INTERNATIONAL MONETARY FUND

IMF Country Report No. 24/157

LUXEMBOURG

FINANCIAL SECTOR ASSESSMENT PROGRAM

FINANCIAL SYSTEM STABILITY ASSESSMENT

June 2024

This paper on Luxembourg was prepared by a staff team of the International Monetary Fund. It is based on the information available at the time it was completed in January 2024.

Copies of this report are available to the public from

International Monetary Fund • Publication Services
PO Box 92780 • Washington, D.C. 20090
Telephone: (202) 623-7430 • Fax: (202) 623-7201
E-mail: publications@imf.org Web: http://www.imf.org
Price: $18.00 per printed copy

International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

LUXEMBOURG

FINANCIAL SYSTEM STABILITY ASSESSMENT

May 8, 2024

KEY ISSUES

Context: The assessment of Luxembourg's large, interconnected, and complex financial system took place against heightened economic, financial, and geopolitical uncertainty. Investment funds have grown since the 2017 FSAP, while their connections to other funds, banks, nonbank financial intermediaries, and foreign entities have also increased. Domestic banks face risks from the ongoing downturn in credit and house price cycles, especially in the high-risk mortgage segment. Securities portfolios in large banks are mostly held-to-maturity and spread across euro area issuers. The banking sector maintains higher capital ratios than euro area peers, has low but rising nonperforming loans, and benefits from support to the economy from a AAA-rated sovereign.

Findings: The authorities have made commendable progress in following up on recommendations from the 2017 FSAP. The stress tests found the financial system resilient to severe shocks, while identifying a few potentially weak entities. Higher interest rates have benefited banks, despite increasing loan losses among households and real estate companies. Under plausible adverse scenarios, the system can handle significant liquidity shocks, with minimal second-round price impacts. However, the growing connections of other financial intermediaries with investment funds and related data gaps call for greater monitoring.

Policy advice: The FSAP recommends strengthening the macroprudential policy framework by reducing the risks of inaction bias and expanding the use of policy measures against rising real estate vulnerabilities. Banks should use the capital headroom to implement a sectoral systemic risk buffer and prepare for tightened borrower-based measures when the financial cycle turns positive. The authorities should establish legal safeguards to improve operational independence of the financial supervisors; consider targeted improvements in the supervision and enforcement frameworks for investment funds, and continue to actively contribute to regulatory reforms at the EU level; foster effective cooperation with foreign supervisors; strengthen inter-agency cooperation on liquidity supervision; conduct simulation exercises for Emergency Liquidity Assistance (ELA); and, improve the operational readiness of the deposit guarantee fund.

Approved By
May Khamis and Laura Papi
Prepared By
Monetary and Capital Markets Department

This report is based on the assessment work under the Financial Sector Assessment Program (FSAP) conducted during October 2023 and January 2024. The findings were discussed with the authorities in January 2024 (the close of the FSAP) and in March 2024 (the Article IV Consultation).

- The FSAP team was led by Srobona Mitra (Mission Chief) and included Antonio Pancorbo (Deputy Mission Chief), Rafael Barbosa, Nila Khanolkar, Pavel Lukyantsau, Ying Xu (all MCM), Tarak Jardak (EUR), Alan Ball, Timo Broszeit, Elias Kazarian, Cyril Pouvelle, and Reto Schiltknecht (all external experts); Arz Murr and Maksym Markevych (both LEG) conducted a desk review of Anti-Money Laundering/Combating the Financing of Terrorism (AML/CFT), and Lilly Siblesz de Doldan and Jesse Steil (MCM) provided administrative support. Michel Scholer (OEDNE) accompanied the FSAP mission.

- The mission presented its conclusions to Minister Roth and Governor Reinesch and met with senior officials from the Ministry of Finance (MoF), *Banque Centrale du Luxembourg* (BCL), *Commission de Surveillance du Secteur Financier* (CSSF), *Commissariat aux Assurances* (CAA), and *Fonds de Garantie des Dépôts Luxembourg* (FGDL) and benefited from extensive discussions with their senior staff. The mission also met with the European Central Bank (ECB), European Systemic Risk Board (ESRB), European Securities and Markets Authority (ESMA), domestic and foreign investment funds, banks, insurance companies, audit firms, and local industry associations.

- FSAPs assess the stability of the financial system as a whole and not that of individual institutions. They are intended to help countries identify key sources of systemic risk in the financial sector and implement policies to enhance its resilience to shocks and contagion. Certain categories of risk affecting financial institutions, such as operational or legal risk, or risk related to fraud, are not covered in FSAPs.

- Luxembourg is deemed by the Fund to have a systemically important financial sector according to SM/10/235 (9/16/2010), and the stability assessment under this FSAP is part of bilateral surveillance under Article IV of the Fund's Articles of Agreement.

CONTENTS

FIGURES

TABLES

APPENDICES

Glossary

AIF	Alternative Investment Fund
AIFM	Alternative Investment Fund Manager
AIM	Aide Mémoire
AML/CFT	Anti-Money Laundering/Combating the Financing of Terrorism
AT1	Additional Tier 1
BCL	*Banque Centrale du Luxembourg*
BBMs	Borrower-based measures
CAA	*Commissariat aux Assurances*
CBL	Clearstream Bank Luxembourg
CCyB	Countercyclical Capital Buffer
CdRS	*Comité du Risque Systémique*
CET1	Common Equity Tier 1
CNAV	Constant Net Asset Value
CRE	Commercial Real Estate
CSD	Central Securities Depository
CSSF	*Commission de Surveillance du Secteur Financier*
DTI	Debt-to-Income ratio
DSTI	Debt-Service-to-Income ratio
ECB	European Central Bank
ELA	Emergency Liquidity Assistance
ESG	Environment, Social, Governance
ESMA	European Securities and Markets Authority
ESRB	European Systemic Risk Board
EU	European Union
FATF	Financial Action Task Force
FGDL	*Fonds de Garantie des Dépôts de Luxembourg*
FIU	Financial Intelligence Unit
FMIs	Financial Market Infrastructures
FSAP	Financial Sector Assessment Program
GAAP	Generally Accepted Accounting Principles
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GFSR	IMF's Global Financial Stability Report
HTM	Held-to-Maturity
HQLA	High-Quality Liquid Assets
ICSD	International Central Securities Depository
IF	Investment Fund
IFRS	International Financial Reporting Standards
IOSCO	International Organization of Securities Commissions
IRRBB	Interest Rate Risk in the Banking Book

IT	Information Technology
LGD	Loss Given Default
LCR	Liquidity Coverage Ratio
LDI	Liability-Driven Investment
LSI	Less Significant Institution
LSREP	Liquidity Supervisory Review and Evaluation Process
LTV	Loan to Value
LVNAV	Low Volatility Net Asset Value
ML/TF	Money Laundering and Terrorist Financing
MMF	Money Market Fund
MoF	Ministry of Finance
MoU	Memorandum of Understanding
MREL	Minimum Requirement for own funds and Eligible Liabilities
NAV	Net Asset Value
NCA	National Competent Authority
NPL	Non-performing Loan
NSFR	Net Stable Funding Ratio
OFI	Other Financial Intermediary
PD	Probability of Default
RAM	Risk Assessment Matrix
PNCCyB	Positive Neutral Countercyclical Capital Buffer
RCR	Redemption Coverage Ratio
SCR	Solvency Capital Requirement
SI	Significant Institution
SRB	Systemic risk buffers
SREP	Supervisory Review and Evaluation Process
SSM	Single Supervisory Mechanism
STATEC	*Institut national de la statistique et des études économiques du Grand-Duché de Luxembourg*
STeM	Stress Test Matrix
TCB	Third-country Branch
UCITS	Undertaking for Collective Investment in Transferable Securities

EXECUTIVE SUMMARY

The assessment of Luxembourg's large, interconnected, and complex financial system takes place against heightened geopolitical uncertainty. Since the 2017 FSAP, the financial sector has continued to grow in both size and complexity, driven by the investment funds sector, the second largest in the world after the U.S. Banks maintain higher capital and liquidity buffers than their euro area peers. The recession in 2023 accompanied a downturn in bank credit and house price cycles, and redemptions from investment funds. The economy and the financial sector continue to face challenges from high borrowing costs. Fiscal measures to support growth from a AAA-rated sovereign have provided short-term relief, and a rebound in output is projected for 2024.

Having made commendable progress in implementing the 2017 FSAP recommendations, the authorities are committed to do more. Resources have increased both at the CSSF—the supervisory and resolution authority for banks and investment funds—and at the CAA—that for insurance companies. Both BCL and CSSF made novel contributions to systemic risk analyses in the last five years. The macroprudential toolkit has been extended to borrower-based limits. The CSSF, in response to the UK Liability Driven Investment (LDI) crisis, has strengthened reporting requirements and engaged in more active international collaboration. A new manual for emergency liquidity assistance (ELA) is fit for purpose. Investment funds were able to use multiple liquidity management tools effectively when faced with acute redemption pressures in the past. The CAA has successfully implemented Solvency II in the insurance sector and has increased resources.

The FSAP assessed the potential impact of broad sources of systemic risk and vulnerabilities on the financial sector and outward spillovers from it. The first, which the FSAP used as basis for an adverse scenario for stress tests on banks, funds, insurers, household, and corporate sectors, is the intensification of geopolitical tensions creating a deep recession with high interest rates. Second, vulnerabilities in the real estate sector and high private sector debt service obligations could amplify any adverse shock. Third, banks could face liquidity risks through intragroup, cross-sectoral, and cross-border sources, including from potentially weak parent banks—the latter could face higher than average retail deposit runs or rates of withdrawals from related investment funds under adverse conditions. Fourth, outward spillover risks could occur if investment funds facing redemptions sold foreign assets in large quantities. Finally, some of the increasing cross-border flows unexplained by economic fundamentals may need additional monitoring in case of ML/TF risks.

Stress tests found the banking sector to be largely resilient while identifying a small tail of weak institutions. In the baseline scenario, the aggregate banking system can sustain the impact of the increase in interest rates experienced so far, with banks accounting for 8½ percent of assets considered to be weak. The share of weak banks in total assets is estimated to double under the adverse scenario, but the ensuing recapitalization needs of 0.5–1 percent of GDP would be manageable. Many banks were sensitive to their largest non-intragroup clients and would see a sharp decline in the capital ratio if they were to fail, suggesting a closer look at concentration risks. On the liquidity side, while all banks can sustain retail deposit outflows of up to 20 percent, some would need to dip into their liquidity buffers if deposit runs reached the levels witnessed in the March 2023 banking turmoil in the United States and Switzerland, or if they had potentially weak foreign parent banks.

The investment fund and insurance sectors have sufficient buffers to absorb large liquidity shocks and minimize second-round effects on global securities markets. The investment fund sector could withstand redemptions of up to 40 percent. Cross-border asset sales by investment funds in a severe adverse scenario would have negligible second-round effects on the financial system and on the economy. The majority of money market funds are prepared for shocks on interest rates up to 300 basis points, higher shocks could expose vulnerabilities in a few funds. The insurance sector could withstand lapse rates of more than 40 percent before insurers would need to tap into less liquid assets.

Concerns over rising household debt include higher income categories. The bank stress tests could not consider the distribution of debt among different categories of households and firms. A separate FSAP analysis using household-level survey data suggests that their debt servicing capacity would be constrained under the IMF's baseline projections, especially for low-income households. Under the severe adverse scenario, credit risk could spread to more affluent households, especially as a material share of households in this group contracted substantial mortgages in recent years. In addition, real estate companies, which have high leverage and low cash cushions, are already showing higher bankruptcy rates and could further experience debt servicing challenges, both under the baseline and adverse scenarios. Such problems could lead to more volatile consumption and investment.

The authorities should enhance the macroprudential policy framework to mitigate risks of potential inaction bias and address real estate risks more effectively. Past measures tended to be delayed and partially effective. To reduce inaction bias, the FSAP recommends reducing the MoF's role in the Systemic Risk Committee (*Comité du Risque Systémique*-CdRS) to uphold the primacy of the financial stability objective. The accountability and transparency to the general public needs strengthening through systematic communication of policy decisions, even when no action is taken. Macroprudential policy should use banks' existing capital headroom to introduce sectoral systemic risk buffers. As the financial cycle turns positive, authorities should introduce a well-calibrated stressed debt-service to income threshold.

The well-supervised financial sector could further benefit from targeted oversight improvements. Legal amendments are needed to future-proof the CSSF and CAA boards from undue potential government influence (not witnessed to date) or as a second-best, subsidiary legislation to protect procedural safeguards. Large cross-border connections require adequate inter-agency cooperation, particularly on information sharing for bank group entities, for onsite supervision of investment fund managers' foreign delegates, and for monitoring cross-border flows for ML/FT risks. The division of responsibilities between CSSF and BCL on liquidity supervision of Less Significant Institutions (LSIs) need to be formalized. CSSF supervision should incorporate group links between depositaries and investment fund managers, and its enforcement framework reviewed with higher and more harmonized powers across types of funds. Closing data gaps related to the large Other Financial Intermediaries (OFI) sector would help monitor its significant connections to other entities.

The financial safety net is now stronger with better resolution planning since the 2017 FSAP but could further improve on operational readiness. The new BCL manual for ELA could strengthen provisions for funding-in-resolution and inter-agency cooperation, while running ELA simulation exercises.

Table 1. Luxembourg: FSAP 2024—Main Recommendations		
Recommendations	**Authorities**	**Priority[1/]**
Systemic Risk Analysis		
1. Improve bank liquidity stress tests by using cash-flow data for key currencies; incorporating liquidity-solvency interactions; and integrating depository-fund manager group links (¶26, 27, 44).	CSSF, BCL	ST
2. Identify OFIs in the corporate micro data to improve vulnerability assessments (¶25).	STATEC	ST
3. Analyze investment funds' interlinkages with OFIs and with other funds, to quantify redemption patterns and potential amplification mechanisms (¶30).	CSSF, BCL	MT
4. Enhance supervisory reporting, especially on investments and derivatives, and conduct regular insurance sector top-down stress tests and sensitivity analysis (¶31).	CAA	ST
5. Further monitor liquidity mismatches in newly emerging investment strategies of large AIF funds, including semi-liquid structures, liability-driven investments, and those promoting "retailization" (¶28, 48)	CSSF	MT
Macroprudential Policy		
6. Enhance accountability and transparency to the general public, by publishing the factors underpinning macroprudential policy decisions, including where no action is taken (¶41).	CdRS	I
7. Uphold the primacy of the financial stability objective of the CdRS by reducing the MoF's role in macroprudential decision-taking (¶41).	MoF, CdRS	ST
8. Reassess whether the legal framework for borrower-based limits preserves the ability of the CdRS to act in a risk-sensitive manner (¶42).	CdRS, MoF	MT
9. Activate income-based macroprudential measures—such as stressed debt-service-to-income limit—early in the recovery cycle and consider gradually reducing the maximum-LTV ratio from 100 percent (¶43).	CdRS, CSSF	ST
10. Fortify banks' resilience on stock vulnerabilities, by raising capital buffer requirements, preferably through targeted capital-based measures on real estate exposures (¶43).	CdRS, CSSF	I
11. Improve coordination with housing and other government policies with financial stability implications and establish a consultation mechanism with the CdRS (¶42).	MoF, CdRS	I

[1/] I: Immediate, less than a year; ST: short term, between 1-3 years; MT: medium term, in 5 years.

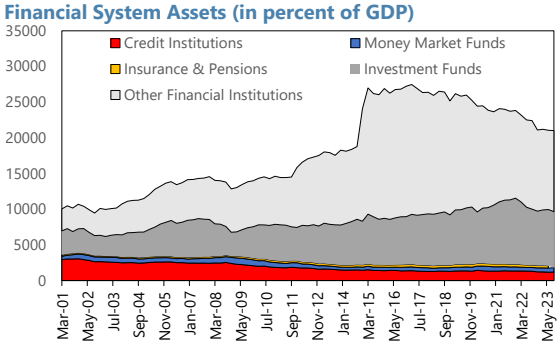
Table 1. Luxembourg: FSAP 2024—Main Recommendations (Concluded)		
Recommendations (concluded)	**Authorities**	**Priority**
Financial Sector Oversight and Supervision		
12. Future-proof CSSF and CAA independence by changes to the law. Where legal amendments are not feasible, issue subsidiary legislation to establish procedural safeguards within the constraints provided by the law (¶36)	MoF, CSSF, CAA	MT
13. Promote EU-level depositary independence reforms; and meanwhile, include supervision of depositary-fund manager group links as risk factors in the risk-based approach (¶44, 45).	CSSF	MT/ST
14. Finalize BCL/CSSF MoU on bank liquidity supervision and specify the criteria used for selecting the LSIs for which the BCL assesses LSREP (¶51).	BCL, CSSF	ST
15. Continue discussions on initiating an on-site inspection framework of investment fund delegates outside Luxembourg, with a risk-based approach (¶46).	CSSF	MT
16. Strengthen the enforcement framework for the investment fund sector in terms of harmonization of powers, increasing administrative fines, and accountability of individuals (¶47).	CSSF	MT
17. Set up an internal audit function to evaluate and enhance CAA risk management, control, and governance (¶56).	CAA	MT
18. Use macroeconomic data in the authorities' analysis of cross-border payments for a more effective management of ML/TF risks (¶59-61)	CSSF, FIU	MT
Financial Safety Net and Crisis Management		
19. Improve operational readiness of the FGDL for timely and reliable payouts; reassess staffing and asymmetry in time gaps for claims recovery (¶64).	CSSF, FGDL	MT
20. Continue the work on the operationalization of the resolution tools, expanding its national resolution handbook and by participating in simulation exercises (¶62).	CSSF	MT
21. Undertake liquidity assistance simulation exercises to test banks' capabilities in mobilizing enough collateral (¶63).	BCL	ST

MACROFINANCIAL CONTEXT

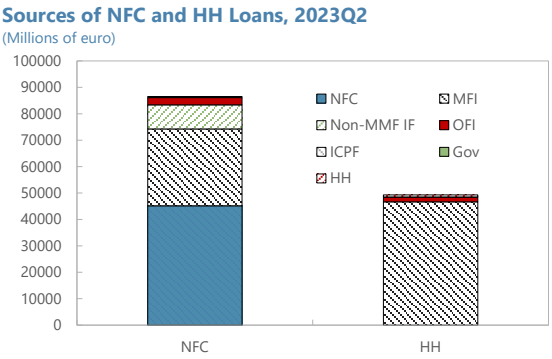
1. The financial sector in Luxembourg has continued to grow since the 2017 FSAP and remains one of the key contributors to the economy. Its growth has been driven mainly by the investment funds sector, the second largest in the world after the United States, and 77 times GDP (Table 2, text figure). The sector benefitted from being the first to adopt the EU Directive on Undertaking for Collective Investment in Transferable Securities (UCITS) in 1988, allowing it to sell to cross-border investors, which spurred rapid growth of the financial ecosystem. Bank assets, having fallen since 2017, are still sizeable at 12 times GDP, while the insurance sector remains at 3 times GDP. Other financial intermediaries (OFI), which are unsupervised and unregulated, are sizeable (text figure). Households borrow mainly from banks, whereas nonfinancial corporates also seek loans from other corporates and nonbank financial intermediaries. About a quarter of the economy's gross value added and employment is linked to the financial sector.

Structure of the Financial System and Funding Sources of the Private Sector

The number and share of banks in the financial system fell since the last FSAP, even as investment funds grew.



Banks are the main sources of domestic loans to households, while NFCs borrow also from other sources.



Sources: Quarterly Integrated Economic and Financial Accounts; ECB; BCL; Haver Analytics LLC; and IMF staff calculations.
Notes: NFC= nonfinancial corporations; HH=households, MFI=monetary and financial institutions, including money market funds (MMFs); Non-MMF IF=non-MMF investment funds; OFI=other financial institutions; ICPF=insurance companies and pension funds; Gov=government.

2. Luxembourg is host to more than a hundred foreign banks. Almost half of the banks are from the EU, and a third are foreign branches (Figure 1). Only a fifth of banking assets engage in commercial banking activities; many are in private banking and fund management activities. Four Luxembourg-owned significant institutions (SI) are supervised by the ECB, as are many Luxembourg subsidiaries of other euro area SIs. Among the LSIs is Clearstream Banking Luxembourg (CBL), one of the world's largest ICSDs, connected to more than 50 countries.

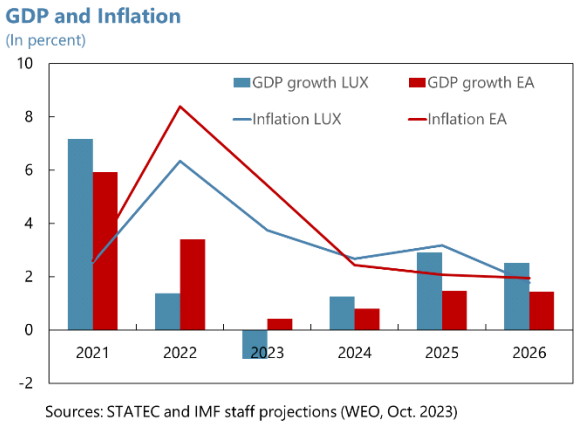
3. The economy has been facing the steep tightening of global and domestic financial conditions, but fiscal support is expected to help in the short term. Real GDP fell by 1.1 percent in

2023, mostly driven by weak external demand and lower residential real estate investment. Growth is expected to rebound to 1¼ percent in 2024 (Table 3). The increase in real wages and fiscal stimulus provided some support to consumption so far, while weak consumer confidence led to persistently high precautionary savings. Unemployment has increased rapidly to 5.5 percent in December 2023 from low levels, especially for youth and low-skilled workers.

4. The bank credit and housing cycles have turned. After growing rapidly for several years, resident private sector credit dropped by 3 percent yoy as of December 2023 (text figure below) with a negative credit-to-GDP gap. Bank loans to nonfinancial corporations declined by 7¾ percent, due to tighter credit standards and lower demand. Firm bankruptcies remained stable on aggregate but increased by about 40 percent for real estate and construction companies. New household credit also declined as demand for housing dropped significantly and banks tightened credit standards for riskier borrowers. House prices have fallen by 15¾ percent from their peak in 2022Q3. The house price overvaluation as of 2023Q3, however, still ranges between 10 and 25 percent based on estimates by the IMF, BCL, CSSF and ECB. Commercial real estate (CRE) prices also show some correction both in offices and retail, mostly reflecting more attractive alternative investments. CRE transactions have plummeted, reducing price discovery for market participants.

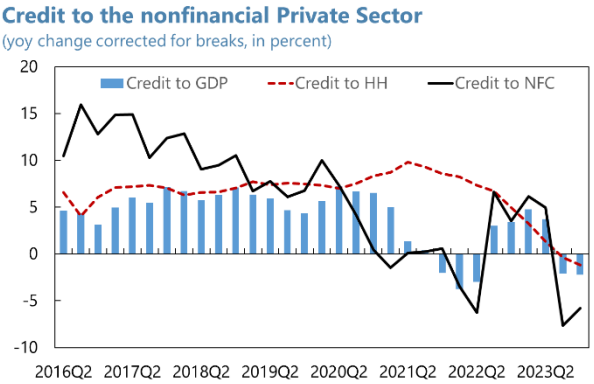
Real GDP, Inflation, and Bank Credit

Real GDP growth has trailed the euro area in 2022 and 2023 but is expected to bounce back in 2024-26.



Sources: STATEC and IMF staff projections (WEO, Oct. 2023)

The credit cycle has turned.



Sources: BCL and IMF staff calculations

Note: EA: euro area; HH: Households; NFC: Non-Financial Corporates.

5. High buffers are helping the financial sector weather challenges from the high inflation environment (Table 4). The Common Equity Tier 1 (CET1) capital ratio of banks are at comfortable levels at 22 percent in 2023Q4—standing 6 percentage points above the euro area average. Profitability improved significantly in 2023 as increasing net interest income helped offset decreasing commissions and increasing valuation losses in the bond portfolio. But nonperforming loans (NPLs) have increased since 2021Q4, mainly driven by the household and corporate sectors, to 1.9 percent of gross loans (Figure 1). Net

redemptions from investment funds picked up in 2023, cumulatively reaching 2½ percent of net assets since 2022Q2. The sector's deposits in banks fell but banks maintained average liquidity coverage ratio (LCR) around 157 percent. Insurance lapses also increased as policyholders repaid variable interest rate loans and moved out from guaranteed products to higher yielding assets (see below "Impact on Insurance Lapses").

6. The authorities have made commendable progress in implementing recommendations from the previous FSAP (Appendix I) and have responded well to recent stress episodes. Resources have increased in the supervisory agencies— *Commission de Surveillance du Secteur Financier* (CSSF) for banks and investment funds, and *Commissariat aux Assurances* (CAA) for insurers. The authorities have significantly expanded data collection, reporting, and analysis of risks. In response to the UK LDI crisis, the CSSF increased reporting requirements, issued regulatory expectations of yield buffers of 300-400bps, and interacted with ESMA, UK, Dutch, and Irish authorities and with LDI fund managers. However, they have yet to take steps to enshrine the operational independence of CSSF and CAA in legislation. Additionally:

- On investment funds, the CSSF aligned its regulatory framework with EU standards, closely monitoring EU-level requirements. It is also pursuing discussions with foreign supervisory authorities on initiating on-site inspections for fund delegates outside Luxembourg.

