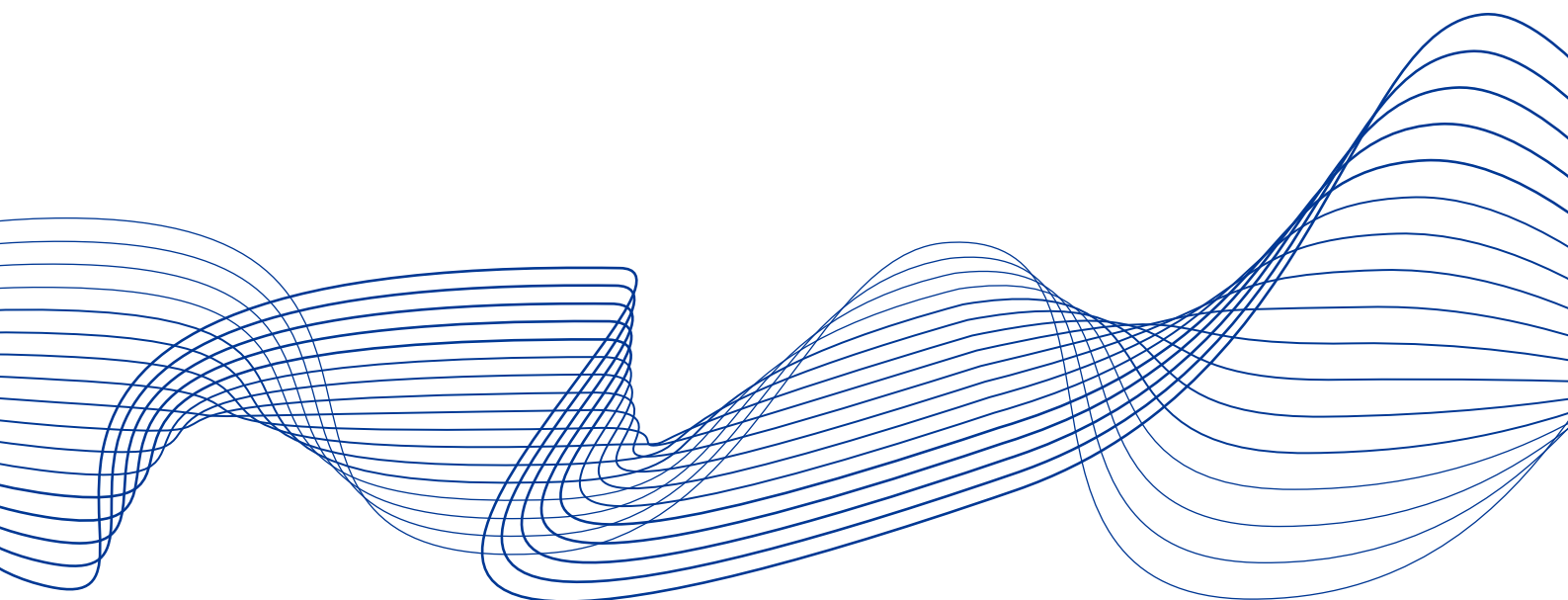


NBFI Monitor

No 8 / June 2023

EU Non-bank Financial
Intermediation Risk Monitor 2023



ESRB
European Systemic Risk Board
European System of Financial Supervision

Contents

1	Executive summary	2
2	Overview	6
2.1	Developments in main aggregates	7
2.2	Overview of risks and vulnerabilities	10
2.3	Engagement in certain risky activities	15
2.4	Recent developments in the EU policy framework	19
Box 1	Financial Stability Board's work on crypto-assets and open-ended funds	20
3	Special features	23
3.1	Stress associated with liability-driven investment strategies	23
3.2	Vulnerabilities in crypto-assets and related intermediaries	37
4	Entity-based monitoring	44
4.1	Investment funds	44
4.2	Other financial institutions	47
5	Crypto-assets, centralised finance and decentralised finance	50
Box 2	The FTX collapse: main facts and lessons learnt	52
6	Activity-based monitoring	55
6.1	Derivatives	55
6.2	Securities financing transactions	58
6.3	Securitisation	60
Box 3	Commercial real estate collateral loan obligations	62
	Annexes	64
	Imprint and acknowledgements	65



1 Executive summary

This report considers the main risks and vulnerabilities associated with investment funds and other financial institutions (OFIs) in 2022; it also extends the monitoring universe to crypto-assets and associated intermediaries. In June 2022 the ESRB identified priorities for future analysis of the crypto ecosystem from a financial stability perspective, including regular risk monitoring in the NBFi Monitor. Although the crypto ecosystem is small and exposed to certain risks that are unique to it, business models of a number of crypto-asset intermediaries resemble those of regulated financial institutions. These businesses tend to offer services such as crypto-asset trading, investing, lending and borrowing. Accordingly, they engage in essentially the same activities as traditional financial actors, i.e. credit intermediation, liquidity and maturity transformation in addition to using leverage. Crypto-assets and associated intermediaries provide financial intermediation and can be exposed to the same vulnerabilities and financial risks as the traditional financial sector while remaining largely unregulated. The monitoring universe of the report has been extended accordingly: Alongside traditional non-bank intermediaries such as investment funds and OFIs, it now also includes stablecoins, centralised finance (CeFi) platforms and decentralised finance (DeFi) protocols. The cut-off date for the report was 31 December 2022. It therefore does not cover the period in March 2023 that saw the failure of three US banks, related adverse developments in the crypto-asset ecosystem and further pressure on the European and US banking systems.

In 2022 risks to the stability of the EU financial system increased due to rising geopolitical tensions, higher-than-expected inflation and tightening financial conditions. In September 2022 the ESRB issued its first general warning to reflect these heightened risks.¹ Against this backdrop, total assets of EU investment funds fell by 11% in 2022. This was accounted for mainly by valuation effects reflecting falls in equity and bond markets. The other financial institutions (OFI) sector declined by 2%. Non-bank credit – i.e. financing provided by investment funds and OFIs through loans and debt securities – granted to EU non-financial corporates increased slightly and at the end of 2022 stood at 20% of external debt funding for 2022. Crypto-assets and their associated intermediaries came under stress during the year. This included collapses of several large actors, as well as a broad-based drop in crypto-asset valuation in the second half of the year. The size of the global crypto ecosystem remains small compared with traditional non-banks. The combined value of crypto-assets was estimated at less than USD 1 trillion (€930 billion), compared with combined assets of EU investment funds and OFIs totalling €41.3 trillion.

This report considers structural vulnerabilities and cyclical risks facing investment funds, OFIs and crypto intermediaries. Despite a challenging environment and pockets of vulnerabilities, investment funds and OFIs proved resilient in 2022. Conversely, certain intermediaries in the crypto ecosystem collapsed when risks crystallised. This year's report focuses on several risks and vulnerabilities (two middle panels in Figure 1):

¹ See [Warning of the European Systemic Risk Board of 22 September 2022 on vulnerabilities in the Union financial system](#) (ESRB/2022/7) 2022/C 423/01, (OJ C 423, 7.11.2022).



First, a broad-based economic slowdown and tightening financial conditions could increase credit risk. This is particularly relevant for investment funds exposed to low-rated bonds and loans, financial vehicle corporations engaged in securitisation and financial corporations engaged in lending. Materialisation of credit risk can lead to losses, which in the case of investment funds could translate to large outflows and liquidity strains. Higher credit risk particularly affects the commercial real estate (CRE) sector. Leveraged investors, including non-bank financial intermediaries, could be forced to sell CRE properties, adding downward pressure on prices and exposing non-mitigated risks associated with a liquidity mismatch in real estate investment funds.

Second, market liquidity risk could put further pressure on non-bank financial intermediaries engaged in liquidity transformation. Several indicators pointed to the deterioration of liquidity conditions in EU bond markets in 2022. Alongside cyclical liquidity risk, challenges persisted due to structural changes in liquidity provision and demand. The development of the investment fund industry over the past few years – including, in particular, open-ended funds offering daily redemptions – has resulted in a higher likelihood of large liquidity demands due to investor outflows during stress periods. In addition, the rise in liquidity demands may be related to the transition to central clearing after the global financial crisis. Such dynamics were at play in the case of equity derivatives in March 2020, in the case of energy derivatives as of March 2022 and in the case of interest rate derivatives in September 2022. Similarly, the sharp decline in crypto-asset valuation was amplified by a broad-based decline in collateral values, triggering the unwinding of leveraged positions. Structural developments that might negatively affect liquidity provision, especially in times of stress, are related to the rise of electronic trading and the movement of banks away from a dealer-based model to a broker-based model.

Third, excessive use of leverage could amplify liquidity and market risks, as well as lead to contagion and magnify shocks to financial stability. This vulnerability applies to traditional non-bank entities included in the monitoring universe of the report and to crypto intermediaries, as both use leverage and rely on collateral. Liquidity risk associated with the use of leverage crystallised in September 2022, when investment funds using liability-driven investment (LDI) strategies faced large collateral requests in repo transactions and margin calls in interest rate derivatives (IRDs) following the sharp rise in UK gilt yields. As LDI funds tried to sell large volumes of gilts to raise cash, market prices fell further and liquidity deteriorated abruptly. Against this backdrop, the Bank of England intervened in the gilt market to safeguard financial stability.² Similarly, the collapse of FTX – a major intermediary in the crypto ecosystem – was partly related to the use of high leverage. As the use of leverage increases interconnectedness, associated risks can spread to other intermediaries. This also applies in principle to the crypto ecosystem, not least through collateral chains and reputational effects. However, risks originating there are currently less likely to transmit to the traditional financial system, as exposures remain low. Risks associated with the use of leverage may also be amplified by low market liquidity, as observed in some bond market segments in 2022.

To complement the monitoring sections, this report includes two special features. The first special feature on stress related to liability-driven investment (LDI) strategies provides insights into how risks associated with liquidity and leverage actually materialise. To this end, it uses regulatory

² See also [Risks from leverage: how did a small corner of the pensions industry threaten financial stability? – speech by Sarah Breen](#), 7 November 2022.

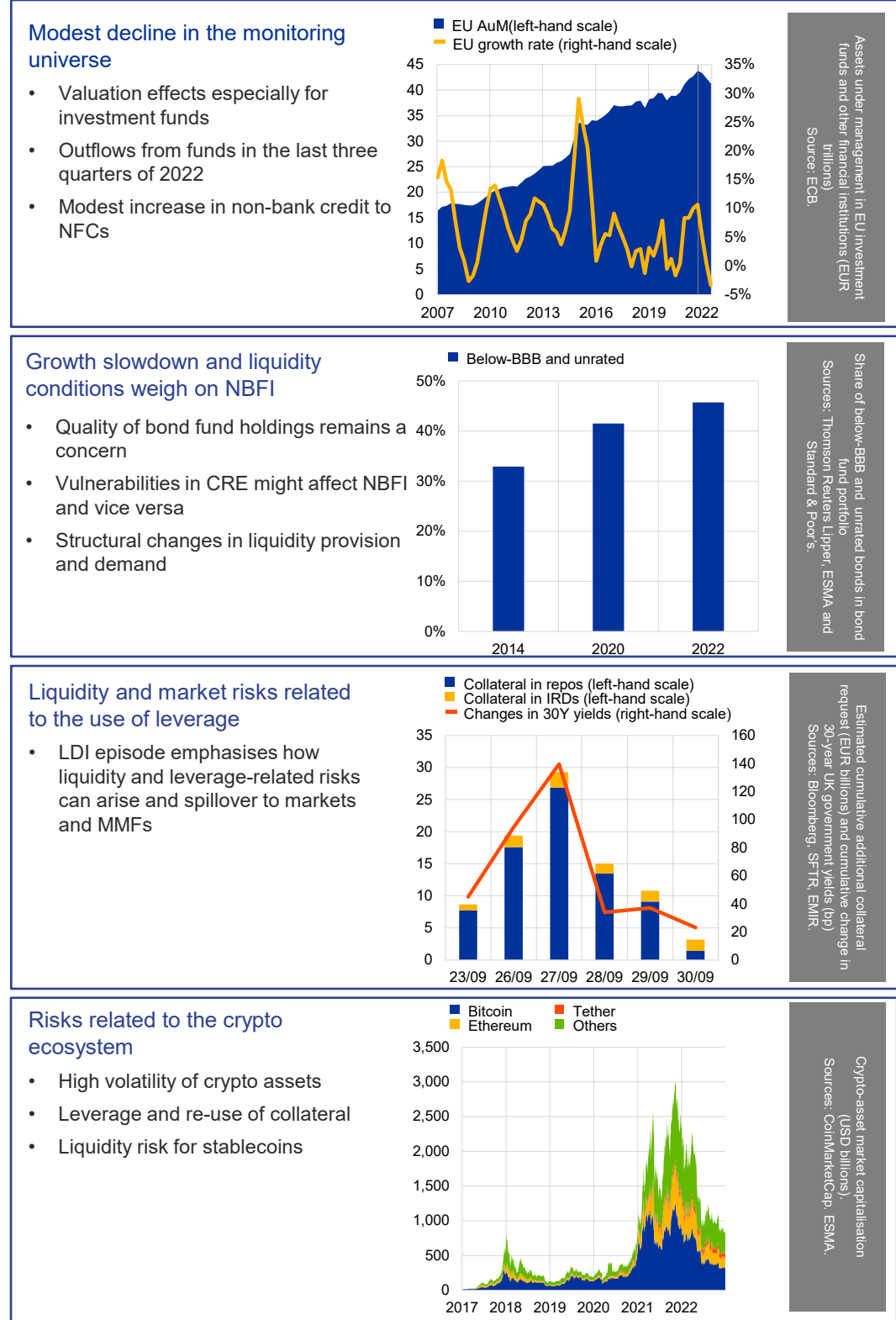


data to assess the resilience of EU LDI funds to a sudden rise in yields. The analysis indicates that, if yields were to rise by 100 or 150 basis points, LDI funds would face a liquidity shortfall, as their liquidity buffers would not be large enough to cover margin and additional collateral requests. They would need to redeem money market fund (MMF) shares and/or sell other securities, including sovereign bonds, transmitting risks to other parts of the financial system. The second special feature focuses on vulnerabilities of the crypto ecosystem that are similar to those present in traditional non-bank financial intermediaries. It considers how crypto-assets and associated intermediaries engage in credit intermediation, as well as liquidity and maturity transformation, and also their use of leverage and interconnectedness.



Figure 1

Summary of main trends and risks in non-bank financial intermediation



Source: ESRB.



2 Overview

The NBF Monitor 2023 discusses the main systemic risks and vulnerabilities associated with investment funds and OFIs while also providing an initial assessment of risks in the crypto ecosystem. The report covers the main developments in 2022³ and considers a range of risks and vulnerabilities associated with financial intermediation outside the banking system, focusing on those related to liquidity and maturity transformation, use of leverage and interconnectedness. The report covers all investment funds and OFIs. It also covers crypto-assets and associated intermediaries insofar as the type of financial intermediation they provide is exposed to similar risks and vulnerabilities to those faced by the ‘traditional’ non-bank financial sector. Insurance companies, pension funds and CCPs are not included in the entity-based monitoring of the report per se due to the differing risk profiles of their main activities.⁴ As investment funds and OFIs participate in a range of financial markets – including derivatives, securities financing and securitisation – entity-based monitoring is complemented by activity-based monitoring to provide a holistic assessment of financial stability risks. This edition of the NBF Monitor introduces dedicated risk monitoring of crypto-assets and their associated intermediaries.

Crypto-assets and associated intermediaries may engage in types of financial intermediation that lead to similar vulnerabilities and expose them to similar risks to those covered in this report. In particular, crypto-asset and associated intermediaries may undertake credit intermediation, as well as liquidity and maturity transformation, and use high leverage, which exposes them to certain risks (see special feature in Section 2.2). First, stablecoins engage in liquidity and maturity transformation and intend to maintain a stable value relative to fiat currencies. To safeguard this peg, they receive cash as (non-insured) ‘deposits’ and rely on various mechanisms such as reinvestment in low-risk assets for reserve-backed stablecoins or automated issuance and repurchases for algorithmic stablecoins. This form of liquidity and maturity transformation is similar to that performed by money market funds (MMFs), in particular by MMFs using constant net asset valuation. Second, centralised finance (CeFi) – which consists of centralised intermediaries within the crypto-asset space, such as lending and trading platforms offering services that include custody of assets, margin lending and collateral re-use – facilitates liquidity and maturity transformation and provides leverage to its clients, including through long collateral chains that can be costly to unwind. Third, decentralised finance (DeFi) – i.e. autonomous protocols that perform financial functions based on smart contracts – provides leverage and credit through collateralised borrowing, which may result in the automatic liquidation of positions when thresholds are breached and thus amplify procyclicality. Risks that are typical of the traditional financial system have repeatedly materialised and may be regarded as a root cause of the extreme cyclicality inherent in crypto-assets, as well as the series of collapses among its intermediaries during 2022. In addition to the risks and vulnerabilities this report focuses on, crypto-assets and associated intermediaries may be subject to specific risks such as operational vulnerabilities or weakness in the consensus mechanisms employed⁵. Data on the crypto ecosystem that are

³ The report might also refer to less timely information due to data availability.

⁴ Key risks and developments in the EU insurance and occupational pensions sectors are examined in EIOPA Financial Stability Reports. See for instance [Financial Stability Report December 2022](#), EIOPA, December 2022.

⁵ For an overview, see [Crypto-assets and their risks for financial stability](#), ESMA, October 2022.



provided in the report should be interpreted with caution, as they are gathered for the most part from commercial sources. In addition, estimates are available only at the global level, and not at EU level, due to data gaps. To account for the global nature of the crypto ecosystem, estimates are provided in USD throughout the report.

The NBF Monitor is structured as follows: The remainder of Section 1 presents the most important changes in main aggregates of the monitoring universe, discusses its key risks and structural vulnerabilities and assesses its engagement in certain risky activities. It also provides a brief overview of recent policy developments that are relevant from a financial stability perspective. Section 2.1 highlights events related to the UK gilt market turmoil and stress in LDI strategies in order to provide further insight into leverage and liquidity risk in the non-bank sector. Section 2.2 discusses risks and vulnerabilities associated with financial intermediation performed by the crypto ecosystem. Sections 3 and 4 explore risk assessment in greater detail, focusing on how the key risks identified in Section 1 might affect, or be amplified by, the monitoring universe of the report. Section 5 complements this by shedding more light on systemic risks related to derivative markets, securities financing transactions and securitisation. Annexes provide more detailed information on statistical classifications for investment funds and other financial institutions, according to the European System of National and Regional Accounts (ESA)⁶, as well as a description of business models of the monitoring universe of the report and a statistical overview.

2.1 Developments in main aggregates

Economic and financial sector conditions deteriorated during the review period, triggering large falls in asset prices. Over the reporting period, the war in Ukraine and a broader increase in geopolitical tensions weighed on growth and pushed up inflation. As soaring energy and food prices raised concerns about persistent inflation, the ensuing monetary policy responses of central banks led to a tightening of financial conditions. This environment also contributed to weaker EU economic activity, with real GDP projected at 3.3% in 2022 and 0.3% in 2023⁷. Uncertainty about growth prospects and monetary policy triggered declines in financial asset prices, increased market volatility and lowered market liquidity in European corporate and sovereign bond markets. Recent data releases that post-date the review period for the report, however, point to a more favourable outlook: decelerating inflation and the possibility of higher-than-expected economic activity in 2023 (with the growth outlook lifted to 0.8%).⁸

The fall in asset prices was reflected in a moderate decrease in the size of the monitoring universe in 2022. As the economic outlook deteriorated and asset prices declined, some of the growth seen in 2021 reversed. Total assets of EU investment funds and OFIs fell to €41.5 trillion at the end of 2022 compared with €43.8 trillion at the end of 2021, but remained above the €39.0 trillion mark at the end of 2020 (Chart 1 panel a). This mainly reflected a fall in investment fund assets under management (AuM) caused by valuation losses during 2022 (Chart A5) and outflows following the first quarter of the year. Valuation losses in bond portfolios were primarily driven by high interest rate sensitivity. There was an increase in the correlation of returns across both

⁶ For more information, see [European system of accounts \(ESA\) 2010](#).

⁷ See [European Economic Forecast](#), Autumn 2022, European Commission.

⁸ See [European Economic Forecast](#), Winter 2023, European Commission and [World Economic Outlook](#), IMF, April 2023.



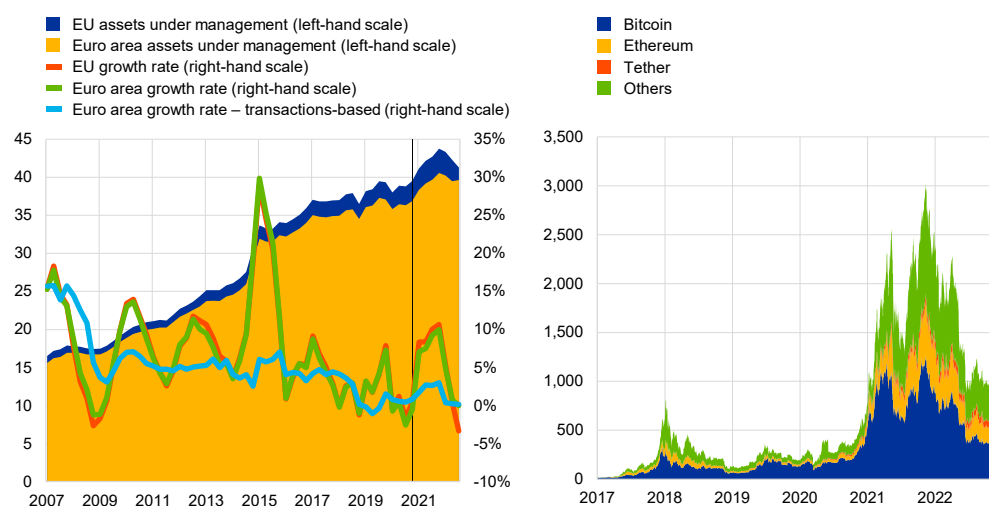
equities and debt securities, affecting a wide range of investment fund categories. As a result, net assets of both equity and bond funds fell during 2022, with approximately 80% of the declines attributable to valuation losses. Similarly, the decline in assets of the EU OFI sector was related to valuation effects. Overall, assets of investment funds and OFIs accounted for 39% of the European financial sector assets, compared with 40% in 2021 (Chart A3). While the combined value of crypto-assets ('market capitalisation') peaked at close to USD 3 trillion (€2.6 trillion) in November 2021, the market subsequently contracted to less than USD 1 trillion (€930 billion, Chart 1 panel b) at the end of 2022.

