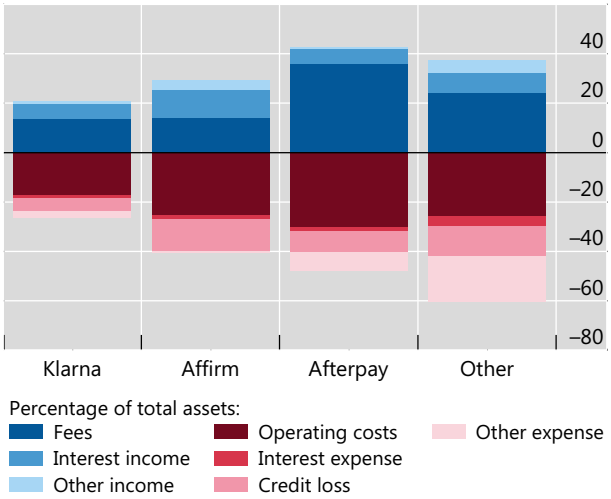
In per cent

Graph 4

A. Return-on-assets is consistently negative[2]



B. Selling, general and administrative costs drag profitability down[3]



[1] See technical annex for details. [2] Based on data for five BNPL platforms. [3] Simple averages from 2019 to 2022. Interest income includes late fees, interest rate and other penalties for missed payments.

Sources: Companies' financial statements; authors' calculations.

The surge of BNPL: global trends and user characteristics

Data documenting BNPL activity are limited and come from different sources. We assemble a novel global data set comprising the following proxies for BNPL activity: (i) gross merchandise volume (GMV) processed through BNPL schemes; (ii) BNPL app downloads; and (iii) BNPL app use.[6] The GMV measure represents the total value of transactions made using BNPL. App downloads indicate the popularity of BNPL platforms. Finally, app use – ie the number of individuals with at least one BNPL app session within a day – proxies for the actual engagement of users with BNPL services.

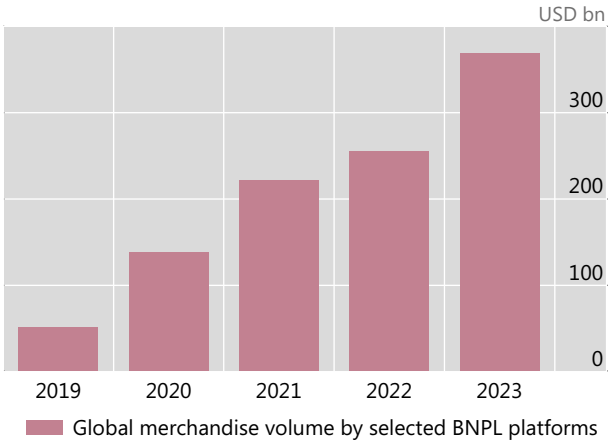
The growth of BNPL activity has been substantial in recent years. In terms of GMV, BNPL activity has increased globally more than sixfold from 2019 to 2023 (Graph 5.A). BNPL app use reveals a similar pattern, as it surged during the Covid-19 pandemic and has continued to grow since (Graph 5.B).

[6] The GMV indicator is available at the yearly frequency for a selected number of platforms that represent the majority of the BNPL market. Data on BNPL app downloads and use are obtained from Sensor Tower for a sample of 29 apps available in 34 countries, at a monthly frequency.

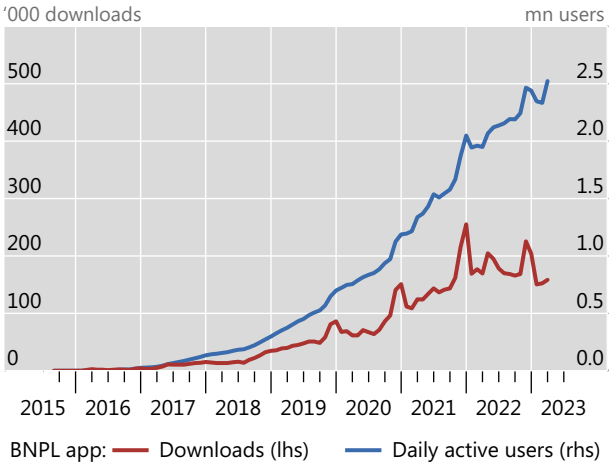
The rise of buy now, pay later[1]

Graph 5

A. Volumes



B. BNPL app downloads and users



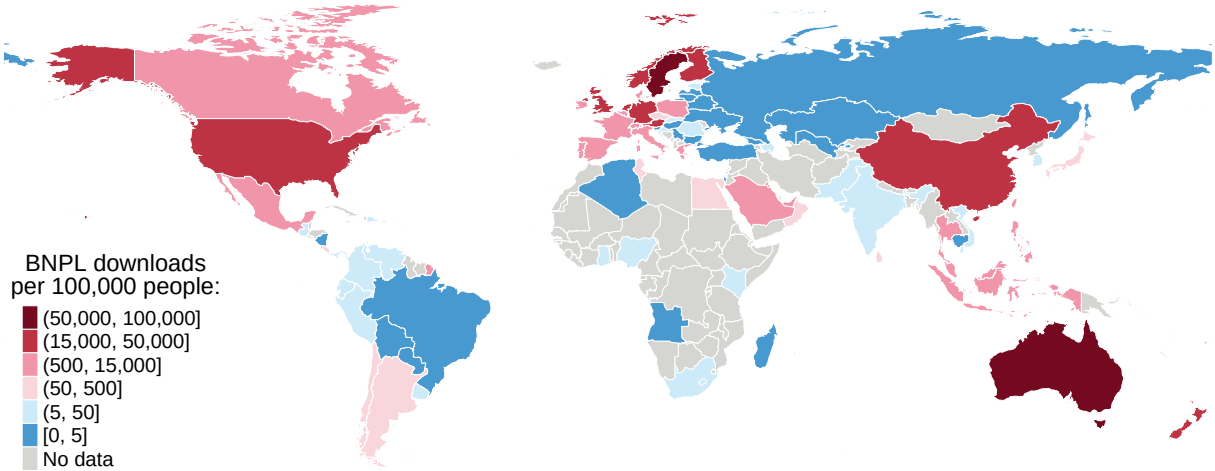
[1] See technical annex for details.

Sources: Sensor Tower; Statista; companies' annual reports; authors' calculations.

The popularity of BNPL varies widely around the globe (Graph 6). The countries with the highest adoption rates are Australia and Sweden. Other countries with significant BNPL uptake are China, Finland, Germany, the Netherlands, New Zealand, Norway, Singapore, the United Kingdom and the United States.

BNPL popularity across the world[1]

Graph 6



The use of this map does not constitute, and should not be construed as constituting, an expression of a position by the BIS regarding the legal status of, or sovereignty of any territory or its authorities, to the delimitation of international frontiers and boundaries and/or to the name and designation of any territory, city or area.

[1] See technical annex for details.

Sources: B Mojon and H Qiu: "Housing wealth effect in China", mimeo, 2023; Sensor Tower; authors' calculations.

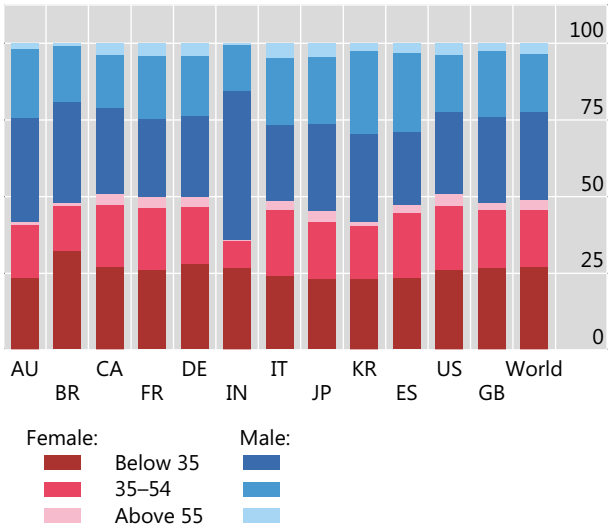
The typical profile of a BNPL user appears high-risk. The majority of BNPL app users across countries are under the age of 35 (Graph 7.A). Younger and tech-savvy individuals, including "Millennials" and "Generation Z", often do not possess credit cards (PYMTS (2023)) and are generally less financially literate than older generations (Lusardi and Mitchell (2023)). Consistent with this, a survey of US BNPL services reveals that they are more often used by individuals with low income levels and less educational attainment (Graph 7.B).

BNPL is popular with young, lower-income and less-educated adults[1]

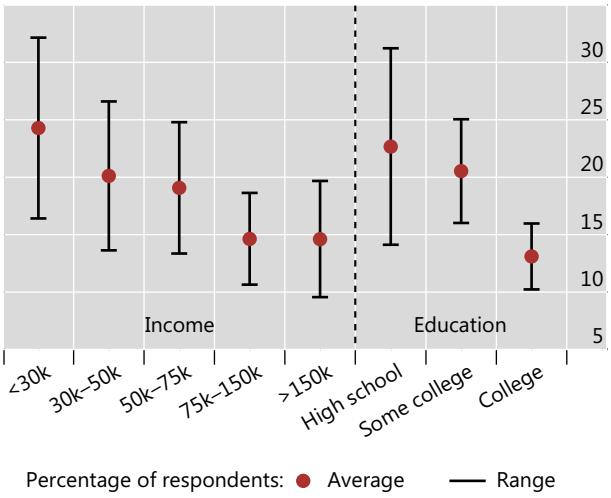
In per cent

Graph 7

A. Youngsters are the lion's share of the BNPL user base



B. In the US BNPL is used by consumers with lower income and educational attainment



[1] See technical annex for details.

Sources: Aidala et al (2023); Federal Reserve Bank of New York, *Survey of Consumer Expectations (SCE) Credit Access Survey*; Sensor Tower; authors' calculations.

There is evidence from the United States that BNPL users are particularly risky. A recent report by the CFPB (2023) finds that, on average, BNPL users in the United States are more highly indebted and have lower credit scores than non-users. Notably, the report also finds that – across a wide range of consumer credit products – BNPL users have higher delinquency rates than non-users (Graph 8.A).[7] Similar evidence comes from CFPB (2022), which reveals that – as government stimulus packages in response to the Covid-19 pandemic stopped in 2021 – the rate of failed BNPL loan payments spiked significantly, whereas credit card loan failures did not. As a result, the former became almost four times higher than the latter (Graph 8.B).[8]

[7] Similar results are obtained by the Financial Counselling Australia's 2023 survey.