- On banking supervision, the CSSF has significantly strengthened its on-site inspection regime, reducing the time for completion of reports; considerably tightened the monitoring of intra-group exposures and waiver compliance (see Technical Note on Bank Supervision); and, with the Banque Centrale du Luxembourg (BCL), continue to closely monitor liquidity risk in LSIs.

- On emergency liquidity assistance, the new BCL guidelines establish the modalities for banks to access liquidity from the BCL during crisis.

SOURCES OF SYSTEMIC RISKS AND VULNERABILITIES

7. The economy faces risks and vulnerabilities that could spiral through the large, complex, and interconnected financial system (Figure 2, and Figure 3, and text figure). The first risk, which the FSAP used as the basis for the adverse scenario for stress test on banks, funds, insurers, and household and corporate sectors, is *geopolitical tensions* with supply chain disruptions that could lead to a deep recession accompanied by high interest rates. Second, *real estate risks* and high private sector debt service obligations could amplify any risk. Third, banks could face *liquidity risks* through intragroup, cross-sectoral, and cross-border sources. Fourth, *outward spillover* risks could occur if investment funds facing redemptions sold foreign assets in large quantities. Finally, the increasing cross-border flows unexplained by economic fundamentals pose elevated *ML/TF risks*.

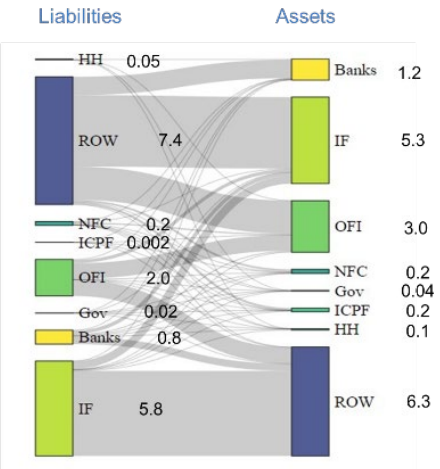
8. Geopolitical risks and supply chain disruptions embodying the adverse scenario for the FSAP stress tests envisages a 5.9 percent cumulative drop in the level of GDP over 2024–25. Inflation spikes due to supply chain disruptions, oil price increases, and labor supply shocks, leading to increases in short-term and long-term interest rates globally and in Luxembourg (Table 6, Figure 4, and Figure 5). Residential real estate prices drop by about 30 percent and commercial real estate prices decline on average by 10 percent in various countries. Real GDP is 10 percent lower than the baseline level of output (based on the October 2023 World Economic Outlook) at the trough, corresponding to

a 2.3 standard deviation shock from the baseline and a 1.4 standard deviation shock from the mean of the historical distribution (see Technical Note on Systemic Risk).

9. Real estate vulnerabilities have been building up since the mid-2010s and higher interest rates could further increase the debt service burden of firms and households (Figure 2 and Figure 6). Household debt has risen steadily to more than 180 percent of gross disposable income, with overvalued house prices that doubled over ten years. Two-thirds of mortgages granted over 2018-2022 have a debt-service-to-income (DSTI) ratio higher than 40 percent, half have a DTI higher than 9, and a quarter have an LTV of 90 percent and over. Among mitigating factors, the share of variable rate mortgages has reduced to 42 percent, from 58 percent in September 2022, and net wealth amongst some risky households is high, though unequally distributed. The introduction of a differentiated legally binding maximum LTV, the CSSF requirement for banks to run a 200-basis point interest rate stress test on new borrowers' capacity to repay, and higher risk perception by banks following the monetary policy tightening have reduced the LTV and DTI, but the DSTI continued to rise. Moreover, real estate firms have high leverage and very low cash buffers as they face rising bankruptcies amid some government support. Stress tests with household-level and firm-level data helped quantify the debt-at-risk under the baseline and the adverse scenarios (see later and Technical Note on Macroprudential Policy).

Interconnectedness

The financial system is tightly interconnected within funds, OFI and NFC sectors, with sizeable connections across sectors, particularly with OFIs and the ROW.



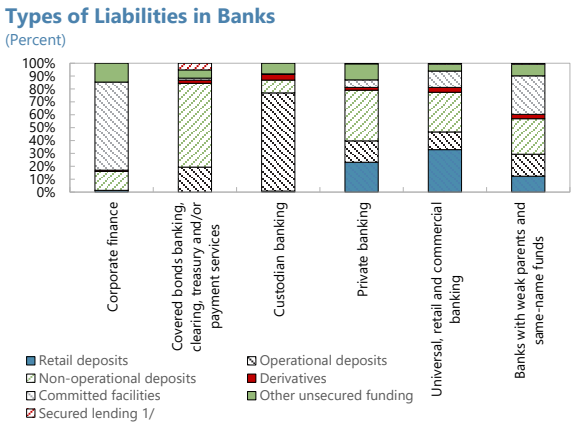
Sources: ECB, Quarterly Integrated Financial Accounts; Haver Analytics L.L.C.; and IMF staff calculations.
Notes: Asset/liability values in trillions of euro. IF=Investment Funds; HH = Households; Gov=Government; OFI=Other Financial Institutions; ICPF=Insurance Companies and Pension Funds; NFC=Nonfinancial Corporates; ROW=Rest of the World.

10. Problems in foreign parent banks could lead to liquidity risks in Luxembourg subsidiaries, which could add to solvency pressures. In general, banks have ample liquidity, although the nature of liabilities and counterbalancing capacity varies by bank type, with universal and retail banks having more retail deposits and custodian banks having higher fund deposits (see below). Direct

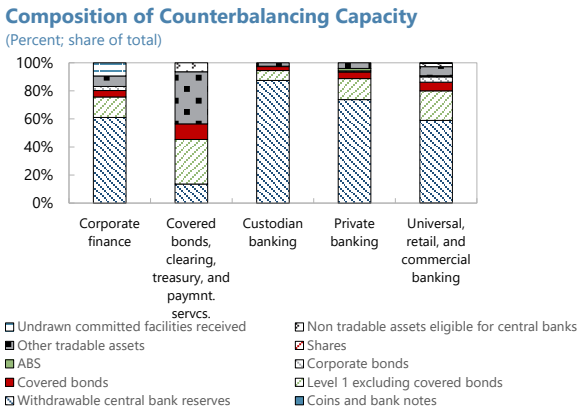
exposures to parent banks are covered by a strengthened waiver regime on large exposure limits—asset exposures to group entities can exceed the large exposure limit of 25 percent of capital under certain conditions (see Bank Supervision Technical Note). However, subsidiaries of potentially weak banks (see the 2023 October GFSR, which identified potentially weak banks globally), could have higher retail deposit runs or higher rates of withdrawals from related investment funds. Moreover, almost half of the banks (comprising 20 percent of assets in the stress test sample, all foreign subsidiaries with diverse business models) are not active users of standing facilities at the BCL. In an adverse liquidity scenario and in the absence of access to BCL facilities, these banks could need to resort to selling held-to-maturity (HTM) assets at a loss—almost 80 percent of large banks' securities portfolios with unrealized losses—or could access interbank liquidity at additional cost, with implications on solvency. These issues are explored through liquidity stress tests with liquidity-solvency interactions (see later and Technical Note on Systemic Risk).

Bank Liquidity—Types of Liabilities and Counterbalancing Capacity

Retail deposits are mainly concentrated in more traditional banks, and financial sector deposits in all types of banks, especially in custodians.



The counterbalancing capacity against liquidity risks mainly comprise central bank reserves in most business models, followed by Level 1 liquid assets.



Sources: CSSF, ECB, and IMF staff calculations.

1/ Counterparty is non-central bank.

Note: "Banks with weak parents and same -name funds" is a sub-sample of 16 banks including 15 banks with parent banks or subsidiaries in Europe identified as weak in the October 2023 Global Financial Stability Report Chapter 2 and two banks with deposits of funds from the same group (one of the two overlaps with the 15 banks with weak parents).

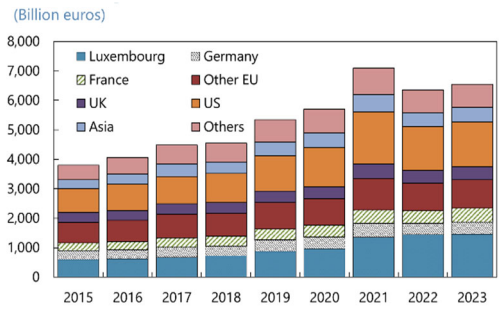
11. Luxembourg investment funds own considerable shares of both domestic and foreign securities (Figure 7 and text figure). While exposures to domestic debt and equity markets are small as a share of investment funds' assets, they account for 2.5 percent of outstanding domestic sovereign debt and close to 15 percent of domestic equities—significant shares to affect market prices (text figure). Funds also hold sovereign debt of France, Germany and the U.K. that are between 1.5 and 2.5 percent of total outstanding amounts, while for equities these shares are 3–5 percent of market

capitalization. The increase in exposures to the U.S. since 2015 is substantial, mainly driven by holdings of U.S. nonfinancial corporate equities. Sovereign debt shares from emerging and frontier markets are even higher (Figure 7). Such levels of holdings relative to market size may create sizable downward pressures on prices of securities if funds were to sell a considerable amount of these assets over a short period to stem redemption pressures, with added impacts on the rest of the financial system and abroad. These second-round effects are assessed through liquidity stress tests on investment funds and the impact of asset sales on foreign markets, with spillbacks to Luxembourg (see later and Technical Note on Systemic Risk).

Investment Funds—Asset Exposures

Investment Funds are increasing portfolio assets in Luxembourg and in the United States…

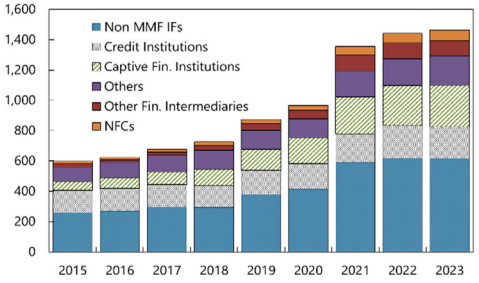
Luxembourg Investment Funds Exposures to Selected Countries/Regions



Souce: BCL and IMF Staff calculations.

… with the exposure to Luxembourg driven by growth of assets in other investment funds, and OFIs.

Investment Funds' Exposures to Luxembourg by Sector

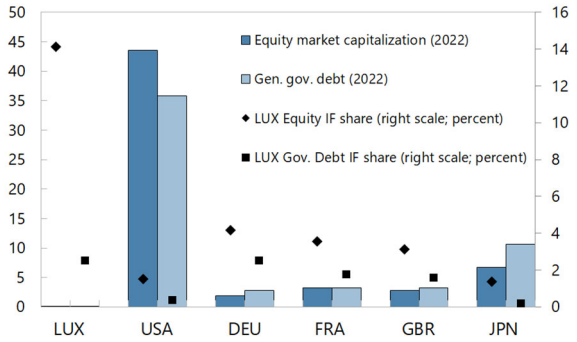


Sources: BCL and IMF Staff calculations.

A significant share of the Luxembourgish bonds and equities are held by investment funds…

Market Capitalization and Luxembourg IF Holdings, 2023

(Trillion of USD)

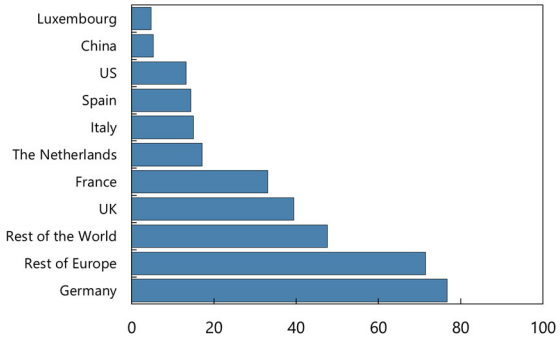


Sources: Haver Analytics LLC; BCL; CSSF; and IMF staff calculations.

…while CRE exposures are heavily concentrated in other European countries.

Stock of Investment Funds' Direct CRE Investments by Country

(Billion of Euros)



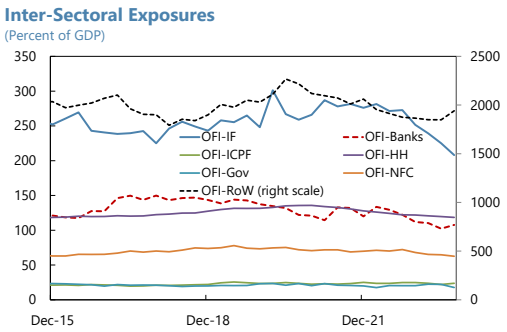
Sources: CSSF and IMF staff calculations.

12. While large cross-border flows from the OFI and the rest of the financial sector are to be expected, large-valued flows have increased since 2019 (text figure below). The OFI sector comprises mainly captive institutions of multinational companies and intragroup holdings, representing over 50,000 entities. US-based companies represent nearly 60 percent of assets. Empirical models show

that both the number and the value of "outlier flows"—those unassociated with economic fundamentals—have increased, especially in 2022 (text figure). Some of these flows warrant additional supervisory monitoring in case of ML/TF risks, although some of these flows could be associated with Brexit-related reconfigurations of multinationals (see later section).

Intersectoral Exposures of OFIs and Cross-Border Financial Flows

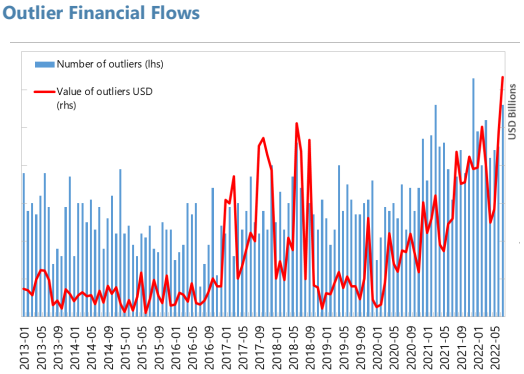
OFIs have large exposures and liabilities with funds and the rest of the world.



Source: ECB Who-to-Whom, IMF staff estimates, Quarterly Integrated Financial Accounts, ECB; Haver Analytics L.L.C.

Note: "Exposure" is the sum of financial assets and liabilities of OFIs in each of the sectors, in percent of GDP.

Empirical models show acceleration of "outlier" inflows insufficiently explained by economic fundamentals.



Source: IMF staff estimates.

Note: The numbers in the left and right axes have been erased to preserve data confidentiality. Identification of outlier financial flows is conducted using a machine learning algorithm based on methods developed by IMF staff for the AML screening of financial flows (see, for example, IMF Nordic-Baltic Report. It uses macroeconomic country-pair variables, such as foreign trade in goods and services, portfolio investments, direct investments, and various indicators of money laundering risks.

STRESS TEST RESULTS

A. Summary

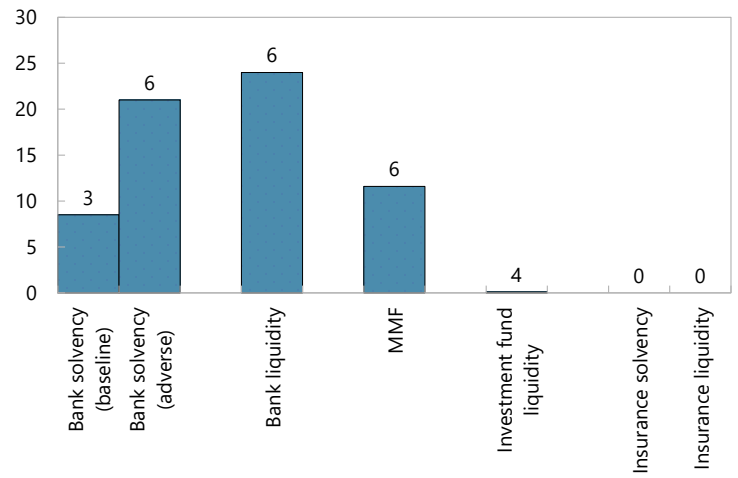
13. Overall, the Luxembourg financial system is resilient to severe adverse shocks used in the FSAP analysis, with a small tail of weak institutions (text figure, Table 16). All banks are able to sustain a retail deposit run up to 20 percent. The solvency stress tests for banks employed a CET1 ratio threshold of 8 percent on average, varying across banks. This threshold comprises the Basel III minimum of 4.5 percent, Capital Conservation Buffer of 2.5 percent, average Pillar 2 requirement of 0.5 percent, as well as an average CCyB of 0.5 percent. The leverage ratio of 3 percent was also a secondary threshold. Stress test results indicate that the banking system as a whole—which has very high starting capitalization and liquidity buffers—is able to sustain a severe stagflationary scenario even when combined with high retail deposit runs. Stress tests on the rest of the financial sector indicate overall resilience. The investment fund sector is able to absorb adverse net asset value outcomes and

has adequate liquid assets to stem redemptions of up to 40 percent. The MMF sector can absorb up to 200 basis points instantaneous shocks to interest rates and spreads (cumulative) before any fund breaking the "20 basis point change in NAV" rule. Likewise, the insurance sector can also withstand lapse rates of more than 40 percent before insurers would have to start liquidating less liquid investment assets (see text figure below, Figure 9, and Technical Note on Systemic Risk).

14. The tests identified a weak tail of institutions. Three banks in the baseline and six banks in the adverse scenario—which factors in additional funding costs for banks that do not have arrangements with the BCL to access central bank liquidity facilities—would breach at least one capital threshold (text figure). The recapitalization needs of the weak banks are 0.5-1 percent of GDP varying across versions of the adverse scenarios and are considered manageable. If the Basel III minimum of CET1 ratio of 4.5 percent were used as the threshold, then one small bank would breach it. On the liquidity side, six banks, one of which overlaps with the solvency exercise, would need to tap into its liquidity buffers under extreme liquidity scenarios. Likewise, six MMFs and four non-MMF funds need further monitoring. The analysis indicates that the impact of cross-border asset sales by the funds industry in a severe adverse scenario have small second-round effects on the financial system.

15. Stress tests of non-financial private sector balance sheets expose significant vulnerabilities accumulated in recent years. Despite the supportive government measures, the share of households with debt-at-risk are expected to increase significantly in the baseline (adverse) scenarios, given high (increasing) interest rates. While the lower income households are the most vulnerable, all other income groups, including the highest income quintile, significantly contribute to the debt-at-risk (Figure 9 and Figure 10). Furthermore, a significant share of nonfinancial firms would see their borrowing needs increase substantially both in the baseline and in the adverse scenario. Real estate firms are most at risk given their weakest initial financial conditions both in the baseline and adverse scenarios (also see Technical Note on Macroprudential Policy).

Summary of Stress Test Results: Weak Institutions



Source: IMF staff estimates; also see Table 8.

Note: The "Baseline" bar refers to the banks below the leverage ratio of 3 percent. The bank solvency (adverse) scenario includes liquidity-solvency interactions.

16. Several caveats are applicable to the analyses as some aspects were difficult to model. First, the tests do not consider the changing nature of the funds sector, especially the swift rise of

alternative investment funds, their new emerging strategies, and use of derivatives. Second, the rising interconnectedness of the OFIs—and the lack of full visibility of this sector in official statistics of the corporate and the investment funds sector—could lead to new forms of redemption patterns. Third, domestic interbank contagion was not considered in view of falling domestic interbank exposures. And finally, short time series and the presence of different business strategies of banks lead to some modelling uncertainty.

B. Impact of Severe Stagflation on Financial and Non-Financial Private Sectors

17. In the baseline scenario, the aggregate banking system would remain well capitalized, but a few banks were identified as weak. Most banks are expected to generate adequate profits to grow their CET1 ratios further and remain above the hurdle rate (see Technical Note on Systemic Risks*)*. But three banks (8½ percent of total assets of the sample) would fall below the leverage ratio of 3 percent in the baseline in 2024. Furthermore, one bank would see its CET1 ratio fall below the hurdle rate in 2025/2026. This is due to its low initial level of capitalization and low profitability.

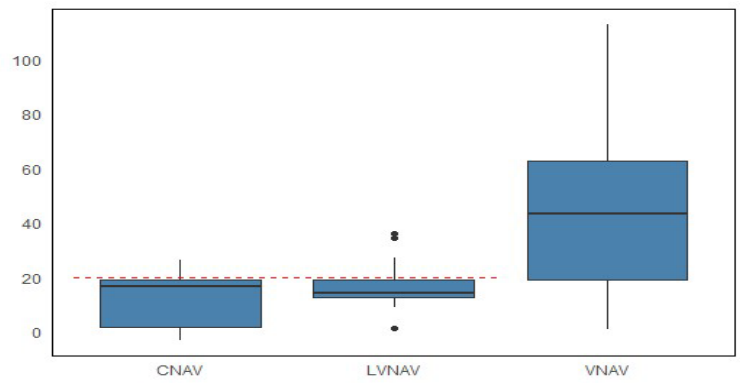
18. High starting levels of system-wide capital allow most banks to absorb a large shock under the adverse scenario and retain substantial buffers. The CET1 ratio would drop by 4.1 percentage points, from 21.7 percent as of December 2023, to 17.6 percent in 2024 (Figure 9 and Figure 11), before gradually recovering from 2025. The banking system remains above both the CET1 ratio and the leverage ratio hurdle rates, benefiting from higher interest rates in this scenario with the lending rate pass-through (0.8) remaining above the deposit rate pass-through (0.6). Domestically oriented banks, exposed to the residential real estate risks, are impacted slightly more than internationally oriented banks (Table 10). Private banks would experience the largest capital depletion mainly from non-interest income losses, but corporate finance banks would end up with the lowest average level of capitalization. Lower noninterest income, loan loss provisions, and losses from bond portfolios drive the decline in capital in the adverse scenario (Figure 11).

19. There are 5 potentially weak banks. The capital of four (five) banks making up less than 10 percent of the banking sector assets would fall below the CET1 (leverage) hurdle rate, entailing recapitalization needs of ½–1 percent of GDP in the adverse scenario (Table 8). Two banks are below both hurdle rates. These have low profitability and initial capital, and a high exposure to the domestic corporate and retail sectors. If banks were allowed to dip into the capital conservation buffer and the countercyclical capital buffer, then two banks would still be below the CET1 hurdle rate, with one bank overlapping with weakness in liquidity stress tests. One additional bank is considered weak after solvency concerns arise in a deposit run scenario (see further below). If the Basel III minimum CET1 ratio of 4.5 percent were used as the threshold, then one small bank would not pass it.

20. The net asset value (NAV) of investment funds falls by 13 percent in the adverse scenario (Figure 9). The negative impact on the NAV is more pronounced for equity funds, which fall by more than 17 percent. The most affected funds, beyond the fifth percentile of the tail, experience NAV declines of 22 percent. A more severe scenario based on the Global Financial Crisis (GFC) financial market shocks would lead to almost a 20 percent fall in NAV, with equity funds declining by 28 percent.

21. Some types of money market funds (MMFs) could experience considerable swings in NAV, if faced with very sharp increases in interest rates and spreads (text figure). Two Constant NAV (CNAV) and four Low-Volatility NAV (LVNAV) funds, with 23 percent of the total NAV of MMFs, decline by more than 20 basis points—the threshold beyond which LVNAV MMFs are automatically converted into variable NAV funds. These results stem from the severity of the shocks and their instantaneous nature in the stress test. For instance, the interest rate and spread shocks assumed in the MMF stress test are larger and sharper than what has been observed historically. Nevertheless, recent episodes of intense market turmoil, such as the mini-budget crisis in the U.K. (where government bond yields increased by up to 130 bps over 7 days) and the March 2023 banking crisis episodes in the U.S. and Switzerland, highlight the need to test against tail risks.

Money Market Funds Stress Test Results—Fall in NAV by Type of Fund
(Basis Points)



Source: CSSF and IMF staff calculations.
Note: Chart depicts boxplots with the distribution of the decline in NAV of MMFs by type (CNAV, LVNAV, and VNAV), following the combination of interest rate and corporate spread shocks from the macrofinancial scenario. The blue box represents the interquartile range of the distribution, the black line inside the box represents the median, the whiskers extend to the maximum and minimum of the distribution, or up to 1.5 times the interquartile range, while outliers beyond that threshold are shown as dots. The red line represents the 20 basis points threshold beyond which LVNAV funds are automatically converted to VNAVs, which is also a threshold usually considered as relevant for CNAVs, as a measure of their stability, even if it does not have any automatic implication for these funds.

22. Life insurers are largely immune due to the large share of unit-linked business, where market risks are borne by policyholders, and the use of reinsurance in guaranteed business (Figure 9 and Figure 13). Assets decline by 9.4 percent for the whole sector, largely offset by a similarly sized decline in liabilities—a result of the upward interest rate stress. Eligible own funds decline by 22 percent, and the median life insurer has a coverage of solvency capital requirement (SCR) after stress of 127 percent, down from 150 percent prior to the stress. No life insurer falls below the regulatory threshold of 100 percent.

