INTERNATIONAL MONETARY FUND

IMF Country Report No. 25/88

SLOVAK REPUBLIC

FINANCIAL SECTOR ASSESSMENT PROGRAM

April 2025

TECHNICAL NOTE ON SYSTEMIC RISK ANALYSIS AND STRESS TESTING

This paper on the Slovak Republic was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on March 24, 2025.

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TECHNICAL NOTE

SYSTEMIC RISK ANALYSIS AND STRESS TESTING

Prepared By
Monetary and Capital Markets Department

This Technical Note was prepared by IMF staff in the context of the Financial Sector Assessment Program mission in the Slovak Republic. It contains technical analysis and detailed information underpinning the FSAP's findings and recommendations. Further information on the FSAP can be found at http://www.imf.org/external/np/fsap/fssa.aspx

CONTENTS

TABLES

APPENDICES

Glossary

AC	Amortized Cost
AIFMD	Alternative Investment Fund Managers Directive
AML/CFT	Anti-Money Laundering/Combating the Financing of Terrorism
BBM	Borrower-Based Measure
BCP	Basel Core Principle
BN	Background Note
BRRD	Banking Recovery and Resolution Directive
BTL	Buy to Let
CCoB	Capital Conservation Buffer
CCyB	Countercyclical Capital Buffer
CEE	Central and Eastern Europe
COREP	Common Reporting
CRE	Commercial Real Estate
CRR	Capital Requirement Regulation
D/E	Debt to Equity
DSTI	Debt Service to Income
DTI	Debt to Income
ECB	European Central Bank
ELA	Emergency Liquidity Assistance
EA	Euro Area
ESRB	European Systemic Risk Board
EU	European Union
FIU	Financial Intelligence Unit
FINREP	Financial Reporting
FOV	Fond Ochrany Vkladov (Deposit Protection Fund)
FSAP	Financial Sector Assessment Program
FSD	Financial Stability Department
FSSA	Financial System Stability Assessment
FTB	First Time Buyer
FTT	Financial Transaction Tax
FX	Foreign Exchange
GDP	Gross Domestic Product
G-RAM	Global Risk Assessment Matrix
HQLA	High-Quality Liquid Asset
ICR	Interest Coverage Ratio
IFRS	International Financial Reporting Standards
IT	Information Technology
IRRBB	Interest Rate Risk in the Banking Book
LCR	Liquidity Coverage Ratio
LSI	Less Significant Institution
LTV	Loan to Value
MoF	Ministry of Finance
MoU	Memorandum of Understanding

MREL	Minimum Requirements for Own Funds and Eligible Liabilities
NAV	Net Asset Value
NBFI	Non-Bank Financial Institutions
NBS	Národná banka Slovenska
NFC	Non-financial Corporate
NFCI	Net Fees and Commissions Income
NII	Net Interest Income
NPL	Non-performing Loan
NRA	National Resolution Authority
NSFR	Net Stable Funding Ratio
O-SII	Other Systemically Important Institutions
P2R	Pillar 2 Requirements
PD	Probability of Default
pnCCyB	Positive-neutral Countercyclical Capital Buffer
RAM	Risk Assessment Matrix
RRE	Residential Real Estate
RRP	Recovery and Resilience Plan
ROA	Return on Asset
ROTA	Return on Total Assets
SI	Significant Institution
SRB	Single Resolution Board
SRF	Single Resolution Fund
SREP	Supervisory Review and Evaluation Process
SSM	Single Supervisory Mechanism
STB	Second Time Buyer
STeM	Stress Test Matrix
SyRB	Systemic Risk Buffer
TN	Technical Note
VAT	Value Added Tax
WC/TA	Working Capital over Total Asset
WEO	World Economic Outlook

EXECUTIVE SUMMARY[1]

The Financial Sector Assessment Program (FSAP) for the Slovak Republic implemented an extensive analysis of systemic risks and assessed the resilience of the banking sector. It identified key vulnerabilities and evaluated sectoral exposures, assessed corporate and household risks, and banking sector solvency and liquidity risks, and explored interconnectedness and contagion risks.

The FSAP assessed the sources of systemic risks and their potential impact on the banking sector given existing vulnerabilities. Main risks to financial stability stem from external factors, coupled with potential corrections in residential and commercial real estate valuations. Despite recent cooling amid declining real wages and rising mortgage rates, house prices remain elevated and appear overvalued by some measures. A slowdown in economic activity and/or tighter financial conditions may lead to a correction in real estate prices with adverse effects on the quality of bank credit portfolios, particularly given banks' large exposure to residential mortgages. Further depression of prices of the highly leveraged and interest-sensitive commercial real estate (CRE) sector poses a potential source of risk given the direct and indirect exposures of banks, investment funds, and households to this sector. Finally, loans to globally integrated non-financial corporates (NFCs) could amplify the impact triggering higher credit losses.

FSAP bank solvency stress tests indicate that the Slovak banking system appears resilient to severe macrofinancial shocks. Under the adverse scenario, the aggregate total capital ratio reaches 16 percent in the second year, declining by 3.8 percentage points compared to the baseline (4.6 percentage points from the starting point), and all banks continue to meet the minimum capital requirements. The decline in the capital ratio is mainly due to credit impairments and lower revenue generation from net fees and commissions income (NFCI), but the overall impact is cushioned by higher net interest income (NII) and high initial levels of capital buffers. A more severe shock on corporate loans in auto and real estate related sectors, combined with the adverse scenario, has the largest impact on the aggregate capital ratio, at 4.5 percentage points below the baseline level. The corporate stress test indicates that the largest corporate borrowers appear relatively resilient under the adverse scenario, suggesting the risks from large exposures in banks' corporate loan portfolios are low.

Liquidity stress tests reveal that Slovak banks exhibit strong resilience against funding and market liquidity shocks. The aggregate liquidity coverage ratio (LCR) for the nine banks in the stress testing sample, remains above the 100 percent threshold under the most adverse scenario, dropping to 112 percent from 205 percent. Under this scenario, which combines market and outflow shocks, three banks fall below the 100 percent threshold, but maintain an LCR level above 80

[1] This Technical Note was prepared by Angelica Lizarazo, Salim Dehmej and Shinya Kotera, with contributions from Laura Valderrama (household analysis), Francisco Vazquez, Zoltan Jakab and Ruy Lama (macrofinancial scenarios), and administrative support from Vanessa Guerrero and David Ramirez. The analysis has benefitted from discussions with the staff of the National Bank of Slovakia and the Slovak FSAP team.

percent. The banking system has a robust net stable funding ratio (NSFR) of 132 percent, which remains above the regulatory limit even under the extremely severe stress scenarios. In the cash-flow analysis, the banking system maintains a positive funding position across all maturities in both scenarios, with two banks facing liquidity shortfalls under the most adverse scenario. The sensitivity analysis on the interplay between liquidity and solvency risks, in case of a hypothetical scenario of fire sales of liquid assets, indicates a limited impact on capital on aggregate, although there is heterogeneity at individual level.

Direct contagion risks within the financial sector, interbank market, and cross-border banking operations are assessed as relatively low. The intersectoral linkages analysis, based on the sectoral exposures in the Balance Sheet Approach, shows limited vulnerabilities for the financial system but highlights a large external funding of nonfinancial corporates primarily reflecting intra-group linkages. The domestic financial system interconnectedness analysis underscores very limited exposures, mainly from pensions to banks acting as depositories. Interbank exposures are also limited in both number and size. The cross-border banking operations are also small relative to their balance sheets, except for one bank.

The NBS' systemic risk assessment framework could be further enhanced by (i) strengthening its stress testing to assess the resilience of the banking sector to adverse macrofinancial shocks and expanding the sensitivity analyses, (ii) strengthening the monitoring for expected losses from emerging risks, especially in vulnerable segments including the CRE sector, and (iii) integrating the cash-flow analyses in the liquidity stress testing framework. A more systematic publication of the results of liquidity stress tests, along with the solvency stress tests in the Financial Stability Report, would increase transparency. Close monitoring of funding through covered bonds would ensure readiness to mitigate risks should they become excessive.

Table 1. Slovak Republic: Key Recommendations

Topic	Agency	I/ST/MT[1]	Priority
Bank Solvency Stress Test			
1. Strengthen the solvency stress tests to assess the resilience of the banking sector to adverse macrofinancial shocks by incorporating the IFRS 9 approach into the credit risk models.	NBS	ST	H
2. Complement the assessment of banks resilience to adverse scenarios with sensitivity analyses on key macro variables (i.e., interest rates).	NBS	ST	H
3. Strengthen the monitoring for expected losses from emerging risks, especially in vulnerable segments including the CRE sector.	NBS	I	H
Liquidity Solvency Stress Test			
4. Implement and integrate the cash-flow analyses in the liquidity stress testing framework.	NBS	ST	H

Table 1. Slovak Republic: Key Recommendations (Concluded)			
Topic	**Agency**	**I/ST/MT[1]**	**Priority**
5. Publish the results of liquidity stress tests more systematically, along with solvency stress tests, in the Financial Stability Report	NBS	I	M
6. Closely monitor covered bonds as their share of bank funding is increasing.	NBS	ST	M

[1] In terms of priorities, H, M, and L stand for high, medium and low. In terms of time frame, I, ST, and MT stand for immediate (within one year), near-term (within 2–3 years), and medium-term (within 3–5 years).

INTRODUCTION

A. Macrofinancial Context

1. The Slovak economy is recovering, and inflation has declined from record-highs in 2023, but the outlook is dominated by downside risks. Economic growth in 2024 reached 2.0 percent (1.4 percent in 2023), supported by a recovery of private consumption and an increase in public consumption, while EU-funded public investments slowed down from record highs in 2023 and net exports remained weak. Headline inflation declined to 2.5 percent in 2024 Q2 from record-highs of 15 percent in early 2023, aided by declines in global commodity prices. However, inflation increased in 2024H2, reaching 3.5 percent in 2024Q4 on higher global food prices, and core inflation remains higher than the EA countries due to service price pressures. Inflation is expected to rise temporarily in the near term before approaching the 2 percent target toward early 2027. While Recovery and Resilience Plan (RRP) investments provide support to growth, the recently announced government plan—beneficial to put debt on a downward path by targeting a reduction in the fiscal deficit to 2.2 percent of GDP by 2028 to comply with the new EU fiscal framework—is expected to weigh on the outlook. The economic outlook is clouded by risks associated with global slowdowns, intensifying trade policy uncertainty, commodity price volatility, and potential delays in structural reforms and fiscal consolidation (Figure 1).

2. Tighter financial conditions dampened credit growth and housing market dynamics, but the financial cycle is showing signs of turning recently. Private sector credit growth decelerated to 2.7 percent in 2024 Q1 from 10.8 percent at end-2022, as lending rates have increased with the ECB policy rate and financial conditions tightened until end-2023 (Figure 2). Loan demand from non-financial corporates (NFCs) has been weak, while mortgage growth stabilized and consumer loan growth increased. Financial conditions have turned accommodative, as the ECB started lowering key rates in June 2024. The NBS's composite indicator of the financial cycle has fallen gradually to its 2015 level, but the decline has slowed recently.[2] The NBS did not fully release the countercyclical capital buffer (CCyB) during the COVID-19 pandemic and raised it back to

[2] Credit-gap measures suffer from relatively short time series, structural changes, and GDP volatility, making the interpretation challenging. The NBS instead uses a composite indicator (Cyclogram), which includes the domestic-credit-to-GDP gap and other indicators capturing credit market risks, macroeconomic risks, and risks in the housing market.

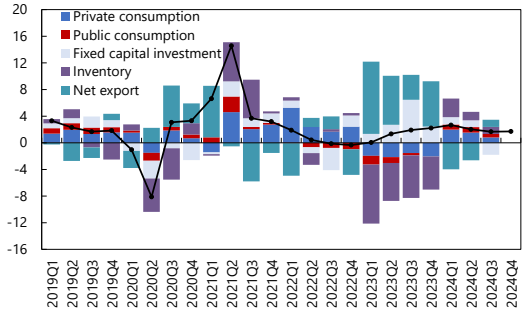
1.5 percent in June 2022 (effective as of August 2023) as mortgage and house price growth accelerated after the initial phase of the pandemic.[3]

Figure 1. Slovak Republic: Real Sector Developments

The recent economic growth was supported by EU-funded public investment and a recovery of consumption.

Contribution to Real GDP Growth

(Percentage points, annualized, 4-quarter moving average)

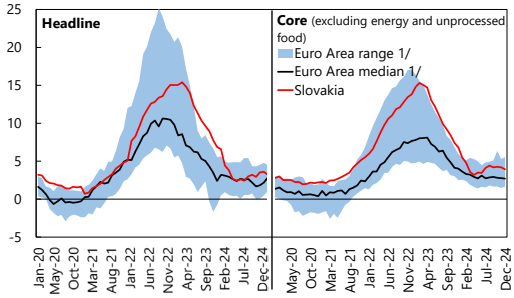


Sources: Haver Analytics and IMF staff calculation.

Inflation fell to close to the euro area median in 2Q 2024, but both headline and core inflation have picked up recently.

Inflation Rate Across Euro Area Countries

(Year-one-year percent change)

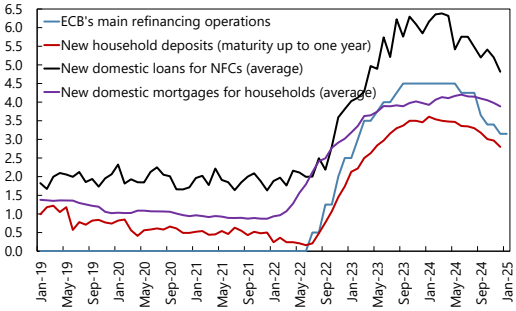


1/Euro Area range and median exclude Slovakia.
Sources: Eurostat and IMF staff calculations.

Deposit and lending rates have increased …

Interest Rate

(Percent)

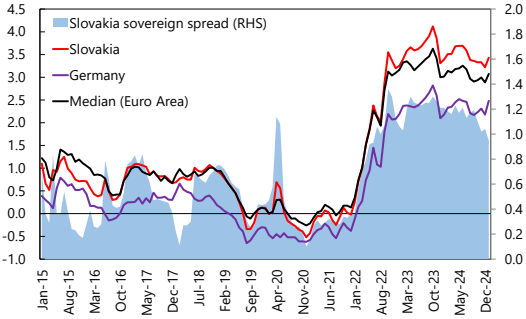


Source: National Bank of Slovakia.

…and the yield on government bonds has moved in line with other countries in the euro area.

10 Years Government Bond Yield

(Percent, percentage point (RHS))

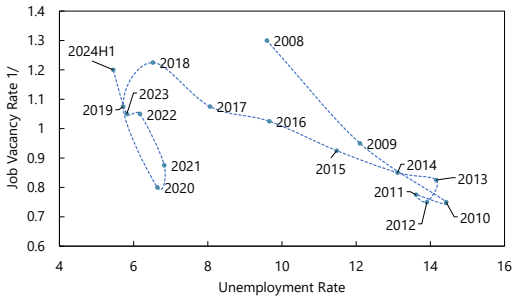


Sources: CEIC and IMF staff calculations.

The unemployment rate decreased to an all-time low of 5.3 percent…

Beveridge Curve

(Percent)

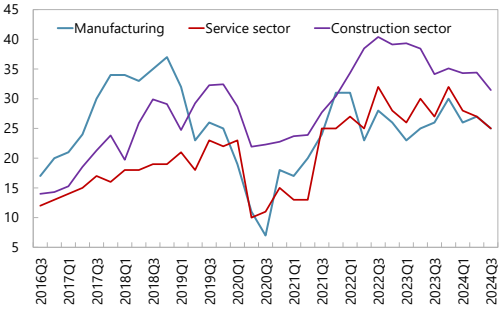


1/ Number of job vacancies / (Number of occupied posts+Number of job vacancies).
Source: Haver Analytics.

…and labor shortages are particularly acute in the construction sector.

Firms Reporting Labor Shortage

(Percent balance, SA)



Sources: Haver Analytics and IMF staff calculations.

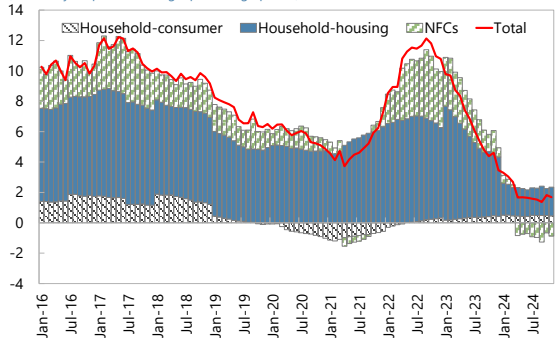
[3] The CCyB is guided by the position in the financial cycle, as estimated by the Cyclogram, between 0 and 2.5 percent calibrated based on losses observed during the Great Financial Crisis. At the beginning of the Covid-19 pandemic, the NBS suspended a planned increase of the CCyB from 1.5 to 2 percent, and later decreased it to 1.

Figure 2. Slovak Republic: Credit Developments

Private credit growth started to decelerate in mid-2022, with household loan growth having stabilized recently.

Contribution to Private Sector Credit Growth

(Year-on-year percent change, percentage points)

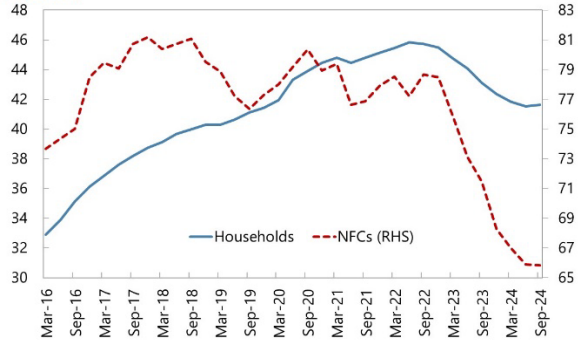


Sources: Haver Analytics and IMF staff calculations.

Both household and corporate debts have moderated and stand at 42 and 66 percent of GDP in 2024Q3, respectively.

Debt to GDP

(In percent)

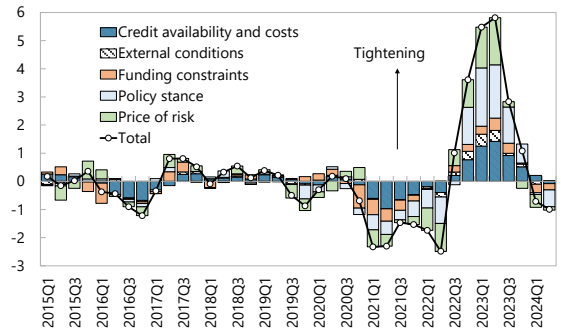


Sources: NBS and ECB

Following the tightening in 2023, financial conditions turned accommodative in 2024 Q1…

Financial Condition Changes

(contribution to quarter-over-quarter first difference of the unscaled FCI)

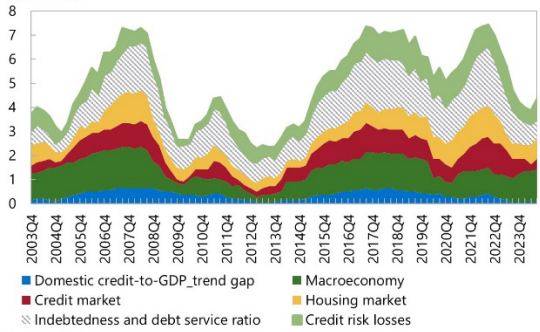


Sources: Borraccia, G. et al. (2023)

… and the NBS's composite indicator of the financial cycle (Cyclogram) showed slight upturn.

Cyclogram, by Component

(Indicator)



Source: NBS.

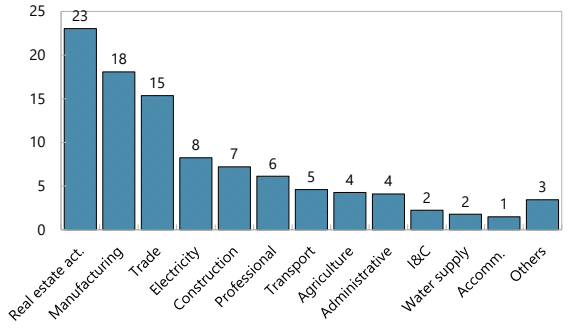
3. The corporate sector has a relatively strong debt repayment capacity. NFC loan growth increased significantly in 2022 amid headwinds of high costs and deteriorating economic outlook but turned to a downward trajectory in 2023 and has fallen into negative territory in 2024. Lower demand for credit by NFCs reflects the rise in interest costs and weakening customer demand. NFC-debt-to-GDP stood at 67 percent in 2024Q1, moderated from 78.5 percent in 2022Q4. Real estate NFCs are the largest borrowers, capturing around 23 percent of total NFC loans. The number of bankruptcies remains stable, and a relatively low debt-to-surplus ratio compared to other euro area countries suggests a relatively high capacity to meet the cost of interest and debt repayments (Figure 3).

Figure 3. Slovak Republic: Stylized Facts in Corporate Sector

Real estate NFCs are the largest borrowers capturing around 23 percent of total loans.

NFC Loans by Economic Activity (as of June 2024)

(Percent of total NFC loans)

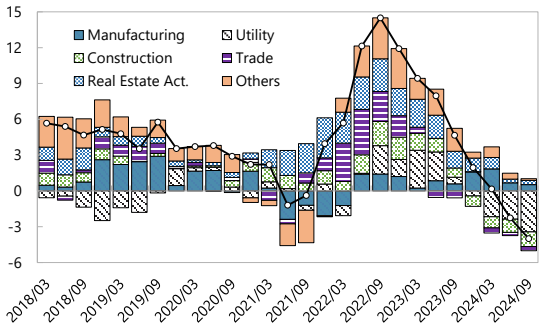


Sources: NBS and IMF staff calculations

Credit growth in NFCs started to decelerate in mid-2022, mainly driven by utility, trade, and CRE sectors.

NFC Loans Growth by Economic Activity

(Year-on-year growth rate, in percent)

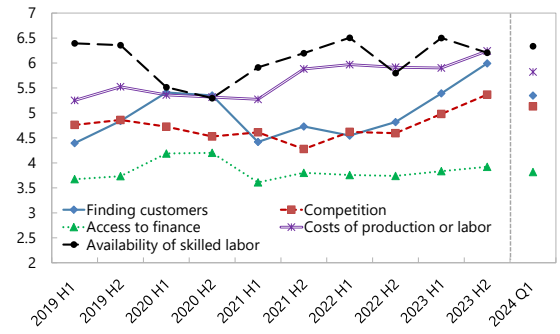


Sources: NBS and IMF staff calculations

Finding customers and competition were the growing concerns for corporates in 2023H2.

Problems Firms are Facing

(Firms' average rating of severity of problems (from 1 to 10), SMEs)

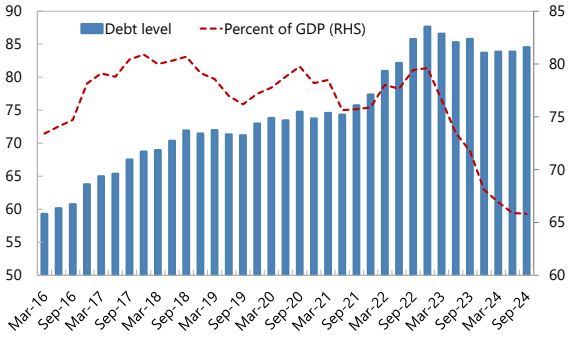


Source: Survey on the Access to Finance of Enterprises

Corporate debts have moderated and stand at 66 percent of GDP in 2024Q3.

NFCs: Debt

(Billion EUR, in percent (RHS))

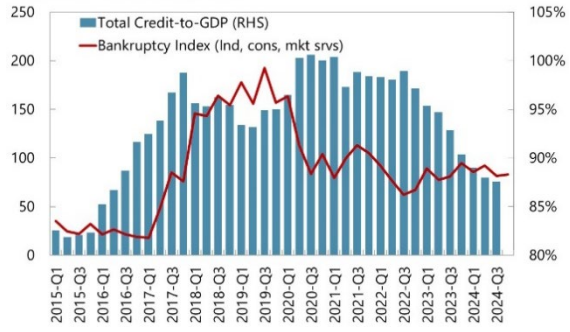


Source: ECB

Bankruptcies remain below the pre-pandemic level…

Bankruptcy Index and Credit-to-GDP

(Index, 2021 = 100, percent (RHS))

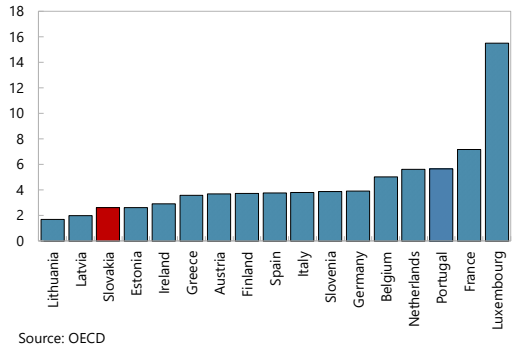


Sources: EuroStat, NBS.

…and corporates have a relatively high capacity to meet debt payments compared to other Euro Area countries.

Debt to Surplus, 2022

(Ratio)

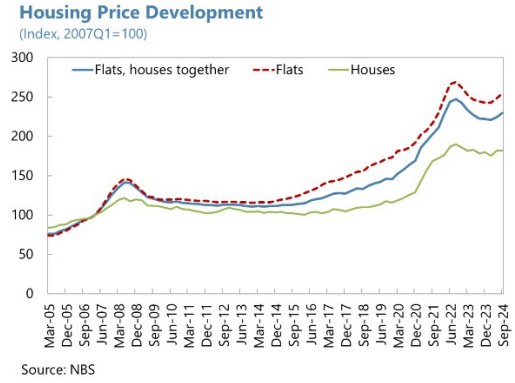


Source: OECD

4. Despite recent cooling, there are still some signs of lingering downside risks to residential real estate (RRE) prices. Residential property prices have more than doubled since 2007, mainly fueled by ultra-low interest rates and supply constraints, and the housing-price-to-income ratio has steadily increased until 2022 (Figure 4). Despite recent cooling amid declining real wages and rising mortgage rates, house prices remain elevated and appear overvalued by some measures,[4] with affordability still high compared to European peers. A RRE-price-at-risk analysis suggests that house prices could fall by 12.9 percent by 2025Q1 with a chance of 10 percent. Downside risks stem from the still tight financial conditions, but uncertainty is exceptionally high as indicated by the widening distance between the fitted 10th and 90th percentiles, with a significant probability of price increase again.