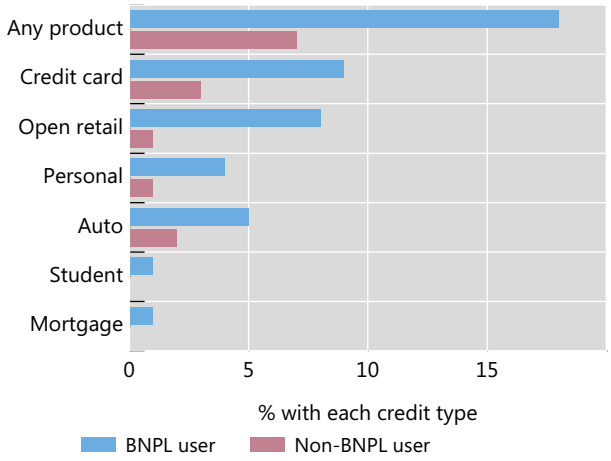
[8] The allure of cost-free borrowing can push households towards overborrowing (Berg et al (2021)), a trend amplified by the growing smartphone reliance of newer generations (Mason et al (2022)).

Delinquencies by BNPL users in the United States[1]

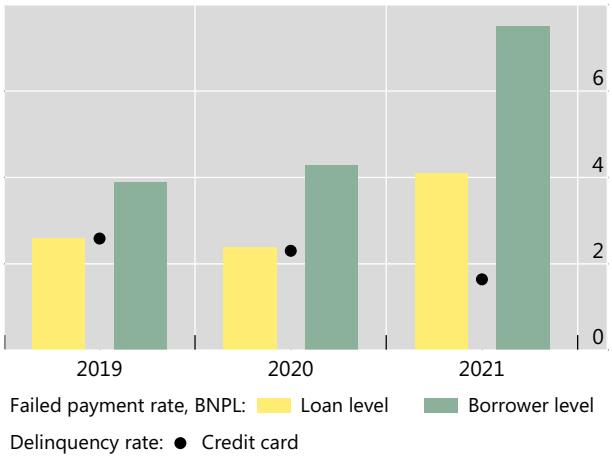
In per cent

Graph 8

A. BNPL users: a higher delinquency rate across products



B. Failed payments: more frequent than for credit cards



[1] See technical annex for details.

Sources: Consumer Financial Protection Bureau (2022, 2023); Federal Reserve Bank of St Louis, FRED.

Regulatory approaches to limiting consumer debt risks in the BNPL sector have been highly varied to date. They have ranged from self-regulation via industry codes to proposals for including BNPL under the umbrella of existing national credit laws (see Box A).

Box A

BNPL regulation around the world

Most common BNPL credit agreements have fallen largely outside the scope of existing regulatory regimes. Recently, several governments started to amend their regulatory frameworks in a way that would bring BNPL into scope. Such amendments seek to ensure that consumers are protected from irresponsible lending practices that could lead to overindebtedness. This box delves into the current BNPL regulation in selected countries.

Australia leads the way in BNPL regulation. In May 2023, the government unveiled its plan to adopt a tailored regulation under the Credit Act. This act mandates BNPL providers to secure a credit licence and comply with selected regulations. Accompanied by a reinforced industry code, the proposed framework would determine the suitability of BNPL platforms on the basis of modified responsible lending obligations. Caps on fees for missed or late payments would also be imposed, alongside enhanced warning and disclosure requirements (Australian Government (2022)).

In the United Kingdom, a consultation on BNPL draft legislation started in early 2023. It is anticipated that, with certain exemptions, BNPL providers will be subject to the Financial Conduct Authority's authorisation regime, supplemented with measures to combat misleading advertising (HM Treasury (2023)) .

In the United States, regulations vary by state and hinge on the categorisation of BNPL. Providers might need state licensing or registration and must observe consumer credit laws. The Consumer Financial Protection Bureau (CFPB) is actively examining the potential risks associated with BNPL products (CFPB (2022, 2023)).

After a 2021 pilot study by the Financial Consumer Agency, Canada has intensified its scrutiny but has not issued specific regulations. Instead, it favours continued market observation and seeks regulatory consistency across its provinces (FCAC (2021)).

In Europe, the European Council ratified a revision of the Consumer Credit Directive (CCD) in October 2023. This legislation aims to bolster consumer protection against irresponsible lending, even for modest credits that include BNPL. EU Member States are expected to implement the CCD II within three years of its EU-level adoption (European Council (2023)).

In Sweden, where BNPL is widespread in e-commerce (Sveriges Riksbank (2023)), providers must obtain a licence from the Swedish Financial Supervisory Authority under the Consumer Credit Act.

While India does not have a dedicated regulatory framework for BNPL, it enforces rules for non-banks that encompass e-commerce and consumer protection. A 2022 directive from the Reserve Bank of India affected the BNPL sector by prohibiting non-banks from combining prepaid payment instruments with credit lines (Reserve Bank of India (2022)).

Singapore's Monetary Authority advocates a self-regulatory approach (Monetary Authority of Singapore (2022)). It has adopted a BNPL industry code that covers aspects ranging from credit evaluation to disclosure, marketing strategies, and credit information-sharing. It also imposes caps on outstanding payments that customers can maintain with each BNPL provider.

Drivers of BNPL payment schemes

For potential explanations of cross-country differences in the use of BNPL payment schemes, we employ panel analysis. We examine both macroeconomic and financial characteristics of national economies as potential drivers. Given data availability, and for comparability across jurisdictions, we focus our empirical analysis on 25 countries for the period Q2 2016–Q4 2022 at the quarterly frequency.

The panel regression is of the form:

$$\begin{aligned}\ln(BNPL_{it}) = {} & \alpha \ln(Inflation_{it}) + \beta \ln(Ecommerce_{it}) + \gamma Regulation_{it} \\ & + \delta \ln(Bank\ cost\ to\ income_{it}) \\ & + \theta Household\ debt_{it} + Other\ controls_{it} + FE + \varepsilon_{it}\end{aligned}$$

where, $BNPL_{it}$ is the number of BNPL app users per capita in country i and quarter t.

On the right-hand side, $Inflation_{it}$ controls for changes in purchasing power. Inflation tends to erode the real value of savings and wages, thus tightening budgets. In addition, high inflation ushers in economic uncertainty. In either case, the option of payment deferrals raises the appeal of BNPL.[9]

In turn, $Ecommerce_{it}$ is equal to e-commerce sales as a percentage of total retail sales. This variable controls for how favourable the existing infrastructure is for the adoption of a BNPL online service.

As we do not have complete information on BNPL regulatory regimes, the vector $Regulation_{it}$ includes two indirect measures. The first is an index of regulatory stringency for the banking sector of economy i, as constructed by Barba Navaretti et al (2017) from World Bank data. We use it as a proxy for overall financial regulation. The second measure captures the government's ability to formulate and implement sound policies and regulations, including for consumer protection and starting a new business.[10] The correlation of these measures and BNPL user activity is a priori

[9] In other specifications, not reported for the sake of brevity, we included the nominal interest rate, to control for consumers' opportunity in terms of other interest-bearing forms of credit. This variable turned out to be insignificant, suggesting that other forms of credit may be simply unavailable to many BNPL users (Bian et al (2023)).

[10] See www.govindicators.org/documentation.

unclear. A positive correlation could indicate the presence of regulatory arbitrage. Conversely, a negative correlation could signal that the launch of innovative lending products, such as BNPL, is easier in countries with relatively loose regulation. Limited consumer risk awareness and insufficient consumer protection measures could have the same effect.

The bank cost-to-income ratio $Bank\ cost\ to\ income_{it}$ proxies for the level of efficiency of the banking sector. Less efficient banks tend to charge higher prices for their financial services (Gambacorta (2008); Shamsur and Weill (2019)). This should increase the relative appeal of BNPL schemes.

The variable $Household\ debt_{it}$ is the ratio of aggregate debt in the household sector over GDP. It controls for potential access limitations to more traditional forms of credit. Households with higher levels of debt have typically lower credit scores and often report a credit application rejection (Aidala et al (2023)).[11]

All the specifications include country and time fixed effects (FE). Country fixed effects control for time invariant country characteristics, such as the rule of law and institutional quality (La Porta et al (2008); Demirgüç-Kunt and Levine (2018)). Time fixed effects control for global developments, especially during the Covid-19 pandemic.

Table 2 presents the results of the econometric analysis. Column (I) indicates a positive correlation of BNPL with inflation, suggesting a preference for such services when purchasing power is eroding. This interpretation is supported by a global survey conducted by Paysafe Group (2022), which indicates that BNPL usage was high among consumers who reported that the rising cost of living influenced their online payment methods in 2022. Moreover, another survey conducted by the Federal Reserve System (2023) on the economic well-being of US households in 2022 shows that 56% of BNPL users indicated BNPL payment scheme as being "the only way I could afford [the purchase]". BNPL use is also positively linked with e-commerce development, reflecting the fact that most of BNPL activity is done online.

Column (II) introduces the variables that account for countries' regulatory characteristics. The negative coefficients indicate that looser financial regulation and consumer protection are associated with more BNPL usage. This finding aligns with the results obtained by Barba Navaretti et al (2017), Claessens et al (2018) and Frost et al (2019) for fintech credit, and Cornelli et al (2023) for fintech and big tech credit.

BNPL thrives where the banking sector is less efficient (Table 2, column (III)). In such contexts, consumers might seek alternative financial solutions that are more convenient and cost-effective. Furthermore, BNPL is more prevalent in countries where households have a higher level of debt and potentially more limited access to traditional forms of credit. Column (IV) confirms the consistency of the results when adding additional controls.

[11] The other control vector variables are the natural logarithm of the real GDP per capita; the real interest rate; the natural logarithm of the country-specific residential property price index, and the natural logarithm of the share of the top income decile in total country income.