23. Non-life insurers and reinsurers have lower sensitivities to market and credit risks and are therefore highly resilient in the adverse scenario. Assets decline by 2.8 percent and eligible own funds by 8 percent. The median SCR ratio after stress amounts to 179 percent, down by 17 percentage points. The largest capital impact stems from higher corporate spreads.

24. The adverse scenario would put significant pressure on households' debt servicing capacity (Figure 9 and Figure 10). A joint BCL-IMF macro-micro simulation using household balance sheet data from the *Household Finance and Consumption Survey wave IV* suggests that household debt servicing capacity would already be adversely affected in the baseline with the effects rising in 2025-26.

The share of households and debt-at-risk would further increase in the adverse scenario to 14 percent of indebted households and 30 percent of total debt, respectively. Lower income quintiles are the most vulnerable. However, the debt characteristics of upper income quintiles deteriorate the most as they contracted the most debt in recent years.

25. A stress test of corporate balance sheets using micro data identifies the real estate sector as risky. Analysis based on data from STATEC shows that despite historically high cash buffers, most sectors would face liquidity pressure in the adverse scenario while solvency risk would increase more moderately. Because of weaker initial conditions and larger sectoral shock, real estate activities appear the most vulnerable.

C. Impact of Bank Deposit Runs

26. Liquidity buffers are sizeable in all banks and most banks are able to withstand severe deposit runs, except for GBP liquidity. The weighted average liquidity coverage ratio (LCR) is 229 percent for the stress test sample, and180 percent in the sample of retail and universal banks. Under a *severe scenario* where banks experience a 30-day deposit run in line with those experienced by Credit Suisse and First Republic in March 2023, with stressed market conditions, six banks (accounting for about 24 percent of total assets in the sample) would fall below the 100 percent LCR requirement. Moreover, added stress in some global parent banks (identified as "weak" in the IMF's October 2023 GFSR), would send a couple of additional banks under the threshold (text figure) where they are assumed to face even higher deposit run rates. When differentiated by currency, 11 banks with GBP liabilities are found to be falling short of GBP liquidity.

27. Under the severe deposit run combined with a market stress scenario, banks with insufficient cash and marked-to-market securities could encounter an additional impact on capital (Table 8). The liquidity stress tests revealed that, in the severe scenario, 15 out of 39 banks in the stress test sample would experience a funding gap—when central bank reserves, undrawn committed facilities, and securities in the trading book do not cover cash outflows over a 30-day horizon. As in Basel III's LCR definitions, interbank exposures (including intragroup) are not included as high-quality liquid assets in the liquidity stress tests. The fifteen banks with funding gaps were assumed to sell or pledge part of their HTM portfolio to cope with the net outflows:

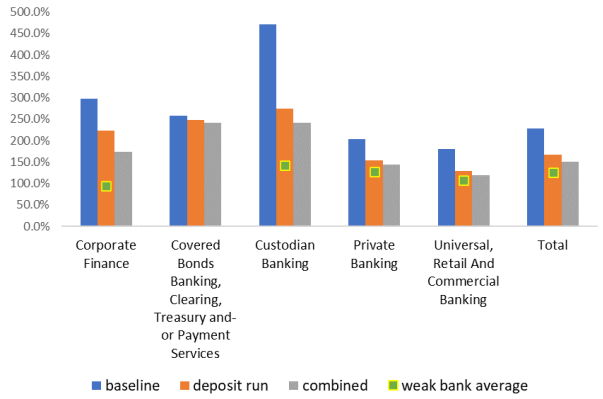
- Nine banks would be able to pledge their HTM securities at an assumed penalty rate of 100bps over the ECB's main refinancing rate in the adverse scenario, assuming the interbank repo market is even more costly. The additional funding cost of €1.1 billion implies a further decrease in the aggregate CET1 ratio by 1.4 percentage points for these nine banks, pushing one more bank below the leverage ratio hurdle rate in 2024.

- Six banks that have not activated their access to central bank facilities would have to sell part of their HTM securities at a loss, based on market prices—again assuming the interbank repo market is even more costly—and to realize a market loss of €88 million, further decreasing their CET1 ratio by 0.8 ppts. The system-wide impact would be equivalent to a decline of an additional 0.5 percentage point of the aggregate CET1 ratio.

Impact of Deposit Runs in Banks

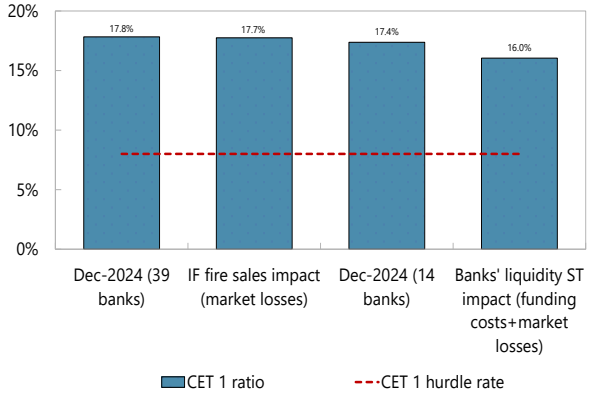
Liquidity stress tests show that most banks have sufficient liquid assets to withstand severe stress events, except for some banks, including subsidiaries of some globally "weak" parent banks.

Liquidity Coverage Ratio (Weighted average, percentage)



When faced with intense liquidity stress, some banks would need to pledge or sell HTM, resulting in higher funding costs and realizing losses from sales.

Liquidity-Solvency Interactions: Impact of Increase in Funding Costs and Market Losses from Liquidity Stress:
(CET1 ratio, in percent)



Source: CSSF, ECB, and IMF staff estimates.

Note: Left panel presents weighted average Liquidity Coverage Ratio (LCR) under four scenarios for different business models. "Baseline": using European Banking Authority (EBA) assumptions. "Deposit run": Severe scenario; experiences based on Credit Suisse (Switzerland) and First Republic Bank (US) run episodes (also see October 2023 GFSR Chapter 2, Box 1). "Combined": Deposit run + market stress (lower inflow rates and higher haircuts of High Quality Liquid Assets. "Weak Bank": Higher deposit run rates + market stress, test applied only for the sub-sample of 16 banks with global parent banks found to be weak in the October 2023 GFSR Chapter 2 or banks that have same-name funds within the group. "Weak bank average" is the weighted average LCR under "weak bank" scenario within each business model. Right panel presents the liquidity-solvency interactions under the "Combined" liquidity stress scenario. See Technical Note on Systemic Risk for further details.

D. Impact of Investment Fund Redemptions

28. Following the NAV declines in the adverse scenario, funds could experience redemption pressures. Based on models linking redemptions to fund performance, the net redemptions are estimated at 4 percent, on average, with some funds experiencing higher outflow rates in the low double digits. For most funds, the estimated outflows from the adverse and GFC scenarios are less severe than their respective historical outliers (Table 7). Only four AIFs have a Redemption Coverage Ratio (RCR) below one in the adverse scenario following the initial shock, due to their inability to meet redemption pressures. This result also highlights the sector's relatively low correlation of net flows with market conditions and NAV declines, which contributes to its stability during market swings (see Technical Note on Systemic Risk TN).

29. In the adverse scenario, investment funds may need to sell up to 150 billion euros in liquid securities to face redemptions. This number assumes that managers choose to prioritize the sale of liquid securities before withdrawing bank deposits. Almost €50 billion would come from the sale

of sovereign bonds, €20 billion from corporate bonds, and €70 billion from the sale of equities. By region, the U.S. is the most represented country in the sales, with €44 billion in assets, followed by France (€16 billion) and Germany (€13 billion). In the GFC scenario the aggregate number, also under the same liquidation assumption, reaches €200 billion euros, with similar composition across asset classes and countries.

30. Interlinkages with the banking sector through deposits do not pose risks to the investment fund sector. In a scenario where investment funds use cash first before liquidating other securities, deposit withdrawals from banks in the adverse scenario would amount to roughly 25 percent of aggregate bank deposits of funds. On average, banks' liquidity coverage ratio already assumes a 25 percent withdrawal of fund deposits in the baseline, and thus such a withdrawal can be absorbed by the banking sector. Results from the bank liquidity stress test further show that banking sector overall are able to withstand much larger deposit runs from investment funds.

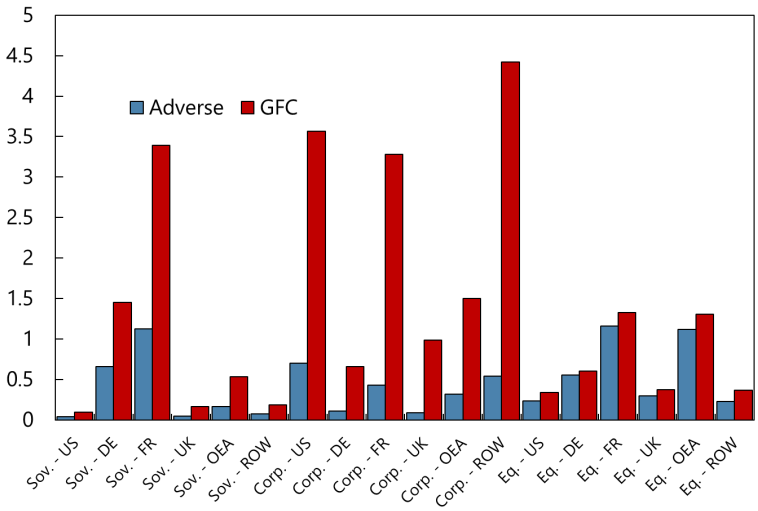
E. Impact of Insurance Lapses

31. Life insurers are broadly resilient to liquidity shocks despite large interest rate swap positions (Figure 14). The FSAP tested the vulnerability of eight large life insurers in a scenario where monthly lapse rates increase by an additional 50 percent compared to the highest level observed since 2020. The simulated outflow—typically paid out to policyholders within a month—amounts to €2.4 billion. This number compares against total sources of liquidity of EUR 32.5 billion (a coverage of 13.6), comprising cash holdings of 1.2 billion, high-quality liquid assets (after haircuts) of 9.3 billion, and reinsurance recoverables of 22 billion. The recoverables are an important risk mitigant for some of the large life insurers. With the group parent being the reinsurer, the CAA requires full collateralization of such reinsurance arrangements to mitigate the counterparty default risk.

F. Second-Round Impact of Securities Sales

32. Selling of liquid assets to meet large investment funds redemptions could lead to a meaningful impact on prices of some securities, especially in European markets. This analysis is based on estimates of market depth in past studies and under the assumption that the aggregate level of securities is sold over a seven-day period. Asset sales from banks and insurers were not included since these sales are not material for the price impact. In the adverse scenario, German and French sovereign bond prices fall by 0.4–1.2 percent, as Luxembourg investment funds sell to meet redemptions under the adverse scenario. This corresponds, approximately, to changes in yields of 10 to 25 basis points for five-year bonds. The prices are less affected in large markets such as the United States or the United Kingdom. Rapid selling of Luxembourg securities is not considered in this scenario. The GFC scenario would entail a much steeper price impact (see below) and is considered only as a sensitivity analysis (see Technical Note on Systemic Risk).

Asset Price Declines due to Sales by Luxembourg Investment Funds
(Percent)



Source: BCL, CSSF and IMF staff calculations.
Note: Chart shows the price impact of asset sales of investment funds following the Adverse and GFC scenarios under the assumption of asset liquidation using a waterfall method where liquid securities are sold first. The period of asset sales is assumed to be seven days.

33. The second-round impact of lower market prices of cross-border securities would have a negligible impact on the Luxembourg financial sector. The spillbacks of the price impact on funds are small and up to an additional one percentage point of adverse impact of funds' NAVs, with small additional wealth and confidence effects on the economy. For the banking sector, the second-round effects are also small, with an aggregate additional loss of €156 million or 0.1 percentage point of CET1 ratio for the 39 banks in the stress test.

34. For the insurance sector, the price impact of investment fund redemptions would only have a marginal impact on solvency positions. Assets of life insurers decline by less than 0.5 percent, and the median SCR ratio declines by another 1 percentage point to 126 percent. The effect is slightly larger in the non-life sector, where the median SCR coverage ends up at 175 percent, 4 percentage points lower than before stress.

G. Sensitivity Analyses

35. Several hypothetical single factor shocks, beyond the narrative of the adverse scenario, helped gain additional insights on banks and funds (Figures 15, 16 and 17).

- First, if the entire HTM securities of banks were marked to market under the adverse scenario, then additional market losses would amount to €13.1 billion in 2024, causing a drop in the aggregate CET1 ratio by a total of 6.5 percentage points and recapitalization needs (up to the CET1 hurdle rate) equivalent to 8 percent of GDP.

- Second, if interest rate increased by 500 bp, the banking system would gain €5.9 billion in net interest income, with a positive impact on the aggregate CET1 capital ratio by 3 percentage points. Conversely, a decline in interest rates by 500 bps would cause a symmetric aggregate decline in banks' net interest income and capital, without undercapitalization of any additional bank.

- Third, the default of the largest net non-parent exposure of each of the thirty-nine banks would lead to a capital shortfall of 1.8 percent of GDP based on the CET1 hurdle rate.

- Fourth, the simultaneous default of the five largest net non-parent exposures would lead fourteen banks to be undercapitalized with a capital shortfall of 7.8 percent of GDP.

- Fifth, tests assessed the resilience of the funds to idiosyncratic redemption shocks based on historical outliers (instead of the adverse scenario). Almost half of high-yield bond funds and six real estate funds would have problems meeting historically large outflows.

- Sixth, life insurers are most sensitive to equity price declines among other shocks. Exposures to the banking sector are also manageable.

- Finally, if the CRE price declines were to double across countries, compared to the adverse scenario, the fall in NAV of open-ended real estate funds, comprising 3.5 percent of total NAV of the stress test sample, would also be double. These funds have very high passthrough of severe shocks to the NAV, given the very low level of holdings of cash and equivalents.

FINANCIAL SECTOR OVERSIGHT

A. Cross-Cutting Themes

36. The composition of the CSSF and the CAA boards poses a potential risk to operational independence. The FSAP did not find evidence of lack of operational independence in practice and the executive board deciding on supervisory issues do not have government representatives. However, the government's majority and the presence of industry representatives on the oversight boards (deciding general policies and the budgets) introduce the potential for future government or industry interference. In line with other FSAPs, the FSAP recommends changes in the law. However, recognizing that legal amendments may take time, or may face constraints, the authorities should in any case establish procedural safeguards through subsidiary legislation, although this would not be the first best solution. Concerns about CSSF's operational independence extend to its role in resolution.

37. The important cross-border connections require adequate inter-agency cooperation arrangements for the supervision of internationally active banking groups. Luxembourg exemplifies the challenges in small host jurisdictions where a significant portion of their financial sector comprises subsidiaries and branches of large international financial groups. Lessons from the GFC have shown that such subsidiaries could face under-capitalization and liquidity problems if the parent group encounters financial difficulties, with associated fiscal costs for host countries. The stress tests show that a couple of subsidiaries that have funding gaps also have potentially weak parents (based on the October 2023 GFSR). It is critical to have adequate supervisory processes to ensure that these banking

groups have effective liquidity risk management in place, including contingency funding plans at group level when subsidiaries in Luxembourg have not set up separate standing facilities with the BCL. A review of regulation and supervision of euro area Significant Institutions will be conducted in the ongoing euro area FSAP.

38. The fund-bank connections need careful oversight. Although custodian banks are generally diversified by having a substantial number of funds with different investment strategies, simultaneous funds' deposit outflows within group entities, where funds park their cash, could give rise to liquidity risks at the depositary bank. The stress tests found that the banking system overall would be able to manage the 25 percent withdrawals of deposits from funds, but a couple of banks were exposed to funds from the same group that could see a higher degree of withdrawal if the group had problems. From the funds' perspective as well, group linkages may create conflict of interest risks, particularly with respect to the oversight responsibilities on the funds and the managers played by the depository banks.

39. Real estate risks and non-financial private sector indebtedness need a coordinated approach among all financial supervisors and the CdRS. With real estate prices facing further downward pressures amid rising lending rates and a deteriorating mortgage risk profile characterized by high DSTI ratios, macrofinancial risks have already started to materialize in the real estate sector and among overleveraged household and corporate borrowers. Macroprudential policy challenges include ways to fortify banks against stock and flow vulnerabilities while avoiding procyclicality.

B. Macroprudential Policy and Framework

40. The institutional setting for macroprudential policy decisions has remained unchanged since the last FSAP, but the authorities have made significant progress on systemic risk analysis. The CdRS—comprising the MoF, CSSF, BCL, and CAA—is the macroprudential authority in Luxembourg, with the Minister of Finance serving as the chair. While CdRS decisions are not legally binding, macroprudential policies are implemented through the hard powers of its member agencies. Decisions require unanimous vote from the four members, and the CdRS is accountable to the parliament. The previous FSAP assessed the framework as broadly adequate but emphasized potential risks of inaction bias associated with the unanimous vote, recommending greater flexibility and enhanced communication. The CSSF and BCL have made commendable progress in developing systemic risk analysis, operational capacity, and filling data gaps, although large revisions in the national accounts leaves a substantial room for judgment.

41. This FSAP recommends upholding the primacy of the financial stability objective of the CdRS by reducing MoF's role and strengthening public communication. Recent experience in macroprudential policy suggests that while some actions were taken, they tended to come somewhat late in the cycle and proved insufficient to address the increasing household indebtedness. Additionally, even if not experienced to date, a potential conflict of interest could arise since the state is a significant shareholder in the primary banks involved in the real estate sector. Against this background, the FSAP recommends reducing the role of the government in macroprudential decisions through various institutional changes: it is recommended to revoke the unanimity requirement by lowering the threshold to three out of four votes for a CdRS decision to be passed (see IMF publication on Guidelines on the macroprudential institutional framework); alternatively, the MoF could be designated

as a non-voting member. It is to be noted that the central bank chairs macroprudential committees in many countries. The CdRS should publish abridged versions of the CdRS' risk assessments and risk dashboards, including a section on decisions even if no action is taken.

42. The operational agility on borrower-based measures (BBMs) should be further enhanced, coordinating with other policies. While a legal framework for BBMs in line with the 2017 FSAP recommendations is there, the authorities should improve their operational flexibility and avoid delays due to lengthy legislative processes. In case of delays, the CSSF should use its semi-hard and soft powers as needed. The authorities are also encouraged to regularly review the law to see whether the corridors on borrower-based limits constrain their ability to act and revise them as needed. Improved coordination between macroprudential and housing policies could be particularly important to enhance the effectiveness of macroprudential measures on financial stability while minimizing potential costs to affordability. The government should evaluate the pros and cons of formally consulting the CdRS on fiscal and housing policies that impact financial stability during the planning phase.

43. In the short term, macroprudential policy should use banks' existing capital headroom to build targeted sectoral systemic risk buffers, then address structural indebtedness early in the recovery cycle through borrower-based measures. In particular, the FSAP recommends the following actions (also see Technical Note on Macroprudential Policy):

- First, strengthen bank resilience against "stock" vulnerabilities, increasing macroprudential capital requirements preferably through sectoral systemic risk buffers (SRB) on the real estate sector. The risk of procyclical effects arising from such a measure is mitigated by banks' comfortable capital headroom amid record profitability and lower credit demand, minimizing the impact on credit provision.

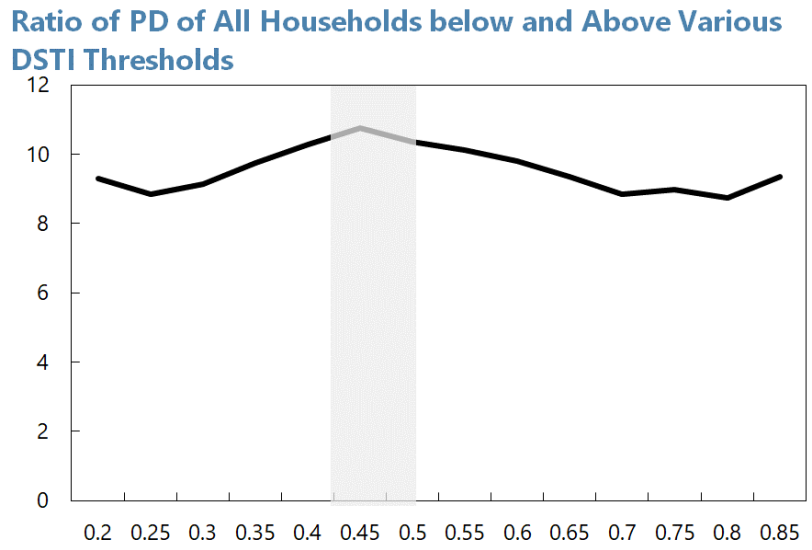
- Subsequently, introduce income-based measures early in the recovery cycle—with preparations on calibrations starting immediately—to reduce the probability of default of households and credit losses, and to reduce the adverse impact on consumption and investment in case of recession. FSAP analysis suggests calibrating stressed-DSTI at around 45-50 percent (see text figure below), possibly tied to the current interest rate stress test required by CSSF for mortgages. The authorities should also consider gradually reducing the maximum LTV limit of 100 percent. FSAP analysis shows that in the context of housing supply rigidity, a sufficiently tight combination of DSTI and LTV could lead to higher affordability of housing and lower household indebtedness in the medium term.

- Given the openness and complexity of the financial system, the authorities are strongly encouraged to evaluate the adoption of a positive neutral CCyB (PNCCyB) in the medium-term. The authorities kept the CCyB at around 0.5 percent during the pandemic in order to maintain resilience, de facto serving as a PNCCyB. When calibrating and implementing the PNCCyB, interactions with other instruments, including other capital-based measures, should be assessed.

- Fiscal support to the real estate sector should be carefully calibrated to reduce moral hazard and allow price adjustment. Instead, the authorities should frontload public investment, and reduce supply bottlenecks through higher densification. Over the medium term, the authorities should rethink their help-to-buy policies and phase out the mortgage interest payments deductibility.

- Collateral valuation effects from CRE overvaluation and refinancing risks for real estate firms should be closely monitored. Support to viable firms could be envisaged under strict conditions.

Calibrating Debt-Service-to-Income Limit
(Ratio of "Probability of Default "(PD) of households above-to-below different DSTI thresholds)



Sources: Household Finance and Consumption Survey wave IV; IMF staff estimates.

Notes: The results are based on a horse race, estimating the "probability of default" of all households below and above different DSTI thresholds (X-axis) in the adverse scenario. The "PD" is based on the household financial margin and the availability of liquid financial assets to service the debt in case the financial margin is negative. The suggested "optimal" threshold corresponds to the peak of the PD ratio. The "optimal" level for all households is 45 percent, while by income level, the majority of households could afford a DSTI for 50 percent. See Technical Note on Macroprudential Policy.

C. Investment Funds Sector

44. The CSSF has a robust supervisory framework with substantive improvements since the last FSAP, but some areas need strengthening. The CSSF has made commendable improvements to its risk-based approach for the fund sector. Considering more than half of the depositaries in Luxembourg have group links with fund managers, the CSSF should consider incorporating such links as key risks in the risk-based approach for both fund managers and depositaries. Luxembourg has a significant third-party fund managers industry (also called white-label service providers) with a business model different from the traditional intra-group fund managers, each model posing a different set of risks, especially on conflicts of interest. The current supervision framework should be enhanced by incorporating the differentiated sets of risks between the two fund manager models. To enhance its reporting framework, the CSSF should obtain clear and granular data on credit lines put in place by IFs, including the extent of sharing, commitment, and drawdown.

45. Enhancing the resilience of outlier MMF LVNAVs could further safeguard the sector against tail risks. Stress tests showed that the majority of the sector is resilient to very large shocks. Nevertheless, given the potential spillover risks specific to the MMF sector, it is advisable to take a prudent stance regarding outliers. This can be achieved by providing guidance to those market participants currently employing riskier strategies and by continuing micro and macro-level supervision of the LVNAV fund sector, in an effort to monitor risk and align funds' risk management practices with their risk profile. Additionally, CSSF should remain at the forefront of EU MMF regulatory developments (see Box 2 on MMFs in the Technical Note on Regulation and Supervision of Investment Funds).

46. The structural importance of foreign delegation for Luxembourg domiciled funds calls for an active on-site inspection framework for such delegates. Although the current framework for delegation has not created any specific problems so far, the CSSF should continue to discuss initiating a risk-based onsite inspection framework with foreign supervisors, with inspection done by CSSF by itself (with the supervisor's consent) or jointly with the relevant supervisor.

47. The CSSF's enforcement framework should be improved on four key fronts. First, harmonizing CSSF's enforcement and investigation powers under different fund-related laws to ensure that CSSF has a comprehensive set of powers to investigate and take enforcement actions against the wide set of entities in the sector. Second, reviewing various laws to enhance the number of fines that can be imposed, so that the overall sanctioning regime has a deterrent effect. Third, integrating, in the enforcement approach against entities, the accountability of relevant individuals and boards and take suitable action. Fourth, prioritizing legislative efforts to introduce a regime for collective action by fund investors, focusing on a mechanism for class action suits.

