The Central Bank of Uzbekistan

Financial Stability Report

2024|1

The Financial Stability Report is released biannually by the Central Bank of Uzbekistan (CBU). Its purpose is to address macro-financial vulnerabilities and systemic risks, assess the resilience of the domestic financial system, and provide policy recommendations to mitigate risks and strengthen financial stability.

This report is based on data as of July 1, 2024.

This is a translation of the original Uzbek version, which is the only official text.

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The Financial Stability Report was prepared by the Financial Stability Department of the CBU.
The report was published in October 2024.

If you have any comments, please send them to rmakhammadiev@cbu.uz.

Abbreviations

AEs	Advanced economies
ATM	Automated teller machine
AUROC	Area under the receiver operating characteristic curve
CAB	Current account balance
CAR	Capital adequacy ratio
CBU	Central Bank of Uzbekistan
CCA	Caucasus and Central Asia
CCoB	Capital conservation buffer
CCyB	Countercyclical capital buffer
CET1	Common Equity Tier 1 capital
CoVaR	Conditional value at risk
D-SIB	Domestic systemically important bank
DSR	Debt service ratio
DTI	Debt-to-income
EMs	Emerging markets
FCI	Financial conditions index
FSI	Financial stress index
FX	Foreign currency
GDP	Gross domestic product
HHI	Herfindahl–Hirschman Index
HP	Hodrick–Prescott filter
HQLA	High-quality liquid assets
ICR	Interest coverage ratio
IMF	International Monetary Fund
IQR	Interquartile range
JSC	Joint-stock company
LCR	Liquidity coverage ratio
LGD	Loss given default
LTV	Loan-to-value ratio
MPP	Macroprudential policy
MSCI	Morgan Stanley Capital International
NII	Net interest income
NNII	Net non-interest income
NPAT	Net profit after tax
NPLs	Non-performing loans
NSFR	Net stable funding ratio
PBT	Profit before tax
PCA	Principal component analysis
POS	Point of sale
PTI	Payment-to-income ratio
ROA	Return on assets
ROE	Return on equity
RORWA	Return on risk-weighted assets
RWA	Risk-weighted assets
SSM	State-space model
SST	Self-service terminal
SyRB	Systemic risk buffer
UCI	Uzbekistan Composite Index
USD	United States dollar
UZS	Uzbek soum
VIX	Volatility Index
WUI	World Uncertainty Index
YoY	Year-on-year

Financial Stability Report for H1 2024

Contents

Executive Summary

Financial conditions in Uzbekistan eased in H1 2024. The decline in the financial conditions index (FCI) reflected the relatively low formation of the country's risk premium in line with historical trends, as well as favorable developments in the international financial market and the banking sector.

The banking system remained financially stable. The capital adequacy ratio (CAR) and the Tier 1 capital ratio both increased, remaining above the established minimum requirements.

Banking stress remained low. The financial stress index (FSI) in Uzbekistan improved amid reduced volatility in the foreign exchange market and continued gains in the banking and money markets.

Concern over liquidity and foreign currency (FX) in the banking sector appears to be easing. A higher share of high-quality liquid assets (HQLA) within banks' total assets, along with a lower level of unstable funding on their balance sheets, points to reduced liquidity vulnerabilities. The gap between FX claims and liabilities has also narrowed.

The solvency macro stress test under the adverse scenario indicates potential losses in the banking system. The CAR of the banking system will reach 10.4% by the end of H1 2027, falling below the established minimum requirement.

The liquidity macro stress test under the adverse scenario indicates that the banking system may experience liquidity stress by the end of H1 2025. Some banks are expected to record negative net cash inflows, and shortfalls are anticipated across all currencies. The occurrence of liquidity stress in Uzbek soum (UZS) at a number of banks could lead to systemic risk.

Housing remains overpriced compared to its fundamental value. The ongoing gap reflects high market prices and a supply-demand imbalance in real estate since 2022. Prices are also driven by non-fundamental factors. Furthermore, the faster rise in housing prices relative to rents indicates that investors expect higher gains from price increases than from rental income.
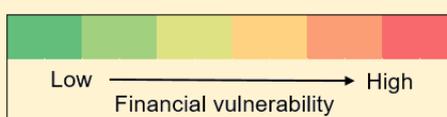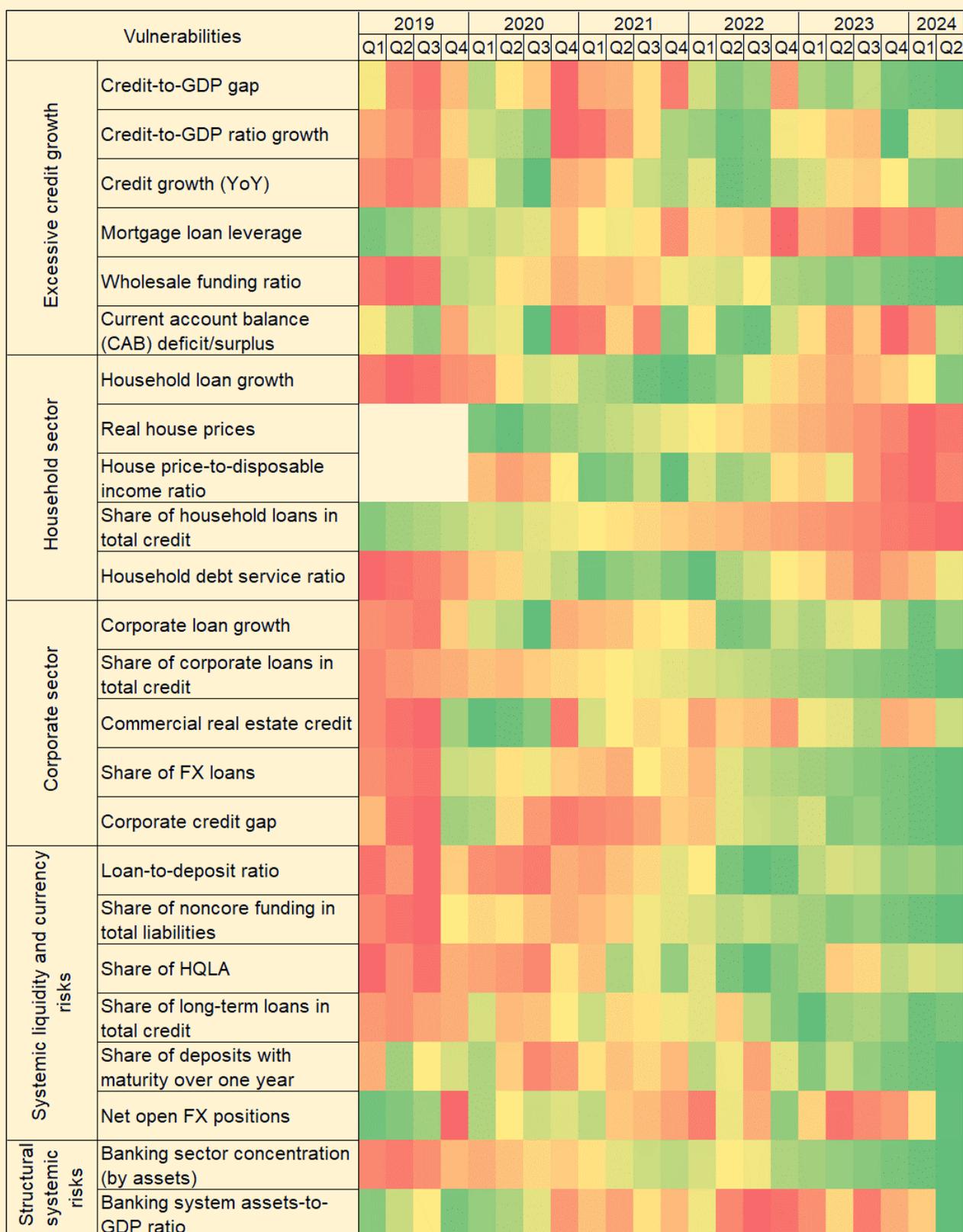
Concerns remain over individuals' capacity to service debt. A survey conducted to assess the total debt burden revealed that the average total debt burden among individuals with bank debt, including obligations from nonbank sources, was 73%.

Banks have tightened mortgage loan standards. In H1 2024, the average weighted maturity of mortgage loans decreased. The debt burden for the population remained stable, at around 40–45%.

There are growing concerns regarding the sharp rise in the microdebt segment. A pronounced increase is observed in the proportion of microdebts within the banking system's total loan portfolio. As of July 1, 2024, the volume of microdebts rose by 77% year-on-year (YoY). The microdebt-to-GDP ratio also climbed by 1 p.p., reaching 2.9%.

The tightening of macroprudential policy (MPP) has contributed to a moderation in the growth of car loans to individuals. The annual growth rate declined by a factor of 2.5, reaching 26% at the end of H1 2024. Additionally, the average loan-to-value (LTV) ratio for car loans in the banking system decreased from 80% to 75%.

Financial Vulnerabilities Heatmap for Uzbekistan's Banking System

Vulnerabilities		2019 Q1	Q2	Q3	Q4	2020 Q1	Q2	Q3	Q4	2021 Q1	Q2	Q3	Q4	2022 Q1	Q2	Q3	Q4	2023 Q1	Q2	Q3	Q4	2024 Q1	Q2
Excessive credit growth	Credit-to-GDP gap																						
	Credit-to-GDP ratio growth																						
	Credit growth (YoY)																						
	Mortgage loan leverage																						
	Wholesale funding ratio																						
	Current account balance (CAB) deficit/surplus																						
Household sector	Household loan growth																						
	Real house prices																						
	House price-to-disposable income ratio																						
	Share of household loans in total credit																						
	Household debt service ratio																						
Corporate sector	Corporate loan growth																						
	Share of corporate loans in total credit																						
	Commercial real estate credit																						
	Share of FX loans																						
	Corporate credit gap																						
Systemic liquidity and currency risks	Loan-to-deposit ratio																						
	Share of noncore funding in total liabilities																						
	Share of HQLA																						
	Share of long-term loans in total credit																						
	Share of deposits with maturity over one year																						
	Net open FX positions																						
Structural systemic risks	Banking sector concentration (by assets)																						
	Banking system assets-to-GDP ratio																						

Low ⟶ High
Financial vulnerability

In H1 2024, the financial vulnerability heatmap highlights growing risks in both the household sector and the real estate market. Retail loans are making up a steadily increasing portion of the banking system's loan portfolio, and there are ongoing concerns about the individual's ability to repay these debts. Additionally, rising mortgage debt burdens and mounting risks in the real estate market are contributing to heightened threats to financial stability.

Risks stemming from the real estate sector continue to threaten the resilience of the banking system. In addition to the rapid increase in the house price-to-disposable income ratio, current housing market prices appear to exceed their fundamental values. Vulnerabilities in the real estate sector, combined with high leverage in mortgage lending, are heightening concerns over a possible correction in house prices.

Corporate sector vulnerabilities are easing. FX lending to corporates has steadily declined in recent years, reducing exposure to exchange rate risks. At the same time, the loan-to-GDP ratio for legal entities has dipped below its long-term trend, reflecting a moderation in credit expansion pressures.

Concerns over systemic risks related to liquidity and FX in the banking system are receding. The rise in HQLA within total bank assets, and the drop in unstable funding in liabilities, indicate lower liquidity exposure. FX-related balance sheet mismatches across commercial banks have concurrently diminished.

The financial system is experiencing a decline in structural systemic risks. This is exemplified by a diminution in asset concentration across the banking sector. Concomitantly, the contraction in the banking system's asset-to-GDP ratio portends a diminished macroeconomic susceptibility to prospective banking-sector disruptions.

I. Global and Uzbekistan's Macrofinancial Environment

Global financial conditions eased in H1 2024. A decline in the World Uncertainty Index (WUI)[1] points to reduced concerns among economists over global risks. This drop in the WUI reflects an ongoing adjustment of the global economy to persistent geopolitical instability and a diminished impact of uncertainty factors.

Figure 1. World Uncertainty Index, WUI*
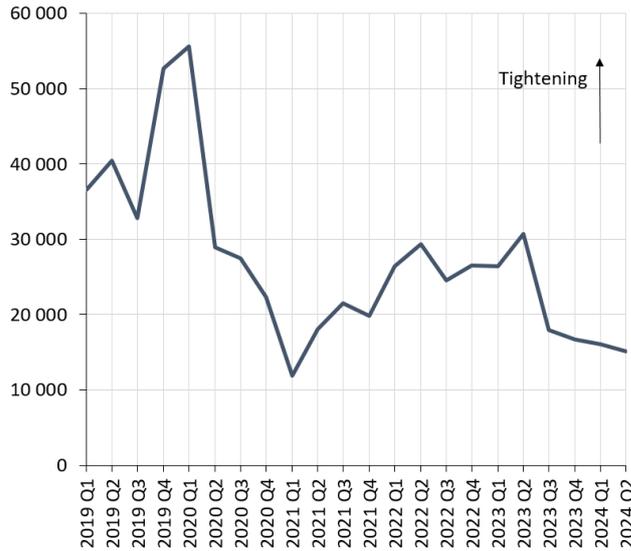
Figure 2. Global Economic Policy Uncertainty, GEPU**
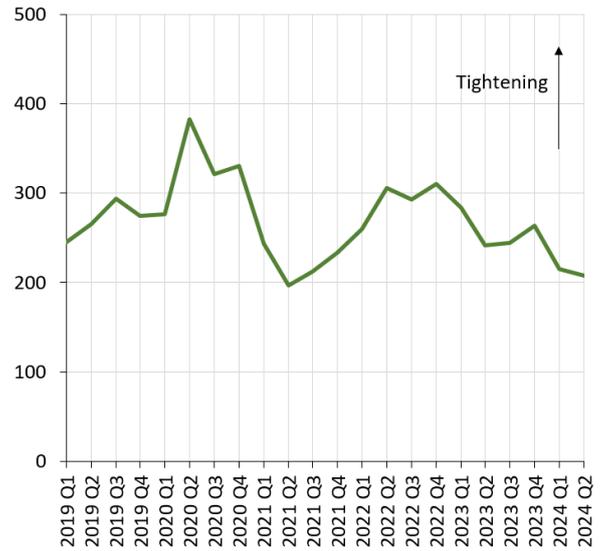
Sources: WUI and GEPU.

Notes: *WUI is a measure that tracks uncertainty around the world, covering 143 countries. It's constructed by text-mining country reports from the Economist Intelligence Unit. The WUI is calculated by counting the percentage of the word "uncertain" (or its variants) in the Economist Intelligence Unit country reports. The WUI is then rescaled by multiplying by 1,000,000 and weight averaged by the countries' GDP. A higher number means higher uncertainty.

**GEPU index is calculated as a GDP-weighted average of the economic policy uncertainty indices for 21 countries[2]. Each country's index is derived by measuring the share of newspaper articles containing the terms "economy," "politics," and "uncertainty" relative to the total number of articles published in that country. The average of these ratios for the period 1997–2015 is normalized to a base value of 100. A higher index value reflects greater economic policy uncertainty, while a lower value indicates reduced uncertainty.

Global concerns regarding economic policy uncertainty and the extent of geopolitical events had subsided. As of the end of H1 2024, GEPU index[3], compiled from 21 major economies[4] with significant global economic influence, registered a notable decline. The downward movement of the GEPU index suggests a reduction in economic uncertainty

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[1] World Uncertainty Index. (2024). World Uncertainty Index (WUI): Global.

[2] Australia, USA, Brazil, United Kingdom, Germany, Greece, South Korea, Ireland, Spain, Italy, Canada, Colombia, Mexico, Netherlands, Russia, France, India, China, Chile, Sweden and Japan.

[3] Economic Policy Uncertainty. (2024). Global Economic Policy Uncertainty Index.

[4] International Monetary Fund. (2024, April). World Economic Outlook Database.

By the end of 2023, the combined GDP of these 21 countries, based on purchasing power parity, accounted for more than 70% of the world's total.

stemming from geopolitical instability in recent years. Concurrently, GPR index[5] indicates a contraction in the scale and volatility of perilous geopolitical developments worldwide.

Figure 3. Geopolitical Risk (GPR) Index*
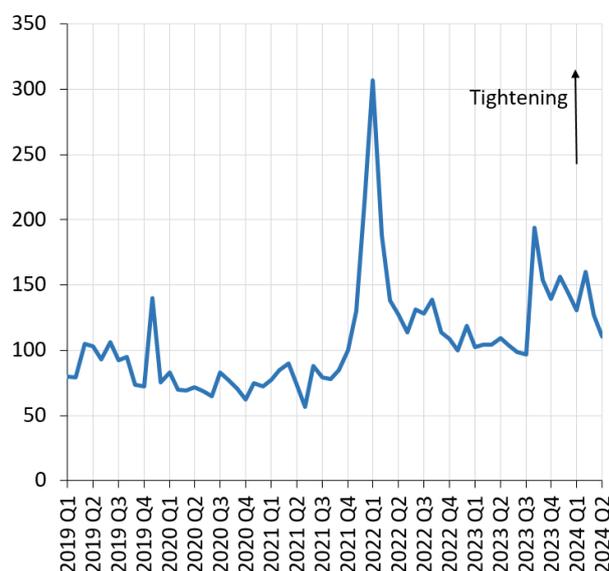
Figure 4. MSCI Indices**, USD
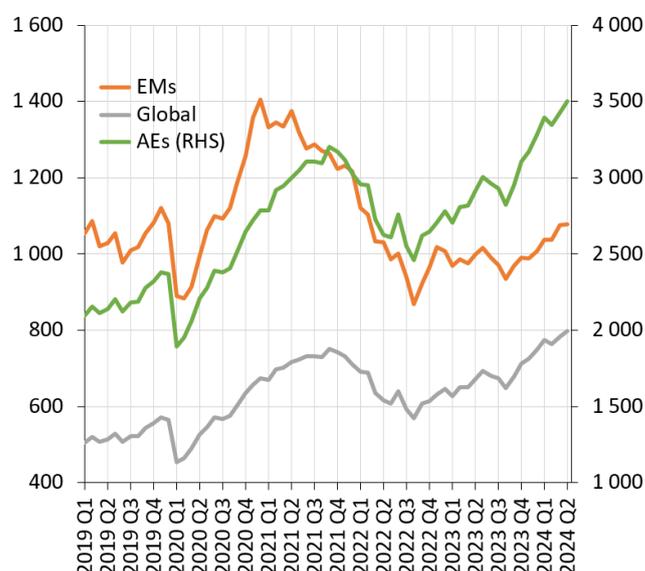
Sources: Matteo Iacoviello and Bloomberg.

Notes: *GPR index is calculated by taking the ratio of articles covering high-risk geopolitical events to the total number of articles published in ten major newspapers[6]—six from the United States, three from the United Kingdom, and one from Canada. The average of these ratios for the period 1985–2019 is normalized to 100. A higher index value reflects a greater level of geopolitical risk, while a lower value indicates reduced geopolitical risk.

**MSCI indexes provide an overview of the global stock market by tracking the large companies' stock prices in 23 AEs and 24 EMs. If the index values increase, it means that the stock prices of the companies in the index have increased.

Global stock markets expanded in H1 2024. The Morgan Stanley Capital International (MSCI) indices, which reflect the performance of global equity markets, continued their upward trend. Elevated profitability in a wide range of industries in both the U.S. and the euro area contributed to a surge in asset prices in these markets[7]. By the end of H1 2024, MSCI indices for Advanced Economies (AEs) and Emerging Markets (EMs) had increased by 20% and 8%, respectively, compared to the same period in 2023. The global MSCI Index increased by 19%, nearing 800 USD.

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[5] Matteo Iacoviello. (2024). Geopolitical Risk (GPR) Index.

[6] Chicago Tribune, Daily Telegraph, Financial Times, Globe and Mail, Guardian, Los Angeles Times, New York Times, USA Today, Wall Street Journal, Washington Post.

[7] International Monetary Fund. (July, 2024). World Economic Outlook.

Figure 5. Uzbekistan's Financial Conditions Index (FCI)
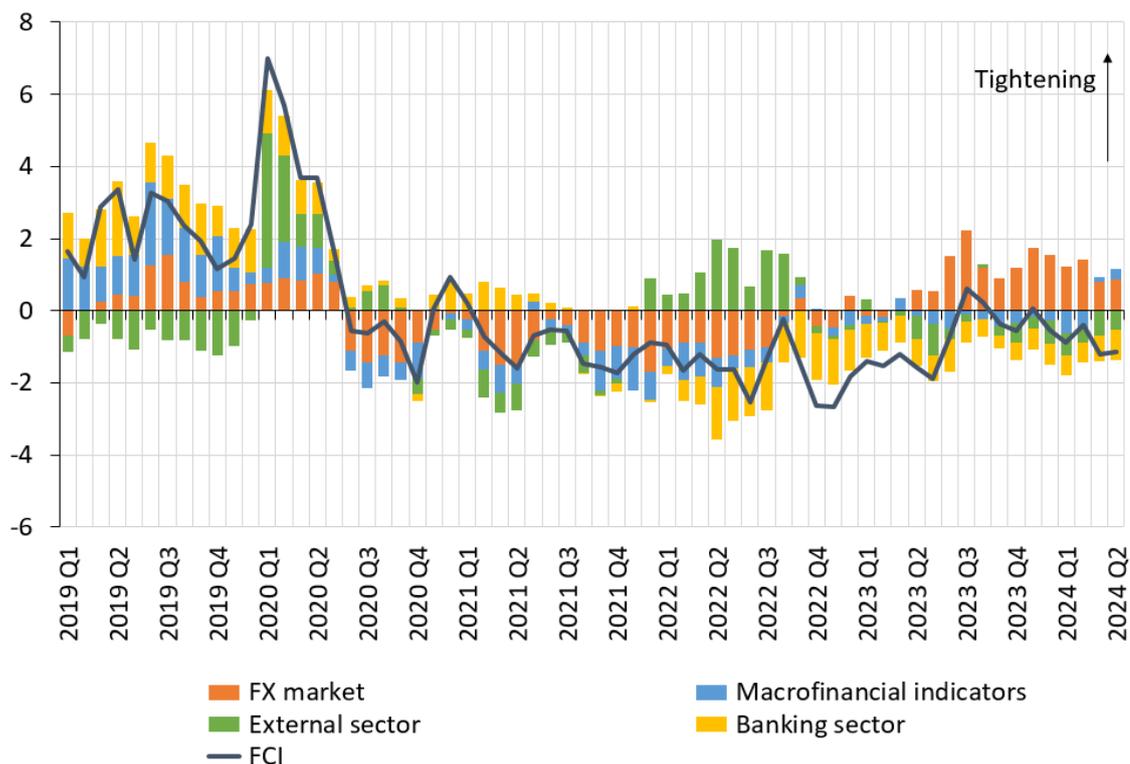
Source: CBU staff calculations.

Note: Positive values of the FCI indicate a tightening of financial conditions, while negative values indicate a softening of financial conditions.

In H1 2024, despite sustained stress in the FX market, easing financial conditions in Uzbekistan were underpinned by improvements in the external and banking sectors. A key contributing factor was the global uptick in investor confidence, reflected in a 25% decline in the Chicago Board Options Exchange Volatility Index (VIX), which averaged 13.8 compared to H1 2023[8]. The combination of favorable global market dynamics and the relatively subdued risk premium for Uzbekistan, consistent with historical patterns, was mirrored in an upward trend in the FCI.

Uzbekistan's economic growth is set to outperform that of its main trading partners. By the end of H1 2024, a notable surge in domestic demand relative to the corresponding period in 2023 contributed an increment of 7.1 p.p. to real GDP growth. Projections by the CBU anticipate GDP growth of 6.0–6.5% in 2024 and 5.5–6.0% in 2025. The IMF expects real GDP to grow by 5.4% and 5.5%[9], while the World Bank forecasts 5.3% and 5.5%[10]. Based on IMF data, the weighted average growth rate of Uzbekistan's main trading partners is estimated at 4.5% in 2024 and 3.9% in 2025[11].

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[8] Federal Reserve Bank of St. Louis. (2024). CBOE Volatility Index: VIX.

[9] International Monetary Fund. (2024, July). Republic of Uzbekistan: 2024 Article IV Consultation–Press Release; and Staff Report.

[10] World Bank. (2024, June). Global Economic Prospects.

[11] International Monetary Fund. (2024, July). World Economic Outlook.

Figure 6. Annual GDP Growth Decomposition*, p.p.

- Domestic demand
- Net export
- ◆ GDP growth, % (RHS)
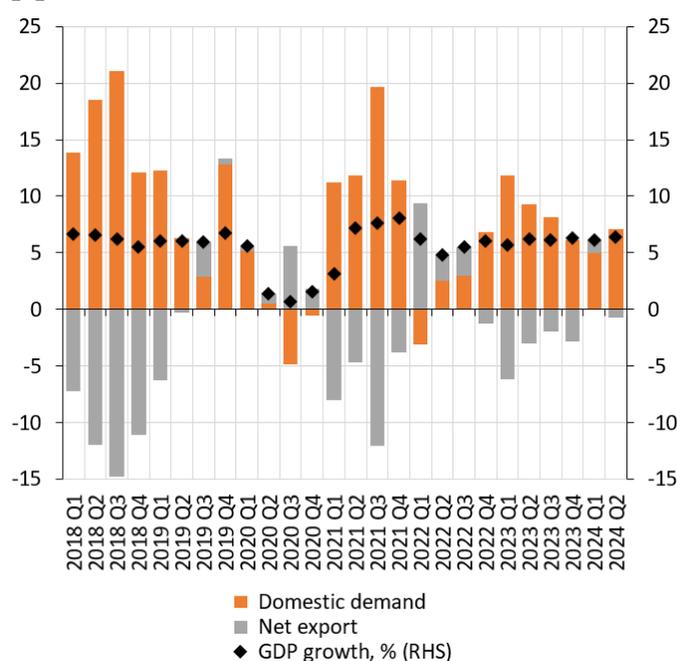
Figure 7. Growth Distribution of Uzbekistan's Main Trading Partners[12]**, %

- ● Uzbekistan
- ▲ Weighted average growth
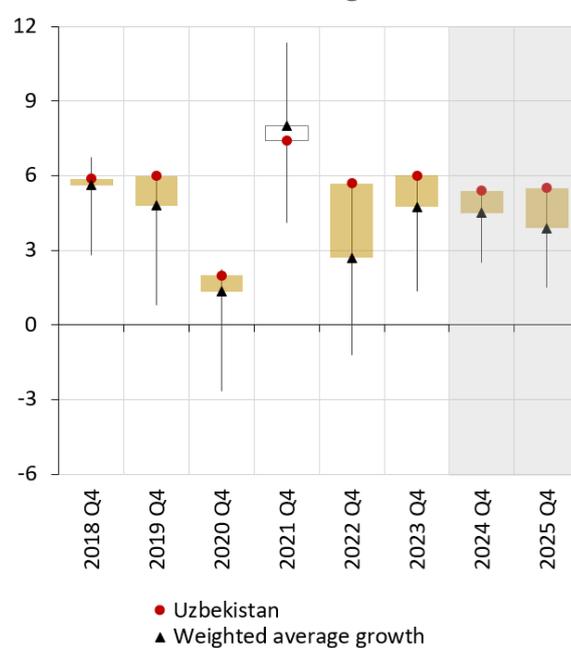
Sources: Statistics Agency, IMF, and CBU staff calculations.

Notes: *Domestic demand is the sum of consumption and gross capital formation.

**The rectangle displayed in the chart represents the variation between Uzbekistan's GDP growth rate and the weighted average of GDP growth rates for main trading partners. The length of the rectangle indicates the difference between the growth rates. If Uzbekistan's GDP growth rate exceeds the weighted average, the rectangle is shaded, and if it is the opposite, the rectangle remains blank. The vertical black line on the chart represents the maximum and minimum growth rates among the seven countries for a given year.

The augmentation of the surplus in primary and secondary income flows contributed to the narrowing of the CAB deficit. At the end of H1 2024, the CAB stood at a deficit of 2.4 billion USD, representing 5.4% of GDP. The trade deficit rose by 5.4% YoY, totaling 7.9 billion US dollars. However, a 5.4 billion USD surplus in income flows led to a 15% reduction in the CAB deficit.

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[12] China, Kazakhstan, Russia, South Korea and Türkiye.

Figure 8. Quarterly Distribution of CAB, billion USD

Legend:
- Goods
- Services
- Secondary income
- Primary income
- CAB
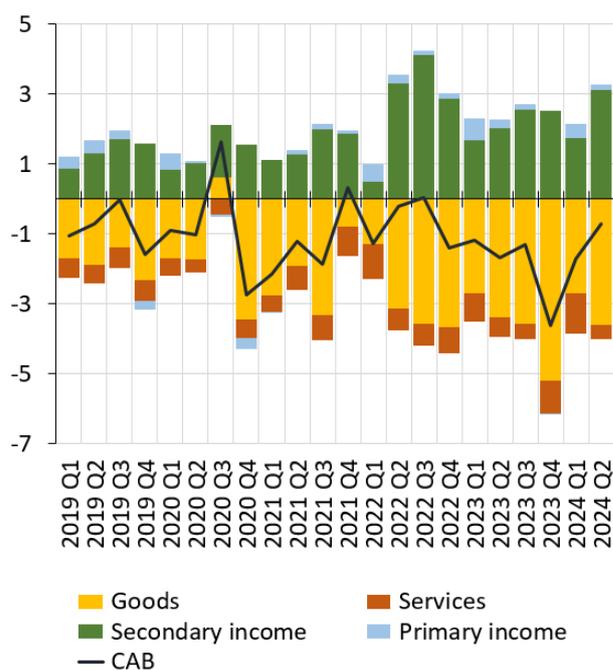
Figure 9. Bank Liabilities to Non-Residents, %

Legend:
- Non-resident liabilities to GDP
- Non-resident liabilities growth, YoY (RHS)
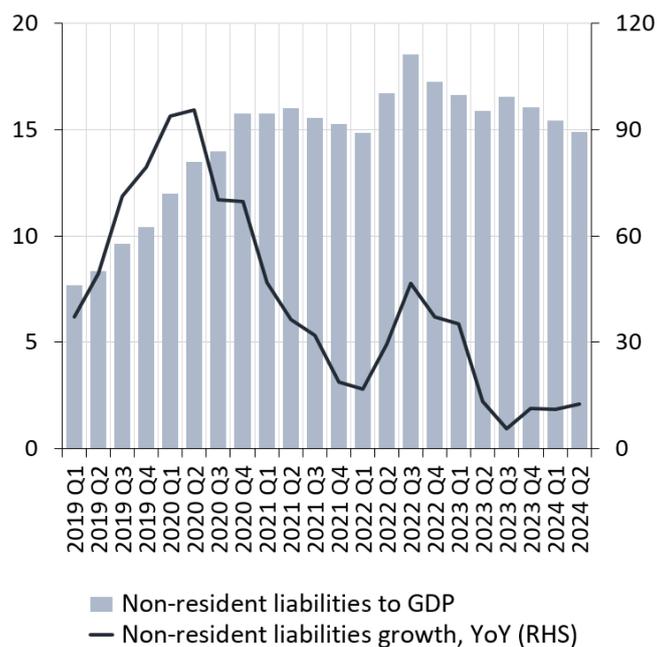
Source: CBU.

The external indebtedness of commercial banks to non-resident entities is expanding at a subdued rate. As of H1 2024, the external liabilities-to-GDP ratio declined to 15%, down 1 p.p. YoY. In absolute terms, the volume of liabilities to non-residents reached 191.2 trillion UZS[13], representing a 13% YoY increase.

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[13] Central Bank of the Republic of Uzbekistan. (2024). Statistical Bulletin June 2024.

II. Financial Sector

2.1. Banking Sector

In H1 2024, financial stress within Uzbekistan's banking sector was assessed as low. The financial stress index (FSI), which serves as a gauge of banking sector stability, remained below the benchmark of its mean plus one standard deviation. This reflects attenuated financial frictions, largely due to reduced exchange rate volatility and strengthening liquidity and solvency positions within the banking and money markets.

Figure 10. Uzbekistan's Financial Stress Index
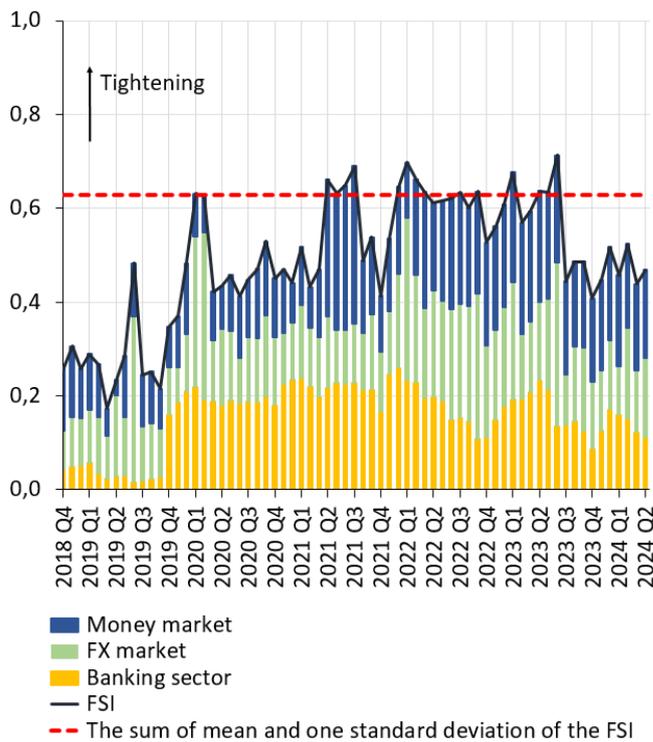
Figure 11. ΔCoVaR for Banking System
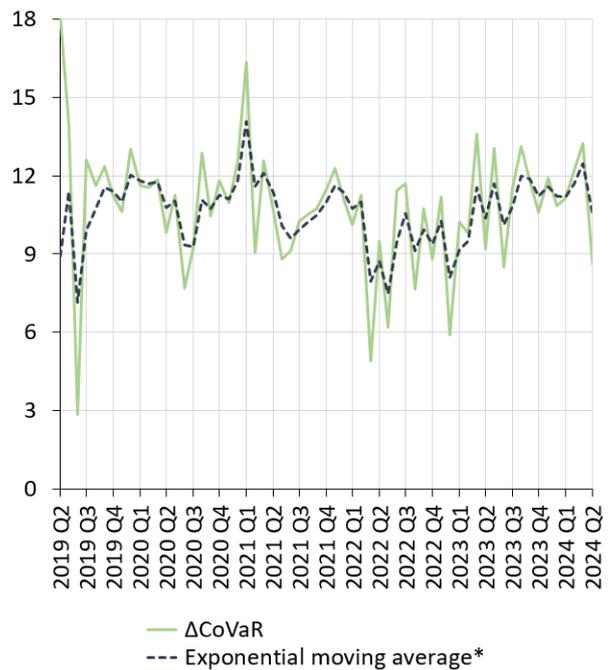
Source: CBU staff calculations.

Notes: The FSI value close to 1 indicates a high level of stress, while a value near 0 indicates a low level of stress.

The ΔCoVaR indicator for the banking system is computed by summing the absolute values of each bank's ΔCoVaR, along with the mutual products of their capital shares relative to the total capital of the banking system. An increase in the ΔCoVaR indicator reflects heightened systemic risk in the banking system, whereas a decrease suggests a reduction in systemic risk.

*The exponential moving average is used to smooth indicator values by minimizing the influence of random or short-term volatility. Unlike the simple moving average, it places more emphasis on recent data, resulting in a more responsive and accurate measure of ongoing changes.

Volatility in the domestic FX market eased in H1 2024, driven by a reduction in the mismatch between FX demand and supply. The spread between FX purchased and sold by banks declined by 13% compared to the same period in 2023. Commercial banks acquired about

7.2 billion USD in FX from individuals, representing a 31% YoY increase[14]. This relatively higher supply growth has contributed to stabilizing the domestic FX market.

The banking system saw positive changes in H1 2024, driven by higher net interest income (NII) amid significant deposit and credit growth. Deposits reached 265.5 trillion UZS by the end of H1 2024, reflecting a 31% YoY increase. The total loan portfolio climbed to 494 trillion UZS by July 1, 2024, 17%[15] higher than a year earlier. Both indicators exceeded their potential trends, indicating increased liquidity and improved income generation. These favorable dynamics were mirrored in a decline in the FSI.

In H1 2024, the ΔCoVaR metric for the banking sector, in line with the FSI, indicated a reduction in systemic risk. This trend was supported by subdued stock market volatility and a narrowing spread between short-term and long-term deposit rates, which influenced the ΔCoVaR[16] with a time lag. Concurrently, improvements in liquidity metrics and strong bank profitability exerted additional downward pressure on the indicator. As a result, systemic risk remained close to its historical average throughout the period.

Figure 12. Credit Market Conditions
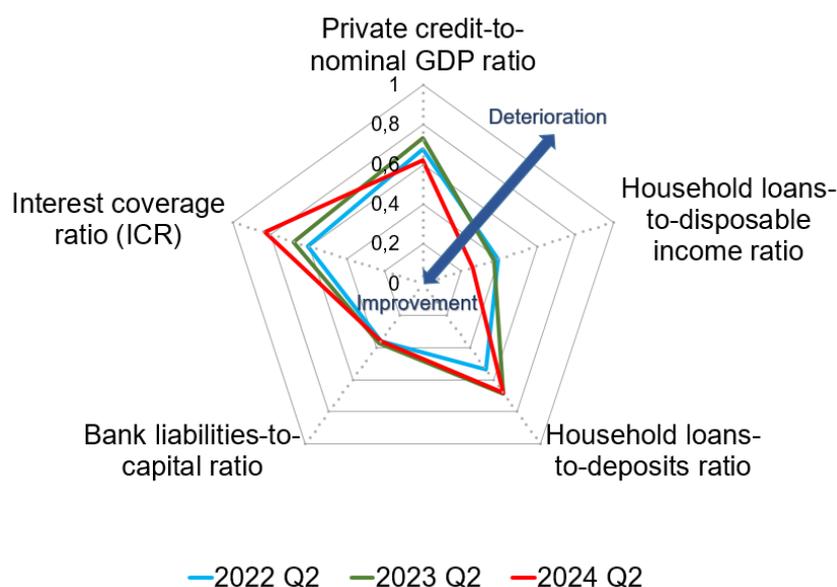
Sources: Statistics Agency and CBU staff calculations.

In H1 2024, both the private credit-to-nominal GDP ratio and the banking sector's liabilities-to-capital ratio remained broadly unchanged. The steadiness of the credit ratio reflects a commensurate rise in credit and nominal GDP, implying a neutral credit impulse. Over the same period, banks' liabilities rose by 20%, and their capital increased by 21%.

[14] Central Bank of the Republic of Uzbekistan. (2024). Statistical Bulletin June 2024.

[15] Central Bank of the Republic of Uzbekistan. (2024). Statistical Bulletin June 2024.

[16] The methodology of the dynamic ΔCoVaR model is presented in the Financial Stability Report for H1 2023.

H1 2024 marked a favorable shift in household debt metrics. As of July 1, 2024, the ratio of retail loans to disposable income declined to 96%, down by 79 p.p. from the same date in 2023. This adjustment reflects both a deceleration in consumer credit expansion and a marked uplift in disposable income levels. Concurrently, the pace of deposit accumulation by individuals outstripped credit issuance, resulting in a retail loan-to-deposit ratio of 166%, 1 p.p. lower YoY.

The interest coverage ratio (ICR) has shown a downward trend. As of July 1, 2024, ICR fell by 10 p.p. YoY. This deterioration was attributed to a 9% decline in banks' net profit before tax (PBT), coupled with a 41% surge in interest expenses.

Figure 13. Financial Soundness Conditions
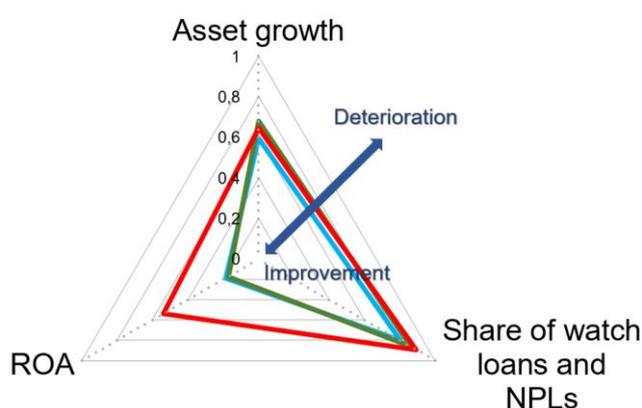
Figure 14. Banking System Resilience
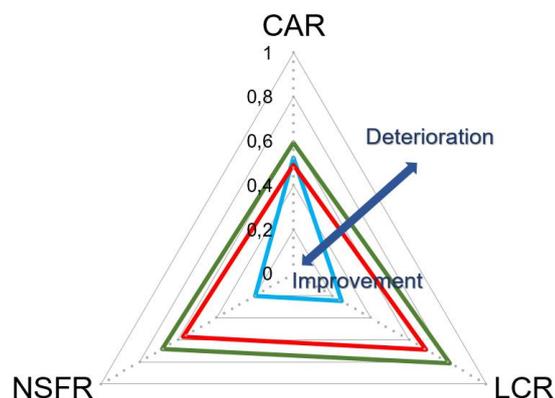
Sources: Statistics Agency and CBU staff calculations.

During H1 2024, the banking system exhibited a mild strengthening in financial soundness This improvement was reflected in a 3 p.p. year on year expansion in asset volumes. As of July 1, 2024, watch loans and NPLs accounted for 21% of total loans, reflecting a 1 p.p. increase compared to the same period in 2023.

The banking sector experienced a reduction in profitability, as indicated by a decline in the ROA. In H1 2024, the ROA measured 2.1%, which is 0.6 p.p. lower than in the corresponding period of 2023.

Resilience indicators of the banking sector demonstrated positive shifts in H1 2024. The CAR increased by 0.8 p.p. year on year, reaching 17.3%. At the same time, the net stable funding ratio (NSFR) remained broadly stable at 111%. The liquidity coverage ratio (LCR) improved significantly, rising by 16 p.p. to 165%.

Figure 15. CAR in Banking Sector, %
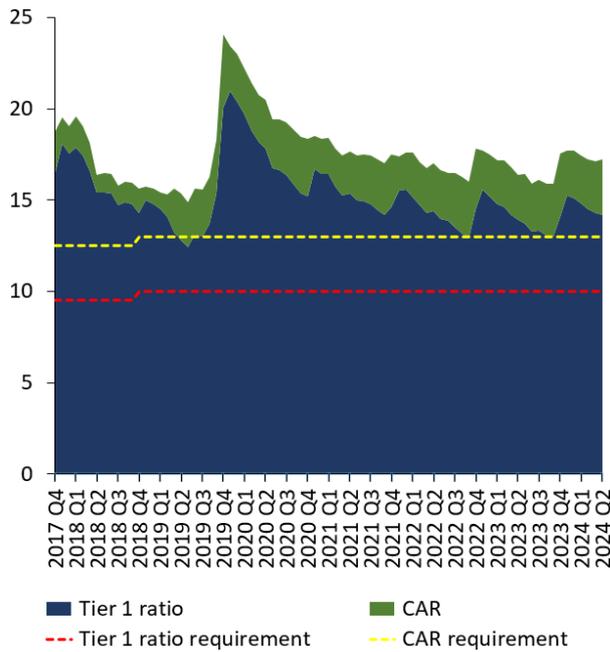
Figure 16. RWA Density [17] and Return on RWA (RORWA), %
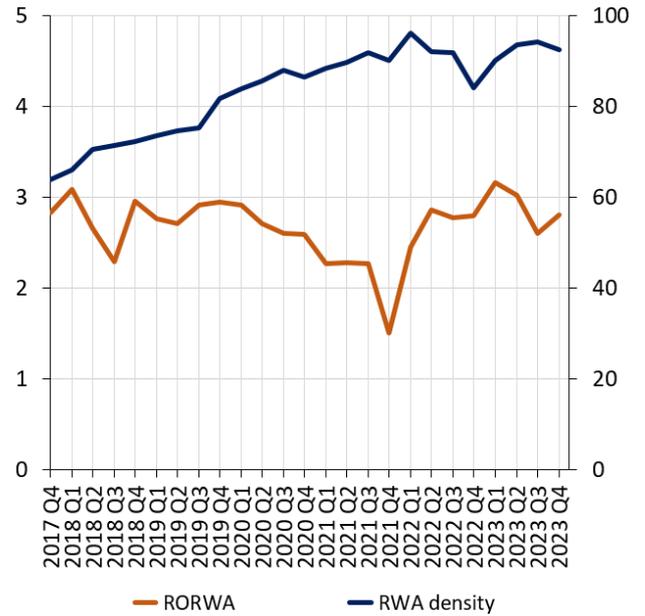
Source: CBU.

In H1 2024, the capital adequacy position of the banking system improved. The CAR[18] was 17.3%, and the Tier 1 ratio[19] was 14.2%, representing increases of 1 p.p. and 0.2 p.p. compared to the same period in 2023. As of July 1, 2024, total regulatory capital amounted to 116 trillion UZS, of which 82% was Tier 1 capital.

The risk-weighted assets (RWA) density of the banking sector continues to rise. As of July 1, 2024, RWA density stood at 97%, reflecting an increase of 4 p.p. compared to the same period in 2023. Uzbekistan exhibits a substantially elevated RWA density relative to peers: Czech Republic[20] (29%), Malaysia[21] (30%), Poland[22] (38%), Montenegro[23] (49%), Albania[24] (51%),

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[17] To calculate the RWA density, the amount of RWA is divided by total assets. The RWA density provides a measure of riskiness of assets. An increase in the RWA density indicates a deterioration in overall risk profile of bank assets, while a decrease in the RWA density indicates an improvement in risk quality of assets.

[18] The ratio of total regulatory capital to RWA.

[19] The ratio of Tier 1 capital to RWA.

[20] Czech National Bank. (2024). Basic indicators of the financial market

[21] Central Bank of Malaysia. (2024). Monthly Highlights & Statistics.

[22] National Bank of Poland. (2024). Capital adequacy of the Polish banking sector.

[23] Central Bank of Montenegro. (2024). Financial Soundness Indicators.

[24] Bank of Albania. (2024). Banking statistics.

Kazakhstan[25] (63%), North Macedonia[26] (71%), and Georgia[27] (77%). Additionally, the RORWA had declined by 0.8 p.p. YoY, reaching 2.2%.

In H1 2024, the Common Equity Tier 1 (CET1) capital ratio rose by 0.3 p.p. compared to H1 2023. Even with RWA density, the CET1 capital ratio reached 14.2%, comfortably above the minimum capital requirement.