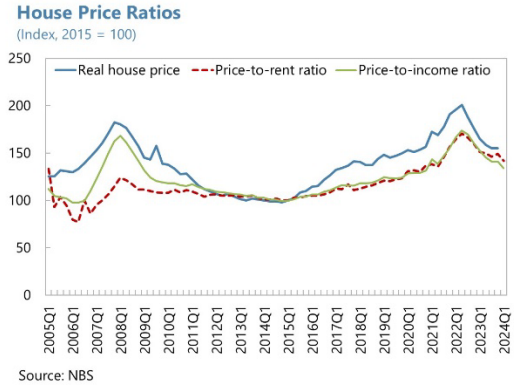
Figure 4. Slovak Republic: Residential Real Estate Developments

House prices have corrected by about 10 percent between mid-2022 and mid-2023 but have since stabilized...



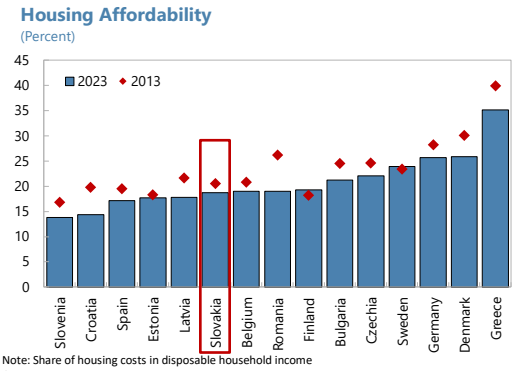
Source: NBS

...mirrored by a decline in house prices ratios that has also bottomed out during 2023.



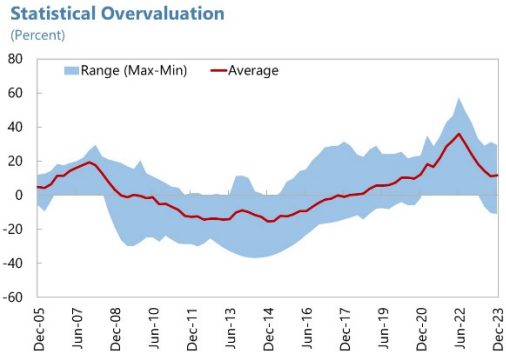
Source: NBS

Housing costs still account for close to 20 percent of disposable household income...



Note: Share of housing costs in disposable household income
Source: Eurostat

...and house prices still appear to be overvalued.



Source: NBS and IMF staff estimates.

Note: House price overvaluation estimates were derived based on real house prices, price-to-rent and price-to-income ratios using the cyclical components extracted from the Hodrick-Prescott, Hamilton, and Christiano-Fitzgerald filters, to ensure robustness and provide a comprehensive view of the underlying cyclical dynamics.

[4] Staff estimates show an average overvaluation of 12 percent in 2023Q4, ranging from a 30 percent overvaluation to an 11 percent undervaluation depending on the filter used. See Box 1 in the Financial System Stability Assessment report and the Technical Note on Macroprudential Policy Framework and Tools for more details.

B. Financial Sector Structure and Vulnerabilities

5. The financial sector size relative to GDP has been increasing since the 2007 FSAP Update, and the sector remains largely dominated by banks. Total system assets were at 1.25 times of GDP, with the banks representing 79 percent at end-2023 (Table 2). The structure has remained broadly stable, with a marginal increase in NBFI participation.

6. The banking sector is highly concentrated and primarily foreign owned.[5] The four largest banks (all SIs) account for around 71 percent of banking-sector assets, all of which are part of large European banking groups and under ECB direct supervision (Table 3). LSIs represent about 16 percent of total banking assets. Banks are domestically oriented and rely on a traditional business model, with little dependence on financial markets and a moderate exposure to the sovereign, around 10 percent of total assets. (Figure 5).

7. The banking sector withstood the multiple shocks of the Covid-19 pandemic and the war on Ukraine well, with capital buffers remaining relatively high and stable, and asset quality, liquidity and profitability improving (Figure 6).

- **Regulatory capital** stayed stable throughout the pandemic, standing at 20.5 percent of risk-weighted assets as of end-2023 (20 percent for SIs and 22.5 percent for LSIs).[6] The non-performing loan (NPL) ratio has steadily declined from a peak of 5.8 percent in 2010 to around 2 percent as of end-2023 despite the withdrawal of pandemic-related support measures. Loan loss coverage declined to pre-pandemic levels, falling below 60 percent and approaching the euro area (EA) median.

- **Profitability**, mainly associated with traditional lending and driven by higher net interest income, reached a record high in 2023 (return on asset (ROA) above 1 percent). However, the bank levy [7] introduced in January 2024 will impede banks' ability to build capital buffers and generate credit, and potentially putting upward pressure on mortgage rates, if it is not unwound as planned.

- **Liquidity** appears ample, with the LCR for the Slovak banking system at 200 percent[8] (192 percent for SIs and 282 percent for LSIs), with Level 1 assets representing 98 percent of high-

[5] As of end-2023, foreign subsidiaries accounted for 61 percent of total financial sector assets while the share of foreign banks' branches was 12 percent.

[6] All banks are subject to a capital conservation buffer (CCoB) of 2.5 percent, a counter-cyclical buffer (CCyB) currently set at 1.5 percent, while 6 banks (all SIs and two LSIs) are subject to O-SII buffer (0.25- 2 percent). Specific Pillar 2 requirements (P2R) and Pillar 2 guidance (P2G) are defined as part of SREP process for each SIs and LSIs and therefore are set at institution basis.

[7] The levy, effective from January 2024, is set at 30 percent of pre-tax profits in 2024, falling gradually to 15 percent by 2027 and will be kept at 4.356 percent from 2028.

[8] The 2017 BCBS RCAP assessment of LCR regulations in the EU identified one material deviation and four potentially material deviations that significantly overstate or may significantly overstate LCR for some banks in the EU.

quality liquid assets. The NSFR remained at 131 percent for both SIs and LSIs. With a predominant reliance on stable funding from households and corporates, the loan-to-deposit ratio is structurally high at 105 percent. However, it has been decreasing recently due to the slowdown in credit growth, outstripped by deposit growth, and the diversification of funding structure through the issuance of covered bonds.[9]

Table 2. Slovak Republic: Structure of Financial System

	2006Q4				2023Q4			
	Number of institutions	Assets (in millions of Euros)	Assets (in percent of financial system)	Assets (in percent of GDP)	Number of institutions	Assets (in millions of Euros)	Assets (in percent of financial system)	Assets (in percent of GDP)
Banks	**24**	**37,777**	**80**	**83.0**	**24**	**121,306**	**78.7**	**98.8**
Commercial banks	17	31,973	67.8	70.2	10	102,343	66.4	83.3
Private	16	31,546	66.9	69.3	9	101,744	66.0	82.8
Domestic	1	708	1.5	1.6	2	7,094	4.6	5.8
Foreign	15	30,837	65	67.7	7	94,650	61.4	77.1
State-owned	1	427	0.9	0.9	1	600	0.4	0.5
Branches of foreign banks	7	5,803	12	12.7	14	18,963	12.3	15.4
Insurance companies	**24**	**3,928**	**9**	**8.6**	**9**	**5,578**	**3.6**	**4.5**
Life insurance companies	5	459	1.0	1.0	2	737	0.5	0.6
General insurance companies	5	54	0.1	0.1	0			
Composite insurance companies	14	3,415	7.2	7.5	7	4,841	3.1	3.9
Pension funds	**24**	**1,207**	**3**	**2.6**	**36**	**17,516**	**11.4**	**14.3**
Pension funds 2nd pillar	18	749	1.6	1.6	16	13,997	9.1	11.4
Pension funds 3rd pillar	6	457	1.0	1.0	20	3,519	2.3	2.9
Investment funds					**100**	**9,630**	**6.2**	**7.8**
Others (securities companies)	**44**	**4,269**	**9**	**9.4**	**20**	**54**	**0.0**	**0.0**
Crowdfunding providers					**3**			
Total financial system	**116**	**47,181**	**100**	**104**	**192**	**154,084**	**100**	**125**

Source: NBS

Note: Data on "Others" cover on-balance sheet assets of non-bank investment firms. Client assets (off-balance sheet) of non-bank investment firms total is € 2957 million.

Table 3. Slovak Republic: Composition of Banking Sector

	# of institutions	% of Banking Assets
SIs	4	71.4
Other SSM SIs via branch	8	12.5
High Impact LSIs	3	11.6
Other LSIs	3	1.4
Branches of other SSM LSIs	2	2.5
Branches of non-SSM banking groups	4	0.6
Total (Source NBS)	**24**	**100.0**

Source: NBS

Source: NBS

Note: LSIs represent about 16 percent of total banking assets, including 3 high-impact LSIs (11.6 percent). As of end-2023, foreign subsidiaries accounted for 61 percent of total financial sector assets while the share of foreign banks' branches was 12 percent.

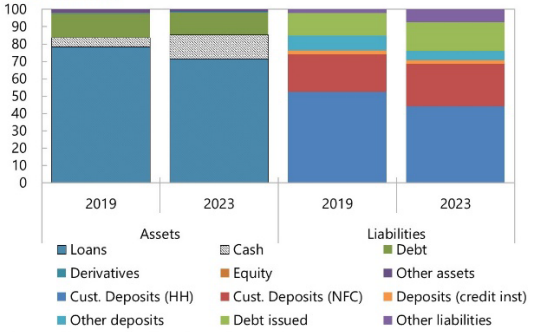
[9] Covered bonds are close to 11 percent of funding, backed by RRE loans and primarily held by foreign investors with low cross-ownership between banks in Slovakia. Asset encumbrance is on average at 20 percent.

Figure 5. Slovak Republic: Banking Sector Balance Sheet and Liquidity

The Slovak banking sector is highly concentrated, with the largest five institutions accounting for about ¾ of the sector's assets. Banks are domestically focused and rely on a traditional business model, with loans and household and corporate deposits accounting for a large part of their asset and liabilities.

Slovak Banks - Balance Sheet Structure

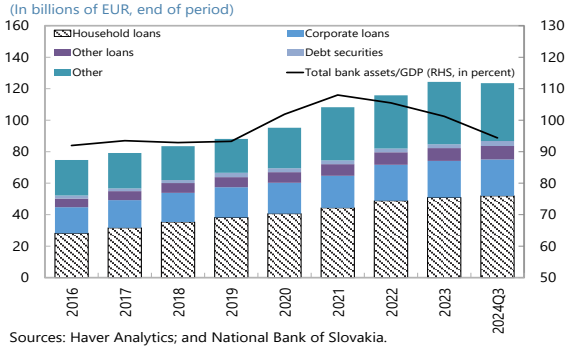
(Percent of total)



Source: European Banking Authority

Slovak Bank Assets by Loan Type

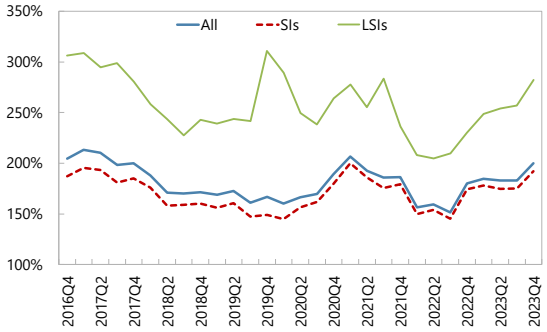
(In billions of EUR, end of period)



Sources: Haver Analytics; and National Bank of Slovakia.

Liquidity Coverage Ratio

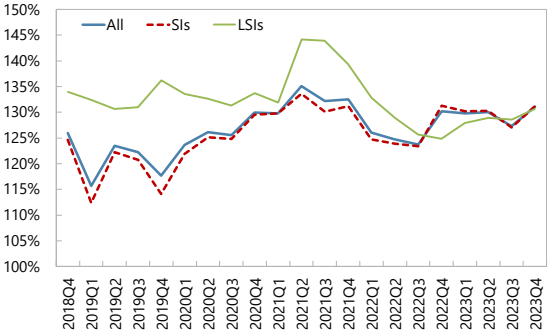
(Percent)



Source: NBS

Net Stable Funding Ratio

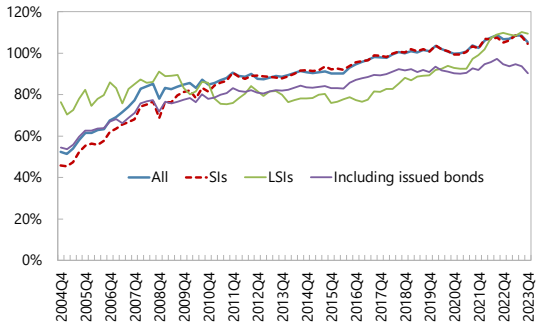
(Percent)



Source: NBS

Loan-to-Deposit Ratio

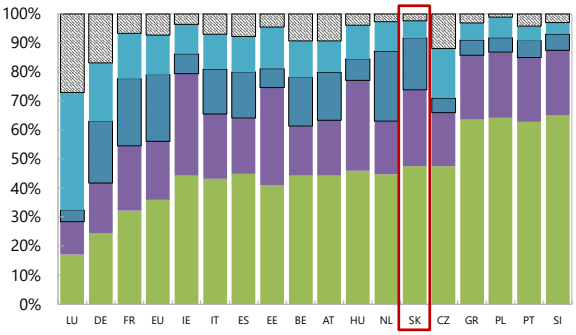
(Percent)



Source: NBS

Composition of Liabilities

(Percent of total liabilities, 2023Q4)



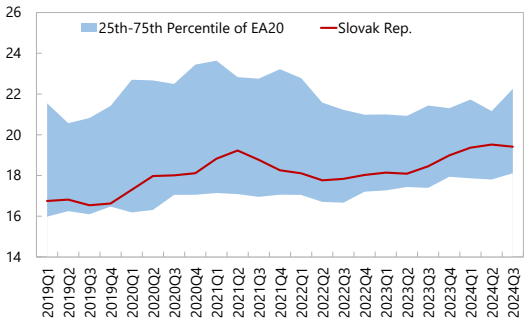
Source: EBA

Figure 6. Slovak Republic: Financial Soundness Indicators

The Slovak banking system's capital buffers remain high and broadly in line with European peer countries. Asset quality has steadily improved, especially for corporate loans, with provisions currently in line with the median of European peers. Profitability has recovered driven by interest income, but stands towards the lower end of the European peers' spectrum.

Tier 1 Capital Ratio (EA20)

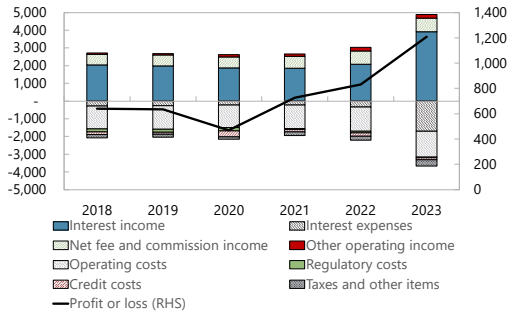
(Percent)



Source: IMF, Financial Soundness Indicators database.

Slovak Banks - Income and Expenses Breakdown

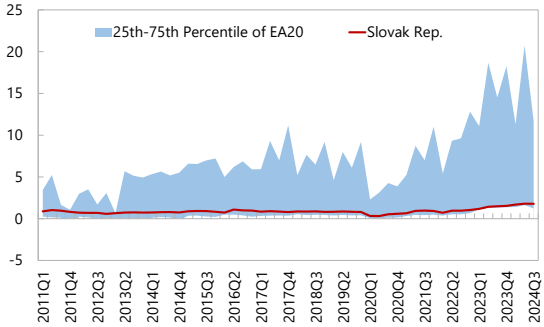
(EUR millions)



Source: NBS

Net Income (EA20)

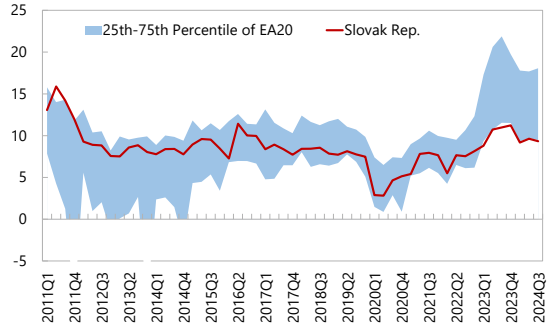
(Bil. EUR)



Source: IMF FSI

Return on Equity (EA20)

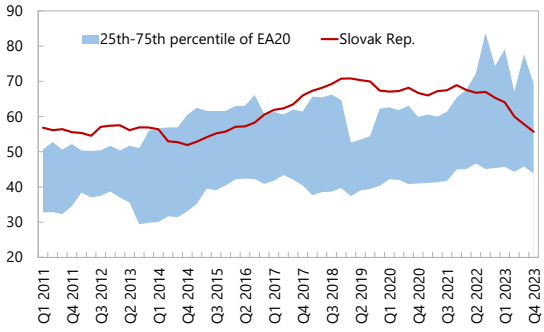
(Percent)



Source: IMF FSI.

Provisions to NPLs (EA20)

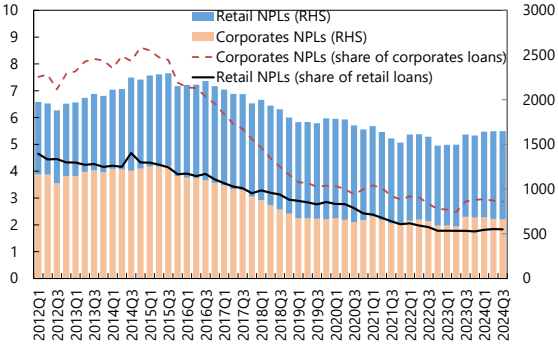
(Percent)



Source: IMF FSI

Non-Performing Loans by Sector

(Percent, million euro (RHS))



Sources: Haver Analytics, National Bank of Slovakia and IMF staff calculations.

SYSTEMIC RISK ASSESSMENT

A. Key Risks to Financial Stability

8. The main risks stem from external factors, including an abrupt global slowdown and further escalation of regional conflicts (Appendix I). The Slovak economy is prone to external shocks, given its reliance on Russian fossil fuels, significant integration in global value chains, and export dependence. A slowdown in external demand could negatively impact economic activity and labor markets through trade channels. This could further lead to a correction in real estate prices with adverse effects on the quality of bank credit portfolios, amid a reset of mortgages to higher interest rates. An intensification of regional conflicts may push up energy and commodity prices, leading to a tighter-for-longer monetary cycle. A failure to rein in the fiscal deficit, amplified by the effect of tighter financial conditions and an economic slowdown, could result in rating downgrades and trigger an increase in risk premia.

9. The high mortgage exposures and loans to globally integrated NFCs are potential sources of vulnerabilities. The high concentration in mortgage lending could trigger higher credit losses if economic activity slows down, financial conditions tighten, and housing prices decline. Most mortgages have a medium-term interest rate fixation, and a significant portion of the portfolio will be repriced in the next one to three years.[10] Although this could have a positive impact on bank profitability, a higher debt service burden could lead to households' default. Banks with a large corporate loan portfolio, especially in those sectors vulnerable to external and geopolitical risks (e.g., auto sector), could be more susceptible to NFC credit losses.

10. The loan-to-deposit ratio has been on the rise, reflecting the faster growth of loans in comparison to deposits. While funding diversification through covered bond issuances helps alleviate this structural constraint, it increases the system's dependence on foreign funding given that bonds are largely held by foreign investors. Liquidity risk mitigants requirements,[11] limited interbank crossholdings, and sufficient counterbalancing capacity help contain the implications of covered bond funding, provided that excessive reliance on this type of funding is avoided.

11. In addition to the RRE market, the CRE sector entails a source of risk that merits closer analysis (Figure 7). Banks, investment funds, and households[12] are directly and indirectly exposed to the CRE sector, which is highly leveraged and sensitive to interest rate increases, with the potential to amplify an economic downturn. In the office segment where the risks are generally higher (about

[10] As of December 2023, close to 19 percent of the mortgage portfolio has an interest rate reset in less than 1 year and 34 percent between 1-3 years.

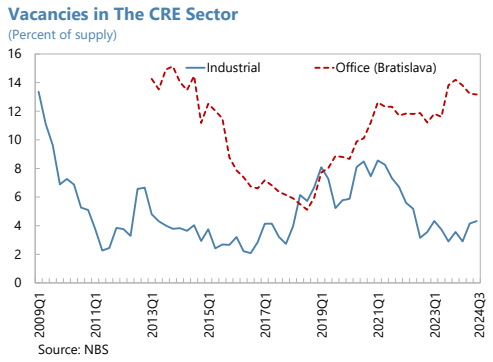
[11] In line with EU Directive no 2019/2162.

[12] Banks' loans to the CRE sector represent about 8 percent of total loan portfolios and make up 90 percent of all CRE-related loans. Households are indirectly exposed to CRE through their exposures to real estate investment funds. As of end 2023, the real estate investment funds relied up to 85 percent on the retail investor base and were exposed up to 65 percent to CRE via equity shares and debt exposures.

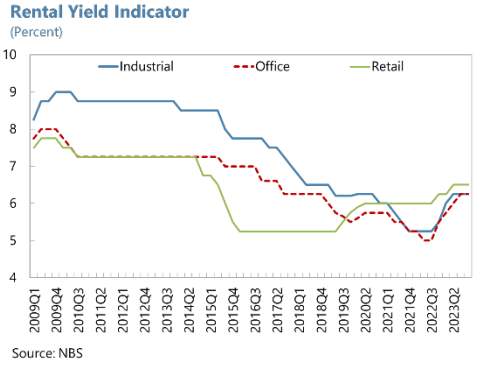
20 percent of CRE loans), demand has structurally declined with vacancy rate reaching 14 percent, and the interest expenses making up 20–30 percent of rental income. Higher-for-longer interest rates and weaker occupier demand could further depress property values and increase the riskiness of loans in this sector. CRE firms' profits have recovered in 2022, limiting NPLs increase in 2023, with most recent NPL rates falling to near pre-pandemic levels. Currently, there are no macroprudential tools specifically tailored to address CRE risk in place, emphasizing the need to scrutinize banks' CRE portfolios and closing data gaps to enhance oversight. (see the Technical Note on Macroprudential Policy Framework and Tools).

Figure 7. Slovak Republic: Developments in the CRE Sector

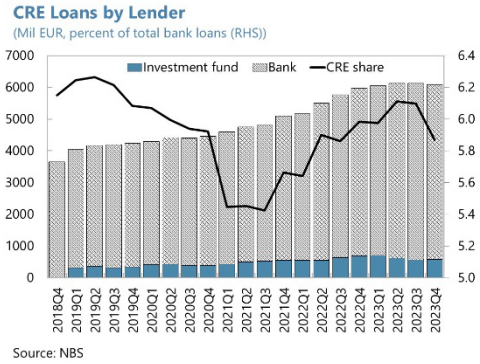
Vacancies have been increasing in the office sector, with other sectors having stabilized.



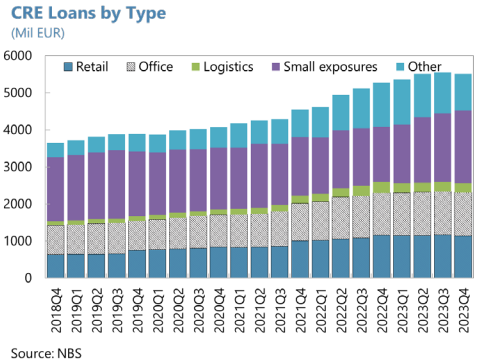
Rental yield indicators have picked up recently, after having decreased for most sectors during the pandemic.



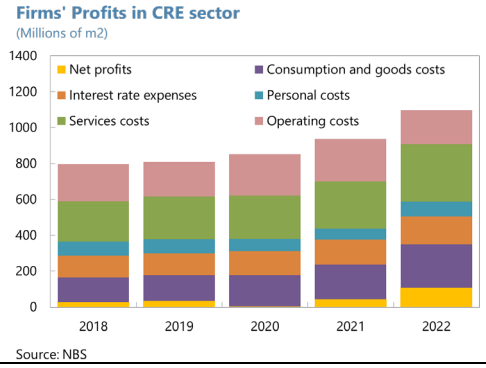
The CRE loan stock has been constant since beginning of 2023, with banks holding about 90 percent of all CRE loans...



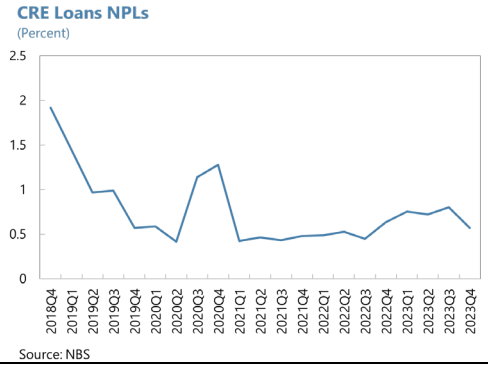
...and the exposure to the office sector having been constant at around 20 percent since the beginning of 2022.



CRE firms' profits have recovered in 2022, enabling them so far to stem higher interest rate costs...



...with NPLs remaining relatively low.



B. Scope of the FSAP Analysis

12. The FSAP assessed the Slovak banking system resilience to severe but plausible shocks based on four main exercises. Corporate stress test and households' analysis, banking solvency stress tests to assess resilience to credit, interest rate, and market risks; banking liquidity stress tests; and interconnectedness analysis were implemented. This set of analytical work (see Appendixes for technical details) explores the risks identified in the Risk Assessment Matrix (RAM) (Appendix I). The main objective of these analyses is to evaluate the potential impact of adverse economic and financial shocks on the stability of the Slovak financial system and identify key areas of risk.