Drivers of BNPL usage[1] Table 2

	Ln(BNPL users per million people)			
	(I)	(II)	(III)	(IV)
Ln(Inflation)	0.398**	0.557**	0.688***	0.685***
	(0.165)	(0.205)	(0.228)	(0.226)
Ln(E-commerce, % of total sales)	1.225***	1.810***	1.728***	1.840***
	(0.187)	(0.262)	(0.313)	(0.334)
Index of banking stringency[2]		–34.769***	–37.580***	–37.398***
		(3.300)	(2.972)	(3.470)
Regulatory quality index[3]		–3.242***	–3.355***	–3.363***
		(0.329)	(0.358)	(0.410)
Ln(Bank cost-to-income)			4.225***	4.132***
			(0.918)	(0.906)
Household debt to GDP			0.381*	0.377**
			(0.190)	(0.183)
Other controls[4]				✓
Number of observations	378	373	361	359
Adjusted R-squared	0.895	0.909	0.909	0.910

[1] The sample covers 25 countries for the period Q2 2016–Q4 2022. All the specifications include country and time fixed effects. Standard errors clustered by time in brackets; ***/**/* indicates statistical significance at the 1/5/10% level. See technical annex for details.

Sources: Cornelli et al (2023); BIS credit statistics; IMF, *World Economic Outlook*; UNU-WIDER, *World Income Inequality Database (WIID) Companion dataset*; eMarketer Inc; Sensor Tower; World Bank; authors' calculations.

Conclusions

BNPL payment schemes are growing rapidly in popularity across the globe, especially among young adults with less educational attainment. While consumers enjoy the advantage of immediate purchases with deferred payments at no added cost, merchants expand sales and their customer base. However, despite earning revenue from merchant fees, BNPL platforms face profitability challenges due to high fixed costs, increasing funding expenses and elevated delinquency rates.

The rapid ascent of BNPL could be of concern to public authorities for two reasons: consumer protection issues and the accumulation of credit risk (FCA (2022a,b)). It is thus important to establish whether BNPL schemes take advantage of financially constrained individuals through misleading promotions and inadequate information. In turn, since BNPL platforms suffer from high delinquency rates, a sustained growth of these platforms would warrant monitoring of their direct and indirect links with the rest of the financial system.

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Technical annex

APAC = Asia-Pacific; CP = commercial papers; EMEA = Europe, Middle East and Africa.

Graph 2.A: Variable costs as a percentage of transaction value. Total costs can be higher in the presence of fixed costs per transaction. Values are calculated based on a selected sample of payment service providers.

Graph 2.B: Based on survey data for a selected number of countries on the share in a representative sample of merchants offering BNPL payment solutions on their websites through the most prominent providers. The sample of BNPL providers corresponds to Affirm, Afterpay, Klarna, Pay in 4, Sezzle and Zip. Data as of August 2023.

Graph 3.A: Other includes asset managers, governments, holding companies, secondary buyers and sovereign wealth funds.

Graph 3.B: Other corresponds to corporations, direct investments, economic development agencies, government agencies and sovereign wealth funds.

Graph 3.C: For other, simple average of Sezzle and Zip. The graph shows simple averages over the period 2019–22. For Affirm, simple average over the period, 2019–21. Category other includes accounts payables, deferred tax liabilities, operating leases liabilities, provisions and subordinated liabilities.

Graph 4.A: For Affirm, data for the period 2019–22; for Afterpay, data for the period 2018–21; for Klarna, Sezzle and Zip, data for the period 2018–22.

Graph 4.B: For other, simple average of Sezzle and Zip. For Affirm, simple average over the period, 2019–21. Operating costs include selling, general, administrative, technology and data costs. Credit loss includes realised losses and provisions.

Graph 5.A: Based on a sample of selected BNPL platforms including Affirm, Afterpay, Beforepay, humm, Klarna, Laybuy, Openpay, Sezzle, Zebit and Zip. In the case of missing data, volumes are proxied by receivables from customers. For 2023, estimate based on data on forecasted GMV for online BNPL.

Graph 5.B: Monthly average of total number of daily downloads and of daily active users for BNPL apps. The sample is selected following Sensor Tower app classification.

Graph 6: The map shows the total number of downloads for the period Aug 2015–Jun 2023 per 100,000 people, based on population data for 2022. Data for mainland China are estimated based on the downloads of daily active users of Alipay app, and the share of Alipay users purchasing goods with the BNPL solution in a randomly selected sample.

Graph 7.A: Based on averages for the period Q3 2015–Q4 2022.

Graph 7.B: The graph shows the percentage of respondents (average and range) by income and education group.

Graph 8.A: "Any product" refers to delinquency in at least one of the products.

Graph 8.B: For credit cards, simple average of quarterly values.

Table 2: Data are winsorised at the third and 97th percentiles. The dependent variable in all underlying regressions is the natural logarithm of the quarterly average number of total daily active users of BNPL apps per million people. The index is normalised between 0 (no regulation) and 1 (most stringent regulation). See Cornelli et al (2023) for further details. The measure of regulatory quality captures the perception of the government's ability to implement policies capable of promoting the development of the private sector. It ranges from –2.5 to 2.5. Real interest rate and the natural logarithm of real GDP per capita, of the country-specific residential property price index, and of the percentage of the total country income of the first income decile.

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Labour markets: what explains the resilience?[1]

The post-pandemic recovery features significant tightness in labour markets – a situation where jobs are plentiful and available workers scarce. This special feature discusses the possible role of supply and demand factors for this tightness and the attendant contrast between buoyant employment and lacklustre output growth. We find that labour hoarding on the demand side, and adverse demographic trends and pandemic-related preference shifts on the supply side, can go a long way in explaining these dynamics. Finally, we relate labour market developments and their persistence to the inflation outlook and monetary policy trade-offs.

JEL classification: E24; J1; J2; J3; J63; J64.

Introduction

One constant during the post-pandemic recovery has been the tightness of labour markets. The labour market is said to be "tight" when the imbalance between labour supply and labour demand manifests itself in an abundance of job opportunities along with a scarcity of workers available and willing to take those jobs. This phenomenon has gone hand in hand with a job-rich recovery as economies started reopening after the acute phase of Covid-19, with unemployment plummeting in many countries and employment growing surprisingly strongly given the path of output.

What supply and demand factors in the labour market could explain this labour market resilience? We seek to provide some answers to this question in order to shed light on how current tightness could affect the outlook for inflation. In particular, this outlook depends on unit labour costs, which are more likely to rise when strong labour demand chases workers against the backdrop of constrained labour supply.

Our findings are as follows. First, there is rather widespread tightness in labour markets – especially among advanced economies (AEs). This is the message of standard indicators, such as the unemployment rate and the vacancy-to-unemployment ratio. Second, a constellation of factors have led to labour demand outstripping labour supply. On the supply side, subdued growth in working age population and shifts in labour force participation have played a role. In addition, workers' preferences have shifted in favour of fewer working hours. On the demand side, there are signs that uncertain hiring prospects in some sectors have led firms to

[1] We thank Douglas Araujo, Claudio Borio, Gaston Gelos, Marco Lombardi, Cristina Manea, Benoît Mojon, Hyun Song Shin and Nikola Tarashev for comments. Adam Cap, Burcu Erik and Emese Kuruc provided excellent research assistance. The views expressed in this article are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

Key takeaways

- *Labour markets recovered rapidly after the Covid-19 pandemic and remain tight: in many countries, jobs are plentiful and available workers scarce.*
- *Labour hoarding by employers, demographic trends and shifting attitudes towards work can explain labour market tightness and how it culminated in a job-rich recovery.*
- *Going forward, the strength and persistence of the shifts in supply and demand for labour will be an important determinant of inflation dynamics.*

hoard labour, ie that tightness begets tightness. Further, excess demand for labour has been concentrated in sectors shunned by workers during the pandemic. These factors can explain why labour markets have been surprisingly resilient even as growth has been losing momentum.

The rest of the feature is organised as follows. The next section takes stock of current labour market indicators to assess the degree of tightness in a large number of countries. It then seeks to explain changes in supply of and demand for labour and, in that context, the factors behind the job-rich recovery. The concluding section discusses the implications of the recent dynamics for inflation and monetary policy.

Taking stock of current labour market indicators

Evaluating the state of the labour market can be difficult, and usually relies on a holistic reading of various quantity (eg employment) and price (eg wage) measures. Labour market indicators are indeed subject to significant lags and uncertainty and may provide conflicting signals, in particular when they overlook composition effects across heterogeneous workers and employers. Such caveats aside, since the pandemic several measures do point on balance to widespread labour market tightness in relation to historical norms, albeit with some variation across countries.[2]

Unemployment rates – the most standard measure of labour market slack – are currently close to the lows seen in the past decade in all major AEs as well as in several emerging market economies (EMEs) (Graph 1.A). In some jurisdictions, such as the euro area, they are at historical troughs. Exceptions to this pattern are China and Malaysia, where unemployment rates are in line with long-term norms and, South Africa, where the unemployment rate is running high by historical standards.

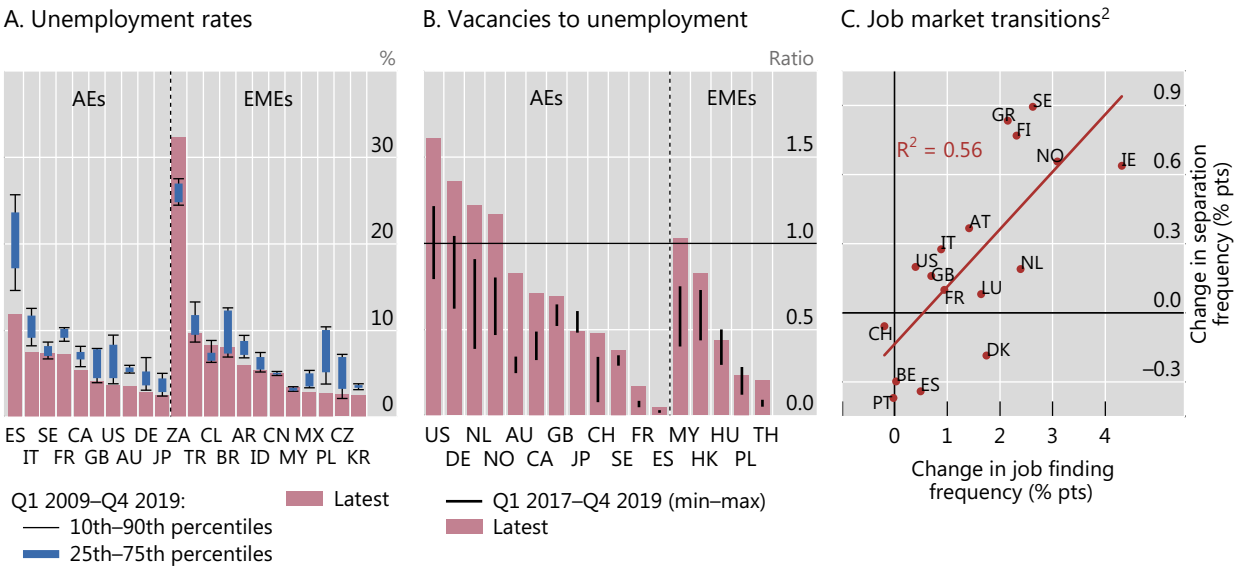
Other metrics generally confirm and, in the case of several AEs, reinforce this picture of tightness. Vacancy-to-unemployment ratios – which capture the availability of jobs relative to those actively looking for one – have generally increased relative to the three-year period preceding the pandemic (Graph 1.B). In EMEs, where data on vacancies are limited, the picture is more mixed than in AEs.[3]

[2] The assessment abstracts from unemployment gaps, ie the difference between the actual and natural rate of unemployment (u^*), implicitly assuming a constant u^* for the horizon under consideration.

