The Central Bank of Uzbekistan

Financial Stability Report

2024

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 January 1, 2025.

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

The Financial Stability Report was prepared by the Financial Stability Department of the CBU.

The report was published in May 2025.

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Abbreviations

AEs	Advanced economies
BSSM	Bayesian state-space model
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
CoVaR	Conditional value at risk
D-SIB	Domestic systemically important bank
DSTI	Debt service-to-income ratio
DTI	Debt-to-income
EMs	Emerging markets
FCI	Financial conditions index
FSI	Financial stress index
FX	Foreign currency
GaR	Growth at Risk model
GDP	Gross domestic product
HHI	Herfindahl-Hirschman index
HP	Hodrick-Prescott
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
MPP	Macroprudential policy
NII	Net interest income
NNII	Net non-interest income
NPAT	Net profit after tax
NPLs	Non-performing loans
NSFR	Net stable funding rate ratio
OLS	Ordinary least squares
PBT	Profit before tax
pnCCyB	Positive neutral countercyclical capital buffer
ROA	Return on assets
ROE	Return on equity
RORWA	Return on risk-weighted assets
RWA	Risk-weighted assets
SSM	State-space model
SyRB	Systemic risk buffer
UCI	Uzbekistan Composite Index
USD	United States dollar
UZS	Uzbek soum
VIX	Volatility Index

Financial Stability Report for 2024

Contents

Executive Summary

During 2024, Uzbekistan experienced an easing of financial conditions while maintaining financial stability within the banking system. The Financial Conditions Index (FCI) showed an upward trend, reflecting favorable conditions in both the banking and external financial sectors and a reduction in foreign exchange (FX) market pressure. At the same time, the FCI and the credit-to-GDP gap indicated a downward phase. Toward the end of 2024, global uncertainties caused a slight tightening of financial conditions. Capital adequacy ratios (CAR) stayed above the minimum requirements, supporting system stability.

Financial stress in the banking system is easing. Throughout 2024, money market conditions remained nearly stable, while improvements in both the banking sector and the domestic FX market contributed to a drop in the financial stress index (FSI). The FSI stands below the sum of its average and one standard deviation.

Even with a low level of concentration in loans to individuals, the risk-related financial losses for banks are increasing. The reduced concentration in retail loans reflects the impact of macroprudential policy (MPP) tools. Despite these developments, lending to households is growing, the share of individual loans in total credit is rising, and the number of individuals with outstanding bank loans continues to expand.

Concerns persist regarding the debt-servicing capacity of households. In 2024, the average total debt burden of individuals, including total liabilities, amounted to 34%. Among borrowers from banks, the share of loans to borrowers with a total DSTI ratio exceeding 50% was 40%.

The results of the macro stress test of the banking system's solvency under the adverse scenario indicate potential losses in the banking sector. It is estimated that by the end of 2027, both Common Equity Tier 1 (CET1) ratio and CAR of the banking system will decrease to 5.6% and 8.1%, respectively, falling below the established minimum requirements.

According to the results of the liquidity macro stress test, it was shown that no liquidity problem is expected in the banking system. The maturity mismatch between assets and liabilities of the banking system denominated in the national currency has decreased. By the end of 2025, the share of the net cash inflow in the total and high-quality liquid assets (HQLA) are expected to be positive. The availability of sufficient HQLA limits the risk of contagion related to liquidity in the event of potential negative net cash inflows in some banks.

Banks exhibit a high concentration risk related to depositors. The share of the largest depositor in the total deposits remains high in many commercial banks. The results of stress tests under the scenario of the largest depositors' fund withdrawal indicate emergence of the risk of liquidity concerns in the banking system.

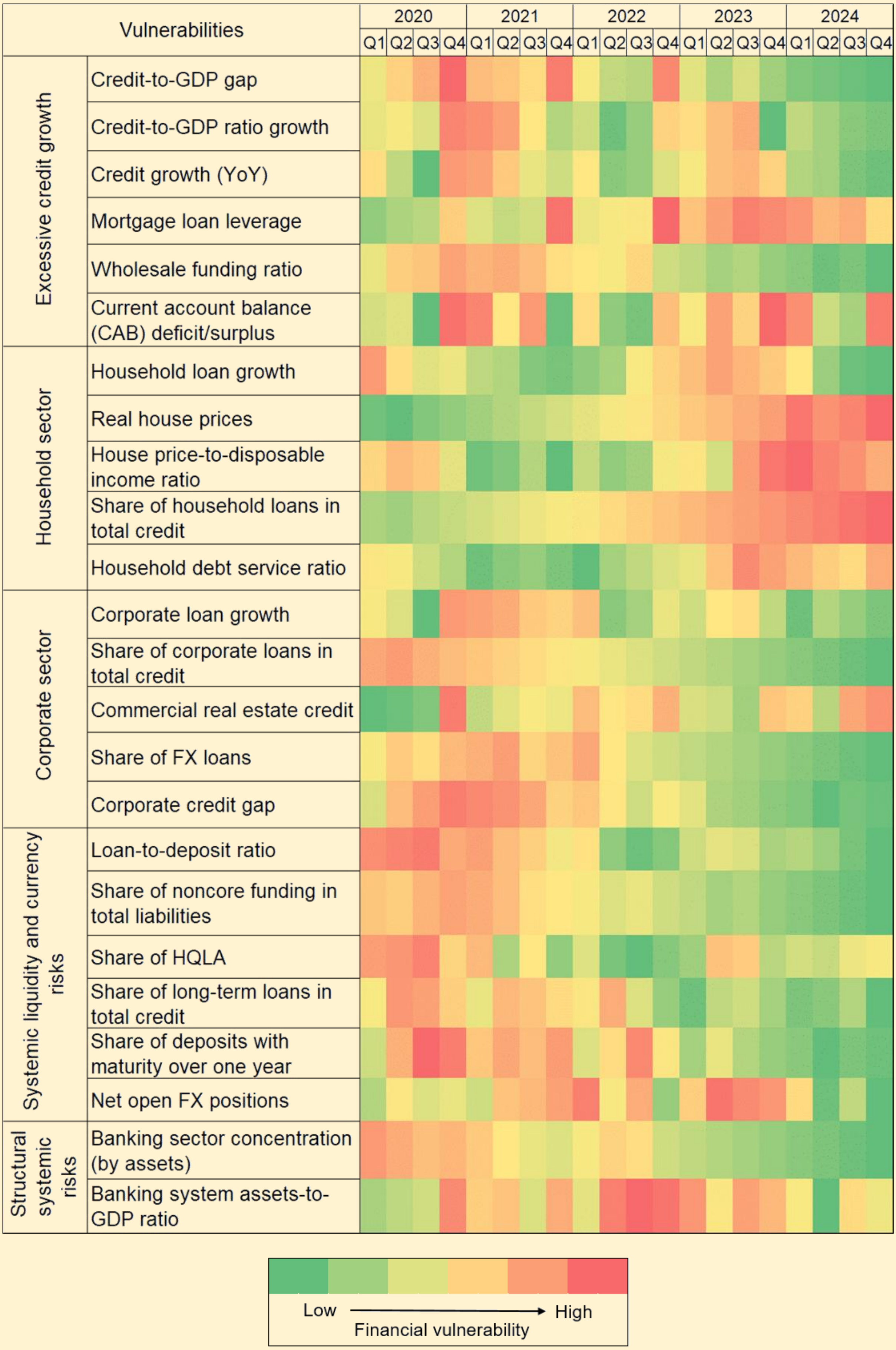
The gap between market and fundamental house prices is narrowing. In 2024, the market price of houses was 17% above than their fundamental price. Additionally, activity in the real estate market has decreased. Banks have tightened mortgage lending standards.

Macroprudential measures have reduced banks' credit risk in the car loans. In 2024, the debt burden of individuals on car loans improved, accompanied by a positive shift in the distribution of LTV ratios for car loans. In addition, car purchase volumes have stabilized, while the gap between market and fundamental car prices has narrowed.

Credit risk on microdebts is rising. In banks with a high share of non-performing loans (NPLs) in the microdebt portfolio, the low level of reserves created for NPLs is increasing the credit risk of microdebts. Both the amount of microdebts extended to individuals and the number of microdebts in the credit portfolio of banks are increasing rapidly. Additionally, the concentration of microdebts allocated to individuals remains on the rise.

Risks to financial stability persist. These include rising external financing costs, overvaluation of housing prices, rapid growth in microdebts, and increasing incidence of cyberattacks.

Financial Vulnerabilities Heatmap



The financial vulnerability heatmap indicates persistent weaknesses related to the household sector and the real estate market. In particular, the practice of extending loans to individuals by commercial banks has increased, raising concerns about the debt burden of households on loan obligations.

The impact of retail credit exposures on bank loan losses is rising. Credit activity in the household sector has increased significantly, and the share of loans extended to individuals in the total loan portfolio is increasing. In addition, the ratio of debt service on bank loans of individuals has increased. This may result in increased financial losses in the loan portfolio of banks due to the accumulation of risks in the household sector and the deterioration of the financial condition of borrowers.

Possible housing price corrections in the real estate market could pose systemic risks by negatively affecting the country's real economy. By the end of 2024, the ratio of house prices to disposable income, despite a decline, remains close to its historical high. Also, the leverage ratio on outstanding mortgage loans has decreased slightly, but remains to be elevated.

I. Macrofinancial Conditions

Global financial conditions continued to tighten in 2024. The World Uncertainty Index[1] and Global Economic Policy Uncertainty[2] indices indicate a growing level of uncertainties on a global scale. The ongoing geopolitical tensions, trade tariffs, and political instability associated with economic sanctions are further tightening global macrofinancial conditions.

As the scale of adverse geopolitical events declines, concerns about trade policy are growing globally. By the end of 2024, the rise in global trade policy uncertainties was reflected in the increase in the Trade Policy Uncertainty[3] Index. Also, a slight decrease in the value of the Geopolitical Risk[4] Index indicates that concerns related to conflicts in the international trade market have replaced adverse geopolitical events.

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[1] World Uncertainty Index. (2024). World Uncertainty Index (WUI): Global.
The index includes 21 countries: Australia, USA, Brazil, United Kingdom, Germany, Greece, South Korea, Ireland, Spain, Italy, Canada, Colombia, Mexico, Netherlands, Russia, France, India, China, Chile, Sweden and Japan.

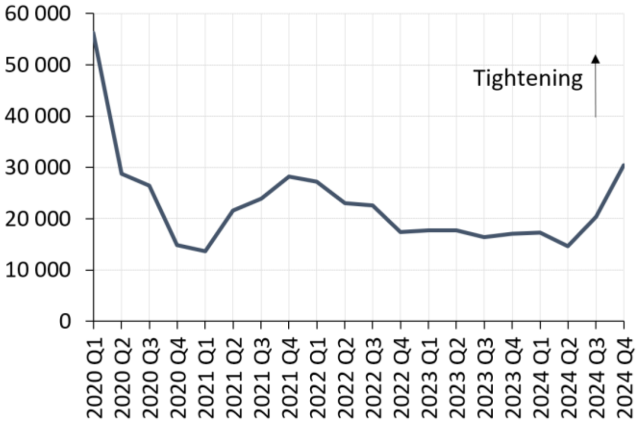
[2] Economic Policy Uncertainty. (2024). Global Economic Policy Uncertainty Index.

[3] Matteo Iacoviello. (2025). Trade Policy Uncertainty (TPU) Index.
The index includes 7 leading newspapers: Boston Globe, Chicago Tribune, Guardian, Los Angeles Times, New York Times, Wall Street Journal, Washington Post.

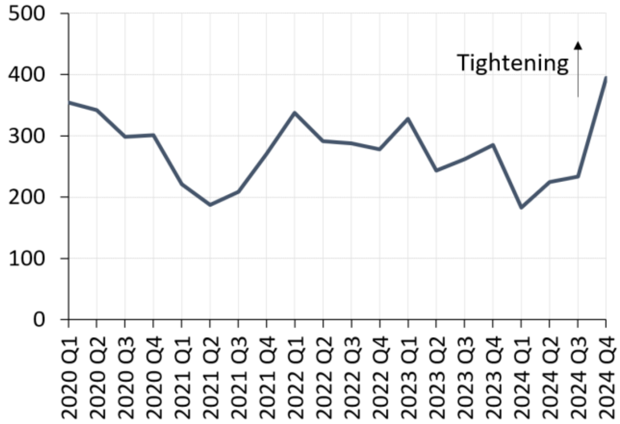
[4] Matteo Iacoviello. (2025). Geopolitical Risk (GPR) Index.
The index includes 10 leading newspapers: Chicago Tribune, Daily Telegraph, Financial Times, Globe and Mail, Guardian, Los Angeles Times, New York Times, USA Today, Wall Street Journal, Washington Post.

Figure 1. Global Uncertainties and Risk Indices

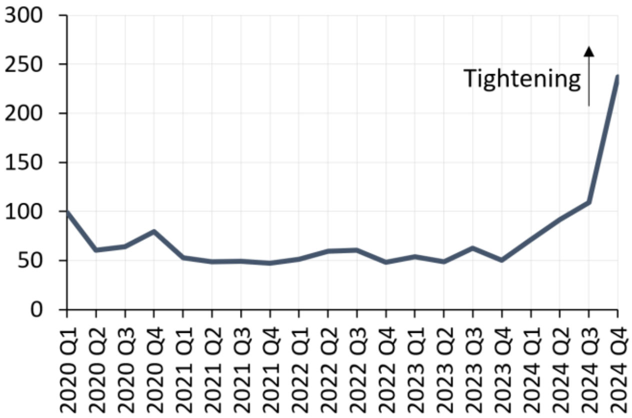
World Uncertainty Index*



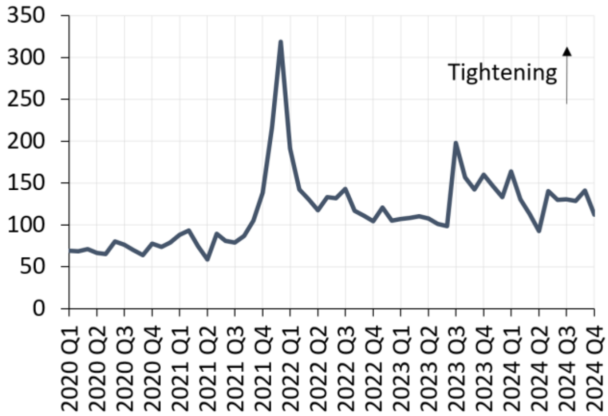
Global Economic Policy Uncertainty Index**



Trade Policy Uncertainty Index***



Geopolitical Risk Index****



Sources: World Uncertainty Index, Global Economic Policy Uncertainty Index and Matteo Iacoviello.

Notes: A high value of the indices indicates an elevated level of uncertainties and risks, while a low value reflects a low level of uncertainties and risks.

*The World Uncertainty Index covers 143 countries and is determined by multiplying 1,000,000 to the share of word "uncertainty" (or its variants) in the total number of words used in the Economist Intelligence Unit's quarterly country reports, and calculating the weighted average value based on the countries' GDP.

**The Global Economic Policy Uncertainty Index is determined by calculating the weighted average value based on the economic policy uncertainty indices computed for 21 countries and the countries' GDP. The Economic Policy Uncertainty index for each country is obtained by finding the proportion of articles in newspapers published in each country that contain sentences related to the words “economics”, “politics” and “uncertainty” in the total number of articles in these newspapers. Then, it is normalized by setting the average value of these ratios for the years 1997–2015 to 100.

***In determining the Trade Policy Uncertainty Index, the shares of the total number of articles discussing trade policy uncertainty in the 7 leading newspapers are calculated as a percentage of the total number of articles. To obtain the final index value in a normalized form, each percentage share is set equal to 100.

****The Geopolitical Risk Index is computed by calculating the number of articles on adverse geopolitical events in the top 10 newspapers, including 6 newspapers published in the United States, 3 in the United Kingdom, and 1 in Canada, as a percentage of the total number of articles in these newspapers. The final index is estimated by setting the average value of the calculated shares for the years 1985–2019 to 100.

Positive developments were observed in the global stock market during 2024. In 2024, the Morgan Stanley Capital International indexes for emerging markets (EMs) and advanced economies (AEs) amounted to 1,094 and 3,790 USD, an increase of 10% and 22%, respectively, compared to 2023. The MSCI World Index stood at 860 USD, marking a 21% increase compared to 2023[5]. However, a slight decline in the index tracking stock prices of companies in EMs reflects investors' concerns about these economies.

Figure 2. Morgan Stanley Capital International Indexes, USD**

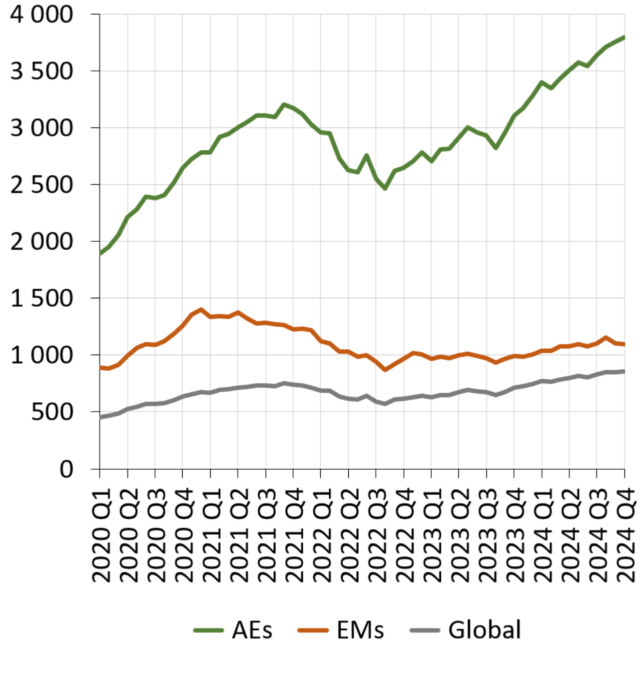
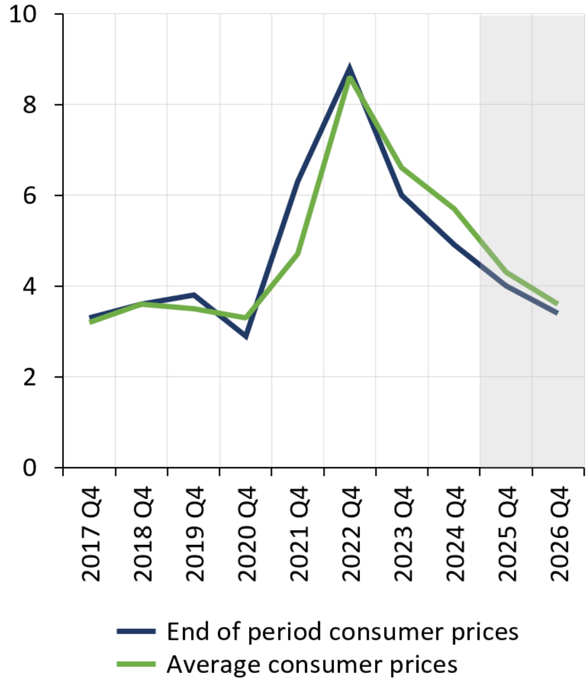


Figure 3. Global Inflation* Projection (CPI) YoY, %



Sources: IMF and Bloomberg.

Notes: *The global inflation rate is determined by calculating the weighted average value of each country's inflation index and GDP based on purchasing power parity.

**MSCI indixes 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 inflation rate is showing a downward trend. By the end of 2024, global inflation is expected to be 4.9%, a decrease of 1.1 percentage points (p.p.) from 2023. The IMF also projects average global inflation rates of 4.3% and 3.6% for 2025 and 2026, respectively[6]. However, global political and fragmentation changes observed in early 2025 are negatively affecting the global trade and increasing uncertainties. Weaknesses in the global trade dynamics are expected to heighten inflationary pressures. As a result, the formation of a high-interest rate environment in international markets could lead to further tightening of financial conditions.

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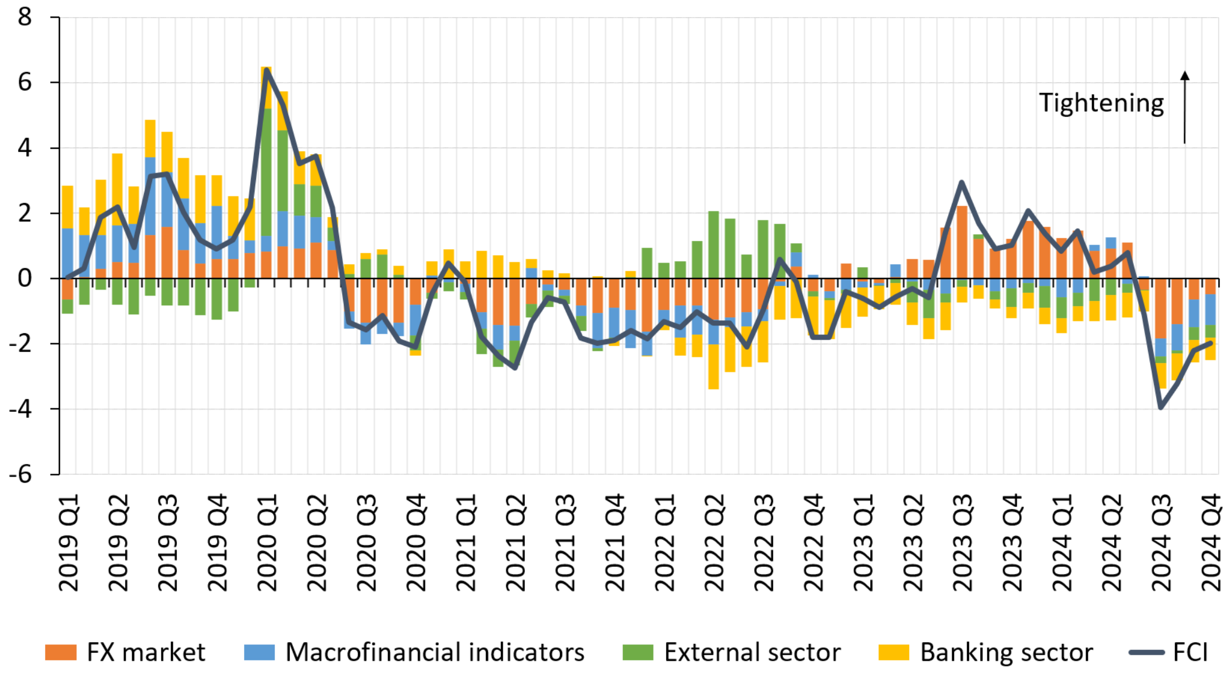
[5] Morgan Stanley Capital International. (2025). Real Time Index Data Search.

[6] International Monetary Fund. (2025, April). World Economic Outlook.

At the end of 2024, a slight tightening of financial conditions was observed in Uzbekistan. Uzbekistan's FCI decreased in 2024 due to the positive situation in the banking and external financial sectors along with reduced pressure in the FX market. By the end of 2024, however, global uncertainties tightened Uzbekistan's financial conditions. The UZS depreciated by 4.7% against the USD in 2024, 5.2 p.p. lower compared to 2023[7]. Also, the Volatility Index (VIX) of Chicago Board Options Exchange, which reflects investor expectations in international financial markets, averaged 16 points in 2024, an 8% decrease compared to 2023[8].

Figure 4. 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 an easing of financial conditions.

The indicators of the FCI and the credit-to-GDP gap show a phase of decline. During 2024, the Uzbekistan FCI formed at its historical minimum values. Also, the credit-to-GDP gap at the end of 2024 was below the threshold for setting the benchmark level of the countercyclical capital buffer (CCyB). In particular, the credit to private sector-to-GDP ratio at the end of 2024 was 2.7 p.p. below than its long-term trend.

[7] The Central Bank of the Republic of Uzbekistan. (2025). Archive of exchange rates.

[8] Federal Reserve Bank of St. Louis. (2025). CBOE Volatility Index: VIX.

Figure 5. Uzbekistan's Financial Cycle Index[9]

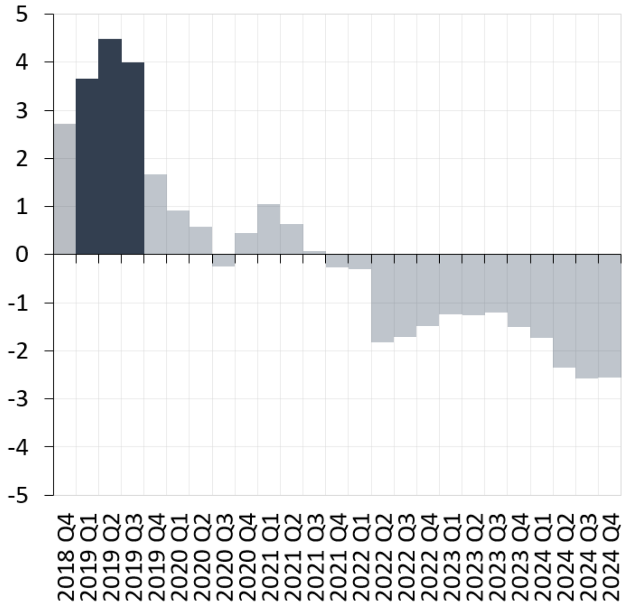
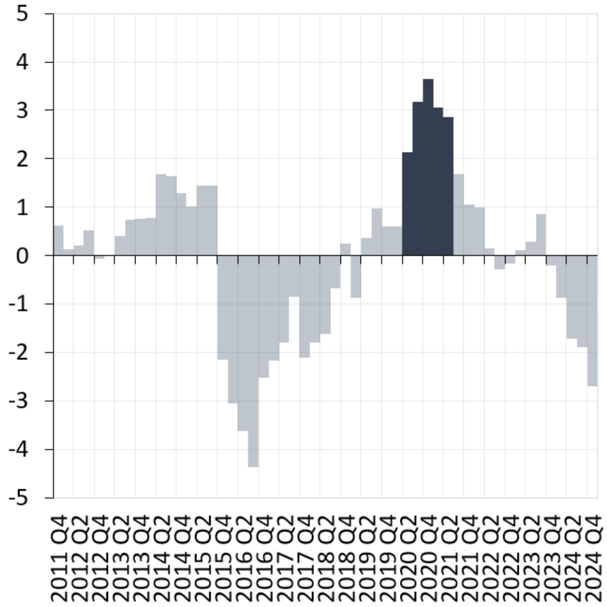


Figure 6. Credit to the Private Sector-to-GDP Gap, p.p.



Sources: National Statistics Committee and CBU staff calculations.

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

The periods for setting a positive neutral countercyclical capital buffer (pnCCyB) based on the credit to the private sector-to-GDP gap were identified when the gap exceeded 2 p.p.[10].The periods for setting a pnCCyB based on Uzbekistan's FCI were determined when the index reached its highest values.

In Uzbekistan, increasing domestic demand has driven economic growth. GDP growth in 2024 reached 6.5%, an increase of 0.2 p.p. compared to 2023[11]. In 2024, the increase in domestic demand in the country had a positive effect on real GDP growth by 7.4 p.p.. The impact of the negative net export balance on real GDP growth was offset by a significant increase in domestic demand in 2024.

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[9] The FCI methodology is presented in the Financial Stability Report for 2023.

[10] The benchmark rate of the buffer is calculated by the following formula based on the difference in the ratio of credit to GDP:

$$BBR = \begin{cases} 0 & if, GAP < 2\ percent\ point \\ 0{,}3125 * GAP - 0{,}625 & if, 2\ percent\ point \leq GAP \leq 10\ percent\ point \\ 2{,}5 & if, GAP > 10\ percent\ point \end{cases}$$

Where,
BBR – benchmark buffer rate;
GAP – credit-to-GDP gap.

[11] National Statistics Committee. (2025). Growth rates of gross domestic product (by expenditures method, quarterly).

Figure 7. Annual GDP Growth Decomposition*, p.p.

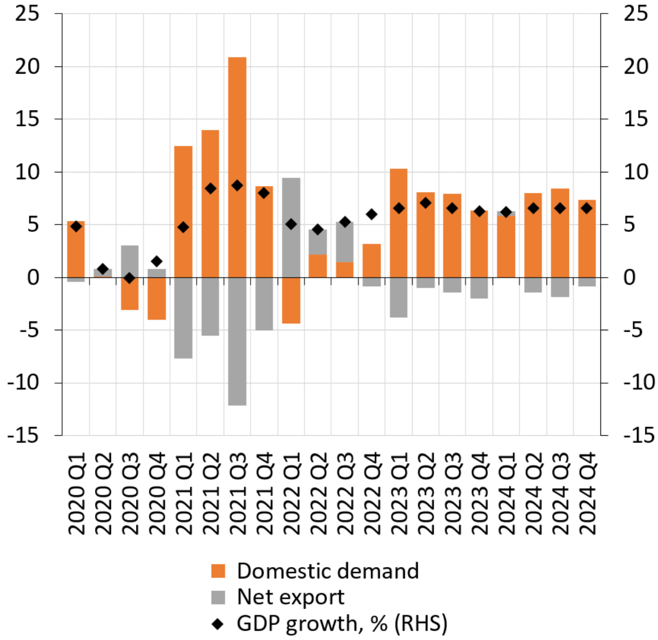
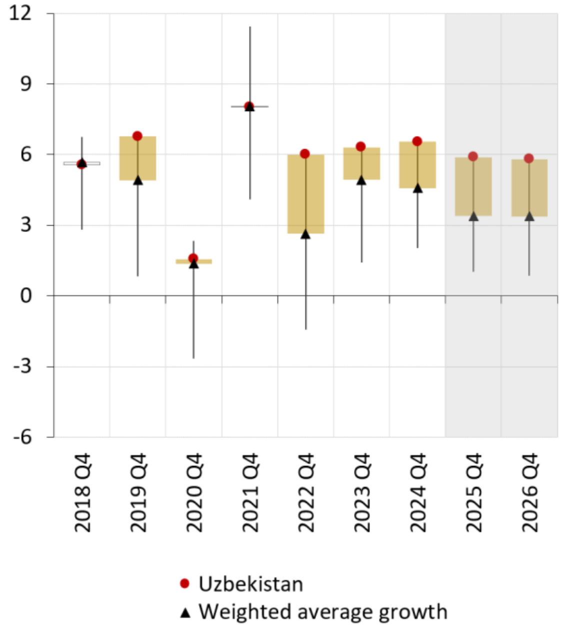


Figure 8. Growth Distribution of Uzbekistan's Main Trading Partners[12], %**



Source: National Statistics Committee, IMF, and CBU staff calculations.

Note: *Domestic demand is the sum of consumption and gross capital formation. The statistical discrepancy in the calculation of GDP by the final consumption method is not reflected in the graph.

**The rectangle displayed in the graph represents the variation between Uzbekistan's GDP growth rate and the weighted average of GDP growth rates for main trading partners. The length of 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 black. The vertical black line on the graph represents the maximum and minimum growth rates among the six countries for a given year.

Uzbekistan's economic growth rates for 2025 and 2026 are estimated to exceed that of its main trading partners. According to the International Monetary Fund (IMF), Uzbekistan's economic growth rate in 2025 and 2026 is expected to be 5.9% and 5.8%[13], respectively, while World Bank projects growth rates of 5.9%[14]. Based on IMF data, the average annual economic growth rate for Uzbekistan's main trading partners is expected to be 3.4% for both 2025 and 2026[15].

[12] The countries of South Korea, Russia, Turkey, China and Kazakhstan are taken into account.

[13] International Monetary Fund. (2025, April). World Economic Outlook.

[14] World Bank. (2025). Accelerating Growth through Entrepreneurship, Technology Adoption, and Innovation.

[15] International Monetary Fund. (2025, April). World Economic Outlook.

Figure 9. Quarterly Distribution of CAB, billion USD

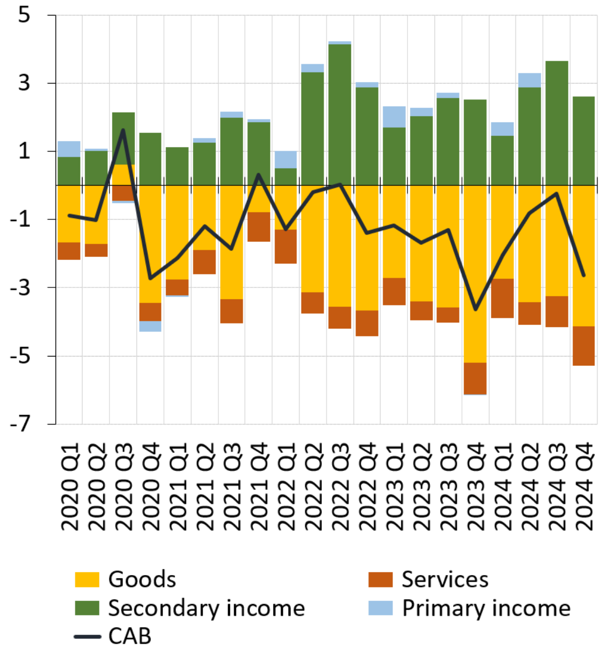
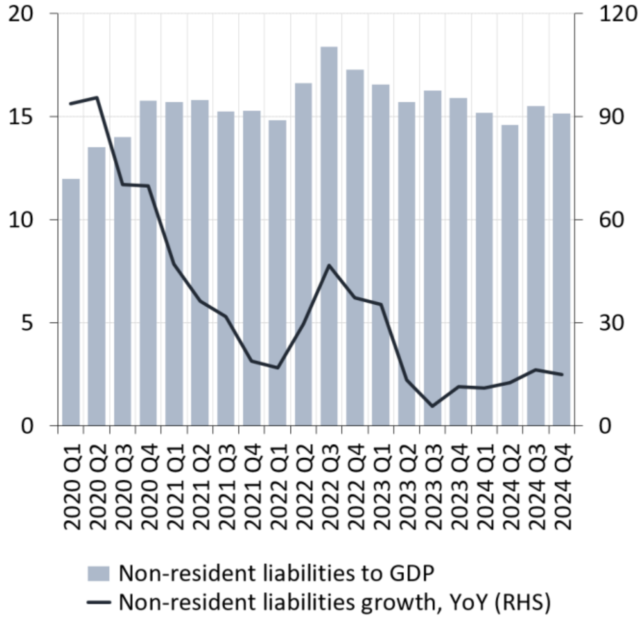


Figure 10. Bank Liabilities to Non-residents-to-GDP Ratio and YoY Growth of These Liabilities, %



Source: CBU.

The negative the current account balance (CAB) has narrowed. By the end of 2024, the CAB deficit amounted to 5.7 billion USD, a 26% decrease compared to 2023. In particular, the positive balance of primary and secondary income in 2024 reached to 11.7 billion USD, which is 20% more than in 2023. In addition, the negative trade balance decreased by 1%[16]. Due to a slight reduction in the trade balance deficit, and an increase in the positive primary and secondary income balances, the current account deficit has decreased to 5% of the country's GDP in 2024.

The growth rate of external liabilities of commercial banks to non-residents has slightly accelerated. At the end of 2024, the balance of banks' liabilities to non-residents totaled to 220.1 trillion UZS, an increase of 15% compared to 2023[17]. Also, by the end of 2024, the ratio of the outstanding commercial banks' liabilities to non-residents to GDP was 15%, a decline of 1 p.p. compared to 2023.

[16] The Central Bank of the Republic of Uzbekistan. (2025). Balance of Payments (analytical presentation).

[17] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

Box 1. Interest Rates in Uzbekistan

In recent years, an upward trend has been observed in the interest rates on bank loans[18] and deposits[19] within Uzbekistan's banking system. In particular, following the decline in the weighted average interest rates on bank loans and deposits in national currency during the Covid-19 pandemic period of 2020, the upward trend in interest rates has continued.

Figure 11. Loan and Deposit Interest Rates in UZS, %

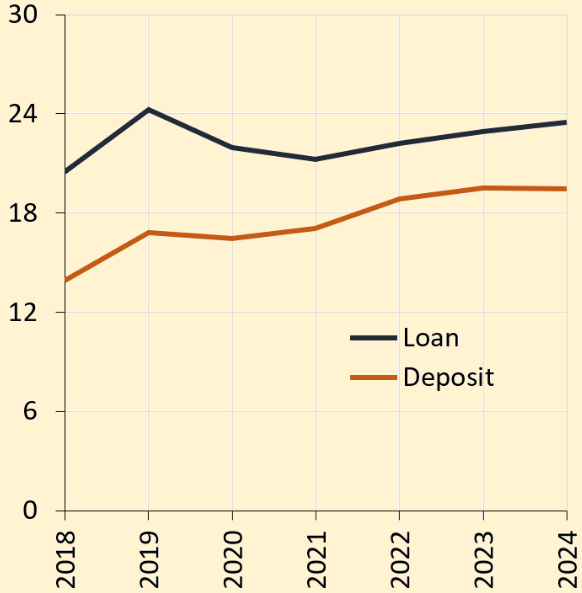
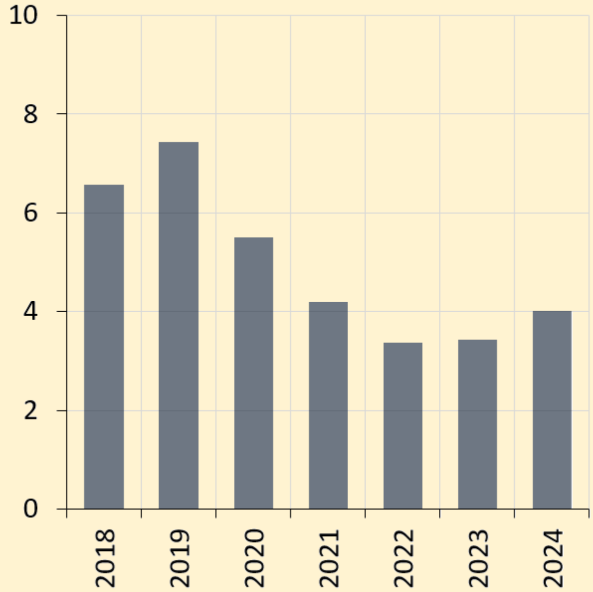


Figure 12. The Spread between Loan and Deposit Interest Rates in UZS, p.p.



Source: CBU staff calculations.

Note: Interest rate spread – the difference between loan and deposit interest rates.

In 2024, the weighted average interest rate on bank loans in the national currency reached to 23.5%, increasing by 0.6 p.p. compared to 2023. The weighted average interest rate on term deposits in UZS remained almost unchanged at around 19.5% throughout 2023 and 2024[20].

The drivers of the loan interest rate and interest rate spread were analyzed by classifying into macro-fiscal conditions, banking sector and business environment[21] groups.

[18] The weighted average loan interest rate represents the weighted average interest rate of loans in national currency, excluding preferential loans and microdebts provided by banks.

[19] The weighted average deposit interest rate takes into account the average interest rates on term deposits in national currency attracted by banks.

[20] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

[21] Erik, F. & Igor, Z. (2020). Bank Lending Rates and Spreads in EMDEs: Evolution, Drivers, and Policies. World Bank Policy Research Working Paper.

Table 1. Indicators Affecting the Loan Interest Rate and Interest Rate Spread

Groups	Indicators
Macro-fiscal conditions	Annual inflation rate
	The volatility of the inflation rate
	Public debt to GDP ratio
	The amount of nominal GDP calculated per capita
	Gross capital formation to GDP ratio
	CBU policy rate
Banking sector	Operating expenses to total assets ratio
	Share of the three largest bank assets in total bank assets
	Share of NPLs in total loans
	Share of non-interest income in total income
	Credit to the private sector-to-GDP ratio
Business environment	Credit Bureau Coverage
	Rule of law indicator

Source: World Bank.

The indicators possibly influencing the determination of the loan interest rates and the spread between loan and deposit rates in Uzbekistan were grouped into combinations. Among various combinations of indicators, the optimal set of indicators were identified using the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC)[22] tests.