13. In addition, the FSAP also assessed specific risks through sensitivity analysis. This includes (i) assessing the impact of vulnerabilities in the households and corporate sectors on the solvency of banks, highlighting how credit risk stemming from these sectors can influence overall banking stability and integrating sector-specific assessments with the broader banking stress test, and (ii) assessing liquidity to solvency interactions, also integrating the liquidity cash-flow analysis with the bank solvency stress test.

C. Macrofinancial Scenarios

14. The stress tests are based on a baseline and an adverse scenario with a horizon of three years (2024-26), with GDP shocks equivalent to a cumulative 2.6 standard deviations from the baseline scenario during the first two years (Figures 8 and 9).

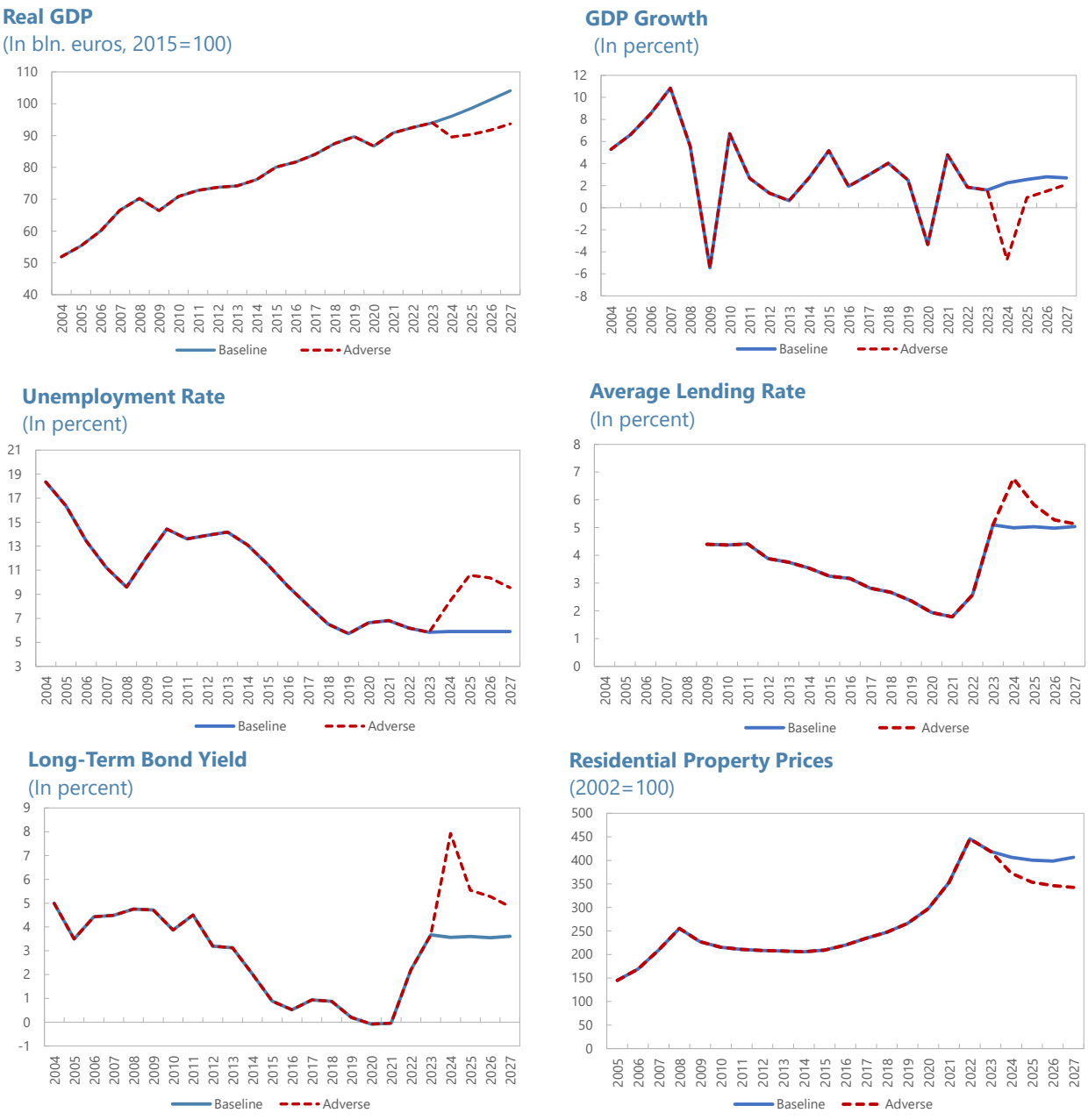
15. The baseline scenario is based on April 2024 WEO. The scenario assumes a mild economic recovery, driven by a rebound in consumption from falling inflation and a tight labor market, as well as continued government support measures, and improvements in supply conditions and exports offsetting a weak external environment. Financial conditions are projected to remain tight, with gradual monetary easing starting in 2025. Credit growth is expected to continue slowing, and house prices to drop by a cumulative 10 percent by 2026 before they gradually start to recover. While households and corporates remain broadly resilient, a fringe of households and some segments in CRE are more challenged by their higher debt burden.

16. The adverse scenario assumes an abrupt global slowdown and further escalation of regional conflicts, leading to spikes in energy and commodity prices and a deepening of the recession in the euro area. Interest rates are assumed to remain higher for longer, contributing to a sharper slowdown in Slovak economic growth. Financial conditions are also assumed to deteriorate in response to the weak fiscal situation, leading to a 350 basis-point increase in long-term bond yields. In this environment, property prices are assumed to drop by a cumulative 17 percent by 2026 before stabilizing, implying a deviation of about 12 percentage points relative to the baseline.[13] The

[13] The evolution of property prices under the adverse scenario is comparable to the correction observed between 2008–2014.

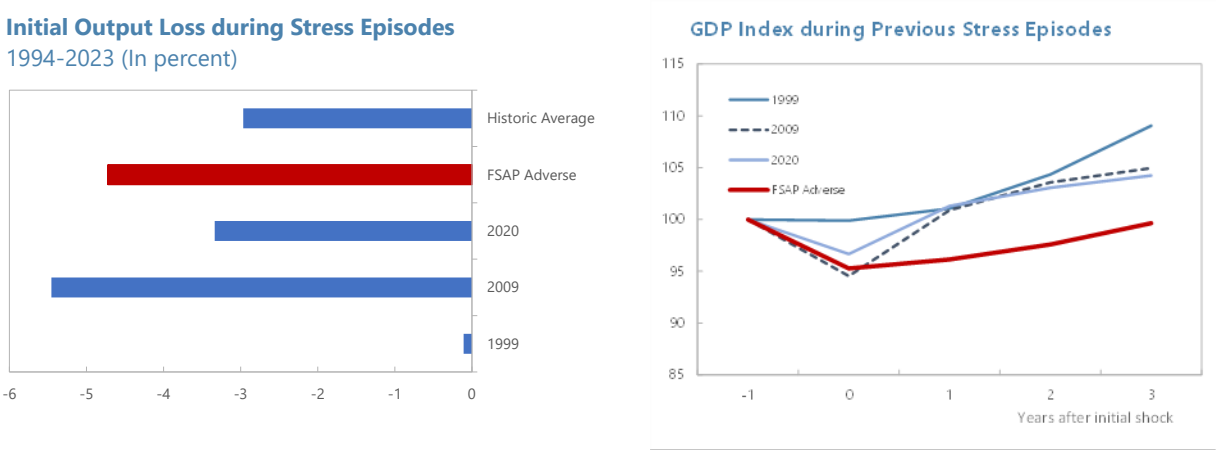
economic rebound is assumed to be less dynamic, remaining below potential during the three years of the projection, fueling unemployment to about 10½ percent by 2025 (Table 4).

Figure 8. Slovak Republic: Stress Test Scenarios



Source: Haver and IMF staff calculations.

Figure 9. Slovak Republic: Adverse Scenario Benchmark



Note: output losses are calculated as the GDP growth during the first year of stress episodes.
Source: Haver and IMF staff calculations.

Table 4. Slovak Republic: Macroeconomic Scenarios

		2023	2024	2025	2026
Real GDP growth	Baseline	1.6	2.2	2.6	2.8
(percentage)	Adverse	1.6	-4.7	0.9	1.5
Unemployment	Baseline	5.8	5.9	5.9	5.9
(percentage)	Adverse	5.8	8.3	10.6	10.4
Inflation	Baseline	11.0	3.2	3.8	2.4
(percentage)	Adverse	11.0	5.7	6.0	2.0
Property Prices growth	Baseline	-5.9	-3.0	-1.5	-0.5
(percentage)	Adverse	-5.9	-11.5	-5.1	-2.1
Short-term Rate	Baseline	3.0	3.0	3.0	3.0
(percentage)	Adverse	3.0	7.3	4.9	3.7
Long-term Rate	Baseline	3.7	3.6	3.6	3.6
(percentage)	Adverse	3.7	7.0	5.9	3.6
Term Spread	Baseline	0.6	0.6	0.6	0.6
(percentage)	Adverse	0.6	-0.4	0.9	-0.1

Source: WEO and IMF staff calculations.

CORPORATE STRESS TEST

A. Scope and Methodology[14]

17. The analysis is based on NFC data from the Orbis database, covering around 90 percent of Slovak firms in terms of turnover. The data comprised more than 200,000 non-financial companies from the Orbis database, maintained by Bureau Van Dijk. The firms are classified by their size (large, medium, small, and micro) and their main sector of economic activity (NACE rev 2).[15] While Orbis's coverage of micro firms is low in terms of the number of firms relative to the population, it offers comparable coverage regarding turnover and total assets across all firm sizes.

18. A scenario-based approach is employed to calculate the impacts under baseline and adverse scenario, as well as sensitivity analysis. Using firm-level data from 2005-2022, the elasticity of changes in turnover to GDP growth and the elasticity of changes in total operating costs to the inflation rate are estimated at 17 sectors separately by employing quantile regression (median). The estimated elasticities and the solvency stress test scenarios (baseline and adverse scenarios) are used to simulate changes in turnover and all operating costs at the firm level over three years (2024-26). Sensitivity analysis is also conducted by assuming additional negative shocks to the auto (manufacturing of motor vehicles) and CRE-related sectors (construction & real estate activities). The elasticities under the sensitivity analysis are estimated by employing the quantile regression with 25 percentiles instead of the median.

19. Potentially risky firms are identified using four financial indicators. These indicators are Return on Total Assets (ROTA), Interest Coverage Ratio (ICR), Working Capital over Total Assets (WC/TA), and leverage (Debt to Equity, D/E). They measure the capacity to cover the interest bills, profitability, liquidity, and solvency, respectively. Based on the firm-level financial statements simulated under different scenarios, the four financial indicators are constructed over 2024-26. Following the widely used ratios and the regression analysis, thresholds for these four indicators were set to identify potentially risky firms.

20. The probability of default (PD) for each firm is estimated by applying regression analysis accounting for non-linearities (Appendix III). The econometric model for predicting PD based on the four financial indicators is developed by merging Orbis and Moody's CreditEdge datasets.[16] Given the limited data on Slovak firms in CreditEdge, the model utilized the data from the Euro Area and Central and Eastern Europe (CEE) countries while controlling for this by adding

[14] See methodology details in Appendix II.

[15] Due to the large number of missing values for the number of employees, firm sizes are classified based on the annual turnover values by following the thresholds by EC (2020). The Nomenclature of Economic Activities (NACE) is the European statistical classification of economic activities. The analysis excluded financial and insurance activities (K), public administration and defense (O), activities of households as employers (T), and activities of extraterritorial organizations and bodies (U).

[16] Moody's CreditEdge estimates the likelihood that a publicly listed company will default on payments within a given period (one year in this analysis) based on the market information.

country and sector dummies.[17] Each of the four indicators was transformed into a set of dummy variables with intervals to capture the possible non-linear relationship between PD and the four financial indicators.

B. Results

21. While the number of risky firms increases under the adverse scenario, the overall rise remains relatively limited, especially regarding debt share (Figure 10)**.** The number of firms at risk, defined as those breaching the thresholds for each of the four indicators, increases by 8 percentage points on average (ranging from 4 to 13 percentage points depending on the indicator) from 2023 to 2026 under the adverse scenario. These increases are smaller in terms of debt share at an average of 5 percentage points (ranging from 2 to 8 percentage points). The increase in the firms at risk under the sensitivity analysis shows a similar trend, with a limited impact in terms of debt share (an additional 2 percentage points deterioration) while almost doubling in terms of the number of firms.

22. The PD increases by 2.2 percentage points on average under the adverse scenario, with micro and small firms and some service sectors among the more vulnerable. The estimated PD (average for the total firms weighted by turnovers) increases by 2.2 percentage points over the three years under the adverse scenario and 3.5 percentage points for the sensitivity analysis. The increase in the PD is relatively high for sectors like trade and accommodation/restaurants, while low for sectors such as health and entertainment. The construction sector experiences a significant increase in the PD under the sensitivity analysis, highlighting the importance of close monitoring of existing risks in the CRE sector and provisioning for expected losses when risks materialize (Figure 10).

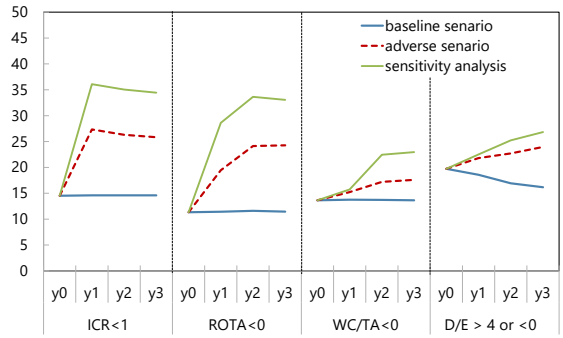
23. The large corporate borrowers appear relatively resilient to shocks. The analysis focused on the 10 largest corporate borrowers in each bank to assess concentration risk (large exposure) in loan portfolios. These largest borrowers account for 12 and 29 percent of total NFC loans for SIs and LSIs, respectively, while their share in total loan portfolios is much lower (around 3 to 4 percent). The PDs for these large corporate borrowers, estimated using the results from the corporate stress test, shows that the increase for these large borrowers is much smaller than aggregate banks' NFC PDs, suggesting risks from large exposure in NFC loan portfolios are lower (Figure 10).

[17] CEE countries in this analysis refer to EU member states (i.e., Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia, and Slovakia).

Figure 10. Slovak Republic: Corporate Stress Tests

Under the adverse scenario, the number of firms at risk increases by 8 pp on average across four indicators, …

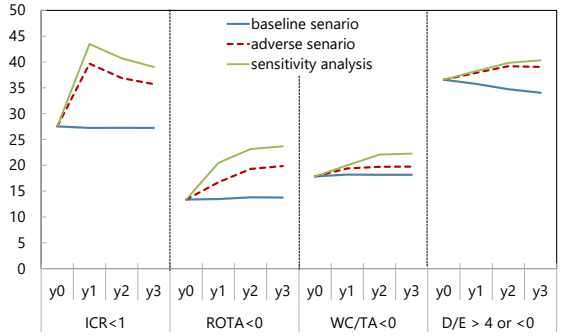
Firms at Risk (share of firm number)
(Percent of total number of firms, weighted by turnover)



Sources: Orbis and IMF staff estimation

… but the increase is smaller in terms of debt share.

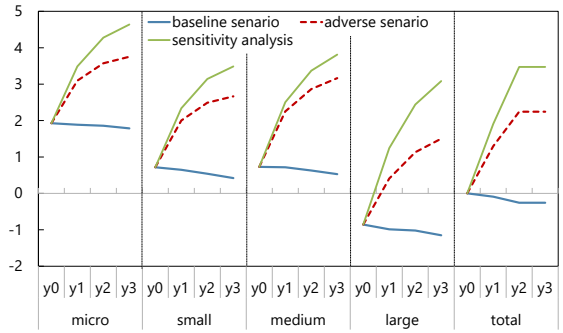
Firms at Risk (share of debt)
(Percent of total corporate debt)



Sources: Orbis and IMF staff estimation

Smaller firms could ultimately face higher PD levels due to ther higher initial levels.

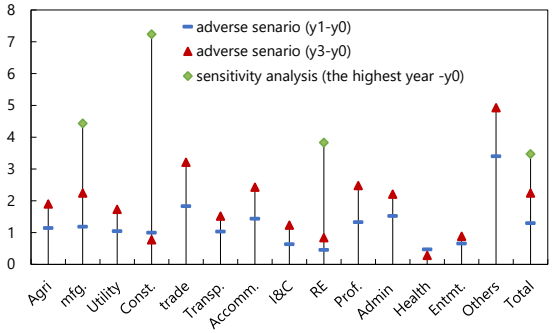
PD by Firm Size (difference between 2023 national average)
(percentage points, weighted average by turnover)



Sources: Orbis, Moody's, and IMF staff estimation.

The construction sector experiences a significant increase in PD under the sensitivity analysis.

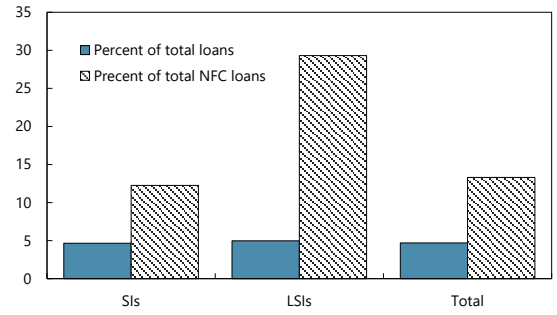
PD by Sector (changes from 2023)
(percentage points, weighted average by turnover)



Sources: Orbis, Moody's, and IMF staff estimation.

The 10 largest corporate borrowers at each bank account for around 13 percent of total NFC loans.

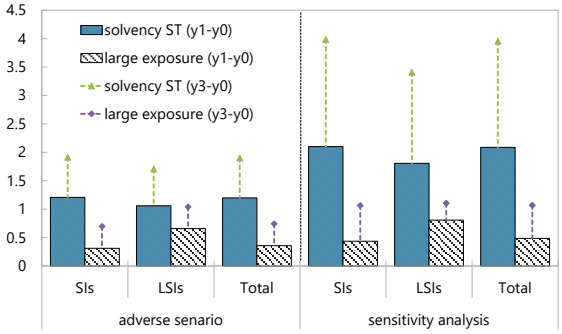
Loan Share of the Ten Largest NFC Borrowers at Each Bank
(In percent)



Note: Firms in default are excluded.
Sources : NBS and IMF staff calculation.

The increase in PDs for the large corporate borrowers is much lower than the aggregate increase in NFC PDs.

PD: Comparison between Large Exposure and Solvency ST
(changes from 2023 PD, percentage points, weighted by outstanding loan value)



Sources : NBS, Orbis, Moody's, and IMF staff estimation.

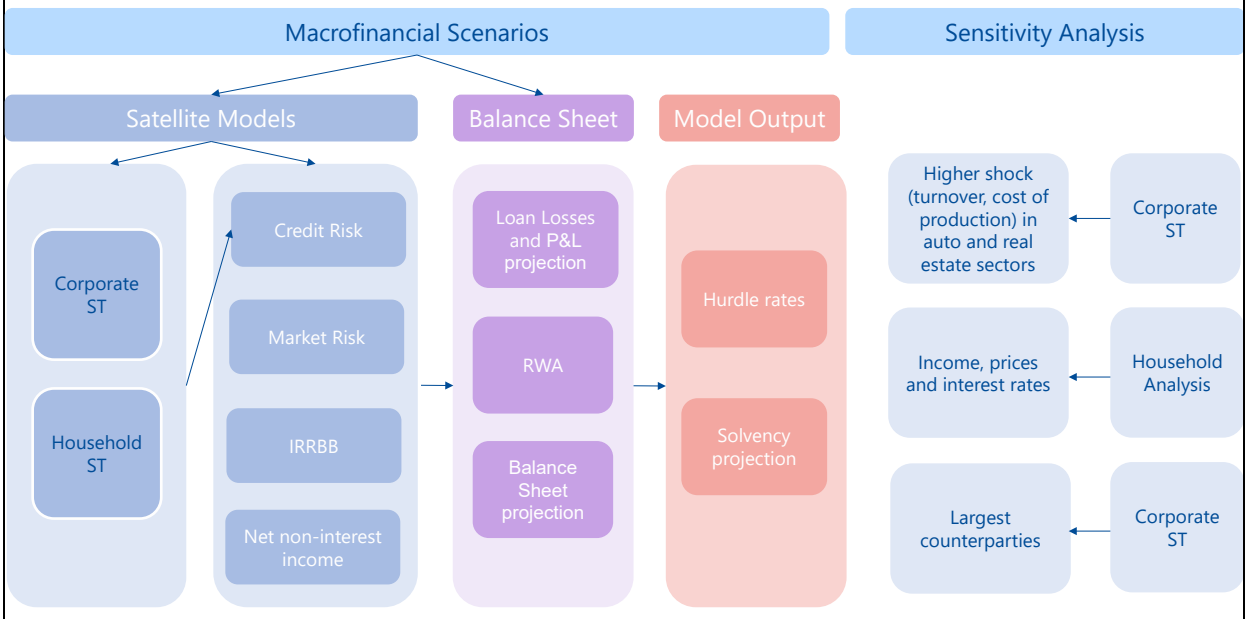
BANK SOLVENCY STRESS TESTS

A. Scope and Approach

24. The FSAP stress tests examine the resilience of the banking system to solvency and liquidity risks based on supervisory data. The top-down (TD) solvency stress test measures the effects of the macroeconomic shocks on individual banks' profitability and capitalization, through satellite models and methodologies developed by IMF staff (Figure 11). The TD liquidity tests assess the capacity of banks to withstand large withdrawals of funding. The liquidity analyses comprise the estimation of the LCR and NSFR under alternative liquidity stress scenarios and cash flow-based analysis over different stress horizons.

25. The stress tests cover a total of 9 banks, of which 4 are SIs and 5 are LSIs. The banking sector is highly concentrated and primarily foreign owned. The four largest and systemically important (SI) banks account for 73 percent of banking-sector assets, all of which are part of large European banking groups and under ECB direct supervision. Banks are domestically oriented and rely on a traditional business model with little dependence on financial markets.

Figure 11. Slovak Republic: IMF Approach to Bank Stress Test



Source: IMF staff.

B. Methodology[18]

26. The projections of revenues, expenses, loan losses and valuation losses are based on bank-by-bank simulation of balance sheets over the scenario horizon. Most components of the model are projected using data on historical revenues and operating and other non-credit-related expenses based on a mix of regression and structural models. Consolidated data were used for SIs and individual data for LSIs. The cut-off date for the stress test is December 31, 2023, and the main source is supervisory data, collected under the Financial Reporting (FINREP) and Common Reporting (COREP) Standards, and NBS macroprudential data.

Credit Risk

27. Provisions are calculated as expected credit losses (ECL) for all asset classes with exposure at default. The key risk parameters used are exposures stage distribution, PD, Loss Given Default (LGD), RWA broken down by exposure class for a total of 4 portfolios: households mortgages and consumer loans, NFC, financial institutions (FI) and government (gov).[19] Starting points for risk parameters assigned to each portfolio are sourced from COREP C09.01 (standardized approach, SA) and C09.02 (Internal ratings-based approach, IRB).

28. Projections credit risk parameters were obtained by leveraging microdata models for corporates and households. The corporate stress tests used microdata on Slovak firms from Orbis database and link the financials indicators vulnerability analysis to PDs using Moody's CreditEdge database and regression analysis (see ¶16 and Appendix III). Household analysis identified vulnerable households who may be at risk of default using the 2023 Household Finance and Consumption Survey and estimated the link between being financially vulnerable (DSTI above 70 percent) and the likelihood of default at the individual household level using the Survey of Income and Living Conditions (see Appendix IV).[20]

29. Credit quality of loans (stocks and flows) are modeled using the IFRS9 approach. For the NFC loan portfolio, bank level PDs are estimated using the corporate stress test results and bank-by-bank exposures by sector and firm size. Then PDs are mapped to transition matrices (TM) using the beta linking method[21] (mapping according to the most recent observed TMs). For household loans, the share of debt at risk (outstanding debt to financially vulnerable households) and the estimated probability of default is used to project bank-by-bank households' loans distribution across IFRS9 stages under baseline and adverse scenarios (see Appendix V, Figures 12-14).

[18] The TD solvency stress tests methodology is in line with other recent European FSAPs, mainly Finland (2022), Spain (2023) and the ongoing 2025 Euro Area FSAP (see Appendix II).

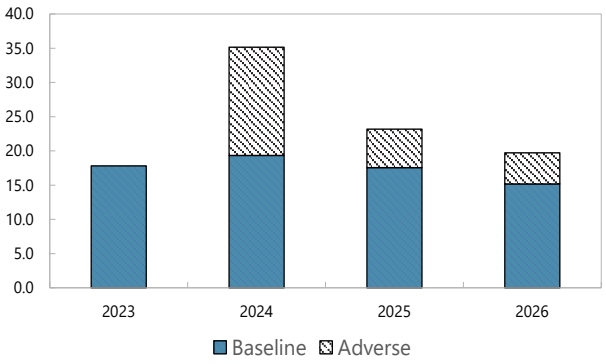
[19] Geographical segmentation is not considered explicitly, since most of the exposures are local and only 1 bank reports geographical exposures in the credit risk templates (FINREP/COREP).

[20] Analysis based on Valderrama et al. (2023).

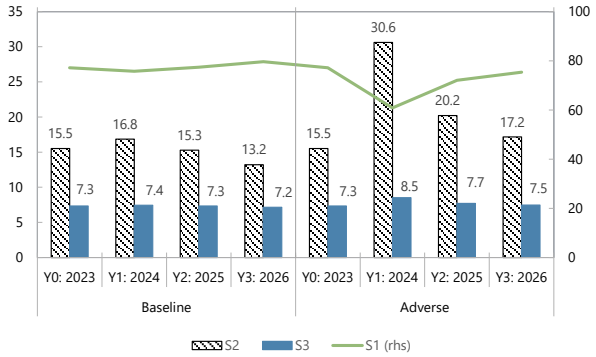
[21] Gross et al. (2020).