[3] The ratio of vacancies to unemployment remains below one in most jurisdictions. But, since data for unfilled vacancies are subject to large uncertainty, changes in the ratio are more informative.

Standard labour market indicators point to tightness in many countries[1]

Graph 1



[1] See technical annex for details. [2] Over Q1 2021–Q4 2022 relative to Q1 2017–Q4 2019.

Sources: International Labour Organization; OECD; Eurostat; Refinitiv Datastream; national data; authors' calculations.

Another set of indicators focusing on labour market flows, the so-called labour turnover, or "churn", also point to significant labour market tightness.[4] In AEs, gross flows in and out of employment, ie the rates at which those without a job find one and those with a job leave it, have increased since the pandemic (Graph 1.C). This is consistent not only with falling unemployment rates but also with people feeling more comfortable switching jobs, in search of better opportunities, as the risk of long unemployment spells looks limited.

Switching from quantity to price indicators and turning to wage growth, the picture is less clear-cut.[5] Wage growth has picked up in nominal terms (Graph 2.A) but has mostly fallen short of inflation, leaving real wage growth in negative territory (Graphs 2.B and 2.C).

Several factors could be at play here. One is the big element of surprise in current inflation, which has made it hard for wages to catch up after a long period of price stability.[6] In addition, wages can be slow-moving since they are often set for a horizon of multiple years. It may just be a matter of time before they pick up and workers recoup accumulated losses. Finally, decisive central bank actions have helped to keep inflation expectations, especially the longer-term ones, in check. This, in turn, may have curbed incentives to negotiate for even higher nominal wages or for indexation mechanisms to protect against erosion of real wages by realised inflation.

[4] Although timely data on job transitions in EMEs are limited, evidence for 2021 also points to labour market tightness in eg Brazil, Chile, Mexico and South Africa (see Donovan et al (2023)).

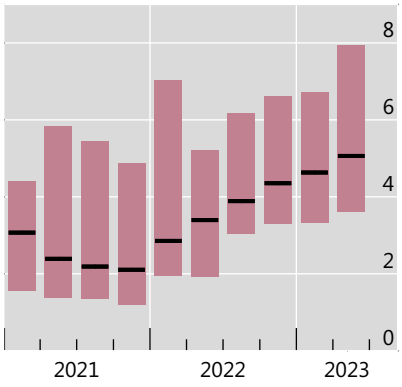
[5] Wages are both an indicator to assess labour market tightness, as well as an outcome variable of labour market tightness. We focus here on the former aspect. The policy section discusses the latter.

[6] Borio et al (2023) investigate how institutions adjust to a low-inflation environment, for instance by reducing workers' bargaining power.

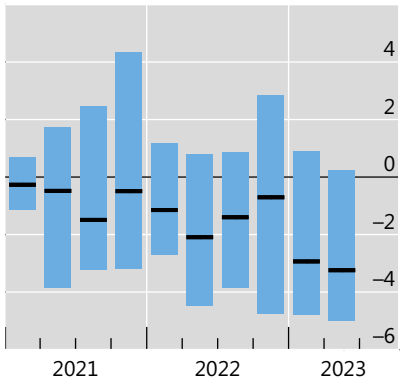
Nominal wage growth picks up, real wages fall behind[1]

Cross-country distributions, year on year, in per cent — Graph 2

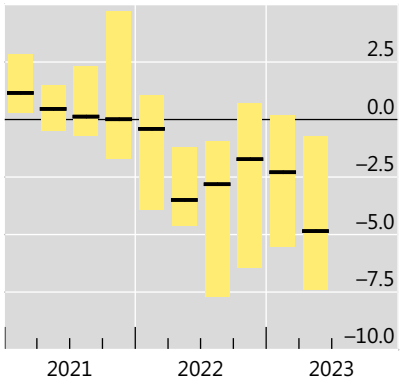
A. Nominal wages have grown…



B. …but, deflated by either the GDP deflator…



C. …or the CPI, real wages have declined



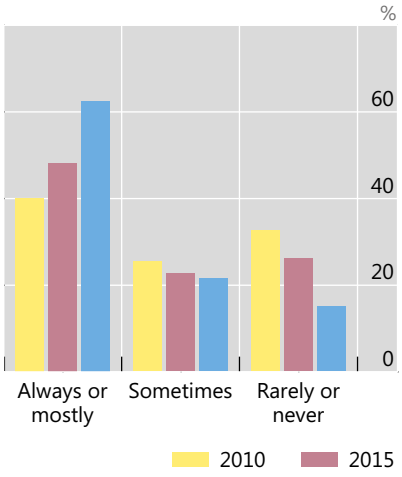
[1] Bars represent the interquartile ranges and horizontal lines denote the medians. See technical annex for details.

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

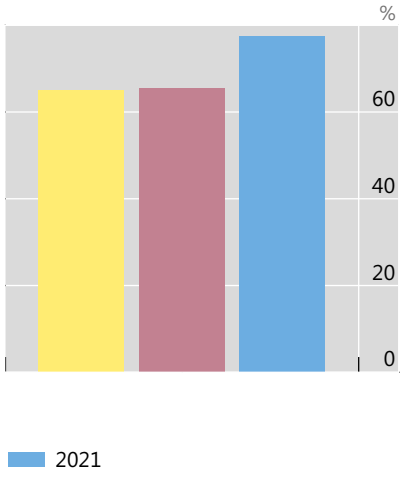
Better work arrangements take centre stage in Europe[1]

Graph 3

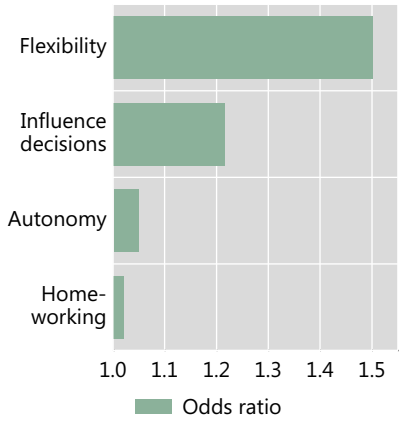
A. Workers report more influence over work-related decisions…



B. …and more flexible working time…



C. …which tend to be positively related to pay satisfaction[2]



[1] Answers to questions "Which best describes your work situation – You can influence decisions that are important for your work?" (panel A) and "Would you say that for you arranging to take an hour or two off during working hours to take care of personal or family matters is easy?" (panel B). See technical annex for details. [2] Odds ratio of higher wage satisfaction when the particular job characteristic improves (Box A).

Sources: Eurofound, European Working Conditions Survey (EWCS); authors' calculations.

To investigate what could blur the signals from wages as regards labour market tightness, we consider the growing importance of non-pecuniary benefits. Mandatory telework during the Covid crisis has left its imprint on working practices. According to the 2021 European Working Conditions Survey (EWCS), workers now report more autonomy and influence over decisions (Graph 3.A). They also mention more flexible

hours (Graph 3.B).[7] Three quarters of workers now find it easy to arrange to take an hour or two off during working hours to take care of personal or family matters, about 15 percentage points improvement compared with the period before the pandemic.

Empirical analysis confirms that flexible work arrangements come hand in hand with higher levels of pay satisfaction (Box A). The odds of higher pay satisfaction are higher for employees benefiting from flexible working arrangements (Graph 3.C). More specifically, the likelihood that an employee belongs to the "highest pay satisfaction" group is 20 percentage points higher if that employee reports "very flexible" rather than "very inflexible" work time. Confirming these large empirical magnitudes, Maestas et al (2023) estimate that the value of non-pecuniary benefits can be the equivalent of wage increases as large as 4–9%. This cross-sectional evidence suggests that nominal wages may not have grown as fast as they otherwise would have after the pandemic as more employers substituted pay rises with non-pecuniary benefits.[8]

Box A

The relationship between pay satisfaction and work time flexibility

To investigate how flexible work arrangements relate to pay satisfaction, we use data from the European Working Conditions Survey for 2021. This survey covers over 70,000 employees from 36 European countries. In particular, it includes responses to question on pay satisfaction, ranging from 1 (highest satisfaction) to 5 (lowest satisfaction) and working time, ranging from 1 (working time is very flexible) to 4 (working time is very inflexible). It also includes information on job features such as the ability to influence decisions, the degree of work autonomy and the ability to work from home.

We employ these data in an ordered logit model, also known as the proportional odds model. The dependent variable is the level of pay satisfaction, $\boldsymbol{PS}$, at the individual survey respondent level. The main regressor is the degree of working time flexibility, $\boldsymbol{F}$, for that same person. In addition, we control for job features that are reported in the survey and could influence pay satisfaction. Denoting the vector of control variables $\boldsymbol{X}$, the level of pay satisfaction s, and the residual $\boldsymbol{u}$, the empirical specification for individual i is as follows:

$$Pr[\boldsymbol{PS_i} = s] = F(\beta_F \boldsymbol{F_i} + \beta_x \boldsymbol{X_i}) + \boldsymbol{u_i}$$

We estimate this empirical specification and report the results in Table A1. Figures in the main text pertain to the odds ratios, obtained by exponentiating the coefficients. Specifically, $\beta_F = 0.4$ implies an odds ratio of roughly 1.5, meaning that a one-notch increase in working time flexibility raises the likelihood of improving pay satisfaction by about 50%. To illustrate, we start from 8% – the share of highest pay satisfaction in the data – and consider a scenario in which a respondent changes his/her answer to the working time flexibility question from 1 to 2 to 3 and then to 4. This would imply that the probability of this respondent enjoying the highest pay satisfaction would increase from 8% to 12% to 18% and (with rounding) to 28% – overall, a 20 percentage point increase.