48. The CSSF can improve the domestic regulatory framework on areas such as winding up, valuation, and approach to indirectly regulated AIFs. Unregulated/indirectly regulated AIFs have increasingly become the most popular structures for new AIFs in Luxembourg. To avoid the risk of regulatory arbitrage, while introducing new regulatory requirements, the CSSF should consider whether such requirements should be applicable to indirectly regulated AIFs. Fund product laws permit significant deviation from fair valuation. To avoid potential misuse, the CSSF should clarify the specific situations where deviation from fair valuation by AIFs is permitted. Furthermore, as part of its ongoing efforts to strengthen the winding up framework, the CSSF should harmonize various winding up provisions in the product laws, as much as possible and consider incorporation of IOSCO's good practices, to the extent not covered in the present framework.

49. Given Luxembourg's position as the domicile of the EU's largest IF sector, the CSSF should continue to actively promote and contribute to EU level reforms. Due to significant depositary-fund manager linkages in Luxembourg, CSSF should take an active role in promoting EU level reforms on strengthening depositary independence. On liquidity risks, the CSSF should continue to contribute to ESMA's guidance on the use of Liquidity Management Tools (LMT) and engage closely with ESMA and the EU Commission on the proposed revision of the Eligible Assets Directive that will guide the eligibility criteria for assets in which UCITS funds are permitted to invest.

D. Banking Sector Supervision of LSIs and Third-Country Branches

50. No material weaknesses were identified in the CSSF's supervisory processes in the areas of focus in the FSAP—namely, LSI supervision of liquidity, interest rate risk in the banking book, operational risk, and related-party transactions. The CSSF follows SSM's Supervisory Review and Evaluation Process (SREP) policies and procedures for these areas of supervision. Comprehensive and sufficiently regular data is collected in each area and the risk analysis is detailed and supported by satisfactory IT systems. Horizontal supervision appears to be embedded effectively in supervisory processes (also see Technical Note on Banking Supervision).

51. The frameworks for supervision and regulation could be improved further for soundness of the LSIs. Key recommendations, in addition to ensuring CSSF's operational independence, include several other areas. Since the establishment of the SSM, the BCL has undertaken the liquidity supervision of 19 LSIs, including preparing their Liquidity SREP to feed into CSSF supervision. This arrangement, where a key element of supervision is not conducted by the designated National Competent Authority (NCA), has not created problems so far. However, clear criteria for selecting the 19 LSIs and regular review of the division of responsibilities are needed, including finalizing the Memorandum of Understanding (MoU) between the BCL and the CSSF regarding the supervision of liquidity.

52. The trend toward "branchification" suggests the need for more formal policies for third country branches (TCB) to avoid potential regulatory arbitrage. Currently, no material retail deposits are accepted by TCBs in Luxembourg as per non-written CSSF policy. The EU is planning to harmonize the EU framework for TCBs and the CSSF is fully engaged in the ongoing policy discussions. To future-proof its regulatory regime, the CSSF should consider whether the proposed EU thresholds for TCBs to accept retail deposits are appropriate for Luxembourg. Hence, existing CSSF policies need to be codified and enforceable.

53. The BCL and other authorities should actively pursue the establishment of a credit register, with a clear deadline. Progress has been delayed due to COVID-19, but a Working Group chaired by the BCL has produced a first draft report. This will benefit not only supervisory processes but also banks' credit risk management. The BCL is part of the ECB AnaCredit initiative, scheduled for 2027, which will only cover corporate exposures, but the dataset will not be publicly available to banks or to the CSSF.

E. Insurance Sector Supervision

54. Solvency II has been fully implemented in Luxembourg without any significant frictions. Still, certain national rules continue to exist under the LUX-GAAP accounting regime, adding an additional layer of prudence specifically for liability valuation. Furthermore, the Insurance Act requires the coverage of insurance liabilities by tied assets, and the CAA requires full collateralization for reinsurance of life insurance products that include a savings element. This collateral requirement mitigates counterparty default risks and potential concentration risks for some of the large life insurers which extensively use reinsurance for their guaranteed business, as shown in the FSAP's risk analysis (see Technical Note on Systemic Risk, and Technical Note on Insurance Supervision).

55. The CAA's supervisory approach is risk-based and early warning signals have been defined. Off-site review of reporting files is comprehensive, and on-site inspections are scheduled rather frequently according to a minimum engagement plan. For internal model users, the CAA monitors model appropriateness on an ongoing basis. As a host supervisor, the CAA participates in around forty supervisory colleges and takes the role as the European lead supervisor for one of the largest reinsurers. After the Brexit decision, the CAA licensed twelve UK insurers in close cooperation with the UK authorities. A robust enforcement framework is in place which is based on clear, objective, and consistent criteria.

56. After having grown substantially in size, the CAA would benefit from setting up an internal audit function to improve overall governance, also related to IT projects that are conducted largely in-house. The CAA staff numbers have more than doubled since the last FSAP. Its independence could be further strengthened by limiting the government's power to dismiss the CAA's Executive Committee. The maximum limits to monetary sanctions should be reviewed and potentially aligned with other financial sector regulation, e.g., by using relative limits based on revenues. Conduct supervision would benefit from the development of risk-based indicators, and resources should continue to be constantly reviewed with expanding tasks.

F. Financial Market Infrastructure—Cyber Resilience

57. Luxembourg would benefit from developing a dedicated cyber strategy for the financial sector. The financial system in Luxembourg is highly digitalized and cyber resilience is crucial for its stability and growth. Furthermore, cyber incidents have been increasing recently. Although the BCL has adopted the Eurosystem cyber strategy for FMIs, it would be useful for the CSSF and BCL to develop a cyber strategy for the broader financial system in Luxembourg, especially taking note of the upcoming Digital Operational Resilience Act (DORA) which will cover a range of different subject matters.

58. The regulatory, supervisory, and oversight framework for cyber risk is evolving. The CSSF has implemented some regulatory measures to address cyber risk of FMIs while the BCL relies on oversight tools developed by the Eurosystem. The BCL should further strengthen its oversight approach for cybersecurity for FMIs and third-party providers. The CSSF should establish a holistic cyber regulatory and supervision framework, considering its mandate and the EU's Digital Operational Resilience Act.

G. Financial Integrity

59. The increase in cross-border flows accelerated over the past several years, and the authorities enhanced the monitoring of related money laundering and terrorist financing (ML/TF) risks. The activities and operations of financial sector firms, including payments service providers, investment firms, and large international banks expanded. While the strategy of banking groups shifted to focus more on servicing the EU market, banks also continued to accept more international clients, including from countries with higher ML/TF risks. Staff's financial flows analysis confirms that while most of the increase was due to payments with EU countries, the financial sector also experienced a broad-based increase in payments with multiple other countries and regions.

60. The authorities monitor cross-border payments through data stemming from a broad array of sources, including an annual survey and other reports obtained from financial institutions. The assessment of the ML/TF risk exposures is at the institutional level, and the authorities maintain their own list of higher risk jurisdictions, having significantly increased the resources dedicated to risk-based AML/CFT supervision. Accordingly, they allocate most of the resources to the largest and highest risk sectors. The financial institutions satisfactorily apply enhanced measures to higher-risk countries.

61. As the authorities continuously advance the understanding of ML/TF risks, additional measures should be considered to manage ML/TF risks related to cross-border flows. Monitoring and analysis of cross-border payments data, combined with macro-economic data, could, on top of the bottom-up analysis performed at entity level, highlight payment patterns that stand out. This analysis could benefit from information exchanges with the key financial institutions and with foreign and domestic authorities, such as tax administration and an anti-corruption agency. The macro-level analysis of cross-border flows through the leveraging of advanced data analytics can help to identify red flags and patterns warranting further oversight by supervisors. Therefore, it can help to strengthen the understanding of ML/TF threats from counterpart jurisdictions, in addition to jurisdictions as identified notably by the FATF and to allow the design and implementation of effective risk-based measures to manage risks. The authorities should continue to ensure the sufficiency of resources available to AML/CFT supervision.

FINANCIAL SAFETY NET AND CRISIS MANAGEMENT

62. The CSSF has made important progress in resolution planning although certain gaps and challenges persist. The assessment focuses on national arrangements, operational readiness, and, where relevant, their interactions within the broader EU framework. Resolution plans have been prepared for all LSIs and resolvability assessments undertaken for the banks which meet the public interest test. The FSAP invites the authorities to carefully re-assess resolvability of the LSI banks earmarked for resolution, and prepare for tail-risk scenarios where actual losses exceed loss-absorption buffers and available resolution financing. The CSSF should also review the existing network of cooperation agreements on recovery and resolution planning with non-EU countries like the US,

China, Japan, and Switzerland. The mission also recommended enhancing the operationalization of resolution tools and participating in simulation exercises.

63. The new BCL manual for Emergency Liquidity Assistance (ELA) is fit for purpose but can be strengthened on funding-in-resolution, and in inter-agency cooperation. To ensure operational readiness, the BCL should undertake ELA simulation exercises to test banks' capabilities in mobilizing enough collateral. Some banks that have chosen not to activate standing facilities with the BCL may be exposed to liquidity-solvency interactive risk in a crisis, as seen in the FSAP stress tests. Moreover, the authorities should assess the possibility of introducing a state guaranteed backstop in case there is insufficient eligible collateral available for granting ELA to a newly resolved bank. Finally, arrangements for information exchange between the BCL and CSSF in crisis situations should be formalized.

64. The operational readiness and staffing of the Luxembourg Deposit Guarantee Fund (FGDL) need strengthening. The introduction and operationalization of the FGDL backstop mark significant progress in the Luxembourg safety net. The FGDL should, however, enhance its operational readiness to meet the 7-working-day payout period mandated by law. Continuous improvements have been made, but improvements, especially in the IT system's quality and reliability, are still needed. The insolvency framework should allow the FGDL to file its claims in a liquidation process within the same time period as the depositors (10 years), therefore ensuring a level playing field in the recovery process and avoiding the risk of FGDL's inability to recover all claims.

65. While cooperation with EU authorities seems adequate, further engagement with non-EU foreign authorities should be pursued. The most relevant authorities in Luxembourg are adequately represented in the national bodies and committees which are designed to deal with crisis of financial institutions, which allows an efficient exchange of information. However, in what concerns cooperation with foreign counterparts, authorities should consider the recent trend by subsidiaries of EU banks to convert into branches. This trend makes it even more critical to engage broadly with all the relevant authorities to ensure that significant branches in Luxembourg are adequately incorporated in the recovery and resolution plans of the parent EU authorities or of banks outside of the EU. In particular, the authorities should sign cooperation agreements on information exchange with non-EU home resolution authorities for branches of foreign banks.

AUTHORITIES' VIEWS

66. The authorities appreciated new insights from the FSAP analysis and provided important nuances on the team's findings. They had a more nuanced view on household indebtedness and associated risks, given the high proportion of fixed-rate loans and households' significant net wealth. Moreover, as regards bank solvency stress tests, they noted that the availability of hedges limits the impact of interest rate risk in practice. On the sensitivity analysis concerning credit concentration risk, they noted that the largest exposures are mostly foreign financial institutions with very low PDs, including parent entities, thus mitigating credit risks. On liquidity risks related to real estate companies, the authorities invited the team to take a more qualified view, citing specific lending practices for real estate developers and micro-structure features of the firms. While the authorities appreciated the inclusion of AIFs in the investment fund stress tests, they cautioned on their different liquidity risk profiles that could have influenced the results. Nevertheless, they also appreciated new insights from

the FSAP team, including on second-round effects of securities sales, on intersectoral spillovers through market prices, and on liquidity-solvency interactions in bank stress tests.

67. There were differences in views on the need to act, the specific policies to use, and the institutional features for macroprudential decisions. The authorities noted that the introduction of the maximum-LTV limits has been effective in lowering LTVs among new mortgage borrowers and found the limits appropriate. They considered CSSF's current requirement for banks to conduct interest rate stress tests on mortgage loans to be an alternative to the FSAP's suggestion for combining this test with a stressed-DSTI limit. Furthermore, the authorities would prefer to have more flexibility in considering specific capital-based measures, emphasizing the high level of capital currently in the system. They considered the current composition and voting rules in the CdRS an important element of consensus-based decision making.

68. The authorities broadly agreed with the recommendations on continuing to improve supervision. They welcomed the FSAP's conclusions that the oversight framework had improved commendably since the 2017 FSAP. The authorities considered the institutional framework for supervision to be appropriate and in line with European and international standards.

Table 2. Luxembourg: Structure of the Financial System, 2016 and 2023

	Number of institutions	Total assets, billion of	Multiples of GDP	Number of institutions	Total assets, billion of euro	Multiples of GDP
	2016			2023		
Banks	142	763.7	13.6	120	957.2	11.7
by legal form						
Private	95	484.0	8.6	74	504.7	6.2
Domestic	3	9.7	0.2	68	28.3	0.3
Foreign	92	474.2	8.4	8	476.4	5.8
State-owned	2	45.3	0.8	2	61.0	0.7
Branches of foreign banks	45	234.4	4.2	44	391.5	4.8
by functional business model (largest groups):						
Retail and commercial banking/universal	14	131.5	2.3	13	240.0	2.9
Custodian banking and activities linked to investment funds	25	115.8	2.1	27	292.3	3.6
Private banking	42	166.8	3.0	33	143.2	1.7
Corporate finance	30	160.9	2.9	37	203.7	2.5
Covered bond banking	...	...	...	2	15.0	0.2
Clearing, treasury and-or payment services	...	...	...	8	62.9	0.8
by geographical business orientation:						
Domestically oriented	11	127.7	2.3	9	180.2	2.2
Internationally oriented	131	636.0	11.3	111	777.0	9.5
Money market funds	...	292.7	5.2	184	481.8	5.9
Non-money market investment funds	...	3767.5	67.0	13,739	6324.2	77.3
by strategy						
Bond funds	...	1313.4	23.4	3,120	1444.9	17.6
Equity funds	...	1169.8	20.8	4,119	2462.4	30.1
Mixed funds	...	888.8	15.8	3,251	1330.1	16.2
Real estate funds	...	82.8	1.5	314	296.7	3.6
Other funds	...	312.7	5.6	2,935	790.2	9.7
Other financial institutions						
Securitisation vehicles	...	223.3	4.0	...	417.7	5.1
Captive financial institutions and money lenders	...	9832.61	174.9	...	8566.0	104.6
Other financial intermediaries	...	193.8	3.4	...	6.5	0.1
Financial auxiliaries	...	18.5	0.3	...	21.8	0.3
Pension funds	14	2.0	0.0	...	2.2	0.0
Insurance companies	297	185.2	3.3	280	253.5	3.1
Life	45	159.5	2.8	36	209.5	2.6
Non-life	44	5.4	0.1	45	14.5	0.2
Reinsurance	208	20.3	0.4	199	29.5	0.4

Sources: BCL; Haver Analytics L.L.C; and IMF staff calculations.

Note: Latest available data were used for 2023. Data on number of investment funds from February 2024.

Table 3. Luxembourg: Selected Economic Indicators, 2019–29

	2019	2020	2021	2022	Projections 2023	2024	2025	2026	2027	2028	2029
Real Economy (percent change)											
Gross domestic product	2.9	-0.9	7.2	1.4	-1.1	1.3	2.9	2.5	2.3	2.3	2.3
Total domestic demand	4.9	-4.0	10.9	-1.0	2.4	1.9	3.3	2.7	2.6	2.5	2.5
Private consumption	2.5	-8.5	11.3	2.3	4.0	2.6	3.8	2.9	2.6	2.6	2.5
Public consumption	2.8	7.3	5.1	2.6	2.5	2.8	2.3	2.5	2.5	2.5	2.5
Gross investment	11.6	-6.4	16.4	-9.8	-0.8	-0.3	3.5	2.5	2.5	2.5	2.5
Foreign balance 1/	-0.3	1.8	0.0	2.0	-2.6	-0.2	0.6	0.7	0.6	0.6	0.6
Exports of goods and nonfactor services	6.0	0.6	10.3	-0.6	-1.4	1.2	2.5	2.5	2.4	2.4	2.4
Imports of goods and nonfactor services	7.4	-0.4	12.4	-1.9	-0.1	1.5	2.6	2.5	2.5	2.5	2.5
Labor Market (thousands, unless indicated)											
Resident labor force	286.8	294.0	298.0	302.3	309.2	314.7	320.7	327.0	333.3	339.8	346.5
Unemployed (average)	15.4	18.7	17.1	14.6	16.2	18.6	18.9	18.6	18.3	18.3	18.4
(Percent of total labor force)	5.4	6.4	5.7	4.8	5.2	5.9	5.9	5.7	5.5	5.4	5.3
Resident employment	271.4	275.3	280.8	287.8	293.0	296.1	301.8	308.3	315.1	321.6	328.1
(Percent change)	2.6	1.4	2.0	2.5	1.8	1.1	1.9	2.2	2.2	2.1	2.0
Cross-border workers (net)	191.9	196.2	204.3	213.7	219.7	223.4	227.9	233.0	238.3	243.8	249.4
Total employment	463.3	471.6	485.1	501.4	512.7	519.5	529.6	541.3	553.4	565.4	577.5
(Percent change)	3.5	1.8	2.9	3.4	2.2	1.3	2.0	2.2	2.2	2.2	2.1
Prices and costs (percent change)											
GDP deflator	0.9	4.3	4.6	5.7	3.4	2.4	3.0	1.9	2.0	2.0	2.0
CPI (harmonized), p.a.	1.7	0.0	3.5	8.2	2.9	2.6	3.1	2.1	2.0	2.0	2.1
CPI core (harmonized), p.a.	1.8	1.2	1.5	4.2	3.9	2.8	2.9	2.2	1.9	2.0	2.0
CPI (national definition), p.a.	1.7	0.8	2.5	6.3	3.7	2.7	3.2	1.8	2.1	2.0	2.0
Wage growth 2/	1.9	1.2	5.1	5.9	7.3	3.5	2.9	2.3	2.3	2.3	2.3
Nominal unit labor costs 2/	2.5	3.9	0.9	8.0	10.9	3.6	1.9	2.0	2.2	2.2	2.1
Public finances (percent of GDP)											
General government revenues	45.3	43.5	43.4	43.5	46.8	47.0	47.9	48.0	48.2	48.4	48.7
General government expenditures	43.1	47.0	42.8	43.9	48.1	49.2	49.4	49.2	49.5	49.9	50.2
General government balance	2.2	-3.4	0.5	-0.4	-1.3	-2.2	-1.5	-1.3	-1.3	-1.5	-1.6
General government cyclically-adjusted balance	0.6	-2.0	0.0	-0.5	-1.4	-1.7	-1.4	-1.3	-1.4	-1.5	-1.6
General government structural balance	0.6	1.8	1.1	0.3	0.2	-0.9	-1.4	-1.3	-1.4	-1.5	-1.6
General government gross debt	22.4	24.6	24.5	24.7	25.7	28.1	28.8	29.5	30.1	30.8	31.4
Balance of Payments (percent of GDP)											
Current account	8.9	8.6	7.9	7.6	6.8	7.0	7.3	7.3	7.2	7.3	7.2
Balance on goods	2.6	2.3	1.2	0.1	-0.2	-0.8	-0.8	-0.9	-0.9	-1.0	-1.0
Balance on services	33.7	37.0	37.3	37.2	34.4	33.9	33.5	33.5	33.4	33.2	33.1
Net factor income	-27.7	-30.7	-30.2	-29.1	-26.9	-26.3	-25.6	-25.6	-25.4	-25.2	-25.0
Balance on current transfers	0.3	0.0	-0.4	-0.6	-0.5	0.2	0.2	0.2	0.2	0.2	0.2
Exchange rates, period averages											
U.S. dollar per euro	1.12	1.14	1.18	1.05	1.08	...	...	...	...	...	...
(Percent change)	-5.2	1.9	3.7	-11.0	2.6	...	...	...	...	...	...
Nominal effective rate (2010=100)	101.7	103.4	104.0	102.7	105.3	...	...	...	...	...	...
(Percent change)	-0.6	1.7	0.6	-1.3	2.5	...	...	...	...	...	...
Real effective rate (CPI based; 2010=100)	99.6	101.0	101.2	98.2	98.3	...	...	...	...	...	...
(Percent change)	-0.7	1.4	0.2	-3.0	0.1	...	...	...	...	...	...
Credit growth and interest rates											
Nonfinancial private sector credit (eop, percent change) 3/	7.2	5.0	5.3	4.4	-3.0	2.2	6.3	4.8	4.8	4.7	4.6
Government bond yield, annual average (percent)	...	...	...	...	...	...	...	...	...	...	...
Memorandum items: Land area = 2,586 sq. km; population in 2019 = 626,108; GDP per head = €101,446											
GDP (billions of euro)	62.4	64.5	72.4	77.5	79.3	82.2	87.1	91.0	95.0	99.1	103.4
Output gap (percent deviation from potential)	0.7	-1.7	2.9	2.1	-1.0	-1.7	-0.8	-0.3	0.0	0.0	0.0
Potential output growth	2.1	1.6	2.4	2.2	2.0	2.0	2.0	2.0	2.0	2.3	2.3

Sources: Luxembourg authorities; IMF staff estimates and projections.

1/ Contribution to GDP growth.

2/ Overall economy.

3/ Including a reclassification of investment companies from financial to non-financial institutions in 2015.

Table 4. Financial Soundness Indicators 2016–2023

	2016	2017	2018	2019	2020	2021	2022	2023
All Banks								
Capital adequacy								
Regulatory capital to risk weighted assets	25.0	25.9	24.8	22.6	24.8	23.9	23.0	24.0
Regulatory tier 1 capital to risk weighted assets	24.0	25.1	24.0	22.1	22.8	21.9	22.0	22.0
Capital to assets	7.0	8.4	8.0	7.4	8.6	7.9	8.0	9.0
Profitability and efficiency								
Return on assets	0.8	0.7	0.6	0.5	0.5	0.6	0.6	1.1
Return on equity	11.0	8.1	7.4	7.4	6.2	5.5	5.0	9.0
Interest margin to gross income	25.0	27.9	27.1	26.7	24.9	21.3	26.0	34.0
Trading income to total income	3.0	1.3	3.5	2.9	1.5	1.5	2.0	1.0
Noninterest expenses to gross income	69.0	73.6	77.5	78.8	79.5	81.1	77.0	72.0
Personnel expenses to noninterest expenses	25.0	25.9	24.9	25.1	24.2	22.4	22.0	22.0
Asset quality and structure								
Residential real estate loans to total loans	6.2	6.2	6.8	6.9	8.5	13.0 1/	15.0	15.0
Household debt to GDP	60.0	59.5	59.8	64.3	69.7	71.0	72.0	72.0
Nonperforming loans to total gross loans	0.9	0.8	0.9	0.7	1.0	1.3 1/	1.6	1.9
Sectoral distribution of loans (in percent of total loans)								
Residents	33.0	33.4	33.7	32.0	36.9	40.4	37.0	37.0
Nonresidents	67.0	66.6	66.3	68.0	63.1	59.6	63.0	63.0
Liquidity								
Liquid assets to total assets	21.2	22.9	24.9	24.7	29.8	32.0 1/	33.0	32.0
Liquid assets to short-term liabilities	31.8	31.7	34.6	33.2	38.8	35.0 1/	37.0	36.0
Customer deposits to total (non interbank) loans	106.0	102.9	106.2	107.7	109.0	76.0 1/	72.0	73.0
Domestically Oriented Banks								
Capital adequacy								
Regulatory capital to risk weighted assets	23.0	23.0	22.9	22.5	22.9	23.1	23.0	23.0
Regulatory tier 1 capital to risk weighted assets	23.0	22.1	22.1	21.8	22.2	22.4	22.0	23.0
Capital to assets	9.0	8.2	8.8	8.7	8.9	8.7	9.0	9.0
Profitability and efficiency								
Return on assets	1.0	0.8	0.8	0.7	0.7	0.8	0.8	1.2
Return on equity	11.0	9.7	8.8	8.6	7.6	9.0	10.0	8.0
Interest margin to gross income	56.1	54.8	52.8	51.5	52.2	47.6	52.0	57.0
Asset quality and structure								
Residential real estate loans to total loans	28.0	26.7	24.9	25.6	28.0	36.7	37.0	37.0
Sectoral distribution of loans (in percent of total loans)								
Residents	71.0	69.5	67.5	71.0	76.4	80.9	82.0	82.0
Nonresidents	29.0	30.5	32.5	29.0	23.6	19.1	18.0	18.0
Liquidity								
Liquid assets to total assets	19.5	20.3	20.9	23.4	24.0	29.1	28.0	29.0
Liquid assets to short-term liabilities	26.0	27.2	28.0	30.7	32.3	32.9	32.0	33.0
Customer deposits to total (non interbank) loans	124.0	128.0	112.0	108.1	99.0	87.5	89.0	88.0

Sources: BCL, and CSSF.
1/ Change in underlying data source and calculation methodology (EBA 3).

