



EUROPEAN CENTRAL BANK

EUROSYSTEM

Financial Stability Review

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Foreword



This spring saw considerable financial turbulence, with the spotlight increasingly turning on systemic risk concerns following a series of bank failures outside the euro area. While the fallout experienced by euro area banks was limited, these events have served as a powerful reminder of the importance of ensuring that banking system fundamentals are sound, in an environment where financial conditions are being tightened to tackle elevated inflation around the world.

Price stability remains as crucial as ever for durably preserving financial stability. Tighter financing conditions to forcefully address high inflation have contributed to a reappraisal of the economic outlook and to a reversal of overly-compressed asset price risk premia. As financial conditions normalise, this may expose fragilities and fault lines in the financial system. Non-bank financial intermediaries remain heavily exposed to a turning financial cycle, despite ongoing de-risking. Such turning is becoming increasingly evident in the real estate sector – in both commercial property markets, where a clear downturn is visible, and their residential counterparts, which are showing signs of correction after several years of expansion. In all of these challenges, the resilience of euro area banks has been noteworthy, but should not give way to complacency.

Recent stresses in the US and Swiss banking sectors have served as a timely reminder of just how much the preservation of financial stability depends on the shock-absorption capacity of the financial system. This is especially true for banks, which operate at the core of the system. The resilience of euro area banks is largely attributable to the strength of their capital and liquidity buffers, under stringent regulatory and supervisory oversight. Strengthening the banking union – and notably making progress on a common European deposit insurance scheme – will reinforce the ability of the euro area financial system to withstand risks going forward.

Beyond the overview of key financial stability vulnerabilities in the euro area, this issue of the Financial Stability Review (FSR) includes three special features. The first examines how interactions in market and funding liquidity can amplify stress in the financial system. The second investigates the channels through which stress in non-bank financial institutions could propagate to euro area banks. The third furthers work on identifying potential threats from climate change, with a primer on associated risks for sovereigns.

This issue of the FSR has been prepared with the involvement of the ESCB Financial Stability Committee, which assists the decision-making bodies of the ECB in the fulfilment of their tasks. The FSR promotes awareness of systemic risks among policymakers, the financial industry and the public at large, with the ultimate goal of promoting financial stability.

Luis de Guindos
Vice-President of the European Central Bank

Overview

Financial stability vulnerabilities remain elevated

Financial markets remain vulnerable to less favourable growth and inflation outcomes. Adverse market dynamics could be amplified by forced sales of securities by non-banks amid low liquidity buffers.

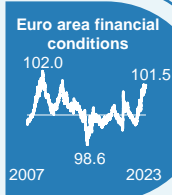
Tighter financial and credit conditions are testing the resilience of euro area firms, households and sovereigns. The correction in property markets could turn disorderly in the event of negative macro-financial surprises.

Euro area banks have had little exposure to the recent unexpected banking sector stress experienced in some mature economies, but funding and asset quality headwinds may weigh on future profitability.

It is essential to complete the banking union and strengthen policies for the non-bank financial sector to further enhance the resilience of the euro area financial sector.

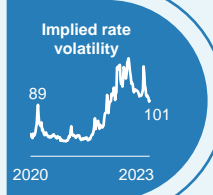
Financial conditions are testing the non-financial sector's debt servicing ability

- Inflation fuelling tighter financial conditions
- Risk of a disorderly property price correction
- Uneven corporate recovery
- Sovereign funding costs set to increase



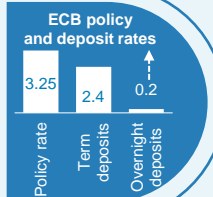
Markets remain vulnerable amid elevated rate volatility

- Sticky inflation may add volatility
- Recession fears re-emerge
- Equity risk premia may widen
- Global risks are rising



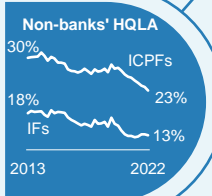
Higher bank funding liquidity and credit risk

- Looming asset quality concerns
- Muted lending activities
- Lingering cost inefficiencies
- Rising cyber risks



Economic uncertainty may raise liquidity and credit risks in non-banks

- Significant holdings of high-risk assets
- Vulnerabilities in real estate exposures
- Liquidity risks from fund outflows
- Inflation may weigh on non-life insurers



Active use of prudential policies in recent years means the euro area banking system is well-placed to withstand shocks.

Targeted macroprudential policy action and completion of the banking union could further enhance resilience.

Structural vulnerabilities in non-banks continue to require a comprehensive and decisive policy response.

Euro area financial stability outlook remains fragile

Euro area financial stability vulnerabilities remain elevated in the context of unexpected stress in the banking sectors of some mature economies. The recent failures of a number of US regional banks and the takeover of a Swiss bank have invited closer scrutiny of bank exposure to long-term fixed income securities, the stability of wholesale uninsured deposit funding and latent business model challenges. While the immediate cause of bank stress was related to idiosyncratic bank fragility in non-euro area economies, the episode prompted more general concerns about bank resilience in an environment of higher interest rates. This led to tensions in the bank equity and funding markets in the euro area. These tensions were short-lived, as euro area bank fundamentals remain solid and prompt regulatory intervention has contained spillovers from other economies. Nevertheless, it is possible that these events could lead to a reassessment of the profitability and liquidity outlooks for euro area banks.

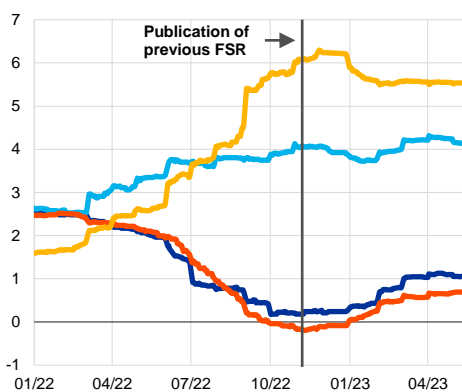
Chart 1

The financial stability outlook remains fragile, with weak macroeconomic growth and a flare-up of systemic stress

a) 2023 real GDP growth and inflation forecasts for the euro area and the United States

(10 Jan. 2022-23 May 2023; percentages)

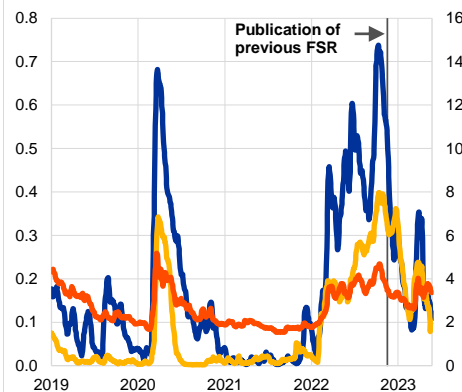
- US real GDP growth
- US annual CPI inflation
- Euro area real GDP growth
- Euro area annual HICP inflation



b) Near-term financial stress indicators for banks, financial markets and sovereigns

(1 Jan. 2019-23 May 2023; probability of default, percentages)

- Composite indicator of systemic stress in financial markets
- Composite indicator of systemic stress in sovereign bond markets
- Probability of default of two or more LCBGs (right-hand scale)



Sources: Consensus Economics, Bloomberg Finance L.P., ECB and ECB calculations.

Notes: Panel a: HICP stands for Harmonised Index of Consumer Prices; CPI stands for consumer price index. Panel b: "Probability of default of two or more LCBGs" refers to the probability of simultaneous defaults in the sample of 15 large and complex banking groups (LCBGs) over a one-year horizon. The composite indicators of systemic stress in financial markets and sovereign bond markets are contemporaneous indicators. To find out more about the composite indicator of systemic stress in financial markets, see Holló et al.* For details on the composite indicator of systemic stress in euro area sovereign bond markets, see Garcia-de-Andoain and Kremer.**

*) Holló, D., Kremer, M. and Lo Duca, M., "CISS – a composite indicator of systemic stress in the financial system", *Working Paper Series*, No 1426, ECB, March 2012.

**) Garcia-de-Andoain, C. and Kremer, M., "Beyond spreads: measuring sovereign market stress in the euro area", *Working Paper Series*, No 2185, ECB, October 2018.

Despite some improvement seen at the turn of the year, weak macro-financial prospects continue to pose a challenge to financial and non-financial sectors alike. Macro-financial conditions have improved slightly since the publication of the

previous Financial Stability Review (**Chart 1**, panel a), thanks to a robust post-pandemic recovery, fading global supply chain disruptions and lower energy prices. That said, the outlook remains highly uncertain, given the presence of downside risks to growth accompanied by persistent inflationary pressures. Also, near-term financial stress indicators have picked up again (**Chart 1**, panel b) in the context of stress in the banking sectors of some mature economies, although they remain below pandemic and war-related levels. At the same time, there are still structural vulnerabilities in the non-bank financial intermediation (NBFi) sector in the form of liquidity mismatch and leverage. High volatility and signs of lower market liquidity are rendering financial markets and the NBFi sector prone to adverse dynamics such as forced asset sales and are increasing the likelihood of credit events materialising. Such amplification effects could tighten broader credit conditions more strongly than expected with regard to both the cost and the availability of credit, and could dampen confidence, potentially weakening the resilience of the non-financial sectors.

Financial markets and non-bank financial intermediaries remain vulnerable to disorderly adjustments

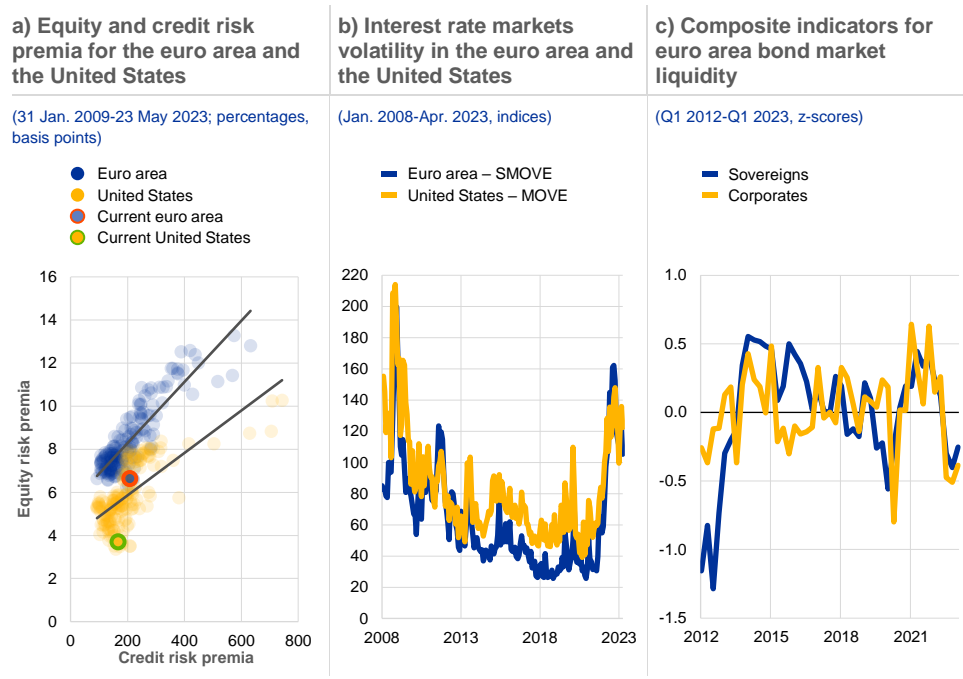
Following the rally in financial markets seen at the turn of the year, stresses in some mature economy banking sectors triggered price adjustments. Global financial markets saw an unusually robust start to 2023, driven by optimistic macroeconomic expectations predicated on the resilience of the euro area economy at the turn of the year, the faster than expected reopening of the Chinese economy and a sharp drop in energy prices. Solid corporate financial results, alongside lower volatility in interest rate markets, pushed euro area equity valuations back above historical averages (**Chapter 2**). The positive risk sentiment started to fade in February, following the more hawkish tone adopted by central banks globally. It reversed more abruptly in March, as unexpected stress in the US and Swiss banking sectors sent shockwaves through global financial markets.

The potential for disorderly adjustments in financial markets has risen in the context of tighter financial conditions and lower market liquidity. Renewed recession concerns in the aftermath of the banking sector stress in the United States and Switzerland have significantly lowered market-based policy rate expectations. Financial conditions have tightened as the market turmoil has led to a widening of credit risk premia in the euro area. By contrast, the fact that equity risk premia remain compressed in absolute and relative terms, especially in the United States (**Chart 2**, panel a), raises concerns over potential overvaluation. Equities may thus be more vulnerable to a disorderly price correction in the event of a further deterioration in the economic outlook (**Chapter 2**). As such, risk sentiment remains fragile and is highly sensitive to surprises as regards the outlook for inflation, growth and monetary policy in mature economies. More persistent inflationary pressures might require more significant monetary policy responses from major central banks than market participants currently expect. Among other things, a renewed surge in energy prices could also pose upside risks to inflation and could add to already-elevated volatility in interest rate markets (**Chart 2**, panel b). The combination of a

tighter monetary policy environment and recession fears could put pressure on the valuations of riskier assets. At the same time, elevated volatility in interest rate markets has contributed to a substantial decline in market liquidity in both corporate and sovereign bond markets, leaving them more vulnerable to adverse dynamics (**Chart 2**, panel c and **Special Feature A**).

Chart 2

The risk of disorderly adjustments in financial markets remains high in an environment of high volatility and low market liquidity



Sources: Bloomberg Finance L.P. and ECB calculations.

Notes: Panel a: equity risk premia are calculated as the five-year CAPE yield for the EURO STOXX (euro area) and S&P 500 (United States) less the five-year real (inflation swap-adjusted) government bond yield (German for the euro area); credit risk premia are calculated as the option-adjusted spread for BBB-rated corporate bonds with a residual maturity of 5-7 years. "Current" refers to the date 23 May 2023. Panel b: SMOVE is the Merrill Lynch 1M EUR Swaption Volatility Estimate Index; MOVE is the Merrill Lynch 1M UST Option Volatility Estimate Index. Panel c: for methodological details please, see Special Feature A in this issue of the Financial Stability Review

The non-bank financial sector has remained resilient during the recent banking sector stresses and market volatility, but liquidity and credit risks remain high.

The highly volatile market conditions which followed the flare-up of banking sector stress in the United States and Switzerland resulted in funds which invest in European and US financials, as well as those exposed to riskier assets such as high-yield corporates, facing significant investor outflows after early March. At the same time, inflows into sovereign bond funds and money market funds accelerated (**Chart 3**, panel a), reflecting safe haven flows in an environment of elevated macro-financial uncertainty as well as higher rates offered compared with bank deposits. Shifts by investors towards safer fund types served to reduce aggregate credit risk in the sector (**Section 4.2**). Portfolio de-risking has also been evident on the balance sheets of insurance corporations and pension funds, as higher interest rates have reduced the incentives for the non-bank financial sector to search for yield. That said, overall exposures to credit risk remain high, exposing the non-bank financial sector to the risk of material losses should corporate sector fundamentals deteriorate

substantially. In addition, non-banks' exposure to property markets has increased markedly in recent years, rendering institutions vulnerable to ongoing property price corrections (**Section 4.1** and **Box 2**). Strong links with banks, as an important source of funding for instance, could also give rise to additional vulnerabilities in the banking sector via liquidity and credit risk spillovers (**Special Feature B**).

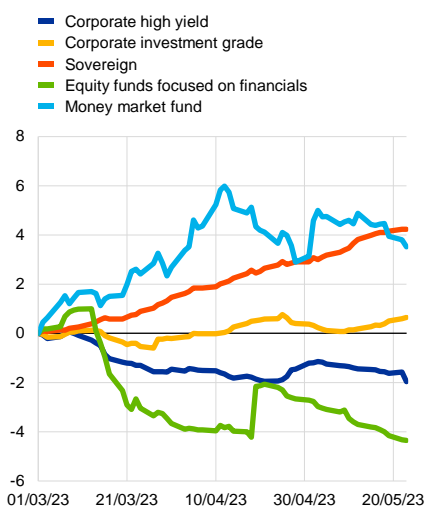
Low liquid asset holdings and potential margin calls could pose the risk of possible forced asset sales, calling for enhanced liquidity preparedness. While increasing slightly in 2022, the share of high-quality liquid assets in investment funds' securities holdings remains relatively low (**Chart 3**, panel b). As such, the risk remains high that, if they were to experience any sudden liquidity needs, funds could amplify adverse market dynamics via procyclical selling behaviour and forced asset sales, thereby introducing risks to wider financial stability. It is therefore necessary to strengthen existing regulatory frameworks and address issues related to structural liquidity mismatches in funds. Past stress events, such as the turmoil in March 2020 and the UK gilt market stress in the autumn of 2022, also vividly illustrate how non-banks can amplify margin call dynamics in the wider financial system, especially when coupled with excessive leverage. This highlights the importance of enhancing liquidity preparedness in the non-bank financial sector (**Box 7**).

Chart 3

Despite ongoing portfolio de-risking, liquidity and credit risks in the non-bank financial sector remain high in a volatile market environment

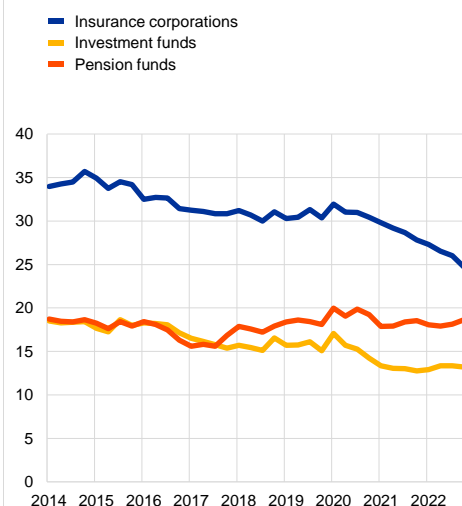
a) Euro area bond, equity and money market fund flows

(1 Mar.-23 May 2023, cumulative daily flows as a percentage of total net assets)



b) Share of high-quality liquid assets in total securities holdings

(Q1 2014-Q4 2022, percentages)



Sources: ECB, EPFR Global and ECB calculations.

Note: Panel b: high-quality liquid assets include debt securities, listed shares and investment fund shares that correspond to Level 1, Level 2A or Level 2B securities according to Commission Delegated Regulation (EU) 2015/61*, which defines liquidity requirements for banks. Shares are calculated based on market values relative to all debt securities, listed shares and investment fund shares held in the respective non-bank financial sector.

*) Commission Delegated Regulation (EU) 2015/61 of 10 October 2014 to supplement Regulation (EU) No 575/2013 of the European Parliament and the Council with regard to liquidity coverage requirement for Credit Institutions Text with EEA relevance (OJ L 11, 17.1.2015, p. 1).

Tighter financial conditions are testing corporate, household and sovereign resilience

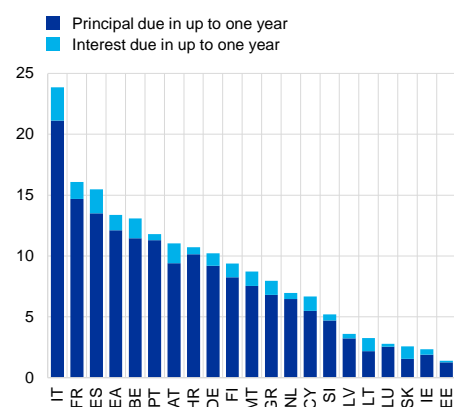
Sovereign vulnerabilities have remained elevated in a context of tightening financial conditions and weak macro-financial prospects. The pressures on public finances have eased in recent months, as the big drop in energy prices has reduced the need for additional energy-related fiscal support to be provided to corporates and households. But fiscal fundamentals remain fragile in some countries given their high debt levels, rising funding costs and high short-term refinancing needs (**Chart 4**, panel a). Vulnerabilities associated with potential abrupt shifts in market sentiment remain contained for now, as in recent years many sovereigns have locked in cheap financing at longer maturities. In addition, the ECB's Transmission Protection Instrument is able to counter any unwarranted and disorderly sovereign debt market dynamics that may pose a serious threat to the transmission of monetary policy across the euro area. Foreign investors can also play a stabilising role when spreads between sovereigns become elevated, as they increase their exposures towards euro area government bond markets (**Box 3**). That said, interest payments are expected to increase gradually going forward, as maturing public debt is rolled over at higher interest rates (**Chart 4**, panel b).

Chart 4

Interest payments are set to rise gradually as maturing public debt is rolled over at higher interest rates, in particular in countries with high short-term refinancing needs

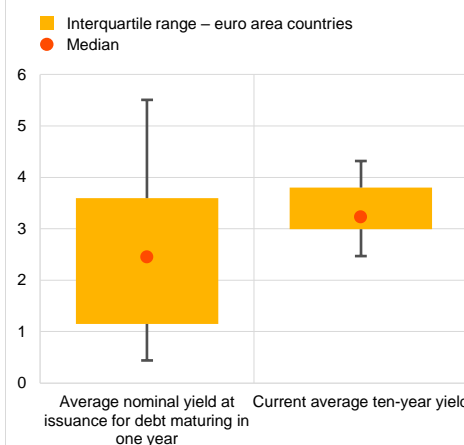
a) Debt service of government securities due over the next 12 months

(Apr. 2023, percentages of GDP)



b) Sovereign bond yields on debt maturing within one year and the current average ten-year yield across the euro area

(May 2023, percentages)



Sources: Bloomberg Finance L.P., ECB and ECB calculations.

Notes: Panel a: sovereign debt service covers all securities instruments at all original maturities with residual maturity of less than one year. Data only reflect existing maturing securities (principal and interest). Panel b: yields are averaged for the notional amount of the maturing debt.

Euro area firms have benefited from high profits in the context of a sharp post-pandemic recovery and lower energy prices, but rising costs are weighing on prospects. Higher revenues and profit margins have both contributed significantly to upbeat corporate financial results. In fact, many firms have been able to raise their

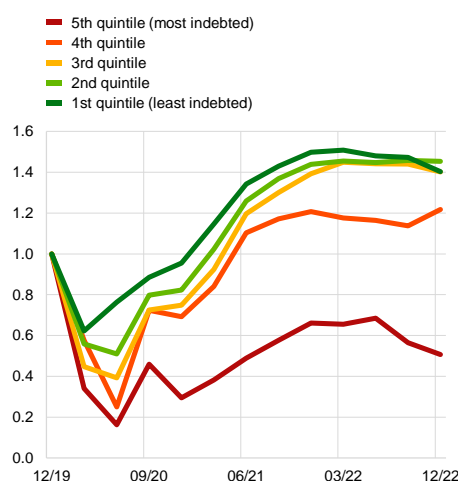
profit margins in sectors facing constrained supply and resurgent demand, contributing to higher wage demands and, by extension, upside risks to inflation. That said, not all firms have benefited equally from the recovery. Highly indebted, energy-intensive and/or pandemic-sensitive sectors have often been unable to increase profit margins (Chart 5, panel a), with some heterogeneity across countries. At the same time, euro area firms are facing challenges from higher refinancing costs (Box 1). There are also signs of corporates switching from market-based financing to bank loans (Box 6), given the faster pass-through of policy rate increases to investment grade corporate bond yields. Looking ahead, a combination of higher financing costs and highly uncertain business prospects will weigh on the corporate sector outlook (Chart 5, panel b). In particular, a sharper economic slowdown than currently anticipated, together with a disorderly tightening of financing conditions, could prove particularly challenging for those firms that exited the pandemic with higher debt levels, subdued earnings and low interest coverage ratios. Small and medium-sized enterprises may be particularly vulnerable to a slowdown in economic activity and higher borrowing costs, as they have benefited less from the economic recovery (Section 1.3).

Chart 5

Euro area corporates are benefiting from high profit margins, but tighter financial conditions and uncertain business prospects could prove a challenge going forward

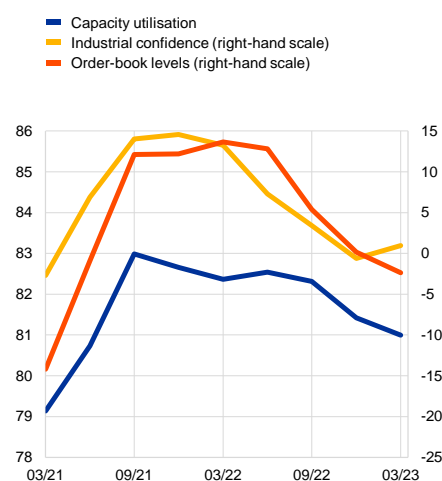
a) Net income margins for euro area non-financial corporations, by indebtedness

(Q4 2019-Q4 2022; index, Q4 2019 = 1)



b) Capacity utilisation, industrial confidence and non-financial firms' order-book levels

(Q1 2021-Q1 2023; percentages, percentage balances)



Sources: S&P Global Market Intelligence, Bloomberg Finance L.P., European Commission, ECB and ECB calculations.
Notes: Panel a: a fixed sample of 1,099 euro area non-financial corporations with total assets in excess of €50 million as at Q4 2022. Indebtedness is based on pre-pandemic debt levels (Q4 2019).

In recent months, euro area households have benefited from lower energy prices and a resilient labour market, but higher interest rates are increasingly weighing on credit dynamics. Household confidence has recovered to some extent in recent months, in line with the marked drop in energy prices and the associated lower headline inflation outturns (Section 1.4). But households' real incomes and consumption remain under pressure from persistently high inflation, especially for lower income buckets. The real income squeeze, coupled with higher

interest rates, is increasingly compromising households' debt servicing capacity, particularly in the consumer loan segment. On a positive note, resilient labour markets have so far supported incomes, and the shift towards more fixed-rate mortgage lending in recent years has shielded many households from the immediate impact of higher interest rates. The use of borrower-based macroprudential measures in most euro area countries in recent years has also helped to limit the build-up of risks. That said, vulnerabilities could resurface, should labour market conditions deteriorate or energy prices rise again.

The euro area property market cycle is turning, as higher interest rates weigh on affordability

The euro area residential real estate cycle has shifted into correction mode, compounding the vulnerabilities of euro area households. Euro area residential real estate markets cooled markedly in the second half of 2022. The easing of residential property price inflation is apparent in most euro area countries, in particular those (notably Germany) which were less affected during previous crises (**Chart 6**, panel a). Orderly price corrections might be warranted, as overvaluation measures have been signalling the potential for corrections in recent years. That said, looking ahead, a fall in prices could become disorderly as rising interest rates on new mortgage lending increasingly compromise affordability and increase the interest burden on existing mortgages, especially in countries where variable-rate mortgages predominate. This is also indicated by the record high number of banks—even more than during the global financial crisis – reporting a decline in the demand for mortgages in the first quarter of 2023. At the same time, euro area banks have tightened credit standards for mortgage loans considerably, against a backdrop of rising interest rates and deteriorating housing market prospects. The pace of prices falling could be further amplified in countries and regions where the presence of institutional investors is strong (**Box 2**).

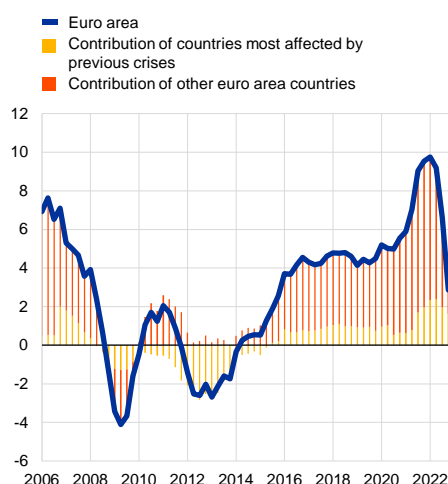
Euro area commercial real estate (CRE) markets remain in a clear downturn. In an environment of tighter financing conditions and elevated macro-financial uncertainty, CRE valuations have continued to decline sharply. Demand has dropped significantly across both the office and the retail segments, with overall transaction volumes declining at a pace similar to that observed during the global financial crisis (**Chart 6**, panel b). The challenges associated with the current uncertain market environment are amplified by pandemic-induced structural changes, particularly in markets for lower quality assets where tenant demand has weakened since the pandemic (**Section 1.5**). While bankruptcies among CRE-exposed non-financial firms remain low, an even more pronounced adjustment in CRE markets could expose structural vulnerabilities in some open-ended property funds, increase credit risk for lenders and lower collateral values.

Chart 6

Higher interest rates and lower affordability have brought about a synchronous correction in residential and commercial property markets

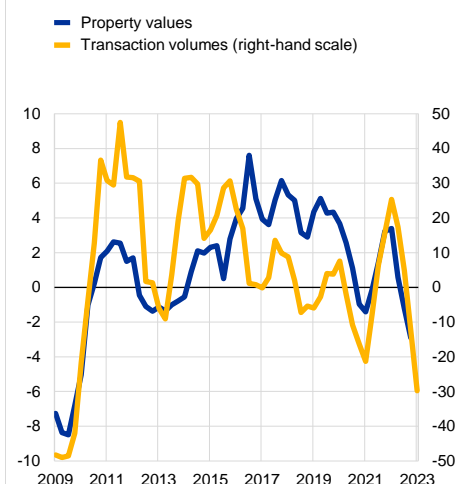
a) Decomposition of euro area residential property price growth, by country group

(Q1 2006-Q4 2022; annual percentage changes)



b) Euro area commercial property values and transaction volumes

(Q1 2009-Q1 2023; annual percentage changes)



Sources: ECB and ECB calculations.

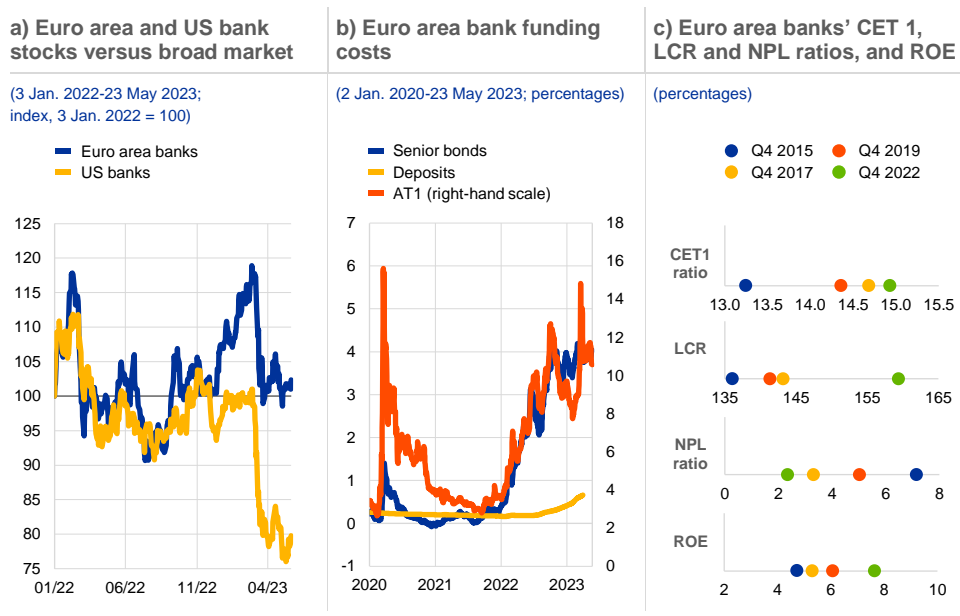
Notes: Panel a: the countries most affected by previous crises (i.e. the global financial crisis and the euro area sovereign debt crisis) are Ireland, Greece, Spain, Italy, Cyprus, Portugal and Slovenia. Panel b: transaction volumes are based on the four-quarter moving average of the underlying total number of transactions.

Euro area banks have proven resilient to bouts of bank stress in some advanced economies

Stress in the US and Swiss banking sectors has triggered concerns over the health of parts of the banking industry, although the impact has been limited in the euro area amid solid bank fundamentals. The bullish market sentiment towards euro area banks that prevailed after the publication of the previous Financial Stability Review reversed abruptly in the first half of March (**Chart 7**, panel a). The failure of three medium-sized banks in the United States – Silicon Valley Bank, Signature Bank and later First Republic – as well as the takeover of Credit Suisse in Switzerland, led to broader market concerns over banks' exposure to long-term fixed income securities, the cost and stability of deposit funding amid the growing digitalisation of banking services, business model viability and banks' risk management practices. Euro area bank share prices fell sharply, while signs of tension became apparent in riskier bank bond markets, notably the Additional Tier 1 (AT1) segment (**Chart 7**, panel b), following the decision by the Swiss authorities to write down Credit Suisse Group's AT1 instruments before its equity capital had been used up. However, given the idiosyncratic nature of the sources of US and Swiss bank stress, tensions have remained contained, and the broader implications for euro area banks have been limited. The resilience of the euro area banking sector has, in aggregate, been underpinned by strong capital and liquidity positions, and by greatly improved asset quality and profitability in recent years (**Chart 7**, panel c).

Chart 7

Tensions in euro area bank equity and bond markets were apparent following the US and Swiss bank stress, but euro area banks remain resilient



Sources: Bloomberg Finance L.P., S&P Dow Jones Indices LLC and/or its affiliates, Refinitiv, ECB and ECB calculations.
Notes: Panel a: euro area bank stocks are reflected by the Dow Jones EURO STOXX Banks Index and US banks stocks by the Dow Jones U.S. Banks Index; the broad market refers to the Dow Jones EURO STOXX 50 Price Index for the euro area and the Dow Jones U.S. Total Stock Market Index for the United States. Index relative to the broad market, i.e. values above (below) 100 indicate bank stocks outperforming (underperforming) the market. Panel b: deposit rates comprise rates paid to households and non-financial corporations on outstanding deposits and are weighted by their respective volume share. Yields of senior bonds comprise covered bonds, senior unsecured bonds and senior non-preferred securities, and are weighted by nominal values. AT1 stands for Additional Tier 1 capital. Panel c: CET1 stands for Common Equity Tier 1; LCR stands for liquidity coverage ratio; NPL stands for non-performing loans; ROE stands for return on equity.

Bank operating profitability improved further in 2022, but the outlook has become more uncertain amid vulnerabilities in non-financial sectors. Supported by higher interest rates and low loan loss provisions, euro area banks showed robust earnings momentum throughout 2022. This is particularly true for banks in countries where variable-rate lending predominates. While the profitability of most euro area banks has benefited from rising interest margins, uncertainties have increased around the profitability outlook. In fact, the net interest income benefits from higher interest rates could turn out to be smaller than expected, given lower interest rate expectations more recently and a catch-up in deposit rates. Also, an environment of more muted economic growth prospects, coupled with considerably tighter credit standards and a slump in credit demand, may weigh on volume growth going forward. Furthermore, some signs of increasing credit risk are already becoming evident in loan portfolios that are more sensitive to cyclical downturns, such as those with exposures to commercial real estate, SMEs and consumer loans (Section 3.4). As a result, banks may face the risk of higher provisioning costs (which tend to increase markedly around credit events), with better-capitalised banks tending to provision significantly more than banks with less capital headroom (Box 5).

The prospects of higher bank funding costs are increasing downside risks to euro area bank earnings, while a stable deposit base is limiting funding risks. Bank bond funding costs have risen markedly since the start of 2022 on account of higher interest rates and, more recently, heightened market concerns regarding

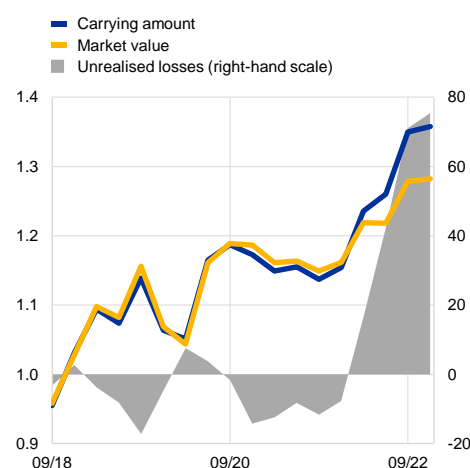
banks. As such, rolling over maturing bonds will increase banks' market funding costs going forward. Banks could also face upward pressure on their funding costs if competition for deposits were to rise and translate into faster deposit repricing (Box 4). In particular, in countries where fixed-rate loans predominate, higher funding costs make it more challenging for banks to fund low-yielding assets until maturity. That said, standard regulatory metrics suggest strong liquidity resilience overall, despite a recent decline in the funding liquidity of banks (Special Feature A). Unrealised mark-to-market losses on bond holdings are limited (Chart 8, panel a), given the relatively low share of bond holdings in total assets, and are fully reflected in regulatory liquidity ratios. Securities held at amortised cost can be used to obtain secured funding, including through ECB operations, without crystallising the valuation losses. Banks' vulnerability to liquidity shocks is further mitigated by composition of high-quality liquid assets, which consist largely of reserves held with the ECB. In aggregate, euro area banks do not share the funding vulnerabilities which have contributed to recent US and Swiss bank failures. They are funded mainly by deposits, with retail customers providing the majority of all deposits. In addition, a relatively high share of deposits is covered by deposit guarantee schemes (Chapter 3.1).

Chart 8

While unrealised losses on bond holdings are relatively limited, interlinkages with the NBFIs sector could challenge euro area banks

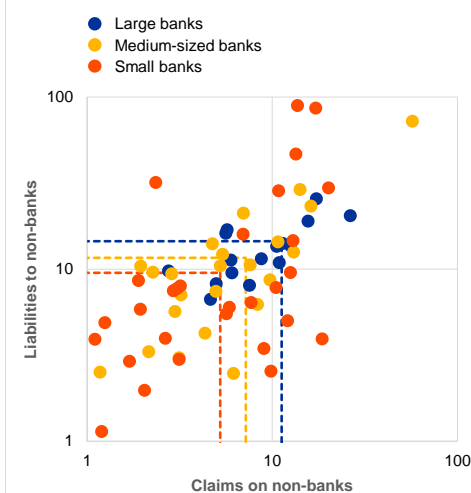
a) Euro area banks' unrealised losses on bonds held at amortised cost

(Q4 2018-Q4 2022; left-hand scale: € trillions, right-hand scale: € billions)



b) Banks' liabilities to and claims on non-bank financial entities

(2022, percentages of total assets, log-scales)



Sources: ECB and ECB calculations.

Notes: Panel a: calculated on debt securities held at amortised cost only. Where a carrying amount is not reported, nominal value is used. Unrealised losses are calculated as the carrying amount minus market values. Intra-group holdings are not accounted for. Panel b: small banks refer to banks with total assets of up to €100 billion, medium-sized banks from €100 billion to €500 billion, and large banks over €500 billion. The dashed lines represent intra-group weighted averages.

A greater need to respond to cyber and climate risks, and strong interlinkages with the NBFIs sector, may also challenge euro area banks. Next to the cyclical headwinds associated with the challenging macro-financial conditions, euro area banks need to press ahead with digital transformation, not least so they can respond

to the growing threat of cyber risks (**Section 3.3**). They also need to manage the implications of the transition to a greener economy. The results of the second ECB top-down economy-wide climate stress test suggest that, while the overall impact of the green transition is limited relative to portfolio size, it increases banks' expected losses and provision needs in the short term (**Box A in Special Feature C**). In addition, elevated vulnerabilities in the NBFIs sector may produce spillover risks for euro area banks, given the strong interconnections, exposing such banks to liquidity, asset price and credit risks (**Special Feature B**). These links appear on both sides of banks' balance sheets and are stronger for larger banks (**Chart 8**, panel b).

Completion of the banking union would further enhance the resilience of the financial system

All in all, the financial stability outlook remains fragile, with stresses in the United States and Switzerland bringing banking sector vulnerabilities back into focus in an uncertain macro-financial environment.

Pre-existing vulnerabilities could become more prominent and risks could spread across different sectors, should further pockets of vulnerability be revealed in the US or other banking sectors and/or macro-financial conditions worsen. The materialisation of downside risks to economic growth, more persistent inflation or a disorderly tightening of financial conditions could expose existing vulnerabilities, notably those associated with high levels of debt across the economy as well as the potential for disorderly adjustments in both financial and tangible asset markets. At the same time, shocks such as the failure to reach a political agreement on the US government debt ceiling or a further escalation of geopolitical tensions could cause these vulnerabilities to materialise, possibly simultaneously.

Preserving financial sector resilience remains key as the financial cycle turns.

In the light of elevated uncertainty, involving accumulated vulnerabilities and signs of a turning financial cycle, macroprudential policy should continue to focus on ensuring that the financial system remains able to withstand adverse shocks. Existing macroprudential capital buffers should therefore be maintained to preserve the resilience of the banking sector, as the conditions for their release have not yet been met. Targeted increases in capital buffer requirements may still be considered in some countries. For example, in countries with a framework that features a positive neutral rate for the countercyclical capital buffer, the build-up of the buffer towards the neutral rate is welcome, provided that procyclical effects are avoided. Banks should, in the context of increased downside risks to economic growth and recent banking sector stresses, refrain from increasing payout ratios further, but should instead focus on preserving their existing substantial resilience. Finally, borrower-based measures under the remit of national authorities should continue to ensure sound lending standards and the sustainability of household debt, in a framework where capital-based and borrower-based measures complement each other.

The sources of US and Swiss banking sector stress have highlighted the need to complete the banking union and to further strengthen the EU bank regulatory framework. The recent banking sector stress has highlighted the need

for sound corporate governance and effective risk control by banks. At the same time, it has also been a powerful reminder of the need to complete the banking union ([Section 5.1](#)), in particular the crisis management framework and a common European deposit insurance scheme. In addition, full implementation of the final Basel III elements by the agreed deadline of January 2025 is essential to ensure that banks remain well-capitalised, in order to foster trust in the EU banking system and to provide additional levers for supervisory scrutiny. ECB Banking Supervision, the Single Resolution Board and the European Banking Authority have recently reiterated the need for the consistent application of the EU's detailed order according to which shareholders and creditors of a troubled bank should bear losses applied in past cases. This will also guide the actions of the Single Resolution Board and ECB Banking Supervision in any possible crisis interventions going forward.

Structural vulnerabilities in different parts of the non-bank financial sector require a comprehensive policy response across entities and activities. In the light of persisting vulnerabilities in the NBFIs sector and the risk of renewed stress, it is critical that policy initiatives continue to be pursued as a matter of priority. The focus should be on policies that reduce liquidity mismatch in investment funds, tackle risks arising from financial and synthetic leverage across the NBFIs sector and enhance liquidity preparedness across a broad range of institutions, especially in relation to margin calls. As it will take time for regulatory reforms to be agreed internationally and then implemented, the authorities regulating and supervising NBFIs entities should pay close attention to vulnerabilities in the sector and should play an active role in strengthening resilience, in accordance with their mandates and existing policy frameworks ([Section 5.2](#)).

1 Macro-financial and credit environment



1.1 An improved but still fragile economic outlook

Amid high uncertainty, private sector forecasters have upgraded their baseline growth expectations for the euro area in the light of moderating energy prices.

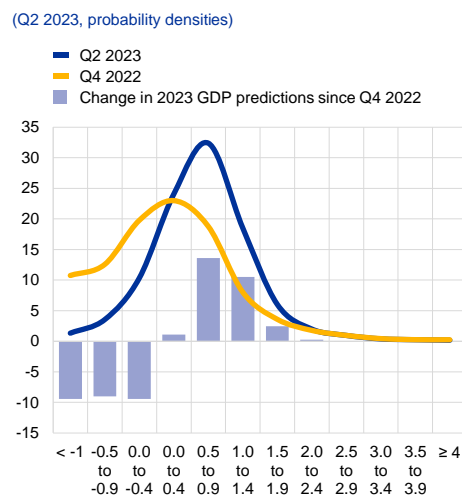
The global economic outlook seems fragile, after a period of high macro volatility, as geopolitical tensions remain high and financial conditions are tightening. At the same time, forecasters have revised euro area growth expectations for 2023 up to 0.6%, in contrast to expectations of a shallow recession of -0.1% as recently as November last year, in response to falling energy prices, China's reopening helping to ease

strains on global supply chains and labour markets remaining tight. In parallel, consensus inflation expectations for 2023 remain high (5.6% as against 5.8% in November 2022). Despite the improvement in growth prospects, risks to the outlook for economic growth remain elevated, as the distribution of expected GDP outcomes for the euro area economy in 2023 remains tilted to the downside (Chart 1.1, panel a) and inflation expectations remain high (Chart 1.1, panel b). Against the background of the stress events in the banking sector, risks to the outlook are driven predominantly by the potential for a disorderly tightening of financial conditions combined with heightened geopolitical risks.

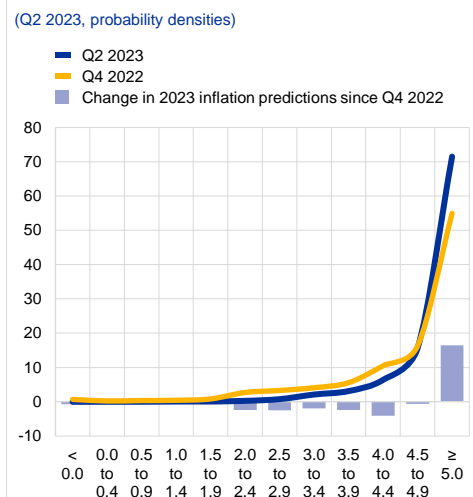
Chart 1.1

Euro area growth expectations improve but tail risks remain elevated

a) Euro area 2023 GDP growth distribution forecasts compared with Q4 2022



b) Euro area 2023 HICP distribution forecasts compared with Q4 2022



Source: ECB Survey of Professional Forecasters.

Notes: Panel a: x-axis labels reflect the year-on-year GDP growth for the euro area economy. Panel b: x-axis labels reflect the year-on-year HICP level for the euro area economy.

Easing energy prices have helped headline inflation to moderate, but risks to energy prices and inflation remain tilted to the upside. Despite a normalisation of energy prices, underlying global price inflation remains elevated and upside risks to commodity prices remain high. Tight and resilient labour markets have contributed to persistent core inflationary pressures. Moreover, measures of core inflation have continued to surprise to the upside, as the pass-through of higher costs to the services, food and industrial goods sectors is still ongoing and is likely incomplete. High geopolitical uncertainty, coupled with efforts to secure natural gas supply for the next winter season (Chapter 2) and a stronger than expected economic rebound in China, could push energy prices higher again.¹

The global growth outlook could be derailed if there is a disorderly tightening of financial conditions while inflation remains at high levels. To ensure the timely return of inflation to their medium-term targets, central banks around the world

¹ See the box entitled “Spillovers to the euro area in a scenario of a stronger rebound in China’s economy”, *ECB staff macroeconomic projections for the euro area*, ECB, March 2023.

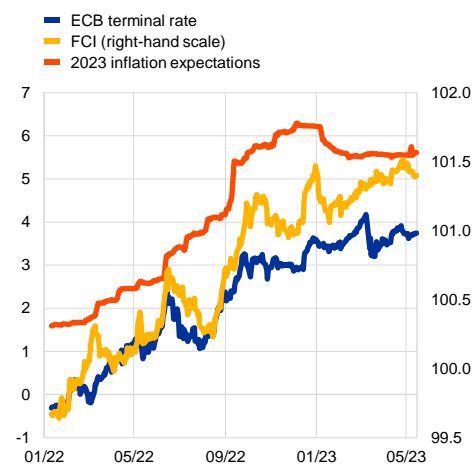
have continued to raise their policy rates, thereby contributing to a global tightening of financial conditions. Consequently, the market pricing of the terminal rate globally, and in the euro area, has increased (**Chart 1.2**, panel a). Adding to tighter conditions, the recent failures of a number of US regional banks and the takeover of a Swiss bank have pushed up risk premia, including in the euro area (**Chart 1.2**, panel b). Moreover, changes in monetary policy expectations have resulted in the euro appreciating against a bucket of major currencies, further contributing to tighter financial conditions. Persistently elevated financial market tensions could tighten credit conditions more strongly than expected, with feedback to the broader economy, as they might impact credit availability and increase debt service costs further.

Chart 1.2

Financial conditions tighten as inflation remains high and risk perceptions increase

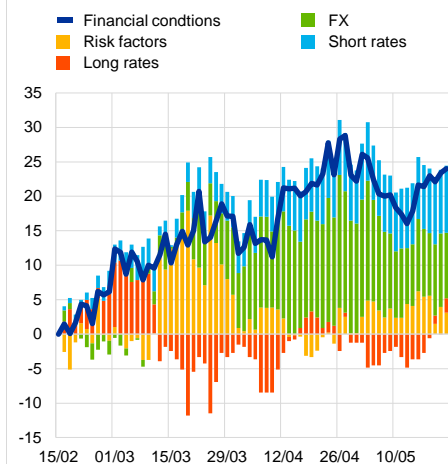
a) Euro area financial conditions, 2023
inflation expectations and market pricing of ECB terminal rate

(Jan. 2022-23 May 2023; percentage points, index)



b) Euro area financial conditions and main drivers

(15 Feb.-23 May 2023; indices)



Sources: Bloomberg Finance L.P., Goldman Sachs, Consensus Economics and ECB calculations.
Notes: Panel a: terminal rate defined as the maximum of the OIS (€STR) forward curve. FCI stands for financial conditions index. Panel b: risk factors represent the sum of the category's sovereign spreads and equities.

Globally, the failure to raise the US debt ceiling, possible side effects of China's reopening and vulnerabilities in emerging markets are adding to downside risk and heightened uncertainty. Against the background of high political uncertainty, the inability to raise the US debt ceiling debate could spark financial market volatility and hit US growth prospects. A disorderly process could add to the risks of US sovereign debt being downgraded (**Chapter 2**).² Moreover, the reopening of the Chinese economy after pandemic lockdowns is having an ambiguous impact on global inflation levels and is adding further to uncertainty. On the one hand, it could exert upward pressure on commodity prices and global inflation levels as pent-up demand boosts consumer expenditure. On the other hand,

² Standard & Poor's downgraded US debt by one notch from AAA to AA+ with a negative outlook after the debt ceiling was reached in 2011.

the reopening is helping to ease supply bottlenecks.³ Moreover, risks in China's property market remain high, even though some improvement in conditions has been observed since the start of the year. Finally, a prudent policy stance in emerging markets is currently helping to mitigate spillovers from higher interest rates in developed economies and has kept vulnerabilities contained.⁴ However, a further – or disorderly – tightening of financial conditions could leave some emerging market economies vulnerable to capital outflows and might challenge their ability to service foreign currency debt.

Against the background of high uncertainty, the risks to financial stability stemming from materialising vulnerabilities remain elevated. The drop in energy prices has relieved some pressure on inflation and has contributed to an improvement in the growth outlook. However, inflation remains high and the outlook for economic growth remains weak, with risks skewed to the downside. Moreover, after an episode of high macro volatility, global economies face renewed uncertainty from the potential financial feedback to credit availability resulting from the recent stress events in the banking sectors of some mature economies.

1.2 Fiscal positions benefit from lower energy prices, while unaddressed challenges lie ahead

The euro area fiscal deficit is expected to decline, as lower energy prices help the fiscal outlook. The projected euro area budget deficit is expected to decline somewhat in 2023 (to 3.4% of GDP) and more significantly in 2024 (to 2.4% of GDP), before remaining unchanged in 2025 (**Chart 1.3**, panel a). The forecast for the euro area fiscal position is driven by the expected improvement in the cyclically adjusted primary balance, followed by an improvement in the cyclical component, while interest payments are expected to gradually increase as maturing public debt is rolled over at higher interest rates. There are significant downside risks to this outlook, however, as fiscal positions ultimately depend on inflation developments and economic uncertainty going forward. Consequently, the improvement in fiscal positions since the previous version of the Financial Stability Review will be susceptible to substantial downward revisions if risks materialise in the form of higher energy prices (**Chapter 2**), Next Generation EU (NGEU) absorption rates are lower than expected or the inflation outlook deteriorates significantly.

Fiscal support measures to cushion the energy price shock remain largely untargeted. Since the end of 2022, favourable energy price and inflation developments have contributed to a slight downward rescaling of fiscal support measures to about 1.8% of GDP from over 1.9% of GDP at the end of 2022.⁵ At the same time, fiscal support has been revised up for some euro area countries since the previous issue of the Financial Stability Review, following the extension of

³ See the box entitled “Spillovers to the euro area in a scenario of a stronger rebound in China's economy”, *ECB staff macroeconomic projections for the euro area*, ECB, March 2023.

⁴ See “What shapes spillovers from US monetary policy shocks to emerging market economies?”, *Economic Bulletin*, Issue 2, ECB, March 2023.

⁵ See [March 2023 ECB staff macroeconomic projections for the euro area](#).

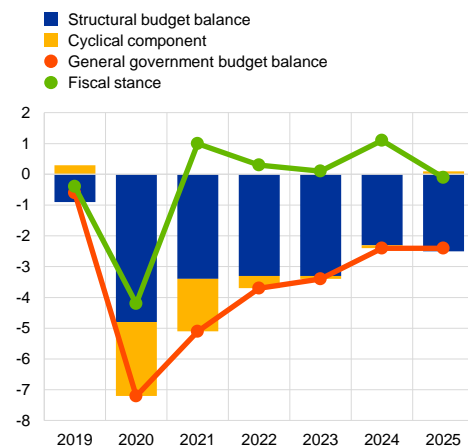
measures into 2023 or updated estimates based on final budget laws. While these support measures are helping to cushion the impact of high inflation in the short term, the effect is expected to reverse in the years after 2023. Additionally, most fiscal support measures remain untargeted and are at odds with the monetary policy response to fight inflation (**Chart 1.3**, panel b).⁶ Broad-based fiscal stimulus to aggregate demand is unwarranted and economically inefficient; this should preferably be replaced by policies that target only vulnerable cohorts of corporates and households.

Chart 1.3

Fiscal balance improves on the back of lower energy prices, but support measures might stoke inflation

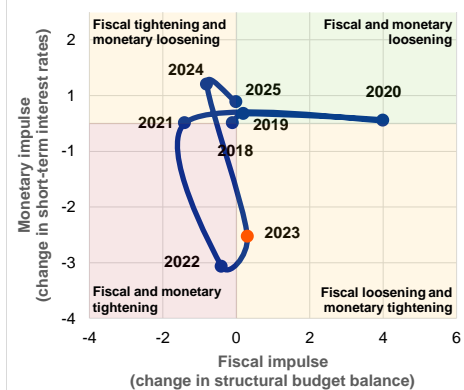
a) Fiscal balances and projections in the euro area, contributing factors

(2019-25E; percentages of GDP)



b) Fiscal and monetary policy impulses in the euro area

(percentages of GDP, percentage points)



Sources: ECB, ECB calculations and Bloomberg Finance L.P.

Notes: Panel a: the data refer to the aggregate general government sector of euro area countries. The fiscal stance is adjusted for the impact of NGEU grants on the revenue side. The cyclical component refers to the impact of the economic cycle and that of temporary measures implemented by governments; it includes one-off revenues and one-off capital transfers. Panel b: monetary impulse reflects the expected change in short-term interest rates as implied by the OIS (€STR) forward curve at the end of each calendar year. The impulse does not include the impact of unconventional monetary policy measures.