According to the results of the tests, the inflation rate, CBU policy rate, the ratio of operating expenses to total assets, the share of non-interest income in total income, and the ratio of credits to the private sector-to-GDP were selected as key indicators impacting the loan interest rate and interest rate spread. The impact of selected indicators on the loan interest rate and interest rate spread was estimated using the least squares method[23].

Based on the model results, the loan interest rate and interest rate spread were found to have direct correlation with the ratio of operating expenses to total assets in banks, CBU policy rate, inflation, and the ratio of credits to the private sector-to-GDP, while an inverse correlation was observed with the share of non-interest income in total income[24] (Appendix 1).

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[22] AIC and BIC tests are methods used to select indicators that best represent the relationship between existing variables.

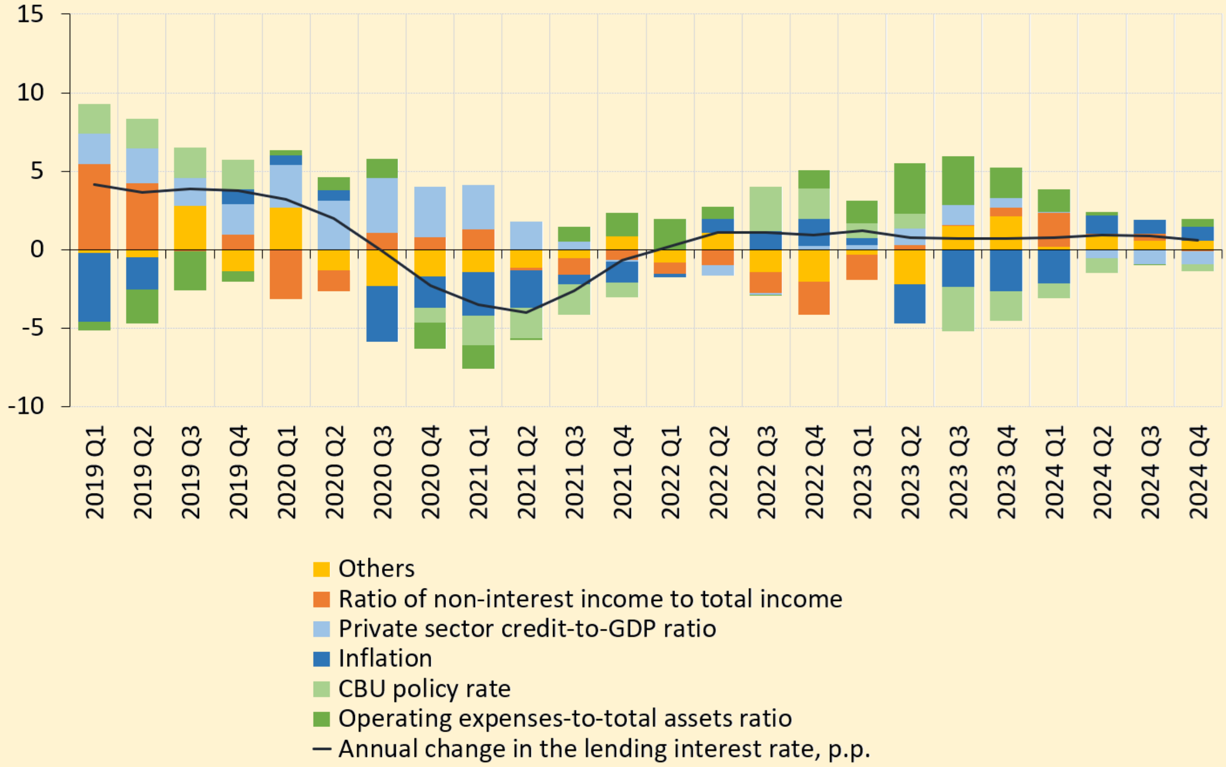
[23] The factors influencing the loan interest rate and the interest rate spread are determined using the following formula:

$$y = C + \beta_i x_i + \varepsilon$$

Where,
y – loan interest rate or interest rate spread;
x_i – optimal indicators;
β_i – unknown coefficients;
C – intercept;
ε – error term.

[24] According to the results of the model, a positive regression coefficient indicates a direct correlation between the dependent and independent variables, while a negative coefficient indicates inverse correlation.

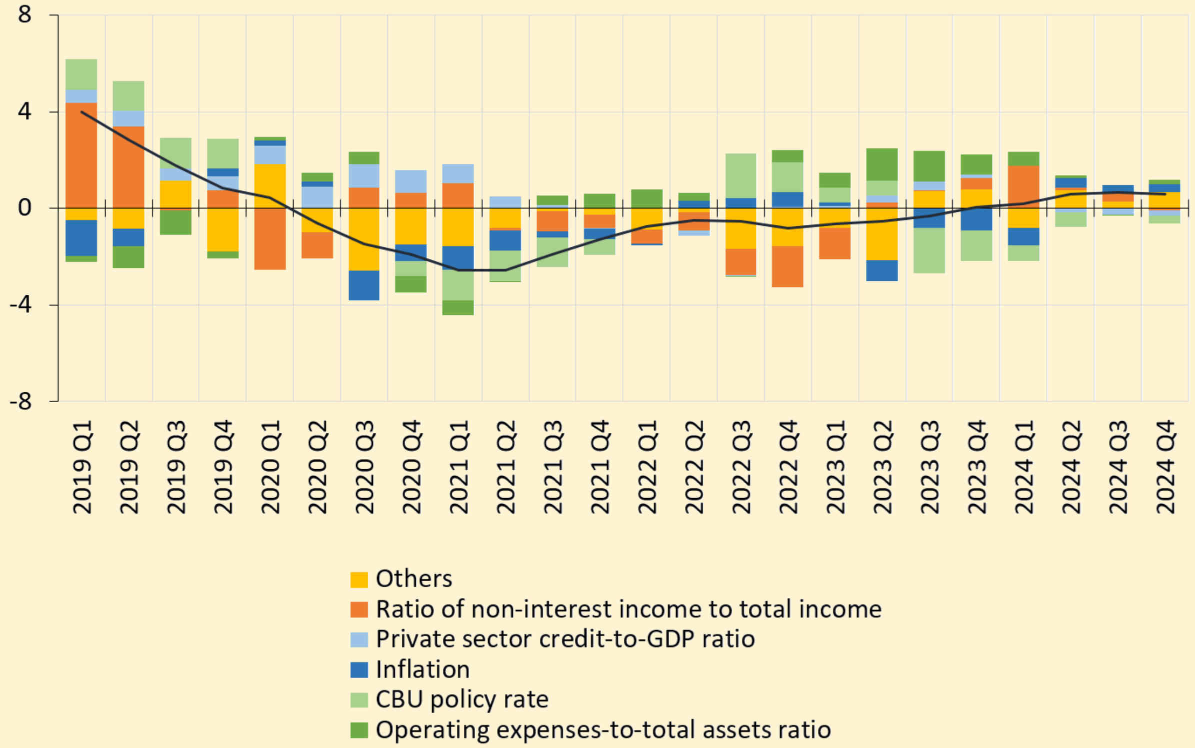
Figure 13. Annual Loan Rate Change Decomposition, %



Source: CBU staff calculations.

In 2024, loan interest rates in UZS increased by 0.6 p.p. compared to 2023. In this context, elevated inflation and the growth in the ratio of operating expenses to total assets contributed to the increases of 0.7 p.p. and 0.3 p.p. in the loan interest rate, respectively. Also, reduction in the credit to the private sector-to-GDP ratio and CBU policy rate had decreasing impacts of 0.8 p.p. and 0.5 p.p., respectively, while an increase in the share of not-interest income in total income exerted a 0.1 p.p. downward pressure on loan interest rates.

Figure 14. Annual Interest Rate Spread Change Decomposition, %



Source: CBU staff calculations.

In 2024, the spread between loan and deposit interest rates widened by 0.6 p.p. compared to 2023. In this case, the inflation increased it by 0.3 p.p., and the ratio of operating expenses to total assets contributed an increase of 0.2 p.p. in the spread. CBU policy rate, the credits to the private sector-to-GDP, and the share of non-interest income in total income were reducing factors in the spread change, contributing 0.3 p.p., 0.2 p.p., and 0.1 p.p. downward effects, respectively.

II. Financial Sector

2.1. Banking Sector

The financial stress condition in Uzbekistan's banking system is improving. During 2024, under stable conditions in the money market, positive developments in the banking sector and the domestic FX market contributed to the decline in the FSI[25]. Uzbekistan's FSI remained below from its average and one standard deviation, indicating a low level of stress in the country's banking system.

Figure 15. Uzbekistan's Financial Stress Index

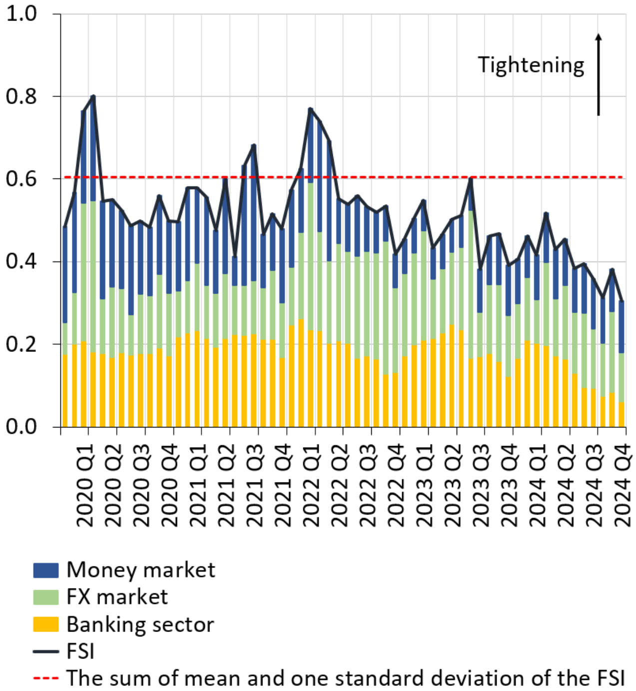
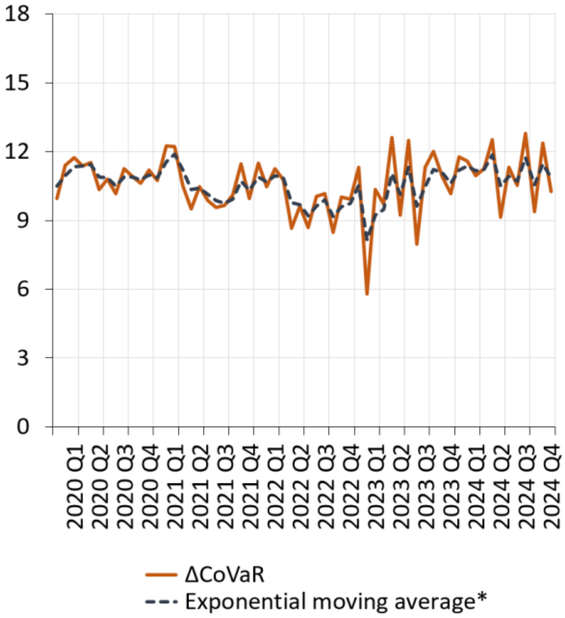


Figure 16. ΔCoVaR for Banking System



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 for the banking sector was calculated as the absolute value of the sum of the products of each bank's ΔCoVaR and their respective shares of total banking system capital. The increase in the ΔCoVaR means that systemic risk in the banking system is building up, while the decrease in ΔCoVaR means that systemic risk is decreasing.

*The exponential moving average is a technique used to smooth out the value of an indicator by reducing random and short-term fluctuations. Unlike the simple moving average, this method gives more weight to recent values of the indicator, making it a more accurate representation of current changes in its value (Appendix 2).

The growth of loan portfolios and deposits in banks, along with the increase in the interest margin, was reflected in the positive developments in the banking system. In 2024, the outstanding amount of loans and deposits grew annually by 13% and 28%, respectively. In the context of the increase in the volume of deposits and loans, the net interest income (NII) of banks increased. In particular, by the end of 2024, the total NII of the banking system amounted to 34.2 trillion UZS, an increase of 18% compared to 2023[26].

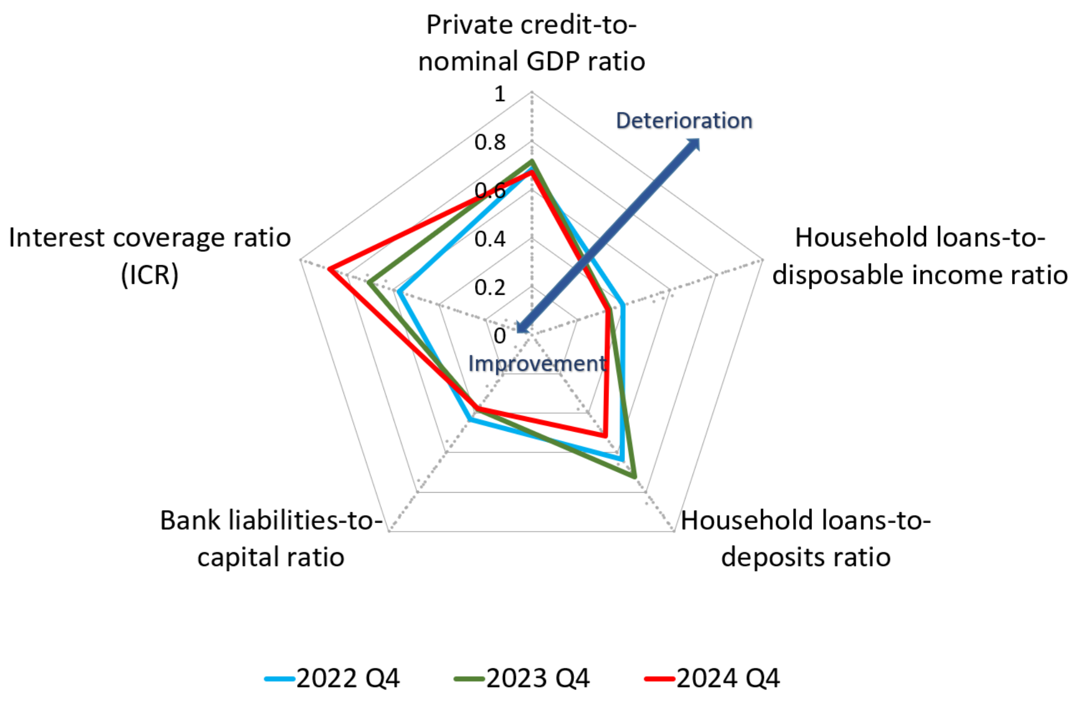
[25] The FSI methodology is presented in the Financial Stability Report for 2022.
[26] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

In the domestic FX market, the supply of foreign currency exceeded the demand. In 2024, the net purchase of foreign currencies[27] from the FX market by commercial banks amounted to 10.4 billion USD, a decrease of 16% compared to 2023. Also, in 2024, the volume of foreign currency sold to banks by individuals was 6.7 billion USD more than the volume of foreign currency purchased. This difference has increased by 2.1 times compared to 2023[28].

The risk level associated with the contagion of financial stress to the banking system is assessed as moderate. By the end of 2024, despite the decline in profitability in the banking system, there was no significant change in the ΔCoVaR[29] due to the improvement in the liquidity of banks and the decrease in capital market volatility. In 2024, the ΔCoVaR remained in its average trend, indicating concerns about the occurrence of systemic risks resulting from banks' vulnerabilities remained unchanged.

The ratios of private credit-to-nominal GDP, household loans-to-disposable income, and bank liabilities-to-capital have improved. According to the credit market conditions map, the private credit-to-nominal GDP ratio in 2024 was 31%, decreasing by 2 p.p. compared to the corresponding period of 2023. Also, due to the almost identical growth rates of liabilities and equity in banks, there were no significant changes in the ratio of these indicators. As of January 1, 2025, the annual growth rates of liabilities and equity in the banking system amounted to 18%.

Figure 17. Credit Market Conditions



Sources: National Statistics Committee and CBU staff calculations.

[27] The net purchase of foreign currencies is determined by subtracting the amount of foreign currencies purchased from the foreign currencies sold by banks at the FX market.

[28] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

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

The household deposits grew at a higher rate than the household loans. By the end of 2024, the outstanding loans extended to households by commercial banks amounted to 177.5 trillion UZS, an increase of 20% compared to 2023. Meanwhile, the outstanding amount of household deposits grew by 42%, reaching 122.4 trillion UZS at the end of 2024[30].

The conditions concerning interest coverage ratio (ICR) has relatively worsened. At the end of 2024, the ICR was 12%, decreasing by 14 p.p. from 2023. In particular, in 2024, the total interest expenses of banks amounted to 77.7 trillion UZS, an increase of 35% compared to 2023. The total net profit before tax of the banking system decreased by 36%, reaching 9.7 trillion UZS at the end of 2024[31]. This development is explained by the increased level of provisioning for asset losses.

Figure 18. Financial Soundness Conditions

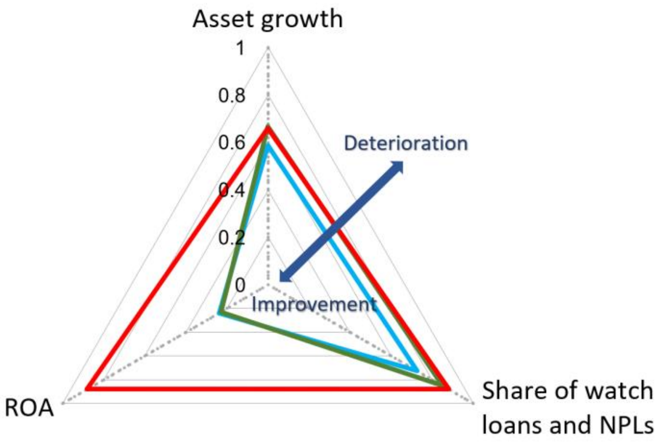
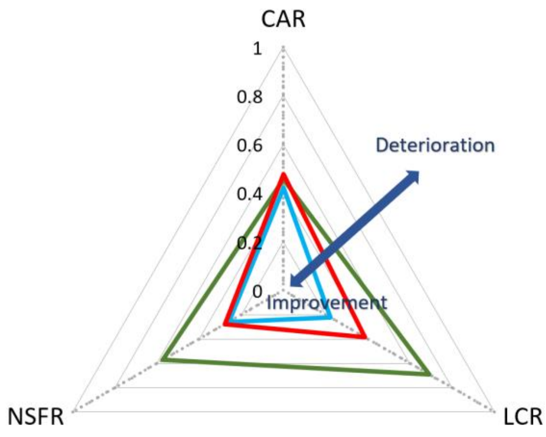


Figure 19. Banking System Resilience



Sources: National Statistics Committee and CBU staff calculations.

The profitability of banking system assets has decreased. As of January 1, 2025, the return on assets (ROA) ratio stood at 1%, decreasing by 1 p.p. from the corresponding period in 2024. In particular, the volume of banking system assets increased by 18% in 2024. In addition, decline in net profit before tax was driven by 41%[32] increase in the losses on provisions for loans and leasing in 2024 compared to 2023.

The share of watch loans and NPLs in the loan portfolio of banks has increased. As of January 1, 2025, the share of watch loans and NPLs in total loans amounted to 21%, rising by 1 p.p. compared to the corresponding period in 2024.

The risk resilience of the banking system has improved. The liquidity coverage ratio (LCR) amounted to 194% at the end of 2024, an increase of 29 p.p. compared to 2023. The net stable funding ratio (NSFR) increased by 4 p.p., reaching 115% at the end of 2024. In addition, the CAR remained above the minimum requirement and amounted to 17% as of January 1, 2025[33].

[30] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

[31] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

[32] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

[33] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

Figure 20. Decomposition of Assets, %

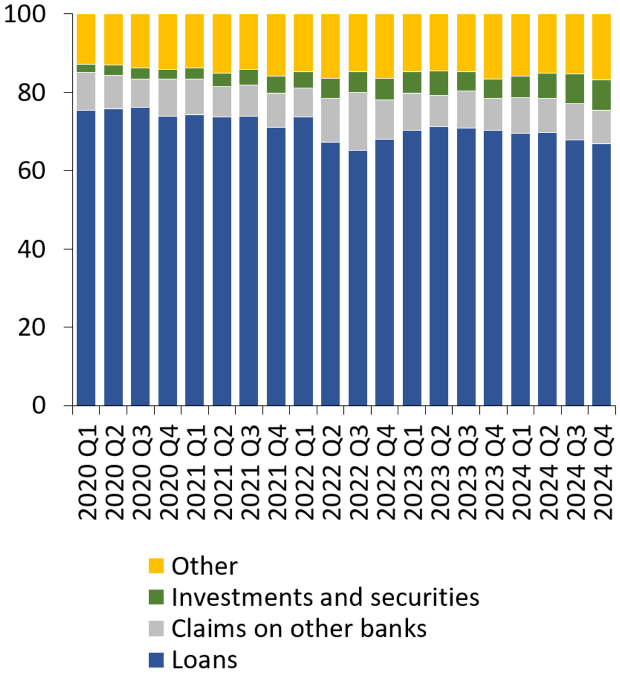
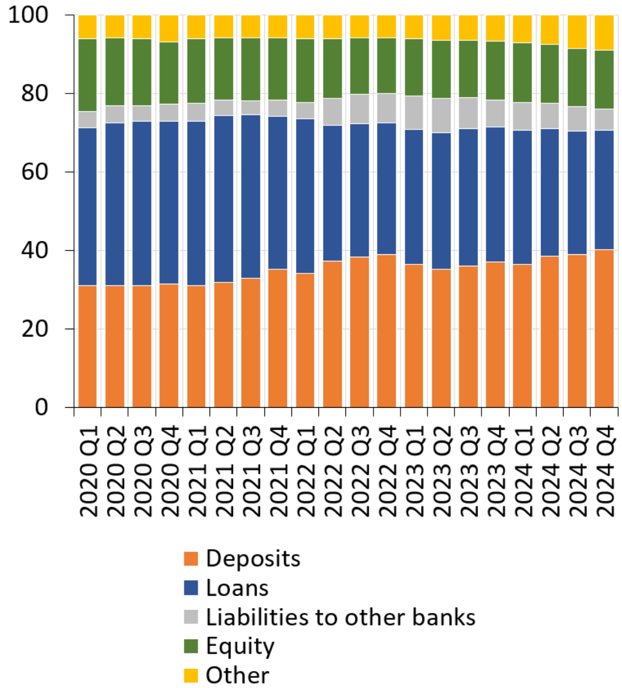


Figure 21. Decomposition of Funding Sources, %

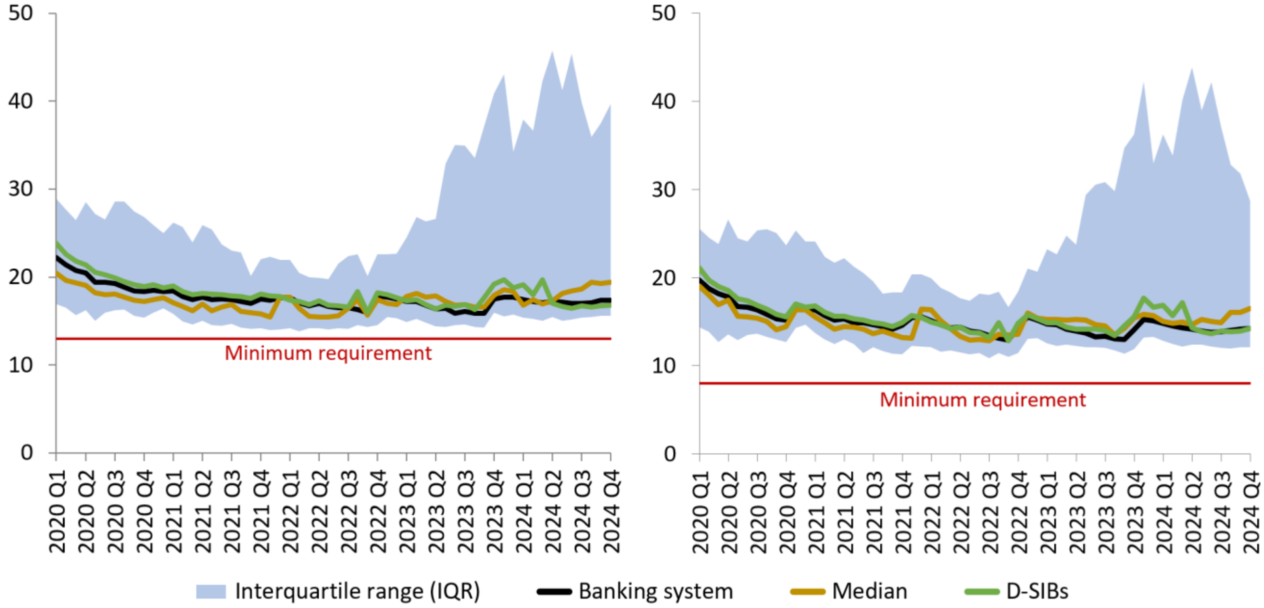


Source: CBU.

Loans remain the main source of income for banks. As of January 1, 2025, the total assets of the banking system amounted to 769 trillion UZS, of which 67% of bank assets were loans. Also, the share of claims in other banks, investments and securities in total assets reached 16%.

The share of deposits in the banking system liabilities is increasing. In 2024, the share of deposits in total liabilities increased by 3 p.p., reaching to 40%. Also, loans, considered as one of the main funding sources of banks, stood at 31% of total liabilities.

Figure 22. CAR in Banking Sector, % **Figure 23. CET1 Ratio in Banking Sector, %**



Source: CBU staff calculations.

Banks' CAR remained above the minimum requirements. The CAR for the banking system and domestic systemically important banks[34] (D-SIBs) were respectively 17.4% and 16.8%. The CET1 capital ratio for the banking system and D-SIBs[35] were both amounted at 14.3%. Additionally, in 2024, the dispersion among the capital adequacy indicators of banks between the interquartile range[36] (IQR) has widened.

Figure 24. RWA Density by Country, % (as of January 1, 2025)

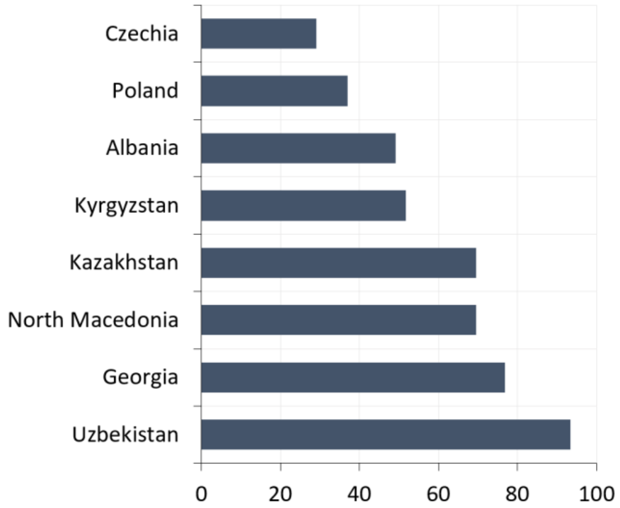
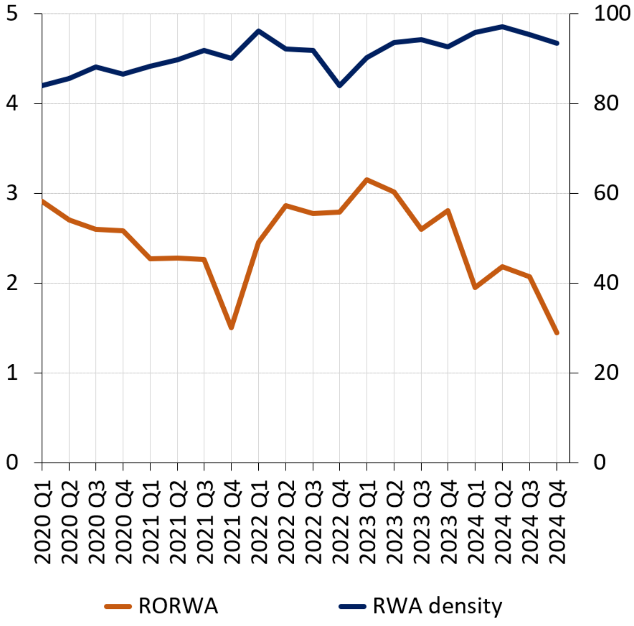


Figure 25. RWA Density[37] and Return on RWA (RORWA) in Uzbekistan, %



Source: National authorities and CBU staff calculations.

The density of RWA remains high in Uzbekistan. At the end of 2024, the average risk weight of total bank assets stood at 93%, indicating high risk appetite among banks. The RWA density of the Uzbekistan banking system is high compared to some countries in Caucasus and Central Asia (CCA), and other regions. This is explained by the conservative approach to risk prevention in Uzbekistan. Also, RORWA continued to decline, reaching 1.4% in 2024.

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

[35] The ratio of CET1 to RWA.

[36] The IQR is the interval between the 25th and 75th quantile boundaries.

[37] To calculate 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.

Figure 26. Changes in CET1 Capital Ratio, %

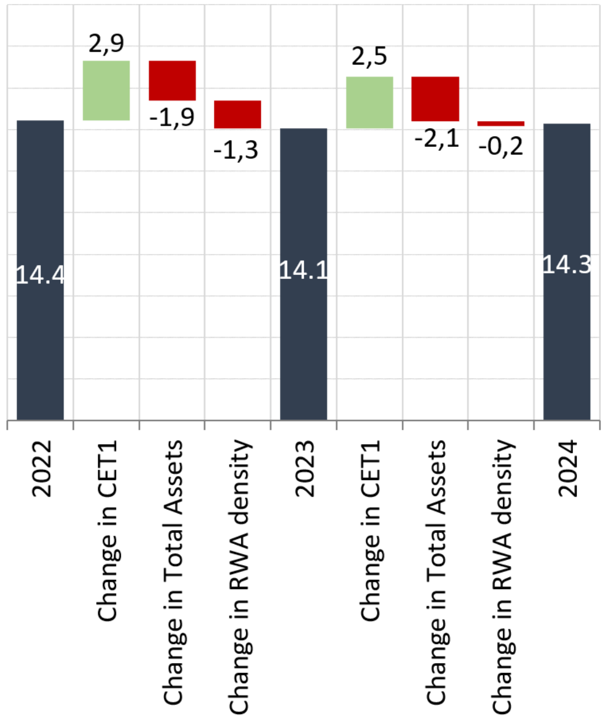
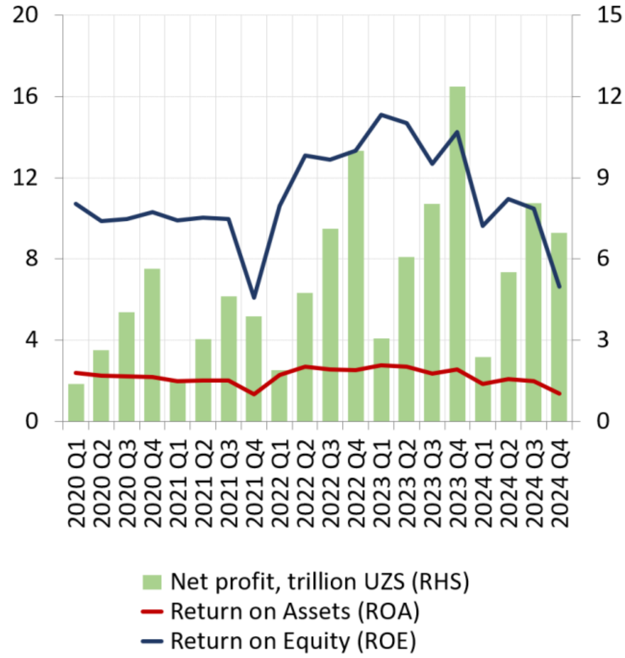


Figure 27. Profitability in Banking Sector



Source: CBU.

In 2024, a downward trend was observed in the profitability of the banking system. At the end of 2024, the net profit of banks amounted to 7 trillion UZS, decreasing by 44% compared to 2023. Due to the decrease in the net profit of banks, the ROE stood at 6.6%.

The ROA of the banking system decreased. By the end of 2024, the ROA stood at 1.4%, a decline of 1.2 p.p. compared to 2023. The increase in operating expenses and potential asset losses by 21% and 45%, respectively, were the primary drivers in the decrease of the ROA.

Figure 28. ROA Decomposition, %

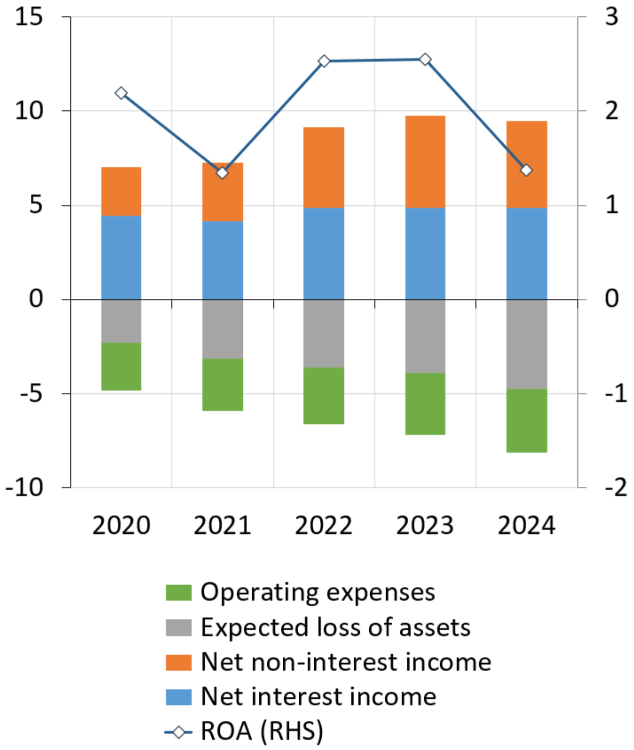
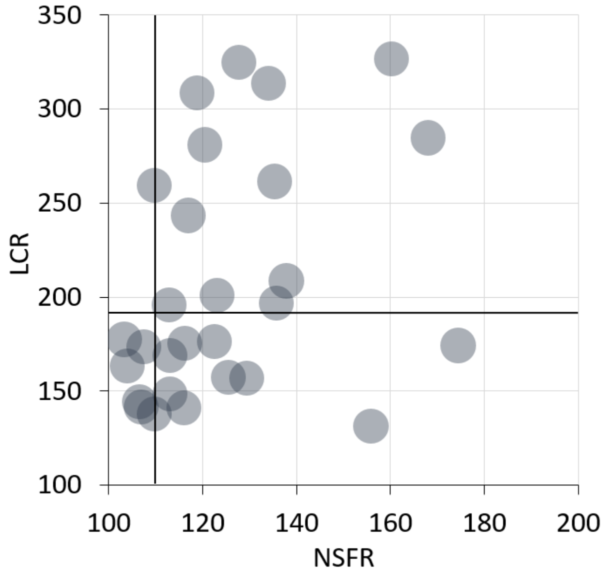


Figure 29. Bank-by-Bank Liquidity Indicators, % (as of January 1, 2025)



Source: CBU.

Note: The continuous straight lines represent the average values of indicators for the banking system as of January 1, 2025. Banks with LCR and NSFR exceeding 350% and 200%, respectively, are excluded in the graph.

The NSFR of banking system has remained stable around the 25th percentile. In 2024, the banking system's NSFR was 115%, an increase of 4 p.p. from 2023. The NSFR for D-SIBs amounted to 114%, while the median stood at 124%, reflecting the dispersion among banks.

Figure 30. NSFR in Banking System, %

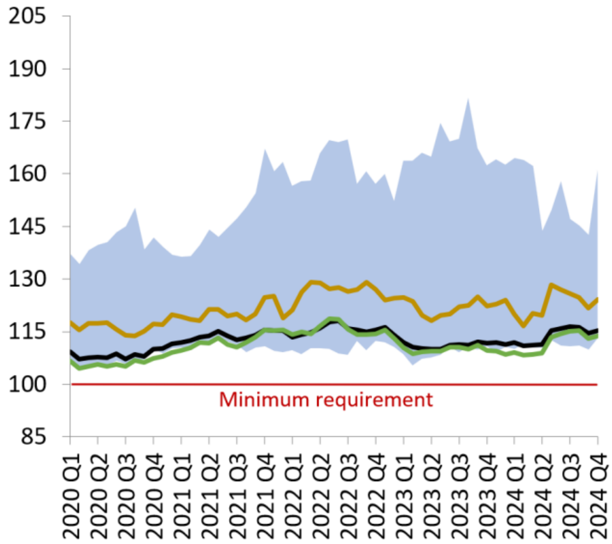
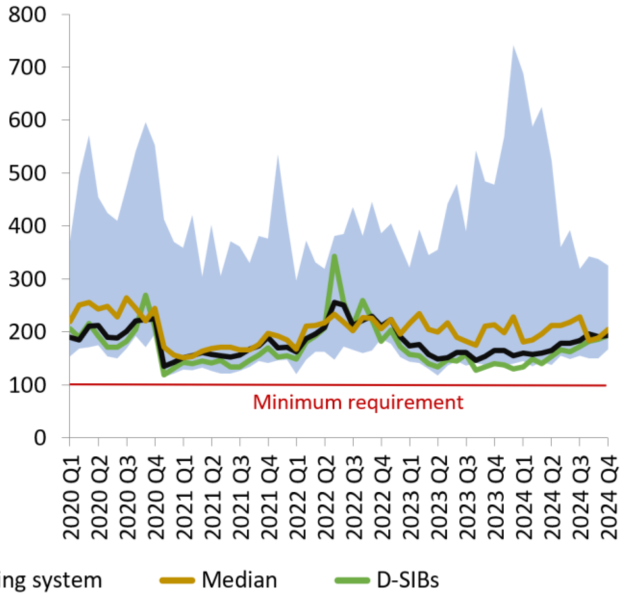


Figure 31. LCR in Banking System, %



Source: CBU.

An upward trend has been observed in the LCR. In 2024, the banking system's LCR increased by 29 p.p., reaching to 194%. The LCR for D-SIBs was 193%. The LCR for the banking system and D-SIBs remained below the median.

The HQLA growth continued in 2024. The ratio of HQLA-to-total assets reached 17.3%, an increase of 2.5 p.p. compared to 2023. The growth of HQLA can be attributed to a 20 trillion UZS increase in the volume of government securities.

Figure 32. HQLA-to-Total Assets Ratio, %

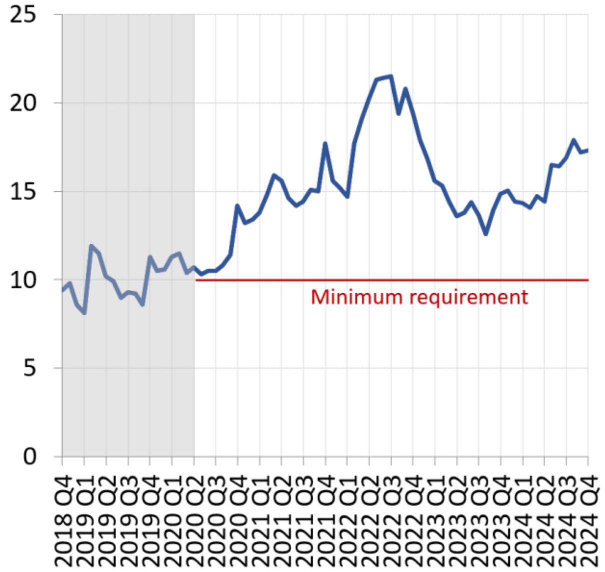
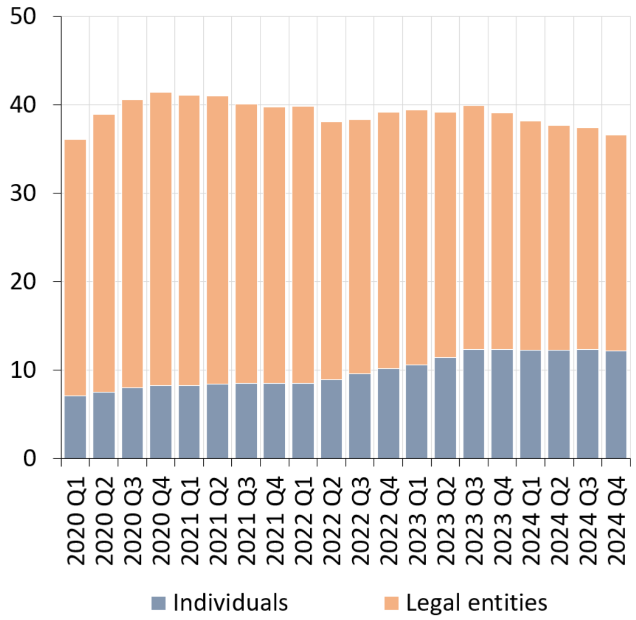


Figure 33. Total Loans-to-GDP Ratio, %



Source: 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 share of retail loans in the total loan portfolio is increasing. At the end of 2024, loans to individuals accounted for 33% of total loans, increasing by 2 p.p. compared to 2023. Loans to legal entities made up remaining 67% of the total loans. Also, the ratio of loans to legal entities and individuals to GDP was 24% and 12%, respectively, in 2024.