Table 5. Luxembourg: Risk Assessment Matrix

Source of risks	Relative Likelihood	Impact if realized
Monetary policy miscalibration. Amid high economic uncertainty and volatility, major central banks slow monetary policy tightening or pivot to loosen monetary policy stance prematurely, de-anchoring inflation expectations and triggering a wage-price spiral in tight labor markets.	**Medium**	**High/Medium.** Higher inflation, including through commodity price rises, will feed into wages, through automatic indexation, hindering competitiveness, or increase fiscal cost for the government. Tighter financial conditions could heighten credit risk. In particular, higher for longer interest rates could severely affect the performance of banks and non-banks, increase unemployment and lower fiscal revenue. FSAP stress test shows the financial sector is overall resilient but the nonfinancial private sector debt service risks are high.
Commodity price volatility. A succession of supply disruptions (e.g., due to conflicts and export restrictions) and demand fluctuations (e.g., reflecting China reopening) causes recurrent commodity price volatility, external and fiscal pressures, and social and economic instability.	**Medium**	
Abrupt global slowdown or recession. Global and idiosyncratic risk factors combine to cause a synchronized sharp growth downturn, with recessions in some countries, adverse spillovers through trade and financial channels, and markets fragmentation. In Europe, intensifying fallout from the war in Ukraine, worsening energy crisis and supply disruptions, and monetary tightening exacerbate economic downturns and housing market corrections.	**Medium** **Medium**	**High/ Medium.** Luxembourg export demand could weaken further, with potentially more severe impact on the economy. Inflation is lower due to lower commodity prices.
Systemic financial instability. Sharp swings in real interest rates, risk premia, and assets repricing amid economic slowdowns and policy shifts trigger insolvencies in countries with weak banks or non-bank financial institutions, causing markets dislocations and adverse cross-border spillovers.	**Medium:**	**Medium.** Stress tests show that the financial sector overall will be able to absorb reasonable degree of stress, unless there is domestic interbank contagion through confidence channels, which is not considered in the FSAP exercise. Banks will be able to withstand contagion from investment funds overall.
Cyber-attacks Cyberattacks on critical domestic and/or international physical or digital infrastructure (including digital currency and crypto ecosystems) trigger financial and economic instability.	**Medium** **ST/MT**	**High.** Payment and financial systems are disrupted, with potential risk to delivery of collateral in time, with large negative impact on financial institutions' ability to meet margin calls and stem funding outflows.
Sharp correction in house prices. A sharp drop in demand for housing could lead to a large correction in prices.	**Low** **ST/MT**	**Low.** Structural imbalances render a large correction unlikely. Risks on the financial sector are mitigated by banks' strong capital and liquidity positions, households' high level of income and financial wealth, as well as strong labor markets.
Possible changes in international corporate and personal taxation.	**Medium** **ST/MT**	**Medium.** This could weaken Luxembourg's attractiveness for businesses, weakening fiscal revenues and foreign investment.

Table 6. Luxembourg: Scenarios—Macrofinancial Variables

External assumptions (in percent, except for VIX)

	Realized		Est.		Proj.	
	2021	2022	Y0=2023	Y1=2024	Y2=2025	Y3=2026
Euro area GDP growth rate						
Baseline	5.6	3.3	0.7	1.2	1.8	1.7
Adverse	5.6	3.3	0.7	-3.0	0.2	1.7
Euro area inflation rate						
Baseline	2.6	8.4	5.6	3.3	2.2	2.0
Adverse	2.6	8.4	5.6	6.3	3.3	1.6
Euro area unemployment rate						
Baseline	7.7	6.7	6.6	6.5	6.4	6.3
Adverse	7.7	6.7	6.6	7.0	8.0	8.2
Euro area ST rate						
Baseline	-0.4	0.3	3.3	3.4	3.0	2.7
Adverse	-0.4	0.3	3.3	6.0	4.7	3.3
Euro area LT rate						
Baseline	0.1	1.8	3.0	3.3	3.5	3.4
Adverse	0.1	1.8	3.0	6.8	5.7	3.4
US GDP growth rate						
Baseline	5.9	2.1	2.1	1.5	1.8	2.1
Adverse	5.9	2.1	2.1	-1.9	1.0	2.7
Oil price growth						
Baseline	63.5	39.8	-16.8	-1.4	-4.7	-4.0
Adverse	63.5	39.8	-16.8	20.1	0.2	2.1
3-month Euribor rate						
Baseline	-0.5	0.3	2.7	2.9	2.9	2.5
Adverse	-0.5	0.3	2.7	6.0	4.7	3.3
VIX index (historical benchmarking)						
Baseline	19.6	25.6	20.0	20.0	20.0	20.0
Adverse	19.6	25.6	20.0	48.3	35.0	20.0

Table 6. Luxembourg: Scenarios—Macrofinancial Variables (concluded)

(Luxembourg-Specific) Domestic Variables (in percent)	Realized		Est.		Proj.	
	2021	2022	Y0=2023	Y1=2024	Y2=2025	Y3=2026
GDP growth rate						
Baseline	7.2	1.4	-0.4	1.5	2.4	2.5
Adverse	7.2	1.4	-0.4	-4.3	-1.7	3.2
Inflation rate (HICP-based)						
Baseline	3.5	8.1	3.2	3.3	2.2	2.0
Adverse	3.5	8.1	3.2	5.5	3.6	2.0
Inflation rate (CPI-based)						
Baseline	2.5	6.3	3.9	3.1	2.5	1.9
Adverse	2.5	6.3	3.9	4.7	5.1	2.6
Energy inflation (CPI-based)						
Baseline	18.9	32.9	-7.0	2.2	12.0	-2.4
Adverse	18.9	32.9	-7.0	7.0	18.0	0.6
Food inflation (CPI-based)						
Baseline	0.9	7.0	9.9	2.0	2.3	1.7
Adverse	0.9	7.0	9.9	3.0	3.7	2.5
Inflation excl food and energy (CPI-based)						
Baseline	1.6	3.6	4.0	3.4	1.7	2.3
Adverse	1.6	3.6	4.0	4.8	4.1	2.8
House price index growth						
Baseline	13.9	9.6	-2.3	-0.4	2.9	1.9
Adverse	13.9	9.6	-2.3	-17.0	-15.0	-1.0
Unemployment rate						
Baseline	5.7	4.8	5.2	5.8	5.9	5.8
Adverse	5.7	4.8	5.2	8.7	12.1	11.1
10-yr gov.-bond yield						
Baseline	-0.4	1.5	1.7	2.9	3.1	3.2
Adverse	-0.4	1.5	1.7	6.8	5.7	3.4
Credit growth						
Baseline	4.5	6.6	2.4	4.7	5.4	4.9
Adverse	4.5	6.6	2.4	0.0	0.0	0.0
Inv. funds' net asset growth						
Baseline	17.8	-14.2	0.0	0.0	0.0	0.0
Adverse	17.8	-14.2	0.0	-14.1	-7.5	4.5
Wage (comp. per empl.) growth						
Baseline	5.1	5.9	5.5	3.5	2.9	2.3
Adverse	5.1	5.9	5.5	3.6	3.7	3.4

Source: IMF team calculations.

Note: "Est" refers to estimates as of January 2024 when stress tests were conducted. "Proj." refers to projections—Baseline refers to the October 2023 WEO projections.

Table 7. Luxembourg: Results of the Investment Fund Liquidity Stress Test

	Adverse and GFC			Historical (First Percentile)		
	Funds with RCR<1	% Funds with RCR<1	% NAV with RCR<1	Funds with RCR<1	% Funds with RCR<1	% NAV with RCR<1
Bond funds						
Emerging market	0	0.0	0.0	1	2.7	2.4
ETF/Index funds	0	0.0	0.0	0	0.0	0.0
High-yield	0	0.0	0.0	17	58.6	44.1
Others	0	0.0	0.0	0	0.0	0.0
Equity Funds	0	0.0	0.0	1	0.2	0.1
Mixed Funds	4	2.5	0.3	4	2.5	0.3
Fund of funds	0	0.0	0.0	0	0.0	0.0
Hedge funds	0	0.0	0.0	0	0.0	0.0
Real estate funds	0	0.0	0.0	6	18.8	26.1
Other funds	0	0.0	0.0	1	5.0	1.5

Source: BCL, CSSF and IMF staff calculations.
Note: The table shows the results of the stress tests for the adverse and GFC scenarios (here presented as one, since the results are equivalent) and for a redemption scenario based on the first percentile of historical outflows assuming homogeneous levels of redemptions across broad investment strategies. For each scenario, the three columns show i) the of number of funds with Required Coverage Ratio (RCR) below one; (ii) the share of the number of funds with RCR below 1, as a percentage of the total number of funds in the group; and (iii) the share of the NAV of the funds with RCR below 1, as a percentage of the aggregate NAV of the corresponding group.

Table 8. Luxembourg: Summary Results of the Stress Tests Across Sectors

Banking sector solvency

	Hurdle rates		Number of institutions below the hurdle rates:			Asset shares of institutions below the hurdle rate:
	CET1 ratio (percent of RWAs)	Leverage ratio (percent of total assets)	After 1st round of shocks	After 2nd round of shocks	After 3rd round of shocks	After all rounds of shocks
Baseline (end of 1st year)	8%	3%	3	3	3	8.5%
Adverse (end of 1st year)	8%	3%	5	5	6	18.2%

Banking sector liquidity

	Hurdle rates			Number of institutions below the hurdle rates			Asset shares of institutions below the hurdle rate	
	Liquidity coverage ratio (percent)	Net Stable Funding Ratio (percent)	Cash-flow based analysis end-of-period counterbalancing capacities (within 12 months)	Liquidity coverage ratio	Net Stable Funding Ratio	Cash-flow based analysis	Liquidity coverage ratio	Cash-flow based analysis
Baseline	100%	100%	0	0	0	1	0	0.5%
Deposit run	100%	100%	0	5	...	3	21.7%	14.2%
Combined (deposit run + market stress)	100%	100%	0	6	...	6	23.8%	23.8%
Weak parent bank	100%	100%	0	3	...	5	17.6%	19.0%

Investment fund liquidity

	Redemption coverage ratio (RCR)	Number of institutions with RCR<1		Asset shares of institutions with RCR<1
		UCITS	AIF	
Adverse	1	0	4	< 0.1%

MMF solvency

	Threshold	Number of institutions crossing the threshold		Asset shares of institutions crossing the threshold (% of total MMF sector)	
	Change in NAV	CNAV	LVNAV	CNAV	LVNAV
Adverse	20 basis points	2	4	< 0.1%	11.6%

Insurance solvency

	SCR ratio (eligible own funds to solvency capital requirement)	Number of institutions with RCR<100 percent		Asset shares of institutions with RCR<100 percent	
		Life	Non-life	Life	Non-life
Adverse (instantaneous)	100%	0	0	...	0%

Insurance liquidity

	Redemption coverage ratio (percent of simulated claims)	Number of institutions with RCR<100 percent		Asset shares of institutions with RCR<100 percent	
		Life	Non-life	Life	Non-life
Adverse	100%	0	...	...	0%

Sources: IMF staff calculations.

Note: In the banking sector solvency stress tests, 1st round refers to the capital impact of the macrofinancial adverse scenario. The 2nd round refers to the impact through market prices when investment fund sells international securities to stem large redemption pressures. The 3rd round refers to the liquidity-to-solvency interactions when banks with funding gaps need to pledge or sell HTM securities in a severe liquidity crisis, with the added funding cost or realized capital loss impacting the capital level.

Table 9. Luxembourg: Use and Calibration of Borrower-Based Limits in Selected EU Countries

	Austria	Belgium	Canada	Cyprus	Czechia	Denmark	Estonia	Finland	France	Iceland	Ireland	Latvia
Loan-to-value (LTV)	90% (20% speed limit)	90% for BTL (with 10% allowed up 90%); 90% for FTB (with 35% allowed up to 100% and 5% over 100%); 90% for SSB (with 20% allowed up to 100%)	95% fpr owner occupied with government guarantee up to 500,000; 80% for others	80% for FTB, 50% for construction of luxury properties, 70% for others	90% for those under age 36, 80% for others.	95%; the share of loans with an interest rate fixation of less than 2 years with an LTV of 75% or above should not exceed 25%	90% if guaranteed by KredEx (15% speed limit); 85% for others (15% speed limit)	95% for FTB, 85% for others.		85% for FTB, 80% for others	90% for FTB (15% 15% speed limit); 70% for BTL (10% speed limit); 80% for others	95% for mortgages with state gurantee;70 % for BTL, 90% for others
Debt service to income (DSTI)or stressed DSTI	40% (10% speed limit)	50%	39% stressed GDS and 44% stressed TDS for loans with government guarantee	80%	50% for thse under age 36, 45% for others		50% stressed DSTI		35%	40% sressed DSTI for FTB; 35% for others (5% speed limit)		40% (10% speed limit)
Loan-to-income (LTI)	-					LTI above 4 requires stress testing					3.5 for FTB (20% speed limit); 3.5 for SSBs (20% speed limit)	

	Lithuania	Luxembourg	Netherlands	New Zealand	Norway	Poland	Portugal	Slovakia	Slovenia	Sweden	Switzerland	United Kingdom
Loan-to-value (LTV)	70% for indebted SSB (with a current LTV of at least 50%), 85% for others	100% for FTB, 90% for owner occupied (15% speed limit), 80% for others	100%	65% for investment properties (5% speed limit); 80% for owener-occupied (15% speed limit)	60% for second homes in Oslo, 85% for others	90% for insured or overcollateralized mortgages, 80% for others	90% for own and permanent residence, 80% for others	80% (with 20% allowed up to 90%)	80% for FTB, 70% for others	85%	25% for investment proprerties, 90% for others	
Debt service to income (DSTI)or stressed DSTI	40% unstressed; 50% stressed DSTI; 5% allowed up to 60%)		13-36% depending on income and interest rate				50% (with 10% alloed up to 60%)	60% (with 5% allowed up to 70%)				
Loan-to-income (LTI)												4.5 times (15% speed limit)

Sources: ESRB macroprudential database (sept 2023), EBA transpancy exercise 2021
Notes: FTB stands for first-time buyers, BTL is buy-to-let.

Table 10. Luxembourg: Bank Solvency Stress Test Results: Breakdown by Business Model

	Universal, retail and commercial banking	Private banking	Custodian banking and activities linked to investment funds	Corporate finance	Other (covered bonds banking, clearing, treasury or payment services)
CET 1 ratio before stress	20.9%	25.2%	42.2%	14.6%	42.4%
CET 1 ratio - baseline (end of 1st year)	22.0%	26.7%	43.5%	15.2%	47.6%
CET 1 ratio - adverse (end of 1st year)	17.0%	16.8%	42.6%	13.8%	46.5%
Capital depletion in the adverse scenario (-/+ implies declines/increases)	-3.8%	-8.5%	0.4%	-0.9%	4.1%

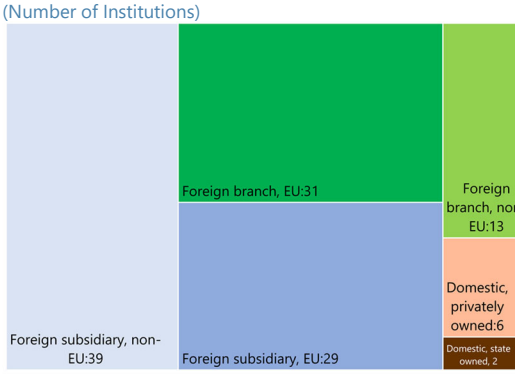
Source: IMF staff calculations

Figure 1. Banking Sector—Structure and Trends

Assets of the 120 banks amount to 12 times GDP, and the system is dominated by foreign banks, almost half from other EU countries.

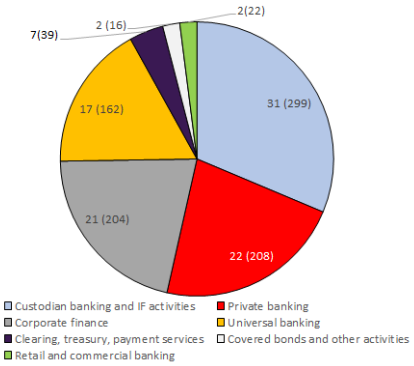
Banking System by Ownership

(Number of Institutions)



Only a fifth of banking assets perform universal and commercial banking functions.

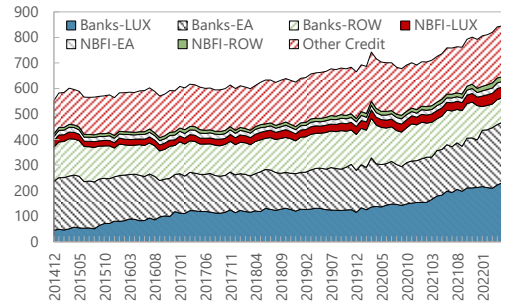
Bank Business Models, 2022 (Share of Total Assets, €bill)



Interbank credit to the euro area has grown even as it has declined domestically, with lower credit to the rest of the world (ROW).

Credit Institutions: Credit

(Billions of euro)



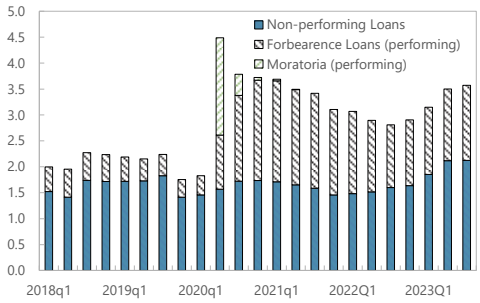
Sources: BCL; and IMF staff calculations.

Note: Includes the Central bank, banks and other deposit-taking corporations. Otl

NPLs remain low but there are signs of small increases.

Asset Quality of Loans to HH and NFCs

(In percent of total loans to households and NFCs)

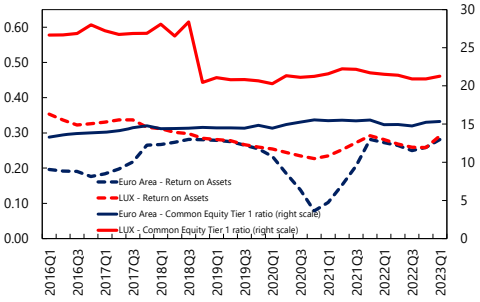


Sources: Sources: CSSF; BCL calculations.

Capital ratios are much higher than the euro area average, but profitability is as low.

Luxembourg and Euro Area: Bank Capital and Profitability

(Percent)

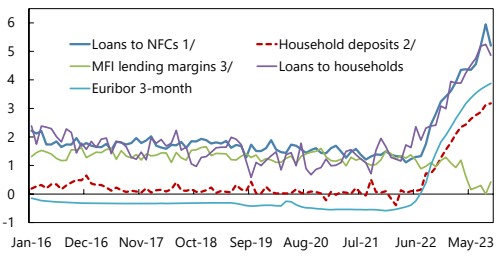


Source: ECB; and BCL.

Financial conditions have tightened significantly for new borrowers, with a sharp increase in lending rates. But banks have also increased short-term deposit rates significantly, albeit with sizeable lending margins.

Interest Rates and Lending Margins

(Percent)



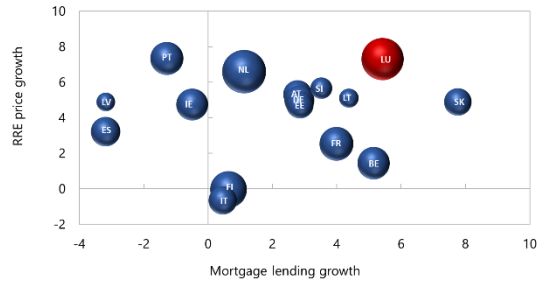
1/ New loans to corporations of up to EUR 1M with an IRF period of up to one year.
2/ New deposits from households with an agreed maturity of up to one year.
3/ MFI lending margins, defined as the difference between average interest rates on loans and average interest rate on deposits.

Sources: ECB; and Haver Analytics L.L.C.

Figure 2. Households and Corporate Vulnerabilities

House prices and mortgages have grown faster than in peers countries in recent years …

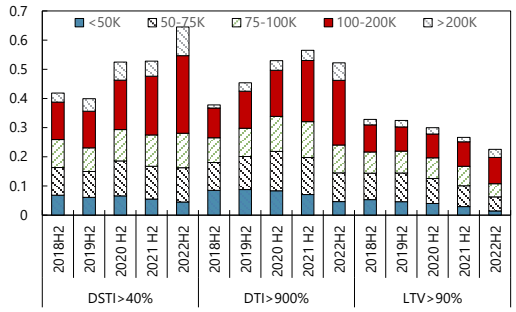
Growth in RRE Prices and Mortgage Lending in the Euro Area
(Percent in real terms, average annual change, 2015-22)



Notes: Bubble sizes indicate household debt-to-net disposable income ratios (2022 or latest available). Mortgage lending refers to MFI
Sources: STATEC, ECB and OECD; and IMF staff calculations.

… and the risk profile of mortgages continued to deteriorate despite the introduction of the LTV

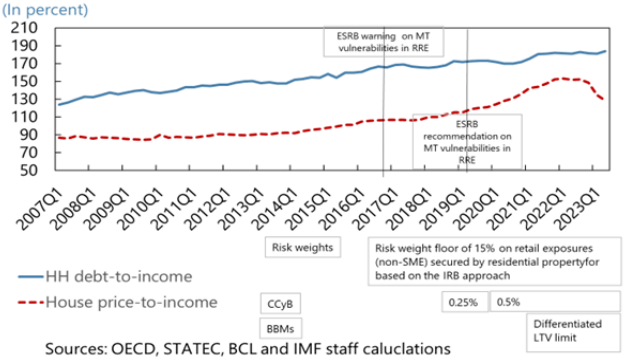
Share of Risky Mortgages
(In percent of total mortgages)



Sources: CSSF and IMF staff calculations

Rising households indebtedness and potential overvaluation remain a key concern.

Households' Indebtedness, Housing Valuation and Macroprudential Measures
(In percent)

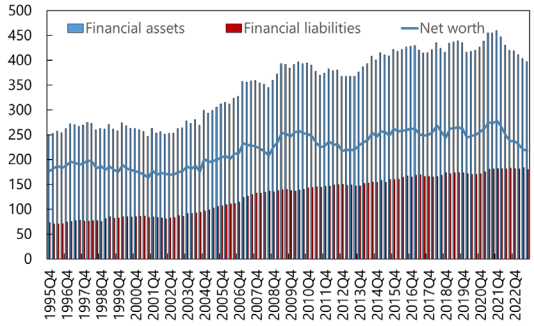


Sources: OECD, STATEC, BCL and IMF staff caluclations

Notes: CCyB stands for countercyclical capital buffers, BBMs are borrower-based limits, LTV is loan-to-value. See Table 7.

After growing for several years, households' financial assets have been declining.

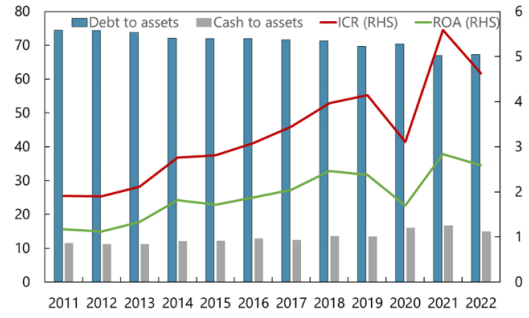
Households Balance Sheet
(In percent of disposable income unless otherwise indicated)



Sources: BCL, STATEC and IMF Staff calculations

The corporate sector financial position has improved since the GFC and in the aftermath of the pandemic.

Selected Financial Indicators
(In percent)



Sources: Centrale des bilans and IMF staff calculations

However, there is significant heterogeneity across firms and sectors, and real estate activities appear to have much weaker fundamentals.

ICR by sector
(In percent)

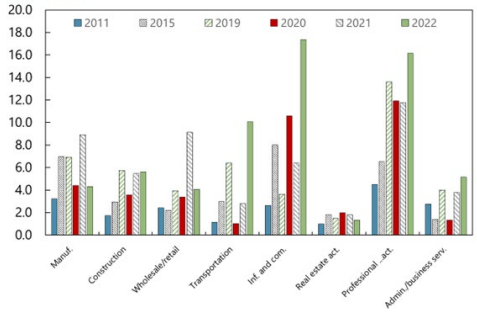
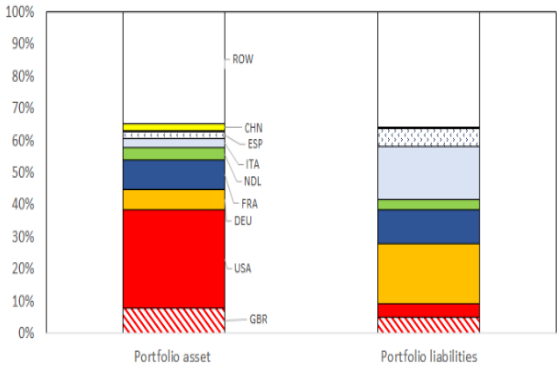


Figure 3. Domestic and Cross-Border Interconnectedness

The overall portfolio investment positions for Luxembourg show that the US, UK, Germany, and France were the main destinations of portfolio assets, with liabilities mainly from the eurozone.