A favourable snowball effect, amid high inflation, has initially helped to push government debt-to-GDP ratios onto a declining trajectory. In a baseline scenario, the euro area debt-to-GDP ratio is projected to decline from 89.4% of GDP in 2023 to slightly below 87% in 2025. Nevertheless, the ratio is projected to remain above pre-pandemic levels (84%) through 2025. The expected decline is driven mainly by a favourable interest rate-growth differential (the snowball effect) stemming from high nominal GDP growth, which should more than offset foreseen refinancing needs arising from persisting, albeit decreasing, primary deficits.⁷

⁶ It is estimated that about 12% of the total support targets vulnerable households and, to a smaller extent, firms directly affected by the hike in energy prices; see the article entitled "Fiscal policy and high inflation", *Economic Bulletin*, Issue 2, ECB, 2023.

⁷ See the article entitled "Fiscal policy and high inflation", *ibid.*

Additionally, sovereign debt ratios have benefited from a declining real debt burden owing to first-round effects (a favourable denominator effect).⁸

In the longer term, euro area public finances would likely be negatively affected by persistently high inflation. High inflation would have an adverse impact on fiscal positions through rising interest rates that would gradually propagate to interest payments. Additionally, the detrimental impact of the energy price shock on real economic activity will have a negative effect on fiscal positions. The size of this negative effect can primarily be explained by the nature and size of the inflation shock in the euro area – mainly a large, external shock that negatively affects household balance sheets, corporate profitability and growth, and puts high pressure on nominal public spending.⁹

Although sovereign debt service risks have been kept in check by benign debt service conditions, they might become more challenging in the future. At present, several factors are helping debt serviceability in the short term. First, the lengthening maturity of the outstanding debt stock means that principal repayment needs are about 15% lower than they would have been for running the same amount of debt against the maturity profile in 2010. Second, although yields have been increasing, the average interest paid on outstanding government debt is still hovering around record lows for most euro area sovereigns (1.7% in March 2023), and sovereigns have continued issuing longer-term debt – despite the steep increase in funding costs. Third, higher interest payments and debt issuance have not offset nominal GDP growth, a situation which has contributed to declining debt service ratios (**Chart 1.4**, panel a). However, debt service ratios in some euro area countries remain high, at around 40% of GDP, and rollover risks have increased as interest rate uncertainty has added to high price volatility in sovereign bond markets (**Chapter 2**). A further tightening of financial conditions could spark an increase in borrowing costs for more-indebted sovereigns. This means that funding conditions could become more challenging, particularly when sovereigns need to issue high volumes of debt in volatile and shallow government bond markets.

As central bank balance sheets are reduced around the world, fiscal issuance will be increasingly absorbed by the private sector. The envisaged balance sheet run-off will reduce the market footprint of the Eurosystem, thus fostering the efficient transmission of monetary policy.¹⁰ At the same time, the higher expected net issuance of sovereign debt this year on top of the higher free float resulting from the balance sheet run-off will need to be absorbed by the private sector.¹¹ This could include foreign investors, which might have a stabilising impact (**Box 3**), and non-banks, but also encompasses domestic banking sectors. Against this background, stress in the euro area banking sector might renew concerns over the sovereign-

⁸ See the box entitled “Sensitivity of sovereign debt in the euro area to an interest rate-growth differential shock”, *Financial Stability Review*, ECB, November 2021.

⁹ See the article entitled “Fiscal policy and high inflation”, op. cit.

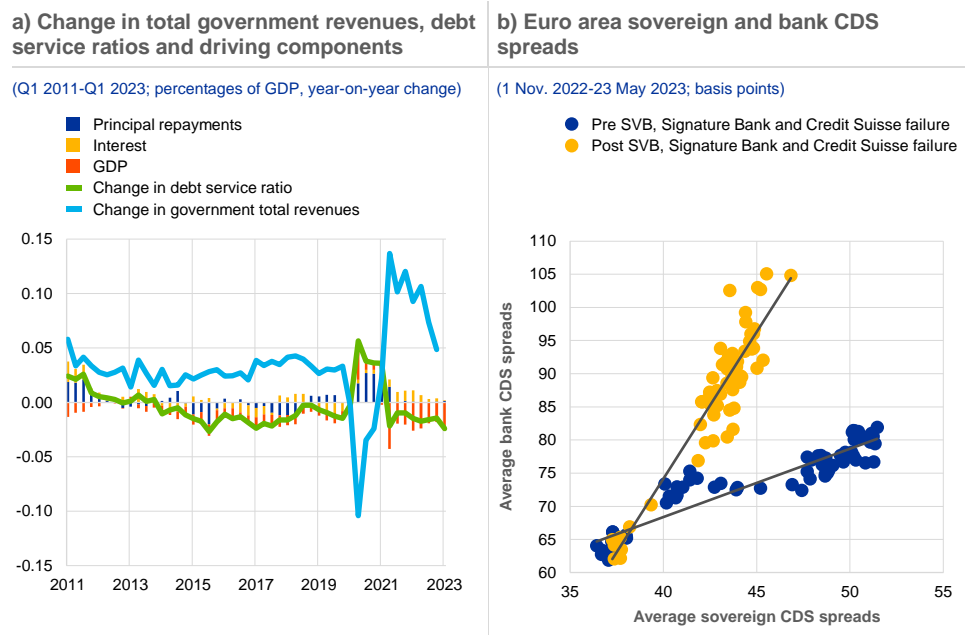
¹⁰ See “Quantitative tightening: rationale and market impact”, speech by Isabel Schnabel, Frankfurt am Main, 2 March 2023.

¹¹ Gross financing needs – a measure of government liquidity risk – are expected to decline from 18.5% in 2022 to 18.4% of GDP in 2023 but to remain above the 16% signalling threshold as defined by the European Commission. See “Debt Sustainability Monitor 2022”, *Institutional Paper 199*, European Commission, 14 April 2023.

bank nexus. So far, the co-movement in sovereign and bank credit risk has been much more contained than in previous joint stress periods (**Chart 1.4**, panel b).

Chart 1.4

Debt service risk are contained, but banking stress might spark concerns over the sovereign-bank nexus



Sources: ECB, Eurostat and Bloomberg Finance L.P.

Notes: Panel a: the debt service ratio is calculated as principal and interest expenditure during the debt service period (two years) as a share of GDP. Panel b: the chart displays the average five-year CDS spreads across euro area banks and sovereigns in basis points. Pre/post failure reflects the period before/after the failures of Silicon Valley Bank, Signature Bank and Credit Suisse as of 10 March 2023.

Short-term fiscal pressures remain contained, but medium-term challenges are adding to financial stability risks. Medium and longer-term challenges are adding to sovereign vulnerabilities. Climate change is a significant source of sovereign risk (**Special Feature C**), and an ageing population aggravates challenges around pensions and longer-term economic growth prospects. At the current juncture, the recent stress episode in the banking sectors of some mature economies remains contained, but credit risk spillovers between sovereign and banks could lead to a reassessment of sovereign risk by market participants. The outlook for sovereigns may deteriorate if financial conditions tighten, geopolitical tensions contribute to higher commodity prices, market liquidity is low, refinancing needs are high and additional fiscal support is needed.

1.3 Corporates bank on high margins, but vulnerabilities might increase as financial conditions tighten

Euro area firms have benefited from a sharp post-pandemic recovery and strong profits, but business prospects are surrounded by high uncertainty.

Aggregate corporate vulnerabilities remained below their long-run average for much

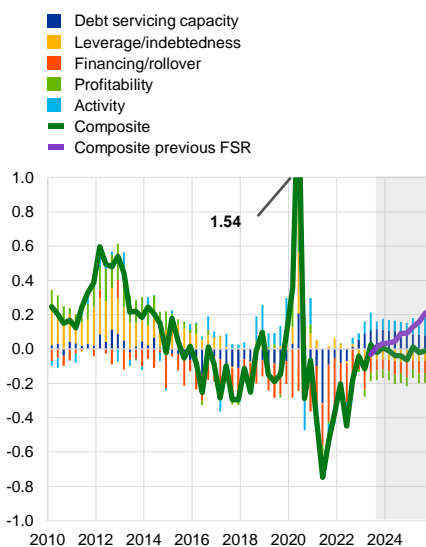
of last year, with nominal gross profits surprisingly strong (19% above pre-pandemic levels in the fourth quarter of 2022). Despite the overall tightening of financial conditions, lower indebtedness and a high interest coverage ratio kept corporate vulnerabilities below their long-term average (**Chart 1.5**, panel a). Furthermore, both higher revenues and stronger profit margins contributed significantly to the corporate recovery in the second half of 2022 (**Chart 1.5**, panel b). These high profit margins are closely linked to high inflation prints in the euro area, as around half of the gross value-added deflator is explained by higher profit margins.¹²

Chart 1.5

Corporates benefit from burgeoning profits

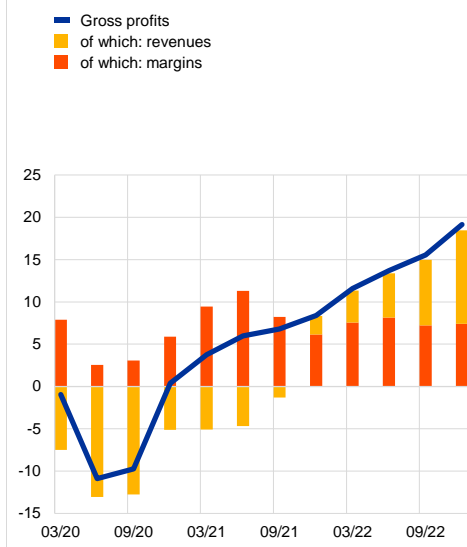
a) Composite indicator of corporate vulnerabilities and contributing factors

(Q1 2010-Q4 2025E; z-scores)



b) Yearly growth rate of gross profits and contributing factors

(Q1 2020-Q4 2022; index: Q4 2019 = 0, percentage points)



Sources: ECB, Eurostat, S&P Dow Jones Indices LLC and/or its affiliates and ECB calculations.

Notes: Panel a: grey shaded area refers to the forecast. Positive values indicate higher vulnerability while negative values indicate lower vulnerability.* Panel b: profit margins are proxied by net operating surplus divided by value added. Gross nominal profits are proxied by the respective growth rate of quarterly gross operating surplus. Data are displayed as two-period moving averages.

*) For more detail on the indicator components, see the box entitled "Assessing corporate vulnerabilities in the euro area", *Financial Stability Review*, ECB, November 2020.

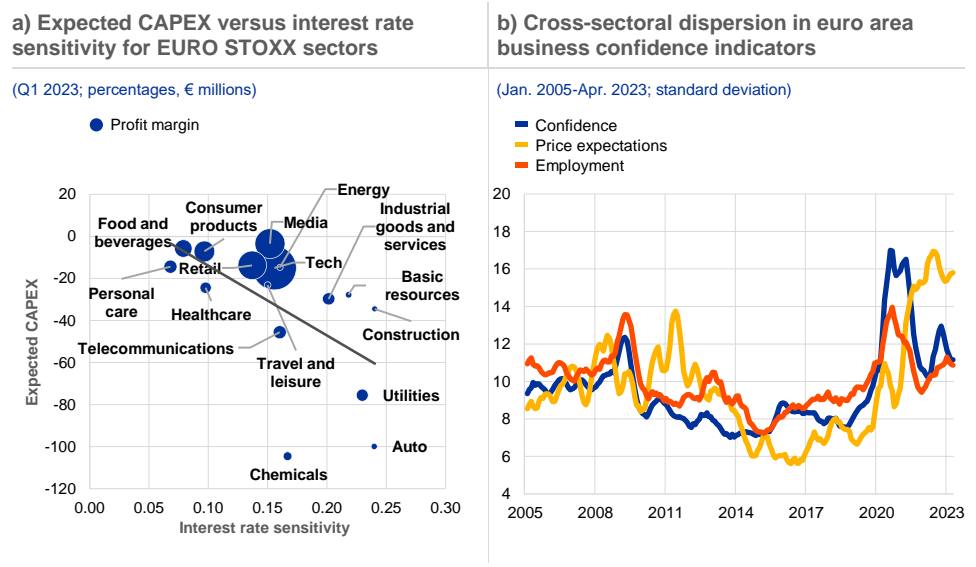
Aggregate corporate vulnerabilities are expected to increase by less than previously anticipated, but a disorderly tightening of credit conditions is a key risk. Revisions in the forecast of the corporate vulnerability indicator since the previous edition of the Financial Stability Review mainly reflect the baseline scenario of an improving economic environment and moderating debt accumulation. At the same time, high downside risks to the economic outlook are also translating into uncertain prospects for corporates, and not all corporates have benefited equally from the economic recovery. Moreover, a disorderly tightening of financial conditions resulting from the recent stress episode in the global banking sector remains a key risk for business prospects.

¹² Proxied by the change in the gross value-added deflator that is not explained by the change in compensation paid to employees.

Despite the overall resilience of the corporate sector, corporate fragilities vary greatly across sectors and firm sizes. Valuations of firms with higher capital expenditure needs are more sensitive to changes in interest rates (Chart 1.6, panel a). Some of these firms might also be more vulnerable to rising borrowing costs and generally have lower interest coverage ratios (Box 1). Additionally, survey-based confidence measures indicate a large dispersion across different sectors in the euro area (Chart 1.6, panel b). In general, lower business confidence has been observed in energy-intensive sectors, while sectors that have benefited more from the post-pandemic reopening demonstrate greater confidence. Moreover, soft data from the survey on the access to finance of enterprises (SAFE) indicate that SMEs have benefited less from the rebound in economic activity.

Chart 1.6

Corporate capital expenditure is expected to drop, as economic sectors face differing prospects



Sources: ECB, Bloomberg Finance L.P., European Commission and ECB calculations.
Notes: Panel a: interest rate sensitivity is calculated as the market beta of the sector EURO STOXX sub-index to the German five-year government bond over the period from January 2015 to May 2023. Expected CAPEX reflects Bloomberg’s estimate of the amount of money a company spends to buy capital assets or upgrade its existing capital assets. A negative value reflects higher expenditure. Panel b: standard deviation across 56 NACE Rev. 2 sectors in the euro area.

Tighter financing conditions have started to have an impact on firms’ debt service costs and issuance behaviour. As financial conditions have tightened, both markets and banks have reassessed the risks surrounding corporate activity. Consequently, the cost of debt has increased sharply since mid-2022 (Chart 1.7, panel a).¹³ Net lending flows fell back strongly in the first months of 2023 as it became more expensive to roll over debt, indicating deleveraging in some countries and sectors. In 2022 higher interest rates and higher working capital needs on account of high production costs also contributed to a shift from long-term lending to loans with a shorter maturity. The results of the ECB’s Q1 2023 bank lending survey indicate that the rise in the general level of interest rates, together with a decline in

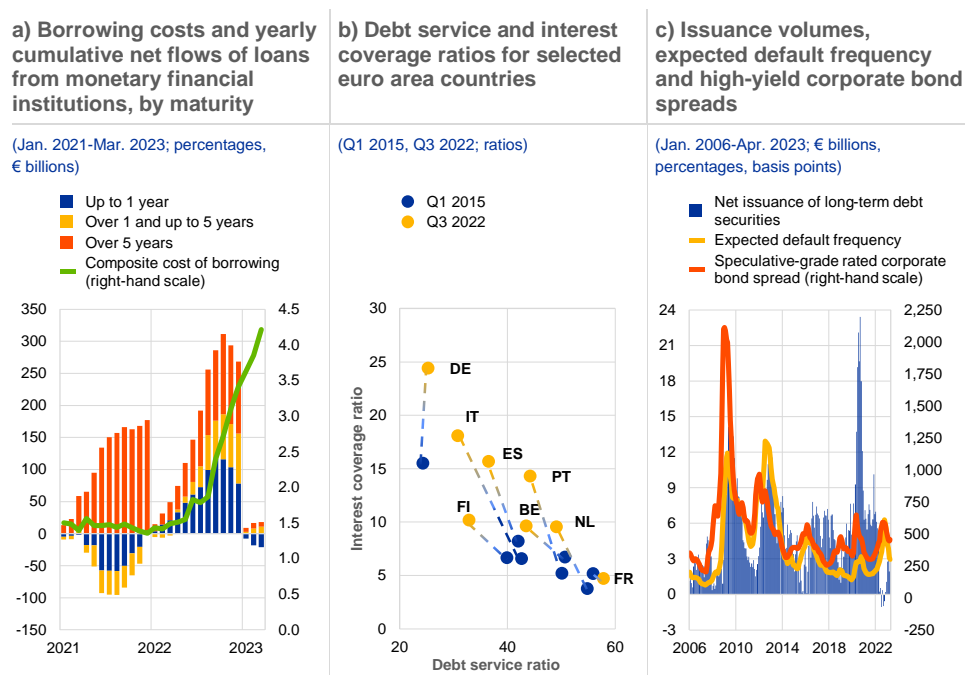
¹³ The increasing reliance on fixed-rate loans compared with the previous hiking cycle is currently mitigating some of the increase in interest rates in some euro area countries.

fixed investments, served to dampen demand for new lending. Furthermore, the impact of tighter credit standards might build up over time, with a delayed pass-through to the real activity of firms. In some euro area countries, high debt service needs are accompanied by lower interest coverage ratios, and corporates might be impacted more by the rising rate environment.

At the same time, corporate balance sheets in most euro area countries are currently healthier than they were during previous rate-hiking cycles. A long period of low interest rates and a strong post-pandemic recovery have helped the average corporate to build resilience in the face of a new downturn and rapidly rising financing costs. Gross interest coverage ratios have improved, particularly for countries which started with lower levels of interest coverage in the non-financial corporate sector (**Chart 1.7**, panel b). Moreover, non-financial corporate debt levels declined to 144% of gross value added in the fourth quarter of 2022, compared with 148% before the pandemic.

Chart 1.7

Corporates have built resilience, but borrowing costs are increasing strongly and bankruptcies have picked up in some euro area countries



Sources: ECB, Eurostat, Bank for International Settlements, Moody's Analytics, Refinitiv and ECB calculations.
 Notes: Panel b: the debt service ratio is defined as the ratio of interest payments plus amortisations to income. As such, it provides a flow-to-flow comparison – the flow of debt service payments divided by the flow of income.* The interest coverage ratio is defined as the ratio of gross operating surplus to gross interest payments before the calculation of financial intermediation services indirectly measured.
 *) See "How much income is used for debt payments? A new database for debt service ratios", *BIS Quarterly Review*, Bank for International Settlements, September 2015.

Bankruptcies in some euro area countries have started to increase from a very low base, although they remain below pre-pandemic levels. Bankruptcies in most large euro area economies remain below pre-pandemic averages, although they have now started to normalise from the low levels reached during the

pandemic.¹⁴ Moreover, forward-looking measures for default risk signal elevated risk (**Chart 1.7**, panel c), driven by those sectors directly impacted by the energy crisis such as transport and industry.

Corporate vulnerabilities might be higher than the aggregate suggests, as not every corporate benefited equally from the post-pandemic recovery.

The uneven impact of two succeeding, and distinctly different, crises has introduced considerable diversity over the cross-section of firms and might imply that an economic recession could have more severe consequences for financial stability than this aggregate picture suggests. Furthermore, the predominance of variable-rate lending in some countries, together with high corporate debt levels by historical and international standards, renders some corporates vulnerable to a further or disorderly tightening of financial conditions. Moreover, debt instruments that are more sensitive to rate increases, such as leveraged loans, might be particularly exposed should financial conditions tighten further. As such, there could be more defaults going forward, with potential knock-on effects on bank balance sheets and household employment prospects.

Box 1

Corporate vulnerabilities and the risks of lower growth and higher rates

Prepared by Nander de Vette, Stephan Fahr, Pablo Serrano Ascandoni and Peter Welz

Following a strong post-pandemic recovery in profits, euro area non-financial corporations are now facing the risk of stagnating economic activity combined with tightening financial conditions.

As monetary policy normalises, interest rates on corporate bonds and loans are increasing at their fastest pace in decades, leading to declining corporate lending and investment. Against this backdrop, this box uses firm-level balance sheet data to identify vulnerable non-financial corporations (NFCs) based on the Altman Z-score, a measure of insolvency risk.¹⁵

Corporate vulnerabilities might increase as higher interest rates start to weigh on the ability of firms to cover their interest expenses, with highly indebted firms being particularly affected.

In aggregate, the corporate sector in the euro area is more resilient than it was during the interest rate hiking cycle that started in 2011 (**Chart A**, panel a). Evidence for this is provided by the higher levels of Altman Z-scores and interest coverage ratios for euro area firms. Helped by the low-interest rate environment, these indicators improved after the global financial crisis until monetary policy tightening started. Moreover, large nominal operating surpluses also helped NFCs to repay their debts. However, corporates typically borrow at a relatively short maturity and against a floating rate, which means that changes in interest rates translate into higher interest expenses more quickly as maturing debt is rolled over.¹⁶ The resulting steep increase in funding costs dents net incomes, leading to less favourable debt dynamics (**Chart A**, panel b). Based on quarterly reporting by larger firms, highly leveraged firms had already experienced a marked decline in their interest

¹⁴ A sizeable pickup in Spanish bankruptcies is an exception, driven largely by sole proprietors, the removal of the bankruptcy moratorium in June 2022 and the amended Spanish Bankruptcy Law which entered into force on 26 September 2022.

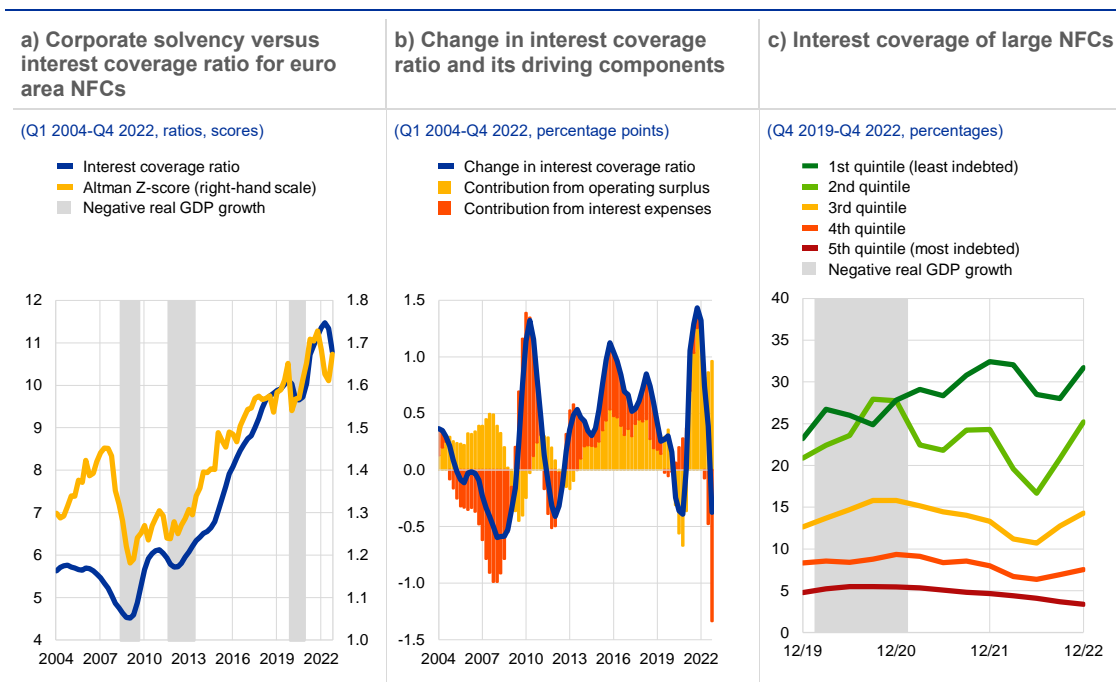
¹⁵ The Altman Z-score captures insolvency risk based on five balance sheet and income statement ratios, together with their joint importance. See Altman, E.I. (1968), “Financial ratios, discriminant analysis and the prediction of corporate bankruptcy”, *The Journal of Finance*, Vol. 23, No 4, pp. 589-609.

¹⁶ According to the loan-level data used in this box, for instance, by December 2021 the share of fixed-rate loans was 45%.

coverage in the second half of 2022, which was not the case for firms with lower debt levels (**Chart A**, panel c). In addition, these highly leveraged firms have far lower profit margins, further contributing to debt service vulnerability.¹⁷

Chart A

Corporate vulnerabilities might increase as interest rates rise



Sources: S&P Global Market Intelligence, ECB, Eurostat and ECB calculations.

Notes: Panel a: corporate solvency is indicated by the Altman Z-score and is calculated as $0.717 \times \text{working capital}/\text{total assets} + 0.847 \times \text{retained earnings}/\text{total assets} + 3.107 \times \text{EBIT}/\text{total assets} + 0.420 \times \text{equity}/\text{debt} + 0.998 \times \text{sales}/\text{total assets}$, where EBIT stands for earnings before interest and taxes. A higher Altman Z-score corresponds to a healthier balance sheet structure. Panels a and b: the interest coverage ratio is defined as the ratio of gross operating surplus to gross interest payments before the calculation of financial intermediation services indirectly measured (FISIM). Panel c: consists of 1,099 large euro area NFCs that report on a quarterly basis. Interest coverage is defined as the median of EBITDA/interest expenses for each quintile, where EBITDA stands for earnings before interest, taxes, depreciation and amortisation.

While the increase in funding costs has weighed significantly on all sectors, vulnerabilities in the manufacturing and real estate sectors pose the largest threat to banks, even though with heterogeneity across euro area countries. The share of vulnerable NFC loans – defined as loans with a probability of default of above 5% and an interest coverage ratio of below 1 – increased from 5.7% to 6.4% in 2022, owing to the rise in borrowing costs since March 2022 and existing high levels of debt. Firms in the real estate, agriculture, entertainment and construction sectors were particularly affected, with an average increase of 1.7 percentage points, whereas leisure activities¹⁸ had a high share of vulnerable loans, totalling more than 15% (**Chart B**, panel a). Among the vulnerable sectors, banks are most exposed to manufacturing and real estate. In aggregate, the high volume of vulnerable NFC loans might lead to a significant increase in non-performing loans. In particular, the non-performing loan ratios in the manufacturing and real estate sectors were less

¹⁷ In Q4 2022 firms in the highest debt quintile had a median net income margin of 5.5%, while those in the lowest quintile reported a median net income margin of 8%.

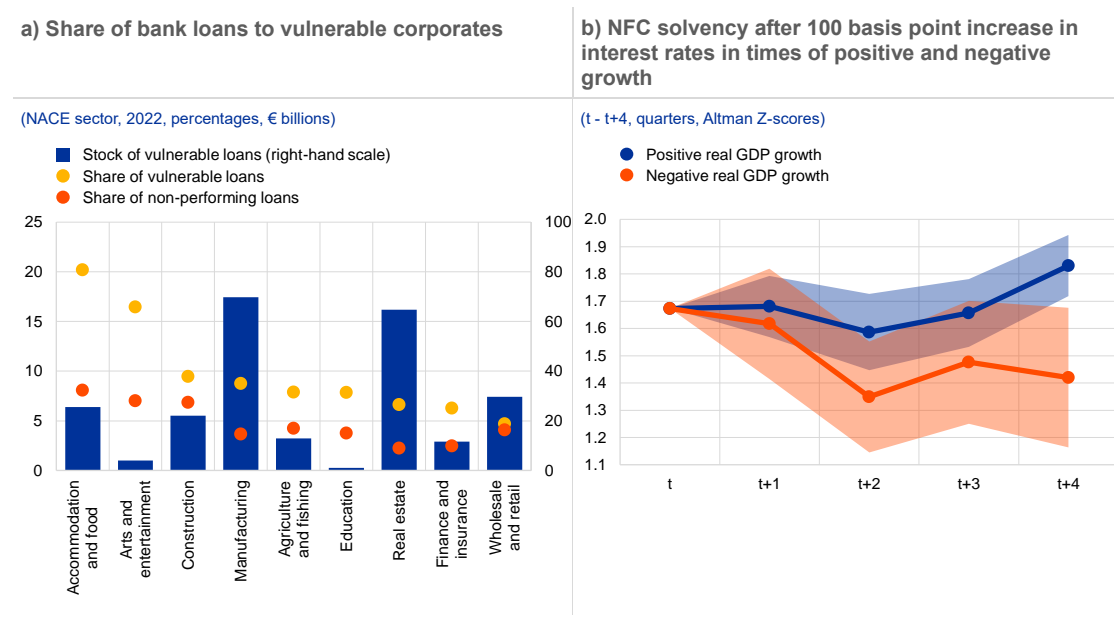
¹⁸ The leisure sector comprises both the accommodation and food sector and the arts and entertainment sector.

than half of the share of vulnerable loans in 2022. Ultimately, vulnerable NFC loans could weigh on bank capitalisation levels if borrowing costs continue to rise.¹⁹

Higher interest rates could increase corporate vulnerabilities, with the impact being greater during periods of low or negative economic growth. To assess the combined impact of higher interest expenses and lower economic growth on corporate default risk, local projections²⁰ are used to relate corporate solvency to an increase in interest expenses during periods of economic contraction and periods of economic growth.²¹ The state-dependent analysis suggests that an increase of 100 basis points in interest expenses during a period of weak or negative economic growth significantly reduces corporate solvency, as Altman Z-scores are estimated to decline by 0.3 points in the two quarters after the rise in interest rates – reflecting higher loan default risk. At the same time, there is no statistically significant impact on firms’ health during periods of economic expansion (**Chart B**, panel b). This implies that currently rising interest rates might exacerbate corporate vulnerabilities if economic growth weakens.

Chart B

Rising interest rates exacerbate corporate vulnerabilities to a varying extent across sectors and significantly more during periods of negative economic growth



Sources: Bureau van Dijk – Orbis, ECB, Eurostat and ECB calculations.

Notes: Panel a: data grouped by NACE sector and sorted by the most vulnerable sectors, excluding sector S: Other service activities. A: Agriculture, forestry and fishing, C: Manufacturing, F: Construction, G: Wholesale and retail trade, repair of motor vehicles and motorcycles, I: Accommodation and food service activities, K: Financial and insurance activities, L: Real estate activities, P: Education and R: Arts, entertainment and recreation. Vulnerable loans are defined as loans with interest coverage ratio <1 and probability of default >5%. Interest payments from floating-rate, mixed and rolled-over fixed-rate loans are adjusted by the difference between the prevailing interest rates at end-2021 and end-2022, and on the basis of their residual maturity. Data covering euro area exposures to 86 euro area significant institutions are consolidated at the euro area level. Panel b: non-linear impulse response function* of the Altman Z-score after a 100 basis point increase in interest rates. Scores were estimated using a non-linear local projection panel model that controls for real GDP, Altman Z-scores and interest rates and the feedback interaction across all variables over time. The non-linearity accounts for periods of positive and negative real GDP growth. Using nominal GDP to identify positive and negative growth periods yields a similar result. The shaded areas represent 90% confidence intervals using Newey-West standard errors robust to heteroscedasticity and autocorrelation.

*Auerbach, A.J. and Gorodnichenko, Y., "Measuring the Output Responses to Fiscal Policy", *American Economic Journal: Economic Policy*, Vol 4, No 2, May 2012, pp. 1-27.

¹⁹ As at end-2022, aggregate CET1 capital of the significant institutions covered by European banking supervision stood at around €1.3 trillion.

²⁰ See Jordà, Ò., "Estimation and Inference of Impulse Responses by Local Projections", *American Economic Review*, Vol. 95, No 1, March 2005, pp. 161-182.

²¹ We define economic contraction as year-on-year real GDP growth below zero.

All in all, higher interest expenses and production costs in conjunction with lower economic growth prospects are likely to dent corporate profitability and solvency. This box shows that the share of vulnerable loans has been increasing since the second half of 2022 as financial conditions tighten, with those sectors of the economy that were impacted the most by the pandemic being significantly more affected than others. Further increases in borrowing costs and existing high corporate debt levels in a number of sectors can significantly increase corporate vulnerability – and hence bank asset quality – when growth surprises to the downside, cost inflation persists and firms face limits when it comes to passing on higher production costs to sales prices.

1.4 A resilient household sector is facing tightening financial conditions

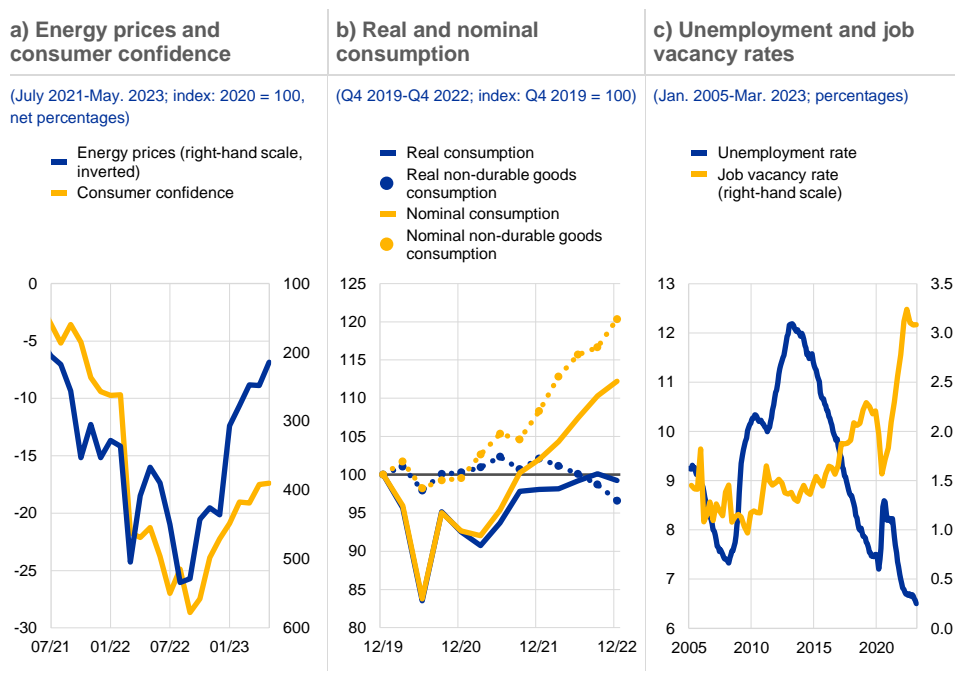
Euro area households have benefited from the improvement in economic conditions, despite elevated uncertainty and the impact of persistent inflation.

While households remain worried about their future economic situation, consumer sentiment improved somewhat as energy prices started to decline at the end of 2022. This helped to ease upward pressure on headline inflation and make it more likely that a recession would be avoided in 2023 (**Chart 1.8**, panel a). Nevertheless, stubbornly high inflation continues to weigh on households' real disposable incomes. This led to a decline in real household consumption in the fourth quarter of 2022 (**Chart 1.8**, panel b).

Strong labour markets have provided constant support to household resilience. The unemployment rate in the euro area remained at historic lows of around 6.6% throughout the end of 2022 and start of 2023, while the job vacancy rate reached an all-time high of over 3% (**Chart 1.8**, panel c). This situation benefits household incomes and suggests that a significant reduction in labour demand would be needed to cause a large increase in unemployment.

Chart 1.8

Real household consumption in the euro area is being squeezed by inflation, but households are benefiting from strong labour markets



Sources: European Commission, Hamburg Institute of International Economics (HWWI), Eurostat and ECB calculations.
Notes: Panel b: non-durable goods consumption is aggregated across those euro area countries for which the breakdown of consumption across different classes of goods and services is available. They account for roughly 80% of total euro area private consumption. Non-durable goods consumption refers to the consumption of goods that can be used only once or that have a lifetime of considerably less than one year (including energy and food). Panel c: the latest data for the job vacancy rate refer to Q4 2022.

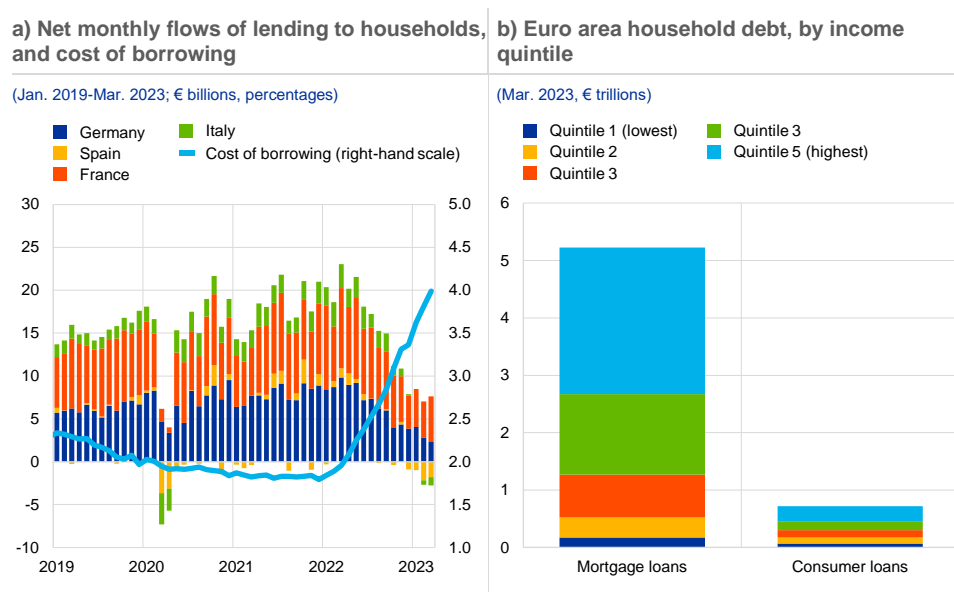
Tightening financial conditions have led to a turn in household borrowing, particularly for interest rate-sensitive items. Interest rates on household loans increased to 4% in March 2023, up by 2 percentage points year on year and marking the fastest increase since the euro was introduced. This resulted in a marked deceleration to 2.8% in the annual growth of lending to households, down by over 1.5 percentage points over the same period, driven predominantly by a contraction in demand for new mortgage loans (**Section 1.5**). While the annual growth in loan volumes has remained positive, net loan flows have turned negative in some euro area countries since the end of 2022, meaning that more loans were repaid than new loans were issued (**Chart 1.9**, panel a). As interest rates rise and banks signal their intention to continue tightening credit standards, lending volumes are likely to decline further – possibly resulting in a deleveraging of the household sector.

The debt servicing capacity of some households may be challenged by tightening financial conditions. Households in many countries continue to be shielded from immediate increases in the interest burden on their outstanding debt as a high share of loans have been issued with longer interest rate fixation periods over the last decade. This trend has reversed somewhat since the second half of 2022, particularly in countries where the relative pricing of variable-rate and fixed-rate loans has changed. Households in these countries are therefore more exposed to a repricing of outstanding debt over the short term. Some households may fall into distress as the purchasing power of their incomes continues to decline and credit

standards are, as expected, tightened further. At the current juncture, households at the lower end of the income distribution are the most vulnerable as they are disproportionately affected by high inflation. Wider risks to financial stability appear contained, however, as households in some countries have experienced a significant deleveraging since the global financial crisis across the income distribution and, in particular, in the lowest income cohorts. Moreover, these households account for only a small share of overall household borrowing (**Chart 1.9**, panel b).²²

Chart 1.9

New household borrowing is declining, but vulnerable households hold only a low share of overall household debt



Sources: ECB and ECB calculations.
Notes: Panel a: financial transactions (flows), monetary financial institutions excluding ESCB reporting sector. Data are working-day and seasonally adjusted. Panel b: shares of loans held by income quintiles are forward-extrapolated from the ECB's 2017 Household Finance and Consumption Survey and are multiplied by outstanding loans.

While vulnerabilities among households have increased further, risks still appear moderate. Although net wealth growth has moderated significantly, aggregate household balance sheets remain resilient and may benefit from deleveraging going forward. Households' real incomes and consumption, while under pressure from persistently elevated inflation, are supported by the continued strength of labour markets and fiscal measures. Nonetheless, some vulnerable households may face difficulties servicing their debt, as reflected in an increase in consumer loans classified by banks as suffering a significant deterioration in credit quality (**Chapter 3**). Such vulnerabilities could worsen, in particular if labour market conditions deteriorate or energy prices rise again significantly. Moreover, housing markets have started to cool in most euro area countries, and price developments could weigh on consumer sentiment going forward (**Section 1.5**). In the medium term, vulnerabilities could be exposed and debt servicing capacity could deteriorate,

²² See also the special feature entitled "Household inequality and financial stability risks: exploring the impact of changes in consumer prices and interest rates", *Financial Stability Review*, ECB, November 2022.

especially in countries where residential properties remain overvalued, debt levels are elevated and household debt is mainly at variable rates. That said, such an adverse scenario currently remains a tail risk.

Box 2

Institutional investors and house price growth

Prepared by Emil Bandoni, Giorgia De Nora, Margherita Giuzio, Ellen Ryan and Manuela Storz

The presence of institutional investors, particularly investment funds, in euro area residential real estate (RRE) markets has increased markedly in recent years. This growth may be attributed to a range of factors, including persistent flows into riskier asset classes such as real estate over the prolonged period of low interest rates (**Chart A**, panel a).²³ Yet the implications for housing markets, as well as for financial stability more broadly, remain largely unstudied. This issue is becoming more pressing as the real estate cycle turns and as rising interest rates reverse the dynamics of flows into real estate funds. It also raises concerns that vulnerabilities in the investment fund sector may amplify any real estate market correction.²⁴ This box provides an initial empirical examination of the role of institutional investors in euro area RRE markets and the possible implications for financial stability.

Fluctuations in the demand from institutional investors for RRE assets are associated with changes in house prices. Purchases of euro area RRE by institutional investors are linked to changes in house prices between the first quarter of 2007 and the fourth quarter of 2021 in an empirical framework which also includes policy interest rates and variables to capture wider demand and supply dynamics in RRE markets. The results from the model suggest that a positive (negative) demand shock from institutional investors has a positive (negative) and persistent impact on RRE prices (**Chart A**, panel b).²⁵ Specifically, a one standard deviation increase in investor demand is associated with an increase in house prices of about 0.4%. It is also followed by an increase of 0.2% in mortgage lending, suggesting that there may be spillovers between the non-bank financial sector and bank activity in RRE markets. The model also shows that a tightening (loosening) monetary policy shock is associated with a drop (increase) in institutional investors' demand for real estate.

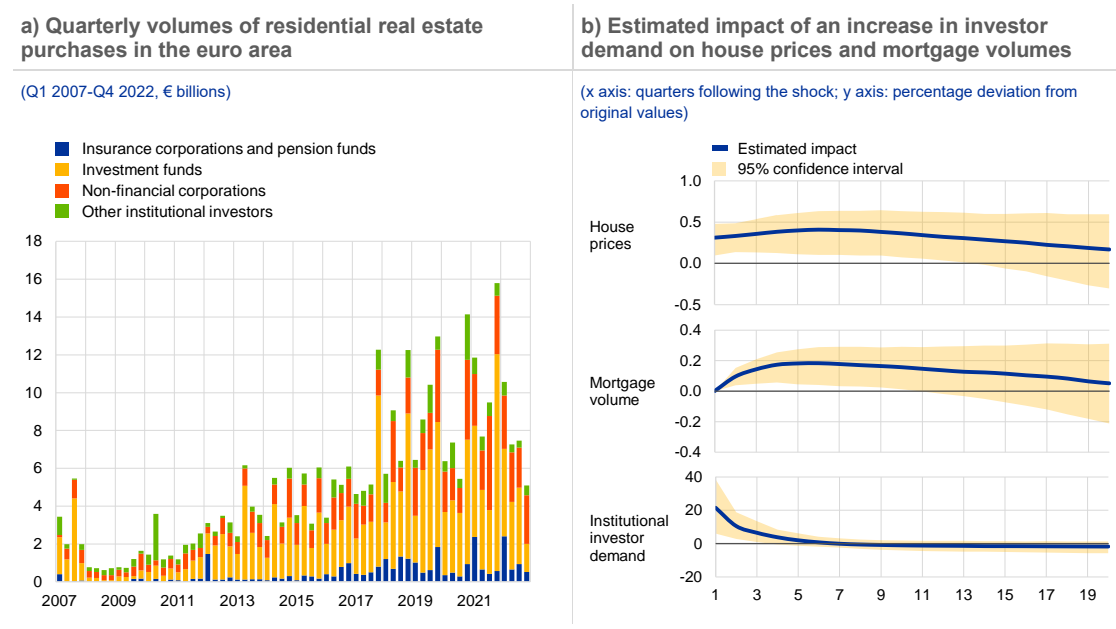
²³ See the box entitled “[Explaining cross-border transactions in euro area commercial real estate markets](#)”, *Financial Stability Review*, ECB, November 2019; Giuzio, M., Kaufmann, C., Ryan, E. and Cappiello, L., “[Investment funds, risk-taking, and monetary policy in the euro area](#)”, *Working Paper Series*, No 2605, ECB, October 2021; “[The rise of non-bank financial intermediation in real estate finance: Post-COVID-19 trends, vulnerabilities and policy implications](#)”, OECD, 2021; Schnabel, I., “[Monetary policy and inequality](#)”, speech at a virtual conference on “Diversity and Inclusion in Economics, Finance, and Central Banking”, 9 November 2021.

²⁴ Amplification effects particularly depend on the prevalence of open-ended real estate funds, which varies across countries.

²⁵ Structural shocks are identified with zero and sign restrictions. We identify household demand shocks and housing supply, as well as mortgage supply and monetary policy shocks. We distinguish between an institutional investors' demand shock and a households' preference-driven demand shock by the different reactions of mortgage lending volume and mortgage lending rates, relying on the assumption that institutional investors do not take out mortgages to finance their purchases. Moreover, we distinguish between the demand from investors and an income-driven demand shock by households by the different reaction in household incomes.

Chart A

Increasing demand from institutional investors may be associated with rising euro area house prices and mortgage volumes



Sources: RCA, Eurostat and authors' calculations.

Notes: Panel a: data shown are aggregated from transaction-level data provided by RCA. This is not a complete sample of purchases of residential real estate by institutional investors, so total values may underestimate total purchases. However, the steady increase in activity remains clear. Panel b: results of a BVAR(2), with normal-Wishart prior and optimised hyperparameters, fitted on euro area aggregate data including the following endogenous variables: real RRE prices, real lending for house purchases, lending rate on new loans for house purchases, shadow policy interest rate, real residential investments, real disposable income and institutional investors' gross RRE purchases, for an estimation sample from Q1 2007 to Q4 2021. The shadow rate estimates are generated regressors proposed as a proxy for policy interest rates during unconventional monetary policy periods; see, for example, Wu and Xia* and Krippner**. The shadow rate used in this exercise is sourced from the [Leo Krippner website](#).

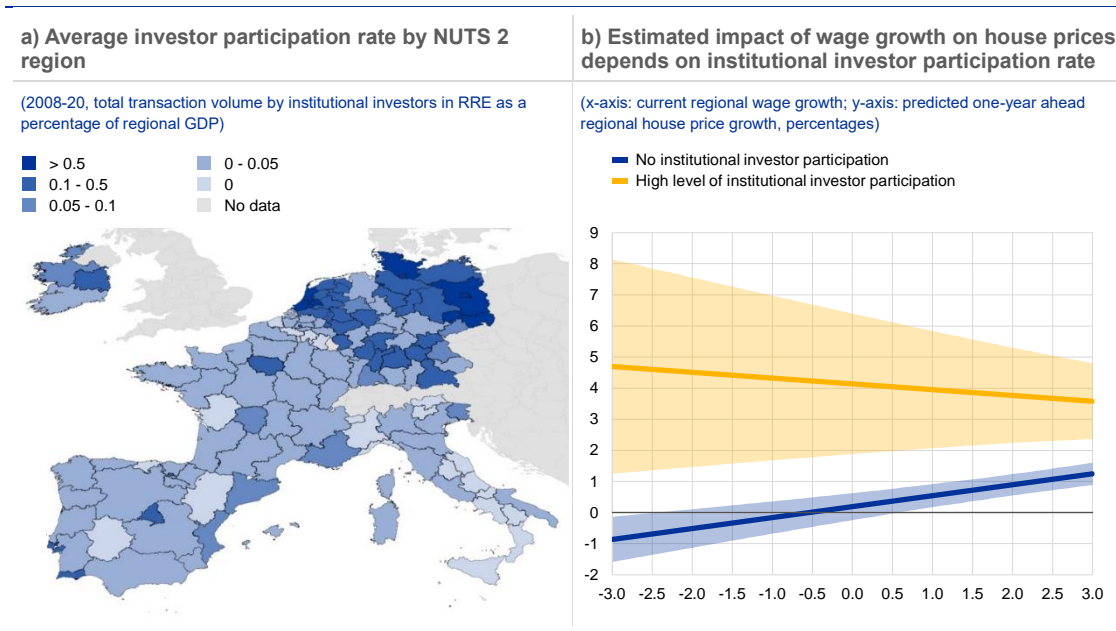
*) Wu, J.C. and Xia, F.D., "Measuring the Impact of Monetary Policy at the Zero Lower Bound", *Journal of Money, Credit and Banking*, Vol 48, Issue 2-3, 2016, pp. 253-291.

**) Krippner, L., "Measuring the stance of monetary policy in zero lower bound environments", *Economics Letters*, Vol. 118, No 1, 2013, pp. 1135-138.

The link between local economic fundamentals and house price growth appears to weaken in regions with a greater presence of institutional investors, which may reinforce the build-up of financial vulnerabilities. The importance of institutional investors varies greatly across the euro area and is concentrated in certain countries and regions (**Chart B**, panel a). Regions in which institutional investors have limited presence are characterised by a clear positive link between local wage growth and house price growth (**Chart B**, panel b). This relationship weakens as the presence of institutional investors increases, while house price growth is typically also higher in such regions. During periods of high investor demand and low wage growth, this may support certain RRE markets but the disconnect between local economic fundamentals and house prices may also contribute to overvaluation. Regions with a strong presence of institutional investors may, therefore, be more vulnerable as investor demand falls and the cycle turns.

Chart B

Institutional investor presence varies across regions and can weaken the link between economic fundamentals and house price growth



Sources: RCA, European Data Warehouse, Eurostat and ECB calculations.

Notes: Panel a: Eurostat's NUTS classification is a system for dividing up economic territories in the EU. NUTS 2 refers to basic regions for the application of regional policies.

Investor participation rate defined as total transaction volume by institutional investors in RRE divided by regional GDP. Only regions where both transaction data and regional price data (taken from European Data Warehouse, a dataset of securitised mortgage loans) are shown, as these are the regions which are included in the regressions shown in panel b. Panel b: predicted one-year ahead house price growth based on a panel regression for NUTS 2 regions as shown in panel a, for the years 2008 to 2020. Estimates include controls for regional GDP per capita and current house price growth and are robust to the inclusion of country-fixed effects. "High level of institutional investor participation" corresponds to the 75th percentile in the NUTS 2-level distribution. Shaded areas indicate 95% confidence intervals.

Institutional investments made via real estate investment funds may amplify the RRE cycle, which raises the importance of developing policies to reduce structural vulnerabilities in such funds. Real estate investment funds play a prominent role among institutional investors. They are subject to a structural liquidity mismatch when they offer daily redemptions to their investors while holding illiquid real estate assets. This makes them particularly vulnerable to the effects of large-scale investor redemptions, which could lead to reduced demand or forced asset sales by funds. Where this results in further real estate price corrections and subsequent additional redemptions, adverse feedback loops can develop, amplifying the initial RRE market shock and its implications for the financial resilience of banks, households and exposed firms. Policies aimed at enhancing the resilience of real estate investment funds could include liability-side measures to reduce liquidity mismatch, such as lower redemption frequencies, longer notice and settlement periods, and longer minimum holding periods.²⁶

²⁶ See also the article entitled "The growing role of investment funds in euro area real estate markets: risks and policy considerations", *Macprudential Bulletin*, ECB, April 2023.

1.5 Vulnerable real estate markets are turning

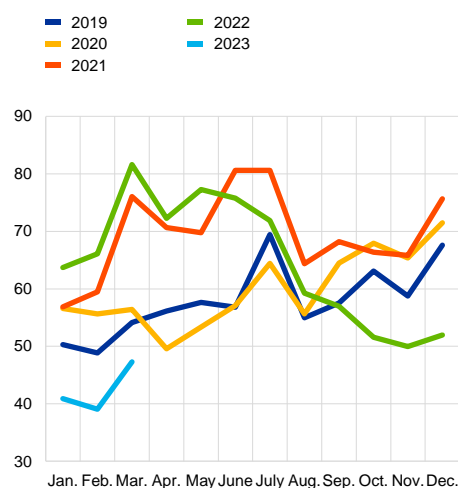
Both mortgage loan origination and house prices have slowed significantly amid higher interest rates. The average interest rate on loans for house purchase in the euro area stood at 3.4% in March 2023, almost 2 percentage points higher than it had been a year earlier. This steep rise in borrowing costs has led to a significant decline in loan origination. While the volume of new lending was higher during the first half of 2022 than in previous years, it declined markedly in the second half of the year and fell again sharply at the beginning of 2023 (Chart 1.10, panel a). Residential real estate (RRE) prices in some euro area countries or market segments also started declining in the second half of 2022. This fall could become more pronounced as higher interest rates reduce mortgage affordability (Chart 1.10, panel b). In the ECB's latest bank lending survey, banks reported a further substantial net tightening of credit standards for housing loans and a strong net decline in loan demand in the first quarter of 2023. They expect credit standards for mortgages to tighten further, and net loan demand to decline further, in the second quarter of the year as well, although to a lesser extent than during the first quarter. In other words, the trends observed in new lending and house prices at the end of 2022 are expected to continue in 2023.