Figure 17. Changes in CET1 Capital Ratio, %
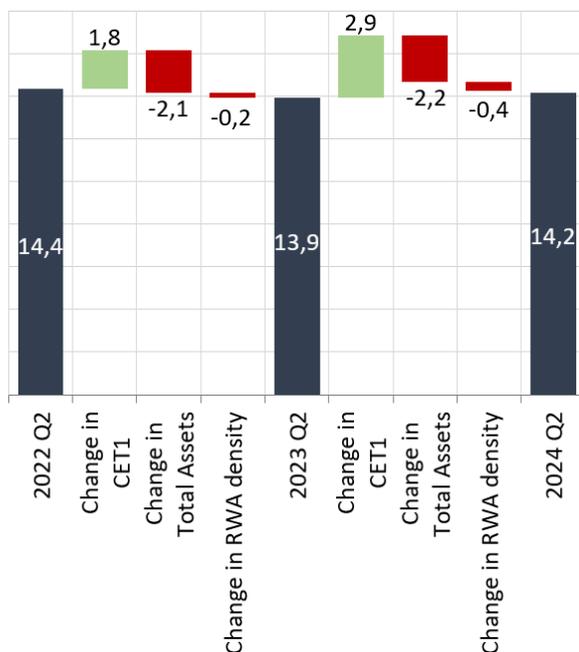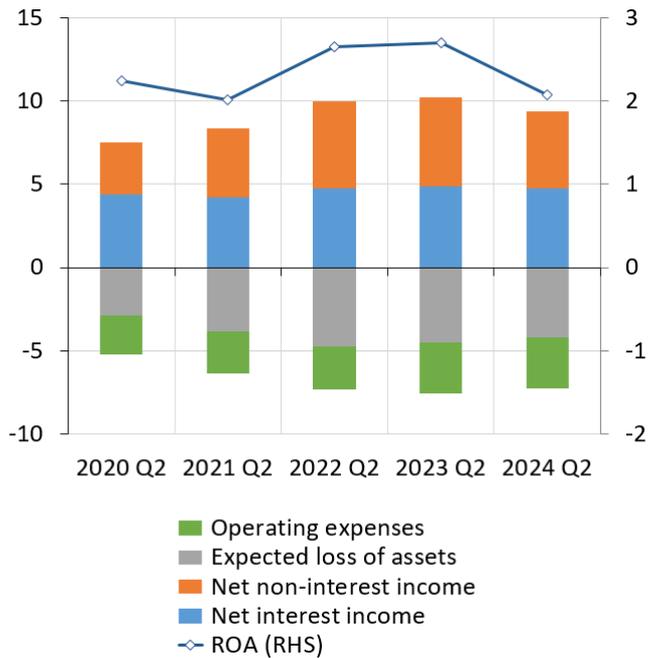

Figure 18. Profitability in Banking Sector

- Net profit, trillion UZS (RHS)
- Return on Assets (ROA)
- Return on Equity (ROE)
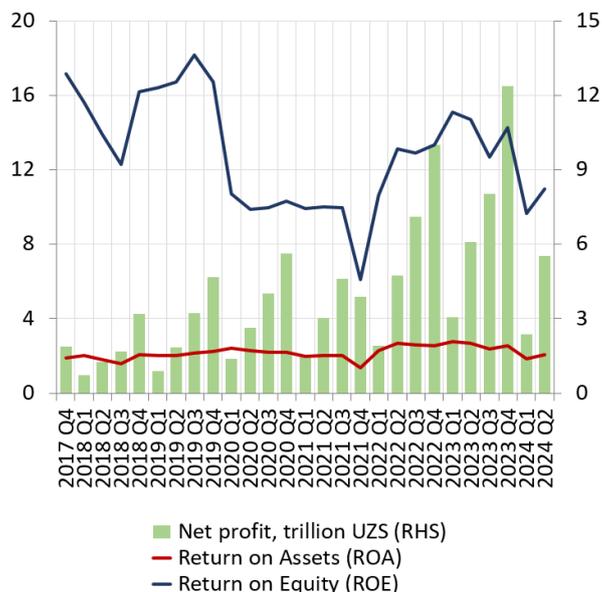
Source: CBU.

The banking sector is exhibiting a declining trend in profitability indicators. As of July 1, 2024, banks reported ROE of 11%, representing a YoY decrease of 3.7 p.p.. This erosion in profitability is primarily attributable to a 9% YoY contraction in net income. Although there were reductions in operational expenditures and anticipated asset impairments, these adjustments failed to materially enhance the overall profitability profile of the sector.

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[25] Agency of the Republic of Kazakhstan for Regulation and Development of the Financial Market. (2024). Current state of the banking sector of the Republic of Kazakhstan as of 01.07.2024.
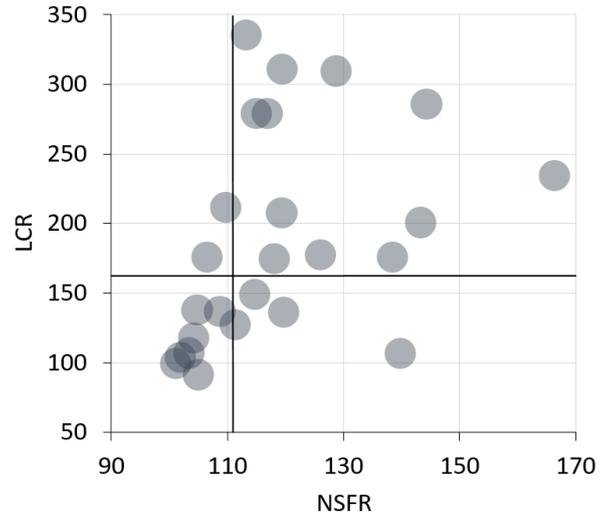
[26] National Bank of the Republic of North Macedonia. (2024). Banking System Indicators.

[27] National Bank of Georgia. (2024). Financial Soundness Indicators.

Figure 19. ROA Decomposition, %

- Operating expenses
- Expected loss of assets
- Net non-interest income
- Net interest income
- ROA (RHS)

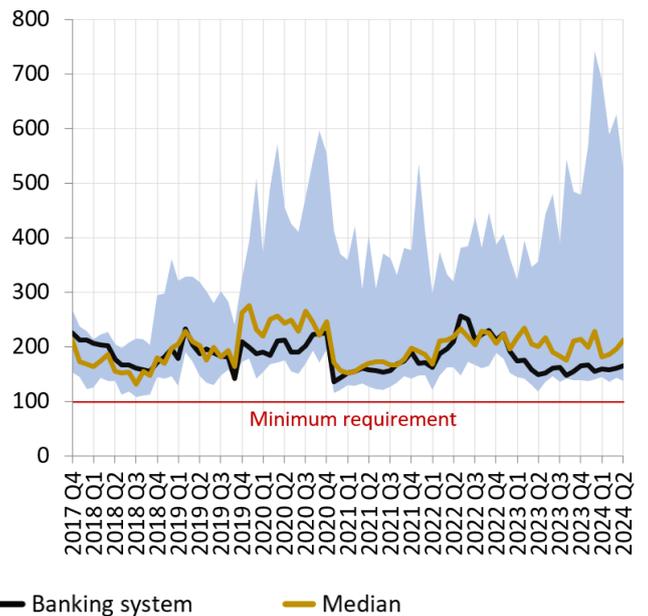**Figure 20. Bank-by-Bank Liquidity Indicators, % (as of July 1, 2024)**

Source: CBU.

Note: The continuous straight lines represent the indicators for the banking system as of July 1, 2024. Banks with LCR and NSFR exceeding 400% and 200%, respectively, are excluded in the graph.

Liquidity indicators in the banking system continue to fall short of the median value, trending toward the lower quartile. As of July 1, 2024, the NSFR was recorded at 8 p.p. below the median. During the period from July 1, 2023, to July 1, 2024, the LCR rose by 16 p.p., although it remained 47 p.p. below the median. This increase in the LCR primarily reflects a 27% growth in HQLA.

**Figure 21. NSFR in the banking system, %**
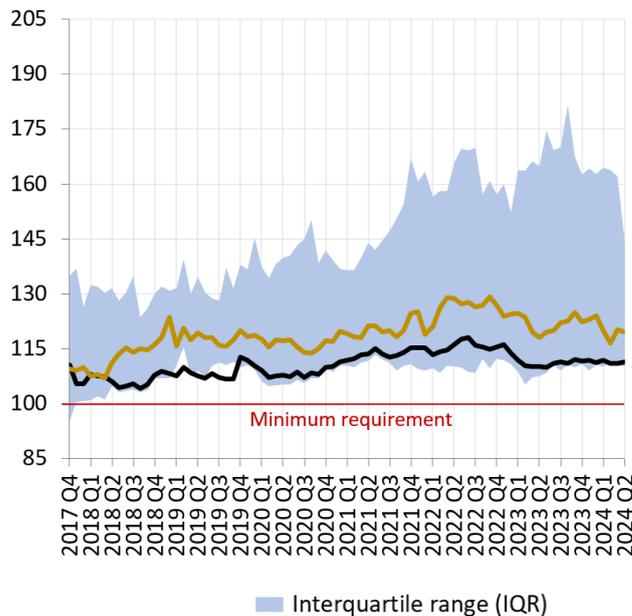

Figure 22. LCR in the banking system, %

- Interquartile range (IQR)
- Banking system
- Median

Source: CBU.

16

The banking sector maintained a positive growth trend in HQLA. In H1 2024, the ratio of HQLA to total assets rose to 14.4%, representing an increase of 0.8 p.p. compared with the same period in 2023. This expansion was largely attributable to the growth in banks' funds with CBU (excluding required reserves) by 3.4 trillion UZS, funds placed with other banks by 13.1 trillion UZS, and holdings of government securities by 2.8 trillion UZS.

Figure 23. HQLA-to-Total Assets Ratio, %
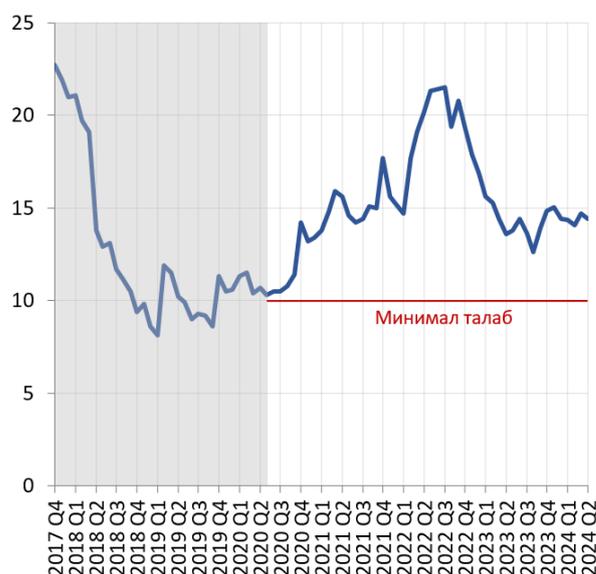
**Figure 24. HQLA Composition, trillion UZS**
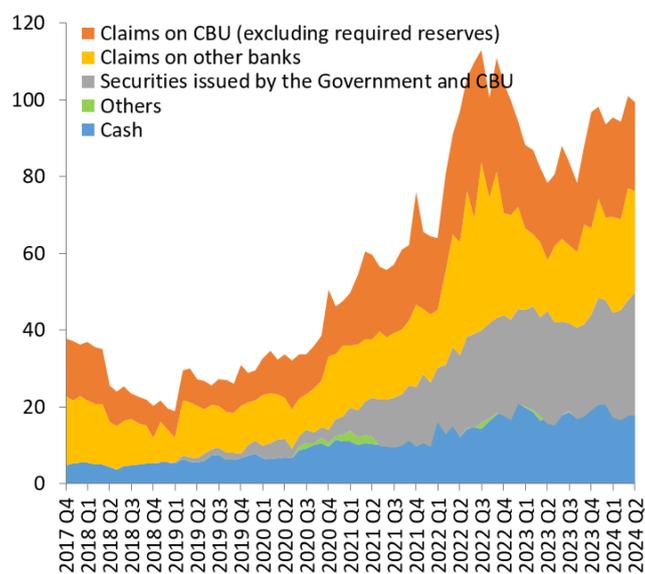
Souce: CBU.

Note: As of June 1, 2020, the CBU has set a minimum requirement of 10% for the ratio of HQLA of banks to total assets.

The loan-to-GDP ratio in Uzbekistan reflects a relatively high level compared to peers in CCA region. As of July 1, 2024, the ratio was 38%, exceeding the CCA median. Since the expansion of loan volumes has been nearly aligned with the growth of nominal GDP, this indicator has not experienced sharp movements in recent years.

Uzbekistan has exhibited a robust expansion in deposit mobilization as a key component of bank funding structures. As of July 1, 2024, although the deposit to liability ratio of the Uzbek banking sector remains below that of peer countries, the indicator has been trending upward, reflecting strong deposit mobilization dynamics in recent years. By the end of the first half of 2024, the annual growth rate of the deposit balance reached 31%, which is 11 p.p. higher than the growth rate of total liabilities. Consequently, as of July 1, 2024, deposits accounted for 45% of the banking sector's total liabilities, 4 p.p. higher than in the same period of 2023[28]. Moreover, demand deposits, which are characterized by higher liquidity risk, comprised one third of total deposits in Uzbekistan.

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[28] Central Bank of the Republic of Uzbekistan. (2024). Statistical Bulletin June 2024.

Figure 25. Total Loans-to-GDP Ratio in CCA Countries*, %
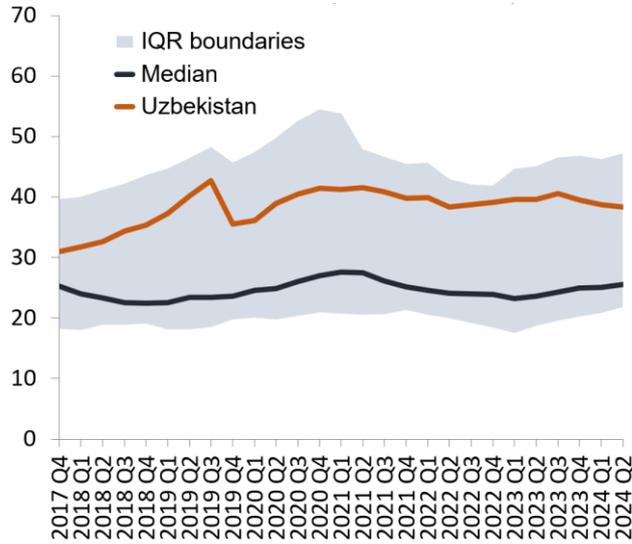
Figure 26. Share of Deposits in Total Liabilities and Share of Demand Deposits in Total Deposits in CCA Countries** (as of July 1, 2024)
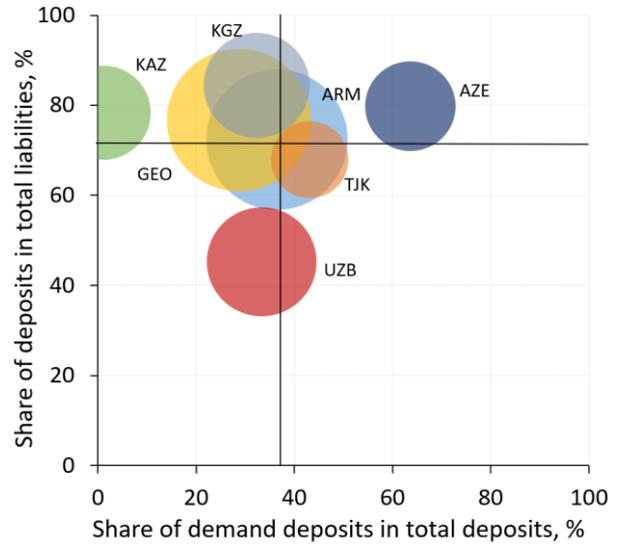

Sources: National authorities, Statistics Agency and CBU staff calculations.

Note: * Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan are included.

** The bubble size represents the share of total banking assets in the country's GDP. The continuous straight lines represent the average values of the indicators for CCA countries as of July 1, 2024.

The gap between loans and deposits in the banking sector is narrowing. As of July 1, 2024, the ratio of loans to deposits stood at 186%, 23 p.p. lower than a year earlier. Over the same period, the stock of loans increased by 17%, while the stock of deposits grew by 31%. Although the gap between loan and deposit volumes did not change sharply in H1 2024, the absolute magnitude of this imbalance remains high. As of July 1, 2024, the gap between loans and deposits reached 228 trillion UZS.

Figure 27. Loan-to-Deposit Ratio and Difference between Loans and Deposits, %

Difference between loans and deposits, trillion UZS (RHS)
Loan-to-deposit ratio, %
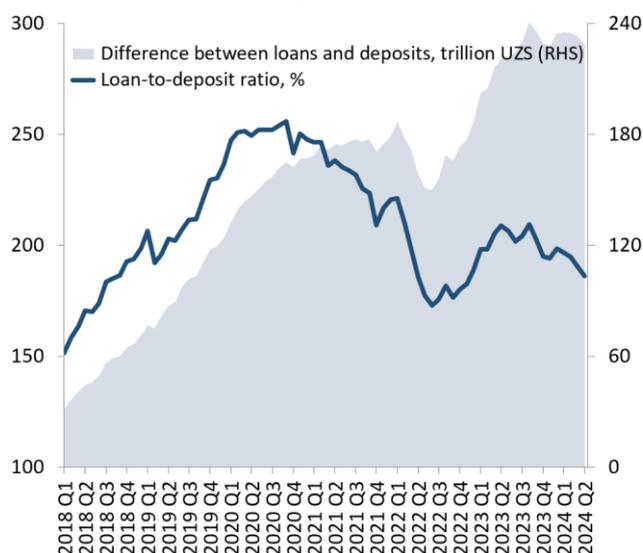
**Figure 28. Concentration of Outstanding Loans and Deposits, HHI***
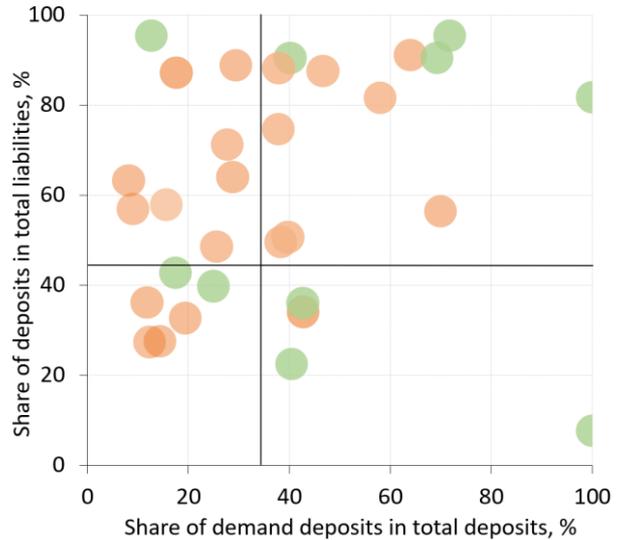

Loans
Deposits
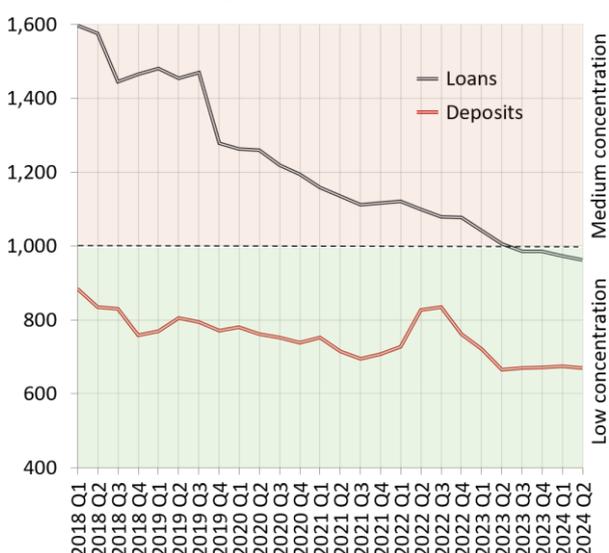
Source: CBU.

Note: *The Herfindahl-Hirschman Index (HHI) categorizes the level of competition in the banking services market into the low concentration (below 1000), medium concentration (from 1000 to 1800), and high concentration (above 1800) groups. The HHI is calculated as the sum of the squares of each bank's shares of deposit and loan balance in the total banking system deposit and loan balance.

Loan concentration has shown a downward trend. As of July 1, 2024, reflecting heightened market competition, the loan HHI reached 962. The loan HHI extended to legal entities and households decreased by 21 and 18 points, respectively. Likewise, deposit HHI remained at a low level during H1 2024.

Figure 29. Bank-by-Bank Annual Growth Rates of Loans and Deposits (as of July 1, 2024)
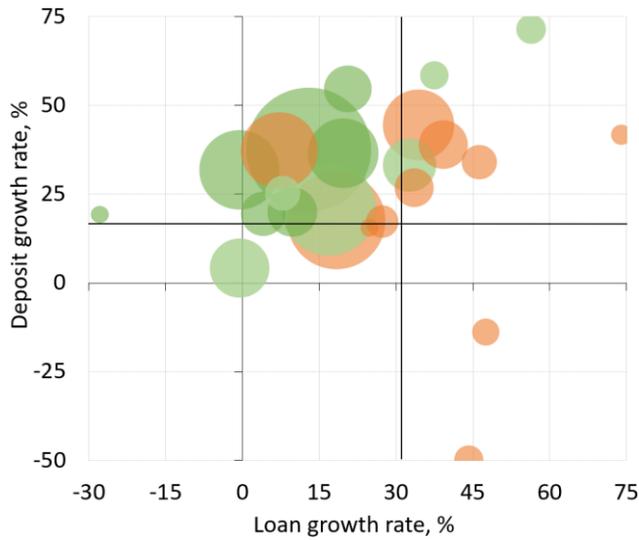
Figure 30. Bank-by-Bank Share of Deposits in Total Liabilities and Share of Demand Deposits in Total Deposits (as of July 1, 2024)
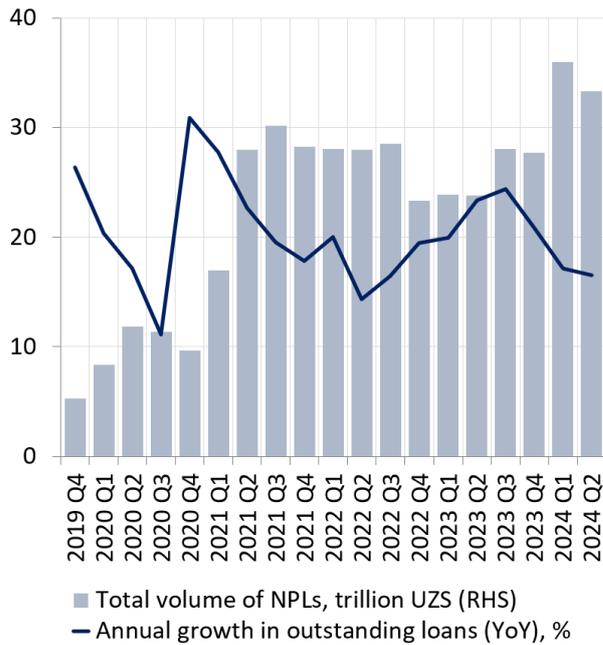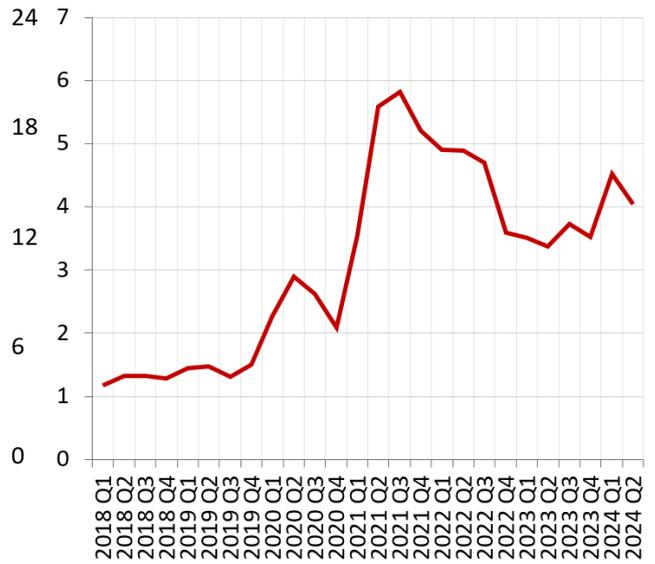

Source: CBU.

Note: In the left graph, green represents banks with a faster growth rate of deposits relative to loans, while light red indicates banks with a slower loan growth rate. In the right graph, green denotes banks where the share of demand deposits in total deposits increased compared to the same period a year earlier, whereas light red shows banks where this share declined. The bubble size reflects each bank's share of total banking system assets. The straight lines represent system-wide average values as of July 1, 2024.

In the banking sector, the share of demand deposits in total deposits declined during H1 2024. The share of demand deposits reached 34%, representing a reduction of 3 p.p. relative to the corresponding period in the previous year. This contraction is likely to strengthen banks' liquidity profiles. Furthermore, deposits constitute 34% of total liabilities in state-owned banks and 69% in private banks.

Figure 31. Total Volume of NPLs and Annual Growth in Outsanding Loans

- Total volume of NPLs, trillion UZS (RHS)
- Annual growth in outstanding loans (YoY), %

**Figure 32. Share of NPLs in Total Loans, %**

Source: CBU.

The share of NPLs in total loans rose slightly. By July 1, 2024, the NPL ratio had risen by 0.7 p.p. from the same period in 2023, reaching 4%. The increase is primarily driven by a sharp 55 p.p. rise in the annual growth of NPLs, coupled with a 7 p.p. slowdown in overall loan growth. Moreover, Uzbekistan's NPL ratio remains 1 p.p. above the median observed in CCA economies.

Figure 33. NPL Ratio in CCA Countries*, %

- IQR
- Median
- Uzbekistan
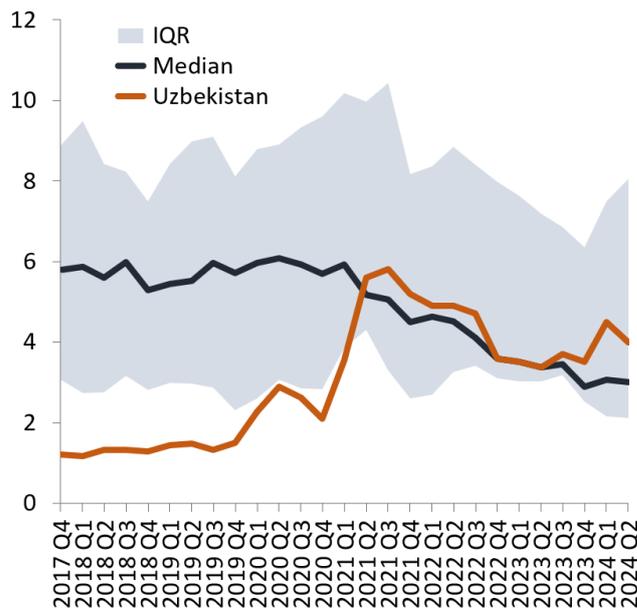
Figure 34. NPL Composition, %
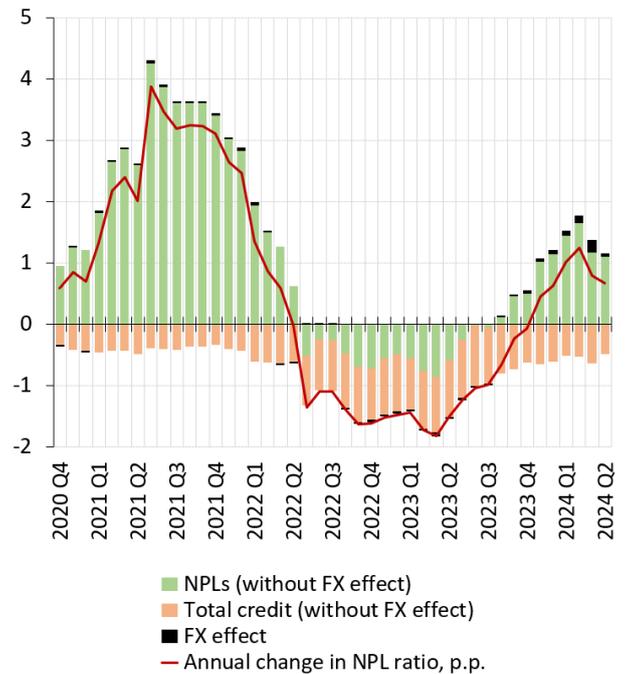

- Non-satisfactory
- Doubtful
- Loss
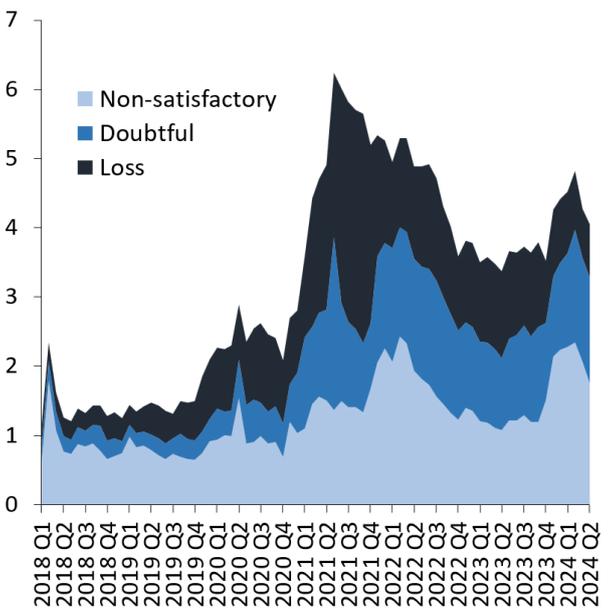
Source: CBU.

The rise in NPLs was mainly attributable to exposures classified as "non-satisfactory" and "doubtful". As of July 1, 2024, the share of "non-satisfactory" loans in the composition of NPLs stood at 19%, representing a decline of 18 p.p. compared with the same period in 2023. Loans classified as "non-satisfactory" and "doubtful" accounted for 43% and 38% of NPLs, respectively.

Figure 35. NPLs and Provisions, %

- NPLs net of provisions to capital
- NPL coverage ratio (RHS)
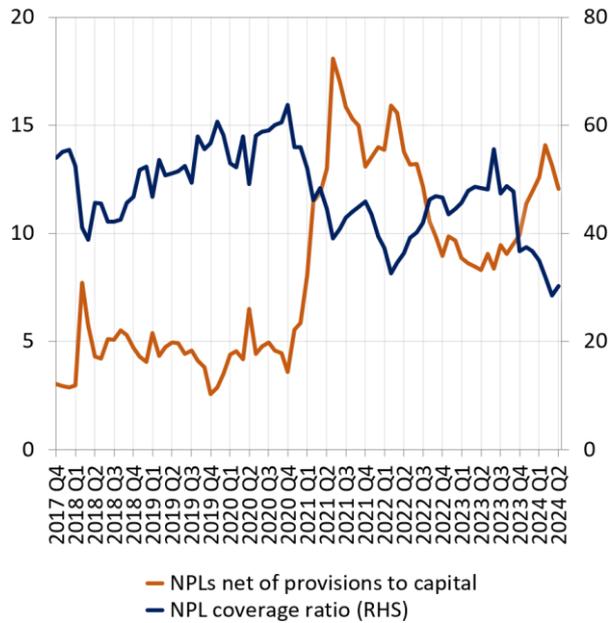
Figure 36. Decomposition of Annual Change in NPL Ratio, %

- NPLs (without FX effect)
- Total credit (without FX effect)
- FX effect
- Annual change in NPL ratio, p.p.

Source: CBU.

The NPL coverage ratio declined. At the end of H1 2024, it fell to 30%, a 38% decrease compared with the same period last year. Furthermore, as of July 1, 2024, NPLs net of provisions to regulatory capital increased by 4 p.p. YoY, reaching 12%. The weakening of these indicators may impair banks' resilience to potential credit losses.

Box 1. Systemic Risk Survey

In July 2024, the CBU conducted a survey[29] among 35 commercial banks (respondents) to identify potential systemic risks in Uzbekistan's financial system. Survey results indicate that respondents consider geopolitical risks, exchange rate volatility, the growing debt burden of individuals, rising inflation, and cyberattacks as the primary threats to the financial system. Compared with the January 2024 survey, the prominence of the most relevant risk has shifted from exchange rate volatility to geopolitical risks.

Figure 37. Principal Systemic Risks in Uzbekistan's Financial Sector

Source: CBU Survey.

Note: The font size of systemic risks reflects their level of importance, determined by a weighting system of one to five.

Specifically, based on a weighted assessment of the five most significant systemic risks identified by each respondent, external geopolitical risks accounted for 45%, sharp exchange rate fluctuations for 37%, an increased household debt burden for 35%, accelerated inflation for 33%, and cyber-related risks for 24%[30].

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[29] A sample questionnaire for identifying systemic risks is provided in the Financial Stability Report for 2023.

[30] In this question, each bank identifies five systemic risks. Importantly, the proportion of respondents citing a particular risk as affecting the financial system does not necessarily correspond to the perceived severity of that risk as a systemic risk. Furthermore, the systemic risks identified by banks are not mutually exclusive, meaning a single bank can designate multiple risks. Consequently, the combined percentage of risks mentioned by respondents does not equal 100%.

Moreover, risks that could pose threats to the stability of the country's financial system include defaults by large borrowers, economic downturns, liquidity risks, decreases in real estate prices, and climate-related risks.

Survey responses indicate that 46% of respondents perceive the probability of systemic risks materializing in the short term (up to 1 year) as low, with a further 43% rating it as medium. In contrast, over the medium-term horizon (1–3 years), 51% expect these risks to materialize with medium probability, while 31% assign a high probability.

Figure 38. Probability of Materialization of Systematic Risks, %
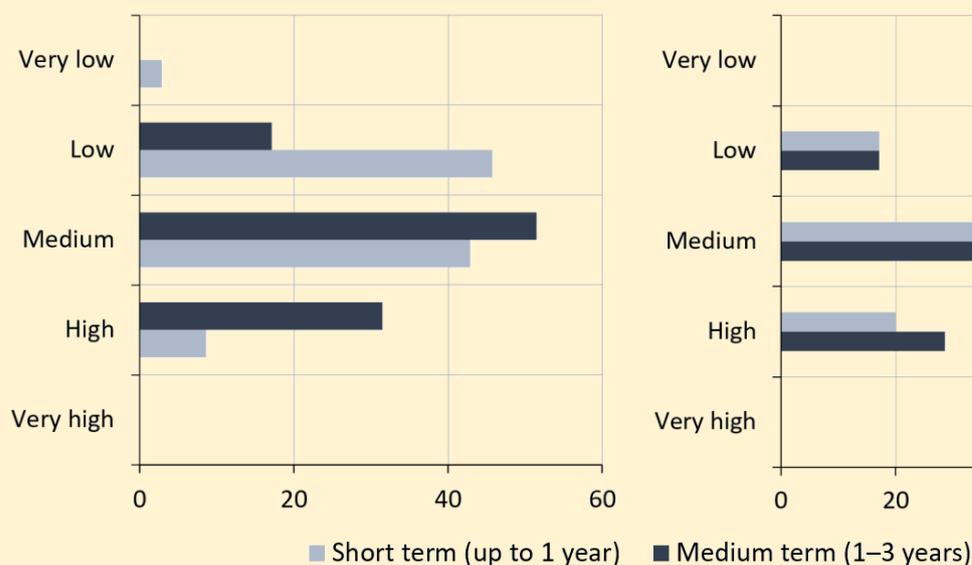
Figure 39. Changes in the Probability of Materialization of Systematic Risks Over the Past Period, %

Short term (up to 1 year) ■ Medium term (1–3 years)
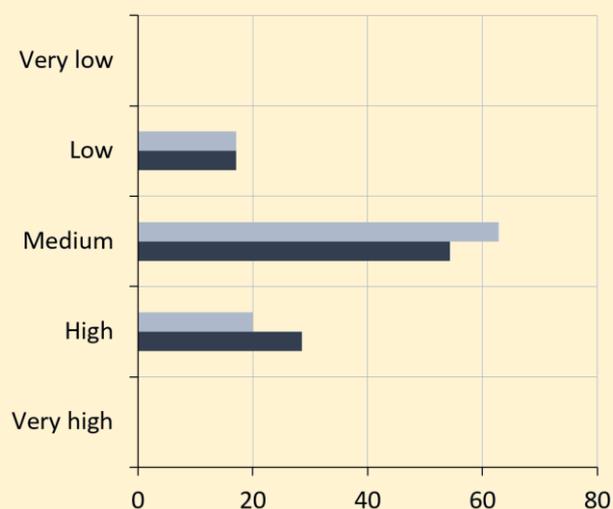
Source: CBU Survey.

Survey results show that 63% of respondents perceive the level of systemic risk to have been moderate in the recent short period, while 54% consider it to have remained moderate over the past 1–3 years.

At the same time, 60% of respondents reported sufficient confidence in the stability of Uzbekistan's financial system over the past three years, reflecting a decline of 14 p.p. compared with the January 2024 survey. Additionally, 37% of respondents expressed partial confidence in the stability of the financial system.

Figure 40. Confidence Level in the Stability of Uzbekistan's Financial System Over the Next Three Years,%
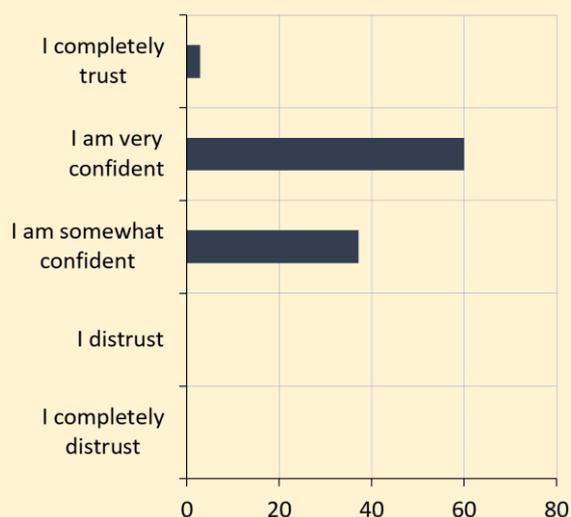
Figure 41. Changes in Factors Affecting Financial Stability Over the Past Six Months, %

■ Increased/ worsened significantly
■ Increased/ worsened slightly
■ Remained unchanged
■ Decreased/ improved slightly
■ Decreased/ improved significantly
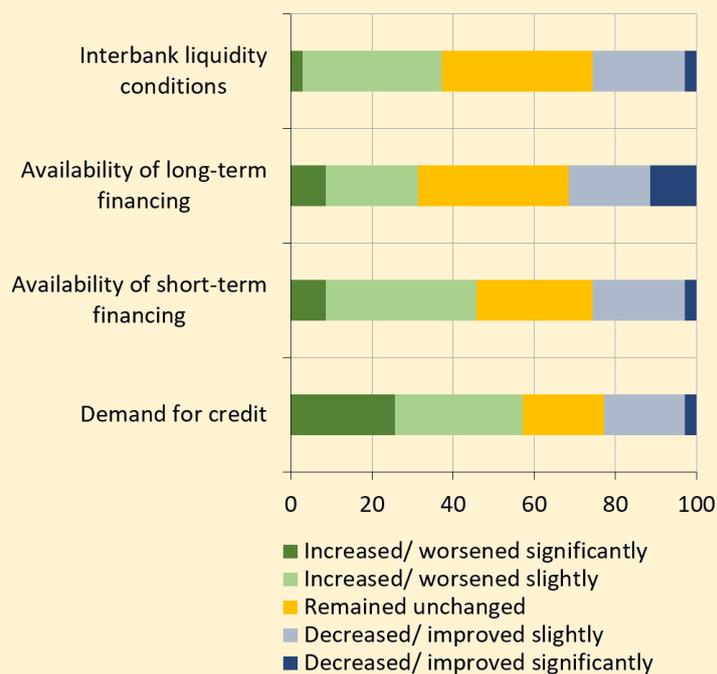
Source: CBU Survey.

Based on the survey assessing changes in financial stability indicators over the past six months, 57% of respondents identified rising credit demand, and 46% observed increased availability of short-term financing. In contrast, 37% of respondents reported no change in the availability of long-term financing and interbank liquidity

2.2. Non-bank Financial Sector

The share of the non-bank financial sector in Uzbekistan's financial system remains low.
As of July 1, 2024, non-bank financial organizations[31] accounted for 3% of total financial system
assets[32] and 1.7%[33] of GDP. Further diversification of services offered by the non-bank financial
sector, including the introduction of Islamic finance–related products[34] in microfinance
organizations, could support the development of these institutions and strengthen financial
intermediation.

Figure 42. Annual Growth Rates of Stock of Loans of Non-bank Credit Organizations, %
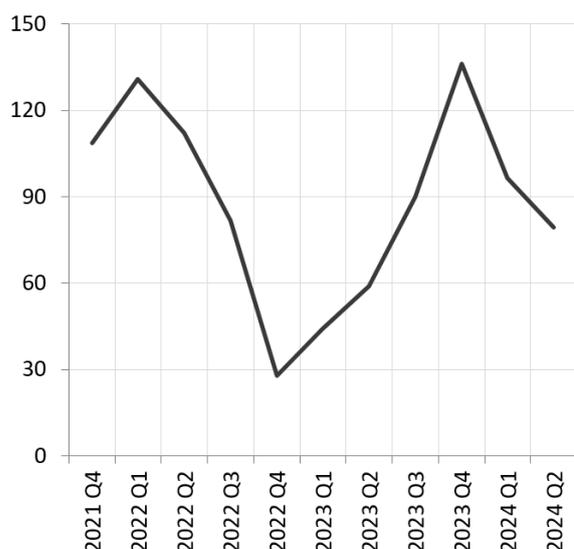
Figure 43. Non-bank Financial Sector Assets, trillion UZS
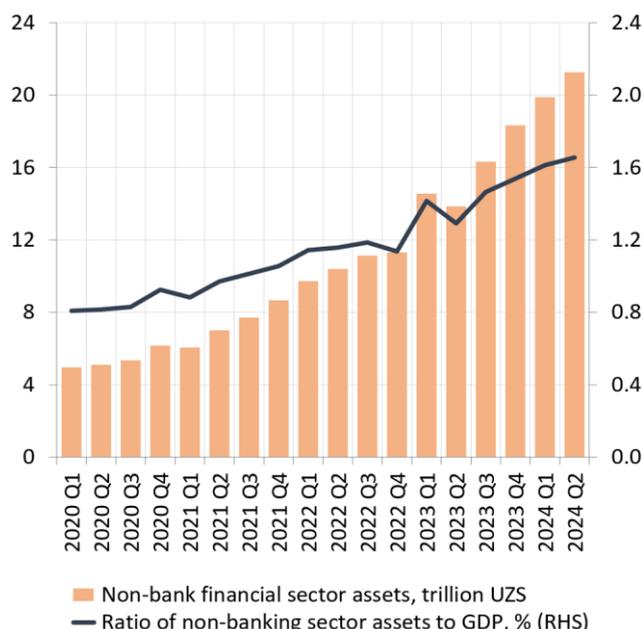
Sources: National Statistics Committee, National Agency of Prospective Projects and Unified Corporate Information
Portal and CBU staff calculations.

The volume of lending by non-bank credit organizations[35] remains limited. As of July 1,
2024, loans extended by non-bank credit organizations accounted for 1.8%[36] of GDP in the
credit market. Although the growth rate of outstanding loans from non-bank credit organizations
has slowed since the beginning of the year, it remained robust, climbing by 20 p.p. compared to
the same period 2023 and reaching 79%[37] by the end of H1 2024.

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[31] In analyzing the non-bank financial sector, non-bank credit organizations and insurance companies were considered.

[32] Financial sector assets include the assets of the banking system and non-banking financial organizations.

[33] The Central Bank of the Republic of Uzbekistan. Statistics.

[34] O'zbekiston Respublikasi Markaziy banki boshqaruvining 2024 yil 19 iyuldagi "Mikromoliya tashkilotlari tomonidan islomiy moliyalashtirishga oid xizmatlarni ko'rsatish tartibi to'g'risidagi nizomni tasdiqlash haqida" 43/4–sonli qarori.

[35] Non-bank credit organizations include microfinance organizations, pawnshops, and mortgage refinancing organizations.

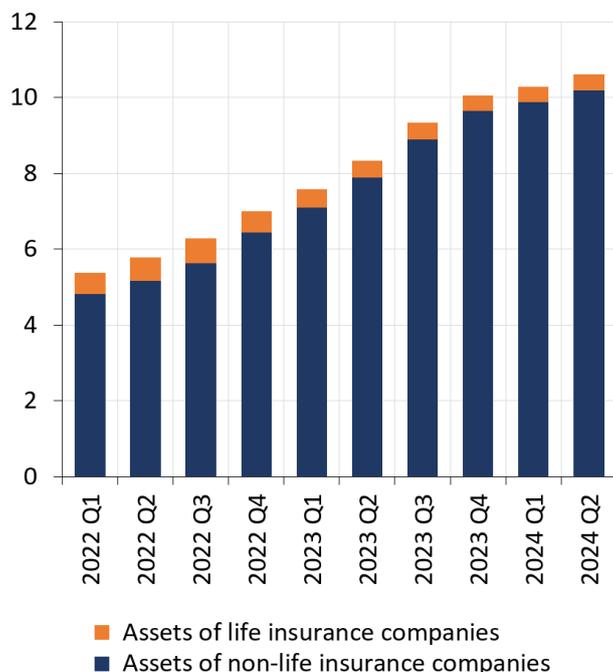[36] The Central Bank of the Republic of Uzbekistan. Statistics.

[37] The Central Bank of the Republic of Uzbekistan. (2024). Indicators of non-banking credit organizations.

Insurance companies account for a significant share of the non-bank financial sector. In H1 2024, total assets of the non-bank financial sector reached 21.3 trillion UZS, of which insurance companies accounted for 50%. Non-bank credit organizations[38] and mortgage refinancing company[39] represented 29% and 21% of sector assets, respectively. Overall, assets of the non-bank financial sector expanded by 54% annually in H1 2024.

Figure 44. ROA and ROE of Insurance Companies, %
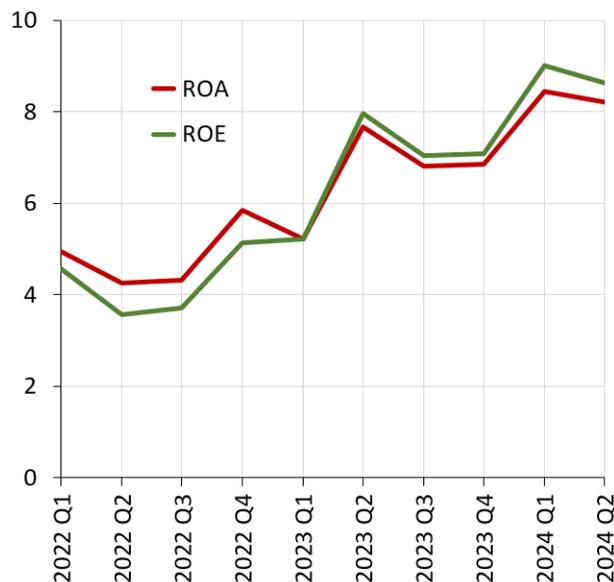
Figure 45. Assets of Insurance Companies, trillion UZS

Sources: Unified Corporate Information Portal and CBU staff calculations.