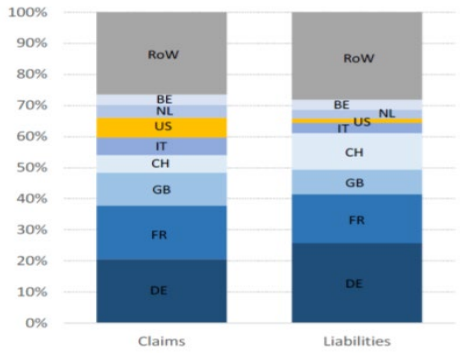
Destination and Sources of Portfolio Investments, Stock



Sources: IMF *Coordinated Portfolio Investment Statistics*, IMF staff estimates.

In the banking sector, more than 50 percent of assets and liabilities are vis-à-vis Germany, France, the UK, and Switzerland.

Cross-Border Assets and Liabilities of the Banking System

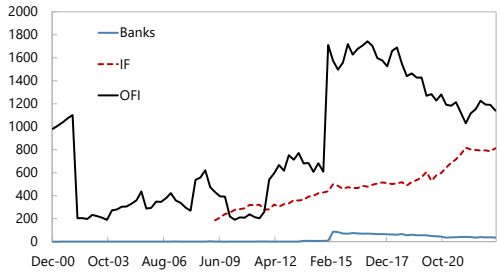


Source: BIS Locational Banking Statistics; BCL.
Note: Percent of total positions, average 2012Q1-2021Q4.

Intra-sectoral exposures are large for OFIs and have grown for IFs, even as interbank exposures declined.

Intra-Sectoral Exposures

(Percent of GDP)

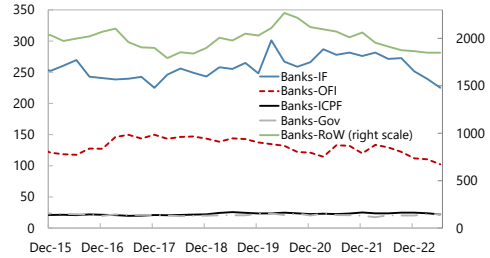


Sources: Quarterly Integrated Economic and Financial Accounts, ECB; and IMF staff calculations.
Note: The jump in 2014 is due to an improvement in data coverage due to a new reporting.

Fund deposits in banks are close to 220 percent of GDP and balance sheet connections have fallen recently since the war in Ukraine.

Inter-Sectoral Exposures 1/

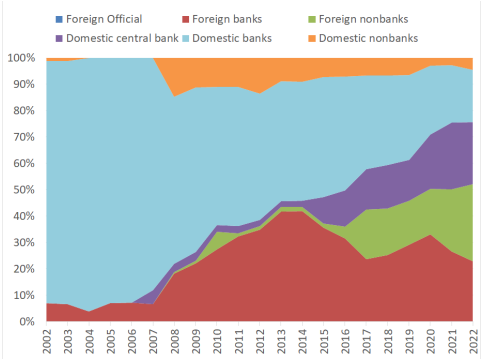
(Percent of GDP)



Sources: Quarterly Integrated Economic and Financial Accounts, ECB; and IMF staff calculations.
1/ The sum of assets and liabilities in percent of GDP.

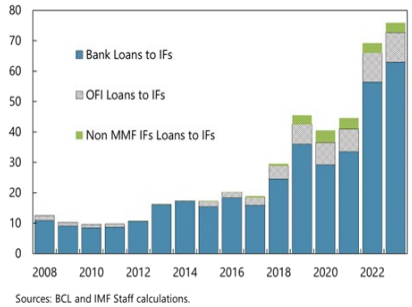
The domestic banking sector holds 20 percent of the domestic sovereign debt, and over 80 percent of the large Luxembourgish banks' sovereign bonds are in HTM portfolio with modified duration of 5.

Holdings of Sovereign Debt (in percent of total)



Loans to investment funds from other investment funds and OFIs have increased rapidly since 2015, although these are still a small share of funds' liabilities.

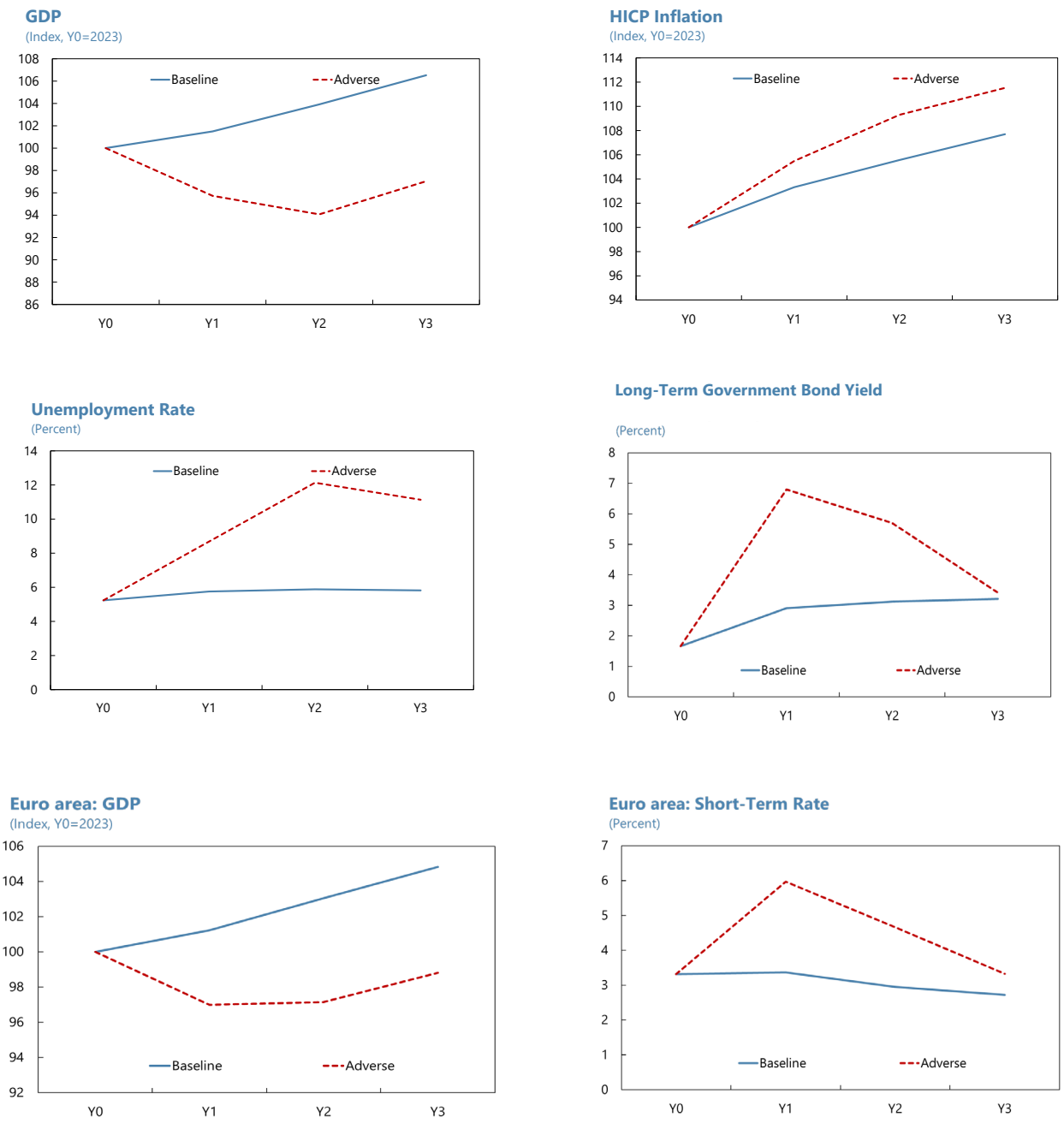
Loans to Investment Funds (billions of euro)



Sources: BCL and IMF Staff calculations.

Source: Arslanalp and Tsuda, 2014; IMF staff estimates.

Figure 4. Stress Test Scenarios: Baseline and Adverse

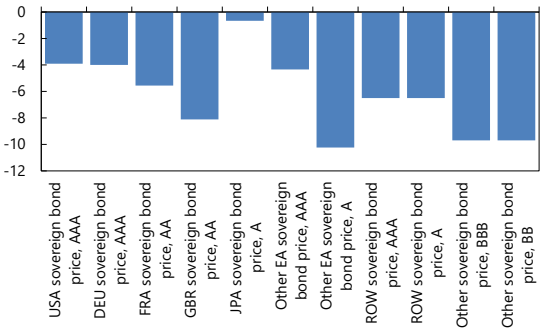


Sources: *World Economic Outlook*, IMF; and IMF staff calculations.
Note: Y0=2023Q2, Y1=2024, Y2=2025, Y3=2026.

Figure 5. Financial Shock Scenario

Financial Shock Calibration: Sovereign Bond Prices

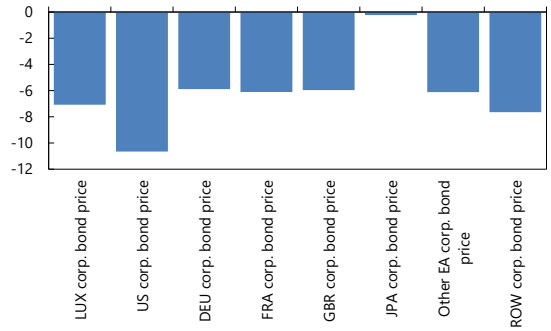
(Percent)



Sources: Haver Analytics L.L.C.; and IMF staff calculations.

Financial Shock Calibration: Corporate Bond Prices

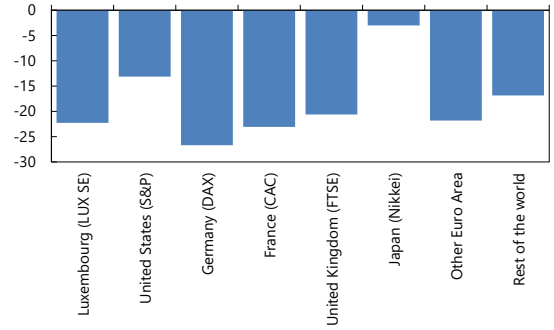
(Percent)



Sources: Haver Analytics L.L.C.; and IMF staff calculations.

Financial Shock Calibration: Price of Equity

(Percent)

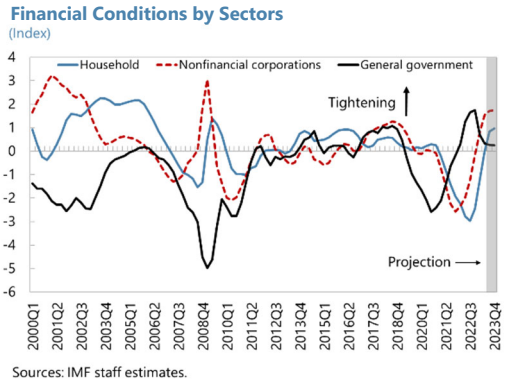


Sources: Haver Analytics L.L.C.; and IMF staff calculations.

Note: The financial shock scenario is calibrated using an empirical copula estimated through a Monte Carlo simulation (for details please see the Technical Note on Stress Testing and Systemic Risk Analysis). A set of risk factors including sovereign and corporate bonds and equities are presumed under stress and their forward paths are simulated over a 1-year horizon. Conditional expected shortfalls for the tail of the estimated empirical distribution are then calculated.

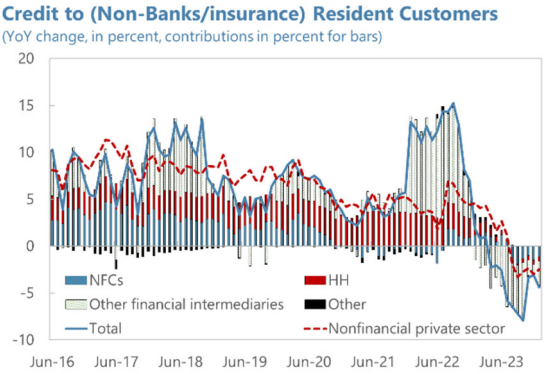
Figure 6. Credit Cycle, Real Estate Sector, and Macroprudential Policy

Following a tightening of financial conditions …



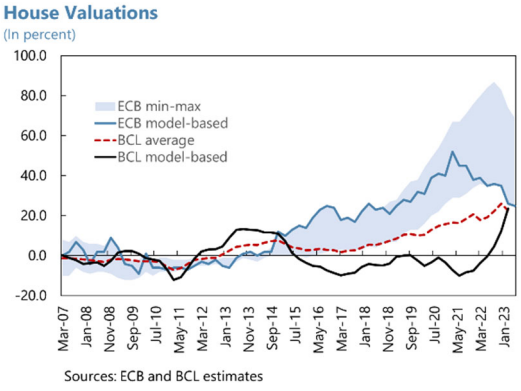
Sources: IMF staff estimates.

… credit growth turned negative



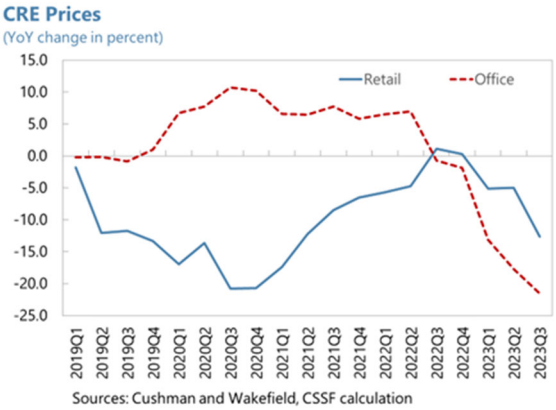
Sources: BCL and IMF staff calculations

… and house prices have dropped, albeit still overvalued.



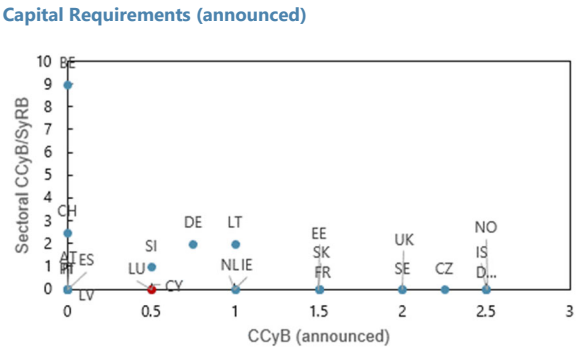
Sources: ECB and BCL estimates

CRE prices are undergoing correction.

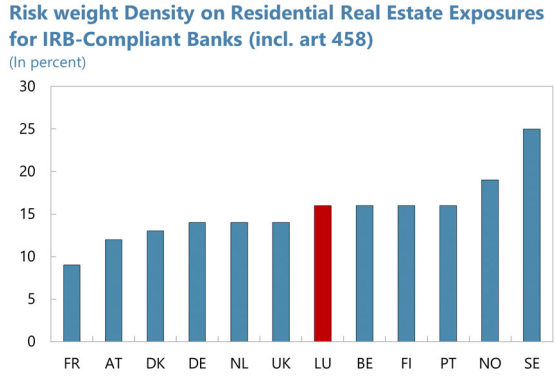


Sources: Cushman and Wakefield, CSSF calculation

The authorities have maintained the CCyB at 0.5 percent to support banks' resilience…



…and the risk-weight floor on RRE collateralized loans is at 15 percent.



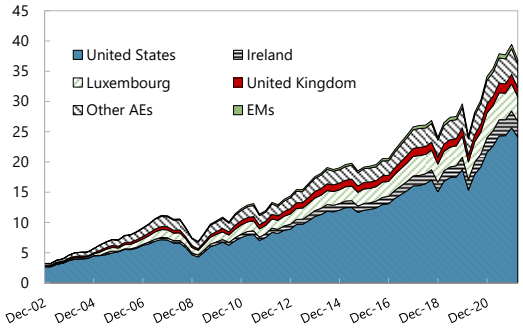
Sources:EBA 2021 transparency exercise and Luxembourgish authorities

Source: CSSF; BCL; ESRB; IMF staff calculations.

Figure 7. Investment Funds

Luxembourg has the second largest open-ended funds industry

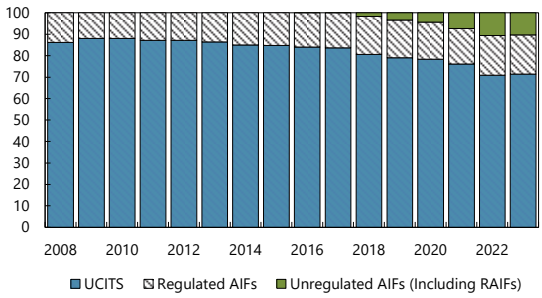
Selected Countries: Total Net Assets of IFs by Domicile
(Trillion of USD)



Sources: Global Financial Stability Review, Fall 2022.

Share of UCITS has been decreasing, as the AIF share, especially the unregulated segment, expands

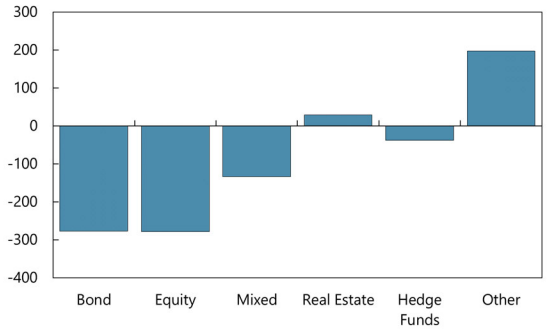
Investment Funds by Type, 2008-2023Q1
(Percent)



Sources: CSSF; and IMF staff calculations.

Since their peak in 2021Q4, funds saw an outflow of 1.6 percent of assets, driven mostly by bond and equity funds.

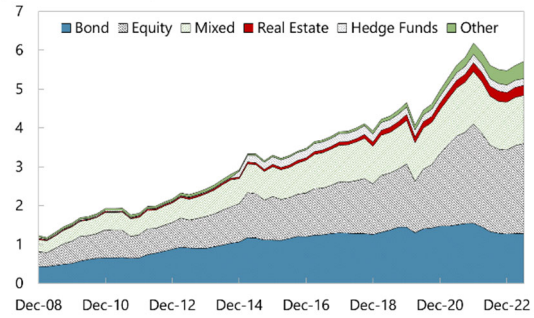
IF Change in Total Net Assets by Type of Fund
(Billions of euro; change from peak in 2021Q4 to 2023Q3)



Source: Haver Analytics and IMF staff calculations.

Equity funds have now overtaken bond and mixed funds.

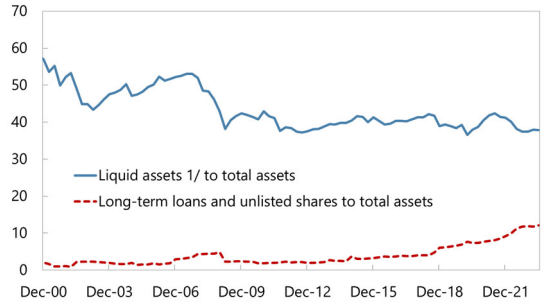
Net Assets by Type of Investment Fund
(Trillions of euro; stock)



Sources: Haver Analytics and IMF Staff calculations.

...while IFs sought higher returns by investing in less liquid assets

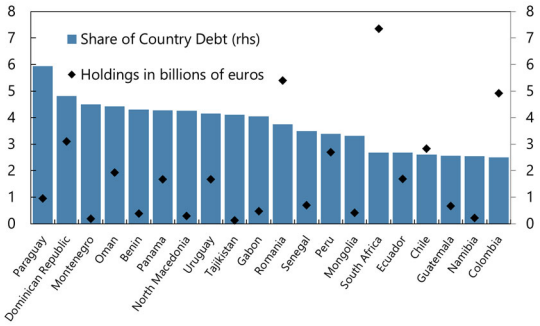
Investment Fund Liquidity Indicators
(Percent)



Sources: Haver Analytics and IMF staff calculations.
1/ Liquid assets comprise deposits, short-term debt, and listed equities.

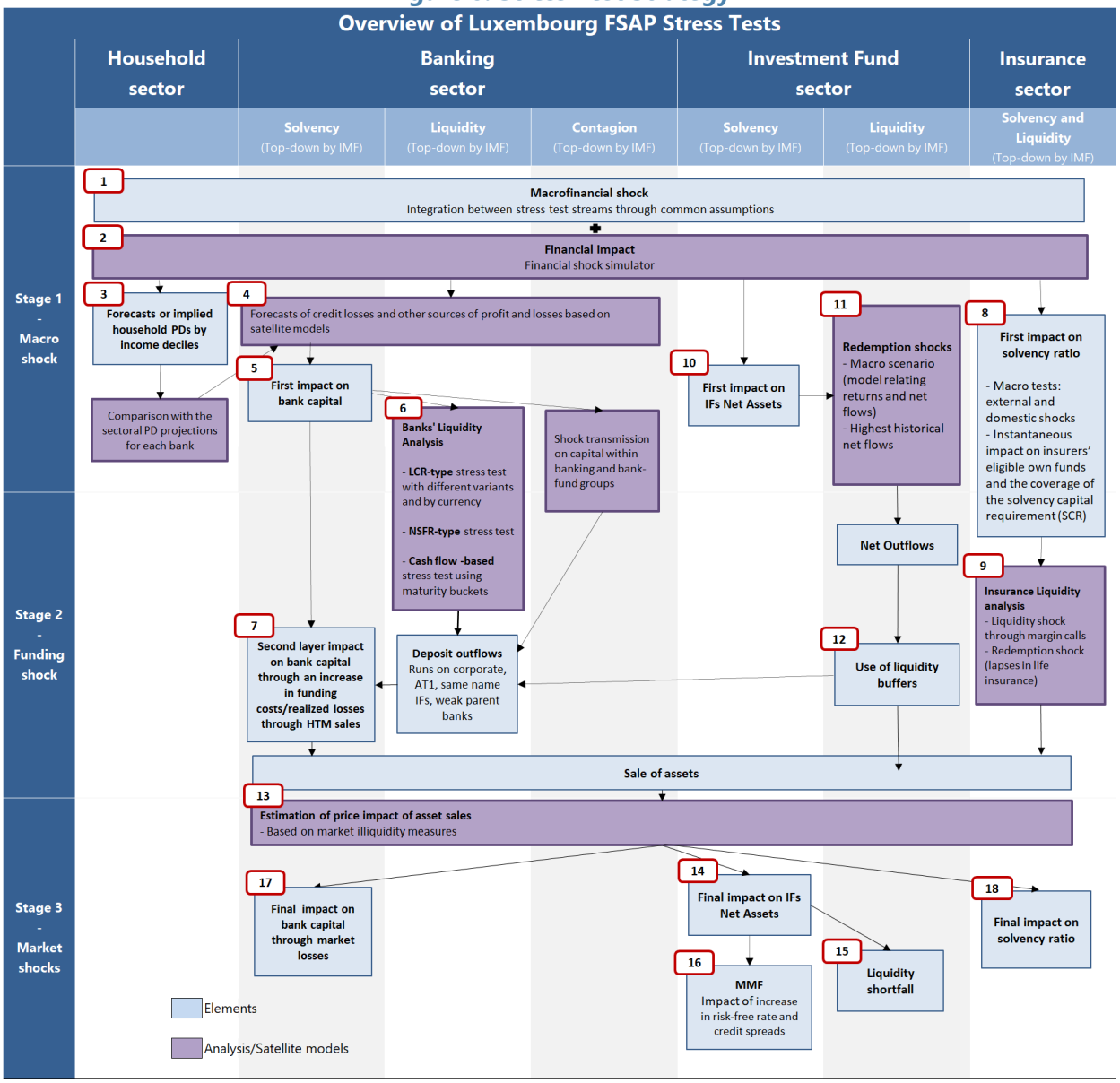
Luxembourg continues to hold significant shares of sovereign debt of many emerging and developing economies.

Holdings of EMDE Sovereign Debt and Share of Outstanding Debt
(Billion euros and Percentage)



Sources: BCL, Haver Analytics and IMF Staff calculations.