Chart 1.10

The housing cycle is turning, as new lending volumes and housing prices decline

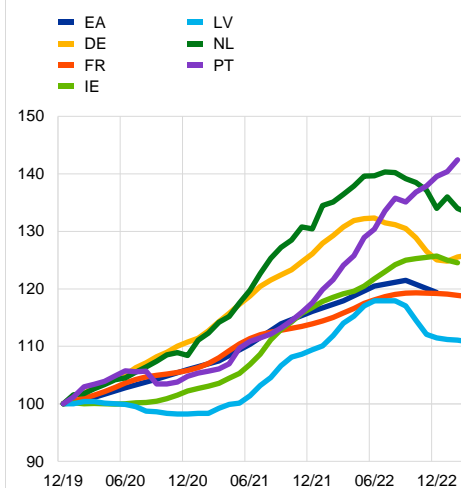
a) New loans to households for house purchase, excluding renegotiations

(Jan. 2019-Mar. 2023; € billions)



b) RRE price dynamics for selected countries

(Dec. 2019-Mar. 2023; indices: Dec. 2019 = 100)



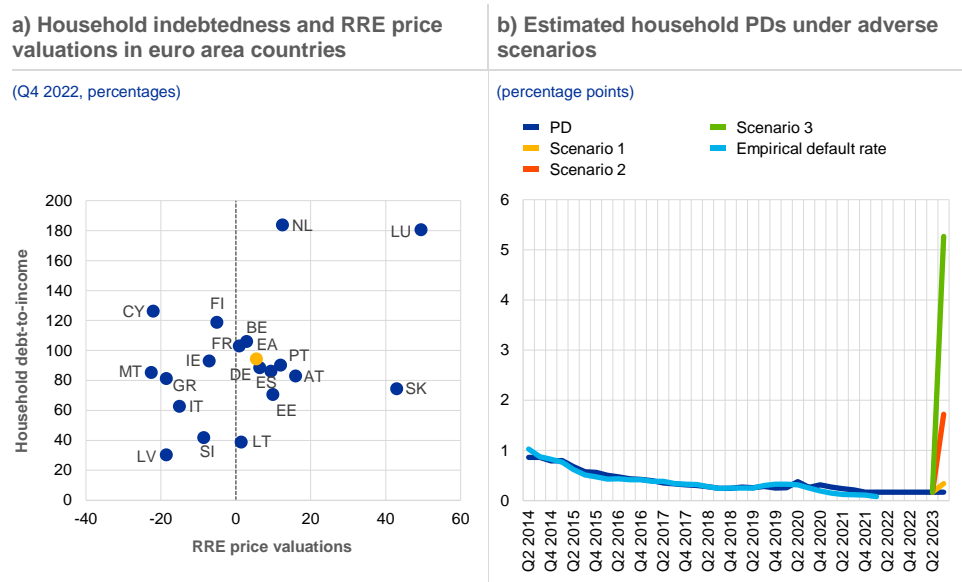
Sources: ECB, Europace (Germany), Statistics Netherlands, Central Statistics Office (Ireland), Confidencial Imobiliário (sourced from BIS, Portugal), Arco Real Estate (Latvia), meilleursagents.com (France), Eurostat (euro area) and ECB calculations. Notes: Panel b: data show developments in house price levels for euro area countries for which higher frequency data are available. For Germany, France, Latvia and Portugal, these data are not obtained from national statistical offices and might only reflect price developments for some segments of the RRE market. The data for Portugal show much stronger growth than the official data, the latter covering the universe of housing transactions. Similarly, the data included in the chart for Latvia reflect only changes in prices for standard apartments in the secondary market. The euro area index, which covers the universe of housing transactions in all euro area countries, is included in the chart as a reference despite being available only until end-December 2022.

A combination of stretched valuations, high debt and interest rate sensitivity in some euro area countries could amplify system-wide losses should an adverse scenario materialise. The rapid growth in RRE prices over the last few

years has led to stretched valuations in some euro area countries, as house price dynamics have exceeded their fundamentals. In some euro area countries, the estimates of house price overvaluation in the fourth quarter of 2022 exceed 10%, increasing the risk of a price correction. At the same time, household indebtedness has remained high, increasing the risk of defaults or lower consumption in the event of adverse shocks, such as a significant increase in unemployment. However, these vulnerabilities vary across euro area countries (Chart 1.11, panel a). In countries where fixed-rate mortgages predominate, rising interest rates will mainly have a negative impact on the demand for new loans in the short term, while they will also push up household debt burdens in countries with a large share of variable-rate mortgages.

Chart 1.11

Accumulated RRE vulnerabilities are elevated in some euro area countries and could amplify losses in an adverse scenario



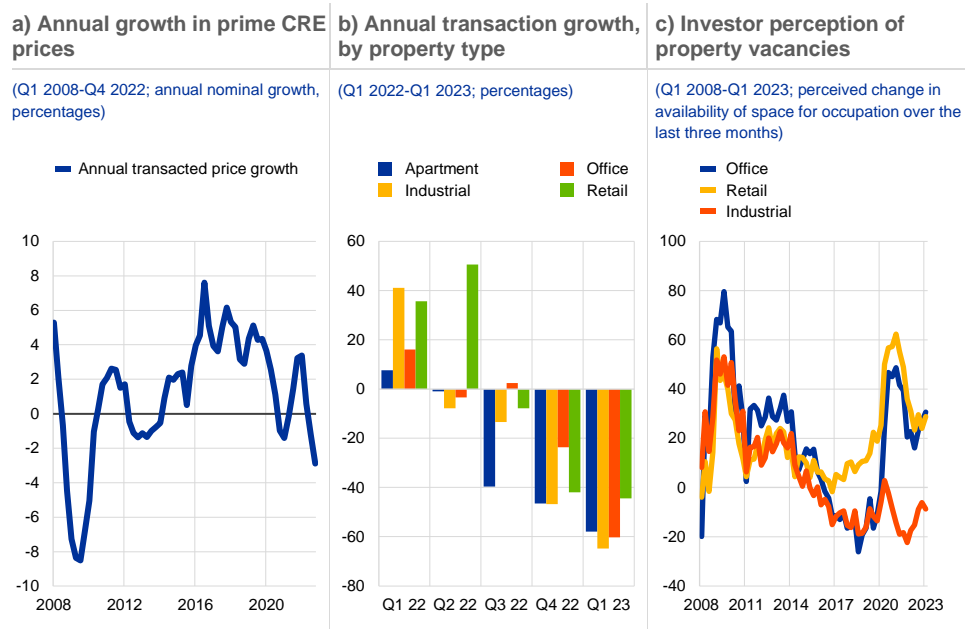
Sources: ECB, European DataWarehouse GmbH and ECB calculations.
Notes: Panel a: the latest data point available is used for countries for which Q4 2022 data are not available. The average valuation estimate is the simple average of the price-to-income ratio and an estimated Bayesian vector autoregression model. For details of the methodology, see the boxes entitled “Tools for detecting a possible misalignment of residential property prices from fundamentals”, *Financial Stability Review*, ECB, June 2011, and “A model-based valuation metric for residential property markets”, *Financial Stability Review*, ECB, November 2015. Overall, estimates from the valuation models are subject to considerable uncertainty and should be interpreted with caution. Alternative valuation measures can point to lower/higher estimates of overvaluation. Panel b: the estimations are based on securitised loan data available for Belgium, Spain, France, Ireland, Italy, the Netherlands and Portugal. As the chart uses information on securitised mortgage loans alone (potentially resulting in selection bias), it might not be an accurate reflection of national mortgage markets. PDs are estimated using data on the stock of loans reported in the database with reference date end-2020. The scenarios considered are as follows: Scenario 1: interest rates rising by 200 basis points from March 2023 level (baseline PD uses end-2021 interest rates); Scenario 2: interest rates rising by 150 basis points, RRE prices falling by 10%, real incomes falling by 10% and unemployment rates rising by 4 percentage points; Scenario 3: interest rates rising by 200 basis points, RRE prices falling by 15%, real incomes falling by 15% and unemployment rates rising by 6 percentage points.

Default rates on household mortgages are likely to rise in the event of an economic downturn, although a severe increase remains a tail risk. Simulations using loan-level data from securitised mortgage loans show that rising mortgage rates alone are unlikely to trigger a significant increase in defaults on mortgages. Estimated probabilities of default (PDs) for mortgages exhibit a moderate increase (around 0.2 percentage points) when considering only the impact of higher interest rates. By contrast, estimated PDs increase much more (by up to 5 percentage points) when considering different scenarios combining higher interest rates with

higher unemployment, lower house prices and lower disposable incomes (**Chart 1.11**, panel b). The more severe scenarios remain a tail risk, as households have generally benefited from favourable labour market conditions and borrower-based macroprudential policy measures, and the increasing share of fixed-rate mortgages has made borrowers more resilient in many countries over recent years.

Chart 1.12

Prices and investor demand are falling across CRE markets, while structural vulnerabilities arising from the pandemic remain



Sources: ECB, RCA, RICS and ECB calculations.
Note: Panel b: data show the annual growth in euro area market transaction numbers. Note that the “Apartment” segment reflects purchases of large residential assets as shown in the RCA database. This will not include purchases of residential buildings by households, for example.

Commercial real estate (CRE) markets are suffering a clear downturn, with declining prices, falling investor demand and residual vulnerabilities persisting from the pandemic. Price growth in CRE markets fell sharply into negative territory at the end of 2022 (**Chart 1.12**, panel a). This was accompanied by a sharp drop in market activity, with 39% fewer transactions in euro area CRE markets in the fourth quarter of 2022 compared with a year earlier. This pace of decline is similar to that observed during the global financial crisis.²⁷ Unlike during the pandemic, this contraction in investor demand applies across all types of CRE assets, as investors in every segment are facing rising financing costs and macro-financial uncertainty (**Chart 1.12**, panel b). In addition, the impact of the current market environment may be amplified by vulnerabilities arising from structural changes in CRE markets. While market intelligence indicates that vacancy rates in euro area CRE markets are substantially lower than in the United States, tenant demand in the retail and office segments has not fully recovered from the pandemic, with vacancy rate indicators remaining substantially above pre-pandemic levels

²⁷ While this holds for the euro area as a whole, there are differences across euro area countries, with some countries showing positive developments in 2022.

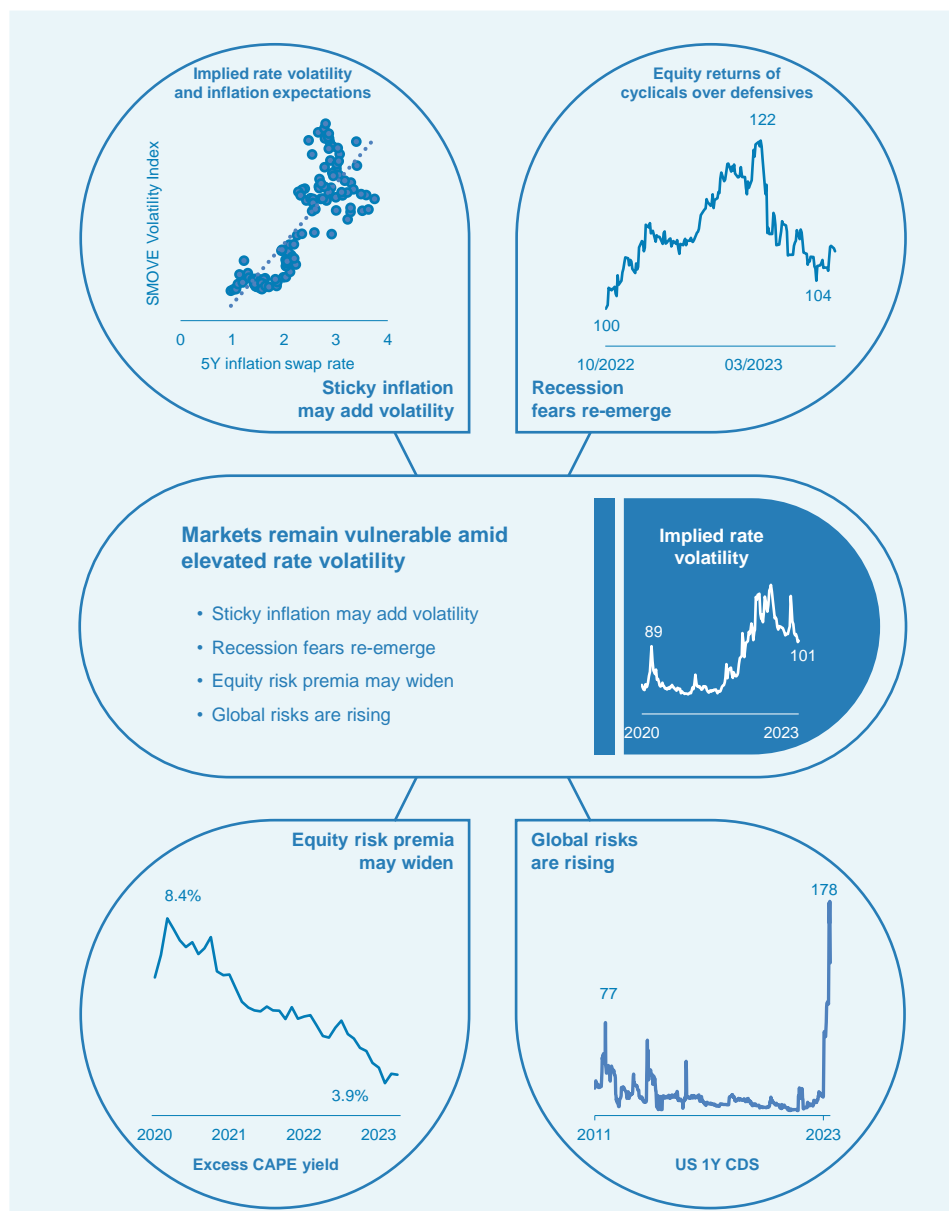
(**Chart 1.12**, panel c). Market intelligence indicates that these structural vulnerabilities are clustered in markets for lower quality CRE assets, as hybrid working and ESG concerns are concentrating investor and tenant demand in prime markets. More widely, flows to real estate funds have been slowing steadily, raising the risk of liquidity events among euro area real estate funds, especially in those countries where open-ended real estate funds dominate (**Section 4.2**).²⁸

The speed and depth of the turn in euro area real estate markets will determine the potential for stress on the financial system, notably so if the correction turns disorderly. Affordability and demand in housing markets have decreased as financial conditions have tightened – thus far in an orderly manner for real estate markets which had seen considerable growth in previous years. Risks remain tilted to the downside, especially in those countries where debt levels are elevated and properties might be overvalued. The commercial segment has seen a steeper downturn, as the changing macro-financial environment compounds structural vulnerabilities that arose from the pandemic. A pronounced correction in real estate markets could have an adverse effect on the wider financial system and the real economy. Stress among institutional investors, who have seen marked increases in exposures to real estate, could amplify any correction in real estate markets (**Box 2**), while the construction sector could suffer in the event of a pronounced decline in demand for new houses.²⁹ At the same time, as banks have tightened financial conditions mainly in the light of their higher risk perceptions – with funding costs or balance sheet constraints playing a smaller role – macroprudential policy measures might still allow resilience to be enhanced in the banking sector without having procyclical effects (**Chapter 5**).

²⁸ See also “[The growing role of investment funds in euro area real estate markets: risks and policy considerations](#)”, *Macroprudential Bulletin*, Issue 20, ECB, April 2023, and “[Vulnerabilities in the EEA commercial real estate sector](#)”, ESRB, January 2023.

²⁹ Such effects may vary across euro area countries depending on the relevance of the CRE sector in their economy.

2 Financial markets



2.1 Inflation persistence might trigger renewed market corrections

Elevated volatility in interest rate markets continues to weigh on wider financial market dynamics and may reveal both cyclical and structural vulnerabilities in the financial system. Rising inflation and market participants' concerns that the major central banks could tighten monetary policy significantly in response were among the main drivers of the market correction seen in 2022. More recently, however, falling energy prices and the easing of supply chain bottlenecks

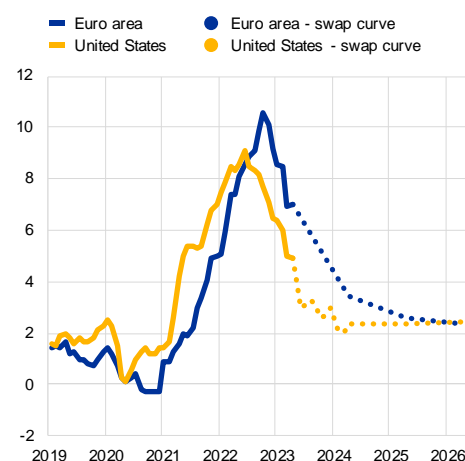
have led to market expectations of a relatively rapid decline in inflation (**Chart 2.1**, panel a). This contributed to a decrease in implied rate volatility and, together with a stronger outlook for growth (**Chapter 1**), supported a substantial rebound of risky-asset valuations until early March (**Chart 2.1**, panel b). In contrast to 2022, the subsequent jump in volatility was related to banking sector stress in some mature economies combined with renewed recession fears. Looking forward, continued large swings in policy rate expectations may lead to a further deterioration of market liquidity conditions (**Special Feature A**) and may also challenge the liquidity preparedness of non-bank financial intermediaries with significant interest-rate derivative exposures (**Chapter 4**, **Chapter 5** and **Box 7**).

Chart 2.1

Inflation expectations and interest rates volatility remain important drivers of market dynamics

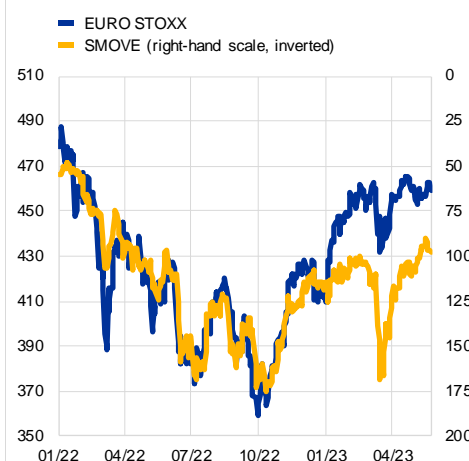
a) Headline inflation in the euro area and the United States and market-based inflation compensation

(1 Jan. 2019-23 May 2023; annual percentage changes)



b) EURO STOXX and EUR interest rates implied volatility (SMOVE)

(1 Jan. 2022-23 May 2023; indices)



Sources: Bloomberg Finance L.P. and ECB calculations.

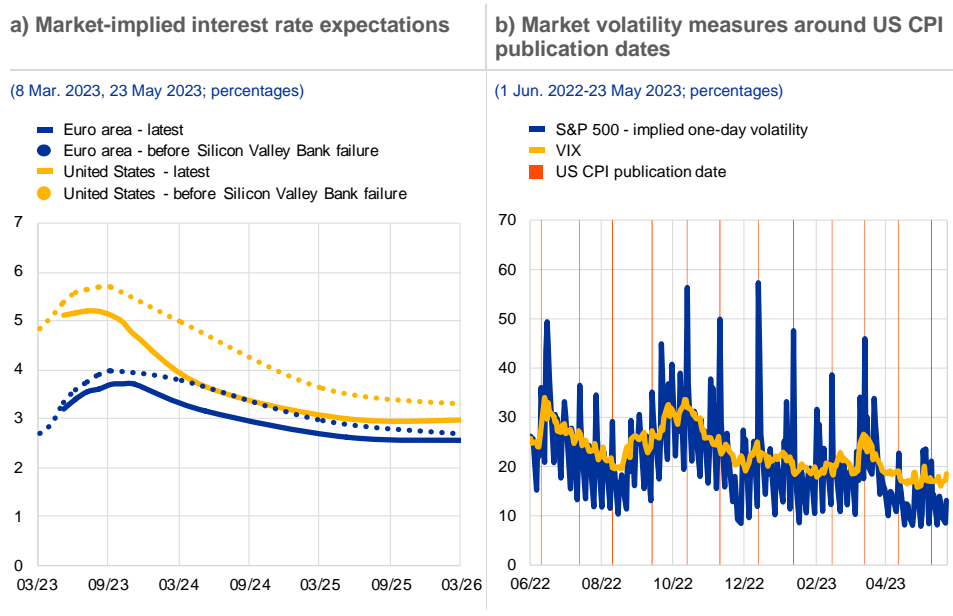
Notes: Panel a: market-based inflation compensation based on euro area one-year, two-year and three-year HICP inflation swap rates and 1M-11M, one-year, two-year and three-year US CPI inflation swap rates. Panel b: SMOVE is the Merrill Lynch 1M EUR Swaption Volatility Estimate Index.

Inflation persistence could put pressure on risky-asset valuations. The stress in the banking sectors of some mature economies following the failure of Silicon Valley Bank has resulted in a substantial decline in market-based interest rate expectations, especially in the United States (**Chart 2.2**, panel a). Growing risk aversion has led some market participants to rebalance their portfolios towards safer assets, thereby pushing risk-free rates lower. In addition, investors have concluded that the stress might result in banks further tightening credit conditions (**Chapter 3**), which could have a disinflationary impact and might, therefore, also be relevant for monetary policy. However, if inflation remains at elevated levels, market expectations for future interest rates might be revised upwards once again. A combination of a tighter policy environment and renewed recession fears could put pressure on risky-asset valuations. Therefore, markets remain sensitive to inflation data, albeit to a lesser

extent recently, as evidenced by short-term implied volatility which increases around CPI publication dates (**Chart 2.2**, panel b).

Chart 2.2

Inflation persistence might lead to a substantial jump in market volatility



Sources: Bloomberg Finance L.P. and ECB calculations.

Notes: Panel a: market expectations are based on the €STR OIS and the USD SOFR OIS implied forward one-month rates, which might also include a term premium component. Data before the failure of Silicon Valley Bank refer to 8 March 2023. Panel b: VIX refers to the Cboe Volatility Index. Implied one-day volatility is calculated as the average annualised one-day volatility implied from the last close prices of put and call options on the S&P 500, with a delta parameter of around 50% and one day to expiry.

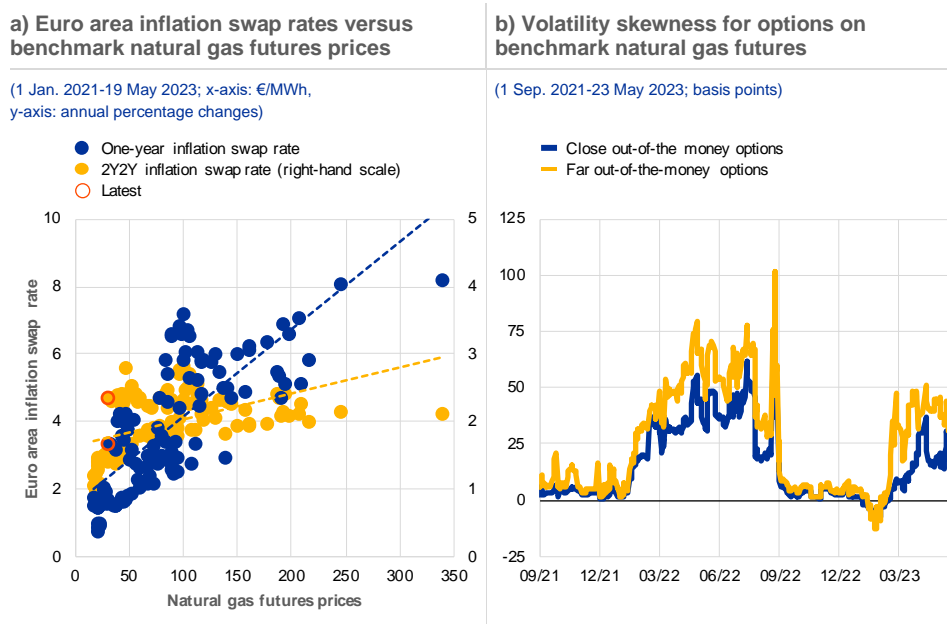
A rebound in energy prices would pose upside risks to the inflation outlook and could also add to market volatility. Since Russia began to cut supplies of natural gas to the EU in 2021, futures prices for this commodity have had a strong influence on both short-term and medium-term market-based inflation expectations (**Chart 2.3**, panel a). Lower gas consumption, increased imports from other countries and an unusually warm winter have caused natural gas prices to fall significantly from their August 2022 peak. Although the futures curve does not suggest that prices are expected to rise greatly in the coming months, there is still a high level of uncertainty in this market. Securing natural gas supply for next winter may push prices substantially higher, given that China’s reopening will probably result in increased competition for the LNG deliveries that Europe is now more reliant on.³⁰ The growing upside risk to natural gas prices is reflected in the increasing skewness of option-implied volatility (**Chart 2.3**, panel b). Another jump in prices could lead to more persistent inflation and weaker growth, potentially precipitating renewed market corrections. Furthermore, increased volatility in commodity derivatives markets would again increase the liquidity needs of energy market participants at a time when access to funding might be challenging.³¹

³⁰ See the box entitled “Spillovers to the euro area in a scenario of a stronger rebound in China’s economy”, *ECB staff macroeconomic projections for the euro area*, March 2023.

³¹ See also the special feature entitled “Financial stability risks from energy derivatives markets”, *Financial Stability Review*, ECB, November 2022.

Chart 2.3

Potential rebound in gas prices might worsen the inflation and growth outlook again, with spillovers to financial markets



Sources: Bloomberg Finance L.P. and ECB calculations.
 Notes: Panel a: prices for benchmark natural gas (TTF) front-month futures listed at ICE Endex. Panel b: close and far out-of-the-money options stand for 25% and 5% delta respectively. Skewness is calculated as the spread between the volatility implied in six-month out-of-the-money call and put options on benchmark natural gas (TTF) front-month futures listed at ICE Endex. Positive values indicate that market participants are more concerned about potentially large price increases than potentially large price drops and are therefore willing to pay more for call options than for the corresponding put options.

2.2 Renewed recession fears could challenge risky-asset valuations

Investors are once again concerned about a potential economic slowdown.

The euro area and US government bond yield curves both show a significant and persistent inversion which peaked at the beginning of March (**Chart 2.4**, panel a). Inverted yield curves are often interpreted as a sign of impending economic downturns.³² Despite the yield curve inversion and generally tighter financial conditions, many other market segments reflect more optimism with regard to growth prospects. Starting last July, cyclical sectors of the European stock market outperformed defensive sectors (**Chart 2.4**, panel b). However, this trend reversed sharply following concerns over potential credit tightening as a result of banking sector stress in some mature economies (**Chapter 3**). As concerns over a possible recession rose, investors rebalanced their portfolios towards safer assets, driving government bond prices substantially higher. This was reflected in a significant

³² For a literature review covering the link between yield curve inversion and recessions, see, for example, Benzoni, L., Chyruk, O. and Kelley, D., "Why Does the Yield-Curve Slope Predict Recessions?", *Chicago Fed Letter*, No 404, Federal Reserve Bank of Chicago, 2018.

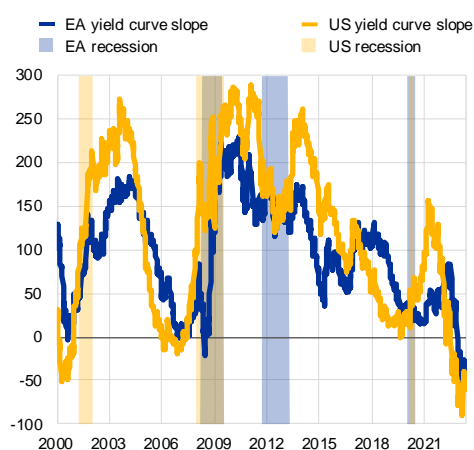
decline in the correlation between equities and highly rated debt securities from elevated levels reached in 2022 ([Chart 2.4](#), panel b).³³

Chart 2.4

Renewed recession fears start to weigh on risky-asset valuations

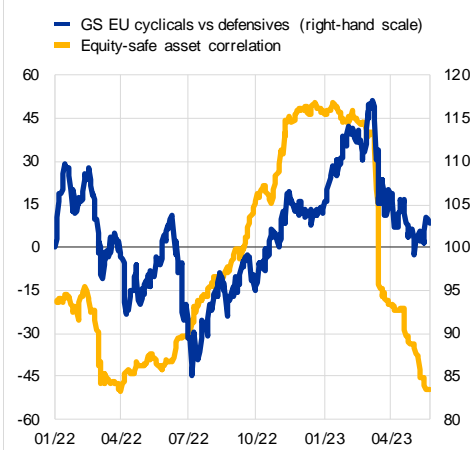
a) Yield curve slope and recessions in the euro area and the United States

(1 Jan. 2000-19 May 2023; basis points)



b) Equity performance of cyclical over defensive sectors and equity-safe asset correlation

(1 Jan. 2022-23 May 2023; left-hand scale: percentages, right-hand scale: 1 Jan. 2022 = 100)



Sources: Bloomberg Finance L.P., CEPR, NBER and ECB calculations.

Notes: Panel a: the yield curve slope is calculated as the difference between ten-year and two-year government bond yields (German bond yields for the euro area). Euro area and US recession periods are those defined by the Centre for Economic Policy Research (CEPR) and the National Bureau of Economic Research (NBER) respectively. Panel b: relative equity performance based on Goldman Sachs (GS) EU cyclicals and defensives indices; the equity-safe asset correlation is the rolling 90-day correlation between EURO STOXX and ICE BofA AAA Euro Government Index returns.

Equity market valuations may be based on overly optimistic expectations for the economy.

Since October 2022, the euro area equity market has rebounded significantly on the back of declining interest rates uncertainty ([Chart 2.1](#), panel b) and improved earnings forecasts. The improved profit outlook has been supported by the fading energy crisis and sector-specific factors such as European banks' growing net interest income ([Chapter 3](#)). However, the extent of the market rebound may be based on overly optimistic expectations for the macroeconomic outlook. Since the market bottomed out on 29 September 2022, all euro area sectoral indices have increased by more than the corresponding change in medium-term earnings forecasts ([Chart 2.5](#), panel a), despite higher levels of risk-free rates. Accordingly, valuation metrics for the euro area equity market, which initially declined following the Russian invasion of Ukraine, have since rebounded to levels above historical averages ([Chart 2.5](#), panel b).

The compressed risk premium in equity markets raises concerns over the potential for disorderly corrections in the event of a major economic downturn.

One key equity valuation metric which raises concerns over possible overvaluation is the equity risk premium, which compressed substantially during 2022. While prices fell across many asset classes last year, equity markets remained relatively robust,

³³ See the box entitled "Cross-asset correlations in a more inflationary environment and challenges for diversification strategies", *Financial Stability Review*, ECB, November 2022.

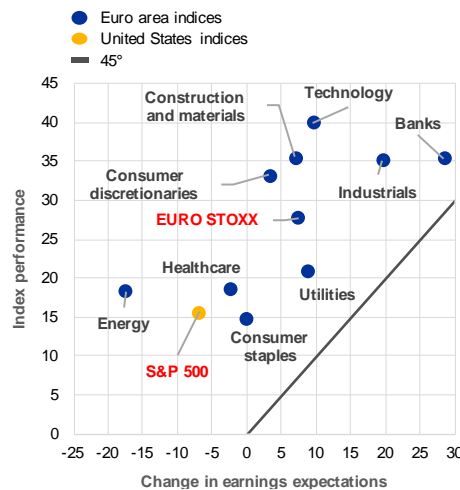
as evidenced by volatility measures. This can be attributed in part to the high-inflation environment, where positive nominal earnings growth makes equities a better inflation hedge for investors than fixed income securities. However, the equity risk premium could widen substantially in the event of a significant economic contraction. In addition, the increased net supply of safe assets resulting from quantitative tightening by major central banks around the world may support higher risk-free rates and may make de-risking more attractive for investors. The crowding out of riskier assets could lead to a less orderly correction in equity and high-yield corporate bond markets (**Chapter 4**).

Chart 2.5

Equity valuations might reflect an overly benign macroeconomic outlook

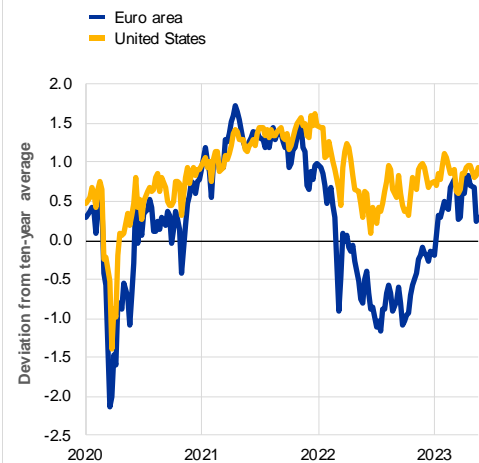
a) Equity returns since the market bottom versus the change in earnings expectations

(29 Sep. 2022-23 May 2023; percentages)



b) Equity market valuation metrics relative to the ten-year average

(1 Jan. 2020-23 May 2023; z-scores)



Sources: Bloomberg Finance L.P. and ECB calculations.

Notes: Panel a: broad market bottom: euro area – 29 September 2022, United States – 30 September 2023. Earnings expectations calculated as blended-forward earnings per share. Panel b: average z-scores of price-to-book ratio, price-to-forward (twelve-month) earnings ratio, price-to-long-term (ten-year) inflation-adjusted earnings ratio, and inverse risk premia proxied by five-year CAPE yield less five-year real (inflation swap-adjusted) government bond yield (German for the euro area) for EURO STOXX (euro area) and S&P 500 (United States).

A significant economic contraction would also further increase the likelihood of credit events, potentially precipitating stress in the corporate bond market.

Corporate bankruptcies picked up in some euro area countries in 2022 (**Chapter 1**). Although default rates on corporate bonds remain low, they are expected to rise, particularly for more indebted issuers. Spreads in the high-yield segment are still above the historical average and appear to be consistent with baseline default forecasts from credit rating agencies (**Chart 2.6**, panel a). However, the recent banking sector stress seen in some mature economies has increased the likelihood of more negative scenarios, which would most likely also lead to a widening of risk premia.³⁴ In addition, any repricing of corporate bonds could be exacerbated by current low market liquidity (**Special Feature A**).

³⁴ In the March 2023 Bank of America Global Fund Manager Survey, “systemic credit event” overtook “inflation staying high” as the key tail risk indicated by respondents.

Renewed recession fears might also limit issuers' access to market funding.

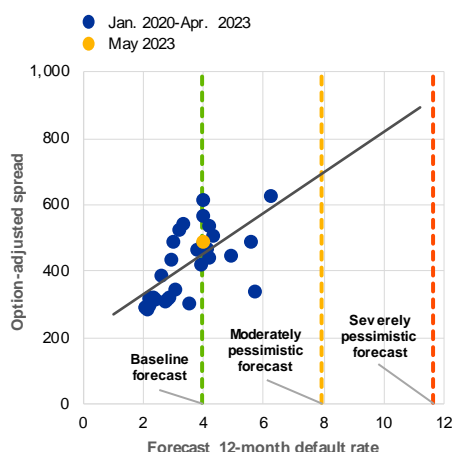
De-risking trends and continued outflows from investment funds focused on lower-rated issuers could limit the ability of such issuers to roll over their debt (Chapter 4). Although the funding needs of these corporates might appear limited in the near-term, given their relatively low share of high-yield debt maturing in 2023 and 2024 (Chart 2.6, panel b), the ongoing tightening of credit conditions by banks (Chapter 3) could push corporates to seek greater funding from capital markets. As the already-subdued primary market activity in the high-yield segment has deteriorated further since early March, the refinancing risk is still high for more indebted companies. In addition, individual corporates could also face impaired market access following rating downgrades, as the investment mandates of some institutional investors restrict the purchase of lower-rated securities.³⁵

Chart 2.6

High-yield corporate bond markets might face challenges if the macroeconomic environment deteriorates, although near-term refinancing needs are limited

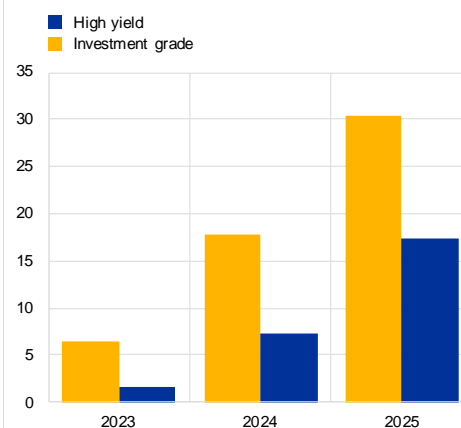
a) Spreads for euro area high-yield corporate bonds versus expected default rates

(Jan. 2020-May 2023; x-axis: percentages, y-axis: basis points)



b) Cumulative share of maturing debt in total debt outstanding for euro area corporate bond issuers

(23 May 2023; percentages)



Sources: Bloomberg Finance L.P., Moody's Analytics and ECB calculations.

Notes: Panel a: option-adjusted spreads based on the average end-of-day value of the Bloomberg Pan-European High Yield (Euro) Average OAS index in a given month; the latest observation is for 23 May. The forecast default rate is based on the Moody's Analytics forecast of the trailing 12-month default rate one year ahead, with the latest estimate period ending in April 2024. The trendline shows a linear regression. Moderately and severely pessimistic forecasts by Moody's Analytics assume one or more of the following: (1) more failures in the financial sector, (2) accelerating inflation leading to higher interest rates and a deeper recession, (3) an escalation of the war between Russia and Ukraine, (4) the inability of the US Congress to raise the debt ceiling in time, (5) a rapid erosion of Europe's relative resilience to the energy shock, (6) a deepening slowdown in the Chinese economy, and (7) a resurgence of COVID-19. Panel b: rating groups based on the average rating assigned to a given issuer.

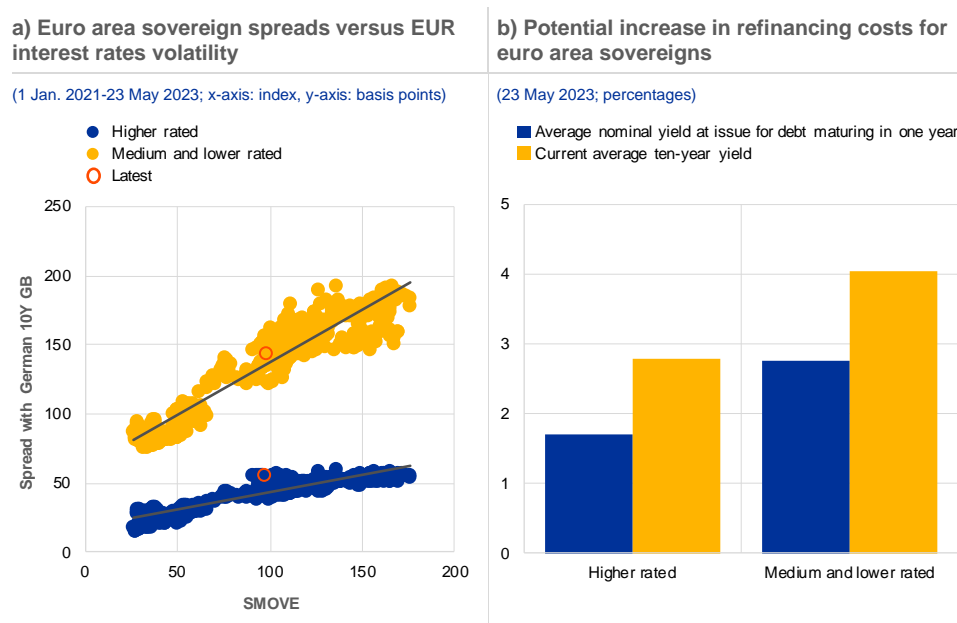
Vulnerabilities also persist in sovereign bond markets. Renewed recession fears coinciding with still-elevated inflation have increased interest rates volatility (Chart 2.1, panel b). Such volatility has been strongly correlated with sovereign bond spreads, with greater sensitivity for medium and lower-rated countries (Chart 2.7, panel a). Moreover, as a large share of outstanding sovereign debt was issued in a low interest rate environment, governments will face growing refinancing costs for a

³⁵ See the box entitled "Understanding what happens when 'angels fall'", *Financial Stability Review*, ECB, November 2020.

considerable period of time ([Chapter 1](#)). This potential increase in costs is also greater for medium and lower-rated sovereigns ([Chart 2.7](#), panel b), making their debt more vulnerable to market sentiment going forward. However, the pace of such an adjustment is expected to be slower for those countries which have managed to substantially increase the average maturity of their debt over the last decade. In addition, the ECB's Transmission Protection Instrument reduces the risk of a deterioration in financing conditions which is not warranted by country-specific fundamentals.

Chart 2.7

Euro area sovereign spreads may be sensitive to interest rates volatility and higher government refinancing costs



Sources: ECB, Bloomberg Finance L.P. and ECB calculations.
Notes: Medium and lower-rated countries, defined here as those having at least one credit rating below Aa3 (Moody's) or AA- (Fitch and S&P). Other euro area countries are considered higher rated. Panel a: SMOVE is the Merrill Lynch 1M EUR Swaption Volatility Estimate Index. Panel b: nominal yield at issuance was calculated for the debt outstanding as at the end of April and represents the total cost of debt (interest payments and discount). Average was weighted by the face value of the maturing debt. Ten-year government bond yields were taken as a liquid benchmark. Individual countries might, however, issue new debt with different maturities and therefore at a lower or higher cost than indicated by the ten-year yield.

2.3 Global vulnerabilities might spill over to the euro area

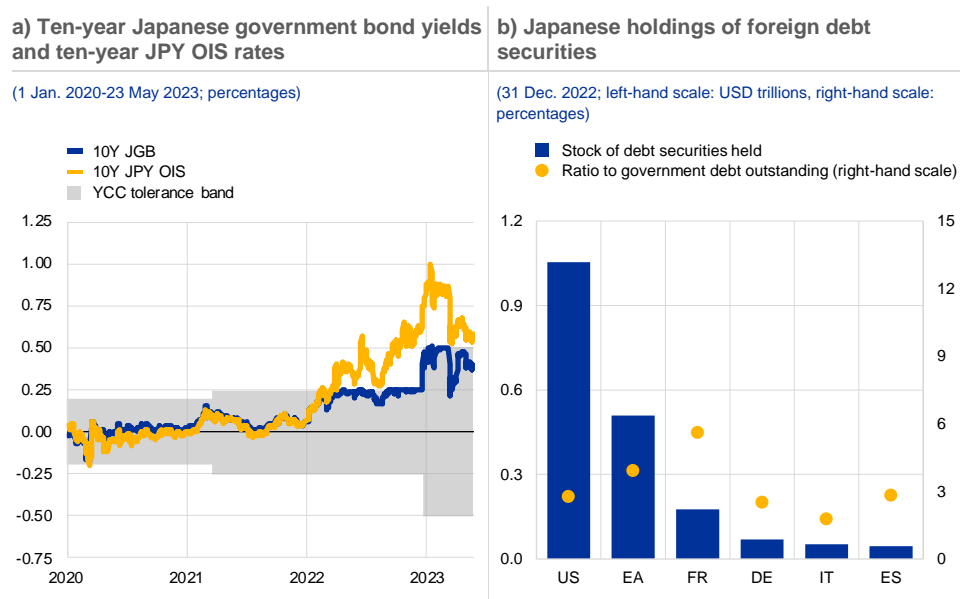
A shift away from the low interest rate environment in Japan could test the resilience of global bond markets.³⁶ Inflation in Japan has been increasing over the past year, leading market participants to expect the Bank of Japan to start normalising its monetary policy. These expectations have resulted in a growing deviation between the Japanese ten-year overnight index swap (OIS) rate and the government bond yield capped by the policy of yield curve control ([Chart 2.8](#), panel a). On 20 December 2022 the Bank of Japan announced an adjustment to this

³⁶ See the box entitled “Potential Spillover Effects of Changes to Japan’s Yield Curve Control Policy”, *Global Financial Stability Report*, International Monetary Fund, 11 April 2023.

policy tool by widening the respective tolerance band to between around plus and minus 50 basis points.³⁷ As a result, the ten-year government bond yield quickly increased and the yen appreciated by around 3% against the euro and US dollar. If the Bank of Japan decides to normalise its policy, this might influence the decisions of Japanese investors who have a large footprint in global financial markets, including the euro area bond market (Chart 2.8, panel b). In particular, a rapid decline in rate differentials and increased exchange rate volatility could reduce the attractiveness of their carry trades.³⁸ In addition, policy normalisation could lead to wider term premia on local government bonds, which could also stimulate the repatriation of portfolio investments. Finally, valuation losses on local bond portfolios and higher risk-free rates could inhibit the investors' risk-seeking behaviour, including their willingness to invest abroad. Japanese investors withdrawing abruptly from the euro area bond market could have a material effect on prices, particularly in more concentrated market segments. Such dynamics could be amplified by the increased net supply of these bonds resulting from quantitative tightening by the ECB.

Chart 2.8

Policy normalisation in Japan might have a sizeable effect on global bond markets



Sources: Bloomberg Finance L.P., Haver Analytics, Japan's Ministry of Finance and ECB calculations.
Notes: Panel a: JGB stands for Japanese government bonds; YCC stands for yield curve control. Panel b: the ratio to the respective country's government debt is for illustrative purposes, as the stock of debt securities includes all debt held by Japanese investors in all sectors of the respective country (not just the government sector).

An inability to raise the US debt ceiling in a timely manner may also lead to increased market volatility. On 19 January 2023 the United States reached the maximum amount of debt that the Department of the Treasury can issue. Since then, the government has had to rely on accumulated cash buffers or use extraordinary

³⁷ See also [Statement on Monetary Policy](#), Bank of Japan, 20 December 2022.
³⁸ By contrast, some portfolio investments by Japanese investors might be driven primarily by credit risk premia, term premia or their willingness to speculate on changes in interest rate expectations. In such cases investors often hedge the foreign exchange risk, hence also losing the benefits of a positive risk-free rate differential.

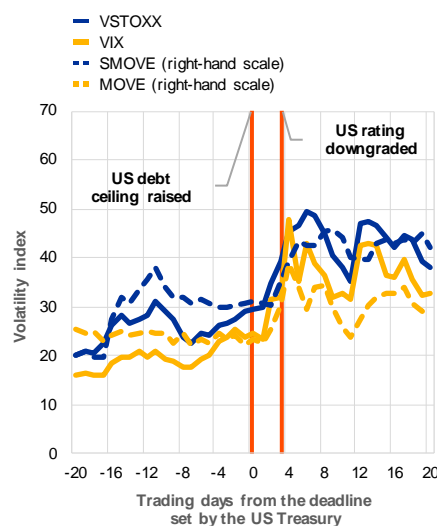
measures to finance its spending, including debt service. Although a technical default on outstanding debt is considered to be an extreme tail risk, a prolonged political stalemate might fuel volatility in global markets, with spillovers to the euro area. This was the case in 2011 when equity indices declined globally, despite the debt ceiling being raised before any payments were delayed (**Chart 2.9**, panel a). Negative sentiment was also fuelled by one rating agency downgrading the US long-term sovereign credit rating by one notch, which was linked to the debt ceiling debate. Similarities to 2011, in terms of the division of political power and the challenges for fiscal policy stemming from a higher interest rate environment, have heightened investor concerns over potential market spillovers in 2023 as well. These concerns are reflected in the rising prices of CDS contracts on debt issued by the United States, which have reached levels that are higher than those seen in 2011 (**Chart 2.9**, panel b)³⁹. In addition, any volatility spike could be accentuated by relatively low liquidity in the US bond market.

Chart 2.9

Political stalemate linked to the US debt ceiling might adversely affect global markets

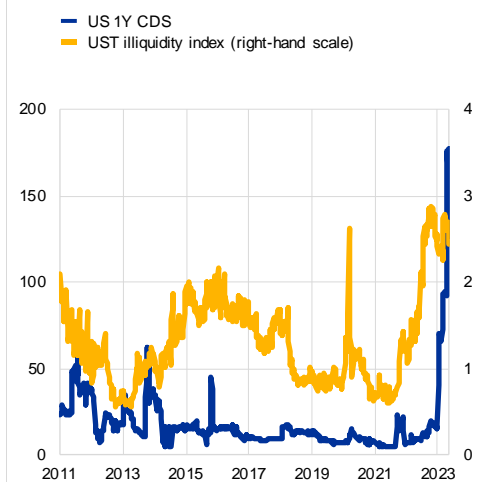
a) Volatility indices during the US debt ceiling debate in 2011

(5 Jul.-30 Aug. 2011; indices)



b) One-year CDS on US debt and illiquidity index for the US Treasury market

(1 Jan. 2011-19 May 2023; left-hand scale: basis points, right-hand scale: index)



Sources: Bloomberg Finance L.P. and ECB calculations.

Notes: Panel a: SMOVE is the Merrill Lynch 1M EUR Swaption Volatility Estimate Index. Panel b: spreads for euro-denominated one-year CDS contracts on US Treasuries. Illiquidity in the US Treasury market is proxied by the Bloomberg UST Liquidity Index, which displays the average yield error across the universe of US Treasury notes and bonds with remaining maturity of one year or more, based on the intraday Bloomberg relative value curve fitter.

Rapidly growing intraday leverage in the US equity market raises the risk of disorderly market moves.

High levels of interest in trading S&P 500 options on the day of their expiry (commonly referred to as “0 days to expiry” or “ODTE”) resulted in the Cboe Exchange expanding the offer of these instruments. As a result, trading in S&P 500 options has soared and recently reached an all-time high (**Chart 2.10**,

³⁹ Higher prices of CDS contracts might be driven by the discount in market prices of cheapest-to-deliver bonds and therefore do not necessarily imply higher probability of default.

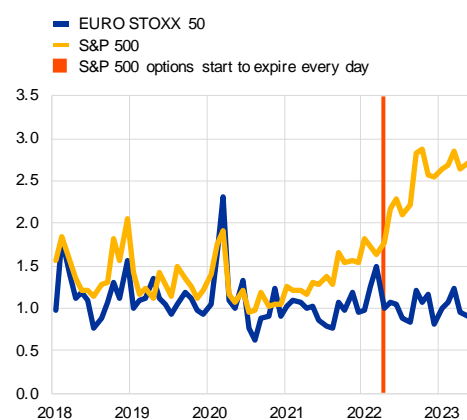
panel a), with 0DTE options accounting for between 40% and 45% of traded volumes.⁴⁰ Their short maturity makes these options much cheaper than longer-dated options. As a result, they offer extremely high leverage to investors (**Chart 2.10**, panel b), which magnifies their impact on the underlying stock market. Furthermore, the effective exposure stemming from these options is very sensitive to even small changes in the underlying equity index. This means that, to ensure that their own portfolios remain hedged, the sellers of these options (typically market-makers) must rapidly trade the underlying securities in line with the short-term trend. As a result, these transactions might further fuel current price momentum and volatility, creating a high degree of procyclicality. This constitutes a structural vulnerability in the event of large, abrupt swings in investor sentiment. In the current environment of high market sensitivity to macroeconomic data, negative surprises might lead to sudden and disorderly corrections in US equity markets, with spillovers potentially also affecting wider financial markets.

Chart 2.10

Growing leverage in the US equity market might exacerbate procyclical behaviour and price volatility

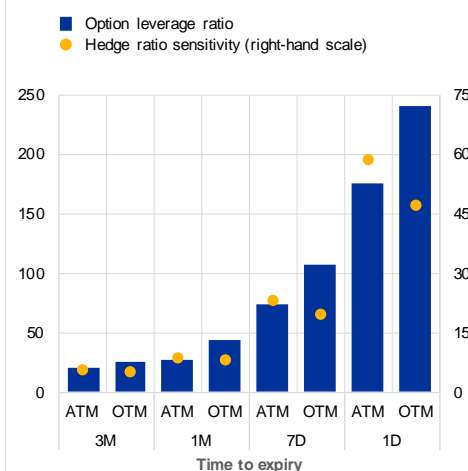
a) Average daily trading volumes for options on equity indices

(Jan. 2018-May 2023; millions of contracts)



b) Option leverage ratios and hedge ratio sensitivities in call options on the S&P 500, by time to expiry

(23 May 2023; left-hand scale: ratio, right-hand scale: percentages)



Sources: Bloomberg Finance L.P. and ECB calculations.

Notes: Panel a: the latest observation is for 23 May. Panel b: the option leverage ratio (i.e. the option lambda parameter) is calculated as the value of the delta-equivalent position over the option price. Hedge ratio sensitivity (i.e. the option gamma parameter) is calculated as the sensitivity of the option delta parameter to the price of the underlying. At-the-money (ATM) and out-of-the-money (OTM) options represent options closest to 50% and 25% delta respectively.

⁴⁰ See the box entitled “The Fast-Growing Interest in Retailers’ Trading in the Zero-Day Options Market: Is It a Hidden Risk?”, *Global Financial Stability Report*, International Monetary Fund, 11 April 2023.

Box 3

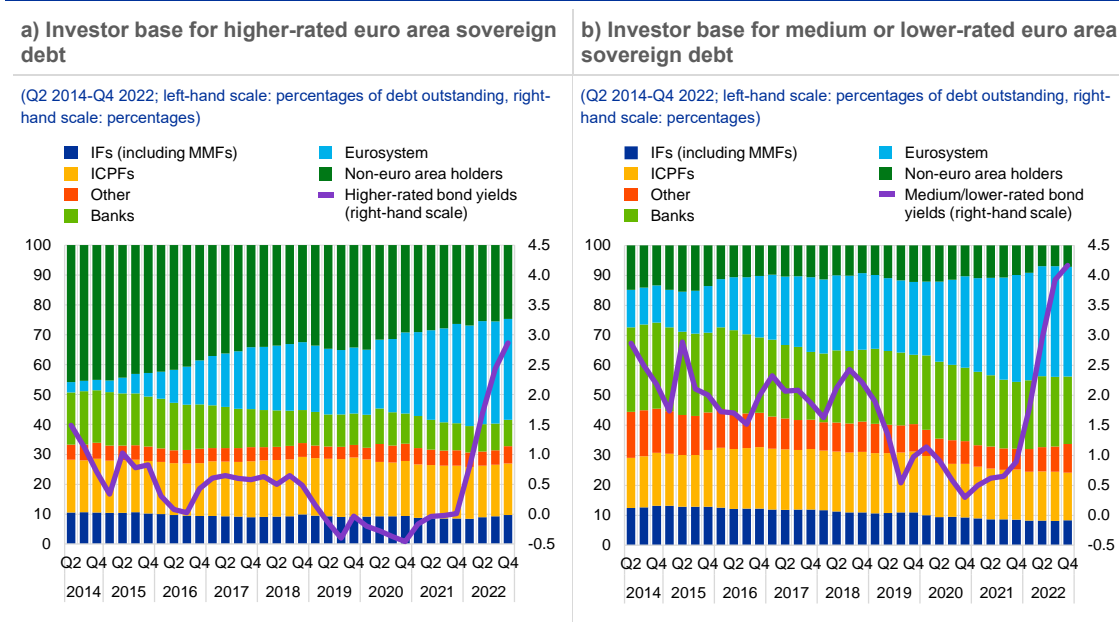
Do global investment funds have a stabilising effect on euro area government bond markets?

Prepared by Pablo Anaya Longaric, Katharina Cera, Georgios Georgiadis and Christoph Kaufmann

This box analyses the role and behaviour of global and domestic investment funds in euro area government bond markets. Over the last year, yields have increased for many euro area sovereigns, while net debt issuance has remained positive (Chart A, panels a and b). Against this background, it is useful to assess how investors might change their holdings of sovereign bonds as central banks reduce their footprint in these markets. In addition, investment decisions are also driven by risk appetite, which can be affected by both global and euro area-specific shocks. The analysis presented in this box focuses on how investment funds react to such global and euro area risk shocks and draws implications for financial stability.

Chart A

The footprint of foreign investors in euro area government bond markets has fallen over time, but euro area yields have become more attractive over the last year



Sources: ECB, Refinitiv and ECB calculations.