[7] Between 2019 and 2022, several other non-monetary aspects of job quality improved. In particular, the share of temporary contracts declined while that of job postings offering health-related benefits, retirement schemes and paid time off increased (OECD (2023)).

[8] In addition, to the extent that non-pecuniary benefits are associated with reduced job mobility, they would also contribute to lower aggregate wage growth because pay rises tend to be larger for job-to-job transitions. Engbom (2022), for instance, documents that higher labour market fluidity in the form of voluntary quits and job-to-job transitions is associated with higher wage growth.

Dependent variable: pay satisfaction[1] Table A1

Explanatory variables	Coefficient	Odds ratio	p-value
Working time flexibility	0.407***	1.503***	0.000
Ability to influence decisions	0.196***	1.217***	0.000
Work autonomy	0.048***	1.049***	0.000
Ability to work from home	0.022***	1.022**	0.041
Observations	42,161		
Wald chi-squared	480.61		
Pseudo R-squared	0.0245		

[1] The regression includes country fixed effects. ***/**/* indicates statistical significance at the 1/5/10% level.

Source: Authors' calculations.

Understanding the drivers of slack and the job-rich recovery

To understand how current labour market tightness could affect wage formation and inflation, one needs to consider the respective roles of the supply and the demand for labour, and their possible evolution going forward. While distinguishing the two may be conceptually clear and simple, in practice the lines separating supply and demand can be blurry. With these caveats in mind, we first provide empirical proxies for labour supply and demand, and then discuss their relative trends.

Proxies for labour supply and labour demand

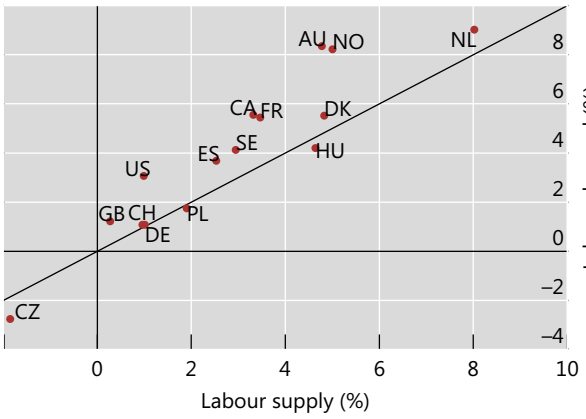
Standard metrics of labour supply and labour demand offer a view of any imbalances in the market. To measure labour supply, we sum the labour force (the working age population that participates in the labour market) and marginally attached workers.[9] In turn, we proxy labour demand by adding employment (satisfied demand for labour) and unfilled vacancies (unsatisfied demand for labour).

Based on these metrics, the demand for labour has expanded more rapidly than the supply of labour since 2019. This is true for several jurisdictions, most notably Australia, Canada, France and the United States (Graph 4.A). Labour demand outgrowing labour supply owes to a constellation of factors, which we discuss next distinguishing between supply and demand side developments.

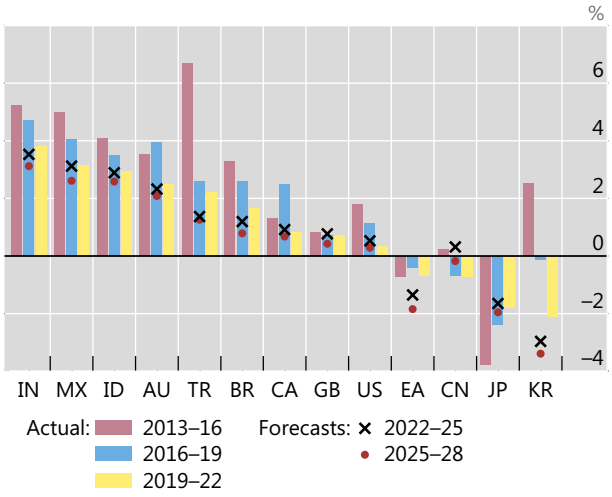
[9] Marginally attached workers are defined as those who are neither employed nor actively looking for work, but willing to work and available for taking a job.

Labour demand has grown faster than labour supply[1] Graph 4

A. Demand outstrips supply in most jurisdictions…[2]



B. …as working age population growth slows down



[1] See technical annex for details. [2] Change between the Q1 2019–Q4 2019 and Q1 2022–Q1 2023 averages.

Sources: OECD; United Nations; authors' calculations.

Developments on the labour supply side

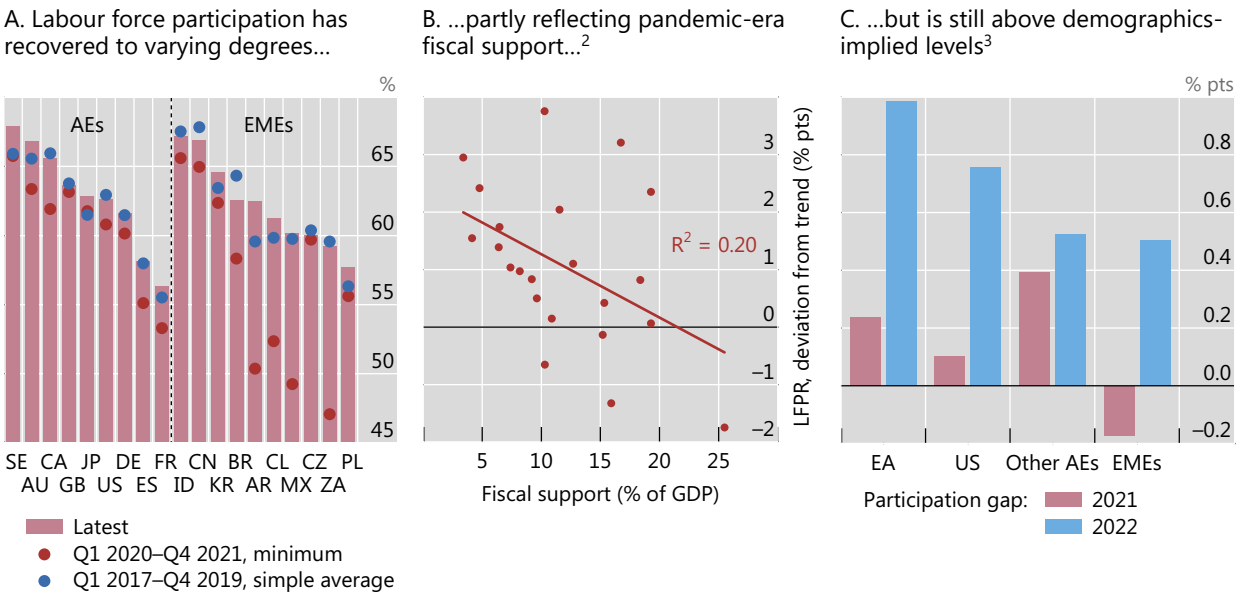
The working age population has grown more slowly since the pandemic than during the 2010s in many countries (Graph 4.B). In most European and some Asian countries, it shrank, intensifying pre-pandemic trends. In a few cases (eg Australia and Canada), reduced migration has been a key factor.

Labour force participation rates have also faced downward pressure, from both cyclical and structural forces. After large declines during the pandemic, the labour force participation rate has generally recovered, but there are some notable exceptions (Graph 5.A, red dots compared with the columns). In Canada, the United Kingdom, the US and quite a few EMEs (including China), participation rates are still below pre-Covid benchmarks (blue dots compared with the columns). In part, this reflects cyclical forces, as the pandemic's legacy is still lingering. In addition to being held back by health concerns,[10] participation has been recovering more slowly where pandemic-related fiscal support was larger (Graph 5.B).[11] Downward pressure could also stem from population ageing, which tends to imply a decline in labour force

[10] Abraham and Rendell (2023) estimate that health concerns, positive wealth effects due to higher asset prices, refinancing at record low interest rates and government cash payments account altogether for 60% of the decline in participation in the US, sometimes showing up as early retirements. In the UK, early retirement and long-term sickness played a key role in the 0.8% shift into inactivity of the working age population (Li and Mulas Granados (2023)).

[11] It is also worth noting that marginally attached workers – which standard measures of labour force participation rate tend to overlook – were drawn back into the labour force as labour markets tightened. As a result, the pool of marginally attached workers, which increased significantly during the pandemic, shrank back to pre-pandemic levels. This transition of marginally attached workers into the labour force has led to an overstatement of the recovery in labour force participation.

Labour supply slows down in many parts of the world[1] Graph 5



[1] See technical annex for details. [2] Difference between latest (Q1 or Q2 2023) figures and country-specific long-term trends before Q1 2020. [3] Actual minus predicted labour force participation.

Sources: International Labour Organization; IMF; OECD; United Nations; World Bank; Eurostat; Refinitiv Datastream; national data; authors' calculations.

participation rates. The positive gap between current participation rates and demographics-implied levels should close in most jurisdictions (Graph 5.C).[12]

Developments on the labour demand side

Employment (the "satisfied" portion of labour demand) has grown rapidly since the Covid recession trough, in both AEs and EMEs (Graph 6.A). In EMEs, for instance, the rebound has been particularly strong, with employment expanding by almost 10% since the pandemic troughs. Compared with the typical past rebound, employment in AEs and EMEs has expanded 3 and 7 percentage points faster, respectively, in the current expansion (Graphs 6.B and 6.C).

In contrast to past experience, the current expansion has been "job-rich" as opposed to "job-less".[13] One indication is that unemployment rates have dropped approximately twice as fast than one would expect on the basis of historical experience and current output growth. Okun's law estimates reveal that a 1 percentage point increase in GDP growth now corresponds to a 0.3 percentage point drop in unemployment, compared with only about 0.15 percentage points in past recoveries.