Chart 1

The size of the monitoring universe has declined due to negative valuation effects for investment funds, while the collapse of some entities in the crypto-asset space has shaken market confidence

a) Assets under management in EU and euro area investment funds and other financial institutions b) Crypto-asset market capitalisation

(left-hand scale: EUR trillions; right-hand scale: annual growth rates in percentages) (USD billions)



Sources: ECB and ESRB calculations, CoinMarketCap and ESMA.

Notes: In Chart 1 panel a, red and green lines indicate annual growth rates based on changes in outstanding amounts. The blue line indicates the annual euro area growth rate based on transactions, i.e. excluding the impact of exchange rate variations or other revaluations and statistical reclassifications.

Against this backdrop, investment funds and OFIs remained an important source of funding to EU non-financial corporations (NFCs). Market-based credit, i.e. intermediated via markets in the form of debt securities and non-retained securitised loans (irrespective of the type of institution that provides financing) as opposed to loans typically originated by banks, declined from 21% to 19% of total external credit to NFCs at the end of 2022 (Chart 2 panel a). This reflected the impact of marked-to-market valuation on debt securities and increased cost of funding following the tightening of monetary policies globally, as well as net debt securities issuance turning negative. On the other hand, non-bank credit, where the ultimate lenders are investment funds and OFIs (irrespective of the mode of financing provided in the form of loans or debt securities), increased



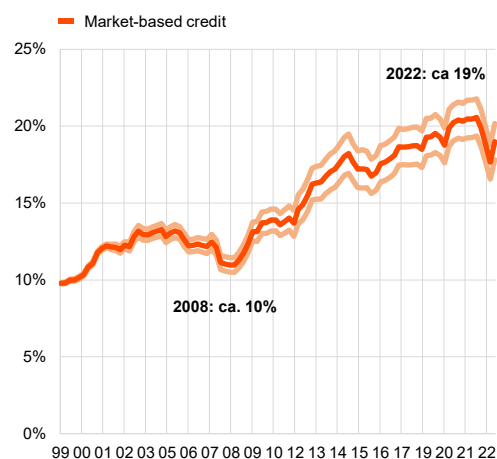
slightly and stood at 20% at the end of 2022 (Chart 2 panel b). In 2022 loans provided to EU NFCs by OFIs increased in nominal terms, while loans provided by investment funds decreased slightly. Both market-based and non-bank credit have roughly doubled since the Global Financial Crisis.

Chart 2

After a steady increase over the last decade, market-based credit to NFCs declined in 2022 due to flow and valuation effects in credit markets

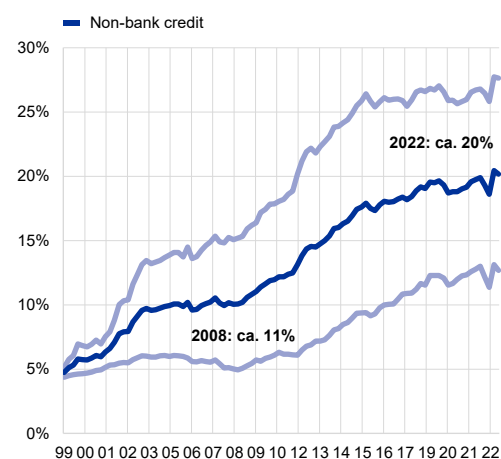
a) Market-based credit to EU NFCs

(percentages of NFC credit from financial institutions)



b) Non-bank credit to EU NFCs

(percentages of NFC credit from financial institutions)



Sources: ECB and ESRB calculations.

Notes: Market-based credit reflects the share of market-based debt finance (debt securities and non-retained securitised loans) relative to the total external debt of euro area NFCs, irrespective of which sector provided the credit. Non-bank credit reflects the relative share of investment funds and OFIs in providing debt financing to euro area NFCs compared with credit provided by all financial institutions (the non-bank financial sector and banks), irrespective of whether that financing is provided in the form of loans or debt securities. The dark line reflects an average of the light lines, which include (dotted line at the top) or exclude (dotted line at the bottom) loans granted by a residual of OFIs. The methodology is similar to described in Box 2, "Financial Integration and Structure in the Euro Area", ECB, April 2022, but insurance corporations and pension funds are excluded.

Linkages between investment funds, OFIs and the banking sector declined slightly in relative terms.

Wholesale funding provided by investment funds and OFIs increased 6.5%, driven by higher deposits, and reached €2.8 trillion at the end of 2022 (Chart A8). As a share of total bank funding, however, deposits from investment funds and OFIs declined to less than 6% of bank liabilities in 2022 (Chart A9 panel b). In addition, bank exposures to investment funds and OFIs on the asset side, as measured by debt and equity instruments from investment funds and OFIs held by banks, as well as bank loans, fell to less than 7% in 2022 (Chart A9 panel a).



2.2 Overview of risks and vulnerabilities

In September 2022 the ESRB issued its first general warning on vulnerabilities in the financial system.⁹ Financial stability risks increased in 2022 due to rising geopolitical tensions, higher-than-expected inflation and tightening financial conditions. The warning highlighted three severe risks to financial stability: (i) deterioration of the macroeconomic outlook, coupled with the tightening of financing conditions, which heightened balance sheet stress for NFCs and households; (ii) risks stemming from a sharp fall in asset prices that could trigger large marked-to-market losses, which in turn might amplify market volatility and cause liquidity strains; and (iii) risks to asset quality and the profitability outlook of credit institutions. In addition to these three risks, the ESRB pointed to a further increase in vulnerabilities in the commercial real estate (CRE) sector, an increased probability of large-scale cyber incidents and a sovereign debt dynamic affected by slower economic growth and tightening financial conditions.

Financial stability risks could adversely affect, or be amplified by, non-bank financial intermediaries. Intermediaries that are included in the monitoring universe of the report are susceptible to risks stemming from the deterioration of macroeconomic prospects, disorderly market corrections and market liquidity strains (Figure 2). High levels of macroeconomic uncertainty, including around inflation and the global monetary policy outlook, could lead to shocks to financial markets and the real economy. Imbalances in liquidity supply and demand in certain market segments could amplify these shocks in times of stress, increasing the risks of disorderly market developments. Structural vulnerabilities in non-bank financial intermediation – liquidity mismatch, use of leverage and interconnectedness – can contribute to systemic risk and spread shocks throughout the financial system. These vulnerabilities apply not only to investment funds and OFIs but also to crypto-assets and their associated intermediaries.

⁹ See [Warning of the European Systemic Risk Board of 22 September 2022 on vulnerabilities in the Union financial system](#), (ESRB/2022/7) 2022/C 423/01, (OJ C 423, 7.11.2022).



Figure 2

Risks and vulnerabilities in EU non-bank financial intermediation

2023 economic outlook for the EU non-bank financial sector remains challenging amid rising rates and economic uncertainty			
Risks	<p>Economy and credit risk Deterioration in the macroeconomic outlook and increased probability of recession; higher funding costs and expected rise of defaults related to tightening financial conditions</p>	<p>Disorderly falls in asset prices Further price falls due to tightening of financial conditions, increased correlation between asset classes</p>	<p>Market liquidity Liquidity strains in some market segments alongside collateral shortages, leading to increasing price volatility</p>
Structural vulnerabilities in the EU non-bank financial sector			
Vulnerabilities	<p>Liquidity mismatch Misalignment between terms of investor withdrawal and the possibility of liquidating assets without large price discounts</p>	<p>Use of leverage Leverage can amplify selling pressure following market declines (e.g. via margin calls, collateral, covenants and deleveraging); margin and collateral calls can generate liquidity strains</p>	<p>Interconnectedness Interconnectedness and the risk of contagion across sectors and within the non-bank financial sector, including domestic and cross-border linkages</p>
Data quality and gaps Remaining gaps in data and poor reporting quality prevent a more comprehensive risk analysis			

Source: ESRB.

Lack of data and poor data quality hamper the ability of authorities to carry out their financial stability mandate. Deficiencies in reporting frameworks – both regular and high-frequency in crisis situations – prevent comprehensive risk assessment and in turn the possibility to properly address risks to financial stability. Inadequate data-sharing arrangements between authorities with financial stability mandates additionally hinder the cooperation and coordination of policy responses. In this regard, a great deal of progress has been made in recent years, yet these efforts remain inadequate. Important gaps persist in terms of leverage in particular, as either some entities do not provide entity level information or else data are fragmented across reporting systems and authorities. In addition, legal restrictions on sharing granular data (including institution-specific) on securities holdings in the EU, as well as on the liability side of financial institutions, hinder analysis. In the investment fund sector, key obstacles relate to the absence of a harmonised reporting framework for UCITS at the EU level, as well as misreporting under the AIFMD. For EMIR and SFTR data – similarly to AIFMD – reporting quality poses the biggest challenge. Regarding OFIs, important data gaps remain in terms of captive financial institutions (CFIs) and OFI residuals. As regards crypto-assets, the lack of regulatory data makes it difficult to assess the size, as well as interlinkages with the traditional financial sector, and related risks. As data on the crypto ecosystem are currently gathered by commercial sources, estimates are uncertain at best and available at the global level only.

2.2.1 Risks

Both the deterioration of the macro-financial environment during the review period and increased credit risk continue to pose challenges to the NBFi sector. Uncertainty caused by geopolitical tensions, persistently high inflation, simultaneous global tightening of monetary policies and the ensuing tightening of global financial conditions have deteriorated the economic growth



outlook. At the end of 2022 (the cut-off date for the report), the risk of a recession in 2023 increased. More recent statistical releases that post-date the review period for this report have been more positive, however, indicating that a recession either might not occur or else be short-lived.¹⁰ Against this backdrop, the rise in funding costs could result in higher default rates and contribute to rising credit risk. An increase in credit risk can weigh on the performance of investment funds exposed to debt securities, loans and CRE assets, alongside financial vehicle corporations engaged in securitisation and financial corporations engaged in lending.

The risk of a disorderly fall in asset markets remains high. Valuations in equity and fixed income markets declined substantially in 2022. Given the uncertainty around the path of interest rates, inflation and economic activity, further declines or shocks could trigger an adjustment of credit premia or risk appetite. A large rapid change in valuations could subsequently trigger procyclical effects, as witnessed in the UK gilt market at the end of September 2022, when a sharp rise in UK bond yields induced by fiscal policy announcements resulted in large margin requests on leveraged positions by LDI funds using sovereign bonds as collateral, which exacerbated initial price falls (see special feature in Section 2.1). The magnitude and repercussions of asset price falls could be amplified by a positive correlation between stock and bond prices, which would diminish the benefits of diversification.

Increased cyclical liquidity risk could amplify shocks. Several indicators pointed to a deterioration of liquidity conditions in EU sovereign and corporate bond markets in 2022, as the provision of liquidity was reduced amid high volatility and further expected monetary tightening. Given uncertainty around changes in monetary policy, concerns about market liquidity remain, including potential collateral scarcity. Lower liquidity and market volatility can be mutually reinforcing and put further pressure on NBFIs performing liquidity transformation, including those that use derivatives or repo transactions.

In addition to cyclical factors, challenges persist due to structural changes in liquidity provision and demand. Liquidity supply refers to the provision of liquidity by economic agents, i.e. the quantity they are willing to trade at their quoted prices. Liquidity demand relates to the need to dispose of assets quickly in exchange for cash. On the supply side (or provision of liquidity), first, the advent of electronic trading has resulted in tighter bid-ask spreads in normal times but a rapid withdrawal of orders during periods of stress. Some of the main liquidity providers are proprietary trading firms with small balance sheets, trading on their own behalf rather than on behalf of clients; hence, their withdrawals tend to be quick when volatility surges. Second, banks have moved from a dealer-based model – where balance sheets were used to carry inventory for market-making activities – to a broker-based model, where banks act more as a pass-through between investors and markets. This implies that shock transmission between markets and investors has increased. At the same time, the liquidity needs of market participants have structurally increased. The development of the investment fund industry, particularly open-ended funds offering daily redemptions, has resulted in a higher likelihood of large liquidity demands due to investor outflows during stress periods. In addition, the rise in liquidity demands can be related to the transition to central clearing. The central clearing obligation has reduced counterparty risk, but it can trigger liquidity risk through large margin requests for clearing members and their clients. Such dynamics were seen in the case of equity derivatives in March 2020, energy derivatives as of March 2022

¹⁰ See [World Economic Outlook](#), IMF, April 2023.



and interest rate derivatives in September 2022. Similarly, the sharp decline in crypto-asset valuation was amplified by a broad-based decline in collateral values, triggering the unwinding of leveraged positions.

2.2.2 Vulnerabilities

Liquidity mismatch remains an important structural vulnerability in non-bank financial intermediation. Investment funds continue to undertake a high level of liquidity and maturity transformation despite the recent decline. Most of EU-domiciled investment funds have an open-ended structure (92% in terms of net assets) and can offer frequent redemption opportunities. Some of these funds invest in lower liquidity instruments, and – especially in times of stress when faced with large investor redemptions – can engage in procyclical selling, exacerbating price movements in underlying markets. Similar dynamics could occur in the crypto-asset space, as some intermediaries also engage in liquidity transformation. For instance, large investor withdrawals could force stablecoin issuers to liquidate the reserves backing the coins. Such sales could test liquidity in markets for assets underlying the reserves of stablecoins.

Excessive leverage in the financial system is a key vulnerability. Leverage amplifies existing risks such as liquidity or market risks. The use of derivatives to obtain synthetic leverage or the reliance on the repo market to obtain financing can trigger margin requests when there are adverse price moves. In such cases, the crystallisation of market risk will result in higher losses due to higher exposure to market volatility and additional liquidity requests via margin demands. In turn, the need to deleverage positions could result in fire sales and put further downward pressure on prices (see special feature in Section 2.1). Additionally, the use of leverage increases counterparty exposures and interconnectedness both within the traditional financial system and within the crypto-asset space.

Exposures within the NBFi sector remain high, with potential to spread shocks. On the asset side, funds are mainly exposed to OFIs and to other investment funds, as well as non-financial corporates (Chart 3 panel a). On the liability side, other non-bank financial institutions such as insurance companies and non-residents are the main investors in European investment funds despite some heterogeneity across countries¹¹ (Chart 3 panel b). This implies that shocks affecting some non-bank entities can be transmitted to other parts of the system. A recent example of cross-sectoral and cross-border risk transmission of liquidity risks relates to the turmoil faced by UK pension funds using EU-domiciled GBP-denominated LDI funds that triggered large redemptions from some European GBP-denominated MMFs (see special feature in Section 2.1). Linkages between sectors can also take the form of ownership ties, as most of the 25 largest asset management companies operating in the EU are owned by banks (Chart 4). In the crypto ecosystem, shocks can spread through collateral chains, commingled accounts and cross-exposures between different crypto-asset intermediaries.

¹¹ Such differences in the investor base are also seen in MMFs, see [EU MMF market 2023](#), ESMA, 8 February 2023 for further details.



Chart 3

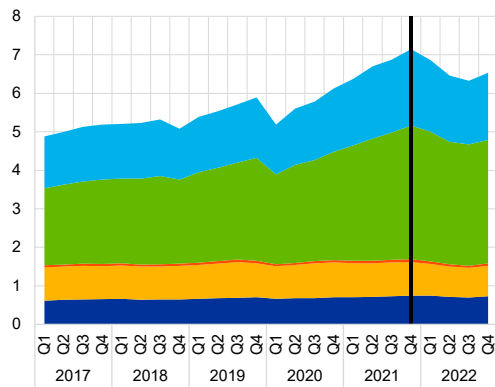
Despite a decline in absolute exposures, funds remain highly exposed to non-bank financial institutions

a) Exposures of euro area investment funds to other financial and non-financial sectors in the euro area

b) Investors in euro area investment funds

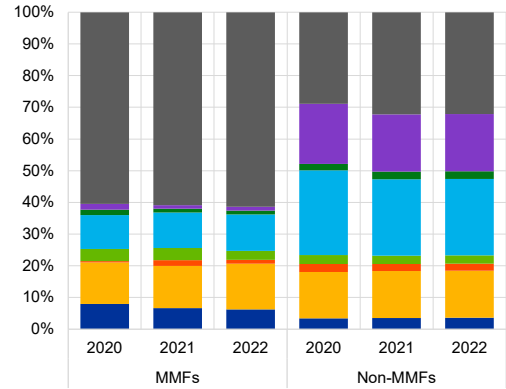
(EUR trillions)

- Monetary financial institutions
- General government
- Insurance corporations and pension funds
- Non-MMF investment funds and other financial institutions
- Non-financial corporations



(percentages)

- NFC
- Non-MMF investment funds
- MFIs
- OFIs
- Insurance corporations and pension funds
- General government
- Households and non profit institutions serving households
- Non-EA investors



Source: ECB.

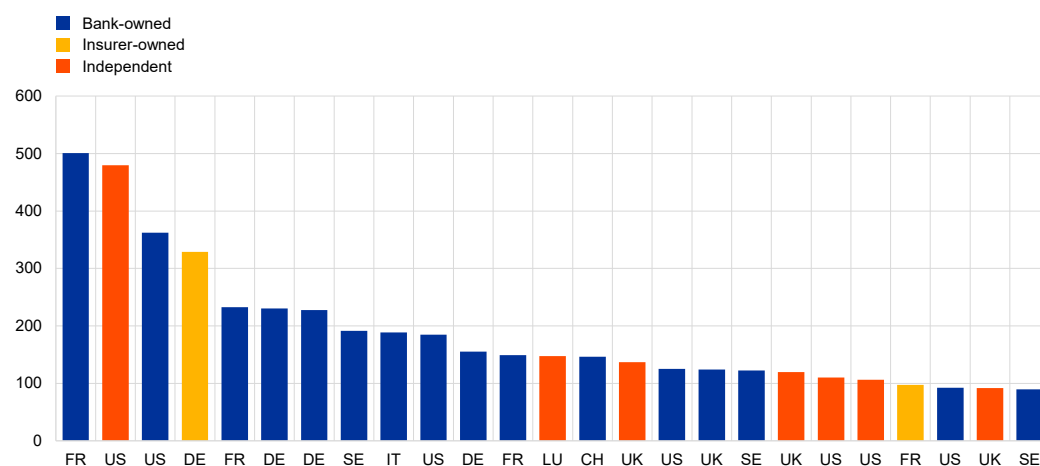
Notes: Chart 3 panel a: euro area investment funds holdings of debt securities, investment fund shares and other equity issued by euro area entities; Chart 3 panel b: investors in euro area non-MMF IF, EA and non-EA investors.



Chart 4

Aggregate net assets of the top 25 asset management companies in the EU by group type

(EUR billions)



Sources: Thomson Reuters Lipper and ESRB calculations.

Notes: Asset managers are classified as held by banks/insurers when the asset manager is a subsidiary of the bank/insurer (this excludes cases where bank/insurance activities are a subordinate business of the group or where the holding company also holds banks/insurers) or has a bank/insurer as majority shareholder. The horizontal axis shows the domicile of the asset manager. The observations are for the end of 2022.

2.3 Engagement in certain risky activities

The monitoring framework considers how investment funds, OFIs and parts of the crypto ecosystem are involved in certain risky activities and how these activities might have an impact on financial stability. Tables 1 and 2 provide an overview of such risky activities carried out by the entities, crypto-assets and associated intermediaries considered in this report, including liquidity and maturity transformation, use of leverage and credit intermediation, along with their interconnectedness with the banking sector. The level of engagement in these activities does not necessarily translate to a measure of risk. The assessment of the level of engagement is informed by descriptive statistics and market intelligence but is ultimately judgement-based. It is reviewed and updated on an annual basis and incorporates improved data availability and regulatory developments. A more detailed analysis is presented in Sections 3 and 4, followed by activity-based monitoring, which is covered in Section 5.

There was no change in the assessment of investment funds and OFIs from 2021 to 2022.

Hedge funds and financial vehicle corporations (FVCs), as well as security and derivative dealers (SDDs), have a pronounced engagement in the risky activities considered in this report (Table 1). Bond funds, private debt (PD) funds and MMFs, as well as special-purpose entities (SPEs) and financial corporations engaged in lending (FCLs), have a medium engagement. The engagement of equity funds, mixed funds (investing in equities and bonds), PE funds and ETFs is low on average.



Table 1

Mapping of activities to entity types – investment funds and OFIs

	Investment funds											OFIs				
	MMFs			Bond funds		Mixed funds	Equity funds	Hedge funds	RE funds	ETFs	PE funds ⁴	PD funds	FVCs	SPEs	SDDs	FCLs
	CNAV	VNAV	LVNAV	Corporate	Sovereign											
Market size																
EA AuM (EUR trillions)	0.1	0.6	0.7	3.3	3.4	4.6	0.5	1.0	1.3	0.6	n.a.	2.2	n.a.	n.a.	0.6	
Annual growth (%)	-3	-2	9	-19	-9	-11	8	12	0.3	23	n.a.	3.1	n.a.	n.a.	7.9	
Summary assessment																
Engagement	●	●	●	●	●	●	○	●	●	●	●	●	●	●	●	
Risk transformation activities																
Credit intermediation	●	●	●	●	●	●	○	●	○	○	●	●	●	●	○	●
Maturity transformation	●	●	●	●	●	●	○	●	●	○	○	●	●	●	●	
Liquidity transformation	●	●	●	●	●	●	○	●	●	○	○	●	●	●	●	
Leverage ²	○	○	○	●	●	●	○	●	●	○	●	●	●	●	●	
Market activities¹																
SFTs	●	●	●	●	●	●	●	●	○	●	○	○	○	○	○	○
Derivatives	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	
Re-use of collateral	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○	
Interconnectedness																
Interconnectedness ³	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○

Source: ESRB.

Notes: The table summarises the assessment of engagement, where the colours of the circles reflect the intensity of the possible institutional engagement in the relevant areas of activity, according to the coding specified in the notes below. The colouring is judgement-based and informed by market intelligence and quantitative evidence. Owing to data limitations and a lack of consistent data, the assessment does not distinguish between consolidated and non-consolidated entities. The geographical coverage of the table refers to entities domiciled in the EU. MMFs stand for money market funds, CNAV for constant net asset value, VNAV for variable net asset value, LVNAV for low-volatility net asset value, FVCs for financial vehicle corporations (non-retained securitisations), SPEs for special purpose entities, SDDs for security and derivative dealers and FCLs for financial corporations engaged in lending. Data on the size and annual growth of EU PD funds, SPEs and SDDs are not available (n.a.). FCL data are for the end of 2021.