Note: ROA and ROE of the insurance sector are determined by aggregating the balance sheet data of all insurance companies.

Profitability indicators of insurance companies improved. As of July 1, 2024, ROA stood at 8.2%, up by 0.5 p.p. compared with the same period in 2023, while ROE reached 8.7%[40], a rise of 0.7 p.p. At the end of H1 2024, companies engaged in general insurance accounted for 96% of total insurance sector assets, which totaled 10.2 trillion UZS. Assets of life insurance companies amounted to 411 billion UZS.

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[38] The Central Bank of the Republic of Uzbekistan. (2024). Indicators of non-banking credit organizations.

[39] Mortgage Refinancing Company of Uzbekistan. (2024). Financial reports.

[40] Unified Corporate Information Portal. (2024). Essential facts.

Figure 46. Investments of Insurance Companies, trillion UZS
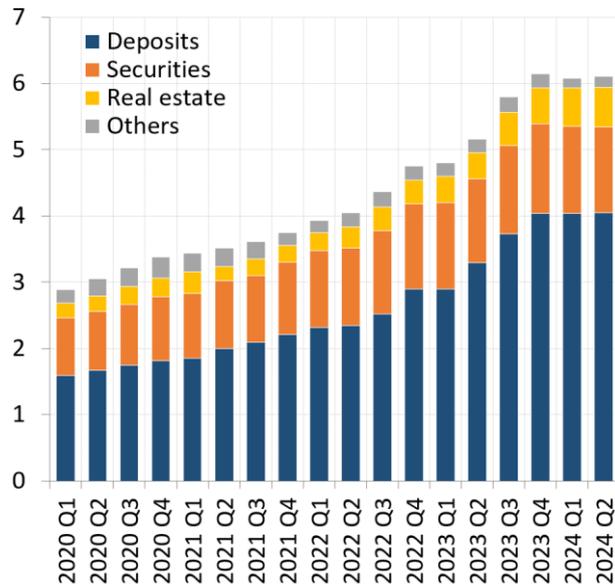
Figure 47. Quarterly Insurance Payments and Premiums, trillion UZS

Source: National Agency for Prospective Projects.

The growth rate of investments by insurance companies moderated. In H1 2024, the volume of investments amounted to nearly 6 trillion UZS, reflecting an uptick of 0.9 trillion UZS compared to the same period in 2023. Two-thirds of these investments were allocated to depos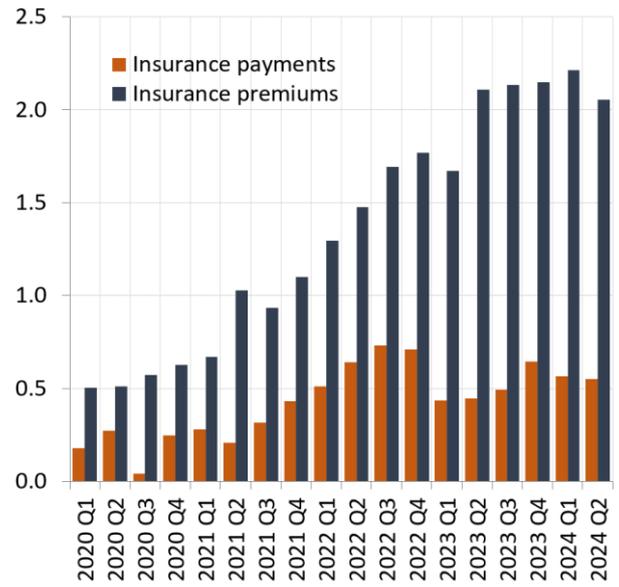its, reflecting a sustained preference for low-risk instruments. As of July 1, 2024, the share of investments in securities came to 21%, down 3 p.p. annually, while real estate accounted for 10% of the total investment portfolio.

There were no significant changes in the indicators of insurance payments and premiums. In H1 2024, insurance premiums[41] totaled to 4.3 trillion UZS, reflecting a 13% growth compared to the same period in 2023. This expansion was driven by a 17% increase in the general insurance sector, which represents the bulk of total insurance. Payments for reinsurance[42] accounted for 32% of total insurance premiums. As of July 1, 2024, insurance payments[43] reached 1.1 trillion UZS, rising by 0.2 trillion UZS compared to the same period in 2023.

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[41] An insurance premium is the amount a policyholder pays an insurer according to the terms specified in the insurance contract and can be paid in national or foreign currency.

[42] Reinsurance is insurance by a reinsurer of all or part of the risk of insurance compensation under the insurance contract of another insurer.

[43] An insurance payment refers to the money paid to the policyholder or beneficiary in the event of an insurance claim. It is typically within the sum insured for each insured person as specified in the insurance contract.

Figure 48. Insurance Payments-to-Insurance Premiums Ratio, %
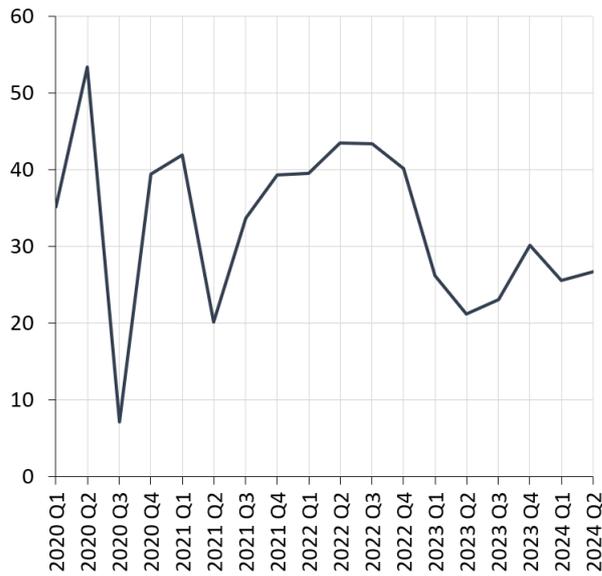
Figure 49. Insurance Premiums Concentration, HHI[44]
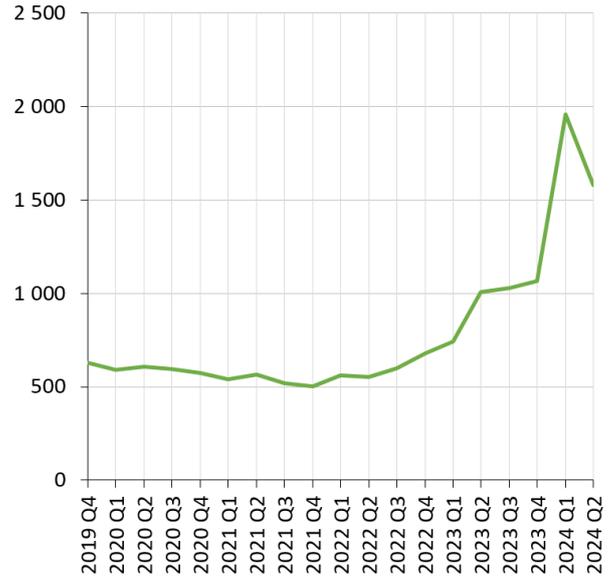
Sources: National Agency for Prospective Projects and CBU staff calculations

The operational efficiency of the insurance sector improved. In H1 2024, the ratio of insurance payments to premiums accounted 26%, up 3 p.p. compared to the same period in 2023.

The level of concentration in the insurance market by premiums increased markedly. The HHI for premiums in the insurance market remained at a moderate level, standing at 1,578 as of July 1, 2024.

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[44] The HHI categorizes industries into low concentration (HHI below 1000), medium concentration (HHI between 1000 and 1800), and high concentration (HHI above 1800)

Figure 50. Insurance Penetration and Density in Uzbekistan

- Insurance density, thousand UZS
- Insurance penetration, ‰ (RHS)
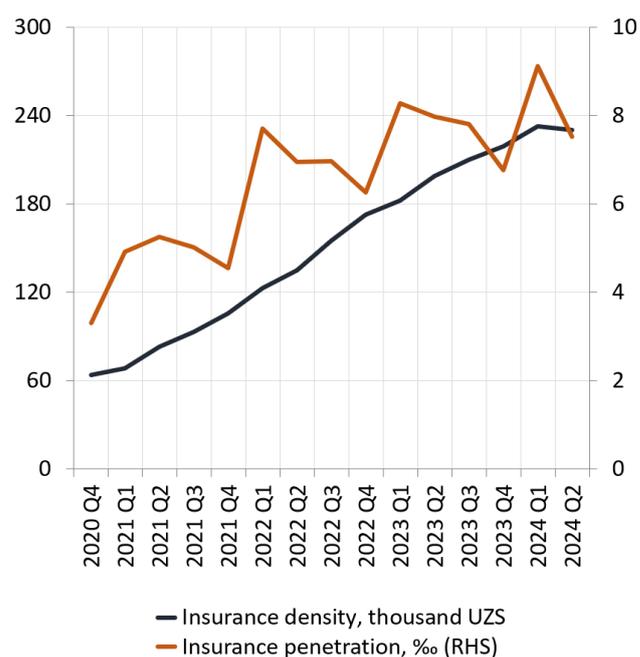
Figure 51. Insurance Penetration and Density in Selected Countries (as of July 1, 2024)

- Insurance penetration, ‰
- Insurance density, USD
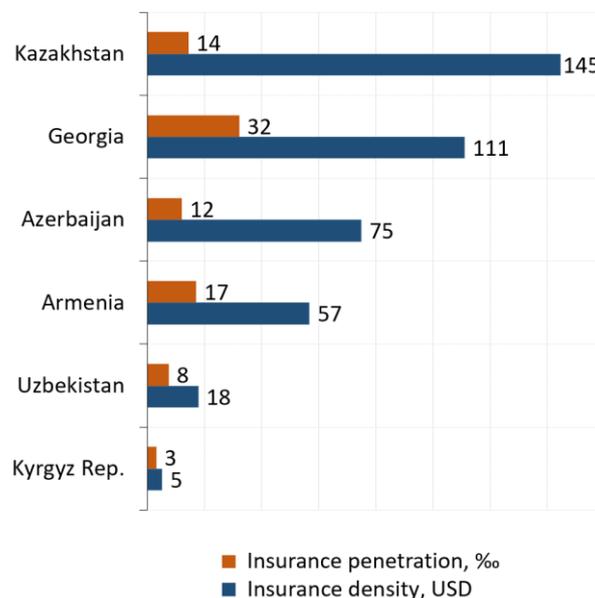
Sources: National authorities, National Agency for Prospective Projects, Statistics Agency and CBU staff calculations.

Note: Per mille (‰) represents one-thousandth of a number or one-tenth of a percent.

Insurance density is calculated by dividing annual total insurance premiums by the population.

Insurance penetration is calculated by dividing the total insurance premiums by the nominal GDP. The values of insurance premiums and the nominal GDP in the corresponding periods are used for this purpose.

The increase in demand for insurance services has positively contributed to the penetration of these services. At the end of H1 2024, the ratio of insurance premiums to the population totaled 230,000 UZS, reflecting a 16% uptick from the same period in 2023. In H1 2024, the insurance penetration declined slightly by 0.45 per mille compared with the corresponding period in 2023, reaching 7.5 per mille. These indicators remain relatively low in Uzbekistan relative to peer countries.

2.3. Capital Market

In H1 2024, there were no significant changes in the Uzbekistan Composite Index (UCI). In January 2024, declines in the prices of preferred shares of several joint-stock companies (JSCs) and common shares of one bank[45] caused the UCI to fall from 710 to 679. In Q1 2024, the delisting[46] of nine issuers from the stock exchange due to non-compliance with listing requirements led to a 1.6% reduction in stock exchange capitalization[47]. At the end of H1 2024, the UCI stood at 678, down 87 points from the level observed in the same period of 2023.

Figure 52. Uzbekistan Composite Index*
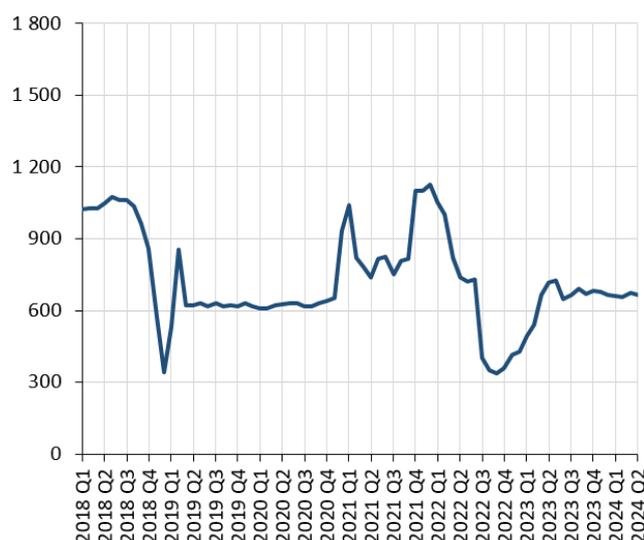
Figure 53. Stock Market Capitalization in Uzbekistan**, trillion UZS

Source: Republican Stock Exchange.

Note: *UCI[48] is a stock market index that represents the overall performance of listed stock issuers on the Republican Stock Exchange. As of June 1, 2024, there were 99 listed stock issuers on the exchange, out of which 15 were banks.

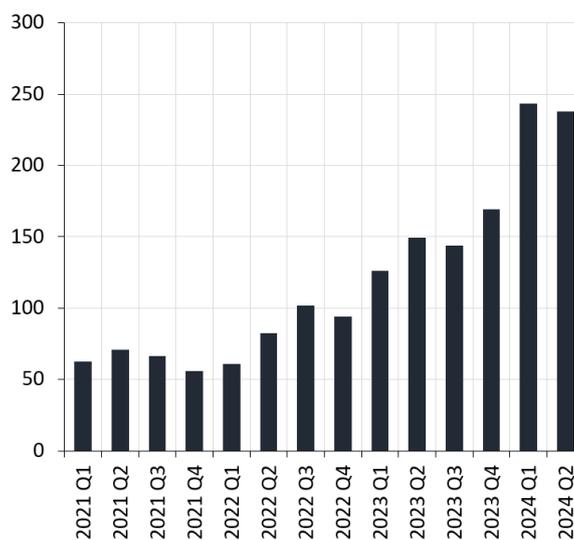**The total market capitalization of stock issuers is determined by multiplying the number of securities of all stock issuers included in the list of stock exchange quotations by their closing prices on the trading day.

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[45] Republican stock exchange. (2024). Quotation price of shares by month.

[46] Republican stock exchange. (2024). Stock Exchange Review. February 2024.

[47] The total capitalization of the Republican Stock Exchange is determined by multiplying the number of securities and their closing prices on the trading day. If the index value decreases, it means there has been a decrease in the stock prices of the issuers included in the quotation list, resulting in a decrease in the overall market capitalization.

[48] UCI is determined by the following formula:

$$UCI = \frac{\text{Market Cap}_{current\ date}}{\text{Market Cap}_{base\ date}} * \text{Base Index}$$

Where,

$Market\ Cap_{current\ date}$ – is the total capitalization of issuers included in the exchange quotation list, which was calculated by the system on the last transaction on the current trading date;

$Market\ Cap_{base\ date}$ – is the total capitalization of issuers included in the exchange quotation list, which was calculated by the system on the last transaction on the date the index was created (29.08.2016);

$Base\ Index$ is the specified value for the index, which is equal to 1000.

The total market capitalization of stock issuers in the Uzbekistan stock market is rising. At the end of H1 2024, total market capitalization reached 237.9 trillion UZS, marking a 59% increase from the same period in 2023. One of the main factors driving this growth was the issuance of large volumes of additional shares by enterprises in the information technology sector[49].

The participation of banks in the republican stock exchange expanded. In H1 2024, more than 246,000 transactions with a total value of nearly 445 billion UZS were concluded on the stock exchange. Securities issued by banks accounted for 60% of total transaction volume during this period. Transactions involving securities of enterprises in the industrial (33.9 billion UZS), energy (26.2 billion UZS), and construction (11.4 billion UZS) sectors ranked next in terms of trading volume[50].

Figure 54. Trading Volume of Republican Stock Exchange, billion UZS
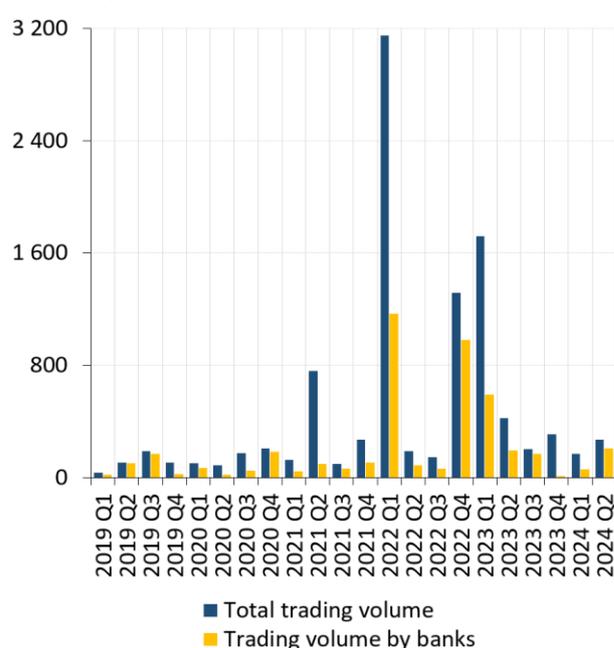
Figure 55. Share of Securities in Bank Assets and Yield on Treasury Bonds, %
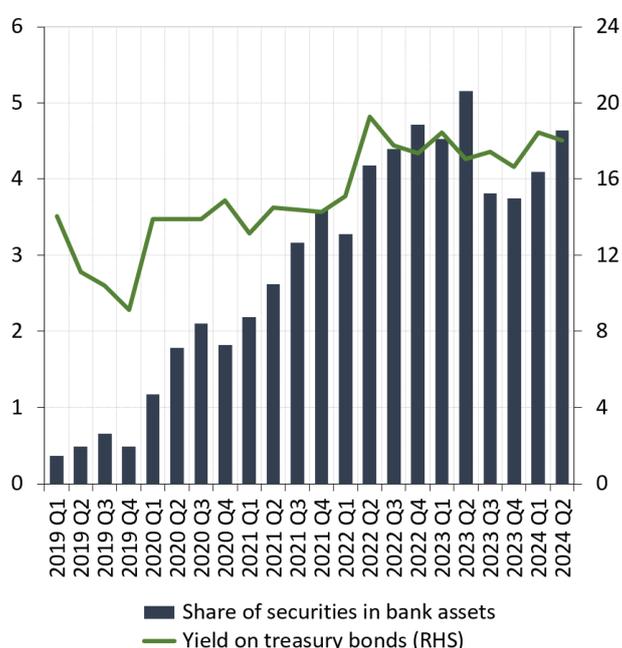
Sources: Republican Stock Exchange, Uzbek Republican Currency Exchange and CBU staff calculations.

The impact of banks on the capital market waned. At the end of H1 2024, the balance of securities held by banks amounted to approximately 32 trillion UZS, reflecting a 7.7% gain compared to the same period in 2023. The expansion of banks' credit activity led to a reduction in the share of securities in total assets. At the end of H1 2024, securities accounted for 4.6% of banks' total assets, fell by 0.5 p.p. compared to the same period in 2023.

The profitability of government securities increased slightly. In H1 2024, the volumes of the announced issuance and submitted bids for the primary placement of government securities totaled 34.4 trillion UZS and 28.1 trillion UZS, respectively[51]. While the volume of announced

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[49] Republican stock exchange. (2024). Trade results.

[50] Republican Stock Exchange. Exchange Review – H1 2024.

[51] Uzbek exchange. (2024). Stock market.

issuance rose by 11% compared to the same period in 2023, the volume of submitted bids contracted by 15%. Imbalances between supply and demand in the financial market, along with a 1.3 p.p.[52] growth in interbank money market interest rates, led to a decline in market prices and a corresponding increase in yields. The average yield on government securities reached 18.3%, representing an uptick 0.6 p.p. compared to the same period in 2023.

Figure 56. Yield on Uzbekistan FX Sovereign Eurobonds, %
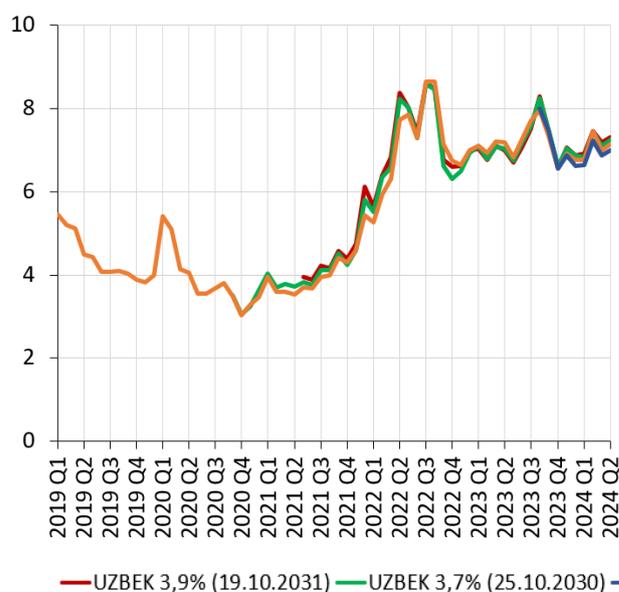
Figure 57. G-spread* of Uzbekistan FX Sovereign Eurobonds, basis points

—UZBEK 3,9% (19.10.2031) —UZBEK 3,7% (25.10.2030) —UZBEK 7,85% (12.10.2028) —UZBEK 5,375% (20.02.2029)
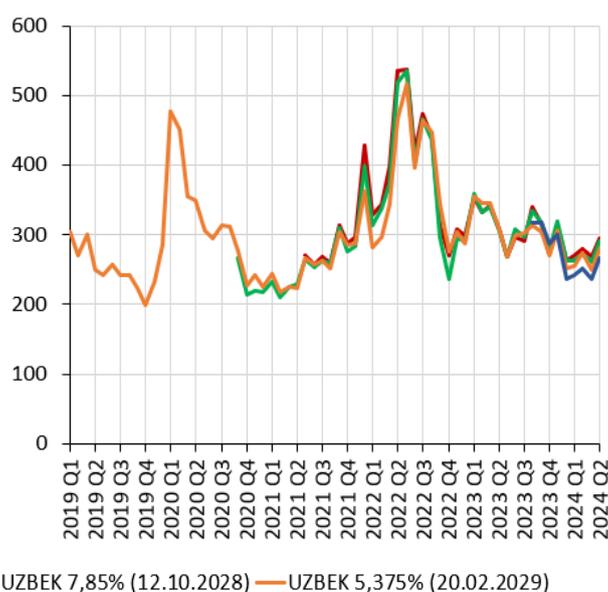
Source: Bloomberg.

Note: *A G-spread is the difference between the bond yield and its benchmark, the US Treasury bond yield. An increase in the G-spread denotes an increase in the risk level of this bond compared to the benchmark bond.

The risk premium on Uzbek sovereign Eurobonds declined relative to benchmark bonds. At the end of H1 2024, the yield on Uzbekistan sovereign Eurobonds stood at around 7%, remaining broadly unchanged compared to the corresponding period in 2023. Over the same period, the spread between the yields on Uzbekistan sovereign Eurobonds and U.S. Treasury bonds narrowed relative to the corresponding period in 2023, amounting to approximately 270–290 basis point. This development is also supported by the stable sovereign credit rating of Uzbekistan at BB-[53], as affirmed by Fitch Ratings in August 2024.

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[52] The Central Bank of the Republic of Uzbekistan. (2024). Interest rates.

[53] Fitch Ratings. (2024). Republic of Uzbekistan.

Box 2. Payment System

The increasing digitalization of the financial system on a global scale is raising concerns about the security of payment systems. Given that potential risks in the payment system can have negative consequences for the country's economy, one of the main objectives of the CBU is to ensure the stability of payment systems[54]. In particular, disruptions in money transfers as a result of cyberattacks, as well as weakening of trust in the financial system due to financial losses of financial system participants and disclosure of their personal data, can lead to liquidity problems.

Figure 58. Number and Amount of Interbank Payment System Transactions*

Number of transactions, million
Transaction value, quadrillion UZS (RHS)
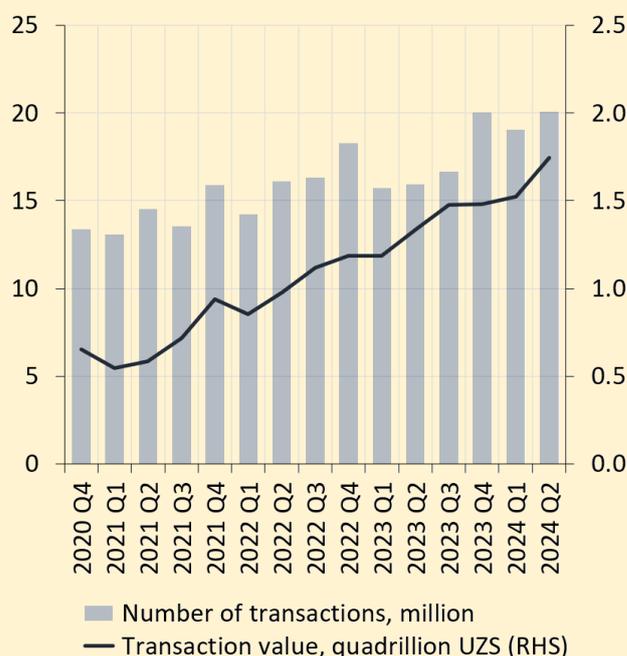
Figure 59. Number and Amount of CBU's Clearing-settlement System Transactions**

Number of transactions, million
Transaction value, trillion UZS (RHS)

Source: CBU

Note: *Interbank payment system is a system for making payments based on electronic payment documents in the form of a memorial order, payment order, payment request, letter of credit application and collection order within a specified period of time.

** CBU's clearing-settlement system is a system for collection, comparison and transfer of mutual claims and obligations of payment system participants in real time without cash.

Transactions conducted through the CBU's clearing-settlement and interbank payment systems is growing. In H1 2024, the number of transactions processed through the interbank payment system reached 39 million, with a total value of 3.3 quadrillion UZS, representing an increase of nearly 30% in transaction value compared to the same period in 2023. During the same period, the number of transactions in the clearing-settlement system amounted to 57.4 million, up 25% year-on-year. The average value of transactions in H1 2024 stood at 722,400 UZS, 12% higher than in the corresponding period of 2023, while the total transaction value rose by 40% to 41.5 trillion UZS.

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[54] O'zbekiston Respublikasining 2019 yil 11 noyabrdagi "O'zbekiston Respublikasining Markaziy banki to'g'risida"gi O'RQ-582–sonli Qonuni.

Figure 60. Ratio of Annual Payment System Transactions to GDP, %

Legend:
- CBU's Clearing-settlement System (red)
- CBU's Instant Payments System (grey)
- Interbank Payment System (blue)
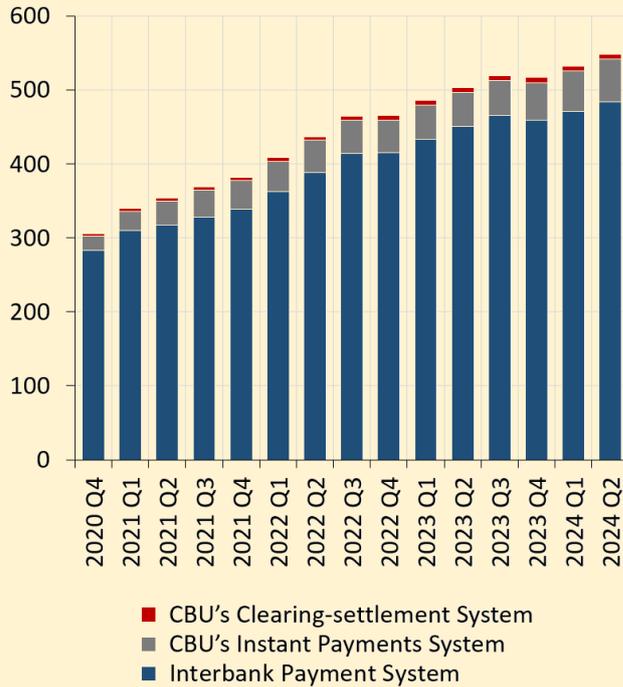
Figure 61. Number and Amount of Transactions Through the CBU's Instant Payments System*

Legend:
- Number of transactions, million (green bars)
- Transaction value, trillion UZS (RHS) (green line)
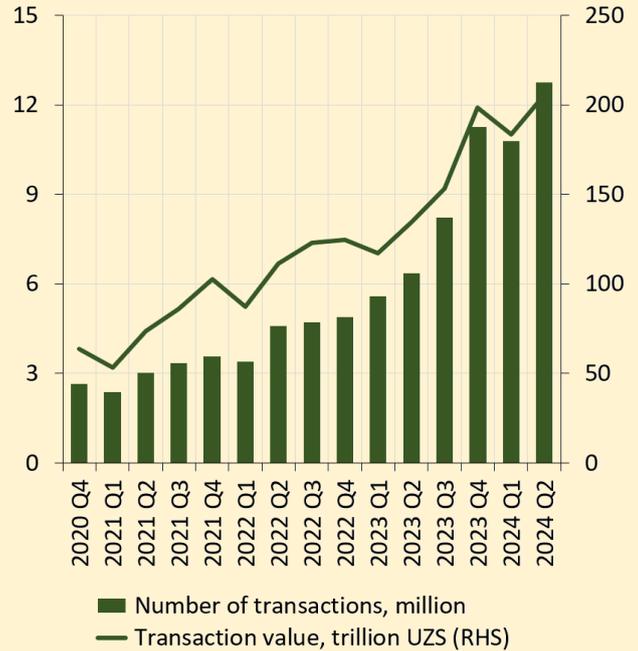
Source: CBU.

Note: *Through the CBU's instant payments system, interbank transactions are carried out online, 24/7. The amount of transactions processed by banks is determined within the balance of the banks' correspondent accounts with the CBU.

The growth in non-cash payments relative to GDP underscores the importance of maintaining the continuity of payment systems. At the end of H1 2024, the annual value of transactions processed through payment systems amounted to 5.5 times nominal GDP. Transactions conducted via the interbank payment system accounted for a substantial share, exceeding GDP by 4.8 times. Meanwhile, the annual ratio of transactions processed through the CBU's instant payments system and the clearing-settlement systems to GDP stood at 58% and 7%, respectively.

The pace of transactions through the CBU's instant payments system is increasing. In H1 2024, 23.6 million transactions were executed through the instant payments system, the total amount of which amounted to 388.9 trillion UZS. In H1 2024, the number and amount of transactions carried out through this payment system skyrocketed by 97% and 54%, respectively, compared to H1 2023.

Figure 62. Number of Bank Cards in Circulation and per Capita*

Legend:
- Number of bank cards, million units
- Number of bank cards per capita, units (RHS)
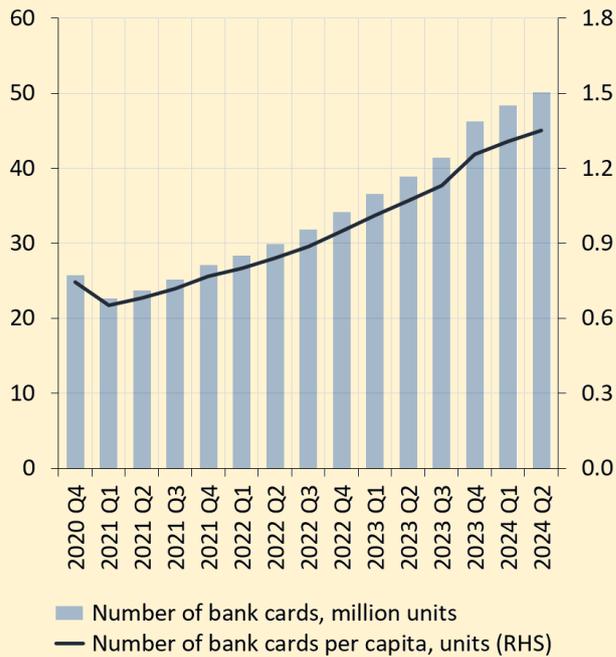
Figure 63. Number of POS Terminals, ATMs and SSTs, thousand

Legend:
- Number of ATMs and SSTs
- Number of POS terminals (RHS)
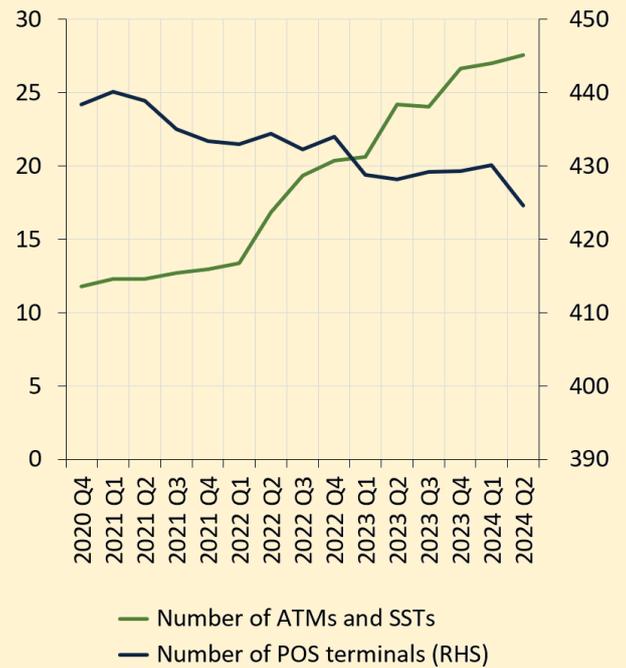
Source: CBU.

Note: *The calculation is based on the number of people who are residents.

The number of bank cards in circulation continues to rise. As of July 1, 2024, the total number of bank cards totaled 50 million, reflecting a 29% increase compared to the same period in 2023. During H1 2024, the number of bank cards per capita reached 1.4, up 0.3 compared to the corresponding period in 2023.

The number of automated teller machines (ATMs) and self-service terminals (SSTs) has increased, whereas the number of point-of-sale (POS) terminals has declined. At the end of H1 2024, the total number of ATMs and SSTs amounted 27,600 units, representing a 14% rise compared to the same period in 2023. The number of POS terminals installed by banks dropped, totaling 424,600 as of July 1, 2024.

Figure 64. Concentration of Bank Cards, ATMs, and SSTs, HHI

Legend:
— Number of bank cards
— Number of ATMs and SSTs
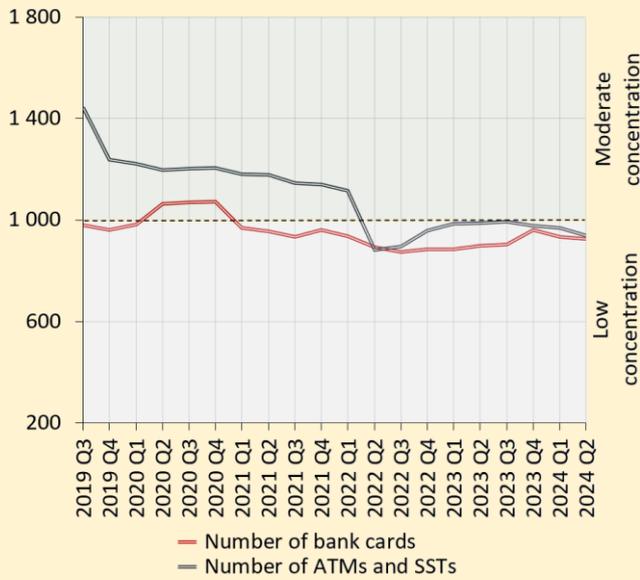
Figure 65. Concentration of Payment Systems by Transaction Value*, HHI

Legend:
— CBU's Clearing-settlement System
— Interbank Payment System
— CBU's Instant Payments System
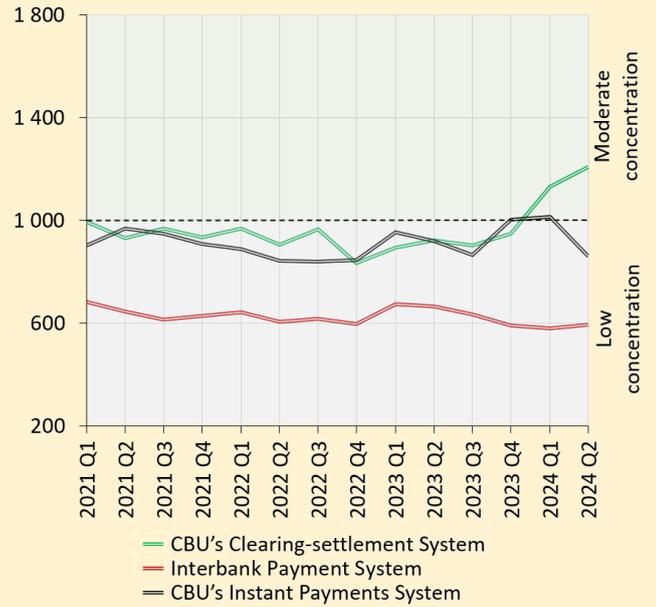
Source: CBU staff calculations.

Note: The Herfindahl-Hirschman Index (HHI) categorizes the level of competition in the banking services market into the low concentration (below 1000), medium concentration (from 1000 to 1800), and high concentration (above 1800) groups.

Market concentration remains low in terms of the number of bank cards in circulation and the number of installed ATMs and SSTs. At the end of H1 2024, the HHI for the number of bank cards in circulation and installed ATMs and SSTs stood at around 930, close to the upper threshold of the low-concentration group.

Concentration levels in the CBU's instant payments and interbank payment systems remain low, while the clearing-settlement system exhibits a moderate level of concentration. During H1 2024, the HHI for the value of payments processed by banks through the CBU's clearing-settlement system stood at 1,210, indicating a medium level of concentration. The HHI for transactions processed through the instant payments system was close to the upper threshold of the low-concentration group, at 860. By contrast, the level of concentration in the interbank payment system remained broadly unchanged, with the HHI at around 590.

Figure 66. Digital Infrastructure Index[55] in Selected Countries (2023)
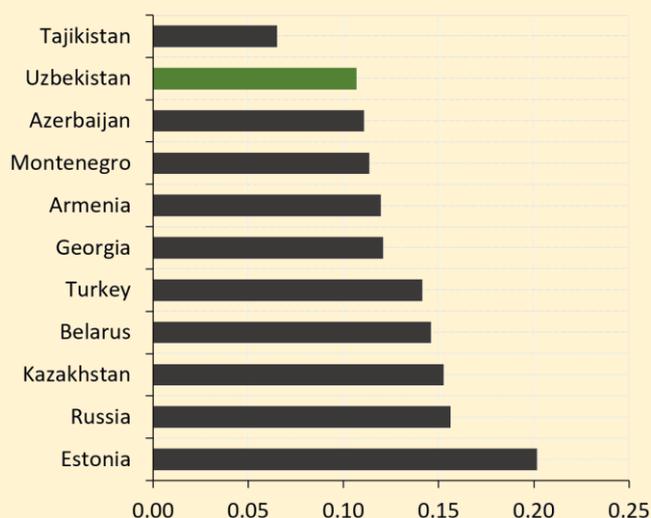
Figure 67. Digital Infrastructure Index by Country Group (2023)

Source: IMF.

Note: The Digital Infrastructure Index was developed by the IMF using data from 174 countries. The index is constructed based on country-level indicators, including the number of internet users per 100 people, the availability of basic telephone lines, internet access prices, transaction conditions for the corporate sector, the prevalence of online transactions, and public internet infrastructure. All indicators are standardized on a scale from 0 to 1, and the index is calculated as the simple average of these standardized values. Higher index values indicate a more advanced level of digital infrastructure development, while lower values reflect a lower level of development.

The Digital Infrastructure Index for Uzbekistan is at the level of emerging market economies. At the end of 2023, the index was relatively high in AEs (0.18) and low in low-income countries (0.06). Also, Uzbekistan's index score was 0.11, which is above the average value calculated for low-income countries based on this index.

The rapid global expansion of digital technologies has been accompanied by a rise in cyberattacks. In addition to the direct financial losses caused by cyber incidents, public trust in digital technologies has been adversely affected, which may, in turn, hinder the development of digital banking services. Between 2020 and 2023, cyber incidents across all sectors resulted in direct[56] losses of nearly 28 billion USD worldwide[57]. In 2023, the number of financially motivated cyber incidents reached almost 1,800 globally, representing a 15% increase[58] compared to 2022. Both direct and indirect[59] losses stemming from cyber incidents undermine confidence among the public and investors and pose risks to the stability of the financial system[60].

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[55] International Monetary Fund. (2024). Digital Infrastructure Index.

[56] Direct losses result from funds spent to cover damages caused by cyber incidents, fines and penalties, extortion payments, or revenue losses due to business interruptions.

[57] International Monetary Fund. (2024, April). Global Financial Stability Report.

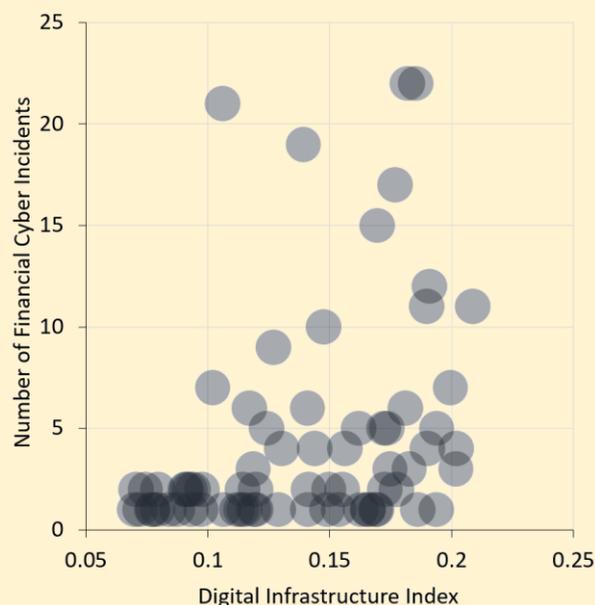[58] Center for International & Security Studies at Maryland.

[59] Indirect losses arise from reputational damage, reduced economic activity, and higher cybersecurity costs.

[60] The impact of cyber risks on financial stability is presented in the Financial Stability Report for H1 2023.

Figure 68. Number of observed financial cyber incidents worldwide*
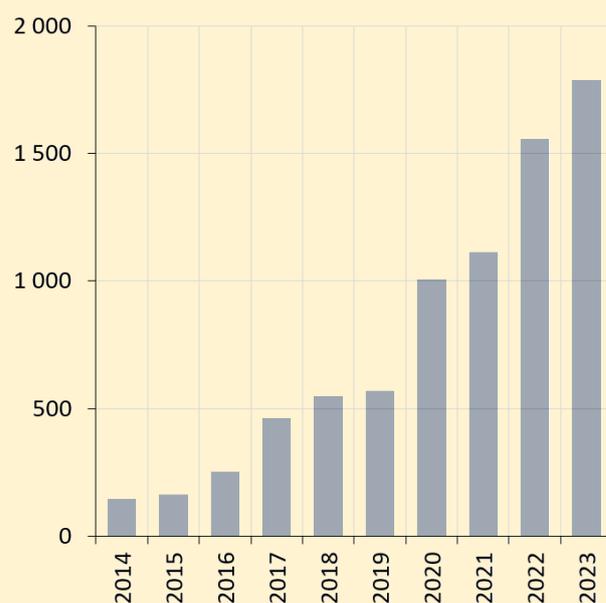
Figure 69. Digital Infrastructure Index and Number of Financial Cyber Incidents** (2023)

Source: IMF and Center for International & Security Studies at Maryland.

Note: *The number of financial cyber incidents observed worldwide is calculated as the aggregate of financial cyberattacks committed across individual countries. In compiling these data, the Maryland Center for International and Security Studies first collects information on reported cyber incidents from Internet web pages using specialized software. In the subsequent stage, researchers analyze the collected data to identify cyberattacks. Financial cyber incidents are defined as incidents with a significant impact that are carried out by cyberattack entities with the objective of obtaining direct or indirect financial gain[61].

**During 2023, countries in which financial cyberattacks occurred, but where the number of financial cyberattacks was fewer than 25 during the year, were taken into account.

The need to strengthen protections for payment system participants against fraud is becoming increasingly urgent. The World Bank has identified key measures to combat fraud in payment systems, including[62] programmatic regulations, technological solutions[63], enhancements to the regulatory framework, and initiatives to improve financial literacy regarding fraud. In particular, programmatic regulations aimed at preventing payment system fraud include quantitative limits on transactions, as well as obligations and mechanisms for reporting fraud-related information.

Globally, software-based rules are widely used to prevent fraud in money transfers, and many countries have introduced transaction limits to mitigate these risks. In the United States, the Real-Time Payment (RTP)[64] system imposes a limit of 1 million USD per transaction.

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[61] Harry, C., Gallagher, N., & Samuelsen, L. (2023). Cyber Events Database Codebook. Center for International & Security Studies at Maryland.

[62] World Bank. (2023, October). Fraud Risks in Fast Payments.

[63] Technological solution include innovations such as fraud monitoring systems, multi-factor digital authentication (including biometrics), and centralized fraud databases.

[64] Real-time payment (RTP).

Transfers through the Single Euro Payments Area (SEPA) Credit Transfer Instant (SCT Inst[65]) system are capped at 100,000 EUR. In Mexico, transactions through the Interbank Electronic Payment System (SPEI)[66] exceeding 50,000 MXN or approximately 2,951 USD may be subject to extended review by the Central Bank of Mexico for additional verification against fraud and money laundering[67]. In Uzbekistan, transfers from one or more bank cards or electronic wallets to a client's bank card or vice versa totaling 500 or more times the base settlement amount, conducted simultaneously or repeatedly within a 30-day period, are classified[68] as suspicious[69]. Ensuring the uninterrupted and stable operation of payment systems, as well as their resilience to cyberattacks, remains a critical component of financial stability.

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[65] Single Euro Payments Area (SEPA) Credit Transfer Instant.

[66] Interbanking Electronic Payment System (SPEI).

[67] World Bank. (2023, October). Fraud Risks in Fast Payments.

[68] O'zbekiston Respublikasi Markaziy banki boshqaruvi va O'zbekiston Respublikasi Bosh prokuraturasi huzuridagi Soliq, valyutaga oid jinoyatlarga va jinoiy daromadlarni legallashtirishga qarshi kurashish departamentining 2023 yil 3 apreldagi "Tijorat banklarida jinoiy faoliyatdan olingan daromadlarni legallashtirishga, terrorizmni moliyalashtirishga va ommaviy qirg'in qurolini tarqatishni moliyalashtirishga qarshi kurashish bo'yicha ichki nazorat qoidalariga o'zgartirish va qo'shimchalar kiritish haqida"gi 2886-10–sonli qarori.