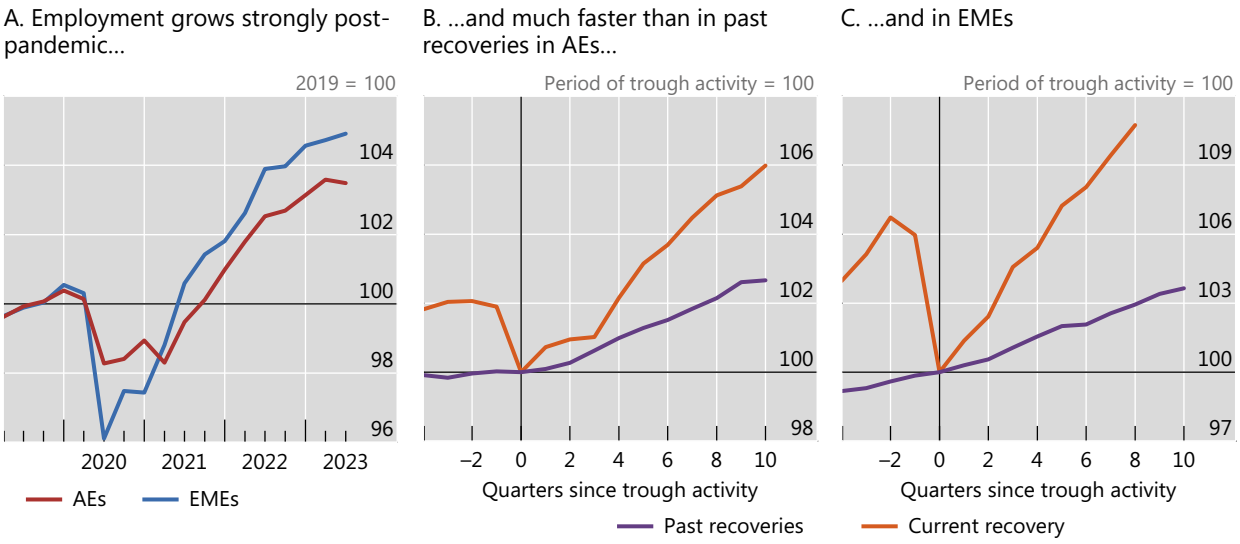
It is possible to shed light on the factors behind the current job-rich recovery by dissecting the employment-output nexus. To do so, we rely on a simple identity whereby GDP is the combination of output per hour, hours per worker and

[12] Goodhart and Pradhan (2020) discuss the implications of such changes for inflation.

[13] See Graetz and Michaels (2017) for cross-country evidence on jobless recoveries for AEs.

Employment growth looks strong by historical standards in both AEs and EMEs[1]

Graph 6



[1] See technical annex for details.

Sources: International Labour Organization; OECD; authors' calculations.

employment (Graph 7). We take GDP as given – determined by aggregate demand at cyclical frequencies – and consider the relative evolution of its components.

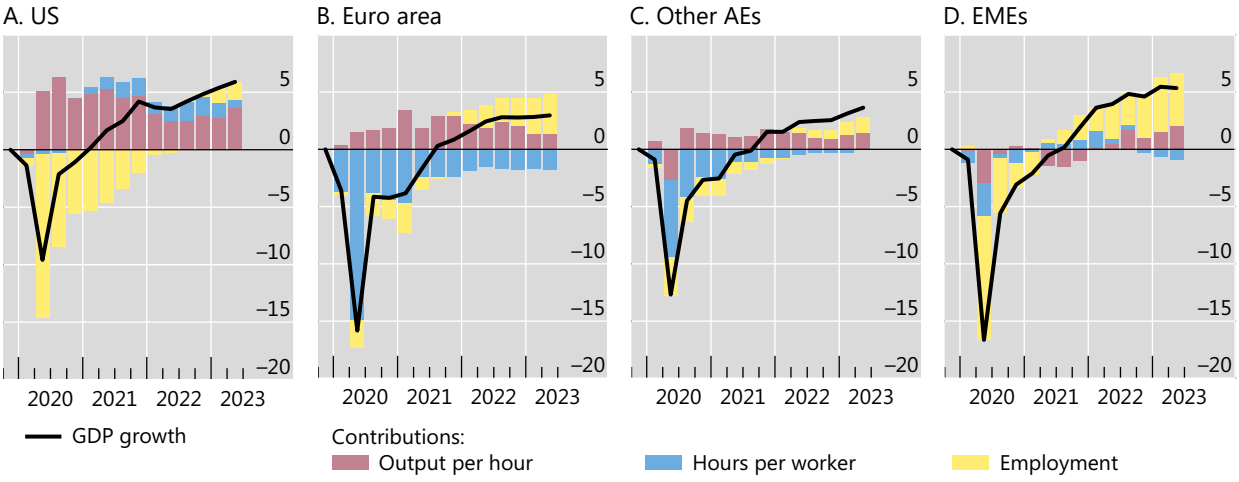
Four non-mutually exclusive factors could help to account for the recovery's job-rich nature. While some are hard to quantify, one can get a sense of their relevance.

First, *output per hour* – a measure of productivity – has been subdued, especially in the euro area (Graph 7, red bars). One possible reason is the recovery's sectoral composition. As a result of large rotations in consumption post-Covid, much of the

Strong employment underpins output amid sluggish productivity[1]

Cumulative changes since Q4 2019, in per cent

Graph 7



[1] See technical annex for details.

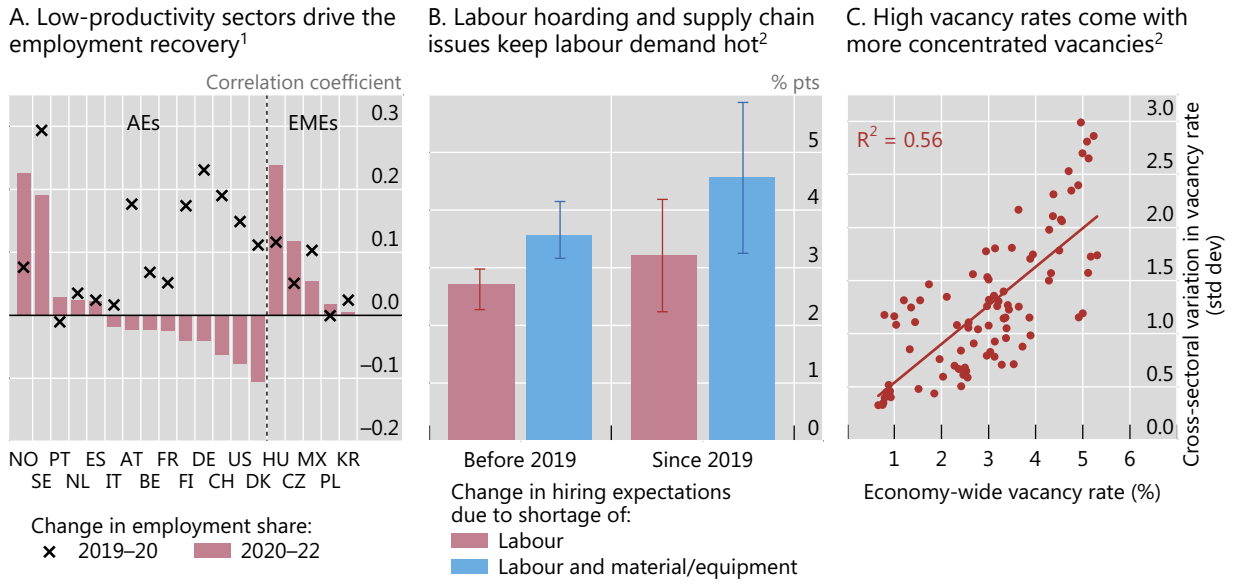
Sources: OECD; Refinitiv Datastream; national data; authors' calculations.

recent employment creation has taken place in lower-productivity sectors, such as the contact-intensive "services, recreation and accommodation" (Graph 8.A, red columns). That said, the magnitude of this effect seems small. Estimates reflecting AE data suggest that a service-intensive expansion implies around 0.15 percentage points lower productivity growth on average over two years than a manufacturing-led one. Another possible reason is a pandemic-induced erosion of skills. But again, this seems unlikely to be material, given that unemployment spells were short and employer-employee relations were maintained through furlough schemes in many countries.[14]

Second, firms may have been hoarding labour. Flat, if not declining, hours per worker coinciding with buoyant employment is consistent with this interpretation (Graph 7, blue bars). This development is, again, particularly visible in the euro area, in part reflecting the prevalence of worker retainment programmes. One should also consider that a tight labour market can foster labour hoarding. The prospect of hiring difficulties materially limiting output induces firms to add labour as a precaution (Graph 8.B). If so, tightness may beget tightness. But hiring intentions also increase when firms face difficulties in sourcing their non-labour inputs. In the post-Covid recovery, these may reflect supply chain disruptions (Graph 8.B, blue bars). Such difficulties may lead firms to switch to more labour-intensive substitutes, including in-house production.

Changing labour demand accounts for some of the tightness

Graph 8



[1] Correlations, across 19 sectors, between labour productivity in 2019 and changes in employment share. [2] See technical annex for details.

Sources: International Labour Organization; OECD; Eurostat; national data; authors' calculations.

[14] The impact of working from home on productivity is ambiguous in theory and too early to discern in the data. Managers and workers have varying opinions about how remote work affects productivity, depending, for example, on how commute time is considered (Barrero et al (2023)). On the one hand, fully remote work can lead to lower productivity because communication becomes less efficient (Emanuel and Harrington (2023), Gibbs et al (2023), Yang et al (2021), Emanuel et al (2023)). On the other hand, hybrid work arrangements may result in productivity gains as workers can tailor time allocation for tasks that require focus and for those that require interaction with others (Bloom et al (2015), Choudhury et al (2021, 2022), Bloom et al (2023)).

We estimate the extent to which hiring intentions relate to hiring difficulties and difficulties to source inputs (Box B). Our objects of interest are "net hiring intentions" (HI) – ie the fraction of firms planning to expand their workforce minus the fraction planning the opposite. On the basis of estimates using data from 2019 onwards, we find that HI increases by 3.2 percentage points in response to a one standard deviation increase in the fraction of firms reporting labour bottlenecks.[15] This estimate rises to 4.6 percentage points if we add the impact from a one standard deviation increase in the fraction of firms reporting materials as a bottleneck. Translated into actual hiring, this could imply employment increasing by as much as 1.3%.