Notes: The charts show the breakdown of euro area government debt outstanding by euro area holding sector, while all non-euro area holders are aggregated in the dark green category because of missing information. Medium or lower-rated euro area sovereigns refer to countries with credit ratings below AA- over most of the sample period. IFs stands for investment funds; MMFs stands for money market funds; ICPFs stands for insurance corporations and pension funds. The purple lines depict the GDP-weighted ten-year government bond yields for higher-rated (panel a) and lower-rated (panel b) euro area sovereigns.

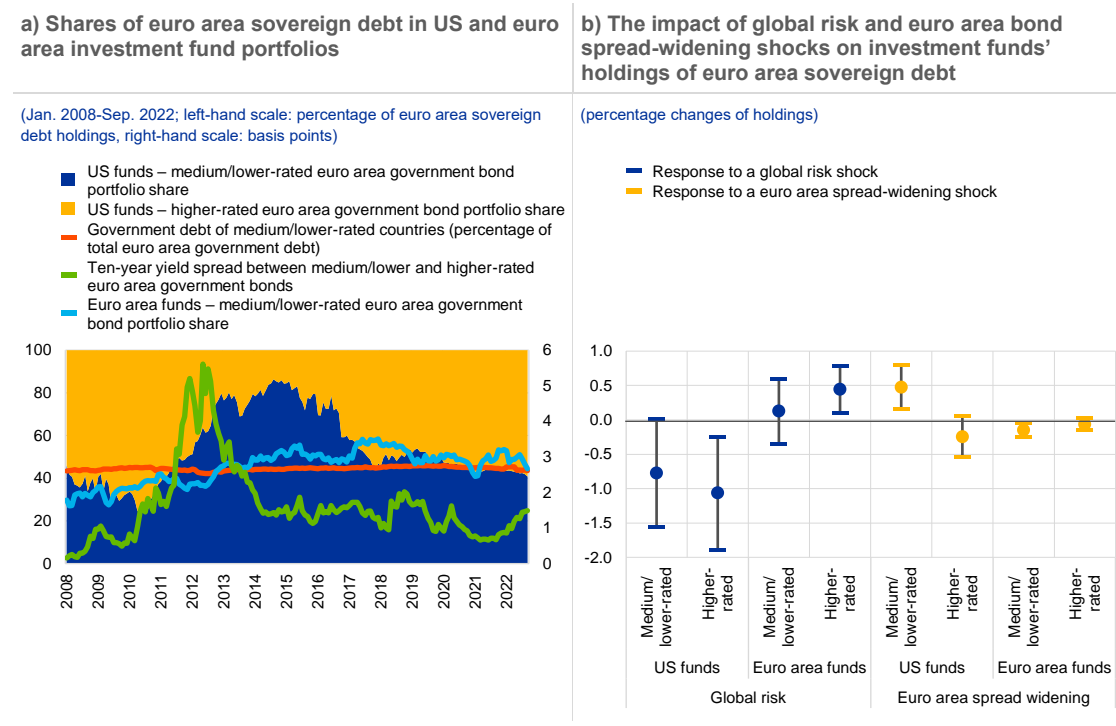
Foreign investors have a significant footprint in euro area government bond markets, but this has fallen since the Eurosystem launched its asset purchase programmes (Chart A, panels a and b).⁴¹ For higher-rated euro area sovereigns, the share of foreign investors fell from almost 50% in 2014 to 25% at the end of 2022, while for medium or lower-rated countries it fell from 15% to 7%. Investment funds domiciled outside the euro area, in turn, make up a sizeable fraction

⁴¹ Foreign investors' nominal holdings of euro area government bonds, as well as their share of total euro area government bonds issued, declined between Q2 2014 and Q4 2022.

of foreign sector holdings.⁴² The euro area sovereign debt holdings of domestic investment funds have also fallen slightly over time and now stand at around 10% of euro area debt outstanding.⁴³

Chart B

Global investment funds have tended to play a stabilising role in euro area government bond markets in the past when euro area bond spreads become elevated



Sources: Refinitiv Lipper IM, Haver Analytics, Refinitiv and ECB calculations.

Notes: Panel a: the dark blue area (light-blue line) shows the share of medium or lower-rated euro area sovereign debt holdings in US (euro area) investment funds' portfolios. The red line shows government debt outstanding of medium or lower-rated euro area countries relative to total euro area government debt. The green line shows the spread between GDP-weighted ten-year government bond yields for higher and medium or lower-rated euro area sovereigns. Panel b: the chart shows the impulse responses of euro area medium or lower-rated and higher-rated debt holdings to a global risk shock and a euro area spread-widening shock over a six-month horizon, calculated using local projections and data at a monthly frequency. The global risk (euro area spread-widening) shock is identified by upward spikes in the daily time series of the VIX (IT-DE CDS spread) that are larger than the 90th percentile. The dots show point estimates and the lines show one-standard deviation confidence intervals. The impulse responses are estimated while also controlling for the euro area monetary policy stance and economic news. Examples of global risk shocks picked up by the methodology include the Lehman Brothers default, the stock market "flash crash" of 2010, the US sovereign downgrade of 2011 and the onset of the coronavirus (COVID-19) pandemic. Examples of euro area spread-widening shocks picked up by the methodology include the euro area sovereign debt crisis, political uncertainty in May 2018 and the onset of the COVID-19 pandemic.

Global investment funds' portfolio weights of medium or lower-rated euro area sovereign debt have fluctuated over time (Chart B, panel a).⁴⁴ Relative to the debt outstanding, both global and domestic investment funds underweighted medium or lower-rated euro area sovereign debt relative to higher-rated debt before and during the euro area sovereign debt crisis. During that

⁴² Information on the sectoral composition of foreign debt holdings is generally limited. Kaufmann, C., "Investment funds, monetary policy, and the global financial cycle", *Journal of the European Economic Association*, Vol. 21, April 2023, pp. 593-636 shows that investment funds account for around 50% of all cross-border portfolio flows globally. Arslanalp, S. and Tsuda, T., "Tracking global demand for advanced economy sovereign debt", *IMF Economic Review*, Vol. 62, 2014, pp. 430-464 document significant exposures of foreign non-banks to euro area sovereign debt. For some higher-rated countries, foreign official sector holdings can also be sizeable, reflecting euro currency reserves.

⁴³ Analysing data at the security level, Kojien, R., Koulischer, F., Nguyen, B. and Yogo, M., "Inspecting the mechanism of quantitative easing in the euro area", *Journal of Financial Economics*, Vol. 140, 2021, pp. 1-20 find that among the sectors, foreign investors have the highest sensitivity to yield changes and that they accommodated most of the Eurosystem's euro area government bond purchases.

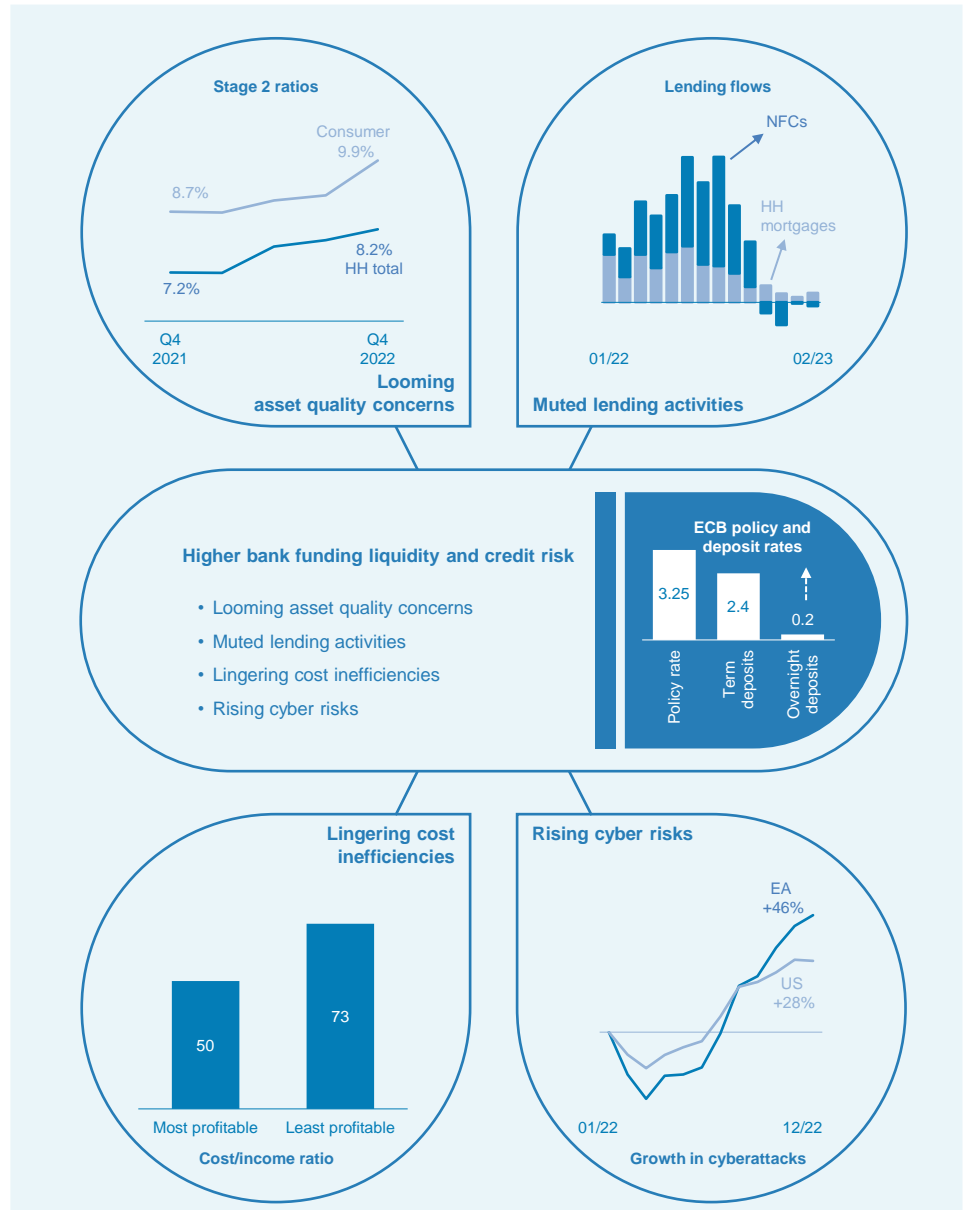
⁴⁴ Global investment funds are proxied by investment funds domiciled in the United States since these represent the bulk of investment funds domiciled outside the euro area in the dataset used in this analysis.

crisis, however, US funds (the dark blue area) started to materially increase the share of medium or lower-rated euro area government bonds in their portfolios, and by much more than domestic funds (the light-blue line). But after the Eurosystem's asset purchases began in early 2015, global funds reduced the share of medium or lower-rated debt again, while domestic funds hardly changed theirs.

After global risk shocks, domestic investment funds tend to turn to euro area government bonds, while foreign funds cut back their exposures (Chart B, panel b). Following global risk shocks, US-domiciled funds decrease their holdings of euro area government bonds irrespective of their rating and may thereby contribute to stress in euro area government bond markets. By contrast, euro area-domiciled funds increase their holdings, especially those of higher-rated bonds. These findings are consistent with a flight-to-safety after global risk shocks: US funds may retrench into dollar-denominated assets, while domestic funds may rebalance their portfolios towards higher-rated government bonds.

Overall, global investment funds have tended to play a stabilising role in euro area government bond markets in the past when spreads between sovereigns become elevated. After past events that led to spreads widening among euro area government bond markets, US investors typically increased their exposure to medium or lower-rated euro area government bonds. This could indicate that for US investors, the opportunity to profit from the higher carry on such bonds – because of higher interest rates and also, potentially, expectations of rebounding bond prices and euro appreciation – may outweigh concerns over potentially higher risks. Euro area funds, by contrast, reduce their holdings of medium or lower-rated government bonds slightly more than their holdings of higher-rated bonds after spreads start widening. As domestic investment funds have larger exposure to medium or lower-rated euro area government bonds than US funds in relative terms, a spread-widening shock could imply an overall sell-off of such bonds, thus possibly contributing to further increases in spreads after the initial event. Overall, this analysis shows that foreign and domestic investment funds have differing sensitivity to global and euro area risk events. It also shows how such financial intermediaries can affect financial stability risks in sovereign bond markets.

3 Euro area banking sector



3.1 Compressing valuations and tighter funding conditions

After a strong start to 2023, the share prices of euro area banks declined sharply in March as volatility and default risk premia surged. Between October 2022 and the beginning of March 2023, bank share prices rose by 50%, driven by rising interest rate margins supported by higher policy rates, and an improving macro environment after China ended its zero-Covid policy. This positive sentiment partly went into reverse when two US banks – Signature Bank and Silicon Valley Bank – failed and Credit Suisse was acquired by UBS, a case which underscored the

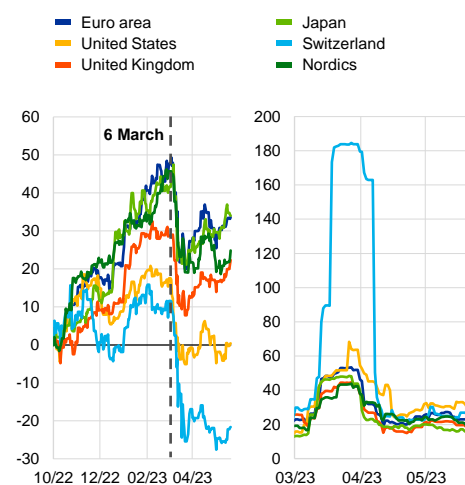
importance of good corporate governance and effective risk controls for business model viability (Chart 3.1, panel a, left graph). While the acquisition of Credit Suisse – a global systemically important bank – caused volatility to surge among bank stocks across advanced economies (Chart 3.1, panel a, right graph), volatility levels nevertheless remained well below those seen at the start of the pandemic. Uncertainty about the riskiness of the senior unsecured securities issued by euro area banks caused a sudden rise in their CDS spreads, with some more affected than others. The fact that expected default frequencies of euro area banks only increased slightly and that there were no downward revisions of their rating outlooks would suggest that these market dynamics were driven more by uncertainties about securities valuations and/or contagion fears, which were not accompanied by a deterioration of bank fundamentals (Chart 3.1, panel b).

Chart 3.1

Bank stock prices fell in March after a long rally, while volatility and CDS spreads surged, but underlying fundamentals did not point to a rise in euro area bank risk

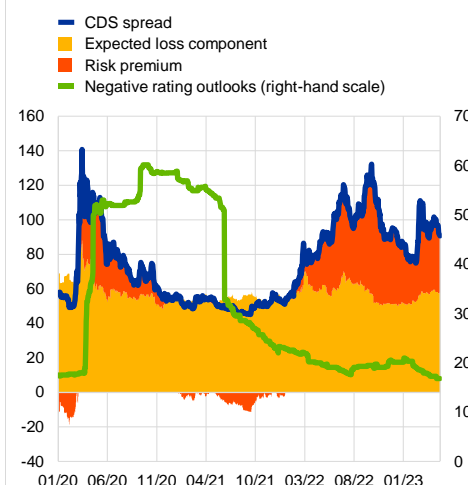
a) Developments of share prices and share price volatility of banks across global regions

(left graph: 3 Oct. 2022-23 May 2023, percentages; right graph: 3 Mar.-23 May 2023, percentages)



b) Decomposition of euro area banks' CDS spreads, and share of negative rating outlooks

(1 Jan. 2020-23 May 2023; basis points, percentages)



Sources: Bloomberg Finance L.P., DBRS, Fitch Ratings, Moody's Analytics, S&P Global Market Intelligence and ECB calculations. Notes: Panel a: the sample consists of 71 global listed banks. Share prices and one-month annualised historical share price volatility across regions are weighted by banks' total assets. Panel b: the decomposition of the CDS spread into the risk premium and the expected loss component is based on the five-year senior CDS spreads and the five-year expected default frequencies of 32 euro area banks.* The euro area aggregates shown are calculated on the basis of bank total asset weights. *) For more details on the approach, see the box entitled "Price of default risk as a measure of aversion to credit risk", *Financial Stability Review*, ECB, December 2008.

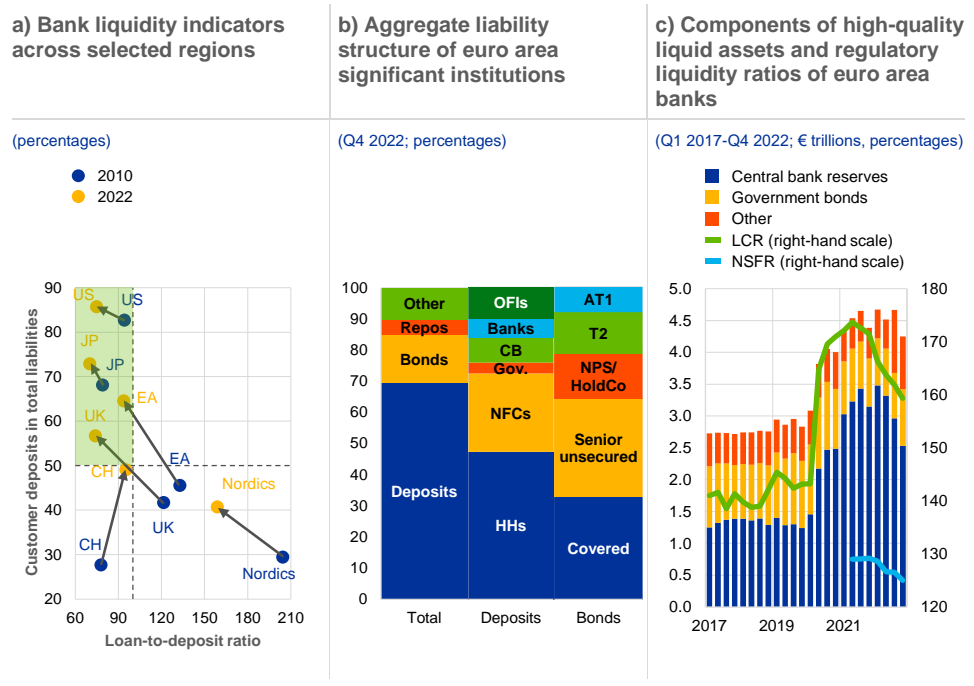
High reliance on customer deposits and long-term bond funding helped to increase the resilience of the euro area banks' funding base.

The rapid rise in interest rates last year contributed to a decline in the funding liquidity of banks due to rollover, redemption and margin risks. It also exposed some fragilities, such as reliance on potentially flighty short-term funding in some financial institutions, which requires close monitoring (Special Feature A). On aggregate, however, the shares of more stable customer deposits in banks' funding structures have increased since the global financial crisis and loan-to-deposit ratios have declined, partly in response

to the ECB’s expansionary monetary policy (**Chart 3.2**, panel a). For the euro area on aggregate, deposits fund about 70% of banks’ liabilities. The largest providers of those funds are households followed by corporates, accounting for 47% and 25% of banks’ liabilities respectively. Stable retail deposits represent over 40% of total deposits (**Chart 3.3**, panel b, left graph). Market funding via bonds contributes another 15% to banks’ liabilities, with non-banks as major investors in bank debt securities (**Special Feature B**). Covered bonds, senior unsecured bonds and three classes of bonds eligible under the minimum requirement for own funds and eligible liabilities (MREL) have broadly similar shares (**Chart 3.2**, panel b). The decline in excess liquidity associated with repayments of the targeted longer-term refinancing operations (TLTRO) led to a gradual decline in banks’ liquidity coverage ratios. However, euro area banks on aggregate hold substantial liquidity buffers, mainly in the form of central bank reserves and government bonds. This availability of collateral limits the risks related to potential adverse market developments. The medium-term resilience of bank funding is reflected in their net stable funding ratios, which have declined only slightly since the end of 2021 and remain well above minimum requirements (**Chart 3.2**, panel c).

Chart 3.2

Euro area banks have a robust funding mix and substantial buffers of high-quality liquid assets following regulatory reforms implemented after the global financial crisis



Sources: Bloomberg Finance L.P., ECB and ECB calculations.
 Notes: Based on a balanced sample of 83 euro area significant institutions. Panel a: the vertical dashed line indicates a loan-to-deposit ratio of 100%, while the horizontal dashed line indicates a customer deposit share of 50%. Panel b: OFIs stands for other financial institutions; CB stands for central banks; Gov. stands for governments; NFC stands for non-financial corporations; HHs stands for households; AT1 stands for Additional Tier 1 securities; T2 stands for Tier 2 securities; NPS/HoldCo stands for senior non-preferred securities. Panel c: LCR stands for liquidity coverage ratio; NSFR stands for net stable funding requirement. NSFR data are only available from mid-2021, when this ratio became a legal requirement.

The pass-through of higher interest rates to depositors has been slow but deposit rates are gradually rising, weighing on overall funding costs. With the exception of some term deposits, banks have so far passed only a small fraction of

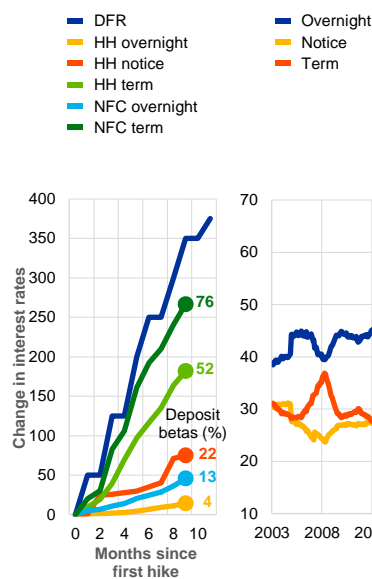
the rise in policy rates through to depositors, which is reflected in low “deposit betas” (Chart 3.3, panel a, left graph and Box 4). Rising policy rates led to a surge in margins last year, helping to support bank profitability. Given the difference in rates on agreed maturity and overnight deposits, customers have started shifting some of their funds to deposit types where the remuneration offered is higher (Chart 3.3, panel a, right graph). Banks are likely to increase average deposit rates further in order to prevent outflows to competitors as customers seek higher-yielding savings products. While some deposit outflows have been observed since the beginning of this year (Chart 3.3, panel b, right graph), they tend to reflect seasonal patterns and outflows from financial customers due to portfolio adjustments towards higher-yielding instruments.

Chart 3.3

Banks have so far been slow to pass higher rates through to depositors, while benefiting from the stability of a retail-dominated deposit base

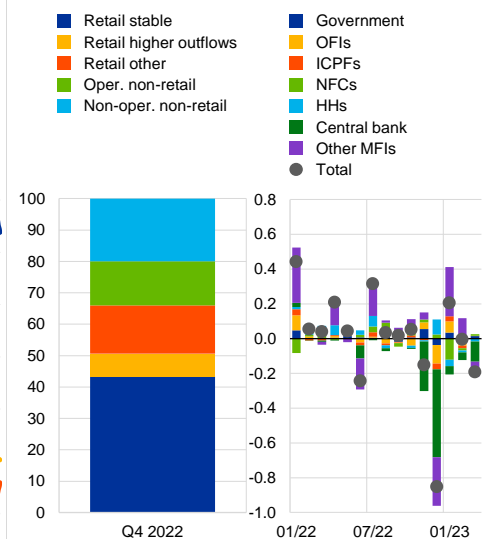
a) Pass-through of policy rates to household and corporate deposit rates, and volume shares of different deposit categories

(left graph: basis points, deposit betas as percentages of changes in DFR; right graph: July 2003-Mar. 2023, percentages)



b) Breakdown of bank deposits and monthly deposit flows of euro area banks

(left graph: Q4 2022, percentages; right graph: Jan. 2022-Mar. 2023, € trillions)



Sources: ECB and ECB calculations.

Notes: Panel a: deposit betas capture the percentage pass-through of the increase in the ECB’s deposit facility rate to household and corporate new business deposit rates since the start of the rate hiking cycle in July 2022. The right graph shows overnight, notice and term deposits aggregated for households and non-financial corporates. The volume shares refer to the outstanding stock. DFR stands for the ECB’s deposit facility rate; HH stands for household; NFC stands for non-financial corporation. Panel b: the left graph shows the decomposition of bank deposits according to their stability and is based on a sample of 83 euro area significant institutions. Specifically, retail deposits subject to higher outflow rates are defined in line with Article 25(2) of Commission Delegated Regulation (EU) 2015/61 to supplement Regulation (EU) 575/2013 of the European Parliament and the Council with regard to liquidity coverage requirement for credit institutions. The right graph shows monthly deposit flows of euro area monetary financial institutions. OFIs stands for other financial institutions; ICPFs stands for insurance corporations and pension funds; NFCs stands for non-financial corporations; HHs stands for households; MFIs stands for monetary financial institutions.

Box 4

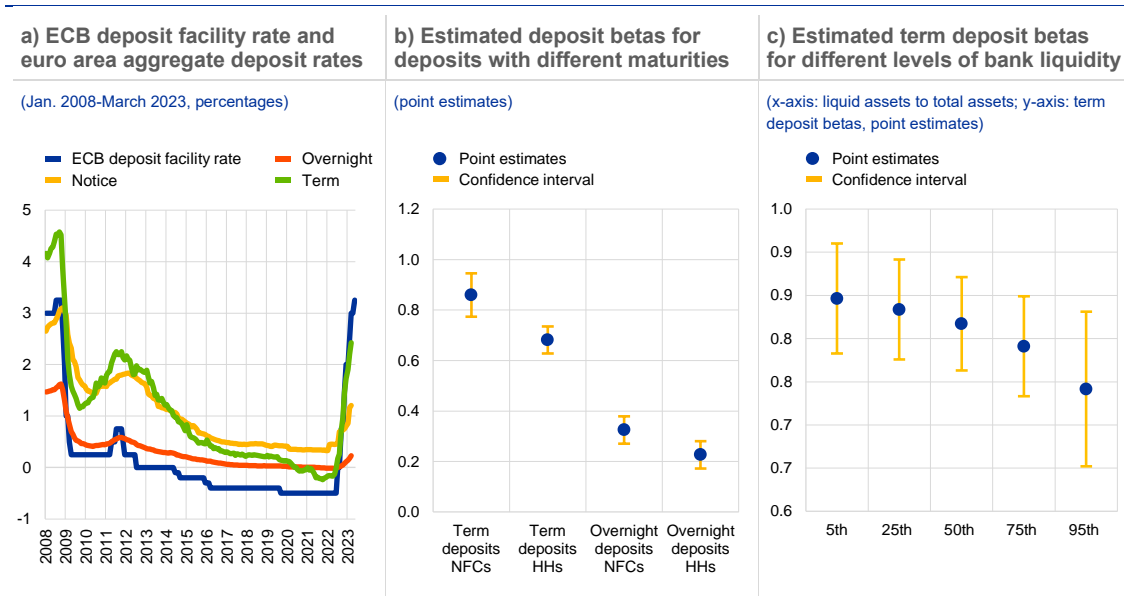
Euro area bank deposit costs in a rising interest rate environment

Prepared by Maciej Grodzicki, Benjamin Klaus, Cosimo Pancaro and Alessio Reghezza

Changes in the cost and the composition of bank deposits have important implications for banks' net interest income. This, in turn, affects their retained earnings, capital position, overall resilience and hence their ability to provide credit to the real economy. The ultimate impact of higher policy rates (**Chart A**, panel a) on banks' net interest income depends, in particular, on the structure of their balance sheets and the sensitivity of their deposit and lending rates to policy rates.⁴⁵

Chart A

Term deposit rates exhibit greater sensitivity than overnight deposit rates to policy rates, with some bank-specific characteristics also playing a role



Sources: ECB and ECB calculations.

Notes: Panel a: deposit rates refer to new business volumes and are calculated as the weighted average for non-financial corporations and households. Panel b: regressions are estimated through OLS panel fixed effect models based on a sample of 83 euro area banks and yearly data over the period from 2007 to 2021. The endogenous variables are the overnight and term deposit rates on new business from households and non-financial corporations. The variable of interest is the policy rate. Control variables include the lag of the endogenous variable, the logarithm of total assets, the return on assets, the ratio of deposits to total assets, the non-performing loans ratio, the liquid-assets-to-total assets ratio, the equity-to-total-assets ratio, the cost/income ratio, the change in the spread between the ten-year government bond yield and the German ten-year sovereign yield, GDP growth and the Herfindahl-Hirschman index. Control variables are all lagged by one period. Robust standard errors are clustered at the bank level. Confidence interval are at the 95% level. Panel c: the sample, the control variables and the fixed effects are the same as in panel b. The endogenous variable is the weighted average of new business term deposit rates for both non-financial corporations and households. The main variable of interest is the interaction between the policy rate and the ratio of liquid assets to total assets. The 5th, 25th, 50th, 75th and 95th percentiles correspond to a ratio of liquid assets equal to 3%, 8%, 15%, 27% and 48% respectively. Confidence intervals are at the 95% level.

Interest rates on “new” term deposits⁴⁶ for both non-financial corporations and households have risen since the start of the monetary policy tightening cycle, while overnight deposit rates have remained relatively sticky. Euro area banks have, to some extent, passed on increases in policy rates to the benefit of both non-financial corporations and households. This applies in particular to interest rates on term and notice deposits. Between June 2022 and March 2023, interest rates on term deposits increased by about 2.44 percentage points, interest rates on notice deposits increased by about 75 basis points respectively, while interest rates on overnight

⁴⁵ This box focuses mainly on deposits from households and non-financial corporations, which account for around 71% of the total deposits and 54% of the total liabilities of euro area banks (source ECB MFI Interest Rate Statistics).

⁴⁶ Term deposits are deposits with an agreed maturity.

deposits increased only modestly, by about 25 basis points. In this context, the sensitivity of banks' deposit rates to changes in interest rates, the so-called "deposit beta", plays a key role.

The sensitivity of banks' deposit rates to changes in policy rates depends on the type of deposit, bank-specific characteristics and the structure of the banking sector. Econometric analyses over the period 2007-21⁴⁷ reveal that about 86% (68%) of the change in policy rates is transmitted to rates on new term deposits from non-financial corporations (households), while 32% (23%) is transmitted to rates on overnight deposits from non-financial corporations (households) (**Chart A**, panel b).⁴⁸ Interest rates on new term deposits from non-financial corporations exhibit the highest sensitivity to changes in policy rates, as firms are more likely to switch to alternative investments and, until recently, were also charged negative deposit rates. The results also show that the pass-through of policy rates is lower in the case of larger and more liquid banks. For instance, a 1 percentage point increase in rates leads to a term deposit rate that is 12 basis points lower for larger banks and 10 basis points higher for less liquid banks (**Chart A**, panel c).⁴⁹ These sensitivities apply to new business and translate into a higher overall funding cost more slowly, in particular for term deposits which are only repriced on maturity.

Deposit outflows and TLTRO repayments could intensify competition in the deposit market, leading to faster and higher deposit repricing than observed recently. In the four months following the first monetary policy tightening in the euro area, the Herfindahl-Hirschman index on term deposits and on notice deposits fell visibly (**Chart B**, panel a), indicating a sharp increase in competition for such deposits among euro area banks. Greater competition has already been reflected in higher rates for these deposits, especially for banks operating in more competitive markets, with negative implications for bank funding costs going forward.

Higher interest rates have increased non-financial corporations' appetite for better remunerated deposit types, shifting banks' deposit mix away from stickier overnight deposits towards rate-sensitive term deposits. The share of term deposits from non-financial corporations increased by about 9 percentage points between February 2022 and March 2023, while the share of overnight deposits from non-financial corporations declined to a similar extent (**Chart B**, panel b). Changes have so far been more limited for households, which also account for the majority of banks' deposits. However, data prior to the low-for-long interest rate environment suggest that the share of term and notice deposits may increase further for both non-financial corporations and households, potentially weighing on total bank deposit funding costs going forward.

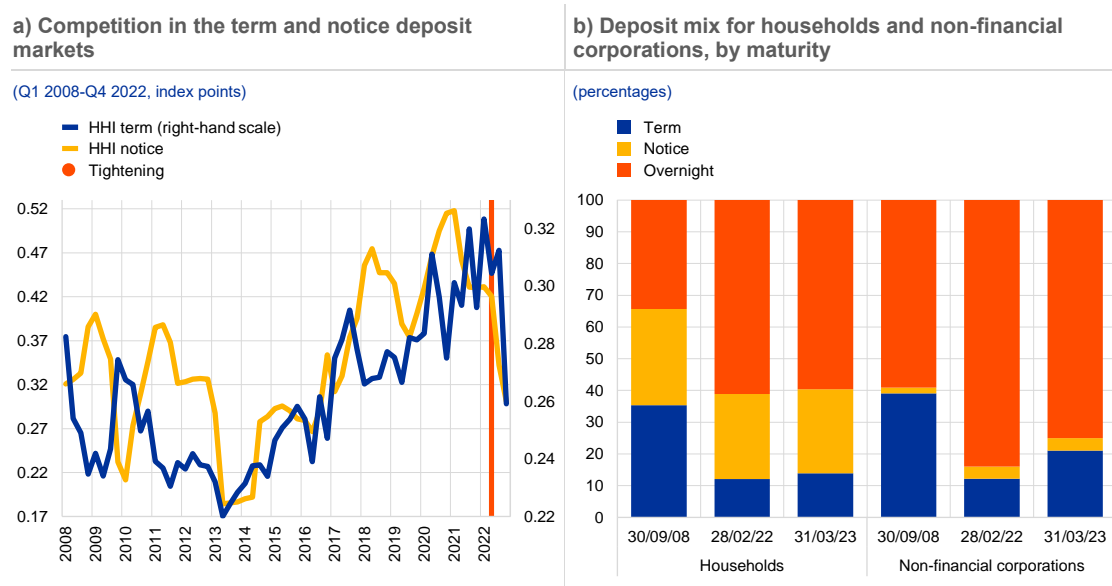
⁴⁷ Findings are based on OLS panel fixed effects estimations. Specifically, deposit rates with different maturities are regressed on the policy rate as well as on bank- and country-specific characteristics, as defined in the notes to Chart A. One caveat to this analysis is the fact that the sample period under consideration includes mainly monetary easing episodes. This means that the results may not be a perfect guide to the behaviour of deposit rates going forward.

⁴⁸ The point estimates for deposit betas are in line with the literature. See, for instance, De Graeve, F., De Jonghe, O. and Vander Vennet, R., "Competition, transmission, and bank pricing policies: Evidence from Belgian loan and deposit markets", *Journal of Banking & Finance*, Vol. 31, Issue 1, 2007, pp. 259-278; Gropp, R., Kok, C. and Lichtenberger, J.D., "The dynamics of bank spreads and financial structure", *The Quarterly Journal of Finance*, Vol. 4, No 4, 2014.

⁴⁹ Larger (more liquid) banks are those banks at or above the 95th percentile of the total assets (liquid assets to total assets) distribution and are compared with smaller (less liquid) banks, which are those at or below the 5th percentile of the total assets (liquid assets to total assets) distribution.

Chart B

Rising competition in the deposit market may lead to higher deposit betas, further exacerbated by a shift from stickier overnight deposits to rate-sensitive term deposits



Source: ECB and ECB calculations.

Notes: Panel a: the Herfindahl-Hirschman index (HHI) is calculated by squaring the market shares of the term or notice deposits of each bank operating in a country and then aggregating the resulting numbers. A lower HHI indicates stronger competition. Based on a sample of 158 euro area banks. Panel b: outstanding deposit volumes by maturity bucket and reported as a share of total deposits.

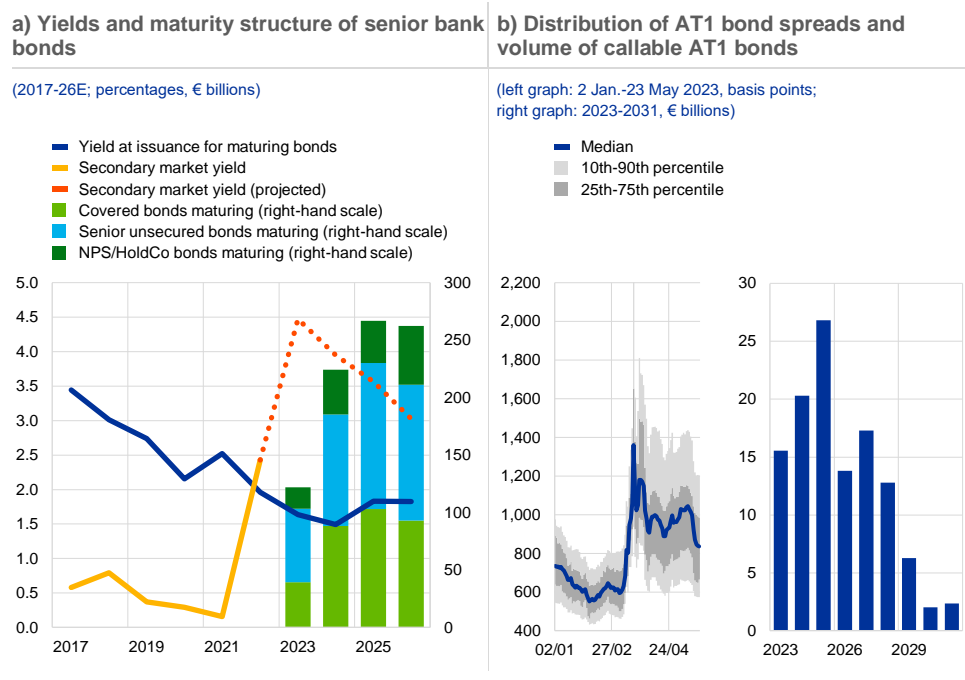
So far euro area banks have managed to contain the increase in deposit costs as the repricing of deposit rates has been limited, allowing them to benefit from higher net interest income. Rising competition and a reallocation of funds from overnight to term deposits might lead to an increase in funding costs that is faster and larger than expected. This could potentially translate into lower profitability for banks, impairing their ability to withstand adverse shocks – and hence their stability – at a time when the provision of credit is being inhibited by a less favourable macroeconomic environment and tighter financing conditions overall.

Rolling over maturing bonds will increase the market funding costs of banks over the next three years. Secondary market yields on bank bonds have risen substantially since the beginning of 2022. By 2026 rolling over senior bank bonds at current yields would nearly double the cost of bond funding (**Chart 3.4**, panel a) and reduce aggregate sector return on equity by around 50 basis points per year. This aggregate picture for the euro area does, however, mask sizeable differences across individual banks, as issuer ratings have a substantial impact on bond yields, in particular for unsecured bonds. Bond issuance volumes have picked up, possibly in anticipation of a further rise in interest rates and gradual TLTRO repayments. Last year bond issuance exceeded the 2015-19 average by 25%, and the first quarter of 2023 saw issuance volumes 36% higher than in the pre-pandemic years. Issuance has been particularly strong for covered bonds which, because they are secured, represent the cheapest form of bond funding but at the same time increase asset encumbrance. The cost of issuing the most junior securities has been highly volatile recently (**Chart 3.4**, panel b, left graph). That said, the impact of these securities on

overall bank profitability is more muted than for senior bonds, even if adverse market conditions persist, as their weight in total funding is low and there is no contractual obligation to redeem these bonds. While about 65% of Additional Tier 1 (AT1) bonds may be called by issuers within the next three years (**Chart 3.4**, panel b, right graph), these bonds are perpetual and banks do not have to exercise the call option if doing so would be uneconomical.

Chart 3.4

About half of euro area banks' senior bonds need to be rolled over at higher costs, and spreads of most junior bonds increased substantially in March



Sources: Dealogic, S&P Dow Jones Indices LLC and/or its affiliates, Bloomberg Finance L.P. and ECB calculations.
Notes: Panel a: issuance and secondary market yields of senior bonds are calculated as the average yields weighted by the nominal amounts of covered, senior unsecured and NPS/HoldCo bonds. NPS/HoldCo stands for senior non-preferred securities.

3.2 Profits boosted by higher interest rates, as banking sector faces uneven prospects

Rising interest margins helped boost the profitability of euro area banks in 2022, particularly in countries with large volumes of variable-rate lending. The aggregate return on equity (ROE) of euro area significant institutions (SIs) rose by 1 percentage point last year to 7.6%.⁵⁰ In contrast with 2021, when a reduction of loan loss provisions was the main factor behind improving profitability, the improvement in 2022 was largely driven by higher core revenues (**Chart 3.5**, panel a). Interest margins surged on the back of the substantial rise in policy interest rates starting in

⁵⁰ This figure differs from the headline ROE reported in the ECB's supervisory banking statistics for at least two reasons. First, in this chapter net income is annualised using trailing four-quarter sums as opposed to the annualised year-to-date net income. Second, ROE is calculated for a balanced sample of 83 euro area significant institutions in contrast to the full (unbalanced) sample of significant institutions covered in the supervisory banking statistics.

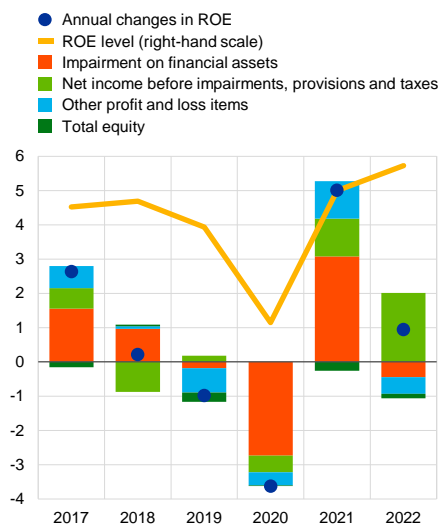
the summer of last year, while banks adjusted their deposit rates slowly. Margin expansion tended to be higher in those countries with a larger share of loans granted at variable interest rates, but other factors also played a role, such as banks' hedging behaviour and the interest rate profile outside the banking book. In addition, lending volumes made a positive contribution to growth in net interest income (NII) in most countries during the first three quarters of last year (Chart 3.5, panel b, right graph). Conversely, NII rose less strongly in countries such as France where fixed-rate lending predominates and banks had already increased deposit rates to a larger extent. Net fee and commission income (NFCI) also increased, although at a slower rate than in 2021, while expenses continued to rise (Chart 3.5, panel b, left graph). First quarter 2023 earnings results for listed banks suggest that despite lower trading income and higher costs, profitability improved further on the back of higher NII.

Chart 3.5

Bank profitability improved further in 2022 on the back of stronger net interest income driven by higher margins, especially in countries with variable interest rates

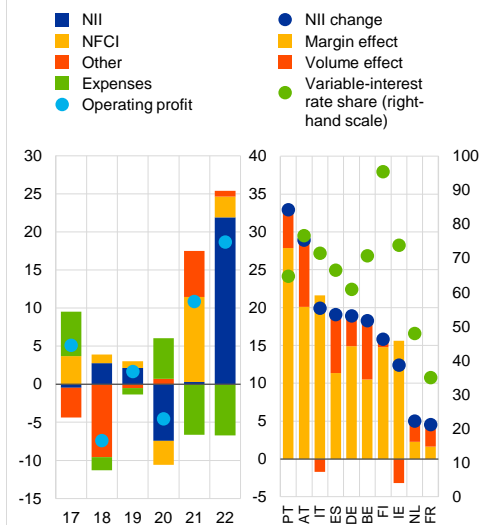
a) ROE of euro area banks and the main drivers of annual changes

(2017-22; percentage points, percentages)



b) Annual changes in operating profits and the main drivers of changes in NII

(left graph: 2017-22, percentage points; right graph: Q4 2022, percentage points, percentages)



Sources: ECB and ECB calculations.

Notes: based on a balanced sample of 83 euro area significant institutions. Panel b: the share of lending at variable rates is based on new business volumes and refers to lending with a variable interest rate and an interest rate fixation period of up to one year. NII stands for net interest income; NFCI stands for net fee and commission income.

Despite the banking sector stress in March of this year and slowing lending dynamics, market analysts expect euro area bank profitability to increase further in 2023.

Market expectations of the future aggregate ROE of listed euro area banks for 2023 have been revised upwards sizeably since the start of this year, with ROE projections increasing from 8.1% to 9.2% between the end of last year and the beginning of March (Chart 3.6, panel a). Most of this improvement was driven by higher expected NII in an environment where interest rate projections were revised to remain higher for longer, more than offsetting the potential impact of tighter credit standards and subdued lending growth. Expectations of lower impairments represent

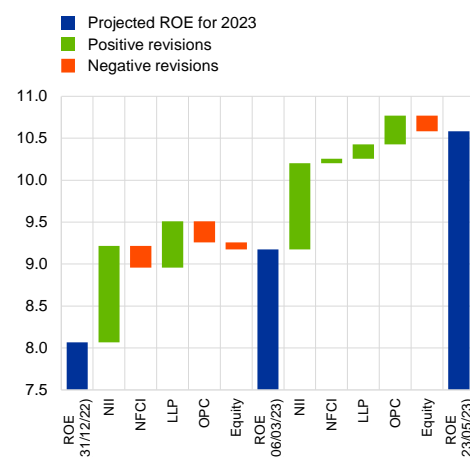
a second important positive factor, reflecting an improvement in the euro area macroeconomic outlook since the start of this year. The compression in banks' market valuations in March and higher bank funding costs did not appear to weigh on bank profitability as ROE expectations increased further to 10.6% at the end of May. The additional upward revisions of ROE expectations since March can be attributed mainly to higher NII, coupled with lower costs, higher NFCI and lower impairments. Bank analysts may well revise their ROE projections down going forward, given considerably tighter bank lending standards, a slump in loan demand and more muted lending dynamics for NFCs in particular as a consequence (Chart 3.6, panel b).

Chart 3.6

ROE projections for 2023 were revised upwards strongly this year, despite tighter credit standards and subdued growth in lending to NFCs in particular

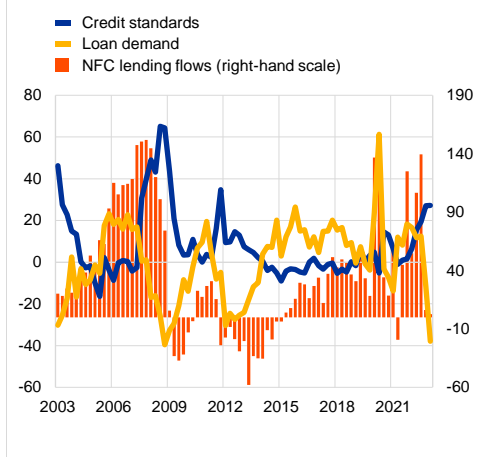
a) Factors driving the revisions in analysts' euro area bank ROE projections for 2023

(percentages, percentage point contributions)



b) Credit standards and demand for NFC loans and NFC lending flows

(Q1 2003-Q1 2023; net percentages, € billions)



Sources: Bloomberg Finance L.P., Refinitiv, ECB and ECB calculations.

Notes: Panel a: based on a balanced sample of 83 euro area significant institutions. ROE stands for return on equity; NII stands for net interest income; NFCI stands for net fee and commission income; OPC stands for operating costs. Panel b: for credit standards, net percentages are defined as the difference between the sum of the percentages of banks responding "tightened considerably" and "tightened somewhat" and the sum of the percentages of banks responding "eased somewhat" and "eased considerably". Net percentages for the questions on demand for loans are defined as the difference between the sum of the percentages of banks responding "increased considerably" and "increased somewhat" and the sum of the percentages of banks responding "decreased somewhat" and "decreased considerably". NFC stands for non-financial corporation.

The strong profitability of euro area banks on aggregate masks substantial heterogeneity across individual banks, with the differences still driven by structural issues.

Rising interest rates have boosted banks' lending margins, thereby lifting profitability to levels not seen in a decade. Taking a closer look at bank profitability patterns across ROE quartiles, however, reveals lingering underlying structural issues. The ROE differential between the best and the worst performing quartiles declined until 2017, but remained persistently close to a level of 12 percentage points thereafter. In addition, a cohort of institutions in the lowest profitability quartile has found it hard to reach sustainable profitability levels (Chart 3.7, panel a). As discussed in previous issues of the Financial Stability Review, legacy asset quality problems and cost inefficiencies appear to be the two

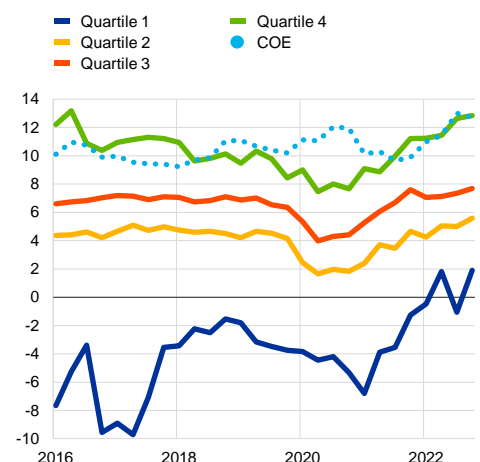
main underlying causes.⁵¹ While the former has been largely addressed since the establishment of the Single Supervisory Mechanism, which is reflected to some extent in improved profitability among the weakest banks, differences in the level of cost efficiency across the profitability spectrum of banks have hardly shifted during this period. While cost efficiency improved for both the best- and the worst-performing banks between 2016 and 2022, the cost/income ratio of the weakest banks is still 22 percentage points higher than for their top-performing peers (Chart 3.7, panel b). Addressing these pockets of weak bank profitability remains key for ensuring a healthy and resilient banking sector that can continue to fulfil its credit intermediation function even in times of economic uncertainty.

Chart 3.7

ROE dispersion across euro area banks highlights lingering cost inefficiencies

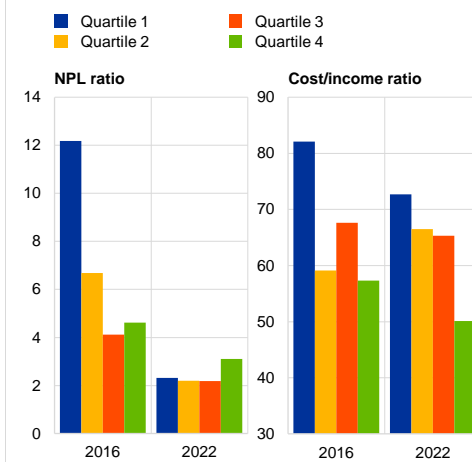
a) Profitability of euro area banks across ROE quartiles

(Q1 2016-Q4 2022; percentages)



b) NPL ratio and cost/income ratio of euro area banks across ROE quartiles

(Q4 2016, Q4 2022; percentages)



Sources: ECB and ECB calculations.

Notes: Based on a balanced sample of 83 euro area significant institutions. Panel a: Altavilla et al.* estimate the cost of equity of euro area banks as an average across ten different models (five implied cost of equity models and five factor models) which are estimated for individual listed euro area banks and then weighted by market capitalisation. COE stands for cost of equity. Panel b: the cost/income ratio is calculated as operating expenses divided by operating income.

*) Altavilla, C., Bochmann, P., De Ryck, J., Dumitru, A., Grodzicki, M., Kick, H., Melo Fernandes, C., Mosthaf, J., O'Donnell, C. and Palligkinis, S., "Measuring the cost of equity of euro area banks", *Occasional Paper Series*, No 254, ECB, 2021.

3.3 Declining yet robust solvency, and rising cyber risks

The capital ratios of euro area banks declined in 2022, reflecting stronger lending and higher average riskiness of total assets.

The aggregate Common Equity Tier 1 (CET1) ratio of euro area banks declined by around 40 basis points last year to 15%. This was mainly due to risk-weighted asset (RWA) growth, driven mostly by rising average risk weights but also, to a lesser extent, by growing total assets. The increase in RWAs stemmed mainly from robust lending growth to non-financial corporations which continued until the third quarter. In addition, the positive

⁵¹ See the special feature entitled "Euro area bank profitability: where can consolidation help?", *Financial Stability Review*, ECB, November 2019.

contribution from retained earnings, related to one-off effects from banks reclassifying share premiums to retained earnings, was more than offset by other changes in equity and higher payouts to shareholders (Chart 3.8, panel a). The decline in capital ratios is also reflected in banks' shrinking, albeit robust, distance to their maximum distributable amount (MDA) threshold over the course of last year (Chart 3.8, panel b, left graph).

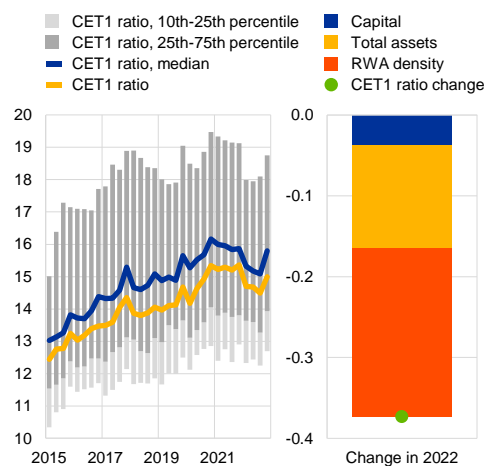
As bank profitability improved, distributions to shareholders increased and are expected to remain high in the coming years. Stronger profitability allowed average dividends and share buybacks to be increased to 1.5% of RWA in 2022 from 0.7% during the pre-pandemic period (Chart 3.8, panel b, right graph). Banking sector stresses in March 2023 have had little impact on future capital distributions. While changes in dividend futures prices since March suggest that payouts for 2024 are expected to decline by around 15%, payout expectations for this year have only been revised downwards marginally and banks have so far maintained their guidance on future share buybacks.

Chart 3.8

Solvency ratios declined in 2022 due to higher RWAs, and a declining distance to MDA highlights the trade-off between higher buffers and shareholder payouts

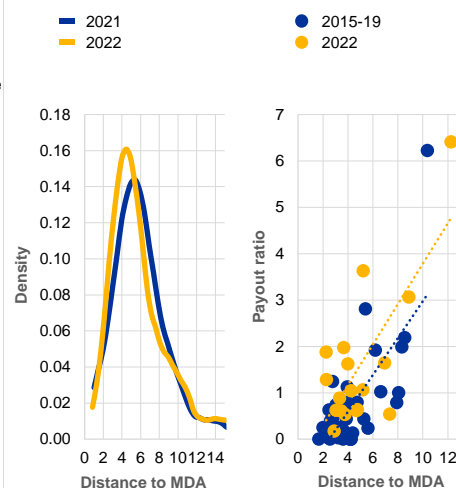
a) Distribution of CET1 ratios and decomposition of annual changes in CET1 ratios

(left graph: Q1 2015-Q4 2022, percentages; right graph: percentage points)



b) Distribution of distance to MDA and shareholder payouts versus distance to MDA

(left graph: percentage points, density; right graph: percentage points, percentages)



Sources: ECB and ECB calculations.

Notes: Based on a balanced sample of 83 euro area significant institutions. Panel b: payouts include dividends and share buybacks. The payout ratio is defined as total payouts divided by risk-weighted assets.

Incidences of cyberattacks increased further last year, above the pandemic peak, reflecting elevated threats to bank operations.

The number of global cyberattacks increased by around 45% in 2022 compared with the previous year and exceeded the peak observed during the pandemic.⁵² Increases in publicly disclosed

⁵² See the special feature entitled "Towards a framework for assessing systemic cyber risk", *Financial Stability Review*, ECB, November 2022.