[69] Suspicious transaction – a transaction that is being initiated, executed, or has already been completed, and which, during internal control, raises suspicions in a bank that it may be intended for the legalization of proceeds from criminal activities, the financing of terrorism, or the proliferation of weapons of mass destruction.

III. Non-financial Sector

3.1. Corporate sector

The growth of the outstanding loans to legal entities is maintained. As of July 1, 2024, outstanding corporate loans increased by 11% compared to the same period in 2023, reaching 333 trillion UZS. The balance of FX loans to the corporate sector remained largely unchanged. By the end of H1 2024, FX loans to legal entities accounted for approximately two-thirds of total corporate loans.

Figure 70. Corporate Loan Stocks by Currency Types and Annual Growth Rate

- Stock of corporate loans in foreign currency, trillion UZS
- Stock of corporate loans in national currency, trillion UZS
- Annual growth of the stock of corporate loans (YoY), % (RHS)
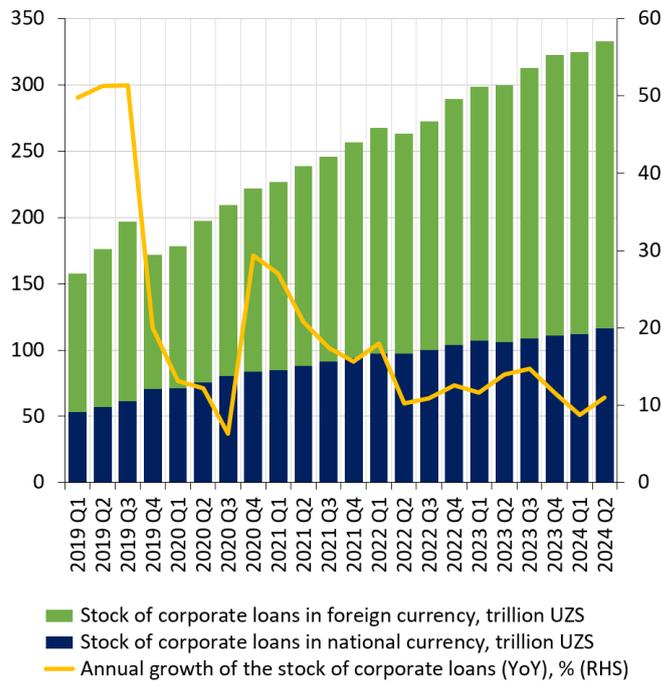
Figure 71. Weighted Average Interest Rate on FX Corporate Loans, %
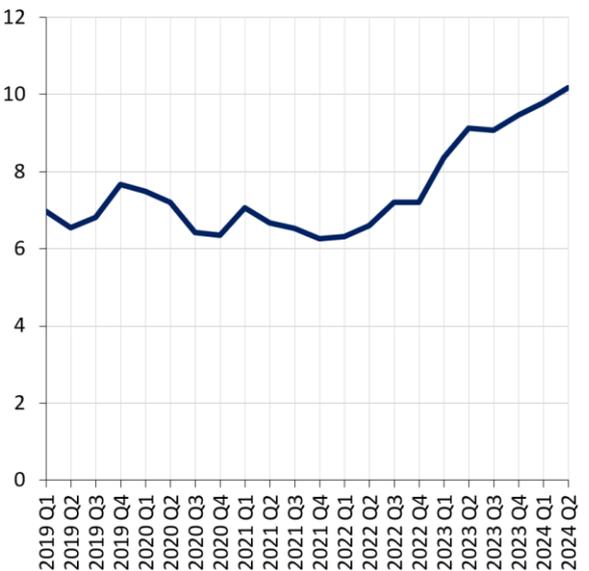
Source: CBU.

The average weighted interest rates on FX loans to the corporate sector continued to expand. In H1 2024, the average weighted interest rate on corporate FX loans reached 10%, marking a rise of 1.3 p.p. compared to the same period in 2023. Higher interest rates may elevate loan servicing costs and, consequently, lead to a deterioration in loan quality.

Figure 72. Corporate Loan Stocks-to-Annual GDP by Sector, %
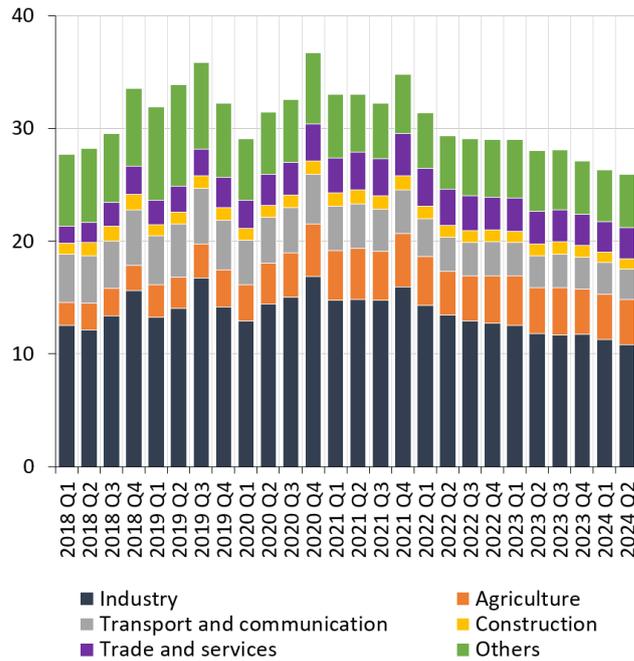
Figure 73. Corporate Loans-to-GDP Gap, p.p.
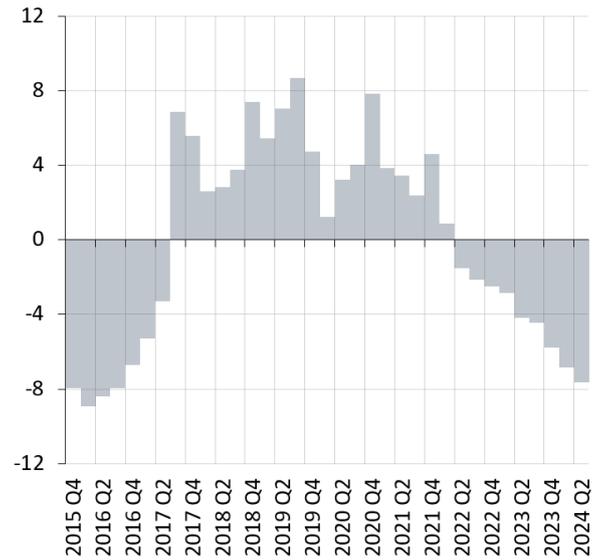
Sources: Unified Corporate Information Portal, financial reports of companies, and CBU staff calculations.

The corporate loans-to-GDP ratio and its gap are contracting. In H1 2024, the ratio of corporate loans to GDP was 26%, declining by 2 p.p. compared to the same period in 2023. Despite a slight decrease in the industrial sector loans-to-GDP ratio, loans to this sector continue to account for the largest share. As of July 1, 2024, the corporate loans-to-GDP gap[70] was around -8%, falling by 3 p.p. compared to the same period in 2023.

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[70] The corporate loans-to-GDP gap is calculated by subtracting the long-term trend from the corporate loans-to-GDP ratio. The long-term trend of the corporate loans-to-GDP ratio is calculated according to the BCBS approach, using a one-sided HP filter with a smoothing parameter of 400,000 for quarterly data.

Figure 74. Total Liabilities-to-Capital Ratio for Selected 70 Large Companies

Figure 75. ICR for Selected 70 Large Companies

Source: Unified Corporate Information Portal, financial reports of companies, and CBU staff calculations.

Note: The total liabilities-to-capital ratio was calculated using the data from 70 large joint-stock companies.

ICR is calculated using an exponential moving average[71] based on the data from the 70 largest JSCs. This ratio measures the number of times a company's PBT can cover its debt interest costs. If the ratio is less than 100, the company may be unable to meet its debt obligations in terms of interest payments with its current income, putting it at a high risk of default.

The leverage ratio of companies improved. In H1 2024, the ratio of liabilities to capital for large enterprises stood at 166%, 25 p.p. lower than in the same period in 2023. This decline in the leverage ratio reflects a reduction in the risks associated with meeting enterprises' obligations.

The downward trend in the ICR in the corporate sector persisted. As of July 1, 2024, the ICR of 70 selected large companies reached 530%. This indicator dropped by 250 p.p. compared to the same period in 2023, signaling a slight weakening in enterprises' ability to service interest payments on loans.

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[71] The exponential moving average is a technique used to smooth out the value of an indicator by reducing random and short-term fluctuations.

Figure 76. Cash[72] and Current[73] Ratios for Selected 70 Large Companies, %
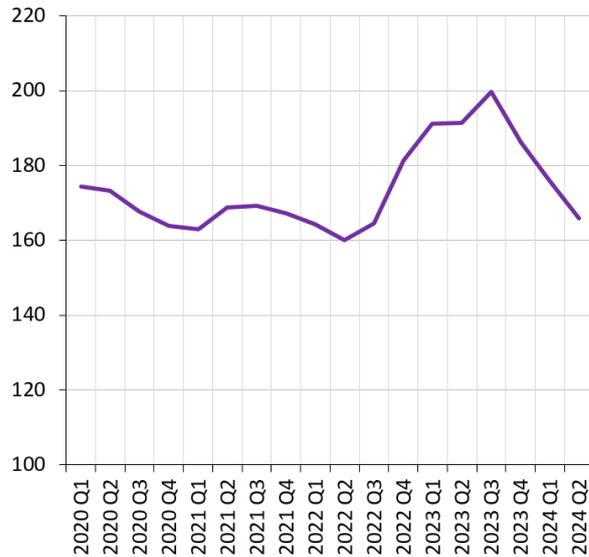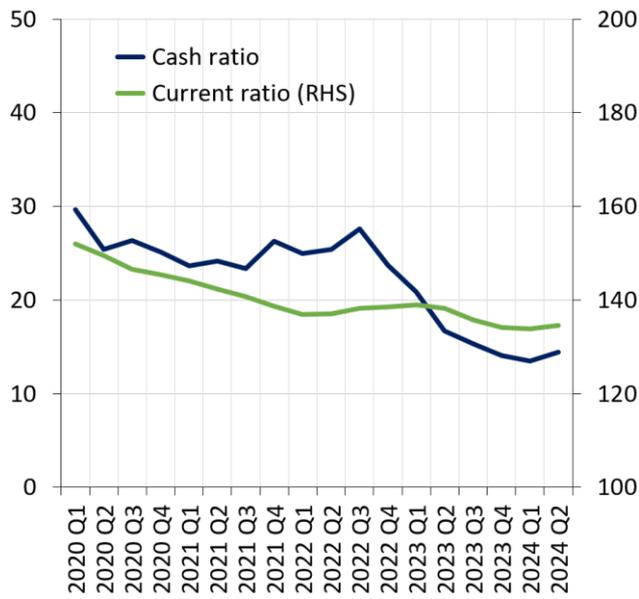
Figure 77. ROE and ROA for Selected 70 Large Companies, %

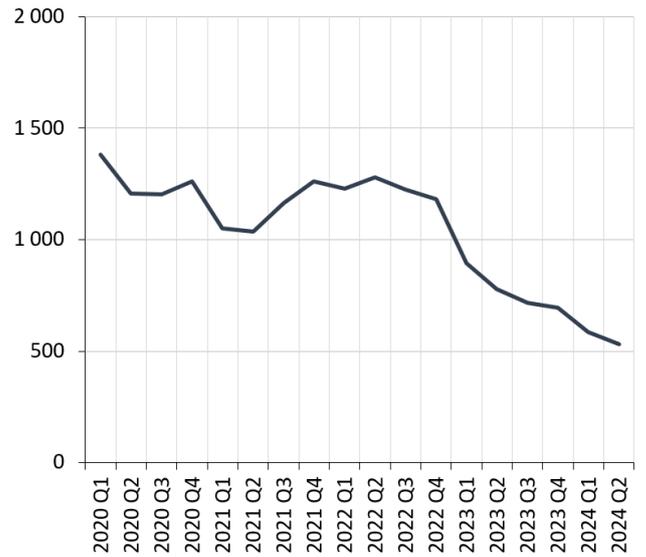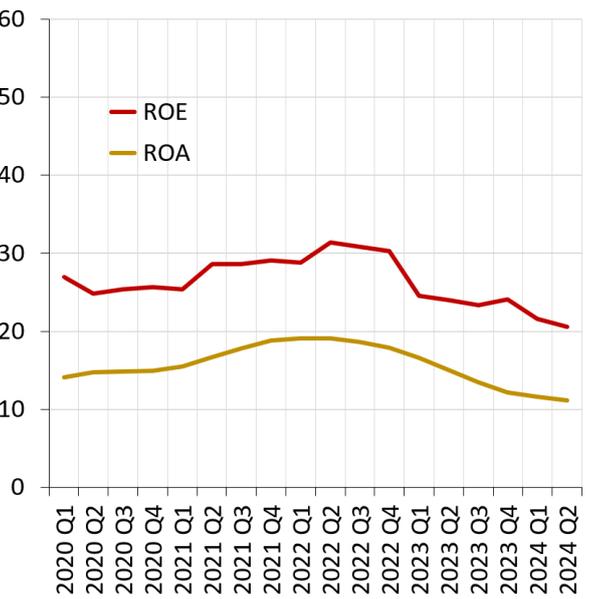Source: Unified Corporate Information Portal, financial reports of companies, and CBU staff calculations.

Note: Indicators are calculated using an exponential moving average based on the data from the 70 largest JSCs.

Liquidity ratios of enterprises declined. In H1 2024, the cash ratio for large enterprises was 14%, 2 p.p. lower than in the same period in 2023. This decline suggests that enterprises may face greater challenges in covering current liabilities with available cash. The current ratio reached 135%, 4 p.p. lower than in the same period in 2023.

The profitability of the corporate sector continued to weaken. In H1 2024, ROE declined by 3 p.p. compared to the same period in 2023, standing at 21%. The downward trend in ROA also persisted. As of July 1, 2024, ROA was 10%, 5 p.p. lower than in the same period in 2023.

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[72] Cash ratio indicates the amount of cash and short-term investments covering current liabilities. This ratio is calculated by dividing the company's most liquid funds by current liabilities.

[73] Current ratio is determined by dividing current assets by current liabilities. A ratio of more than 1 indicates a stable financial condition of a company.

3.2. Household Sector

As a result of tighter MPP and weaker credit demand, the household's debt burden has stopped increasing. Since August 2023, a procedure has been introduced[74] to assess the risk level of car loans – given their high share in banks' credit portfolios – based on the loan-to-value (LTV) ratio. Consequently, by the end of H1 2024, the average annualized loan amount per borrower for total population loans fell by 5% compared to the corresponding period in 2023. The population's average monthly income rose by 18% annually[75].

Figure 78. DSR for Mortgages to Individuals (YoY), %
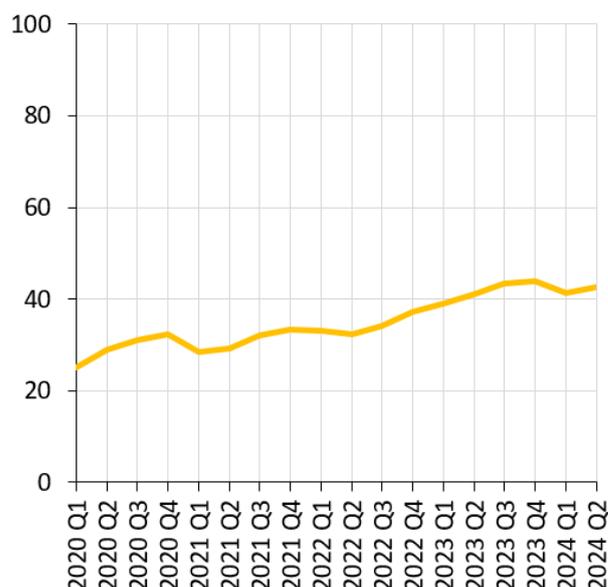
Figure 79. DSR for Mortgages to Individuals (YoY), %
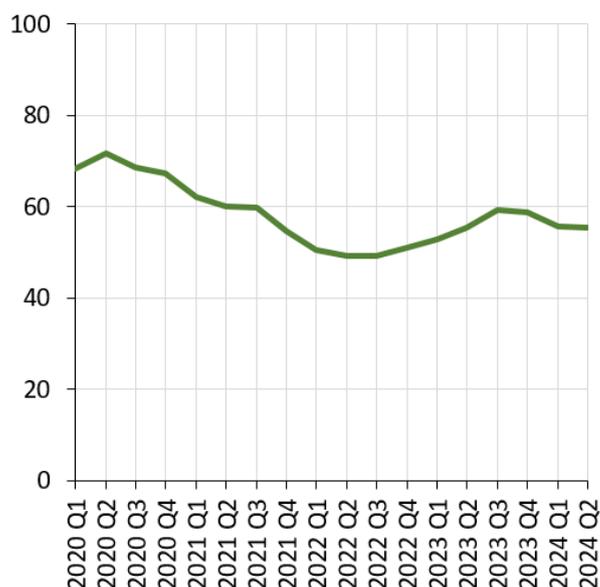
Source: CBU staff calculations.

The population's debt burden on mortgages remains around 40–45%. In H1 2024, this ratio remained largely stable. The average mortgage loan per borrower totaled 226 million UZS, representing a 25% increase compared to the same period in 2023. The average loan repayment period shortened by 7 months, reaching 17 years.

The population's debt obligations on car loans remained stable. In H1 2024, borrowers allocated 55% of their disposable income on an annualized basis to car loan payments. The average car loan per borrower rose to 133 million UZS, marking a 12% increase compared to the same period in 2023. Meanwhile, the average interest rate on car loans climbed by 3 p.p.

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[74] O'zbekiston Respublikasi Markaziy banki boshqaruvining 2023 yil 6 iyundagi "Tijorat banklari kapitalining monandligiga qo'yiladigan talablar to'g'risidagi nizomga o'zgartirishlar va qo'shimcha kiritish haqida"gi 14/7–sonli qarori.

[75] National Statistics Committee. (2024). Average Nominal Wages (quarterly).

Figure 80. LTV Distribution of Mortgage Loans
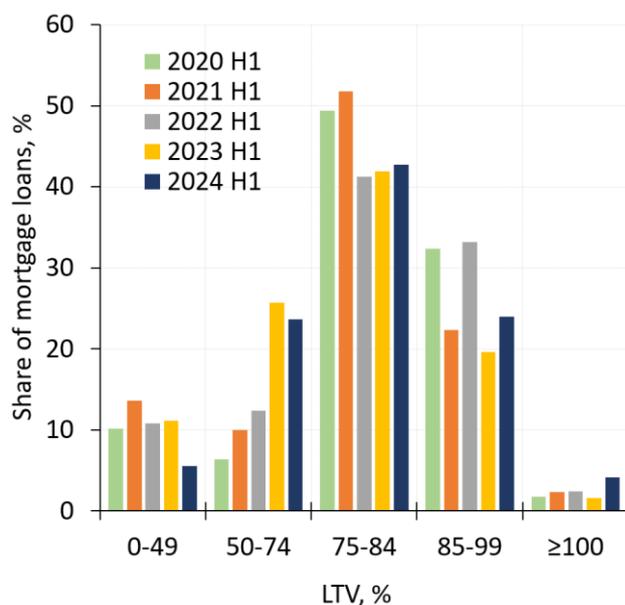
Figure 81. Weighted Average LTV of Mortgage Loans, %
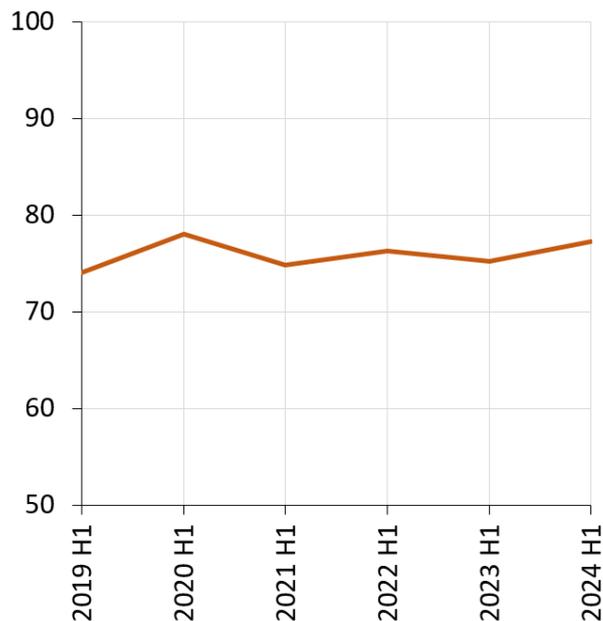
Source: CBU.

In H1 2024, the collateralization of total mortgages issued by banks weakened. The average LTV ratio for newly issued mortgage loans stood at 77%, reflecting a 2 p.p. increase compared to the corresponding period in 2023. As of July 1, 2024, the LTV ratio for total mortgage loans in the 50–84% range reached 66%, down 1 p.p. from the same period in 2023. The LTV ratio in the 85–99% range rose significantly, reaching 24% as of July 1, 2024. Overall, this points to a modest deterioration in mortgage loan collateralization.

Figure 82. LTV Distribution of Car Loans
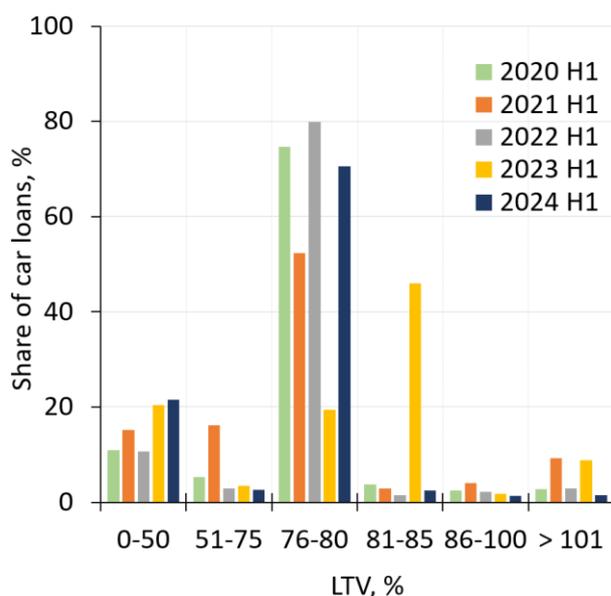
Figure 83. Weighted Average LTV of Car Loans, %
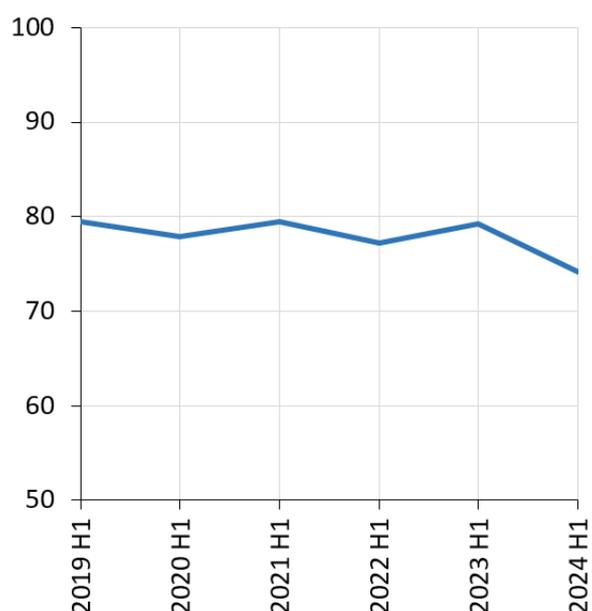
Source: CBU.

Collateralization of car loans has strengthened. As of July 1, 2024, the average LTV ratio declined to 74%, representing a 5 p.p. reduction compared with the same period in 2023. Loans with LTV ratios of 81–85% have shifted into the 76–80% range. The share of car loans with LTV in the 76–80% range increased sharply, rising by 51 p.p. to 71% as of July 1, 2024. The share of loans with LTV ratios of 81–85% fell markedly, declining from 46% to 2% over the same period.

Figure 84. Annual Growth (YoY) of Outstanding Loans of Individuals, %
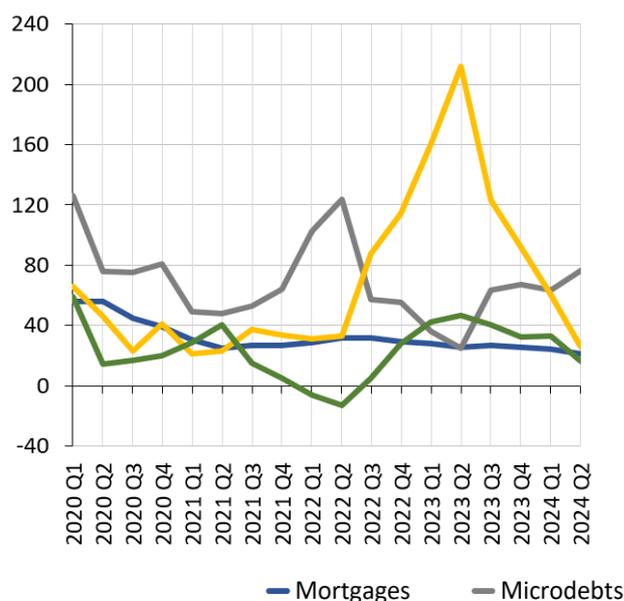
Figure 85. Outstanding Loans of Individuals, trillion UZS
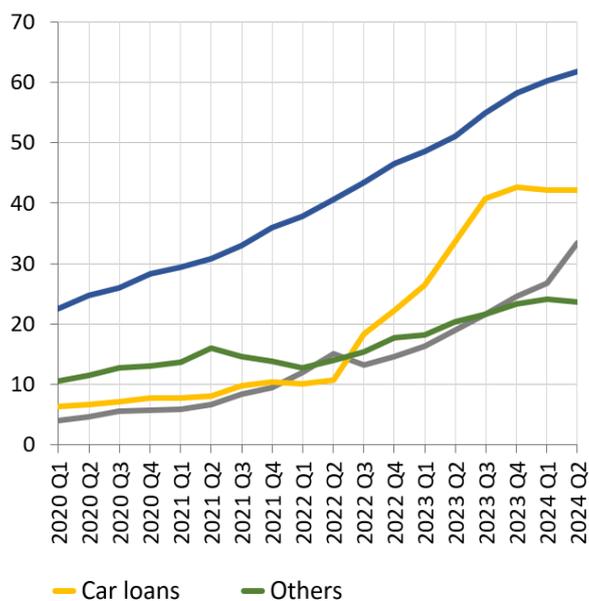
Source: CBU.

The annual growth rates of mortgage and car loans slowed. In H1 2024, mortgage loans grew by 21%, 5 p.p. lower than in the same period of 2023. The annual expansion of the outstanding balance of car loans to individuals declined sharply by 186 p.p., reflecting the tightening[76] of MPP requirements for banks in issuing car loans.

The upward trend in the outstanding of microdebts to individuals continues. As of July 1, 2024, the outstanding microdebts reached 33.4 trillion UZS, representing a 77% rise compared with the same period in 2023. The increase in the maximum microdebt amount from 50 million UZS to 100 million UZS[77], effective January 1, 2024, has supported the rapid growth of outstanding microdebts.

[76] O'zbekiston Respublikasi Markaziy banki boshqaruvining 2023 yil 6 iyundagi "Tijorat banklari kapitalining monandligiga qo'yiladigan talablar to'g'risidagi nizomga o'zgartirishlar va qo'shimcha kiritish haqida"gi 14/7–sonli qarori.

[77] O'zbekiston Respublikasi Prezidentining 2023 yil 10 noyabrdagi "Tadbirkorlik faoliyatini rivojlantirishda mikromoliya xizmatlarining o'rni va ulushini oshirish bo'yicha qo'shimcha chora-tadbirlar to'g'risida"gi PQ-364–sonli Qarori.

Figure 86. Microdebt Borrowers and Microdebt Agreements per Borrower, million people

Legend:
- Number of borrowers, million people
- Number of agreements per borrower, units (RHS)
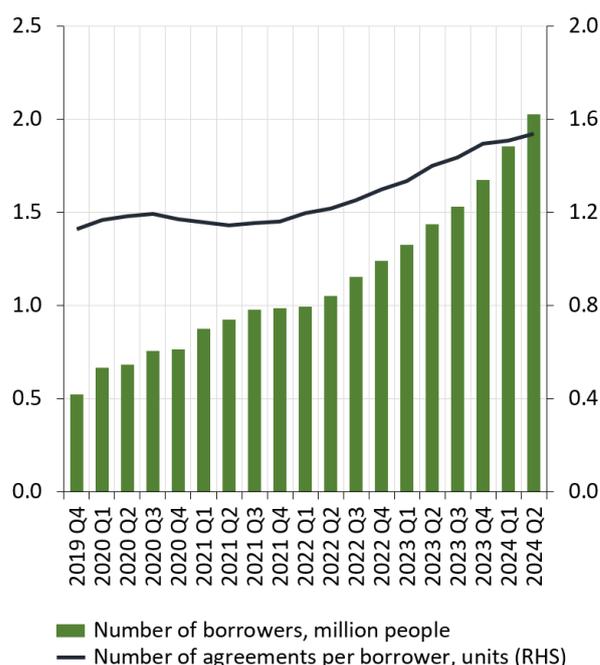
Figure 87. Concentration of Outstanding Microdebts, HHI*
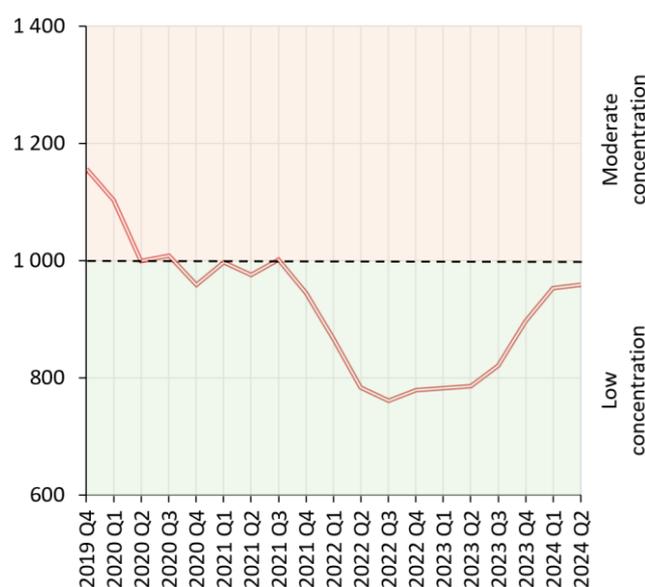
Source: CBU.

Note: *The HHI is calculated as the sum of the squares of each bank's share of the total microdebt balance in the banking system.

The number of individuals with microdebt obligations is rising. The absence of requirements for specific collateral or designated loan purposes has contributed to the growing popularity of microdebts. As of July 1, 2024, more than 2 million individuals had received microdebts from banks, representing a 41% increase compared with the same period in 2023. By the end of H1 2024, the average number of microdebt agreements per borrower rose to 1.5, a 10% increase from the previous year. The combination of an increasing number of borrowers holding multiple microdebt obligations, the rising concentration of microdebt in banks' loan portfolios, and the lack of collateral requirements may lead to an accumulation of risks associated with this type of lending.

The concentration of microdebts to individuals is approaching the medium group. By the end of H1 2024, the HHI for microdebts rose by 22% compared with the same period in 2023, reaching 959. At the same time, a high rate of growth in the microdebt portfolios of many banks was observed. In the end of H1 2024, microdebts accounted for 21% of the total loan balance of individuals in the banking system.

Despite a continued decline, loans of individuals-to-GDP gap remains positive. As of July 1, 2024, the change in the ratio of loans to individuals relative to GDP amounted to 0.5%, which is 0.2 p.p. lower than in the corresponding period of 2023.

Figure 88. Loans of Individuals-to-GDP Gap[78], p.p.
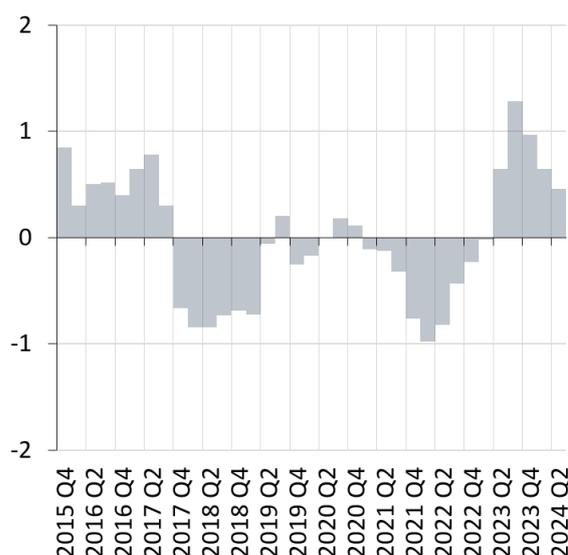
Figure 89. Loans of Individuals by Types, % of GDP
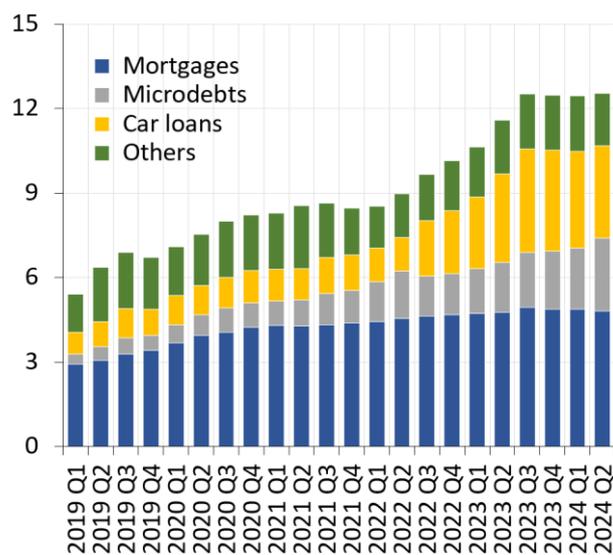
Sources: National Statistics Committee and CBU staff calculations.

The ratio of loans to individuals relative to GDP remained broadly unchanged. In H1 2024, retail loans accounted for 33% of total loans, which is 3 p.p. higher than in the same period of 2023. Over the same period, the ratios of mortgage and car loans to GDP stood at 4.8% and 3.3%, respectively, showing little change compared with July 1, 2023. The ratio of outstanding microdebts to GDP rose by 1 p.p., reaching 2.6%.

Figure 90. Decomposition of Nominal GDP Per Capita, USD

Figure 91. Decomposition of Annual Change in Nominal GDP Per Capita in USD, %
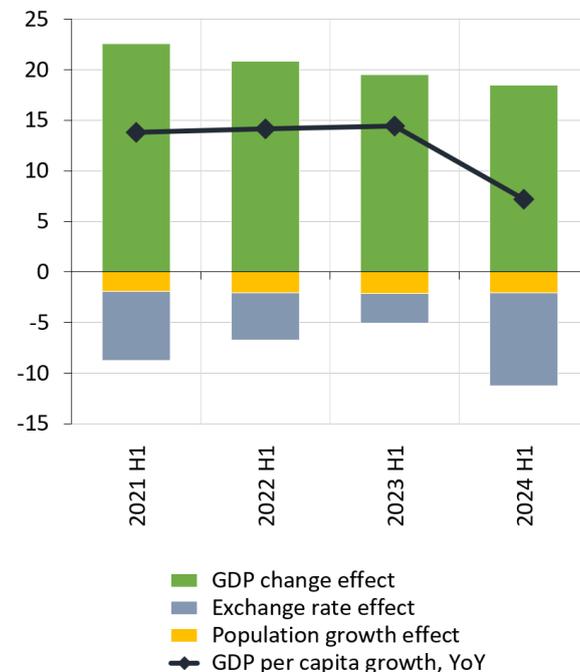
Sources: National Statistics Committee and CBU staff calculations.

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[78] The long-term trend of the loans of individuals-to-GDP ratio is calculated according to the BCBS approach, using a one-sided HP filter with a smoothing parameter of 400,000 for quarterly data.

GDP per capita at current prices in USD is growing. In H1 2024, nominal GDP per capita reached 1,221 USD, 82 USD higher than in the same period of 2023. However, by the end of H1 2024, a 2% increase in the average permanent resident compared with the same period in 2023 partially offset this growth, reducing GDP per capita by 24 USD[79].

Figure 92. Bank Borrowers and Borrowers per 1,000 Individuals*

Number of borrowers, million people
Number of borrowers per 1000 people (RHS)
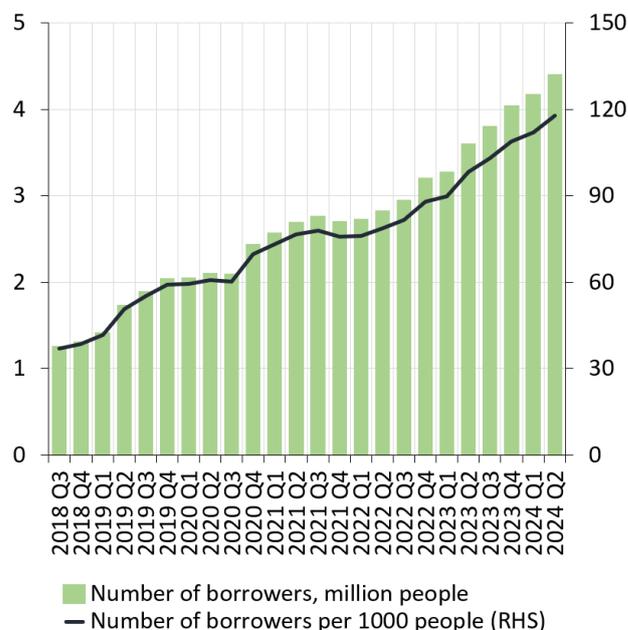
Figure 93. Annual Growth of Nominal Wages (YoY), %
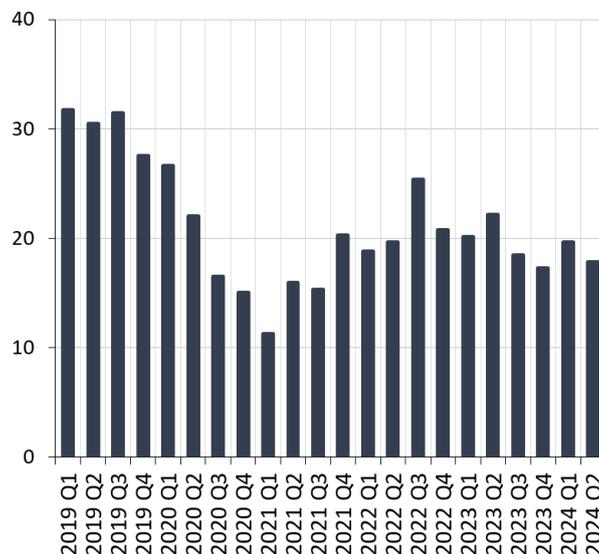
Source: CBU.

Note: *The calculation takes into account individuals who are residents.

The number of borrowers is growing faster than the population of permanent residents. In H1 2024, the number of individuals with credit obligations reached 4.4 million, representing a 22% increase compared with the same period in 2023. In H1 2024, 118 out of every 1,000 permanent residents held credit obligations to banks, 20 more per 1,000 than in the same period of 2023.

The annual rise of nominal wages has slowed. At the end of H1 2024, nominal wages reached 5.1 million UZS. Between July 1, 2023, and July 1, 2024, nominal wages increased by 18%, reflecting a 4 p.p. slowdown in the growth rate compared with the same period from July 1, 2022, to July 1, 2023.

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[79] National Statistics Committee. (2024). Gross Domestic Product in the Republic of Uzbekistan. January-June 2024.

Box 3. Debt Burden Survey

From 12 to 24 July 2024, the CBU conducted a survey to gauge the total debt burden of individuals (Appendix 1). A total of 2,503 respondents from all regions of Uzbekistan participated. The survey captured the population's debt obligations arising from both banking and non-banking sources.

Half of the respondents reported living in households consisting of 4 or 5 members. Household members were primarily employed in finance, education, agriculture, healthcare, and other sectors.

Figure 94. Number of Household Members, %

Figure 95. Breakdown of Monthly Primary Income by Household, %
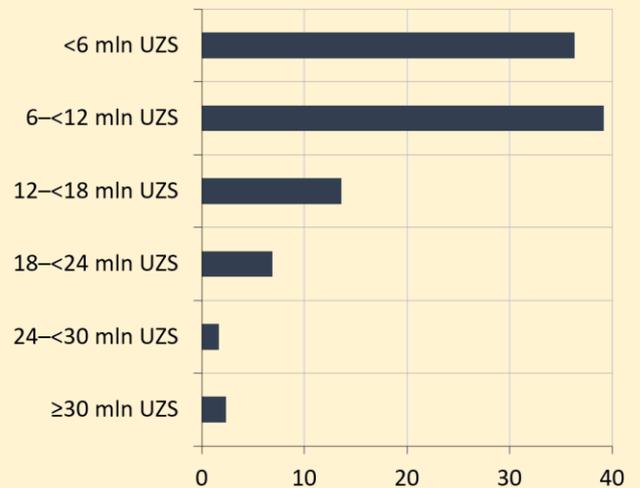
Figure 96. Share of Households with Secondary Income
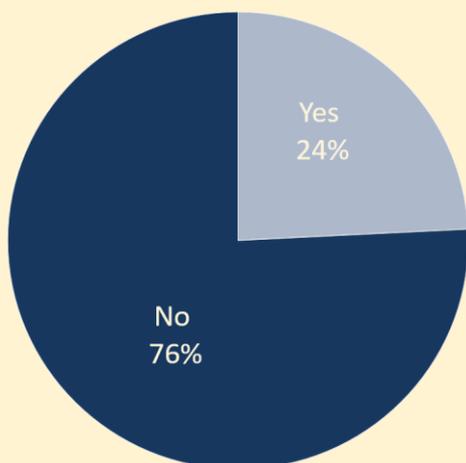
Figure 97. Breakdown of Monthly Secondary Income by Household, %

Source: CBU Survey.

The share of respondents with an average monthly income of up to 12 million UZS by main labor activity was 75%. Also, a quarter of all respondents have an additional source of income. It was noted that 77% of these respondents have an additional income of up to 6 million UZS.

80% of respondents reported that they or a member of their household had bank or non-bank loans or debt obligations. Of these, 72% reported having loans specifically from banks. Notably, 23% of respondents with bank loan also reported holding other types of debt in addition to bank obligations.

Figure 98. Existence of Bank and Non-Bank Debt Obligations

No 20%

Yes 80%
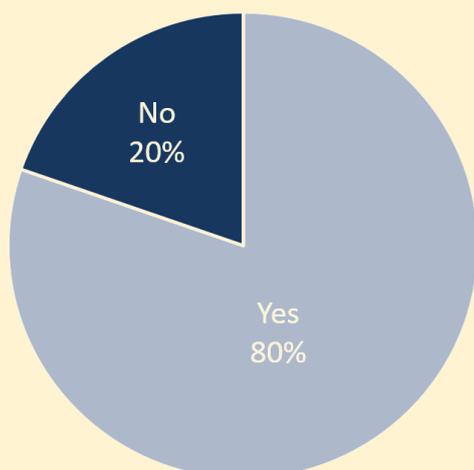
Figure 99. Share of Households Indebted to Banks

No 28%

Yes 72%
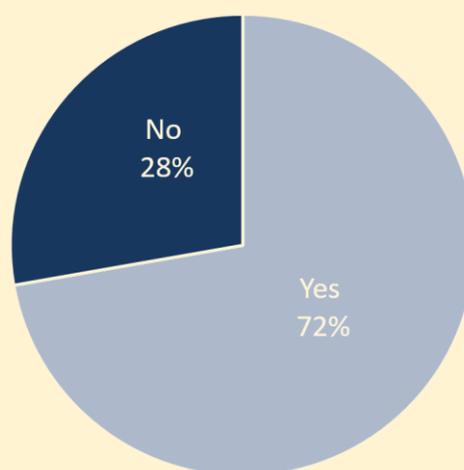
Figure 100. Existence of Non-Bank Liabilities Among Bank Borrowers

Yes 23%

No 77%
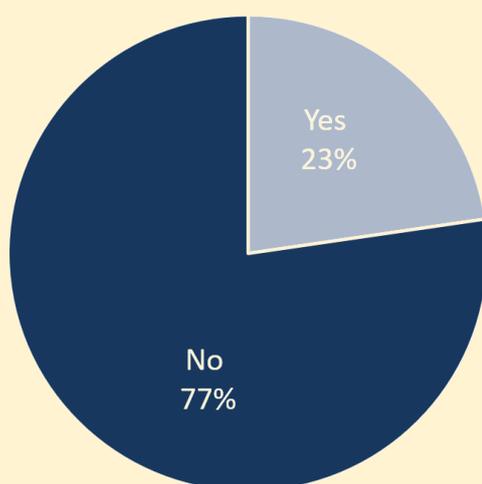
Figure 101. Objectives of Bank and Non-Bank Credit Borrowing, %

Category	%
Medical treatment	~3
Wedding expenses	~3
Private entrepreneurship	~4
Daily living expenses	~5
Loan repayment	~6
Education expenses	~8
Others	~8
Purchase of consumer goods	~13
Vehicle purchase	~21
Real estate purchase or repairs	~24

Source: CBU Survey.

Respondents borrowed from banks and non-banks primarily for the purchase or renovation of housing, the acquisition of vehicles, and the purchase of consumer goods.

27% of respondents have monthly payments on bank or non-bank debt obligations ranging from 2 to 4 million UZS. In addition, 70% of respondents reported monthly payments on total debt obligations of less than 6 million UZS.

64% of respondents with loans or debt obligations indicated that they have difficulty repaying their debts on time. Meanwhile, 46% of respondents with debt obligations expect their ability to repay to improve over the next six months, while 42% expect it to remain unchanged.

A total of 62% of respondents do not plan to obtain a loan or debt for themselves or their household members in the next six months, while 22% indicated that they have a need to borrow.