1) Market activities through which risk transformation can be undertaken by investment funds and OFIs can take various forms. The list focuses on those market activities deemed to be most susceptible to risks.

2) Leverage refers to financial leverage and not to leverage that is created synthetically through the use of derivatives.

3) Direct and indirect interconnectedness with the banking system based on asset and liability data and staff assessment.

4) While credit intermediation and leverage at the fund level may be low, private equity funds can facilitate credit and leverage in the financial system by engaging in leveraged buyout transactions.

Colour coding: ●=pronounced engagement; ●=medium engagement; ●=low engagement; ○=unlikely or insignificant engagement



The assessment of crypto-assets and associated intermediaries highlights their engagement in liquidity transformation, leverage and re-use of collateral (Table 2).

Stablecoins are crypto-assets which are predominantly pegged to fiat currencies and backed by fiat-denominated collateral or by an algorithm that seeks to adjust supply and demand to maintain the peg. They share similarities with MMFs as they offer liquidity on demand while investing in short-term instruments with differing degrees of liquidity. Centralised finance covers crypto exchanges and other platforms which typically offer leverage through derivatives or margin lending and provide other types of investment or lending services that often involve collateral and subsequent collateral re-use (which are considered securities financing transaction (SFT) activities). Decentralised finance relies on autonomous protocols, where crypto-assets are locked in “liquidity pools” and are used to trade against, or are lent to, other entities via collateralised borrowing. The re-use of collateral is a key characteristic of DeFi due to its inherent composability (i.e. the capacity to combine several different protocols). For the three segments of the crypto-asset market covered here, interconnectedness within the crypto ecosystem is high whereas linkages with the traditional financial system are low at present.



Table 2

Mapping of activities to crypto-assets and associated intermediaries

	Stablecoins	CeFi	DeFi
Market size			
Global size (USD billions)	140	96	58
Annual growth (%)	-14	n.a.	-76
Summary assessment			
Engagement	●	●	●
Risk transformation activities			
Credit intermediation	●	●	●
Maturity transformation	●	●	●
Liquidity transformation	●	●	●
Leverage	○	●	●
Market activities¹			
SFTs	○	●	●
Derivatives	○	●	●
Re-use of collateral	○	●	●
Interconnectedness			
Interconnectedness ²	●	●	○

Source: ESRB.

Notes: The table summarises the assessment of engagement, where the colours of the circles reflect the intensity of the possible institutional engagement in the relevant areas of activity, according to the coding specified in the notes below. The colouring is judgement-based and informed by market intelligence and quantitative evidence. Owing to data limitations and a lack of consistent data, the assessment does not distinguish between consolidated and non-consolidated entities. Due to data gaps, the geographical coverage of the table does not refer to the EU level but to the global level instead. Caveats on the availability and quality of data are important, particularly as the majority of data are gathered from commercial sources. Furthermore, there are concerns over the validity of market capitalisation figures and trading volumes. Data on the annual growth of CeFi proof of reserves are not available (n.a.). Data pertaining to size refer to the market value for stablecoins, the amounts of reserves on crypto-exchange (including assets under custody) for CeFi and total value locked for DeFi at the end of 2022.

1) Market activities through which risk transformation can be undertaken in the crypto-asset universe can take various forms. The list focuses on those market activities deemed to be most susceptible to risks.

2) Direct and indirect interconnectedness with the traditional financial system based on asset and liability data and staff assessment

Colour coding: ●=pronounced engagement; ●=medium engagement; ●=low engagement; ○=unlikely or insignificant engagement



2.4 Recent developments in the EU policy framework

In 2022 there were several policy developments related to the monitoring universe of the report and their potential impact on financial stability. Given the risks identified at the current juncture, this section provides a brief summary of some of the main policy developments. These include a focus on crypto-asset regulation and liquidity risks for investment firms, as well as making securitisation more resilient.

The Markets in Crypto-Assets Regulation¹² (MiCA) establishes a comprehensive EU regulatory framework for crypto-assets that are not already covered by EU rules, intended to protect consumers and financial stability. More specifically, MiCA sets out transparency and disclosure requirements for the issuance and listing of crypto-assets, the authorisation and supervision of crypto-asset service providers in addition to the management, organisation and governance of issuers of crypto-assets, as well as consumer protection provisions and measures to prevent market abuse to ensure the integrity of crypto-asset markets. MiCA distinguishes between three types of crypto-assets: asset-referenced tokens (ART), electronic money tokens (EMT) and other crypto-assets not covered by existing EU law. Enhanced requirements apply to ARTs and EMTs that may commonly be designated as stablecoins. In particular, issuers of ARTs and EMTs will need to (i) be authorised, (ii) seek prior approval for their informational documents (White Papers) and (iii) conform with a full set of requirements concerning, among other things, their own funds, the investment and safekeeping of assets backing the tokens, the rights of token holders, the need to monitor liquidity needs to meet redemption requests and the need to have a plan to support an orderly wind-down in place. The European Parliament and the Council have adopted MiCA on 20 April 2023 and 16 May 2023 respectively. The final text of MiCA is expected to be published in the EU's Official Journal in summer 2023. From a financial stability perspective, current financial regulation could be further improved to better address risk related to interconnectedness, for instance.¹³

Work on amending the AIFMD and UCITS Directive continued in 2022. In 2021 the European Commission adopted a legislative proposal to amend the two directives aiming to improve functioning of the investment fund market in the EU, to enhance investor protection and to tackle vulnerabilities of the asset management sector that could destabilise the financial system.¹⁴ The Council reached agreement on a general approach in June 2022,¹⁵ and the European Parliament agreed its position in February 2023.¹⁶ The file entered the phase of trilogues among EU co-legislators in March 2023. To better monitor risks in the financial system, the Commission proposed

¹² **Proposal for a regulation of the European Parliament and of the Council on Markets in Crypto-assets and amending Directive (EU) 2019/1937, COM/2020/593, September 2020.**

¹³ See also speech by Christine Lagarde **Macroprudential policy in Europe: building resilience in a challenging environment**, 8 December 2022.

¹⁴ See **Proposal for a Directive of the European Parliament and of the Council amending Directives 2011/61/EU and 2009/65/EC as regards delegation arrangements, liquidity risk management, supervisory reporting, provision of depositary and custody services and loan origination by alternative investment funds**, 25 November 2021, COM/2021/721 final, 2021/0376 (COD).

¹⁵ See **Proposal for a Directive of the European Parliament and of the Council amending Directives 2011/61/EU and 2009/65/EC as regards delegation arrangements, liquidity risk management, supervisory reporting, provision of depositary and custody services and loan origination by alternative investment funds**, 21 June 2022.

¹⁶ See Parliament's Committee on Economic and Monetary Affairs **report on the proposal for a directive of the European Parliament and of the Council amending Directives 2011/61/EU and 2009/65/EC as regards delegation arrangements, liquidity risk management, supervisory reporting, provision of depositary and custody services and loan origination by alternative investment funds**, February 2023.



widening the scope and increasing the granularity of supervisory data reported by AIFM and subjecting UCITS to supervisory reporting, to include reporting stress-testing results. ESMA would be mandated to carry out a feasibility study on the data to be collected, taking into account the needs of the supervisors while at the same time seeking to identify and remove duplications under the currently applicable Union laws. To this end, ESMA would be required to work together with the ECB, the other ESAs and NCAs. In addition, it was proposed to improve data-sharing among the relevant supervisory authorities. The Council and European Parliament broadly endorsed these suggestions. Furthermore, to address liquidity mismatches in the asset management sector, the legislative proposal requires fund managers to select an appropriate liquidity management tool (LMT) among redemption gates or fees and notice periods. The Council and European Parliament leaned towards a mandatory selection of two LMTs from the complete harmonised list of LMTs providing a derogation for MMFs to select only one LMT. The Commission also proposed that AIFMs managing investment funds that originate loans would be required to ensure that such funds are closed-ended. However, the Council and European Parliament preferred that, where AIFMs can prove that they have robust liquidity management systems in place, they continue managing loan-originating AIFs as open-ended.

Box 1

Financial Stability Board's work on crypto-assets and open-ended funds

In October 2022 the Financial Stability Board proposed a framework to strengthen the international regulation of crypto-asset activities.¹⁷ The framework consists of two core components: (i) recommendations to promote consistent and comprehensive regulatory, supervisory and oversight approaches to crypto-asset activities and markets; and (ii) revised high-level recommendations for "global stablecoin" arrangements. The FSB proposes that, where crypto-assets and intermediaries perform an equivalent economic function to that performed by instruments and intermediaries of the traditional financial sector, they be subject to equivalent regulation.

In December 2022 the Financial Stability Board published its assessment of the effectiveness of the 2017 Recommendations.¹⁸ In the report, the FSB concluded that further enhancements were needed to strengthen liquidity management practices and reduce structural liquidity mismatch. FSB and IOSCO are working on revisions to the recommendations to promote greater inclusion and use of liquidity management tools, as well as detailed guidance on their use. Consultation reports are expected in 2023.

Regulatory Technical Standards (RTS) on the measurement of liquidity risks for investment firms¹⁹, published by EBA in November 2022, aim to address liquidity risk that may have an impact on these institutions, their clients and wider financial markets. The RTS enumerate the relevant elements to be considered by NCAs when assessing the materiality of liquidity risk in view of adopting additional liquidity requirements. The relevant elements depend on the size,

¹⁷ See [International Regulation of Crypto-asset Activities - Questions for consultation](#), Financial Stability Board, October 2022.

¹⁸ See [Assessment of the effectiveness of the FSB's 2017 Recommendations on Liquidity Mismatch in Open-Ended Funds](#), FSB, December 2022.

¹⁹ See [Final report Draft regulatory technical standards on specific liquidity measurement for investment firms in accordance with Article 42\(6\) of Directive \(EU\) 2019/2034](#), EBA, November 2022.



structure and internal organisation of investment firms, as well as the scope and complexity of their activities, including trading activities, portfolio management and granting loans to investors to allow them to carry out transactions in financial instruments. The RTS also point out specific elements related to investment firms' funding sources and liquidity dependencies within investment firms' group structures.

In December 2022 the ESAs published a Joint Advice addressed to the EU Commission on the review of the securitisation prudential framework, which aims to improve the resilience of securitisations.²⁰ After looking into capital and liquidity requirements for banks, insurance and reinsurance undertakings, the ESAs proposed targeted amendments to the capital framework for banks, including a reduction in the risk weight floor for certain senior tranches retained by originators. In addition, the ESAs stressed the need for further analysis on whether existing provisions ensure the growth of securitisation markets while at the same time preventing the build-up of risks to financial stability and whether investor protection is warranted.

In December 2022 the ESRB adopted a Recommendation on vulnerabilities in the commercial real estate sector in the European Economic Area (EEA).²¹ The recommendation was based on an assessment of vulnerabilities identified in the CRE sector that could be a source of risk to financial stability. The findings showed that the sector is currently vulnerable to cyclical risks related to higher inflation, tightening financial conditions that limit the scope for refinancing existing debt and taking new loans and the pronounced deterioration in the growth outlook following Russia's invasion of Ukraine. The ESRB recommends that EU and national authorities improve the monitoring of systemic risks stemming from the CRE sector. Monitoring vulnerabilities related to this sector is key to identifying potential risks to financial stability and to assessing possible responses. Vulnerabilities in the CRE sector may be amplified by spillovers across countries and through interlinkages between financial institutions. Hence, to increase the resilience of investment funds that hold CRE-related material exposures, supervisory authorities should consider measures that may include an assessment of risks arising from a liquidity mismatch and leverage in the investment fund sector with respect to CRE market investment and lending.

In November 2022 the Central Bank of Ireland introduced new macroprudential measures for Irish alternative investment funds investing over 50% directly or indirectly in Irish property assets.²² In the presence of vulnerabilities related to high leverage and significant variation in the redemption terms, the property fund sector could respond to future adverse shocks through sales of property assets over a short period of time. This type of selling behaviour has potential to amplify adverse shocks to the commercial real estate market and the wider economy. The Central Bank of Ireland therefore introduced (i) a 60% limit on the ratio of property funds' total debt to their total assets and (ii) Central Bank Guidance, which sets out that Irish property funds should generally provide for a liquidity time frame of at least 12 months, taking into account the nature of the assets held. This time frame should be appropriately balanced between the notification and settlement period. The Central Bank will provide a five-year implementation period for the leverage limits for existing Irish property funds and 18 months for existing property funds to take appropriate action in

²⁰ See [EBA communication: ESAs publish joint advice to the EU Commission on the review of the securitisation prudential framework](#), EBA, December 2022.

²¹ See [Recommendation of the European Systemic Risk Board of 1 December 2022 on vulnerabilities in the commercial real estate sector in the European Economic Area \(ESRB/2022/9\) \(2023/C 39/01\)](#).

²² See [The Central Bank's macroprudential policy framework for Irish property funds](#), Central Bank of Ireland.



response to the guidance. The measures will apply immediately to any funds authorised after 24 November 2022.



3 Special features

3.1 Stress associated with liability-driven investment strategies

This special feature draws on stress in the UK gilt market in September 2022 as a case study to provide further insights on leverage and liquidity risk in the non-bank sector. At the end of September 2022 UK gilt yields surged following the announcement of an expansionary budget by the UK Chancellor, including through large, unfunded tax cuts. This surge caused acute liquidity stress for investors following liability-driven investment (LDI) strategies discussed below – not only UK-defined benefit pension funds but also EU-domiciled investment funds used by UK pension funds, often as pooled investment vehicles. As yields rose, LDI funds faced liquidity demands on their repo and interest rate derivative (IRD) exposures. To meet collateral and margin requests LDI funds had to raise cash, either by requesting additional capital from their pension fund investors or by liquidating some of their holdings. In the latter case, redeeming MMF shares led to LDI funds transmitting liquidity pressure to a number of GBP-denominated EU MMFs, and selling gilts put additional downward pressure on prices, resulting in further margin and collateral calls. Heightened stress in the gilt market prompted the Bank of England to intervene by purchasing gilts to mitigate the self-reinforcing feedback loop²³, and the UK Government withdrew its fiscal proposals.

This special feature combines information from various EU regulatory datasets – AIFMD, EMIR and SFTR²⁴ – to analyse the event in more detail. It also illustrates how scenario analysis can be used to assess the resilience of LDI funds to interest rate shocks and identify vulnerable entities. The results of the scenario analysis, which are presented below, should be cautiously interpreted as a retrospective view of vulnerabilities, inasmuch as the analysis is based on (i) AIFMD data referring to the period prior to the events of September 2022, (ii) SFTR and EMIR data to capture LDI fund positions both ahead of and during the events. EU and UK authorities have since taken steps to increase LDI funds' resilience to interest rate risks. Although the analysis uses the UK gilt market turmoil as a case study, it suggests broader conclusions about leverage and liquidity risks. The lessons are also relevant within an EU context, as many EU entities may be exposed to risks similar to those that materialised in the United Kingdom in September 2022.

3.1.1 An overview of liability-driven investment strategies and the associated risks

Liability-driven investment strategies are used by defined benefit pension funds that provide guaranteed returns to future retirees. Defined-benefit pension funds typically face liabilities that have a long-term duration and are linked to inflation. In addition, meeting the benefits guaranteed to

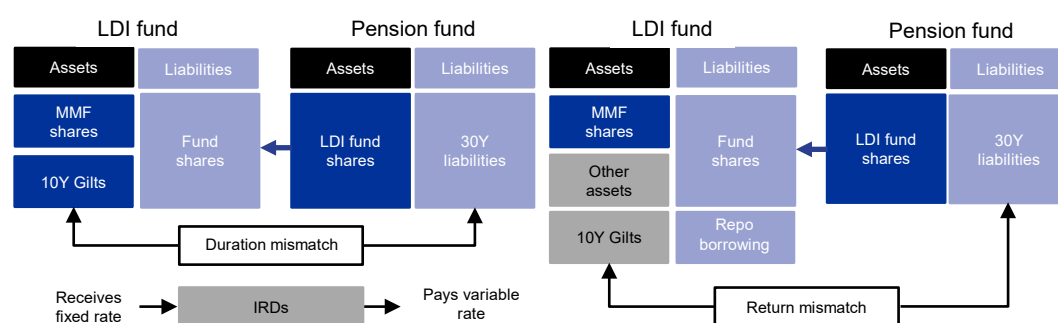
²³ See news release: [Bank of England announces gilt market operation](#), 28 September 2022.

²⁴ AIFMD data cover entity level data for Alternative Investment Funds, while EMIR and SFTR data provide activity-based information on, respectively, derivatives and securities financing transactions with at least one EU counterparty.



retirees tends to require higher investment returns than the returns on sovereign bonds. To match this duration and inflation exposure while simultaneously achieving the necessary investment return, UK pension funds have as a rule followed LDI strategies. First, to match the duration of their liabilities while conserving funds, LDI funds may enter IRD positions with long maturity (Figure 3), typically receiving a fixed rate and paying a variable rate. Second, LDI funds may invest in long-dated sovereign bonds and subsequently use these securities as collateral in repo transactions. Repo borrowing can then be used to invest in additional sovereign bonds to further increase interest rate sensitivity and amplify investment returns. This use of leverage conserves cash, which pension funds may also deploy in higher yielding growth assets (e.g. equities or alternative asset types), further helping to reduce the return mismatch between the fund's performance and the benefits guaranteed to retirees. LDI strategies may either be implemented by pension funds themselves or else outsourced to asset managers. Outsourcing in this case may take one of two forms: (i) the pension fund asks the asset manager to set up and manage a bespoke investment vehicle for them ('segregated mandates'); (ii) the pension fund invests in an 'off the shelf' investment fund ('pooled' LDI funds). In the United Kingdom, pooled funds are estimated to account for 10-15% of the LDI market. Pooled funds usually take the form of open-ended alternative investment funds (AIF).

Figure 3
Defined-benefit pension funds using LDI funds to reduce their duration and return mismatch. Stylised view of pension fund and LDI fund balance sheets



Source: ESRB.

A sudden large and rapid increase in interest rates and bond yields improves the solvency of pension funds but may create liquidity strains for LDI funds. An increase in interest rates triggers margin calls for LDI funds as the marked-to-market value of their IRD position declines (since LDIs have to pay a higher variable rate while receiving the same fixed rate). In addition, as bond prices move inversely with yields, the value of the sovereign bonds used as collateral in repo transactions falls, with funds having to pledge additional assets to secure those transactions. LDI funds maintain liquid asset buffers comprising cash, MMF shares and other liquid assets that they can use to meet such margin/collateral requirements. The size of these buffers is targeted to withstand a specific level of market stress; when margin calls deplete the buffers to below predefined thresholds, the LDI funds will call on investors to deliver additional liquid assets within a fixed period (typically one week) to replenish them to their original target levels, which is referred to as recapitalisation. At the same time, higher interest rates reduce the present discounted value of

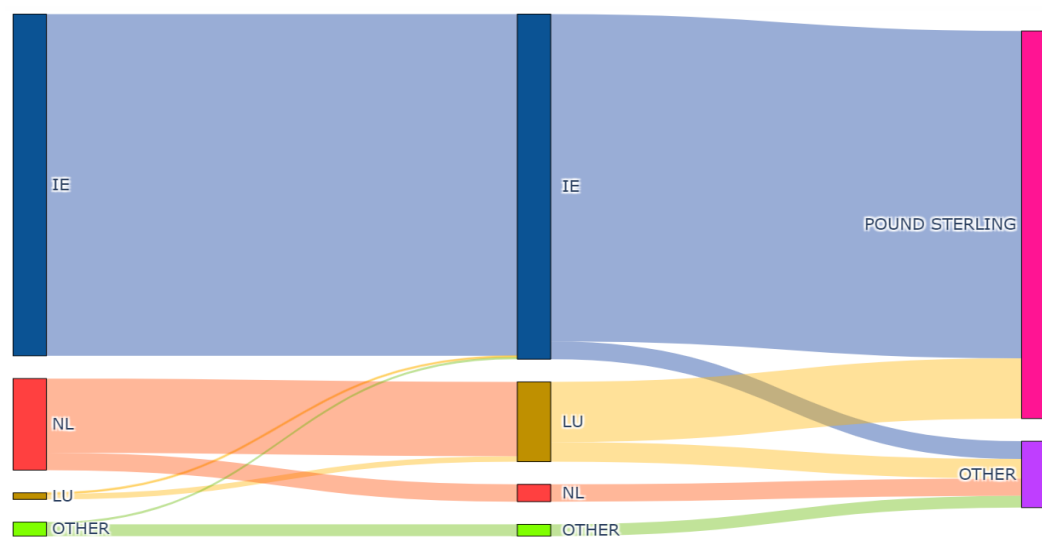


future payment obligations to future retirees. This reduces pension fund liabilities, improving the solvency of pension funds as a result, and tends to offset the negative impact of higher interest rates and bond yields on the value of their assets. Hence, while higher rates and yields benefit solvency positions of pension funds employing LDI strategies, the negative impact is often a tendency to crystallise through cash needs.

Chart 5

Most EU LDI funds are denominated in GBP to cater to UK investors. Links between domiciles of LDI AIF managers, AIFs and AIF base currency

(net asset value)



Source: AIFMD.

Notes: The first column represents the AIF manager domicile, the second column shows the AIF domicile and the third column denotes the base currency. The width of the link between columns represents the sum of net asset values. Data are for the end of 2021.

At the end of 2021 EU LDI funds had €250 billion in net asset value (NAV), held mainly by UK pension funds. AIFMD data allow the identification of around 500 LDI AIFs domiciled in the EU²⁵.

The funds are mainly domiciled in Ireland and Luxembourg whereas the managers of these funds are mainly domiciled in Ireland and the Netherlands (Chart 5). The top three AIF managers account for 90% of the number of LDI funds, indicating high concentration. The NAV of LDI funds amounted to around €250 billion at the end of 2021 (less than 4% of the AIF sector). Most LDI funds are denominated in GBP and held by pension funds outside the euro area – most likely UK pension funds²⁶. Assets of pooled, UK-owned LDI funds were estimated to be approximately €230 billion at

²⁵ LDI funds were identified by looking for AIF names and descriptions of investment strategies that include “LDI”, “liability-driven”, “liability matching”, “liability solution”, “liability aware” or “overlay”. The list of funds was then corroborated by supervisors in Ireland and the Netherlands but might not include all LDI funds.

²⁶ AIFMD data do not provide information on the domicile of investors, but ECB Securities Holdings Statistics indicate that most of LDI fund shares are held by investors outside of the euro area.