Figure 34. Total Loans-to-GDP Ratio in CCA countries*, %

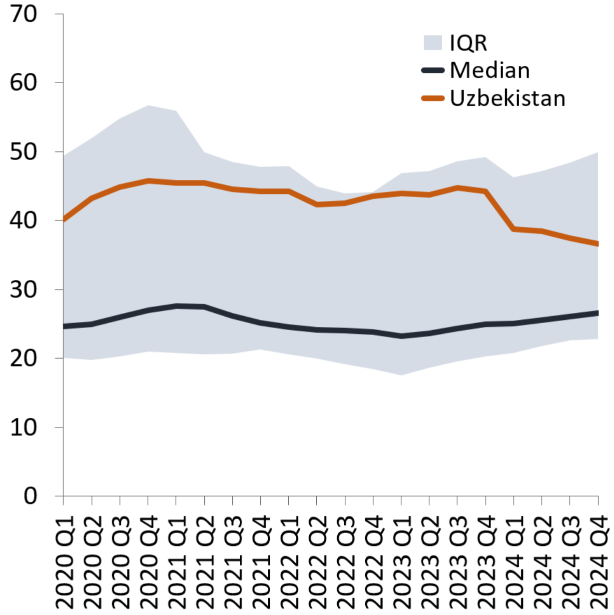
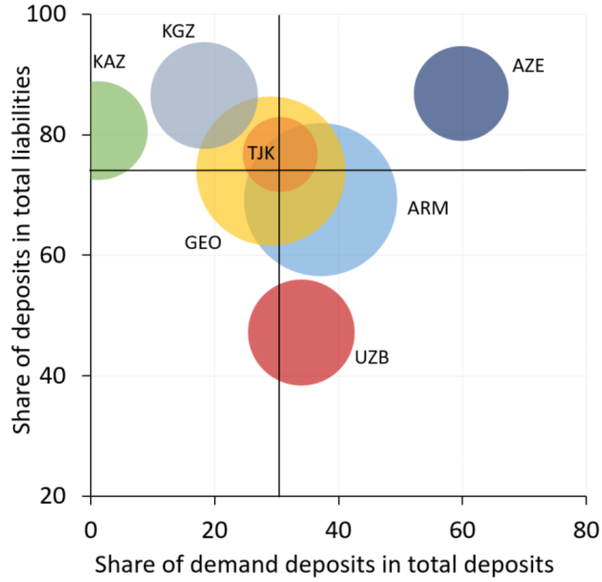


Figure 35. Shares of Deposits in CCA Countries, % (as of January 1, 2025)**



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

Note: *Armenia, Georgia, Azerbaijan, Tajikistan, Uzbekistan, Kyrgyzstan and Kazakhstan 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 the CCA countries as of January 1, 2025.

The total loans-to-GDP ratio in Uzbekistan was higher than in CCA countries, while the ratio of deposits to liabilities was lower. In 2024, the ratio of total loans-to-GDP in Uzbekistan exceeded the median of CCA countries by 10 p.p.. As of January 1, 2025, the share of deposits in total liabilities in Uzbekistan was 47%, indicating a lower level compared to CCA countries.

Figure 36. Loan-to-Deposit Ratio and Difference between Loans and Deposits, %

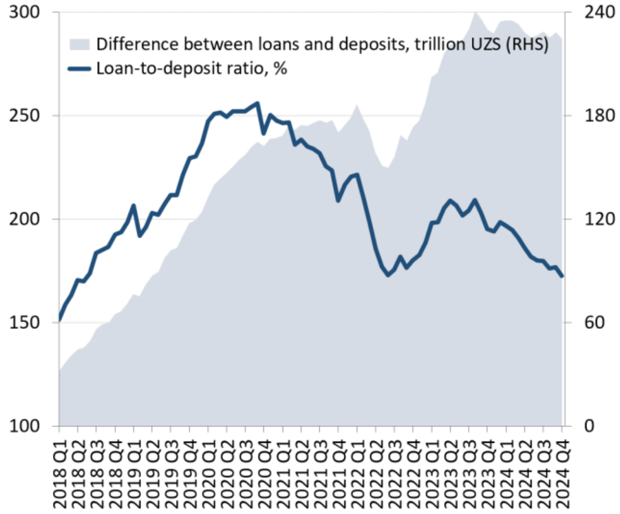
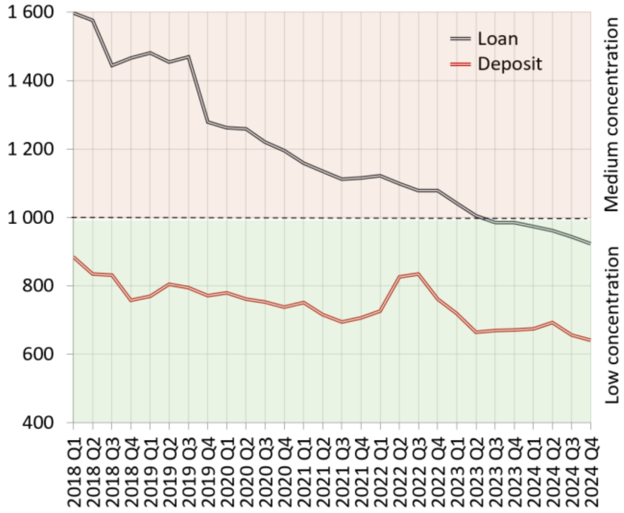


Figure 37. Concentration of Outstanding Loans and Deposits, HHI*



Source: CBU.

Note: *The Herfindahl-Hirschman Index (HHI) categorizes the level of competition in the banking services market into 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 share of deposit and loan balance in the total banking system deposit and loan balance.

The concentration of outstanding loans and deposits remained at a low level. In 2024, the loan concentration in the banking system decreased by 62, reaching 924. In particular, the loan concentration level for legal entities was medium, while it remained low for individuals. Meanwhile, the concentration of bank deposits continued to remain at a low level.

The difference between loans and deposits in the banking sector continued to narrow. The deposits grew at a rate 15 p.p. higher than loans. As a result, the difference between loans and deposits in the banking system amounted to 224 trillion UZS, a contraction of 5.3 trillion UZS compared to 2023. At the same time, the ratio of loans-to-deposits decreased by 22 p.p..

Figure 38. Bank-by-Bank Annual Growth Rates of Loans and Deposits, % (as of January 1, 2025)

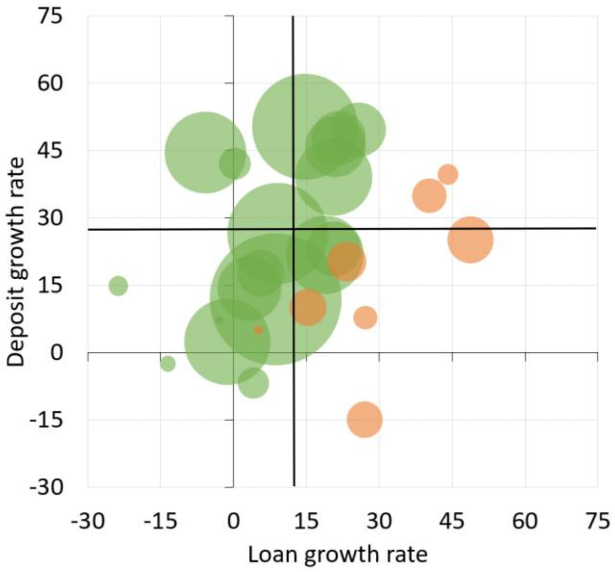
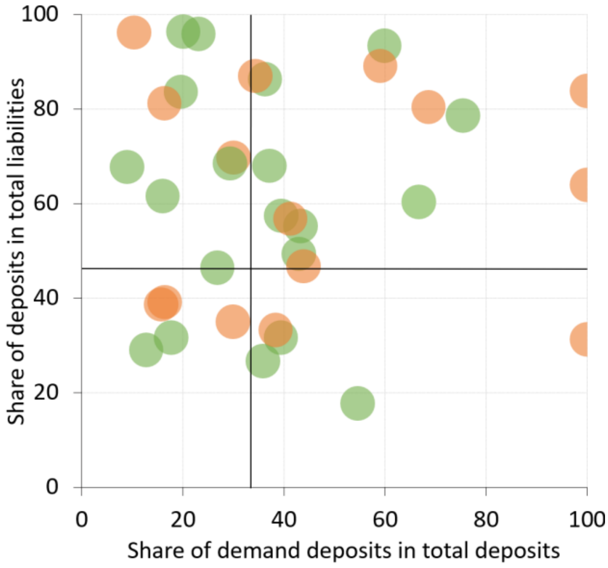


Figure 39. Bank-by-Bank Share of Deposits (as of January 1, 2025)



Source: CBU.

Note: In the left graph, the color green on the graph represents banks with a faster growth rate of deposits compared to loans, while light red indicates banks with a lower growth rate of loans. The bubble size represents the share of bank's assets in all banks' assets.

In the right graph, the color green on the graph indicates banks where the share of demand deposits in total deposits decreased compared to the same period in 2024. Light red, on the contrary, represents banks where the share of demand deposits in total deposits increased compared to the same period in 2024. The continuous straight lines represent indicators for the banking system as of January 1, 2025.

The growth of deposits in large banks is outpacing the growth of loans. In addition**,** a downward trend has been observed in the share of demand deposits in total deposits in the banking system. In particular, by the end of 2024, demand deposits accounted for 34% of total deposits, marking a 2 p.p. decrease compared to 2023.

The share of NPLs was elevated in D-SIBs. An increase was observed in the share of NPLs in total loans. In 2024, the volume of NPLs in the banking system rose by 27%, reaching 21.2 trillion UZS. Meanwhile, at the beginning of 2025, the annual growth rate of the outstanding loans was 13%, a slowdown of 8 p.p. compared to same corresponding period in 2024. The share of NPLs in D-SIBs stood at 4.4%, while in other banks, the indicator was around 3%. In Uzbekistan, the share of NPLs in total loans amounted to 4%, exceeding by 1 p.p. the median value for CCA countries.

Figure 40. Annual Growth in NPL Ratio and Outstanding Loans

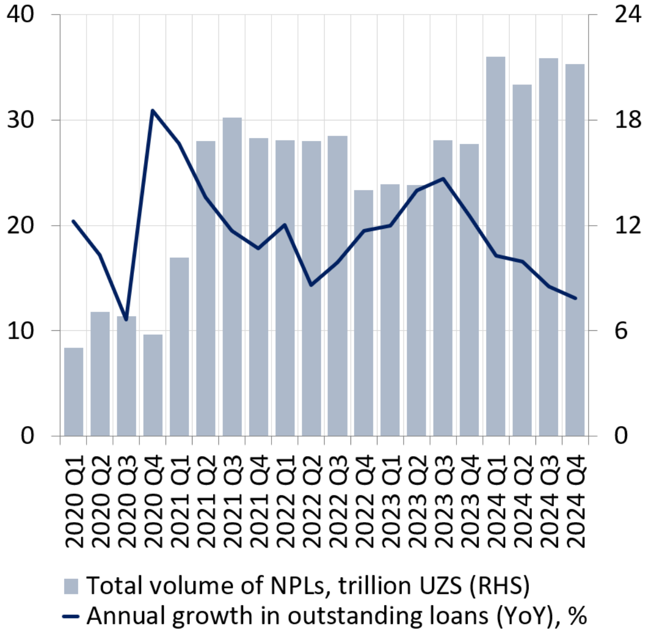
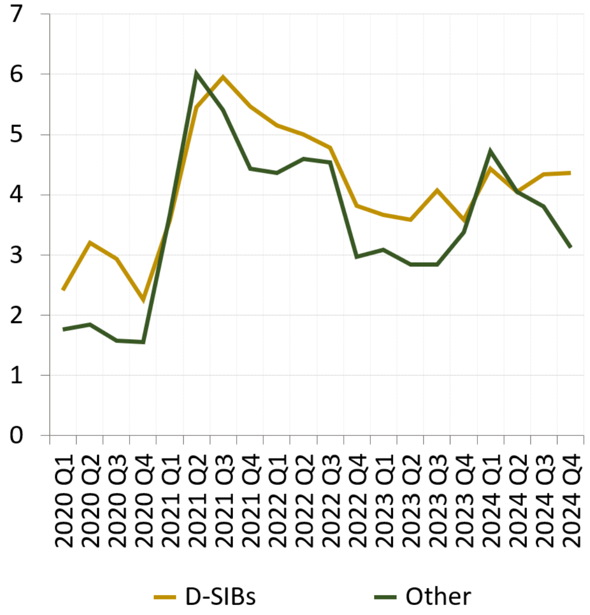


Figure 41. Share of NPLs in Total Loans, %



Source: CBU.

A decline was observed in the share of "loss" loans within NPLs. By the end of 2024, the share of "loss" loans in the total NPLs amounted to 18%, decreasing by 7 p.p. compared to 2023. At the same time, 47% of NPLs accounted for "unsatisfactory" loans and 35% for "doubtful" loans.

Figure 42. NPL Ratio in CCA Countries*, %

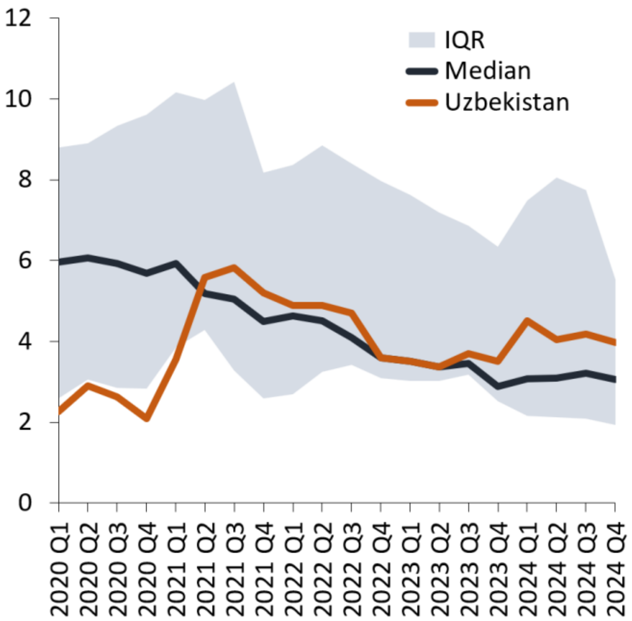
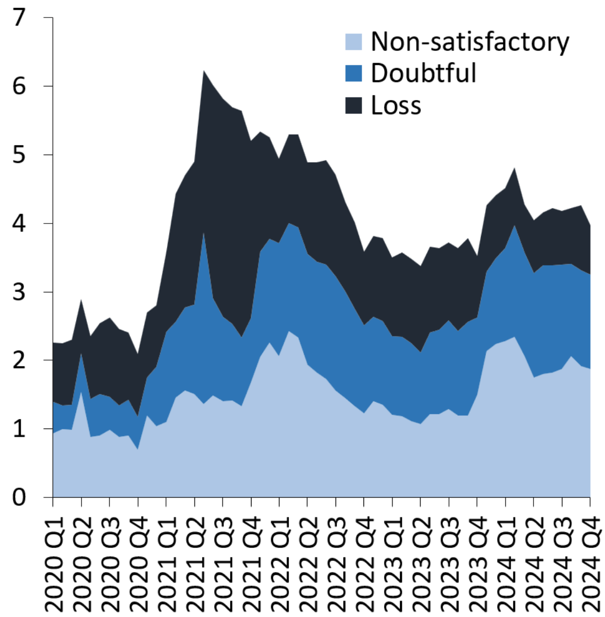


Figure 43. NPL Composition, %



Source: CBU.

Note: *Armenia, Georgia, Tajikistan, Uzbekistan, Kyrgyzstan and Kazakhstan, and from Q4 2021 Azerbaijan are taken into account.

Figure 44. NPLs and Provisions, %

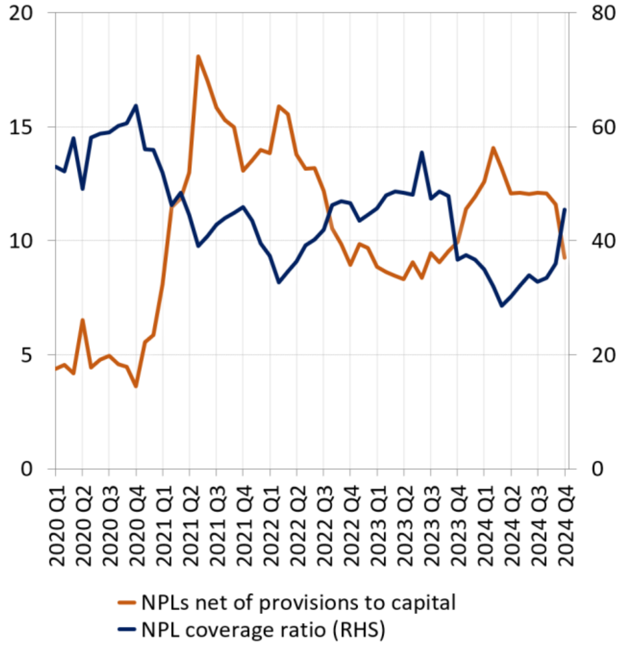
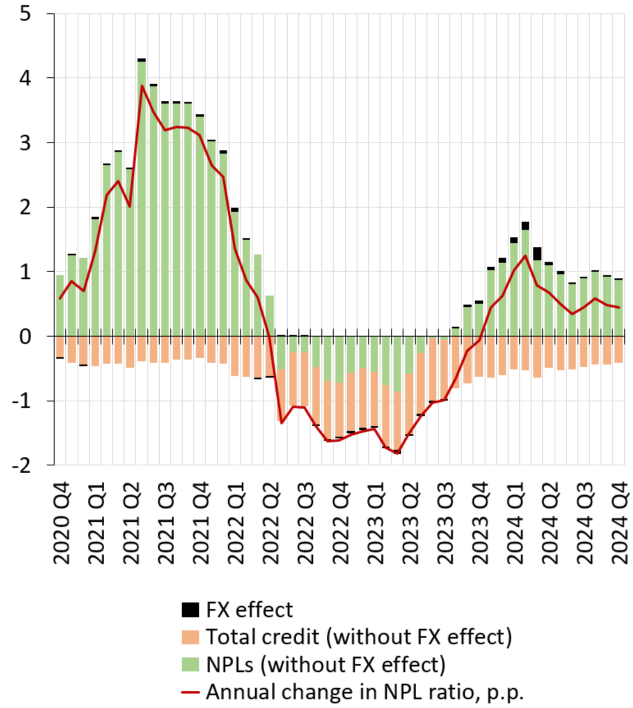


Figure 45. Decomposition of Annual Change in NPL ratio, %



Source: CBU.

The banking system's resilience to loan losses improved. In 2024, the NPL coverage ratio increased by 24 p.p. compared to 2023, reaching 45%, indicating an improvement in the coverage of NPLs with provisions in the banking system. Furthermore, at the end of 2024, the ratio of NPLs net of provisions to capital was 9%.

Box 2. Systemic Risk Survey

In January 2025, the CBU conducted the most recent survey[38] involving all commercial banks (respondents) to identify potential systemic risks in the financial system of Uzbekistan and assess their impact.

According to the survey results, geopolitical risks, high inflation, exchange rate, increasing household debt, and credit risks are identified as top five systemic risks to the Uzbekistan's financial system. Geopolitical risks remain the most prominent risk noted by respondents. Respondents' concerns about exchange rate volatility have slightly eased, while the risk of high inflation has emerged among the top five systemic risks.

Figure 46. 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.

Among the top five most important systemic risks identified by each respondent, external geopolitical risks were cited by 53%, accelerating inflation by 37%, sharp exchange rate volatility by 35%, rising household debt by 29%, credit risk by 27%, and risks associated with cyberattacks by 24%[39].

[38] The sample of Systemic Risk Survey is provided in the Financial Stability Report for 2023.

[39] In this question, each bank identifies five systemic risks. Importantly, the proportion of respondents citing a particular risk, calculated based on weights, 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%.

Furthermore, liquidity risk, large borrower defaults, economic slowdown, and climate change risks were listed among the potential risks with an adverse impact on the country's financial stability.

56% of respondents assessed the probability of systemic risks materializing in the short term (up to 1 year) as low. In the medium term (1–3 years), 61% of respondents considered the probability of systemic risks occurring to be medium.

Figure 47. Probability of Materialization of Systematic Risks, %

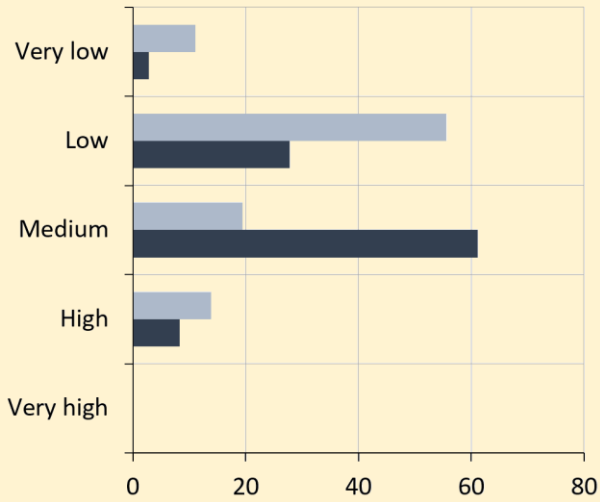
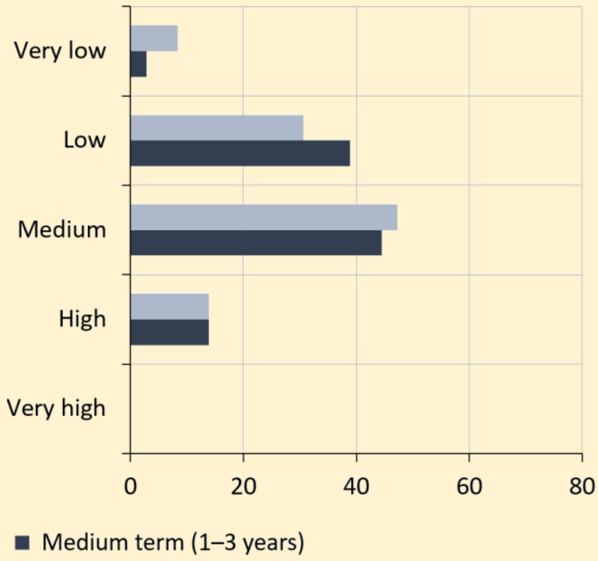


Figure 48. Systematic Risks Level Over the Past Period, %



Source: CBU Survey.

According to the survey results, 47% of respondents indicated that the level of systemic risk in the short term was medium, while 44% noted that the medium level of risk has persisted over the past 1-3 years.

At the same time, 67% of respondents reported increased confidence in the stability of the Uzbekistan's financial system over the next three years. In particular, the share of respondents indicating sufficient confidence in the stability of the financial system rose by 7 p.p. compared to the survey conducted in July 2024. Additionally, 31% of respondents expressed partial confidence in the future stability of the country's financial system.

Figure 49. Confidence Level in the Stability of Uzbekistan's Financial System Over the Next Three Years, %

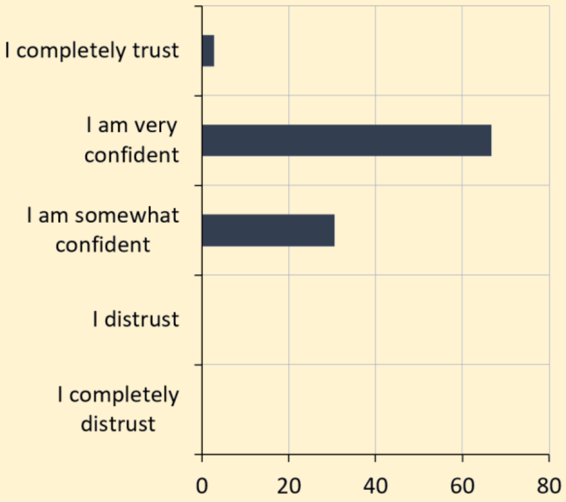
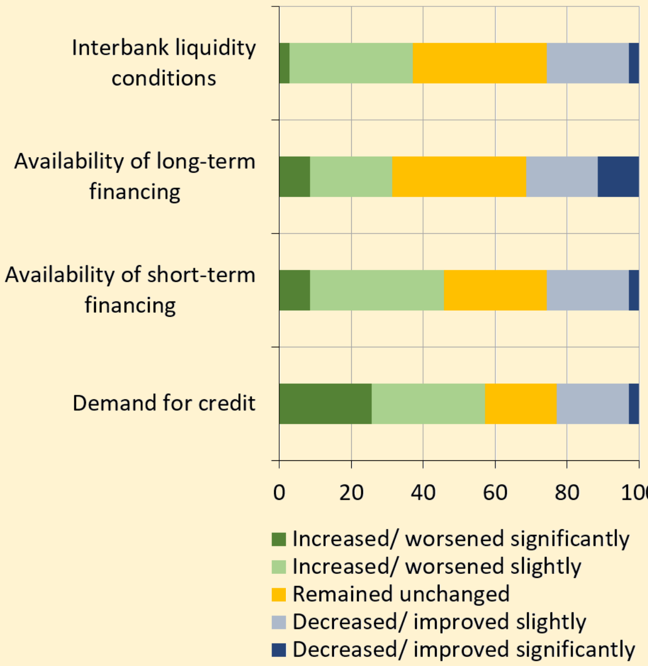


Figure 50. Changes in Factors Affecting Financial Stability Over the Past Six Months, %



Source: CBU Survey.

Over the past six months, no significant adverse changes were observed by respondents in the financial stability indicators cited in the survey. In addition, 47% of respondents experienced an increase in credit demand and an improvement in interbank liquidity conditions. Separately, 47% of respondents noted both short-term and long-term financing conditions have remained unchanged over the last six months. Meanwhile, 39% of respondents reported an increase in availability of short-term financing during this period.

2.2. Non-bank Financial Sector

The non-bank financial sector[40] maintains a small share in Uzbekistan's economy, and the probability of vulnerabilities triggering systemic risks remains low. At the end of 2024, the ratio of non-bank financial sector assets to GDP stood at 1.7%, an increase of 0.3 p.p. compared to 2023. In 2024, in the context of the expansion of non-bank credit organizations, microfinance organizations maintained minimum CAR requirement, and mortgage refinancing organization demonstrated high profitability. In addition, despite positive changes in the development of the insurance market, Uzbekistan remains among the countries with a relatively small insurance market size.

Figure 51. Annual Growth rates of Stock of Loans of Non-bank Credit Organizations, %

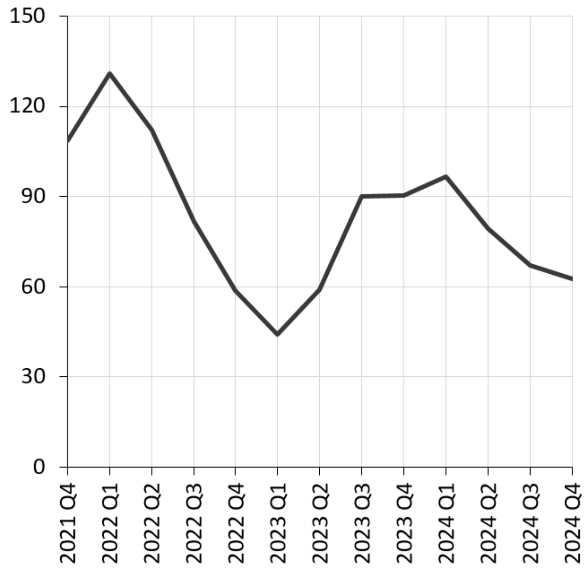
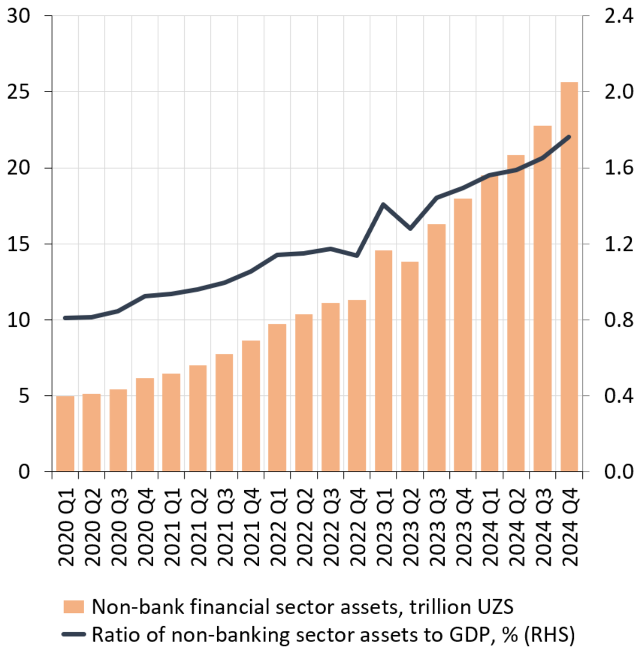


Figure 52. Non-bank Financial Sector Assets, trillion UZS



Sources: National Statistics Committee, National Agency of Prospective Projects and Unified Corporate Information Portal and CBU staff calculations.

The growth of outstanding loans by non-bank credit organizations[41] has decelerated. At the end of 2024, the annual growth rate of outstanding loans issued by non-bank credit organizations amounted to 63%, a decrease of 28 p.p. compared to 2023. Microfinance organizations and pawnshops accounted for 64%[42] of the non-bank credit organizations' loan portfolio.

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

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

[42] The Central Bank of the Republic of Uzbekistan. (2025). Indicators of non-bank credit organizations.

The share of non-bank financial organizations in the total financial sector[43] assets increased slightly. In particular, at the end of 2024, non-bank financial sector assets accounted for 3.2% of total financial system assets, an increase of 0.5 p.p. compared to 2023. In 2024, non-bank financial sector assets grew by 41%, reaching 25.4 trillion UZS[44].

Figure 53. Profitability of Insurance Companies, %

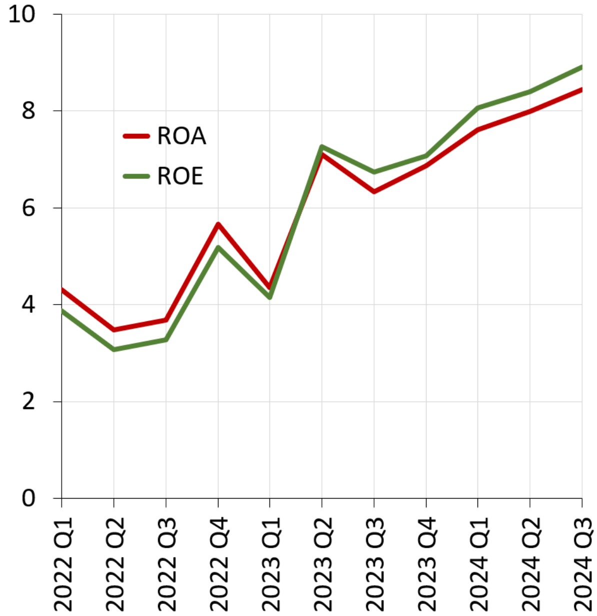
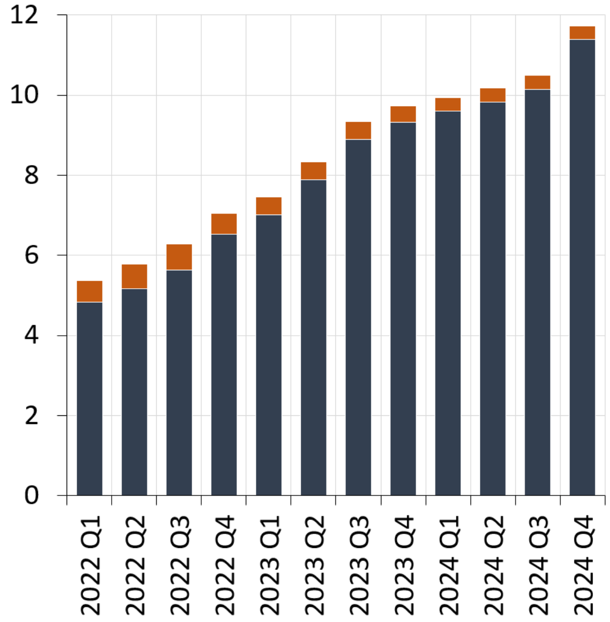


Figure 54. Assets of Insurance Companies, trillion UZS



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.

An increasing trend was observed in the profitability indicators[45] of insurance organizations. As of October 1, 2024, the annual ROA of insurance companies amounted to 8.4%, rising by 2.1 p.p. compared to the corresponding period in 2023. The ROE of insurance companies increased by 2.2 p.p., reaching to 8.9%.

The share of life insurance companies in the total assets of the insurance sector has further declined. By the end of 2024, the assets of life insurance companies constituted 2.8% of the insurance market assets, a decrease of 1.3 p.p. compared to 2023. This reduction is explained by the contraction in the number of life insurance companies operating in the sector from seven to five[46] in 2024.

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[43] Assets of banks and non-banking financial organizations are included in financial sector assets.

[44] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

[45] ROE is determined by dividing annual NPAT by average capital and reserves. Meanwhile, ROA is calculated by dividing annual PBT by average total assets.

[46] The National Agency of Perspective Projects of the Republic of Uzbekistan. (2025). Insurance Market Indicators of Uzbekistan for 2024.

Figure 55. Investments of Insurance Companies, trillion UZS

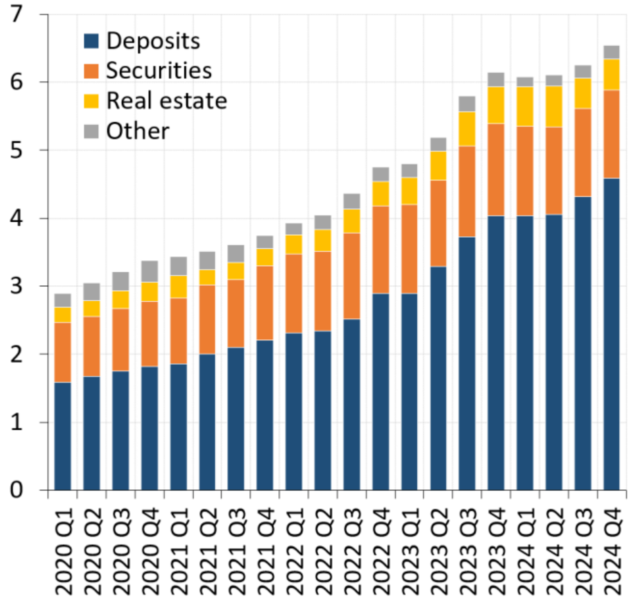
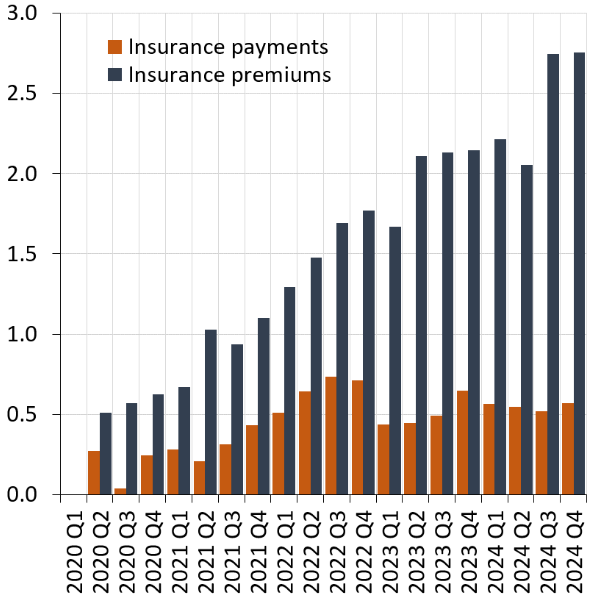


Figure 56. Quarterly Insurance Payments and Premiums, trillion UZS



Source: National Agency for Prospective Projects.

The deposits share in the investment portfolio of insurance companies continued to increase. As of the end of 2024, the total investments by insurance companies amounted to 6.5 trillion UZS, an increase of 6% compared to 2023. Insurers' investment activity in deposits continued to expand, with deposits accounting for 70% of total investments by the end of 2024. Specifically, in 2024, the amount of deposits in insurance companies' investment portfolio grew by 14%, while investments in real estate and securities declined by 16% and 4%, respectively. This indicates a preference for safe and more stable sources of income by insurance companies.

Figure 57. Insurance Payments-to-Insurance Premiums Ratio, %

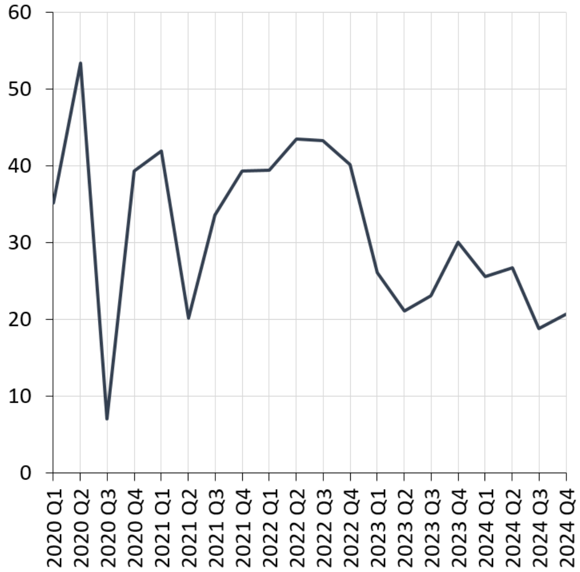
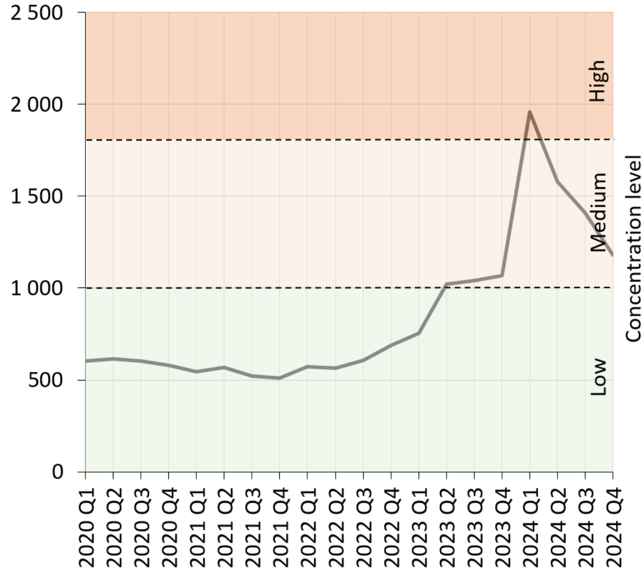


Figure 58. Insurance Premiums Concentration, HHI[47]



Sources: National Agency for Prospective Projects and CBU staff calculations.