Figure 102. Monthly Payment for Total Debt Obligations, %
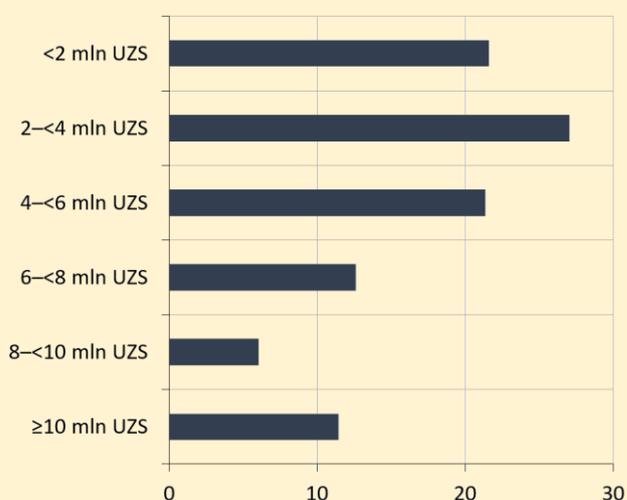
Figure 103. Remaining Maturity of Total Debt Obligations, %
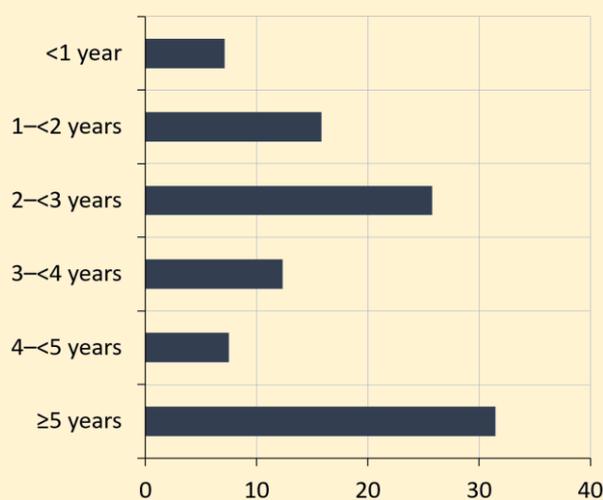
Figure 104. Challenges with On Time Repayment of Debt Obligations
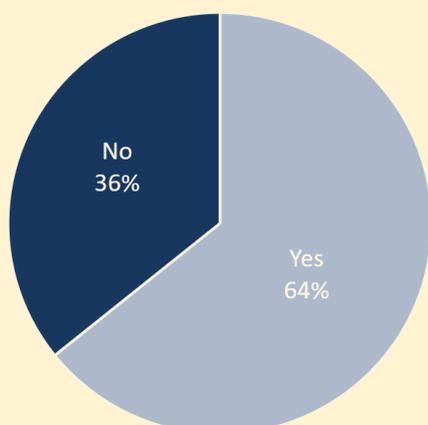
Figure 105. Solvency Outlook for the Next 6 Months
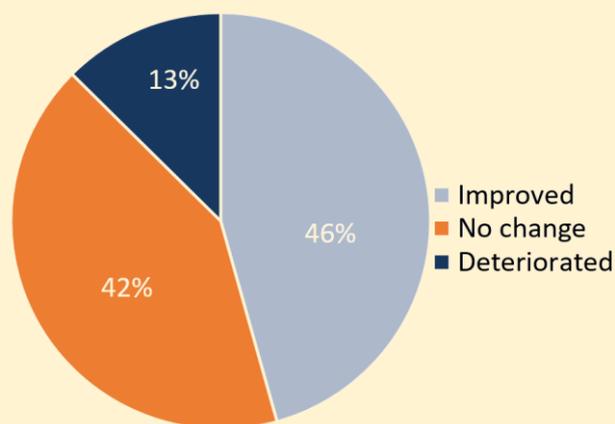
Source: CBU Survey.

Among respondents planning to borrow in the next six months, 44% intended to purchase or renovate a home, as well as acquire a car.

The average total debt burden[80] of respondents with bank loans, including non-bank debt obligations, was 73%[81]. According to the distribution of debt burden levels, a quarter of respondents with bank debt have a debt burden exceeding 80%.

Figure 106. Intentions for Credit and Debt Over the Next 6 Months

- Yes
- No
- Not sure
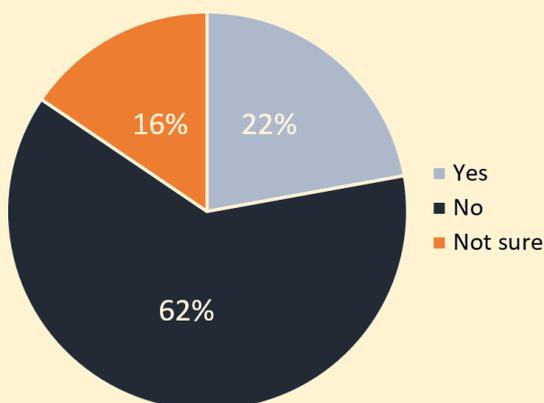
Figure 107. Borrowing Objectives for the Next 6 Months, %
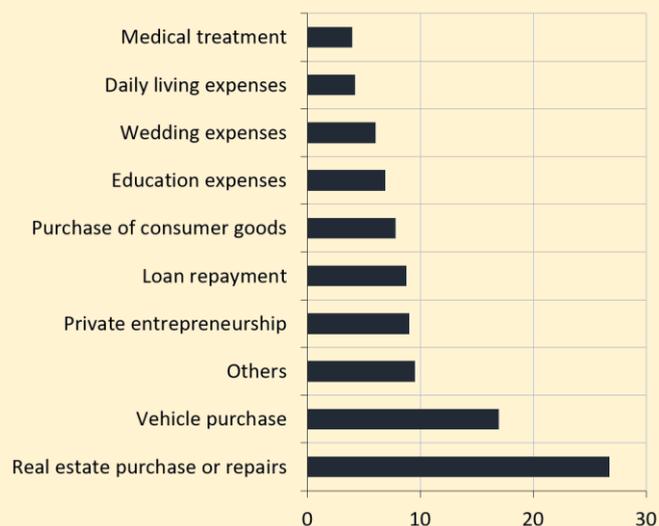
Figure 108. Distribution of DSTI Ratio for Respondents with Bank Loans
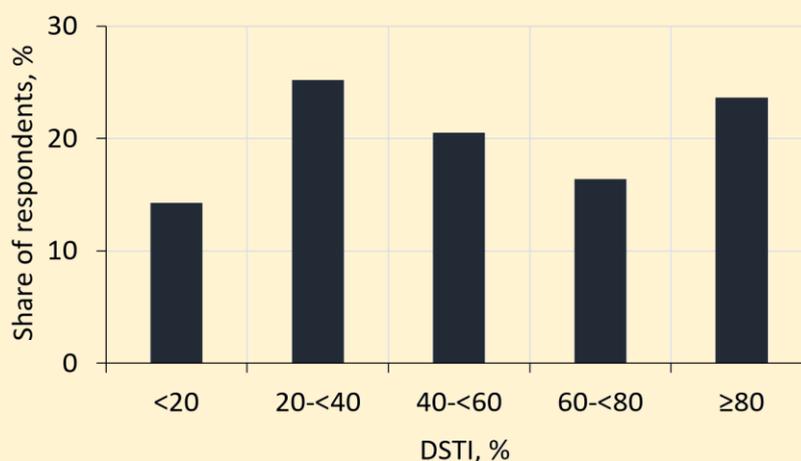
Source: CBU Survey.

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[80] The total average debt burden of respondents with bank loans was calculated by dividing their total monthly payments on bank and non-bank debt obligations by their total monthly income from primary and additional sources.

[81] To determine households' basic and additional monthly income, expenses, and monthly payments on loans and debts, the average of the upper and lower limits of the intervals given by respondents was used. The conditional upper limit of an unbounded interval was found by adding the previous interval size (the difference between its upper and lower limits) to the lower limit of the current interval.

IV. Asset Markets

4.1. Real Estate Market

The gap between fundamental and market prices in the real estate market remains. In H1 2024, in addition to the State Space Model (SSM)[82] and price and income models[83], the Bayesian State Space Model (BSSM) (Appendix 2) was used to estimate the fundamental value of residential property prices. In H1 2024, the market price of residential property is estimated at 28% more than the average value of the fundamental prices determined by these models. The high market prices and the imbalance of supply and demand observed in the real estate market since 2022 are further widening the gap between market and fundamental prices.

Figure 109. Market and Fundamental Prices of Houses in Uzbekistan, million UZS per square meter
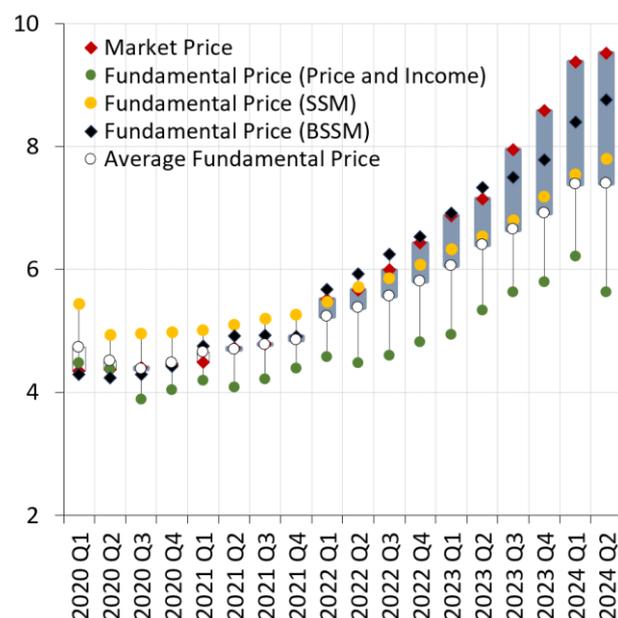
Figure 110. Difference Between Market and Average Fundamental Prices of Houses in Uzbekistan, %
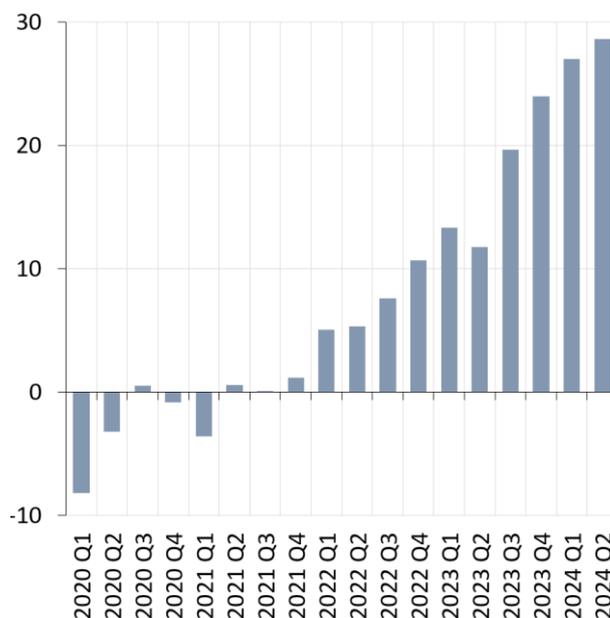
Source: CBU staff calculations.

Note: The rectangular shape in the diagram illustrates the difference between the market price and the average fundamental price of housing in Uzbekistan. The length of the rectangle increases with the size of the difference between the market and average fundamental prices. When the market price exceeds the average fundamental price, the interior of the rectangle is completely filled with dark color; when it is lower, the rectangle is white. The highest point of the vertical black line represents the maximum price index between the market price of houses and the fundamental prices determined by the models for a given year, while the lowest point represents the minimum price.

The market prices per square meter are average prices calculated from online advertisements and may not reflect the actual sales prices.

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[82] The State Space Model (SSM) methodology is presented in the Financial Stability Report for 2023.

[83] The price and income methodology is presented in the Financial Stability Report for 2022.

The gap between the growth of residential property prices in UZS and FX has widened. At the end of H1 2024, the residential property price indices in UZS and FX increased by 44 and 23 units, respectively, compared to the same period in 2023.

Housing prices in the real estate market remain elevated due to non-fundamental factors. The imbalance between supply and high demand continues to sustain these high prices. The influence of rising costs for construction and assembly works on residential property price formation is diminishing. The ratio of construction volume to GDP stood at 14% at the end of H1 2024, down nearly 0.5 p.p. compared with the same period in 2023. Additionally, between July 1, 2023, and July 1, 2024, the price of construction and assembly works rose by 4%.

Figure 111. Residential Property Market Price Indexes (2020 Q1=100)

— House price index (UZS)
— House price index (USD)

Figure 112. Construction and Assembly Works Prices (YoY change), %

■ Share of construction and assembly works in GDP
— Annual growth of construction and assembly works prices (YoY)
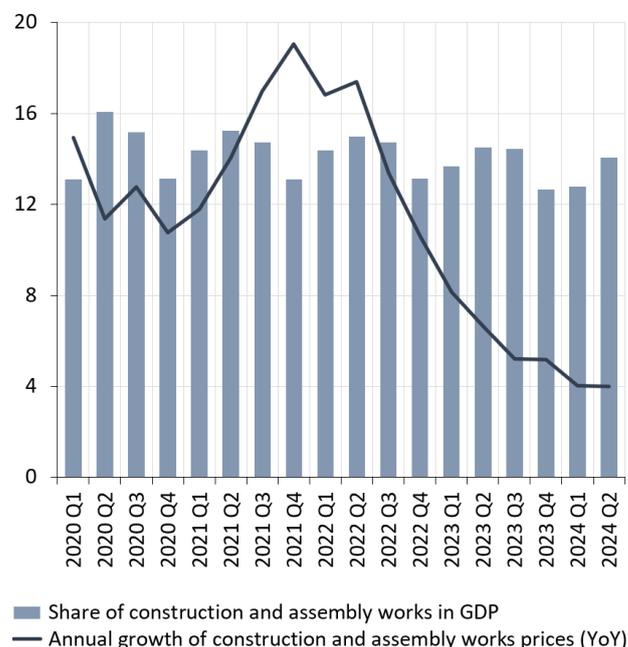
Sources: Statistics Agency and CBU staff calculations.

The risk of price corrections in overvalued residential property remains. At the end of H1 2024, the ratio of market real estate prices to nominal GDP per capita stood at 28%, up 3 p.p. compared with the same period in 2023. The growth rate of this ratio remains high relative to its historical standard deviation, indicating that residential property prices in the real estate market are overvalued and may decline over time[84].

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[84] International Monetary Fund. (2019, April). Global Financial Stability Report.

Figure 113. Ratio of Residential Property Prices* to Nominal GDP Per Capita, %
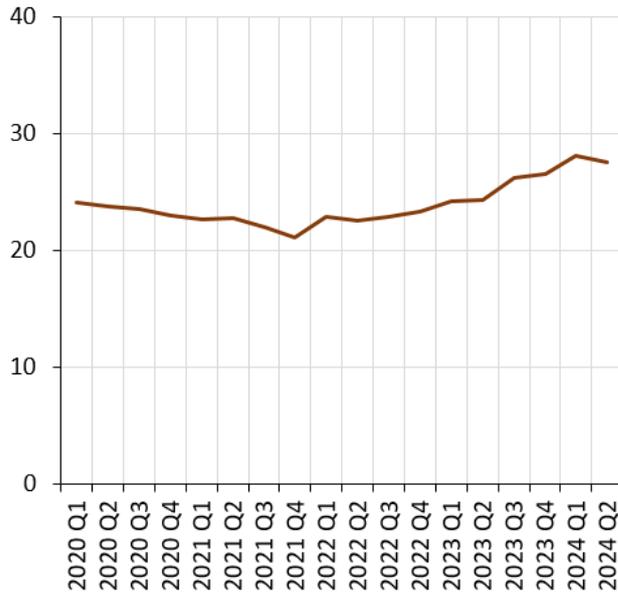
Figure 114. Ratio of Annual Growth Rate of House Prices to Annual Growth Rate of Rents
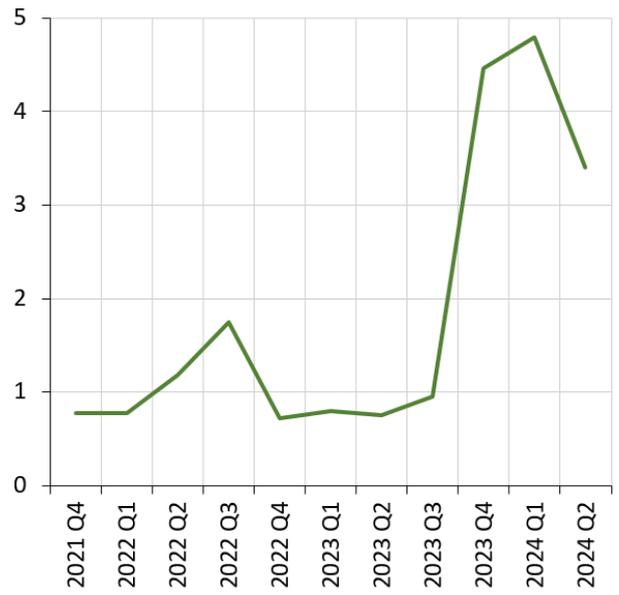
Sources: Statistics Agency and CBU staff calculations.

Note: The market prices per square meter are average prices calculated from online advertisements and may not reflect the actual sales prices.

The ratio of annual growth rates of house prices to rents remains elevated. As of July 1, 2024, this ratio stood at 3.4. Although the ratio declined in Q2 of 2024, it remains high. This reflects the behavior of real estate market participants who view housing primarily as an investment, expecting greater returns from price appreciation than from rental income.

Figure 115. Ratio of Annual Growth Rate of Housing Prices to Annual Growth Rate of Average Monthly Salary, %
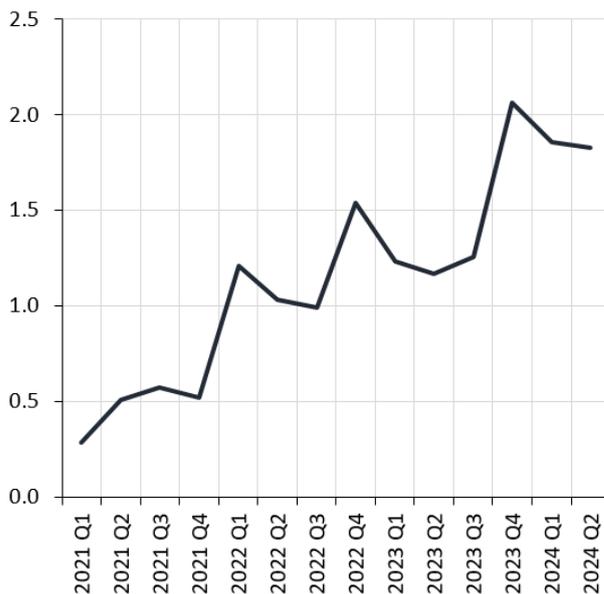
Figure 116. Ratio of Annual Growth Rate of Housing Prices to Annual Growth Rate of Average Monthly Salary in Selected Countries in 2023
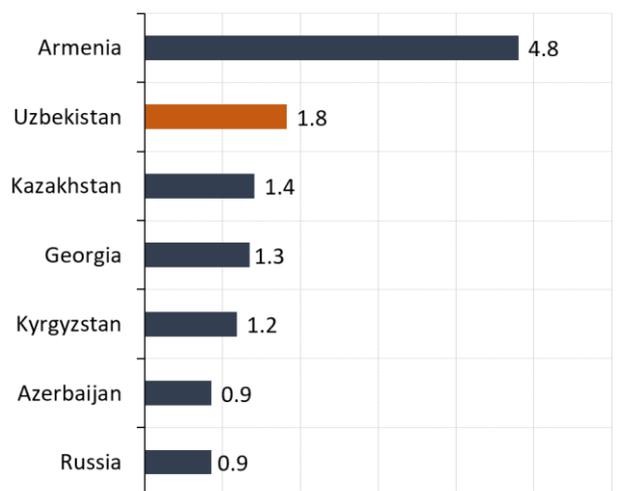
Sources: National authorities, Statistics Agency and CBU staff calculations.

The gap between the growth of wage and residential property price dynamics remains significant. In H1 2024, average nominal wages increased by 17.7%[85] annually. Over the same period, market residential property prices rose at a pace 1.8 times faster than the annual growth rate of average wages. Moreover, the ratio of residential property price growth to wage growth in Uzbekistan exceeds that observed in several CCA and other countries. A persistently elevated value of this indicator suggests that residential property prices in the real estate market may be deviating from their fundamental determinants, potentially heightening risks to financial stability[86].

Figure 117. Population Density in CCA Countries*, people per square kilometer
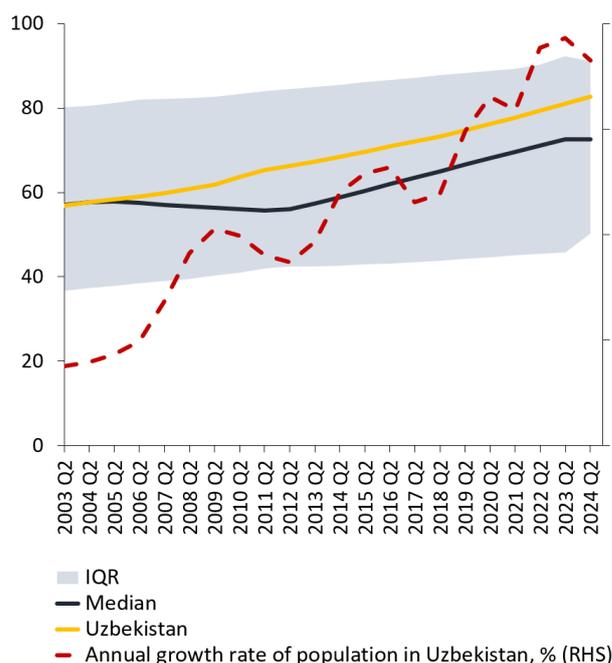
Figure 118. Housing Contracts and Mortgage Borrowers per 1,000 Individuals**
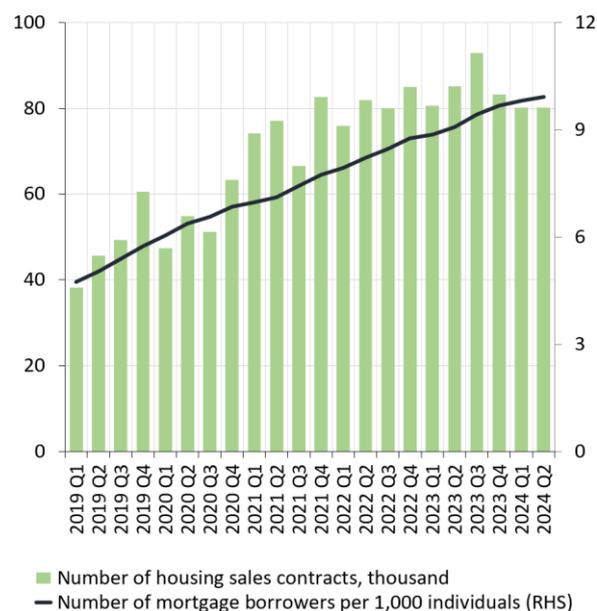
Sources: United Nations, Statistics Agency, Ministry of Justice, and CBU staff calculations.

Note: *Armenia, Azerbaijan, Tajikistan, Uzbekistan, Kyrgyzstan, and Kazakhstan are taken into account.
**The calculation is based on the number of people who are residents.

Uzbekistan's demographic indicators suggest that demand in the real estate market will remain strong. By the end of H1 2024, the permanent population reached 37.1 million[87], reflecting a 2.1% year-on-year increase. Population density in Uzbekistan was 83 people per square km, exceeds the median for CCA countries by 10 people and approaches the 75th percentile for the region. The combination of a growing population and relatively high population density points to continued strong demand in the real estate market going forward.

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[85] Statistics Agency under the President of the Republic of Uzbekistan. (2024). Labor market.

[86] Binici. M., & Suphaphiphat. N. (2022). Housing Market Risks and Housing Affordability. International Monetary Fund.

[87] Statistics Agency under the President of the Republic of Uzbekistan. (2024). Demographic situation of the Republic of Uzbekistan, January-June 2024.

Activity in the real estate market has slightly declined. In H1 2024, 160,000 purchase and sale contracts were registered in notary offices, representing a 3.3% decrease compared to the same period in 2023. This modest decline in market activity may reflect the population's purchasing power. The number of mortgage borrowers per thousand permanent residents reached 10 by the end of H1 2024, a 9% growth from 2023. The relatively low share of the population with mortgage loans suggests potential for additional demand in the real estate market through increased mortgage uptake in the future.

The population's ability to purchase housing[88] through mortgage loans has slightly weakened. The rise in mortgage lending in H1 2024 largely reflects higher residential property prices. At the same time, the average mortgage loan per borrower increased by 25% compared to the same period in 2023. Combined with a shorter average repayment period, this led to a 22% rise in the average monthly mortgage payment. Although average monthly wages also rose in H1 2024, the faster growth in monthly mortgage payments may constrain borrowers' repayment capacity and reduce the population's ability to acquire housing through mortgage financing.

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[88] National Association of Realtors. Methodology: Housing Affordability Index.

The housing affordability index measures the ability of households to purchase a home with a mortgage based on their average income. A decrease in the index indicates that the household's ability to purchase a home with a mortgage has decreased due to housing prices growing at a higher rate than household incomes.

Housing affordability index is determined using the following formula:

$$AI = \frac{MI}{QI} * 100$$

Where,

AI – housing affordability index;
MI – average disposable income of the household;
QI – the income required for the average monthly mortgage payment.

Rosser, M. (2003). Basic Mathematics for Economists, second edition. Taylor & Francis Group.

The income required for the average monthly mortgage payment is determined using the following formula:

$$QI = \frac{iL}{1 - (1 + i)^{-n}}$$

Where,
QI – the income required for the average mortgage loan;
L – average mortgage loan amount;
i – weighted average monthly interest rate of outstanding mortgage loans;
n – weighted average monthly maturity of outstanding mortgage loans.

Figure 119. Ratios of Tier I Capital to Total Loans and Mortgages to Total Loans, % (as of July 1, 2024)
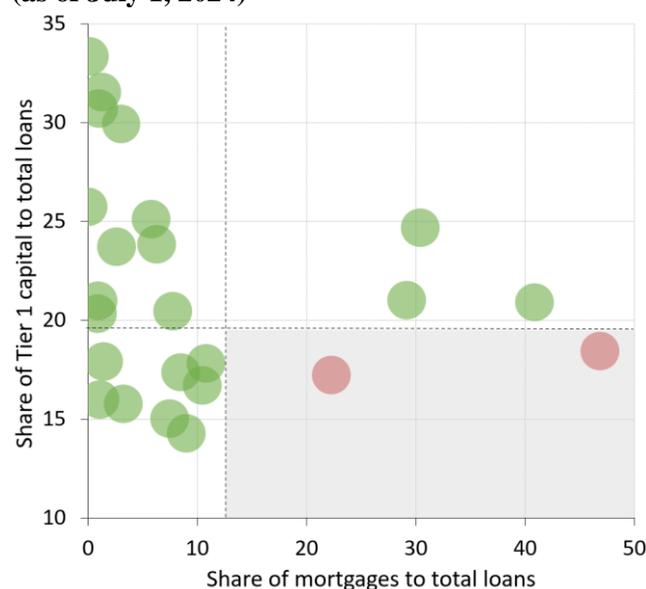
Figure 120. Housing Affordability Index*, %
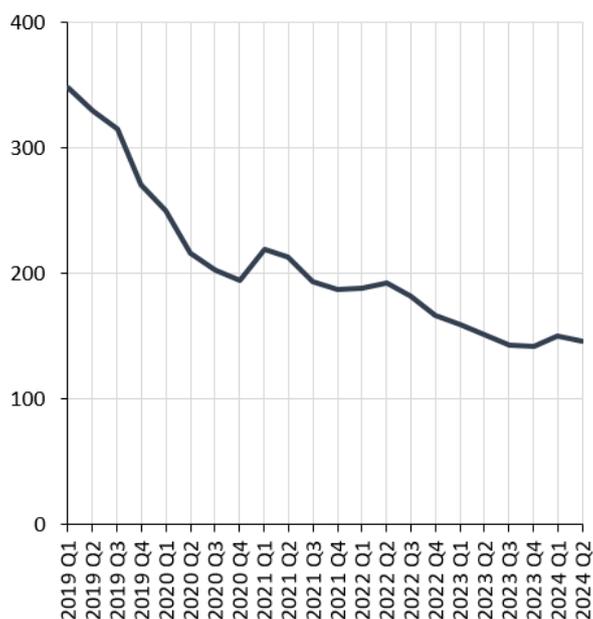
Sources: Statistics Agency and CBU staff calculations.

Note: The color green represents banks with lower risk than the banking system average on at least one of the following indicators: Tier I capital to total loans or mortgage loans to total loans. The color red represents banks with higher risk than the banking system average on both of these indicators. Banks with a Tier I capital to total loans ratio exceeding 50% were excluded from the analysis. The straight lines on the chart represent the average values of these indicators for the banking system as of January 1, 2024.

*A decrease in the housing affordability index indicates a decline in the population's ability to purchase housing, while an increase reflects an improvement in their purchasing ability.

Mortgage lending standards have tightened. The weighted average interest rate on mortgage loans issued in H1 2024 reached 19.7%, edging up by 1 p.p. compared to the same period in 2023. At the same time, the weighted average amortization period declined from 18 to 17 years. The shorter amortization period, combined with higher interest rates, has increased monthly mortgage payments. This may raise the debt burden of mortgage borrowers and further constrain the household's ability to purchase residential property through mortgage financing.

Figure 121. Weighted Average Term and Interest Rate of Mortgage Loans

- Weighted average annual interest rate, %
- Weighted average maturity, years (RHS)
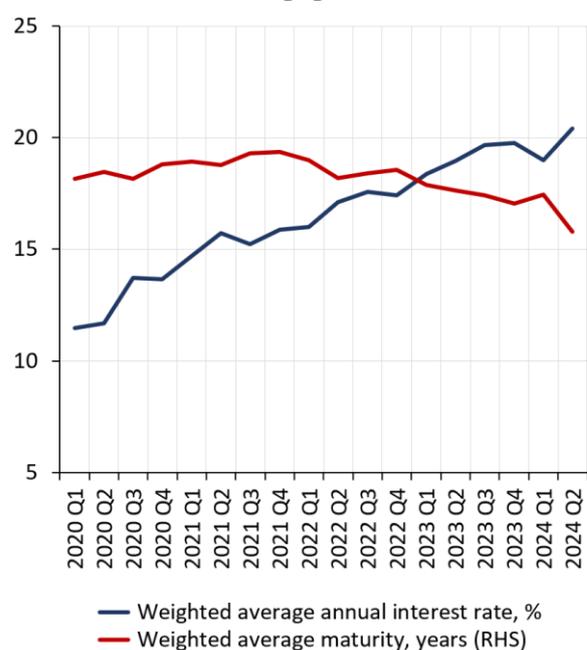
Figure 122. Mortgage Loan Distribution by Purpose, %

- Purchase
- Construction
- Renovation
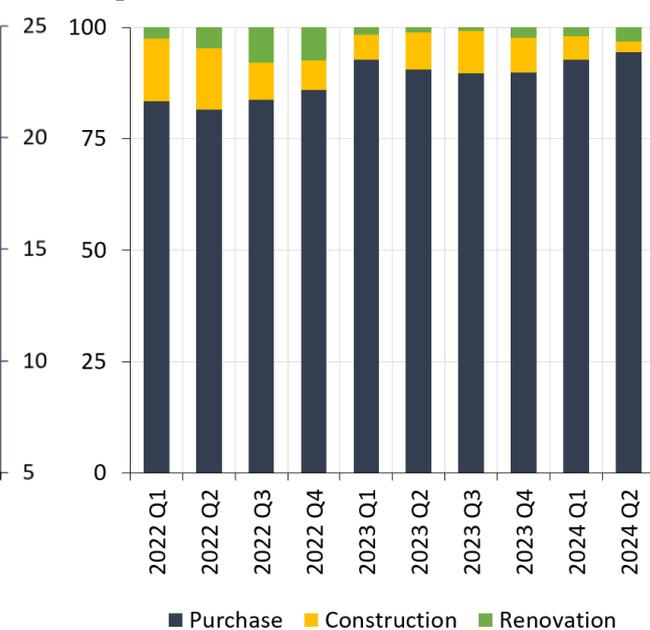
Source: CBU.

Mortgage loans by banks is a key driver of demand in the real estate market. In H1 2024, mortgage loans totaling nearly 6.9 trillion UZS were issued. Notably, 94% of these loans were extended to households for the purchase of residential property. The predominance of mortgage lending directed toward housing purchases by the individuals have a direct and significant impact on stimulating demand in the housing market.

4.2. Car Market

The gap between market and fundamental prices of cars has been narrowing. By the end of H1 2024, this gap had declined by 44% compared to the beginning of the year. The supply of passenger cars in the domestic market increased due to nearly 10% higher production compared to 2023, coupled with a substantial rise in imported vehicles. Against the backdrop of a modest decline in passenger car prices, higher disposable incomes among the population contributed to the further reduction of the gap between market and fundamental car prices.

Figure 123. Market and Fundamental Prices of Cars*, million UZS per unit**

Figure 124. Car Affordability Index***
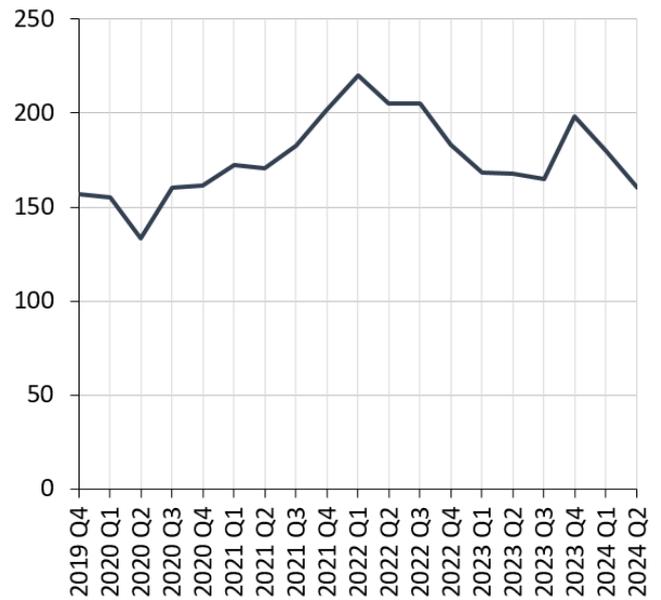
Source: CBU staff calculations.

Note: *The rectangle in the chart illustrates the difference between market and fundamental prices of cars. The longer the rectangle, the greater the price difference. If the market price exceeds the fundamental price, the rectangle will be fully colored; if it is lower, the rectangle will be white.

**When determining car market prices, according to banks' requirements for car conditions in car loan allocations, only cars manufactured within the past 5 years are considered for determining market prices. The average market price is calculated by averaging each car model's price and computing the weighted average based on the number of advertisements on public internet pages. The average market price of used cars in this review is derived from advertisements on open internet web pages and does not reflect actual sales contracts at these prices.

***A decline in the Car Affordability Index signifies a reduced capacity of the population to purchase a vehicle, whereas a rise indicates an enhanced ability to do so.

The decline in the individual's purchasing power for cars has led to weaker demand in the car market. In H1 2024, the average interest rate on car loans rose by 3.8 p.p. compared to the same period in 2023. The average loan amount per borrower increased by 6.1% annually. However, the higher interest rates combined with a slightly shorter repayment period have constrained the individual's ability to purchase vehicles through car loans.

Figure 125. Annual Growth Rate of Vehicle Prices and Annual Change in Car Loans, %

- Annual growth of vehicle prices
- Annual change in car loans (RHS)
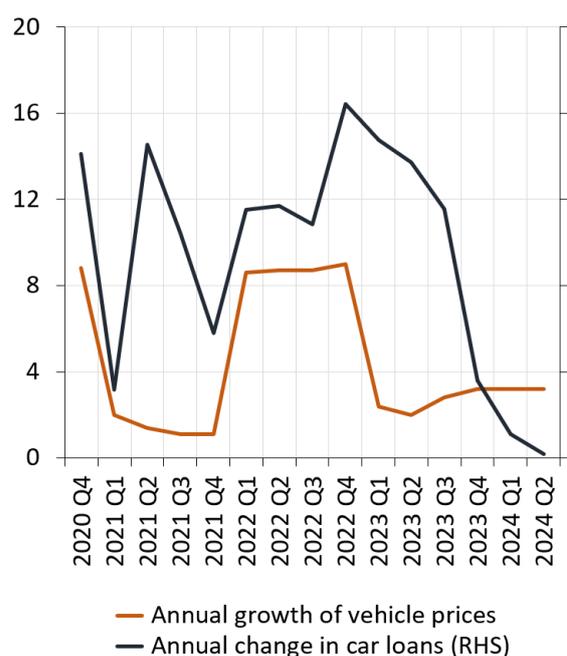
Figure 126. Weighted Average Term and Interest Rate of Car Loans

- Weighted average annual interest rate, %
- Weighted average term, years (RHS)
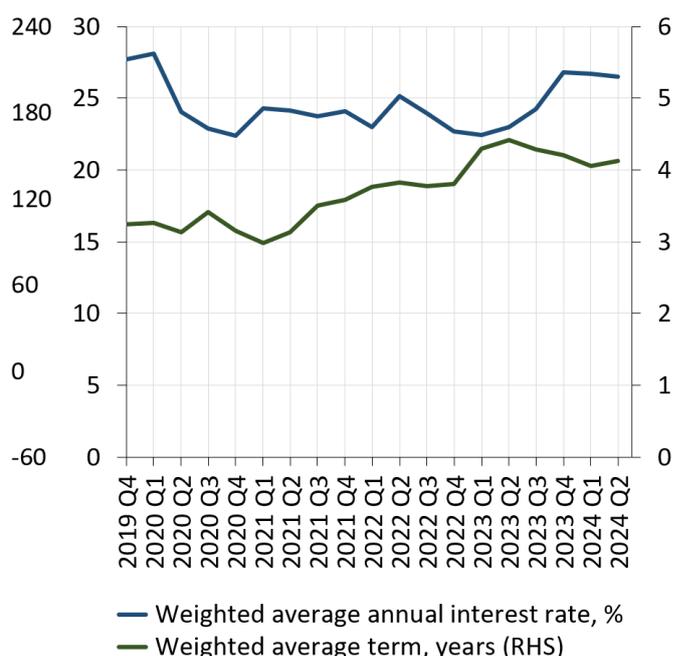
Sources: Statistics Agency and CBU staff calculations.

The decline in the volume of car loans has dampened demand in the car market, which is reflected in a slowdown in the growth rate of vehicle prices. Banks have moderately tightened the terms of car lending. In H1 2024, the average loan term for car was 4.1 years, 0.3 years shorter than in the same period of 2023. At the same time, the overall scale of car lending by banks fell sharply. By the end of H1 2024, banks had issued car loans totaling 8.9 trillion UZS, 2.1 times lower[89] than in the same period of 2023. As a result, the growth rate of vehicle prices moderated, rising by 3.2%[90] over the period from July 1, 2023, to July 1, 2024.

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[89] The Central Bank of the Republic of Uzbekistan. (2024). Statistical bulletin June 2024.

[90] Statistics Agency under the President of the Republic of Uzbekistan. (2024). Consumer Price Index in the Republic of Uzbekistan.

Figure 127. Car Sales Contracts, thousand
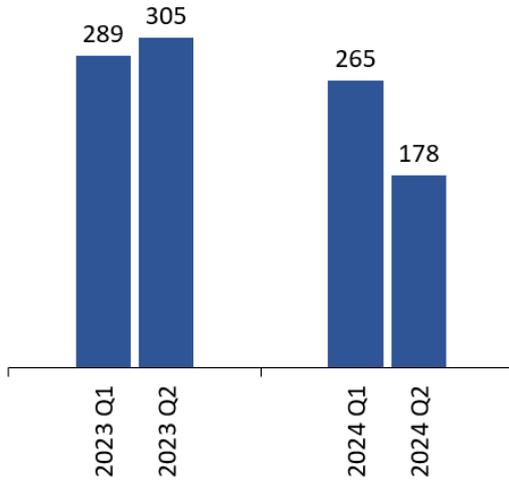
Figure 128. Passenger Cars Manufactured in Uzbekistan (Excluding Special Vehicles) and Passenger Car Imports to Uzbekistan, thousand
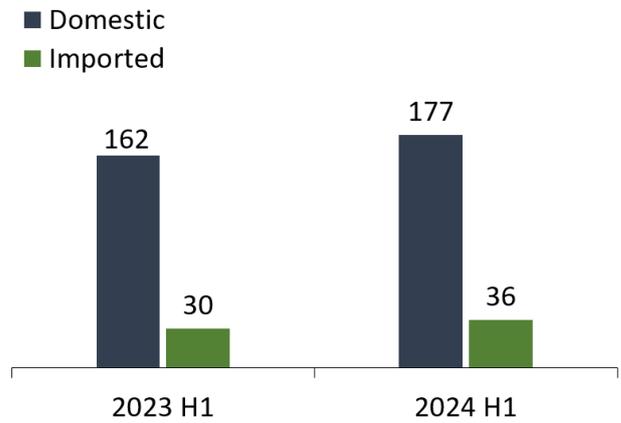
Source: Ministry of Justice, Statistics Agency and Customs Committee.

The decline in car purchase and sale agreements reflects weaker demand and higher vehicle registration fees. In H1 2024, 442,800 contracts were registered at notary offices, 25% fewer than in the same period of 2023. The decrease appears to have been driven not only by weaker demand in the car market but also by the higher cost of vehicle registration. Effective April 1, 2024, fees for the registration and re-registration of motor vehicles were increased, further contributing to the reduction in transactions[91].

Additional supply in the car market has increased. In H1 2024, domestic production of passenger cars (excluding special-purpose vehicles) reached 177,000 units, 9.6% higher[92] than in the same period of 2023. Over the same period, passenger car imports rose by 22% year-on-year to 36,000 units[93]. The expansion of both domestic production and imports has contributed to a significant increase in supply in the car market.

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[91] O'zbekiston Respublikasi ichki ishlar vazirining 2024 yil 31 martdagi "Ro'yxatdan o'tkazish davlat raqami belgilarini va qat'iy hisobdagi blankalarni berishda, avtomototransport vositalari, ularning tirkamalari (yarim tirkamalari)ni ro'yxatdan o'tkazishda, qayta ro'yxatdan o'tkazishda, majburiy texnik ko'rikdan o'tkazishda, shuningdek imtihonlarni olishda undiriladigan to'lovlar stavkalariga o'zgartirish va qo'shimcha kiritish to'g'risida"gi 164-sonli buyrug'i.

[92] Statistical Agency under the President of the Republic of Uzbekistan. (2024). Industrial production of the Republic of Uzbekistan January–June 2024.

[93] Customs committee under the Ministry of Economy and Finance of the Republic of Uzbekistan. (2024). Import of consumer goods (Vehicles).

Figure 129. Concentration in Bank Car Loan Portfolio, HHI
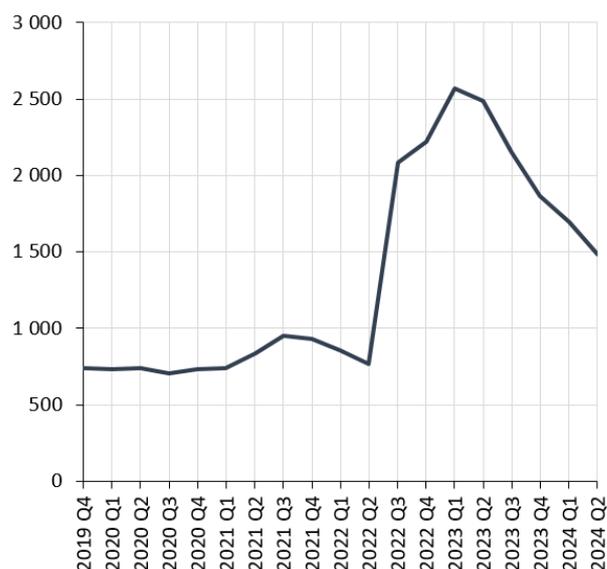
Figure 130. Bank-by-Bank Car Loans Issued to Individuals*, % (As of July 1, 2024)
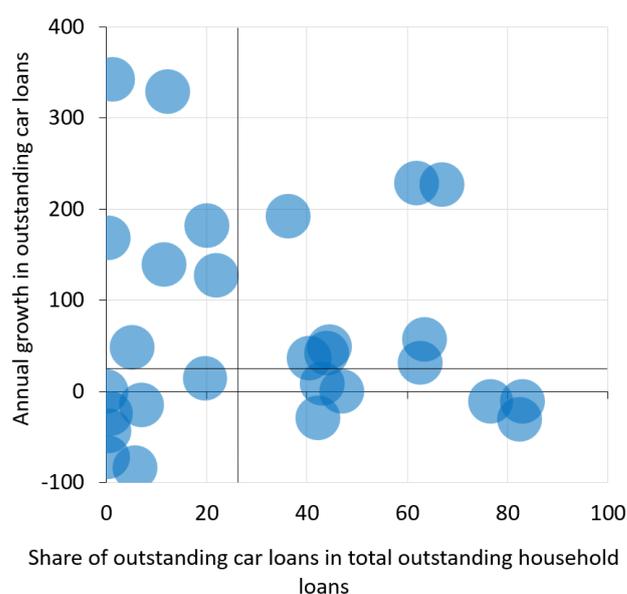
Source: CBU staff calculations.

Note: *Banks with an annual growth rate in outstanding car loans exceeding 400% are excluded. The continuous straight lines represent the average values of indicators for the banking system as of July 1, 2024.

The HHI for car loan balances issued by banks has declined to a medium level of concentration. By the end of H1 2024, the concentration index for outstanding car loans fell below 1,500, representing a decrease of 1,004 points compared to the same period in 2023. At the same time, in most banks with annual car loan growth rates exceeding 100%, outstanding car loans accounted for less than 40% of total loans to individuals. This suggests a modest reduction in concentration risk, limiting potential vulnerabilities arising from car price fluctuations being concentrated in a small number of banks.

V. Macro Stress Test for Banking System

5.1. Solvency Macro Stress Test

The resilience of the banking system was assessed using a "top-down" macro stress test[94] on solvency, based on both baseline and adverse scenarios for H1 2024 and H1 2027. The baseline scenario represents the most plausible trajectory of the economy under the continuation of current macroeconomic trends, whereas the adverse scenario incorporates the potential impact of internal and external shocks on key macroeconomic indicators, including real GDP growth, interest rates, inflation, exchange rates, and the annual growth rate of the loan portfolio. (Appendix 3).

Under the adverse scenario, the real GDP growth rate was assumed to reflect tail risks. This scenario assumes a persistently tense external geopolitical environment, heightened risk of a global recession, reduced domestic and foreign demand, and increased instability in the global financial system.

The quality and profitability of banking system assets were evaluated under both baseline and adverse macroeconomic scenarios. Satellite models were used to analyze the share of NPLs in total loans and the proportion of net non-interest income (NNII) in total assets over future periods. Banks' NII was estimated by accounting for the impact of changes in interest rates on the composition of assets and liabilities on their balance sheets.

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[94] The top-down macro stress-test tool is an instrument designed to assess the stability of the banking system based on macroeconomic scenarios. It employs the same scenarios, assumptions, and models for all banks.