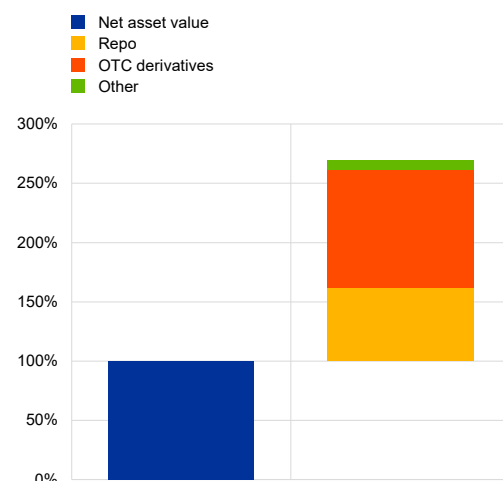
the end of 2021²⁷. This implies that EU AIFs denominated in GBP accounted for a large majority of LDI pooled funds used by UK pension funds.

Chart 6

LDI funds obtain leverage from repo and derivatives markets

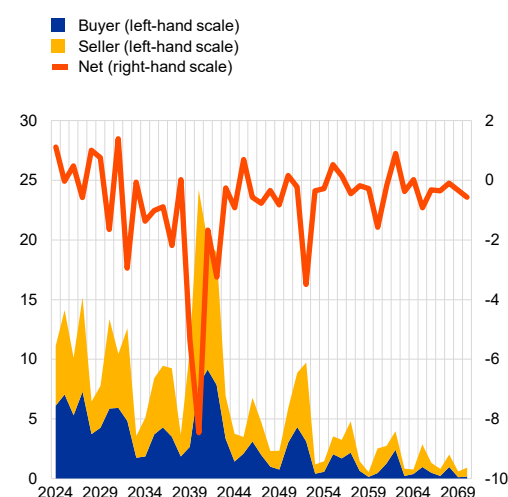
a) LDI AIFs leverage decomposition

(percentages of net asset value)



b) IRD exposures by maturity

(EUR billions)



Sources: AIFMD and EMIR.

Notes: AIFMD data as of the end of 2021; EMIR data as of September 2022; in Chart 6 panel b, long positions in IRD exposures mean that funds receive a variable rate while paying a fixed rate. Conversely, short position in IRD exposures means that funds receive a fixed rate while paying a variable rate. A long position implies that, if rates increase, funds realise a marked-to-market gain (receive variation margins) and, conversely, funds with short positions will have marked-to-market losses and face variation margins.

LDI funds are exposed to leverage, liquidity and concentration risks. At the end of 2021 LDI funds had leverage (measured as assets under management divided by NAV) of around 270% of NAV (Chart 6 panel a), obtained mainly from the use of OTC derivatives (€251 billion) and repo transactions (€157 billion). Notional exposures of most derivatives were related to IRDs in GBP and EUR (around 80% of gross exposures). Net exposures to IRDs were negative, especially around the 20-year tenor, consistent with the business model of LDIs but still not matching the duration of liabilities (Chart 6 panel b). LDI funds were net borrowers in the repo market (Chart 7 panel a) of around €120 billion as of mid-September 2022, exclusively in GBP, and using gilts as collateral (Chart 7 panel b). LDI fund portfolios were mainly composed of concentrated positions in sovereign bonds (Chart 13), most likely UK gilts²⁸. Holdings of cash-like assets that could be used immediately to meet cash needs were much smaller. Long positions in cash and cash equivalents amounted to €46 billion. Holdings of MMF shares equalled €18 billion, which corresponded to

²⁷ **Risks from leverage: how did a small corner of the pensions industry threaten financial stability? – speech by Sarah Breenen**, 7 November 2022.

²⁸ AIFMD data do not provide detailed information on bond issuers but distinguish between EU, non-EU G10 and non-G10 bonds. Around 95% of LDI AIFs sovereign bond exposures were non-EU G10 instruments, and the ESRB estimates that UK gilts accounted for at least two-thirds of these exposures.



around 5% of the NAV of GBP-denominated MMFs. While in normal times LDI funds could mobilise cash by selling sovereign bonds, any disruption to sovereign markets would reduce LDI funds' ability to meet large cash needs. Overall, LDIs were highly exposed to concentration risk: A negative shock to sovereign bonds would lower the value of their portfolio and trigger margin calls on derivatives and repo positions. This risk is also amplified by a high degree of portfolio overlap among LDI funds: Funds are exposed to the same issuer and tend to hold similar bonds. Hence, any sale of bonds by some funds would directly impact other LDI funds.

Chart 7

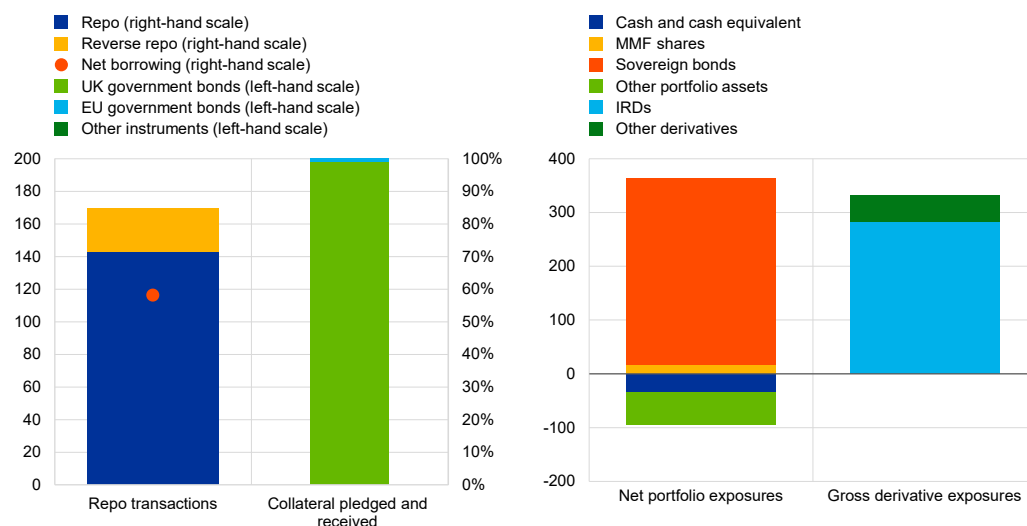
Concentration in LDI exposures: Repo borrowings are almost exclusively backed by gilts, and portfolio holdings are highly skewed towards sovereign bonds, with a small share of cash-like assets that could be used immediately to meet cash needs

a) Use of repo transactions and collateral pledged in repo transactions

b) LDI AIFs portfolio exposure

(left-hand scale: EUR billions; right-hand scale: percentages)

(EUR billions)



Sources: SFTR and AIFMD.

Notes: In Chart 7 panel a, SFTR data as of 16 September 2022; in Chart 7 panel b, AIFMD data as of the end of 2021.

3.1.2 The events of September 2022

Stress in UK markets spread to GBP-denominated EU LDI funds and EU MMFs, which in turn further amplified the pressure on gilt markets. Following the release of the mini-budget, gilt yields spiked, with the 30-year yield increasing by more than 130 basis points between 22 and 29 September (Chart 8 panel a). As some bonds lost more than 25% in value, UK pension funds and LDI funds faced margin calls on their IRDs and had to post additional collateral for the repo positions (Chart 8 panel b) or repay their repo borrowings by selling assets. The Bank of England estimates that the total margin and collateral calls faced by LDI funds and pension schemes



amounted to more than GBP 70 billion (around €80 billion).²⁹ Given the magnitude and speed of the shock, liquid asset buffers of LDI funds (mainly cash and MMF shares) depleted rapidly, triggering recapitalisation processes and, in some cases, accelerating the standard time windows provided to investors to deliver the additional liquid assets. To the extent that pension schemes were unable to meet the accelerated timelines, LDI funds had to resort to gilt sales to de-lever and meet collateral requirements. During the same week, outflows from GBP-denominated EU MMFs amounted to 6% of net asset value, and for some LVNAV MMFs redemptions amounted to more than 20% of the net asset value (Chart 9 panel a). A number of funds saw an increasing deviation between the market value of their assets and the amortised cost valuation, with the deviation reaching up to 17 basis points, which was very close to the regulatory limit of 20 basis points (Chart 9 panel b)³⁰. Therefore, LDI funds' (and UK pension funds') redemption of MMF shares spread the liquidity pressure to some segments of the money market fund sector. LDI and pension funds also started selling gilts. Given the high levels of volatility at the time, however, the large market footprint of LDI and UK pension funds in index-linked and very long-dated bonds and the low liquidity of this market segment (typically lower than benchmark bonds) made the sale of the bonds challenging and, in some cases, not possible³¹. There was a risk that the selling pressure could not be absorbed by the market without triggering price spirals and possibly jeopardising financial stability³².

²⁹ See **Financial Stability Report**, Bank of England, December 2022.

³⁰ After breaching the 20 basis point collar, LVNAV MMFs have to use marked-to-market or marked-to-model valuation for all assets and have fluctuating net asset value. The 2021 ESRB **Recommendation on reform of money market funds** called for reducing threshold effects that might incentivise runs. It envisaged the removal of the 20 basis point collar and suggested that LVNAV MMFs should have fluctuating net asset value at all times.

³¹ According to **the Bank of England letter to the Chair of the Treasury Committee**, 5 October 2022, "Some funds had already tried to sell gilts and failed to do so".

³² According to **the Bank of England letter to the Chair of the Treasury Committee**, 5 October 2022, forced sales could have reached GBP 50 billion, compared with average daily trading volumes of GBP 12 billion.



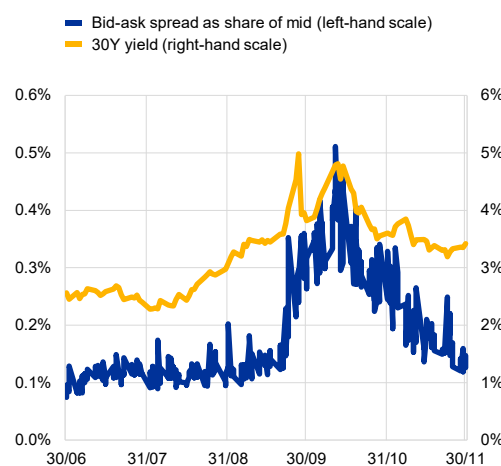
Chart 8

As gilt yields and bid-ask spreads spiked, LDI funds had to post additional collateral

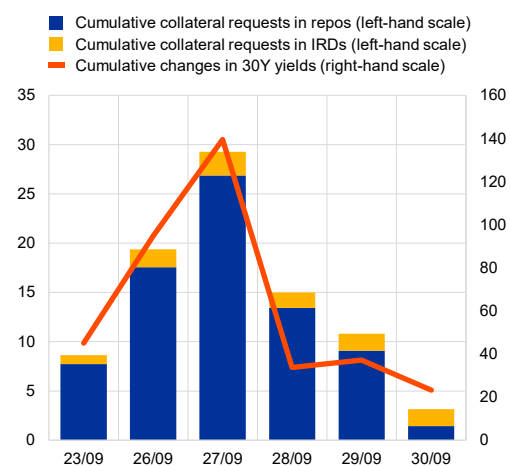
a) 30-year UK government bond bid-ask spreads and yields

b) Estimated cumulative additional collateral request and cumulative changes in 30-year UK government yields since 23 September 2022

(percentages)



(left-hand scale: EUR billions; right-hand scale: basis points)



Sources: Bloomberg, SFTR and EMIR.

Note: Estimates in Chart 8 panel b are based on changes in market prices of bonds pledged as collateral and changes in market value of IRD positions.

Tensions waned following intervention by the Bank of England. On 28 September, in response to liquidity strains and dysfunction on the gilt market, the Bank of England announced a temporary and targeted intervention to restore orderly functioning in long-dated government bond markets through purchases of up to GBP 65 billion (around €73 billion) of bonds. Between 28 September and 14 October, the Bank of England purchased GBP 19.3 billion (around €20 billion) of conventional and index-linked bonds.³³ Following the intervention, bond market liquidity improved and yields declined substantially. This eased liquidity pressures for LDI funds and consequently for GBP-denominated MMFs. As LDI funds rebuilt and enlarged their liquid asset holdings at that point, GBP-denominated MMFs recorded large inflows. Supervisory authorities in Ireland and Luxembourg have since asked LDI fund managers to maintain an appropriate level of resilience, including by having sufficient liquid assets to cover a further rise in interest rates, an initiative supported by ESMA³⁴.

³³ See news release: [Bank of England completes unwind of recent financial stability gilt purchases](#), 12 January 2023.

³⁴ See [CSSF](#), [Central Bank of Ireland](#) and [ESMA](#) communications in November 2022. [The UK FCA](#) also made a similar statement.

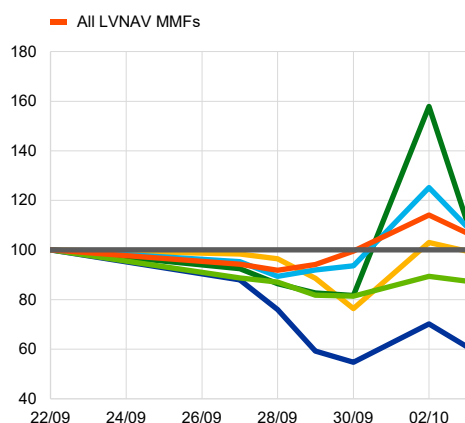


Chart 9

Some LVNAV MMFs recorded very high outflows and large NAV deviations

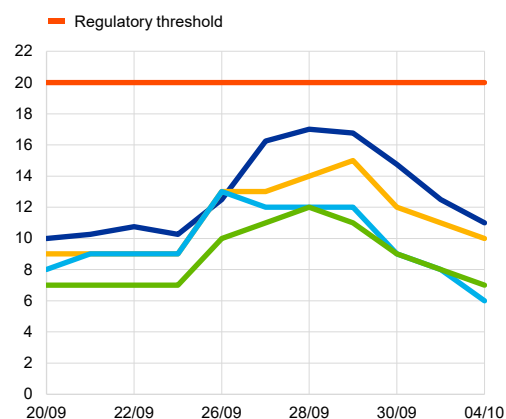
a) Cumulated flows for LVNAV MMFs

(values based to 100 as of 22 September 2022)



b) NAV deviations in certain LVNAV MMFs

(basis points)



Source: Crane.

Note: Lines in the charts represent individual LVNAV MMFs, except for the red line, which in Chart 9 panel a represents all LVNAV MMFs, while in Chart 9 panel b it denotes the regulatory threshold (20 basis point collar).

3.1.3 Stress testing of EU liability-driven investment funds

Stress-testing can be used to assess preparedness of LDI funds for interest rate shocks and to identify vulnerable entities. The events of September 2022 have shown that some LDI funds were not resilient to a large increase in rates. Regulatory data can be used to assess the ability of LDI funds to withstand liquidity shocks, specifically whether LDI funds would have enough highly liquid assets to face liquidity demands if rates were to increase. If such an analysis were conducted ex ante, it could provide insights into the resilience of individual funds, should shocks materialise. As such, stress-testing constitutes an important input for financial stability analysis and the identification of vulnerable entities.

Here, information from various regulatory datasets enables a liquidity stress test on LDI funds. First, similarly to previous work³⁵, information on funds' exposures is used to assess the sensitivity of bonds and IRDs used by LDI funds to abrupt changes in rates at fund level (Figure 4)³⁶. Second, the sensitivity estimates are used to calculate cash needs related to variation margins

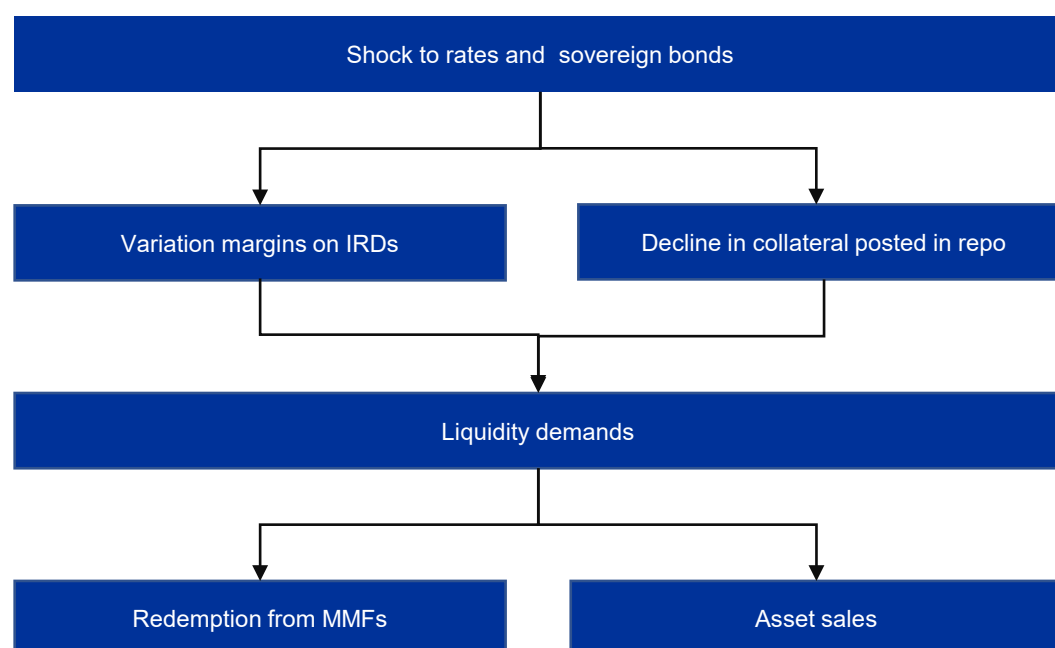
³⁵ See special feature on bond funds and interest rate risk in the ESRB **NBFI Monitor 2022**.

³⁶ The sensitivity of bond prices to changes in interest rates is measured by the duration (which quantifies how prices change when rates move) and convexity (which reflects the rate at which the duration changes when rates move). The sensitivity of IRSs to changes in rates is measured by the dollar value of a basis point (DV01), which quantifies the change in value of the derivative position when rates move by 1 basis point.



on IRDs and additional collateral requests in repo transactions³⁷. The volumes of cash to be used, MMF shares to be redeemed and assets to be sold are subsequently estimated, assuming that funds cannot use external sources of liquidity (e.g. capital injection by investors to additional borrowing through new repo operations)³⁸. The stress test uses two scenarios: an increase of 100 basis points and of 150 basis points of yields across the entire curve (irrespective of the currency). These values are used since they are consistent with the events of September 2022 for GBP LDI funds, where 30-year nominal rates increased by 130 basis point, and because EU LDI funds are predominantly denominated in GBP. Reverse stress tests are also used to assess the magnitude of the shocks that would be required for LDI funds to be unable to meet cash needs without selling portfolio holdings.

Figure 4
Overview of the LDI liquidity stress test



Source: ESRB.

At the aggregate level, LDI funds would face liquidity pressures under both stress scenarios, mainly due to repo exposures. Results³⁹ show that, for a 100 basis point increase in interest rates, liquidity demands would amount to €17 billion for repo transactions and €5 billion for

³⁷ For bonds used as collateral for repo transactions, it is assumed that LDI funds do not have other eligible securities; hence, any reduction in the value of the collateral pledged triggers additional cash collateral requests to maintain the value of the collateral pledged or partial repo repayment with cash. For LDI funds receiving bonds as collateral from their counterparties, it is assumed that the LDI funds cannot use the additional collateral posted by their counterparty to meet liquidity demands with other counterparties: LDI funds do not trade off counterparty risk for liquidity risk. No change in haircuts is assumed. It is also assumed that, for LDI funds with long IRD positions, cash received from counterparties when interest rates increase may be used to offset additional collateral requests in repo transactions.

³⁸ The liquidation strategy assumes the following pecking order: (i) cash and cash equivalents, (ii) MMF shares, (iii) sales of sovereign bonds.

³⁹ Results are based on AIFMD data for 487 AIFs as of June 2022, and EMIR and SFTR data as of September 2022.

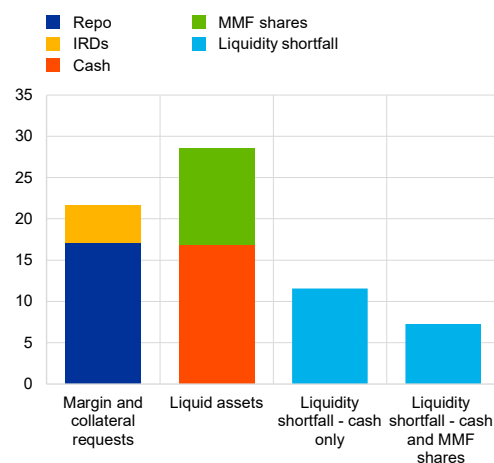


derivatives, corresponding to 17% NAV in total of funds facing margin and collateral requests (Chart 10 panel a). For a 150 basis point shock, liquidity demands would reach €24 billion for repo and €7 billion for derivatives, or 24% of NAV in total (Chart 10 panel b). In contrast, LDI AIFs that faced cash needs related to margin calls on derivatives and additional collateral requests on repos would have only €17 billion in cash and cash equivalents and €12 billion in MMF shares available. Assuming that raising additional capital from investors would not be possible due to operational constraints and that LDI funds do not deleverage their positions, the funds would therefore need to redeem MMF shares and sell other assets, i.e. sovereign bonds, in order to meet liquidity demands stemming from margin and collateral requests.

Chart 10
Liquidity demands following a sharp increase in yields outweigh highly liquid assets

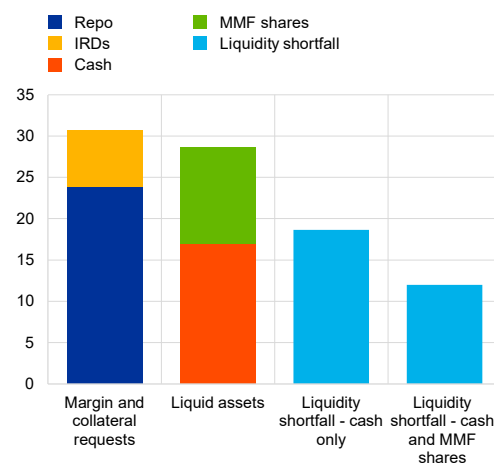
a) Simulation of an interest rate shock: 100 basis points – results at aggregate level

(EUR billions)



b) Simulation of an interest rate shock: 150 basis points – results at aggregate level

(EUR billions)



Source: ESRB.