Insurance premiums growth outpaced growth rate of insurance payments in 2024. The amount of insurance payments by insurance companies in 2024 reached 2.2 trillion UZS, an increase of 9% compared to 2023[48]. Concurrently, in 2024, the total insurance premiums[49] rose by 21%, amounting to 9.8 trillion UZS. In 2024, the stronger growth of insurance premiums relative to insurance payments was reflected an improvement in the profitability of insurance companies.

The operational efficiency of insurance companies has improved. In 2024, the ratio of insurance payments to insurance premiums stood at 23%, representing a 3 p.p. increase compared to 2023. The faster growth of insurance premiums compared to insurance payments indicates positive developments in the efficiency of insurance companies.

The concentration of insurance premiums remains at a medium level. At the end of 2024, although insurance premiums concentration in the insurance market decreased to 1181, it still increased by 11% compared to 2023. This indicates that the concentration of insurance premiums remained within medium concentration group by the end of 2024.

Insurance density in Uzbekistan has increased. In particular, insurance density grew by 14%, reaching 20 USD by the end of 2024. Despite this improvement, Uzbekistan remains among the countries with a relatively low insurance density in CCA region. In addition, at the end of 2024, the insurance penetration ratio stood at 7 per mille, remaining unchanged from 2023.

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

[48] 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.

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

Figure 59. Insurance Penetration and Density in Uzbekistan

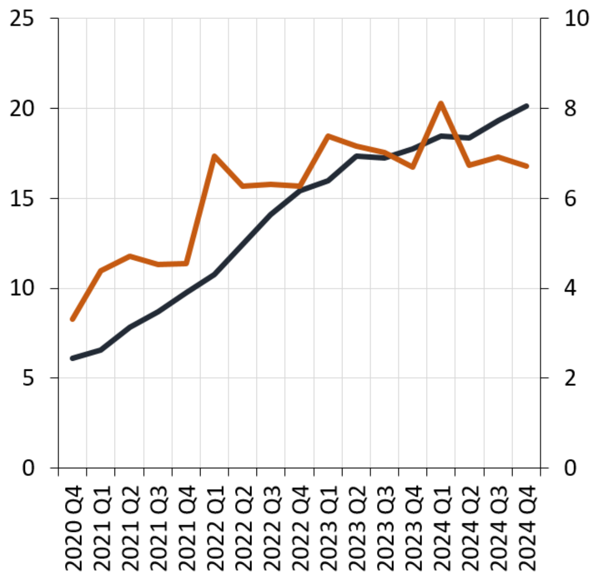
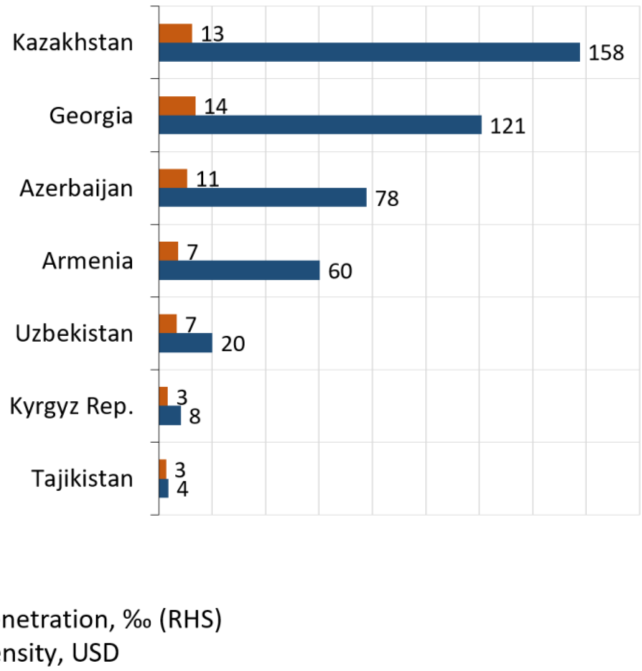


Figure 60. Insurance Penetration and Density in Selected Countries (as of January 1, 2025)



Sources: National authorities, National Agency for Prospective Projects, National Statistics Committee 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 total insurance premiums by nominal GDP. The values of insurance premiums and the nominal GDP in the corresponding periods are used for this purpose.

The capital adequacy of total assets decreased due to the expansion of lending by microfinance organizations. In 2024, the total assets of microfinance organizations expanded by 77%, amounting 7.9 trillion UZS, while total capital grew by 44%[50]. Consequently, the stronger growth rate of assets compared to capital reflected in the reduction of the CAR[51]. As of January 1, 2025, the CAR of microfinance organizations was 32%, a 7 p.p. decrease from the corresponding period in 2024. Nevertheless, the CAR of microfinance organizations stayed above the established minimum requirements.

[50] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

[51] The CAR of microfinance organization is calculated by the ratio of total equity of microfinance organization to total assets.

Figure 61. CAR of Microfinance Organizations, %

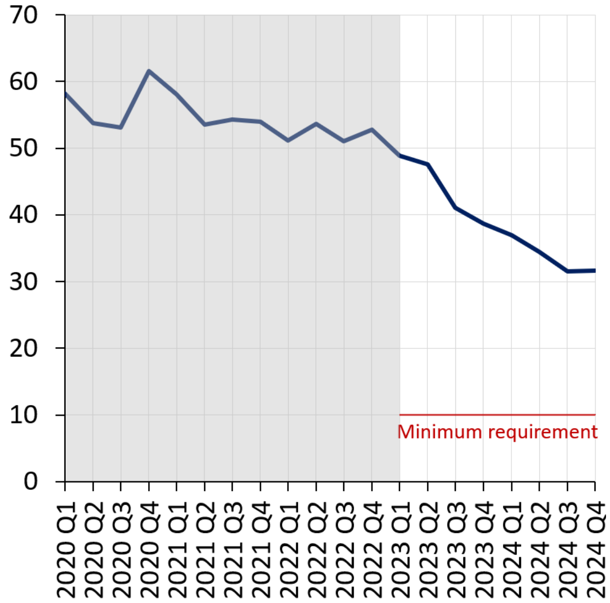
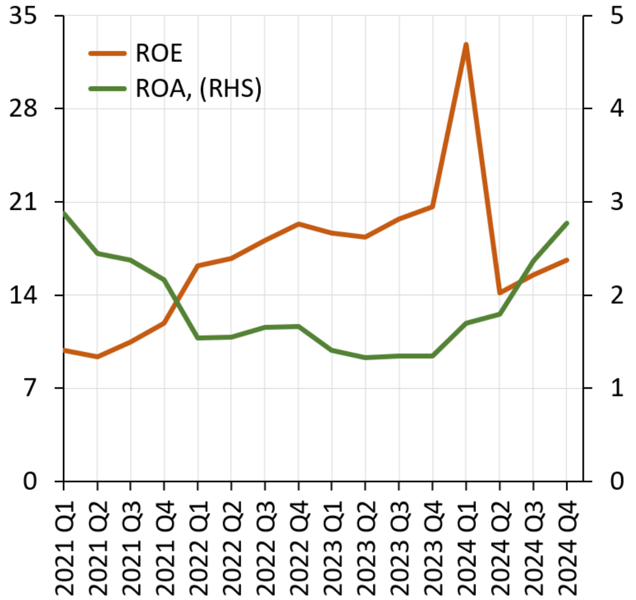


Figure 62. ROE and ROA of Mortgage Refinancing Company, %



Sources: Mortgage Refinancing Company of Uzbekistan and CBU staff calculations.

Note: As of April 14, 2023, a minimum CAR requirement for microfinance organizations has been established.

ROE for mortgage refinancing company of Uzbekistan decreased due to the expansion in capital. By the end of 2024, ROA and ROE of mortgage refinancing company amounted to 3% and 17%, respectively. In 2024, the mortgage refinancing company's net profit increased by 3.7 times compared to 2023, while the total amount of capital rose by 5.5 times[52].

[52] Mortgage refinancing company of Uzbekistan. (2025). Financial reports.

2.3. Capital Market

The importance of developing domestic capital market is increasing due to heightened volatility in the global capital markets. Elevated global economic policy and trade uncertainties have amplified investor concerns. In Q1 2025, reduced demand for sovereign and corporate bonds in global stock markets depressed market prices of securities and raised yields. Investor concerns regarding countries with high public debt may further reduce demand for their securities in the future[53]. This, in turn, constrains the EMs' opportunities to attract external financing. Consequently, the development of the domestic capital market in Uzbekistan is becoming increasingly important for ensuring the efficiency of financial resource mobilization amid uncertainties in global capital markets.

Rise in geopolitical tensions is causing instability in global capital markets. Geopolitical risks contribute to a decline in financial asset prices through the channels of economic and market expectations. At the beginning of 2025, the announcement of new tariff policy by the US led to price fluctuations in global stock markets. In addition, the imposition of countermeasures by other countries against the US is further intensifying uncertainties[54]. In particular, in the first week of Q2 2025, the S&P 500[55] and NASDAQ Composite[56] indices fell sharply by 10%[57] and 11%[58], respectively.

A decline in demand for Uzbekistan's sovereign eurobonds, resulting from global uncertainties, could further increase external financing costs. In the context of global geopolitical risks, yields on sovereign bonds of EMs tend to rise[59]. This, in turn, further raises the costs of additional external financing attracted by Uzbekistan, alongside other EMs, in the context of the persistently high-interest rate environment in global financial markets.

[53] International Monetary Fund. (2025, April). Global Financial Stability Report.

[54] International Monetary Fund. (2025, April). Global Financial Stability Report.

[55] A stock index that includes securities of 500 leading companies covering approximately 80% of the total market capitalization on the US stock exchange.

[56] A stock index composed of the securities of all companies listed on the NASDAQ (National Association of Securities Dealers Automated Quotations) stock exchange.

[57] S&P Dow Jones Indices. (2025). S&P 500.

[58] Nasdaq. (2025). NASDAQ Composite Index.

[59] International Monetary Fund. (2025, April). Global Financial Stability Report.

Figure 63. Uzbekistan Composite Index (UCI)

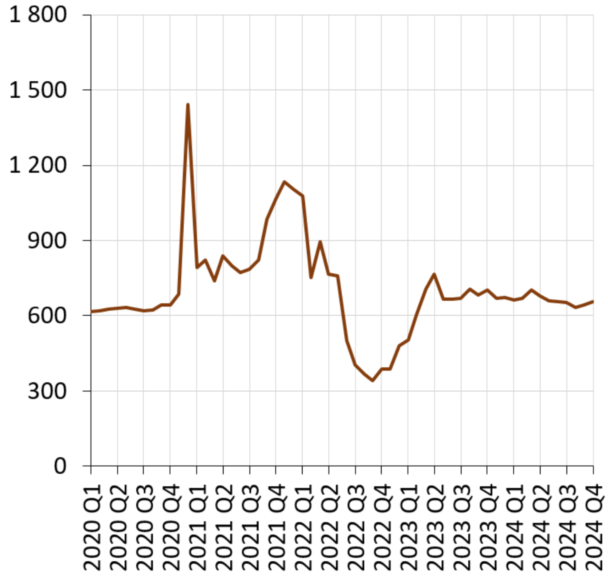
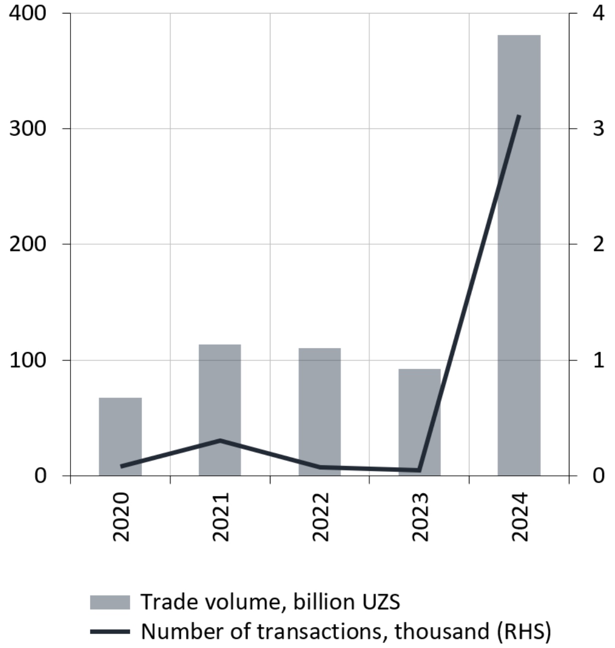


Figure 64. Trading Volume and Number of Transactions in Uzbekistan's Corporate Bond Market



Source: Republican Stock Exchange.

Note: Uzbekistan Composite Index (UCI)[60] is a stock market index that represents the overall performance of listed stock issuers on the Republican Stock Exchange. 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. As of January 1, 2025, there were 89 listed stock issuers on the exchange, out of which 15 were banks.

The UCI experienced a slight decrease but remained stable. Despite a significant reduction in the number of issuers included in the quotation list in 2024, positive developments in the stock prices of issuers prevented sharp volatilities in the index value. At the end of 2024, the UCI stood at 655.1, decreasing by 48.1 compared to 2023[61]. This decline is attributed to the contraction in the number of listed stock issuers from 117 to 89[62].

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[60]UCI is determined by the following formula:

$$UCI = \frac{Market\ Cap_{current\ date}}{Market\ Cap_{base\ date}} * Base\ Index$$

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 day;

$Market\ Cap_{base\ date}$ 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.

[61]Republican stock exchange. (2025). UCI.

[62] Republican stock exchange. (2025). Press release: 2024 Summary.

The corporate bond market is primarily composed of banks and non-bank financial sector organizations. By the end of 2024, the total nominal value of bonds issued by entities listed in the quotation list amounted to 825.2 billion UZS with banks and non-bank financial organizations accounting for 18% and 82%, respectively[63]. The volume of trading in the corporate bond market is also increasing. In particular, 3,118 trades totalling 381 billion UZS were executed in 2024, marking 4.1 times increase compared to 2023[64].

The stock market in Uzbekistan, although relatively small, is expanding. In 2024, the trade volume in the stock market reached 19.2 trillion UZS, increasing 7.3 times compared to 2023[65]. The significant rise in the stock market activity was also reflected in the growth of market capitalization. Specifically, during 2024, the country's stock market capitalization increased by 43%, reaching 17% of GDP. The ratio of stock market capitalization to GDP in Uzbekistan remains among countries with a relatively low indicator compared to countries with a similar economic development level.

Figure 65. Stock Market Capitalization* and Penetration in Uzbekistan

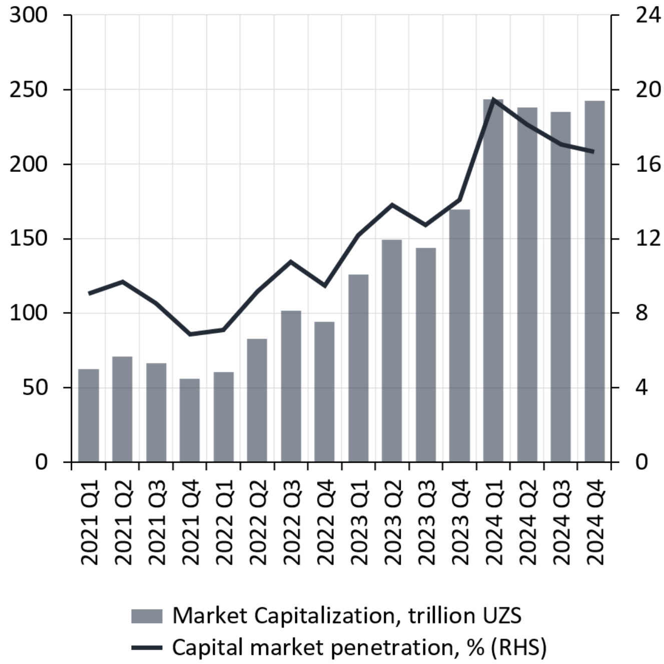
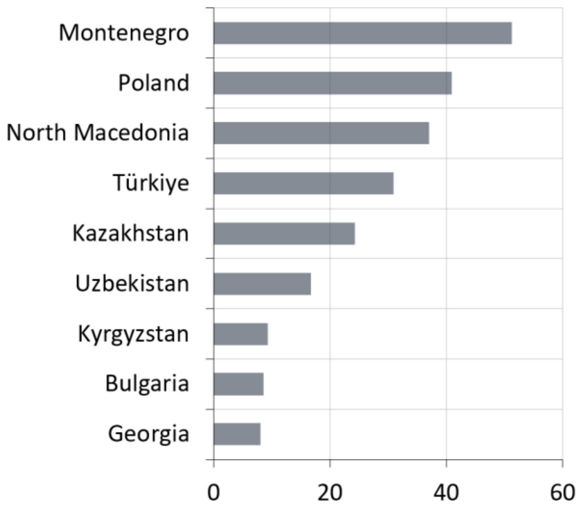


Figure 66. Stock Market Penetration in Some Countries as of January 1, 2025, %



Sources: National authorities and Republican Stock Exchange.

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

[63] Republican Stock Exchange. (2025). Exchange Review. December 2024.

[64] Republican Stock Exchange. (2025). Press release: 2024 Summary.

[65] Republican Stock Exchange. (2025). Press release: 2024 Summary.

The main share of participants in the stock exchange trades in 2024 consisted of industrial enterprises and banks. The volume of trades involving securities of issuers included in the exchange quotation list amounted to 19.6 trillion UZS in 2024, almost 8 times more than in 2023. Industrial enterprises accounted for the largest share, representing 63% of the trades concluded, while transactions with bank securities made up 33%[66] of total trade volume. In addition, starting from 2024, market data of the Uzbekistan stock exchange became available on the Bloomberg terminal, making it easier for investors to access information on trades of Uzbekistan stock exchange.

Figure 67. Trading Volume of Republican Stock Exchange, trillion UZS

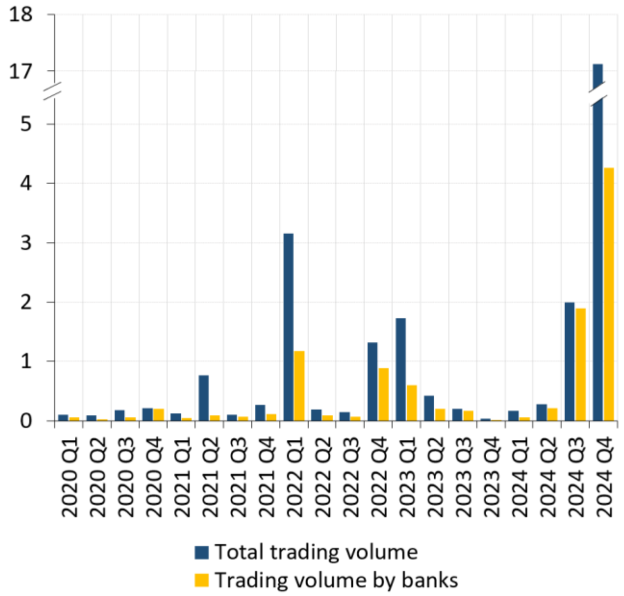
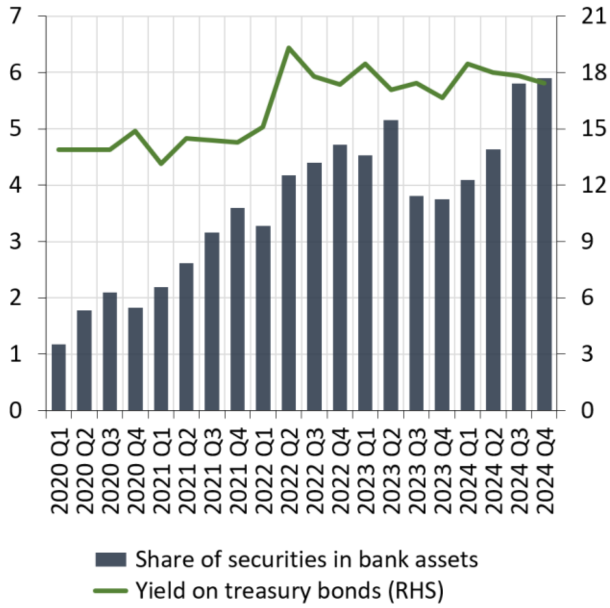


Figure 68. Share of Securities in Bank Assets and Yield on Treasury Bonds, %



Sources: Republican Stock Exchange, Uzbek Republican Currency Exchange and CBU staff calculations.

The yield on treasury bonds has increased slightly. In 2024, the average yield on treasury bonds stood at 18%, an increase of 0.4 p.p. compared to 2023. As of January 1, 2025, securities accounted for 6% of total banks assets, representing an increase of 2 p.p. compared to the corresponding period in 2024.

Risk expectations for sovereign eurobonds have increased in the global stock market. In 2024, the yield on Uzbekistan's sovereign eurobonds fluctuated, settling at around 7% by the end of the year. Despite the rise in the yield on Uzbekistan's sovereign eurobonds, the country's risk premium decreased compared to 2023, standing around 240-280 basis points. This indicates that, under the influence of ongoing geopolitical risks, benchmark price of sovereign eurobonds in the global stock market has also shown a downward trend.

[66] Republican Stock Exchange. (2025). Trade statistics.

Figure 69. Yield on Uzbekistan Foreign Currency Sovereign Eurobonds, %

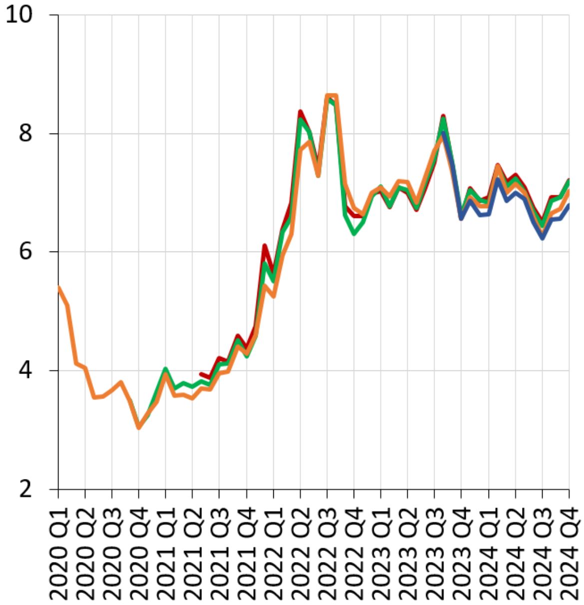
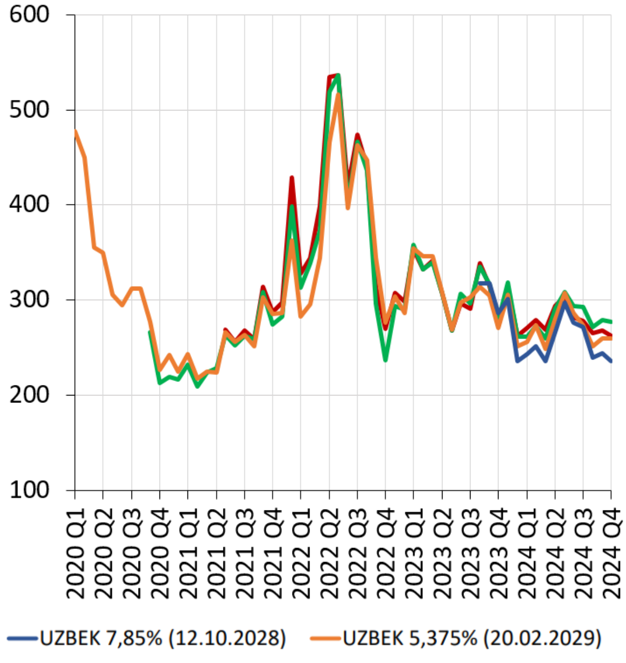


Figure 70. G-spread* of Uzbekistan Foreign Currency Sovereign Eurobonds, basis points



Source: Bloomberg and Ministry of Economy and Finance.

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.

As a result of geopolitical risks, the demand for sovereign bonds of EMs has decreased. Amid global uncertainties, investors are allocating their financial resources towards safe-haven assets, as well as sovereign bonds of AEs. Consequently, the demand for sovereign bonds of EMs weakens, and the market price of these bonds will decrease in the global financial markets. Under the influence of external geopolitical risks, the risk premium of EMs with high public debt and low levels of international reserves may rise significantly[67]. This, in turn, raises concerns regarding higher costs of external financing for Uzbekistan.

[67] International Monetary Fund. (2025, April). Global Financial Stability Report.

III. Non-financial Sector

3.1. Corporate Sector

In 2024, concerns over the financial condition of enterprises in the corporate sector increased. The rise in loans denominated in FX and high interest rates indicate vulnerabilities within the sector. This condition is associated with an increased probability of enterprise defaults, difficulties in covering interest expenses, and decline in profitability indicators.

The lending to legal entities is slowing down. In 2024, the growth rate of corporate loans stood at 10.2%, a decrease of 1.5 p.p. compared to 2023 with the outstanding amount of corporate loans reaching 355.6 trillion UZS. Furthermore, a decline was observed in the share of FX loans allocated to legal entities. In particular, in 2024, the share of the corporate FX loans in the total corporate loan portfolio was 64%, marking a decrease of 1.4 p.p. compared to 2023.

Figure 71. Corporate Loan Stocks by Currency Types and Annual Growth Rate

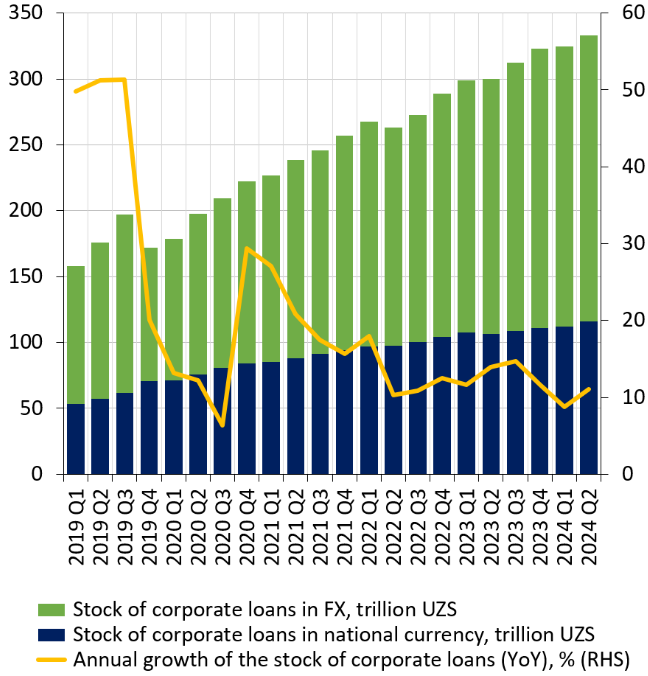
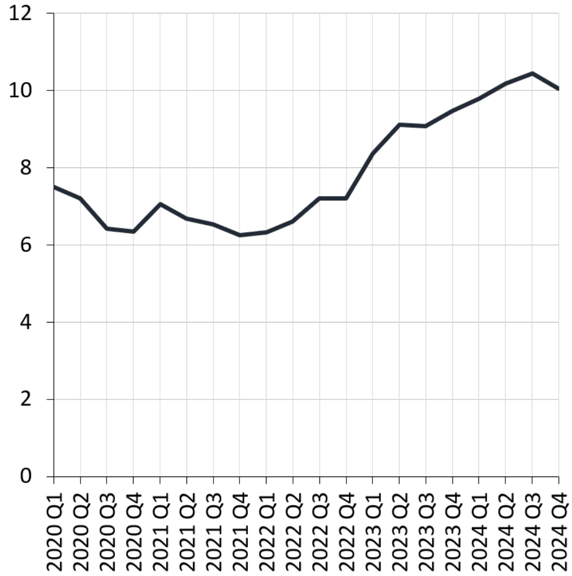


Figure 72. Weighted Average Interest Rate on FX Corporate Loans, %



Source: CBU.

The upward trend in weighted average interest rates on FX loans persisted. In 2024, the weighted average interest rates on corporate FX loans increased by 0.6 p.p., reaching 10.1%. These rise in interest rates increases the debt servicing costs.

Figure 73. Corporate Loan Stocks-to-Annual GDP by Sector, %

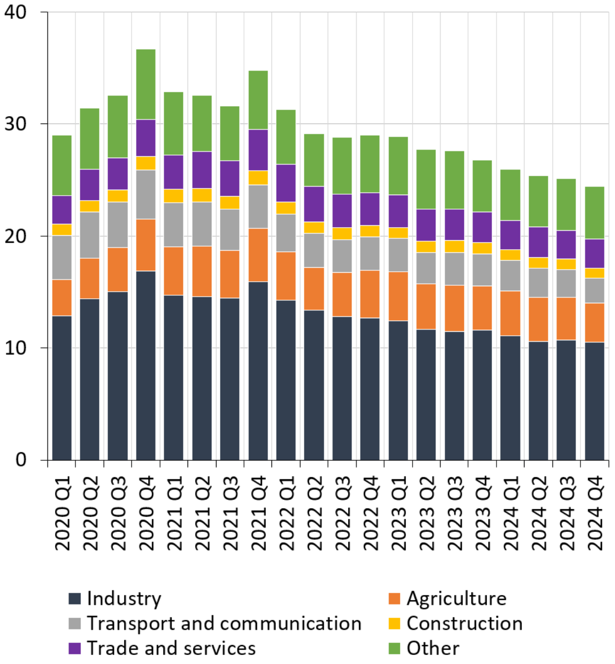
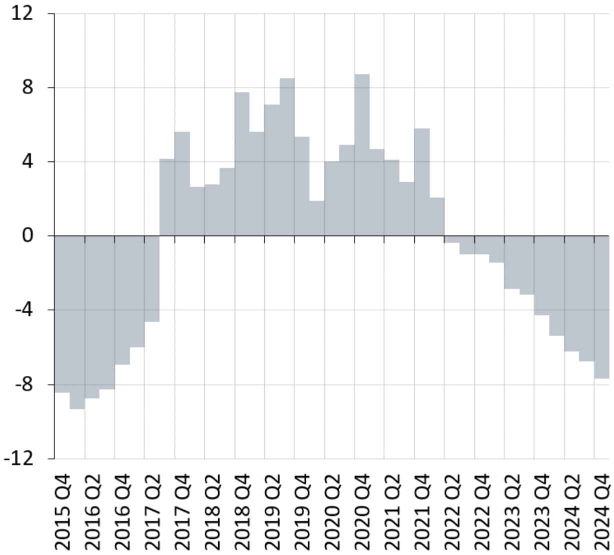


Figure 74. Corporate Loans-to-GDP Gap, p.p.



Source: CBU staff calculations.

The corporate loans-to-GDP gap remains negative. At the end of 2024, the corporate loans-to-GDP ratio decreased by 2.4 p.p. compared to 2023, reaching 24%. Among sectors, the ratio of loans to industry sector relative to GDP remains high. By the end of 2024, the corporate loans-to-GDP[68] gap was around negative 8%, decreasing by 3 p.p. compared to the corresponding period in 2023.

The corporate sector condition was assessed based on the financial performance analysis of 200 large enterprises. In this context, joint-stock companies (JSCs) classified as large taxpayers with substantial assets were selected.

The leverage of enterprises continues to rise. In Q3 2024, the total liabilities-to-capital ratio for 200 selected large JSCs was 206%, an increase of 8 p.p. compared to the same period in 2023. This growth trend indicates the increased vulnerabilities associated with the fulfillment of enterprises' obligations.

[68] 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 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 75. Total Liabilities-to-Capital Ratio* and Share of Loss-Making Enterprises, %

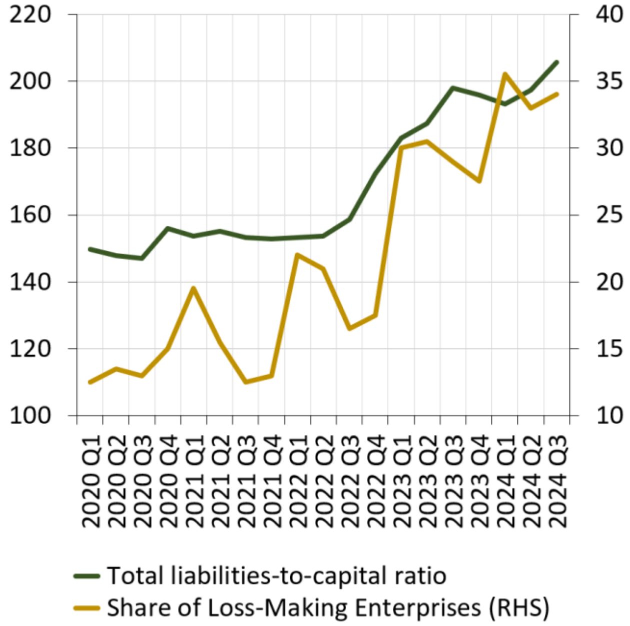
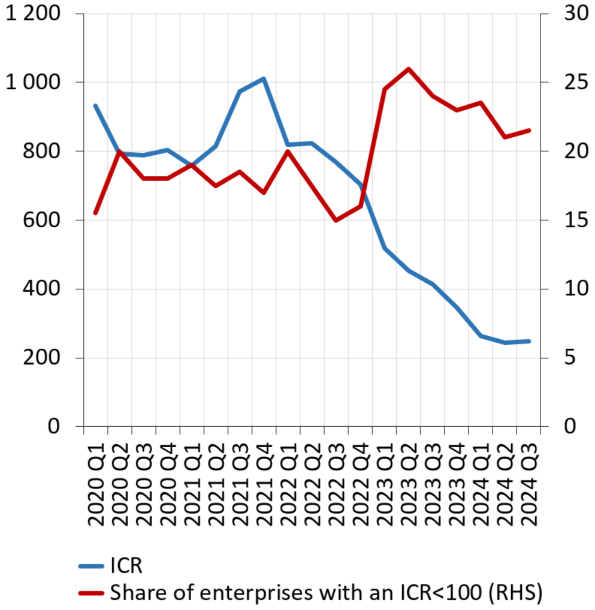


Figure 76. ICR, %**



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 200 large JSCs.

** The ICR is calculated using an exponential moving average[69] based on the data from the 200 largest JSCs. This ratio measures the number of times a company's net profit before tax can cover its debt interest costs. If this 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 ICR of enterprises is declining. At the end of Q3 2024, the ICR for 200 large JSCs amounted to 249%. This ratio was 165 p.p. lower than the corresponding period in 2023, explained by the decrease in the debt-servicing capacity of enterprises to make interest payments on their debts.

Despite the reduction in the number of enterprises unable to fully cover interest expenses, the number of loss-making enterprises has increased. At the end of the Q3 2024, enterprises with an ICR below 100 accounted for 22% of all enterprises, a decrease of 3 p.p. compared to the same period in 2023. Meanwhile, the share of loss-making enterprises increased by 5 p.p., reaching 34% of all enterprises.

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

Figure 77. Cash[70] and Current[71] Ratios, %

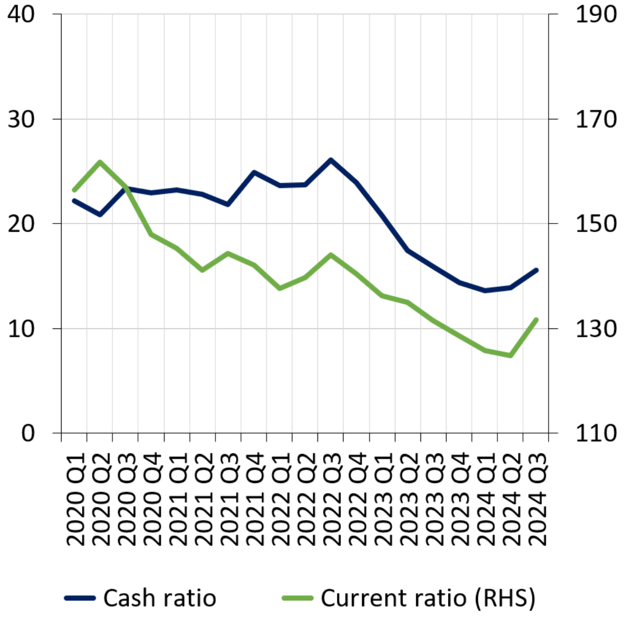
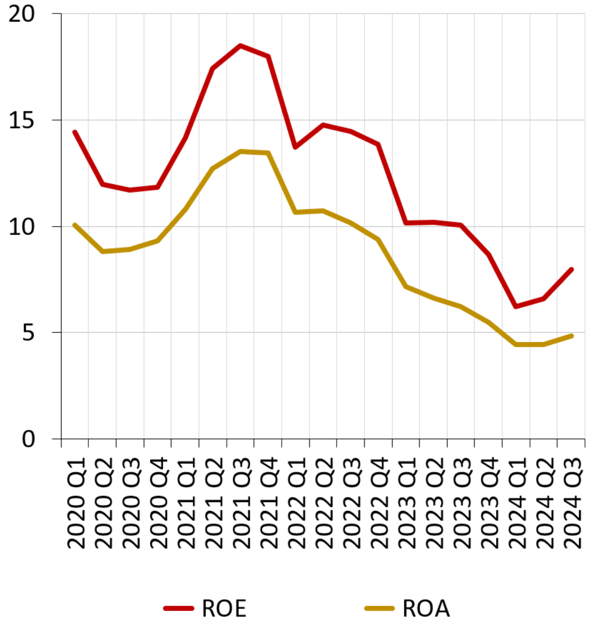


Figure 78. ROE and ROA, %



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

Note: Indicators are calculated using an exponential moving average based on the data from the 200 largest JSCs.

Liquidity indicators of the corporate sector remained almost unchanged. In Q1–Q3 2024, the cash ratio was 16%, indicating the enterprises' cash assets can partially cover current liabilities. The current ratio stood at 132%, reflecting the stable condition of enterprises in fulfilling obligations.

A decline was observed in the ROE and ROA indicators of enterprises. The ROE was 8% in Q1–Q3 2024, dropping by 2 p.p. compared to the corresponding period of 2023. Meanwhile, the ROA indicator contracted by 1 p.p., reaching 5%.

[70] Cash ratio indicates the amount of cash covering current liabilities. This ratio is calculated by dividing the company's most liquid funds by current liabilities.

[71] Current ratio is determined by dividing current assets by current liabilities. A ratio of more than 100 indicates a stable financial condition of a company.

3.2. Household Sector

Timely implementation of MPP tools reduced the risk of loan losses associated with individuals in banks. The introduction of a debt service-to-income (DSTI) limit[72] for borrowers in household lending has reduced the practice of issuing loans to individuals without official income source or sufficient debt-servicing capacity to meet their obligations.

Higher risks weights were assigned for borrowers without official income. In H1 2024, 23% of loan contracts issued by banks were concluded with individuals without official income, and in H2 2024, this figure dropped to 13%. Furthermore, the application of higher risk weights for loans allocated as exception to the DSTI cap[73] in the banks' loan portfolio is contributing to reduce the risks associated with household debt burden.

The growing share of borrowers with multiple loan obligations is raising concerns related to debt burden. The rise in the number of borrowers with multiple loan obligations within banks' loan portfolio may also cause an increase in contagion risk among banks. In this context, deterioration in a single borrower's debt-servicing capacity could simultaneously affect the assets quality of the respective banks. 68% of individuals who obtained loans from banks throughout 2024 had more than one loan obligation. Among individuals with mortgages and car loans, the share of borrowers with multiple loans was 48% and 42 %, respectively. This indicator was relatively higher for microdebts, with 70% of borrowers had more than one loan.