Figure 8. Stress Test Strategy

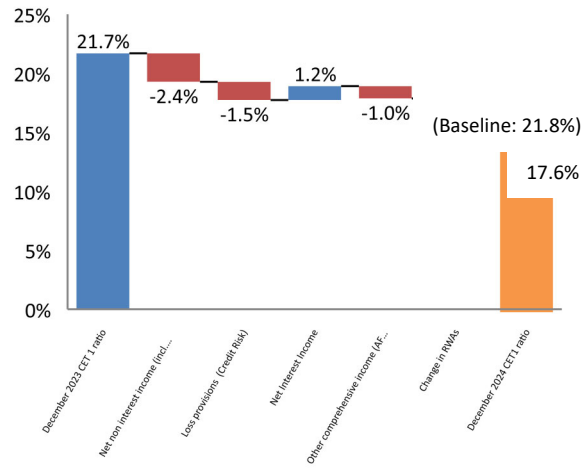


1. Macrofinancial shock
2. Financial Impact
3. Household sector
4. Banks' forecasts of losses
5. Banks' first impact on capital
6. Banks' liquidity stress test
10. IFs first impact on net assets
11. IFs redemption shocks
12. IFs use of liquidity buffers
13. Price impact of asset sales
14. IFs final impact on net assets
15. IFs liquidity shortfall

Figure 9. First-Round Impact of the Severe Stagflationary Shock

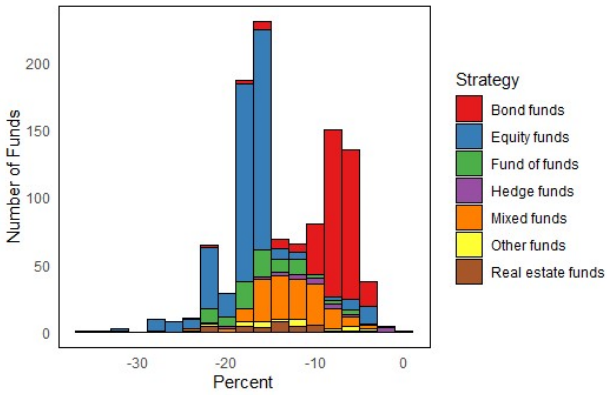
The banking sector overall fares well in the baseline aided by profits in 2024. In the adverse scenario, both pre-provision profits and provisions as well as market losses would bring down the CET1 ratio.

Contribution to Change in CET1 Ratio in the 1st year of the Adverse Stress Scenario
(points of RWA)



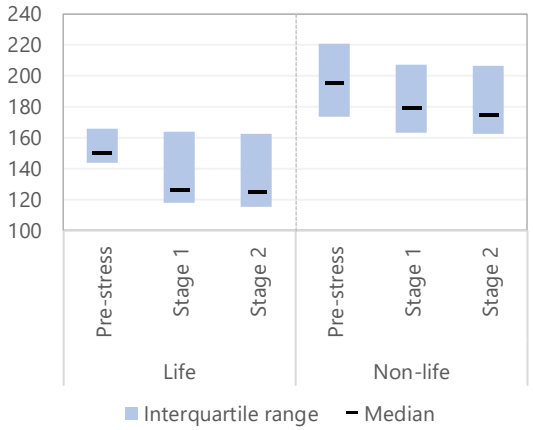
Funds experience a first-round impact of 13.1 percent, with equity funds experiencing the largest fall.

Distribution of Estimated Change in NAV following Adverse Scenario for Stress Test Sample
(Percent)



The median life insurer's Solvency Capital Requirement (SCR) ratio declines from 150 to 127 percent after stress. The non-life sector starts from a higher pre-stress level and is less impacted by the market stress scenario.

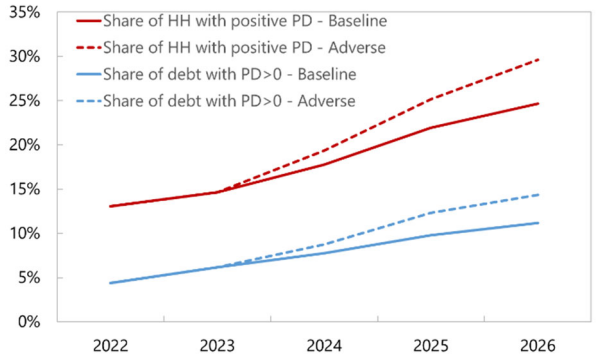
SCR Coverage (in percent)



The share of households with debt-at-risk are expected to increase significantly in the baseline and adverse scenarios.

Household and Debt at Risk

(In percent)



Sources: Joint BCL-IMF estimates on the basis of HFCS wave IV.

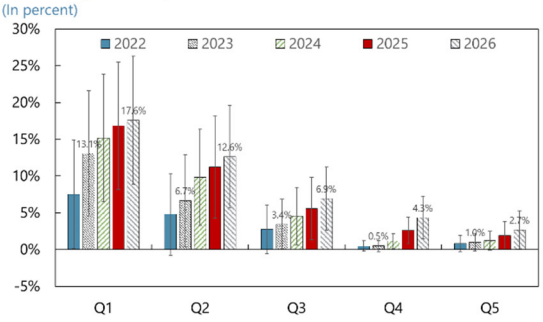
Source: IMF staff estimates.

Figure 10. Stress Test Results: Household and Corporate Sectors

In the adverse scenario, the low-income quintiles have the highest PD, but the PDs of the richer quintiles increases the most.

Mean "Indicative" Probability of Default by Income Quintile (Adverse)

(In percent)

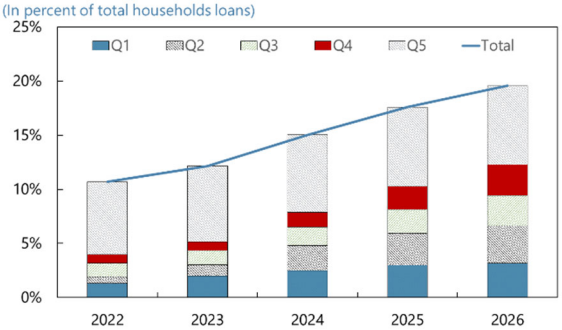


Sources: Joint BCL-IMF estimates based on HFCS wave IV.

The contribution of the highest income quintile to the exposure at default (EAD) is significant.

Exposure at Default and Contributions by Income Quintiles (Adverse)

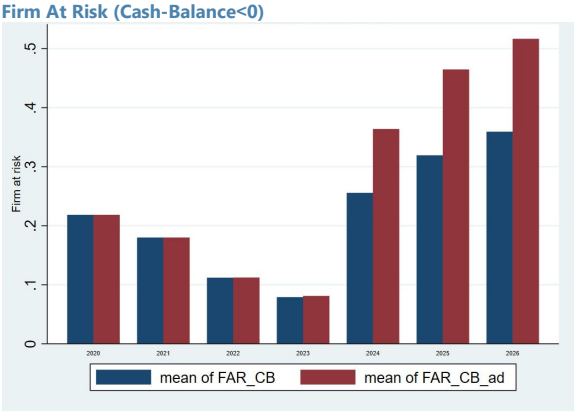
(In percent of total households loans)



Sources: BCL-IMF staff joint estimates

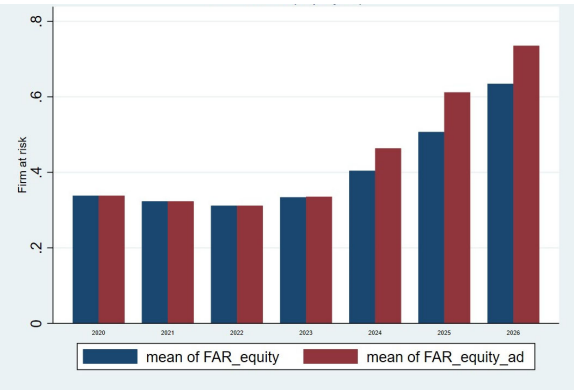
Even in the baseline scenario, the share of illiquid corporates would increase significantly…

Firm At Risk (Cash-Balance<0)



…as would the share of insolvent real estate firms.

Firm At Risk (Equity <0)

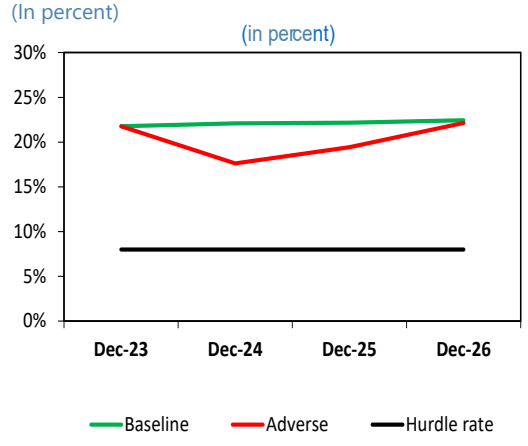


Sources: STATEC; Refinitive; and IMF staff calculations.
Note: Y0=2023Q2, Y1=2024, Y2=2025, Y3=2026.

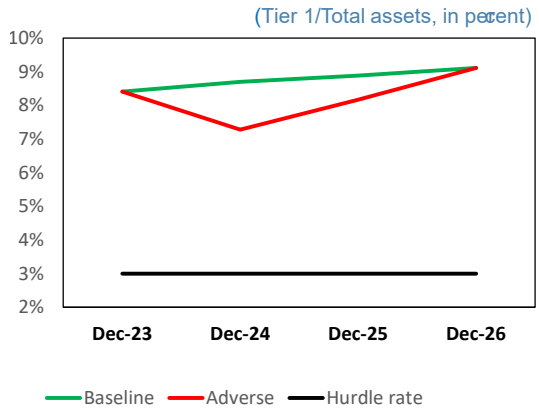
Figure 11. Bank Solvency Stress Test Results: Breakdown Between Domestically and Internationally-Oriented Banks

Domestically Oriented Banks

Common Equity Tier 1 Capital Ratio
(In percent)

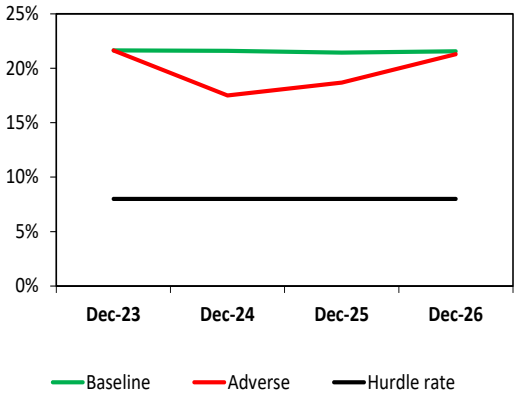


Leverage Ratio
(Tier 1/Total assets, in percent)

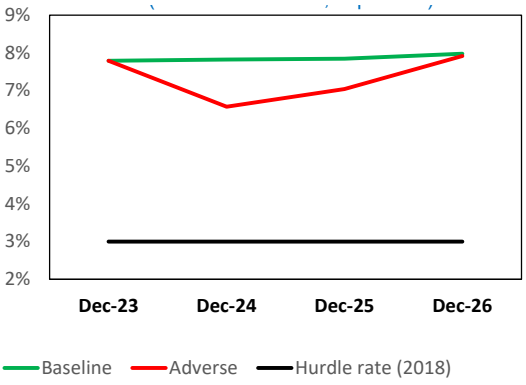


Internationally Oriented Banks

Common Equity Tier 1 Capital Ratio (in percent)



Leverage Ratio
(Tier 1/Total assets, in percent)

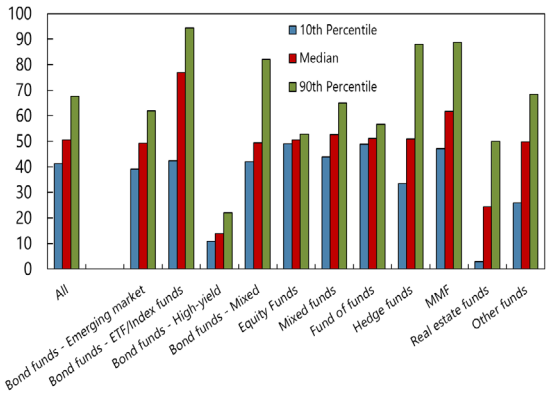


Sources: IMF staff calculations.

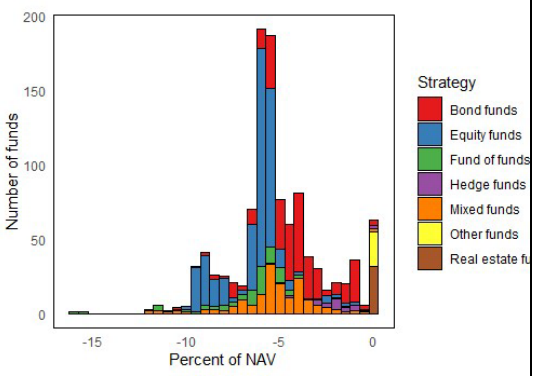
Figure 12. Stress Test Results: Investment Funds

Distribution of HQLA Buffers

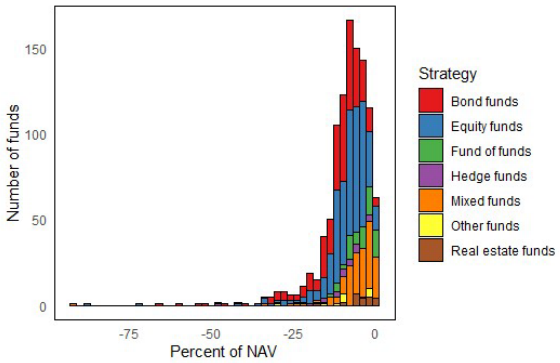
(Percent)



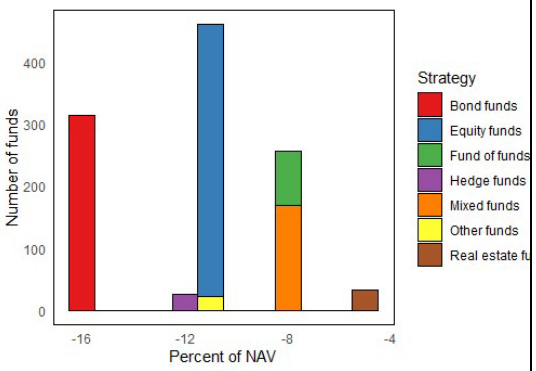
Distribution Net Outflows in GFC Scenario



Distribution of First Percentile Historical Net Outflows Under Heterogeneity Assumption



Distribution of First Percentile Historical Net Outflows Under Homogeneity Assumption



Investment Funds' Liquidity Stress Test Results—Slicing Liquidation

	Adverse and GFC			Historical (Heterogeneity, First Percentile)			Historical (Heterogeneity, Fifth Percentile)		
	Funds with RCR<1	% Funds with RCR<1	% NAV with RCR<1	Funds with RCR<1	% Funds with RCR<1	% NAV with RCR<1	Funds with RCR<1	% Funds with RCR<1	% NAV with RCR<1
Bond funds									
Emerging market	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
ETF/Index funds	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
High-yield	0	0.0	0.0	5	17.2	13.8	1	3.4	2.9
Others	0	0.0	0.0	2	0.9	1.0	0	0.0	0.0
Equity Funds	0	0.0	0.0	2	1.6	1.0	0	0.0	0.0
Mixed Funds	4	2.5	0.3	3	1.9	0.4	2	1.2	0.1
Fund of funds	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Hedge funds	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Real estate funds	0	0.0	0.0	1	3.1	15.1	0	0.0	0.0
Other funds	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0

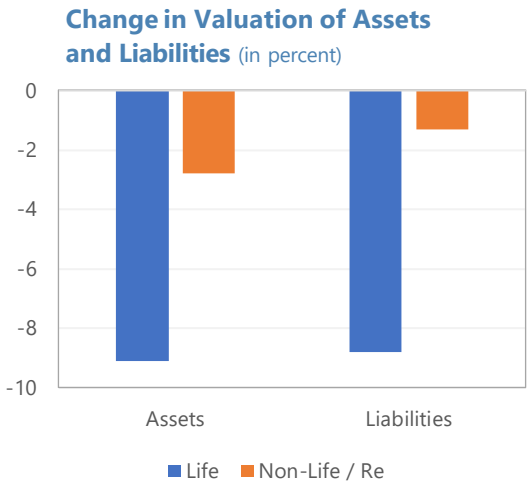
Sources: BCL, CSSF and IMF staff calculations.

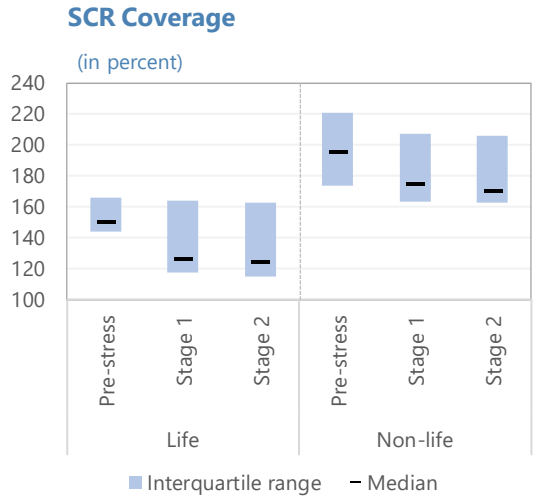
Note: The chart on HQLA shows the level of HQLA buffers at different percentiles of the distribution of funds within the investment strategies shown in the x-axis. HQLA is measured applying the Basel liquidity weights for different asset classes to the portfolio data provided by the BCL. Distribution of net flows show the flows used in different scenarios of the liquidity stress test as a percentage of the NAV of the funds in the sample. The table shows the results of the stress tests for the adverse and GFC scenarios (here presented as one, since the results are equivalent) and for two redemption scenarios based on the first and fifth percentile of historical outflows assuming heterogeneous levels of redemptions across funds. RCR refers to the Redemption Coverage Ratio.

Figure 13. Insurance Solvency Stress Test

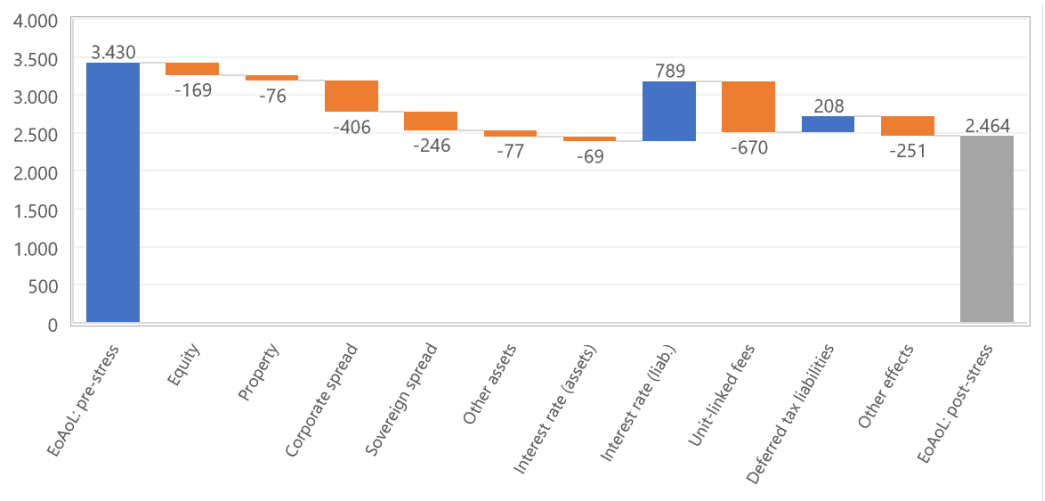
Assets in the life sector decline by 9.1 percent, almost offset by an 8.8 percent reduction in liabilities (through higher interest rates). Non-life insurers see small valuation changes in their balance sheet.

The median life insurer's SCR ratio declines from 150 to 127 percent after stress. The non-life sector starts from a higher pre-stress level and is less impacted by the market stress scenario.





*In the life sector, the excess of assets over liabilities declines from EUR 3.43bn to 2.46bn, mainly driven by higher sovereign and corporate spreads and the impact of lower assets under management on future fee income in unit-*linked *business.*



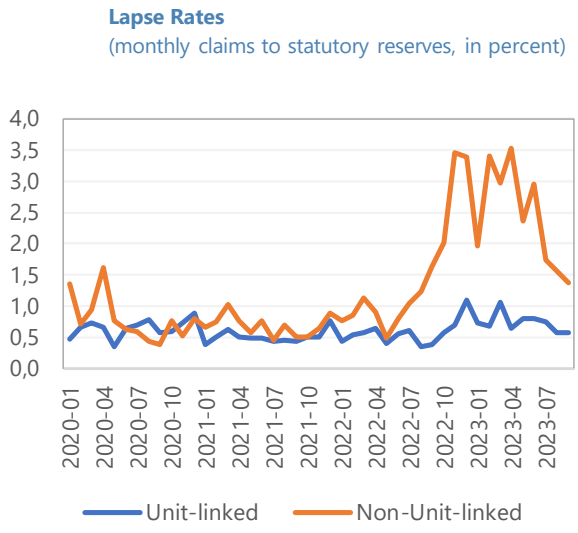
Notes: "Other effects" include the revaluation of reinsurance recoverables after stress.

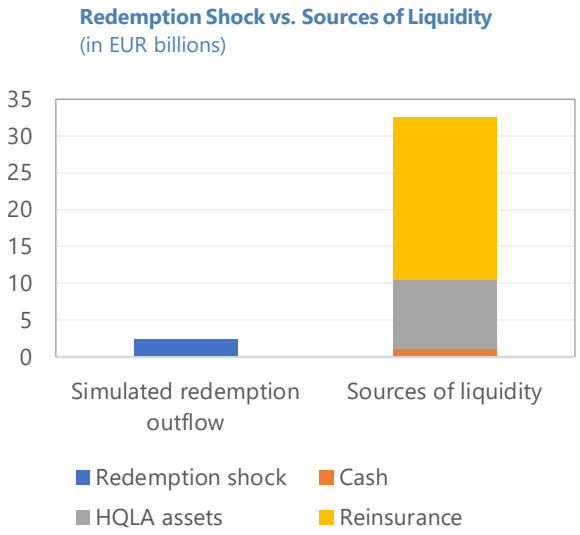
Source: IMF staff calculations based on CAA data.

Figure 14. Insurance Liquidity Analysis

Monthly lapse rates in guaranteed life insurance peaked at 3.5 percent in late 2022 and early 2023 and have started normalizing thereafter.

A simulated monthly outflow of EUR 2.4bn could easily be matched with cash, HQLA assets and through reinsurance arrangements, totaling EUR 32.5bn.



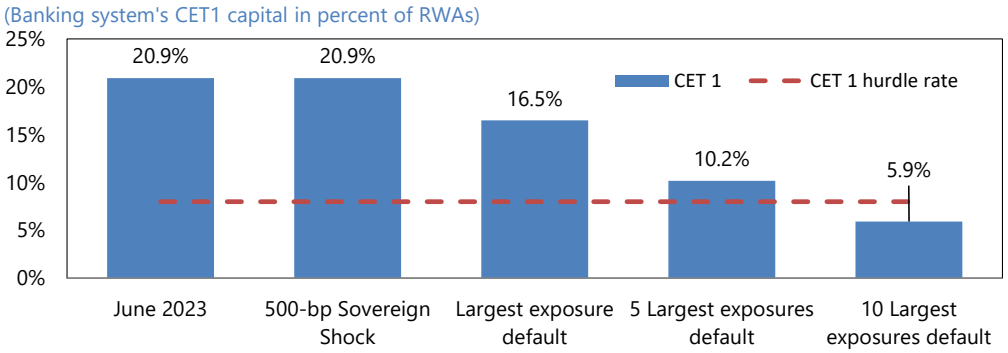


Source: IMF staff calculations based on CAA data and company submissions.

Figure 15. Stress Test Results: Sensitivity Tests—Banking Sector

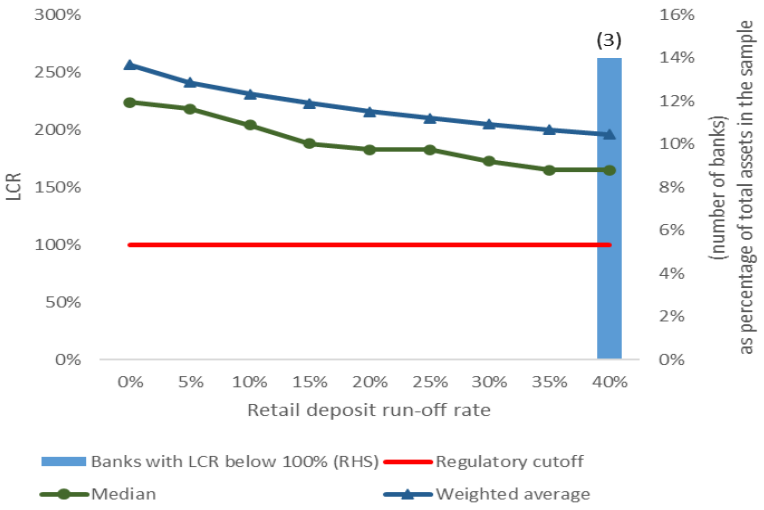
Sovereign Shock on Banks and Credit Concentration Tests

(Banking System's CET 1 capital in percent of RWAs)



Sources: ECB; and IMF staff estimates.