Notes: Cash includes cash and cash equivalents. Liquid assets are presented in long values and for all LDI funds facing margin and collateral requests. At individual level, some funds would have more liquid assets than required. This explains why, although aggregate liquidity levels may exceed margin and collateral requests, some funds would face liquidity shortfall (i.e. the excess liquidity of some funds cannot be used to compensate for the liquidity shortfall of others).

Liquidity pressures would be transmitted to MMFs and bond markets. As holdings of cash and cash equivalents would not suffice to meet margin and additional collateral requests, LDI funds would need to redeem MMF shares for around €4 billion in the event of a 100 basis point shock, and €7 billion under a 150 basis point shock scenario. While MMF redemptions account for only 2% of net asset value of GBP-denominated EU MMFs, LDI fund exposures tend to be concentrated in a few MMFs, some of them from the same manager. Hence, redemptions from certain MMFs could be sizeable. In turn, MMFs would need to dispose of further assets to meet the redemptions, exerting pressure on short-term UK debt markets. As the majority of GBP-denominated MMFs are of the LVNAV type, large outflows could increase deviations in net asset value, bringing it closer to the 20 basis point collar. Since no LVNAV MMF has breached the collar to date, the systemic implications of such an event, including potential run dynamics and spillover



effects, are difficult to assess. In addition, LDI funds with a liquidity shortfall would need to sell sovereign bonds for around €7 billion under a 100 basis point shock scenario, and €12 billion under a 150 basis point shock scenario. Given that the value of sovereign bonds would be negatively affected by the interest rate shock, LDI funds would need to sell a larger amount of bonds to raise the requisite cash. In turn, such sales would exert substantial downward pressure on markets. Since average daily trading volumes on long-term gilts are around €13 billion, sales from EU LDI funds alone would amount to between 50% and 90% of average daily trading volumes.

A large proportion of funds would not have sufficient liquid assets to meet liquidity demands.

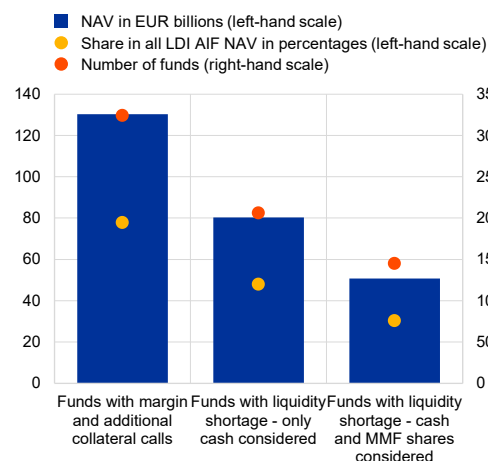
The impact of the shocks is heterogenous across the funds in the sample. Of all LDI funds, around 30% (in terms of NAV) would not have enough cash or MMF shares to meet liquidity demands under a 100 basis points scenario, and close to 40% under a 150 basis points scenario (Charts 11 panel a and b). The liquidity shortfall would amount to €7 billion or 6% of the NAV of the funds with liquidity strains under a 100 basis points shock scenario and €12 billion or 9% of NAV under a 150 basis points shock scenario, when considering both cash and MMF shares as a liquidity buffer. For some funds, the liquidity shortfall after depletion of cash and MMF shares would be substantial under a 150 basis points shock scenario: above 50% of the NAV for 39 funds, and above 100% of the NAV for 7 of them (Chart 12 panel a).

Chart 11

A large portion of LDI funds would face liquidity shortfalls

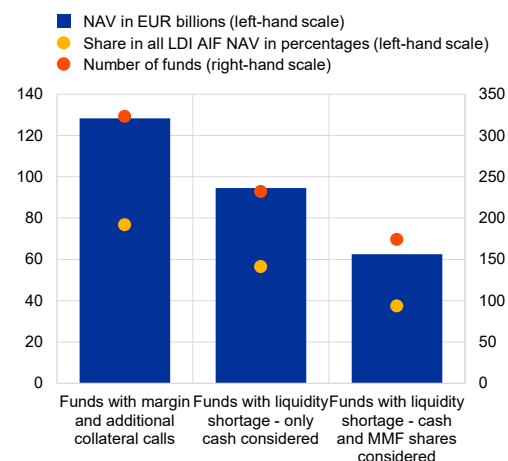
a) Funds with margin calls and liquidity shortfall under stress scenarios of 100 basis points

(EUR billions, percentages and number)



b) Funds with margin calls and liquidity shortfall under stress scenarios of 150 basis points

(EUR billions, percentages and number)



Source: ESRB.

Notes: Cash includes cash and cash equivalents; NAV stands for net asset value.



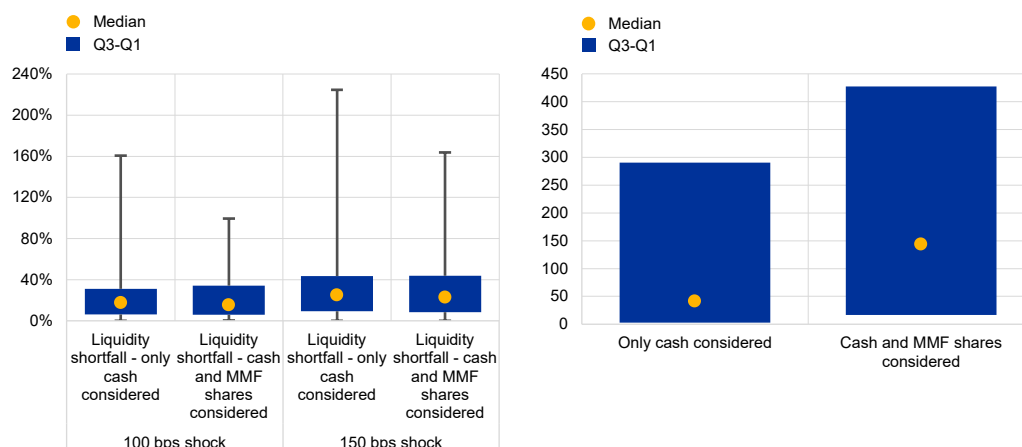
Chart 12

For some LDI funds, the shortfall could reach more than 50% of NAV; MMFs play an important role in liquidity risk management

a) Liquidity shortfall in response to a 100 basis point and 150 basis point interest rate shock b) Fund resilience to an interest rate shock

(percentage of NAV)

(basis points)



Source: ESRB.

Notes: Cash includes cash and cash equivalents. In Chart 12 panel a, the sub-sample includes only funds facing a liquidity shortfall. In Chart 12 panel b, only LDI funds with NAV above €500 million are included.

A reverse stress test indicates that interest rate shocks of around 144 basis points would exhaust the liquidity buffers of most LDI funds.

Reverse stress tests seek to assess the breaking point, i.e. the rise in interest rates that would make LDI funds unable to meet liquidity demands without selling assets or raising additional capital from investors. If interest rates were to rise abruptly by 144 basis point, a median LDI fund would not have enough cash and MMF shares to meet margin calls and additional collateral requests (Chart 12 panel b). Of all funds that face such liquidity demands if interest rates were to rise, 25% of entities with €24 billion of net assets would be able to withstand a shock larger than approximately 430 basis points by relying solely on cash and MMF shares, i.e. without the need to sell other assets or raising additional capital from investors. In a more conservative scenario – where LDI funds rely only on cash and cash equivalents to meet margin and collateral calls – a median fund would be able to withstand a rate increase of around 41 basis points before having to liquidate other portfolio holdings or raise additional capital from investors. If solely funds denominated in EUR are taken into account, the resilience of a median fund increases to an interest rate shock of 290 basis points if liquidity buffers include cash and MMF shares, and to an interest rate shock of 60 basis points if only cash is considered. This analysis shows how the risks that crystallised in September 2022 could have been identified beforehand and how stress tests can help identify vulnerable entities.⁴⁰

⁴⁰ See also The Pensions Regulator, OMB Research, **DB Pension Scheme Leverage and Liquidity Survey**, DB Pension Scheme Leverage and Liquidity Survey, which points to an increased use of leverage.



The analysis is subject to a number of limits and caveats. First, the analysis assumes instantaneous interest rate increases and so does not consider the possibility of UK pension funds recapitalising LDI funds, which is the standard response to adverse price moves in practice; nor does it include any potential arrangements put in place by pension schemes and their LDI managers related to the automatic liquidation of other pension fund assets (e.g. daily liquidity credit funds) held by the same manager and their subsequent use to cover capital calls. Moreover, as the analysis is static, it cannot take account of any capital injections that might already have been triggered and about to replenish LDI funds as of the date on which liquid assets were observed (30 June 2022). Additionally, the results of the scenario analysis should be cautiously interpreted as a retrospective view of vulnerabilities since AIFMD data on liquid assets are based on June 2022 figures, whereas data on exposures is taken from EMIR/SFTR data reported in September 2022. Since then, EU and UK authorities have taken steps to increase LDI resilience to interest rate risks. Furthermore, EU LDI funds under analysis were identified based on AIF names and descriptions of investment strategies. The list of funds was corroborated by supervisors in Ireland and the Netherlands; nevertheless, the sample might be underestimated. Another simplification relates to the estimates of liquidity demands, which assume a parallel shift of 100 or 150 basis points across all yield curves. In addition, margin calls in IRDs might be overestimated, as they do not take into account convexity, which reduces the impact of higher rates on the value of IRDs.

3.1.4 Lessons

The LDI event shows how risks associated with leverage, liquidity and concentration can crystallise. The stress related to LDI strategies illustrates how concentration and correlation in risk exposures may strain market functioning with adverse effects on financial stability. The rise in collateralisation levels for derivative exposures has increased the resilience of market participants to counterparty credit risk, but it has also increased the sensitivity of liquidity demands to market volatility. As exposures of pooled LDI funds were highly concentrated and correlated, forced selling by market participants spread across the sector, which puts further strain on supply/demand dynamics. The UK example revealed that around GBP 200 billion (€228 billion) of pooled LDI funds jeopardised the GBP 1.4 trillion traded gilt market (€1.6 trillion) underlying around GBP 2 trillion (€2.3 trillion) of lending to the real economy through wider credit markets.⁴¹ The LDI episode also highlights the importance of MMFs as liquidity management vehicles for institutional investors, as well as the need for ensuring the resilience of this part of the investment fund sector.

This event also emphasises the role of cross-border linkages in the fund sector, including outside the EU. The global nature of the asset management industry implies that shocks originating outside the EU can have an adverse impact on EU investment funds, even if their investors are also outside the EU. This set-up also presents challenges when designing and coordinating backstop measures or when considering policy tools such as leverage limits. In the case of LDI funds, the central bank implementing support measures – the Bank of England – was outside the EU and intervened only with UK-domiciled bank counterparties, while the supervisors of most of the UK-owned LDI funds were in the EU.

⁴¹ **Risks from leverage: how did a small corner of the pensions industry threaten financial stability? – speech by Sarah Breedon**, 7 November 2022.



Other types of entities in the EU could be exposed to risks similar to those that materialised during the UK gilt market turmoil.

There are other financial institutions that have directional positions on interest rate derivatives to reduce their duration mismatch or obtain leverage via repo transactions, possibly with concentrated exposures. Regarding derivatives, EU insurance and pension funds tend to have short positions in IRDs, some of which could be subject to liquidity strains in case of a substantial shock to EUR interest rates. For example, in the first half of 2022 Dutch pension funds, constituting the largest part of the EU pension sector, sold a record amount in assets, largely due to margin calls in IRDs.⁴² In 2019 EIOPA estimated that more than 15% of insurers would not have enough cash to meet margin requests following a one-day 50 basis points rise in rates (which corresponds to what was observed on 26 September in the case of gilts) and accordingly would have to sell sovereign bonds and redeem from MMFs.⁴³ In a related vein, an ECB analysis indicates that around 1/3 of investment funds with derivative exposures would face liquidity issues in the event of a large shock occurring over a single day.⁴⁴ Regarding repos, a number of articles have shown how, during the global financial crisis, the fall in the value of collateral triggered liquidity demands through higher haircuts and the need to post additional collateral⁴⁵. As many entities may be exposed to similar vulnerabilities, as highlighted by the UK gilt market turmoil, there is a need for broader monitoring of leverage and liquidity risks.

Further work is needed to assess and enhance the resilience of non-banks to liquidity shocks related to margin and collateral requirements.

The LDI episode and the analysis presented above show how regulatory datasets can be used to assess the resilience of specific institutions. The use of collateral, while benefiting financial stability by addressing counterparty risk, may increase systemic liquidity risks. If preparedness to meet margin and collateral calls is low, the actions of market participants to raise liquidity in stressed markets may exacerbate shocks, especially if shocks are large and occur rapidly, as was the case in the gilt market at the end of September 2022. Non-banks need to make sure that they are adequately prepared to face liquidity demands, including sufficient holdings of highly liquid assets, and use stress test analyses to assess their resilience to severe scenarios, including through reverse stress tests. Recently, UK authorities have made recommendations to LDI funds regarding their expected level of resilience. In March 2023 the UK Financial Policy Committee recommended that LDI funds be able to withstand a 250 basis point shock, at a minimum, in addition to the resilience required to manage other risks and day-to-day movements in yields. This minimum level of resilience was estimated using a reverse stress test approach and comprises of two elements: (i) baseline resilience, which aims to reflect the idiosyncratic risks of assets held by LDI funds; and (ii) systemic resilience, which aims to ensure that LDI funds are able to absorb severe but plausible historical stress over the period of time required in order to recapitalise the fund without the need for forced asset sales.⁴⁶ In April 2023 the Financial Conduct Authority set out further recommendations related to risk management, stress testing, operational arrangements, communication and client relationships for

⁴² See DNB communication [Dutch pension funds sell record amount in assets](#), 8 September 2022.

⁴³ [Financial Stability report](#), EIOPA, December 2019.

⁴⁴ [Derivatives-related liquidity risk facing investment funds](#), Financial Stability Review, ECB, May 2020 and Jukonis et al. (2022), [“The impact of derivatives collateralisation on liquidity risk: evidence from the investment fund sector”](#), ECB Working Paper No 2756.

⁴⁵ See for example [Gorton and Metrick \(2012\)](#), [Krishnamurthy et al. \(2014\)](#) or [Copeland et al. \(2014\)](#).

⁴⁶ See [Financial Policy Summary and Record – March 2023](#) and [Bank staff paper: LDI minimum resilience – recommendation and explainer](#), Bank of England, March 2023.



LDI managers,⁴⁷ and the UK Pensions Regulator issued guidance for pension schemes to reduce their risk in investing in the LDI sector.⁴⁸ Also in April 2023 supervisory authorities in Luxembourg reiterated their expectation that investment fund managers managing LDI funds denominated in GBP maintain a buffer of 300-400 basis points as build-up following the September 2022 episode. Investment fund managers of LDI funds denominated in other currencies were reminded to maintain a sufficient level of resilience to enable them to absorb severe but plausible market shocks.⁴⁹

3.2 Vulnerabilities in crypto-assets and related intermediaries

The rapid growth of the crypto ecosystem in the past few years has attracted the attention of regulators and policymakers.⁵⁰ The combined value of crypto-assets ('market capitalisation') initially peaked at USD 800 billion (approximately €700 billion) at the beginning of 2018, only to fall back to around USD 130 billion (€110 billion) within a year; yet in 2021 a new 'crypto boom' set in, this time driving the value to almost USD 3 trillion (€2.6 trillion) in November 2021. The market has since fallen again and amounted to less than USD 1 trillion (€930 billion) in December 2022. In a related vein, crypto-asset trading volumes were one-fifth of their peak in May 2021 (Chart 13). Developments related to crypto-assets and associated intermediaries have raised concerns among policymakers around channels through which crypto-assets may influence the traditional financial system and the real economy, with potential implications for financial stability.

To help address potential financial stability implications, the ESRB decided in June 2022 to include certain parts of the crypto ecosystem in its regular risk monitoring through the NBFi Monitor. In January 2022 the ESRB General Board created a High Level Exploratory Group on Crypto-assets and DeFi (HLEG) to explore the scope and necessity of future analytical work on the systemic implications of crypto-asset markets and DeFi applications for the stability of the EU financial sector. At the current juncture, the ESRB has not identified any material systemic implications stemming from the crypto ecosystem. If the rapid growth trends resume and the interconnection with the traditional financial system increases, however, crypto-assets could pose risks to financial stability. In that context, the ESRB identified three priorities: (i) considering policy options to mitigate risks arising from crypto-assets, (ii) identifying the systemic implications of crypto-asset markets and (iii) regular risk monitoring, including by enhancing the NBFi Monitor to include parts of the crypto ecosystem. The ESRB's work in this area complements international initiatives addressing potential financial stability risks associated with crypto-assets, most notably through the work of the FSB and IOSCO.

⁴⁷ See **Further guidance on enhancing resilience in Liability Driven Investment**, Financial Conduct Authority, April 2023.

⁴⁸ See **New LDI guidance published by TPR to ensure schemes minimise risk**, The Pensions Regulator, April 2023.

⁴⁹ See **CSSF Communication**, Commission de Surveillance du Secteur Financier, 3 April 2023.

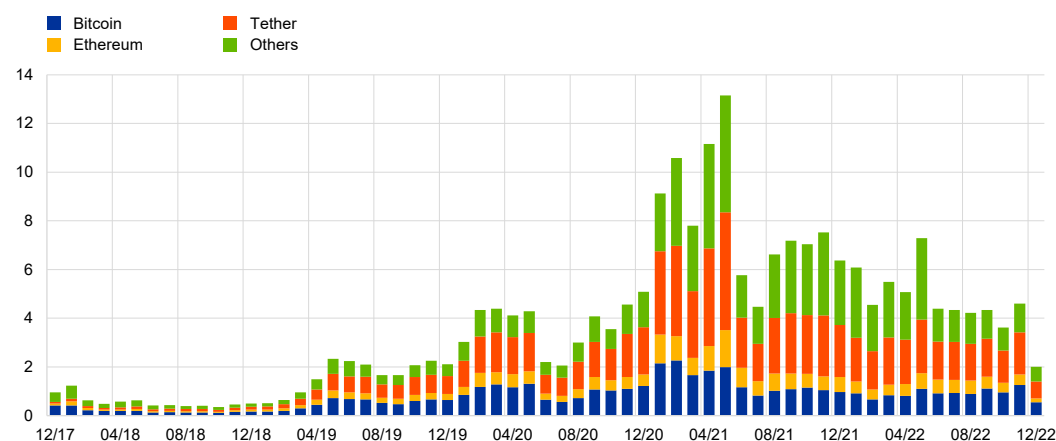
⁵⁰ The cut-off date for the report was 31 December 2022. It therefore does not cover the period in March 2023 that saw the failure of three US banks and related adverse developments in the crypto-asset ecosystem.



Chart 13

Fall in trading activity since May 2021. Monthly crypto-asset trading volumes

(USD trillions)



Sources: CoinMarketCap and ESMA.

This special feature focuses on vulnerabilities of the crypto ecosystem that are similar to those present in traditional non-bank financial intermediaries. The crypto ecosystem is exposed to some specific risks such as operational risk or weakness in the consensus mechanisms used⁵¹. However, several business models of crypto-asset intermediaries resemble those of regulated financial institutions. Crypto-asset and associated intermediaries can perform credit intermediation, liquidity and maturity transformation and can use high leverage. Additionally, though linkages with the financial system remain small, crypto-asset exposures of traditional financial players can be a channel of risk transmission. The special feature focuses on three types of crypto-assets and related intermediaries that are likely to be most relevant from a financial stability perspective: (i) issuers of reserve-backed stablecoins, (ii) centralised finance (CeFi) platforms and (iii) decentralised finance (DeFi) protocols.

3.2.1 Stablecoins

Stablecoins are a specific type of crypto-asset that aim to remain ‘stable’ in value relative to an underlying asset or fiat currency. Stablecoins tend to be used as ‘entry points’ to, and ‘safe havens’ within, the crypto ecosystem. They promise a stable value between the coin and a fiat currency to investors, who can then use their stablecoins to trade crypto-assets and obtain leverage through margin lending or other collateralised borrowing. Accordingly, trading volumes of stablecoins regularly exceed trading volumes of other crypto-assets.

Reserve-backed stablecoins resemble deposit-taking banks or money market funds (MMFs).

Stablecoin issuers accept customer deposits (denominated in fiat money, e.g. USD). In exchange, they issue tokens on a blockchain with the implicit promise to the investor to redeem those tokens

⁵¹ For an overview, see [Crypto-assets and their risks for financial stability](#), ESMA, October 2022.



at par. The deposited amount is typically used as a reserve and either held as cash or invested in money market instruments. The sizes of the largest stablecoins compare with those of the largest US and EU-domiciled MMFs (Chart 14 panel a). However, the combined value of all stablecoins represents only 1.5% of global MMF assets (around USD 130 billion for stablecoins, compared with USD 8,305 billion for MMFs).⁵²

Consequently, stablecoins are prone to similar vulnerabilities. Investing cash into financial instruments inevitably causes some degree of liquidity and/or maturity mismatch and renders stablecoins vulnerable to runs. If a stablecoin issuer were unable to satisfy all redemption requests, this could have knock-on effects within the crypto system – for example, by also triggering runs on other stablecoins. It could also affect traditional money markets if off-loading financial instruments held as reserves drove their prices down, triggering fire sales.

Stablecoins tend to disclose their reserves on a voluntary basis but are currently not fully audited, which means that the existence and composition of reserves remain unverifiable.

Following investor concerns around the lack of transparency and the quality of the reserve assets backing the largest stablecoin, Tether began publishing quarterly reserve reports in 2021. Disclosures indicate a reduction in exposures to lower credit quality issuers and less liquid assets. Tether reports that it holds 80% of its reserves (around USD 50 billion) in US-Treasuries or cash (Chart 14 panel b).

While stablecoins are opaque and unregulated in nature, they currently they pose no immediate threat to the stability of the broader financial system. This conclusion is based on two arguments: (i) stablecoins remain small compared with traditional financial markets, with a combined capitalisation of USD 140 billion (€130 billion); and (ii) traditional market participants have no meaningful exposures to stablecoins or crypto-assets more broadly. Hence, even if the failure of a large stablecoin were to trigger a broader crypto-asset market collapse, there should be no meaningful spillovers to the traditional financial system. One potential contagion channel could be the market footprint of stablecoins in short-term funding markets. Large withdrawals from reserve stablecoins could trigger forced sales of short-term money market instruments while secondary market liquidity on those markets is low. However, for this risk to materialise at a relevant magnitude, the size of stablecoins would need to grow substantially, as stablecoins currently represent less than 2% of US and EU short-term (unsecured) funding markets.