Figure 12. Slovak Republic: Households Credit Risk

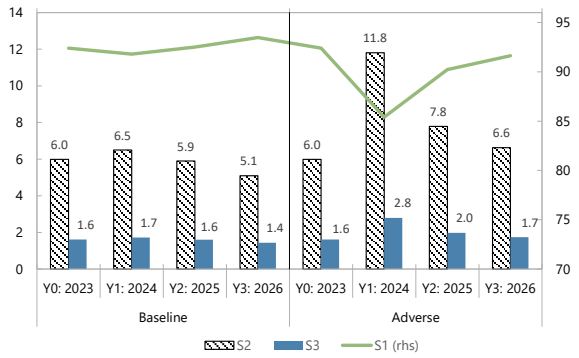
Share of Debt at Risk
(Share of HH with DSTI + Essential >=70%)



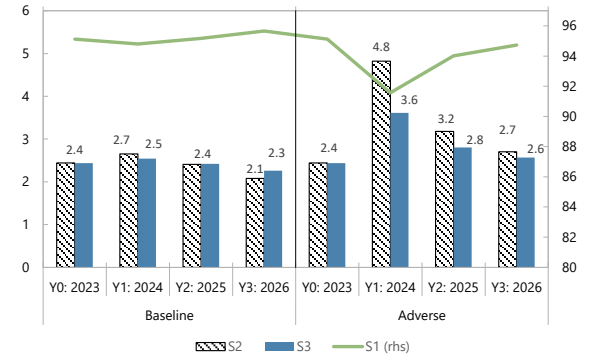
Share of Debt at Risk
(Share of HH with DSTI + Essential >=70%)



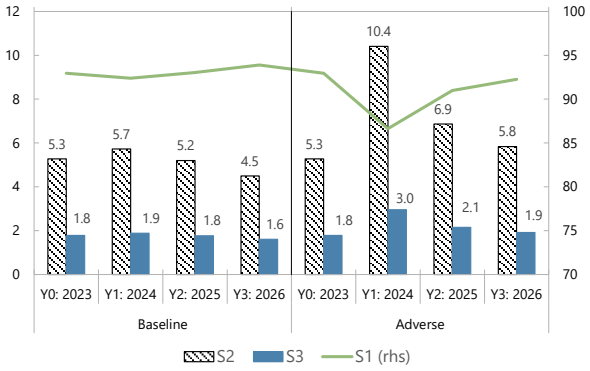
Stage Distribution: SIs
(Percent)



Stage Distribution: LSIs
(Percent)



Stage Distribution: All Banks
(Percent)

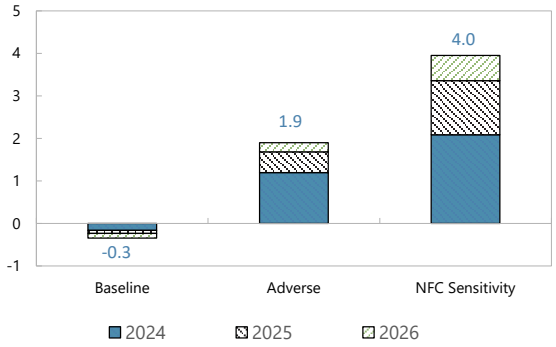


Note: Chart 2 shows to the projection of the household model which results in a starting loan stage distribution different to the actual observed distributions at bank level. Charts 3-5 show the results after mapping household model results to the bank-by-bank data taking into account their initial levels.

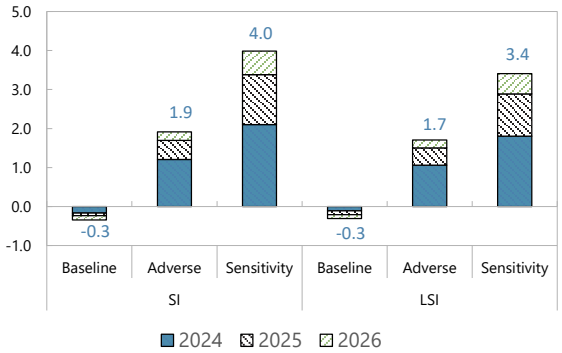
Source: NBS and ECB. IMF staff calculations.

Figure 13. Slovak Republic: NFC Credit Risk

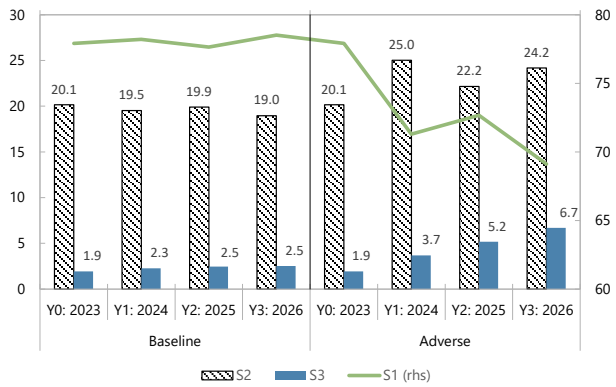
Increase in PDs: NFC
(Percentage points)



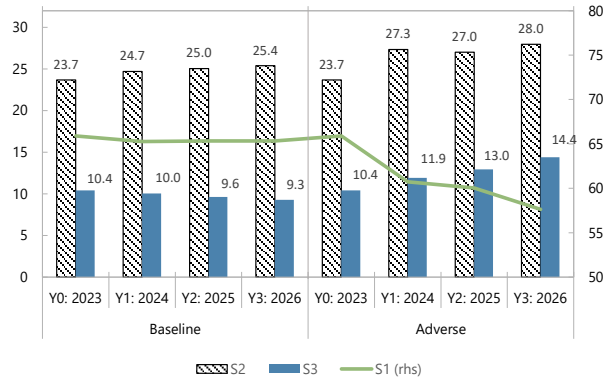
Increase in NFC PDs: SI vs LSI
(Percentage points)



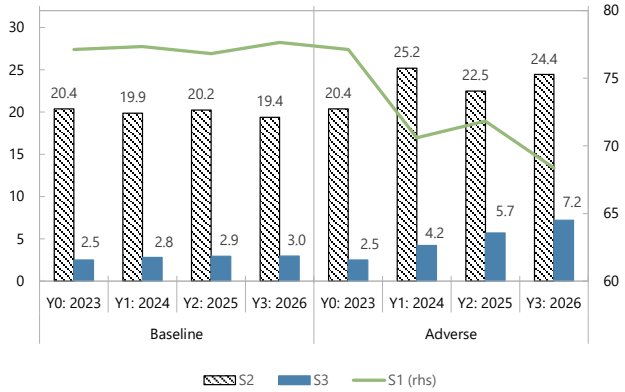
Stage Distribution: SIs
(Percent)



Stage Distribution: LSIs
(Percent)

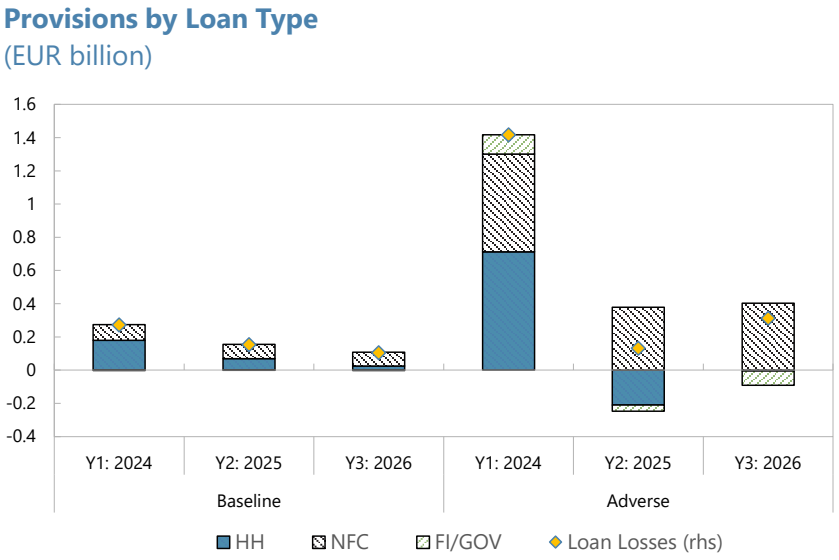


Stage Distribution: All Banks
(Percent)



Source: NBS and ECB. IMF staff calculations.

Figure 14. Slovak Republic: Loan Losses



Source: NBS and ECB. IMF staff calculations.

30. LGDs for collateralized lending are calibrated assuming a linear relationship between house price index and the recovery value, using the starting point reported LGDs and house price paths from the macro scenario. LGD for unsecured lending is calibrated through the Frye-Jacobs method.[22] Other exposures are assumed to have constant LGDs throughout the scenario.

31. Credit risk RWAs are updated according to the portfolio regulatory treatment. For the standardized approach (SA), densities at the cut-off point are assumed constant over the scenario horizon. For the Internal Risk Based approach exposures, Basel formulas are used to calculate credit RWAs for each asset portfolio, using projections of point-in-time default rates to obtain through-the-cycle PDs. Downturn LGDs are updated only if stressed LGDs exceed what is reported by banks and kept constant otherwise.

Market and Interest Rate Risks

32. The market risk component estimates valuation losses due to interest rates changes on fair value sovereign and corporate debt securities. Market risk losses on the securities portfolios at fair value through P&L (FVPL) and fair value through Other Comprehensive Income (FVOCI) accounts are calculated as an additional component of the stress test capital impact. Other

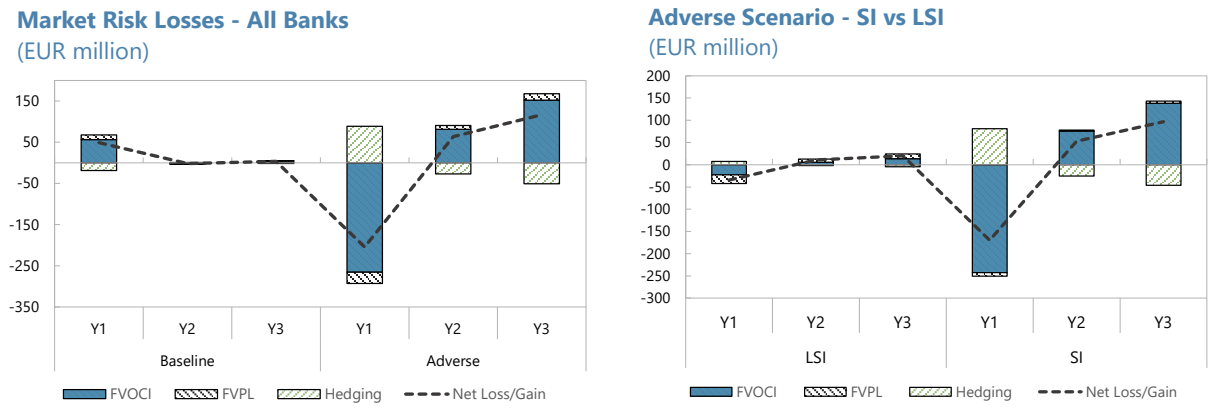
[22] J. Frye and M. Jacobs (2012).

instruments, such as commodities and equities are not considered due to low materiality for Slovak banks.[23]

33. Valuation losses for debt securities are assessed through a modified duration approach. The module considered losses in the value of fixed income securities due to interest rate and sovereign spread shocks. Losses on FVOCI securities contribute to accumulated OCI. The amortized cost portfolio (AC) was not included in this module, to comply with accounting standards, but a sensitivity analysis was performed to gauge the extent of unrealized losses (¶61-63).

34. Supervisory reporting on sovereign exposures was used as the main source of banks' positions.[24] Duration is approximated as the mid-point maturity bucket, for different classes of fixed-income securities and seven maturity buckets.[25] The impact of hedging was considered following NBS guidance on Slovak banks recent patterns.[26]

Figure 15. Slovak Republic: Market Risk



Source: NBS and ECB. IMF staff calculations.

[23] The investment portfolio of Slovak banks is mainly comprised by government and corporate bonds under AC and investments in equity instruments represent less than 3% of total regulatory capital. The Net Open Position (NOP) in other major currencies (US dollar, British pound sterling, Czech Koruna and Polish Zloty) is below 1% for all banks in the sample.

[24] Specifically, COREP C33.00 reported in 2023Q4, complemented by NBS data.

[25] These are: below three months, between three months and one year, between one and two years, between two and three years, between three and five years, between five and ten years, above five years.

[26] According to NBS, a third of the FVOCI bond portfolio is being interest rate hedged to stabilize revaluation reserves, therefore the model includes the simplifying assumption that hedging mitigate a 1/3 of OCI valuation losses.

Figure 16. Slovak Republic: Interest Rate Risk in the Banking Book

Source: NBS and ECB. IMF staff calculations.

35. Market RWA was updated based on the balance sheet growth. The projection of RWA assumes that the current market risk contribution to total RWA for each bank is constant during the stress test horizon.

36. A structural model is used to project the net interest income (NII) components of the stress test. Several interest-bearing assets and interest-paying liabilities were considered, aggregating portfolios considered in the credit and market risk modules. Bank-specific projections are obtained based on: (i) initial exposures generating interest income and expenses, (ii) the repricing and maturity profile, derived from IRRBB and maturity ladder reporting, respectively, which is assumed constant during the stress test horizon, (iii) initial effective interest rates, and (iv) the projection of interest rates on new business. The structural model adjusts the estimated NII with the projected non-performing exposures (see Appendix VI, Figure 16).

Non-interest Income and Expenses

37. Net fee and commissions income (NFCI) is projected in stressed conditions based on the historical variance of the non-interest income components by income activity. For the baseline scenario, NFCI grows in line with the bank's business (i.e. shares of non-interest income and non- interest expenses to total assets are kept constant). Under the adverse scenario, NFCI is assumed to have a shock during the first year and is projected to be equal to the baseline scenario net income minus one standard deviation of the historical variability at the end of the first year of the horizon; the following years NFCI grows in line with balance sheet growth under this scenario.

38. Other operational income and expenses, as well as administrative costs grow at the same rate of the balance sheet under the baseline and adverse scenarios. Extraordinary items and minority interest are assumed to be equal to zero.

Balance Sheet and Capital Dynamics

39. Balance-sheet components are projected using a quasi-static assumption under the adverse scenario. The projected balance sheet items are assumed to grow at a rate equal to the nominal GDP growth when the latter was positive. The growth is set to zero when the economy shrinks, assuming banks do not deleverage during the recession.

40. The tax rate is set at the bank-specific median effective tax rate across the past five years for the stress testing horizon in case of positive net income and zero otherwise. Capital impact projections also take into account the temporary bank levy following the Slovak regulation (levy of 30 percent in 2024, 25 percent in 2025 and 20 percent in 2026).

41. Only well capitalized banks are assumed to have dividend payouts. Dividends are assumed to be paid out of each period net income after taxes and bank levy by banks in compliance with supervisory capital requirements. The dividend payout ratio is determined from the bank-specific median dividend payout ratio over the past five years. If banks are not well capitalized or income is negative, it is assumed that there is no dividend payout. Also, the model does not consider new shares issuances or share repurchases during the stress test horizon.

42. Minimum capital requirements used as hurdle rates were consistent with the Slovak capital regulatory standards that reflect Basel III capital requirements. The hurdle rate applied

in the stress test accounts for Common Equity Tier 1 (CET1) regulatory minimum of a 4.5 percent Pillar 1 requirement, bank-specific Pillar 2 requirements, Capital Conservation Buffer (CCoB) of 2.5 percent and the bank specific O-SII buffers, while CCyB is not included as part of the hurdle rate for both baseline and adverse. This led to a CET1 hurdle rate around 9.9 percent for the system. For the leverage ratio the hurdle rate of Pillar 1 requirement was considered, corresponding to 3 percent.

C. Results

43. The Slovak banking system has high levels of capital buffers and banks appear resilient to severe macrofinancial shocks (Figure 17). In the baseline scenario, the aggregate total capital ratio is on a downward trajectory, mainly due to the impact of the bank levy on profits (close to 2 percentage points over the 3-year horizon). However, credit impairments remain low and banks' revenue-generating capacity from NII is stable. The system's aggregate capital ratio would decrease from 20.5 to 19.8 percent in 2026.

44. In the adverse scenario, the aggregate total capital ratio declines by 4.6 percentage points to 16 percent at end-2025. In the same year, aggregate capital projection is 3.8 percentage points lower compared to the baseline, and the decline is more pronounced for SIs (decrease of 5.1 percentage points to 15 percent). On aggregate, banks record losses in the first year of the stress test horizon, but have a subsequent recovery in the last years of the scenario. The decline in the capital ratio is mainly a result of credit impairments and lower revenue generation from NFCI compared to the baseline scenario. All banks meet the minimum capital and leverage requirements, including the capital conservation buffer (CCoB) and the other systemically important institutions buffer (O-SII, Figure 17).

45. Credit impairments and provisions are the key factor underpinning the profitability decline in the adverse scenario. Three-year cumulative credit impairments contribute to 3.4 percentage points of the capital decline, compared to 1.1 percentage points in the baseline scenario (Figure 17). Most of the credit risk impairments are recorded during the first year of the scenario. The sharp increase in interest rates after the first year under the adverse scenario allows banks to compensate with high NII. Despite the interest rate shock (350 basis points on average), market risk losses are contained due to the limited size of the fair value investment portfolio.[27]

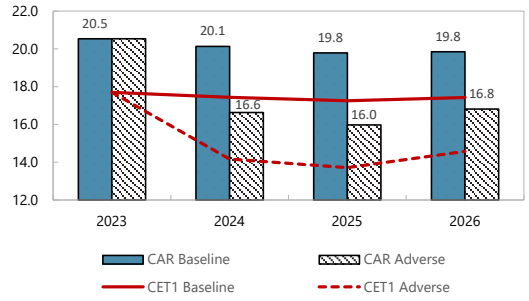
[27] AC bonds accounts for 88.3 percent of the aggregate bond portfolio for Slovak banks and 13.4 percent of total assets.

Figure 17. Slovak Republic: Solvency Stress Test Results

All banks are highly capitalized at the start of the stress test. Total capital and CET1 capital sufficiently cover losses under the adverse scenario.

Capital Ratios

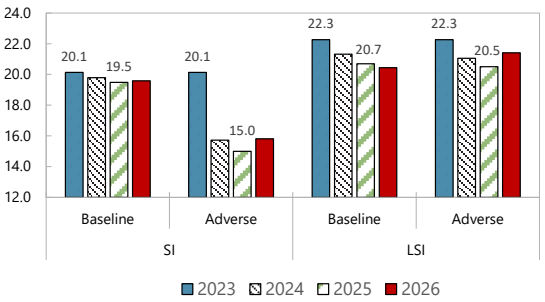
(Percent)



Capital decline is more pronounced for SIs compared to LSIs.

Capital Ratio – SI vs LSI

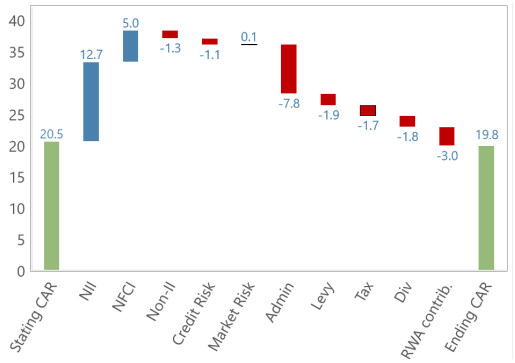
(Percent)



The total capital ratio is on a downward trajectory in the baseline scenario, mainly due to the impact of the newly implemented bank levy.

Baseline: Cumulative Impact up to Year 3

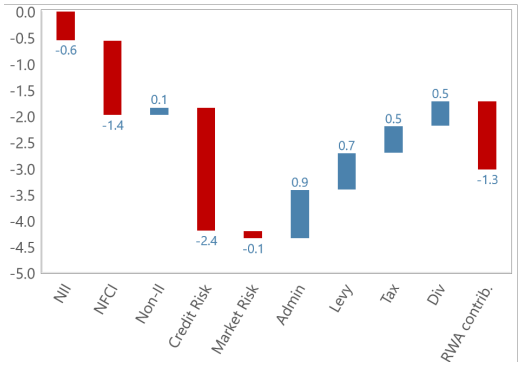
(Percent of 2026 RWA, except for starting CAR)



Credit impairments are the key factor underpinning the profitability decline in the adverse scenario.

Adverse - Baseline: Cumulative Impact

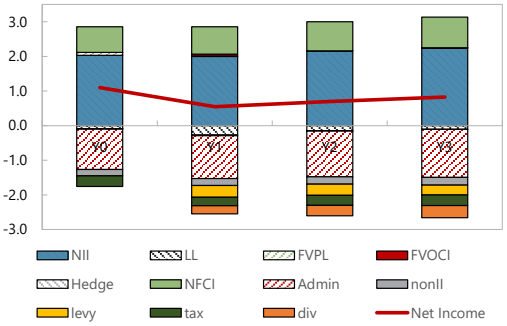
(Percent of 2026 RWA, except for starting CAR)



High NII keeps supporting income generation for the banking system under the baseline scenario.

P&L: Main Contributors – Baseline

(EUR billion)



Banks record losses in the first year of the adverse scenario but have a subsequent recovery.

P&L: Main Contributors – Adverse

(EUR billion)

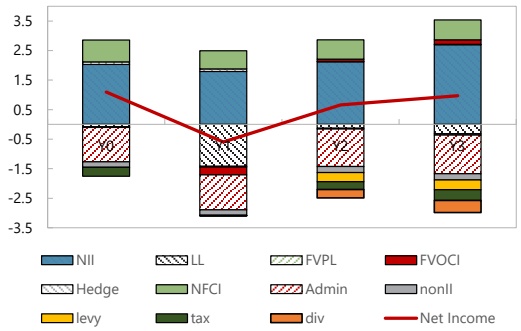
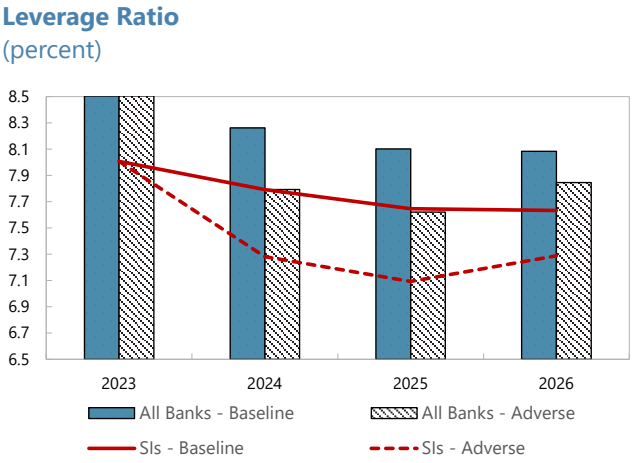


Figure 17. Slovak Republic: Solvency Stress Test Results (Concluded)

Aggregate leverage ratio is also on a downward trajectory, but all banks remain well above the hurdle rate of 3 percent.



Note: NII: net interest income, LL: loan losses, FVTL: fair value through profit and losses, FVOCI: fair value through other comprehensive income, NFCI: net fee and commission income, nonII: net non-interest income.

Source: NBS and ECB. IMF staff calculations.

46. The increase in loan loss provisions under the adverse scenario across the nine banks is not homogeneous. The extent of variability appears to hinge on the specific composition of their lending portfolios and the banks' capacity to compensate losses with higher interest income due to a shorter repricing profile. However, the divergence among the largest banks is not markedly substantial, while the smaller banks see on average lower impact. Contrastingly, market losses exhibit a more heterogeneous pattern across banks reflecting the differences in the size of fair value securities portfolios.

D. Sensitivity Analysis

47. Given the significant contribution of the NFCI in the profit generation of the Slovak banking system, a sensitivity analysis was conducted (Figure 18). The adverse scenario assumes a shock equivalent to one standard deviation of the last 5 years of the NFCI for each bank in the first year, which on aggregate implies a decrease of 17.5 percent compared to the starting NFCI. The sensitivity analysis, with the decline in NFCI ranging from 5 to 20 percent, indicates a low sensitivity to capital impact, even assuming a non-conservative shock of 5 percent.[28]

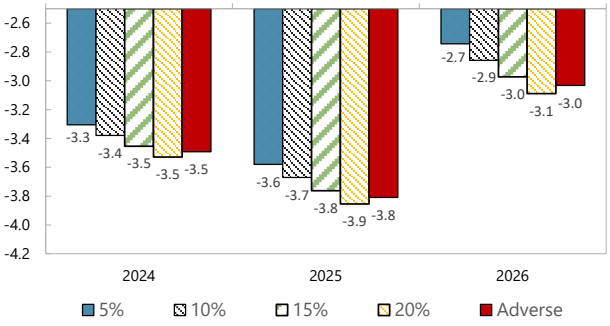
48. Sensitivity analyses on the satellite credit risk models were conducted, with different stand-alone shocks on the macro variables underpinning the household vulnerability model. The scenarios of the households sensitivity analyses aimed to assess the impact of individual and

[28] The difference in the NFCI capital impact between baseline and adverse scenarios is mainly explained by the assumption that in the baseline NFCI grows in line with the business growth (i.e. nominal GDP growth) while in the adverse scenario NFCI has a negative growth. Therefore, the magnitude of the NFCI shock in the adverse does not change significantly the impact result.

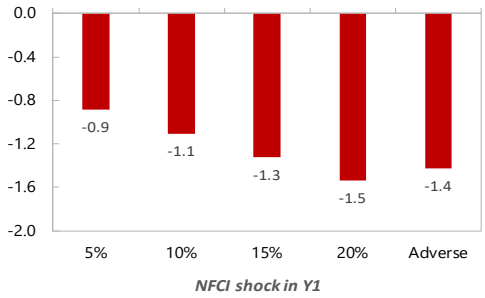
combined ad-hoc shocks on macrovariables on the share of the Slovak vulnerable households and the corresponding estimation of debt at risk (Figure 18). All scenarios show lower impact on capital ratios compared to the adverse scenario, highlighting the severity of the FSAP adverse scenario.