Figure 131. Macroeconomic Scenarios[95]

Annual Real GDP Growth, %

Share of NPL in Total Loans, %

NII, trillion UZS

NNII to Total Assets, %

History — Baseline — Adverse
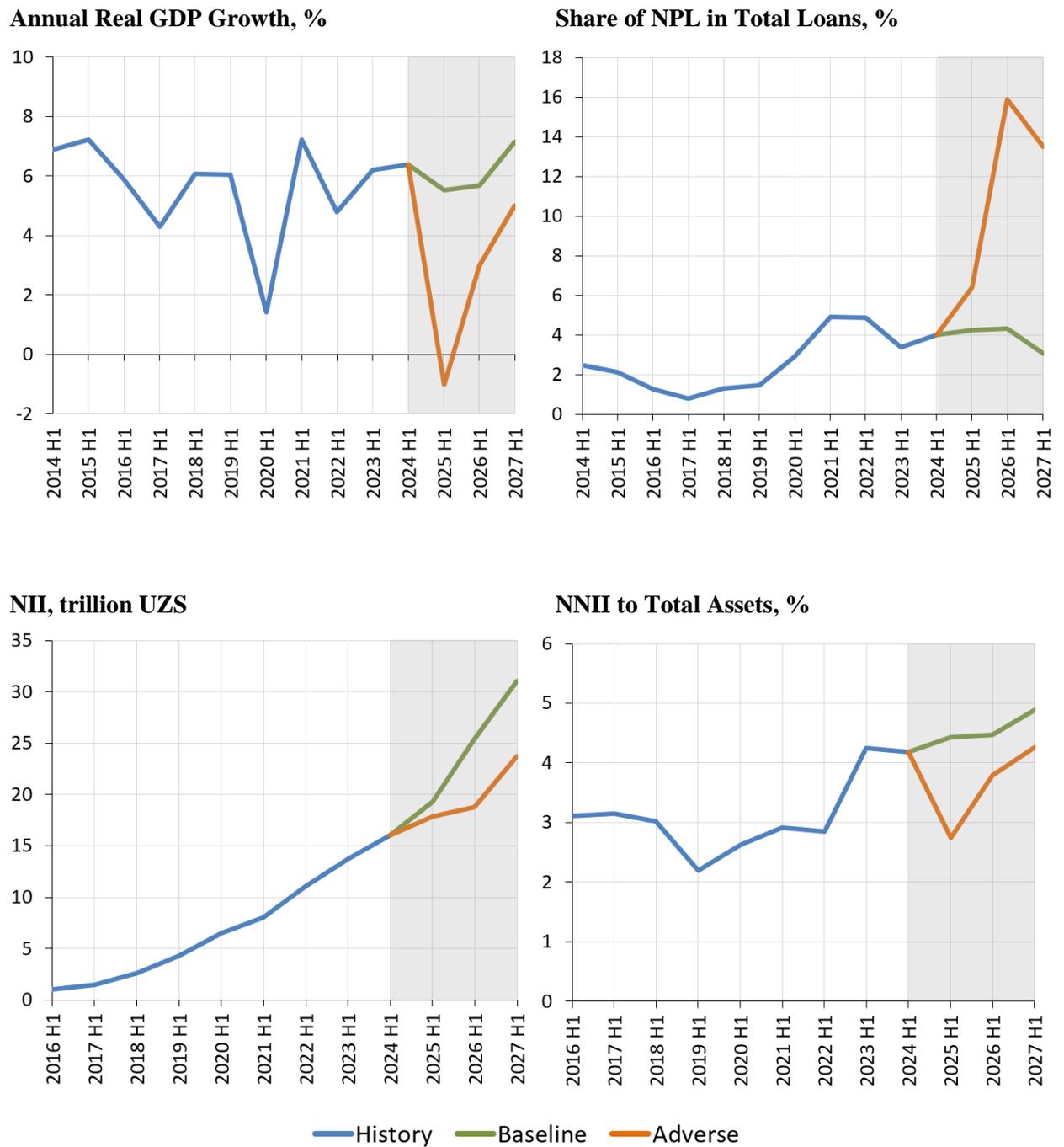
Source: CBU staff calculations.

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[95] Macroeconomic scenarios do not constitute forecasts of indicators. The scenarios address high-level risks, known as tail risks, which have a very low probability of occurrence. The tail risks were developed to create adverse scenarios and assess the resilience of banks in Uzbekistan to the shocks.

The credit risk model[96] indicates that under the adverse scenario, the share of NPLs could rise to 16% between H1 2024 and H1 2027. In this scenario, borrowers' incomes are expected to fall due to the slowdown in economic growth. The resulting decline in borrower solvency, combined with higher loan interest rates, would increase the debt burden, leading to a deterioration in the quality of banks' loan portfolios and a higher share of NPLs in total loans.

Banks' interest income is expected to rise under both the baseline and adverse scenarios. Interest income was estimated by assessing the impact of changes in the policy rate and the depreciation of the UZS on banks' assets and liabilities. The analysis specifically considered the effect of policy rate changes on short-term loans (up to one year) within bank assets, as well as on total deposits, interbank deposits up to one year, and loans received by banks.

Under the adverse scenario, the decline in the ratio of NNII to total assets is expected to be short-term. The slowdown in economic growth is expected to reduce the volume of banking services and financial operations, leading to a temporary decrease in NNII. According to the model[97] of the ratio of NNII to total assets, under the scenarios, depreciation of the UZS has a positive effect on the level of NNII. Since a significant portion of NNII is earned in FX, currency depreciation increases its value in UZS.

According to the baseline scenario, the solvency of banking system is expected to strengthen. By the end of H1 2027, the CAR is estimated to remain above the regulatory minimum, reaching 18.2%. Under this scenario, no concentration risks are anticipated in the banking system, losses in the real estate market are expected to be limited, and losses on securities are projected to remain low. Economic growth is expected to support an increase in both NII and NNII, alongside a rise in operating expenses, while a reduction in loan loss volumes contributes to a 2.5 p.p. decrease in the CAR.

The results of the adverse scenario indicate that the banking system may incur significant losses. The CAR is expected to decline to 10.4%, falling below the regulatory minimum by the end of H1 2027. Reduced economic activity and a sharp depreciation of the UZS would increase the cost of servicing FX loans for borrowers, leading to a rise in NPLs and higher potential loan losses. These losses are projected to reduce the CAR by 13.3 p.p. Substantial loan losses and elevated operating expenses could be partially offset by NII and NNII.

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[96] The credit risk model projects the share of NPLs by using the NPL value lagged once, GDP growth, and the loan interest rate values based on scenarios.

[97] The ratio of net non-interest income to total assets was estimated using the scenario-specific values of GDP growth and the exchange rate.

Figure 132. Solvency Macro Stress Test Results

	Baseline Scenario	Adverse Scenario
CAR (2024 H1)	17,3	17,3
NII	9,1	9,0
Loan losses	-2,5	-13,3
Losses on securities	-0,1	-0,8
FX revaluations	0,0	0,0
Losses on real estate	0,0	-0,3
NNII	22,5	15,9
Operating expenses	-12,5	-10,9
Taxes	-3,3	-0,9
Dividends	-0,7	-0,2
RWA	-11,4	-5,5
CAR (2027 H1)	18,2	10,4
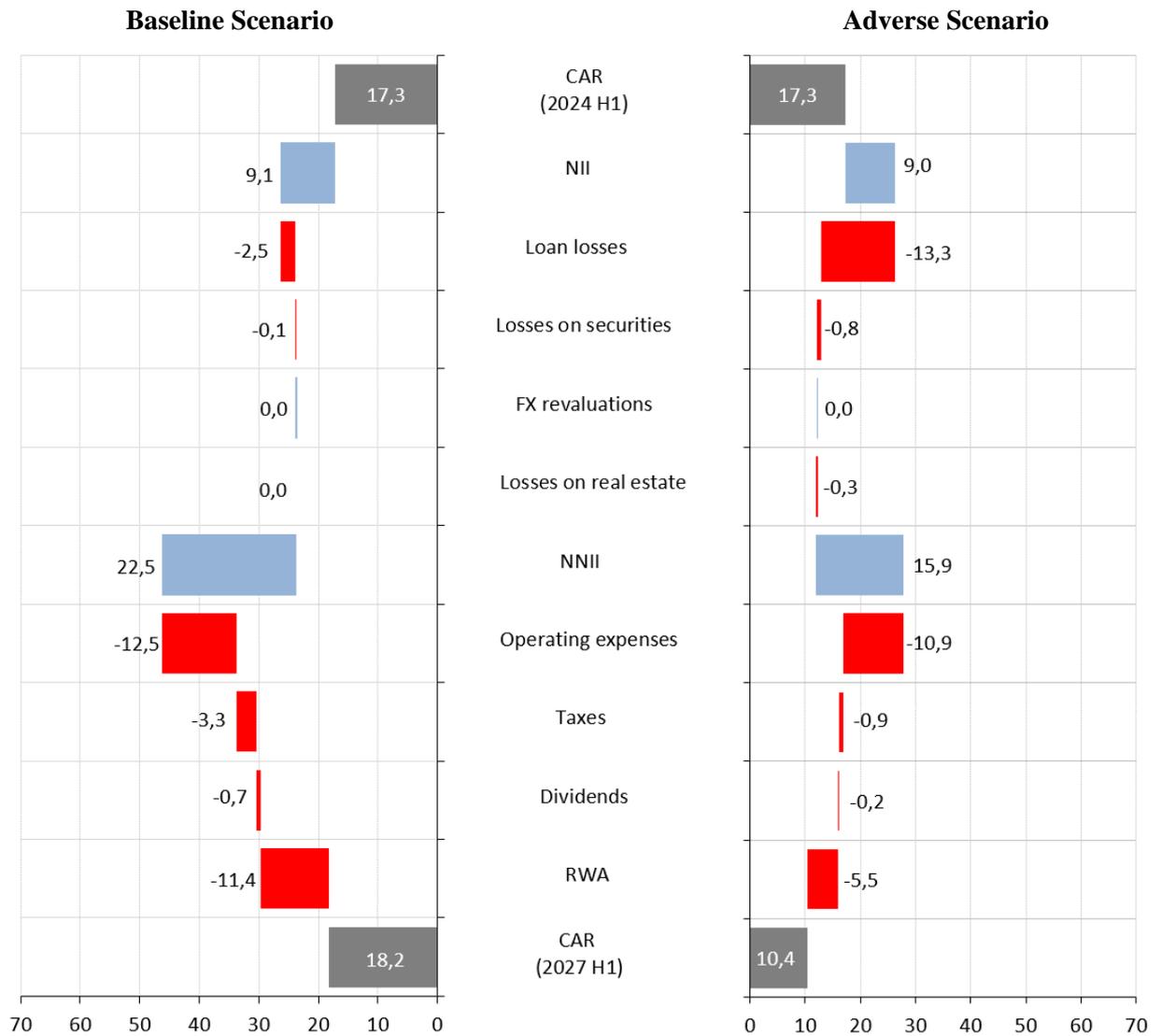
Source: CBU staff calculations.

Under the baseline scenario, some banks may fail to meet the minimum capital requirements. By the end of H1 2027, the assets of banks unable to meet the minimum CAR requirement under the baseline scenario are expected to account for 12% of the total assets of the banking system. The potential for structural systemic risks arising from the financial instability of these banks may therefore be underestimated.

Figure 133. CAR of Banking Sector in Baseline and Adverse Scenarios, %
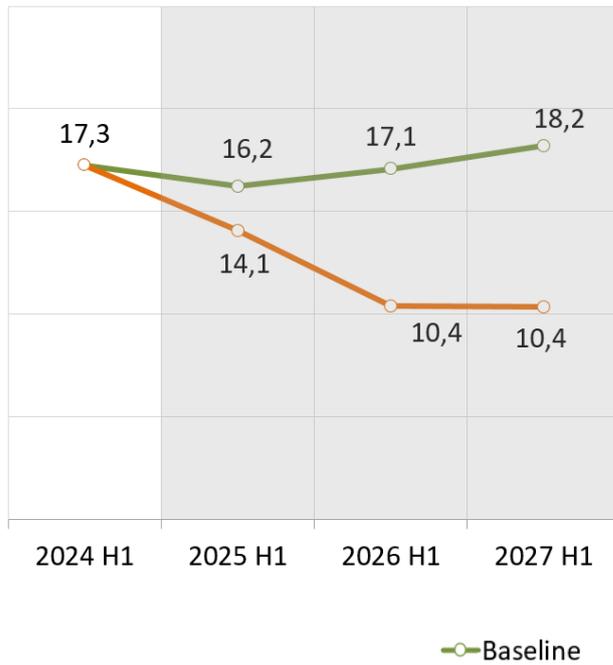
Figure 134. Distribution of Banking Sector's CAR Intervals and Shares in Total Assets*, %
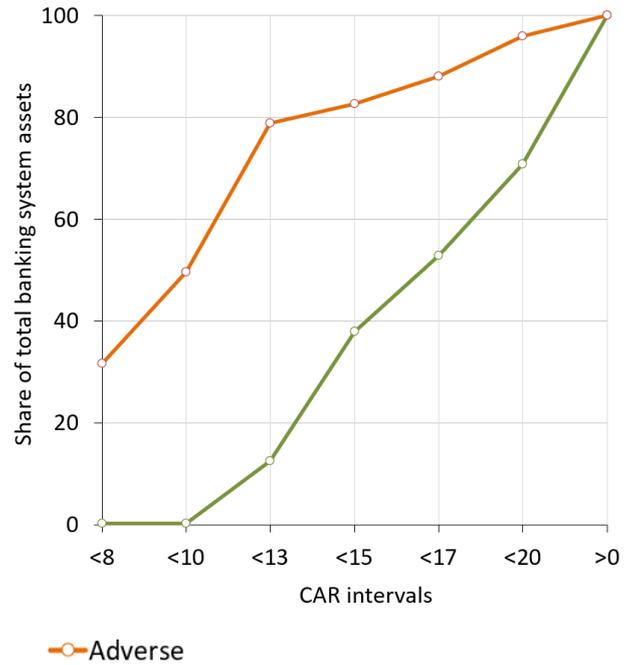
Source: CBU staff calculations.

Note: *The cumulative order is used to set the shares of total assets of banks located within specific CAR intervals.

Under the adverse scenario, potential losses in banks could give rise to structural systemic risks. By the end of H1 2027, the assets of banks unable to meet the CAR requirement are expected to account for 79% of the total assets of the banking system.

Some banks are projected to have insufficient high-quality capital to cover their total assets in the adverse scenario. Several banks are expected to fall below the minimum leverage ratio requirement of 6% by the end of H1 2027.

Figure 135. Bank-by-Bank Macro Stress Test Results
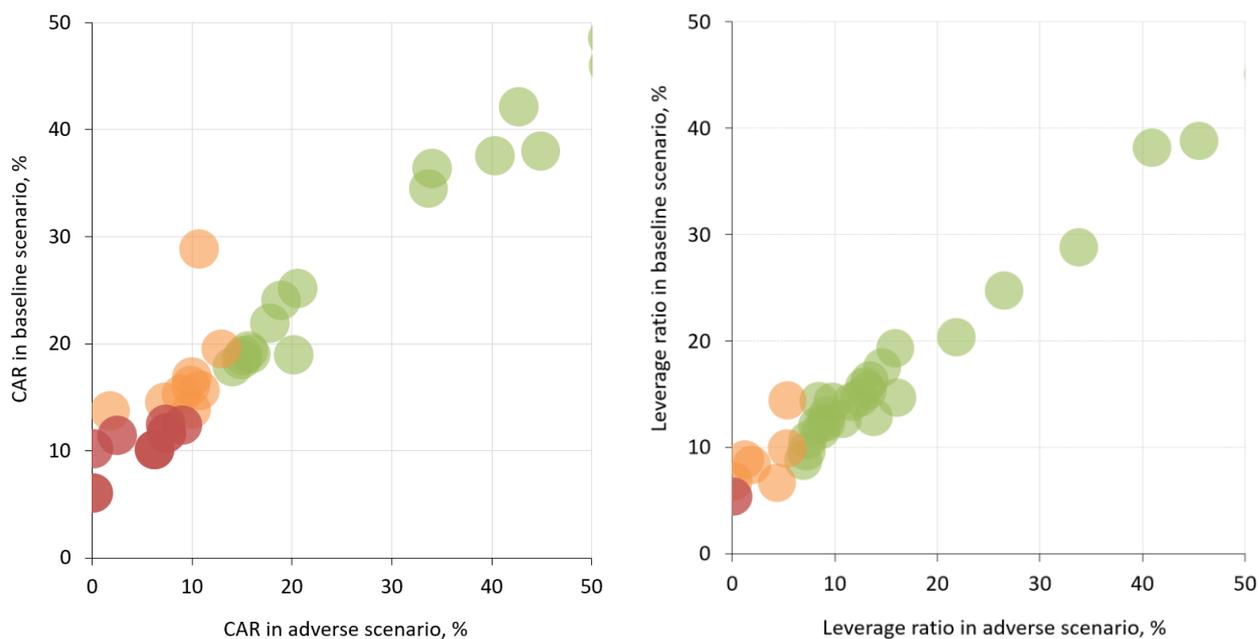
Source: CBU staff calculations.

Note: The graph presents data on banks, each depicted by a bubble, showing their CAR within the 0–50% range. Banks are color-coded: a green bubble denotes a bank that satisfies the minimum capital adequacy requirement of 13% and leverage requirement of 6% in both the baseline and adverse scenarios; a light red bubble represents a bank that falls short of these thresholds in the adverse scenario; and a dark red represents a bank that falls short of these thresholds in the baseline scenario a light red bubble represents a bank that falls short of this threshold.

The banking system's leverage ratio[98] remains above the established minimum requirement in both the baseline and adverse scenarios. Under the baseline scenario, high profitability growth in banks has led to a substantial increase in Tier 1 capital, resulting in a leverage ratio well above the regulatory minimum of 6%. In the adverse scenario, higher loan losses and increased operating expenses stemming from slower economic growth are expected to reduce banks' net profit. Consequently, lower retained earnings from the previous period, combined with an increase in total assets, would reduce the capitalization of bank assets to 7.6%. Supported by higher NII and NNII, the leverage ratio is expected to remain above the minimum requirement.

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[98] The leverage ratio is a measure that indicates the level of capital adequacy in relation to a bank's total assets. It is calculated as the ratio of Tier 1 capital to the sum of total assets and off-balance-sheet exposures.

Figure 136. Leverage Ratio of Banking Sector in Baseline and Adverse Scenarios, %
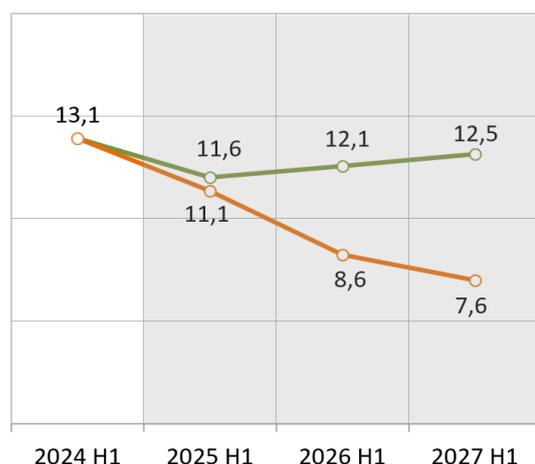
Figure 137. Banking Sector ROA in Adverse Scenario, %
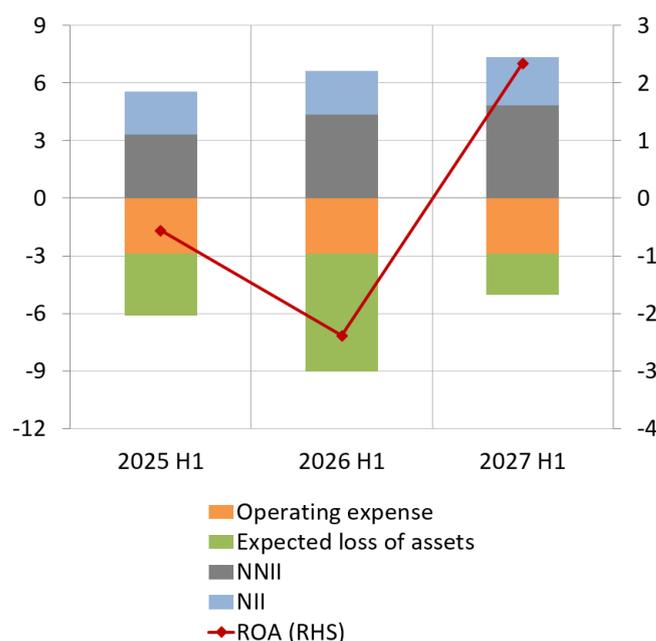
Source: CBU staff calculations.

According to the adverse scenario, a slowdown in economic growth is expected to reduce bank profitability. Despite an increase in the ratio of NII and NNII to total assets and operating expenses growing in line with total assets, ROA is projected to be negative due to a rise in potential losses on assets. However, by the end of H1 2027, improvements in loan portfolio quality, a decline in potential losses, and higher NII and NNII are expected to increase the banking system's ROA to 2.3%.

The risk of a bank default spreading to the broader banking system remains low. Using the losses-tied-to-capital[99] approach, losses from a bank default would cause the CAR of only one bank to fall below the minimum requirement. In this case, losses in other banks would be inversely proportional to the CAR of the potentially defaulting banks under the adverse scenario. Using the unrecoverable-losses[100] approach, the failure of a single bank to meet the minimum capital requirements. At the same time, a bank with a higher probability of default (PD) but low interbank dependence does not create difficulties for other banks in maintaining the required minimum capital rates.

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[99] In the approach, where losses from bank defaults are tied to capital, the extent of banks' losses from contagion risk is influenced by the defaulting bank's CAR. The lower the failing bank's CAR, the greater the proportional losses incurred by banks that have financial connections with it, such as those that have provided loans to or placed deposits with the defaulting bank.

[100] In the approach, where losses from bank defaults are not recoverable, banks face the loss of all their loans to or deposits placed with a bank with a high probability of default, i.e., a bank with the CAR below the required minimum.

Figure 138. Contagion Risk: Bank Default Losses Tied to Capital
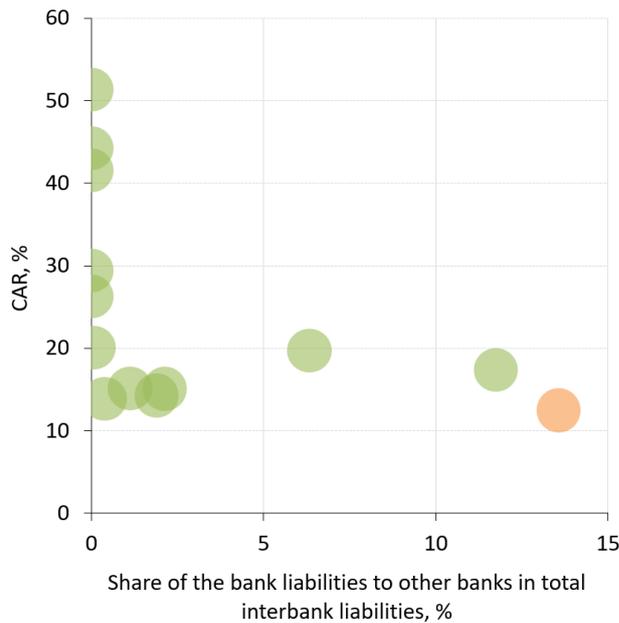
Figure 139. Contagion Risk: Unrecoverable Bank Default Losses
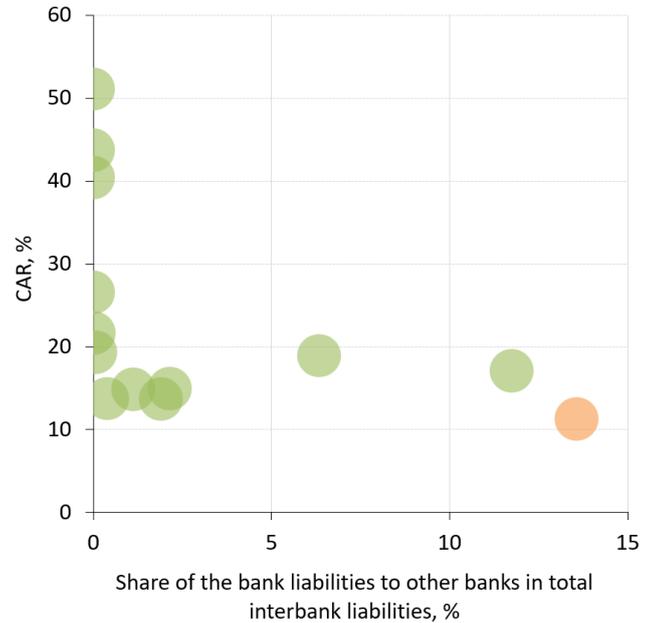
Source: CBU staff calculations.

Note: The graph presents an analysis of various banks, categorized based on three criteria: those with a CAR below 60%, those with liabilities to other banks, and those that meet the minimum capital adequacy requirement of 13% under the adverse scenario. Banks that comply with the minimum capital adequacy requirement are denoted by green bubbles, whereas light red bubbles indicate banks that fail to meet this threshold.

The resilience of the banking system was further assessed by applying additional shocks to the adverse scenario. These shocks included high concentration risk in banks' loan portfolios and potential systemic risks arising from sharp declines in asset prices. Concentration risk was evaluated by considering the default of the largest borrower and the five largest borrowers. The impact of a 30% and 40% decline in residential property and car prices in the asset market was also assessed, assuming that borrowers with an LTV ratio above 120% would default on their loans.

The default of large borrowers would result in capital losses for banks. By the end of H1 2027, losses arising from the default of the largest borrower or the five largest borrowers at each bank could reduce the banking system's CAR to 8.3% and 5.1%, respectively. It is assumed that the loss-given default (LGD) is 50% of outstanding loan in the event of large borrower defaults.

Figure 140. Macro Stress Test Results with Concentration Risk, %

Default of Single Largest Borrower   **Default of 5 Largest Borrowers**
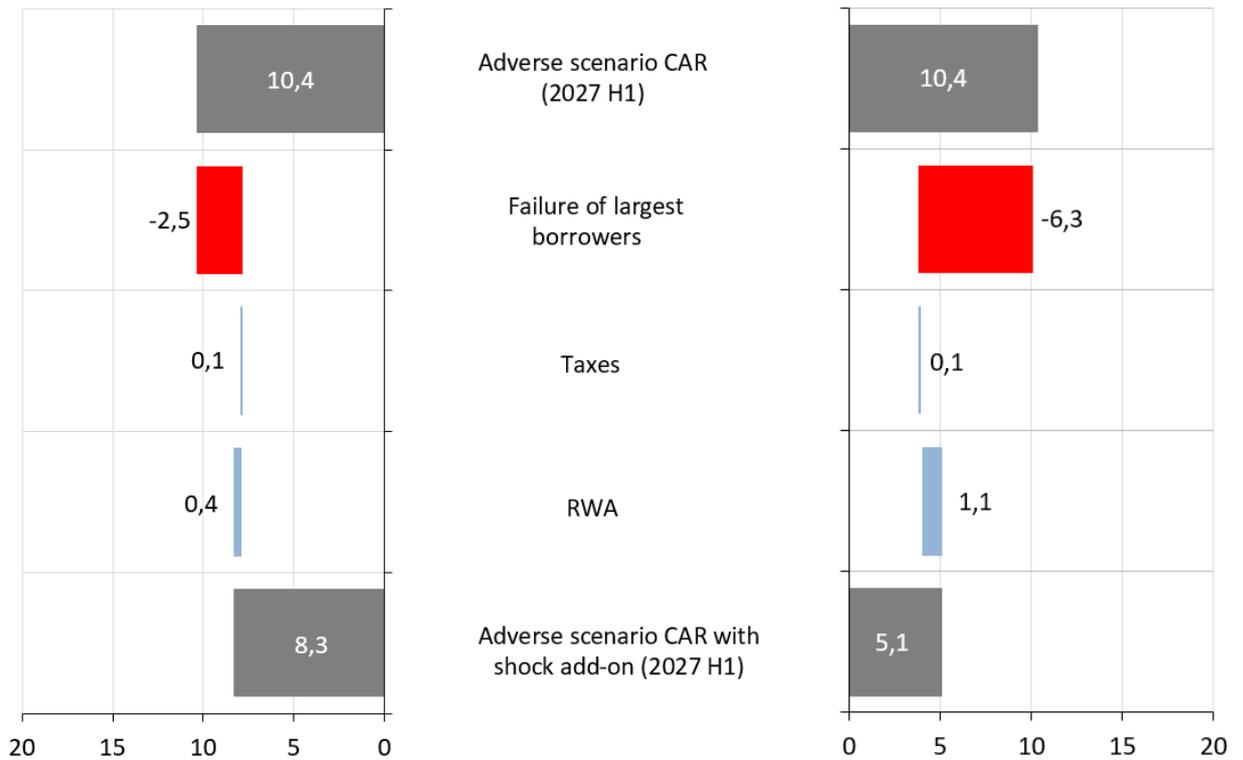
Source: CBU staff calculations.

Despite a 30% decline in residential property and car prices, banks did not experience significant credit losses. As a result of the price decline in the real estate and car markets, 87% of mortgage loans and 77% of car loans issued in H1 of 2024 may become insufficiently collateralized. The share of mortgage and car loans for which borrowers might prioritize foreclosure, in total mortgages and car loans issued during H1 2024 is projected to be 30% and 4%, respectively. As a result, the share of NPLs in total loans may increase by 0.6 p.p. by the end of H1 2027.

Figure 141. LTV Distribution of Mortgages after House Price Shocks, H1 2025
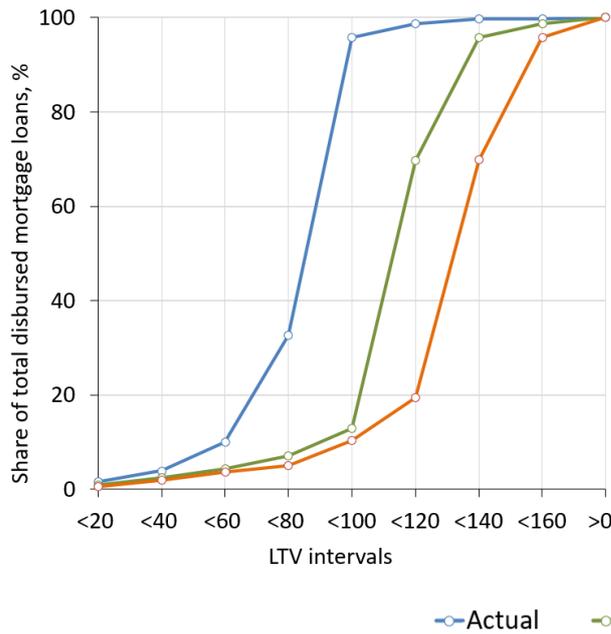
Figure 142. LTV Distribution of Car Loans after Car Price Shocks, H1 2025
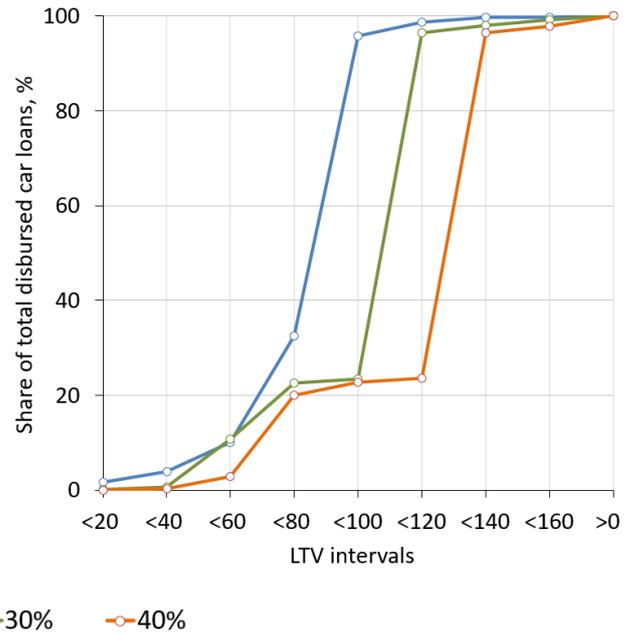
Source: CBU staff calculations.

Note: The total share of loans in the LTV range is set in ascending order of mortgage and car loans.

A 40% decline in asset prices is expected to lead to a deterioration in the quality of bank assets. As a result of the sharp fall in asset prices, 81% of mortgage loans and 76% of car loans issued in H1 2024 would have an LTV ratio above 120%. By the end of H1 2027, this drop in asset market prices is projected to increase the share of NPL in total loans by 1.2 p.p. for mortgage loans and by 1.4 p.p. for car loans. Consequently, the share of NPL for individuals in total loans may rise to 15.6% for mortgage loans and 16.3% for car loans.

Figure 143. Macro Stress Test Results with 30% Decline in Asset Market Prices, %

Decline in House Prices   **Decline in Car Prices**
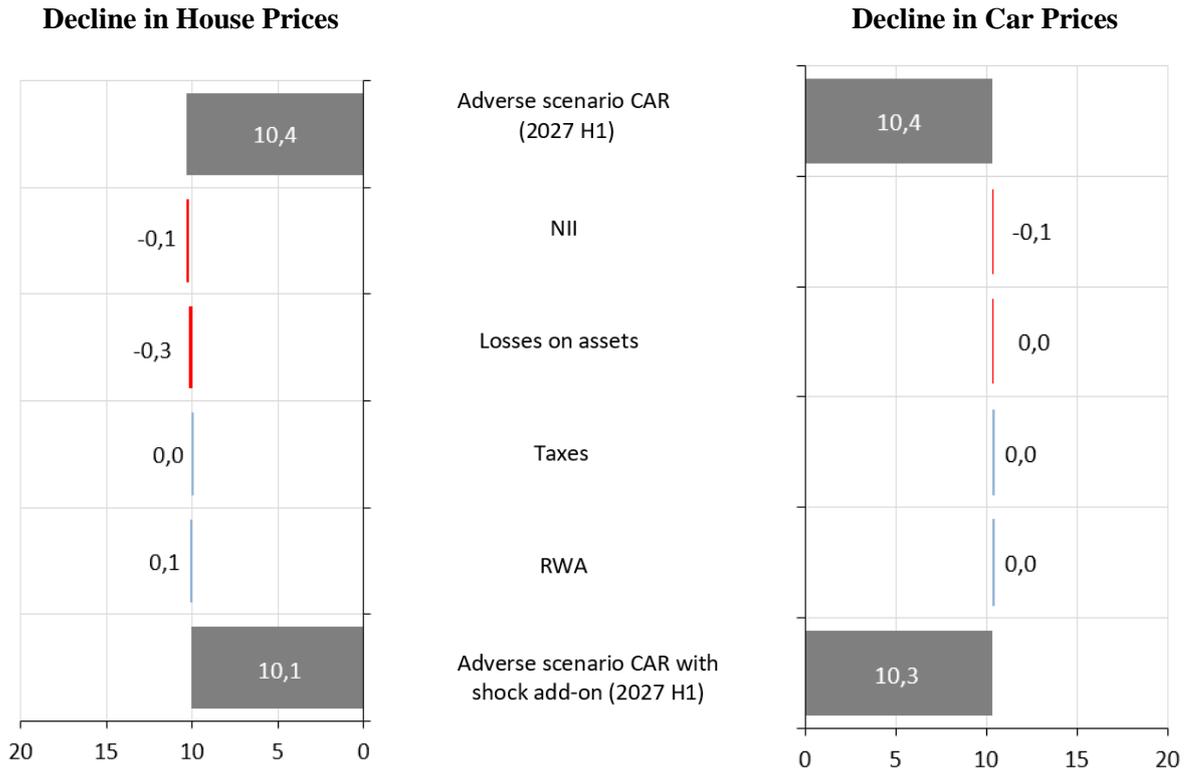
Source: CBU staff calculations.

The impact of a 30% drop in asset prices on the capital adequacy of the banking system is minimal. By the end of H1 2027, the CAR is expected to decrease by 0.3 p.p. compared to the adverse scenario due to losses on assets resulting from a 30% fall in residential property prices. A decrease of 0.1 p.p. will occur due to the reduction in car prices.

Figure 144. Macro Stress Test Results with 40% Decline in Asset Market Prices, %
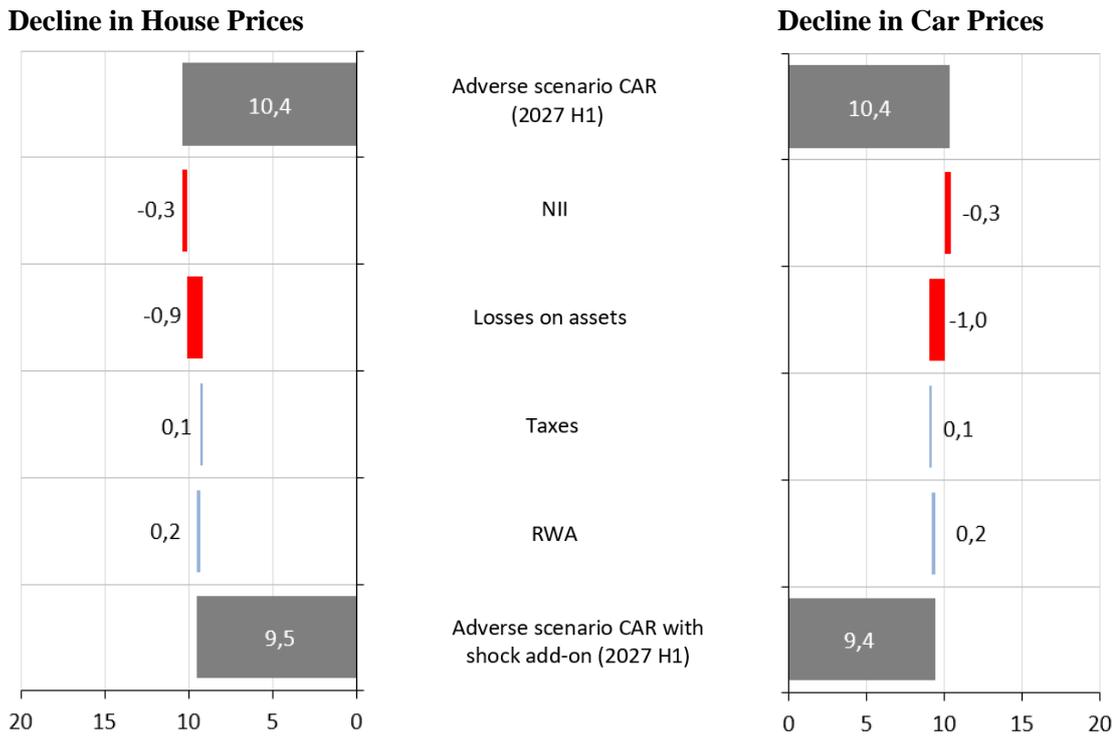
Source: CBU staff calculations.

The negative impact of a 40% drop in asset prices on the stability of the banking system remains significant. Such a fall in asset values is expected to reduce banks' NII. Consequently, the banking system's CAR could fall below the established minimum requirement, potentially reaching 9.5% and 9.4%.

5.2. Liquidity Macro Stress Test

The liquidity of the banking system was assessed through the macro stress test based on the baseline and adverse scenarios for H1 2025. The expected cash inflows and outflows under the baseline scenario were determined based on the recommendations of the Basel Committee on cash flow factors (Appendix 4). The adverse scenario was developed by considering lower cash inflows and higher cash outflows compared with the baseline scenario due to internal and external shocks, as well as depreciation of UZS. In particular, the adverse scenario considered partial withdrawal of funds by depositors, extensions of loan repayment terms by banks for certain borrowers, and declines in market prices of government securities (Appendix 5).

Figure 145. Breakdown of Banking System Assets and Liabilities by Term, %
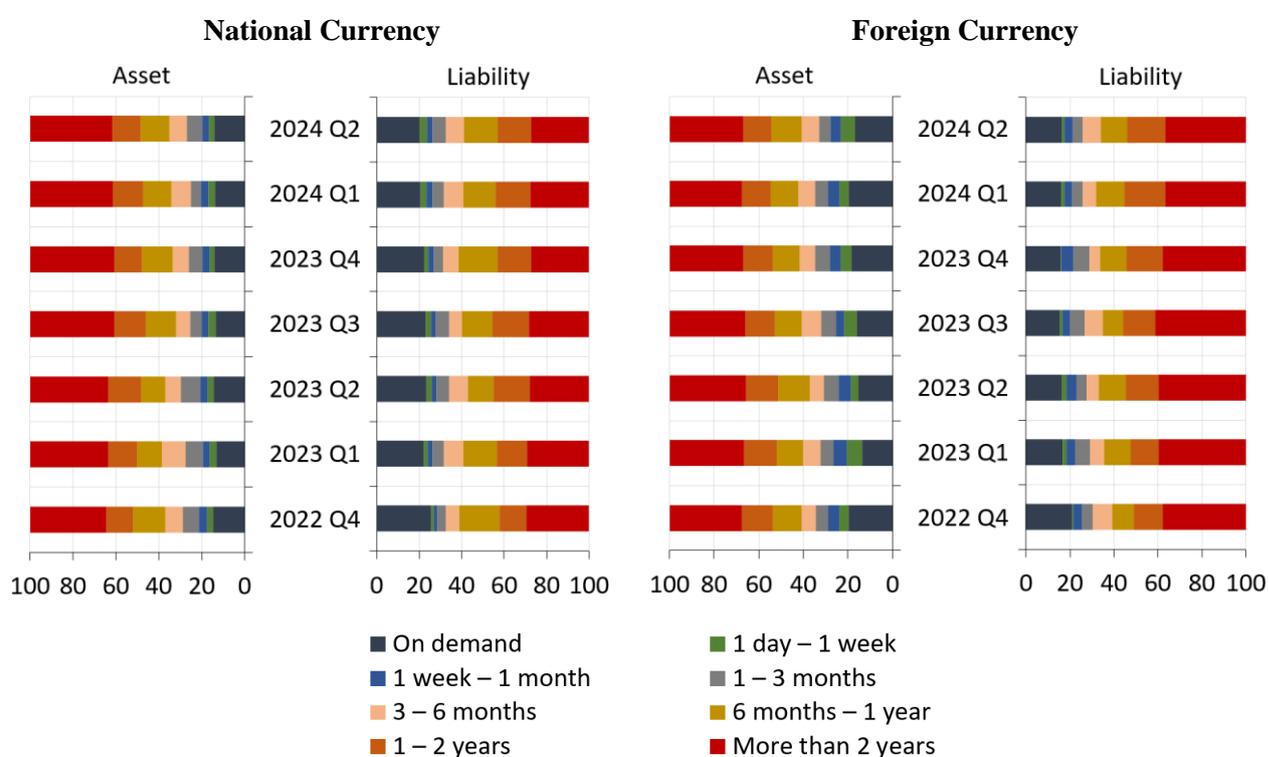
Source: CBU staff calculations.

The maturity mismatch between assets and liabilities of the banking system remains the main source of liquidity risk. As of the end of H1 2024, the share of short-term (up to 1 year) assets in the UZS in total assets was 48%, while this share was 57% in the liabilities. The high share of long-term assets in banks' total assets, combined with a high share of short-term liabilities can lead to the risk of maturity mismatch. Difficulties in financing short-term liabilities with long-term assets lead to liquidity problems in banks.

The risk level of maturity mismatch between total assets and liabilities in FX remains relatively low in the banking system. At the end of H1 2024, the share of short-term assets in total assets was 9 p.p. higher than the share of short-term liabilities in total liabilities. Based on the composition of cash flows, the liquidity of the banking system in FX relative to UZS can be assessed as favorable.

Figure 146. Net Cash Inflow[101] to Total Assets Ratio of Banking System, %
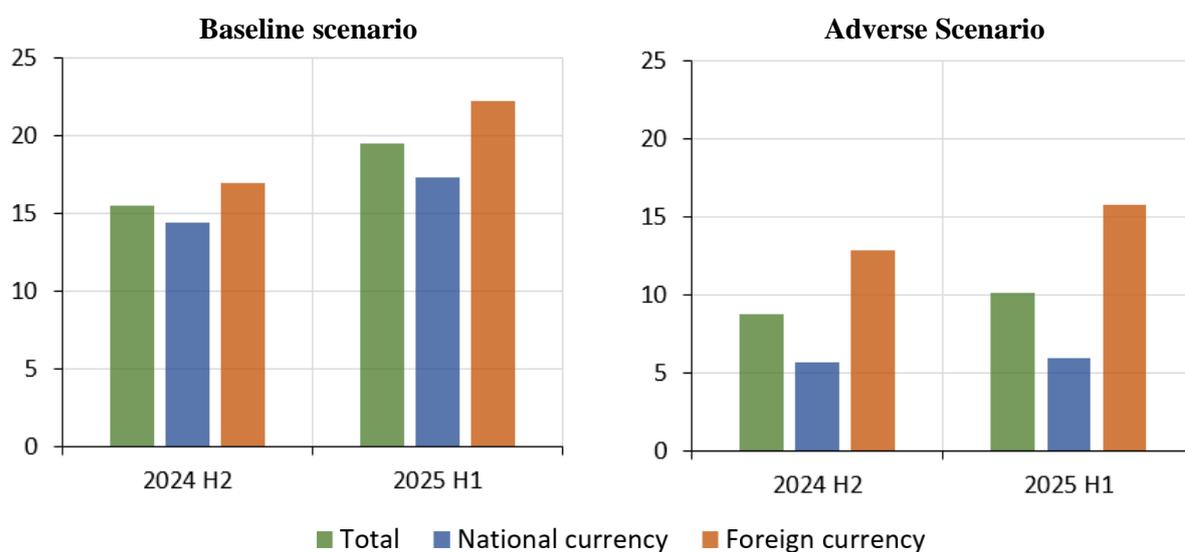
Source: CBU staff calculations.

The results of the baseline scenario exhibit that the banking system is expected to have a high share of positive net cash inflows relative to total assets. In this scenario, the expectation of higher inflows compared to outflows in the banking system generate positive net cash inflows. By the end of H1 2025, the ratio of expected net cash inflows (the difference between cash inflows and cash outflows) to total assets in the banking system could account for 17% and 22% in UZS and FX, respectively.

In the adverse scenario, a decline in cash inflows combined with an increase in outflows leads to a contraction in net cash inflows. At the end of 2024, the net cash inflow to total assets ratio is expected to stand around 6% and 13% in UZS and FX, respectively. Also, at the end of H1 2025, this ratio will remain unchanged in UZS, while amounting to 16% in FX.

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[101] Net cash inflows are determined by subtracting cash outflows from cash inflows.