⁵² See [International Investment Fund Association Worldwide regulated open-end fund assets and flows. Third quarter 2022](#).

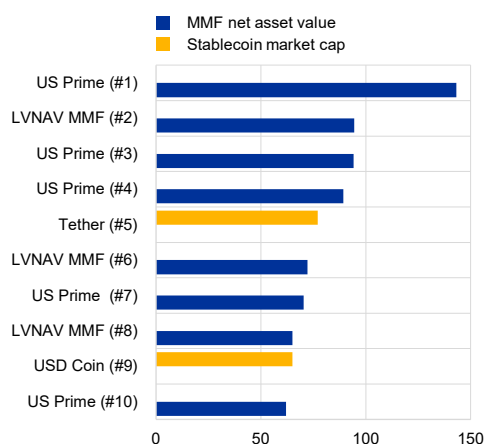


Chart 14

Some stablecoins are as large as the biggest MMFs. Stablecoin reserves look similar to MMF assets

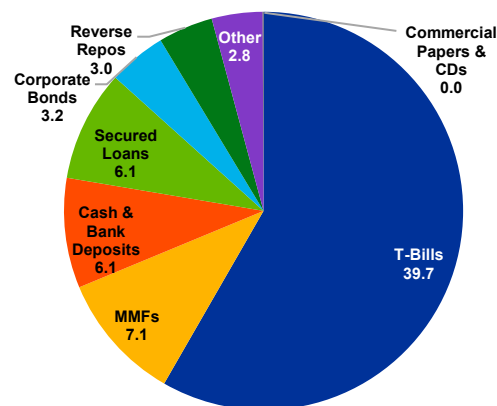
a) Comparison of largest stablecoins US Prime and EU-domiciled MMFs

(USD billions)



b) Breakdown of Tether reserves

(USD billions)



Sources: Crane, Fitch Ratings, CoinMarketCap, Tether and ESMA.

Note: Data in Chart 14 panel a as of July 2022; data in Chart 14 panel b as of September 2022.

3.2.2 Centralised finance

Centralised finance (CeFi) platforms, e.g. crypto-asset exchanges, typically offer a wide range of services, including custody services, spot and derivatives trading, as well as crypto-asset ‘staking’ and lending.⁵³ The increase in trading volumes during 2021, coupled with the extension of services, further heightened the importance for the crypto system of CeFi entities, especially crypto-conglomerates, but also the extent to which they might endanger the stability of traditional markets.

Leveraged spot and derivative products on CeFi platforms may amplify risks. Crypto-asset trading platforms offer derivative products such as futures and options with leverage multiples of up to 125x (Table 3), which are usually not cleared by a central counterparty. Investors – often retail and non-qualified investors – use these to synthetically increase their exposure to crypto-asset returns. Moreover, investors sometimes use borrowed funds to invest, increasing the risk of default and consequently contagion to the wider financial system. ECB estimates indicate that positions on crypto-assets by leveraged investors have increased since 2020⁵⁴, along with the development of services allowing borrowed funds to be used as collateral for another loan. Exchange level measures based on both Bitcoin and Ether futures indicate that the median aggregate leverage of

⁵³ As identified in the EBA’s 2022 **Non-bank lending report**, staking and lending activities require continued monitoring, especially as these activities fall outside the proposal for the Regulation on Markets in Crypto-assets.

⁵⁴ See Special Feature B in the **Financial Stability Review**, ECB, May 2022.



investors trading on those platforms has risen since 2021, especially in the case of Ether, and that the multiple on individual trading platforms can reach close to 50x (Charts 15 panel a and b).

Table 3

Crypto trading platforms offer a very high level of leverage to clients although actual use has been trending downward. Leverage amount offered by selected crypto trading platforms

Trading platform	Maximum leverage offered	Products used in leverage
BitMEX	100x	Perpetual swaps
Kraken	5x	Crypto-assets
FTX	20x	Futures, leveraged tokens
eToro	2x	Contracts for differences
BitMEX	100x	Options
Bybit	100x	Perpetual swaps and futures
Binance	125x	Leveraged tokens

Sources: *Decrypting financial stability risks in crypto-asset markets*, L. Hermans et al., *ECB Financial Stability Review*, May 2022.

Crypto lending services enable their users to borrow fiat currency or crypto-assets against crypto collateral, i.e. margin lending, and are often used for speculative purposes. The loan-to-value ratio is usually between 50% and 70%; if collateral values drop below 50%, margin calls are triggered or positions are automatically liquidated. While overcollateralisation and auto-liquidation are effective ways to protect lenders against counterparty risk, lending services used for speculation increase the system's combined leverage. In addition, auto-liquidation may amplify procyclicality, as the automatic unwinding of positions may propagate market shocks almost immediately, considering also the usual absence of circuit breakers on CeFi exchanges.

CeFi firms are highly interconnected with other parts of the crypto ecosystem and amplify market movements in crypto-assets, as demonstrated by the successive bankruptcies in 2022. The collapse of algorithmic stablecoin Terra USD had a direct impact on some crypto hedge funds using this stablecoin as collateral to borrow crypto-assets. The liquidation of some hedge funds triggered bankruptcies for lending platforms highly exposed to these firms. The bankruptcy of FTX – one of the largest crypto exchanges – presents another example where risks associated with leverage, concentrated exposures and re-use of collateral materialised and were amplified by potential fraud and general opacity about the financial soundness of crypto operators (Box 2).

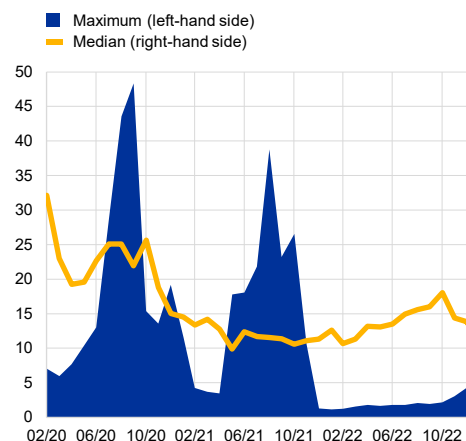


Chart 15

Median aggregate leverage in Bitcoin and Ether futures

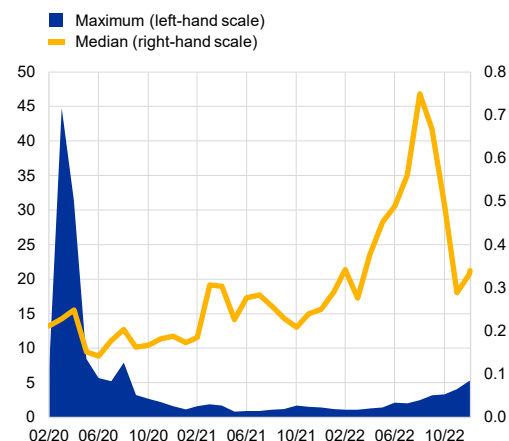
a) Leverage estimates of Bitcoin

(leverage multiple)



b) Leverage estimates of Ether

(leverage multiple)



Sources: Glassnode and ESRB calculations.

Notes: The estimated leverage ratio is calculated as (open interest of the trading platform) / (reserve of the trading platform). The following exchanges are covered for Bitcoin: Binance, Bitfinex, BitMEX, FTX, Huobi, Kraken, Bybit, Derbit, FTX and OKX; and for Ether: Binance, Bitfinex, Bybit, Derbit, FTX, Huobi, Kraken and OKX.

3.2.3 Decentralised finance

Decentralised finance (DeFi) provides its users with a variety of services that involve, among other things, leverage, liquidity and maturity transformation. DeFi encompasses an array of products and services in crypto-asset markets that aim to replicate certain functions of the traditional financial system by seemingly disintermediating their provision and in some cases decentralising their governance.⁵⁵ In doing so, financial intermediaries are substituted by non-custodial, autonomous (and self-executing) open-source software protocols deployed on public blockchains. Since DeFi services are currently offered in unregulated fashion and can be used pseudonymously from all over the world, separation by jurisdiction is scarcely possible.

DeFi lending protocols allow their users to engage in margin borrowing, similarly to SFTs, and are often used to leverage speculative positions. Loans are usually overcollateralised to protect lenders against a default (since no information on the borrower is available due to the pseudonymity characterising DeFi activity) and against unintentional liquidations due to the high volatility of the crypto-assets used as collateral. The leverage in DeFi lending is restricted by the degree of required overcollateralisation and is difficult to measure, not least because borrowed funds are often used as collateral for other loans, giving rise to “collateral chains” (akin to rehypothecation). When the value of collateral falls below a certain predetermined threshold, it is

⁵⁵ Usually, the governance of DeFi protocols is initially in the hands of the founders or developers and is only gradually handed over to an emerging community. Depending on the project, the actual degree of decentralisation can therefore vary greatly, depending on the individual protocol. For more details see **DeFi risks and the decentralisation illusion**, BIS, December 2021. See also **The Financial Stability Risks of Decentralised Finance**, FSB, February 2023.



automatically released for liquidation. This automated execution amplifies market volatility, similarly to flash crashes caused by algorithmic trading. Furthermore, as in CeFi, some DeFi protocols support margin trading and trading of highly leveraged derivatives.⁵⁶

DeFi services, especially lending protocols, often perform liquidity and maturity

transformation. In addition to the liquidity mismatches in stablecoins that are widely used in DeFi protocols, there is also an inherent liquidity and maturity transformation in DeFi services. While collateralised loans in DeFi do not have any predefined maturity, liquidity providers are often promised the possibility of immediate redemption. In the event of abrupt liquidity withdrawals, this can lead to lending pools becoming illiquid as soon as the sum of all loans outstanding exceeds the submitted liquidity, similarly to a bank run. This risk is magnified by the fact that a large portion of the liquidity provided in lending protocols is highly concentrated in a small number of accounts.⁵⁷ Further liquidity risks can arise if crypto-assets that are accepted as collateral do not have sufficient market depth.

Interconnectedness among DeFi protocols and with other segments of the crypto-asset market is high, albeit linkages with the traditional financial system remain small.

Composability, i.e. the capacity to combine several different protocols, is a unique feature of DeFi and enables significant interlinkages, which may amplify the reach and speed of financial contagion within DeFi and the wider crypto-asset market. Procyclical selling within DeFi can therefore have an impact on the overall crypto market volatility. The recent bankruptcies of CeFi companies such as lending platforms Celsius and FTX (Box 2) originated to some extent from the collapse of algorithmic stablecoin Terra/Luna and its ecosystem. To date, DeFi is mainly self-referential: Direct links to the traditional financial system are currently insignificant. However, spillovers from DeFi to traditional markets are theoretically possible – for example, through the use of stablecoins collateralised with traditional financial assets in lending protocols.

⁵⁶ The amount of maximum leverage offered is comparable to that found on centralised trading platforms. For example, GMX, currently the largest decentralised derivative exchange in terms of TVL, allows a leverage factor of up to 50x on individual crypto-assets via perpetual swaps.

⁵⁷ See [Global Financial Stability Report](#), IMF, April 2022, Figure 3.10.



4 Entity-based monitoring

The ESRB's entity-based monitoring covers investment funds, OFIs, crypto-assets and associated intermediaries. Thus, the monitoring universe for entity-based monitoring excludes, for example, banks, insurance corporations and pension funds, as well as CCPs with a banking licence. Section 1 considers current key risks for entities included in the monitoring universe. Tables 1 and 2 provide an overview of entities that are most relevant from a financial stability perspective and summarise their engagement in certain activities that pose, or potentially propagate, systemic risk. The subsequent sections explore this assessment in greater detail, focusing on how the key risks identified in Section 1 might affect, or be amplified by, certain entities included in the monitoring universe.

4.1 Investment funds

Main risks of investment funds

Credit risk	The credit quality of bond fund portfolio has continued to deteriorate. The economic slowdown could result in credit losses for investors, triggering waves of redemptions and forced selling, which could weigh on other market participants.
Leverage	Some funds use derivatives to obtain synthetic leverage, amplifying market and liquidity risks.
Liquidity transformation	While cash buffers have increased, markets may be subject to bouts of illiquidity, rendering the quick disposal of assets to meet redemptions challenging.

Net assets of investment funds declined by 11% to €16 trillion in 2022, the largest drop since the global financial crisis, mainly due to valuation effects and, to a lesser extent, outflows.

Funds exposed to equities and bonds recorded the largest declines, with most of the reduction in net assets occurring in the first half of 2022 as markets plummeted. In contrast, assets of real estate investment funds increased.

Liquidity transformation has declined moderately, as investment funds have increased their cash buffers. Against a backdrop of rising rates, investment funds have increased their cash holdings to their highest levels since 2012 (Chart 16 panel a) although a decline was observed at the end of 2022. The increase in cash holdings during the year might also reflect precautionary measures taken by funds in an uncertain macroeconomic environment. However, a number of investment funds remain exposed to a potential liquidity mismatches. For instance, around 25% of open-ended real estate AIFs offer daily redemptions to investors while investing in assets which are inherently illiquid and can take several months to liquidate. In addition, the market footprint of EU investment funds in the EU commercial real estate (CRE) market is estimated at around 26%⁵⁸, which implies that asset sales could weigh substantially on CRE markets. Given existing vulnerabilities in real estate markets and commercial real estate in particular, as outlined in

⁵⁸ Estimates based on AIFMD data and [MSCI Real Estate Market Size Report 2021-2022](#).



the ESRB Recommendation issued in December 2022⁵⁹ (Section 1.4), such funds could face liquidity strains if large redemptions were to materialise.

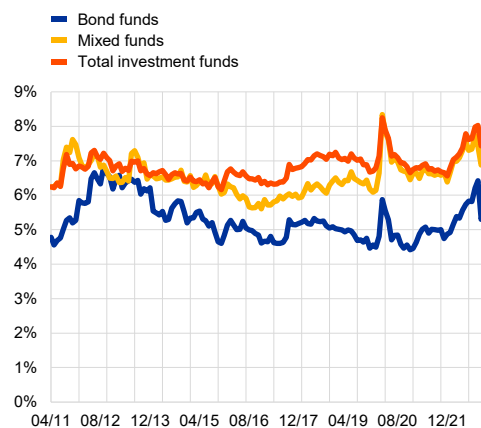
Maturity transformation performed by bond funds has declined, as funds reduced their exposures to longer dated instruments against a backdrop of rising rates, but credit risk remains important. Credit quality has stabilised at relatively low levels, with bonds rated below BBB accounting for 40% of total assets (Chart 16 panel b). After increasing steadily between 2017 and 2021, the weighted maturity of portfolio holdings for bond funds has declined from a peak of 9.5 years to around 8.3 years over the past 15 months (Chart 17 panel a). However, the average maturity remains historically high, exposing bond funds to interest rate risk within a context of further expected monetary tightening. Conversely, the average maturity for MMFs reached a historical minimum and stood at approximately 22 days at the end of 2022 (Chart 17 panel b).

Chart 16

Investment funds have increased their cash holdings to their highest levels since 2012, while credit quality of bond holdings remains worrisome, as credit risks are more likely to materialise in 2023

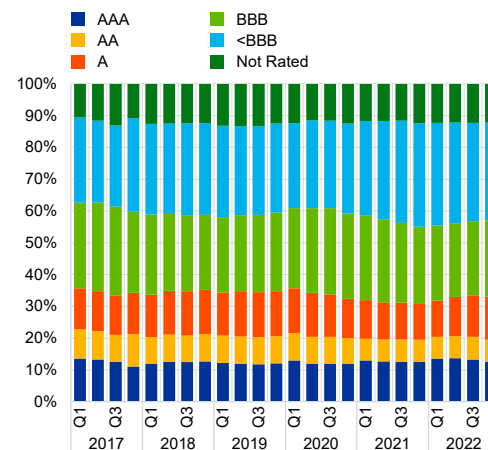
a) Share of deposits and loan claims in total assets of EU investment funds

(percentages)



b) Average rating of EU bond fund holdings

(percentages)



Sources: Thomson Reuters Lipper, Standard & Poor's, ECB and ESMA.

⁵⁹ See **ESRB Recommendation on vulnerabilities in the commercial real estate sector in the European Economic Area** (ESRB/2022/9) (2023/C 39/01).



Chart 17

Weighted maturity of portfolio holdings for bond funds declined in 2022 but remains high; weighted average maturity of MMFs reached a historical minimum

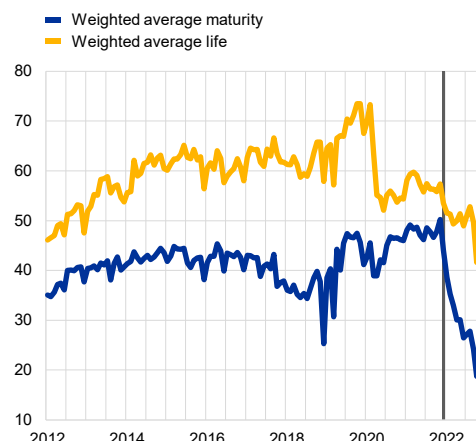
a) EU bond funds: weighted average maturity of assets

(years)



b) EU MMFs: weighted average maturity and life

(years)



Sources: Thomson Reuters Lipper and ESMA.

Risks associated with the economic slowdown could impact investment funds and be amplified.

Uncertainty around the pace of economic activity could lead to the crystallisation of credit risk, triggering losses for investors. The deterioration of fund performance could in turn trigger redemptions. Such mechanisms were at work in 2022, as bond funds experienced outflows throughout the year amid tepid performance related to interest rate hikes. Investment funds were able to meet those redemptions in an orderly manner, as they were spread out over long periods rather than concentrated within a short time frame. If large redemptions were to occur quickly, a disorderly adjustment, including through forced sales, could take place.

Hedge funds tend to exhibit high levels of leverage, mainly stemming from derivative exposures.

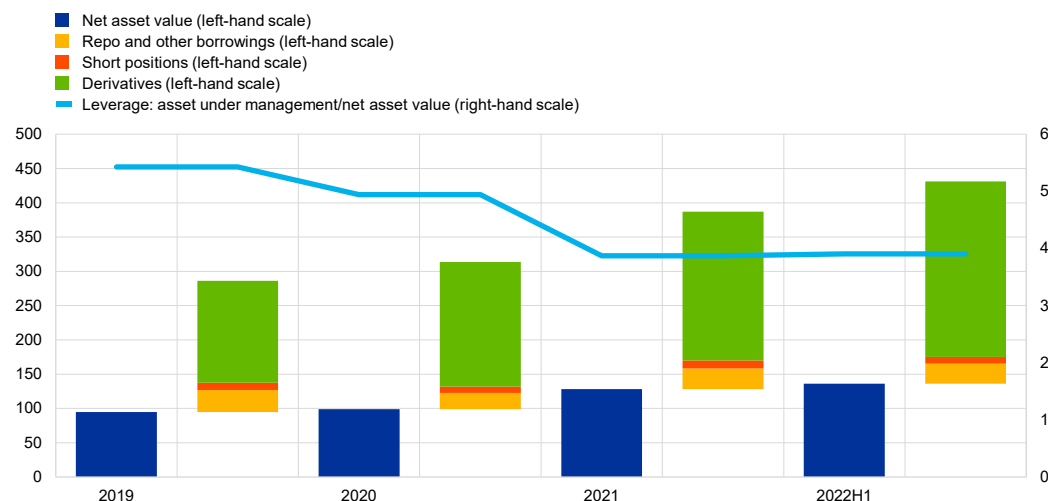
AIFMD data indicate that EU hedge funds had an NAV of €136 billion in the first half of 2022, and gross exposures (proxied by regulatory assets under management, which includes gross notionals on derivatives) of €532 billion, implying a gross leverage close to 4 times the NAV (Chart 18). Most of the leverage comes from derivatives (with more than 60% of exposures stemming from OTC instruments). Direct borrowings represent less than 25% of NAV and stem mainly from repo operations.



Chart 18

Derivatives are the main source of hedge fund leverage. Leverage decomposition and gross leverage of EU hedge funds

(left-hand scale – EUR billions; right-hand scale – multiple of NAV)



Source: AIFMD.

Note: Data cover hedge fund AIFs reporting at least on a semi-annual basis and managed by EU-domiciled AIFMs.

4.2 Other financial institutions

Main risks of other financial institutions

Data gaps	There is little information available to monitor vulnerabilities in some other financial intermediaries, captive financial institutions and money lenders.
Interconnectedness	Financial vehicle corporations engaged in securitisation have strong linkages with the banking sector. Security and derivative dealers are connected to a wide variety of market participants in their role as liquidity providers.
Liquidity/maturity transformation	Security and derivative dealers may rely on short-term funding to provide market-making services and conduct proprietary trading. Financial corporations engaged in lending rely on short-term loans and deposits in order to fund long-term loans.

The other financial institutions (OFI) sector includes a wide variety of heterogeneous entities, which may contribute to systemic risk in various ways.

OFIs are financial institutions that are not monetary financial institutions, investment funds, insurance corporations or pension funds. The OFI sector is composed of three sub-sectors based on their main activities and business models (Annexes I and II): (i) other financial intermediaries, (ii) financial auxiliaries and (iii) captive financial institutions and money lenders. Other financial intermediaries include, among other things, financial vehicle corporations engaged in securitisation transactions (FVCs), security and derivative dealers (SDDs) and financial corporations engaged in lending (FCLs). The interconnectedness and



the liquidity/maturity transformation inherent in intermediation activities undertaken by other financial intermediaries make them particularly relevant to financial stability.

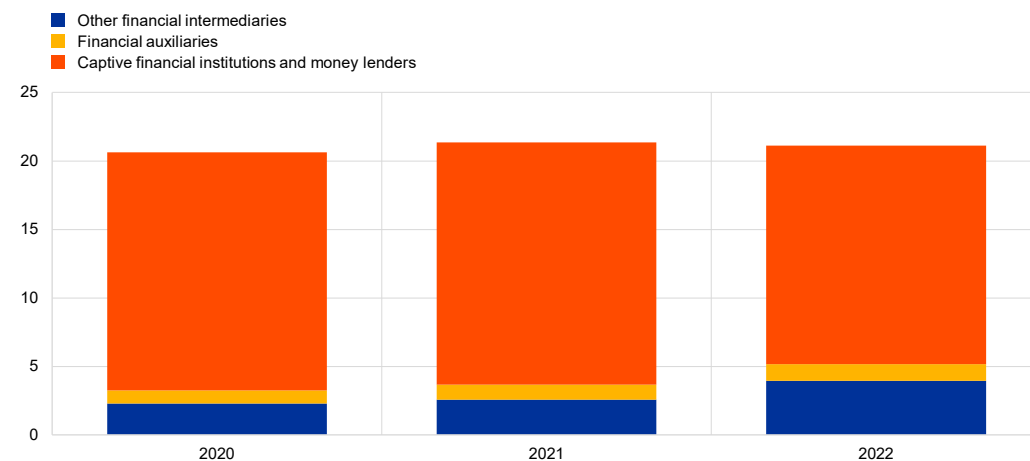
The size of the OFI sector increased slightly in 2022 (Chart 19). Assets of euro area FVCs, as well as risk indicators, remained relatively stable (Chart A25 panel a and A26 panel b). Securitised loans continued to be the main component of FVC portfolios. The balance sheet composition of FCLs has remained broadly stable in recent years, with loans to non-monetary financial institutions representing the lion's share of assets funded and liabilities primarily consisting of deposits and loans.