Figure 18. Slovak Republic: Sensitivity Analysis Results

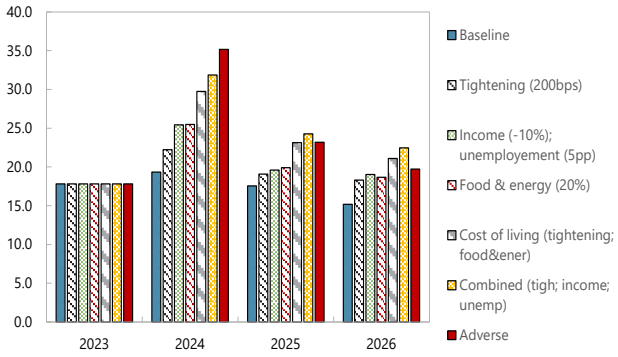
Adverse - Baseline: Impact on Capital Ratio with Different Shocks to NFCI
(percentage points)



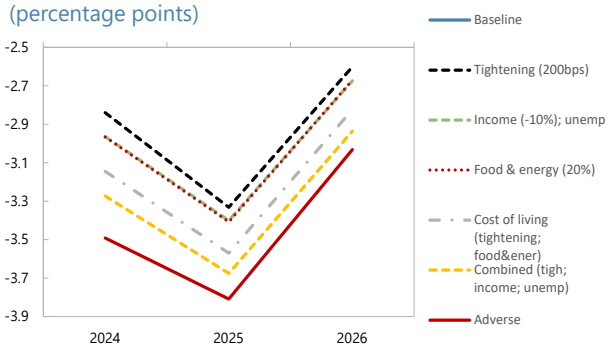
Adverse - Baseline: NFCI Cumulative Capital Impact
(percent of 2026 RWA)



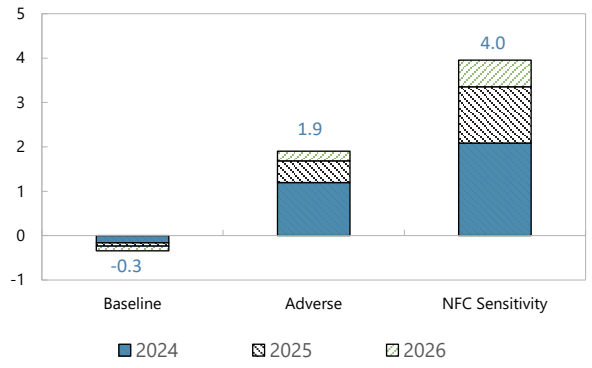
Share of Debt at Risk: HH Sensitivity Analysis
(share of HH with DSTI +essential >=70%, percent)



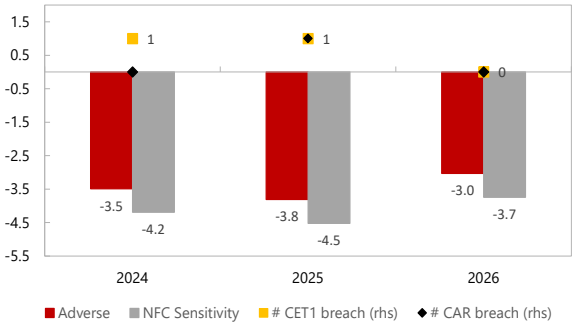
Adverse - Baseline: Capital Impact HH Sensitivity Analysis
(percentage points)



Increase in PDs: NFC Sensitivity Analysis
(percentage points)



Adverse - Baseline: Capital Impact NFC Sensitivity Analysis
(percentage points)



Source: NBS and ECB. IMF staff calculations.

49. The sensitivity analysis on NFC PDs focused on a higher shock on auto and real estate-related sectors combined with the adverse scenario. A most conservative scenario for the corporate portfolio assumes an additional negative shocks to the auto (manufacturing of motor vehicles) and CRE-related (construction & real estate activities) sectors. Results show a higher impact on aggregate capital ratios with a decline of 5.3 percentage points to 15.3 percent in 2025 (4.5 percentage points decline compared to the baseline, compared to 3.8 percentage points in the adverse scenario). Although all banks meet the minimum capital requirements, one bank would not meet its CCoB/O-SIIB.

50. The NBS should continue to assess and incorporate the potential impact from emerging risks and changing macroeconomic environment in its stress tests. While the impact of the bank levy is absorbed by NII under the baseline scenario, it could have larger and longer-lasting implications if it is not phased out as scheduled[29] and becomes more permanent. Furthermore, the recently announced financial transaction tax (FTT)[30] could affect banks through its impact on activities and behavioral changes of clients, though the direct impact seems limited. Future stress tests should incorporate a changing macroeconomic environment and assess its potential impact on financial stability in a timely manner.

BANK LIQUIDITY STRESS TESTS

A. Overview

51. Deposits dominate the structure of liabilities, making up 67 percent of total liabilities. The funding structure exhibits a stable and diversified composition, with household and corporate deposits forming the backbone, accounting for 58 percent of the funding (Figure 19).[31] Household deposits constitute the largest share, accounting for 36 percent of the total funding, followed by corporate deposits at 22 percent. Secured and unsecured bonds account for 11 percent, underscoring a measured approach to market-based funding. Demand deposits constitute 72 percent of total deposits, reflecting depositors' high preference for liquidity. The share of time deposits has increased since mid-2022, to 26 percent from 24 percent in 2019, mainly driven by corporates.[32] Figure 15 offers a comparison of the Slovak banking system structure with selected European countries in terms of liabilities, liquid assets, available stable funding, and assets.

[29] See the 2023 Article IV Staff Report for Slovak Republic.

[30] FTT is expected to be levied on NFCs transactions using banks (e.g., transfers, ATM withdrawals and card transactions), similar to Hungary (see the 2024 Article IV Staff Report for Hungary).

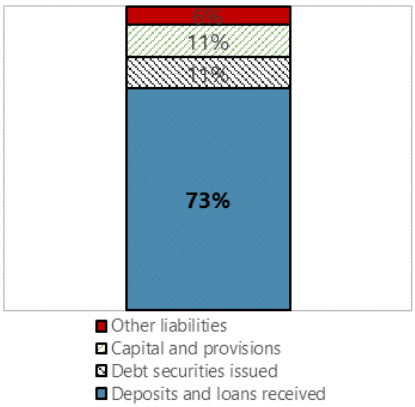
[31] Breaking down deposits by depositor type, households' deposits make up 66 percent, while corporate deposits constitute 34 percent. This composition has been stable since 2012. Resident deposits overwhelmingly dominate at 96.4 percent, with non-resident deposits contributing a modest 3.6 percent. This strong reliance on domestic sources for deposit funding suggests lower vulnerability to external shocks.

[32] Looking at households' sector, demand deposits represent 74 percent of total deposits as of end 2023, from 68 percent in 2019. By contrast, the share of demand deposits in corporate accounts declined from 82 percent to 69 percent over the same period.

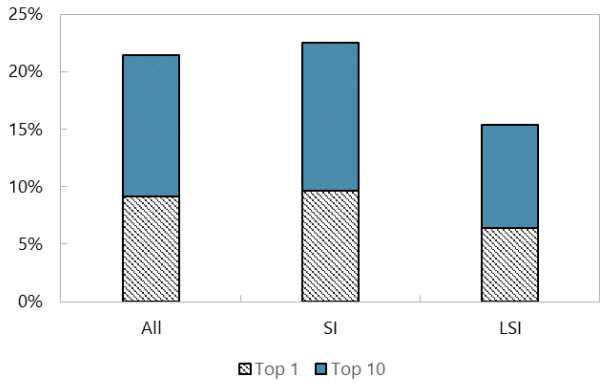
Figure 19. Slovak Republic: Banks' Balance Sheet and Funding Composition

Composition of Banks' Assets (2023Q4)

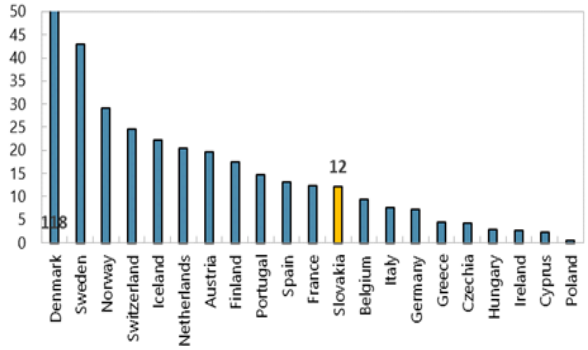
Composition of Bank's Liabilities (2023Q4)



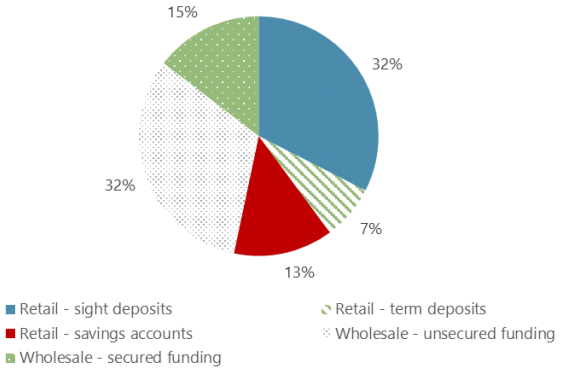
Concentration of Funding by Counterparty
(Percent)



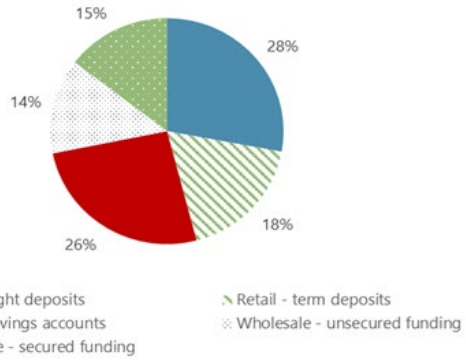
Outstanding Covered Bonds
(Backed by mortgages only, percent of GDP, 2023Q4)



Concentration of Funding by Product
(SIs, percent)



Concentration of Funding by Product
(LSIs, percent)



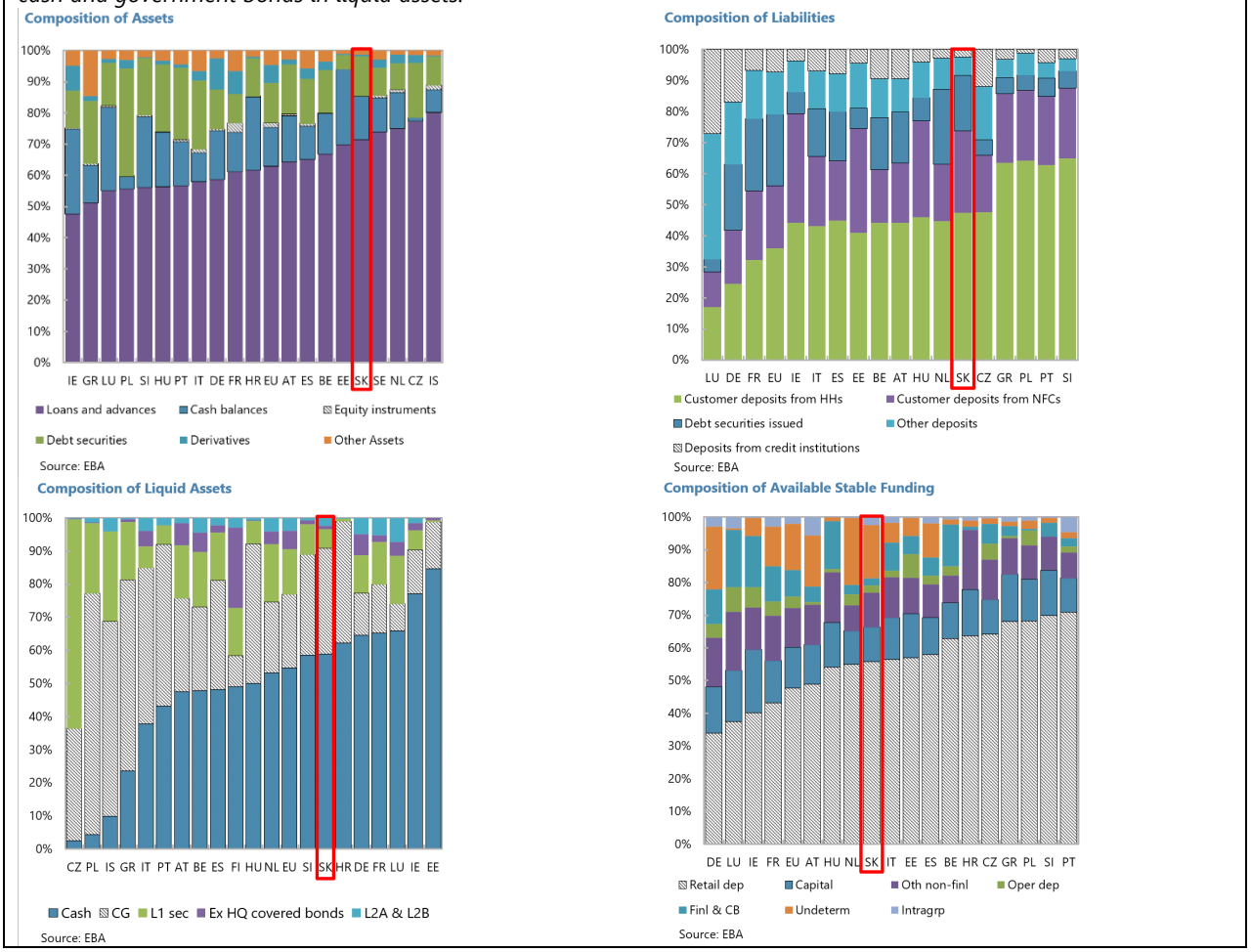
Source: NBS, ECB, and European Covered Bond Council. IMF staff calculations.

52. Asset encumbrance, funding concentration, and the share of covered bonds in funding remain low. Supervisory data for the nine banks show that the overall asset encumbrance, measured by the ratio of encumbered to unencumbered assets, is low at 25 percent (24 percent for SIs and 30 percent for LSIs). This is in line with the relatively low share of debt securities at 14

percent of total liabilities, with covered bonds representing 10 percent of total liabilities, although there is a large heterogeneity between banks. The share of covered bonds as a percentage of GDP is relatively high compared to Eurozone countries but much lower than in Scandinavian countries. The concentration of funding by counterparty shows the largest funding source represents less than 10 percent of total funding, while the top 10 sources account for less than 25 percent. LSIs exhibit even lower concentration. The concentration of funding by product shows that SIs rely more on wholesale funding compared to LSIs (Figure 20).

Figure 20. Slovak Republic: Comparison with Selected European Banking Systems

Slovakia is part of EU countries with the largest dominance of loans in assets, retail and NFC deposits in liabilities, and cash and government bonds in liquid assets.



53. Liquidity stress tests assessed the banking sector's resilience to funding and market liquidity shocks using standard regulatory and cash-flow analyses. The analysis covers nine banks, including four SIs, and uses bank-level supervisory data from common reporting (COREP) as of December 2023, which provides detailed information on liquid assets, cash inflows and outflows, maturity ladder, funding sources, and asset encumbrance. Liquidity stress tests focus on liquidity in

EUR as funding and exposures in other currencies are minimal.[33] The Liquidity Coverage Ratio (LCR) stress test measures banks' ability to cover 30-day liquidity needs (net outflow) with high-quality liquid assets under three scenarios, calibrated to replicate stress in retail and/or wholesale funding and market dislocations. The Net Stable Funding Ratio (NSFR) stress test evaluates banks' capacity to fund long-term activities with stable funding sources. The cash flow-based analysis examines banks' ability to meet cash outflows under stress, assessing cash inflows and outflows across different maturity buckets ranging from overnight to one year, and evaluates whether banks can address liquidity shortages using their counterbalancing capacity.

B. LCR

54. LCR analysis is based on three scenarios in addition to the baseline, simulating an outflow, market, and combined (most adverse) shocks. The stress scenarios are not based on the macroeconomic assumptions of the solvency stress tests, but instead built around Basel-based coefficients for liquid assets, inflows, and outflows. Run-off rates are calibrated to reflect system-wide deposit runs and a dry-up of unsecured wholesale and retail funding, drawing from historical events, recent international liquidity crises, and IMF expert judgment. Run-off rates applied to wholesale funding are higher than those applied to retail funding, and run-off rates on insured funding are lower than those applied to uninsured funding. Haircuts applied to high-quality liquid assets (HQLA) are based on ECB practices and past FSAPs in the Euro Area. The most relevant parameters in the context of Slovak banks can be found in Table 5.

55. The LCR stress tests reveal that Slovak banks exhibit strong liquidity positions both under normal and stressed conditions. As of December 2023, the LCR of the nine banks stands at 200 percent, reflecting an increase over the past year. It remains above 100 percent on aggregate even under the most adverse scenario, with only a few banks falling slightly below the threshold (Figure 21).

- **The "market" shock scenario** assumes larger haircuts on HQLA, including a 10 percent haircut on government assets. The aggregate LCR declines to 188 percent and no bank falls below the 100 percent threshold given the low share of securities in their assets. Moreover, securities are predominantly sovereign bonds (level 1, CQS 2) with a relatively low haircut under stress.[34] In this scenario, the LCR for SIs drops to 177 percent, while LSIs exhibit greater resilience, with a LCR at 253 percent.
- **The "outflow" shock scenario** assumes higher run-offs of funding sources. Higher run-off rates are applied to wholesale and unsecured funding than to retail deposits and secured funding, with lower rates for those covered by deposit insurance. Under this scenario, a more pronounced decline in the aggregate LCR is observed, reflecting higher vulnerability to funding outflows, especially for two banks (one SI and one LSI) where the LCR falls slightly below the

[33] Most banks do not report liquidity templates for other currencies, as aggregate liabilities in individual foreign currencies remain below 5 percent (Regulation (EU) No 575/2013 (CRR)).
[34] Level 1 assets represent 98 percent of HQLA.

minimum requirement. The LCR for SIs drops to 112 percent, and for LSIs to 169 percent, with the overall sector LCR at 121 percent.

- **The "most adverse" scenario** combines both shocks, resulting in an LCR drop to 112 percent (105 percent for SIs and 155 percent for LSIs), with three banks (two SIs, one LSI) falling below the 100 percent threshold, though all maintain LCR levels above 80 percent.

Table 5. Slovak Republic: Most Relevant Stress-Testing Parameters for Slovak Banks

Assets	Regulatory	Market Shock[1]
TOTAL UNADJUSTED LIQUID ASSETS		
Total unadjusted level 1 ASSETS		
Total unadjusted level 1 assets excluding extremely HQ covered bonds		
Coins and banknotes	1.00	1.00
Withdrawable central bank reserves	1.00	1.00
Central government assets	1.00	0.90
Total unadjusted level 1 extremely high-quality covered bonds		
Extremely high-quality covered bonds	0.93	0.80
Total unadjusted level 2 ASSETS		
Total unadjusted level 2A assets		
High quality covered bonds (CQS2)	0.85	0.70
Total unadjusted level 2B assets		
Corporate debt securities (CQS2/3)	0.50	0.30
Outflows – Run-off Rates	**Regulatory**	**Outflow Shock**
OUTFLOWS FROM UNSECURED TRANSACTIONS/DEPOSITS		
Retail deposits		
deposits exempted from the calculation of outflows	0.00	0.00
deposits subject to higher outflows[2]		
category 1	0.15	0.25
category 2	0.20	0.30
stable deposits	0.05	0.10
other retail deposits	0.10	0.20
Operational deposits		
covered by DGS	0.05	0.10
not covered by DGS	0.25	0.35
Non-operational deposits		
deposits by other customers		
covered by DGS	0.20	0.40
not covered by DGS	0.40	0.60

[1] The haircut is calculated as the difference between 1 and the applicable regulatory or market shock parameters, times 100.

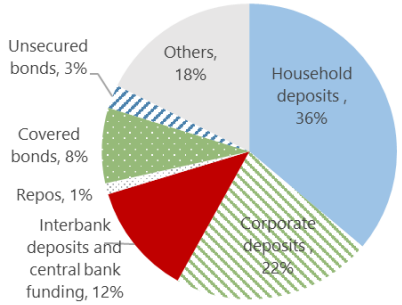
[2] Categories 1 and 2 refer to deposits that are subject to higher potential outflows under the LCR framework (Article 25(3) of Commission Delegated Regulation (EU) 2015/61), with category 2 deposits having a higher likelihood of withdrawal in a stress scenario.

Source: NBS and ECB. IMF staff calculations.

Figure 21. Slovak Republic: Funding Structure and LCR and NSFR Results

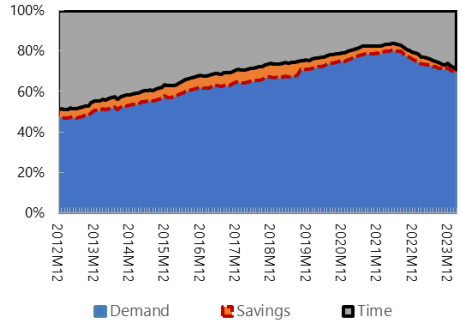
Banks' funding is diversified and stable…

Funding Structure of the Slovak Banking Sector, 2023Q4



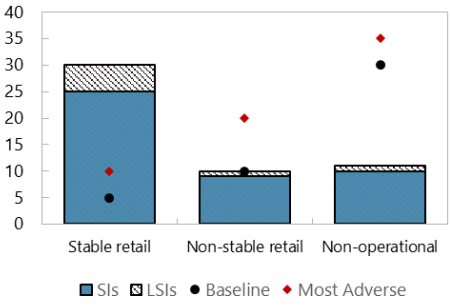
…with demand deposits dominating the composition of deposits by product.

Evolution of Households and Corporates Deposits by Product



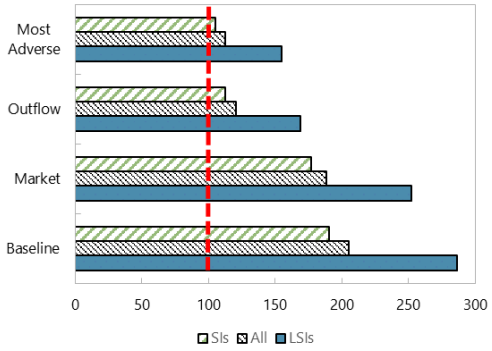
Stable retail deposits have lower run-off rates under stress.

Deposit Decomposition (Bil. EUR) and Average Assumptions for Run-off Rates (percent)



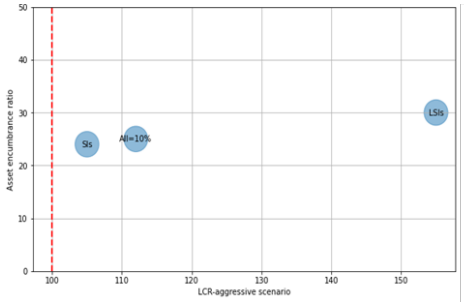
On aggregate, SIs and LSIs satisfy the regulatory LCR under both baseline and stressed scenarios.

LCR Stress Tests by Scenario



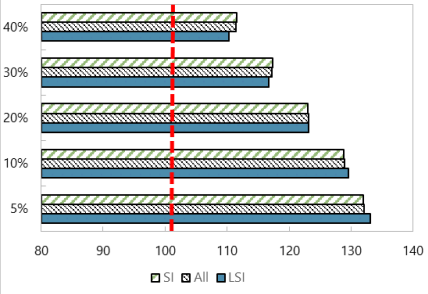
Asset encumbrance ratio is relatively low at 25 percent, while stressed-LCR is high especially for LSIs.

LCR, Asset Encumbrance Ratio, and Share of Covered Bonds in Liabilities (bubbles)



On aggregate, SIs and LSIs satisfy the regulatory NSFR under severe outflows of stable retail deposits.

NFSR Reverse Stress Test by Severity of Run-off Rates (Stable Retail Deposits < 6 months)



Source: NBS and ECB, IMF staff calculations.

C. NSFR

56. Banks in the liquidity stress testing sample have a robust NSFR of 131 percent, which remains above the regulatory limit even under the extremely severe stress scenarios. The NSFR provides a complementary view of banks' funding profile in relation to the composition of their assets and off-balance sheet activities at a one-year horizon. A targeted reverse stress test incrementally increased the run-off rate on stable retail deposits with maturities under six months, which form the largest component of the available stable funding. The NSFR reaches the threshold for two banks (one SI and one LSI) only when the run-off rate reaches 40 percent. The overall NSFR remains above the regulatory threshold at 111 percent (Figure 21). Under an extremely severe scenario, with a 60 percent run-off rate, the overall NSFR drops to 105 percent. Four banks fall below 100 percent, though all remain above 80 percent.

D. Cash Flow Based Analysis

57. Cash-flow analyses were performed using banks' maturity ladders[35] to assess funding pressures across different time horizons, ranging from overnight to one year. The analysis evaluates banks' capacity to offset negative funding gaps with their existing counterbalancing capacity. A liquidity gap or shortfall arises when the bank exhausts its counterbalancing capacity to fulfill the net funding gap. The baseline scenario closely mirrors the regulatory LCR, while the severe scenario aligns with the most adverse LCR scenario, combining market dislocations and outflows from both retail and wholesale markets. Higher run-off rates are applied to wholesale and unsecured funding compared to retail and secured funding sources.

58. The counterbalancing capacity is comfortable and dominated by level 1 assets. The counterbalancing capacity represents 20 percent of assets, primarily comprising central bank reserves (45 percent) and sovereign bonds (36 percent). Coins and banknotes account for 5 percent, while Level 1 central bank assets account for 4 percent. The remaining 9 percent falls under 'Other' assets, encompassing covered bonds with 2 percent of the total counterbalancing capacity.

59. In the cash-flow analysis, the banking system maintains a positive funding position across all maturities, in both scenarios. The heatmap of contractual cash flows shows concentrated outflows overnight due to the high share of demand deposits, while inflows are concentrated beyond the one-year horizon, reflecting the high share of mortgages (Figure 22). Under the baseline scenario, only one bank shows a funding gap at the six-month maturity bucket. Under the most severe scenario, one bank has a funding gap starting at one month and a second one from two months (Figure 23). These funding gaps are small relative to the banks' total assets.

[35] COREP 66 reporting template.