Figure 147. Net Cash Inflow to Total Assets Ratio, % (as of January 1, 2025)
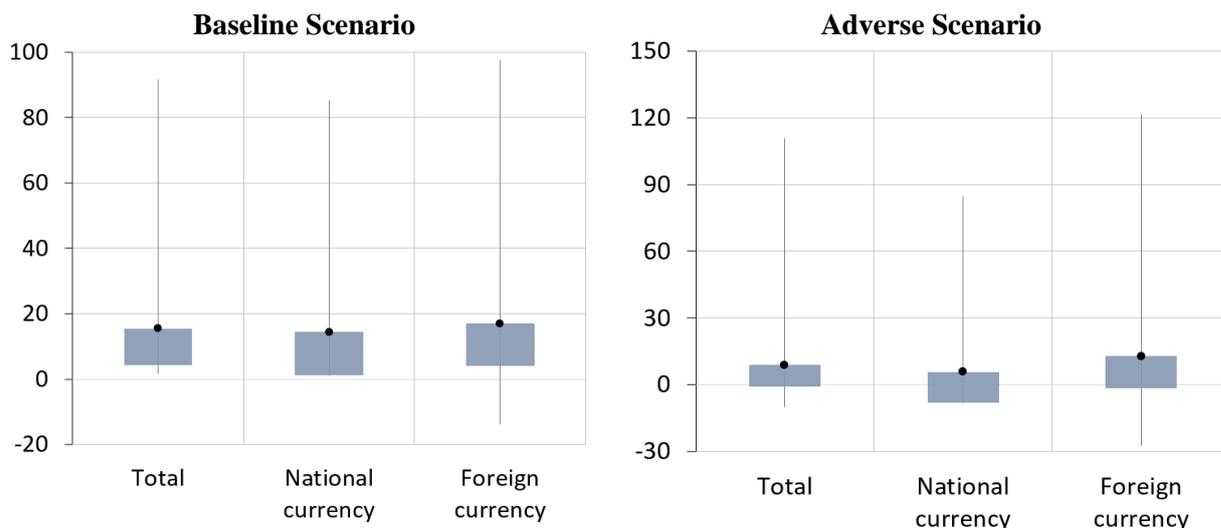
Source: CBU staff calculations.

Note: In the chart, the rectangular shape represents the results of macro stress test, illustrating the difference between the banking system's net cash inflow to total assets ratio and the corresponding ratio of the bank with minimum value over the next year. The longer the rectangle, the greater the difference between the banking system and the bank with the lowest ratio. The top point of the vertical black line represents a bank with the maximum net cash inflow to total assets ratio across time intervals, whereas the bottom point represents a bank with the minimum value of this ratio. The black circle indicates the banking system's net cash inflow to total assets ratio.

In the baseline scenario, most banks are expected to maintain a high level of positive net cash inflows relative to total assets. As of January 1, 2025, the ratio of net cash inflow to assets for the banking system in total, UZS and FX will be around 15-17%. The lowest ratio of net cash inflows to total assets among banks in FX, reflecting a negative net cash inflow balance, is estimated at approximately 14%. All banks are expected to have a positive net cash inflows in total and national currencies.

Under the adverse scenario, some banks may experience substantial negative net cash inflow balances. By the end of 2024, net cash inflows in UZS and FX may amount to 6% and 13% of the banking system's assets. At the individual bank level, negative net cash inflows to bank assets in UZS and FX may fell to 8% and 27%, respectively.

Figure 148. Bank-by-Bank Liquidity Stress Test Results: Total Currencies, % (as of July 1, 2025)
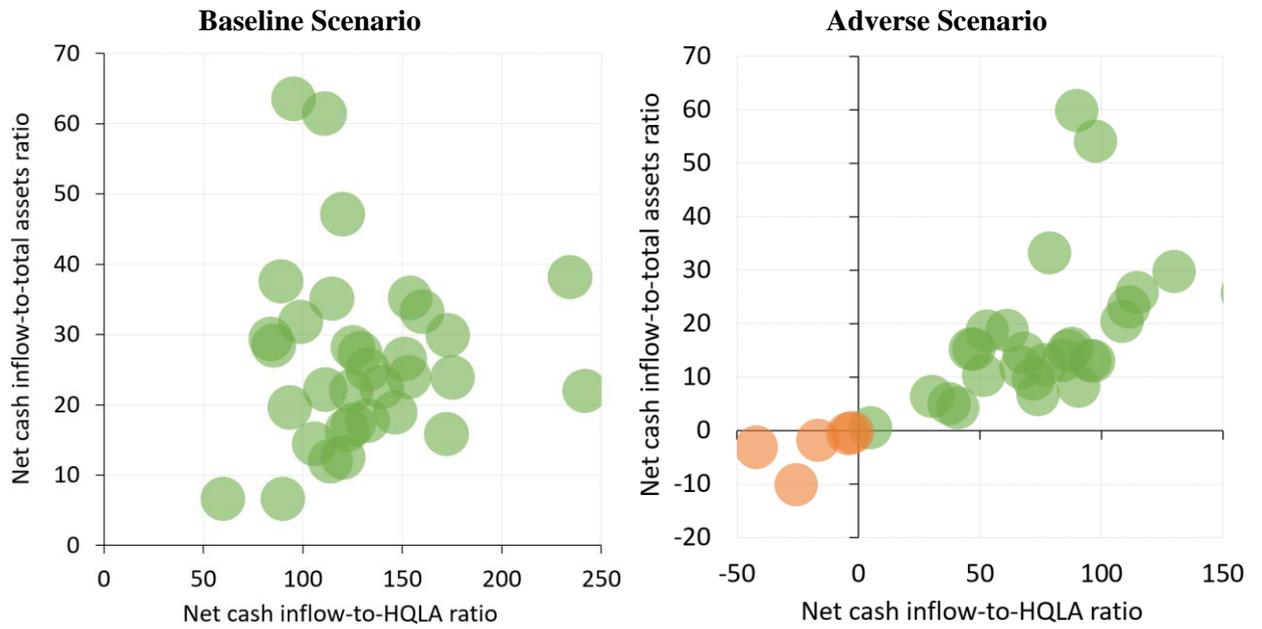
Source: CBU staff calculations.

Note: The graph presents data on banks, each depicted by a bubble, showing a ratio of net cash inflow to total bank assets within the 0–70%, and a ratio of net cash inflow to HQLA within the 0–250% under the baseline and adverse scenarios. Banks are color-coded: a green bubble denotes a bank with positive net cash inflows in UZS, whereas a light red bubble represents a bank with negative net cash inflows in UZS.

Under the adverse scenario, a number of banks may face liquidity pressures across all currencies. By the end of H1 2025, up to five banks are projected to record negative total net cash inflows across all currencies. In such a scenario, banks may experience a negative net inflow equivalent to up to 50% of their HQLA and capped at 10% of total assets.

Figure 149. Bank-by-Bank Liquidity Stress Test Results: UZS, % (as of July 1, 2025)
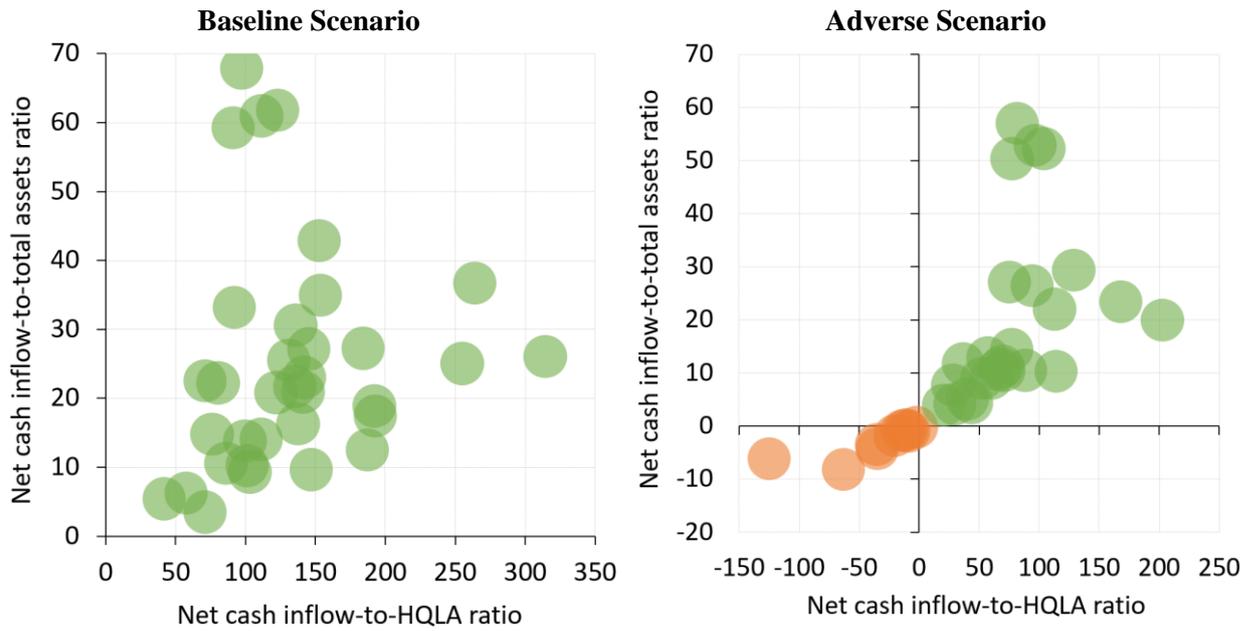
Source: CBU staff calculations.

Note: The graph presents data on banks, each depicted by a bubble, showing a ratio of net cash inflow to total bank assets within the 0–70%, and a ratio of net cash inflow to HQLA within the 0–350% under the baseline and adverse scenarios. Banks are color-coded: a green bubble denotes a bank with positive net cash inflows in UZS, whereas a light red bubble represents a bank with negative net cash inflows in UZS.

Under the adverse scenario, liquidity pressures emerging in the national currency could pose systemic risks to the banking sector. Stress test results indicate that, by the end of H1 2025, a total of nine banks may face liquidity shortfalls in the national currency. The relatively large number of affected banks increases the likelihood of systemic liquidity stress, underscoring the potential for contagion effects within the banking system.

Figure 150. Bank-by-Bank Liquidity Stress Test Results: FX, % (as of July 1, 2026)
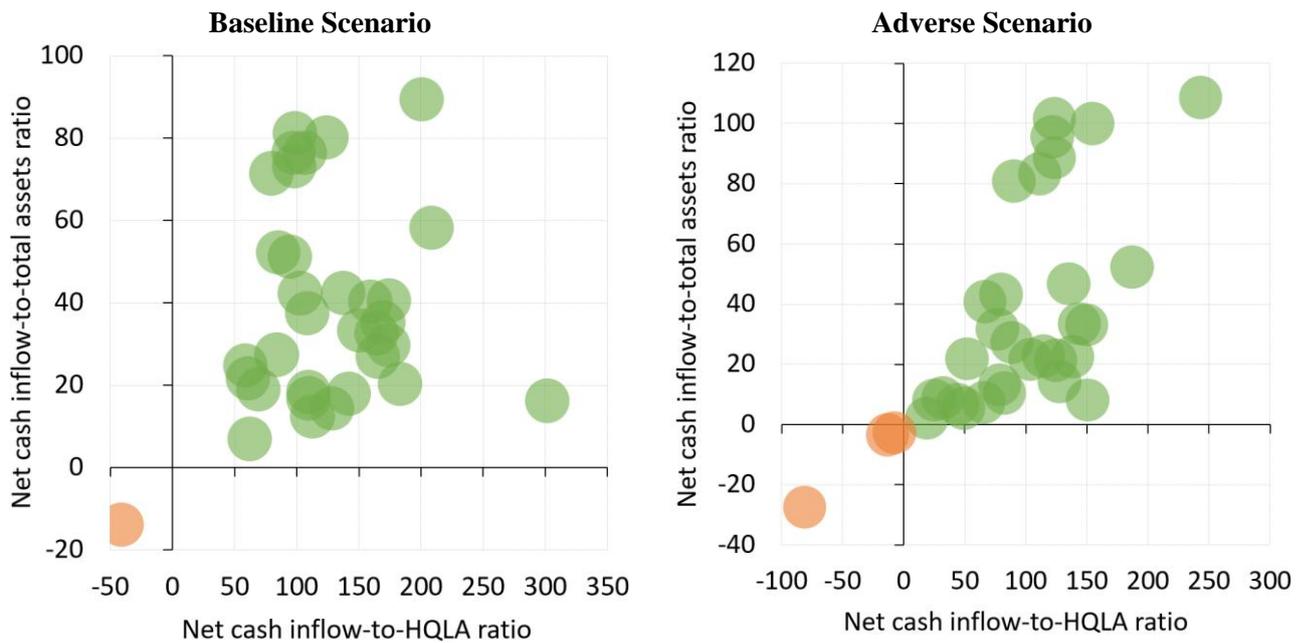
Source: CBU staff calculations.

Note: The graph presents data on banks, each depicted by a bubble, showing a ratio of net cash inflow to total bank assets within the 0–120%, and a ratio of net cash inflow to HQLA within the 0–350% under the baseline and adverse scenarios. Banks are color-coded: a green bubble denotes a bank with positive net cash inflows in UZS, whereas a light red bubble represents a bank with negative net cash inflows in UZS.

Liquidity pressures may emerge in a limited number of banks with relatively small shares in the banking system. According to the adverse scenario of the FX liquidity stress test, by the end of H1 2025, three banks are projected to record negative net cash inflows in FX.

VI. Macroprudential Policy

6.1. Macroprudential Tools

In Uzbekistan, the importance of maintaining capital buffers under standard risk conditions is increasing. Banks should build the necessary capital buffers in advance of periods in which systemic risks that could adversely affect financial stability may materialize. In this context, the partial or full release of capital buffers would provide banks with additional high-quality capital. At the same time, postponement of the capital buffer accumulation period and the need to enhance banks' resilience to shocks unrelated to the financial cycle indicate that capital buffers should not be relaxed but rather maintained at their current levels (Appendix 6).

Figure 151. Uzbekistan's Financial Cycle Index[102]
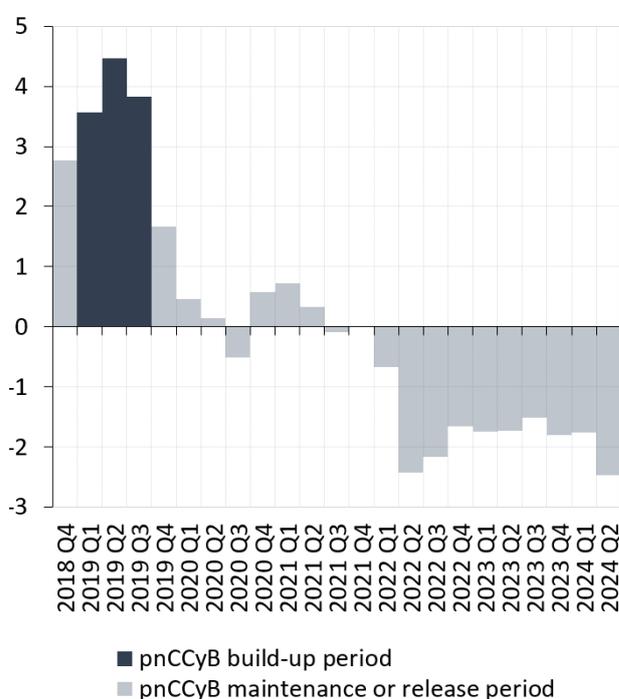
Figure 152. Credit to the Private Sector-to-GDP Gap and Benchmark Buffer Rate
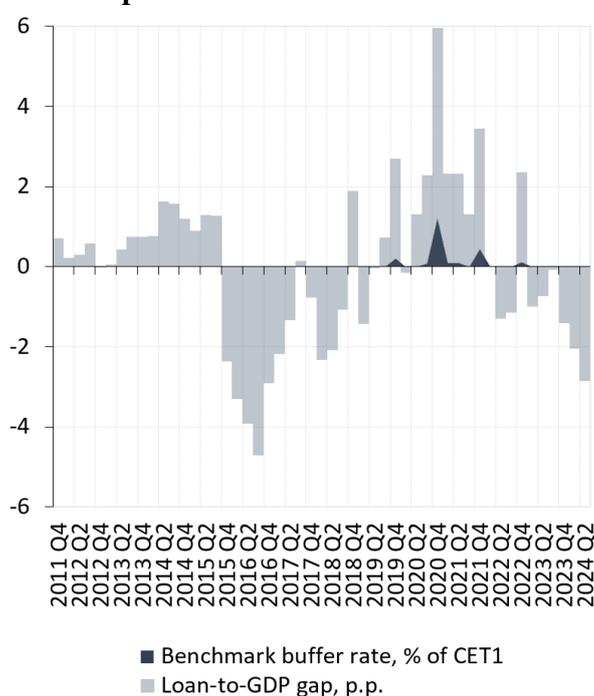
Sources: Statistics Agency and CBU staff calculations.

Note: An increase in the financial cycle index signals a period of economic growth, while a decrease indicates economic contraction.

The financial cycle index indicates that cyclical systemic risks have not materialized in Uzbekistan's financial system. The financial cycle index, which reflects changes within the financial system, has remained relatively stable in recent years, suggesting the emergence of a standard risk environment in the country. This phase of the financial cycle signals that the level of existing risks has not changed significantly and underscores the importance of maintaining pnCCyB.

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[102] The financial cycle methodology is presented in the Financial Stability Report for 2023.

Credit to the private sector-to-GDP gap continues to remain negative. As of July 1, 2024, credit to the private sector-to-GDP gap stood at negative 3%. Since the credit-to-GDP gap alone cannot completely reflect the economic condition of the country, additional indicators are considered important.

Table 1. Early Warning Indicators (EWI)

	Indicators	2019				2020				2021				2022				2023				2024	
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Core	Credit to private sector-to-GDP gap																						
Additional	Growth in credit-to-GDP ratio																						
	Total credit growth (YoY)																						
	GDP growth (YoY)																						
	Real house prices																						
	Leverage ratio																						
	CAB (percent of GDP)																						
	Tier 1 capital-to-RWA ratio																						
	Household DSR																						

Source: CBU staff calculations.

Note: A shift from green to red indicates escalating financial risks.

Early warning indicators point to the presence of vulnerabilities in the country's financial system. Weaknesses related to real house prices in the real estate sector remain. There is also a possibility of a slowdown in GDP growth. Furthermore, the current account balance, despite a positive trend observed, remains negative.

Figure 153. CET1 Capital Ratio of Banking System in Baseline and Adverse Scenarios, %
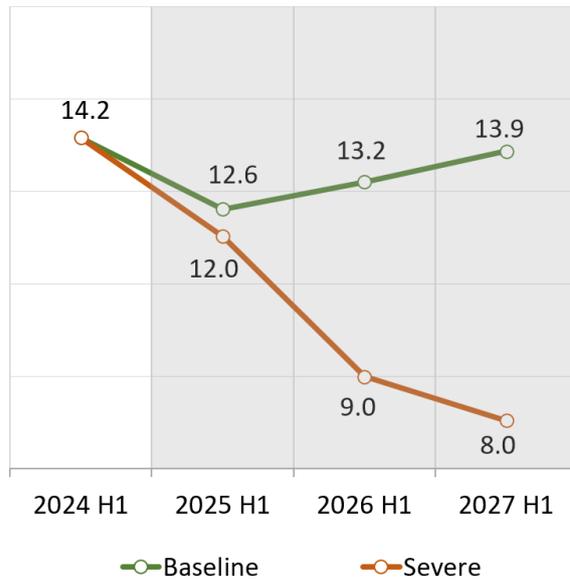
Figure 154. Tier I Capital Ratio of Banking System[103], %
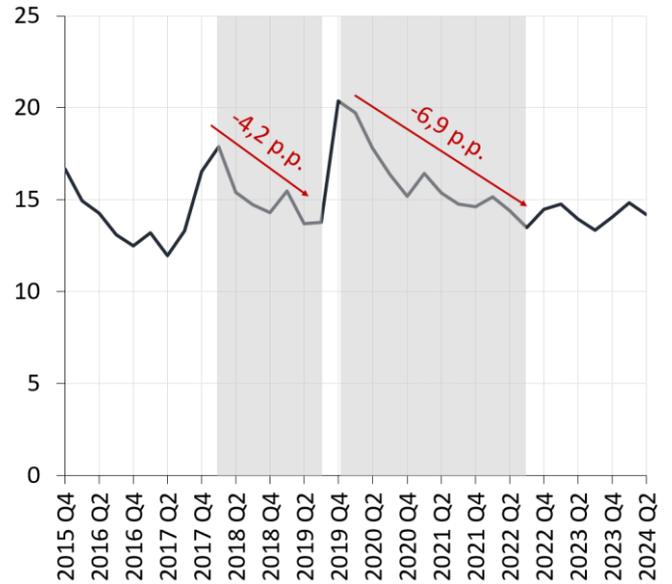
Source: CBU staff calculations.

Based on the results of macro stress test[104] and historical losses approach[105], additional macroprudential buffers are required under possible shock scenarios. According to the macro stress test approach, under the adverse scenario, CET1 ratio of the banking system could decline to 8%, requiring the implementation of an additional capital buffer of 6.2%. Meanwhile, according to the historical losses approach, an additional capital buffer of 5.6% is needed (Appendix 7).

Direct limits on borrower-based MPP have been tightened. Effective July 1, 2024, a debt service-to-income ratio (DSTI) limit has been applied to all types of loans for individuals and has been set at 60%. From January 1, 2025, this limit will be lowered to 50%. The DSTI ratio is intended to prevent excessive household indebtedness and to reduce the risk associated with loans. As an exeption, banks may issue up to 15% of their total individual loans without assessing or applying the debt burden indicator (Appendix 8).

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[103] Considering the availability of time series data and the fact that Tier I capital accounted for almost 100% of CAR as of July 1, 2024, the analysis focused on the Tier I capital ratio.

[104] The macro stress test approach for calibrating macroprudential buffers is presented in detail in the Financial Stability Report for 2023.

[105] The historical losses approach calculations are presented in detail in the Financial Stability Report for 2023.

Table 2. Risk Weights for Residential Real Estate Exposures (from July 1, 2024)

Classification	DSTI ≤ 60%*	60%* < DSTI or if not possible to determine
LTV < 50%	35%	50%
50% ≤ LTV < 75%	50%	100%
75% ≤ LTV < 100%	100%	150%
100% ≤ LTV	150%	150%

Source: CBU.

Note: *The limit will be set at 50% starting from January 1, 2025.

Effective from July 1, 2024, indirect limits were implemented for mortgages and car loans. Banks are required to determine the risk weights of mortgages and car loans using the LTV and DSTI ratios[106]. Higher LTV and DSTI ratios correspond to higher risk weights. For mortgage loans issued as an exception to the direct household debt burden limits, a risk weight of 150% was applied, while a 200% risk weight was assigned for car loans. This limit creates an additional capital buffer for banks against loans that do not meet the household debt burden requirement.

Table 3. Risk Weights for Car Exposures (from July 1, 2024)

Classification	DSTI ≤ 60%*	60%* < DSTI or DSTI if not possible to determine
LTV ≤ 75%	100%	150%
75% < LTV	150%	200%

Source: CBU.

Note: *The limit will be set at 50% starting from January 1, 2025.

As a result of MPP tightening, the LTV distribution of car loans exhibited noticeable improvement. In H1 2024, outstanding car loans declined sharply, and concentration levels decreased. Moreover, the LTV distribution range representing the majority of car loans shifted downward, from 81–85% to 76–80%.

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[106] O'zbekiston Respublikasi Markaziy banki boshqaruvining 2024 yil 31 yanvardagi "Tijorat banklari kapitalining monandligiga qo'yiladigan talablar to'g'risidagi nizomga o'zgartirish va qo'shimchalar kiritish haqida" 42/14–sonli qarori.

6.2. Risks and Mitigation Measures

Key risks for financial stability of Uzbekistan and mitigation measures	Risk level and its change	
	In the short term	In the medium term
External risks		
Persistence of high external financing costs in the long term. The expectation that high interest rates in international financial markets will persist over the long term makes it more difficult for the country to attract financial resources from external sources, leading to increased foreign debt-servicing costs. This reduces banks' ability to provide loans to the economy using foreign funds and creates upward pressure on domestic lending interest rates. **Risk mitigation measures:** - increasing opportunities of attracting foreign direct investments by improving investment condition; - ensuring strict adherence to the upper limit of the consolidated budget deficit; - implementing export promotion measures to alleviate the devaluation pressure of the reduction in external financing on the UZS; - using relatively short-term financing under conditions of elevated interest rates in international financial markets.	↗	→
The risk of imposing secondary sanctions on participants in Uzbekistan's financial and non-financial sectors. The risk of secondary sanctions being imposed by the USA and the European Union on enterprises and banks operating in Uzbekistan could restrict the country's access to international financial markets, hinder the attraction of foreign investments, and increase transaction costs. **Risk mitigation measures:** - expanding and diversifying partnerships beyond the influence of sanctions in foreign trade and international financial relations; - enhancing measures to ensure compliance with international sanctions and strengthening the legal framework to prevent their imposition.	↗	→

Climate change risks. Risks stemming from climate change can lead to significant losses for businesses and individuals, ultimately impacting the financial system. In particular, the vulnerability of key sectors of the national economy to physical and transition risks associated with climate change may increase. **Risk mitigation measures:** - continuous assessment of the impact of physical and transition risks of climate change on the financial health of banks through climate stress testing; - implementing stricter capital requirements for sectors vulnerable to climate change risks while applying lower capital requirements for green investment projects; - tightening liquidity requirements for banks with a high concentration of exposure to sectors vulnerable to climate change risks.	→	↗ (yellow)
Internal risks		
Housing price overvaluation. When housing market prices exceed their fundamental values, there's a heightened risk of banks incurring loan losses. This is because the value of housing, used as collateral, may plummet during economic downturns. Additionally, the population's debt burden on mortgage loans will increase. **Risk mitigation measures:** - tightening the LTV cap for mortgage loans relative to RWA; - introducing a systemic risk buffer or a sectoral CCyB for mortgage loans.	↗ (yellow)	↗ (yellow)
Rapid growth in microdebts. The growth in microdebts within banks' loan portfolios leads to higher concentration risk and, consequently, raises credit risk. Additionally, since collateral is not required for microdebts, banks may incur loan losses if borrowers fail to meet their obligations under microdebts. **Risk mitigation measures:** - excluding the application of loans allocated as exceptions to DSTI ratio relative to microdebts within the framework of debt burden requirements; - introducing a debt-to-income (DTI) ratio requirement for microdebts; - establishing a minimum monthly income requirement for obtaining a microdebt, based on minimum monthly consumer expenses;	↗ (yellow)	↗ (red)

- setting concentration limits for microdebts within the total loan portfolio.		
Rising cyber risks. With the acceleration of payment systems and digitalization, the occurrence of cyber risks is also rising. This rise in such risks may weaken confidence in the financial system and, consequently, adversely affect financial system stability. **Risk mitigation measures:** - strengthening control over transactions and establishing restrictions on suspicious transactions; - enhancing households' financial literacy regarding cyberattacks and fraud.	↗	↗

Low risk	Medium risk	High risk

Note: The direction of the arrow indicates the change in the risk level.

Box 4. Climate Change Risks

Table 4. Climate change dashboard for Uzbekistan

	Indicator	Unit	The value of before the reference period	The value of the reference period	Reference period	Change
Real economic indicators	Total greenhouse gas emissions	million metric tons of carbon dioxide (CO_2)* equivalent	218,2	223,8	2022	↑
	Total carbon dioxide emissions	million metric tons	124,3	129,1	2022	↑
	Total greenhouse gas emissions per capita	metric tons of carbon dioxide (CO_2) equivalent	6,2	6,2	2022	→
	Total greenhouse gas emissions per unit of GDP	metric kilogram of carbon dioxide (CO_2) equivalent per 1 million UZS	335,6	286,9	2022	↓
	Total greenhouse gas emissions from agriculture	million metric tons of carbon dioxide (CO_2) equivalent	49,7	51,1	2022	↑
	Total greenhouse gas emissions from industrial processes and product use	million metric tons of carbon dioxide (CO_2) equivalent	9,3	9,0	2022	↓
	Total greenhouse gas emissions from energy sectors	million metric tons of carbon dioxide (CO_2) equivalent	152,1	156,3	2022	↑
	Total greenhouse gas emissions from waste	million metric tons of carbon dioxide (CO_2) equivalent	9,6	9,8	2022	↑
	Effects of land-use and forestry on greenhouse gas emissions	million metric tons of carbon dioxide (CO_2) equivalent	-3,4	-3,4	2022	→
	Other greenhouse gas emissions	million metric tons of carbon dioxide (CO_2) equivalent	0,3	0,4	2022	↑
	Total methane emissions	million metric tons of carbon dioxide (CO_2) equivalent	79,8	80,4	2022	↑
	Total methane emissions from agriculture	million metric tons of carbon dioxide (CO_2) equivalent	35,4	36,4	2022	↑
	Total methane emissions from industrial processes and product use	million metric tons of carbon dioxide (CO_2) equivalent	0,9	1,0	2022	↑
	Total methane emissions in energy sectors	million metric tons of carbon dioxide (CO_2) equivalent	34,8	34,1	2022	↓
	Total methane emissions from waste	million metric tons of carbon dioxide (CO_2) equivalent	9,6	9,8	2022	↑
	Total energy efficiency**	percent	5,0	4,5	2023	↓
	The share of renewable energy sources in the total volume of electricity production	percent	7,7	9,3	2022	↑
	Share of industry in total electricity consumption	percent	27,9	25,7	2023	↓
	Share of agriculture in total electricity consumption	percent	9,0	7,7	2023	↓
Mobili...	Volume of "green" sovereign international bonds	million USD	0,0	348,4	2023	↑

Indicator	Unit	The value of before the reference period	The value of the reference period	Reference period	Change
Environmental protection expenditure as percent of GDP	percent	0,04	0,01	2022	↓
State budget expenditures with a positive impact on climate change *** as percent of GDP	percent	3,3	3,8	2023	↑
Exports of low carbon technology products as percent of GDP	percent	0,0	0,1	2022	↑
Imports of low carbon technology products as percent of GDP	percent	2,0	1,8	2022	↓
Total trade in low carbon technology products as percent of GDP	percent	2,0	1,9	2022	↓
Risk indicators — ND-GAIN index	index	53,0	53,5	2022	↑
Vulnerability level according to the ND-GAIN index	index	0,3	0,3	2022	→
Readiness level according to the ND-GAIN index	Index	0,4	0,4	2022	→
Climate-driven INFORM Risk Indicator	Index	3,9	3,9	2022	→
Climate altering land cover index (CALCI)****	index	99,04	98,98	2022	↓
Temperature change with respect to a baseline climatology, corresponding to the period 1951–1980	Celsius	2,5	2,3	2023	↓

Sources: IMF, University of Notre Dame, Statistics Agency, Ministry of Economics and Finance, and CBU staff calculations.

Note: Positive changes in the indicator are represented by green symbols, negative changes by red symbols, and unchanged states by yellow symbols. In addition, the direction of these signs means changes in the value of indicators.

*Carbon dioxide (CO_2) equivalent is a metric used to compare the emissions from greenhouse gases on the basis of their global-warming potential (GWP), by converting the amounts of other gases to the equivalent amounts of carbon dioxide with the same global-warming potential. Carbon dioxide equivalents are usually expressed as million metric tons of carbon dioxide equivalents. The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated global warming potential.

**Total energy efficiency determines the amount of GDP per unit of consumption of total fuel and energy resources.

***State budget expenditures with a positive impact on climate change include the expenses for measures of climate change mitigation and climate change adaptation. These represent the expenditures directed at financing measures that result in the reduction of greenhouse gas emissions, as well as the expenditures aimed at timely adaptation to irreversible climate change impacts in order to prevent or reduce the related potential losses.

****The Climate Altering Land Cover Index (CALCI) is used to assess changes in land cover that may have a significant impact on climate change. It takes into account changes in land cover such as deforestation, level of urbanization and expansion of agricultural land. The year 2015 was selected as the base for the index since all countries reported land cover data for that year (2015 = 100).

The climate change dashboard for Uzbekistan indicates that the impact of climate transition risks on country's economy is moderate[107], while physical risks[108] are relatively low. In certain key sectors of the economy, high levels of total greenhouse gas and methane emissions, as well as upward trend in emissions, increase these sectors' vulnerability to technological, legal, and policy changes associated with the country's transition to low carbon economy.

The relatively small share of trade in low-carbon technology products in GDP, the low contribution of renewable energy sources to total electricity production, and the observed decline in total energy efficiency suggest that the adverse impact of climate change-related transition risks on the country's economy may be more pronounced. A slight decrease in the climate altering land cover index and in the average annual temperature change alleviates concerns regarding climate change-related physical risks.

Furthermore, as of the end of 2022, despite a rise in Uzbekistan's vulnerability to climate change, the country's reresilience to possible climate-related risks improved at a higher level, as reflected in the positive change in the ND-GAIN index[109]. This indicates that Uzbekistan's level of resilience to climate-related risks has been increasing compared to previous periods. In addition, rising share of State budget expenditures with a positive impact on climate change relative to GDP reflects an expansion in the scale of efforts to mitigate climate change in the country.

The impact of climate transition risks remains significant in the agriculture and energy sectors. In 2022, greenhouse gas emissions from the agriculture and energy sectors increased compared to 2021 and accounted for a substantial share of total greenhouse gas emissions. By the end of 2022, nearly 93% of total greenhouse gas emissions were attributable to the energy and agriculture sectors. This indicates that these sectors may be vulnerable to transition risks arising from legislative and technological changes associated with Uzbekistan's transition to a low-carbon economy.

The scale of physical climate risks are establishing at a slightly lower level. By the end of 2023, the average temperature in Uzbekistan increased by 2,3ºC relative to baseline climatology corresponding to the period 1951–1980, representing 0,2ºC slowdown compared with 2022. The average temperature in Uzbekistan is rising faster relative to the target[110] set under Paris Agreement to keep global warming below 2ºC relative to the pre-industrial period (1850–1900), highlighting physical risks associated with climate change in Uzbekistan remain persistent.

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[107] Transition risks are related to the process of adaptation to a low-carbon economy. During such an adjustment, changes in climate change mitigation and adaptation policies can affect the value of financial assets and liabilities.

[108] Physical risks are the economic costs due to the intensification of climate-related extreme weather events, which can reduce the value of financial assets or increase liabilities.

[109] Detailed information on the ND-GAIN index is presented in the Financial Stability Report for 2023.

[110] United Nations. (2015). Paris Agreement.

Debt Burden Survey

This survey is conducted by the CBU to gauge the level of household debt burden. Respondents are required to answer the survey questions on behalf of their household. A household is a group of individuals living together at a certain accommodation who manage some, or all of their income and expenses collectively.

The survey is completely anonymous. The CBU does not collect or disclose respondents' personal information to any third parties.

The survey consists of 15 questions.

1. Please indicate your current area of living:

- Republic of Karakalpakstan
- Andijan region
- Bukhara region
- Jizzakh region
- Kashkadarya region
- Kashkadarya region
- Khorezm region
- Namangan region
- Samarkand region
- Surkhandarya region
- Syrdarya region
- Tashkent region
- Fergana region
- Tashkent city

2. How many members are there in your household?

● 1 ● 2 ● 3 ● 4 ● 5 ● 6 ● 7 ● 8 or more

3. Select the primary types of employment of your household members:
You can choose multiple options

- agriculture, forestry, and fishing
- industry
- construction
- trade
- driving, freight transport, and delivery services
- information and communication

- finance (bank, insurance and others)
- education
- healthcare and social services
- food service/catering
- accommodation (hotel)
- arts, entertainment, and recreation
- entrepreneurship
- other

4. What is the average monthly income of your household from primary employment?
- up to 2 million UZS
- from 2 million UZS to less than 4 million UZS
- from 4 million UZS to less than 6 million UZS
- from 6 million UZS to less than 8 million UZS
- from 8 million UZS to less than 10 million UZS
- from 10 million UZS to less than 12 million UZS
- from 12 million UZS to less than 14 million UZS
- from 14 million UZS to less than 16 million UZS
- from 16 million UZS to less than 18 million UZS
- from 18 million UZS to less than 20 million UZS
- from 20 million UZS to less than 22 million UZS
- from 22 million UZS to less than 24 million UZS
- from 24 million UZS to less than 26 million UZS
- from 26 million UZS to less than 28 million UZS
- from 28 million UZS to less than 30 million UZS
- 30 million UZS and more

5. Do your household members have additional stable source of income (e.g.., renting property, land, or vehicles, interest income from bank deposits, and others)?
- yes
- no

6. What is your household's average monthly additional income?
- up to 2 million UZS
- from 2 million UZS to less than 4 million UZS
- from 4 million UZS to less than 6 million UZS
- from 6 million UZS to less than 8 million UZS
- from 8 million UZS to less than 10 million UZS
- 10 million UZS and more

7. Do you or any members of your household currently have any loans or debt obligations?
- yes
- no

8. What type of loans or debt obligations are these?
You can choose multiple options

• bank loan

• loans from non-bank credit organizations (pawnshops, microfinance organizations, leasing companies and others)

• debt to non-financial organizations (e.g.., installment purchases of residential property, car, household appliances, and others directly from construction companies, car dealers, or stores)

• other

9. What were the objectives of these loans or debts?
You can choose multiple options

• purchase or renovation of real estate

• vehicle purchase

• purchase of consumer goods (household appliances, furniture, and others)

• development of private entrepreneurship

• medical treatment

• education

• wedding expenses

• vacation or travel

• daily living expenses

• loan repayment

• other

10. What is the total monthly payment for these loans or debt obligations?

• up to 2 million UZS

• from 2 million UZS to less than 4 million UZS

• from 4 million UZS to less than 6 million UZS

• from 6 million UZS to less than 8 million UZS

• from 8 million UZS to less than 10 million UZS

• from 10 million UZS to less than 12 million UZS

• from 12 million UZS to less than 14 million UZS

• from 14 million UZS to less than 16 million UZS

• from 16 million UZS to less than 18 million UZS

• from 18 million UZS to less than 20 million UZS

• 20 million UZS and more

11. What is the remaining maturity on these loans or debt obligations?

• up to 1 year

• more than 1 year to less than 2 years

• more than 2 years to less than 3 years

• more than 3 years to less than 4 years

• more than 4 years to less than 5 years

• 5 years and more

12. Do you experience difficulties in making timely repayments of your loans or debts (monthly payments)?

- yes
- no

13. In your opinion, how will your household's solvency change over the next 6 months?

- it will improve
- it will not change
- it will deteriorate

14. Do you or any members of your household have intensions for loan or debt over the next 6 months?

- yes
- no
- not sure

15. For what objectives do you intend to take these loans or credits?
You can choose multiple options

- purchase or renovation of real estate
- vehicle purchase
- purchase of consumer goods (household appliances, furniture, and others)
- private entrepreneurship
- medical treatment
- education expenses
- wedding expenses
- vacation or travel
- daily expenses
- loan repayment
- others

Thank you for participating in this survey!

Bayesian state space model (BSSM)

Bayesian state space model (BSSM) is considered more efficient than the state space model (SSM)[111] for estimating parameters with a high degree of confidence in short time series. In particular, BSSM provides opportunities for managing uncertainty and adapting parameters to observed data. It allows for rapid updating of posterior distributions[112], enabling better representation of dynamic changes in data over short time series.

BSSM treats all uncertain quantities as random variables and uses the laws of probability. These models are widely used in the fields of signal filtering and prediction. To quantify uncertainties in the model, posterior distributions over all the parameters are required. In particular, the model consists of an observable or measurement equation representing the level of interdependence and a transition equation[113] representing dynamic state variables:

$$y_t = Cx_t + Du_t + v_t$$
$$x_t = Ax_{t-1} + Bu_t + w_t .$$

Where,
y_t – vector of observable endogenous variables;
x_t – vector of hidden state variables;
u_t – vector of observable exogenous variables;
$A - kxk$ state dynamics matrix;
$C - pxk$ observation matrix;
$B - kxd$ input-to-state matrix;
$D - pxd$ input-to-observation matrix;
$v_t \sim N(0, R)$ – vector of measurement errors for the observation equation;
$w_t \sim N(0, Q)$ – vector of measurement errors for the state equation;
A, B, C and D matrices – matrices of estimated coefficients;
Q and R – covariance matrices for errors.

The displacements in the observation space can be learnt as parameters of the input-to-state and input-to-observation matrices. Since the hidden state is unobserved, state noise covariance matrix Q can be incorporated into the state dynamics matrix A. As a result, hidden state rescaled according to this change. Covariance matrix, R, of output noise can not be incorporated to observation matrix C since the data is observed. In particular, the output noise covariance matrix R, which is assumed diagonal, is defined through the precision vector ρ as follows:

$$R^{-1} = diag(\rho)$$

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[111] State space model (SSM) methodology is presented in the Financial Stability Report for 2023.

[112] Posterior distribution is the updated distribution of a parameter after observing the data.

[113] Beal, M. (2003). Variational Algorithms for Approximate Bayesian Inference. University of Cambridge.

Here, R denotes the covariance matrix of output noise, $diag(p)$ denotes a matrix with all off-diagonal elements equal to zero.

For conjugacy[114], each dimension of ρ is assumed to be gamma distributed with hyperparameters a and b. Prior distribution of ρ is defined as follows:

$$p(\rho|a,b) = \prod_{s=1}^{p} \frac{b^a}{\Gamma(a)} \rho_s^{a-1} \exp\{-b\rho_s\}.$$

The parameters and hyperparameters are linked through following probabilities:

$$p(a_{(j)}|\alpha) = N(a_{(j)}|0, diag(\alpha)^{-1})$$
$$p(b_{(j)}|\beta) = N(b_{(j)}|0, diag(\beta)^{-1})$$
$$j = 1,2,\dots,k$$
$$p(c_{(s)}|\rho_s,\gamma) = N(c_{(s)}|0, \rho_s^{-1} diag(\gamma)^{-1})$$
$$p(d_{(s)}|\rho_s,\delta) = N(d_{(s)}|0, \rho_s^{-1} diag(\delta)^{-1})$$
$$p(\rho_s|a,b) = Ga(\rho_s|a,b)$$
$$s = 1,2,\dots,p.$$

Where,

$a_{(j)} - j$th column of matrix A;

$b_{(j)} - j$th column of matrix B;

$c_{(s)} - s$th column of matrix C;

$d_{(s)} - s$th column of matrix D.

Figure 153. BSSM Overview
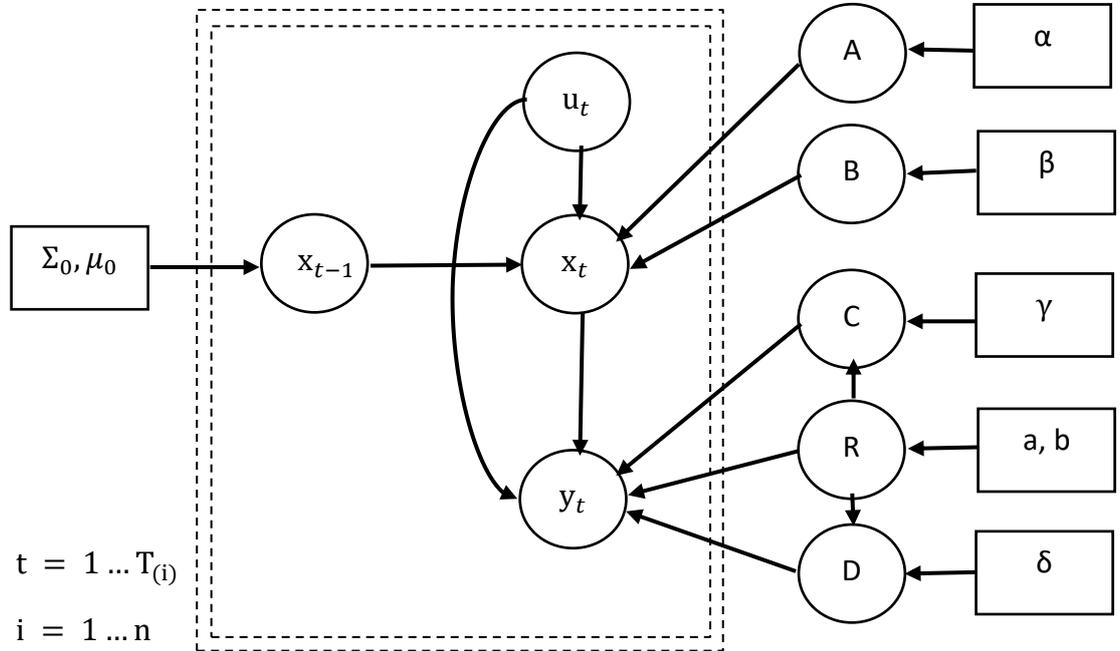
Source: Beal, M. (2003). Variational Algorithms for Approximate Bayesian Inference. University of Cambridge.

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[114] Conjugation is the method of expressing the prior and posterior distributions in the same form to simplify calculations.

In addition, for each row of matrix A, zero mean Gaussian prior has precision[115] equal to $diag(\alpha)$. Each row of C matrix is given a zero mean Gaussian prior with precision equal to $diag(\rho_s\gamma)$. The dependence of the precision of $c_{(s)}$ on the noise output precision ρ_s is motivated by conjugacy. Two more hyperparameter vectors β and δ are placed on the rows of the input-related matrices B and D. The covariances across the rows of A and B matrices remain unchanged. However, the covariances within the rows of matrices C and D may change as a result of ρ_s. If the jth column of A become zero, the jth column at time $t-1$ is not involved in generating the hidden state at time t. However, jth hidden dimension is used in producing covariance structure in the data at each time step.

BSSM is implemented in six steps. The first step is initialization, in which the auxiliary hidden state is set, prior distribution[116] of parameters is specified, and the log marginal probability[117] is evaluated using Jensen's inequality. The second step is Variational Bayesian M-step (Maximisation). At this step, the optimal forms of the posterior distributions of the parameters are determined and the natural parameter vector is calculated. Next, in the Variational Bayesian E-step (Expectation), the distributions of hidden state variables vector are determined. In the fourth step, the lower bound on the marginal probability, the value of F is computed. The fifth is the hyperparameter updating step, in which hyperparameters are adjusted to maximize lower bound of the marginal probability. In the final step, the lower bound estimate of the log marginal probability is compared with its previous value, and if the lower bound has increased, the Variational Bayesian M-step is repeated. These computational steps are continued iteratively until the lower bound estimate no longer exceeds its previous value.

Initialization

At first, for time $t = 0$, auxiliary hidden state x_0 is initialized. In this context, the auxiliary hidden state x_0 follows Gaussian distribution with mean μ_0, covariance Σ_0, and prior distribution is defined as follows:

$$p(x_0|\,\mu_0,\Sigma_0) = N(x_0|\,\mu_0,\Sigma_0)$$
$$\mu_0 \sim N(\mu_0|\,0, b_{\mu_0}I)$$
$$\Sigma_0 \sim \prod_{j=1}^{k} Ga\,(\Sigma_{0jj}^{-1}|\,a_{\Sigma_0}, b_{\Sigma_0})$$

Where,
x_0 – auxiliary hidden state;
μ_0 – mean of auxiliary hidden state;
Σ_0 – covariance of auxiliary hidden state.