Further work on identifying and addressing data gaps is fundamental to disentangle the potential risks and complexities of OFIs. As of October 2022 the three OFI subsectors can be distinguished in the quarterly financial accounts published by the ECB. However, primary statistics are available at the EU level only for some other financial intermediaries. Large data gaps remain for other entities, including CFIs – the largest component of the OFI sector – preventing comprehensive risk monitoring. While some progress has been made through recent initiatives at the EU level, there are still difficulties in identifying CFIs other than holding companies. Hence, the relative importance of the wide variety of entities belonging to this subsector remains unknown. A clear assessment of the risks borne, propagated or possibly generated by CFIs is currently not possible.

Chart 19

CFIs and money lenders account for the lion's share of the OFI sector. Assets of EU other financial institutions

(EUR trillions)



Source: ECB.

Due to their strong linkages with financial institutions, OFIs can spread risk throughout the financial system. FVCs are highly interconnected with banks: Banks often use securitisations by FVCs to offload assets and their related risks from their balance sheets onto investors in FVC



securities. Nevertheless, banks retain some of the risk due to risk retention rules⁶⁰ and may also hold FVC securities in excess of the mandated quantity. In addition, banks may face potential “step-in” risk if they sponsor an FVC and decide to provide support during times of stress. SDDs, on the other hand, may rely on banks as a funding source, especially when they are consolidated into banking groups. The consolidated banking group is usually required to hold capital, including against the risks associated with the group’s SDDs. This incentivises banks to exert a degree of control over the risks borne by SDDs, which implies that risks stemming from SDDs that have such interconnections with the banking sector are lower. For FCLs, only a small part of their assets had direct counterparty exposure to the banking sector. However, deposits and loans taken constituted the largest share of FCLs liabilities. In contrast, linkages between CFIs and the banking system appear to be low. CFIs can still form part of complex financial intermediation chains, however, where they may engage in securities financing transactions or maintain high levels of leverage through the use of derivatives.

Elevated credit risk can affect OFIs which engage in credit intermediation. Heightened credit risk is of direct relevance to FCLs. Due to their business model, FCLs have assets that consist almost exclusively of loans to non-monetary financial institutions. Sectoral concentration in counterparties can create vulnerabilities in FCLs, which may be compounded by cyclical risks. In addition, FCLs may contribute to procyclicality if they are forced to reduce lending in a recession. When carrying out lending activities, FCLs engage in credit intermediation outside the banking regulatory perimeter unless they are prudentially consolidated into a banking group⁶¹. Heightened credit risk could also interact with FVCs’ interconnections to banks since securitised loans account for a large share of FVC assets. Developments in residential real estate are of particular concern in that residential mortgage-backed securities (RMBSs) dominate the EU securitisation market⁶².

In certain circumstances, OFIs may amplify liquidity strains. SDDs are active in derivatives and repo markets and engage in market making while also relying on short-term funding. In a stressed environment, the willingness or capacity of SDDs to intermediate may be limited.⁶³ Market participants may then experience difficulties in obtaining secured funding. In addition, the market liquidity of securities may decline substantially. Following regulatory changes, certain EU SDDs have recently been classified as systemic investment firms (SIFs) and are now subject to the same prudential requirements as credit institutions.⁶⁴ Continued monitoring of the sector remains important as the recent changes in EU regulation may result in changes in business models, total assets held, and risks borne by SDDs.

⁶⁰ See [Regulation \(EU\) 2017/2402 of the European Parliament and of the Council of 12 December 2017 laying down a general framework for securitisation and creating a specific framework for simple, transparent and standardised securitisation, and amending Directives 2009/65/EC, 2009/138/EC and 2011/61/EU and Regulations \(EC\) No 1060/2009 and \(EU\) No 648/2012](#).

⁶¹ In November 2017 the EBA published an opinion on regulatory perimeter issues relating to Capital Requirements Directive IV (CRD IV). This opinion explains that FCLs which are in the same group as a credit institution must be consolidated pursuant to Article 18(1) of the CRR, as they are regarded as “financial institutions”.

⁶² See [Monitoring systemic risks in the EU securitisation market](#), ESRB, July 2022.

⁶³ See [Holistic Review of the March Market Turmoil](#), FSB, November 2020.

⁶⁴ In June 2021 the new Investment Firm Regulation (IFR) and Investment Firm Directive (IFD) and amendments to the Capital Requirements Regulation (CRR) entered into force. This new framework governs the prudential requirements of investment firms and their prudential supervision. See press release: [ECB takes over supervision of systemic investment firms](#).



5 Crypto-assets, centralised finance and decentralised finance

Main risks of crypto-assets, centralised finance and decentralised finance

Leverage	Excessive leverage multiples offered to retail investors on crypto exchanges or DeFi protocols through margin lending and derivatives are common in crypto.
Market risk	Leverage coupled with crypto-assets' speculative nature, i.e. lack of underlying cash flows or claims on tangible assets, cause and amplify boom and bust cycles.
Liquidity risk	Several crypto business models rely on maturity and liquidity transformations but do not have appropriate safeguards in place and are thus vulnerable to 'runs'.
Credit risk	Predominantly stemming from opaque business structures and unsustainable business models that have frequently resulted in defaults
Operational risk	Immature technology, combined with a lack of mandatory standards and regulatory surveillance of crypto businesses, allow for unintentional failures and malevolent misconduct.
Interconnectedness	Very high interconnectedness within the crypto ecosystem, but limited linkages with traditional markets, mainly through reserve holding of money market instruments by stablecoins

Risks associated with stablecoins remain small due to the size and minimal (albeit increasing) linkages with the traditional financial system.⁶⁵ The global size of stablecoins declined in 2022, in line with a broad-based decline in crypto-asset valuation. They represent about 15-20% of the total crypto market capitalisation and are dominated by three reserve-backed coins pegged to the US dollar: USD Tether, with USD 66 billion (€60 billion) market cap; USD Coin, with USD 45 billion (€40 billion); and Binance USD, with USD 17 billion (€15 billion) (Chart 20 panel a). Euro-pegged stablecoins remain negligible, with a combined value of less than €500 million.

⁶⁵ The cut-off date for the report was 31 December 2022. It therefore does not cover the period in March 2023 that saw the failure of three US banks and related adverse developments in the crypto-asset ecosystem.

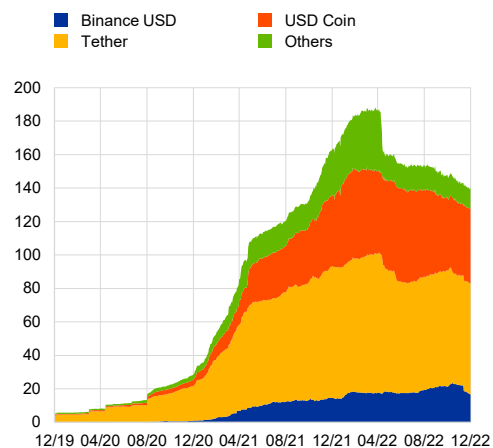


Chart 20

Stablecoins declined in value in 2022 and faced challenges in defending the peg during stress episodes

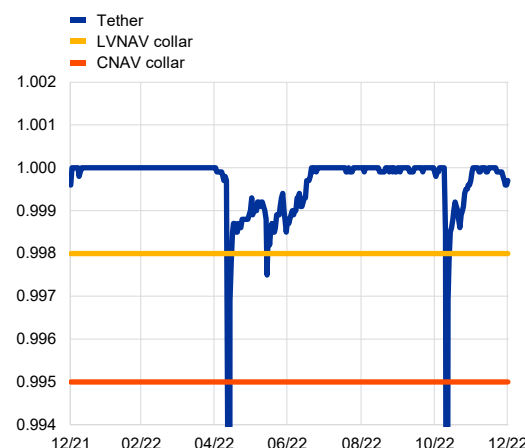
a) Stablecoin market capitalisation

(USD billions)



b) Value of Tether

(ratio to peg or amortised costs for MMFs)



Sources: CoinMarketCap and ESMA.

Some stablecoins experienced large fluctuations against their peg during stress periods, showing vulnerabilities. Among the largest stablecoins, mark-to-market valuation differed substantially from the peg during stress episodes such as the collapse of algorithmic stablecoin Terra USD in May 2022 and the bankruptcy of FTX, one of the largest crypto-intermediaries, in November 2022. The large fluctuations observed are several orders of magnitude higher than those that would force MMFs using amortised cost valuation to switch to marked-to-market valuation for redemptions. Such differences between the actual value and the peg partly reflect the lack of regulatory framework for stablecoins – unlike MMFs, which are subject to stringent regulatory and reporting requirements (Chart 20 panel b). Stablecoin valuation can also fluctuate during times of market stress – for instance, in the event of a failure of a bank custodian of reserve assets – highlighting possible sources of interconnectedness and the potential for contagion effects, albeit not yet at a level that could pose risks from a financial stability perspective.

Activity on CeFi platforms declined in 2022 due to a drop in crypto-asset valuation and a sharp decline in investor confidence in crypto intermediaries. Monthly trading volumes on crypto exchanges decreased throughout the year and reached a two-year low in December 2022. Annual trading volumes accordingly fell from USD 97 trillion (€80 trillion) to around USD 56 trillion (€50 trillion) (down 35% year-on-year). The decline reflects both price and volume effects and was most likely caused by the series of collapses witnessed in 2022 among crypto intermediaries such as the Terra ecosystem, Celsius and FTX. Moreover, crypto-assets have often proven to move in tandem with traditional risky assets such as technology stocks, which suffered a major decline in 2022. Decreased crypto trading volumes might thus, to some extent, also reflect muted institutional activity. The fall of FTX has shown that crypto-assets that are held in custody on CeFi platforms can become lost indefinitely. As a consequence, investors have progressively shifted their assets to



self-hosted wallets, which led to major asset outflows from leading crypto-exchanges in November and December.

The collapse of one of the largest crypto exchanges shows how risks can crystallise and spread throughout the ecosystem due to their interconnectedness. FTX, one of the largest crypto exchanges, went bankrupt in November 2022, triggering spillover effects across the rest of the crypto ecosystem. While the causes of the collapse were multiple (Box 2), this event shows how liquidity risk can materialise quickly and be amplified by the use of leverage, including by related entities.

Box 2

The FTX collapse: main facts and lessons learnt

In November 2022 the bankruptcy of FTX – once one of the largest crypto exchanges – rekindled concerns about the crypto ecosystem and the risk of contagion to traditional financial markets.

FTX was launched in May 2019 and grew rapidly into one of the leading crypto-asset trading platforms. FTX, like similar platforms, issued an unbacked token, called FTT, that could be used to obtain discounted trading fees. Moreover, FTX consistently used one-third of its trading revenue to repurchase FTT from the market, thereby raising the value of the tokens that remained in circulation, similarly to share repurchases.

Alameda Research, belonging to the same owner, was a crypto-asset trading and investment firm. It also engaged in proprietary trading. Unlike FTX's other customers, Alameda enjoyed certain privileges that allowed it to trade on FTX regardless of the usual risk and leverage limits.

By early 2022 Alameda had invested several billion dollars in directional, unhedged, illiquid and long-term assets. To fund these bets, Alameda had relied on loans granted by digital asset lending platforms, traditional bank lines of credit and its unlimited borrowing abilities from FTX (including customer funds). As a consequence of the Terra/Luna crash in May 2022, Alameda faced a large number of margin calls and loan recalls but lacked the liquid assets to meet these demands. Against this backdrop, Alameda most likely further increased its use of an FTX credit line, financed through customer assets. By mid-2022 Alameda's liability reflected USD 7.4 billion of loans to undisclosed creditors in addition to assets, of which were to 40% (USD 8 billion) composed of the FTX proprietary token, FTT.

In just ten days, between 2 and 11 November, multiple concatenated events led to the collapse of both FTX and Alameda Research. These events included (i) the leak of Alameda's financial statements⁶⁶; (ii) the announcement by the CEO of Binance to liquidate a sizeable position of FTT; (iii) massive withdrawals of customer funds initially from FTX, followed by the suspension of withdrawals and ultimately the halt of all FTX trading. On 8 November, Binance's CEO announced his intention to acquire FTX but abandoned this plan almost immediately. On 11 November, FTX and Alameda Research filed for bankruptcy.

⁶⁶ See CoinDesk, [Divisions in Sam Bankman-Fried's Crypto Empire Blur on His Trading Titan Alameda's Balance Sheet](#), 2 November 2022.



The collapse of FTX largely resulted from high-risk activities, coupled with the absence of governance controls and regulatory surveillance. For instance, the lack of information on management bodies, offshore corporate structure and governance frameworks concealed the tremendous conflicts of interest that existed between FTX and Alameda Research, Alameda's access to FTX's customer funds and the opacity and lack of operational segregation between Alameda and FTX.

No significant contagion to the rest of the financial system took place⁶⁷, largely because only a small number of traditional entities were exposed by modest amounts. Nevertheless, this case once again highlighted the interconnectedness within the crypto-asset market. The collapse can also be attributed to some financial risks and vulnerabilities that are well understood by traditional financial intermediaries. This is the case with excessive leverage, undue re-hypothecation and liquidity imbalances. FTX accepted its self-issued token (FTT) as collateral for margin loans, thereby generating wrong-way risk and enabling the eventual death spiral. In terms of liquidity, FTX did not have sufficient liquid funds on hand to cover all customer redemptions.

The size of the global DeFi market decreased substantially in 2022, in line with the overall crypto market development. A key metric to evaluate the size of DeFi is total value locked (TVL), reflecting the sum of all crypto-assets deposited in DeFi protocols. TVL increased more than tenfold in 2021, from €15 billion to €220 billion, outpacing even the growth of the overall crypto market. Following a number of adverse events such as the collapse of algorithmic stablecoin Terra USD in May 2022 and the failure of FTX in November 2022, TVL dropped back to around €50 billion.⁶⁸ The number of active DeFi applications, however, continued to increase despite the decline in TVL, touching close to 2000 in December 2022 (Chart 21 panel a). The largest protocol types in terms of TVL are decentralised exchanges, lending and liquid staking protocols which facilitate the trading, lending/borrowing and "staking" of crypto-assets, respectively (Chart 21 panel b).

⁶⁷ Clients pulled USD 8.1 billion in deposits from Silvergate during a "crisis of confidence" (see [article](#) by Asgari and Franklin, 2023) in late 2022, forcing the sale of assets and underscoring the impact on the regulated financial sector of the collapse of FTX.

⁶⁸ [DeFiLlama - DeFi Dashboard](#), January 2023. The TVL varies according to the chosen calculation method from around USD 40 billion to USD 70 billion.

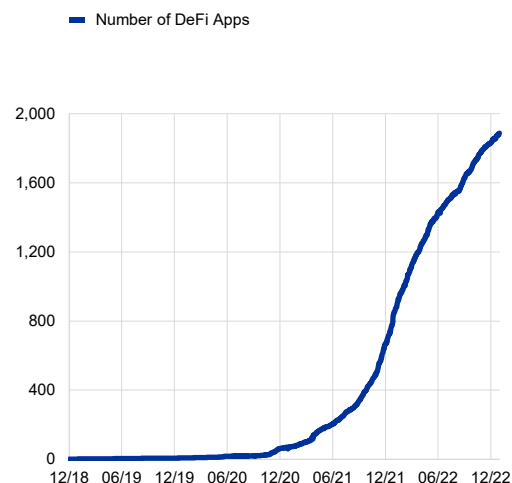


Chart 21

DeFi activity peaked at the end of 2021 before collapsing despite a pick-up in DeFi applications

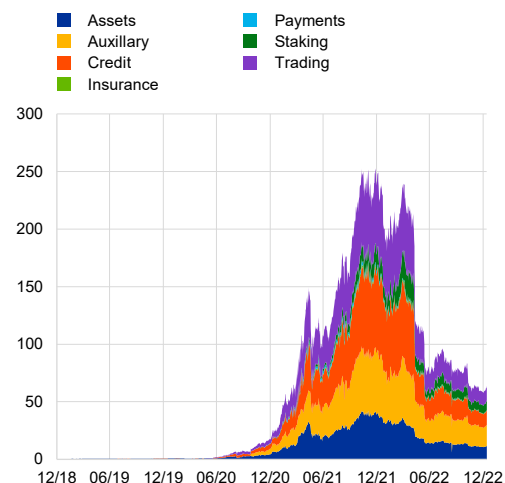
a) Number of DeFi apps

(number)



b) DeFi total value locked by protocol type

(USD billions)



Sources: DeFiLlama and ESRB calculations.

Notes: In Chart 21 panel a, the number of DeFi apps with positive TVL. In Chart 21 panel b, the categories include (i) Assets, including derivatives, synthetics, options, indices, algorithmic stablecoins and protocols that mint their own stablecoins or launch new projects and “coins”; (ii) Auxiliary, protocols that allow users to bet on future results, that bridge tokens from one network to another or allow for the interoperability among different blockchains and that support DeFi services (incl. gaming and NFT mining); (iii) Credit, protocols that allow users to borrow and lend assets and that pay a reward for the liquidity provision or aggregate yield from various protocols, as well as protocols that use reserves of assets to issue and back their native tokens; (iv) Insurance, protocols that offer coverage against losses caused by events typically in the DeFi ecosystem, such as hacking, malfunctioning of exchanges or smart contracts; (v) Payments, protocols that allow users to pay/send/receive crypto-assets; (vi) Staking, protocols that reward for staked assets with crypto-assets; and (vii) Trading, protocols that allow users to swap and trade crypto-assets. TVL might be overestimated due to token re-usage.



6 Activity-based monitoring

Activity-based monitoring complements entity-based monitoring, thereby providing a broader understanding of financial stability risks. Entity-based monitoring may not capture all aspects of systemic risks, in particular those that may arise in specific markets and that cut across entities. Complementing entity-based monitoring with activity-based monitoring sheds further light on the use of certain financial instruments and the type of markets in which investment funds and OFIs interact with each other and with entities outside the monitoring framework. Thus, it provides further insights from a systemic perspective into the nature of risks that may arise due to these activities.

6.1 Derivatives

Main risks of derivatives	
Interconnectedness	Use of derivatives can create complex intermediation chains, which can include various financial sectors and asset classes.
Leverage risk	Use of derivatives can increase market risk exposure beyond risk-bearing capacities.
Counterparty risk	Insufficient margining can lead to unintended market exposures in the event of counterparty default.

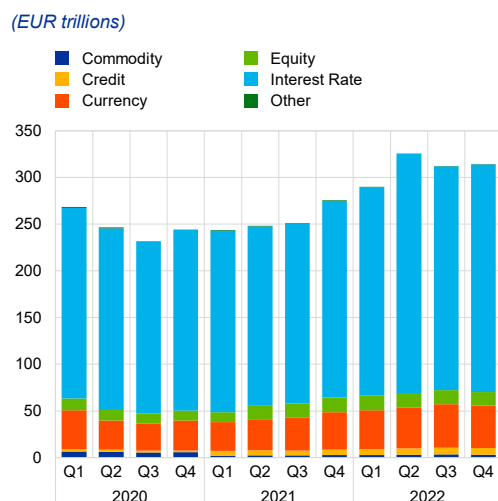
EMIR data show that the EU derivatives market had a total gross notional outstanding amount of €314 trillion in 27 million open trades at the end of 2022. This represented an increase in notional terms from the €274 trillion a year earlier. The market continued to be largely dominated by IRDs, accounting for 78% of the total gross notional amount, while 14% of the total gross notional amount was in currency derivatives, and 8% in equity, credit and commodity derivatives (Chart 22 panel a). Over-the-counter (OTC) contracts accounted for 95% of the total gross notional amount in the fourth quarter of 2022, with 5% in exchange-traded derivatives (ETDs). ETDs remain small in gross notional outstanding terms compared with OTC derivatives although, in terms of equity and commodity derivatives, ETDs continue to account for a sizeable proportion, at 51% and 34%, respectively, at the end of 2022.



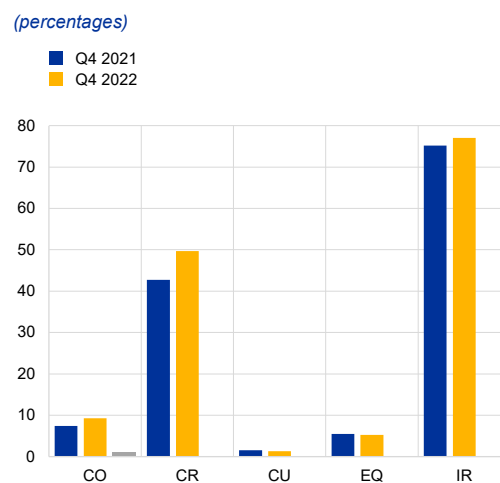
Chart 22

Derivatives markets remain dominated by IRDs, most of which were traded OTC and cleared

a) Gross outstanding notional amounts by asset class by quarter for the EU



b) Share of outstanding notional amount cleared in the fourth quarter of 2021 and the fourth quarter of 2022



Sources: Trade repositories and ESMA.

Note: In Chart 22 panel b, CO stands for commodity, CU for currency, CR for credit EQ for equity and IR for interest rate derivatives.