Bank loans constitute the largest share in the loans and debt obligations of individuals. As of January 1, 2025, the number of individuals with bank or non-bank liabilities totaled 5.3 million people. 89% of the total indebted individuals had bank loans, and 9% of them also held obligations to non-bank organizations.

The likelihood of systemic risks occurring due to vulnerabilities associated with obligations outside the banking system is assessed as low. As of January 1, 2025, bank loans to individuals accounted for 96% of the total household debt obligations, while the shares of loans to the households by non-bank credit and non-financial organizations were 3% and 1%, respectively.

In 2024, the total debt burden of individuals with bank loans increased slightly. In 2024, the total DSTI ratio for bank borrowers, including all bank and non-bank debt obligations, was 34% on average. In 2024, the amount of loans to borrowers with total DSTI[74] ratio exceeding 50% accounted for 40% of total bank loans to individuals. Also, the share of loans with a DSTI ratios in 26–50% range amounted to 42% in total loans. 12% of borrowers had a high probability of loan losses, with the DSTI ratio for these borrowers exceeding 100%.

One-fifth of the individuals with a mortgage spend the majority of their income on covering debt obligations. In 2024, 21% of mortgage borrowers had a DSTI ratio exceeding 100%, while the share of borrowers with a DSTI ratio below 50% constituted 39%. Also, the average DSTI ratio for individuals with mortgages from banks, including all bank and non-bank liabilities, was 65%.

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[72] O'zbekiston Respublikasi Markaziy banki boshqaruvining 2024-yil 26-yanvardagi "Qarz oluvchi jismoniy shaxslarning qarz yukini tartibga solish to'g'risidagi nizomga o'zgartirish va qo'shimchalar kiritish to'g'risida"gi 42/16–sonli qarori.

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

[74] The DSTI methodology is presented in the Debt Service Ratio Analysis for Individuals of CBU.

Figure 79. Distribution by Number of Borrowers* (as of January 1, 2025)

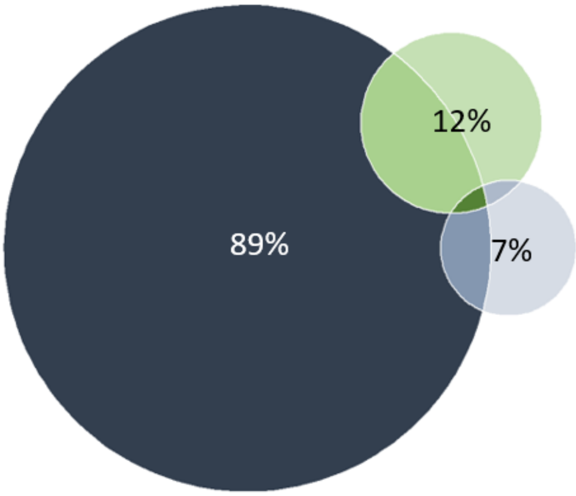


Figure 80. Distribution by Loan Volume (as of January 1, 2025)**

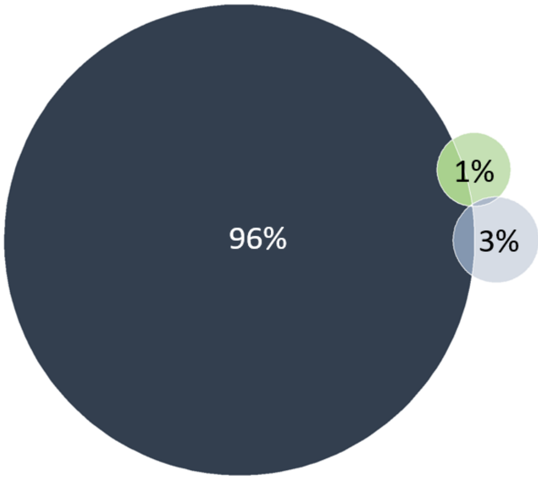
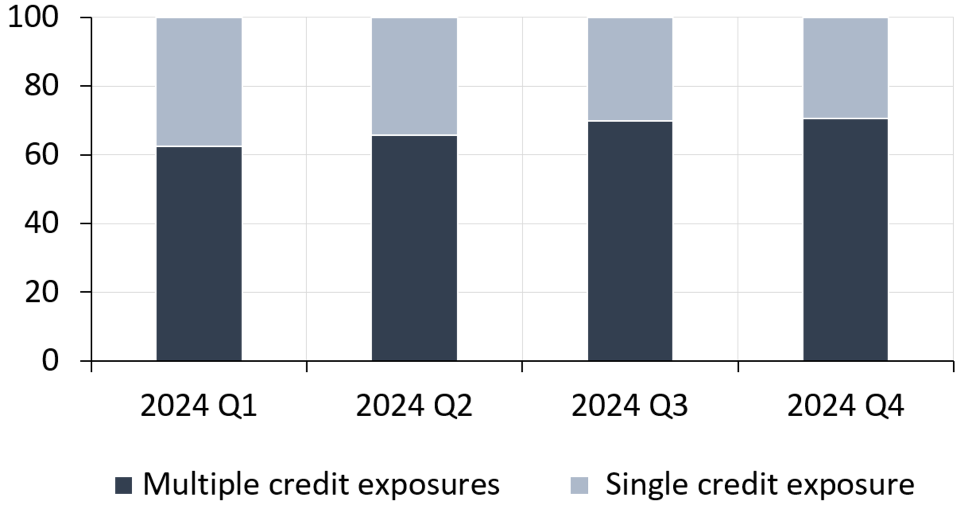


Figure 81. Indebtedness of Individuals, %

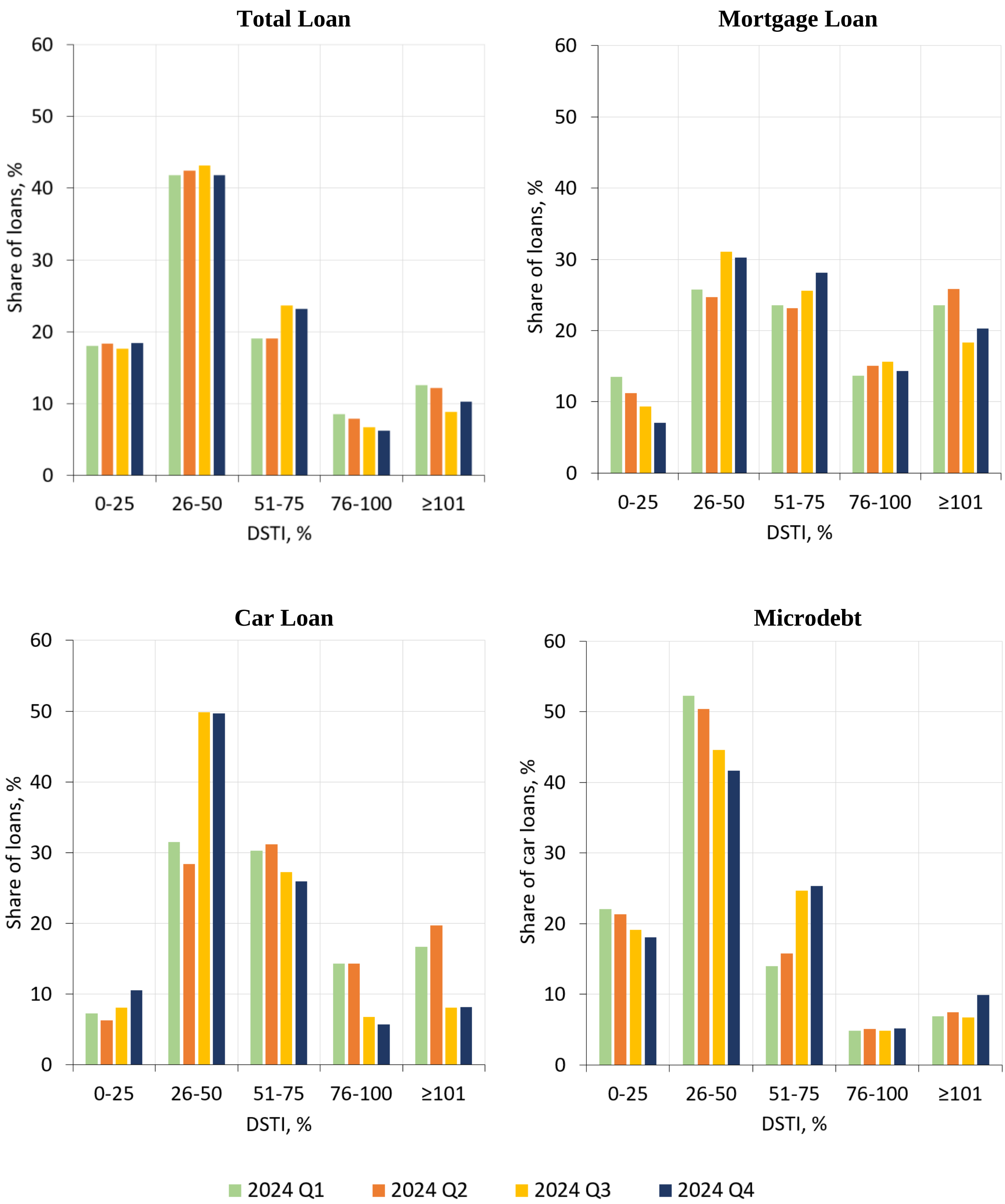


Source: CBU staff calculations.

Note: *The size of the circles in the diagram is determined proportionally to the number of individuals with loans or debt obligations. The Personal Identification Number of an Individual was used to determine the number of individuals with loans or debt obligations. The calculations were performed based on the number of borrowers, multiple loan or debt contracts held by a single borrower from banks and non-bank organizations were disregarded.

**The distribution of loans and debt obligations to individuals by banks, non-bank financial and non-financial organizations is presented by respective share of funds allocated to the households by these organizations. The color of the intersections of circles reflects the predominance of the amounts issued by the organizations. The area of the intersections is determined to proportionally to the volume of the funds allocated by the organization, indicated by the color of the intersection to the individuals with multiple loans and debt obligations.

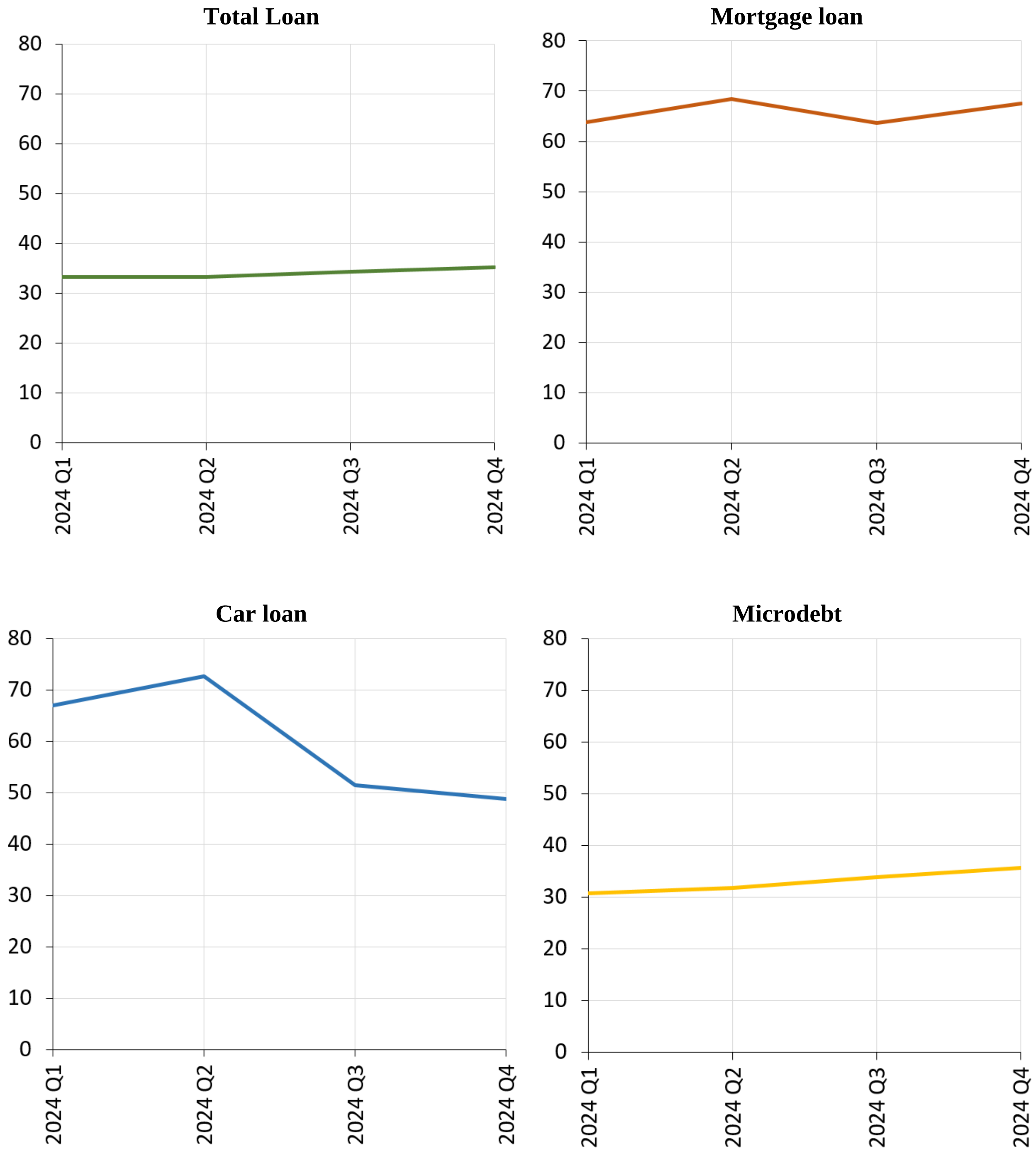
Figure 82. Distribution of DSTI Ratio of Bank Borrowers Including Total Non-Bank Liabilities, 2024



Source: CBU.

Note: The DSTI ratio is calculated for borrowers with income whose monthly income is not less than the average household's minimum monthly living expenses. To calculate the DSTI ratio for individuals who obtained loans from banks in 2024, all outstanding obligations under loan and debt contracts concluded with banks, non-bank and non-financial organizations are taken into account.

Figure 83. Average DSTI[75] Ratio for Bank Borrowers Including Total Non-Bank Liabilities, 2024



Source: CBU.

Note: The average DSTI ratio is determined by calculating the arithmetic mean of the ratio of total monthly payment of existing debt obligations of individuals to their monthly income.

[75] In calculating the DSTI ratio for individuals, borrowers with income whose monthly income is not less than the minimum monthly living expenses of the average household are included. In 2024, 41% of all bank borrowers were included in determining the household debt burden. The coverage rate was 77% for mortgage loans, 61% for car loans, and 46% for microdebts.

As a result of the implemented macroprudential measures, individuals' debt burden for car loans is improving. In 2024, the average DSTI ratio for bank borrowers with car loans was 61%. Macroprudential measures implemented on car loans[76] from July 1, 2024, are contributing to reduction in borrowers' debt burden. In particular, in H2 2024, the share of borrowers with a DSTI ratio exceeding 50% among individuals with car loans constituted 40%, representing a 23 p.p. decrease compared to H1 2024.

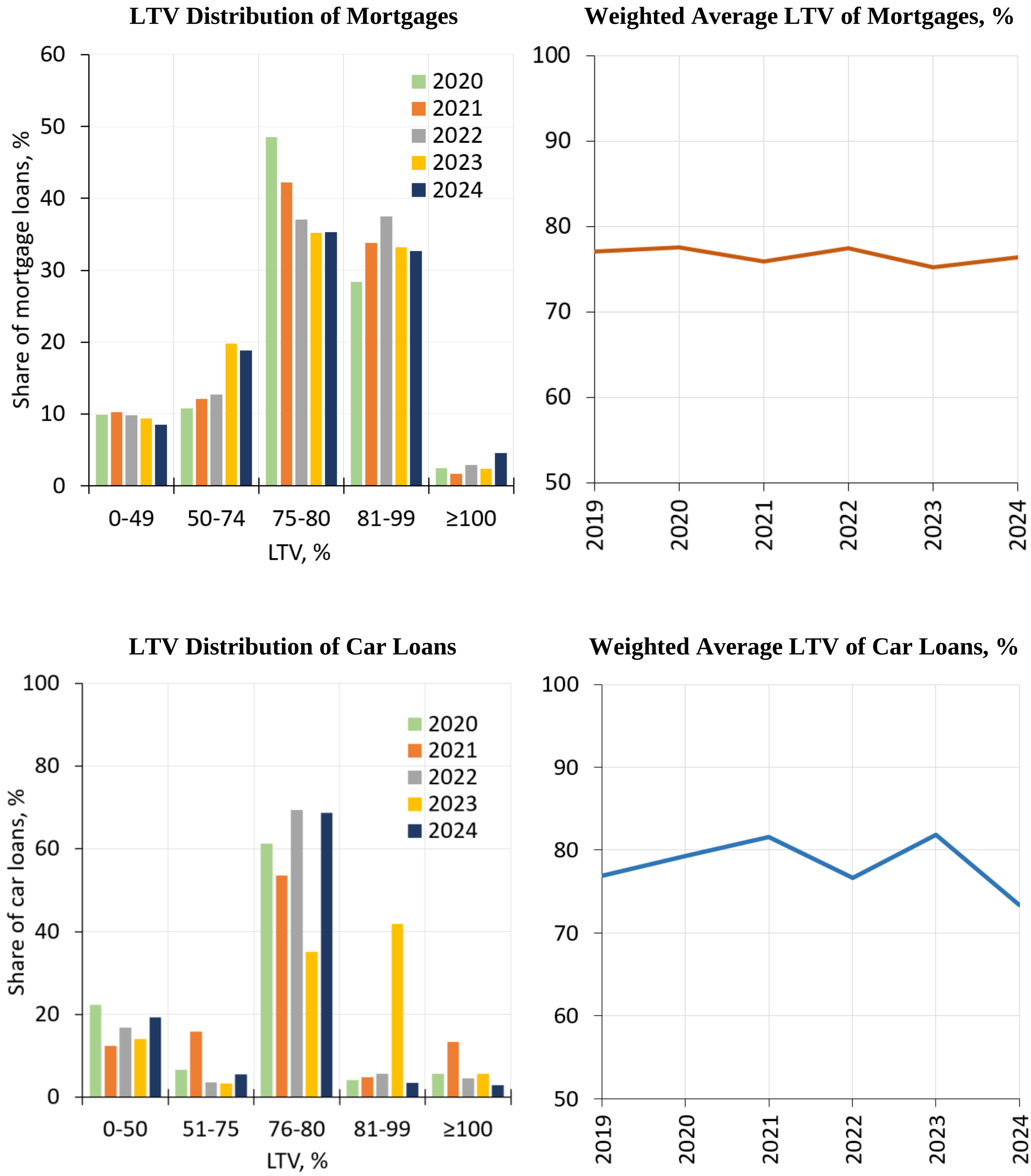
The debt burden of microdebt borrowers is increasing. In 2024, the average DSTI ratio for individuals with microdebt, including all bank and non-bank liabilities, was 34%. Although the debt burden of microdebt borrowers was lower compared to debt burden of mortgage or car loan borrowers, its growth rate accelerated. The easing of debt burden requirement for microdebt borrowers from July 1, 2024[77], was reflected in the rise of the DSTI ratio.

There was no significant change in the LTV ratio for mortgages. The weighted average LTV ratio for mortgages issued by commercial banks during 2024 was 76%, increasing by 1 p.p. compared to 2023. The share of mortgages with LTV ratio exceeding 75% constituted 73% of total mortgages issued in 2024, an expansion of 2 p.p. compared to 2023.

[76] The risk weights associated with mortgage and car loans issued by banks are required to be set based on LTV and DSTI ratios. In particular, under this regulation, the higher the LTV and DSTI ratios, the greater the risk weight.

[77] While a 50% DSTI cap applied to individuals when issuing microdebts, this requirement was relatively eased starting from July 1, 2024. Specifically, starting from July 1, 2024, DSTI cap for microdebt borrowers, alongside all other loans, was set at 60%.

Figure 84. LTV Ratios for Mortgage and Car Loans



Source: CBU.

The tightening of macroprudential tools has contributed to a positive improvement in the collateralization of car loans. In particular, in 2024, the share of car loans to individuals with LTV ratio exceeding 80% in total car loans contracted by 6 p.p. compared to 2023, amounting 48%. Furthermore, the weighted average LTV ratio for car loans issued in 2024 stood at 73%, declining by 9 p.p. compared to 2023.

The amount of microdebts in the loan portfolio of banks is growing at a high rate. By the end of 2024, driven by rapid growth of microdebts, the outstanding amount of microdebts in the loan portfolio of commercial banks amounted to 42.4 trillion UZS, surpassing outstanding amount of car loans by 6%. Furthermore, the outstanding amount of car loans issued contracted by 6% in 2024, while the outstanding amount of microdebts expanded by 73%. At the end of 2024, the outstanding amount of mortgage loans reached 67.7 trillion UZS, rising by 16% compared to the end of 2023. The absence of requirements for clearly defined purposes and collateral in the issuance of microdebts elevates the risk of loan losses for banks due to borrowers defaulting on their obligations.

Figure 85. Annual Growth (YoY) of Outstanding Loans of Individuals, %

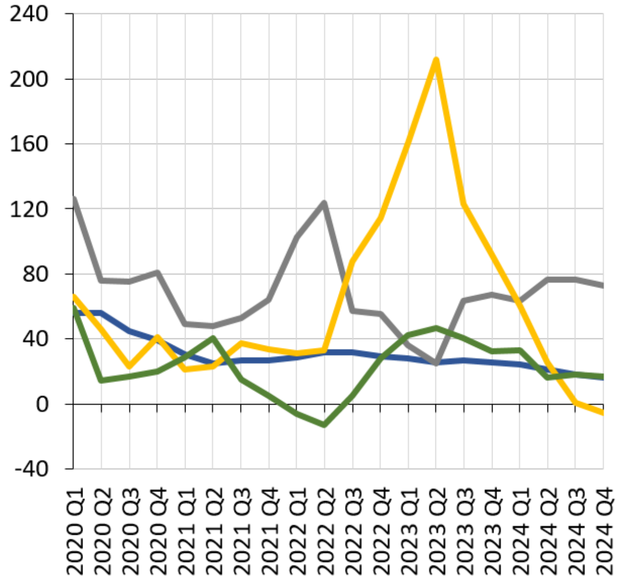
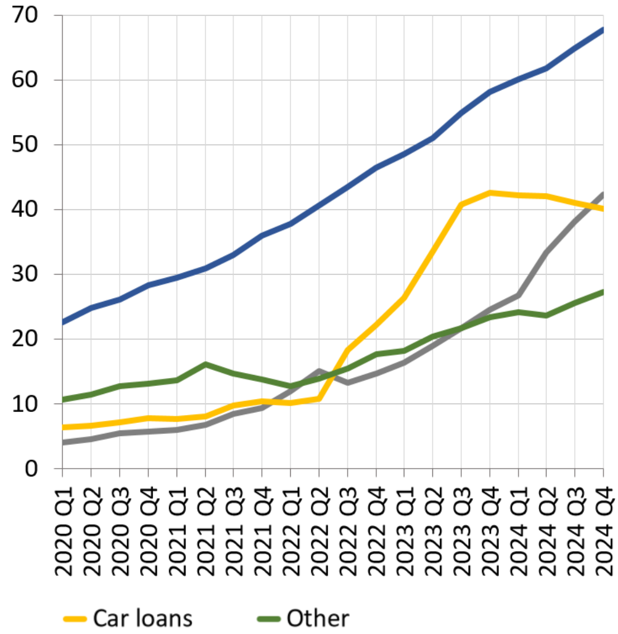


Figure 86. Outstanding Loans of Individuals, trillion UZS



Source: CBU.

Loans of individuals-to-GDP remained below its long-term trend. At the end of 2024, the ratio of the outstanding loans of individuals issued by banks to GDP was 12.2%, reflecting a decrease of 0.3 p.p. compared to 2023. By the end of 2024, the largest shares in the loan portfolio of individuals were attributed to mortgage loans and microdebts, with the ratio of these loans to GDP constituting 7% and 3%, respectively.

Figure 87. Loans of Individuals-to-GDP Gap[78], p.p.

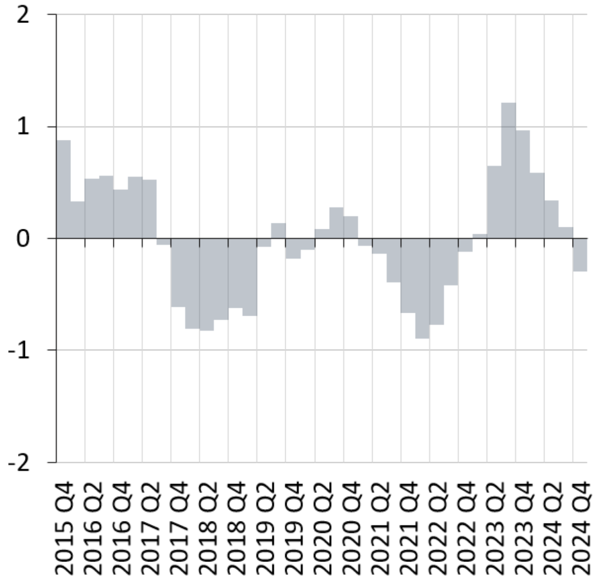
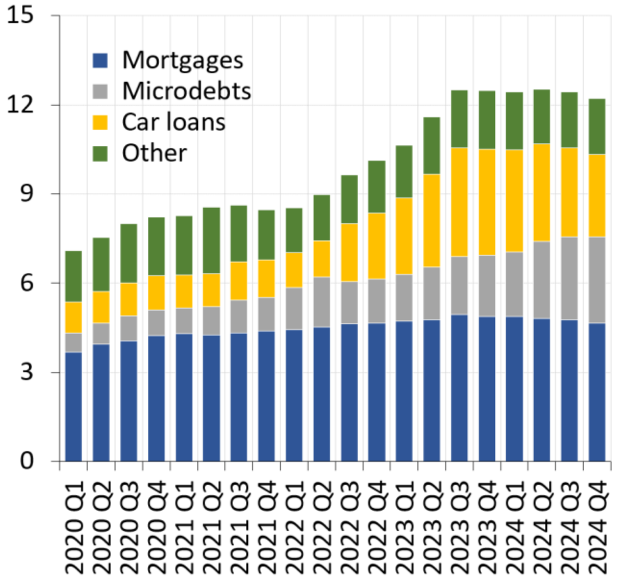


Figure 88. Loans of Individuals by Types, % of GDP



Sources: National Statistics Committee and CBU staff calculations.

The nominal GDP per capita in USD increased. Despite the growth in population and FX rate fluctuations throughout 2024, the high nominal GDP growth contributed to the rise in GDP per capita. At the end of 2024, GDP per capita amounted to 3,093 USD[79], rising by 274 USD compared to 2023. In this context, the change in nominal GDP during 2024 had a positive impact of 532 USD, while population growth and FX rate movements jointly exerted negative impact of 258 USD.

[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.

[79] National Statistics Committee. (2025). Production of gross domestic product of the Republic of Uzbekistan for 2024.

Figure 89. Decomposition of Nominal GDP Per Capita, USD

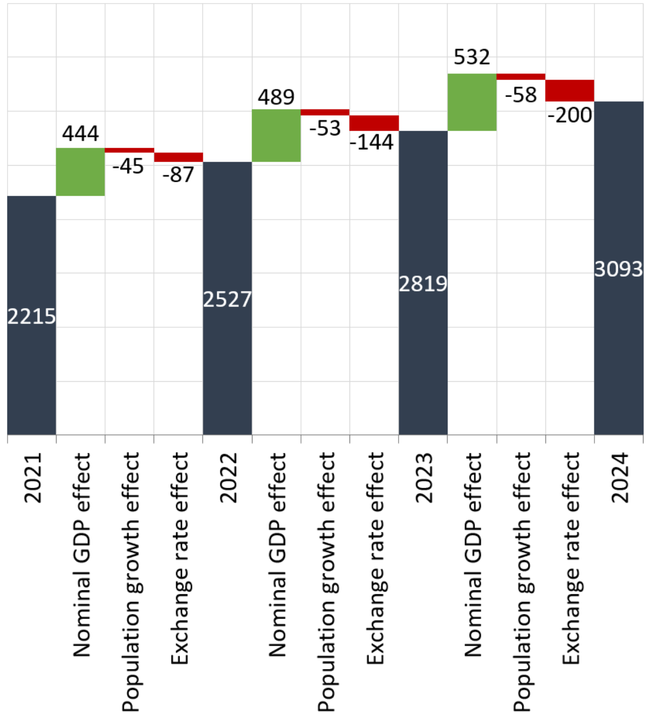
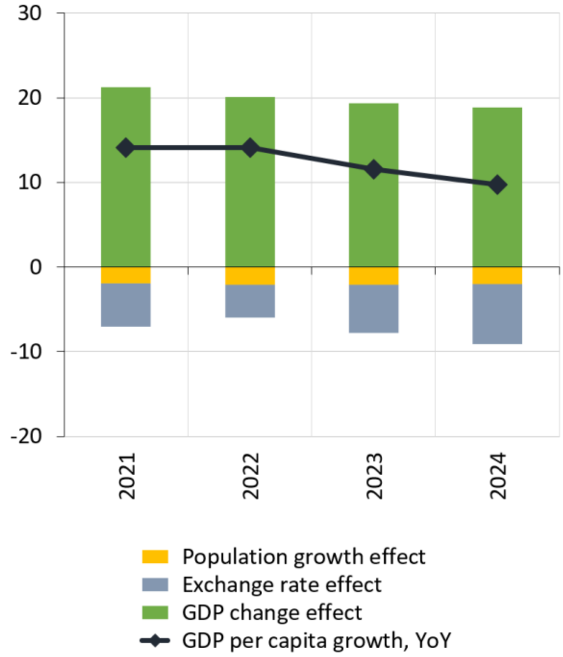


Figure 90. Decomposition of Annual Change in Nominal GDP Per Capita in USD, %



Sources: National Statistics Committee and CBU staff calculations.

A downward trend was observed in the annual growth rate of nominal GDP per capita in USD. At the end of 2024, the annual growth rate of GDP per capita in USD was 10%, falling by 2 p.p. compared to 2023. At the end of 2024, the outstanding amount of individual loans per bank borrower reached 37.6 million UZS, reflecting an increase of 1.5% relative to the corresponding period in 2023. The fact that the annual growth rate of nominal GDP per capita exceeded the growth rate of the loan volume per individual borrower contributed to the decline in the household debt burden.

Figure 91. Bank Borrowers and Borrowers per 1,000 Individuals*

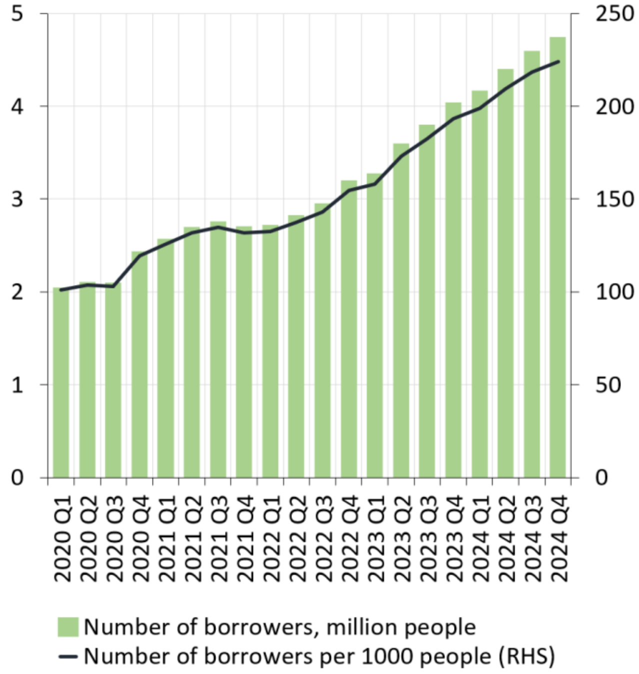
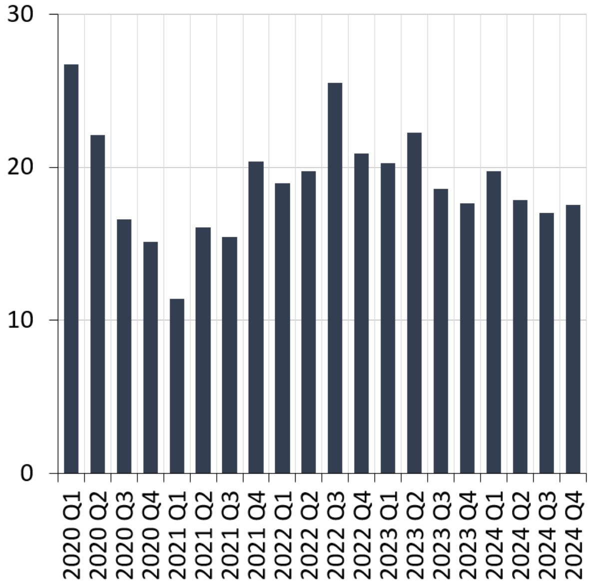


Figure 92. Annual Growth of Nominal Wages (YoY), %



Sources: National Statistics Committee and CBU staff calculations.

Note: *The calculation takes into account individuals who are both residents and within the working age group.

The working age population refers to the total number of men aged 16 to 60 and women aged 16 to 55 who permanently reside in a particular settlement or region.

The number of individuals with bank loans is increasing. At the end of 2024, the number of bank borrowers per 1,000 working-age residents was 224, an increase of 31 individuals compared to 2023. Also, at the end of 2024, the number of bank borrowers reached 4.7 million people, rising by 18% compared to 2023. The increase in the scale of state programs aimed at promoting employment and the expansion of the financial inclusion are contributing to wider utilization of bank loans by individuals.

The growth of nominal wages was one of the factors contributing to improvement in debt-servicing capacity of individuals with outstanding loans. In 2024, the average nominal wage increased by 17% annually, reaching 5.4 million UZS[80]. The rapid growth in nominal wages is considered as a driver supporting the improvement in debt-servicing capacity of households.

[80] National Statistics Committee. (2025). Average monthly nominal accrued wage for January-December 2024.

Figure 93. Share of NPLs and NPL Coverage Ratio in Microdebts, %

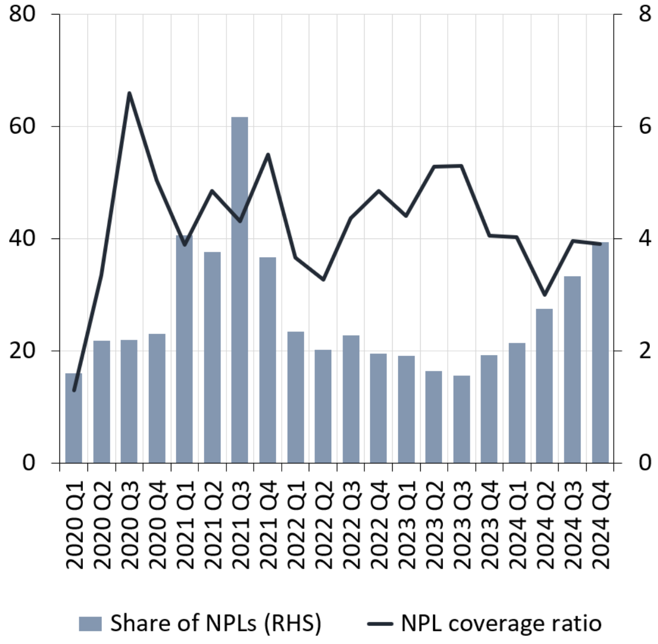
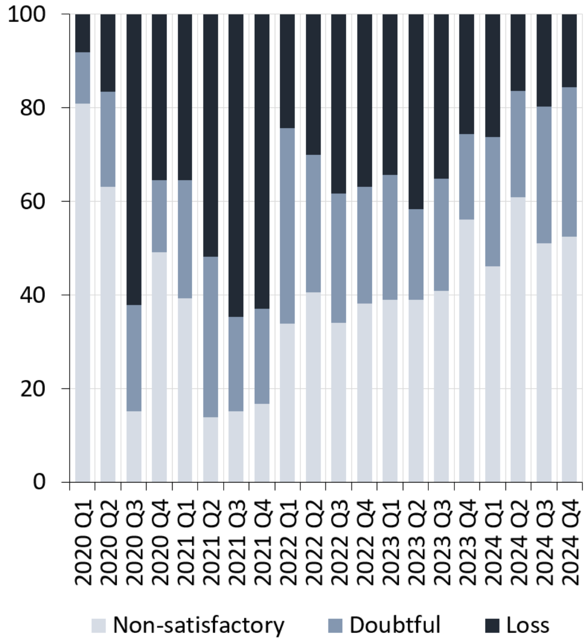


Figure 94. NPL Composition of Microdebts, %



Source: CBU.

Credit risk on microdebts is rising. At the end of 2024, the share of NPLs in the microdebt portfolio amounted to 4%, expanding by 2 p.p. compared to the corresponding period in 2023. In 2024, the NPL coverage ratio of microdebts fell by 1 p.p., reaching 39% by the year-end. At the end of 2024, non-satisfactory loans accounted for 53% of NPLs in microdebts, while loans classified as loss constituted 16%. Insufficient provisioning for NPLs in banks with a high share of non-performing microdebt portfolios increases credit risk in the microdebt segment.

Figure 95. Bank-by-Bank Share of NPLs in Total Microdebts and NPL Coverage Ratio (as of January 1, 2025), %

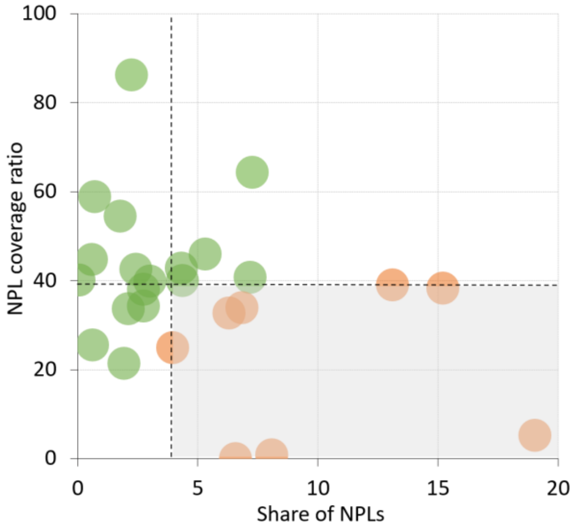
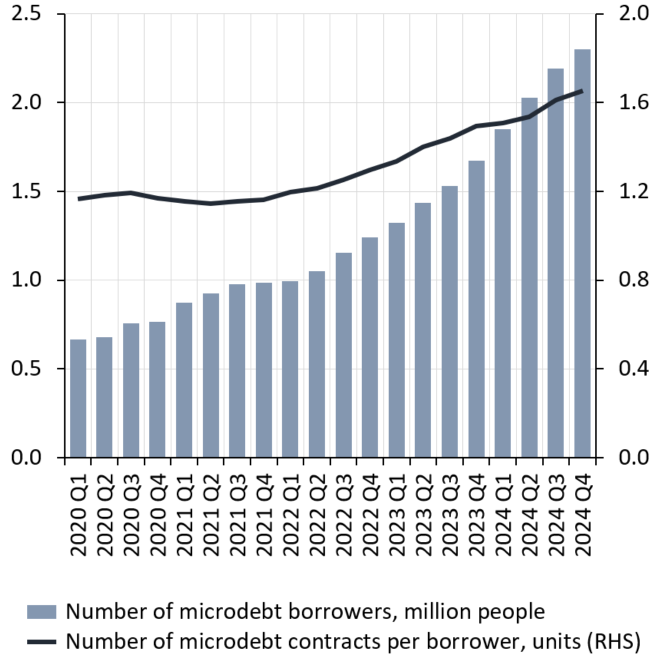


Figure 96. Microdebt Borrowers and Microdebt Contracts per Borrower, million people



Source: CBU.