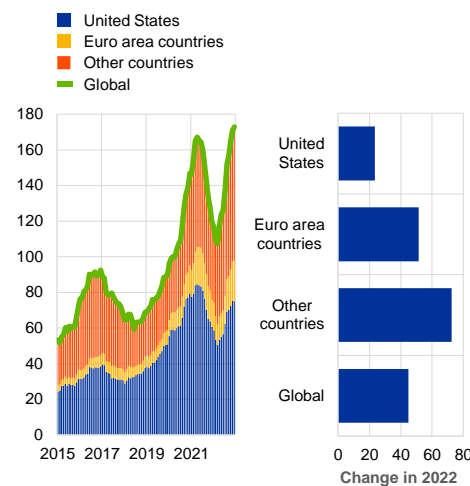
cyberattacks varied greatly across regions, rising by 51% in euro area countries, 23% in the United States and 72% in other countries (Chart 3.9, panel a). The economic sectors targeted most by cyberattacks seem to be changing, with a decline evident in the share of total cyberattacks aimed at pandemic-sensitive sectors like healthcare, education, retail and IT. Conversely, it appears that core economic sectors, such as public administration, science, manufacturing and finance, are being increasingly targeted (Chart 3.9, panel b).

Chart 3.9

Global cyberattacks reached a new peak in 2022, with the focus shifting back towards industry, finance and the public sector

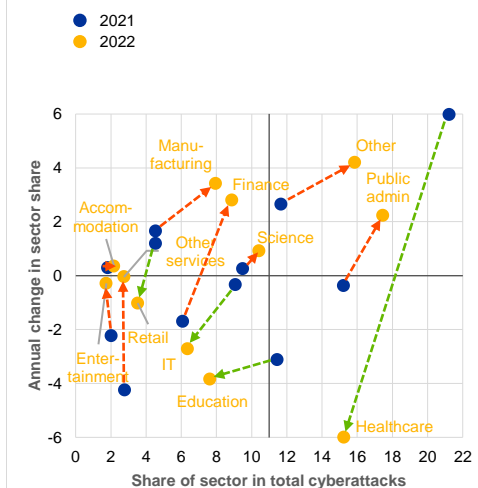
a) Number of publicly disclosed global cyberattacks over time and changes in 2022

(left graph: Jan. 2015-Dec. 2022; total, 12-month moving average; right graph: change between Dec. 2021 and Dec. 2022, percentages)



b) Recent developments in cyberattacks across sectors of economic activity

(percentages)



Sources: University of Maryland CISSM Cyber Events Database and ECB calculations.

3.4 Asset quality concerns rise as economic outlook weakens

On aggregate, non-performing loans (NPLs) were not badly affected by worsening economic conditions in the second half of 2022. Banks' NPL ratios

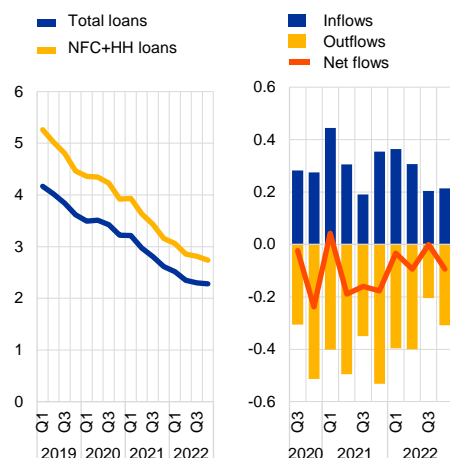
for total loans and for loans to the non-financial private sector declined only marginally in the second half of 2022 (Chart 3.10, panel a, left graph). A decomposition of quarter-on-quarter changes in NPLs shows that the contribution of declines in NPL stocks slowed considerably during 2022 following the significant NPL disposals seen in 2021 (Chart 3.10, panel a, right graph). This suggests that banks' aggregate NPL ratio may be close to reaching its trough, not least given the fact that NPL trends lag economic developments. Default rates on exposures to euro area corporates picked up in the second half of 2022, albeit remaining at low levels (Chart 3.10, panel b). At the same time, aggregate corporate vulnerabilities are expected to increase, although by less than previously expected (Chapter 1).

Chart 3.10

The aggregate NPL ratio declined only marginally in the second half of 2022, while corporate default rates picked up

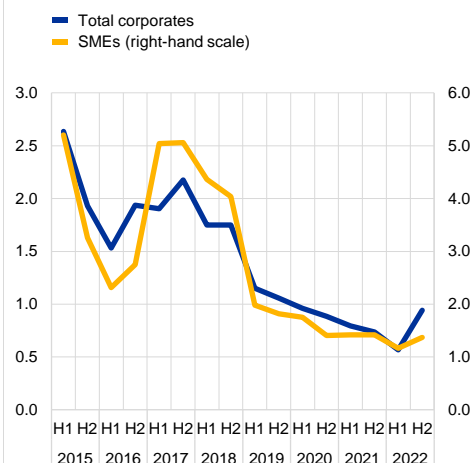
a) NPL ratios for total loans and loans to the non-financial sector, and quarterly NPL flows as a share of loans

(left graph: Q1 2019-Q4 2022, percentages; right graph: Q3 2020-Q4 2022, percentage of loans at end of previous quarter)



b) Default rates on banks' euro area corporate and SME exposures

(H1 2015-H2 2022; annualised half-yearly default rates, percentages)



Sources: ECB and ECB calculations.

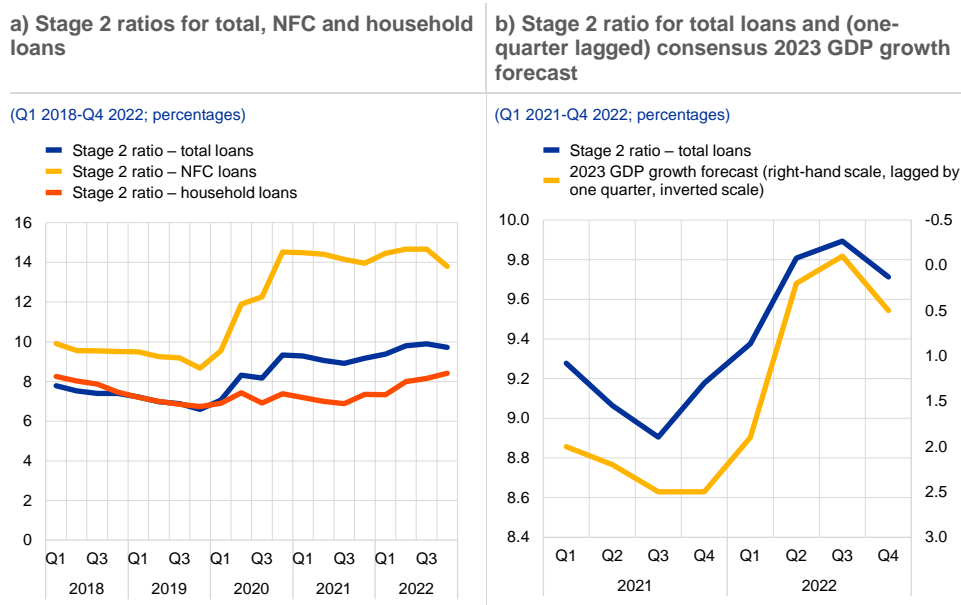
Notes: Panel a: the NPL ratio for total loans excludes cash and central bank balances. NFC stands for non-financial corporations; HH stands for households. Panel b: based on 61 and 56 significant institutions which use the internal-rating based approach for total corporate and SME exposures respectively.

Early warning signs of asset quality deterioration have become more pronounced as there has been some evidence of an increase in Stage 2 loans.

Stage 2 ratios for both loans to NFCs and loans to households increased in the first half of 2022 amid a worsening economic outlook. In the second half of the year, by contrast, they diverged, with the Stage 2 ratio dropping slightly for NFC loans and continuing to edge up for household loans (Chart 3.11, panel a). However, the recent improvement in the aggregate NFC Stage 2 ratio masks considerable heterogeneity at the country level, as the number of countries recording increases and declines in Stage 2 ratios for NFC loans in 2022 was roughly equal. Taking into account the reporting lag, the Stage 2 ratio for total loans appears to have moved in tandem with consensus GDP growth forecasts for 2023 (Chart 3.11, panel b), although changes in the Stage 2 ratio were relatively small, considering the weakening growth outlook. This suggests that a renewed deterioration in the growth outlook could lead to (further) increases in Stage 2 loans and higher provisioning needs.

Chart 3.11

Stage 2 ratios for household loans gradually rose further in the second half of 2022, but declined slightly for NFC and total loans



Sources: Bloomberg Finance L.P. and ECB.
 Note: Stage 2 ratios are based on data for 102 IFRS-reporting significant institutions.

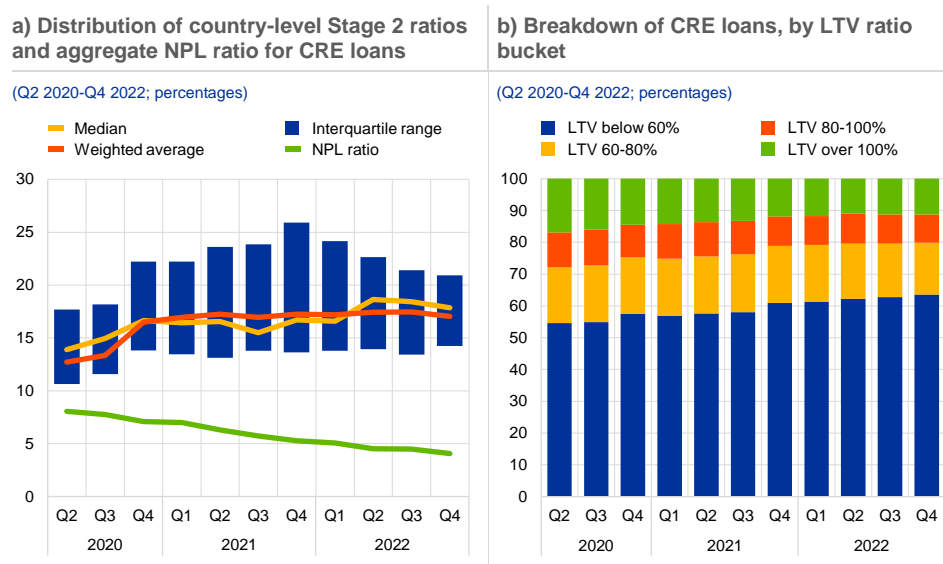
Within the corporate sector, there are emerging concerns about the outlook for commercial real estate (CRE) loans. Despite worries about an ongoing downturn in the commercial property market (Chapter 1), growth for CRE loans accelerated to 7% in 2022, outpacing growth for total loans by around 3 percentage points. CRE loans remain a relatively small part of the loan book, however, accounting for little more than 8% of the total loans granted by significant institutions, although this share varies within a wide range across banks. The majority of this exposure is located in the euro area, while US CRE loans, where vacancy rates are substantially higher (Chapter 1), are limited to around 6% of significant institutions' total CRE loans, or 0.5% of their total loans. Following an increase in the second quarter, the aggregate Stage 2 ratio for CRE loans dropped slightly in the last two quarters of 2022, albeit still remaining well above its pre-pandemic level (Chart 3.12, panel a).

Credit risk stemming from banks' CRE exposures is mitigated by strong collateralisation. The share of CRE loans with higher loan-to-value (LTV) ratios (above 80%) was relatively low on aggregate, at around 20% at the end of 2022 (Chart 3.12, panel b). However, these benign aggregate data hide significant cross-country heterogeneity in terms of both asset quality and collateralisation. Nearly half of all euro area countries saw Stage 2 ratios increase, while NPL ratios also rose slightly in a few countries. Some countries have a share of high-LTV loans in excess of 30%, reaching up to 53% in one case. Overall, banks' CRE loans remain vulnerable to increasing loan losses should the rise in refinancing costs and weaker demand for commercial property lead to further property price corrections (Chapter 1). This is particularly the case for those banks with a larger share of high-

LTV loans or with a higher share of lending exposures related to non-prime properties.

Chart 3.12

The quality of CRE loans remains vulnerable to further property price corrections, although this risk is mitigated by the relatively low share of high-LTV loans



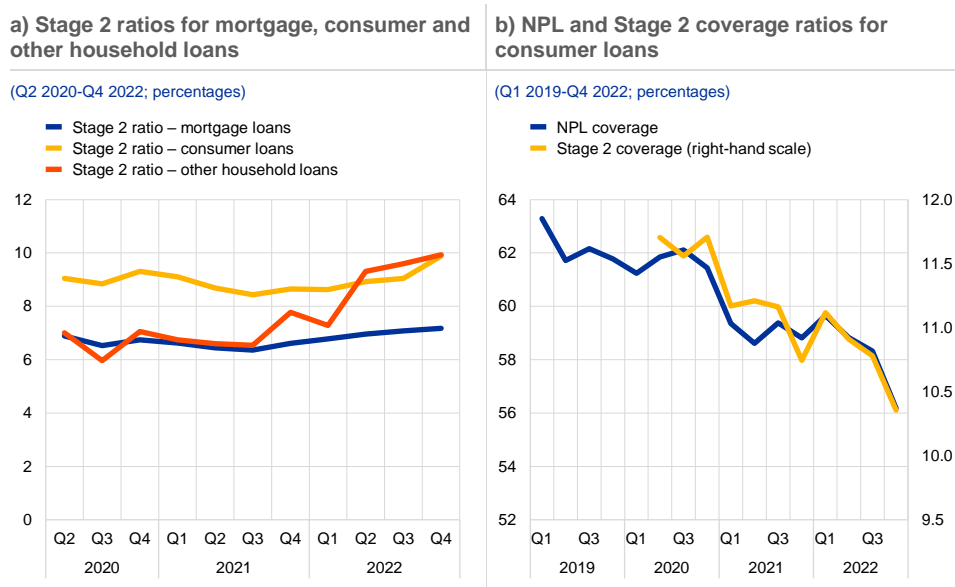
Sources: ECB and ECB calculations.
Notes: Panel a: Stage 2 ratios are based on data for 95 IFRS-reporting significant institutions. Panel b: based on current LTV ratios.

In the household segment, the most material signs of credit quality deterioration in the second half of 2022 were seen in consumer and other (non-mortgage) loans. Consumer loans account for only 6% of significant institutions' total loans on aggregate, but they are typically more vulnerable to economic downturns, partly because of their low collateralisation. Some signs of worsening credit quality could already be observed during 2022. Following a gradual increase in the first three quarters of the year, the share of Stage 2 consumer loans rose more sharply in the fourth quarter amid worsening economic conditions and high inflation.⁵³ Stage 2 ratios for other (non-mortgage) household loans also increased significantly during 2022, whereas the rise in Stage 2 ratios for mortgage loans was more contained (Chart 3.13, panel a). At the same time, banks' provisioning did not keep pace with the increase in underperforming loans, while the NPL provision coverage ratio also continued its downward trend (Chart 3.13, panel b). Banks' consumer credit exposures remain vulnerable to the negative impacts of still elevated inflation and rising interest rates on households' repayment capacity, in particular in lower income quintiles.

⁵³ See the special feature entitled "Household inequality and financial stability risks: exploring the impact of changes in consumer prices and interest rates", *Financial Stability Review*, ECB, November 2022.

Chart 3.13

The rise in the share of underperforming loans in 2022 was most pronounced for consumer and other (non-mortgage) household loans, while both NPL and Stage 2 coverage ratios for consumer loans have continued to decline



Sources: ECB and ECB calculations.
Note: Stage 2 ratios are based on data for 93 IFRS-reporting significant institutions.

Box 5

IFRS 9, accounting discretion and provisioning behaviour around credit events

Prepared by Markus Behn and Cyril Couaillier

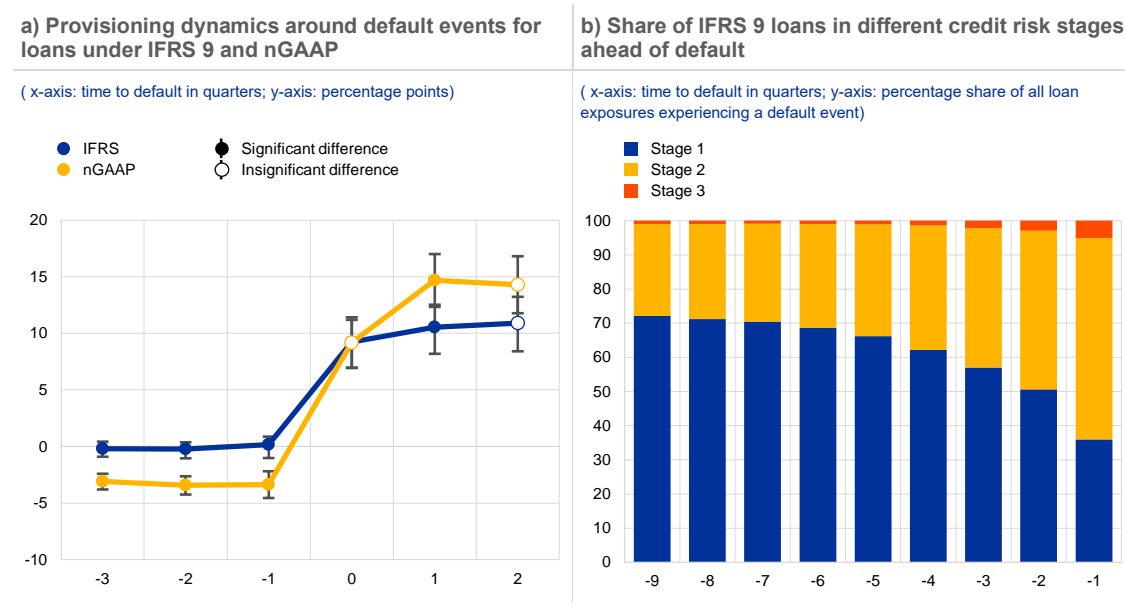
The aim of International Financial Reporting Standard 9 (IFRS 9) is to improve the recognition of banks' credit losses, but its implementation has triggered discussions about potential side effects.⁵⁴ IFRS 9 was adopted in 2018 to introduce a more forward-looking estimation of credit losses and a loan-staging approach that more accurately captures the level of risk. The general goal was to increase transparency and to tackle the “too little, too late” problem of previous accounting principles that were criticised after the global financial crisis.⁵⁵ However, there have been concerns that an undue interpretation of the approach may imply significant increases in provisioning at the onset of a shock (“cliff effects”), where the corresponding erosion of capital may prompt banks to cut lending at the worst moment for the economy (procyclicality). There have also been fears that less well-capitalised banks could exploit the discretion associated with reliance on internal provisioning models to provision less and avoid further reductions in capital, which would conflict with the objective of transparency.

⁵⁴ See, for example, “Financial stability implications of IFRS 9”, European Systemic Risk Board, July 2017, or “The procyclicality of loan loss provisions: a literature review”, Working Paper Series, No 39, Basel Committee on Banking Supervision, Bank for International Settlements, 2021.

⁵⁵ Loans are sorted into stages, where Stage 1 comprises performing loans, Stage 2 underperforming loans that have seen a significant increase in credit risk and Stage 3 credit-impaired loans (see, for example, “Snapshot: Financial Instruments: Expected Credit Losses”, IASB, 2013).

Chart A

Provisioning dynamics around credit events for IFRS 9 loans remain similar to those of nGAAP loans, as many IFRS 9 loans are still in Stage 1 shortly before or even at the time of default



Sources: ECB and ECB calculations.

Notes: Panel a: provisioning rates at the bank-firm level are defined as impairments over carrying amount plus impairments. The sample includes all bank-firm pairs reporting a default and without missing values in the interval of [-3; +2] quarters around default. Dots refer to regression coefficients for interaction terms between dummy variables indicating the time to default (in quarters) and the accounting approach (IFRS 9 or nGAAP). Coefficient estimates indicate the difference in provisioning rate relative to the comparison group, comprising all observations outside the indicated timeframe (i.e. observation more than three quarters before or more than two quarters after the default event for the respective bank-firm pair). The regression also includes a broad set of control variables at the bank and loan level (including for support measures implemented during the pandemic) as well as firm-quarter fixed effects that systemically control for any differences in borrower riskiness. Solid (light) dots indicate whether the Wald test for difference of the coefficients is (in)significant at the 10% level. Negative coefficient estimates mean that provisions in the corresponding quarter are on average lower than in the reference group, comprising observations before and after the default but outside the interval shown of [-3; +2] quarters around default. Panel b: The sample is an unbalanced panel with 53,088 bank-firm observations nine quarters before default and 207,201 observations one quarter before default.

This box uses loan-level data from the European credit register (AnaCredit) to analyse provisioning patterns for different types of loan.⁵⁶ Specifically, it compares provisioning dynamics for IFRS 9 loans with those of comparable loans under pre-existing national generally accepted accounting principles (nGAAP) and examines whether IFRS 9 loans from well-capitalised and less well-capitalised banks exhibit divergent dynamics.⁵⁷ It relies on information on loans from 1,721 distinct banks for the period running from the second quarter of 2018 to the second quarter of 2022 and examines provisioning patterns around credit events and the energy price shock in 2022.

Average provisions for a performing IFRS 9 loan are higher than those for a comparable nGAAP loan, while the dynamics of provisioning ratios around credit events are similar under both approaches. While IFRS 9 loans start off with higher ex ante provisions, the bulk of provisioning for the average loan still occurs at or after default, as is the case with nGAAP loans (Chart A, panel a). By contrast, a pronounced cliff effect when IFRS 9 loans are first moved to Stage 2 is not detectable in these aggregate patterns. One reason for this is that the timing of the move to Stage 2 (and the associated increase in provisions) differs across loans and tends to occur

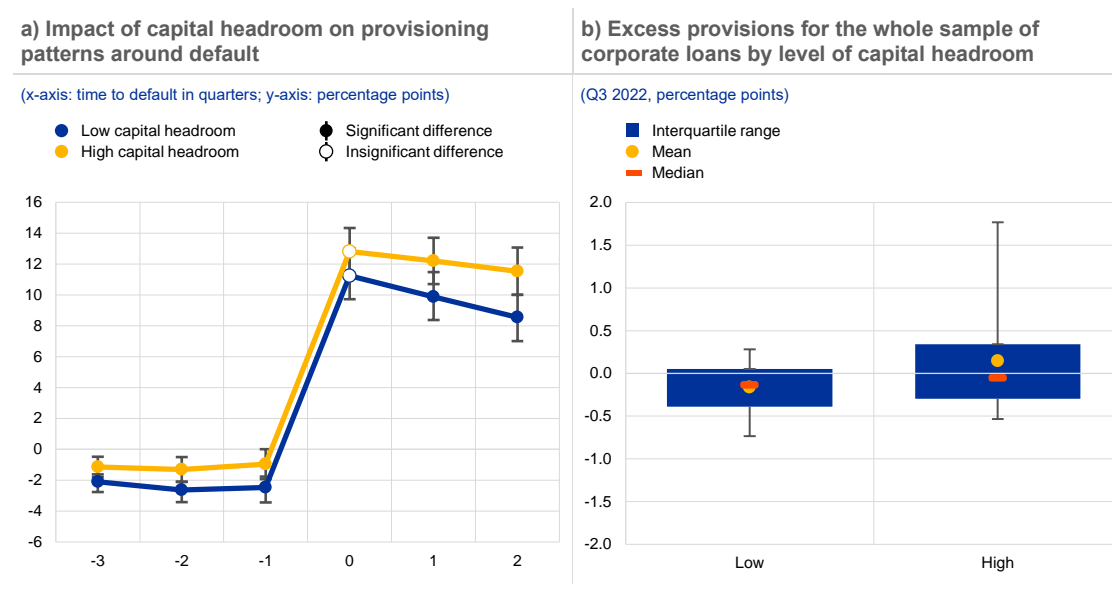
⁵⁶ For further details on the regression analysis, see Behn, M. and Couaillier, C., "Same same but different – credit risk provisioning under IFRS 9", *Working Paper Series*, ECB, forthcoming.

⁵⁷ In the EU, application of IFRS 9 is mandatory for the consolidated financial statements of public companies listed in any Member State. Other companies (e.g. unconsolidated or non-listed entities) may, in several Member States, also resort to nGAAP. Of the 1,721 banks in the sample, 1,318 (including 47 significant institutions) report under nGAAP for at least some of their loans. While nGAAP exposures are particularly prevalent in Austria and Germany, they are also observed in other countries.

late or not at all: around 50% of IFRS 9 loans are still in Stage 1 two quarters ahead of the default and around 35% one quarter ahead (**Chart A**, panel b). Moreover, loans that are already in Stage 2 still exhibit a sizeable jump in provisioning at default, albeit one that is smaller than for the loans that are still in Stage 1. Overall, this suggests that IFRS 9 has not fundamentally changed provisioning patterns.⁵⁸

Chart B

Banks with less capital headroom tend to provision substantially less than other banks, both around default events and for the whole sample of loans



Sources: ECB and ECB calculations.

Notes: Panel a: variables, sample composition and estimation approach are the same as in Chart A. Dots refer to regression coefficients for interaction terms between dummy variables indicating the time to default (in quarters) and a dummy variable that indicates whether the bank's capital headroom is above or below the sample median. Solid (light) dots indicate whether the Wald test for difference of the coefficients is (in)significant at the 10% level. Panel b: to calculate excess provisions, bank-firm provisioning rates are first demeaned at the firm level. The demeaned ratios are then averaged at the bank level, weighted by the sum of carrying amount and impairment amount. Values are winsorised at 2.5% and 97.5%. Diamonds report the mean across banks in a given bucket.

Provisioning patterns for IFRS 9 loans around default events depend on banks' capital headroom, which is consistent with accounting discretion having a strong impact.

Better-capitalised banks posted considerably higher provisions than less well-capitalised banks for loans to the same firm in the same period under IFRS 9, particularly after a default event (**Chart B**, panel a). This is consistent with capital management considerations which see banks "provision as much as they can afford", possibly facilitated by a reliance on banks' internal models for provisioning under IFRS 9.⁵⁹ Estimates suggest that this behaviour could have a material impact on provisioning rates at the bank level, with less well-capitalised banks showing, on average, significantly lower provisioning rates (**Chart B**, panel b).

⁵⁸ These results are confirmed by robustness analyses which control for the possibility that banks using IFRS 9 or nGAAP differ in any other characteristics that drive their provisioning behaviours via: (i) constructing a set of comparable IFRS 9 and nGAAP banks using propensity score matching and (ii) restricting the sample to banks that have at least 20% of their loans in each accounting framework (which is possible if some unconsolidated entities of the bank use IFRS 9 and others nGAAP).

⁵⁹ Capital headroom also affects provisioning rates for nGAAP loans, indicating that there is accounting discretion under both approaches, although the effects tend to be stronger under IFRS 9.

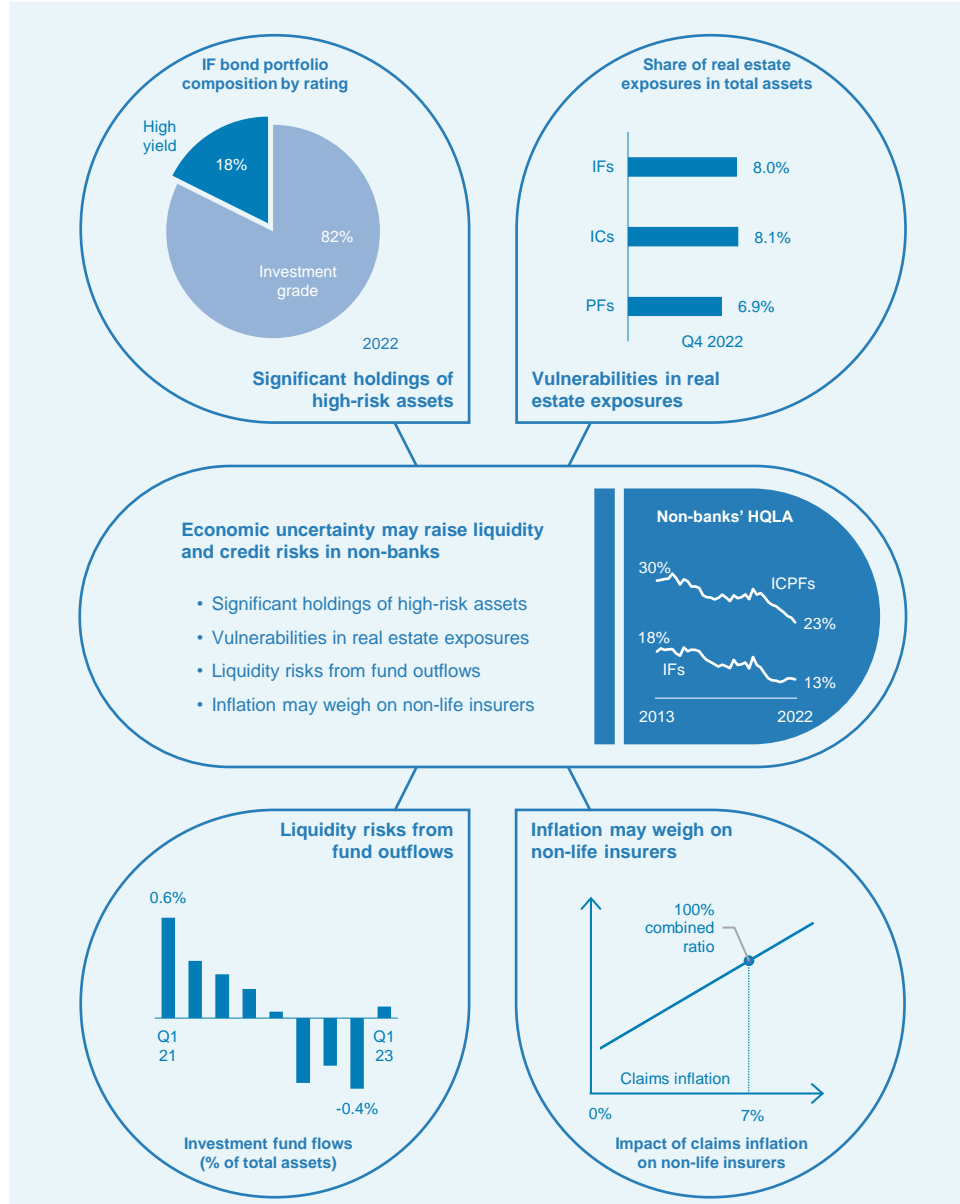
Provisioning dynamics around the energy price shock in 2022 were a function of accounting standards, but also of capital headroom.⁶⁰ While the dynamics around the shock are similar for the average loan under different standards, provisions for IFRS 9 loans were more risk sensitive, rising faster for firms that were more exposed to the energy price shock, in line with the intended functioning of the new framework. However, while banks with more capital headroom increased their provisioning across the board, those with less excess capital followed a more targeted approach, focusing on firms that were more exposed to the shock. Thus, accounting discretion and capital management considerations affected not only the overall level of provisioning, but also its distribution across borrowers.

Overall, this box suggests that IFRS 9 has only partly delivered on its objective of fostering transparency and speedier provisioning. Provisions have been higher ahead of credit events and increased more risk-sensitively around the energy price shock. However, the bulk of the adjustment still occurs at default, and IFRS 9 and nGAAP show similar provisioning dynamics around credit events. As such, the objective of encouraging speedier provisioning has not been fully achieved, while concerns about possible cliff effects at the onset of a shock may be overstated. The consequences of IFRS 9 in terms of procyclicality may not be much different from nGAAP.⁶¹ While it is difficult to arrive at firm conclusions on the overall adequacy of current provisions, banks with less capital headroom may be at greater risk of being under-provisioned, possibly also due to the discretion offered by IFRS 9. This may conflict with the transparency objective of IFRS 9 and warrants close supervisory scrutiny.

⁶⁰ We use this shock rather than the coronavirus (COVID-19) pandemic shock as it allows for an interaction with the firm's risk exposure to the shock (in this case the jump in energy prices), measured as the share of energy in the input used by the NACE-2 sector to which the firm belongs.

⁶¹ Concerns about potential procyclicality could still arise if a lot of exposures are moved simultaneously to Stage 2 soon after a shock occurs. The change in aggregate provisioning ratios does not support such concerns for the sample period Q2 2018-Q2 2022.

4 Non-bank financial sector



4.1 Despite de-risking, the NBFIs sector remains vulnerable amid macroeconomic uncertainty and volatile markets

Non-bank financial institutions have continued to reduce credit risk while remaining supportive of corporate debt markets. In the context of rising interest rates, the non-bank financial intermediation (NBFIs) sector has further reduced its exposure to lower-rated securities. During 2022 the sector expanded its share of AAA, AA and A-rated securities in bond portfolios, while reducing its share of high-yield assets (**Chart 4.1**, panel a). As a result, exposure to credit risk declined,

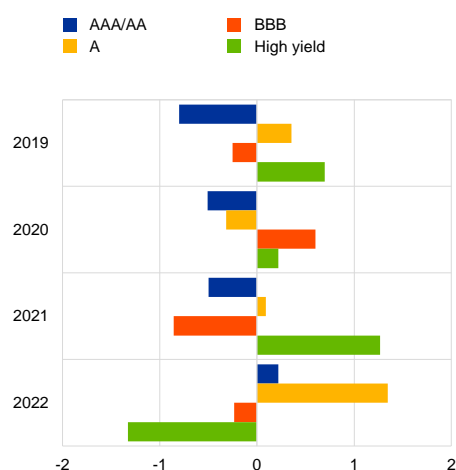
especially in the investment fund sector, reversing the search-for-yield behaviour observed during the low interest rate environment of previous years (Section 4.2). The NBFIs nevertheless remained active in purchasing new debt issued by non-financial corporations (NFCs). It increased both the absolute amount of higher-rated bonds purchased and its share in the total issuance across all categories of credit quality, absorbing more than 50% of newly issued NFC debt in 2022 (Chart 4.1, panel b). This highlights the importance of the sector's role in financing the real economy, even in a challenging market environment where NFCs have increasingly turned towards bank financing (Box 6).

Chart 4.1

The NBFIs sector continued to reduce credit risk in its portfolios in 2022 while supporting NFC bond issuance

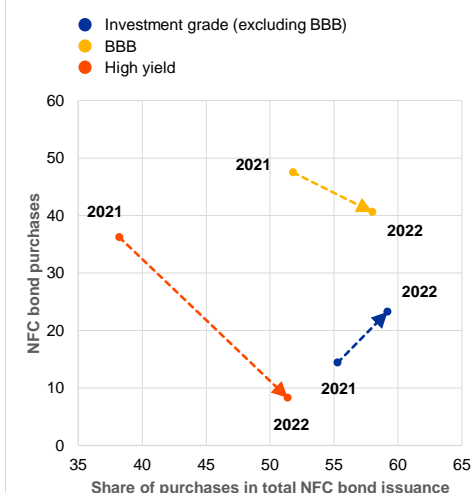
a) Shifts in euro area non-banks' holdings of debt securities, by credit rating

(2019-22; percentage point change on previous year's share of all rated bonds)



b) Euro area non-banks' purchases of new debt securities issued by NFCs

(2021, 2022; percentage of newly issued NFC bonds, € billions)



Sources: ECB and ECB calculations.

Notes: Non-banks include investment funds, insurance corporations and pension funds. Panel a: all issuer sectors are included. Changes in holding composition are calculated as the percentage point change in the share of holdings by rating in total holdings, excluding securities of unrated issuers, and relative to the previous year-end. The worst rating is chosen in the event of multiple ratings. Panel b: newly issued debt securities are defined as all bonds issued by euro area NFCs during the same year. Short-term bonds and purchases by money market funds are excluded. NFC stands for non-financial corporation.

Box 6

Corporate loans versus market-based finance: substitutes or complements?

Prepared by Margherita Giuzio and Francesca Lenoci

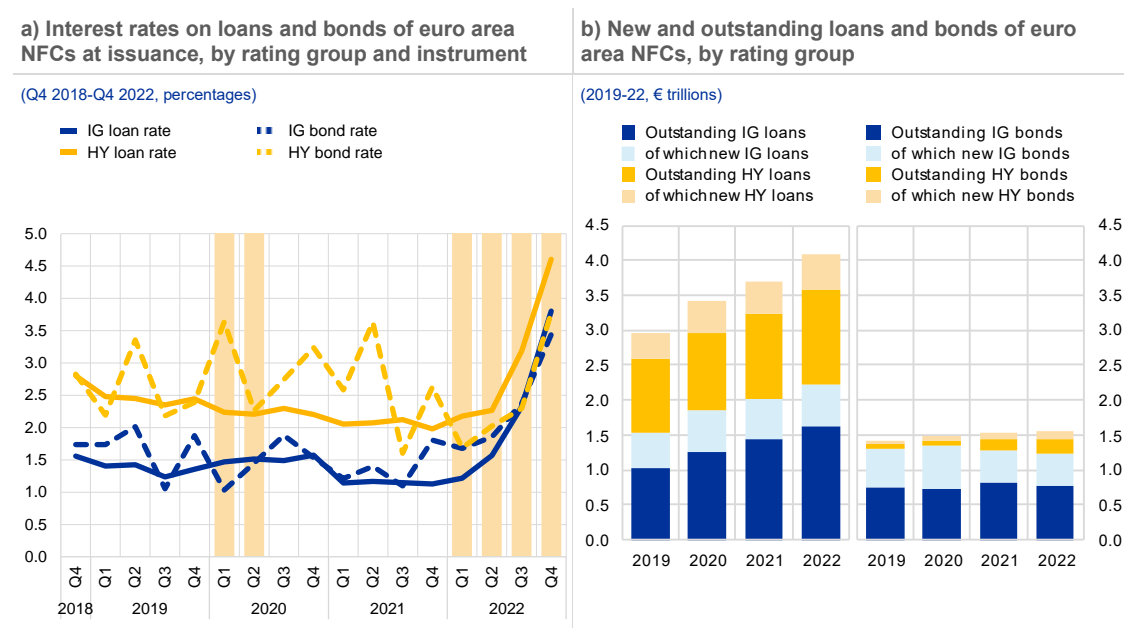
The financing structure of firms has changed markedly over the last few decades as capital markets and non-bank financial intermediaries have evolved.⁶² Bond markets became an important source of credit for firms following the deleveraging of banks after the global financial crisis and the launch of the Eurosystem's asset purchase programme. As of the third quarter of

⁶² For trends in the external sources of funding of euro area firms, see "Non-bank financial intermediation in the euro area: implications for monetary policy transmission and key vulnerabilities", *Occasional Paper Series*, No 270, ECB, 2021, and the article entitled "Firm debt financing structures and the transmission of shocks in the euro area", *Economic Bulletin*, Issue 4, ECB, 2022.

2022, they channelled around 20% of total credit to euro area non-financial corporations (NFCs). This box investigates whether or not banks step in when market-based credit declines in the face of increased market volatility and rising interest rates. While large and better-rated firms would benefit the most from such a substitution, smaller and riskier firms may find it harder to access credit as their ability to tap bond markets is more limited and they are more reliant on bank loans.

Chart A

Financing costs have increased for firms in the last year, with banks offering cheaper financing than bond markets to better-rated firms



Sources: Dealogic, ECB and ECB calculations.

Notes: IG stands for investment grade; HY stands for high yield. Panel a: loan rates are calculated as the average annualised agreed rate on loans granted to borrowers with a non-null LEI, as reported in AnaCredit. Bond rates are calculated as the average coupon rate of bonds with a fixed coupon. The yellow bars correspond to the outbreak of the pandemic (Q1 and Q2 2020), the start of the war in Ukraine (Q1 and Q2 2022) and the periods of monetary policy normalisation (Q3 and Q4 2022). The maturity profile of bonds and loans for the firms in the sample does not show any significant differences for the two categories, as 50% of outstanding bonds (in terms of nominal value) have a maturity of between seven and ten years, and 50% of outstanding loans (in terms of nominal value) have a maturity of between five and ten years. Panel b: new and outstanding loans also include credit lines, revolving credit and overdrafts, as reported in AnaCredit, while new and outstanding bonds also include medium-term notes, money market instruments and commercial paper, as reported in the ECB's Centralised Securities Database (CSDB) and Dealogic. Both panels: to preserve consistency between the two samples and to maximise rating availability, we also applied (average) banks' internal ratings, as reported in AnaCredit, to firms issuing bonds or with outstanding bond financing, even where ratings from credit rating agencies were available.

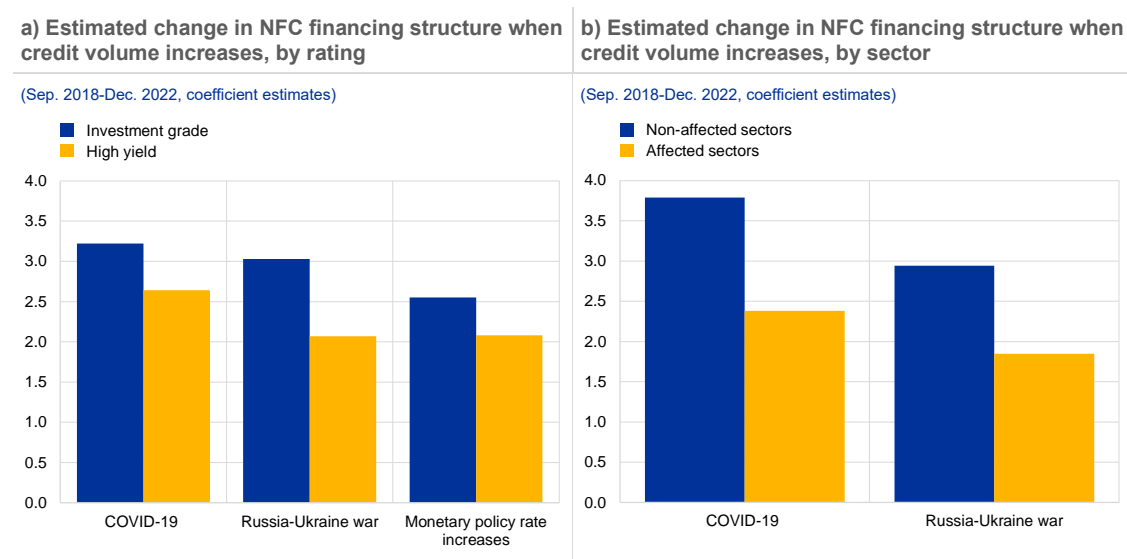
Banks tend to offer lower rates than bond markets to larger and better-rated firms, but interest rates are not the only factor behind firms' financial structure decisions. Interest rates have increased markedly in both loan and bond markets in recent quarters, with bond rates being more volatile, particularly at the outbreak of the pandemic, when Russia invaded Ukraine and during the recent monetary policy normalisation (**Chart A**, panel a). On average, bank loan rates are cheaper than bond rates for better-rated firms in the euro area, while lower-rated firms have recently been able to obtain cheaper credit from the market (**Chart A**, panel a).⁶³ During the recent periods of monetary policy rate increases, lower-rated firms could only replace bond financing with loans at a higher cost (the difference averaging around 0.9 percentage points), as bank loans may have been crowded out by large and better-rated firms. Outstanding corporate debt has risen since

⁶³ See Rajan, R., "Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt", *The Journal of Finance*, Vol. 47, Issue 4, September 1992.

2019, driven by strong bank lending (**Chart A**, panel b).⁶⁴ As loans and bonds are not perfect substitutes, firms' choices of funding sources vary depending on their balance sheet features, the structure of the capital markets in which they are domiciled, and the cost and terms of alternative funding sources.⁶⁵ NFCs issuing bonds are, on average, larger and more leveraged. Also, firms are more likely to tap the market if they have issued bonds in the past and if market supply increases or bank credit is constrained.

Chart B

Many euro area firms replaced bond funding with bank credit during the market turmoil in 2020 and 2022 and during the recent period of monetary policy normalisation



Sources: Dealogic, ECB and authors' calculations.

Notes: The charts show the estimated coefficient obtained using a panel regression model where the change in financing structure over two subsequent months is regressed on the change in bond and loan credit volumes, interacted with the periods of analysis. Firms' financing structure is measured as the share of bank loans in total debt. Panel a: the set of control variables includes firms' size in t-1, firms' profitability in t-1 measured as turnover, the difference in firms' cost of credit in the bond market relative to the loan market, firm-time fixed effects, firms' demand for loans and bonds and country-level fixed effects. COVID-19 refers to March-April 2020, the Russia-Ukraine war to February-June 2022 and monetary policy rate increases to July-December 2022. Panel b: sectors affected by the outbreak of COVID-19 and the related restrictions in euro area countries include mining, manufacturing, retail and wholesale trade, transport, accommodation, food services, and arts and entertainment. The sectors affected by higher energy prices in 2022 are manufacturing and energy.

Many firms replaced bond funding with bank loans at the start of the pandemic and the onset of the Russia-Ukraine war, but overall credit to riskier firms was crowded out. Euro area firms were using bond and loan financing as complementary sources of credit in 2019 when interest rates were expected to stay low for a long period.⁶⁶ In March 2020 the financial conditions in bond markets tightened suddenly as economic uncertainty related to the pandemic increased, while bank lending was supported by government guarantee schemes and loan moratoria. Many NFCs responded by shifting towards bank financing (**Chart B**, panel a).⁶⁷ Bank loans to lower-rated firms increased by 20% while the issuance of high-yield bonds stalled, and better-rated firms borrowed more from banks than lower-rated ones by around 0.6 percentage points. Monetary policy

⁶⁴ The use of short-term credit through credit lines, revolving credit and commercial papers also intensified in 2022, relative to longer-term loans and bonds.

⁶⁵ See Crouzet, N., "Credit Disintermediation and Monetary Policy", *IMF Economic Review*, International Monetary Fund, Vol. 69, No 1, 2021, pp. 1-67.

⁶⁶ At the same time, large firms were substituting loans with bonds between 2014 and 2019. See the box entitled "Market-based finance for corporations – the demand for and supply of credit", *Economic Bulletin*, Issue 4, ECB, 2022.

⁶⁷ This evidence is consistent with De Fiore, F. and Uhlig, H., "Corporate Debt Structure and the Financial Crisis", *Journal of Money, Credit and Banking*, Vol. 47, No 8, 2015, pp. 1571-1598.

actions helped to improve financial market conditions and bond issuance resumed in the second half of 2020.⁶⁸ When Russia invaded Ukraine, firms in those sectors more heavily affected by high energy prices reduced their debt issuance, irrespective of their credit ratings. These firms could not fully replace the reduction in bond financing with an increase in bank loans and borrowed around 1 percentage point less than firms that were less sensitive to energy prices (**Chart B**, panel b).⁶⁹

Firms have replaced bond funding with bank loans during the recent monetary policy normalisation.⁷⁰ The bond rates of investment grade firms have, on average, responded more quickly than bank loan rates to changes in monetary policy. As a result, NFCs have decreased their share of bonds in total debt relative to bank loans, with better-rated firms borrowing 0.5 percentage points more from banks than lower-rated firms (**Chart B**, panel a). However, this has not crowded out bank loans to lower-rated firms, which increased by around 2 percentage points.

Bank lending to riskier and smaller firms with limited access to different sources of credit may be crowded out when larger, better-rated firms replace bond issuance with bank loan financing. The ability of euro area firms to switch between bank loans and market-based finance varies across firms and depends mainly on their creditworthiness and size. This can have significant financial stability implications. Under normal circumstances, better-rated and larger firms benefit the most from a stable supply of loans and bonds and may have incentives to increase their leverage by relying on both sources of financing jointly. In periods of market distress, a reduction in corporate bond credit leads investment grade and large firms to substitute bonds with loans, partially crowding out bank lending to high-yield and smaller firms which do not have access to bond markets.

The NBFIs sector remains vulnerable to price corrections, given macroeconomic uncertainty, volatile markets and a turning real estate cycle.

Despite the recent decline, credit risk in NBFIs sector portfolios continues to be elevated and may rise against a backdrop of prevailing recession risk and high inflation (**Chapter 1**). The sector may therefore face (revaluation) losses from rising risk premia and potential increases in the probability of firm defaults. In the event of sudden liquidity needs, forced asset sales might amplify price pressures, emphasising the importance of sufficient liquidity preparedness across the broader NBFIs sector and appropriate redemption terms for funds investing in relatively illiquid assets (**Chapter 5**). Revaluation losses in the sector could also arise from a downturn in real estate markets (**Chapter 1** and **Box 2**). Real estate investment funds (REIFs) have grown considerably over recent years. At the end of 2022, investment funds, insurance corporations and pension funds held 8.0%, 8.1% and

⁶⁸ Empirical evidence shows some complementarity between NFC loans and bonds in the euro area, when the effects are estimated over a longer time period. See the article entitled "[Firm debt financing structures and the transmission of shocks in the euro area](#)", *Economic Bulletin*, Issue 4, ECB, 2022.

⁶⁹ The results are obtained using firm-level data from AnaCredit, Dealogic and CSDB, controlling for firms' demand for bonds and loans.

⁷⁰ This evidence is consistent with the article entitled "[Substitution between debt security issuance and bank loans: evidence from the SAFE](#)", *Economic Bulletin*, Issue 1, ECB, 2023.

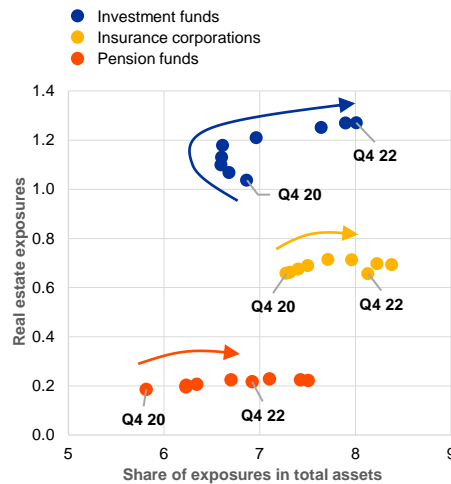
6.9% respectively of their total assets in real estate and REIFs (**Chart 4.2**, panel a, **Sections 4.2** and **4.3**).⁷¹

Chart 4.2

The NBF1 sector remains vulnerable to corrections in real estate and financial markets

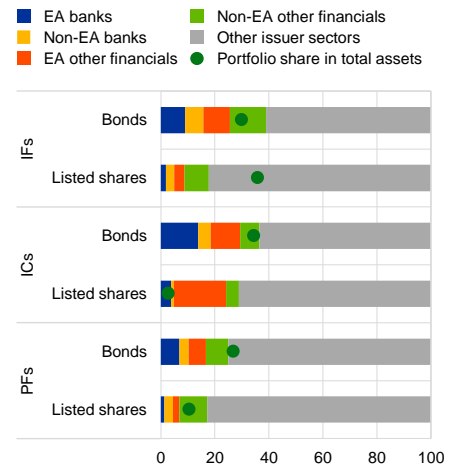
a) Real estate exposures of euro area non-banks

(Q4 2020-Q4 2022; percentages of total assets, € trillions)



b) Financial sector exposures of euro area non-banks

(Q4 2022, percentages)



Sources: EIOPA, ECB and ECB calculations.

Notes: Panel a: real estate exposures are proxied by real estate investment funds' assets for investment funds, and investments in real estate and real estate investment funds for insurance corporations and pension funds. Panel b: data are in market values. Portfolio shares indicate the percentage of total assets invested in bonds or listed shares respectively. EA stands for euro area; IFs stands for investment funds; ICs stands for insurance corporations; PFs stands for pension funds.

Interconnectedness between the NBF1 and banking sectors can also give rise to vulnerabilities and financial contagion risks. Investments in banks and other financial sectors can expose non-banks to spillovers from other financial entities. Given its holdings of bank-issued debt and listed shares, the NBF1 sector is also an important source of funding for banks (**Chart B.3**, panel a) in **Special Feature B** and **Chart 4.2**, panel b). In particular, the investment fund sector holds almost all contingent convertible bonds issued by banks, even though such holdings comprise only 0.2% of total investment fund assets. The various direct and indirect interlinkages between different parts of the financial system can lead to spillovers in liquidity and credit risks, potentially serving to amplify asset price movements (**Special Feature B**). Pre-emptive measures, in the form of adequate liquidity buffers for instance, can both strengthen the resilience of the NBF1 sector against spillovers and mitigate the risk of further financial contagion.

⁷¹ For further discussion of property funds, see the article entitled "The growing role of investment funds in euro area real estate markets: risks and policy considerations", *Macprudential Bulletin*, ECB, April 2023.

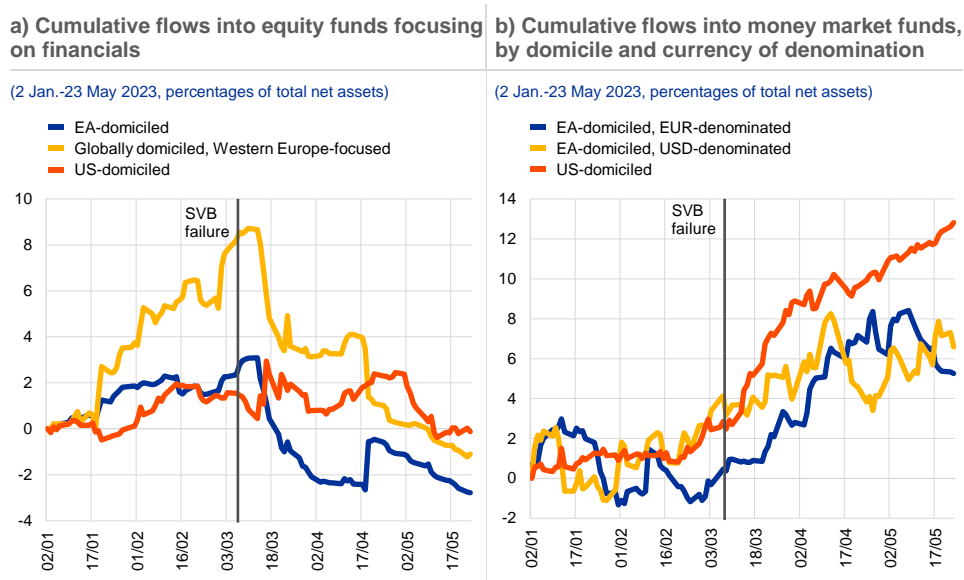
4.2 Investment funds remain vulnerable to liquidity risk in a challenging market environment

Amid recent elevated uncertainty and financial market volatility, investment funds exposed to relatively risky assets have faced significant investor outflows, while inflows into sovereign bond funds have accelerated.

Following the banking sector stress seen in the United States and Switzerland in early March, high-yield funds have experienced significant outflows, while flows into funds focused on investment-grade corporate bonds have remained broadly unaffected. In parallel, inflows into sovereign funds have accelerated, reflecting investor de-risking (**Overview, Chart 3**, panel a). The banking sector stress also caused funds invested in the European financial sector to experience net outflows (**Chart 4.3**, panel a). Significant outflows from such investment funds may trigger sales of securities issued by banks and other financials. This could amplify the negative impact of price pressures on bank funding markets, as the non-bank financial intermediation (NBFi) sector is an important source of funding for euro area banks (**Section 4.1** and **Special Feature B**). In addition, money market funds (MMFs) have experienced net inflows since early March, especially in the United States (**Chart 4.3**, panel b). This may reflect an increase in MMF returns, with investors seeking a safe haven amid elevated macro-financial uncertainty and – in the United States – heightened concerns over uninsured deposits in the banking sector.