Central clearing rates for credit and IRD assets increased in 2022 for products subject to a clearing obligation in the EU.⁶⁹

The proportion of gross outstanding notional amount for OTC credit and interest rates cleared stood at 50% and 77%, respectively, at the end of 2022, both up from a year earlier (up 7 and 2 percentage points, respectively) (Chart 22 panel b). Central clearing of OTC derivatives in other asset classes remained low (9% in commodities, 5% in equities and 1% in currencies). Given a record surge in gas prices with Russia’s invasion of Ukraine, margins collected by EU CCPs for energy commodity derivative positions increased very significantly during the second half of 2022. The sharp increase was accompanied by a shift away from ETD to OTC in commodity derivatives, likely driven in part by market participants looking to reduce margin costs. Prices and margins later fell back again at the end of 2022 as market fundamentals shifted. Given the ongoing geopolitical uncertainty, however, the potential for further sharp increases in commodity prices and margins in 2023 remains. Interest rate margins also increased in the second half of 2022, continuing the ascending trend that started at the beginning of 2022 with movements on underlying interest rates and related monetary tapering (Chart 23 panel a).

Non-bank financial institutions (excluding CCPs) accounted for €81 trillion in outstanding notional in the fourth quarter of 2022, up from €74 trillion a year earlier.

Funds accounted for €11 trillion, while investment firms (part of the OFI sector) accounted for €71 trillion. The NBFi share of the outstanding notional amounts is sizeable across asset classes. At the end of 2022 this

⁶⁹ ESMA has recommended that the European Commission apply the clearing obligation to pension funds from June 2023, as such entities are currently exempted. If this recommendation is endorsed, pension funds will be subject to requirements to clear their OTC interest rate derivatives. See [ESMA news release](#), February 2022.



ranged from 26% for IRDs and around 30% in credit and currencies to about 40% in both equities and commodities. Most of these exposures are associated with large investment firms in particular (Chart 23 panel b). Investment funds also held sizeable exposures, particularly in credit (14% of total outstanding notional amount), currencies (7%) and equities (7%). Moreover, as some of the banks' exposures are on behalf of non-bank clients that do not report directly under the EMIR, these figures are liable to understate the derivative exposures of NBFIs to a certain extent. The sizeable role of NBFIs in derivative markets, combined with a significant interconnectedness of derivative markets, presents a contagion channel for risks from NBFIs to the wider financial system and vice versa. These risks are greater where NBFIs have built up excessive leverage and where exposures are in uncleared OTC contracts, which are less transparent, have lower margins and do not benefit from the risk reduction of netting through clearing. Recent trends in commodity markets, as well as a move away from ETD to OTC in response to sharply increasing margins in energy derivatives, also show how risks can grow with increasing market volatility.

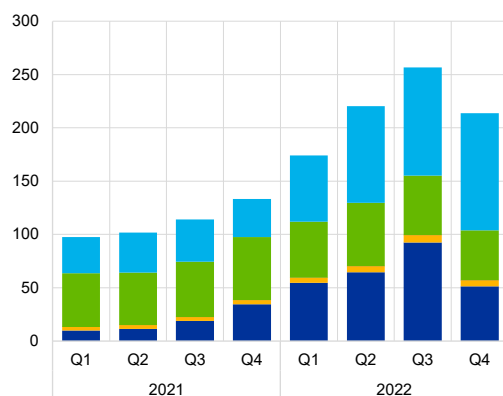
Chart 23

Sharp increase in margins required for commodities; significant footprint of investment funds in credit derivatives

a) Outstanding amounts of initial margin required and excess collateral received by EU27 CCPs for derivatives

(EUR billions)

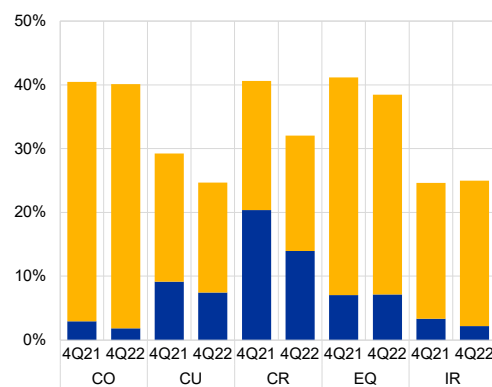
- Commodities
- Credit
- Currency
- Equities
- Interest rates



b) Proportion of outstanding notional amount held by investment funds and investment firms by asset class

(percentages)

- Investment funds
- Investment firms



Sources: Trade repositories and ESMA.

Notes: In Chart 23 panel a, data for CCP.A, CC&G, BME is missing. In Chart 23 panel b, CO stands for commodity, CU for currency, CR for credit EQ for equity and IR for interest rate. Outstanding notional amounts by asset class of underlying; percentage split by ETD and OTC.



6.2 Securities financing transactions

Main risks of securities financing transactions

Counterparty risk	During volatile periods, the price of collateral might fluctuate widely. In the case of non-centrally cleared SFTs, if the price declines by more than the haircut applied to collateral and the borrower fails to pay the repurchase price, the market value of the collateral will not cover the lender's losses resulting from the counterparty's default. If, on the other hand, the price increases and the lender fails to deliver the security, the borrower will be exposed to losses from the counterparty's default.
Leverage	SFTs can enable institutions to increase their exposures via secured borrowing.
Reinvestment	If cash collateral is reinvested in volatile/illiquid assets, the counterparty may suffer losses, which may in turn result in a more widespread spillover to unsecured funding markets.
Liquidity	SFTs typically have short maturities but may be subject to a drop in activity (and hence liquidity), especially at quarter-end, thus exposing market participants to funding liquidity risk. Moreover, additional collateral requests might result in liquidity strains for borrowers during stress periods.
Procyclicality	During periods of stress, counterparties may face liquidity demands from higher haircuts and a decline in the value of collateral. Procyclicality associated with margining and haircut practices may increase contagion risks.

The total value of the EU repo market increased by 13% to reach €10.4 trillion in December 2022 (Chart A34 panel a), according to industry surveys, accompanied by an increase in the use of non-government bonds. Government securities are the primary assets used as collateral although their share decreased from 48.7% in 2021 to 40.1% in 2022. The share of non-government bonds such as corporate and covered bonds rose from 17% to 27.1%, while there was a significant decrease in equity (to 11.4%, down from 13.1%).⁷⁰

According to EU regulatory data, repo activity reported by EU counterparties amounted to €8.5 trillion at the end of 2022, most of the activity having been conducted with non-EU firms. According to SFTR data, the market size of outstanding repo and buy-sell back transactions was approximately €8.5 trillion in mid-November, with repo trades amounting to 92% of market value. 43.2% of the total amounts are transacted between EEA entities, whereas 30.4% (26.4%) have an EEA entity as lender (borrower). Consequently, EEA entities have an overall net lending position since their exposure in reverse repo transactions is higher than their repo exposures. The most relevant players interacting with EEA market participants are US and UK entities. The entities with the largest exposures are banks, followed by CCPs and investment firms. Investment funds represent 3% of repo and reverse repo exposures, with AIFs mostly borrowing through repo transactions, while UCITS display a net lending position. Overall, investment funds are net borrowers (€290 billion of repo versus €250 billion of reverse repo exposures).

Tensions have materialised in repo markets due to collateral scarcity, with repo rates lagging policy rates. Despite increasing, repo rates have lagged policy rates, as witnessed in the second half of 2022 (Chart A34 panel b). Due to heightened demand for high-quality collateral amid limited supply, repo rates even turned negative for some sovereign bonds, implying that a cash lender would pay a borrower to lend cash against the collateral. In a bid to help meet demand for

⁷⁰ Data from the International Capital Market Association based on a survey completed by 61 offices of 54 financial groups in December 2022.



the securities, the ECB has eased the limits on its securities lending operations, addressing in this manner the collateral scarcity in the repo markets. More specifically, during a non-monetary policy meeting on 9 November 2022, the ECB significantly increased the amount of cash it would accept as collateral from banks looking to borrow sovereign debt – to €250 billion, up from €150 billion⁷¹ – in order to ease any potential bottlenecks. This has led to a normalisation towards relatively orderly trading in the repo markets.

Securities lending activity remained strong throughout 2022, especially for sovereign bonds amid collateral scarcity.⁷² EU securities on loan include government bonds, corporate bonds and equities. SFTs involving European government bonds remained strong amid ongoing volatility in the markets. Average loan balances decreased by 8% year-on-year to USD 375 billion at the end of 2022; however, the amount of loanable assets remained unchanged at high levels (to USD 1.3 trillion), while the average utilisation (ratio of assets on loan to lendable assets) increased even further, to 29%. Securities lending activity involving European equities increased on average. More specifically, the average value of loan balances increased across the majority of European markets, and for the major contributors, by 47% to USD 59 billion in France, by 48% to USD 48 billion in Germany and by 6% to USD 33 billion in the United Kingdom. Average utilisation has increased for almost all markets, which has supported revenues. The highest revenue-generating countries in European securities finance markets were Germany (USD 110 million), France and Sweden (USD 108 million each).

Overall financing conditions on euro-denominated SFTs tightened for all collateral types in the fourth quarter of 2022.⁷³ The tightening was related to a general deterioration of market liquidity and market functioning. The liquidity of all collateral types continued to deteriorate, with the largest percentage of respondents reporting a decrease in the liquidity of high-yield corporate bonds, while even high-quality domestic government bonds saw a decline in liquidity. The maximum amount of funding against sovereign collateral remained unchanged in the fourth quarter of 2022 following an increase observed during the third quarter of 2022 as lenders were eager to source high-quality collateral.

Interconnectedness between banks and the monitoring universe through the use of repo transactions remains significant. Banks' repo liabilities to non-MMF investment funds and other OFIs increased from €78.8 billion in December 2021 to €80.6 billion in December 2022 (Chart A35). However, the share of repo transactions conducted by banks as counterparties to non-MMF investment funds and OFIs remained stable and amounted at 36% both in December 2021 and in December 2022 (average share amounted at 33% throughout both 2021 and 2022). On the other hand, banks' repo liabilities to CCPs – the largest bank counterparty, as most EU repo transactions are centrally cleared⁷⁴ – increased to €122.2 billion in December 2022, compared with €118.8

⁷¹ See [ECB to lend out more of its bonds to ease market squeeze, Reuters](#), November 2022; [ECB Raises Limit on Securities Lending to Ease Year-End Crunch](#), Bloomberg, May 2023.

⁷² See IHS Markit Securities Finance Quarterly Reviews, H1 2021, H2 2021, H1 2022 and H2 2022.

⁷³ See the ECB's [Survey on credit terms and conditions in euro-denominated securities financing and OTC derivatives markets \(SESFOD\)](#), December 2022 and [Survey on credit terms and conditions in euro-denominated securities financing and OTC derivatives markets \(SESFOD\)](#), March 2023.

⁷⁴ See also [Setting EU CCP policy – much more than meets the eye](#), CEPS, November 2021.



billion in December 2021. CCPs were bank counterparties for around 55% of transactions in December 2022, compared with 54% of transactions in December 2021.

6.3 Securitisation

Main risks of securitisation

Interconnectedness	Interconnections through securitisation open contagion channels between financial institutions, as well as across sectors and the whole economy.
Leverage	Securitisation may create excessive leverage in the financial system, fuelling a rise in asset prices and over-indebtedness across borrowers.

European issuance of securitisations decreased by approximately 15% in 2022. This decline was spread across most types of underlying loans (Chart A27), apart from residential mortgage-backed securities (RMBSs). RMBSs remained the largest segment of the EU securitisation market, representing approximately 60% of total outstanding securitisations.⁷⁵ In 2022 issuance of collateralised debt obligations (CDOs) and commercial mortgage-backed securities (CMBSs) amounted to €29.6 billion and €5.6 billion, respectively.

Rising credit risk weighs on EU securitisation markets, including CDOs, as borrower over-indebtedness increases vulnerabilities in the financial system. Collateralised debt obligations (CDOs) are typically structured credit products backed by a portfolio of fixed income assets. At present, the most common type of CDOs are collateralised loan obligations (CLOs). CLOs are primarily exposed to leveraged loans – that is to say, bank loans where the counterparts are highly indebted, have high debt service costs relative to earnings and are typically rated below investment grade.⁷⁶ CLOs are a potential source of systemic risk because of their complexity as an investment product and their linkages across the financial system. Fuelled by increased risk appetite (driven by higher returns from CLOs than other assets), investors may lower credit standards, incentivising borrowers to take excessive amounts of debt and rendering the leveraged loan market – which delivers most of the underlying assets for CLOs – more vulnerable to negative shocks as a result.⁷⁷ During times of elevated financial uncertainty, holding CLOs may amplify stress across the financial system, as was the case during the global financial crisis. Interlinkages with the CRE markets also warrant monitoring (Box 3).

In recent years, EU CLOs have regained impetus in tandem with a rise in the leveraged loan market. In Europe, following a standstill in the wake of the global financial crisis, CLO activity resumed in 2013. Since then, CLO issuance in Europe has increased substantially, reaching €26 billion in 2022 (Chart 24 panel a). During this period, issuance volumes increased almost every year except in 2020 (coronavirus (COVID-19) pandemic) and 2022 (period of high uncertainty

⁷⁵ See [Monitoring systemic risks in the EU securitisation market](#), ESRB, July 2022.

⁷⁶ See [Monitoring systemic risks in the EU securitisation market](#), ESRB, July 2022.

⁷⁷ See [EU Non-bank Financial Intermediation Risk Monitor 2020](#), ESRB, October 2020.



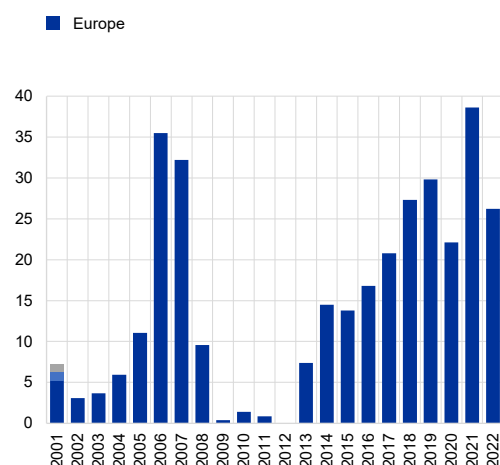
following Russia's invasion of Ukraine). Total outstanding CLOs in the EU remain much smaller than in the United States – the main issuer of CLOs globally (Chart 24 panel b).

EU CLOs are mainly backed by leveraged loans with weak covenant protection (covenant-lite loans). European CLOs accounted for more than 75% of the European institutional leveraged loan market in 2022 (Chart 25 panel a). The quality of CLOs is closely linked to the quality of the broader leveraged loan market. Lending standards for leveraged loans, as reflected by the amount of covenant-lite loans (loans with weak covenant protection), have deteriorated since 2013, generally pointing to higher risk-taking (and hence higher returns) by investors. Between 2013 and 2022, the share of covenant-lite loans as a percentage of leveraged loans increased significantly, from 6% to 95% (Chart 25 panel b).

Chart 24
EU CLO market doubled in four years, thanks to new issuance

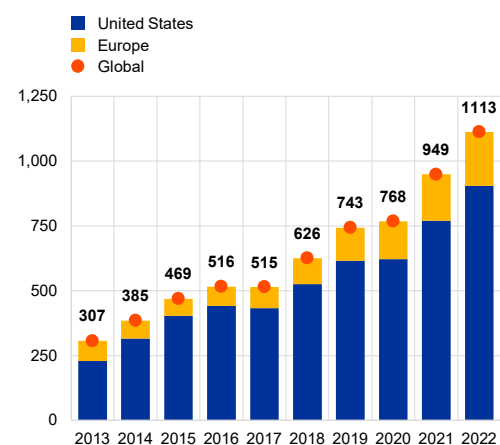
a) EU CLO issuance

(EUR billions)



b) Global CLO outstanding

(EUR billions)



Sources: S&P LCD, Bloomberg, JP Morgan, AFME and ESRB.
Note: Figures are based on institutional leveraged loans.

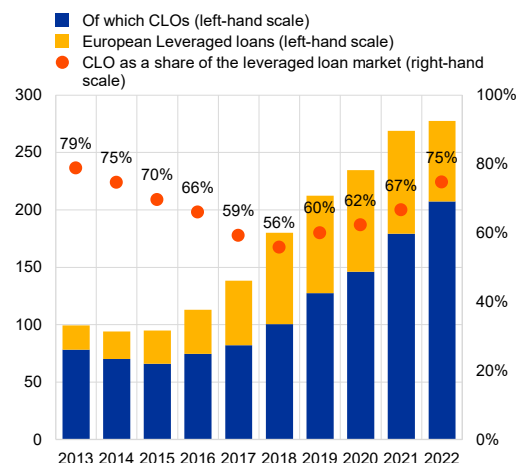


Chart 25

European CLOs account for a significant chunk of the leveraged loans market, most of which is covenant-lite

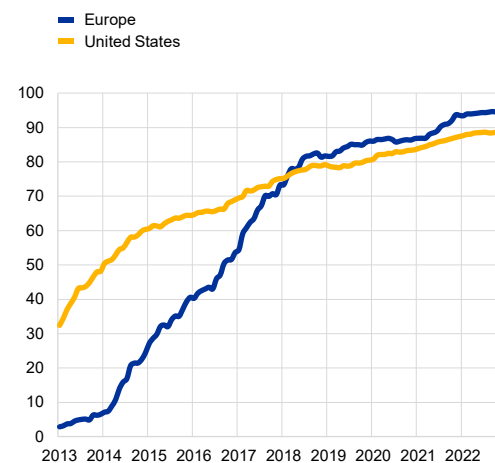
a) European leveraged loans

(EUR billions and percentages)



b) Covenant-lite loans in the United States and Europe

(percentages of total leveraged loans outstanding)



Sources: S&P LCD and ESRB.

Box 3

Commercial real estate collateral loan obligations

A commercial real estate collateral loan obligation (CRE CLO) is a collateralised loan obligation backed by CRE loans. The underlying CRE properties (residential, office, retail, industrial and hospitality) are transitional in nature, meaning that the purpose of the underlying property changes over time and may respond to an immediate change of usage or the most profitable application. Because of their transitional nature, CRE CLO loans are highly structured and customised to individual business plans⁷⁸.

Compared with commercial mortgage-backed securities (CMBS), CRE CLOs have a number of advantages, primarily relating to their flexibility. A CRE CLO can be actively managed, meaning that the collateral manager can have control of the underlying pool of loans. This means that the manager can remove and/or add new CRE loans to the underlying pool along the maturity of the obligation. In contrast, CMBS are static, with the underlying pool of loans not actively managed ex post. In addition, CRE CLOs primarily focus on transitional property types and have a shorter maturity (3-5 years) compared with CMBS, which focus on stabilised property types and have a longer maturity (5-10 years). Investors are attracted to CRE CLOs because of their short-term durations, floating rate aspects and the better alignment of incentives vis-à-vis sponsors, as the latter tend to retain junior tranches of these CLOs. For sponsors, CRE CLOs are attractive because

⁷⁸ See [A primer on European CRE CLOs](#), Scope Ratings, April 2022.



they can actively manage the collateral, which reduces the costs of financing. However, the credit risk of CRE CLOs is more complex to assess due to the high reliance on the sponsor.

While being a novelty in Europe, the US CRE CLO market has grown rapidly in recent years. In 2022 a London-based real estate lender⁷⁹ issued the first CRE CLO in Europe.⁸⁰ The transaction was collateralised by nine commercial mortgage loans located in four European countries: the United Kingdom, Ireland, the Netherlands and Spain. Although the size of the transaction only amounted to GBP 220 million, the market expectation for the European expansion of this type of CLOs is high⁸¹, mainly due to the advantages they bring compared with traditional CMBSs. In the United States, the CRE CLO market grew from issuance of around USD 18 billion in 2017 to USD 45 billion in 2021.⁸² In 2022 the issuance of US CRE CLOs amounted to around USD 30 billion.

Compared with other securitisation products, the size of CRE CLOs is small, but associated risks require further monitoring. Vulnerabilities of the CRE sector, as identified by the ESRB in 2022,⁸³ warrant monitoring of EU developments in this new market. Currently tighter financing conditions and higher interest rates are expected to have a negative impact on CRE firms' revenues and property valuations. In turn, low availability of loans in such an environment would limit refinancing possibilities, forcing some investors to sell their properties, adding to the downward pressure on prices and affecting financial stability as a result.

⁷⁹ See [First CRE collateralised loan obligation tests European market](#), STARZ Realty Capital, 18 November 2021.

⁸⁰ See [A primer on European CRE CLOs](#), Scope Ratings, April 2022.

⁸¹ See [A primer on European CRE CLOs](#), Scope Ratings, April 2022.

⁸² See Trepp [CRE CLO Research](#), November 2022.

⁸³ See [Recommendation of the European Systemic Risk Board of 1 December 2022 on vulnerabilities in the commercial real estate sector in the European Economic Area \(ESRB/2022/9\)](#) (2023/C 39/01).



Annexes

See [more](#).



Imprint and acknowledgements

The EU Non-bank Financial Intermediation Risk Monitor No 8 (2023) was approved by the ESRB General Board on 30 March 2023. It was prepared by the ESRB Expert Group on Non-bank Financial Intermediation (NBEG) co-chaired by Steffen Kern (Advisory Technical Committee) and Richard Portes (Advisory Scientific Committee) under the auspices of the ESRB Advisory Technical Committee and the ESRB Advisory Scientific Committee. Substantial contributions were provided by:

Anna Maria Agresti ECB	Emilio Hellmers ESRB Secretariat
José Alonso Olmedo Banco de España	Diego Hernández García Banco de España
Enrico Apicella ESRB Secretariat	Konstantinos Kanellopoulos Bank of Greece
Sara Batres Fernandez ESRB Secretariat	Urszula Kochanska ECB
Antoine Bouveret ESMA and Chair of the NBEG Risk Metrics Taskforce	Jeremy Kostons ESRB Secretariat
Claire Brousse Banque de France	Kiki Kuijs ESRB Secretariat
Anne Choné ESMA	Youssef Mouheb Banque de France
Lorenzo Danieli ESMA	Dorota Okseniuk ESRB Secretariat and Secretary to the NBEG
Francesco D'Ignazio ESRB Secretariat	Jean Quin ESRB Secretariat
Yanis El Omari ESMA	Paul Reiche ESMA
Tobias Etzel Deutsche Bundesbank	Alessandro Spolaore ESMA
Damien Fennell ESMA	Luis Miguel Tavares Banque de France
Paul Grau Deutsche Bundesbank	Eva Valdeolivas Banco de España

© European Systemic Risk Board, 2023

Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.esrb.europa.eu

All rights reserved. Reproduction for educational and non-commercial purposes is permitted provided that the source is acknowledged.

The cut-off date for the data included in this report was 31 December 2022.

For specific terminology please refer to the [ESRB glossary](#) (available in English only).

PDF ISBN 978-92-9472-337-6, ISSN 2600-2434, doi:10.2849/39469, DT-AK-23-001-EN-N