Note: The color green indicates banks with lower risk relative to the banking system average in terms of either the share of NPLs in total microdebts or the NPL coverage ratio for microdebts. Light red, on the contrary, represents banks with higher risk relative to the banking system average on both of these indicators. Banks with no microdebts in their loan portfolio or have no NPLs on microdebts were excluded. The dashed straight lines represent the average values of indicators for the banking system as of January 1, 2025.

The number of microdebt borrowers is on the rise. As of January 1, 2025, the number of microdebt borrowers from commercial banks reached 2.3 million people, surging by 37% compared to the corresponding period in 2024. Also, the number of contracts per microdebt borrower increased from 1.5 to 1.7, reflecting heightened concerns regarding the growth of household debt burden.

Figure 97. Bank-by-Bank Microdebt Conditions*, % (as of January 1, 2025)

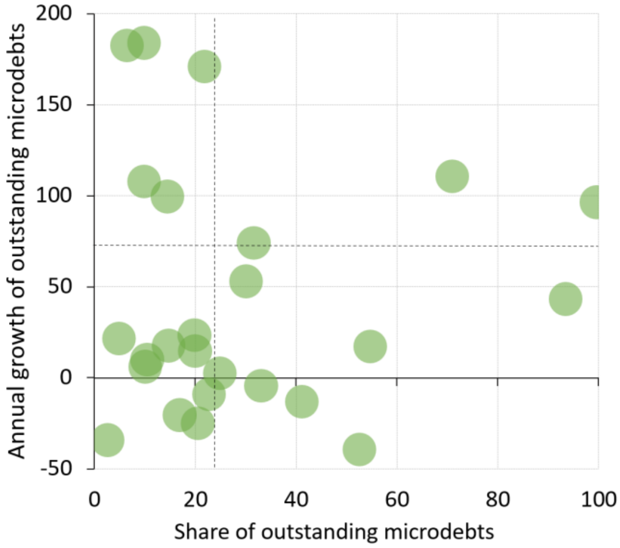
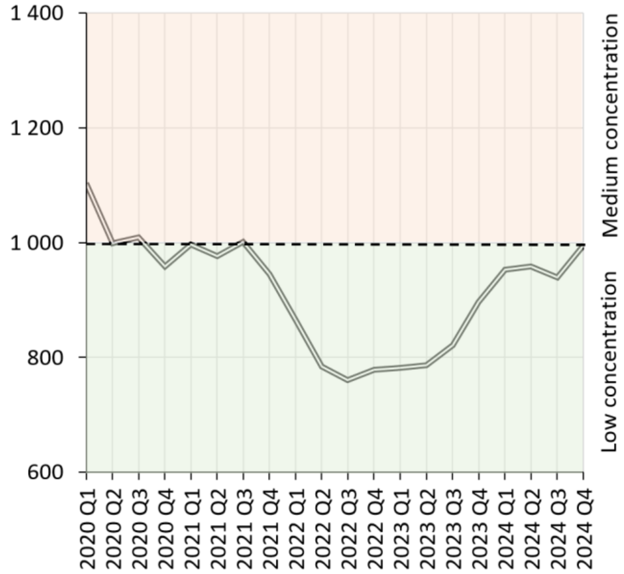


Figure 98. Concentration of Outstanding Microdebts, HHI



Source: CBU.

Note: *Banks with annual growth rates of microdebts exceeding 200% were excluded. The dashed straight lines represent the average values of indicators for the banking system as of January 1, 2025.

An upward trend in the concentration of outstanding microdebt portfolio for individuals persists. In recent years, high activity has been observed in the microfinance market. From the beginning of 2024, the HHI for outstanding microdebts rose by 11%, approaching the medium concentration level by the year-end. As of January 1, 2025, microdebts accounted for 24% of total outstanding loans to individuals in the banking system, reaching 42.4 trillion UZS.

Box 3. Methodology for Calculating DSTI

The debt burden of individuals with debt obligations to banks or non-bank organizations is assessed using the DSTI ratio. The DSTI ratio for individual borrowers is calculated using the following formula[81]:

$$DSTI_{j,t} = \frac{i_{j,t}}{(1 - \left(1 + i_{j,t}\right)^{-s_{j,t}}} * \frac{D_{j,t}}{Y_{j,t}}$$

Where:
$DSTI$ – debt service to income ratio;
i – annual interest rate on flows of loans or debts;
s – annual maturity of flows of loans or debts;
D – loan or debt balances;
Y – annual income of borrowers;
j – loan or debt type;
t – years.

The DSTI ratio for individuals was calculated for borrowers with income whose monthly income is not less than the minimum monthly living expenses of the average household. In this context, the monthly minimum living expenses of the average household is determined based on the cost of minimum consumer expenses per person[82] and the average household size[83].

In calculating the DSTI ratio for each borrower, all outstanding debt obligations of these borrowers were taken into account, based on microdata of the credit bureau[84]. In particular, for each borrower, the DSTI ratio for loan and debt obligations to banks, non-bank credit and non-financial organizations is calculated by dividing the total monthly payment amount on all outstanding obligations by monthly income. The total average DSTI ratio for all borrowers is determined by calculating the simple arithmetic mean of the DSTI ratios computed for each borrower.

[81] The Central Bank of the Republic of Uzbekistan. (2022). Debt Service Ratio Analysis for Individuals.

[82] The minimum monthly consumer expenses per person from January 2024 to May 2024 amounted to 621 thousand UZS, and from May 2024 to 648 thousand UZS.

[83] Average household size is 5 people.

[84] For example, when calculating the DSTI ratio of a mortgage loan borrower from a bank, the obligations of this borrower under all pre-existing bank loans are taken into account.

Box 4. Debt Burden Survey

Between January 20 and 25, 2025, the CBU conducted its next round of survey to determine the debt burden of households on bank and non-bank debt obligations. A total of 3,546 respondents from all regions of Uzbekistan participated in this survey.

Among the respondents, half of them reported having a household of four or five members. Furthermore, the primary employment of the respondents and their household members are largely concentrated in finance, education, agriculture, healthcare, trade and other sectors.

Figure 99. Number of Household Members, %

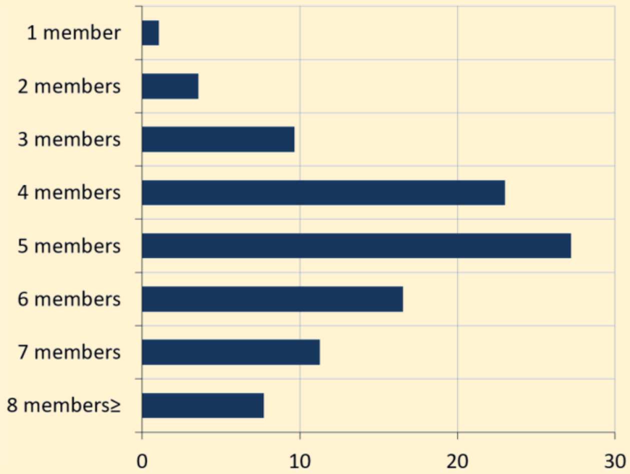


Figure 100. Breakdown of Monthly Primary Income by Household, %

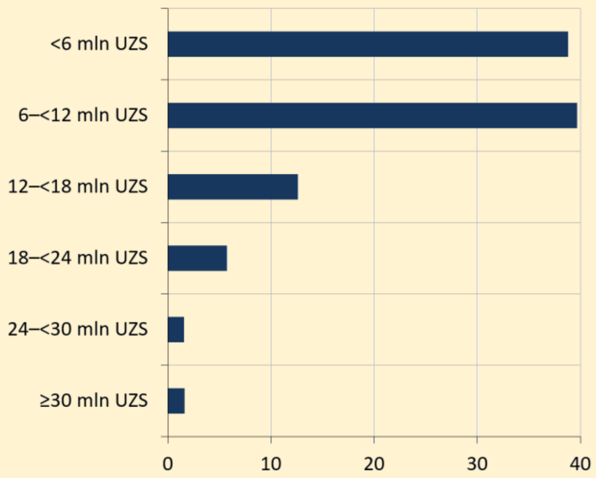


Figure 101. Share of Households with Secondary Income

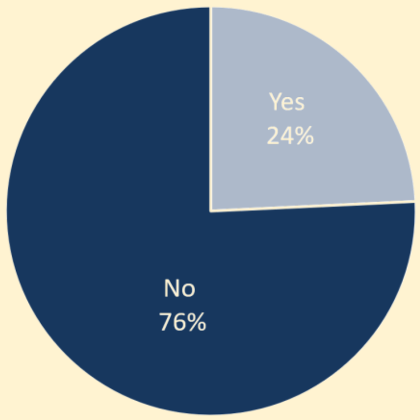
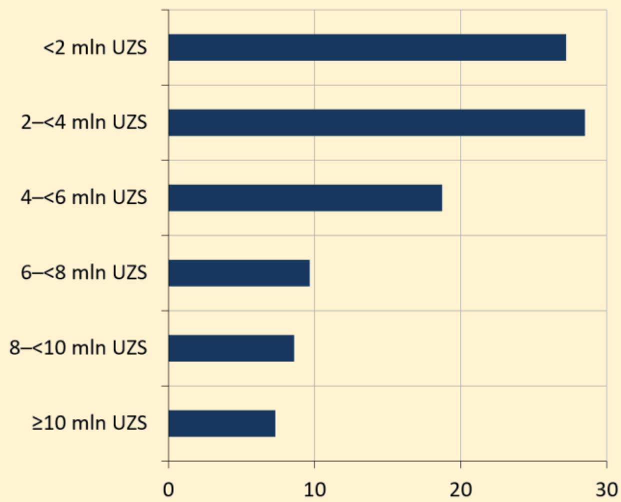


Figure 102. Breakdown of Monthly Secondary Income by Household, %



Source: CBU survey.

The share of respondents with an average monthly household income of up to 12 million UZS from primary employment amounted to 78%. Also, a quarter of the respondents had an additional income source besides their primary employment with 56% of these respondents earning extra income of up to 4 million UZS.

73% of all respondents reported that either they or a household member had outstanding loan or debt obligations[85] to a bank or non-bank organization. In addition, 64% of respondents indicated having bank loans. Among respondents who were indebted to banks, 19% also noted existence of other debts besides bank loans.

Figure 103. Existence of Bank and Non-Bank Debt Obligations

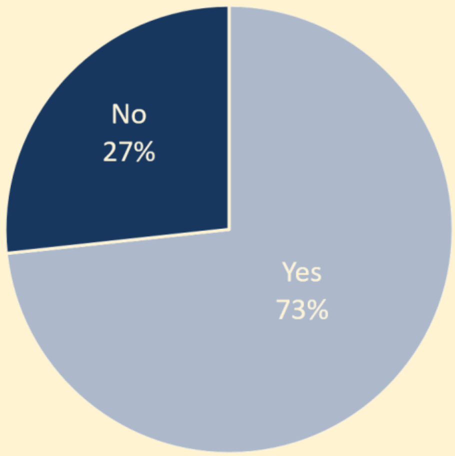


Figure 104. Share of Households Indebted to Banks

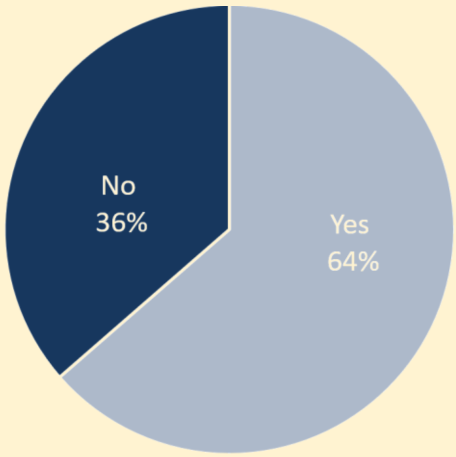


Figure 105. Existence of Non-Bank Liabilities Among Bank Borrowers

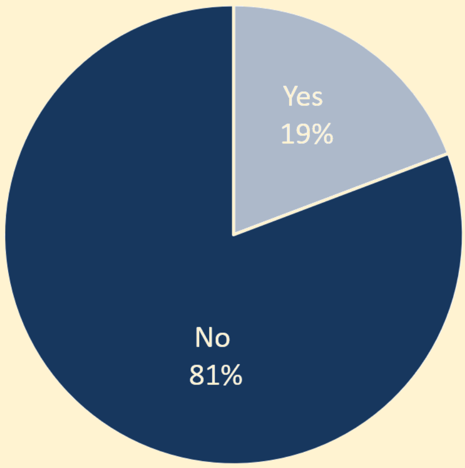
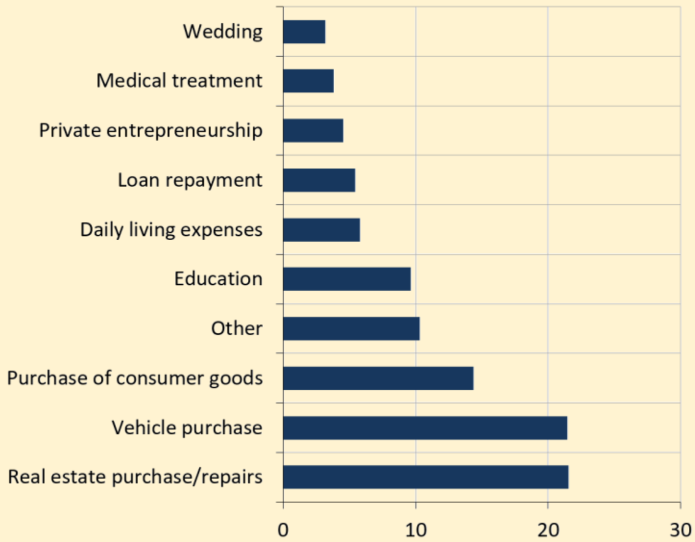


Figure 106. Objectives of Bank and Non-Bank Credit Borrowing, %



Source: CBU survey.

[85] The calculations take into account the obligations of the households from the bank, non-bank credit and non-financial organizations, as well as other debts.

Debt obligations were mainly incurred mainly for purchases of real estate, vehicles, consumer goods and home repairing. In particular, 43% of respondents used their debt to acquire or repair real estate and purchase vehicle.

For 70% of respondents, the total monthly payments on bank and non-bank debt obligations amount to less than 6 million UZS. Also, a quarter of respondents with debt obligations have monthly payments falling in the range of 2–4 million UZS. 55% of respondents noted that they have remaining debt obligations with maturities of 2–3 years, 5 years or more.

64% of the respondents reported difficulties in timely servicing of their debt obligations. Nearly half of respondents with debt obligations expect improvements in their debt-servicing capacity within the next 6 months.

Figure 107. Monthly Payment for Total Debt Obligations, %

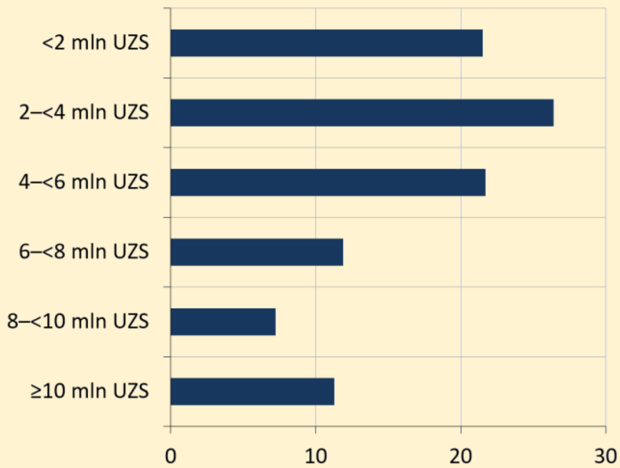


Figure 108. Remaining Maturity of Total Debt Obligations, %

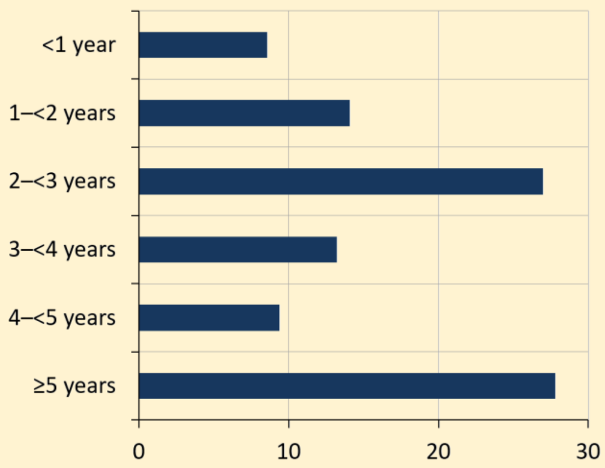


Figure 109. Challenges with On Time Repayment of Debt Obligations

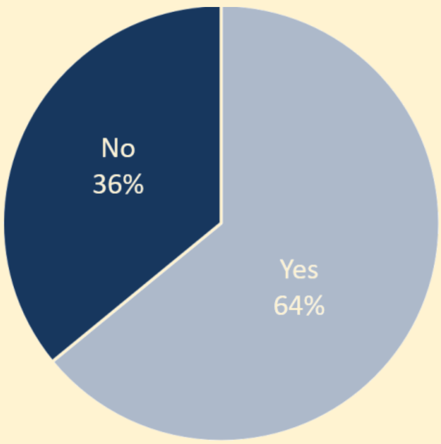
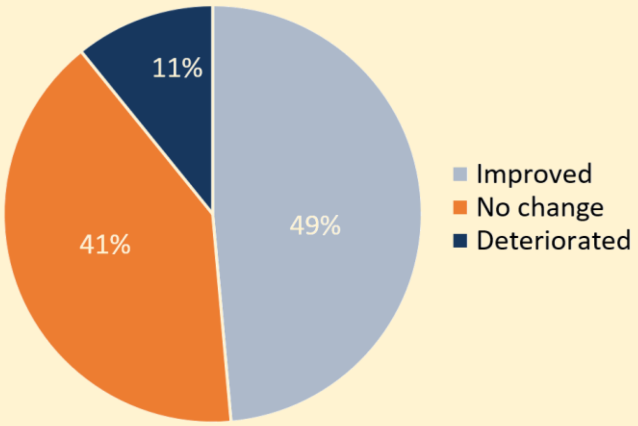


Figure 110. Solvency Outlook for the Next 6 Months



Source: CBU survey.

20% of respondents indicated a need for borrowing by themselves or household members over the next 6 months. These debt obligations are primarily intended for the purchase or renovation of a real estate.

According to the survey results, the total average DSTI ratio of respondents with outstanding bank loans, taking into account all non-bank debt obligations[86] was 73%[87]. Furthermore, the median DSTI ratio stood at 50%, while 43% of respondents exhibited DSTI ratio exceeding 60%.

Figure 111. Intentions for Credit and Debt Over the Next 6 Months

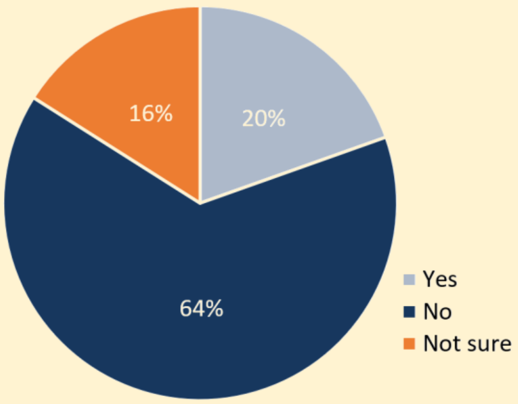


Figure 112. Borrowing Objectives for the Next 6 Months, %

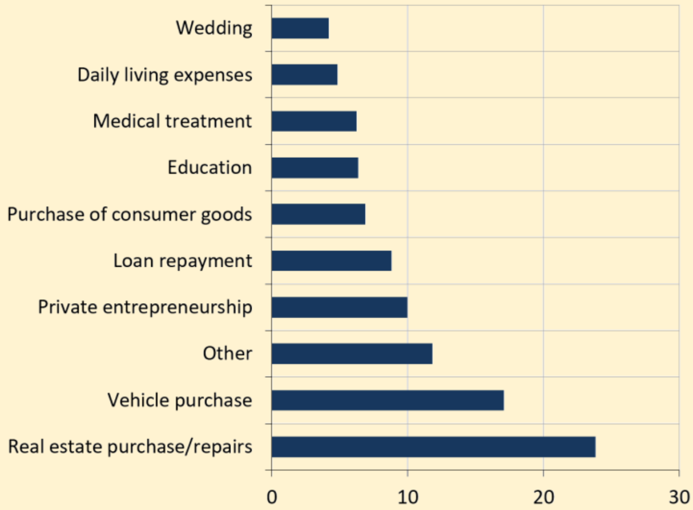
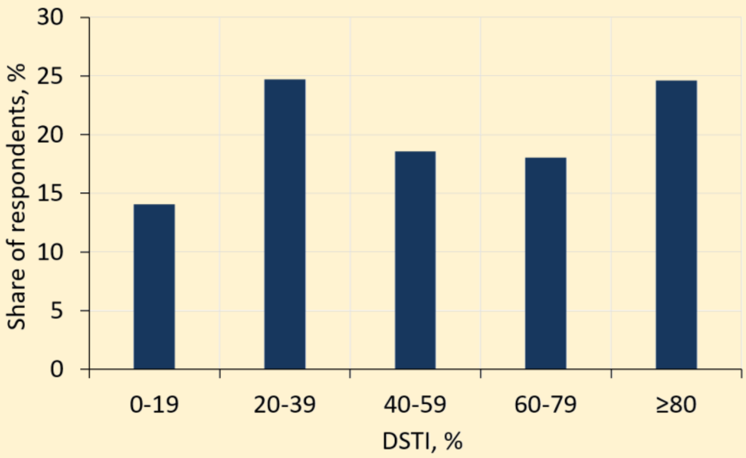


Figure 113. Distribution of DSTI Ratio for Respondents with Bank Loans



Source: CBU survey.

[86] 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.

[87] To determine households' basic and additional monthly income, 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 current interval.

IV. Asset Market

4.1. Real Estate Market

The gap between market and fundamental housing prices is narrowing. In the context of elevated market prices, a reduction in demand alongside an increase in additional supply has reduced the imbalance between supply and demand in the real estate market. The stabilization of market housing prices during 2024, combined with sustained growth of fundamental prices, contributed to the narrowing of the gap. The fundamental value of housing prices in the real estate market was assessed using price and income[88], State Space Model (SSM) [89], Bayesian State Space Model (BSSM) [90], and quantile regression[91] models. In 2024, the market housing price was overvalued by 17% compared to the average value of the fundamental prices determined by these models (Appendix 3).

The fundamental price in the real estate market was assessed additionally using a quantile regression model. The non-normal distribution of errors of the indicators and the presence of outliers over the observation period reduce model's accuracy. Therefore, the quantile regression model was employed to evaluate the impact of fundamental factors on the dependent variable. In this context, the market price of housing exceeding the fundamental price determined by 80th quantile of the quantile regression model represents overvaluation, while prices falling below the value determined by the 20th quantile indicates periods of undervaluation[92].

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

[89] The SSM methodology is presented in the Financial Stability Report for 2023.

[90] The BSSM methodology is presented in the Financial Stability Report for H1 2024.

[91] Fabozzi, F., Focardi, S., Rachev, S., & Arshanapalli, B. (2014). The Basics of Financial Econometrics.

[92] Gerdesmeier, D., Lenarcic, A., & Roffia, B. (2012). An alternative method for identifying booms and busts in the euro area housing market. European Central Bank.

Figure 114. Market and Average Fundamental Prices of Houses, million UZS per square meter

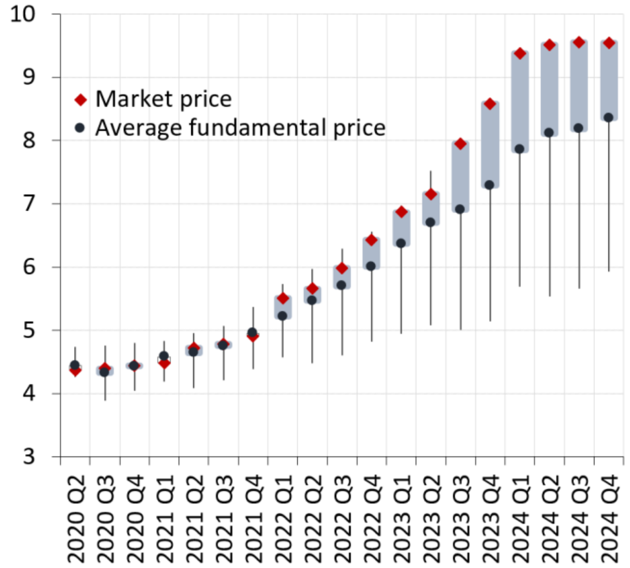
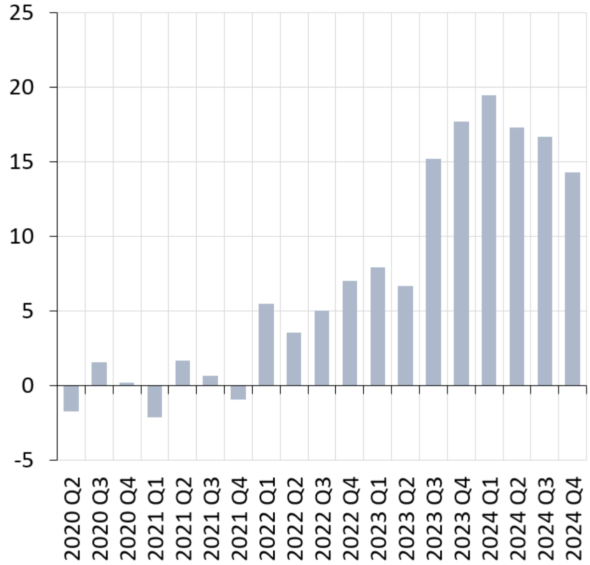


Figure 115. Difference Between Market and Average Fundamental Prices of House, %



Source: CBU staff calculations.

Note: The average fundamental price of houses is calculated using the simple arithmetic mean of fundamental prices determined by the SSM, BSSM, price and income, and quantile regression (50th quantile) models.

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 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. The average market price of houses in Uzbekistan is determined by calculating the weighted average price, derived from average housing prices in the regions and Tashkent city, based on the number of sales contracts in these respective territories.

The tightening of mortgage lending standards is moderating housing affordability of households through mortgage loans. Due to the slight rise in interest rates on mortgage loans issued by banks and the shortening of the loan maturity period, the monthly debt servicing costs for mortgage loans have increased. This, in turn, is impacting housing affordability of households through mortgage loans. Despite a 17% growth in the average monthly nominal wage in 2024[93], 44% surge in the average mortgage payment resulted in the contraction of housing affordability index by 27 p.p..

[93] National Statistics Committee. (2025). Average monthly nominal accrued wage for January-December 2024.

Figure 116. Housing Affordability Index*, %

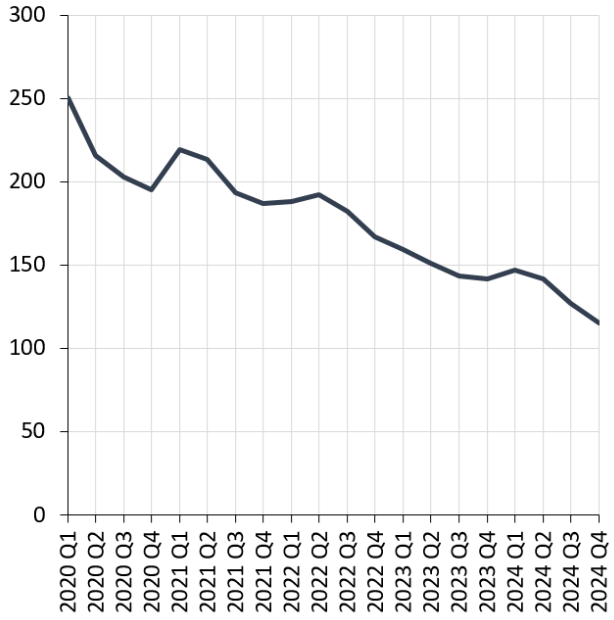
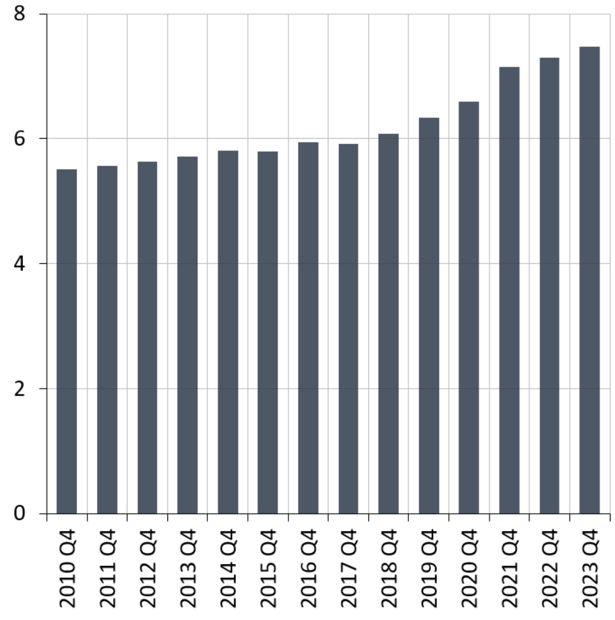


Figure 117. Number of Residential Apartments in Uzbekistan, million units



Sources: National Statistics Committee and CBU staff calculations.

Note: *A decrease in the housing affordability index[94] indicates a reduction in the ability of the households to purchase houses, while an increase in the housing affordability index reflects an improvement in the ability to purchase housing.

The number of residential apartments in Uzbekistan is increasing. By the end of 2023, the total housing stock reached 7.5 million units, reflecting an increase of 2.4% compared to the same period in 2022[95]. At the end of 2023, there was one residential property for every five permanent residents. The constant growth of the population underscores the need to expand the country's housing stock at a higher rate.

A decline was observed in housing prices when adjusted for the effects of the national currency exchange rate fluctuations. Although the housing price index denominated in UZS rose by 5.3 units at the end of 2024 compared to the corresponding period in 2023, it decreased over the last two quarters. In addition, the housing market price index in FX fell by 1.7 units.

The volume of supply in the real estate market expanded. Within the framework of state programs[96], the provision of various incentives to construction companies, the easing of rating requirements for the construction of multi-storey residential buildings, and the application of a zero customs duty rate to certain construction materials, raw materials, and specialized equipment contributed to a significant increase in construction activity. In particular, in 2024, the construction volume to GDP ratio constituted 16.1%, rising by 3.6 p.p. compared to 2023.

[94] The housing affordability index methodology is presented in the Financial Stability Report for H1 2024.

[95] National Statistics Committee. (2025). Number of residential apartments (houses).

[96] O'zbekiston Respublikasi Prezidentining 2024-yil 30-apreldagi "2024-yilda ipoteka kreditlarini ajratish mexanizmlarini takomillashtirish va aholining uy-joy sharoitlarini yaxshilashga oid qo'shimcha chora-tadbirlar to'g'risida"gi PF-70–sonli Farmoni.

Figure 118. Housing Market Price Indexes (Q1 2020=100)

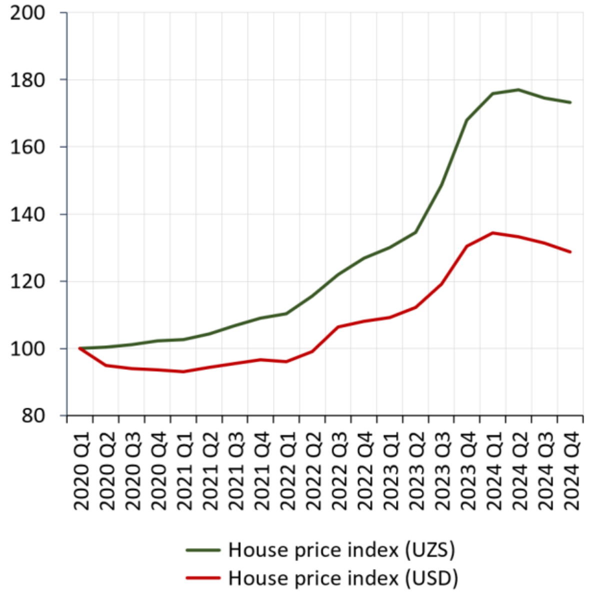
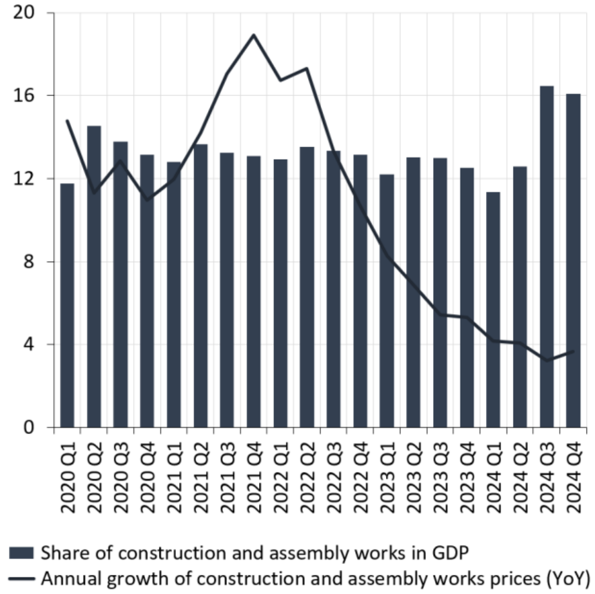


Figure 119. Construction and Assembly Work Prices (YoY change), %



Sources: National Statistics Committee and CBU staff calculations.

The growth rate of construction and assembly work prices decelerated. A downward trend was observed in the growth rate of construction and assembly work prices, with the annual growth rate slowing to 3.7% by the end of 2024. The subdued rise in construction and assembly work prices also indicates an expansion in the actual supply volume in the real estate market.

Figure 120. Ratio of House Prices* to Nominal GDP Per Capita, %

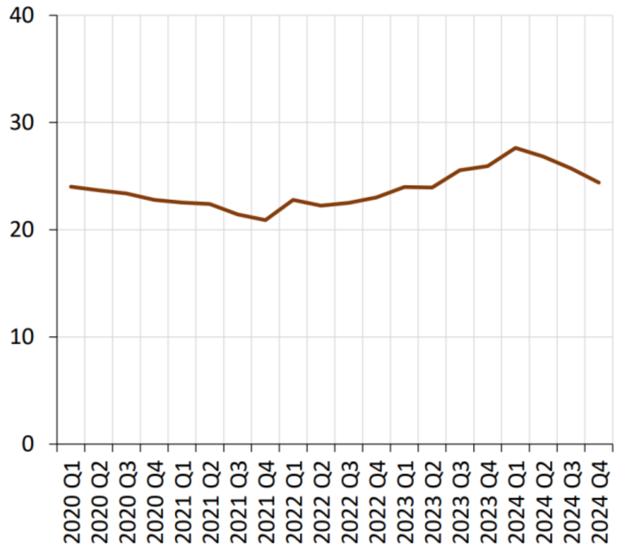
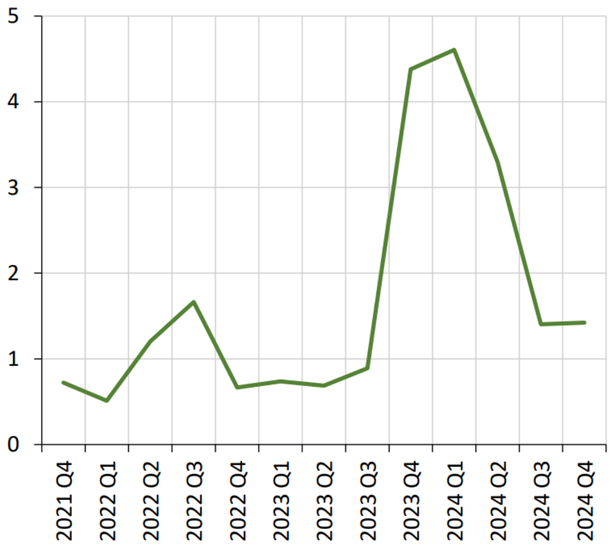


Figure 121. Ratio of Annual Growth Rate of House Prices to Annual Growth Rate of Rents



Sources: National Statistics Committee 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 influence of fundamental factors on housing prices strengthened. In 2024, GDP per capita at current prices expanded by 18.3%, amounting to 39.1 million UZS[97]. As GDP per capita rose and housing price growth rate slowed, the ratio of housing market prices to nominal GDP per capita stood at 24.4% at the end of 2024, marking a contraction of 1.5 p.p. compared to 2023. Furthermore, alignment of house price growth rates with the rise in average monthly wages indicates the increasing the impact of fundamental factors on market price dynamics. Additionally, at the end of 2024, the ratio of the annual growth rate of house prices to the annual growth rate of rents amounted to 1.4.

Figure 122. Ratio of Annual Growth Rate of Housing Prices to Annual Growth Rate of Average Monthly Salary

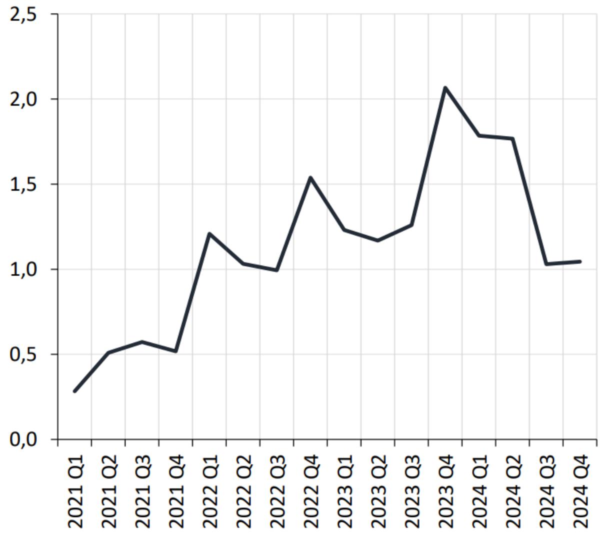
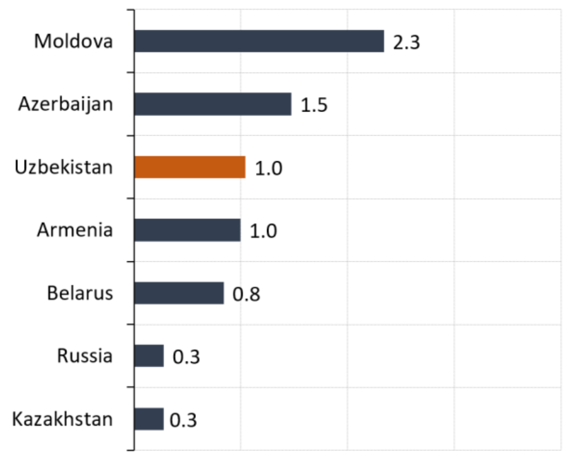


Figure 123. Ratio of Annual Growth Rate of Housing Prices to Annual Growth Rate of Average Monthly Salary in Selected Countries in 2024



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

Corrections to the elevated growth rate of prices was observed in the real estate market. The annual growth rates of average monthly wages and housing prices exhibited almost identical levels. In particular, the annual growth rate of housing market prices in 2024 was 18.2%, a contraction of 14.2 p.p. compared to 2023[98]. In Uzbekistan, the ratio of annual housing price growth to annual growth of average wage remained among the countries with the higher indicator, compared to some countries in CCA and other regions.

The rate of demographic growth in Uzbekistan is slowing down. As of January 1, 2025, the population density per square kilometer^2 in Uzbekistan was 84 people, exceeding median level for CCA countries by 5 people. In particular, in 2024, Uzbekistan's population expanded by 2%, reaching 37.5 million people.