Chart 4.3

Banking sector stress in the United States and Switzerland precipitated outflows from equity funds focusing on financials and inflows into money market funds



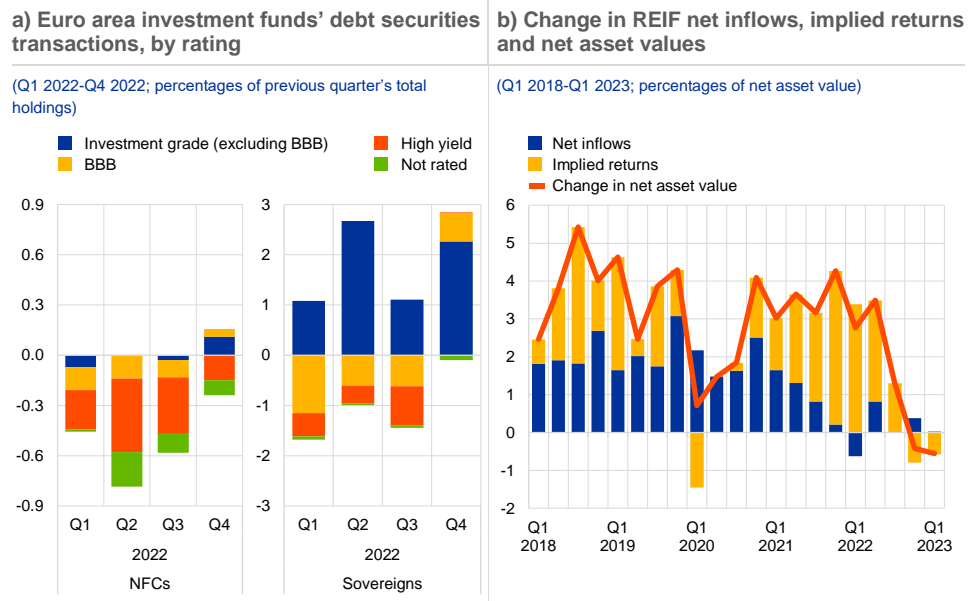
Sources: EPFR Global and ECB calculations.
 Notes: EA stands for euro area; SVB stands for Silicon Valley Bank.

In recent quarters, euro area investment funds have continued to reduce their exposure to credit risk by selling high-yield securities and purchasing investment-grade bonds. Investor shifts towards comparatively safer investment funds led to an increase in funds' overall holdings of sovereign and investment-grade

corporate bonds, as well as sales of lower-rated corporate bonds, in the fourth quarter of 2022 (Chart 4.4, panel a). This has contributed to a reduction of investment funds' exposure to credit risk. Should such de-risking continue, however, it could put pressure on high-yield bonds and make issuance more challenging.

Chart 4.4

Investment funds continue to de-risk, while real estate funds' net asset values and returns decline



Sources: ECB and ECB calculations.

Notes: Panel a: unrated holdings are excluded. NFCs stands for non-financial corporations. Panel b: implied returns are calculated as the difference between the change in net asset value and net inflows into real estate investment funds (REIFs).

Property funds face particular challenges in the current environment. Falling values of commercial real estate assets caused the total assets of real estate investment funds (REIFs) to decline in the fourth quarter of 2022 – for the first time since the global financial crisis (Chart 4.4, panel b). Moreover, net inflows into REIFs have been falling since the fourth quarter of 2020, with implied returns decreasing over the past two quarters. In this context, REIFs could face larger outflows in the future. Rising liquidity pressures could potentially lead to forced asset sales and amplify corrections in real estate markets (Section 4.3 and Box 2), particularly in countries where REIFs have a large market footprint.⁷²

Despite the recent de-risking, liquidity and credit risks in investment funds could materialise should macroeconomic conditions deteriorate and market volatility increase. The share of high-quality liquid assets held by the euro area investment fund sector remained broadly stable in 2022, but – at 13% of total holdings – remains well below the average of 17% observed between 2014 and 2020 (Overview, Chart 3, panel b). Cash holdings by equity and bond funds remain low, especially in the context of elevated financial market volatility and sizeable

⁷² See also “The growing role of investment funds in euro area real estate markets: risks and policy considerations”, *Macprudential Bulletin*, Issue 20, ECB, April 2023.

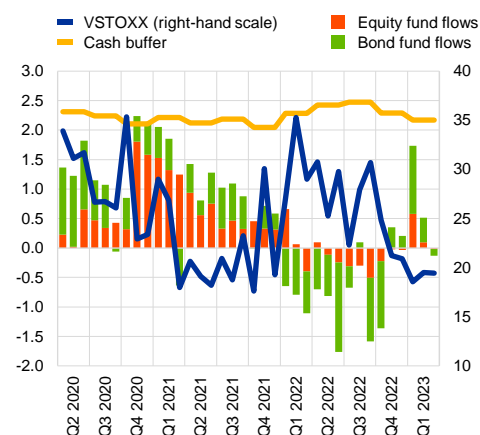
redemptions seen in 2022 (Chart 4.5, panel a).⁷³ In an adverse scenario, relatively small cash buffers could lead investment funds to engage in procyclical selling behaviour, potentially amplifying market corrections.⁷⁴ Credit risk for investment funds also remains elevated, despite declining in the past two years. Since late 2020, the investment fund sector's shares of holdings of high-yield bonds and BBB-rated bonds have declined by 2 and 3 percentage points respectively, while holdings of higher-rated bonds have increased. Nonetheless, the combined share of BBB-rated and high-yield assets among all bond holdings was still close to 50% at the end of 2022 (Chart 4.5, panel b). Thus, in the face of recession risks and tightening financial conditions, investment funds could suffer losses associated with credit risk and asset price revaluations, especially in lower-rated segments. This could cause surges in outflows and forced asset sales. For investment funds using derivatives for hedging purposes, these effects may be amplified by asset sales to meet margin calls (Box 7). In the light of these risks, and given the relevance of investment funds as a source of funding to non-financial corporations and the banking sector, there is a need to strengthen the resilience of the sector and tackle issues related to structural liquidity mismatch (Chapter 5).

Chart 4.5

Investment funds remain vulnerable to liquidity and credit risks

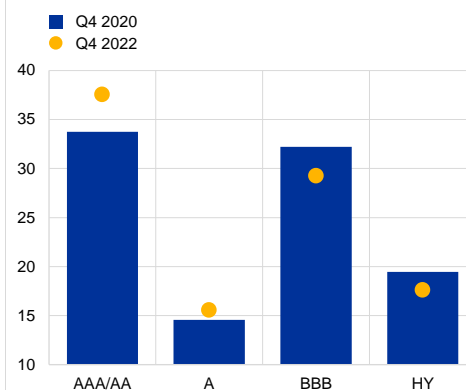
a) Flows into euro area equity and bond funds, and cash buffers

(Apr. 2020-Mar. 2023; percentages of total net assets, index)



b) Share of bond holdings, by rating

(Q4 2020, Q4 2022; percentages of rated bond holdings)



Sources: ECB, EPFR Global and ECB calculations.

Notes: Panel a: VSTOXX and flows are monthly data until March 2023. Cash buffers are at a quarterly frequency, the latest available observation being for March 2023 (Q1 2023). The cash buffer is calculated as the sum of cash holdings of euro area equity and bond funds in these funds' total assets. Panel b: total euro area investment funds' bond holdings as a share of total holdings of rated bonds, by rating category. HY stands for high yield.

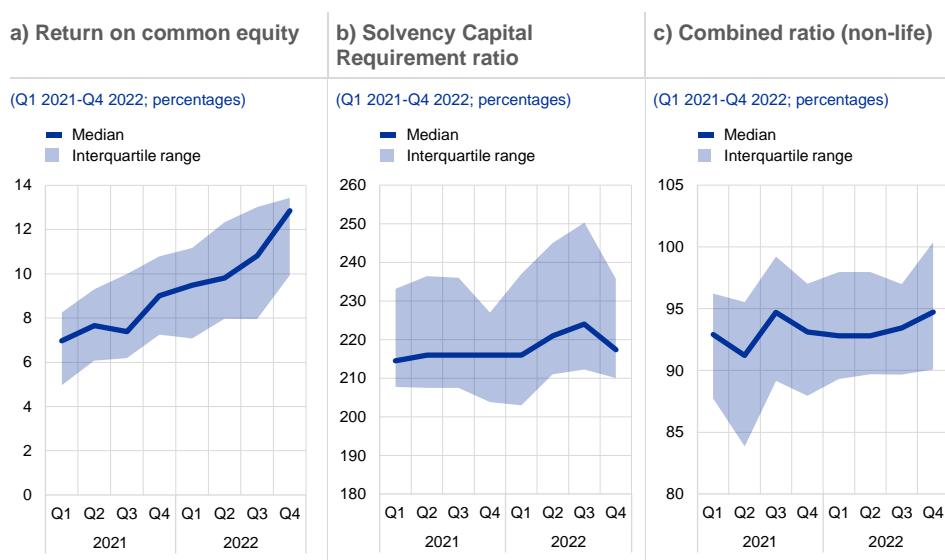
⁷³ Between January 2014 and May 2020, the average cash buffers of bond and equity funds combined was 2.8% of total assets. Within this, bond funds had an average cash buffer of 3.4% while equity funds had an average cash buffer of 2.2% of their total assets. In December 2022, the combined cash buffer for both types of fund was 2.3% of total assets, and 2.8% and 1.9% for bond and equity funds respectively. ECB calculations are based on EPFR Global data.

⁷⁴ See the box entitled "Investment funds' procyclical selling and cash hoarding: a case for strengthening regulation from a macroprudential perspective", *Financial Stability Review*, ECB, May 2021.

4.3 Insurers remain resilient, but rising economic uncertainty could pose challenges

Euro area insurers maintained robust profitability and solvency positions in the second half of 2022. Insurers continued to perform well in the second half of 2022, despite high inflation. Aggregate profitability – as measured by return on equity – increased rapidly (Chart 4.6, panel a), supported by strong underwriting results. Solvency Capital Requirement ratios fell marginally in the final quarter of 2022, but remain strong at over 200% on average (Chart 4.6, panel b), thanks mainly to the net positive effects of rising interest rates on life insurers’ balance sheets. At the same time, rising dispersion in the combined ratio (i.e. claim-related losses and expenses divided by premiums earned) in the second half of 2022 may point to reduced underwriting profitability for some non-life insurers (Chart 4.6, panel c).

Chart 4.6
Insurers’ profitability and solvency remain generally strong



Sources: Bloomberg Financial L.P. and ECB calculations.
Notes: Data are based on a sample of large euro area insurers offering life and non-life products. The combined ratio is a common measure of non-life insurance profitability and is calculated as claim-related losses plus expenses divided by net premiums earned.

Life and non-life insurers face different challenges stemming from rising uncertainty and inflation. Following the banking sector stress in the United States and Switzerland in mid-March, insurers’ stock prices declined sharply, driven by broader market sentiment. This is despite insurers’ limited exposures to bank bonds and equity relative to their total assets (Section 4.1, Chart 4.2, panel b). Insurers’ equity prices have largely recovered since then, except in the life insurance sector (Chart 4.7, panel a). In part, this may reflect rising economic uncertainty, as slower growth and high inflation could have negative repercussions in the life sector. Declining real household incomes could reduce future demand for new life policies, while policy lapses could become more widespread.⁷⁵ In addition, early redemptions

⁷⁵ A policy lapse occurs when a policyholder stops paying the policy premium, in which case the benefits and coverage provided under the policy are terminated.

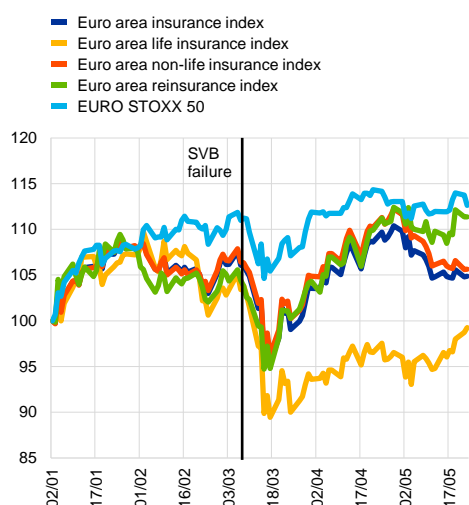
of traditional savings products by policyholders could also weigh on life insurers' profitability. In particular, the potential for early redemptions may increase as interest rates rise, given that policyholders may seek to reinvest in new contracts offering higher returns.

Chart 4.7

Rising uncertainty could have implications for the future profitability of insurers

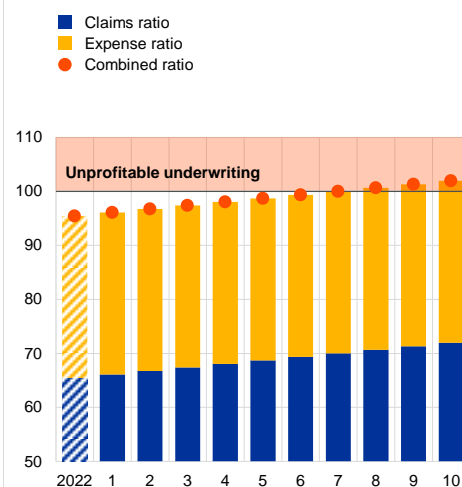
a) Stock price developments of insurers

(2 Jan.-23 May 2023; index: 2 Jan. 2023 = 100)



b) Sensitivity analysis of non-life insurers to rising claims

(H1 2022; percentage growth in claims, percentages)



Sources: Refinitiv, EIOPA and ECB calculations.

Notes: Panel a: the chart shows daily observations. SVB stands for Silicon Valley Bank. Panel b: the chart shows the increase in claims ratios and combined ratios stemming from an increase in claims of 1% to 10%, based on H1 2022 data. The claims ratio is calculated as claims incurred divided by net premiums earned, the expense ratio is calculated as expenses divided by net premiums earned, and the combined ratio is calculated as claims plus expenses divided by net premiums earned.

Non-life insurers are particularly exposed to claims inflation.⁷⁶ As is the case with life insurers, slower economic growth could pose a challenge to non-life (re)insurers through falling demand for new policies and increasing numbers of policy lapses. In addition, non-life insurers are exposed to claims inflation (i.e. increases in the nominal value of claims), which may weigh on their profitability. This is particularly the case where they face difficulties in raising prices to keep pace with inflation. A significant rise in the nominal value of claims would increase non-life insurers' claims ratios (i.e. the ratio of claims incurred to premiums earned) which could, in turn, push their combined ratios (i.e. claim-related losses and expenses divided by premiums earned) above the threshold required for profitable underwriting (Chart 4.7, panel b).

The resilience of insurers and pension funds may benefit from rising interest rates in the medium term. Gradually rising interest rates generally have a positive impact on the capital positions of life insurers. This effect tends to be more material for insurers with larger negative duration gaps and with an elevated share of traditional life policies in their back-books. This is because insurers can invest the

⁷⁶ Claims inflation refers to the increase in the cost of claims payments, which may be higher than the increase in the consumer price index which often serves as a base for indexed contracts.

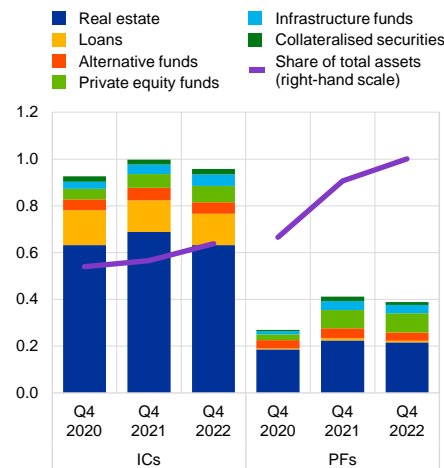
premiums earned on these policies at a higher return than was previously the case. Given that the guaranteed returns to policyholders remain unchanged, such rising returns may result in a net gain for the insurer. By contrast, rising returns on investments through unit-linked investment policies benefit solely policyholders and not the insurer.⁷⁷ A gradual increase in yields may also lead to greater demand for higher-quality bonds from insurance corporations and pension funds (ICPFs), as seen in recent quarters (Section 4.1). This may help to lower credit risk for ICPFs and alleviate concerns regarding the absorption of future issuances of sovereign bonds (Box 3), although it could contribute to funding challenges for higher-yielding non-financial corporations going forward (Chapter 2). At the same time, rising interest rates may result in valuation losses on portfolio holdings. Moreover, a sharp increase in yields, or a spike in financial market volatility, could expose ICPFs with interest rate derivative exposures to large margin calls. Recent stress events (such as the March 2020 financial market turmoil and the UK gilt market episode) demonstrate how liquidity pressures faced by ICPFs can propagate stress to other markets. This underscores the importance of strengthening liquidity preparedness to meet margin calls (Section 4.1, Chapter 5 and Box 7).

Chart 4.8

ICPFs could be exposed to losses on real estate holdings

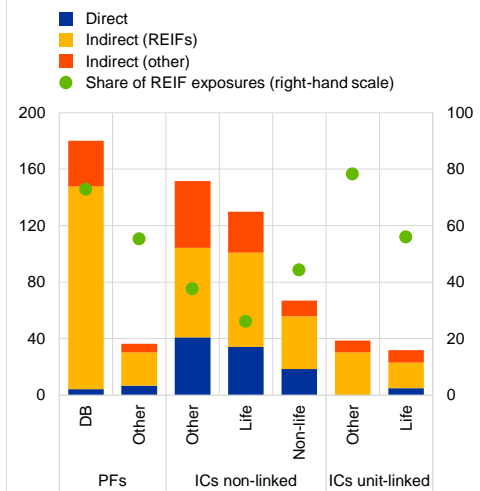
a) ICPF alternative asset holdings

(Q4 2020-Q4 2022; left-hand scale: € trillions, right-hand scale: percentages)



b) ICPF real estate investments, by type

(Q4 2022; left-hand scale: € billions, right-hand scale: percentages)



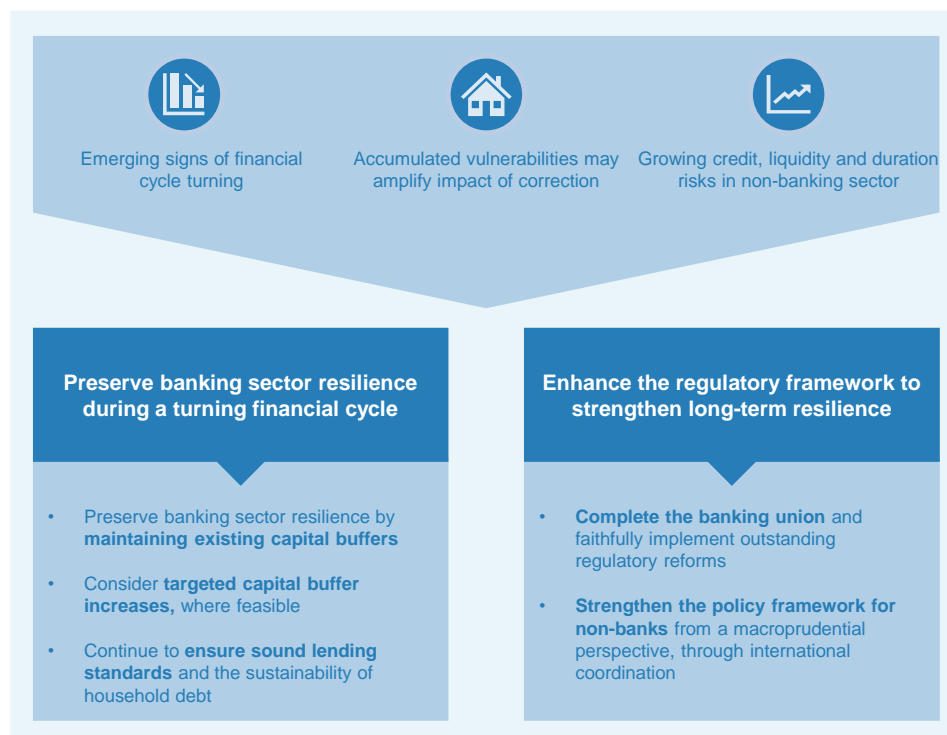
Sources: EIOPA and ECB calculations.

Notes: The charts are based on aggregate asset exposure statistics published by EIOPA. ICs stands for insurance corporations; PFs stands for pension funds. Data on pension funds reflect occupational pension schemes only. Panel a: the "Real estate" category includes exposures to residential and commercial properties (excluding those for own use), mortgages, corporate bonds and the equity of real estate-related corporations and real estate funds. Panel b: direct and indirect exposures to real estate exclude mortgages. For insurers, "Other" includes real estate holdings where the insurer type is unknown, as well as holdings by other insurer types (e.g. reinsurers). For pension funds, "Other" includes holdings by pension funds where the scheme type is unknown, as well as defined contribution schemes. DB stands for defined benefit; REIFs stands for real estate investment funds.

⁷⁷ Unit-linked policies offer both an insurance component and an investment component. Part of the premiums paid by policyholders goes towards life insurance cover, with the remainder pooled and invested (e.g. in equities, bonds or real estate). Unlike traditional insurance products, unit-linked policyholders bear the investment risk (i.e. gains or losses on investment exposure).

ICPFs could be exposed to losses from ongoing corrections in real estate markets or could add to liquidity pressures for real estate investment funds (REIFs). In the low interest rate environment of the past decade that came to an end last year, ICPFs significantly increased their holdings of alternative, less liquid assets, especially real estate (**Chart 4.8**, panel a). While ICPF real estate exposures declined in value in 2022, their share of total assets actually increased on account of the falling valuations of other asset classes (i.e. securities and equities). Nonetheless, commercial real estate (CRE) prices have fallen as financial conditions have tightened (**Chapter 1**) and remain at risk of further correction. ICPFs generally have indirect exposure to real estate, mainly in the form of shares in euro area REIFs and other listed real estate companies (**Chart 4.8**, panel b). Further corrections in CRE markets would increase potential redemption pressures for, and forced sales by, REIFs (**Section 4.2**). Such scenarios would result in losses for investors in REIFs, including ICPFs. Equally, ICPFs could also contribute to growing liquidity pressures faced by REIFs. Further corrections in CRE markets would generally affect ICPF balance sheets, rather than their policyholders and beneficiaries, given that their exposures are mainly via non-unit-linked products or defined benefit pension schemes. This could incentivise ICPFs to rebalance their portfolios away from CRE, including divestment from REIFs. In the context of corrections in real estate markets, interconnectedness within the NBFIs sector, as well as with the banking sector, warrants ongoing monitoring.

5 Macprudential policy issues



5.1 Preserving banking sector resilience during a turning financial cycle

The euro area banking sector demonstrated great resilience during both the pandemic and Russia’s initial invasion of Ukraine, and continued to provide key financial services to the real economy. Euro area banks continue to enjoy comfortable capital and liquidity positions (**Chapter 3**), indicating that they are well placed to withstand adverse shocks.

Macroprudential policy action taken since the pandemic has further increased the financial system’s resilience to adverse shocks. Despite the challenges induced by a highly uncertain geopolitical and economic environment, the authorities have followed up on the lessons learnt from the pandemic and have made more active use of the countercyclical capital buffer (CCyB), including by introducing a positive neutral rate.⁷⁸ Specifically, 12 countries have now activated the CCyB, increasing its weighted average rate in the banking union to 0.56%⁷⁹ in the fourth quarter of 2022 (**Chart 5.1**, panel a). Through these actions, the authorities have

⁷⁸ Five euro area countries have now adopted a framework that foresees a positive neutral rate for the CCyB (Estonia, Ireland, Cyprus, Lithuania and the Netherlands). See the article entitled “[A positive neutral rate for the countercyclical capital buffer – state of play in the banking union](#)”, *Macroprudential Bulletin*, Issue 21, ECB, April 2023.

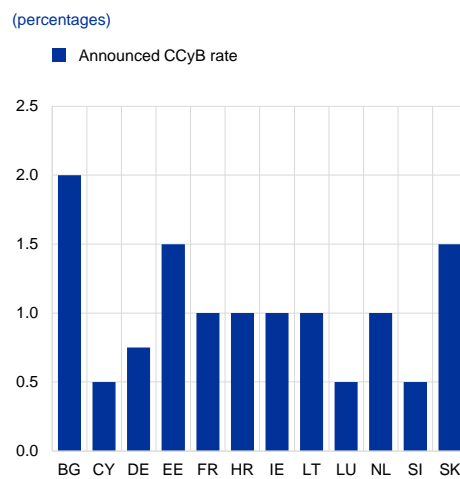
⁷⁹ The weighted average is calculated including the countries in which the CCyB rate is 0%.

addressed existing vulnerabilities and have enhanced their capacity to make capital available by releasing the accumulated buffers when necessary. In this vein, several countries have increased sectoral capital buffers to address vulnerabilities related to residential real estate (RRE). These actions complement the significant RRE-related policy measures taken before the pandemic, which comprised both capital-based measures to enhance bank resilience and borrower-based measures to address flow risks in relation to exuberant real estate dynamics and deteriorating lending standards.⁸⁰

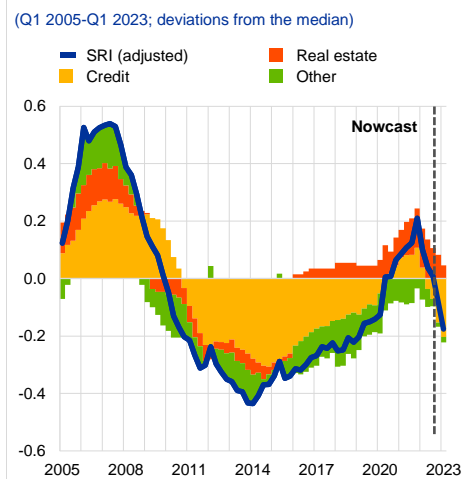
Chart 5.1

Macroprudential policy measures have further increased banking sector resilience, while the financial cycle appears to be turning

a) CCyB rates in participating banking union countries



b) Systemic risk indicator



Sources: Notifications from national authorities, Eurostat, ECB and ECB calculations.

Notes: Panel a: current announced rates for the CCyB, as notified to the ECB by national authorities. The announced rate is already effective in Germany and Luxembourg, while in other countries it will become effective in the course of 2023 (2024 in France), one year after the announcement date. Panel b: the systemic risk indicator (SRI) measures the build-up of vulnerabilities from credit developments, real estate markets, asset prices and external imbalances; it has better early warning properties for financial crises in European countries than the Basel credit-to-GDP gap. The SRI is based on Lang et al.* "Credit" includes the contributions of the two-year change in the bank credit-to-GDP ratio and the two-year growth rate of real total credit; "Real estate" denotes the contribution of the three-year change in the price/income ratio for residential real estate; "Other" includes the contributions of the current account-to-GDP ratio, the three-year change in real equity prices and the two-year change in the debt-service ratio. The latest observations are for Q3 2022. Nowcasts are based on data from the March 2023 ECB staff macroeconomic projections.

*) Lang, J.H., Izzo, C., Fahr, S. and Ruzicka, J., "Anticipating the bust: a new cyclical systemic risk indicator to assess the likelihood and severity of financial crises", *Occasional Paper Series*, No 219, ECB, February 2019.

The current environment, which combines elevated uncertainty with existing vulnerabilities and signs of a turning financial cycle, poses challenges for macroprudential policy. Against a background of low growth, high inflation and rising interest rates, there are already clear signs that the financial cycle is turning.

These are particularly evident for the real estate sectors, where mortgage credit and house price dynamics have decelerated as of late and commercial real estate markets have entered a downturn (**Chapter 1.5**), while broader cyclical indicators such as the systemic risk indicator (SRI) are projected to decline further over the

⁸⁰ To find out more about the complementarity of capital and borrower-based measures, see the article entitled "The transmission and effectiveness of macroprudential policies for residential real estate", *Macroprudential Bulletin*, Issue 19, ECB, 2022. For an overview of currently implemented borrower-based measures, see the [ESRB's website](#).

next few quarters (**Chart 5.1**, panel b). Nevertheless, vulnerabilities arising from high private sector indebtedness and house price overvaluation remain elevated in several banking union countries. Such vulnerabilities may amplify the effects of falling incomes, higher borrowing costs and real estate price corrections. Moreover, although banks and households are resilient overall, the likelihood of risk materialising has increased, as illustrated by the recent banking sector turmoil. In such an environment, it is of the utmost importance for macroprudential authorities to monitor developments closely and adjust their course of action when necessary.

In this context, macroprudential policy should continue to focus on ensuring that the financial system is resilient and that it remains able to withstand adversity while continuing to provide key services to the real economy. While there are some indications that credit supply is tightening on the back of perceived greater risk and higher funding costs, capital requirements are not a constraining factor as banks continue to exhibit sizeable capital headroom. The existing macroprudential capital buffers should therefore be maintained to preserve banking sector resilience, given that the conditions for their release are not yet in place. Moreover, notwithstanding the macroprudential measures that have recently been implemented, targeted increases in capital buffer requirements might still be considered in some countries. In countries with a framework that features a positive neutral rate for the CCyB, for example, building up the buffer towards the target rate would be welcome, provided that procyclical effects are avoided. The risk of the latter occurring continues to be mitigated by the existing capital headroom and a robust profitability outlook in the baseline scenario. At the same time, as downside risks have increased, banks should refrain from increasing payout ratios further and should instead focus on preserving their existing strong resilience. Finally, borrower-based measures under the remit of national authorities should continue to ensure that lending standards are sound and that household debt is sustainable, in a framework where capital-based and borrower-based measures complement each other. Existing borrower-based measures in the banking union are mostly calibrated as structural backstops and often incorporate flexibility in the form of exemptions or less stringent limits for specific types of borrowers, which may be used to guarantee the continued availability of credit while at the same time ensuring that lending standards remain sound. Where not yet in place, borrower-based measures could be introduced as structural backstops to preserve debt sustainability and promote sound lending standards, provided that procyclical effects are avoided.

Further strengthening of the robust and comprehensive EU regulatory framework for banks

The recent turmoil in the US and Swiss banking sectors highlighted the benefits of the broad and consistent application in all jurisdictions of global regulatory reforms introduced after the global financial crisis. The recent banking sector stresses in the United States and Switzerland further underline the importance of adequate capitalisation, appropriate liquidity levels and the transparent accounting of risks on bank balance sheets. To this end, the Basel Committee on Banking Supervision has agreed to take stock of the regulatory and supervisory

implications of recent events, with a view to learning lessons. The Financial Stability Board has agreed to review the lessons learnt from the recent measures taken by the authorities to resolve financial institutions for the operation of the international resolution framework.

Although the bank regulatory framework is robust and widely applied in the EU, the full, faithful and timely implementation of outstanding regulatory reforms will help by strengthening the resilience of the European banking system still further. In the EU, the international standards set by the Basel Committee on Banking Supervision, to the extent that they have already been transposed into EU law, are applied to all EU banks irrespective of size. All EU significant institutions are stress-tested by the ECB at least once a year. Every other year they are stress-tested in cooperation with the European Banking Authority as part of the EU-wide stress test, with additional “thematic” stress tests conducted in the “off years”. Given recent banking tensions, the full, faithful and timely implementation of outstanding Basel III elements will ensure that banks continue to be well-capitalised. It will also foster trust in the EU banking system and provide additional levers for supervisory scrutiny.⁸¹ The EU should strive, consistently with other major jurisdictions, to ensure that the outstanding Basel III standards enter into force by the agreed deadline of January 2025.

The recent surge in global financial stability risks is also a reminder to complete the banking union, and this should be a key priority for legislators in the coming months. Although there are instruments in place to address risks, minimise the likelihood of bank failures and manage such failures when they do occur, the European Commission’s proposal on crisis management and deposit insurance published on 18 April 2023 offers some very welcome ideas for further improving the framework, for example by making it suitable for a broader set of banks.⁸² This could be achieved by introducing a general depositor preference which would rank all deposits equally in the creditor hierarchy, for example, or by improving access to the Single Resolution Fund. The Commission’s proposal should be swiftly advanced by co-legislators so that agreement can be reached within the current institutional cycle. The establishment of the common backstop to the Single Resolution Fund, which will require all EU Member States to ratify the amended European Stability Mechanism Treaty, is another important way to further strengthen the bank resolution framework. In addition, the swift introduction of a European deposit insurance scheme is warranted to enhance depositor confidence and represents a key step towards completing the banking union. Finally, work should continue on liquidity in resolution to address possible liquidity shortfalls for those

⁸¹ In 2022 the ECB published its opinions on the European Commission’s proposed amendments to the [Capital Requirements Directive \(CRD VI\)](#) and the [Capital Requirements Regulation \(CRR III\)](#). The ECB has also published two blog posts (entitled “[Mind the gap, close the gap – the ECB’s view on the banking package reforms](#)” and “[Strong rules, strong banks: let’s stick to our commitments](#)”) on its concerns over proposed deviations from international standards.

⁸² See “[Reform of bank crisis management and deposit insurance framework](#)”, European Commission, 18 April 2023.

banks that, despite being recapitalised, still face a shortage of liquidity after resolution.⁸³

Recent banking sector tensions in Switzerland have turned the spotlight onto the functioning of Additional Tier 1 (AT1) instruments and the design of their contractual triggers. In the context of the acquisition of Credit Suisse by UBS on 19 March 2023⁸⁴, the Swiss authorities also announced the planned write-down of Credit Suisse Group's AT1 instruments, whereby the write-down was to take place before the equity capital of the bank had been completely used up or written down.⁸⁵ In the EU, prudential regulation only requires the terms and conditions of AT1 instruments to include an automatic loss-absorption mechanism that can take the form of either a write-down (permanent or temporary) or a conversion triggered by the CET1 ratio falling below a contractually agreed threshold (which must be at least 5.125%). EU law does not require capital instruments to have permanent contractual write-down clauses that would be automatically activated if a bank were to receive public support.

The EU resolution framework has established a detailed sequence representing the order in which the shareholders and creditors of a troubled bank should bear losses. The EU resolution framework requires a write-down to follow a specific sequence which assumes that common equity instruments will absorb losses first, and only after these have been fully used will AT1 instruments be written down. ECB Banking Supervision, the Single Resolution Board and the European Banking Authority recently reiterated the fact that this sequence has been consistently applied in past cases and will continue to guide the actions of the Single Resolution Board and ECB Banking Supervision in crisis interventions.⁸⁶

5.2 Enhancing resilience in the non-bank financial sector

Persistent structural vulnerabilities and the risk of renewed stress make it vital to enhance the resilience of the non-bank financial sector. Priority should be given to policies which reduce liquidity mismatch in money market and investment funds, tackle risks arising from financial and synthetic leverage across the non-bank financial intermediation (NBFi) sector and enhance liquidity preparedness across a broad range of institutions, especially in relation to margin calls. International policy initiatives are key in this regard, given the pronounced cross-border dimension of NBFi activities, and the Financial Stability Board (FSB) has pursued (or will pursue) policy work in all of these areas.⁸⁷ But as it will take time for regulatory reforms to be

⁸³ For an acknowledgement of this limitation in the current framework, see the Eurogroup [press release](#), 4 December 2018.

⁸⁴ See the [statement](#) by the Swiss Financial Market Authority (FINMA), 19 March 2023.

⁸⁵ FINMA, based on the contractual agreements and the Emergency Ordinance, instructed Credit Suisse to write down the AT1 bonds following the extraordinary public support provided by the Swiss authorities; see FINMA's [statement](#) of 23 March 2023.

⁸⁶ See "[ECB Banking Supervision, SRB and EBA statement on the announcement on 19 March 2023 by Swiss authorities](#)", [press release](#), 20 March 2023.

⁸⁷ See "[Enhancing the Resilience of Non-Bank Financial Intermediation – Progress report](#)", FSB, November 2022.

agreed internationally and implemented, authorities regulating and supervising NBFIs should pay close attention to vulnerabilities in the sector and take an active role in strengthening resilience, within their mandate and existing policy frameworks.

Policy proposals for money market fund (MMF) reforms should be implemented as soon as possible. Following the pandemic-related market turmoil of March 2020, proposals to enhance the resilience of MMFs without unduly curtailing their economic function were developed at both the international and the European level. Such policy proposals focused on removing regulatory threshold effects, strengthening MMF liquidity requirements and improving the availability and usability of liquidity management tools.⁸⁸ In the EU, however, reform of the Money Market Fund Regulation has seen no progress to date but should be pursued as a matter of priority, while ensuring consistency with the international approach.

It is important to strengthen the liquidity management practices of open-ended funds (OEFs). In 2022, the FSB assessed the effectiveness of its 2017 recommendations on liquidity mismatch in OEFs.⁸⁹ The FSB analysis suggested that there has been no measurable reduction in the degree of structural liquidity mismatch since the recommendations were issued. The FSB concluded that while its recommendations remained broadly appropriate, “enhancing clarity and specificity on the intended policy outcomes the FSB Recommendations seek to achieve would make them more effective from a financial stability perspective.” Specifically, the daily creation and redemption of fund shares would remain appropriate for funds that mainly invest in assets that are liquid during normal as well as stressed periods (e.g. certain listed equities or government bonds). For funds invested in assets that are less liquid during normal periods but which could become illiquid under stress, such as corporate bond funds, daily dealings may be appropriate if the asset manager can demonstrate to the authorities that higher standards of liquidity management are being met. However, the asset manager should consider longer notice periods or a lower redemption frequency to reduce liquidity mismatch vulnerability, if the costs of selling assets cannot be passed on to redeeming investors by anti-dilution measures. Finally, it would not be appropriate for open-ended funds holding a significant share of assets (such as real estate) that are illiquid even under normal market conditions to offer daily liquidity to investors. In this regard, national regulators and authorities supervising property funds in the EU have devised a range of policy measures.⁹⁰ For example, in Germany the minimum notice period for property funds is 12 months and the minimum holding period is 24 months,⁹¹ while the Central Bank of Ireland has recently introduced a minimum liquidity time frame of

⁸⁸ At the international level, see “[Policy Proposals to Enhance Money Market Fund Resilience – Final report](#)”, FSB, October 2021. At the European level, see “[Eurosystem contribution to the European Securities and Markets Authority \(ESMA\) consultation on the framework for EU money market funds](#)”, ECB, June 2021, “[Recommendation of the European Systemic Risk Board of 2 December 2021 on reform of money market funds](#)”, ESRB, January 2022, and “[ESMA opinion on the review of the Money Market Fund Regulation](#)”, ESMA, February 2022.

⁸⁹ See “[Assessment of the Effectiveness of the FSB’s 2017 Recommendations on Liquidity Mismatch in Open-Ended Funds](#)”, FSB, December 2022.

⁹⁰ For a more detailed discussion, see the article entitled “[The growing role of investment funds in euro area real estate markets: risks and policy considerations](#)”, *Macprudential Bulletin*, ECB, April 2023.

⁹¹ See report and guidelines on “[Liquidity stress testing in German asset management companies](#)”, BaFin, April 2018.

at least 12 months, consisting of the notice period plus the settlement period.⁹² In Italy, real estate funds are structured as closed-end funds that limit investors' rights to redeem their units.

Price-based liquidity management tools can usefully complement – but not replace – measures that better align asset liquidity with redemption terms.

Enhancing the availability and use of anti-dilution liquidity management tools should form part of the policy response to vulnerabilities in the OEF sector. In particular, OEFs should be able to pass on to redeeming investors the explicit and implicit costs of selling assets under both normal and stressed market conditions. This could be achieved by employing price-based anti-dilution tools, such as swing pricing or anti-dilution levies, which could help mitigate first-mover advantages.⁹³ However, if the swing factors or levies are not appropriately calibrated or capped, they cannot effectively mitigate first-mover incentives.⁹⁴ Price-based liquidity management tools may also be difficult to use in stressed market conditions when liquidity has dried up and price information may be missing or distorted. Therefore, to avoid withdrawals causing liquidity strains during such periods, it is important to ensure that asset liquidity is commensurate with redemption terms.⁹⁵ In particular, as discussed above, longer notice periods might be warranted for funds investing in less liquid assets, and higher liquidity buffers might be needed for funds offering daily redemptions.

Recent stress episodes and the associated liquidity challenges have underlined the need to reduce procyclicality by enhancing margining practices as well as the NBFIs sector's liquidity preparedness to meet margin and collateral calls.

Since the March 2020 market turmoil, the NBFIs sector has repeatedly faced periods of high market volatility and surging liquidity needs arising from margin and collateral calls (**Box 7**). The higher margin calls were intended to protect central counterparties (CCPs) and market participants from heightened counterparty exposure in the face of high price volatility in underlying markets. It is, however, important to reduce procyclical demand for liquidity arising from margining practices by increasing the transparency and predictability of initial margin models and by assessing their responsiveness to market stress.⁹⁶ In addition, these episodes also exposed vulnerabilities arising from inadequate liquidity preparedness to meet margin and collateral calls. Enhancing the NBFIs sector's liquidity preparedness should include ensuring that liquidity risk management and contingency planning frameworks are robust, while the challenges posed by relying

⁹² See "The Central Bank's macroprudential policy framework for Irish property funds", Central Bank of Ireland, November 2022.

⁹³ Such tools aim to impose the cost of redemptions on redeeming investors, thereby preventing the remaining investors from having to bear the cost. This can be achieved, for example, by adjusting the price at which investors buy and sell shares in the fund or by imposing a redemption fee.

⁹⁴ A cap means that the additional levy or NAV adjustment cannot exceed a certain percentage.

⁹⁵ The prudential framework for investment funds in the EU stipulates that the liquidity profile of investments must be in line with the redemption policy for funds under the UCITS Directive. For alternative investment funds asset managers should ensure consistency between a fund's liquidity profile and its redemption policy.

⁹⁶ See BCBS, CPMI, IOSCO, "Review of margining practices", Bank for International Settlements, September 2022. At the European level, ESMA is consulting on central counterparty anti-procyclicality measures (see "Review of RTS No 153/2013 with respect to procyclicality of margin", *Consultation Paper*, ESMA, 27 January 2022).

on the same sources of liquidity as other players during periods of stress should be considered. Given the interplay between leverage and liquidity risk arising from margin and collateral calls, addressing the risks associated with NBF1 sector leverage would help to reduce the risk of inadequate liquidity preparedness. Finally, the policy work carried out on margining should be complemented by strengthening the global risk assessment, for instance, by enhancing information sharing of derivatives data across jurisdictions and tackling data gaps.

Box 7

Non-banks' liquidity preparedness and leverage: insights and policy implications from recent stress events

Prepared by Benjamin Mosk, Charles O'Donnell, Elisa Telesca and Christian Weistroffer

Recent stress episodes have shown how non-bank financial institutions can amplify stress in the wider financial system when faced with sudden increases in margin and collateral calls (Table A). The March 2020 market turmoil, tensions in commodity markets in 2022 and, most recently, stress in the UK government bond (gilt) market in September 2022 revealed non-bank financial intermediation (NBF1) vulnerabilities associated with rapid surges in margin and collateral calls. The resulting spikes in the demand for liquidity and/or deleveraging pushed some NBF1 entities towards disorderly asset sales or large cash withdrawals, from money market funds for instance, with spillovers to other financial institutions or markets. In several cases, extraordinary policy responses by public authorities and central banks helped to stabilise markets and limit contagion. This box examines two of the key vulnerabilities – excessive leverage and inadequate liquidity preparedness to meet margin calls – and discusses policy implications for enhancing the resilience of the NBF1 sector.

Excessive leverage in NBF1 entities and inadequate liquidity preparedness can interact, amplifying margin call dynamics, especially in stressed markets. Irrespective of whether derivatives are used for speculative or hedging purposes, their use exposes derivative counterparties to margin calls.⁹⁷ For example, as at end-March 2023, euro area insurance corporations and pension funds held 33% of the receive-fixed interest rate swap net notional,⁹⁸ making them vulnerable to margin calls in an environment of rising interest rates. Although margin calls offer protection against counterparty risk in derivative transactions, they may amplify liquidity stress in two ways (Table A). First, excessive leverage can create solvency issues, forcing entities to deleverage and abruptly unwind their positions if significant margin calls are accompanied by large mark-to-market losses. Such dynamics affected US hedge funds in March 2020 and UK liability-driven investment (LDI) funds in September 2022.⁹⁹ Second, inadequate liquidity preparedness can force entities to sell assets in a disorderly manner in order to raise liquidity to meet margin calls, even if they do not face immediate solvency issues. This was the case for EU

⁹⁷ Financial leverage implies an on-balance-sheet exposure from the borrowing of funds. Synthetic leverage is usually obtained via derivative exposures and requires daily mark-to-market margining as a result, which exposes entities to liquidity risk in the event of significant adverse price movements.

⁹⁸ The share reflects the notional outstanding for receive-fixed interest rate swaps with a residual maturity of more than ten years. Exposures are netted for each institution at different maturity buckets. Central counterparties and intragroup transactions are excluded. Snapshot from the EMIR database as at 31 March 2023.

⁹⁹ For US hedge funds, see Schrimpf, A., Shin, H.S. and Sushko, V., "Leverage and margin spirals in fixed income markets during the Covid-19 crisis", *BIS Bulletin*, No 2, Bank for International Settlements, April 2020. For LDI funds, see "Letter from the Bank of England to the Chair of the Treasury Committee", Bank of England, 5 October 2022.

pension funds in March 2020 and UK pension funds in September 2022.¹⁰⁰ Both types of vulnerability give rise to adverse feedback dynamics. Forced selling in periods of market stress may depress asset prices further and, in turn, accelerate margin calls and the need to deleverage.¹⁰¹

The episode in the UK gilt market brought the interplay between these vulnerabilities into sharp focus as some institutions struggled to raise funds at short notice. The announcement of the UK Government’s mini-budget in September 2022 triggered a strong initial sell-off in UK gilts. The sudden increase in yields led to large margin calls for UK pension funds on their interest rate derivative positions, which largely needed to be met with cash collateral. However, the main source of stress was related to the outsourcing of their underlying liability-driven investment (LDI) strategies.¹⁰² This related in particular to the use of “pooled” LDI funds by smaller pension funds. These funds had relied heavily on obtaining leverage via the repo market¹⁰³ and were subject to large collateral calls when the value of gilts fell. This led to the need for significant deleveraging, which was further amplified by delays in raising capital from their pension fund trustees.¹⁰⁴ This combination of factors related to leverage and liquidity preparedness among pension funds and LDI funds contributed to large asset sales, which amplified gilt market movements and liquidity stress, leading to further margin calls and threatening the viability of LDI funds.¹⁰⁵ In response to these significant one-sided selling pressures and rising tensions in the gilt market, the Bank of England was prompted to intervene on financial stability grounds by making temporary purchases of long-dated UK government bonds.¹⁰⁶

The stress episode in UK gilt markets is yet another example illustrating the significant challenges authorities face in anticipating where and through which channels NBFIs stress can materialise. The event underlines the challenges in identifying leverage – and liquidity-related vulnerabilities – including, for instance, that leverage can be “hidden” in third-party entities, such as LDI funds, which may be subject to less regulatory and supervisory scrutiny. This can be compounded by the cross-border dimension to NBFIs sector risks – the LDI funds which experienced stress were typically domiciled outside the UK. In addition, given the interplay between leverage

¹⁰⁰ See the box entitled “[Interconnectedness of derivatives markets and money market funds through insurance corporations and pension funds](#)”, *Financial Stability Review*, ECB, November 2020.

¹⁰¹ Liquidity risk can turn into solvency risk if the losses from depressed asset prices are sufficiently large. Independently, margin calls may also reflect the losses on (leveraged) derivative positions. This was the case with Archegos Capital Management in March 2021, which defaulted on its margin calls. While the collapse of Archegos had only a limited impact on the broader financial system, the event highlighted the amplifying effect of leverage and possible contagion channels to banks/primary dealers.

¹⁰² LDI strategies aim to reduce interest rate risk on pension funds’ balance sheets. Such strategies typically involve leverage, which can be obtained through interest rate swaps, repo market activity or indirectly by investing in leveraged third-party entities.

¹⁰³ In the United Kingdom, many smaller pension funds outsourced their LDI strategies to investment funds operating as separate legal entities (i.e. LDI funds).

¹⁰⁴ Raising funds from pension fund trustees can be a difficult process for pooled LDI funds, in part due to the large number of trustees involved across different pension funds. Pooled LDI funds were reported to have been more heavily involved in forced selling. See also “[Risks from leverage: how did a small corner of the pensions industry threaten financial stability?](#)”, speech by Sarah Breeden given at ISDA & AIMA, Bank of England, 7 November 2022.

¹⁰⁵ The risks of a similar amplification occurring in the euro area would appear less pronounced for several reasons. Compared with UK pension funds, for example, Dutch pension funds rely less on leverage, hedge less of their interest rate risk, are more diversified in terms of assets and rely significantly less on the use of LDI funds. See also “[Leverage and liquidity backstops: cues from pension funds and gilt market disruptions](#)”, *BIS Quarterly Review*, Bank for International Settlements, December 2022.

¹⁰⁶ See “[Bank of England announces gilt market operation](#)”, *news release*, Bank of England, 28 September 2022.

and liquidity preparedness, the episode highlights the importance of considering these dimensions together when designing a policy response to tackle systemic risks related to margin calls.

Table A

Excessive leverage and inadequate liquidity preparedness in the NBFi sector have led to several recent episodes where margin calls have threatened to amplify stress in the wider financial system

Overview of stress events

Event	Sector	Type of leverage		Source of margin calls	Vulnerability		Amplification and contagion channel
		Financial	Synthetic		Excessive leverage	Inadequate liquidity preparedness	
COVID-19 market turmoil (March 2020)	Euro area PFs		x	Interest rate swaps		x	Procyclical demand for liquidity and asset sales; redemptions of MMF shares
Archegos (March 2021)	US hedge funds	x	x	Repo and futures contracts	x		Deleveraging; liquidity squeeze in US Treasury market
	US family office, primary dealers globally		x	Equity total return swaps	x		Liquidation of concentrated equity positions; contagion through banks/primary dealers
Energy markets (2022)	Commodity traders, utilities, energy firms		x	Energy futures	x	x	Concentrated markets and market infrastructures; opaqueness
UK gilt market (September 2022)	PFs		x	Interest rate swaps, repo and LDI funds		x	Liquidation of UK gilts in stressed market conditions; correlation between derivative and collateral value (wrong-way risk)
	LDI funds	x	x	Interest rate swaps and repo	x	x	

Source: ECB.

Notes: See also the box entitled “Lessons learned from initial margin calls during the March 2020 market turmoil”, *Financial Stability Review*, ECB, November 2021, and the special feature entitled “Financial stability risks from energy derivatives markets”, *Financial Stability Review*, ECB, November 2022. MMF stands for money market funds; LDI stands for liability-driven investment.

The lessons from recent episodes underline the need to strengthen NBFi sector resilience for a wide range of entities and activities, especially in relation to liquidity preparedness and leverage. First, it is critical to enhance margining practices and NBFi sector liquidity preparedness to meet margin calls from a system-wide perspective.¹⁰⁷ For example, NBFi entities often rely on the same sources of liquidity and may not internalise the extent to which their actions aimed at raising liquidity could contribute to systemic stress.¹⁰⁸ Second, due to the interplay between leverage and liquidity preparedness in derivatives markets, addressing vulnerabilities related to one aspect would help mitigate the risks associated with the other. For instance, entity-based measures such as leverage limits for highly leveraged funds could reduce the size of their margin calls and need for deleveraging. On the other hand, enhanced liquidity risk management would mitigate the need for forced asset sales to meet large margin calls. In both cases, entities would be better able to withstand market-wide shocks, thereby lowering the risk of spillovers to broader market liquidity. Finally, the cross-border dimension of activities in the NBFi sector underlines the need for close international cooperation and coordination in the regulation and monitoring of the sector.

¹⁰⁷ See BCBS, CPMI, IOSCO, “Review of margining practices”, Bank for International Settlements, September 2022.

¹⁰⁸ The reliance on money market funds to raise large amounts of cash during times of stress is a case in point. See also the box entitled “Interconnectedness of derivatives markets and money market funds through insurance corporations and pension funds”, *Financial Stability Review*, ECB, November 2020.

Proposals to make the clearing system in the EU safer are currently being developed and include measures to enhance model transparency and reduce excessive reliance on CCPs based outside the EU.

European Commission proposals included in its capital markets union package aim to make EU clearing safer and more resilient.¹⁰⁹ Measures such as enhancing transparency and reducing the impact of intraday margins are in line with international efforts to improve margining practices. The proposals also include measures aimed at reducing excessive exposure to Tier 2 CCPs.¹¹⁰ An example of this is an active account requirement which would require EU market participants to clear a portion of their derivatives through active accounts at EU CCPs.¹¹¹ The active account will need to be carefully calibrated if the requirement is to sufficiently reduce tail risks stemming from third-country Tier 2 CCPs. In addition, the calibration will need to take account of any potential negative effects on financial stability and market liquidity for EU market participants, for which it will be important to allow an adequate phase-in period.

Given the complexities involved in the use of leverage in an interconnected financial system, a policy response needs to take a holistic perspective across NBFIs sector entities and activities.

A key priority for the FSB should be to develop a globally consistent approach for addressing risk deriving from either financial or synthetic leverage in the NBFIs sector. For this purpose, it is important for work to continue on globally consistent metrics, on improving data quality and coverage, as well as on information-sharing to assess leverage-related risks across NBFIs sector entities and activities. Such work should be complemented by identifying gaps in policy frameworks globally, especially where financial entities are not subject to adequate leverage rules. The provision of leverage through banks and broker-dealers, including via repo transactions, should be considered as part of a holistic approach to NBFIs sector leverage. The policy response should also consider how haircuts and margining in derivatives markets disincentivise excessive leverage in the NBFIs sector, while it should also take into account the potential negative impact on the propensity to hedge for end users. Where leverage rules are already part of regulatory frameworks, as is the case for investment funds in the EU, consideration should be given to whether existing rules should be enhanced from a financial stability perspective. Moreover, supervisors of NBFIs sector entities should actively identify excessively leveraged institutions and tackle the resulting risk. This could be achieved by requiring more severe stress test scenarios, for example, or by imposing leverage limits, as provided for under the European Alternative Investment Fund Managers Directive.¹¹²

¹⁰⁹ See “[Capital markets union: clearing, insolvency and listing package](#)”, European Commission, 7 December 2022.

¹¹⁰ A Tier 2 CCP is a systemically important CCP based in a non-EU country, a status which allows for supervision by ESMA.