Third, workers may want to work fewer hours. Survey evidence suggests so, with the pandemic being one of the drivers.[16] This would be observationally equivalent to labour hoarding since average hours worked would fall and employment would rise.

Box B

The relationship between hiring intentions and factors limiting production

To quantify how hiring intentions relate to hiring difficulties and difficulties to source inputs, we use data from the European Commission Survey on Industry Business Climate indicators. These data cover 24 (two-digit) manufacturing subsectors for 10 European countries: Austria, Denmark, Finland, France, Germany, Italy, the Netherlands, Portugal, Spain and Sweden).

The panel regression specification is as follows. We use as a dependent variable "net hiring intentions" (HI), defined as the fraction of firms planning to expand their workforce minus the fraction of firms planning to shrink their workforce over the next 12 months. Then we include, as explanatory variables, the fraction *L* of firms facing hiring difficulties, ie declaring labour as a factor limiting output, and the fraction *M* of firms facing input shortages, ie declaring material or equipment as a factor limiting output. Moreover, we include controls *X* for: the rate of capacity utilisation, the fraction of firms declaring demand as a factor limiting output and the fraction of firms declaring finance as a factor limiting output. Finally, saturating the specification with fixed effects, the empirical specification for sector s, in country c, at time t, is:

$$\boldsymbol{HI}_{s,c,t} = \alpha_{s,c} + \alpha_{s,t} + \alpha_{c,t} + \beta_L \boldsymbol{L}_{s,c,t} + \beta_M \boldsymbol{M}_{s,c,t} + \beta_X \boldsymbol{X}_{s,c,t} + \boldsymbol{u}_{s,c,t}$$

We estimate this regression using quarterly data. We first estimate the regression over the full sample, ie from the first quarter of 2000 until the second quarter of 2023 (Table B1, first column). We then estimate two regressions: one using the sample period up to the fourth quarter of 2018 (second column) and another where we focus on the period between the first quarter of 2019 and the second quarter of 2023 (third column).

[15] To be sure, changes in the share of firms reporting hiring difficulties or difficulties in sourcing input observed during the post-Covid recovery are one order of magnitude larger than the one historical standard deviation change considered here.

[16] For instance, work-life balance considerations may have reduced preferred hours of work in Europe (Eurofound (2022)). Workers using more sick leave may also explain the reduction (Arce et al (2023)).

Dependent variable: net balance of hiring intentions[1] Table B1

Time period	Q1 2000–Q2 2023	Q1 2000–Q4 2018	Q1 2019–Q2 2023
Labour as a factor limiting output	0.322***	0.347***	0.200***
	(0.0246)	(0.0343)	(0.0368)
Material as a factor limiting output	0.0800***	0.0772***	0.0589**
	(0.0183)	(0.0247)	(0.0244)
Change in capacity utilisation rate	0.0830***	0.0825***	0.0954
	(0.0285)	(0.0315)	(0.0605)
Demand as a factor limiting output	–0.146***	–0.144***	–0.142***
	(0.0122)	(0.0138)	(0.0233)
Finance as a factor limiting output	–0.123***	–0.102***	–0.107
	(0.0283)	(0.0289)	(0.0708)
Observations	15,769	12,393	3,376
R-squared	0.646	0.659	0.726
Within R-squared	0.0482	0.0558	0.0677

[1] All regressions include the full set of sector-time, country-time and country-sector fixed effects. Robust standard errors are reported in brackets. ***/**/* indicates statistical significance at the 1/5/10% level.

Source: Authors' calculations.

Figures reported in the main text pertain to coefficients estimated over the latest period. Consider first a one standard deviation increase in the fraction of firms reporting labour as a factor limiting output, about 16 percentage points. Given β_L = 0.2, the net balance of hiring intentions would increase by 3.2 percentage points. Now consider a one standard deviation increase in the fraction of firms reporting material as a factor limiting output, about 23 percentage points. Given β_M = 0.06, the net balance of hiring intentions would increase by about 1.4 percentage points. The combined effect amounts to 4.6 percentage points. Based on the historical correlation between employment growth and the net balance of hiring intentions (about 0.28), this would amount to additional employment growth of about 1.3 percentage points.

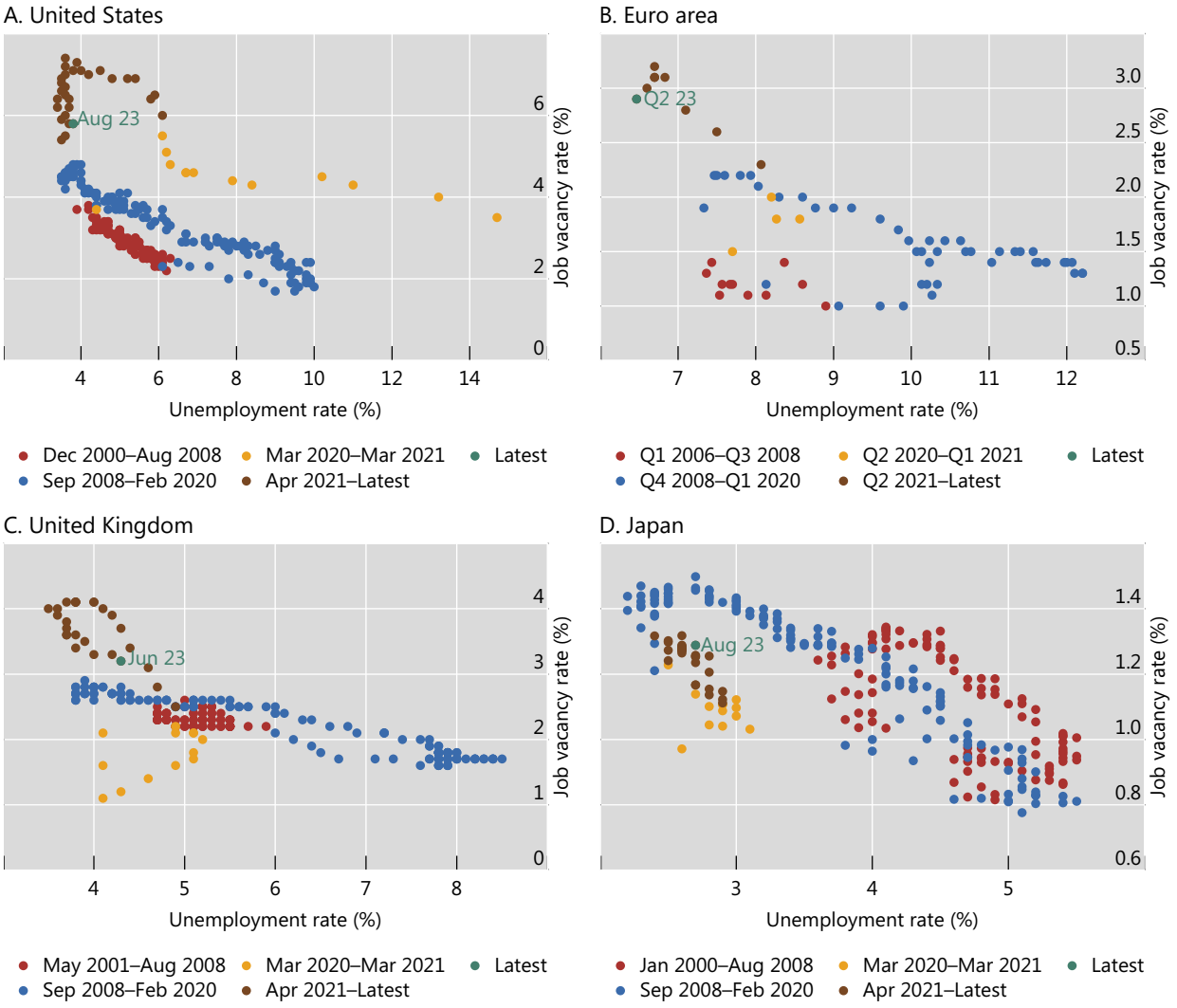
In turn, "unsatisfied demand", as captured by vacancies, is unusually large. That is, there are more job openings on offer for the same level of unemployment than in the past – the Beveridge curve has shifted outwards (Graph 9). This is particularly visible in the US but also in the UK. Such a shift has therefore materialised even in jurisdictions where worker-firm relationships have remained in place. In these cases, the driver for the abnormal excess demand goes beyond the challenge of finding workers with the right skills or experience.

There are several possible explanations for unsatisfied demand. One is the sheer speed of the recovery, as a more rapid return of GDP to its pre-Covid level has usually translated into larger increases in the vacancy-to-unemployment ratio. Another possibility could be that people have been shunning the sectors where labour demand has been higher. For instance, anecdotal evidence suggests that the experience with Covid-19 has reduced labour supply in contact-intensive sectors. Indeed, unfilled vacancies in such sectors – notably, recreation and accommodation – have been especially high in the later stage of the recovery. Furthermore, lingering health concerns from Covid could also be playing out. Yet another possibility is the sectoral reallocation. Additional labour demand in the post-Covid period has

emanated from a small set of sectors, as high aggregate vacancy rates have come hand in hand with more dispersed vacancy rates across sectors (Graph 8.C).[17,18]

Beveridge curves[1]

Graph 9



[1] See technical annex for details.

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

[17] Furthermore, the interaction between labour demand and labour supply can exacerbate the difficulty of filling job vacancies. Specifically, the tighter the labour market, the more likely it is that the marginal worker is less productive. Ravenna and Walsh (2022) estimate that this labour demand and supply composition effect accounts for a 1.5% fall in measured labour productivity, even as total factor productivity stays constant.

[18] This argument may be less relevant from a quantitative viewpoint. Previous recessions have also featured sizeable, and arguably longer-lasting, reallocations (eg out of the overblown construction sector in the wake of the Great Recession). And the sectors that have expanded most post-Covid are those that suffered most during the recession: the reallocation turned out to be much more limited than initially anticipated (crosses with positive values mostly correspond to columns with negative values in Graph 8.A).

Policy considerations

While by no means the only factor, labour market tightness is key to assessing future wage growth and possible related inflationary pressures. This is because, in tighter markets, there is a greater likelihood that bargaining power will shift in favour of workers and pass-through between wages and prices will gain strength (BIS (2023) and Borio et al (2023)). The evolution of the labour market will reflect the intensity and persistence of the demand and supply factors driving the job-rich post-pandemic recovery examined above.