Figure 22. Slovak Republic: Cash-Flow Analysis – Heatmap of Outflows and Inflows

Most of the contractual cash outflows are concentrated within two days, and open maturity deposits dominate…

0389 INFLOWS	overnight	2d	3d	4d	5d	6d	1w	2w	3w	1m	5w	2m	3m	4m	5m	6m	9m	1y	2y	5y	>5y
Monies due from secured lending and capital market driven transactions collateralised by:	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Of which: Intragroup or IPS	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level 1 tradable assets	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level 2A tradable assets	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level 2B tradable assets	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Other tradable assets	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Other assets	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Monies due not reported in 2.1 resulting from loans and advances granted to:	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	2%	1%	1%	1%	2%	2%	9%	17%	40%
Retail customers	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	1%	4%	10%	35%
Non-financial corporates	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%	0%	1%	1%	1%	4%	7%	3%
Credit institutions	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Other financial customers	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Central banks	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Other counterparties	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FX-swaps maturing	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Derivatives amount receivables other than those reported in 2.3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Paper in own portfolio maturing	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	2%	5%	7%
Other inflows	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%
Share in total intflows	**1%**	**1%**	**0%**	**0%**	**0%**	**0%**	**0%**	**1%**	**1%**	**1%**	**0%**	**1%**	**2%**	**1%**	**1%**	**1%**	**3%**	**2%**	**12%**	**24%**	**48%**

… while most of the cash inflows are concentrated outside of the one-year horizon

0005 OUTFLOWS	overnight	2d	3d	4d	5d	6d	1w	2w	3w	1m	5w	2m	3m	4m	5m	6m	9m	1y	2y	5y	>5y
Liabilities resulting from securities issued (if not treated as retail deposits)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	7%	2%
Liabilities resulting from secured lending and capital market driven transactions collateralised by (Counterparty is non - Central Bank)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%
Liabilities resulting from secured lending and capital market driven transactions collateralised by (Counterparty is Central Bank):	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Liabilities not reported in 1.2, resulting from deposits received (excluding deposits received as collateral)	52%	3%	1%	1%	0%	0%	0%	1%	2%	2%	1%	2%	3%	1%	1%	1%	2%	1%	2%	3%	1%
Of which: Intragroup or IPS	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Stable retail deposits	29%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%	0%	0%	1%	1%	0%
Other retail deposits	12%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%
Operational deposits	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-operational deposits from credit institutions	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Non-operational deposits from other financial customers	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-operational deposits from central banks	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-operational deposits from non-financial corporates	5%	2%	1%	0%	0%	0%	0%	1%	1%	1%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%
Non-operational deposits from other counterparties	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FX-swaps maturing	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Derivatives amount payables other than those reported in 1.4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%
Other outflows	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Share in total outflows	**52%**	**4%**	**1%**	**1%**	**0%**	**0%**	**0%**	**2%**	**2%**	**2%**	**1%**	**3%**	**3%**	**1%**	**1%**	**1%**	**3%**	**2%**	**7%**	**11%**	**3%**

Note: d= days, w= weeks, m=months, and y= years. Color intensity indicates the concentration of inflows (red for highest values) and outflows (green for highest values) across time buckets.

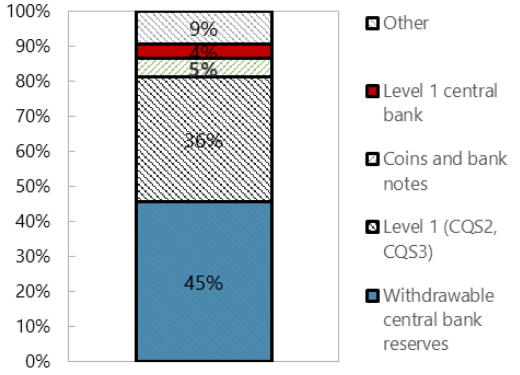
Source: NBS and ECB. IMF staff calculations.

60. The sensitivity of the cash-flow analysis was assessed through a reverse-stress-testing exercise. The severity of all parameters is increased incrementally by a scalar factor that represents a multiple of the baseline (subject to a cap for all parameters at zero and one). Increasing the severity of haircuts on the counterbalancing capacity and runoff rates on outflows reveals additional banks with liquidity shortfalls at shorter maturities (Figure 23).

Figure 23. Slovak Republic: Cash-Flow Analysis

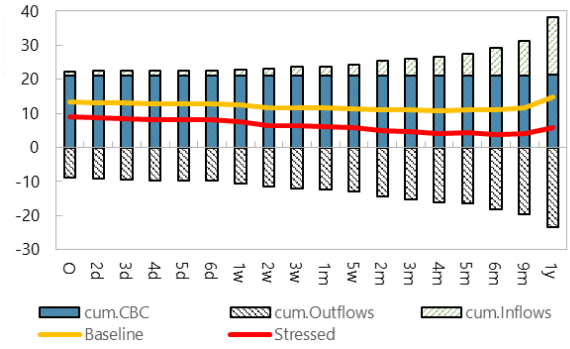
Banks counterbalancing capacity is comfortable and diversified.

Composition of the Counterbalancing Capacity



On aggregate, banks remain liquid under both baseline and stress scenarios…

Cash-Flow Analysis under Baseline and Aggressive Scenarios (Bil. EUR)



… but few banks have liquidity shortfalls below 3 months in the adverse scenario, or when the stress severity increases further by a scalar factor of 15 percent relative to baseline.

Number of Banks with Funding Gap by Scenario

	Scenario\Maturity	O	1w	1m	3m	6m	1y
Stress test	Baseline	0	0	0	0	1	1
	Aggressive	0	0	1	2	1	1
Reverse stress test (increasing the severity by a scalar)	10%	1	2	2	3	3	1
	15%	2	3	3	3	3	4
	20%	3	4	5	7	7	5

Note: O= overnight, d= days, w= weeks, m= months, y= years

Source: NBS and ECB. IMF staff calculations.

E. Liquidity to Solvency Interaction

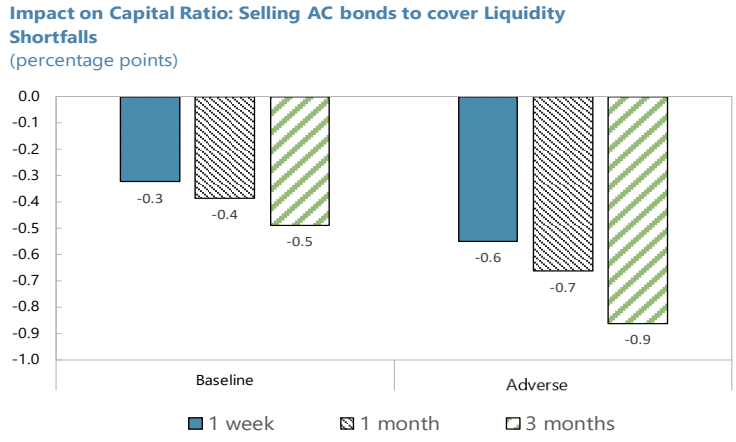
61. The sensitivity analysis on the interplay between liquidity and solvency risks indicates a limited aggregate capital impact. This analysis simulates a hypothetical situation where banks with the liquidity shortfalls estimated in the cash-flow analysis are unable to pledge their bonds with the central bank to obtain liquidity and therefore need to sell amortized cost (AC) bonds to cover those shortfalls under the baseline and adverse scenarios of the solvency stress test.

62. This liquidity-solvency interaction exercise offers useful insights about the potential effect of liquidity stress on solvency in case banks face operational failures during liquidity crisis. However, it is worth noting that the nine banks had full access to central bank liquidity facilities at end-December 2023 as they met the eligibility criteria for ECB's counterparties[36], including the financial soundness criterion. Also, from an operational point of view, it may be easier for banks to access the central bank facilities than to sell the bonds on the market, since the current bond portfolio has already been pledged against NBS in the collateral pool.

[36] Criteria for ECB's eligible counterparties are public by NBS in Eligible counterparties – Národná banka Slovenska.

63. The scenarios correspond to the horizons of 3 weeks, 1 month and 3 months under the cash flow analysis. Each scenario is treated as a standalone event and does not imply a transformation of the AC portfolio into a fair value through profit or loss portfolio, since it is assumed that the securities are sold and banks must realized losses[37]. Results suggest that the liquidity to solvency interactions would have an additional impact on the aggregate capital ratio of 0.5 percentage points in the baseline scenario and 0.9 percentage points in the adverse scenario, albeit heterogeneity at individual level (Figure 24).

Figure 24. Slovak Republic: Liquidity to Solvency Interactions



Source: NBS and ECB. IMF staff calculations.

INTERCONNECTEDNESS ANALYSIS

64. The analysis of systemic risk and interconnectedness enhances understanding of risk transmission across the financial system. Using network maps, the interconnectedness analysis examines (i) gross and net bilateral financial exposures across sectors using the Balance Sheet Approach (BSA), (ii) domestic links between financial institutions, including domestic banks, and (iii) the Slovak banking system's cross-border exposures to foreign banking systems. Overall, direct contagion risk within the financial sector, interbank market, and cross-border banking operations is assessed as relatively low.[38]

A. Intersectoral Linkages

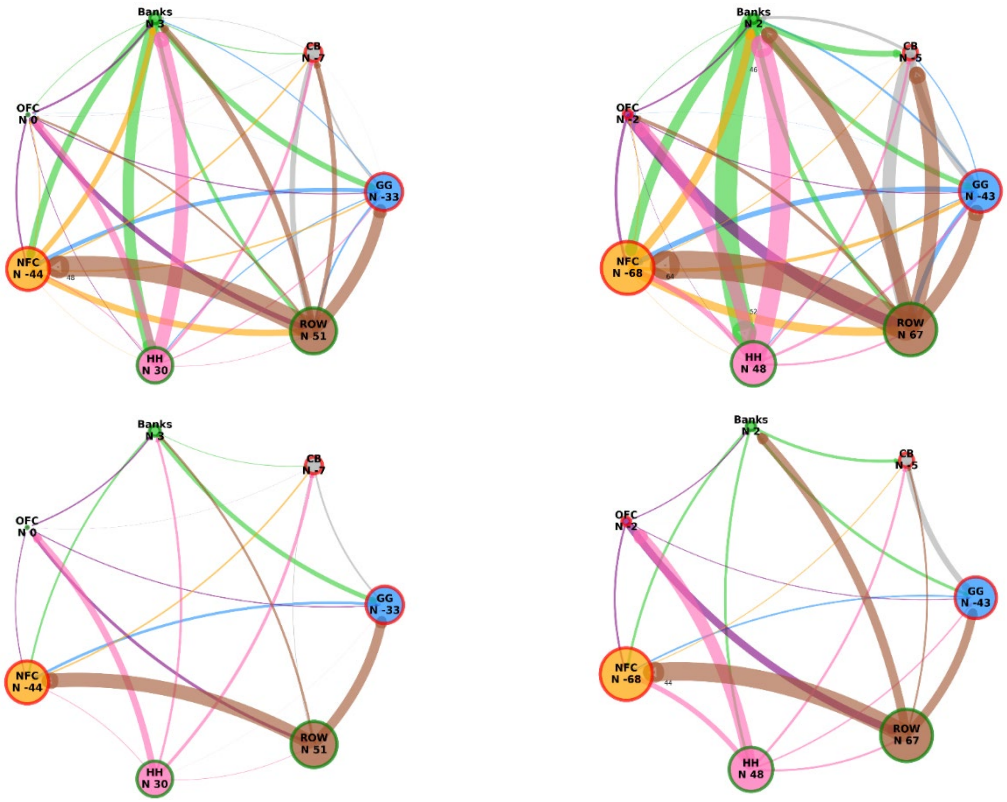
65. The BSA network maps of financial sector exposures reveal limited systemic vulnerabilities but highlight substantial external funding for corporates. The BSA, using 'from-whom-to-whom' data, helps assess financial positions, intersectoral linkages, and detect potential

[37] Losses are estimated using the same market risk duration approach of the solvency stress test and interest rate paths of the macroeconomic scenarios.
[38] Potential indirect contagion risk through common exposures could arise.

vulnerabilities, such as excessive indebtedness, FX mismatches, and contagion risks.[39] The BSA matrix for Slovakia, illustrated by network maps (Figure 25), confirms the bank-oriented structure of the financial system, which has remained stable since 2015. Overall, households and the rest of the world are net creditors, while nonfinancial corporates and the general government are net debtors. The large external funding of nonfinancial corporates primarily reflects intra-group linkages. Mutual exposures between banks and other financial corporations remain low.

Figure 25. Slovak Republic: Intersectoral Interlinkages Network Maps

(gross *(top) and net (bottom)* exposures, in 2015 *(left)* and 2023 *(right)*, in billion euro)



Legend: OFC = Other Financial Corporations; CB = Central Bank; GG = General Government; NFC = Non-financial Corporates; HH = Households; ROW = Rest of the World; INS = Insurance; INF = Investment funds; PEN = Pensions; and N = Net position.

Notes: The thickness of the arrows represents the relative size of each sector's gross or net financial exposure to other sectors, following the balance sheet approach (BSA). The arrowheads indicate the direction of flows. The size of the nodes reflects each sector's aggregate net financial position, while the edge colors of the nodes distinguish net creditors (green) from net debtors (red).

Source: NBS and IMF staff calculation.

B. Domestic Financial Linkages

66. The interconnectedness of the domestic financial system is very limited. A recent NBS analysis (Financial Stability Report, May 2024) examined the interconnectedness of the Slovak

[39] It involves constructing a matrix that provides a snapshot of the gross and net financial positions of each sector relative to other resident sectors and the rest of the world. Seven sectors are included: general government, central bank, banks, non-bank financial institutions, non-financial corporations, households, and the rest of the world.

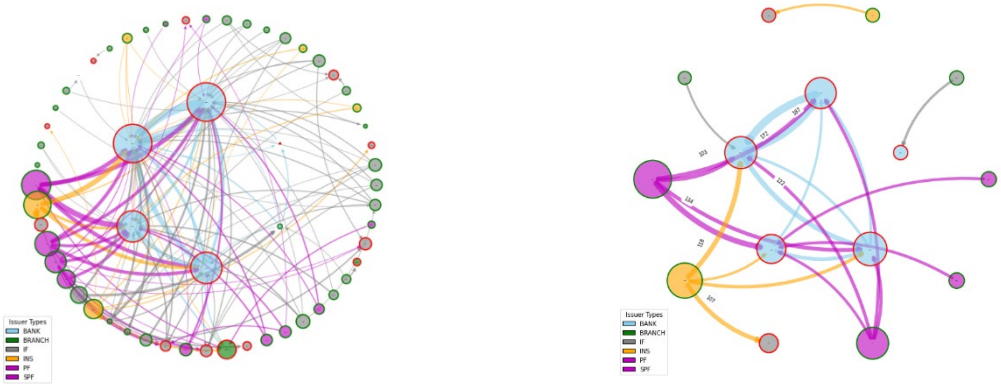
financial sector, focusing on the ownership within bank-led groups and the links between pension and investment funds and banks acting as depositories. NBS data on individual exposures of all financial institutions indicate that the interconnectedness of the financial system is very limited. Only four exposures exceed 100 million euros (excluding interbank exposures), primarily from a few pension funds and one insurance company to banks acting as depositories (net debtors, Figure 26).

67. Interbank exposures are also limited in both number and size, especially when considering loans (Figure 27). The assessment did not use network analysis to evaluate interbank interconnectedness, such as the Espinosa-Vega and Solé (2011) model, as the exposures are too low to generate sufficient initial distress within the banking network to trigger a cascade effect through credit and funding channels.

C. Cross-border Linkages

68. Cross-border banking operations are also small relative to bank balance sheets, except for intragroup exposures within the euro area (Figure 28). Cross-border banking linkages are concentrated in a few countries, with net exposures exceeding 100 million euros only with Belgium, Czech Republic, Italy, Austria, and Germany. These operations are often intragroup. The aggregate banking system has a net debtor position of 2.6 billion euros toward foreign banks mainly due to one bank's significant intragroup exposure. However, this remains low as a share of the total balance sheet, at around 2 percent. The analysis does not cover exposures to non-bank financial institutions or from banks' covered bond issuances, which are predominantly held by foreign investors (70 percent). Close monitoring of funding through covered bonds would ensure readiness to mitigate risks should they become excessive.

Figure 26. Slovak Republic: Domestic Financial Interconnectedness Network Maps
(Exposures above 10 (left) and 50 million euro (right), December 2023)

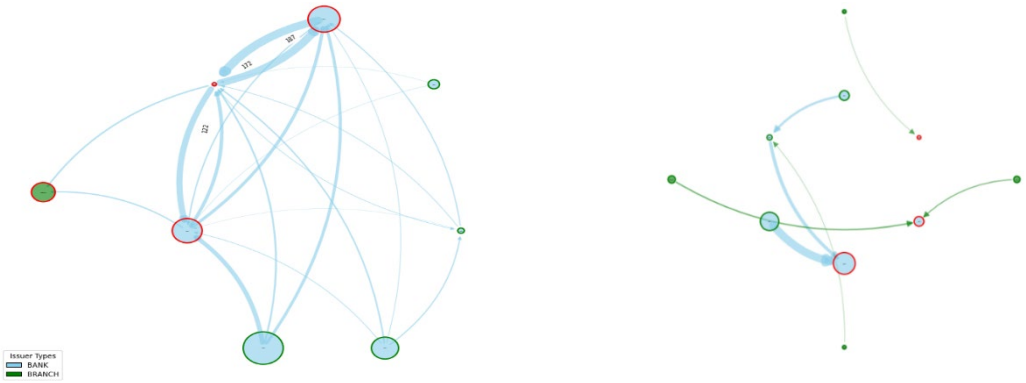


Legend: BANK= Domestic bank or foreign bank subsidiary; BRANCH= Branch of foreign bank; IF = Investment fund; PF= 2nd pillar pension fund; SPF= 3rd pillar supplementary pension fund; INS = Insurance.

Notes: The thickness of the arrows represents the relative size of each financial institution category's gross financial exposure (bonds, loans, and deposits) to other categories. The arrowheads indicate the direction of flows. The size of the nodes reflects each category's aggregate net financial position, while the edge colors of the nodes distinguish net creditors (green) from net debtors (red).

Source: NBS and IMF staff calculation.

Figure 27. Slovak Republic: Banks Interconnectedness Network Maps
(Interbank exposures (left) and interbank loans only (right), in million euro, December 2023)

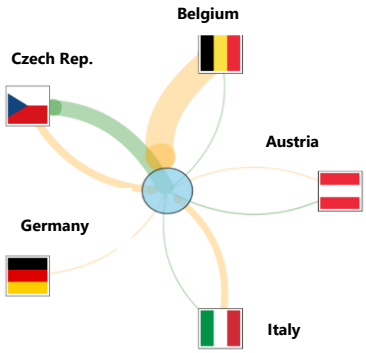


Legend: BANK= Domestic bank or foreign bank subsidiary; BRANCH= Branch of foreign bank.

Notes: The thickness of the arrows represents the relative size of each bank's gross financial exposure to other categories. The arrowheads indicate the direction of flows. The size of the nodes reflects each bank's aggregate net financial position, while the edge colors of the nodes distinguish net creditors (green) from net debtors (red). Exposure amounts are displayed only for values exceeding 100 million euros.

Source: NBS and IMF staff calculation.

Figure 28. Slovak Republic: Slovak Banks Cross-Border Interconnectedness Network Map
(December 2023)



Notes: The cross-border exposures chart aggregates individual banks' loans and deposits, excluding covered bonds, in relation to foreign banks aggregated at the jurisdiction level. The thickness of the arrows indicates the relative size of each aggregate banking system's gross exposure to other banking systems. The color of the arrows represents the direction of claims, with orange signifying cross-border funding of Slovak banks, and green denoting their exposure. Exposure amounts are displayed only for values exceeding 100 million euros.

Source: NBS and IMF staff calculation.

Appendix I. Risk Assessment Matrix

Appendix I. Table 1. Slovak Republic: Risk Assessment Matrix[1,2]

Nature/Source of Main Threats	Overall Level of Concern	
	Likelihood of Severe Realization of Threat in the Next 1–3 Years (high, medium, or low)	**Expected Impact on Financial Stability if Threat is Realized** (high, medium, or low)
1. Regional conflicts	**Medium** Intensification of conflicts (e.g., in the Middle East, Ukraine, Sahel, and East Africa) or terrorism disrupt trade in energy and food, tourism, supply chains, remittances, FDI and financial flows, payment systems, and increase refugee flows.	**High** Slovakia is highly vulnerable to an intensification of regional conflicts given its geographical proximity and dependence on Russian fossil fuels, and high integration in global value chains. An escalation of conflicts would lead to higher energy and commodity prices pushing up inflation and leading to higher for longer policy rates in the euro area.
2. Commodity price volatility	**Medium** Supply and demand volatility (due to conflicts, trade restrictions, OPEC+ decisions, AE energy policies, or green transition) increases commodity price volatility, external and fiscal pressures, social discontent, and economic instability.	**High** Increased cost pressures on private sector and/or higher fiscal costs. Higher uncertainty undermines household and corporate confidence. Tighter financial conditions would affect economic activity and heighten credit risk and housing market corrections.
3. Trade policy and investment shocks	**High** Higher trade barriers or sanctions reduce external trade, disrupt FDI and supply chains, and trigger further U.S. dollar appreciation, tighter financial conditions, and higher inflation.	**High** Export growth falls significantly given the openness of the Slovak economy and integration in global value chains. Trade disruptions could lead to an increase in unemployment. Higher credit risk would contribute to a deterioration in banks' profitability and asset quality, with adverse effects on banks' solvency.
4. Sovereign debt distress	**High** Higher interest rates, stronger U.S. dollar, and shrinking development aid amplified by sovereign-bank feedback result in capital outflows, rising risk premia, loss of market access, abrupt expenditure cuts, and lower growth in highly indebted countries.	**Medium** Higher risk premia on sovereign bonds increases the cost of financing the fiscal deficit, delaying fiscal consolidation, reducing fiscal space, and deteriorating the long-term sustainability of public finances. Bank exposure to sovereign debt is modest, around 10 percent of total assets, but the indirect impact on banks, through the macroeconomic channel, could be considerable.

Appendix I. Table 1. Slovak Republic: Risk Assessment Matrix (Concluded)		
Nature/Source of Main Threats	**Overall Level of Concern**	
	Likelihood of Severe Realization of Threat in the Next 1–3 Years (high, medium, or low)	**Expected Impact on Financial Stability if Threat is Realized** (high, medium, or low)
5. Delays in the implementation of structural reforms and fiscal consolidation	**High/Medium** Delays in the implementation of structural reforms and fiscal consolidation in Slovakia. Shift in market perception in the EA undermines high-debt countries' ability to roll over and service debt.	**High** Increase government borrowing costs, reduce fiscal space, and increase the risk of debt distress.
6. Real estate market downturn	**Medium** A sharp and sudden decline in prices of residential and commercial properties combined with an economic downturn.	**High** With elevated banking sector exposure to real estate markets (mortgage and CRE), steep price corrections would weaken macrofinancial stability. The quality of banks' credit portfolios deteriorates with a significant increase in NPLs, leading to tighter credit conditions and a slowdown in credit growth. Risks to the banking sector are mitigated to some extent by banks' strong capital, boosted with macroprudential buffers.
7. Tight labor market	**Medium** A tight labor market, including due to increasing skill mismatches, puts upward pressure on wages and triggers a wage-price spiral.	**High** Higher wages and inflation may lead to abrupt adjustments in financial markets. High inflation for longer may lead to abrupt adjustments in financial markets. Bank interest margins could get compressed by the relocation of demand deposits towards costlier liabilities. .
8. Automotive sector	**Medium** The automotive sector fails to adjust to the shift to electric vehicles and increased automation. Increasing automation erodes Slovakia's competitive advantage as a source of low-cost skilled labor.	**High** Loss of competitiveness and shrinking share of the automotive market would threaten the country's growth model and lower potential growth.

[1] In line with the February 2025 G-RAM.

[2] The Risk Assessment Matrix (RAM) shows events that could materially alter the baseline path. The relative likelihood is the staff's subjective assessment of the risks surrounding the baseline ("low" is meant to indicate a probability below 10 percent, "medium" a probability between 10 and 30 percent, and "high" a probability between 30 and 50 percent). The RAM reflects staff views on the source of risks and overall level of concern as of the time of discussions with the authorities. Non-mutually exclusive risks may interact and materialize jointly. The conjunctural shocks and scenarios highlight risks that may materialize over a shorter horizon (between 12 to 18 months) given the current baseline. Structural risks are those that are likely to remain salient over a longer horizon. G-RAM operational guidance is available from the SPR Risk Unit website.

Appendix II. Banking Sector Stress Testing Matrix (STeM)

Domain		Assumptions
		Top-down by FSAP team
Banking Sector: Solvency Stress Test		
1. Institutional Perimeter	Institutions included	• All banks, excluding foreign branches (9 institutions, including 4 SIs that are part of different large European banking groups under ECB direct supervision).
	Market share	• About 86 percent of banking system assets and 67 percent of the financial system assets.
	Data source and starting date	• Data Sources: Supervisory returns, data from the credit registry, COREP and FINREP, and publicly available data. • Baseline date: balance sheets as of December 2023. • Scope of Consolidation: consolidate basis for SIs and individual basis for LSIs.
2. Methodology	Overall framework	• Credit risk assessed with scenario-based, top-down, bank-level stress test model complemented with sensitivity analysis focusing on credit risk stemming from mortgage portfolios and NFC. • The credit portfolio was split in four main credit types: households, corporate, government and financial loans.
	Satellite models for macro-financial linkages	• Credit risk: link credit risk variables to the set of macroeconomic variables using micro-models for households (simulate DSTI ratio of households and loans IFRS9 stage distribution), and corporates (projection of PDs link to key financial indicators from the corporate stress test). • Market Risk: valuation losses/gains due to the impact of interest rate shocks on banks' investment portfolio at fair value. • Net interest income: structural model to estimate the impact of interest rates shocks on interest income and expenses using repricing ladder and projected interest rates on new/repriced assets and liabilities
	Stress test horizon	• 3-years (2024-2026).
	Assumptions	• Balance-sheet components were projected using a quasi-static assumption under the adverse scenario. The projected balance sheet items are assumed to grow at a rate equal to the nominal GDP growth when the latter was positive. The growth is set to zero when the economy shrinks, assuming banks do not deleverage during the recession. The tax rate is set at the bank-specific median effective tax rate across the past 5 years for the stress testing horizon in case of positive net income and zero otherwise. Capital impact projections also take into account the temporary bank levy following the Slovak regulation (levy of 30 percent in 2024, 25 percent in 2025 and 20 percent in 2026). • Dividends are assumed to be paid out of each period net income after taxes and bank levy by banks in compliance with supervisory capital requirements. The dividend payout ratio is determined from the bank-specific median dividend payout ratio over the past five years, with a floor at 50 percent. If banks are not well capitalized or income is negative, it is assumed that there is no dividend payout.