[97] National Statistics Committee. (2025). Production of gross domestic product of the Republic of Uzbekistan for 2024.

[98] National Statistics Committee. (2025). Dynamics of the price index in the housing market (compared to the corresponding quarter of the previous year).

Figure 124. Population Density in CCA countries*, population per square kilometer

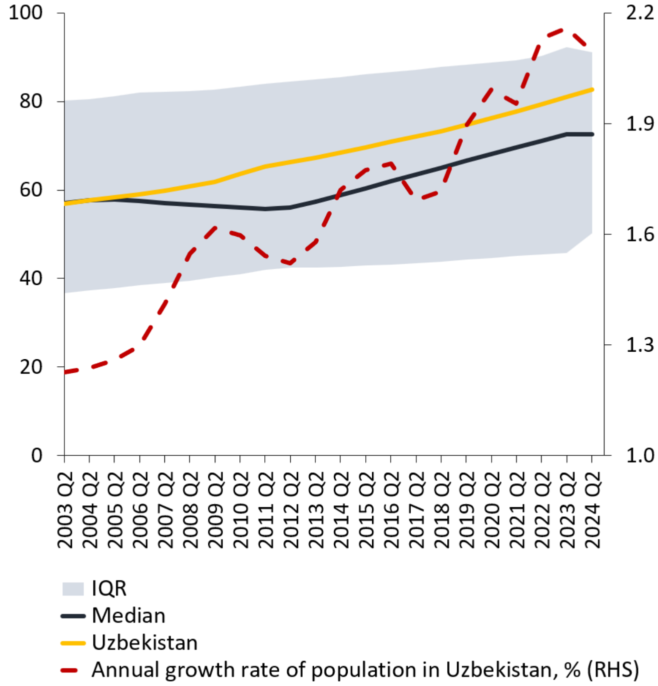
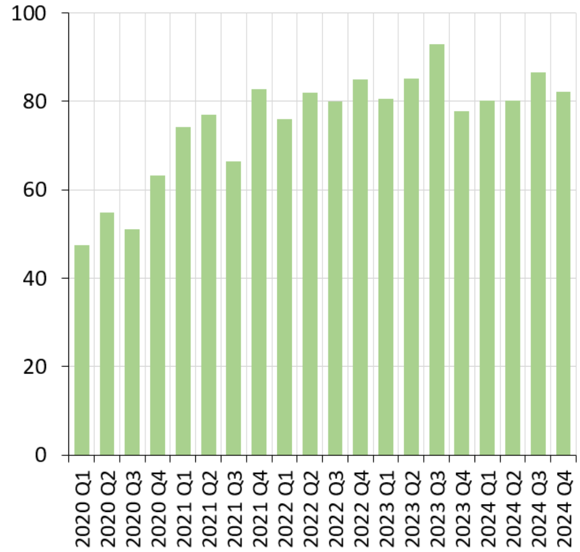


Figure 125. Housing Contracts, in thousands



Sources: United Nations, National Statistics Committee, Ministry of Justice, and CBU staff calculations.

Note: *Armenia, Azerbaijan, Tajikistan, Uzbekistan, Kyrgyzstan, and Kazakhstan are taken into account.

Activity in the real estate market slowed. In 2024, a total of 329,000 housing sale contracts were concluded, marking a decrease of 2.2% compared to 2023. The moderation of housing affordability, the slowdown in mortgage lending, and increasing role of fundamental factors in housing prices are contributing to the downturn in demand in the real estate market.

The vulnerability of D-SIBs[99] to real estate market risks can be assessed as low. As of January 1, 2025, mortgage loans accounted for 13% of the total banking system loan portfolio, while ratio of Tier I capital to total loans was 19%[100]. In several banks with high concentration of mortgage lending, the low amount of capital relative to total loans indicates possible weaknesses in their solvency. However, the indicators for D-SIBs exceeding the average for the banking system mitigate the probability of systemic risks materializing.

[99] The list of D-SIBs for 2025 is provided on the official website of the Central Bank of the Republic of Uzbekistan.

[100] The Central Bank of the Republic of Uzbekistan. (2025). Indicators of banking system.

Figure 126. Ratio of Tier I capital to Total Loans and Mortgages to Total Loans, % (as of January 1, 2025)

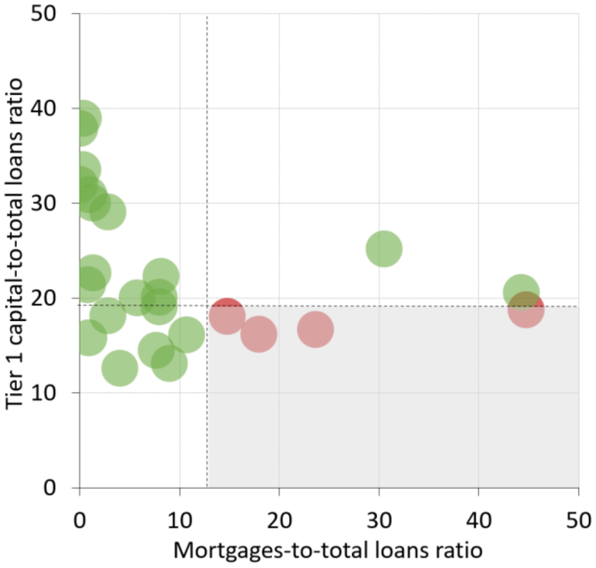
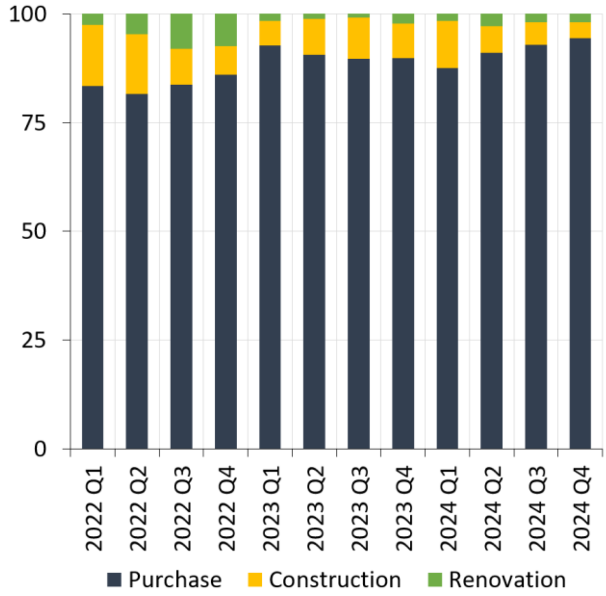


Figure 127. Mortgage Loan Distribution by Purpose, %



Source: CBU.

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 graph represent the average values of these indicators for the banking system as of January 1, 2025.

Mortgage loans were mainly directed toward housing purchases by households. In 2024, the outstanding amount of mortgage loans to households amounted to 17.1 trillion UZS, with 92% of these loans allocated for the purchase of housing. In 2024, the share of mortgage loans to individuals for housing purchases rose by 1.3 p.p. compared to 2023.

Figure 128. Number of Mortgage Loans to Households and Mortgage Borrowers per 1,000 Individuals*

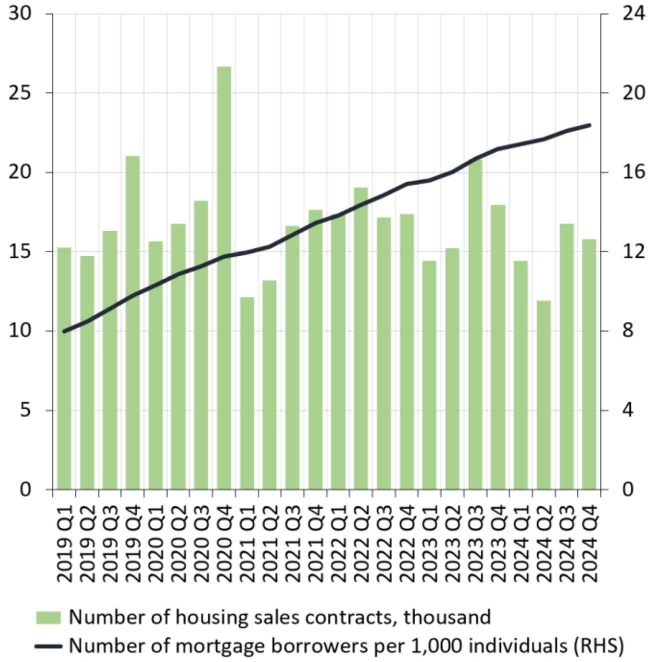
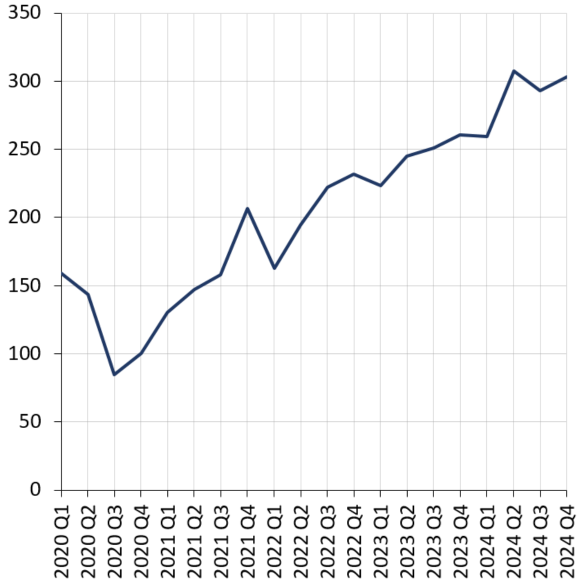


Figure 129. Average Amount of Mortgage Loans to Households, million UZS



Sources: National Statistics Committee and CBU staff calculations.

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

The working age population refers to the total number of men aged 16 to 60 and women aged 16 to 55 who permanently reside in a particular settlement or region.

The impact of mortgage loans on real estate market demand is diminishing. In 2024, banks issued total of 58,900 mortgage loans, marking a decrease of 14% compared to 2023[101]. In addition, growth in the share of mortgage borrowers within working-age residents also slowed down. In particular, at the end of 2024, the number of mortgage borrowers per 1,000 individuals amounted to 18 people, reflecting a 7% increase compared to 2023. However, the growth rate of the number of mortgage borrowers per 1,000 individuals in 2024 contracted by 4 p.p. compared to 2023.

[101] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

The average amount of mortgages is on the rise. In 2024, the average mortgage loan amount reached 291 million UZS, an increase of 18% compared to 2023[102]. In this context, the growth of housing market prices contributed to the expansion in the average amount of mortgage loans.

Figure 130. Weighted Average Interest Rate of Mortgage Loans, %

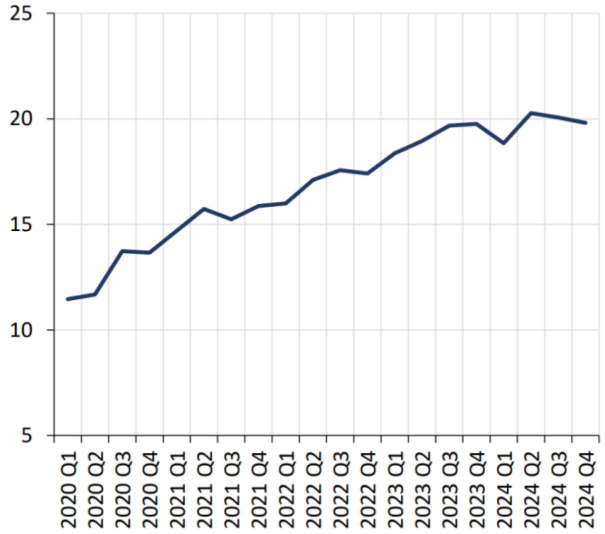
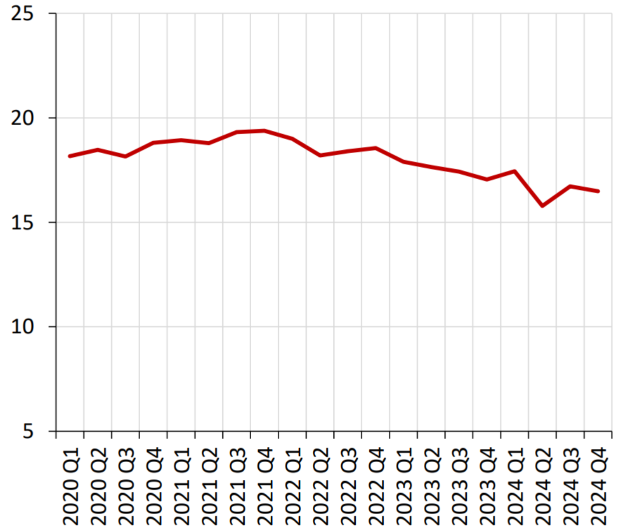


Figure 131. Weighted Average Term of Mortgages, years



Source: CBU staff calculations.

Mortgage lending standards slightly tightened. In 2024, the weighted average maturity of mortgages was 16.6 years, shortening by 0.8 years compared to 2023. The weighted average interest rate on mortgages also increased by 0.5 p.p., reaching 19.8% in 2024. The tightening of mortgage lending standards by banks, on the one hand, raising debt-servicing costs of mortgages and diminishing housing affordability of households through mortgages, on the other hand it mitigates credit risks associated with mortgages.

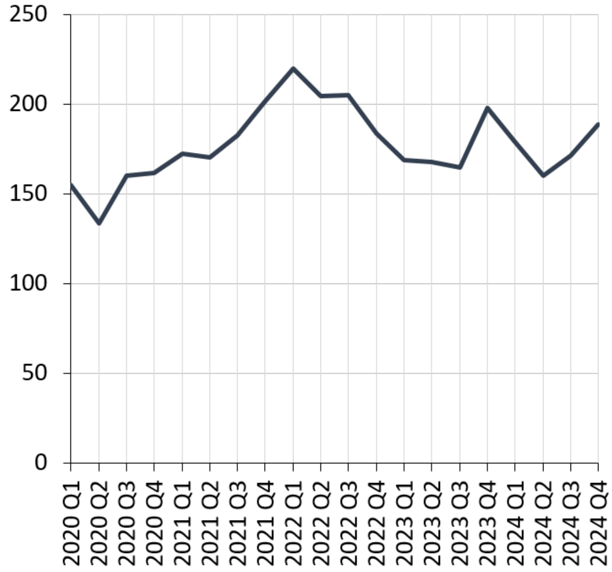
[102] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

4.2. Car Market

The gap between market and fundamental car prices narrowed by the end of 2024. At the end of 2024, the overvaluation of car market prices relative to their fundamental value fell to 26%. The additional supply in the car market, the stabilization of prices in the secondary market, and the increase in household disposable income contributed to the contraction of the gap between the market and fundamental prices of cars.

Figure 132. Market and Fundamental Prices of Cars*, million UZS per unit **

Figure 133. Car Affordability Index ***



Source: CBU staff calculations.

Note: *The rectangle in the graph 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.

**According to commercial 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 websites 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.

In 2024, car affordability of households slightly diminished. The tightening of car loan standards by banks moderated households' car affordability. In particular, the weighted average repayment term for car loans issued in 2024 was 4 years, shortening by 0.3 years compared to 2023. In 2024, the weighted average interest rate on car loans stood at 26.1%, an increase of 2.1 p.p. compared to 2023. In addition, the growth rate of car loan issuance decelerated. In 2024, the amount of car loans issued by commercial banks contracted by 2.1 times compared to 2023, totaling 17.1 trillion UZS[103].

Figure 134. Annual Growth Rate of Vehicle Prices and Annual Change in Volume of Car Loans, %

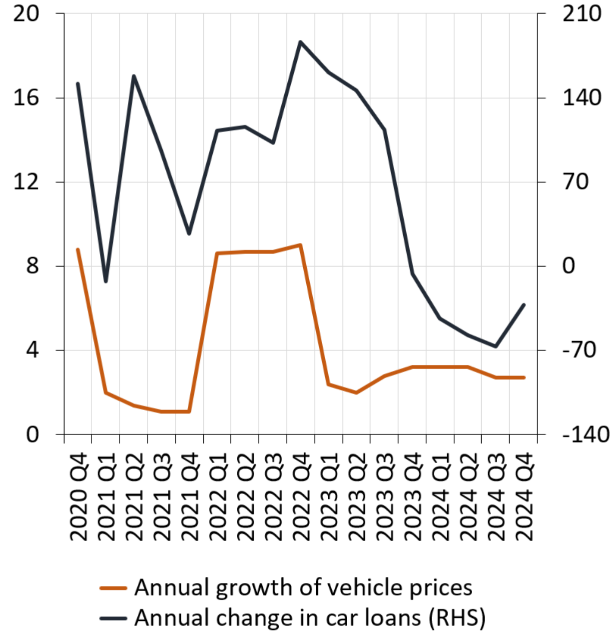
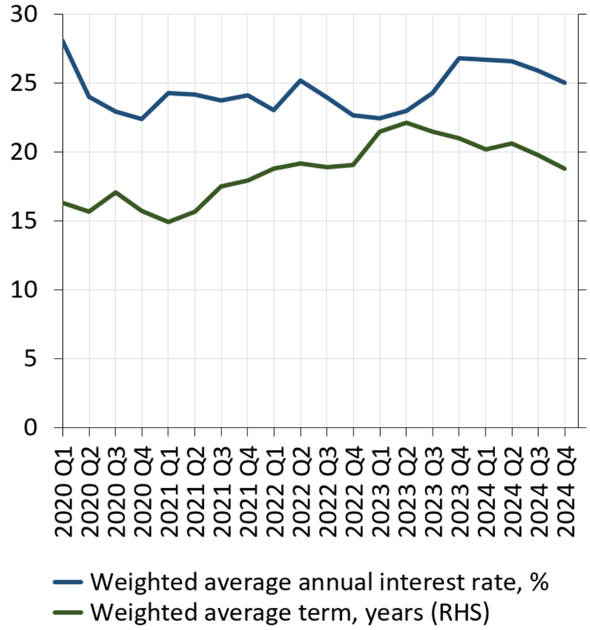


Figure 135. Weighted Average Term and Interest Rate of Car Loans



Sources: National Statistics Committee and CBU staff calculations.

Activity in the car market weakened in 2024. The passenger car imports in 2024 decreased by 7% compared to 2023[104]. Furthermore, passenger cars (excluding special vehicles) produced in Uzbekistan amounted to 399,000 in 2024, reflecting an increase of almost 1% compared to 2023[105]. During 2024, 1.1 million car sale contracts were executed, with this indicator contracting by 27% compared to 2023.

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[103] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

[104] Customs Committee under the Ministry of Economy and Finance. (2025). Information on the import of consumer goods (Vehicles).

[105] National Statistics Committee of the Republic of Uzbekistan. (2025). Industrial production of the Republic of Uzbekistan for January-December 2024.

Figure 136. Car Sales Contracts, thousand

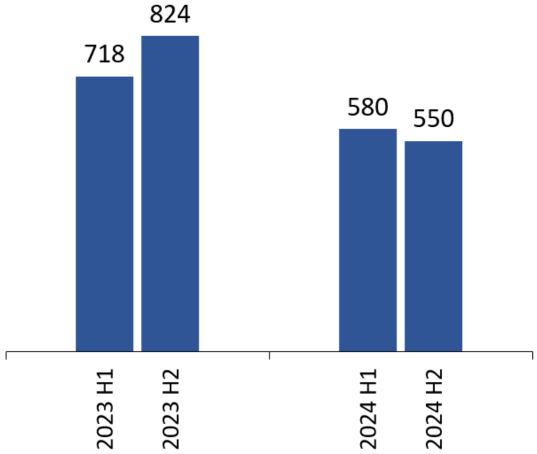
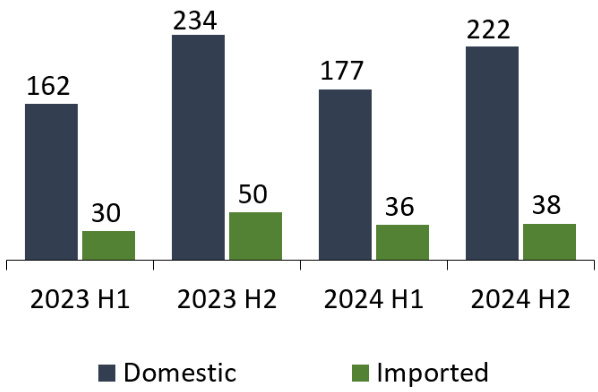


Figure 137. Passenger Cars Manufactured in Uzbekistan (Excluding Special Vehicles) and Passenger Car Imports, thousand



Source: Ministry of Justice, National Statistics Committee and Customs Committee.

Throughout 2024, lower-priced passenger vehicles were imported. A total of 74,500 passenger cars valuing 1.3 billion USD were imported. The average price of imported passenger cars in 2024 amounted to 17,100 USD, which was 28% cheaper than the average price of imported passenger cars in 2023[106].

Figure 138. Concentration in Car Loan Portfolio, HHI

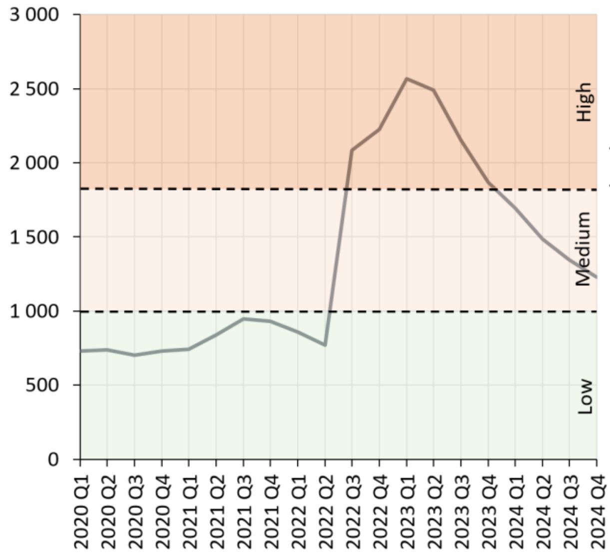
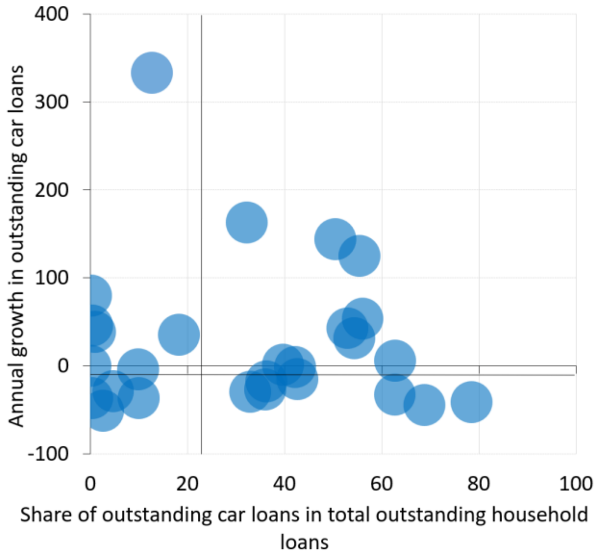


Figure 139. Bank-by-Bank Car Loans*, % (As of January 1, 2025)



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 January 1, 2025.

[106] Customs Committee under the Ministry of Economy and Finance. (2025). Information on the import of consumer goods (Vehicles).

The concentration in outstanding car loans is approaching the low concentration range. The HHI for the outstanding car loans of commercial banks stood at 1,229 at the end of 2024, declining by 639 compared to 2023. In 2024, the total amount of outstanding car loans in the banking system fell by 5.7%, amounting 40.2 trillion UZS. Also, in many banks with a high share of car loans in the retail loan portfolio, the annual growth rate of the car loans slowed down. This, in turn, is reducing the risk of concentration on car loans and significantly mitigating the possible adverse impact of systemic risks in the car market on the banking system.

V. Macro Stress Test for Banking System

5.1. Macroeconomic Scenarios

The financial stability of Uzbekistan's banking system for the period 2025-2027 was assessed based on both baseline and adverse macroeconomic scenarios. The baseline scenario evaluates the possible state of the country's economy in the future assuming the continuation of current economic trends. The adverse scenario, in turn, incorporates heightened internal and external vulnerabilities, including the escalation of the external geopolitical tensions and intensification of instability in the global financial system.

Under the adverse scenario, the real GDP growth rate was determined by applying an additional shock to the one percent probability value of the Growth-at-Risk (GaR) model. In this, the economic growth rate was estimated using the FCI[107] and historical values of real GDP. To capture cyclical systemic risks in the real GDP growth rate in the adverse scenario for 2025, an additional shock of three standard deviations was applied to the FCI, which is considered as one of the factors influencing the GaR model (Appendix 4).

Within these scenarios, the impact of changes in macroeconomic indicators on the quality and profitability of banking system assets was evaluated. Based on the baseline and adverse scenarios, the share of NPLs in total loans, the ratio of NII to total interest-bearing assets, and the ratio of NNII to total assets were estimated using satellite models.

The economic downturn will have a time-lag effect on the deterioration of the loan portfolio quality in the adverse scenario. According to the credit risk model[108], the share of NPLs in the loan portfolio under adverse scenario could grow to 11% during 2025–2027. In this context, the slowdown of economic growth in the country has a negative impact on the debt-servicing capacity of borrowers, leading to the increase in the share of NPLs within the total loans.

The interest income in banks is projected to rise under both the baseline and adverse scenarios. Based on the model for the ratio of NII to total interest-bearing assets[109], a slight decrease in the return on interest-bearing assets is expected under the adverse scenario. The expansion of the interest-bearing assets in the banks will increase the NII on a nominal basis. Also, under conditions of contraction in interest income due to decline in loan interest rates, interest expenses are reduced due to lower deposit interest rates. Thus, the satellite model accounts for the stable NII in banks.

In the medium term, the recovery of the economy may support growth in banks' non-interest income. Under the adverse scenario, the slowdown in economic growth is expected to reduce the volume of banking services and financial operations in banks, possibly lowering the share of NNII in total banking system assets to 3.6% by the end of 2025. Following the short-

[107] The FCI methodology is presented in the Financial Stability Report for 2023.

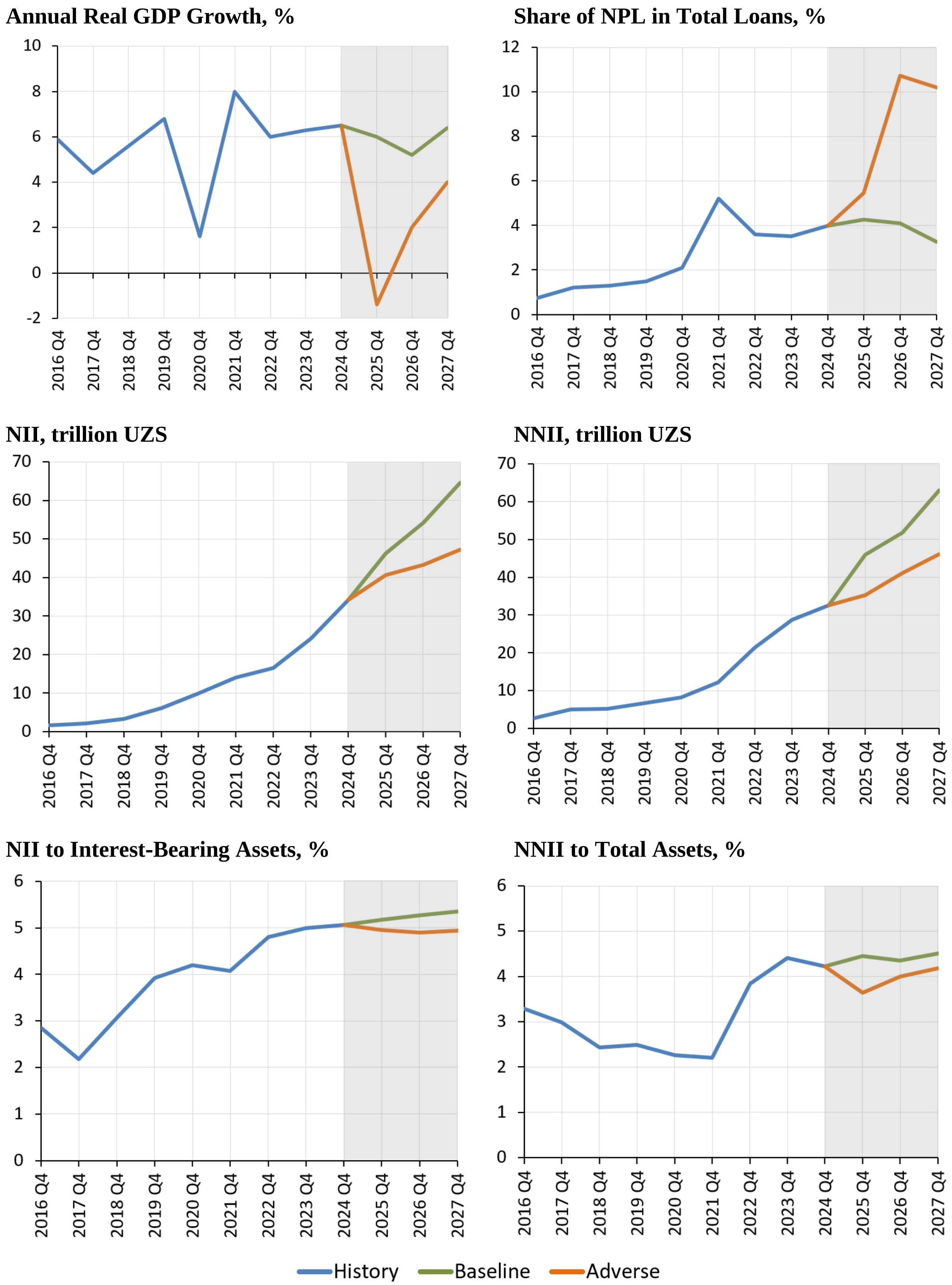
[108] The credit risk model estimates the share of NPLs by using the NPL value lagged, GDP growth, and the loan interest rate values based on scenarios.

[109] The model estimating the ratio of NII to total bank interest-bearing assets uses its value lagged, scenario-specific values of credit growth, currency exchange rate and interest rate margin (the difference between loan and deposit interest rates).

term downturn, the medium-term economic recovery is likely to have a positive impact on banks' non-interest income. In addition, the model for the ratio of NNII to total assets[110] incorporates the positive impact of the UZS depreciation on NNII under the scenarios. In particular, the high share of net profit in FX within NNII of commercial banks contributes to an increase in NNII in UZS following depreciation of UZS.

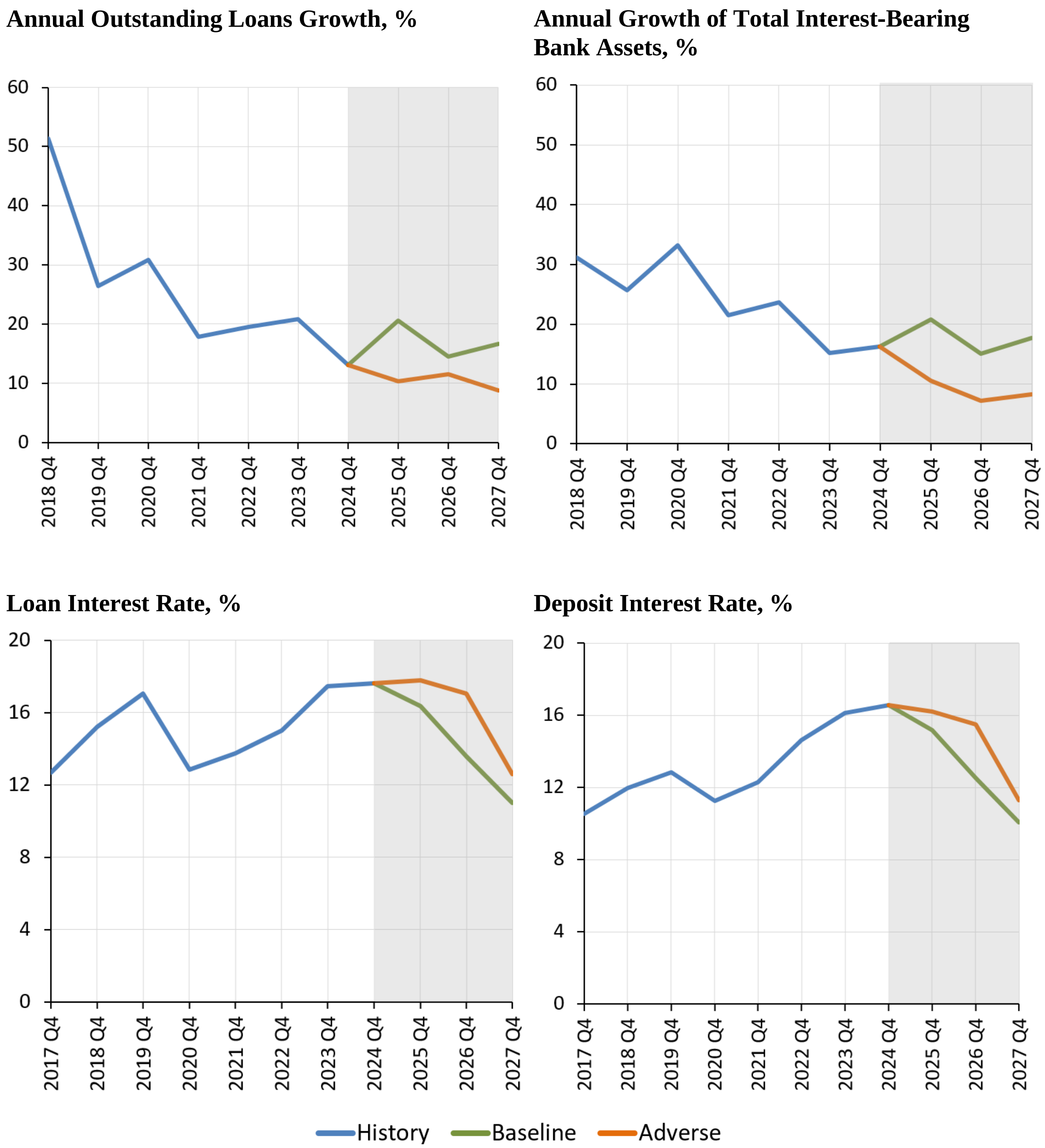
[110] The ratio of NNII to total assets was estimated using the scenario-specific values of GDP growth and the exchange rate.

Figure 140. Macroeconomic Scenarios



Source: CBU staff calculations.

Figure 141. Macroeconomic Scenarios[111]



Source: CBU staff calculations.

[111] 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.

Under the adverse scenario, the growth rates of interest-bearing assets and outstanding loans is expected to decelerate. Due to the decline in economic activity in adverse scenario, banks may reduce their lending, and the households could face difficulties in servicing their outstanding loan obligations. The reduction in loan supply and the increase in loan losses will slow the growth rate of both loans and interest-bearing assets in banks.

In the medium term, loan and deposit interest rates[112] are expected to follow a downward trend. Under both the baseline and adverse scenarios, the expectation of achieving the inflation target by the end of 2027[113], alongside with slowdown in economic growth rates, was reflected in the probable decline of loan and deposit interest rates.

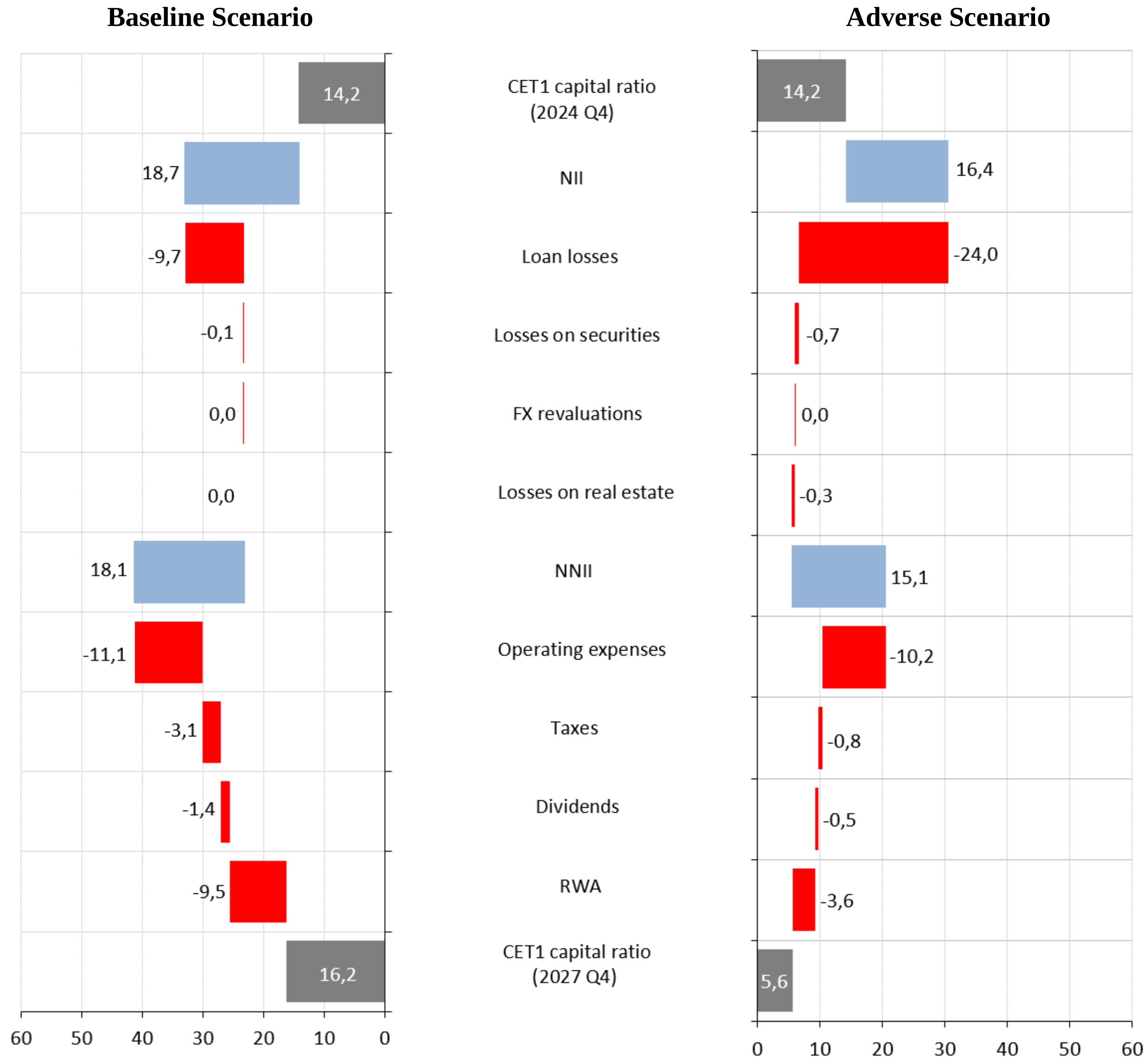
[112] Loan and deposit interest rates was determined using the weighted average interest rates on loans and deposits allocated in national and foreign currency.

[113] The Central Bank of the Republic of Uzbekistan. (2024). Monetary policy guidelines for 2025 and the period of 2026-2027.

5.2. Solvency Macro Stress Test

According to the results of the macro stress test, by the end of 2027, CAR and CET1 ratio are projected to increase in the baseline scenario, while under the adverse scenario they are expected to fall below the minimum requirement. The impact of various shocks on banks' capital adequacy under the baseline and adverse scenarios was assessed using a "top-down" solvency macro stress test[114] (Appendix 5).

Figure 142. Macro Stress Test Results for CET1 Capital Ratio



Source: CBU staff calculations.

[114] 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.

The high profitability observed in the banking system under the baseline scenario was reflected in the improvement in the CET1 ratio. According to the results of the macro solvency stress test, the banking system's CET1 ratio is expected to reach16.2% by the end of 2027. In this regard, NII and NNII are projected to contribute a positive impact on the CET1 ratio in the banking system by 18.7 p.p. and 18.1 p.p., respectively, while loan losses and operating expenses may exert a negative impact totaling 20.8 p.p..