On the one hand, the specific factors behind the unusually strong labour market tightness may quickly fade away. The pandemic's legacy has been, by and large, short-lived, and reallocation movements are now largely completed. In addition, changes in work preferences curtailing labour supply have proven mostly temporary and labour hoarding could easily dissipate if the global economy keeps slowing down. And, since willingness to work trails the business cycle, the recovery in participation rates is likely to continue even as the economy cools down (Hobijn and Şahin (2021)).

On the other hand, even if the pandemic experience does not leave a long-lasting imprint on the behaviour of workers and firms, structural, longer-term forces may keep labour markets tight. Labour supply may remain subdued because of adverse demographic trends, and the current reconfiguration of global supply chains – the so-called reshoring movement – could reinforce the shift in firms' business models from "just in time" to "just in case". This would lead firms to build extra buffers, including on the labour side, which could then generate upward pressure on wages and, in turn, prices. The implications for inflation would be even greater short of a pickup in labour productivity growth.

The balance of these forces, which naturally varies across countries, will be an important factor influencing monetary policy. There is an agreement that a stance committed to bringing inflation back to target is essential to limit the erosion of real wages. Sustaining this commitment will be particularly important in economies where labour market tightness is more persistent, the bargaining power of labour is stronger and/or wage adjustments take longer (eg because of multi-year contracts). In such economies, the monetary policy trade-offs will be starker.

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Technical annex

Graph 1.A–B: Seasonally adjusted series; semiannual data for ID. Definitions differ among economies.

Graph 1.A: For BR, percentiles over Q2 2012–Q4 2019; for CN, over Q1 2018–Q4 2019. Latest observations for Q2 2023 except CA and US (Q3 2023) and ID (Q1 2023).

Graph 1.B: Latest observations for Q2 2023 except CH (Q3 2023), DE, ES, FR, HU, NL, PL and SE (Q1 2023).

Graph 1.C: The job finding frequency is the fraction of the unemployed and inactive that become employed in the following quarter. The job separation frequency is the fraction of the employed that become unemployed or inactive in the following quarter. For the US, changes in job finding (hiring) and separation rates as defined by the Bureau of Labor Statistics.

Graph 2: The sample covers AU, BR, CA, CL, CZ, DE, ES, FR, GB, IT, JP, KR, NL, SE, PL and US.

Graph 3: Based on survey responses from the EU countries and CH, GB, NO and TR.

Graph 3.A: Survey question: "Which best describes your work situation – You can influence decisions that are important for your work?"

Graph 3.B: Survey question: "Would you say that for you arranging to take an hour or two off during working hours to take care of personal or family matters is…?" Plot shows the share of respondents saying that it is easy.

Graph 3.C: Odds ratio based on an ordered logit regression of pay satisfaction on the four variables listed in specification (1) in Box A using individual responses to the 2021 EWCS. An odds ratio above one signals greater likelihood of higher wage satisfaction when the explanatory variable takes a higher value. All estimated coefficients are significant at the 1% level.

Graph 4.A: Labour demand is the sum of employment and vacancies; labour supply is the sum of the labour force and marginally attached workers. Marginally attached are persons aged 15 and over who are neither employed nor actively looking for work, but are willing/desire to work and are available for taking a job.

Graph 4.B: Working age population is defined as those aged 15 to 64. Forecasts use data from the UN Population Division, medium fertility variant.

Graph 5.A: Aged 15 and over. Based on seasonally adjusted quarterly series, except for CN (annual) and ID (semiannual). Latest observations for Q2 2023 except for AR (Q1 2023) and CN (2022).

Graph 5.B: The sample includes 17 AEs and five EMEs. Fiscal support is defined as the additional spending or foregone revenues. The numbers are based on official estimates covering cumulative spending in 2020 and the first four months of 2021, estimates as of 27 September

2021. LFPR = labour force participation as a percentage of working age population, aged 15 and over; seasonally adjusted.

Graph 5.C: Euro area = euro 19 excluding LU. Other AEs = AU, CA, CH, DK, GB, JP, NO, NZ and SE. EMEs = BR, CL, CO, CZ, HU, ID, IL, KR, MX, PL, RO and TR. For country groups, population-weighted average across economies. Predicted labour force participation is computed using trend estimates of labour force participation by age cohort (15–24; 25–64; 64 and older) and the corresponding shares of each age cohort in working age population.

Graph 6.A: Median employment growth based on data for 16 AEs and 10 EMEs.

Graph 6.B-C: Median percentage change in employment across output recoveries relative to $t = 0$ across 16 AEs and 10 EMEs, from Q1 1960 to Q1 2023. $t = 0$ corresponds to trough activity according to the OECD classification of turning points in the cyclical component of real GDP.

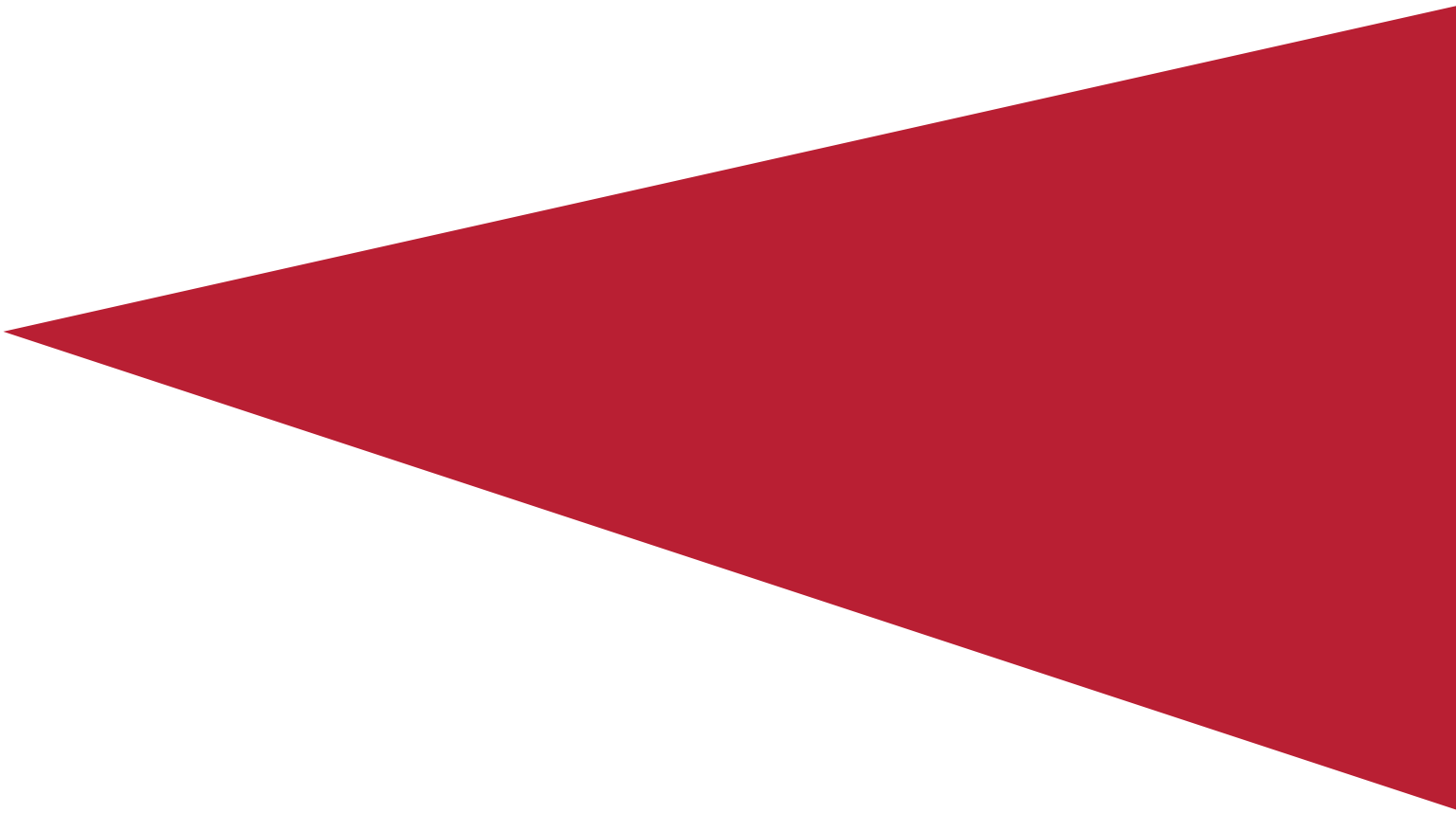
Graph 7: GDP-PPP-weighted averages for regions. Euro area = AT, BE, DE, EE, ES, FR, IE, IT, LT, NL, PT, SI and SK; other AEs = AU, CA, DK, GB, JP, NO, NZ and SE; EMEs = CZ, HU, IL, MX and PL.

Graph 8.B: Change in the net share of firms planning to hire, given a one standard deviation increase in the fraction of firms reporting a particular shortage. The empirical specification controls for capacity utilisation, the fraction of firms reporting demand or financial constraints, as a factor limiting output, and is saturated with fixed effects. The sample covers AT, DE, DK, ES, FI, FR, IT, NL, PT and SE. Sector sample covers all two-digit manufacturing sectors. Vertical lines indicate the 90% confidence interval. Before 2019 refers to Q1 2000–Q4 2018. Since 2019 refers to Q1 2019–Q2 2023.

Graph 8.C: The scatterplot shows the standard deviation of the vacancy rate across sectors against the average. The sample covers BE, DE, DK, ES, FI, FR, NL, NO, PT and SE over Q1 2021–Q1 2023.

Graph 9: For EA, JP and US, job vacancy rate is computed as the number of job vacancies divided by (number of occupied posts + number of job vacancies) multiplied by 100. For GB, job vacancy ratio is computed as the three-month rolling average ratio of vacancies per 100 employee jobs. For US, job vacancy rate for total non-farm. For EA and GB, job vacancy rate/ratio for industry, construction and services (except activities of households as employers and of extraterritorial organisations and bodies). For JP, job vacancy rate for new job openings.

Promoting global monetary and financial stability



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ISSN 1683-013X
ISBN 978-92-9259-714-6