Domain		Assumptions
		Top-down by FSAP team
3. Type of analyses	Scenario analysis	• Scenario-based stress tests focus on the impact of the macroeconomic environment on credit risk, focusing on the mortgage and commercial real estate portfolios. • Given the domestic orientation of banks, the scenarios focus on domestic macrofinancial variables (e.g., GDP, interest rates, unemployment rate, and sovereign spreads). • Two macroeconomic scenarios were simulated at the yearly frequency: • Baseline scenario: The baseline follows the April 2024 WEO. It assumes a mild economic recovery and a weak but stable external environment. GDP growth is projected to increase to 2.1 percent in 2024, initially driven by a rebound in consumption, and continued government support measures. On the external front, improving supply chain conditions are projected to help exports, offsetting a generally weak external environment. Headline inflation keeps falling and the labor market remains tight, with the unemployment rate stabilizing at around 6 percent. • Adverse scenario: The adverse scenario assumes the realization of external risk factors, including the escalation of regional conflicts and an abrupt global slowdown that drives down economic activity in the euro area. This scenario leads to spikes in energy and commodity prices relative to the baseline. The drop in external demand directly impacts Slovakia's economic growth via trade channels. Inflation in the euro area remains above target, as higher energy prices lessen the effects of weak demand. In response, the ECB maintains higher policy rates for longer, contributing to the slowdown. Second round effects stemming from wage increases affect export competitiveness and contribute to the downturn. In this environment, property prices and construction activity undergo a substantial drop. On the fiscal front, lower economic growth would further increase the debt level, widening sovereign spreads and contributing to deteriorating financial conditions. This scenario is simulated using MCM models (an extension of the Global Macrofinancial Model - GFM) and deviation shocks for specific variables.
	Sensitivity analysis	• Sensitivity analyses to complement the scenario-based analysis. • Credit risk from households and CRE loans assessed with additional scenarios in the household and corporate micro-models. • Sensitivity analysis for the net fee and commission projection under the adverse scenario given the significant contribution of this component in the profit generation of the Slovak banking system, • Concentration risk assessed with a separate assessment of individual bank exposures to their 10 largest borrowers.
4.Risks and Buffers	Risks assessed	• Credit risk and sovereign risk using IFRS approach. • Market risks in the trading book, focused on the revaluation of the bond portfolio using duration analysis. • Interest rate risk in the banking book, compression of interest margins. • FX risk and equity price risk not material.

Domain		Assumptions
		Top-down by FSAP team
	Buffers	• Existing loan loss provisions and capital buffers. • Internal capital generation (i.e., income after taxes). • No new capital injections.
5. Regulatory Standards	Regulatory Standards	• Bank-specific (STA/IRB). • Hurdle rates consistent with the Slovak capital regulatory standards that reflect Basel III capital requirements. The hurdle rate applied in the stress test accounts for Common Equity Tier 1 (CET1) regulatory minimum of a 4.5 percent Pillar 1 requirement, bank-specific Pillar 2 requirements, the Capital Conservation Buffer (CCoB) of 2.5 percent and the bank specific OSII buffers. For the leverage ratio the hurdle rate of Pillar 1 requirement was considered, corresponding to 3 percent.
6. Reporting Format for Results	Output presentation	• System-wide capital shortfalls from macroprudential perspective. • Number of banks and percentage of banking system assets below hurdle rates. • Impact of shocks on key P&L components.
Banking Sector: Liquidity Stress Test		
1. Institutional Perimeter	Institutions included	• All banks, excluding foreign branches (9 institutions, including 4 SIs that are part of different large European banking groups under ECB direct supervision and considered on individual basis).
	Market share	• About 86 percent of the banking system assets.
	Data and Starting position	• Cut-off date: December 2023. • Data Source: supervisory data from FINREP and COREP (LCR, NSFR, and ALMM Maturity Ladder template).
2. Methodology	Overall framework	• Regulatory liquidity stress test. Evaluation of LCRs (30-day horizon) and NSFRs (1-year horizon). • Cash-flow-based liquidity stress test. Evaluates the ability of banks to withstand a sequence of liquidity shocks in different maturity buckets (from one day to one year), incorporating both contractual and behavioral assumptions (where available). • Liquidity test in EUR.
3. Type of analyses	Scenario analysis	• The run-off rates are calibrated to reflect scenarios of system-wide deposit runs and a dry-up of unsecured wholesale and retail funding, following historical events, recent international experience in liquidity crises and IMF expert judgment. • The haircuts of high-quality liquid assets (HQLA) are calibrated against ECB haircuts and past EA FSAPs.
4. Risks and Buffers	Risks	• Funding liquidity. • Market liquidity.
	Buffers	• The counterbalancing capacity includes liquidity obtained from markets and/or the central bank's facilities. Expected cash inflows are also included in the cash-flow based and LCR-based analyses.
5. Regulatory Standards	Regulatory Standards	• Consistent with Basel III regulatory framework. • Liquidity shortfall by bank.

Domain		Assumptions
		Top-down by FSAP team
6. Reporting Format for Results	Output presentation	• Liquidity ratio or shortfall by groups of banks and aggregated (system wide). • Number of banks that fail to meet their obligations.
Corporate Stress Test		
1. Institutional Perimeter	Entities included	• The coverage comprises all companies with available financials, including small and medium-sized enterprises (SMEs).
	Data	• Subscription financial database on corporations, including balance sheets and profit and loss statements. Corporate stress test for the ten largest borrowers of each lender bank fully integrated with the bank stress, exploiting bank data on outstanding credit amounts, provisions, and credit risk mitigants at the level of the lender banks.
	Time Horizon	• Corporate-level data in 2023 will be used as a starting point. Firms without 2023 data will be imputed by using growth rate of other firms with the same sector and firm size. The data will be projected to 2026 using the same scenarios used for the bank solvency assessment.
	Overall framework	• Liquidity and solvency of companies will be tested based on the four indicators (Return on Asset (ROA), Interest Coverage Ratio (ICR), Working Capital over Total Asset (WC/TA), and leverage (debt to equity, D/E), conditional on the baseline and adverse scenarios applied to the bank stress tests. • Individual firms are classified by their economic activities and subject to the adverse scenarios used in the bank stress tests. The shocks include an increase in interest expenses on short-term debt, a drop in turnover, and an increase in costs, estimated from the baseline and adverse scenarios. • Individual firms are mapped to their lender banks, and the results used to inform the bank stress tests of credit risk.
	Scenarios	• The analysis applies the same baseline and distressed scenarios used in the bank stress tests. The corporate stress test uses the sectoral estimated scenarios and shocks to interest rates to come up with a set of firm-specific shocks consistent with the bank stress tests.
2. Risks and Buffers	Risks	• Insolvency risk.
	Buffers	• EBIT (earnings before interest and taxes) and capital.
3. Reporting Format for Results	Output presentation	• Total debt, and number of risker firms (such as firms with ROA below 0 percent, ICR below 100 percent, negative working capital, and negative equity) as well as default probability will be presented by economic sectors, firm sizes, and lender banks, under baseline and distressed scenarios.
Banking System: Interconnectedness Analysis		
1. Institutional Perimeter	Institutions Included	• Sectoral linkages analysis. • Interbank network: 9 banks. • Domestic financial system interconnectedness: banks, pensions, investment funds, and insurance companies. • Cross-border interconnectedness: interbank cross-border exposures.

Domain		Assumptions
		Top-down by FSAP team
	Data	• Data source: NBS data on interbank, domestic financial system, and bank cross-border exposures. Balance sheet approach matrix for sectoral linkages. • Cut-off date: December 2023.
2. Methodology	Overall framework	• Analyses of network maps. Due to limited interconnectedness, contagion models could not be used.
3. Reporting of Results	Output presentation	• Network maps.

Appendix III. Corporate Stress Test Methodology

Data

1. Orbis database provides historical balance sheet and income statement data for non-financial firms. For the analysis of the corporate stress test, entities operating within finance and insurance (NACE Rev. 2, 64-66), public administration and defense (84), activities of households as employers (97-98), and activities of extraterritorial organizations and bodies (99) were excluded. The database covers both listed and unlisted firms and all firm sizes (micro, small, medium, and large). Firm sizes are classified based on the annual turnover values, as many firms do not have records of the number of employees. The thresholds of annual turnover are set based on the EC (2020).

2. Various filters were imposed to clean the dataset, and required financial data are imputed if they are missing. The clearing is based on Kalemli-Ozcan et al. (2015) and eliminates firms with possible reporting errors. This includes firms with zero or negative revenue and assets, extreme revenue to asset ratios, and extremely high/low growth in revenue, employees, assets, and total operating costs. If a firm has a record in 2022 but not in 2023, its 2023 data is imputed using growth rates of other firms within the same sector and firm size. If a firm's interest expense data is missing, its value is imputed by using the ratio of interest expense to financial expense of other firms with the same sector and firm size.

3. To estimate the probability of default (PD), the Orbis dataset was merged with Moody's/KMV based on firms' identification number. Moody's database provides the likelihood that a publicly listed company will default on payments within a given period (one year in this analysis) based on the available information in the market. Daily one-year PDs were converted to annual by taking annual averages for each firm, aligning these averages with the respective closing data for a firm's financial statement and for each year.

Methodology

4. The firm's financial statements over 2024-26 were simulated based on the scenarios from the solvency stress test. The assessment of the financial health of the companies is based on the four financial indicators and the following equations.[1]

1. $$Interest\ coverage\ rate\ (ICR)_{i,t} = \frac{Earnings\ before\ interest\ and\ taxes\ (EBIT)_{i,t}}{Interest_{Expense_{i,t}}} = \frac{EBIT_{i,t}}{Interest\_Expense_{i,t-1} + \Delta\, Interest\_Expense_{i,t}}$$

2. $$Retun\ on\ Total\ Asset\ (ROTA)_{i,t} = \frac{EBIT_{i,t}}{Total\ Assets_{i,t}}$$

[1] These indicators and equations are formulated based on IMF (2023), Ebeke et al. (2021), and Gornicka et al. (2021).

3. $Working\ Capital\ over\ Total\ Asset\ (WC/TA)_{i,t} = \frac{working\ capital_{i,t}}{Total\ Assets_{i,t}}$

$$= \frac{net\ income_{i,t} + liquid\_assets_{i,t} - maturing\ liabilities_{i,t}}{Total\ Assets_{i,t}}$$

4. *Solvency: Leverage*: $(D/E_{i,t}) = \frac{Total\ libalities_{i,t}}{Equity_{i,t}} = \frac{Total\ libalities_{i,t-1} + \Delta Short\ Term\ Debt_{i,t}}{Equity_{i,t-1} + net\ income_{i,t}}$

- $EBIT_{i,t} = EBIT_{i,t-1} + (x\%) * turnover_{i,t-1} - (y\%) * total\ operating\ cost_{i,t-1}$
- $\Delta\ Interest\ Expense_{i,t} = Short\ Term\ Debt_{i,t-1} * \Delta\ Interest_{rate_{i,t}}$ *(with the cap of* $3 * Interest\_Expense_{i,t-1}$*)*
- $total\ operating\ cost_{i,t-1} = Cost\ of\ Goods\ Sold_{i,t-1} + Other\ Operating\ Expenses_{i,t-1}$
- $net\ icnome_{i,t} = \{Profit\ before\ tax_{i,t-1} + (x\%) * turnover_{i,t-1} - (y\%) * total\ operating\ cost_{i,t-1} - \Delta Interest\_Expense_{i,t}\} * (1 - tax\ rate)$
- $liquid\ assets_{i,t} = current\ assets_{i,t-1} - trade\ recievables_{i,t-1}$
- $maturing\ liabilities_{i,t} = current\ liabilities_{i,t-1} - short\ term\ debt_{i,t-1} - trade\ credit_{i,t-1}$
- $\Delta short\ term\ debt_{i,t} = -\Delta working\ capital_{i,t}\ (if\ working\ capital_{i,t-1} < 0)$

$$= -\ working\ capital_{i,t}\ (if\ working\ capital_{i,t} < 0\ \&\ working\ capital_{i,t-1} > 0)$$

5. The change in turnover (x%) and total operating costs (y%) are calculated based on the following two equations. The regressions are estimated separately for 17 sectors using firm-level data from 2005-2022 and employing quantile regression (at median).

$$\Delta\ turnover_{i,t} = \alpha 1 + \beta 1 * GDP\ growth_t + \beta 2 * X_{i,t-1} + \beta 3 * D_t + \varepsilon_t$$

$$\Delta total\ cost_{i,t} = \alpha 2 + \gamma 1 * inflation\ rate_t + \gamma 2 * \Delta\ turnover_{i,t} + \gamma 3 * X_{i,t-1} + \gamma 4 * D_t + \varepsilon_t$$

where GDP_growth_t is real GDP growth, $inflation\_rate_t$ is headline HCPI inflation rate, $X_{i,t-1}$ is the firm specific factors (firm size dummy, asset tangibility (the ratio of fixed assets to total assets), and cashflow generation ratio (the ratio of turnover to total assets)), and D_t is the pandemic dummy.[2] Based on the result of these regression, growth of turnover is calculated as $(x\%) = \beta 1 * GDP\ growth_t$ and growth of total operating cost is calculated as $(y\%) = \gamma 1 * inflation\ rate_t + \gamma 2 * (x\%)$. The sensitivity analysis scenario (higher shock on auto and real estate related sectors) is constructed by using the coefficients of quantile regression with 25 percentiles. The table AVIII-1 and 2 show the results of the regression analysis as well as cumulative changes over 2024-26.

[2] The regression model is specified based on IMF (2024a).

Appendix III. Table 1. Slovak Republic: Estimated Coefficients (Quantile Regression)

	baseline & adverse senario																	sensitivity		
Nace	A	B	C	D	E	F	G	H	I	J	L	M	N	P	Q	R	S	Auto	F	L
gdp (β1)	0.60	1.77	1.28	0.46	0.71	1.76	1.06	1.32	1.19	0.69	0.25	0.86	1.00	1.02	0.37	1.20	1.09	1.53	1.55	0.63
cpi (γ1)	0.12	0.19	0.09	0.09	0.09	0.03	0.07	0.06	0.13	0.13	0.09	0.13	0.07	0.09	0.05	0.09	0.09	0.18	0.24	0.35
rev (γ2)	0.87	0.77	0.92	0.76	0.92	0.96	0.91	0.93	0.81	0.88	0.80	0.87	0.91	0.83	0.74	0.84	0.76	0.70	0.79	0.46

Note: A - Agriculture, forestry and fishing, B - Mining and quarrying, C – Manufacturing, D - Electricity, gas, steam and air conditioning supply, E - Water supply; sewerage, waste management and remediation activities, F – Construction, G - Wholesale and retail trade; repair of motor vehicles and motorcycles, H - Transportation and storage, I - Accommodation and food service activities, J - Information and communication, L - Real estate activities, M - Professional, scientific and technical activities, N - Administrative and support service activities, P – Education, Q - Human health and social work activities, R - Arts, entertainment and recreation, S - Other service activities.

Appendix III. Table 2. Slovak Republic: Cumulative Changes over 2024-26

	Nace1	A	B	C	D	E	F	G	H	I	J	L	M	N	P	Q	R	S	Auto
baseline	x %	4.7	14.1	10.0	3.5	5.5	14.0	8.2	10.3	9.3	5.4	1.9	6.7	7.8	8.0	2.9	9.4	8.5	-
	y %	5.2	12.7	10.0	3.5	5.9	13.7	8.2	10.2	8.8	6.0	2.3	7.0	7.7	7.4	2.6	8.7	7.3	-
adverse	x %	-1.4	-4.4	-3.1	-1.1	-1.7	-4.4	-2.6	-3.2	-2.9	-1.7	-0.6	-2.1	-2.4	-2.5	-0.9	-2.9	-2.6	-
	y %	0.5	-0.8	-1.6	0.4	-0.4	-3.8	-1.3	-2.2	-0.6	0.3	0.7	0.0	-1.3	-0.8	0.1	-1.3	-0.8	-
sensitivity	x %	-1.4	-4.4	-3.1	-1.1	-1.7	-3.8	-2.6	-3.2	-2.9	-1.7	-1.5	-2.1	-2.4	-2.5	-0.9	-2.9	-2.6	-3.8
	y %	0.5	-0.8	-1.6	0.4	-0.4	0.4	-1.3	-2.2	-0.6	0.3	4.2	0.0	-1.3	-0.8	0.1	-1.3	-0.8	-0.1

Note: A - Agriculture, forestry and fishing, B - Mining and quarrying, C – Manufacturing, D - Electricity, gas, steam and air conditioning supply, E - Water supply; sewerage, waste management and remediation activities, F – Construction, G - Wholesale and retail trade; repair of motor vehicles and motorcycles, H - Transportation and storage, I - Accommodation and food service activities, J - Information and communication, L - Real estate activities, M - Professional, scientific and technical activities, N - Administrative and support service activities, P – Education, Q - Human health and social work activities, R - Arts, entertainment and recreation, S - Other service activities.

6. To estimate the probability of Default, the following econometric model is estimated by merging Orbis and Moody's CreditEdge database and using data of 2005-2023.[3]

$$logit(PD_{it}) = \alpha + \sum \beta_{k1} * D\_ICR_{itk1} + \sum \gamma_{k2} * D\_ROTA_{itk2} + \sum \theta_{k3} * D\_D/E_{itk3} + \sum \delta_{k4} * D\_WC/TA_{itk4} + \mu * X + \varepsilon_t$$

where $\mathrm{PD_{ft}}$ is 1-year expected probability of default, $\mathrm{D\_ICR_{itk1}}$ are ICR dummy variables with the interval of *0.5,* $\mathrm{D_ROTA_{itk1}}$are ROTA dummy variables with the interval of *0.005,* $\mathrm{D\_D/E_{itk1}}$ are leverage dummy variables with the interval of *0.25, and* $\mathrm{D\_WCTA_{itk1}}$, WC/TA dummy variables with the interval of *0.05,* and X are country and sector dummy variables. The intention of transforming four financial indicators into a set of dummy variables is to capture the possible non-linear relationship. Given the limited recordings of Slovak firms, the data for Euro Area (EA) as well as Central and Eastern Europe (CEE) countries (EU member states) are used. The table AVIII-3 indicates the sample size and Table AVIII-4 shows the estimated coefficients from the regression analysis.

[3] The analysis here introduced non-linearity based on the model by IMF (2024b).

Appendix III. Table 3. Slovak Republic: PD Analysis - Sample Size

AT	BE	BG	CY	CZ	DE	EE	ES	FI	FR	GR	HR	HU
935	1,824	4	183	139	8,858	260	2,159	2,052	9,699	2,723	49	370

IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SI	SK	total
1,012	3,618	29	620	6	63	1,829	5,385	591	1,032	267	71	43,778

Appendix III. Table 4. Slovak Republic: Estimated Coefficients for PD Analysis

ICR		***ROTA***		***D/E***		***WC/TA***	
min to -1	0.09291	min to -0.035	0.87413***	min to -4	1.86128***	min to -0.25	0.16203***
	(0.09546)		(0.09479)		(0.07345)		(0.05390)
-1 to -0.5	0.23751**	-0.035 to -0.03	0.84669***	-4 to -2	1.89875***	-0.25 to -0.2	0.10844*
	(0.10507)		(0.11213)		(0.08116)		(0.06351)
-0.5 to 0	0.31705***	-0.03 to -0.025	0.78940***	-2 to 0	1.97618***	-0.2 to -0.15	0.10719*
	(0.10798)		(0.11142)		(0.08593)		(0.06039)
0 to 0.5	0.82137***	-0.025 to -0.02	0.71909***	0 to 0.25	*base*	-0.15 to -0.1	0.10607*
	(0.06340)		(0.11327)	0.25 to 0.5	0.35329***		(0.05726)
0.5 to 1	0.81714***	-0.02 to -0.015	0.79815***		(0.06269)	-0.1 to -0.05	-0.02079
	(0.05205)		(0.10828)	0.5 to 0.75	0.49681***		(0.05345)
1 to 1.5	0.68666***	-0.015 to -0.01	0.73751***		(0.06307)	-0.05 to 0	-0.05602
	(0.04565)		(0.11019)	0.75 to 1	0.57043***		(0.05056)
1.5 to 2	0.58433***	-0.01 to -0.005	0.66624***		(0.06334)	0 to 0.05	-0.06604
	(0.04605)		(0.10862)	1 to 1.25	0.72866***		(0.04849)
2 to 2.5	0.51000***	-0.005 to 0	0.62681***		(0.06594)	0.05 to 0.1	-0.08041*
	(0.04621)		(0.11482)	1.25 to 1.5	0.76546***		(0.04838)
2.5 to 3	0.42790***	0 to 0.005	0.03116		(0.06611)	0.1 to 0.15	-0.09105*
	(0.04938)		(0.07133)	1.5 to 1.75	0.93396***		(0.04655)
3 to 3.5	0.38525***	0.005 to 0.01	0.10914*		(0.06781)	0.15 to 0.2	-0.13009***
	(0.05673)		(0.06041)	1.75 to 2	0.96383***		(0.04601)
3.5 to 4	0.22450***	0.01 to 0.015	0.06759		(0.07179)	0.2 to 0.25	-0.01707
	(0.05706)		(0.05296)	2 to 2.25	1.00241***		(0.04901)
4 to 4.5	0.10714*	0.015 to 0.02	0.13526***		(0.07201)	0.25 to 0.3	-0.05912
	(0.05649)		(0.05190)	2.25 to 2.5	1.01876***		(0.04886)
4.5 to 5	0.15655**	0.02 to 0.025	0.06822		(0.07284)	0.3 to 0.35	-0.05387
	(0.06411)		(0.05222)	2.5 to 2.75	1.15833***		(0.05056)
5 to 5.5	0.15629**	0.025 to 0.03	0.13558***		(0.07453)	0.35 to 0.4	0.01314
	(0.06466)		(0.04715)	2.75 to 3	1.16015***		(0.05280)
5.5 to 6	0.11830*	0.03 to 0.035	0.04005		(0.07716)	0.4 to 0.45	-0.00825
	(0.06646)		(0.04558)	3 to 4	1.21033***		(0.05560)
6 to max	*base*	0.035 to max	*base*		(0.06979)	0.45 to max	*base*
				4 to 5	1.33785***		
					(0.07542)		
				5 to 6	1.34751***		
					(0.08160)		
				6 to 8	1.57453***		
					(0.08144)		
				8 to max	1.62649***		
					(0.07251)		

Note 1: Robust standard errors in parentheses
Note 2: *** p<0.01, ** p<0.05, * p<0.1
Note 3: Observations 43,778. The regression includes constant as well as country and sector dummies.

Appendix IV. Household Analysis Methodology

Data and General Approach

1. The household vulnerability analysis uses micro data from the Household Finance and Consumption Survey (HFCS) and EU statistics on income and living conditions (EU-SILC) to conduct simulations of macroeconomic shocks to household balance sheet. This allows to identify vulnerable households who may be at risk of default by computing, under different scenarios, household vulnerability measures based on DSTI and essential consumption on food, utilities, and rents (for more details see Valderrama et al, 2023). The methodology follows a three-step procedure:

i. First, HFCS data on households' balance sheets, payments, income, and consumption is used to predict household financial stress using a simulation approach.
ii. Second, the link between being financially vulnerable and the likelihood of default is estimated at the individual household level. For this, the model relies on the EU-SILC micro data, which contains information on housing costs, the minimum income needed to pay for essential expenses, and whether the household is in arrears (on mortgage loans or other loan obligations).
iii. Third, the simulated increase in the share of financially vulnerable households is used to estimate the increase in the average PDs. The PD for households with DSTI above 70% ($\mathrm{PD}_{\mathrm{DSTI=1}}$) and for households with DSTI below 70% ($\mathrm{PD}_{\mathrm{DSTI=0}}$) is estimated with the logistics regressions.

Results from this micro model are used to estimate loan stage distribution in the retail loan portfolio for the solvency ST (see Appendix V).

Definition of Household Vulnerability

2. Two definitions of household vulnerability are considered: DSTI greater than or equal to 40 percent, and debt service plus consumption of food, utilities, and rents exceeding 70 percent of household income (debt-service-and-essential-consumption-to-income-ratio, DSECTI>0.7).