In this case, the prior of x_1 via the state dynamics process is denoted by the following:

$$p(x_1|\,\mu_0,\Sigma_0,\theta) = \int dx_0\, p(x_0|\,\mu_0,\Sigma_0)\, p(x_1|\,x_0,\theta)$$
$$= N(x_1|\,A\mu_0 + Bu_1,\, A^T\Sigma_0 A\,+\,Q)\,.$$

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[115] In the distributions, the precision is equal to the inverse of the variance, meaning that the product of the precision and the variance is equal to one.

[116] Prior distribution is the distribution of the parameters before any data are observed.

[117] Marginal probability is the likelihood of an event occurring independently of other events.

For simplicity, the parameters are integrated into a single parameter vector $\theta = (A, B, C, D, R)$. In addition, the dependence of A, B, C and D matrices with hyperparameters is given by the following hyperprior distribution:

$$\alpha \sim \prod_{j=1}^{k} Ga\left(\alpha_{(j)} | a_{(\alpha)}, b_{(\alpha)}\right)$$
$$\beta \sim \prod_{c=1}^{d} Ga\left(\beta_{(c)} | a_{(\beta)}, b_{(\beta)}\right)$$
$$\gamma \sim \prod_{j=1}^{k} Ga\left(\gamma_{(j)} | a_{(\gamma)}, b_{(\gamma)}\right)$$
$$\delta \sim \prod_{c=1}^{d} Ga\left(\delta_{(c)} | a_{(\delta)}, b_{(\delta)}\right)$$

The marginal probability takes the following form:

$$p(y_{1:T}) = \int dA \, dB \, dC \, dD \, d\rho \, dx_{0:T} \, p(A, B, C, D, \rho, x_{0:T}, y_{1:T})$$

Due to some conditional independencies between the parameters of the model, it is possible to see how posterior distributions for the dynamics and output processes decompose. The full joint probability for parameters, hidden variables and observed data, taking into account the inputs, is given as follows:

$$p(A, B, C, D, \rho, x_{0:T}, y_{1:T} | u_{1:T}) =$$
$$p(A|\alpha)p(B|\beta)p(\rho|a, b)p(C|\rho, \gamma)p(D|\rho, \delta)p(x_0| \mu_0, \Sigma_0) \cdot$$
$$\prod_{t=1}^{T} p(x_t| x_{t-1}, A, B, u_t) \, p(y_t| x_t, C, D, \rho, u_t)$$

Next, the dependence on the input sequence $u_{1:T}$ is dropped and inputs is left as implicit. A distribution $q(\theta, x)$ over the parameters and hidden variables is introduced. By applying Jensen's inequality lower bound the marginal probability is estimated:

$$\ln p(y_{1:T}) = \ln \left(\int dA \, dB \, dC \, dD \, d\rho \, dx_{0:T} \, p(A, B, C, D, \rho, x_{0:T}, y_{1:T}\right) \geq$$
$$\int dA \, dB \, dC \, dD \, d\rho \, dx_{0:T} \, q(A, B, C, D, \rho, x_{0:T}) \ln \frac{p(A,B,C,D,\rho,x_{0:T},y_{1:T})}{q(A,B,C,D,\rho,x_{0:T})} = F$$

The next step in the variational approximation is to assume some approximate form for the distribution $q(\cdot)$. First, hidden variables and parameters are separated based on conditional independency:

$$q(A, B, C, D, \rho, x_{0:T}) = q_\theta(A, B, C, D, \rho)q_x(x_{0:T})$$
$$q(A, B, C, D, \rho, x_{0:T}) = q_{AB}(A, B) \, q_{CD\rho}(C, D, \rho) \, q_x(x_{0:T}) \, .$$

To simplify the estimation of the lower bound of the log marginal probability, the following terms of conditional probability are used:

$$q_{AB}(A, B) = q_B(B) \, q_A(A|B)$$
$$q_{CD\rho}(C, D, \rho) = q_\rho(\rho) \, q_D(D|\rho) \, q_C(C|D, \rho)$$

Using the above terms, the lower bound of the log marginal probability, F is expressed as the following sum:

$$F = \int dB \, q_B(B) \ln \frac{p(B|\beta)}{q_B(B)} + \int dB \, q_B(B) \int dA \, q_A(A|B) \ln \frac{p(A|\alpha)}{q_A(A|B)} +$$
$$\int d\rho \, q_\rho(\rho) \ln \frac{p(\rho|a,b)}{q_\rho(\rho)} + \int d\rho \, q_\rho(\rho) \int dD q_D(D|\rho) \ln \frac{p(D|\rho,\delta)}{q_D(D|\rho)} +$$
$$\int d\rho \, q_\rho(\rho) \int dD \, q_D(D|\rho) \int dC \, q_C(C|\rho,D) \ln \frac{p(C|\rho,\gamma)}{q_C(C|\rho,D)} -$$
$$\int dx_{0:T} \, q_x(x_{0:T}) \ln q_x(x_{0:T}) + \int dB \, q_B(B) \int dA \, q_A(A|B) \int d\rho \, q_\rho(\rho) \cdot$$
$$\int dD \, q_D(D|\rho) \int dC \, q_C(C|\rho,D) \int dx_{0:T} \, q_x(x_{0:T}) \ln p(x_{0:T}, y_{1:T}|A,B,C,D,\rho) =$$
$$F(q_x(x_{0:T}), q_B(B), q_A(A|B), q_\rho(\rho), q_D(D|\rho), q_C(C|\rho,D))$$
$$H(q_x(x_{0:T})) = - \int dx_{0:T} q_x(x_{0:T}) \ln q_x(x_{0:T})$$

The lower bound of the log marginal probability depends on the hyperparameters. The optimum forms of these approximate posteriors can be found by setting functional derivatives of F equal to zero with respect to each distribution over parameters and hidden variable sequences.

Variational Bayesian M-step (Maximisation), VBM

In this step, the variational posterior distributions over the parameters are determined by applying Bayesian theorem and from these the expected natural parameter vector is computed. The posterior distribution is factorized in the following form:

$$q_\theta(A,B,C,D,\rho) = \prod_{j=1}^{k} q(b_{(j)}) q(a_{(j)}|b_{(j)}) \prod_{s=1}^{p} q(\rho_s) \cdot$$
$$q(d_{(s)}|\rho_s) q(c_{(s)}|\rho_s, d_{(s)})$$

Where,
$b_{(j)}$ —jth row of B matrix;
$a_{(j)}$ —jth row of A matrix;
$d_{(s)}$ —sth row of D matrix;
$c_{(s)}$ —sth row of C matrix.

Some statistics of the input and output variable vectors, required for the calculations, is defined as follows:

$$\ddot{U} = \sum_{t=1}^{T} u_t \, u_t^T$$
$$U_y = \sum_{t=1}^{T} u_t \, y_t^T$$
$$\ddot{Y} = \sum_{t=1}^{T} y_t \, y_t^T$$

The sufficient statistics used to compute the posterior distributions of the parameters and the natural parameter vector are obtained using the following equations:

$$W_A = \sum_{t=1}^{T} <x_{t-1}x_{t-1}^T> = \sum_{t=1}^{T} \Upsilon_{t-1,t-1} + \omega_{t-1}\omega_{t-1}^T$$

$$G_A = \sum_{t=1}^{T} <x_{t-1}>u_t^T = \sum_{t=1}^{T} \omega_{t-1} u_t^T$$
$$\tilde{M} = \sum_{t=1}^{T} u_t <x_t^T> = \sum_{t=1}^{T} u_t \omega_t^T$$
$$S_A = \sum_{t=1}^{T} <x_{t-1}x_t^T> = \sum_{t=1}^{T} \Upsilon_{t-1,t} + \omega_{t-1}\omega_t^T$$
$$W_C = \sum_{t=1}^{T} <x_t x_t^T> = \sum_{t=1}^{T} \Upsilon_{t,t} + \omega_t \omega_t^T$$
$$G_c = \sum_{t=1}^{T} <x_t>u_t^T = \sum_{t=1}^{T} \omega_t u_t^T$$
$$S_c = \sum_{t=1}^{T} <x_t>y_t^T = \sum_{t=1}^{T} \omega_t y_t^T.$$

The posterior distributions for A and B are defined by the following equations:

$$q_B(B) = \prod_{j=1}^{k} N(b_{(j)}| \Sigma_B \bar{b}_{(j)}, \Sigma_B)$$
$$q_A(A|B) = \prod_{j=1}^{k} N(a_{(j)}| \Sigma_A [S_{A(j)} - G_A b_{(j)}], \Sigma_A)$$
$$\Sigma_A^{-1} = diag(\alpha) + W_A$$
$$\Sigma_B^{-1} = diag(\beta) + \ddot{U} - G_A^T \Sigma_A G_A$$
$$\bar{B} = \hat{M}^T - S_A^T \Sigma_A G_A$$
$$q_A(A) = \prod_{j=1}^{k} N(a_{(j)}| \Sigma_A [S_{A(j)} - G_A \Sigma_B \bar{b}_{(j)}], \tilde{\Sigma}_A)$$
$$\tilde{\Sigma}_A = \Sigma_A + \Sigma_A G_A \Sigma_B G_A^T \Sigma_A$$

Here, $\bar{b}_{(j)}$ denotes jth row of $\bar{B}$ matrix, while $S_{A(j)}$ defines jth column of S_A matrix.

Additionally, the posterior distributions over ρ, C and D are determined by the following:

$$q_\rho(\rho) = \prod_{s=1}^{p} Ga(\rho_s| a + \frac{T}{2}, b + \frac{1}{2}G_{ss})$$
$$q_D(D|\rho) = \prod_{s=1}^{p} N(d_{(s)}| \Sigma_D \bar{d}_{(s)}, \rho_s^{-1}\Sigma_D)$$
$$q_C(C|D, \rho) = \prod_{s=1}^{p} N(c_{(s)}| \Sigma_C [S_{C(s)} - G_C d_{(s)}], \rho_s^{-1}\Sigma_C)$$
$$\Sigma_C^{-1} = diag(\gamma) + W_C$$
$$\Sigma_D^{-1} = diag(\delta) + \ddot{U} - G_C^T \Sigma_C G_C$$
$$G = \ddot{Y} - S_C^T \Sigma_C S_C - \bar{D}\Sigma_D \bar{D}^T$$
$$\bar{D} = U_Y^T - S_C^T \Sigma_C G_C$$
$$q_C(C|\rho) = \prod_{s=1}^{p} N(c_{(s)}| \Sigma_C [S_{C(s)} - G_C \Sigma_D \bar{d}_{(s)}], \rho_s^{-1}\hat{\Sigma}_C)$$
$$\hat{\Sigma}_C = \Sigma_C + \Sigma_C G_C \Sigma_D G_C^T \Sigma_C$$

Here, $\bar{d}_{(s)}$ and $S_{C(s)}$ denote sth row of $\bar{D}$ and sth column of S_C matrices, respectively.

In the Variational Bayesian M-step (Maximisation), $\varphi(\theta)$ is considered the vector of expected natrural parameters. These will then be used in the Variational Bayesian E-step (Expectation) which infers the distribution $q_x(x_{0:T})$ over hidden states in the system. The vector of relevant natural parameters is given by the following form:

$$\varphi(\theta) = \varphi(A, B, C, D, R) = [A, A^T A, B, A^T B, C^T R^{-1}C,$$
$$R^{-1}C, C^T R^{-1}D, B^T B, R^{-1}, \ln|R^{-1}|, D^T R^{-1}D, R^{-1}D].$$
$$<A> = [S_A - G_A \Sigma_B \bar{B}^T]^T \Sigma_A$$
$$<A^T A> = <A>^T<A> + k [\Sigma_A + \Sigma_A G_A \Sigma_B G_A^T \Sigma_A]$$

$$< B > = \bar{B}\Sigma_B$$
$$< A^T B > = \Sigma_A [S_A < B > - G_A \{< B >^T < B > + k\Sigma_B\}]$$
$$< B^T B > = < B >^T < B > + k\Sigma_B$$
$$< \rho_s > = \bar{\rho}_s = \frac{a_\rho + T/2}{b_\rho + G_{ss}/2}$$
$$< ln\rho_s > = \overline{ln\rho_s} = \Psi\left(a_\rho + \frac{T}{2}\right) - \ln(b_\rho + \frac{G_{ss}}{2})$$
$$< R^{-1} > = diag(\bar{\rho})$$
$$< C > = [S_C - G_C\Sigma_D\bar{D}^T]^T \Sigma_C$$
$$< D > = \bar{D}\Sigma_D$$
$$< C^T R^{-1} C > = < C >^T diag(\bar{\rho}) < C > + p [\Sigma_C + \Sigma_C G_C \Sigma_D G_C^T \Sigma_C]$$
$$< R^{-1}C > = diag(\bar{\rho}) < C >$$
$$< C^T R^{-1} D > = \Sigma_C [S_C diag(\bar{\rho}) < D > - G_C < D >^T diag(\bar{\rho}) < D > - pG_C\Sigma_D]$$
$$< R^{-1}D > = diag(\bar{\rho}) < D >$$
$$< D^T R^{-1} D > = < D >^T diag(\bar{\rho}) < D > + p\Sigma_D .$$

Here, $<\cdot>$ denotes expectation with respect to the variational posterior.

Variational Bayesian E-step (Expectation), VBE

The posterior distribution of the hidden state variable vector $x_{0:T}$ is jointly Gaussian over the time steps, and the logarithm of the posterior distribution of the hidden state vector is expressed as follows:

$$\ln q_x(x_{0:T}) = -\ln Z + < \ln p(A, B, C, D, \rho, x_{0:T}, y_{1:T}) >$$
$$= -\ln Z' + < \ln p(x_{0:T}, y_{1:T}| A, B, C, D, \rho) >$$
$$Z' = \int dx_{0:T} \, exp < \ln p(x_{0:T}, y_{1:T}| A, B, C, D, \rho) > .$$
$$\ln Z' = \sum_{t=1}^{T} \ln \zeta_t{}'(y_t)$$
$$\ln \zeta_t{}'(y_t) = -\frac{1}{2}[< \ln|2\pi R| > - \ln |\Sigma_{t-1}^{-1}\Sigma_{t-1}^*\Sigma_t| + \mu_{t-1}^T \Sigma_{t-1}^{-1}\mu_{t-1} - \mu_t^T \Sigma_t^{-1}\mu_t$$
$$+ y_t^T < R^{-1} > y_t - 2y_t^T < R^{-1}D > u_t + u_t^T < D^T R^{-1}D > u_t$$
$$- (\Sigma_{t-1}^{-1}\mu_{t-1} - < A^T B > u_t)^T \Sigma_{t-1}^* (\Sigma_{t-1}^{-1}\mu_{t-1} - < A^T B > u_t) .$$

$\alpha_t(x_t)$ is posterior over the hidden state at time t given observed data up to time t ($t = \{1, 2, \dots, T\}$). At the same time, filtered mean μ_t and covariance Σ_t of hidden state $\alpha_t(x_t)$ are estimated:

$$\alpha_t(x_t) \equiv p(x_t| y_{1:t}) .$$

In addition, recursion of $\alpha_t(x_t)$ with previous $\alpha_{t-1}(x_{t-1})$ is formed as following form:

$$\alpha_t(x_t) = \int dx_{t-1} \frac{p(x_{t-1}| y_{1:t-1}) \, p(x_t| x_{t-1})p(y_t| x_t)}{p(y_t| y_{1:t-1})}$$
$$= \frac{1}{\zeta_t(y_t)} \int dx_{t-1} \alpha_{t-1}(x_{t-1}) \, p(x_t| x_{t-1}) \, p(y_t| x_t)$$

$$= \frac{1}{\zeta_t(y_t)} \int dx_{t-1} N(x_{t-1}| \mu_{t-1}, \Sigma_{t-1}) N(x_t| Ax_{t-1}, I) N(y_t| Cx_t, R)$$

$$= N(x_t| \mu_t, \Sigma_t)$$

Here, $\zeta_t(y_t) \equiv p(y_t| y_{1:t-1})$ is the filtered output probability.

$$\Sigma_{t-1}^* = (\Sigma_{t-1}^{-1} + A^T A)^{-1}$$
$$x_{t-1}^* = \Sigma_{t-1}^*[\Sigma_{t-1}^{-1}\mu_{t-1} + A^T x_t]$$
$$\Sigma_t = [I + C^T R^{-1} C - A\Sigma_{t-1}^* A^T]^{-1}$$
$$\mu_t = \Sigma_t [C^T R^{-1} y_t + A\Sigma_{t-1}^* \Sigma_{t-1}^{-1}\mu_{t-1}].$$

At each step the normalising constant $\zeta_t(y_t)$, obtained as the denominator of $\alpha_t(x_t)$, contributes to the calculation of the probability of the data. In this context, the probability of the data can be written in the following form:

$$p(y_{1:T}) = p(y_1)p(y_2| y_1) \dots p(y_t| y_{1:t-1}) \dots p(y_T| y_{1:T-1}) =$$
$$p(y_1) \prod_{t=2}^{T} p(y_t| y_{1:t-1}) = \prod_{t=1}^{T} \zeta_t(y_t)$$
$$\zeta_t(y_t) = N(y_t| \varpi_t, \xi_t)$$
$$\xi_t = (R^{-1} - R^{-1} C\Sigma_t C^T R^{-1})^{-1}$$
$$\varpi_t = \xi_t R^{-1} C\Sigma_t A\Sigma_{t-1}^* \Sigma_{t-1}^{-1}\mu_{t-1}.$$

With these distributions, the probability of each observation y_t given the previous observations in the sequence is computed, and predictive mean and variance are assigned to the data at each time step as it arrives. However, this predictive distribution will change once the hidden state sequence has been smoothed. To obtain the posterior over the hidden state given all the data, the smoothed estimate γ of the hidden state is determined. In particular, $\gamma_t(x_t) = p(x_t|y_{1:T})$, the smoothed estimate of the hidden state, is expressed as follows:

$$\gamma_t(x_t) = p(x_t| y_{1:T}) = \int dx_{t+1}\, p(x_t, x_{t+1}| y_{1:T})$$

$$= \int dx_{t+1}\, p(x_t| x_{t+1}, y_{1:T})p(x_{t+1}| y_{1:T})$$

$$= \int dx_{t+1}\, p(x_t| x_{t+1}, y_{1:t})p(x_{t+1}| y_{1:T})$$

$$= \int dx_{t+1} \frac{p(x_t| y_{1:t})p(x_{t+1}| x_t)}{\int dx'_t\, p(x'_t| y_{1:t})p(x_{t+1}| x'_t)} p(x_{t+1}| y_{1:T})$$

$$= \int dx_{t+1} \left[\frac{\alpha_t(x_t)\, p(x_{t+1}|x_t)}{\int dx'_t\, \alpha_t(x'_t)\, p(x_{t+1}|x'_t)}\right]\gamma_{t+1}(x_{t+1})$$

$$\gamma_t(x_t) = N(x_t| \omega_t, \Upsilon_{tt})$$
$$K_t = (\Upsilon_{t+1,t+1}^{-1} + A\Sigma_t^* A^T)^{-1}$$
$$\Upsilon_{tt} = [\Sigma_t^{*-1} - A^T K_t A]^{-1}$$
$$\omega_t = \Upsilon_{tt} [\Sigma_t^{-1}\mu_t + A^T K_t(\Upsilon_{t+1,t+1}^{-1}\omega_{t+1} - A\Sigma_t^* \Sigma_t^{-1}\mu_t)].$$

In this case, once the data at time t, y_t has been filtered, $\alpha_t(x_t)$ is used instead of hidden variables.

To estimate the states at different time steps, parallel recursion $\beta_t(x_t) = p(y_{t+1:T}|x_t)$ is calculated:

$$\beta_{t-1}(x_{t-1}) = \int dx_t\, p(x_t|\,x_{t-1})\, p(y_t|\,x_t)p(y_{t+1:T}|\,x_t) =$$
$$\int dx_t\, p(x_t|\,x_{t-1})\, p(y_t|\,x_t)\, \beta_t(x_t) \propto N(x_{t-1}|\,\eta_{t-1}, \Psi_{t-1})\,.$$

$\beta_T(x_T) = 1$ is defined in $\Psi_T^{-1} = 0$ form to satisfy the end condition. The recursion proceeds from $t = T$ to $t = 1$. At the last step of this recursion, the probability of all data on the auxiliary hidden state variable x_0 is determined:

$$\Psi_t^{*} = (I + C^T R^{-1} C + \Psi_t^{-1})^{-1}$$
$$\Psi_{t-1} = [A^T A - A^T \Psi_t^{*} A]^{-1}$$
$$\eta_{t-1} = \Psi_{t-1}\, A^T \Psi_t^{*}[C^T R^{-1} y_t + \Psi_t^{-1} \eta_t]\,.$$

Using the formulas presented above, $\{\eta_t, \Psi_t\}_{t=0}^{T}$ is computed over the interval from $t = 0$ to $t = T$.

In the Variational Bayesian scenario the marginals cannot be obtained easily with backward sequential pass and instead they are computed by combining α and β messages described as follows. In particular, ω_t and $\Upsilon_{t,t}$ are computed for $t = \{0, 1, 2, \dots, T-1\}$ in the following form:

$$p(x_t|\,y_{1:T}) \propto p(x_t|\,y_{1:t})p(y_{t+1:T}|\,x_t) =$$
$$\alpha_t(x_t)\,\beta_t(x_t) = N(x_t|\,\omega_t, \Upsilon_{tt})$$
$$\Upsilon_{t,t} = [\Sigma_t^{-1} + \Psi_t^{-1}]^{-1}$$
$$\omega_t = \Upsilon_{t,t}\,[\Sigma_t^{-1}\mu_t + \Psi_t^{-1}\eta_t]\,.$$

For $t = \{0, 1, 2, \dots, T-1\}$, taking into account all observations, the cross-covariance of the hidden variable vector, $\Upsilon_{t,t+1}$, is defined as follows:

$$\Upsilon_{t,t+1} = \Sigma_t^{*} A^T \Upsilon_{t+1,t+1}.$$

Calculation of the lower bound on the log marginal probability

Due to the complexity of directly computing the log marginal probability, its lower bound is evaluated and denoted by F as the estimate of the lower bound of the log marginal probability. As this estimate of the lower bound of the log marginal probability is itself a complex function, it is derived through several steps and ultimately expressed as a simplified summ.

KL (Kullback-Leibler) is divergence between two normal or two gamma distributions over the same variables and computed using the following equations for a pair of variables J and K:

$$KL(J) = \int dJ\, q(J)\, \ln\frac{q(J)}{p(J)}$$

$$KL(J|K) = \int dJ\, q(J|K)\, \ln\frac{q(J|K)}{p(J|K)}$$

$$< KL(J|K) >_{q(K)} = \int dK\, q(K)\, KL(J|K)$$

Where,

$KL(J)$ – KL divergence,

$KL(J|K)$ – conditional KL,

$< KL(J|K) >_{q(K)}$ – expected conditional KL.

By applying these equations, F can be redefined in the following form:

$$F = -KL(B) - < KL(A|\,B) >_{q(B)} - KL(\rho) - < KL(D|\,\rho) >_{q(\rho)} -$$
$$< KL(C|\,\rho, D) >_{q(\rho,D)} + H(q_x(x_{0:T})) +$$
$$< \ln p(x_{1:T}, y_{1:T}|\,A, B, C, D, \rho) >_{q(A,B,C,D,\rho)q(x_{1:T})} .$$
$$H(q_x(x_{0:T})) = -\int dx_{0:T}\, q_x(x_{0:T}) \ln q_x(x_{0:T}) =$$
$$-\int dx_{0:T}\, q_x(x_{0:T})[-\ln Z' + < \ln p(x_{0:T}, y_{1:T}|\,A, B, C, D, \rho, \mu_0, \Sigma_0) >_{q_\theta(A,B,C,D,\rho)}]$$
$$= \ln Z' - < \ln p(x_{0:T}, y_{1:T}|\,A, B, C, D, \rho, \mu_0, \Sigma_0) >_{q_\theta(A,B,C,D,\rho)q_x(x_{0:T})}$$

Using $H(q_x(x_{0:T}))$, the equation for F is transformed into the following simplified form, which facilitates its computation:

$$F = -KL(B) - < KL(A|\,B) >_{q(B)} - KL(\rho) - < KL(D|\,\rho) >_{q(\rho)} -$$
$$< KL(C|\,\rho, D) >_{q(\rho,D)} + \ln Z'.$$

Updating hyperparameters

The hyperparameters α, β, γ, δ, a, b, and the prior parameters Σ_0 and μ_0, are updated to maximise the lower bound on the marginal probability. In this context, hyperparameters is updated as follows:

$$\alpha_j^{-1} \leftarrow \frac{1}{k}\big[k\Sigma_A + \Sigma_A[S_A S_A{}^T - 2G_A < B >^T S_A{}^T +$$
$$G_A\{k\Sigma_B + < B >^T < B >\}G_A{}^T] \Sigma_A\big]_{jj}$$

$$\beta_j^{-1} \leftarrow \frac{1}{k}[k\Sigma_B + < B >^T < B >]_{jj}$$

$$\gamma_j^{-1} \leftarrow \frac{1}{p}[p\Sigma_C + \Sigma_C[S_C diag(\bar{\rho})S_C{}^T - 2S_C diag(\bar{\rho}) < D > G_C{}^T + pG_C\Sigma_D G_C{}' +$$
$$G_C < D >^T diag(\bar{\rho}) < D > G_C{}^T] \Sigma_C]_{jj}$$

$$\delta_j^{-1} \leftarrow \frac{1}{p}[p\Sigma_D + < D >^T diag(\bar{\rho}) < D >]_{jj}$$

Here, $[\cdot]_{jj}$ denotes (j, j)th element of matrix $[\cdot]$.

In order to maximise the probability of the hidden state sequence under the prior, the hyperparameters of the prior over the auxiliary hidden state are set according to the distribution of the smoothed estimate of x_0:

$$\Sigma_0 \leftarrow \Upsilon_{0,0}$$
$$\mu_0 \leftarrow \omega_0$$

The hyperparameters a and b governing the prior distribution over the output noise, $R = diag(\rho)$, are set to the fixed point of the equations:

$$\Psi(a) = \ln b + \frac{1}{p}\sum_{s=1}^{p}\overline{\ln \rho_s}$$
$$\frac{1}{b} = \frac{1}{pa}\sum_{s=1}^{p}\overline{\rho_s}$$

Comparison of the lower bound estimates on the log marginal probability

As the estimate of the lower bound of the log marginal probability is determined, in the final step, this estimate is compared with its value from the previous iteration. If the lower bound has increased relative to its value in the preceding iteration, the computations are repeated starting from the Variational Bayesian M-step. This iterative process continues until the lower bound no longer increases. When the estimate of the lower bound on the log marginal probability remains unchanged from its previous value, it is considered to have reached its optimal value. At this stage, the parameters obtained through the hyperparameters also achieve their optimal values. Based on the identified parameters and the hidden variables, the observable endogenous variable Y is estimated.

Table 6. Solvency Top-down Macro Stress Test Tool

Basic parameters	A total of 35 banks, 10 of which are state-owned, were taken into account. As of July 1, 2024, the assets of banks included in the macro stress test constituted 100% of the assets of the banking system. All banks must comply with the capital adequacy requirements set by the CBU. The starting period for the macro stress test is H1 2024.
Stress test horizon	3 years (from H1 2024 to H1 2027)
Assumptions	Dynamic balance: – The amount of total loans and other bank assets, including securities issued by the Ministry of Finance or CBU, securities of private organizations, claims on other banks, and the CBU, increases based on the scenarios of the annual loan outstanding growth; – Asset composition changes during the stress test period; – Banks form their own capital from retained earnings.
Macroeconomic scenarios	Macroeconomic scenarios do not represent forecasts of the indicators. Instead, high-impact risks (tail risks) that have a very low probability of occurring are designed to construct adverse scenarios and assess the resilience of banks in Uzbekistan. In the baseline scenario, the future state of the economy is projected based on the continuation of current economic trends. The internal and external shocks (tail risks) that have a low probability of materializing in the future but have a high negative impact on the banking system are taken into account in the adverse scenario. Under the adverse scenario, the policy rate is estimated on the basis of the Taylor rule, taking into account growth rates in inflation and real GDP. The impacts of inflation and real GDP growth on the policy rate are incorporated at a ratio of 3:1, respectively. Furthermore, loan growth rate under the adverse scenario is determined to be equal to the nominal GDP growth rate, calculated based on the product of the inflation rate and the real GDP growth rate.

	The annual values of macroeconomic indicators for future periods under the scenarios are converted into quarterly values using cubic spline interpolation for use in the satellite models.

Regulatory standards	Capital adequacy requirements are set for total regulatory capital, CET1 and Tier 1, and the minimum requirement is established for the leverage ratio.
	
	Banks use a standardized approach[118] in calculating RWA for credit risk.
	
	Assets are classified into five different groups according to their quality, and the following provisions are created for them as determined by the CBU [119]:
	
	   – 1% for "standard" assets;
	
	   – 20% for "substandard" assets;
	
	   – 25% for "non-satisfactory" assets;
	
	   – 50% for "doubtful" assets;
	
	   – Reserves for "loss" assets must be formed using 100% of bank's expenses.
	
	"Non-satisfactory", "doubtful" and "loss" loans that are more than 90 days past due are considered NPLs.

Methodology and types of risks	Based on macroeconomic scenarios, the components of the profit and loss module are evaluated. **Credit risk.** In credit risk, the NPL share is estimated for future periods using a satellite model based on its lagged value, and the scenario-based values of GDP growth and loan interest rate. The effect of a sharp UZS depreciation on the NPLs in FX was calculated based on the practice observed in countries similar to Uzbekistan. When classifying assets by quality and creating provisions for them, loans are divided into three categories: standard, watch, and NPL. In subsequent periods, the change in the share of watch loans by sector in performing loans (total loans less NPLs) follows a similar pattern to the change in the NPL share. This change is set according to the combined movement of watch loans and NPLs in Uzbekistan and similar countries. Through this process, the

[118] Bank for International Settlements. Calculation of RWA for credit risk, standardized approach.

[119] O'zbekiston Respublikasi Markaziy banki boshqaruvining 2021 yil 19 noyabrdagi "Tijorat banklarida aktivlar sifatini tasniflash va aktivlar bo'yicha ehtimoliy yo'qotishlarni qoplash uchun zaxiralar shakllantirish hamda ulardan foydalanish tartibi to'g'risidagi nizomga o'zgartirish va qo'shimchalar kiritish haqida"gi 27/7–sonli qarori.

amount of standard and watch loans for subsequent periods is calculated, and provisions are formed for all types of loans. When calculating provisions for loans, the average provisioning indicator for NPLs is used for each bank, with additional provisions accounted for in the adverse scenario.

Market and currency risk. According to current regulations in Uzbekistan, banks are not required to revalue securities in their possession at market prices. Therefore, the book value of securities is reflected at base prices, and changes in market interest rates do not affect the value of securities.

However, the current regulation mandates the creation of reserves for securities that do not generate income for a certain period. Thus, the creation of additional reserves for securities of private organizations in the adverse scenario is considered. Furthermore, the macro stress test incorporates the profit or loss arising from the revaluation of assets and liabilities deonominated in FX. This assessment is based on the banks' disclosed currency positions and reflects the impact of fluctuations in the exchange rate.

Changes in NII under the impact of sharp interest rate fluctuations. Banks' NII is assessed through the difference between interest income and interest expenses arising from the rapid increase in interest rates, disaggregated by UZS and FX. In this context, the impact of interest rate changes is taken into account for interest rate–sensitive assets and liabilities with a remaining maturity of up to one year on banks' balance sheets.

The future values of performing loans, which constitute the primary source of interest income, are determined based on scenario-based growth rates of total loans and the share of NPLs estimated through a satellite model.

In determining the future values of bank liabilities that incur interest expenses, it is assumed that liability growth rates correspond to the loan growth rates under the respective scenarios.

NNII. The ratio of NNII to total assets is estimated for future periods using a satellite model based on the scenario-based values of GDP growth and the exchange rate.

The amount of NNII is calculated by multiplying total assets by the ratio of NNII to total assets as estimated through a satellite model.

Operating expenses. Since the ratio of operating expenses to total assets remained almost unchanged in previous periods, the growth of operating expenses for future periods is projected to follow the same growth rate as total assets.

	The growth rate of total assets is set to be the same as the growth rate of interest-bearing assets, which account for a large share of total assets.
	Dividends. Dividend payments for future periods are taken into account for banks whose net profit after tax (NPAT) is positive. The dividend payout ratio from NPAT is determined for each bank based on the dividend payout indicators of previous periods.
Capital requirements	Capital adequacy requirements set by the CBU for commercial banks [120]: • CET1 ratio is 8% of RWA • Tier 1 ratio is 10% (the CCoB is 3% of RWA) • CAR is 13% of RWA. If the amount of Tier 2 capital exceeds one-third of the amount of Tier 1 capital, the excess amount is not included in the regulatory capital. In addition, provisions for loans of "standard" classification, included in Tier 2 capital, should not exceed 1.25% of RWA. The minimum requirement for the leverage ratio is 6% [121].
Concentration risk	As an additional shock to the adverse scenario, the impact of the default of the largest borrowers on the banking system's total capital is considered. In this context, the LGD of 50% is assumed for the outstanding loans of defaulted large borrowers.
Risks associated with fluctuations in the asset market prices	The impact of a sharp decline in asset prices on the quality of the banks' loan portfolios and total capital is assessed as an additional shock in the adverse scenario. A sudden fall in asset prices lowers the market value of collateral used for securing loans, increasing the probability of loan losses for banks. The rise in the LTV ratio, caused by the lower market value of properties serving as collateral for mortgage and car loans issued by banks, is taken into account. It is assumed that borrowers may default on loans with LTV ratio exceeding 120% as a result of the sharp drop in house and car prices.
Contagion risk	In the adverse scenario, contagion risk is evaluated using the losses-tied-to-capital and unrecoverable-losses approaches: – In the approach, where losses from bank defaults are tied to capital, the extent of bank's losses from contagion risk is influenced by the defaulting bank's CAR. The lower the

[120] O'zbekiston Respublikasi Markaziy banki boshqaruvining 2021 yil 11 yanvardagi "Tijorat banklari kapitalining monandliliga qo'yiladigan talablar to'g'risidagi nizomga o'zgartirish va qo'shimchalar kiritish haqida"gi 28/22–sonli qarori.

[121] O'zbekiston Respudlikasi Markaziy banki boshqaruvining 2018 yil 31 martdagi "Tijorat banklari kapitalining monandligiga qo'yiladigan talablar to'g'risidagi nizomga o'zgartirish va qo'shimchalar kiritish haqida"gi 12/21–sonli qarori.

	failing bank's CAR, the greater the proportional losses incurred by banks that have financial connections with it, such as those that have provided loans to or placed deposits with defaulting bank.
	– In the approach, where losses from bank defaults are not recoverable, banks face the loss of all their loans to or deposits placed with a bank with a high probability of default, i.e., a bank with the CAR below the required minimum.
Result	Capital adequacy ratios (CET1, Tier 1 and CAR) and the leverage ratio, are the final results of the macro stress testing conducted for the entire banking system as well as for individual banks.

Table 7. Liquidity Stress Test Tool

Basic parameters	A total of 35 banks, 10 of which are state-owned, were taken into account. As of July 1, 2024, the assets of banks included in the liquidity stress test constituted 100% of the assets of the banking system. The starting period for the macro stress test is H1 2024.
Stress test horizon	1 year (from H1 2024 to H1 2025)
The essence of the liquidity stress test	In the liquidity stress test, banks' resilience to liquidity risk is assessed based on the projected cash flows under the scenarios. Over the time horizons considered in the liquidity stress test, situations where expected cash inflows fall short of corresponding cash outflows are considered indication of the potential materialization of liquidity risks within banks.
Scenarios	In the liquidity stress test, cash flow indicators are analyzed at both banking system and individual bank levels under the baseline and adverse scenarios. In the baseline scenario, factors for calculating the expected cash inflows and outflows for banks are determined in line with the recommendations of the Basel Committee. When determining the coefficients for expected cash inflows, the quality of bank assets and their liquidity levels are taken into account. The factors for calculating expected cash outflows, in turn, are established taking into account the characteristics of banks' liabilities. Under the adverse scenario, possible risks in the economy are reflected in higher expected cash outflows and lower cash inflows compared to the baseline scenario. Specifically, the adverse scenario reflects an increase in deposit withdrawals by households and corporates, extensions of loan repayment terms for certain borrowers by banks, a decline in market prices of government securities, and a rise in off-balance-sheet liabilities resulting from higher payments under guarantees and letters of credit.
Liquidity indicators	Across the relevant time horizons, banks' expected cash inflows should not fall below their cash outflows in total, national and FX currencies. In particular, to prevent liquidity problems arising from maturity mismatches, the cumulative expected net cash inflows across time buckets must remain positive at all times.

Cash flow indicators	To continuously monitor the expected liquidity of banks, liquidity stress tests may be conducted every 30 days.
	In liquidity stress test, banks' expected net cash inflow are evaluated based on scenarios. The difference between expected cash inflows and outflows over various time horizons represents the expected net cash inflow. Possible liquidity risk in banks is analyzed by aggregating the expected net cash inflows across different maturities.
	In the analysis of cash inflows, bank assets, including cash and other cash items, funds held with CBU excluding mandatory reserves, securities and investments on securities, loans and leasing provided to customers, as well as other assets, are classified by maturity.
	Expected cash inflows by maturity are determined by multiplying the volume of bank assets by the scenario-specific factors (representing expected cash inflow rates by asset type).
	In the analysis of cash outflows, bank liabilities are distributed by maturity, including deposits, amounts due to the CBU and other banks, liabilities for loans and leases, and other on-balance and off-balance sheet obligations. Expected cash outflows by maturity are determined by multiplying the volumes of various on-balance and off-balance sheet obligations by the scenario-specific factors (representing expected cash outflow rates by liability type).
Liquidity stress test advantages	In the liquidity stress test, unlike the LCR and NSFR ratios, cash flow indicators are analyzed over time intervals of non-maturing, 1 to 7 days, 7 to 30 days, 30 to 90 days, 90 to 180 days, and 180 to 365 days. This, in turn, allows for the identification of the timing of potential liquidity pressures in banks.
Exchange rate risk	As an additional shock to the adverse scenario, the impact of currency depreciation on expected cash flows has been assessed. In this context, the magnitude of the shock is based on the currency depreciation under the adverse scenario of the solvency macro stress test.
Result	The net cash flow indicators (difference between cash inflows and outflows) are the final results of the liquidity stress test conducted for the banking system as well as for individual banks.
	In addition, to assess the impact of banks with liquidity problem on the banking system, the share of assets in the total banking system assets is evaluated for banks with negative net cash inflows by currencies.

Table 8. Cash Flow Factors in Liquidity Stress Test in Baseline and Adverse Scenarios

Cash inflows and outflows	Baseline scenario	Adverse scenario
Cash inflows		
1. Cash and other cash items	100%	100%
2. Bank's funds in the CBU (excluding mandatory reserve)	100%	100%
3. Amounts due from other banks and financial organizations	100%	100%
4. Securities issued by the Government of the Republic of Uzbekistan and the CBU	100%	90%
5. Securities of low-risk countries	85%	85%
6. Securities issued by IMF, WBG, ADB, AIIB, EBRD, EIB, EIF, IsDB and the CEB.	100%	100%
7. Securities of leading companies of low-risk countries	50%	50%
8. Securities of mortgage refinancing organizations	75%	65%
9. Other securities	100%	100%
10. Customers' liabilities on drafts secured by letters of credit and trust documents, net	100%	100%
11. Customers' liabilities on unpaid acceptances to the bank, net	100%	100%
12. Loans and leases to the CBU, net	100%	100%
13. Loans and leases to other banks, net	100%	100%
14. Loans and leases to customers, net	50%	25%
15. Securities purchased under REPO agreements	100%	100%
16. Unrealized profit as a result of the revaluation of derivative instruments	100%	100%
17. FX trading and currency positions	100%	100%
18. Other assets	100%	100%
19. HQLA pledged as collateral	100%	100%
Cash outflows		
1. Household demand deposits	5%	20%
2. Household deposits pledged as loan collateral	100%	100%
3. Other deposits pledged as loan collateral	100%	100%
4. Demand deposits	40%	50%
5. Term deposits	40%	40%
6. Household deposits	5%	20%
7. Individuals' balances on bank cards	5%	20%
8. Other customers' balances on bank cards	40%	50%
9. Customers' deposits under letters of credit	-20%	-20%
10. Other deposits	40%	50%
11. Amounts due to the CBU	40%	40%
12. Other amounts due to the CBU (instant payments and clearing systems)	25%	25%
13. Amounts due to other banks' correspondent accounts	100%	100%
14. Accounts of other banks - Deposits	100%	100%

15. Amounts due to banks for payments made from bank cards	100%	100%
16. Other items	100%	100%
17. Unpaid acceptances of the bank	100%	100%
18. Liabilities for loans and leases	5%	5%
19. Securities issued by the bank	100%	100%
20. Subordinated debt	100%	100%
21. High-quality liquid securities sold under REPO agreements	100%	100%
22. Other securities sold under REPO agreements	100%	100%
23. Unrealized losses and other deferred income as a result of revaluation of derivative instruments	100%	100%
24. Clearing transactions	100%	100%
25. Other liabilities	100%	100%
26. Off-balance sheet items	5%	20%

Table 9. Current and Announced CCyB Rates, % of RWA

Country	Buffer rate as of July 1, 2024	Scheduled buffer rate in the upcoming period
Albania	↑ 0,25	
Armenia	→ 1,5	
Australia	→ 1	
Austria	→ 0	
Belgium	↑ 1	
Bulgaria	→ 2	
Chile	↑ 0,5	
Cyprus	↑ 1	
Croatia	↑ 1,5	
Czech	↓ 1,25	
Denmark	→ 2,5	
Estonia	→ 1,5	
France	→ 1	
Georgia	↑ 1	
Germany	→ 0,75	
Greece	→ 0	
Hong Kong	→ 1	
Hungary	↑ 0,5	01.07.2025: ↑1
Iceland	↑ 2,5	
Ireland	↑ 1,5	
Italy	→ 0	
Lithuania	→ 1	
Luxembourg	→ 0,5	
Moldova	→ 0	
Montenegro	→ 0	
Netherlands	↑ 2	
North Macedonia	→ 1	01.11.2024: ↑1,25 01.01.2025: ↑1,5
Norway	→ 2,5	
Poland	→ 0	
Portugal	→ 0	
Romania	→ 1	
Serbia	→ 0	
Singapore	→ 0	
Slovakia	→ 1,5	
Slovenia	→ 0,5	01.01.2025: ↑1
South Korea	↑ 1	
Spain	→ 0	01.10.2024: ↑0,5
Sweden	→ 2	
Switzerland	→ 2,5	
United Kingdom	→ 2	

Sources: National authorities.

Table 10. CARs and Buffers Across Countries as of July 1, 2024, % of RWA

Country	Minimum capital requirements			Capital buffer requirements			
	CET1[122]	Tier 1[123]	CAR	CCoB	CCyB	SyRB	D-SIB buffer
Albania	6,75	9	12	2	0	0	0,5–3
Belgium	4,5	6	8	2,5	0,5	6	0,75–1,5
Canada	4,5	6	8	2,5	3,5	0	0
Croatia	4,5	6	8	2,5	1,5	1,5	0,25–2,5
Cyprus	4,5	6	8	2,5	1	0	0,25–1,875
Czech	4,5	6	8	2,5	1,25	0	0,5–2,5
Estonia	4,5	6	8	2,5	1,5	0	2
Finland	4,5	6	8	2,5	0	1	0,5–2,5
France	4,5	6	8	2,5	1	3	0,25–1,5
Georgia	4,5	6	8	2,5	1	0	1–2,5
Germany	4,5	6	8	2,5	0,75	2	0,25–2
Greece	4,5	6	8	2,5	0	0	1–1,25
Hong Kong	4,5	6	8	2,5	1	0	1–3,5
Hungary	4,5	6	8	2,5	0,5	0	0,25–1
Ireland	4,5	6	8	2,5	1,5	0	0,5–1,5
Italy	4,5	6	8	2,5	0	0	0,25–1,5
Kazakhstan	5,5	6,5	8	2–3	0	0	1
Latvia	4,5	6	8	2,5	0	0	0,25–2
Liechtenstein	4,5	6	8	2,5	0	1	2
Malaysia	4,5	6	8	2,5	0	0	0,5–1
Malta	4,5	6	8	2,5	0	1,5	0,25–2
New Zealand	4,5	6	8	2,5	0	0	2
North Macedonia	4,5	6	8	2,5	0,75	0	1–3,5
Norway	4,5	6	8	2,5	2,5	4,5	1–2
Poland	4,5	6	8	2,5	0	0	0,25–2
Romania	4,5	6	8	2,5	1	0–1	0,5–2
Saudi Arabia	4,5	6	8	2,5	0	0	0,5–2,5
Slovenia	4,5	6	8	2,5	0,5	0,5–1	0,25–1,25
South Africa	4,5	6	8	2,5	0	0–2	0,5–2,5
Spain	4,5	6	8	2,5	0	0	0,25–1,25

Sources: National authorities and the European Systemic Risk Board.

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[122] The minimum requirement for Tier 1 capital, which is 6%, includes the minimum requirement for CET1 capital, 4,5%.

[123] The minimum requirement for CAR, 8%, includes the minimum requirement for Tier 1 capital, 6%.

Table 11. Financial Stability Measures in Uzbekistan as of July 1, 2024

Measure	Tool	Applicable norm
Ensuring liquidity in the banking system	Share of HQLA in total assets	10%
	Instant liquidity ratio	25%
	LCR	100%
	NSFR	100%
Maintaining capital adequacy in the banking system	CAR	13%
	Tier 1	10%
	CET 1	8%
	CCoB	3% (as part of regulatory requirements)
Reducing leverage and risk appetite in the banking system	RWA	Based on the annual interest rate and other indicators
	Leverage ratio	6%
Reducing dollarization	Ban on issuing FX loans to individuals	Loans in FX are not granted
	Differentiated reserve requirements	4% for the national currency 14% for the FX
	LCR in FX	100%
	NSFR in FX	100%
Debt burden mitigation	DSTI	60%
	Daily limit of interest payments on a loan or microloan in relation to the principal outstanding	0,3%
	Differentiated RWA	In line with LTV and DSTI ratios on mortgages and car loans
Structural risk mitigation	Bank's maximum exposure limit for one borrower or a group of interconnected borrowers	25% of the bank's Tier 1 capital
	The maximum amount of unsecured credit risk of a bank attributable to a single borrower or group of related borrowers	5% of bank's Tier 1 capital
	A limit on the total amount of all major risks of the bank	Up to 5 times the bank's Tier 1 capital
	A limit on the maximum amount of risk per affiliated person	25% of the bank's Tier 1 capital
	Maximum exposure limit for all affiliated persons	50% of the bank's Tier 1 capital

Source: CBU.

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