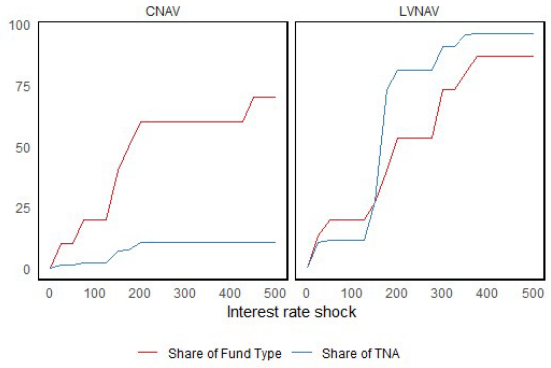
Sensitivity of LCRs to Deposit Run-off Rates



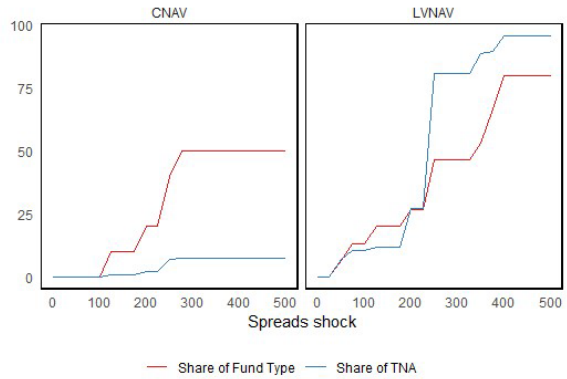
Sources: CSSF, ECB, Refinitive; and IMF staff calculations.
Note: Y0=2023Q2, Y1=2024, Y2=2025, Y3=2026. The cutoffs for 1 or 2 banks not shown for confidentiality reasons.

Figure 16. Stress Test Results: Investment Funds Sensitivity Tests

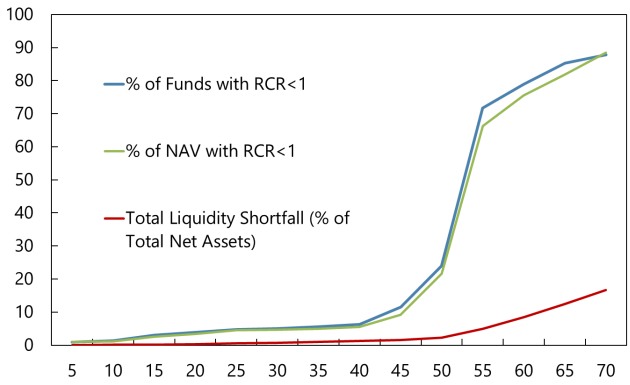
MMFs with NAV Declines Greater than 20 bp for Various Levels of Interest Rate Shock Keeping Baseline Spread Shock
(Percent)



MMFs with NAV Declines Greater than 20 bp for Various Levels of Corporate Spreads Shock Keeping Baseline Interest Rate Shock
(Percent)



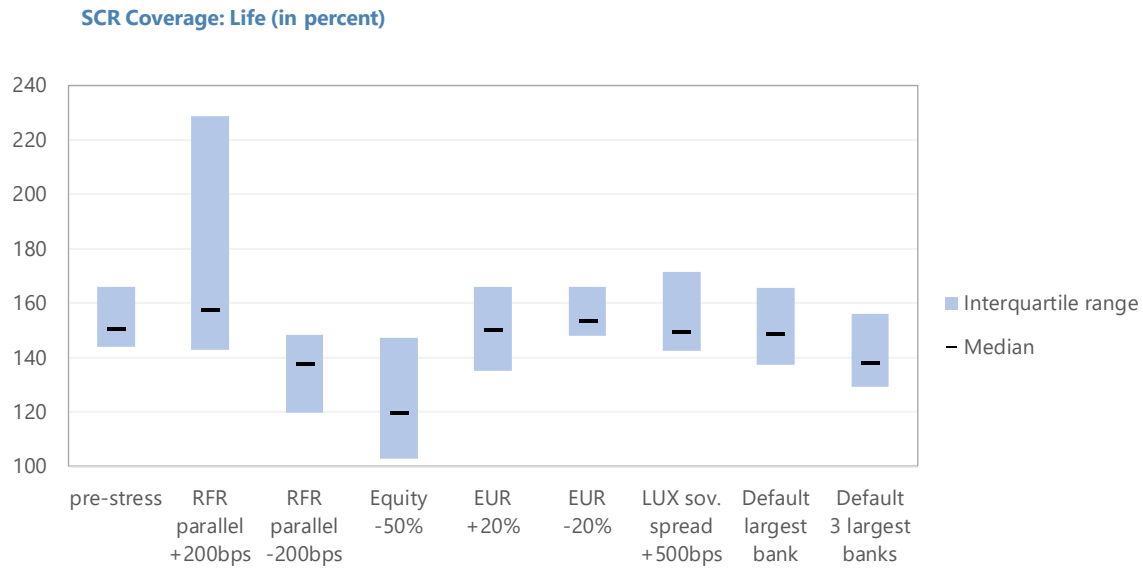
Investment Funds Reverse Liquidity Stress Test Results
(Percent)



Sources: BCL, CSSF and IMF staff calculations.
Notes: Upper charts show on the x-axis instantaneous shocks, measured in basis points, to interest rates (left chart) and corporate spreads (right chart) for CNAV and LVNAV MMFs. The red line shows the percentage of number of funds of the type (CNAV or LVNAV) for which the NAV falls by more than 20 basis points in each scenario, while the blue line shows the total total net assets of the funds crossing the 20 basis points threshold as a percentage of the total net assets of each group. For each shock plotted in the x-axis, the other shock is kept constant relative to the baseline value of the main MMF stress test, meaning the corporate shock is kept the same as the baseline in the interest rate shock and the interest rate shock is kept the same as the baseline in the corporate spread shock.
Bottom chart shows in the x-axis different levels of exogenous redemption shocks in percentage of NAV applied homogenously to all funds in the stress test sample. The blue line shows the share of the number funds for which the HQLA is insufficient to match the net outflow (RCR<1). The green line shows the corresponding share of the NAV of funds with RCR below 1 in percentage of total NAV. The red line depicts the associated cumulative value of the liquidity shortfall of funds with RCR below 1.

Figure 17. Luxembourg: Insurance Sensitivity Analyses

Life insurers are most sensitive to changes in the risk-free interest rate (RFR), with an increase benefiting the sector. A large decline in stock prices (-50 percent) would lead to a large decline in SCR ratios.



Source: IMF staff calculations based on CAA data.

Appendix I. Implementation of 2017 FSAP Recommendations—Staff Assessment

Recommendation (Responsible Agency)	Progress	Observations
General / cross-cutting		
1. Continue resource allocation toward risk-based supervision (BCL, CSSF and CAA)	Largely Implemented	BCL, CSSF, and CAA increased resources for risk-based supervision. Essential growth aligns with banking regulation complexity and ongoing needs. Resources gaps still remain.
2. Increase engagement with supervision and resolution authorities in countries where Luxembourg's LSIs and investment funds conduct significant activities (CSSF)	Implemented	CSSF enhances supervision globally, bilateral contacts for resolution, and regular meetings with international regulators.
3. Enshrine in legislation the operational independence of the CSSF and CAA, and introduce (CSSF, CAA) or update (BCL) board member codes of conduct (MoF, BCL, CAA, CSSF)	Partially implemented	CSSF and CAA have codes of conduct. However, authorities have not addressed the recommendation to enshrine operational independence in legislation.
Risk Analysis		
4. Examine merits of a regulatory LCR requirement in FX at the group level and step-up monitoring of related FX liquidity risk (EC, ECB)	Not applicable	This recommendation is to be considered by the ECB and the EC.
5. Provide industry guidance on liquidity stress test modalities and liquidity management tools for investment funds, and develop internal liquidity stress testing capacity (CSSF)	Implemented	CSSF actively contributes to global liquidity risk initiatives. Supports legislative actions on liquidity management tools. Implements annual internal liquidity stress testing, evolving based on experience and industry guidelines.
Macroprudential Policy		
6. Strengthen the institutional framework in order to increase the willingness to act (MoF, CdRS)	No action	The authorities consider the current institutional framework to be adequate.
7. Expand the macroprudential policy toolkit to include borrower-based lending limits (MoF, CdRS)	Implemented	Law adopted in 2019, expanding the macroprudential toolkit with borrower-based lending limits. It includes limits on loan-to-value, debt service to income, debt to income and maturity.
8. Continue to strengthen risk-based monitoring of the residential real estate market and bank-investment fund interlinkages, and close remaining related data gaps (CdRS, BCL, CSSF)	Implemented	CSSF and BCL conducts regular stress tests, bank-investment fund interlinkage analysis, and collaborates on data access. Monitoring real estate risks includes regular surveys and participation in ECB working groups.

Banking Regulation and Supervision		
9. Increase the intensity of supervision over intra-group exposures, with banks required to demonstrate continued eligibility in their use of large exposure limit waivers (CSSF)	Implemented	CSSF intensified intra-group exposure supervision with enhanced monitoring. Waivers undergo regular reevaluation, aligning with ongoing SREP processes and additional dedicated resources since 2019.
10. Continue monitoring ability of banks to absorb a real estate market price decline (CSSF, ECB)	Implemented	CSSF conducts annual stress tests, assessing banks' ability to withstand real estate market declines.
11. Increase frequency of on-site inspections of subsidiaries of SIs (CSSF, ECB)	Not applicable	This recommendation is to be considered by the ECB.
12. Harmonize data reporting standards for loan-to-value and debt-to-income ratios (CSSF, ECB)	Implemented	CSSF follows ESRB's recommendation on harmonizing LTV and DSTI ratio definitions, improving data reporting standards through circulars, and assessing semiannual results for residential real estate market risks.
Investment Fund Regulation and Supervision		
13. Strengthen guidance on substance in the context of delegated activities and actively engage with regulators in jurisdictions where such activities are prominent (CSSF)	Implemented	CSSF provided guidance on substance for delegated activities in Circular, engaging with global regulators, notably with France, Ireland, Germany, Switzerland, Asia, and the U.S.
14. Issue guidance on the holdings of directorships of funds and their managers (CSSF)	Implemented	CSSF has issued specific guidance on the holdings of directorships of funds and their managers in Circular.
15. Assess whether safeguards to ensure depositary independence are adequate (CSSF)	Partially implemented	While acknowledging EU requirements, CSSF engaged with industry representatives and considered group links in on-site inspections but should integrate them better in overall risk-based supervision.
Insurance Regulation and Supervision		
16. Implement revised early warning system under Solvency II regime (CAA)	Implemented	CAA's risk system triggers external verification if a (re)insurer's ratio drops below 110 percent.
Financial Market Infrastructure Oversight		
17. Reduce CBL's exposure to commercial banks vis-à-vis CSDs and central banks (CSSF, BCL)	Implemented	CBL has reduced reliance on commercial banks by diversifying Correspondent Central Banks, ensuring currency contingency, and swift switchover plans.
18. Require establishment of third data center and conduct a full failover test (CSSF, BCL)	Partially implemented	CBL conducts annual failover tests simulating primary facility loss. While no decision on a third data center is final, cloud technology is considered for geographical diversification.
AML/CFT		
19. Ensure the 2016/2017 national risk assessment focus adequately on Trust and Company Service Provider risks (MoF)	Implemented	2016/2017 NRA highlighted high risks in Trust and Company Service Providers (TCSPs).

Contingency Planning and Financial Safety Nets		
20. Develop policies on intragroup exposures and the transfer of custodian functions in recovery and resolution (CSSF, SRB, ECB)	Largely implemented	While CSSF has incorporated transfer tools emphasizing substitutability in recovery plans, challenges remain, such as complexities in transferring custodian functions in resolution and the need for alternative strategies. Further work is necessary for full implementation.
21. Agree on the roles and responsibilities in dealing with a system-wide crisis (MoF)	Largely implemented	Progress is substantial, with allocated roles, established frameworks, and ongoing handbook development under a proactive approach. Full implementation awaits the completion of the national handbook.
22. Finalize the operational modalities of emergency liquidity assistance provision (BCL)	Partially implemented	The BCL has improved its ELA Crisis Manual, with enhanced collateral monitoring and procedures. Areas for improvement include CSSF information exchange, and consideration of an ELA testing framework, and consideration of a state's ELA backup guarantee.
Source: IMF staff's assessment.		

Appendix II. Stress Test Matrix (STeM)

Appendix II. Table 1. Banking Sector STeM		
Banking Sector: Solvency Stress Test		
Top-Down by IMF		
1. Institutional Perimeter	Institutions included	• 39 banks. • 19 banks subcategorized as Sis. • One bank is domestically owned, 24 are subsidiaries of euro area banks, 14 are subsidiaries of non-euro area banks.
	Market share	• 90 percent of the banking sector's assets. • 100 percent of residential mortgage loans. • At least 80 percent of the different business models (retail and commercial, private banking, custodian, and corporate finance).
	Data and baseline date	• Supervisory data: bank balance sheet and supervisory statistics (including FINREP and COREP), information on interest rate risk in the banking book (IRRBB), liquidity risk and market risk sensitivities (including STE templates) provided by the national authorities and the ECB. • Market and publicly available data. • Baseline date: October 2023. • Scope of consolidation: highest level of consolidation in Luxembourg: bank consolidated level data for banks having their headquarters in Luxembourg and sub-consolidated level data for the subsidiaries of foreign banks.
2. Channels of Risk Propagation	Methodology	• FSAP team satellite models and methodologies. • Balance-sheet regulatory approach. • Market data-based approaches. • The losses for securities portfolios are based on duration approach. • Provisioning for IRB and STA are modeled using IFRS9 transition matrix approach.
	Satellite models for macro-financial linkages	• Models for credit losses, funding costs, lending rates, net fee and commission income and risk weights. • Models to integrate solvency-funding interactions through changes in funding costs and the impact of fire sales.
	Stress test horizon	• 3-years (2024-2026).
3. Tail shocks	Scenario analysis	• Two scenarios: • A baseline scenario based on the October 2023 WEO macroeconomic projections. • An adverse scenario that captures the key risks in the RAM, External assumptions are given by GFM, a structural macroeconometric model of the world economy, disaggregated into 40 national economies. As Luxembourg is not included into the GFM projections, a specific Bayesian VAR model was estimated for Luxembourg domestic variables, taking some of the exogenous variables given by GFM as explanatory variables.

Appendix II. Table 1. Banking Sector STeM (Continued)		
Banking Sector: Solvency Stress Test		
Top-Down by IMF		
		• The TD analysis covered three main sources of risk: domestic real estate, exposures to parent companies and investment funds and sovereign risks.
	Sensitivity analysis	• Sensitivity analyses was conducted in the TD exercises, evaluating financial shocks and concentration risks. • In particular, direct effects of interest rate shocks; direct effects of exchange rate shocks; a decline in the prices of sovereign bonds; and failure of the largest to 10 largest corporate exposures were estimated through sensitivity analysis.
4.Risks and Buffers	Risks/ factors assessed.	• Risks covered include credit (on loans and debt securities), market (instantaneous shocks with valuation impact of debt instruments through repricing and credit spread risk as well as the P&L impact of net open positions in market risk factors such as foreign exchange risks) and interest rate risk (IRRBB) on the banking book (hedge not considered). • Solvency and liquidity risk interactions, mainly through funding costs.
	Behavioral adjustments	• Quasi-static approach followed for the banks' balance sheet size growth: balance sheet grows in line with nominal GDP, but with a floor set at 0 percent in order to prevent banks from deleveraging. • Interest income from nonperforming loans is not accrued. • Dividends are paid out by banks that remain adequately capitalized throughout the stress.
5. Regulatory and Market-Based Standards and Parameters	Calibration of risk parameters	• Through the cycle and Point-in-time for credit risk parameters or proxies.
	Regulatory/ accounting and market-based standards	• National regulatory framework of Basel III regulatory minima: CET1 ratio of 4.5 percent, leverage ratio of 3 percent. The hurdle rate for CET1 is equal to the Overall Capital Requirements.
6. Reporting Format for Results	Output presentation	• System-wide capital shortfall. • Number of banks and percentage of banking assets in the system that fall below regulatory minima. • Outputs also include information on impact of different result drivers, including profit components.

Appendix II. Table 1. Banking Sector STeM (Concluded)		
Banking Sector: Liquidity Risk		
Top-Down by IMF		
1. Institutional Perimeter	Institutions included	• 39 banks.
	Market share	• 90 percent of banking sector's assets.
	Data and baseline date	• Latest data: June 2023 for LCR, NSFR and cash flow analysis. • Source: supervisory data (COREP, ST exercise). • Scope of consolidation: perimeter of individual banks.
2. Channels of Risk Propagation	Methodology	• Basel III-LCR and NSFR type proxies. • Cash-flow based liquidity stress test using maturity buckets by banks. • Liquidity test in foreign currencies.
3. Risks and Buffers	Risks	• Funding liquidity (liquidity outflows, instantaneous shocks). • Market liquidity (price shocks, instantaneous shocks).
	Buffers	• Counterbalancing capacity. • Central bank facilities.
4. Tail shocks	Size of the shock	• Run-off rates calculated following historical events, or IMF expert judgment and LCR/NSFR rates. • Bank run and dry up of wholesale funding markets, taking into account haircuts to liquid assets.
5. Regulatory and Market-Based Standards and Parameters	Regulatory standards	• Basel III standards (revision as of January 2013). See Committee on Banking Supervision (2013), "Basel III: The Liquidity Coverage Ratio and liquidity monitoring tools," Basel, January 2013. • European Commission Delegated Act.
6. Reporting Format for Results	Output presentation	• Liquidity gap by bank, and aggregated. • Survival period in days by bank, number of banks that can still meet their obligations.

Appendix II. Table 2. Investment Funds STeM		
Investment Funds Sector: Change in NAVs/Solvency Risk		
Top-Down by IMF		
1. Institutional Perimeter	Institutions included	• 1135 largest open-ended funds. • Largest UCITS Investment Funds covering EM bond funds, HY bond funds, Mixed funds Equity funds and MMFs with total net assets over 1 billion euros, totaling close to 2.7 trillion euros in total net assets. • Largest open-ended AIFs with total net assets over 1 billion euros subject to same reporting standards as UCITS, totaling close to 400 million euros in total net assets.
	Market share	• 70 percent of total net assets of UCITS within full reporting scope. • Roughly 50% of total net assets of open-ended AIFs subject to same reporting standards as UCITS in full reporting scope.
Investment Funds Sector: Change in NAVs/Solvency Risk		
Top-Down by IMF		
	Data and baseline date	• Source: Supervisory data. • Baseline data: March 2023.
2. Channels of Risk Propagation	Methodology	• IMF's Financial shock simulator. • Market data-based approaches. • Specifically, for MMFs, increase in risk free rates and credit spreads that would result in deviations between shadow Net Asset Value (NAV) and Constant Net Asset Value.
	Satellite models	• IMF's Financial shock simulator.
3. Tail shocks	Scenario analysis	• Two scenarios: • An adverse scenario (same as for other sectors) that captures the key risks in the IMF's RAM. External assumptions given by GFM. • A GFC scenario based on changes in asset prices during September and October 2008.
	Sensitivity analysis	• Reverse stress test for MMFs based on various levels of exogenous shocks to interest rates and corporate spreads.
4.Risks and Buffers	Risks/ factors assessed.	• Market risk (valuation impact through repricing and credit spread risk) and interest rate risk on the investment fund portfolio. • For MMFs, inability to maintain Constant NAV due to interest rate and corporate spread shocks from adverse scenario. • For AIFs and UCITS, there is no buffer requirement. The change in NAVs affects outflows (see Liquidity Risk).
5. Regulatory and Market-Based Standards and Parameters	Regulatory/ accounting and market-based standards	• According to the IMMFA Code of Practice, and ESRB Regulation, escalation procedures should exist for deviation between the published price and the shadow NAV above 20 basis points.

Appendix II. Table 2. Investment Funds STeM (Continued)		
Investment Funds Sector: Change in NAVs/Solvency Risk		
Top-Down by IMF		
6. Reporting Format for Results	Output presentation	• Impact on value of assets and liabilities for all funds in the sample from. No pass/fail threshold applied. • For MMFs, deviations between constant NAV and shadow NAV. Number of MMFs and share of funds for which the deviation crosses the 20-basis points threshold.
Investment Fund Sector: Liquidity Risk		
Top-Down by IMF		
1. Institutional Perimeter	Institutions included	• 1,085 largest open-ended funds. • Largest UCITS Investment Funds covering EM bond funds, HY bond funds, Mixed funds, and Equity funds F with total net assets over 1 billion euros, totaling close to 2.3 trillion euros in total net assets.
		• Largest open-ended AIFs with total net assets over 1 billion euros subject to same reporting standards as UCITS, totaling close to 400 million euros in total net assets.
	Market share	• 70 percent of total net assets of UCITS within full reporting scope. • Roughly 50% of total net assets of open-ended AIFs subject to same reporting standards as UCITS in full reporting scope.
	Data and baseline date	• Source: Supervisory data • Latest data: March 2023
2. Channels of Risk Propagation	Methodology	• Liquidity measure based on ii) cash and high-quality liquid assets. • Flow-performance Model to integrate impact of macro shock on redemptions. • Models of market depth to integrate second round effect coming from sales of assets, taking into account illiquidity of assets. • Incorporation of intersectoral linkages, especially with Luxembourg banks, to assess liquidity access capacity.
3. Risks and Buffers	Risks	• Severe redemption shock following asset devaluations. • Funding liquidity (liquidity outflows) and inability to sell assets to cope with redemptions. • Market liquidity (price shocks) leading to second round effects.
	Buffers	• Stock of high-quality liquid assets (HQLA).
4. Tail shocks	Size of the shock	• Initial shock coming from impact of scenarios on Total Net Assets and redemption shock estimated from a model relating funds flows to macrofinancial variables. • Second round effects coming from price effect due to sales of assets. • Separately, exogenous monthly redemption shock equal to the first percentile of historical net flows

Appendix II. Table 2. Investment Funds STeM (Concluded)		
Investment Fund Sector: Liquidity Risk		
Top-Down by IMF		
	Sensitivity Analysis	• Reverse stress test based on exogenous levels of redemptions (as a percentage of NAV) applied homogeneously to all funds in the test sample.
5. Reporting Format for Results	Output presentation	• Number of funds with a redemption coverage ratio (ratio of highly liquid assets to redemptions) below one. • Total net assets of funds with RCR below one, as a percentage of aggregate total net assets. • Liquidity shortfall amount for individual funds after redemptions.

Appendix II. Table 3. Insurance Sector STeM		
Insurance Sector: Solvency Risk		
Top-Down by IMF		
1. Institutional perimeter	Number of institutions	• 10 life insurers • 12 non-life insurers and reinsurers
	Market share	• Life: ~83 percent of investment assets non-life: 81 percent of gross written premiums
	Data	Supervisory reporting (Solvency II Quantitative Reporting Templates)
	Reference date	30 June 2023
2. Channels of risk propagation	Methodology	• Investment assets: market value changes of assets after price shocks • Liabilities: valuation change due to interest rate shock • Impact on available capital (net assets as the difference between stressed assets and liabilities) • Recalculation of the solvency capital requirement
	Time horizon	Instantaneous shock
3. Scenario analysis	Scenario analysis	Adverse scenario: aligned with the scenario used for the investment fund risk analysis, but with additional granularity on market and interest rate risks
	Single-factor sensitivities	• Additional interest shocks: EUR Risk-free rate term structure +/-200bps • Additional currency shocks: EUR external value +/-20 percent • Equity prices shock: -50 percent • Domestic sovereign shock: +500bps • Default of largest and the three largest banking counterparties
4. Risk factors		• Market risks (equity, property) • Interest rate risks • Credit risks (credit spread risk, default of largest counterparty) • Currency risks
5. Buffers and mitigating factors		• Eligible own funds • Loss-absorbing capacity of deferred taxes • No management actions
6.Regulatory/accounting standards		• Solvency II • National GAAP
7. Reporting format for results		• Impact on value of assets and liabilities • Impact on solvency ratio (SCR coverage)

Appendix II. Table 3. Insurance Sector STeM (Concluded)		
Insurance Sector: Solvency Risk		
Top-Down by IMF		
		• Aggregated capital shortfall • Dispersion across companies • Contribution of individual shocks
Insurance Sector: Liquidity Risk		
Top-Down by IMF		
1. Institutional perimeter	Number of institutions	• 8 life insurers
	Market share	• Life: ~90 percent of investment assets in non-unit-linked business
	Data	• Supervisory reporting (Solvency II Quantitative Reporting Templates) Additional data request to life insurers
	Reference date	30 June 2023
Insurance Sector: Liquidity Risk		
Top-Down by IMF		
2. Channels of risk propagation	Methodology	• Outflow through surrenders of guaranteed life insurance policies
	Time horizon	One month
3. Scenario analysis	Scenario analysis	Simulated monthly outflow which exceeds highest historical outflow by 50 percent
4. Risk factors		Liquidity risk
5. Buffers and mitigating factors		• Holdings of highly liquid assets • Surrender payouts to policyholders according to contractually allowed periods. • No management actions
5. Regulatory/accounting standards		• Solvency II • National GAAP
6. Reporting format for results		• Cash in- and outflows • Coverage of net outflows by liquid assets • Distribution across companies