¹¹¹ This will target market participants subject to the EMIR clearing requirement for derivatives identified by ESMA as being systemically important. These include interest rate derivatives (EUR, PLN), credit default swaps (EUR) and short-term interest rate derivatives (EUR).

¹¹² See “[Guidelines on Article 25 of Directive 2011/61/EU](#)”, ESMA, 23 June 2021.

5.3 Other ongoing policy initiatives that support euro area financial stability

Topic	Recent initiatives
<p>Review of the EU macroprudential framework</p>	<p>The ECB response to the European Commission's call for advice on the review of the EU macroprudential framework of March 2022 outlined the ECB's key priorities with regard to updating the Capital Requirements Regulation and Capital Requirements Directive (CRR/CRD). Further revisions of the EU macroprudential framework are necessary to enhance its effectiveness and ensure the consistent and timely implementation of policy measures across Member States. The ECB supports targeted amendments to the current regulatory framework, drawing on the lessons learnt from recent crises. In particular, the ECB sees merit in creating further space and flexibility for macroprudential policy, specifically in respect of the early implementation and timely release of CCyBs. Furthermore, clarifying certain provisions on the use of sectoral systemic risk buffers to address cyclical risks would further enhance the consistency of the EU's capital framework.</p>
<p>O-SII scores and buffers</p>	<p>In view of developments in the banking union, its proper recognition in the assessment of other systemically important institutions (O-SIIs) is very important to strengthen financial stability, ensure a level playing field and reduce heterogeneity across Member States. EU legislation requires the ECB to carry out its tasks with a view to ensuring the stability of the financial system of the Union as well as that of individual participating Member States. Going forward, the ECB will continue to promote the development of a common EU methodology for buffers for O-SIIs to counter unwarranted heterogeneity in how they are set and ensure greater consistency in the resilience of O-SIIs.¹¹³</p>
<p>Climate change</p>	<p>Banking sector: The Basel Committee on Banking Supervision is pursuing a holistic approach to addressing climate-related financial risks. On regulation, it is carrying out analytical work to assess the materiality of gaps in the existing Basel framework. On supervision, the Committee is monitoring the implementation of its "Principles for the effective management and supervision of climate-related financial risks", published in 2022. It has also initiated work on the prudential relevance of banks' transition plans, complementing the work of the Financial Stability Board on the same topic from a financial stability perspective and also extending it beyond banking. On disclosure, the Committee is developing a set of bank-specific Pillar 3 disclosure requirements building on the International Sustainability Standards Board's initiatives. At the European level, the European Banking Authority is analysing whether and how environmental risks could be incorporated into the Pillar 1 prudential framework and aims to deliver a report on this topic by the end of 2023.</p> <p>Greenwashing: The European Commission mandated the European Banking Authority, together with the other European supervisory authorities, to provide advice on greenwashing risks and supervision. They then launched a Call for Evidence to gather input from stakeholders on how to understand the key features, drivers and risks of greenwashing and to collect examples of potential greenwashing practices. In parallel, the EU co-legislators have reached provisional agreement on a European green bond regulation.</p> <p>Insurance protection gap: The ECB and EIOPA have published a joint Discussion Paper on Policy options to reduce the climate insurance protection gap, which sets out possible actions to mitigate catastrophe risks from climate change in the EU. Private (re)insurance should be the first line of defence when seeking to cover losses from climate-related natural disasters. The use of financial markets to transfer risks via catastrophe bonds may also support the reinsurance of risks. However, as natural catastrophe risks are expected to rise and become more difficult to insure, frameworks including public-private partnerships and ex ante public backstops, reinforced with an EU-wide component, could be considered to deal with extreme weather events and minimise future costs to taxpayers.</p>
<p>Crypto-assets</p>	<p>The EU's proposed Markets in Crypto-assets regulation (MiCA) is an important step towards ensuring a high level of protection for retail crypto-asset holders and integrity in crypto-asset markets, while also promoting financial stability. Its expected entry into force in July 2023 will bring crypto-assets and their service providers within the regulatory perimeter. MiCA's provisions will then apply to stablecoins from July 2024 and to other crypto-assets from January 2025.</p> <p>At the international level, the Financial Stability Board (FSB) is finalising its recommendations for the regulation, supervision and oversight of crypto-asset activities and markets and its revisions to the FSB's high-level recommendations for "global stablecoin" arrangements by mid-2023. These recommendations should ensure that all crypto-asset activities posing a risk to financial stability will become subject to comprehensive, globally coordinated regulation, supervision and oversight. The finalisation of the Basel Committee on Banking Supervision's standard on the prudential treatment of banks' crypto-asset exposures marks an important milestone in protecting the banking system from risks related to crypto-assets. From an EU perspective, the Committee's standard complements the forthcoming regulation of the crypto-asset sector by the MiCA regulation. As a next step, it will be key for the EU and other Basel jurisdictions to transpose the Basel standard into their legislation by the 1 January 2025 deadline.</p>
<p>Capital markets union (recent legislative package on EMIR, corporate insolvency law, listing)</p>	<p>On 7 December 2022 the European Commission published a package of legislative proposals to continue the implementation of the 2020 capital markets union action plan. First, the package includes a proposal to strengthen the EU's central clearing system by amending the European Market Infrastructure Regulation (EMIR). Second, it contains proposals for harmonising key aspects of corporate insolvency rules to make them more efficient and help promote cross-border investment. Third, it aims to make it less burdensome for companies to list and raise capital on public exchanges by, for example, simplifying the prospectus framework or allowing companies to use multiple-vote shares which will help company owners to retain control over the company after listing. These proposals should generally improve access to capital market funding for firms, broaden investment opportunities for investors and support the integration of European capital markets.</p>

¹¹³ See "[Governing Council statement on macroprudential policies](#)", ECB, 2022.

Special Features

A Gauging the interplay between market liquidity and funding liquidity

Prepared by Nander de Vette, Benjamin Klaus, Simon Kördel and Andrzej Sowiński

The ability of market participants to access funding and conduct transactions in an efficient way is a prerequisite for financial stability, providing shock-absorption capacity and, in turn, limiting the scope for shock amplification. Market liquidity and funding liquidity are inherently connected. When market liquidity evaporates, financial market pricing becomes less reliable and tends to overreact, leading to increased market volatility and higher funding costs. Funding liquidity enables market participants to take exposures onto their balance sheets, thus absorbing fluctuations in demand and supply in the name of efficient market functioning. Under extreme conditions, markets can stop functioning altogether. While liquidity has many dimensions, from a systemic perspective the interplay between market liquidity and funding liquidity¹¹⁴ is key, as these two dimensions can reinforce each other in ways that generate liquidity spirals. Cyclical factors such as the business cycle, systemic leverage, as well as monetary and fiscal policy affect the probability of liquidity stress arising. In the light of the current challenges of high financial market volatility, increased risk of recession, bouts of heightened risk aversion and monetary policy normalisation, this special feature constructs composite indicators for market liquidity and funding liquidity. It also attempts to identify what can cause poor market liquidity and funding liquidity conditions and to show how the two dimensions interact in the euro area.

Introduction

Concerns have recently been increasing over the resilience of liquidity. For much of the last decade, volatility in bond markets has been low (**Chart A.1**, panel a) and holdings of high-quality liquid assets (HQLAs) in the banking sector have been large (**Chart A.1**, panel b). Recently, though, these tailwinds have started to change direction. Despite a regime of continuing high excess reserves, liquidity conditions have become more fragile and, at times, unreliable. Moreover, a constellation of a subdued free float of high-quality debt securities and globally high inflation, which has introduced uncertainty as to the future path of monetary policy, has greatly increased volatility in bond markets.

Financial system liquidity has a market component and a funding component, both of which have structural and cyclical drivers. In theory, market liquidity (the ability to rapidly execute sizeable securities transactions at a low cost and with a

¹¹⁴ Throughout this special feature, funding liquidity refers to funding liquidity for banks.

limited price impact) can be distinguished from funding liquidity (the ease with which financial intermediaries can borrow). In practice, these two types of liquidity constitute financial system liquidity and can interact and – on occasion – reinforce one another in generating liquidity spirals. These components can be influenced by structural trends such as market-making practices, issue size, trade transparency and investor landscape.¹¹⁵ The dimensions of liquidity can also be strongly influenced by cyclical determinants which underpin shifts in liquidity regimes. Such cyclical determinants¹¹⁶, including investor risk appetite, macroeconomic conditions and global monetary policy cycles, have started to turn. This has given rise to concerns over a shift towards a regime of less system liquidity and more fragile liquidity.

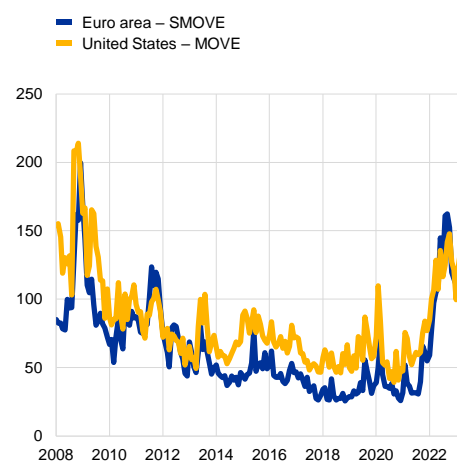
This special feature develops composite indicators of market liquidity and funding liquidity and assesses how they interact. It introduces concepts pertinent to both market and funding liquidity. It then presents a suite of indicators that sheds light on the evolution of both concepts for the euro area in recent years, investigating the main drivers behind them and examining how the two dimensions interact.

Chart A.1

Cyclical market and funding liquidity factors turn more restrictive as policy normalises

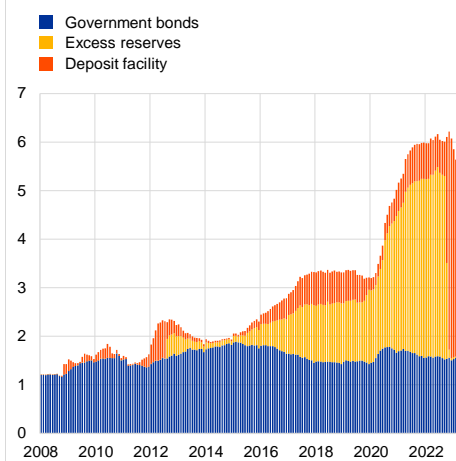
a) Volatility indices for the euro area and US bond markets

(Jan. 2008-Apr. 2023; indices)



b) HQLAs of euro area banks

(Jan. 2008-May 2023; € trillions)



Sources: ECB and Bloomberg Finance L.P.

Notes: Panel a: SMOVE is the Merrill Lynch 1M EUR Swaption Volatility Estimate Index; MOVE is the Merrill Lynch 1M UST Option Volatility Estimate Index.

¹¹⁵ See “Market Liquidity – resilient or fleeting?”, *Global Financial Stability Report*, Chapter 2, International Monetary Fund, October 2015.

¹¹⁶ See Miranda-Agrippino, S. and Rey, H., “US monetary policy and the global financial cycle”, *The Review of Economic Studies*, Vol. 87, Issue 6, 2020, pp. 2754-2776.

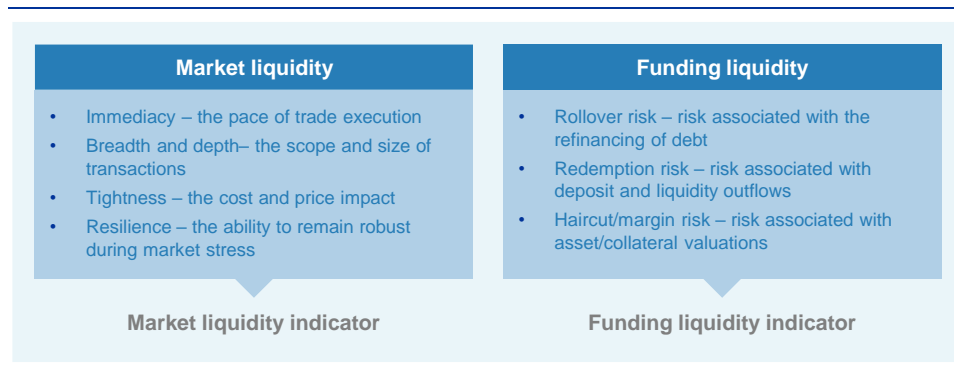
Why market and funding liquidity matter and how they interact

When liquid, financial markets provide efficient, reliable pricing of financial assets, and funding can be easily obtained at a fair price. Liquidity consists of two main pillars: market liquidity and funding liquidity. Market liquidity may be defined as the ability to rapidly execute large transactions at a low cost and with a limited price impact. Funding liquidity indicates the ease of borrowing conditions and capital flows in global financial markets. Focusing on the specific dimensions of market liquidity and funding liquidity, and distinguishing between them, can provide clarity on how their interaction can create adverse liquidity spirals which harbour the potential for systemic stress.

Market liquidity has several dimensions which are closely, but not solely, related to trading conditions in financial markets. These dimensions include immediacy (the pace of trade execution), breadth and depth (the scope and size of transactions), and tightness (the cost and price impact). From a financial stability perspective, it is also important to consider the resilience of market liquidity, which is the ability of market-makers to continue to provide market-making services during periods of market stress (**Chart A.1**).¹¹⁷

Figure A.1

Dimensions of market liquidity and funding liquidity



Source: ECB.

However, market liquidity is not directly observable, and there is no single indicator that can comprehensively capture its multiple dimensions. Individual indicators are also hampered by conceptual issues. Tight bid-ask spreads, which are often used to show abundant market liquidity, may conceal the fact that there is little volume available at the best quotes. Data on liquidity indicators, especially for the corporate bond market, are often sparse, as bond trading is still fragmented given the prevalence of over-the-counter trading and waivers from pre-trade and post-trade transparency rules. In addition, any assessment is complicated by data quality issues, such as differences across commercial databases, a lack of consolidated tape providers¹¹⁸ and gaps in available data for less-regulated non-bank financial

¹¹⁷ See Sarr, A. and Lybek, T., "Measuring liquidity in financial markets", *IMF Working Papers*, No 2002/232, International Monetary Fund, December 2002.

¹¹⁸ A consolidated tape provider is an entity authorised under MiFID II to provide the service of collecting trade reports for financial instruments and consolidating them into a continuous electronic live data stream providing price and volume data per financial instrument.

intermediaries and principal trading firms.¹¹⁹ Finally, the gradual automation of trading, including the use of high-frequency trading, might, in some cases, undermine the robustness of individual liquidity measures. Limited access to data on algorithmic trading makes it challenging to make a proper assessment of its impact on market liquidity and its resilience.

Funding liquidity focuses on the ease of obtaining deposits and borrowing conditions in capital markets, which also affects the overall cost of funding. If funding is abundant, investors can obtain cheap funding, while financing is more expensive if funding liquidity is shallow. Funding liquidity risk can take different forms, depending on the type of funding. These risks are rollover risk, redemption risk and haircut/margining risk (**Figure A.1**). If a bank relies to a large extent on short-term funding (e.g. via repos), it runs the risk that it might be unable to replace or roll over maturing short-term funding or that it might only be able to do so at significantly higher cost. Redemption risk captures the risk, in the case of a bank, of depositors withdrawing their funds. Lastly, haircut or margining risk surfaces if a financial intermediary is funded via a secured loan (e.g. a repo transaction or margin loan) and the haircut or margin applied to the collateral increases. In any of these cases, the financial firm might be forced to exit positions or liquidate assets.¹²⁰

Even in a regime with ample reserves, funding liquidity might become impaired, notably for weaker banks. Central bank asset purchase programmes over the past decade – including in the euro area – have contributed to a rapid increase in excess liquidity in the financial system (**Chart A.1**, panel b). However, the normalisation of monetary policy that began in 2022, including ongoing quantitative tightening (QT), could change these dynamics, along with the risks to financial stability. Disruptions in funding markets are closely related to the short-term availability of liquidity. Two effects are seen to have a negative impact on the short-term availability of reserves. First, reserves might be encumbered because banks have sold liquidity guarantees in the form of contingent credit lines which can be called during times of liquidity stress.¹²¹ Second, reserves might be encumbered in order to maintain liquidity coverage ratios in times of stress (reserve hoarding by well-capitalised banks), making them unavailable for interbank lending to liquidity-stressed banks.¹²² As such, high levels of aggregate excess reserves might hide vulnerabilities at weaker individual banks. Banks might therefore find that initially

¹¹⁹ See “[Liquidity in Core Government Bond Markets](#)”, Financial Stability Board, October 2022.

¹²⁰ Brunnermeier, M.K., “Deciphering the liquidity and credit crunch 2007-08”, *Journal of Economic Perspectives*, Vol. 23, No 1, 2009, pp. 77-100, and Drehmann, M. and Nikolaou, K., “Funding liquidity risk: Definition and measurement”, *BIS Working Papers*, No 316, Bank for International Settlements, July 2010.

¹²¹ A bank holding highly liquid reserves, with the reserves being required only in situations of liquidity stress, might want to “sell” liquidity wherever it is not needed, by offering contingent lines of credit, for instance.

¹²² The collateral value of an asset in market transactions might also be depressed, further limiting banks’ ability to borrow in the secured market. Furthermore, in crisis periods, elevated systemic risk might reduce the credit quality of otherwise safe banks, also limiting their ability to borrow in the unsecured market. Banks can use main refinancing operations and the marginal lending facility to obtain unlimited liquidity from the central bank against appropriate collateral.

issued bank-held reserves are not available during periods of stress, implying that changes in the level of reserves might be equally important.¹²³

Since the global financial crisis, changes in the behaviour of financial sector participants and regulatory reforms have had implications for both funding and market liquidity. First, in money markets, banks have shifted from unsecured to secured transactions, often cleared by central counterparties. The secured segment became the largest segment of the euro area money market around the time of the global financial crisis and has continued to grow ever since, increasing systemic liquidity needs in the form of cash and collateral to secure lending.¹²⁴ Moreover, the widespread increase in collateralised transactions has magnified the sensitivity of liquid-asset demand to market volatility. If market participants are ill-prepared for rapidly rising margin calls, their short-term liquidity needs to fund such margin calls could squeeze liquidity in already stressed markets, further amplifying shocks. For this reason, collateralised funding, while greatly reducing counterparty credit risk, may also increase systemic liquidity risk. Second, banks changed their business models as they deleveraged, increased their regulatory capital and liquidity buffers, and shrank their inventories. While these developments enhanced banks' resilience, they may also have made banks' market-making services more restrictive and led non-bank financial institutions to take on a more prominent role in market-making. Restrictions on proprietary trading and regulations requiring banks to increase associated capital buffers may also have led them to retreat from trading and market-making activities. Moreover, a continued shift towards electronic trading platforms and the growing use of automated trading may have made market liquidity conditions less predictable.

Assessing euro area funding and market liquidity conditions

Combining different market liquidity indicators could help to capture different dimensions and shed light on drivers. The analysis below uses a suite of 21 indicators of liquidity in sovereign bond markets, representing all five dimensions of market liquidity. These indicators range from standard measures, such as the bid-ask spread, traded volume and dealer inventories, to less commonly used indicators such as the share of non-quoted securities, and are based on a variety of data sources. To make the indicators comparable, they are standardised by transforming them into z-scores based on their historical distribution. Afterwards, individual indicators are first aggregated into five sub-indicators and then translated into a composite indicator. This makes it possible to track developments in market liquidity over time, and to identify broader trends and understand their underlying drivers.

Market liquidity has deteriorated as volatility has increased in an environment of high uncertainty over the path of future monetary policy. Market liquidity conditions in the euro area sovereign bond market have deteriorated below the

¹²³ See Acharya, V. and Rajan, R., "Liquidity, Liquidity Everywhere, Not a Drop to Use – Why Flooding Banks with Central Bank Reserves may not Expand Liquidity", *NBER Working Paper Series*, No 29680, National Bureau of Economic Research, 2022.

¹²⁴ See "Euro money market study 2022", ECB, 2023.

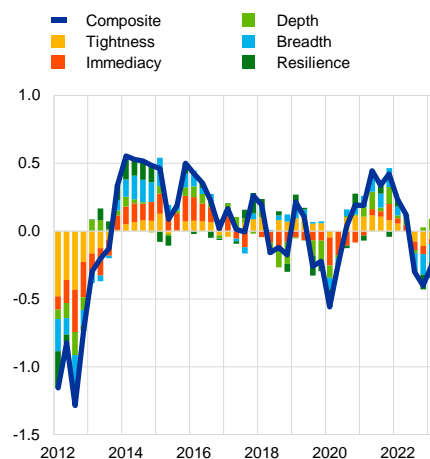
sample average since mid-2022 across many dimensions (Chart A.2, panel a). The composite indicator has declined to similar levels seen during the outbreak of the COVID-19 pandemic in 2020. At the same time, high sensitivity to macroeconomic surprises has been reflected in extremely high bond price volatility, as investors have adjusted their expectations of the pace of policy normalisation (Chart A.2, panel b). Looking at the various dimensions of liquidity that have driven the deterioration in the composite indicator, liquidity providers widened quoted spreads, thus undermining market tightness. Market-makers thereby compensated for potentially higher market risk stemming from large and rapid price moves that make it more challenging for them to keep their trading books matched. The biggest deterioration was, however, observed in market breadth, as bid-ask spread dispersion increased substantially. Such dynamics might be partly explained by the different sensitivities in the credit risk of individual issuers to higher risk-free rates. For bonds issued by more-indebted sovereigns, bid-ask spreads might have increased more because of a lower level of willingness or capacity to hold them among dealers. The ECB's withdrawal from asset purchase programmes further challenged the ability of market-makers to limit risk, should they find themselves with outsized exposures relative to risk-bearing capacity. Their willingness to provide quotes to other market participants might thus have been reduced. As a result, around the end of 2022 the average number of market-makers active in the euro area bond market dropped to the lowest levels on record.

Chart A.2

Euro area market liquidity has declined since last year as uncertainty over rates has fed into higher bond price volatility

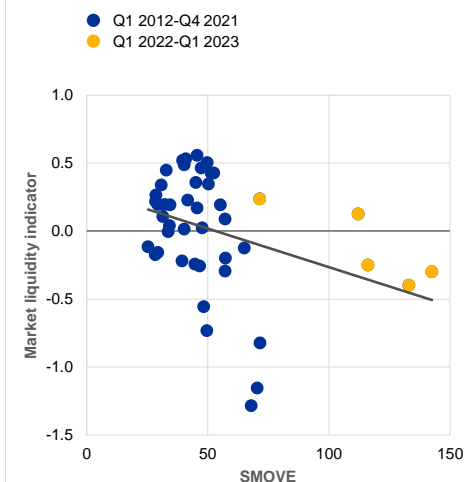
a) Composite indicator for euro area sovereign bond market liquidity

(Q1 2012-Q1 2023; z-scores)



b) Composite euro area sovereign bond market liquidity indicator vs. rate volatility

(Q1 2012-Q1 2023 x-axis: index, y-axis: z-scores)



Sources: Bloomberg Finance L.P., Euro MTS Ltd, MarketAxess, Refinitiv, ECB and ECB calculations.

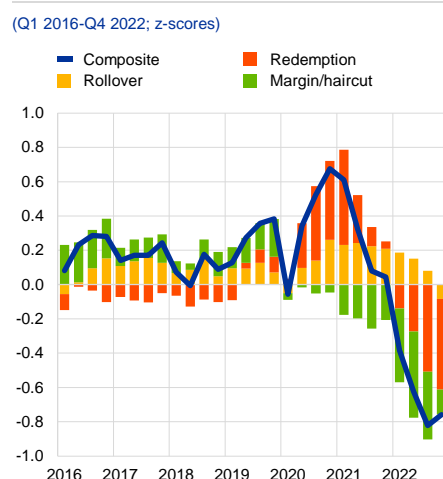
Notes: Panel a: composite liquidity indicator based on number of market-makers, share of non-quoted or non-traded securities, transaction frequency, trade size, dealer inventory, quote slope, quoted volume, traded volume, turnover ratio, Amihud ratio, effective spread, spread dispersion, volume concentration, market efficiency coefficient and Bloomberg Liquidity Index. Panel b: the chart shows the OLS fit between the SMOVE and the composite indicator for euro area sovereign bond market liquidity between Q1 2012 and Q1 2023. SMOVE is the Merrill Lynch 1M EUR Swaption Volatility Estimate Index.

By comparison, a composite indicator for euro area funding liquidity captures rollover risk, redemption risk and margining risk. A set of 28 indicators covering various characteristics of funding liquidity for euro area banks are monitored along the dimensions of rollover risk, redemption risk and haircut/margining risk (Chart A.3, panel a). The indicators aim to capture reliance on short-term funding and repo markets and the ability to obtain funding from the central bank. For example, (short-term) wholesale funding indicators capture rollover risk, indicators on deposit rates and volumes capture redemption risk, and asset encumbrance indicators capture haircut/margining risk.^{125, 126}

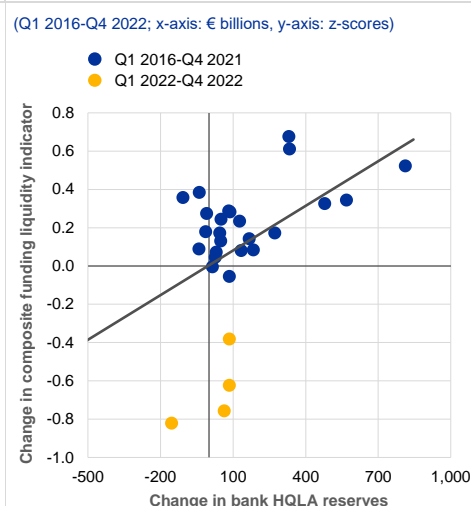
Chart A.3

Funding liquidity for euro area banks deteriorated as redemption and haircut risks linked to monetary policy normalisation rose

a) Composite indicator for funding liquidity



b) Change in composite funding liquidity indicator vs. change in bank HQLA reserves



Sources: ECB, Bloomberg Finance L.P. and Refinitiv.

Notes: Panel a: composite liquidity indicator based on, for rollover risk: deposit flows agreed maturity, overnight and term deposit rates to households and non-financial corporations, non-deposit funding as a share of total funding, yields on covered, senior bail-in-able and senior unsecured debt, short rates for secured MMSR transactions, ESTR market depth, interbank repo volumes, the EURIBOR-OIS spread, position in the monetary corridor (floor versus corridor) and euro-dollar cross-currency basis; for redemption risk: deposit growth rates for households, non-financial corporations and non-monetary financial institutions, the euro short-term rate minus agreed deposit rate for households and non-financial corporations and the liquidity coverage ratio; for haircut/margining risk: asset encumbrance ratio, collateral reuse ratio, market funding encumbrance ratio, share of covered bonds in total bond issuance volume and Schatz volatility. The indicators are first aggregated for deposit rates, yields and deposit growth, then taken as a simple average over all indicators to construct the composite indicator. Panel b: the chart shows the OLS fit between the change in the composite funding liquidity indicator and the change in bank HQLAs between Q1 2016 and Q4 2022.

Funding liquidity indicators have deteriorated since the start of 2022,

consistent with cyclical factors such as greater redemption and margining

risks. Redemption risk has increased amid lower deposit growth rates and weaker competitiveness of deposits compared with money market rates. The indicators for haircut and margining risk also increased due to higher volatility in government bond markets and higher asset encumbrance ratios, but then eased somewhat at the end of 2022 as volatility normalised and central bank-related asset encumbrance

¹²⁵ Individual indicators are first aggregated into sub-indicators to reflect the three dimensions of funding liquidity and then translated into a composite indicator of funding liquidity for the banking sector.

¹²⁶ Care should be taken when interpreting deposit redemptions, as in some countries they also reflected the pre-payment of (part of) mortgage debt.

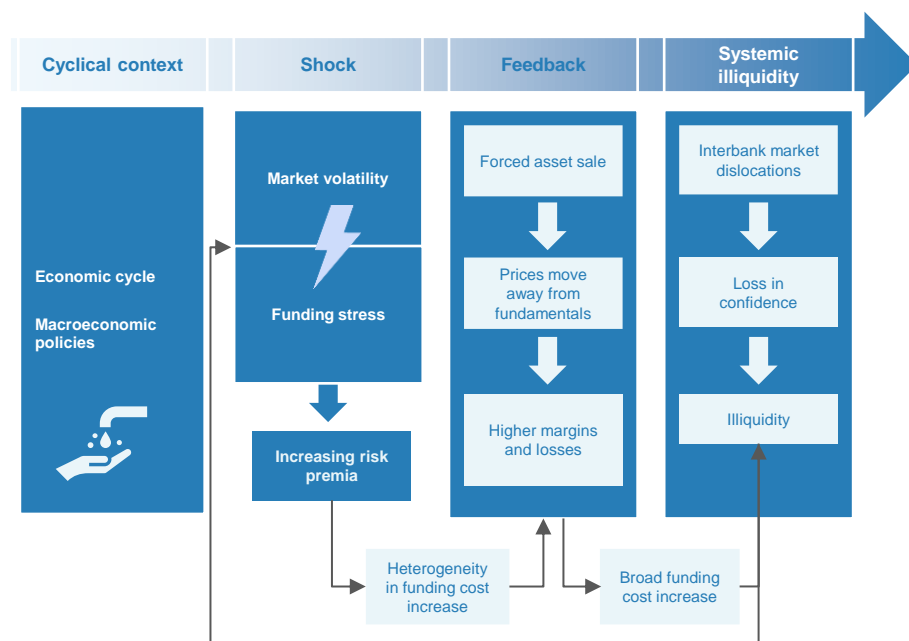
declined (**Chart A.3**, panel a). High asset encumbrance ratios during 2022 were mainly driven by two factors. First, a high level of central bank lending increased the amount of collateral encumbered at the central bank. Second, banks continued to make extensive use of secured funding markets to maintain liquidity buffers against a backdrop of heightened economic uncertainty. Rollover risk is considered somewhat lower because the increase in deposit rates has remained contained so far and (interbank) money markets are functioning in an orderly manner. At the same time, bank bond yields have increased, reflecting rising policy rates, resulting in higher market funding costs. In recent years, accommodative monetary policy and central bank asset purchases that increase reserves have supported funding liquidity conditions, but liquidity conditions have weakened as these reserves have been removed from the system funding (**Chart A.3**, panel b).

Risk of market and funding liquidity spirals

Market liquidity and funding liquidity are interrelated and can reinforce each other, potentially creating liquidity spirals. The extent to which dealers can make markets and provide liquidity depends on their ability to take exposures onto their own balance sheets, absorbing fluctuations in demand and supply. To finance these activities, dealers borrow in repo markets using the bonds purchased as collateral. In this way, market and funding are inherently connected.¹²⁷ A funding liquidity shock, such as an increase in margins and haircuts, could therefore limit dealers' capacity to take own positions, thereby hampering their ability to provide liquidity and, ultimately, worsening overall market liquidity conditions. Deteriorating market liquidity conditions can, in turn, negatively affect funding liquidity. As poor market liquidity conditions exacerbate price volatility, they can also lead to an increase in margins and haircuts, which again worsens overall funding liquidity conditions. Ultimately, such liquidity spirals can become self-fulfilling (**Figure A.2**).

¹²⁷ Shin, H.S., "Market liquidity and bank capital", speech at the 'Perspectives 2016: Liquidity Policy and Practice' conference, AQR Asset Management Institute, London Business School, 27 April 2016.

Figure A.2
Overview of a systemic funding illiquidity event



Source: ECB.

Since early 2022, market liquidity and funding liquidity have declined simultaneously as volatility has risen.

Historically, the indicators for market liquidity and funding liquidity have not always moved in the same direction. At the start of the COVID-19 pandemic in 2020, for example, market liquidity conditions deteriorated significantly, while policy support measures kept bank funding conditions favourable (Chart A.4). Beginning in mid-2022, however, market liquidity and funding liquidity deteriorated simultaneously as policy started to normalise and economic uncertainty remained highly elevated. Market liquidity indicators returned to levels observed during the pandemic. By contrast, it was only during the most recent observation period that funding liquidity deteriorated to record lows, as it had been supported by central bank liquidity during the pandemic. Lower funding liquidity largely reflects the environment of higher interest rates, in which competition for deposits has increased and volatility in safe assets is high – contributing to rising margins and haircuts. At the same time, market functioning has remained orderly, keeping rollover risk contained.

Funding liquidity conditions affect market liquidity conditions, while market liquidity appears to have a more limited impact on funding liquidity.

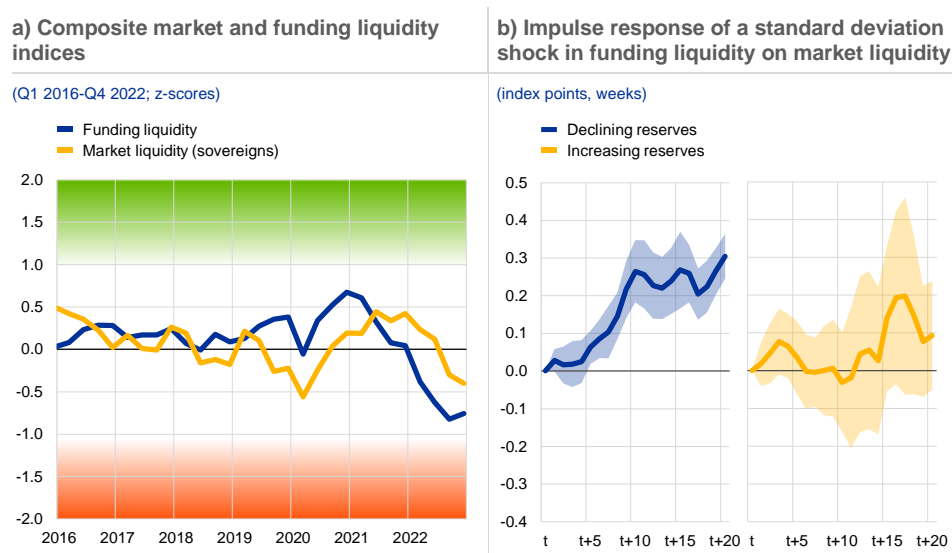
An analysis of time series data shows that after a shock in bank funding conditions – measured as the EURIBOR-OIS spread – market liquidity conditions in sovereign bond markets deteriorate significantly.¹²⁸ This finding is in line with other studies and suggests that a funding shock affects the ability of banks to intermediate in bond markets, resulting

¹²⁸ After the reforms of July 2019, the EURIBOR switched to a hybrid methodology to address robustness and representativeness concerns, which might impact the measure of funding liquidity after July 2019. However, the results of the analysis are unchanged if the period between July 2019 and February 2023 is excluded from the data.

in less-liquid market conditions.¹²⁹ Moreover, the opposite relationship does not appear to hold, meaning that, on aggregate, a shock in market liquidity does not necessarily translate into deteriorating funding conditions for banks. A local projections exercise shows that the finding is driven by periods in which excess liquidity is low or declining.¹³⁰ When excess liquidity is increasing, there are no significant spillovers from a shock in funding liquidity to market liquidity (Chart A.4, panel b, right graph). This highlights the difference between the current period of policy normalisation and the period of the pandemic, when bank funding liquidity was abundant due to fiscal and central bank support.

Chart A.4

Market liquidity and funding liquidity show stronger co-movement lately, with a funding liquidity shock having more potential to disrupt market liquidity than vice versa



Sources: ECB, Eurostat, Bloomberg Finance L.P., Refinitiv and ECB calculations.

Notes: Panel a: for a description of the indicators, see the notes for Charts A.2 and A.3. Panel b: the chart shows impulse response functions with their respective 95% confidence bands for market liquidity – as proxied by the Bloomberg Liquidity Index for German sovereign bonds – after a shock in funding liquidity, as proxied by the EURIBOR-OIS spread. Higher values mean lower liquidity. The results are corrected for implied volatility (VSTOXX), log returns in the EURO STOXX Banks index and economic surprises (Citi Economic Surprise Index). Increasing and decreasing reserves are defined by changes in excess liquidity. Excess liquidity is defined as deposits at the deposit facility net of the recourse to the marginal lending facility. The impulse response functions were estimated using a non-linear local projection model* on weekly data between 1 January 2008 and 31 February 2023. The shaded areas represent 90% confidence intervals using Newey-West standard errors robust to heteroscedasticity and autocorrelation.

(* See Jordà, Ó., “Estimation and Inference of Impulse Responses by Local Projections”, *American Economic Review*, Vol. 95, No 1, March 2005, pp. 161-182.

As central banks normalise their portfolios, reserves held in banks will gradually be replaced by the securities currently held by the Eurosystem, reversing the market impact of asset purchases. The reduction of central bank balance sheets (i.e. QT) might not mirror the impact of quantitative easing (QE), but

¹²⁹ See Khan, M.S., Scheule, H. and Wu, E., “Funding liquidity and bank risk taking”, *Journal of Banking & Finance*, Vol. 82, Issue C, 2017, pp. 203-216.

¹³⁰ We define the regimes based on the changes in excess liquidity in the same way as Acharya et al., who argue that banks’ desire to match the maturity of assets and liabilities after QE has implied an increase in central bank reserves (see Acharya, V. and Rajan, R., “Liquidity, Liquidity Everywhere, Not a Drop to Use – Why Flooding Banks with Central Bank Reserves may not Expand Liquidity”, *NBER Working Paper Series*, No 29680, National Bureau of Economic Research, 2022). Banks might not, however, be able to increase the maturity of their liabilities once QT is under way.

it could affect funding conditions for banks in several ways. First, by making a positive contribution to financial stability, it could alleviate pressures on repo markets as the free float of HQLA securities increases; this would reduce the collateral scarcity that has accompanied central bank QE programmes and resulted in money market frictions in recent years.¹³¹ Second, as QT might reverse the compression of risk premia,¹³² valuations for some securities earmarked as HQLAs might become more volatile, potentially increasing rollover and margining risks in stressed liquidity regimes. Third, there has been substantial portfolio rebalancing in the euro area, with risk premia on bonds issued by lower-rated sovereigns and firms falling measurably.¹³³ QT might lead to a partial reversal of these effects via the “risk-taking channel” of monetary policy, increasing risk premia, potentially lowering collateral values and sparking a decline in risk appetite.

Conclusions

A substantial deterioration in market liquidity and funding liquidity has been evident since the start of 2022. So far, funding markets have functioned in a largely orderly manner, supported by cyclical factors such as large central bank balance sheets and the post-pandemic recovery. These cyclical factors may have reached a turning point, potentially exposing the underlying risks that have been masked by accommodative policy over the last decade. This mainly reflects changing cyclical factors such as heightened economic uncertainty, monetary policy normalisation and overall tighter financial conditions. It signals the heightened risk of a shift towards a stressed liquidity regime.

As global central banks normalise their portfolios, the portfolio rebalancing channel will slowly start to turn, potentially affecting funding conditions.¹³⁴ Reserves will be gradually replaced by the securities currently held by central banks, which potentially increases volatility and hence the demand for HQLAs in financial markets. Reduced central bank presence in the bond markets might further challenge market-makers’ willingness to provide liquidity as it decompresses risk premia.¹³⁵ Moreover, unlike central bank reserves, marketable safe and liquid assets are subject to valuation changes, which might affect funding conditions in a stressed liquidity regime.

This special feature suggests that some structural liquidity factors have so far remained supportive, and that the reserves held by banks to meet high

¹³¹ See Arrata, W. et al., “The scarcity effect of QE on repo rates: Evidence from the euro area”, *Journal of Financial Economics*, Vol. 137, Issue 3, September 2020, pp. 837-856.

¹³² See Motto, R. and Özen, K., “Market-stabilization QE”, *Working Paper Series*, No 2640, ECB, February 2022.

¹³³ See Albertazzi, U. et al., “Portfolio rebalancing and the transmission of large-scale asset purchase programs: Evidence from the Euro area”, *Journal of Financial Intermediation*, Vol. 48, October 2021.

¹³⁴ See Krishnamurthy, A. and Vissing-Jorgensen, A., “The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy”, *Brookings Papers on Economic Activity*, Brookings Institution Press, Fall 2011.

¹³⁵ See Schnabel, I., “Quantitative tightening: rationale and market impact”, speech by Isabel Schnabel, Member of the Executive Board of the ECB, at the Money Market Contact Group meeting, 2 March 2023.

liquidity coverage requirements remain at an elevated level. At the same time, the shift towards widespread collateralisation, while greatly reducing counterparty credit risks, has increased the sensitivity of liquid-asset demand to market volatility and has resulted in high asset encumbrance at banks. Moreover, banks' desire to match the maturity of assets and liabilities after the period of QE has sparked an increase in central bank reserves. However, banks might not be able to adjust the maturity of their liabilities overnight once QT is under way and might face exposure to liquidity claims by non-banks and non-financial corporations.¹³⁶ As such, both market liquidity and funding liquidity conditions might be more fragile and flightier than the aggregate measures for liquidity suggest, and they therefore warrant continuous monitoring. At the same time, the euro area banking sector is resilient, with strong capital and liquidity positions, which helps to mitigate the potential risks that follow from deteriorating liquidity conditions.

¹³⁶ See Acharya, V. and Rajan, R., "Liquidity, Liquidity Everywhere, Not a Drop to Use – Why Flooding Banks with Central Bank Reserves may not Expand Liquidity", *NBER Working Paper Series*, No 29680, National Bureau of Economic Research, 2022.

B Key linkages between banks and the non-bank financial sector

Prepared by Emanuele Franceschi, Maciej Grodzicki, Benedikt Kagerer, Christoph Kaufmann, Francesca Lenoci, Luca Mingarelli, Cosimo Pancaro and Richard Senner

Banks are connected to non-bank financial intermediation (NBFi) sector entities via loans, securities and derivatives exposures, as well as funding dependencies. Linkages with the NBFi sector expose banks to liquidity, market and credit risks. Funding from NBFi entities would appear to be the most likely and strongest spillover channel, given that NBFi entities maintain their liquidity buffers primarily as deposits and very short-term repo transactions with banks. At the same time, direct credit exposures are smaller and are often related to NBFi entities associated with banking groups. Links with NBFi entities are highly concentrated in a small group of systemically important banks, whose sizeable capital and liquidity buffers are essential to mitigate spillover risks.

The elevated vulnerabilities in the NBFi sector, which have been flagged repeatedly in previous issues of the FSR, raise questions about the risk of spillovers to the euro area banking sector. Since the global financial crisis, growth in the euro area NBFi sector has far outstripped growth in its banking sector.¹³⁷ This trend has been beneficial in that it has led to a diversification of sources of finance in the economy, although the NBFi sector is marked by material liquidity and leverage risks. Banks have maintained their central role in financial markets as the main market-makers, clearing counterparties and gateways for NBFi entities. Recent episodes such as the failure of Archegos Capital Management have been idiosyncratic and largely contained, but they show that spillovers from such entities to banks may be material. This special feature examines the linkages which enable financial stress to be transmitted from the NBFi sector to banks, starting with asset-side exposures and funding dependencies, and followed by linkages in the derivatives markets and indirect linkages through overlapping securities portfolios.¹³⁸ The special feature identifies exposure concentrations and ranks the spillover channels in terms of their systemic relevance.

¹³⁷ The term “NBFi entities” is used throughout this special feature to refer to a wide range of institutions including investment funds, insurance companies, pension funds and other financial institutions. The last category includes institutions such as securitisation vehicles, broker-dealers, captive financial institutions and family offices; see di Filippo, G. and Pierret, F., “A typology of captive financial institutions and money lenders (sector S127) in Luxembourg”, *Working Papers*, No 146, Banque Centrale du Luxembourg, July 2020. For an assessment of developments in the NBFi sector, see “Financial integration and structure in the euro area”, ECB, April 2022.

¹³⁸ For an extensive discussion of mechanisms of contagion between investment funds, as an example of an NBFi sector, and banks, see Sydow, M. et al., “Shock amplification in an interconnected financial system of banks and investment funds”, *Working Paper Series*, No 2581, ECB, August 2021. This special feature does not cover ownership linkages which can lead to reputational and step-in risk; see the box entitled “The role of bank and non-bank interconnections in amplifying recent financial contagion”, *Financial Stability Review*, ECB, May 2020.

Euro area banks' asset exposures to the NBFi sector

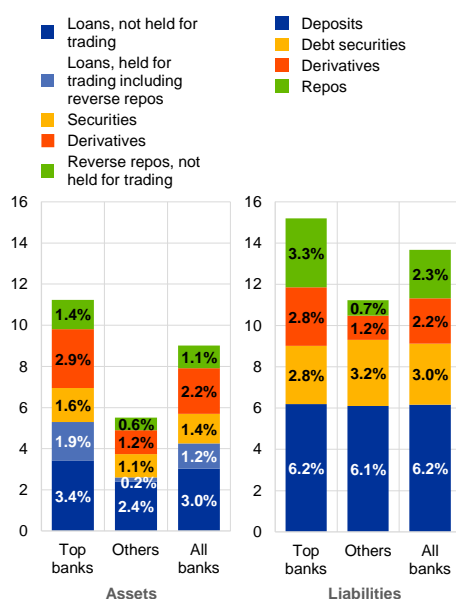
Banks' asset exposures to NBFi entities are considerable and, on average, account for about 9% of significant institutions' total assets. These asset-side exposures consist primarily of loans, with securities playing a more limited role (**Chart B.1**, panel a). The credit risk associated with these exposures tends to be low, thanks to the large share of collateralised lending in the loan exposure and investment grade-rated instruments in the securities holdings. Over the past three years, banks' loans to NBFi entities and holdings of securities issued by NBFi entities have increased materially, even if at a slower pace than total assets. Large banks are more strongly linked to NBFi entities, as 80% of funding and about 90% of asset exposures are concentrated in fewer than 20 banks (**Chart B.1**, panel b).

Chart B.1

Liability-side exposure to NBFi entities is larger than asset-side exposure, and both are concentrated in large, complex banks

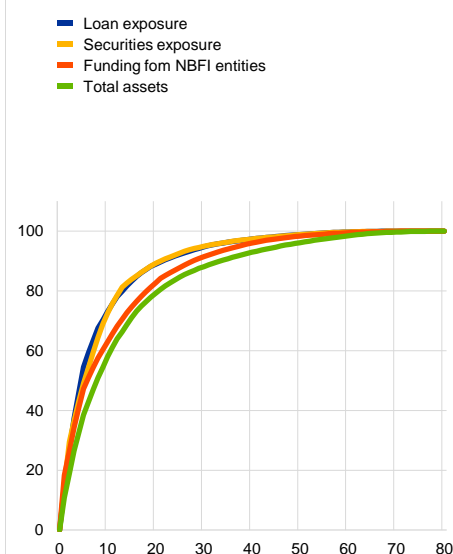
a) Asset- and liability-side exposure of euro area significant institutions to NBFi entities

(end-2022; left-hand graph: percentages of total assets; right-hand graph: percentages of total liabilities)



b) Concentration of exposures of euro area significant institutions to NBFi entities

(end-2022; x-axis: number of banks, y-axis: cumulative share of exposure, percentages)



Sources: ECB and ECB calculations.

Notes: The analysis is based on samples of 98 banks (panel a) and 80 banks (panel b) for Q4 2022. Top banks include the 13 euro area banks that are among the ten banks most exposed to NBFi entities in terms of either loan or securities exposure, as shown in panel b. The value of derivatives is reported using carrying amounts. Loans and reverse repos classified as "held for trading" are presented together due to the scope limitations of supervisory reporting. More granular data indicate that reverse repos account for a large share of this item.

Banks have less economic exposure to NBFi entities than the headline data would imply, as many NBFi entities are part of banking groups. The top hundred NBFi entities account for about 46% of total bank exposure to this sector. 64 of these entities are connected to euro area banking groups, reflecting ownership linkages and sponsorship of special-purpose vehicles. Based on AnaCredit data and supervisory large exposure reporting, a sizeable part of lending to NBFi entities is extended to securities firms owned by banks, which often benefit from implicit

support from the parent bank. Some of the large exposures also arise from holdings of securitisations as well as repo and liquidity lines made available to securitisation vehicles.¹³⁹ Similarly, banks often hold securities issued by financial conduits. Although these are classified as NBF entities for statistical purposes, they are, in economic terms, equivalent to exposures to the bank sponsoring the conduit. Some of these linkages remain within the same consolidated banking group.

Euro area banks' reliance on funding from NBF entities

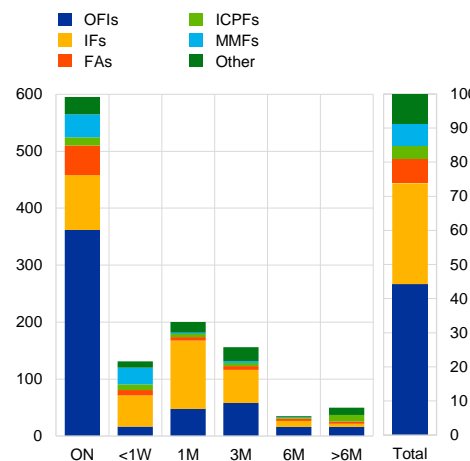
The NBF entity sector is an important source of funding for euro area banks. The total share of funding from NBF entities in bank liabilities amounts to about 14%, substantially higher than the total share of exposures to such entities in bank assets. Unsecured deposits account for the largest part of funding, followed by debt securities funding and repo funding (**Chart B.1**, panel a). The share of funding from NBF entities is higher and more diversified for larger banks than for smaller banks.

Chart B.2

Banks' repo funding is highly concentrated in a small number of institutions and is subject to high rollover risk

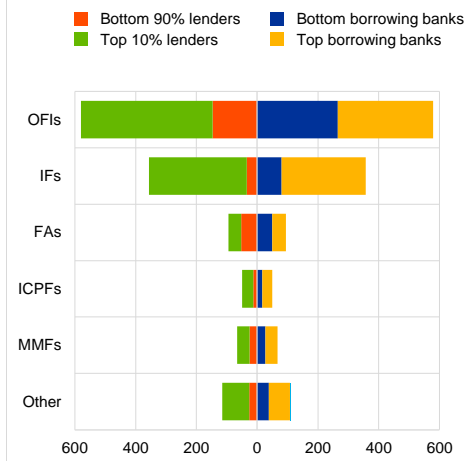
a) Repo funding of euro area banks from NBF entities, by maturity and counterparty sector

(Q1 2023; left-hand scale: € billions, right-hand scale: percentages)



b) Concentration of euro area banks' repo funding from NBF entities, by sector of lending entity and borrowing banks

(Q1 2023, € billions)



Sources: ECB and ECB calculations.

Notes: The analysis is based on a sample of 120 euro area banks with 1,529 counterparties. Top borrowing banks are 13 euro area large banks, including all global systemically important banks (G-SIBs) based in the euro area. On the lender side, "Top 10% lenders" are the largest bank funding providers within a given NBF entity sector. Data represent median of daily values over the first quarter of 2023. Transactions include the stock of repurchase agreements and buy/sell-backs. OFIs stands for other financial institutions; IFs stands for investment funds; FAs stands for financial auxiliaries; ICPFs stands for insurance companies and pension funds; MMFs stands for money market funds; ON stands for overnight.

Although small relative to retail and corporate deposits, deposit funding from NBF entities can be particularly vulnerable to changes in market conditions.

About half of all deposits from NBF entities are held with banks for non-operational

¹³⁹ These holdings often consist of senior tranches retained by the sponsor.

purposes: these deposits are not related to clearing, custody or cash management and can be withdrawn freely.¹⁴⁰ They often reflect the liquidity buffers of the NBFIs and would typically be the first line of defence for meeting redemptions and other cash needs. They would be the main vehicle for transmitting liquidity shocks from the NBFIs sector to the banking sector.

NBFIs entities also play a major role as providers of repo funding to banks. In the last quarter of 2022, almost half of all repo funding to banks came from these entities. The share of euro area bank repo funding from non-banks has fluctuated between 41% and 54% since 2015. Investment funds and other financial institutions are the largest group of NBFIs entities providing repo funding to banks (**Chart B.2**, panel a), with French, German and Dutch banks being the main recipients.

The bulk of the NBFIs sector’s repo funding to banks has a very short maturity. Around half the repo funding provided by NBFIs entities consists of overnight transactions, while almost 80% of volumes have a maturity of one month or less (**Chart B.2**, panel a). This suggests that banks may face significant rollover risk. As is the case for unsecured deposits, repo transactions often serve as a liquidity buffer for NBFIs entities, in particular for investment funds and other financial institutions, including broker-dealers (**Chart B.2**, panel b). Banks might therefore need to replace the funding obtained in the repo market very rapidly if the NBFIs sector were to be hit by large, abrupt outflows.

Euro area NBFIs entities are also significant investors in bank debt securities. They hold 28% of outstanding bank debt securities, a share that has remained broadly stable over the past few years. Their role is larger in the short-term bank debt market, including commercial paper where money market funds are a key investor group (**Chart B.3**, panel a) and a possible source of funding tensions, as the March 2020 “dash for cash” episode showed.¹⁴¹ Investment funds and insurers are slightly more exposed to longer-term bank debt and are a key source of funding for banks needing to meet MREL requirements.¹⁴²

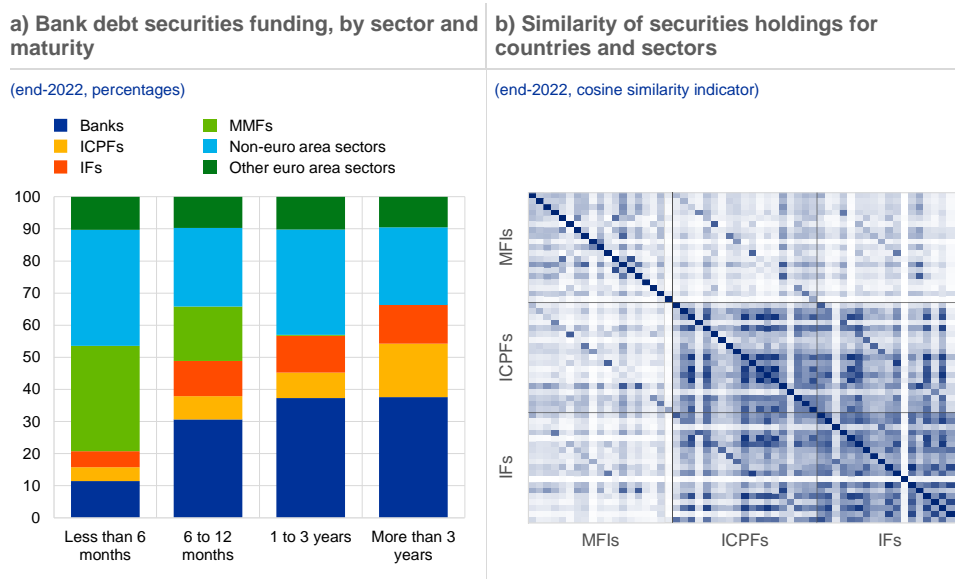
¹⁴⁰ Based on supervisory data. Non-operational deposits are defined in line with Article 27 of Commission Delegated Regulation (EU) 2015/61 to supplement Regulation (EU) 575/2013 of the European Parliament and the Council with regard to liquidity coverage requirement for credit institutions.