3. The impact of shocks on household finances is highly non-linear. The following equations show the channels through which macrofinancial shocks affect households' ability to fulfil their debt service obligations and afford essential consumption.

$$\boldsymbol{DSTI^{h}_{T,j}} = \frac{\sum_{k=1}^{N}\left(\boldsymbol{P^{h}_{t,k}} + \boldsymbol{O^{h}_{t,k}} \times \boldsymbol{i^{h}_{t,k}}\right) + \sum_{s=1}^{M}\left(\boldsymbol{O^{h}_{t,s}} \times \boldsymbol{\Delta i^{s}_{T-t,j}} \,|\boldsymbol{s = variable}\right)}{\boldsymbol{I^{h}_{t}} \times \left(\mathbf{1} + \boldsymbol{\Delta inc_{T-t,j}}\right)} \times \boldsymbol{gD_{T-t,j}}$$

$$\boldsymbol{DSECTI^{h}_{T,j}} = \boldsymbol{DSTI^{h}_{T,j}} + \frac{\boldsymbol{food^{h}_{t}} \times \left(\mathbf{1} + \boldsymbol{\Delta CPI^{food}_{T-t,j}}\right) + \boldsymbol{utilities^{h}_{t}}\left(\mathbf{1} + \boldsymbol{\Delta CPI^{energy}_{T-t,j}}\right) + \boldsymbol{rent^{h}_{t}} \times \left(\mathbf{1} + \boldsymbol{\Delta CPI_{T-t,j}}\right)}{\boldsymbol{I^{h}_{t}} \times \left(\mathbf{1} + \boldsymbol{\Delta inc_{T-t,j}}\right)}$$

Where $\Delta i_{T-t,j}$ as the interest rate shock from time t to T, I_t^h stands for household h gross household income, $P_{t,k}^h$ is the principal repayment of outstanding loans, $O_{t,s}^h$ is the amount of outstanding debt, $i_{t,k}^h$ is the lending rate, $\boldsymbol{gD_{T-t,j}}$ is the outstanding debt growth, $\boldsymbol{\Delta CPI}$ is the change in the corresponding consumer price index, $\boldsymbol{\Delta inc_{T-t,j}}$ stands for household's income growth, N is the total number of loans, M is the number of loans with interest rates to be re-set over the next two years, T is the year, and j the country

Application of Macroeconomic Shocks

4. Given the latest HFCS for Slovak household was conducted in 2021 and households' liabilities and consumption patterns could have changed since then, the model applies the observed cumulative changes in the macroeconomic conditions from 2021 to 2024 and the scenario projections from 2024 to 2026 to assess the health of household balance sheet during the ST horizon. The application of each macroeconomic variable to individual household balance sheet follows Valderrama et al. (2023):

- **Income.** From 2021 to 2023, extrapolate each household's income growth using the cumulative growth in disposable income per capita. For 2024 onwards, projected wage growth to proxy for household income growth is used. The same growth rate is applied to each household.

- **Debt.** The model applies the same ratio of debt growth to all households following the sectoral wide growth rate. This simplifying assumption may not reflect specific debt evolution, since some households may offset principal repayment since 2021 with new borrowing, while others may fully amortize debt and be replaced by new borrowers. Moreover, as interest rate increases, households with sufficient financial assets may choose to repay their variable-rate loans early.

- **Interest payments.** For simulations up to 2023, the model assumes that adjustable-rate loans had not been repriced. For 2024 onwards, interest rate changes are assumed to be fully passed through to variable-rate loans and fixed-rate loans are not affected.

- **Consumption.** No change to the structure of the real consumption basket is assumed.

- **Prices.** Changes in the price of food and energy follow global wholesale prices sourced from IMF's WEO, while the value of rents, non-essential goods, and services is adjusted by core inflation.

- **Unemployment rate.** Changes of unemployment rate are assumed to apply evenly to anyone who is currently in the labor force. When a worker changes from employed to unemployed, its wage income will become the average social benefits available to unemployed (unemployment benefit, unemployment assistance, private insurance, and ERTE). Similarly, when an unemployed worker becomes employed, it will lose all the unemployment-related social benefits but started to earn an average wage income.

Vulnerable Households and Probability of Default

5. The following results from the logistic regression that estimates PD for households with DSTI above 70% ($PD_{DSTI=1}$) and for households with DSTI below 70% ($PD_{DSTI=0}$) were used for the household satellite credit risk model.

Appendix IV. Table 1. Slovak Republic: Regression Odd Ratios

			Spec 1		Spec 2		Spec 3		Spec 4	
arrears										
overb=0	0	(.)	0	(.)	0	(.)	0	(.)	0	(.)
overb=1	0.512**	-2.59	0.530**	-2.91	0.590***	-3.32	0.764**	-2.82	0.818**	-3.21
AT	0	(.)	0	(.)	0	(.)	0	(.)	0	(.)
BE	-0.751***	(-57.65)	-0.742***	(-63.76)	-0.619***	(-25.08)	-0.390***	(-6.32)	-0.358***	(-5.83)
CY	1.533***	-48.16	1.452***	-45.76	1.493***	-67.61	2.114***	-24.58	1.902***	-21.18
DE	0.407***	-30.8	0.410***	-34.98	0.512***	-43.15	0.964***	-13.12	0.996***	-13.87
EE	0.319***	-10.2	0.326***	-12.11	0.353***	-8.22	0.678***	-8.01	0.164**	-2.87
ES	0.0884*	-2.3	0.0982**	-2.77	0.0977*	-2.14	0.423***	-5.95	0.097	-1.22
FR	-0.550***	(-17.63)	-0.549***	(-19.23)	-0.535***	(-11.46)	-0.326***	(-5.15)	-0.279*	(-2.57)
GR	1.659***	-71.84	1.671***	-86.06	1.754***	-42.4	1.927***	-19.09	1.834***	-18.83
HR	0.326***	-11.05	0.382***	-15.02	0.407***	-5.86	1.931***	-25.68	1.497***	-14.02
HU	1.280***	-38.31	1.292***	-44.71	1.363***	-24.09	1.412***	-18.99	1.405***	-15.84
IE	-0.00830**	(-3.18)	-0.00753**	(-2.61)						
IT	0.180***	-7.87	0.179***	-9.3	0.217***	-9.66	1.039***	-9.44		
LT	1.123***	-24.63	1.139***	-27.71	1.437***	-17.96	2.082***	-10.26	1.503***	-6.49
LU	-0.389***	(-20.57)	-0.349***	(-19.98)	-0.352***	(-8.45)	0.0134	-0.16		
LV	0.313***	-5.65	0.320***	-6.39	0.321***	-7.58	0.900***	-9.71	0.527***	-6.9
MT	-0.841***	(-26.46)	-1.335***	(-50.18)						
NL	-0.346***	(-18.44)	-0.333***	(-20.85)	-0.257***	(-6.33)	0.0506	-0.59	-0.0891	(-0.57)
PT	-0.0836***	(-4.13)	-0.0708***	(-4.20)	-0.0679*	(-2.06)	0.298***	-3.95	-0.00875	(-0.13)
SI	-1.111***	(-37.08)	-1.082***	(-40.52)	-1.000***	(-34.55)	-0.202***	(-4.38)	-0.520***	(-8.53)
SK	-0.0408*	(-2.52)	-0.0986***	(-7.13)	-0.0652	(-1.14)	0.616***	-6.5	0.604***	-7.83
tercome=1	0	(.)	0	(.)	0	(.)	0	(.)	0	(.)
tercome=2	-0.654***	(-5.25)	-0.643***	(-5.58)	-0.573***	(-3.96)	-0.485*	(-2.43)	-0.205	(-1.09)
tercome=3	-1.182***	(-6.88)	-1.170***	(-7.08)	-0.948***	(-9.04)	-0.567*	(-2.25)	-0.314	(-1.25)
saving_ratio			0.0000596***	-6.13	0.0000616***	-6.36	0.0000712***	-5.81	0.0000737***	-5.4
age					-0.00508	(-0.99)	-0.00055	(-0.02)	-0.0024	(-0.11)
gender					0.00576	-0.03	-0.348***	(-4.74)	-0.270***	(-3.44)
university					-0.333	(-1.48)	-0.00629	(-0.02)	0.196	-0.5
fin_knowledge					0.00376	-0.04	-0.378*	(-2.49)	-0.433**	(-3.16)
unempl					1.002***	-4.61	1.428***	-4.73	1.249***	-3.95
work_experience					0.00504	-0.62	0.041	-1.34	0.0348	-1.22
n_hh_empl					-0.00863	(-0.08)	0.126	-0.94	0.00801	-0.12
n_dep_child					0.0415	-1.23	0.071	-1.04	0.0246	-0.32
ltv_main_residence							0.684***	-3.33	0.442+	-1.94
family_assistance							1.081***	-5.84	0.907***	-5.27
public_assistance							0.372**	-3.01	0.375***	-4.58
leasing							-0.939+	(-1.75)	-0.956+	(-1.78)
adj_rate									0.433***	-4.92
liq_asset									-0.704*	(-2.22)
credit_constr									1.032***	-9.28
inheritance									-0.44	(-1.27)
net_wealth_income_ratio									0.0245*	-1.96
Observations	22788		22595		19344		11895		10488	
R-squared										
Pseudo R-squa	0.067		0.068		0.079		0.098		0.131	
AIC	26672181		26462062.2		25312412.6		12437165		10358125.8	
BIC	26672205.1		26462094.3		25312507.1		12437283		10358234.7	

Note 1: t statistics in parentheses
Note 2: * p<0.05, ** p<0.01, *** p<0.001"

Appendix IV. Table 2. Slovak Republic: Probabilities of Default

	Spec 1		Spec 2		Spec 3		Spec 4	
	DSTI=0	DSTI=1	DSTI=0	DSTI=1	DSTI=0	DSTI=1	DSTI=0	DSTI=1
AUT	6.74%	10.90%	6.24%	10.70%	3.38%	7.00%	3.45%	7.48%
BEL	3.33%	5.52%	3.46%	6.07%	2.32%	4.85%	2.43%	5.35%
CYP	23.60%	34.40%	22.80%	34.80%	22.50%	38.40%	19.30%	35.20%
DEU	9.82%	15.60%	9.99%	16.70%	8.41%	16.50%	8.81%	18.00%
EST	9.10%	14.50%	8.64%	14.60%	6.45%	12.90%	4.04%	8.70%
ESP	7.38%	11.90%	6.83%	11.70%	5.08%	10.30%	3.78%	8.18%
FRA	4.01%	6.62%	3.75%	6.57%	2.47%	5.15%	2.63%	5.77%
GRC	27.80%	39.50%	27.80%	40.90%	19.40%	34.10%	18.30%	33.60%
HRV	9.57%	15.20%	9.08%	15.30%	19.50%	34.20%	13.80%	26.60%
HUN	20.80%	30.90%	20.60%	31.90%	12.60%	23.60%	12.70%	24.80%
IRL	6.69%	10.90%						
ITA	7.95%	12.80%	7.63%	13.00%	9.01%	17.50%		
LTU	18.40%	27.70%	21.90%	33.50%	21.90%	37.60%	13.80%	26.70%
LUX	4.85%	7.97%	4.47%	7.78%	3.43%	7.09%	0.00%	0.00%
LVA	9.05%	14.50%	8.40%	14.20%	7.93%	15.60%	5.70%	12.10%
MLT	1.86%	3.13%						
NDL	4.92%	8.09%	4.89%	8.50%	3.55%	7.33%	3.16%	6.89%
PRT	6.31%	10.30%	5.85%	10.10%	4.51%	9.21%	3.42%	7.42%
SVN	2.39%	3.99%	2.39%	4.23%	2.78%	5.79%	2.08%	4.59%
SVK	6.14%	10.00%	5.86%	10.10%	6.09%	12.20%	6.13%	12.90%

Appendix V. Solvency Stress Test: Credit Risk

Loan Stocks Projection: IFRS9[1]

Household Loans:

1. According to the household's vulnerability model (see Appendix IV), the share of loans at risk (LaR) correspond to households with debt service plus essential consumption greater than 70% of household income. Therefore, Stage 1 ($S1_t$) loans were projected as loans that are not at risk and not in default, Stage 2 ($S2_t$) loans as loans at risk but not in default, while Stage 3 ($S3_t$) loans are projected as the sum of loans at risk in default and loans not at risk but in default:

$$S1_t = (1 - LaR) \cdot (1 - PD_{DSTI=0}) \cdot S_t$$

$$S2_t = LaR \cdot (1 - PD_{DSTI=1}) \cdot S_t$$

$$S3_t = LaR \cdot PD_{DSTI=1} + (1 - LaR) \cdot (1 - PD_{DSTI=0}) \cdot S_t$$

Where S_t is the total household loans at time t.

Corporate Loans:

2. Performing and nonperforming exposure stocks were projected based on the transition matrix-implied flows, while allowing for write-offs and asset sales and also cure flows form Stage 3 to Stages 1 and 2. Stocks of Stage 2 and 3 exposures were simulated following:

$$S2_t = S2_{t-1} + TM_t^{12} S1_{t-1} + TM_t^{32} S3_{t-1} - TM_t^{21} S2_{t-1} - TM_t^{23} S2_{t-1} - M_t^2 S2_{t-1}$$

$$S3_t = S3_{t-1} + TM_t^{13} S1_{t-1} + TM_t^{23} S2_{t-1} - TM_t^{31} S3_{t-1} - TM_t^{32} S3_{t-1} - WRO_t S3_{t-1}$$

The stock of Stage 1 is implied by total loans, which is projected with the loan growth rate, and the stock of loans in Stage 2 and 3; therefore, new business flows and repayment remain implicit:

$$S_t = (1 - g_t) \cdot S_{t-1}$$

$$S1_t = Max(0, S_t - S2_t - S3_t)$$

The write-off rate and asset sales rates (WRO_t) were assumed to remain constant at the observed bank-portfolio levels at the cut-off date. Transition matrix TM_t^{ij} entries are updated simultaneously with the stocks S_t^i, in three steps:

a. TM_t^{13} and TM_t^{23} are derived from PD_t path:

[1] Projections for loan stocks and stage distribution, loan losses and credit risk parameters for the corporate loan portfolio are based on Gross et al. (2020).

$$TM_t^{23} = \Phi\left(\Phi^{-1}(TM_0^{23}) + \left(\Phi^{-1}(PD_t) - \Phi^{-1}(PD_0)\right)\right)$$

$$TM_t^{13} = \min\left(1, \max\left(0, \frac{PD_t \cdot (S_{t-1}^1 + S_{t-1}^2) - TM_t^{23} \cdot S_{t-1}^2}{S_{t-1}^1}\right)\right)$$

b. Project other TM_t^{ij}, $i \neq j$ based on sensitivity to shock in distance-to-default space (DD_{ij}):

$$TM_t^{ij} = \Phi\left(\Phi^{-1}\left(TM_0^{ij}\right) + DD_{ij}\left(\Phi^{-1}\left(TM_t^{i3}\right) - \Phi^{-1}\left(TM_0^{i3}\right)\right)\right), \quad i \neq 3$$

$$TM_t^{3j} = \Phi\left(\Phi^{-1}\left(TM_0^{3j}\right) + DD_{3j}\left(\Phi^{-1}(TM_t^{23}) - \Phi^{-1}(TM_0^{23})\right)\right)$$

c. Derive diagonal terms TM_t^{ii} to have rows summing up to 1.

Provisions

3. Expected credit loss for household loans used the estimated stage distribution and the bank-by-bank observed provision coverage ratios. For corporate exposures, loan losses are computed by calculating provision stocks by stage and taking into account the fact that provision stocks shrink when S3 (NPL) assets are written-off.

$$PROV_t^{S1} = TM_t^{13} \cdot LGD_t \cdot S1_{t-1}$$

$$PROV_t^{S2} = \sum_{s=t+1}^{L} \frac{TM_s^{23,*} \cdot LGD_s \cdot S2_{s-1}}{(1+r)^s}$$

$$PROV_t^{S3} = LGD_t \cdot S3_{t-1}$$

$$PROV_t^{k} = PROV_t^{S1} + PROV_t^{S2} + PROV_t^{S3}$$

$$LL_t = PROV_t - PROV_{t-1} + WRO_t \times LGD_t \times S3_{t-1}$$

Loss Given Default (PiT)

4. For all portfolios, except mortgages, a link of LGDs to PDs was established through a Vašíček equation. The equation is derived based on the premise that there is an inherent link, a positive association, between PDs and LGDs[2]. The LGD is expressed as a function of PDs as follows:

[2] Details can be found in Frye and Jacobs (2012).

$$\mathrm{LGD}_{\mathrm{b,t0+h}} = \Phi\left(\Phi^{-1}\left(\mathrm{PD}_{\mathrm{b,t0+h}}\right) - \mathrm{k}\right)\mathrm{PD}_{\mathrm{b,t0+h}}$$

where Φ and Φ^{-1} denote the normal and inverse normal distributions, and *k* is a bank-portfolio specific parameter computed at the outset and kept fixed thereafter, involving a correlation coefficient ρ (set judgmentally, additional subscripting for each portfolio is omitted for brevity).

$$\mathrm{k} = \frac{\Phi^{-1}(\mathrm{PD}_{\mathrm{t0}})\Phi^{-1} - (\mathrm{PD}_{\mathrm{t0}} \cdot \mathrm{LGD}_{\mathrm{t0}} \cdot \mathrm{f})}{\sqrt{1-\rho}}$$

The factor *f* is implied such that LGD matches the bank-portfolio specific observed LGDs.

5. For mortgages, the LGD are computed assuming a linear relation between house price index (HP) and recovery value.

$$\mathrm{LGD}_{\mathrm{t}} = 1 - (1 - \mathrm{LGD}_{0}) \cdot \frac{\mathrm{HP}_{\mathrm{t}}}{\mathrm{HP}_{0}}$$

Risk Weighted Assets

Standardize Loan Portfolios (STA):

Performing*:* RWA are projected using the RWA densities at the cut-off date (ρ), which are assumed constant over the scenario horizon.

RWA densities per portfolio/segment 'e' and RWA projection:

$$\rho_e^{PE}[0] = \frac{RWA(STA)_e^{PE}[0]}{EAD(STA)_e^{PE}[0] - PROV(STA)_e^{PE}[0]}$$

$$RWA(STA)_e^{PE}[t] = \rho_e^{PE}[0] \cdot (EAD(STA)_e^{PE}[t] - PROV(STA)_e^{PE}[t])$$

Non-Performing: same assumption for non-performing loans.

$$\rho_e^{NPE}[0] = \frac{RWA(STA)_e^{NPE}[0]}{EAD(STA)_e^{NPE}[0] - PROV(STA)_e^{NPE}[0]}$$

$$RWA(STA)_e^{NPE}[t] = \rho_e^{NPE}[0] \cdot (EAD(STA)_e^{NPE}[t] - PROV(STA)_e^{NPE}[t])$$

Internal Ratings-based – IRB - Loan Portfolios

Performing: Use of Basel formulas. PD through-the-cycle (TTC) and downturn LGD (DT) are projected as follows:

i. PD TTC: given that no historical information on PD PiT is available, but PD PiT and PD TTC are known at the cut-off point, then a formula that mimics a moving average is used.

$$PD\ TTC[t] = \frac{\left(TTC\ Window - (t+1)\right) \cdot \frac{PD\ TTC[T_0] \cdot TTC\ Window - PD\ PiT[T_0]}{TTC\ Window - 1} + \sum_{k=0}^{k=t} PDPiT[k]}{TTC\ Window}$$

This have the implicit assumption that TTC is a simple cycle average, which ignores any conservatism when banks do not update downwards PD TTCs during boom cycles.

ii. LGD DT

$$\text{LGD DT}_e[t] = \max(\text{LGD PiT}_e[t], \text{LGD DT}_e[T_0])$$

Non-Performing:

$$\text{RWA(IRB)}_e^{\text{NPE}}[t] = \text{EAD(IRB)}_e^{\text{NPE}}[t] \cdot (\text{LGD T}_e[t] - \text{ELBE}_e[T_0]) \cdot 12.5 \cdot \text{RWA(IRB)}_e^{\text{NPE}}[t]$$

$$= \text{EAD(IRB)}_e^{\text{NPE}}[t] \cdot (\text{ELBE}_e[T_0] - \text{LGD T}_e[t]) \cdot 12.5$$

where ELBE_e is the expected loss best estimate for a given portfolio/segment 'e'.

Appendix VI. Solvency Stress Test: Net Interest Income

1. Denote as $E_t^{[k,k+1]}$ as the exposures in bucket $[k, k+1]$ at the end of year-t (i.e., the exposures that have between k and $k+1$ years until repricing at the end of year-t), as $\theta_t^{[k,k+1]}$ the share of total exposures in that bucket according to the repricing ladder of exposures at the cut-off date, as $r_t^{[k,k+1]}$ as the average YTM of the exposures that at end of year-t are in bucket $[k, k+1]$, and as r_t^E the corresponding average YTM of all exposures in the portfolio at end of year-t. The latter can be written as a weighted average in the following way:

$$r_t^E = \sum_{k=0}^{5} \theta_t^{[k,k+1]} r_t^{[k,k+1]}$$

Also, denote as $I_t^{[k,k+1]}$ the newly issued or repriced exposures in bucket $[k, k+1]$ during year-t, and let I_t^E denote the newly issued/repriced exposures in the whole portfolio. That is,

$$I_t^E = \sum_{k=0}^{5} I_t^{[k,k+1]}$$

2. The model makes two key simplifying assumptions:

(i) The same interest rate on new business $r_t^{E,nb}$ applies both to newly issued exposures and to variable-rate instruments when they reset their rate before maturity; accounting for data limitations found.

(ii) The shares of exposures across buckets are constant over time. That is,

$$\theta_t^{[k,k+1]} = \theta_0^{[k,k+1]}$$

3. Interest income in year-t (II_t) takes the following form:

$$II_t = r_{t-1}^E E_{t-1} + \left(1 - \frac{\text{avg days to repricing}}{365}\right)\left(r_t^{E,nb} - r_{t-1}^{[0,1]}\right) E_{t-1}^{[0,1]} + \frac{1}{2} r_t^{E,nb} \left(I_t^E - E_{t-1}^{[0,1]}\right)$$

4. The three terms in the equation capture the following effects:

(i) the first term is the base rate, which is determined in year-$(t-1)$ and is therefore not affected by the year-t interest rate shock;

(ii) the second term captures the effect of the year-t interest rate shock on the interest income from exposures that reprice during that year. That is, the exposures that reprice during year-t will, on average, continue to earn the old interest rate $r_{t-1}^{[0,1]}$ during the fraction of average days to repricing, and during the remaining fraction of the year their rate will change by a magnitude $r_t^{E,nb} - r_{t-1}^{[0,1]}$.

(iii) The third term captures the interest income from issuance/repricing of exposures over and above those needed to replace $E_{t-1}^{[0,1]}$. These newly issued/repriced exposures earn an interest rate $r_t^{E,nb}$, which is multiplied by $\frac{1}{2}$ because we assume that these exposures enter the portfolio at the midpoint of the year, on average.

5. The projection of the YTM for each bucket is based on simulating how the exposures move through the repricing ladder over time. For example, if at the end of year-0 an exposure has [2;3] years remaining until repricing, then at the end of year-1 it must have [1;2] years remaining. This is captured by the following equation:

$$I_t^{[k-1,k]} = E_t^{[k-1,k]} - E_{t-1}^{[k,k+1]}\left(1 + r_{t-1}^{[k,k+1]}\right) \text{ for } k = 1,2,\ldots,5$$

Note that the exposures $E_{t-1}^{[k,k+1]}$ are multiplied by $\left(1 + r_{t-1}^{[k,k+1]}\right)$ because, although they do not generate any cashflow, they accrue interest through an increase in their book. For the last bucket we simply define:

$$E_t^{[T-1,T]} = I_t^{[T-1,T]}$$

The average interest rate for each bucket, $r_{t-1}^{[k,k+1]}$, is calculated recursively:

$$r_t^{[k-1,k]} = \frac{E_{t-1}^{[k,k+1]}\left(1 + r_{t-1}^{[k,k+1]}\right)}{E_t^{[k-1,k]}} r_{t-1}^{[k,k+1]} + \frac{I_t^{[k-1,k]}}{E_t^{[k-1,k]}} r_t^{E,nb} \quad \text{for } k = 1,2,\ldots,5 \qquad (4)$$

$$r_t^{[T-1,T]} = r_t^{E,nb}$$

The recursive definition requires an initial condition, $r_0^{[k,k+1]}$, so we make the simplifying assumption that $r_0^{[k-1,k]} = IIr_0$ for all k, meaning that all the exposures in the portfolio at the cut-off date were issued/repriced at the same interest rate IIr_0.

6. For interest expenses, the model does exactly the same, just replacing exposures for liabilities. For demand deposits, all liabilities are assigned to the overnight repricing bucket. Finally, in order to incorporate defaults and NPEs into the model, we multiply the interest income II_t obtained from the structural model by the share of (average) performing exposures:

$$II_t = \left(1 - \frac{av\{NPEr_t \cdot E_t\,;\; NPEr_{t-1} \cdot E_{t-1}\}}{av\{E_t; E_{t-1}\}}\right) \cdot II_t^{non-adj} \qquad (5)$$

7. For each bank, the assets and liabilities portfolio was divided in 12 categories to calculate the repricing structure. Assets: debt securities, loans - Credit Institutions, loans - Gov, loans - HH, loans NFC. Liabilities: debt securities issued, sight deposits - Credit Institutions, sight deposits – Other, sight deposits – HH, term deposits - Credit Institutions, term deposits – Other and term deposits – HH).

8. While the structural model was implemented at bank-by-bank level, the interest rates on new deposits ($r_t^{E,nb}$) were projected using the observed initial effective interest rates, the macro scenario rates and the estimated pass-through from short-term interest rates to deposits interest rates. Given the lack of granular data for interest rates on new loans, and following the expert judgement of the NBS, it was assumed a full pass-through to household new loans with long term rate shocks, and full pass-through to NFC new loans with short term rates shocks.

Appendix VI. Table 1. Slovak Republic: Interest Rates on New Business Pass-through

Short-term rate	***Spec 1***	***Spec 2***	***Spec 3***	***Spec 4***
d_sight_retail	0.024***			
	(3.440)			
d_sight_whole		0.137***		
		(6.956)		
d_term_retail			0.599***	
			(11.024)	
d_term_whole				0.856***
				(17.538)
Observations	68	68	60	60
R-squared	0.152	0.423	0.677	0.841
Adjusted R Square	0.139	0.414	0.671	0.839
Standard Error	0.001	0.002	0.005	0.004

Note 1: t statistics in parentheses
Note 2: * p<0.05, ** p<0.01, *** p<0.001"

Appendix VII. Solvency Stress Test: Market Risk

1. Market risk consider the market revaluation on debt securities booked under FVPL and FVOCI (separated into government and corporate bonds) using a duration approach.

2. Under this approach, valuation losses are calculated multiplying the modified duration of the portfolio by the changes in benchmark risk free rate/credit spread and portfolio valuation. The underlying interest rate shock (ΔY_t) consider changes due to 1) risk free rates (r) and 2) sovereign spread (s). Securities are partitioned according to duration/maturity and the relevant interest rate is considered for the shock:

$$FV_t = FV_{t-1} \cdot \left(1 - \frac{D}{1+Y} \cdot \Delta Y_t\right)$$

$$FV_t = FV_{t-1} \cdot \left(1 - \frac{D}{1+Y} \cdot \Delta Y_t\right)$$

$$\Delta Y_t = \Delta s_t + \Delta r_t$$

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