¹⁴¹ See the box entitled “Recent stress in money market funds has exposed potential risks for the wider financial system”, *Financial Stability Review*, ECB, May 2020.

¹⁴² See “Interim Report on MREL: Report on implementation and design of the MREL framework”, *EBA-Op-2016-12*, European Banking Authority, 19 July 2016.

Chart B.3

NBFI entities are a key investor class in bank debt securities, while their portfolios do not overlap significantly with those of euro area banks



Sources: ECB and ECB calculations.

Notes: ICPFs stands for insurance companies and pension funds; IFs stands for investment funds; MFIs stands for monetary financial institutions, excluding central banks; MMFs stands for money market funds. Panel b: based on the cosine similarity indicator, which measures the level of commonality between pairs of portfolios. The indicator equals zero (white) if the portfolio allocations of two country-sectors are uncorrelated and equals one (dark blue) if they are the same. Shades within this range quantify the degree of similarity. Assets belong to the same group if they are issued in the same country/region and by the same sector. The chart is symmetric.

Indirect linkages through common securities portfolios

Common exposures between NBFI entities and banks appear to be limited.

Indirect links between banks and non-banks, such as those related to common exposures, can also be a source of risk. Banks tend to display a greater home bias in their securities portfolios compared with NBFI entities, which limits the extent of common exposures (Chart B.3, panel b). The countries with the greatest similarity between bank and NBFI securities holdings are financial centres like Ireland, Luxembourg and Malta which attract banks and NBFI entities operating mainly on a cross-border basis. Portfolio similarities may also amplify funding tensions in the repo and derivatives markets, reducing the amounts that NBFI entities and banks can borrow from each other and pledge as collateral in the event of asset price shocks triggering outflows from the NBFI sector. Measures of portfolio similarity may not fully capture exposure to correlated assets, which can give rise to spillovers even when there is no similarity between the asset holdings of banks and NBFI entities.

Banks' exposure to NBFI entities as counterparties and clearers of derivatives

Banks are also exposed to NBFI entities through direct trading in derivatives or because they provide access to central clearing counterparties (CCPs).

Usually, NBF1 entities do not act as clearing members in the derivatives market and use banks to access CCPs. In markets not subject to central clearing, banks often intermediate customer trades, taking offsetting positions with NBF1 counterparties.

Banks trade more than 20% of their gross notional derivative exposures with NBF1 entities, which are mainly investment funds and other financial institutions.

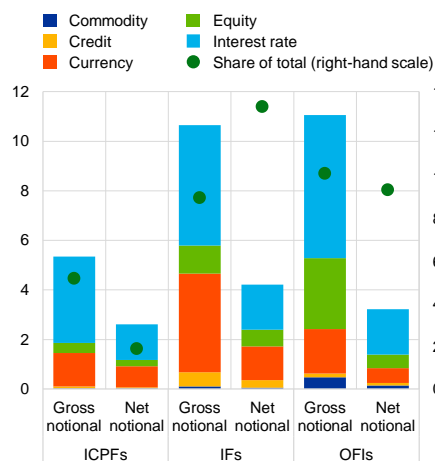
The breakdown by asset class of euro area banks' derivative exposures to NBF1 entities reflects the market landscape for derivatives, where interest rate contracts make up more than half of total positions (Chart B.4, panel a). Investment funds and other financial institutions also actively trade currency and equity derivatives with banks. Commodity and credit derivatives are marginal in comparison, and are traded mostly by the financial arms of energy firms seeking to hedge their commodity business and by bond funds seeking to hedge sovereign and corporate bond exposures. Net notional exposures, which measure the open positions taken by NBF1 entities with banks in the underlying asset, are significantly smaller than gross positions. For some asset classes, such as equity derivatives, banks operate matched books by netting opposite exposures across different counterparties. For other asset classes, such as interest rate derivatives, banks transfer some financial risks to the NBF1 sector and may be restricted in their ability to manage these risks should major NBF1 entities become distressed.

Chart B.4

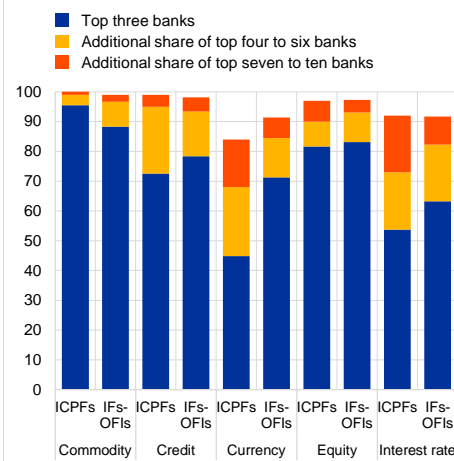
Banks provide access to clearing services for NBF1 entities and make the market for derivatives traded over the counter

a) Gross and net absolute notional derivative positions of euro area banks with NBF1 entities **b) Concentration in euro area banks' derivative exposures to NBF1 entities, by NBF1 entity type and asset class**

(Jan. 2023; left-hand scale: € trillions, right-hand scale: percentage shares of total derivative positions)



(Jan. 2023; percentage shares of outstanding gross notional)



Sources: ECB, EMIR and ECB calculations.
 Notes: The analysis is based on a sample of 95 euro area banks, directly supervised by the ECB and active in the euro area derivatives market, which have outstanding derivative positions with NBF1 entities. ICPFs stands for insurance companies and pension funds; IFs stands for investment funds and money market mutual funds; OFIs stands for other financial institutions. Net notional is calculated at counterparty, asset class, contract type and clearing level, and absolute values are aggregated at NBF1 sector and asset class levels. EMIR sector classification based on Lenoci, F.D. and Letizia, E., "Classifying Counterparty Sector in EMIR Data", in Consoli, S., Reforgiato Recupero, D. and Saisana, M. (eds.), *Data Science for Economics and Finance*, Springer, Cham, 2021.

Banks' derivative exposures to NBFi entities create counterparty and liquidity risks. When acting as market-makers, banks generally take limited directional positions in their trading books. However, their NBFi counterparties may take on exposures to the underlying assets, which exposes banks to counterparty credit risk. This risk is mitigated through margining practices, which expose banks to step-in liquidity risk if counterparties are unable to meet initial or variation margin calls after abrupt market movements. On average, the magnitude of such margin calls is limited in comparison with the size of the banking sector and its liquidity buffers. However, such calls may pose a challenge to NBFi entities and may also trigger funding outflows and further spillovers to banks via credit impairments to their asset-side exposure.

Concentration of spillover risks among large, systemically important banks

Any turmoil in the NBFi sector is likely to disproportionately affect large, complex, systemically important banks, as asset exposures, funding linkages and derivative exposures are concentrated in this group. The concentration of banks' exposure to NBFi entities on the lender side is much higher than the concentration of euro area banking assets (**Chart B.1**, panel b). The top five banks account for about 50% of total loan and securities exposure and the top 13 banks for over 80%. This group of banks includes the eight euro area G-SIBs, as well as several other large universal banks.

Banks' funding from NBFi entities is also highly concentrated, on both the borrower and the lender side. 13 large banks account for about 80% of euro area banks' total repo borrowing from NBFi entities (**Chart B.2**, panel b). These banks play a central role in the market, as they are virtually the only recipient of repo liquidity from investment funds, insurers, pension funds and money market funds. Most of the repo volume is also concentrated in a small number of lenders. The top 10% of lenders by size provide 88% of total funding. These figures suggest that concentration risk is elevated, as there is a small number of banks which heavily rely on repo funding, which is provided by a small number of NBFi entities.

A similar group of large banks is also central to the functioning of the derivatives market. On top of taking limited directional positions and acting as natural counterparties for some derivatives transactions, banks provide market access to NBFi entities, acting as clearing members and market-makers.¹⁴³ Only large and systemically important banks, which have the necessary size and balance sheet capacity to keep a matched book and which can manage the associated market and liquidity risks, are able to run a derivatives desk (**Chart B.4**, panel b). 80% of the outstanding notional for derivatives traded by NBFis in the euro area is intermediated by ten banks, mainly domiciled in France or Germany or subsidiaries of non-euro area banks. The degree of concentration is even higher in commodity

¹⁴³ See the box entitled "Euro area interest rate swaps market and risk-sharing across sectors", *Financial Stability Review*, ECB, November 2022.

and credit derivatives trading, where the three largest banks account for over 75% of all trades with NBFIs.

Conclusions

Linkages with the NBFIs sector expose banks to liquidity, market and credit risks, with liquidity risk seeming to be the main concern at present. The materialisation of liquidity and credit risks in the NBFIs sector would lead to an outflow of the funding provided by this sector, which primarily holds its liquid assets in the form of bank deposits and short-term securities. This funding may be highly sensitive to the credit quality of the recipient banks and can amplify the funding pressures faced by banks if the soundness of their fundamentals has been called into question. Liquidity pressures on NBFIs entities may also lead to heightened drawing from credit facilities provided by banks. Should liquidity stress force NBFIs entities to sell assets, the resulting impact on asset prices could trigger a revaluation of assets held by banks, in particular in the cases where the portfolios of banks and NBFIs entities overlap or asset prices are correlated. This could affect bank capital as well as liquidity, assuming these assets are used to support secured funding or margins on derivatives portfolios. Based on the magnitude of the linkages discussed in this special feature, funding spillovers are likely to be more significant from a systemic risk perspective, while direct credit exposures are likely to be less significant.

A small group of systemically important banks is key to ensuring the smooth operation of parts of the NBFIs sector. If one or a group of such institutions were to become distressed, there would probably be substantial ramifications in terms of the ability of significant parts of the NBFIs sector to manage liquidity and market risks. At the same time, distress in the NBFIs sector would probably affect these key banks more significantly than smaller banks. The limited substitutability of these key banks has already been recognised in the global and European framework governing the identification of systemically important banks and is one reason why such banks are subject to more stringent capital and disclosure requirements. Greater resilience of these key nodes in the financial system is a precondition for containing spillovers between the NBFIs sector and the banking sector and for insulating the provision of bank credit to the real economy from shocks stemming from NBFIs entities. The sizeable capital and liquidity buffers held by these banks help to mitigate potential spillovers. That said, improving liquidity risk management practices and tackling synthetic leverage in the NBFIs sector (**Section 5.2**) would indirectly support the resilience of banks, by mitigating the risk of such spillovers occurring.

C Climate change and sovereign risk

Prepared by Stephan Fahr, Margherita Giuzio, Clementine Mc Sweeny Pourtalet, Martina Spaggiari and Josep Maria Vendrell Simón¹⁴⁴

Climate change can have a negative effect on sovereign balance sheets directly (when contingent liabilities materialise) and indirectly (when it has an impact on the real economy and the financial system). Part of this risk is embedded in the analyses of the macroeconomic costs of climate change which show that transition and physical risks can significantly reduce GDP growth and fiscal buffers. This special feature highlights the contingent sovereign risks that stem from an untimely or disorderly transition to a net-zero economy and from more frequent and severe natural catastrophes. It also looks at the positive role that governments can play in reducing climate-related financial risks and incentivising adaptation. If the recent trend of ever-lower emissions across the EU is to be sustained, further public sector investment is essential. In this context, the progress made to strengthen green capital markets has fostered government issuance of green and sustainable bonds to finance the transition. While putting significant resources into adaptation projects can increase countries' resilience to climate change, the economic costs of extreme climate-related events are still set to rise materially in the EU. Only a quarter of disaster losses are currently insured and fiscal support has mitigated related macroeconomic and financial stability risks in the past. Looking ahead, vulnerabilities arising from contingent liabilities may increase in countries with high physical risk and a large insurance protection gap. If these risks rise alongside sovereign debt sustainability concerns, the impact on financial stability could be amplified by feedback loops that see sovereign credit conditions and ratings deteriorate.

Introduction

In advanced economies, climate-related fiscal risks have not been explored as extensively as other climate-related financial stability risks. Much progress has been made in assessing the financial stability impact of climate change in recent years, mainly as it relates to non-financial firms, financial markets and intermediaries.¹⁴⁵ While fiscal risks have been widely explored for emerging markets

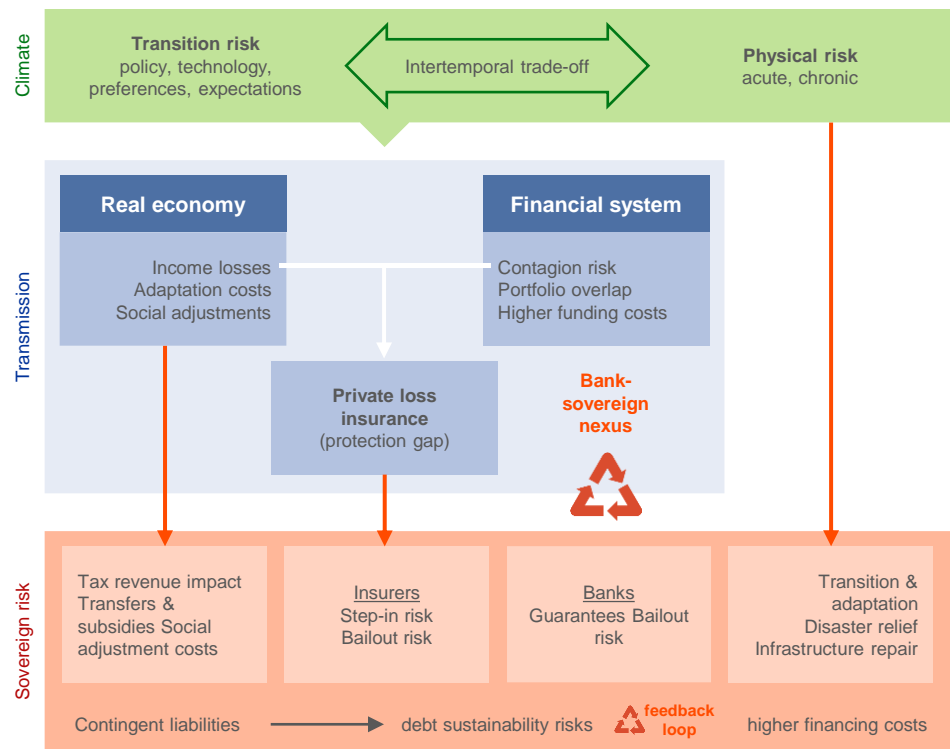
¹⁴⁴ This special feature has benefited from input from Tina Emambakhsh, Riccardo Pizzeghello and Elisa Telesca.

¹⁴⁵ Much of the evidence to date on euro area financial stability relates to transition and physical risks to non-financial firms and risks to the financial system, sustainable financial markets and the development of related policies. See the box entitled "[Carbon-related concentration risk: measurement and applications](#)", *Financial Stability Review*, ECB, November 2022, the special feature entitled "[Climate-related risks to financial stability](#)", *Financial Stability Review*, ECB, May 2022, and the special feature entitled "[Climate-related risks to financial stability](#)", *Financial Stability Review*, ECB, May 2021. IMF staff have also recently outlined the emerging approach to assessing the impact of climate change in the context of the IMF's Financial Sector Assessment Program (FSAP). See "[Approaches to Climate Risk Analysis in FSAPs](#)", Staff Climate Notes, July 2022.

and developing economies,¹⁴⁶ they remain less well examined for sovereigns in advanced economies.

Figure C.1

Sovereign climate-related risks and link to financial stability



Source: ECB.

Although climate change could affect sovereign balance sheets directly, many effects are dependent on the materialisation of physical and transition risks.

Physical and transition risks can affect sovereign debt sustainability by impacting the public finances directly, in the form of the substantial investments needed for the transition to net zero and for adaptation as well as the higher fiscal costs incurred following disasters (Figure C.1). In addition, while climate policies such as carbon pricing might increase public revenues, the public finances might be affected indirectly through lower tax revenues as and when risks materialise in the real economy.¹⁴⁷ Higher disaster losses and reconstruction costs for companies imply lower fiscal revenues in areas affected by physical risk. At the same time, governments will face calls for subsidies, social adjustments and compensation packages. Sovereigns may also face contingent liabilities through the financial sector, especially on account of credit losses and explicit or implicit sovereign guarantees, or also through gaps in insurance coverage that governments might be

¹⁴⁶ See, for instance, “Scaling up Climate Finance in Emerging Markets and Developing Economies: Challenges and Opportunities”, Chapter 2, *Global Financial Stability Report*, International Monetary Fund, October 2022.

¹⁴⁷ For an overview of EU fiscal policies and instruments related to climate change, see Avgousti, A. et al., “The climate change challenge and fiscal instruments and policies in the EU”, *Occasional Paper Series*, No 315, ECB, 2023.

asked to cover. Taken together, these factors can affect a sovereign's credit quality and debt financing rates.

Governments can help to reduce these risks by fostering the transition to a low-carbon economy and encouraging adaptation.¹⁴⁸ In the past, fiscal support has mitigated some climate-related financial stability risks, especially following large natural disasters. As such risks are expected to intensify, the vulnerabilities arising from contingent liabilities may increase, particularly in countries that are exposed to high levels of transition and physical risk and that have a large insurance protection gap. The following sections analyse how the public sector could reduce climate risk and foster private investment in adaptation measures and in the transition to net zero.

Financing the transition to a net-zero economy

The EU has set targets and designed policies to reduce greenhouse gas emissions by 55% by 2030 and become climate-neutral by 2050. The Fit for 55 package contains a set of policy proposals for achieving this objective. At the same time, the REPowerEU programme complements this with a plan to rapidly reduce dependence on Russian fossil fuels following the Russian invasion of Ukraine. Progress has also been made in strengthening green capital markets, with the European green bond standard designed to foster government issuance of green and sustainable bonds and reduce greenwashing risk. Overall, the EU economy has already reduced emissions by more than 30% compared with 1990 levels, with sectors covered by the EU Emissions Trading System making important contributions, and the share of renewables in the EU energy mix has almost tripled since 1990.¹⁴⁹ However, the road to net-zero emissions is still long. Energy transition scenarios calibrated by the ECB on the basis of pathways defined by the Network for Greening the Financial System (NGFS) point to the need to reduce the share of fossil fuels in the aggregate EU energy mix from 65% in 2022 to 50% by 2030 to achieve the emission reductions outlined above. The share will need to fall to 31% by 2030 to limit the increase in temperature to no more than 1.5°C by the end of the century (**Box A**).

Box A

The energy transition through the lens of the ECB's second economy-wide climate stress test

Prepared by Tina Emambakhsh and Martina Spaggiari

The transition to a carbon-neutral economy is essential to limit the catastrophic impact of climate change and is now a key global priority. The ECB's first top-down, economy-wide climate stress test demonstrated the importance of a prompt transition.¹⁵⁰ Furthermore, the Russian

¹⁴⁸ A joint, coordinated transition effort involving governments around the world is essential if physical risks and their medium/long-term impact are to be reduced.

¹⁴⁹ According to data from the European Environment Agency and Eurostat.

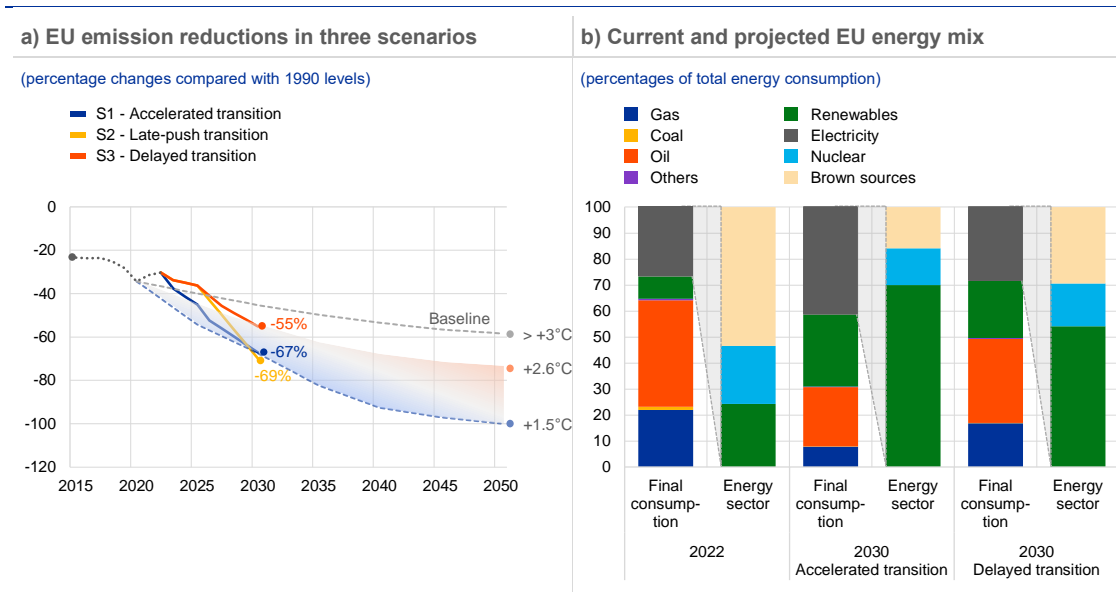
¹⁵⁰ See Alogoskoufis, S. et al., "ECB economy-wide climate stress test – Methodology and results", *Occasional Paper Series*, No 281, ECB, September 2021.

war in Ukraine has highlighted the additional costs and risks that arise from a high level of dependency on fossil fuels, presenting several challenges but also offering some incentives to speeding up the transition. Building on the premise that the transition is necessary, the ECB's second top-down, economy-wide climate stress test assessed the impact of three potential transition pathways on the real economy and the financial system over the next eight years.¹⁵¹

The three transition scenarios differ with regard to the timing and extent of emission reduction by 2030, which lead to different projected temperature increases by the end of the century (Chart A, panel a). The three scenarios imply different levels of long-term transition and physical risk. The **accelerated transition** scenario assumes an immediate start for the transition which quickly brings the economy onto the optimal Net Zero 2050 pathway defined by the Network for Greening the Financial System (NGFS). In the **late-push transition** scenario, recent geopolitical and macroeconomic developments lead to a different time profile for the transition, which does not intensify until 2026 but is strong enough to reach a comparable level of emission reduction. The **delayed transition** scenario assumes similar transition timing but more limited policy action, less investment and hence less emission reduction by 2030.

Chart A

The EU will have to reduce its reliance on carbon-intensive energy sources to meet its climate goals



Sources: European Environment Agency, Eurostat, NGFS and ECB calculations.

Notes: Panel a: Emission pathways refer to the EU aggregate. Temperature increases refer to the year 2100. Emission pathways until 2050 correspond to the NGFS's Net Zero 2050 (+1.5°C), Nationally Determined Contributions (+2.6°C) and Current Policies (>+3°C) scenarios. Panel b: Brown sources for the energy sector include gas, coal and oil.

A refined modelling framework makes it possible to measure the impact of transition risk on corporates and households by capturing changes in energy dynamics. The main transition efforts in the real economy focus on reducing the use of fossil fuels in favour of renewables and on electrifying production processes. The latter is reinforced by a rapid switch from fossil fuels to renewable inputs in the electricity generation process (**Chart A, panel b**). The ECB toolbox

¹⁵¹ The three transition scenarios have been calibrated by combining climate scenarios developed by the [Network of Central Banks and Supervisors for Greening the Financial System](#) with December 2022 Eurosystem staff macroeconomic projections and incorporating the latest data on the energy mix. The eight-year horizon is selected because the green transition is expected to take place in the short to medium term and 2030 represents the cut-off date for several climate policy targets.

estimates the impact of transition risk on firms' energy expenses, green investment, and the revenues of the energy sector as a whole. The main transition risk drivers are energy prices, energy mix and energy consumption, the latter being directly responsible for greenhouse gas emissions. In the short term, firms' profitability is hit by energy price shocks, causing firms' operating costs to increase. Higher energy prices and climate change concerns provide an incentive to invest in carbon mitigation activities and renewable energy, thereby increasing firms' indebtedness.¹⁵² The results feed a credit risk model that estimates transition-shocked probabilities of default (PDs) based on the changes in firms' profitability and leverage. An additional module assesses the impact of transition risk on households' solvency.¹⁵³

Comparing results across scenarios, the accelerated transition and the delayed transition scenarios lead to similar (and lower) risk levels in 2030; however, the latter entails substantially greater long-term transition and physical risks. Transition impact differs greatly across sectors, with the largest increase in credit risk being experienced if the transition happens late and abruptly (**Chart B**, panel a). The median corporate PD is slightly below 1% at the starting point and is projected to almost double in the late-push transition scenario in 2030. While corporate PDs increase by around 40 basis points by 2030 in both the accelerated and the delayed transition scenarios, credit risk is expected to increase more strongly in the delayed transition after 2030 due to continuing increases in energy prices and less renewable energy capacity. Moreover, given that emission reductions to 2030 are less ambitious, greater increases in temperatures are expected to lead to more frequent and more severe natural hazards in the long term.¹⁵⁴ Firms in the mining, manufacturing and utility industries are among those with the most severe credit risk impact in the tail of the distribution.

The green transition – be it accelerated or delayed – increases the expected losses and provision needs of banks in the short term but has a limited impact overall relative to portfolio size. Mapping firm-level PDs to information on banks' individual corporate loans makes it possible to assess the transmission of transition risk from firms to banks. At the same time, the transmission of transition risk from households to banks is assessed using the projected deterioration in the credit quality of the respective portfolio. Annual expected losses for the median bank are 25% higher in 2030 than in 2022 in a baseline scenario without transition risk. This increases by an additional 23% in the accelerated transition scenario, 53% in the late-push transition scenario and 23% in the delayed transition scenario due to transition efforts beyond current climate policies (**Chart B**, panel b). It follows that banks would be required to increase provisions by at least as much. Annual expected losses relative to portfolio size for the median bank range between 0.6% and 1%, depending on the scenario, and are almost double that level in the tail. The wider distribution of bank-level increases in expected losses indicates greater risks in the

¹⁵² Investment needs are estimated at firm level and are assumed to be proportional to projected emission reductions. This results in aggregate green investments of between €2.5 and €3.2 trillion over the next eight years, depending on scenario, for 2.9 million firms that account for 50% of total corporate assets in the euro area. See Chart C.1 for further details.

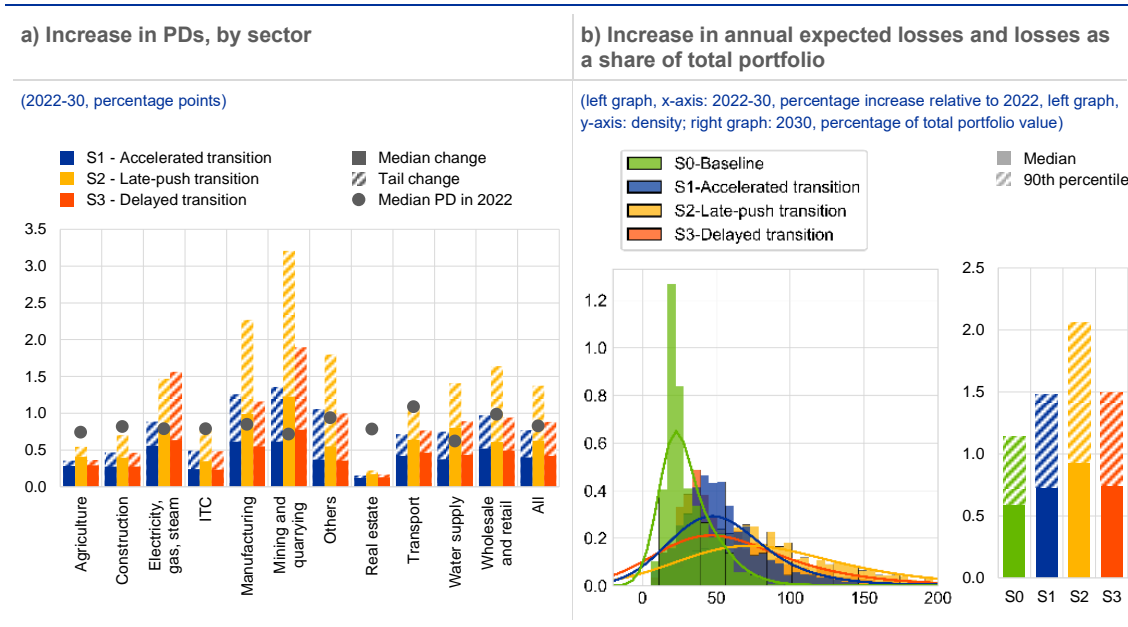
¹⁵³ Households' financial resilience is assessed based on bank-to-country-level information on mortgages combined with country-level information on households' energy consumption, emissions and investments, as well as financial and macroeconomic variables. The deterioration in the credit quality of households' portfolios is measured by the share of newly defaulted loans over time.

¹⁵⁴ The considerations regarding long-term physical risk hold under the assumption that all global economies will reduce their emissions as described in the respective NGFS scenario and therefore in a way which is compatible with global temperatures increasing by no more than 1.5°C (in the first two scenarios) or 2.6° (in the third scenario) by 2100.

late-push transition, where annual expected losses are in excess of 2% of total portfolio value in 2030.

Chart B

Macroeconomic and transition-related developments increase corporates' PDs and banks' annual expected losses, but the impact is limited overall relative to loan portfolio size



Sources: Bureau van Dijk – Orbis database, ECB, Eurostat and ECB calculations.

Notes: Panel a: the tail change refers to the 75th percentile of the firm-level distribution for each sector. Panel b: the left graph shows the distribution of bank-level expected losses for a sample of 1,480 euro area banks (instrument coverage: €6.15 trillion of loans to corporates and households), while the right graph refers to a sub-sample of 103 significant institutions (instrument coverage: €5.43 trillion). BL stands for "baseline".

All in all, an accelerated transition to a carbon-neutral economy would help to contain systemic risk.

At the end of the horizon, credit risk is highest in a late-push transition. The accelerated transition and the delayed transition scenarios lead to similar risk levels by 2030, but the latter achieves less ambitious emission reductions. Overall, an accelerated transition does not seem to generate financial stability concerns for the euro area, as long as firms and households can finance their green investments in an orderly manner. However, the heterogeneous results across economic sectors and banks suggest that more careful monitoring of some sub-sets of entities and credit exposures will be required during the transition process.

Governments have proposed transition plans that imply large-scale public and private investment.

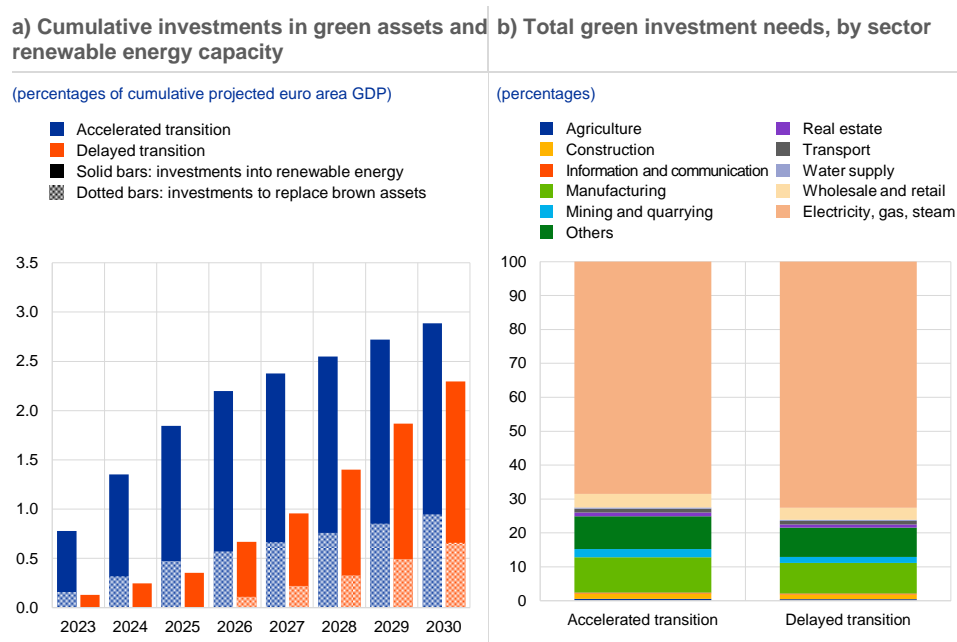
The European Commission estimates that the additional green investment needed at EU level by 2030 amounts to €520 billion per year (around 3.7% of 2019 GDP).¹⁵⁵ The share of total green investment expected to come from the public sector is between 25% and 45%, but there is a considerable uncertainty

¹⁵⁵ See "Towards a green, digital and resilient economy: our European Growth Model", European Commission, March 2022. The more recent REPowerEU plan requires around €210 billion of investment between now and 2027 to phase out Russian fossil fuel imports, only part of which is included in these estimates.

around this estimate.¹⁵⁶ A bottom-up analysis, run at firm level and covering around 50% of euro area corporates' total assets, estimates that the overall amount of green investment required will total around 3% of cumulative GDP over the next eight years in the current macroeconomic environment, and will be mainly targeted at the electricity sector (**Chart C.1**, panel b). Further public investment in the transition across sectors such as transport, water, housing and telecommunications infrastructure may also have a positive impact on medium-term growth and energy security. At the same time, temporary measures to replace Russian natural gas supplies could jeopardise the green transition in the medium term. More than 100 energy contracts have been signed in the EU since January 2022, mainly for the provision of gas and only half of which involve clean energy.¹⁵⁷ Most of these contracts have long maturities averaging eight years.

Chart C.1

The transition towards net zero implies high levels of investment



Sources: ECB calculations based on Bureau van Dijk – Orbis database, Urgentem, Eurostat, NGFS, the Intergovernmental Panel on Climate Change and IRENA.
 Notes: Investments are estimated at firm-level for 2.9 million euro area companies (accounting for 52% of euro area corporates' total assets as at end-2020) as part of the ECB's second top-down, economy-wide climate stress test. For the electricity sector, investment in renewable energy capacity is modelled based on experience curves and includes solar and offshore/onshore wind energy. For all other sectors, investments in carbon mitigation activities like carbon sequestration, energy-efficient buildings and machinery, and carbon capture and storage are also considered. The transition scenarios are described in Box A.

The issuance of sovereign green bonds has picked up in the euro area in recent years. Green sovereign bonds increasingly help to fund government investment in projects with environmental objectives (mostly climate change mitigation). So far, clean transport has been the main beneficiary (almost 50%) of investment from green bond issuance by euro area governments, followed by energy

¹⁵⁶ See “Building a smart and green Europe in the COVID-19 era”, *Investment Report 2020/2021*, European Investment Bank, January 2021, and the article “Fiscal policies to mitigate climate change in the euro area”, *Economic Bulletin*, Issue 6, ECB, 2022. Green investments from the public sector can take the form of direct investments or subsidies.
¹⁵⁷ See *EU Energy Deals Tracker*, European Council on Foreign Relations, November 2022.

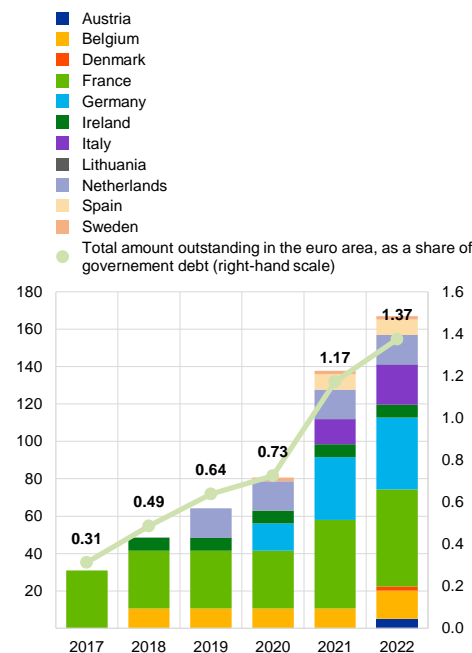
efficiency (including green construction) and renewable energy which together represent a third of allocations (**Chart C.2**, panel b). Public sector participation also fosters the development of private sector green markets by increasing liquidity and by setting frameworks with best practices that promote standards for green bond classifications and their verification. This also helps to minimise the risk of greenwashing.

Chart C.2

Sovereign green bond markets in the euro area continue to develop, and the proceeds help to support environmental projects

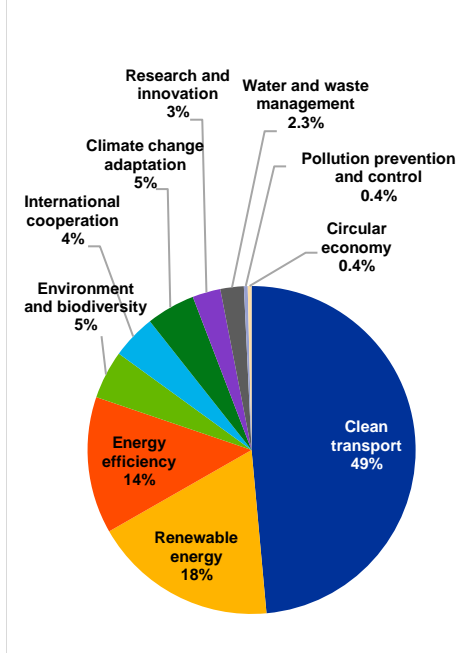
a) Amount outstanding of euro area green sovereign bonds, by country

(2017-22; left-hand scale: € billions, right-hand scale: percentages)



b) Use of proceeds from the issuance of euro area sovereign green bonds

(2022, percentages)



Sources: Bloomberg Finance L.P., debt agencies (allocation reports) and ECB calculations.

Notes: Panel a: the light green line represents the total amount outstanding of green bonds issued by euro area sovereigns as a share of euro area government debt. Bloomberg classifies bonds as green according to the information provided by the debt agencies. Panel b: the latest publicly available allocation reports are used.

The efforts made to strengthen green capital markets in the EU have

encouraged euro area sovereigns to enter green bond markets.¹⁵⁸ While the market is expanding rapidly, it still only accounts for less than 1.5% of all euro area government debt (**Chart C.2**, panel a). Performance-linked bonds with a less restrictive use of proceeds and whose payout depends on verifiable reductions in overall greenhouse gas emissions – such as sustainability-linked bonds¹⁵⁹ – could

¹⁵⁸ See “Towards a green capital markets union for Europe”, speech by Christine Lagarde at the European Commission’s high-level conference on the proposal for a Corporate Sustainability Reporting Directive, 6 May 2021, and “New challenges in a changing world”, speech by Christine Lagarde at the Deutsche Börse Annual Reception in Eschborn, 23 January 2023.

¹⁵⁹ See “Sovereigns and sustainable bonds: challenges and new options”, *BIS Quarterly Review*, Bank for International Settlements, September 2022.

attract more investors, while also being more conducive to long-term policy commitments.

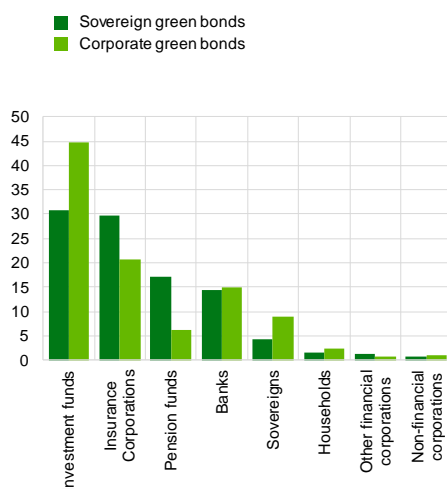
The non-bank financial intermediation sector is the main holder of euro area sovereign green bonds. Financial institutions are by far the main investors (over 90%), with households and non-financial corporations at the other end of the scale. The share of institutional investors with a long-term perspective, such as insurance corporations and pension funds, is almost 50% (Chart C.3, panel a). Many of these investors have incorporated ESG considerations into their mandates and asset allocation strategies, but are probably also attracted by the normally longer maturity of sovereign green bonds (given the longer horizon of green projects) that matches their buy-and-hold strategies. At the same time, participation rates for investment funds are substantially lower than in the corporate green bond market.

Chart C.3

Sovereign green bonds are attractive for long-term institutional investors amid a vanishing greenium

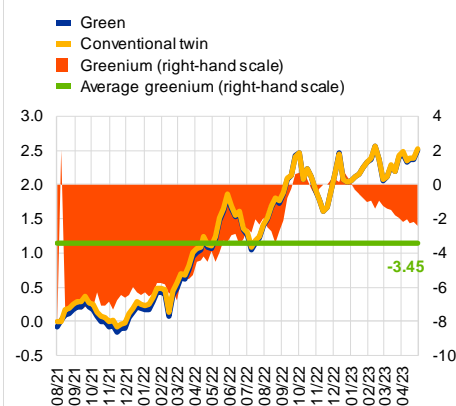
a) Holders of euro area sovereign and corporate green bonds

(2022, percentages)



b) Greenium of euro area green bonds

(Aug. 2021-May. 2023; left-hand scale: yield to maturity in percentage, right-hand scale: basis points)



Sources: Bloomberg Finance L.P., ECB and ECB calculations.

Notes: Panel b: amount outstanding weighted average greenium. The greenium refers to the difference in yield to maturity between green bonds and conventional bonds. Different methods are used in the literature to estimate this discount – for this analysis it has been estimated by matching, when possible, each green bond with a conventional sovereign bond based on similar features such as rating and maturity (the “conventional twin”).

Early issuances of euro area sovereign green bonds benefited from the existence of a greenium.¹⁶⁰ Similar to the green corporate bond segment¹⁶¹, euro area sovereigns have until recently been able to finance green projects using green bonds at a cheaper rate (averaging -3.5 basis points lower) than if they had issued an equivalent regular bond (with similar maturity and the same credit risk)

¹⁶⁰ When a green bond has a lower yield than a similar conventional bond without the green label, the green bond is said to exhibit a greenium. A greenium implies that the price of the green bond is higher than that of a similar, conventional bond.

¹⁶¹ See Pietsch, A. and Salakhova, D., “Pricing of green bonds: drivers and dynamics of the greenium”, Working Paper Series, No 2728, ECB, 2022.

(**Chart C.3**, panel b).¹⁶² The imbalance between supply and demand in the green bond market is the most likely factor behind the existence of a greenium. In recent months, this greenium has shrunk, which might reflect a better supply-demand balance but could also point towards worsening liquidity conditions in euro area sovereign bond markets (**Chapter 2** and **Special Feature A**). While the disappearance of the greenium implies higher returns for investors, it also means that it has become more expensive for sovereigns to finance green projects.

Contingent liabilities and risk-reduction and adaptation policies

Governments can themselves face the risk of having to step in to cover some of the costs of climate risk.

Public investments aimed at fostering the green transition may be characterised by a fiscal multiplier which is able to enhance economic growth while having a positive effect on the public finances. At the same time, higher costs following disasters, as well as greater investment (or the lack thereof) in adaptation and risk mitigation, can have direct fiscal implications.¹⁶³ In particular, climate risks could have a gradual, negative impact on the conditions surrounding public finance as a result of lower tax revenues, higher public debt and the reallocation of funds from other investments. They could also trigger explicit and implicit contingent liabilities – which are potential costs that materialise if catastrophes occur – that may exceed previously allocated funds and thus suddenly hit public finances. Although the exact fiscal implications are difficult to predict, they could clearly weigh on debt sustainability and borrowing costs.

Contingent liabilities may be a significant source of risk for sovereigns, should the net-zero transition be untimely or disorderly.

¹⁶⁴ Historical evidence shows that the largest fiscal costs relate to financial sector claims and public bailouts of state-owned enterprises stemming from implicit commitments. This is especially the case in sectors of the economy that are relevant for the transition, such as utilities, transport and manufacturing. In addition, sovereign contingent liabilities tend to materialise in waves and can be exacerbated by drops in GDP growth.

As climate change advances, the explicit and implicit contingent liabilities from physical risk could increase as well.

Historically, the fiscal costs of natural disasters have been less severe than financial sector claims (**Chart C.4**, panel a),

¹⁶² See Ando, S., Fu, C., Roch, F. and Wiriadinata, U., “How Large is the Sovereign Greenium?”, *IMF Working Papers*, No 23/80, International Monetary Fund, 2023.

¹⁶³ See Dunz, N. and Power, S., “Climate-Related Risks for Ministries of Finance: An Overview”, *technical report*, The Coalition of Finance Ministers for Climate Action, 2021; Cebotari, A., “Contingent Liabilities: Issues and Practice”, *IMF Working Papers*, No 8, International Monetary Fund, 2008; “NGFS Climate scenarios for central banks and supervisors”, *NGFS Publications*, Network for Greening the Financial System, June 2020; Schuler, P., Oliveira, L.E., Mele, G. and Antonio, M., “Managing the Fiscal Risks Associated with Natural Disasters”, *Fiscal Policies for Development and Climate Action*, World Bank Group, 2018; Volz, U. et al., “Climate change and sovereign risk”, SOAS, University of London, 2020; and Zenios, S.A., “The risks from climate change to sovereign debt”, *Climatic Change*, Vol. 172, No 30, June 2022, pp. 1-19.

¹⁶⁴ See the box entitled “Contingent liabilities: past materialisations and present risks”, *Financial Stability Review*, ECB, May 2021.

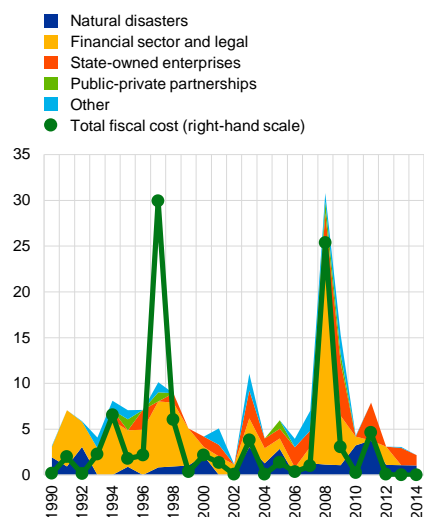
but the frequency and severity of extreme weather events is on the rise.¹⁶⁵ Explicit costs, such as damage to infrastructure and property, and implicit liabilities, such as guarantees for private investments and the financial sector, can become increasingly significant. In addition, this fiscal pressure may come in periods of lower growth and tax revenues, as capital is typically absorbed by reconstruction activities. A recent analysis by the European Commission, which simulates the fiscal shocks of natural disasters in 13 EU countries, projects debt-to-GDP ratios to be on average 2.3 and 2.7 percentage points higher by 2032 in 1.5°C and 2°C global warming scenarios respectively.¹⁶⁶ This highlights the need for fiscal authorities to reflect contingent liabilities related to physical risk in their debt sustainability analysis.¹⁶⁷

Chart C.4

As climate change advances, contingent liability risks are more likely to materialise if the share of insured disaster losses remains low

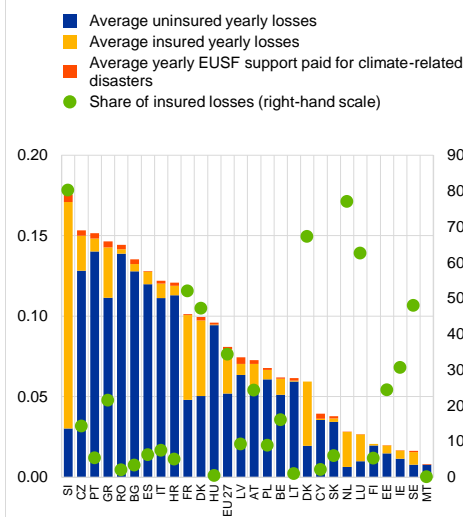
a) Number of contingent liability materialisations, by year and type

(1990-2014; left-hand scale: number of episodes, right-hand scale: percentage of total GDP)



b) Insured versus uninsured costs of extreme climate-related events

(1980-2021; left-hand scale: loss as a percentage of GDP, right-hand scale: share of insured losses in total)



Sources: Panel a: Bova et al.*; panel b: CATDAT, Eurostat, EUSF data and ECB calculations.

Notes: Contingent liabilities are defined as obligations that only materialise when a certain event occurs. Panel a: data are for 34 advanced economies and 46 emerging markets and developing economies. Panel b: only data for EU countries are included. The figures on insurance are based on CATDAT and do not account for public-private partnerships or other factors affecting the share of insured losses. The yearly insured and uninsured losses are calculated as averages over the aggregate estimates of losses between 1980 and 2021 inclusive, while the EU Solidarity Fund (EUSF) support paid for climate-related disasters is an average between 2002 and 2021. GDP is as of 2021. There have been no applications by Denmark or Finland for financial support under the EUSF. *) Bova, E., Ruiz-Arzanza, M., Toscani, F. and Ture, H., "The Impact of Contingent Liability Realizations on Public Finances", *International Tax and Public Finance*, Vol. 26, Issue 2, 2019, pp. 381-417.

In this context, insurance can mitigate the fiscal costs associated with disasters, yet only 25% of disaster losses are insured (Chart C.4, panel b).

¹⁶⁵ See Bova, E. et al., "The impact of contingent liability realizations on public finances", *International Tax and Public Finance*, Vol. 26, Issue 2, 2019, pp. 381-417.

¹⁶⁶ See "Fiscal Sustainability Report 2021", *European Economy Institutional Papers*, No 171, European Commission, April 2022, and the box entitled "Including climate change risks in the DSA: concepts and definition", *Debt Sustainability Monitor 2019*, European Commission, January 2020.

¹⁶⁷ See also "OECD Recommendation on Disaster Risk Financing Strategies", OECD, February 2017, and "Enhancing Financial Protection Against Catastrophe Risks: The Role of Catastrophe Risk Insurance Programmes", OECD, October 2021.

Fiscal support measures have mitigated macroeconomic and financial stability risks related to natural disasters in the past, as governments have typically funded some of the recovery and reconstruction activities.¹⁶⁸ But expectations of such unconditional government support can create moral hazard and lower the incentives for households and firms to adapt and reduce their vulnerability to climate-related catastrophe risks. A large insurance protection gap can therefore increase the vulnerabilities arising from contingent liabilities in countries with high physical risk, amplifying the direct impact of disasters on debt sustainability and potentially having a negative effect on sovereign creditworthiness.¹⁶⁹ Climate-related events are also likely to have varying effects on the fiscal stability of European countries, as economies differ significantly in their climate risk exposures, vulnerabilities and resilience.

This emphasises the need for enhanced catastrophe risk management tools and risk-sharing mechanisms that can complement private insurance and increase resilience, at both national and EU level. As climate-related risks are unlikely to be sufficiently insured by the private sector, targeted fiscal buffers, natural disaster funds, catastrophe bonds and investments in risk reduction and adaptation can help tackle uninsured losses from disasters. In addition, fostering stronger cooperation with the private (re)insurance sector through public-private partnerships could direct a greater share of financial assets towards climate resilience. Finally, an EU-wide scheme for catastrophe insurance could help further reduce the losses from less frequent and large-scale disasters by exploiting the risk-pooling benefits across EU countries, while incentivising and promoting adaptation.¹⁷⁰

As climate risks can materially affect public finances, credit ratings globally seem to reflect some climate-related variables at country level, especially after the Paris Agreement.¹⁷¹ Higher temperature anomalies and more frequent natural disasters are associated with lower ratings for advanced, emerging and developing economies. Countries that are more resilient to extreme weather events consistently tend to have higher ratings. But transition risk factors, such as carbon emissions and energy consumption, do not appear to be reflected in ratings. And even when statistically significant, climate variables play a marginal role in influencing credit ratings.

¹⁶⁸ A recent costly event in Europe occurred in 2021 when summer floods hit several western European countries, causing overall damage of €46 billion, of which only €11 billion was insured. As a result, [Germany committed up to €30 billion to fund its reconstruction efforts](#).

¹⁶⁹ See Fache Rousová, L. et al., “[Climate change, catastrophes and the macroeconomic benefits of insurance](#)”, European Insurance and Occupational Pensions Authority, July 2021, and “[The macroprudential challenge of climate change](#)”, ECB/ESRB Project Team on climate risk monitoring, European Systemic Risk Board, July 2022.

¹⁷⁰ See “[Policy options to reduce the climate insurance protection gap](#)”, *Discussion Paper*, ECB/EIOPA, April 2023.

¹⁷¹ This evidence is based on a panel regression including 124 countries over the period from 1999 to 2021. The dependent variable is the average of sovereign ratings issued by S&P, Moody's, Fitch and DBRS. Physical risk variables include country-level temperature anomalies and the frequency of natural disasters. Transition risk variables include carbon emissions, primary energy consumption per unit of GDP, and a forward-looking measure calculated as the percentage difference in carbon emissions under the business-as-usual and the target-achievement scenarios. As a robustness test, two Notre Dame-Global Adaptation Index (ND-GAIN) indicators of a country's readiness and vulnerability to physical risk are used to proxy the resilience of a country in the face of extreme weather events and its predisposition to be impacted by these climatic events respectively.

For financial stability, it is important for rating agencies to incorporate all relevant climate-related variables into their credit risk assessments. This would reduce the risk of abrupt repricing and allow investors, financial institutions such as banks and insurers, and central banks to reflect sovereign climate-related risks adequately and consistently in the risk weights used for prudential and risk management purposes. In addition, following its strategy review, the ECB is exploring the extent to which climate considerations are included in credit ratings.¹⁷²

Conclusions and policy implications

Climate change can be a significant source of risk for sovereigns through contingent liabilities and through its impact on the real economy and the financial system. Beyond the sizeable investments associated with the transition to net zero and the costs of adaptation, higher disaster losses and reconstruction costs imply lower tax revenues from companies in areas affected by physical risk, while governments will face calls for subsidies, social adjustments and compensation. In addition, if climate-related financial risks rise together with sovereign debt sustainability concerns, the impact may be amplified by feedback loops that see credit conditions and ratings deteriorate.

The public sector can adopt policies and investments to increase countries' resilience to these risks and incentivise risk reduction and adaptation. The available evidence suggests that green investments should increase further if the EU emissions-reduction target is to be met by 2030. The ECB's recent economy-wide stress test shows that the corporate sector needs an overall amount of green investment totalling around 3% of cumulative GDP over the next eight years. The progress made to strengthen green capital markets, such as the European green bond standard, has fostered government issuance of green and sustainable bonds by reducing greenwashing risk to some extent and reinforcing flows of funding that support the transition. Governments also face the risk of having to step in to cover the costs of climate-related catastrophes materialising. In this context, a recent ECB-EIOPA Discussion Paper sets out possible actions to tackle the insurance protection gap and mitigate catastrophe risks from climate change in the EU. These include enhanced disaster risk management tools for the public sector and risk-sharing mechanisms that can enhance resilience at both national and EU level, such as public-private partnerships and an EU scheme for natural disaster insurance.¹⁷³

¹⁷² See Breitenstein, M., Ciummo, S. and Walch, F., “[Disclosure of climate change risk in credit ratings](#)”, *Occasional Paper Series*, No 303, ECB, September 2022.

¹⁷³ See “[Policy options to reduce the climate insurance protection gap](#)”, *Discussion Paper*, ECB/EIOPA, April 2023.

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