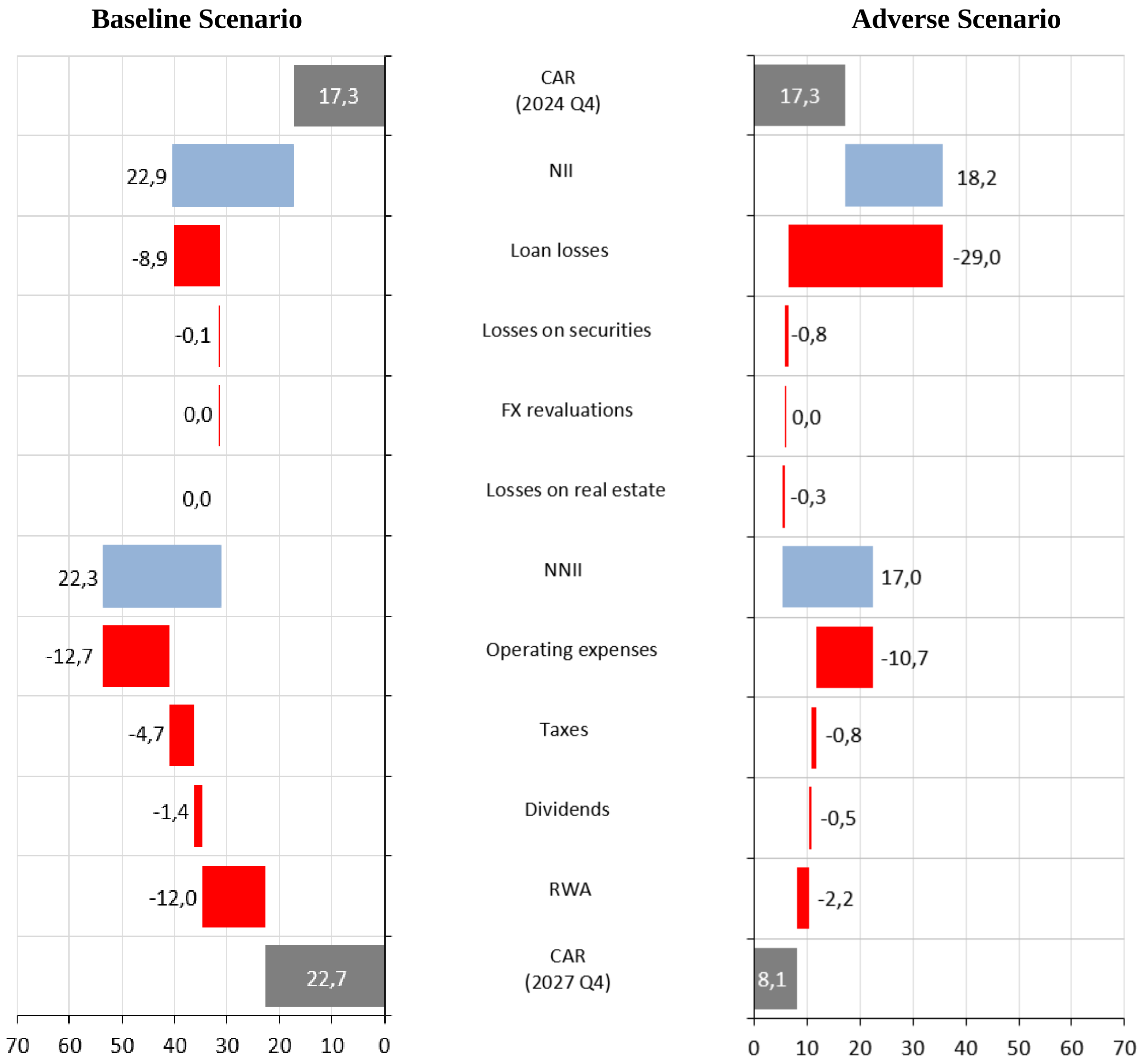
The banking system's CET1 ratio in the adverse scenario is projected to shrink to 5.6% by the end of 2027. The primary factors driving this deterioration in the CET1 ratio are elevated loan losses and rise in operating expenses. Furthermore, the balanced position between FX assets and liabilities in the banking system will mitigate the direct impact of national currency depreciation on CET1. At the end of 2024, the banking system held a net short FX position[115], amounting to 0.1% of RWA[116].

Under the baseline scenario, a significant increase in the CAR is expected across the banking system. The rise in operating expenses in banks associated with strong economic activity, as well as the elevated level of RWA in the environment of robust lending, are factors expected to reduce the banking system's CAR. As a result of high expectations for the growth in banks' NII and NNII, the CAR is projected to reach 22.7% by the end of 2027.

[115] A short FX position refers to an open FX position where a bank's liabilities denominated in foreign currency exceed its foreign currency claims.

[116] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

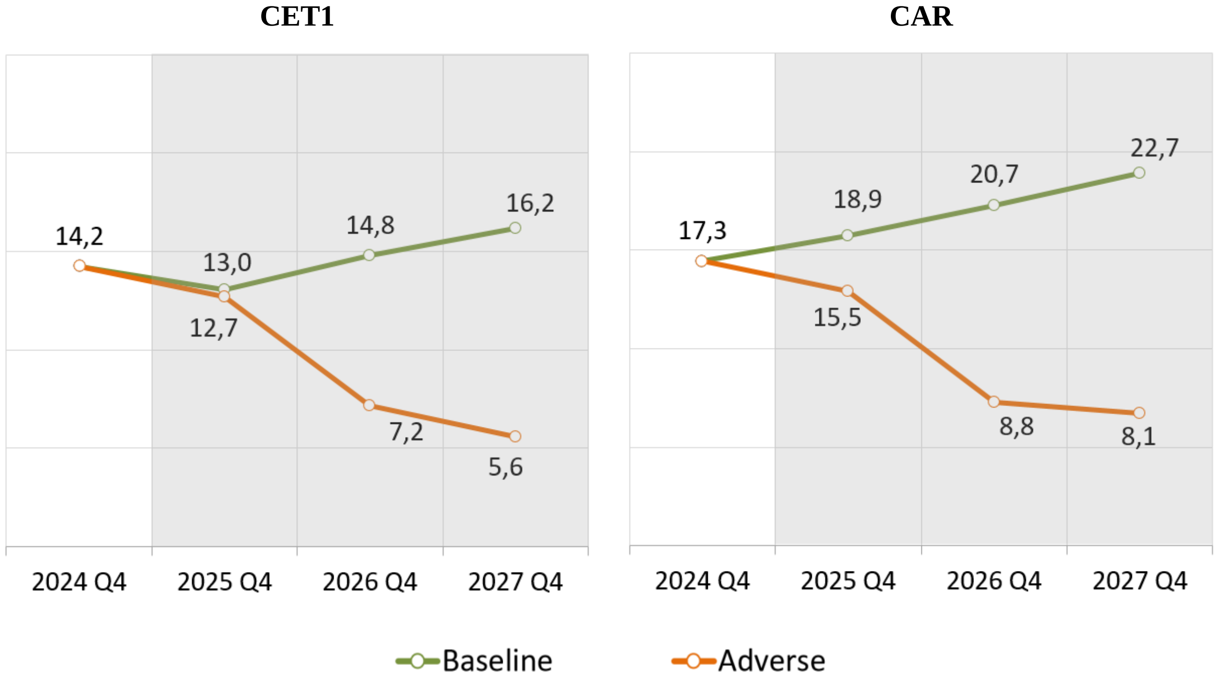
Figure 143. Macro Stress Test Results for CAR



Source: CBU staff calculations.

Banks will likely be unable to meet the minimum requirement for the CAR under the adverse scenario. By the end of 2027, the CAR of the banking system is projected to stand at 8.1%, falling below the minimum requirement of 13%. The deterioration of the loan portfolio, driven by deceleration of economic growth rates under the adverse scenario, is expected to increase the loan losses in banks. In this context, the negative impact of elevated loan losses and operating expenses on the CAR, amounting 29 p.p. and 10.7 p.p., respectively, will be partially offset by the growth in NII and NNII. Also, low expectations for banks' net profits before tax will likely reduce the impact of tax and dividend payments on the CAR.

Figure 144. Capital Adequacy Indicators of Banking Sector in Baseline and Adverse Scenarios, %

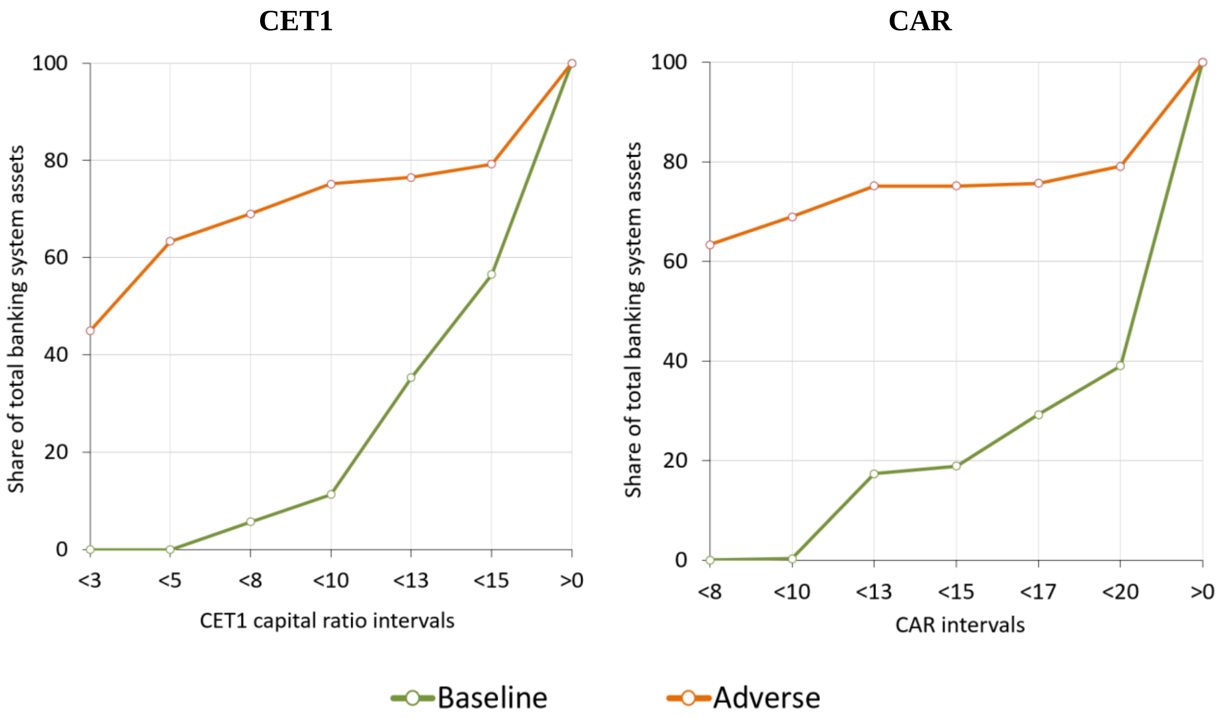


Source: CBU staff calculations.

The majority of banks will be able to meet capital adequacy requirements in the baseline scenario. By the end of 2027, the share of assets corresponding to banks that will be unable to meet the CAR requirement is projected to account for 17% of the total banking system assets. Under this scenario, the assets of banks that will likely to fail to meet the CET1 capital ratio requirement are projected to constitute 6% of the banking system assets.

Under the adverse scenario, the scale of banks unable to meet minimum capital requirements is expected to expand. In particular, by the end of 2027, the assets of banks with capital adequacy indicators falling below the minimum requirements for the CET1 ratio and CAR are projected to constitute 69% and 75% of the total banking system assets, respectively.

Figure 145. Distribution of Banking Sector's Capital Adequacy Indicators Intervals and Shares in Total Assets, %



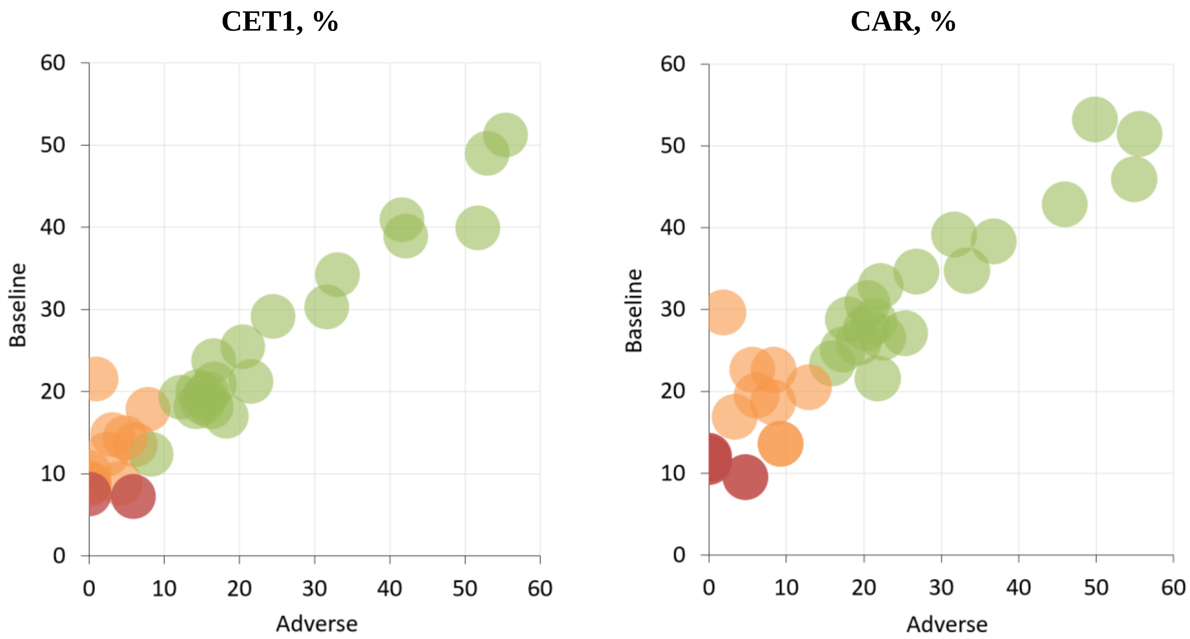
Source: CBU staff calculations.

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

The number of banks unable to meet the CET1 capital requirement in the adverse scenario accounted for one-third of all banks. By the end of 2027, while only two banks are expected to fail to meet the minimum CET1 capital requirement under the baseline scenario, twelve banks are projected to face difficulties in meeting this capital requirement in the adverse scenario.

A substantial number of banks will fail to meet the CAR requirement under adverse scenario. By the end of 2027, the CAR is expected to fall below the established minimum requirements in five and thirteen banks under the baseline and adverse scenarios, respectively.

Figure 146. 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 and CET1 capital ratio within the 0–60% range. Banks are color-coded: a green bubble denotes a bank that satisfies both the minimum capital adequacy requirement of 13% and CET1 capital requirement of 8% under the baseline and adverse scenarios. A light red bubble indicates a bank that fails to meet established requirements under the adverse scenario, whereas a red bubble represents a bank that falls short of these thresholds even under the baseline scenario.

The capital adequacy of total banking system assets in the adverse scenario is projected to fall below the minimum requirement. By the end of 2027, the leverage ratios under the baseline and adverse scenarios are expected to stand at 5% and 14%, respectively. Loan losses arising under the adverse scenario would reduce the banks' Tier I capital, thereby decreasing the leverage ratio relative to total assets.

Some banks may fail to meet leverage ratio requirement under the adverse scenario. According to the macro stress test results, by the end of 2027, all banks in the baseline scenario are projected to maintain leverage ratios above the minimum requirement of 6%, while under the adverse scenario, twelve banks may fail to meet the minimum leverage requirement.

Figure 147. Leverage Ratio of Banking Sector in Baseline and Adverse Scenarios, %

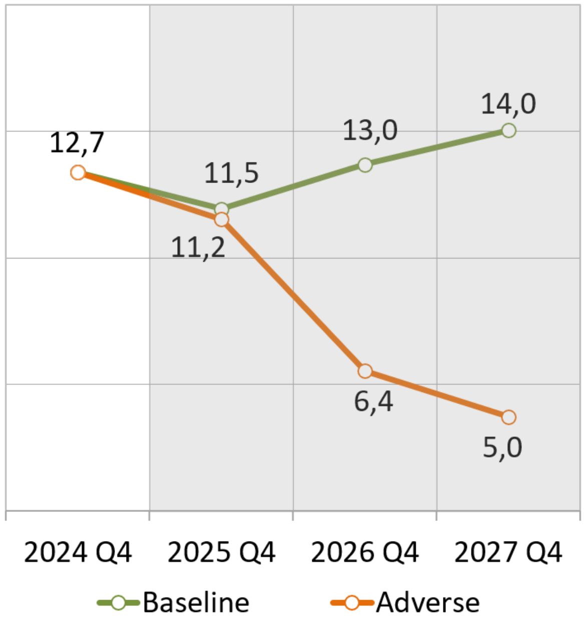
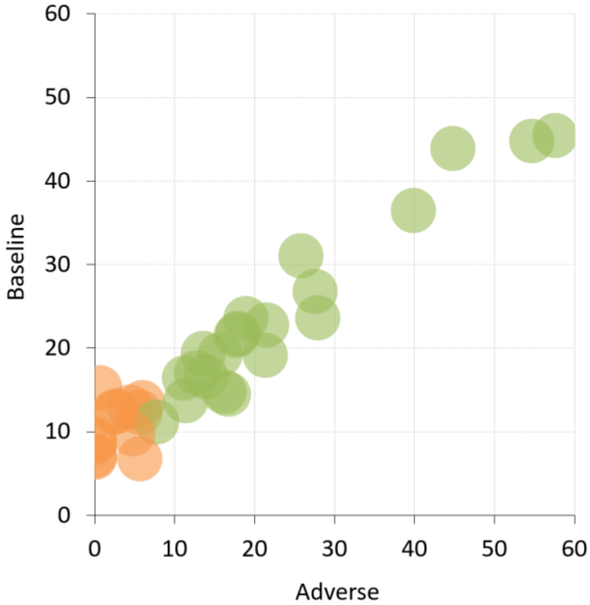


Figure 148. Bank-by-Bank Leverage Ratio, %



Source: CBU staff calculations.

Note: Banks with leverage ratios in the 0–60% range are taken into account. The green bubble represents a bank that meets the minimum requirement of 6% for the leverage ratio under both the baseline and adverse scenarios. Whereas the light red bubble denotes a bank that fails to meet these requirements in the adverse scenario, the red bubble indicates a bank that fails even in the baseline scenario.

Under the adverse scenario, banks would be required to raise additional capital to meet the minimum capital requirements. The amount of additional capital required by banks failing to meet the minimum requirements for the CAR under the adverse scenario is projected to expand, constituting 4.9% of GDP by the end of 2027. Meanwhile, banks will need to raise additional capital equivalent to 0.2% of GDP to meet the minimum capital requirements under the baseline scenario. Additionally, D-SIBs are projected to maintain additional capital equivalent to 0.1% and 3.4% of GDP under the baseline and adverse scenarios, respectively, to meet the minimum capital requirements.

Figure 149. Additional Capital to GDP Ratio in Adverse Scenario, %

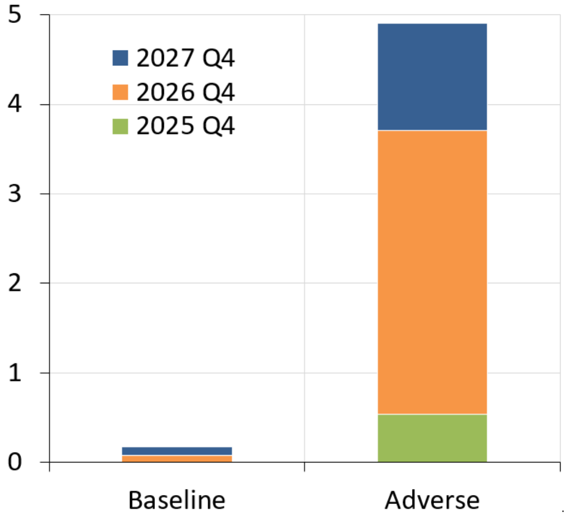
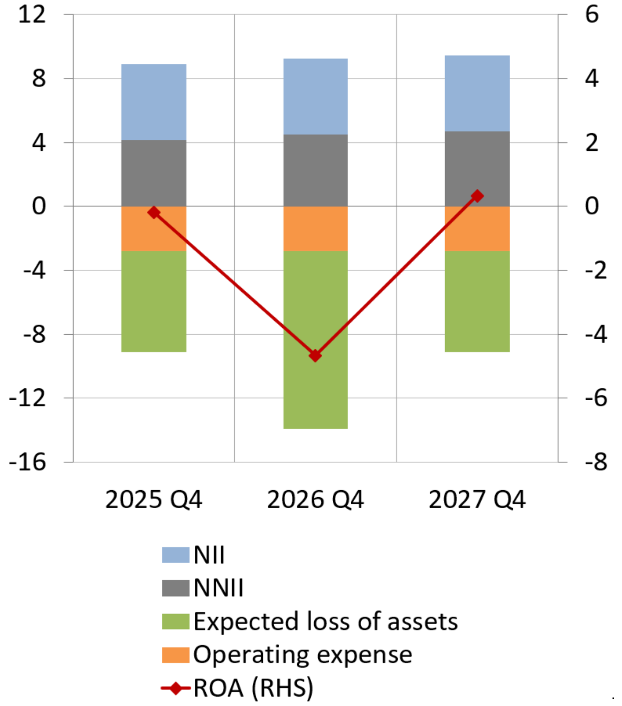


Figure 150. Banking Sector ROA in Adverse Scenario, %



Source: CBU staff calculations.

By the end of 2027, a positive ROA is projected under the adverse scenario. The recovery of economic growth is expected to improve asset quality, which in turn supports positive developments in profitability indicators. Operational expenses, which are projected to remain aligned with asset growth, together with expected loss of assets, are fully offset by the increase in NII and NNII by the end of 2027.

The contagion risk is evaluated using the losses-tied-to-capital[117] and unrecoverable-losses[118] approaches. Based on the adverse scenario results, contagion risk is expected to arise as banks failing to maintain minimum capital requirements will fail to service their interbank liabilities. The assessment of contagion risk continues until losses from a bank's default cease to trigger subsequent defaults in other banks.

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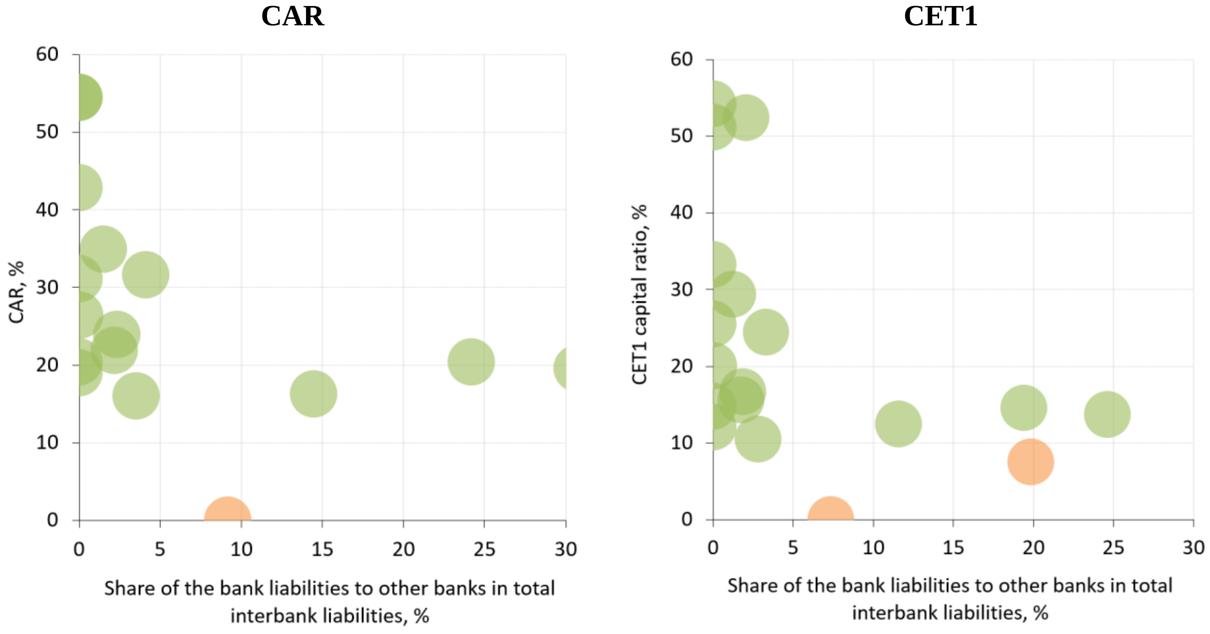
[117] In the approach, where losses from bank defaults are tied to capital, the extent of banks' losses from contagion risk is influenced by the defaulting bank's capital adequacy ratio. The lower the failing bank's capital adequacy ratio, the greater the proportional losses incurred by banks that have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

[118] 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 capital adequacy ratio below the required minimum.

Figure 151. Contagion Risk: Bank Default Losses Tied to Capital Approach

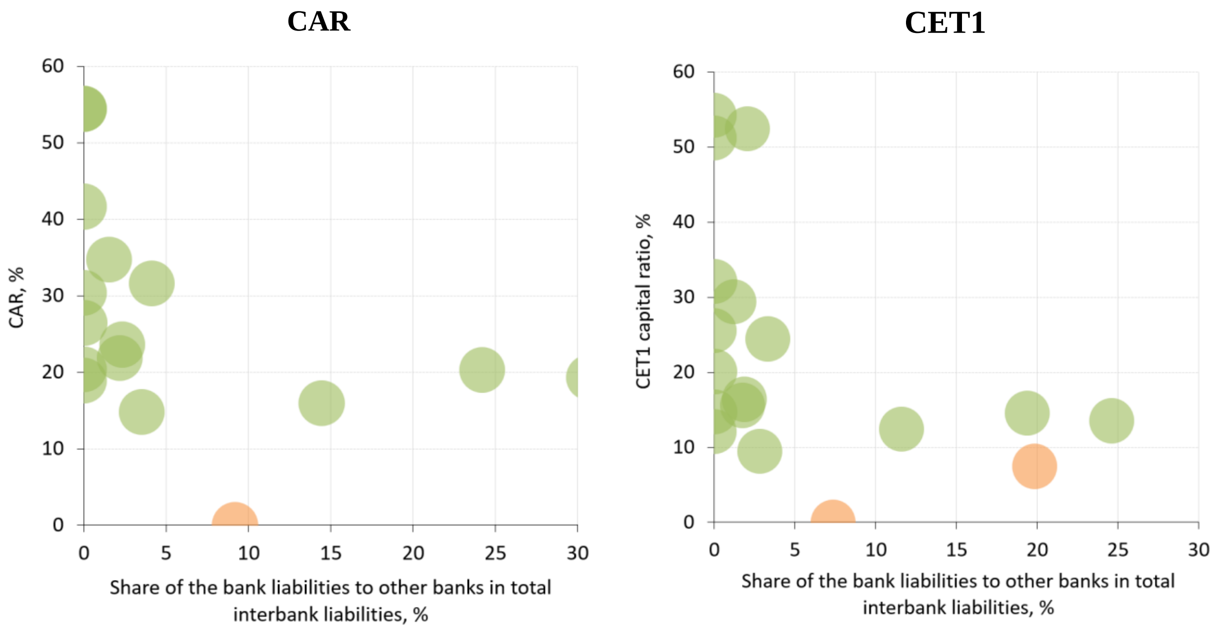


Source: CBU staff calculations.

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 contagion risk within the banking system remained low. Under the adverse scenario, banks with the CAR below the minimum requirement are not expected to result in substantial losses through failure to meet their obligations to other banks. Specifically, losses arising from bank defaults under both the losses-tied-to-capital and unrecoverable-losses approaches are projected to impact only one bank to experience difficulties in meeting its capital requirements. Additionally, in the context of banks that encounter subsequent difficulties in complying with the minimum CET1 requirement, their failure to fulfill interbank obligations could possibly lead to the default of an additional two banks.

Figure 152. Contagion Risk: Unrecoverable Bank Default Losses Approach

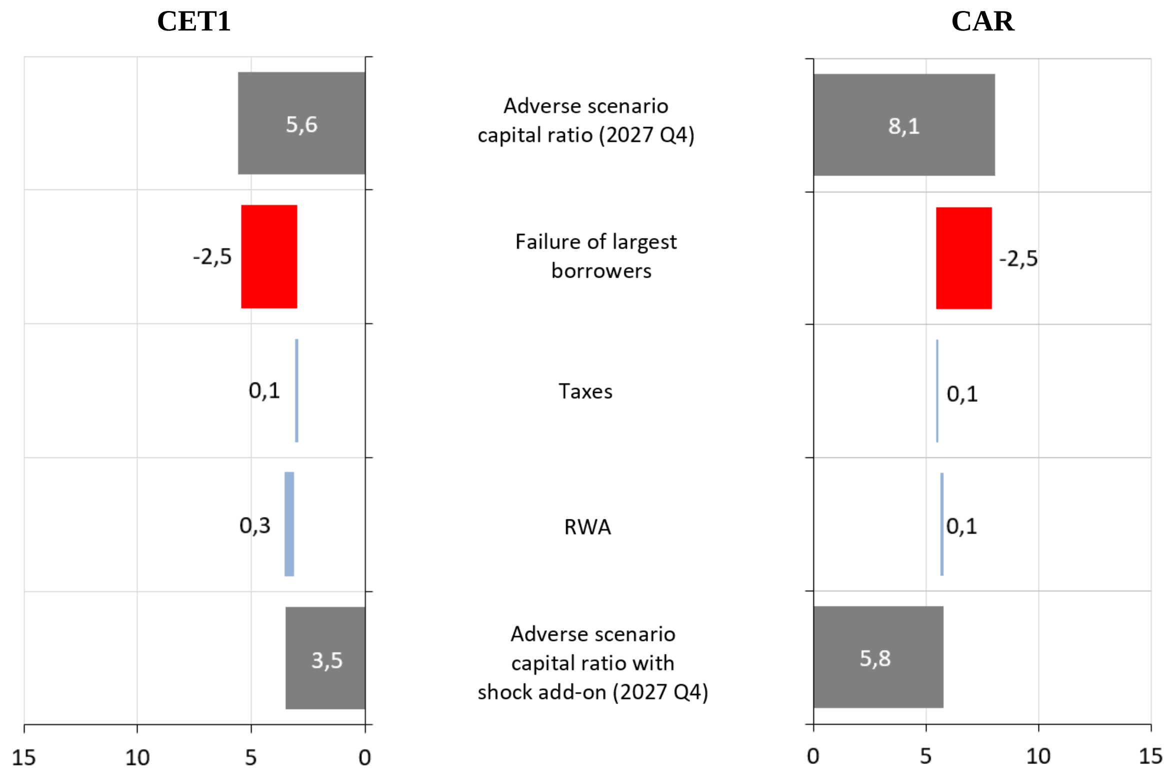


Source: CBU staff calculations.

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 CET1 capital requirement of 8% under the adverse scenario. Banks that comply with the CET1 capital ratio 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 evaluated by introducing additional shocks to the adverse scenario. The effects of vulnerabilities associated with concentration risk and sharp declines in asset market prices on the banking system's solvency were analyzed. In assessing concentration risk, losses on bank assets were estimated based on the default of each bank's largest borrower, assuming that the loss-given default (LGD) of 50%, implying half of the exposure to the borrower would be unrecoverable. In addition, the impact of probable risks in the asset market on the banking system was examined through scenarios in which housing and car prices drop by 30% and 50%, respectively, leading to loan defaults.

Figure 153. Macro Stress Test Results with Concentration Risk, %

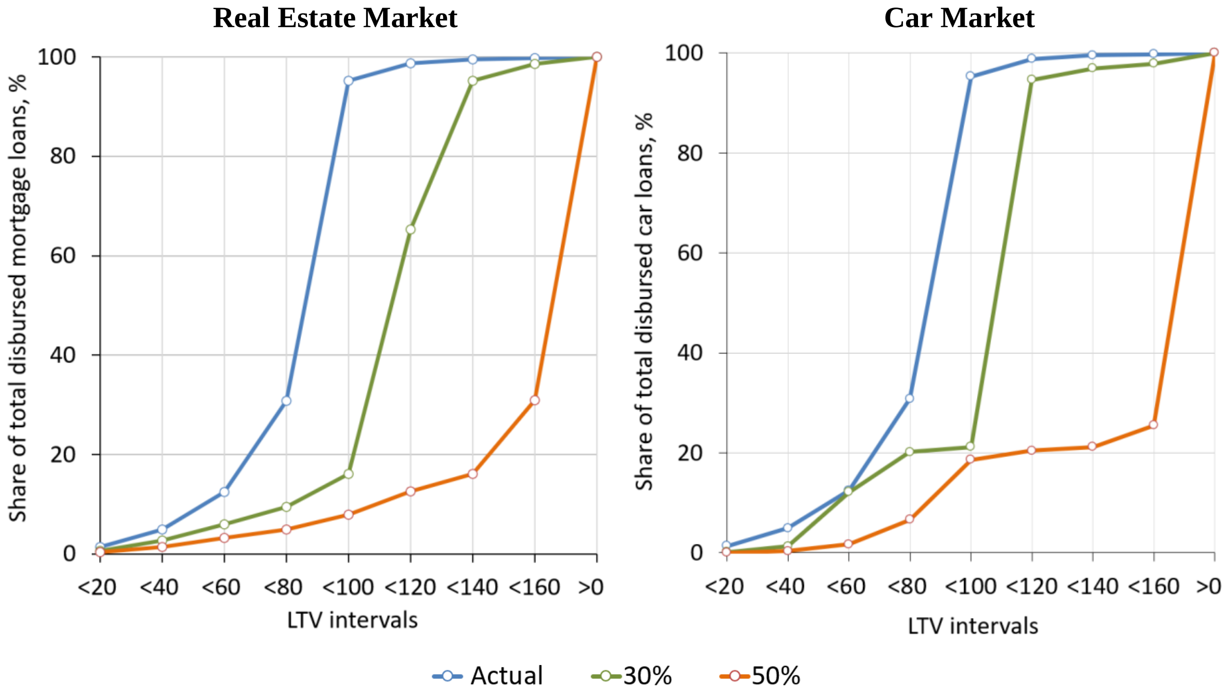


Source: CBU staff calculations.

Note: Concentration risk was assessed based on the assumption of single largest borrower default for each bank.

The impact of concentration risk in bank loan portfolios on the banking system's solvency is projected to be significant. By the end of 2027, under the adverse scenario, the default of the largest borrower within the banks' loan portfolios is expected to reduce the CAR and CET1 ratio of the banking system by 2.5 p.p.. Specifically, due to the materialization of concentration risk, the CET1 ratio could decrease to 3.5%, while the CAR could fall to 5.8%.

Figure 154. LTV Distribution by Loan Type after Asset Price Shocks, 2025



Source: CBU staff calculations.

Note: The graph displays the cumulative shares of mortgage and car loans distributed across LTV intervals.

A sharp decline in asset prices is expected to raise the likelihood of losses on mortgages and car loans. The rise in the LTV ratio exceeding 120% due to the decline in asset prices may increase the probability of borrowers forfeiting their collateral rather than continue servicing their loans. Under the scenario of a 30% fall in housing prices, the proportion of mortgage loans issued in 2024 with an LTV ratio exceeding 120% is projected to reach 35%. Similarly, a 30% decline in car prices would result in car loans with an LTV above 120% constituting 5% of the total car loan portfolio in 2024.

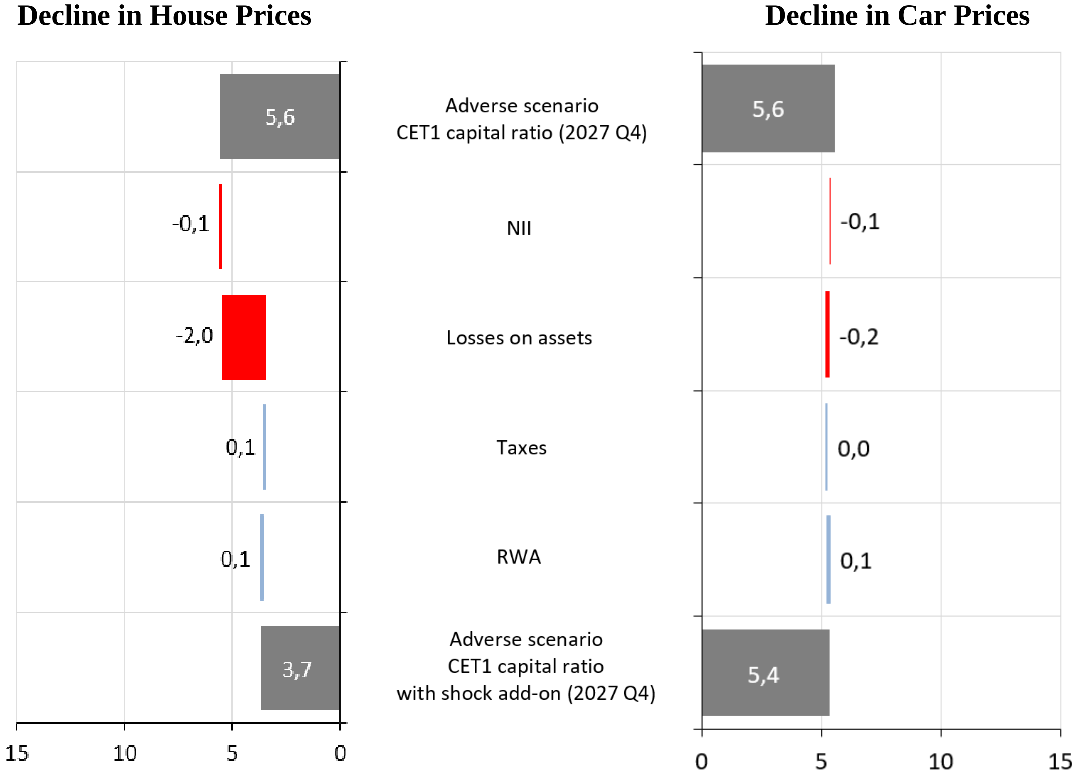
A 50% drop in real estate prices would worsen the collateral coverage for mortgage loans. In particular, as a result of a 50% fall in housing prices, the share of loans with principal amount exceeding the collateral value within the mortgage loans issued in 2024 would account for 92%, while mortgage loans with LTV ratio exceeding 120% would constitute 87%.

Loan losses would be intensified as car prices fall by 50%. A sharp drop in the car market prices could result in 81% of car loans issued in 2024 being insufficiently collateralized. Additionally, under the scenario of severe price decline, borrowers with car loan may prefer to forfeit collateral rather than repaying the loan. Specifically, car loans with LTV ratio exceeding 120% are projected to constitute around 80% of the total car loans issued in 2024.

Under the adverse scenario, a 30% decline in asset market prices is unlikely to significantly shorten loan quality. The assessment of the impact of asset price shocks on bank loan quality[119] indicates a 30% reduction in housing and car prices is projected to increase the share of NPLs in the total loan portfolio by 1.1 p.p. and 0.2 p.p., respectively, by the end of 2027.

A deterioration in asset quality is expected due to a 50% contraction in asset prices. Under the adverse scenario, 50% fall in housing prices is expected to raise the share of NPL in the total and household loan portfolios to 17.7% and 15.6%, respectively, by the end of 2027. Meanwhile, a 50% decline in car prices would expand the share of total NPLs to 15.4%.

Figure 155. Macro Stress Test Results with 30% Decline in Asset Market Prices for CET1 Capital Ratio, %

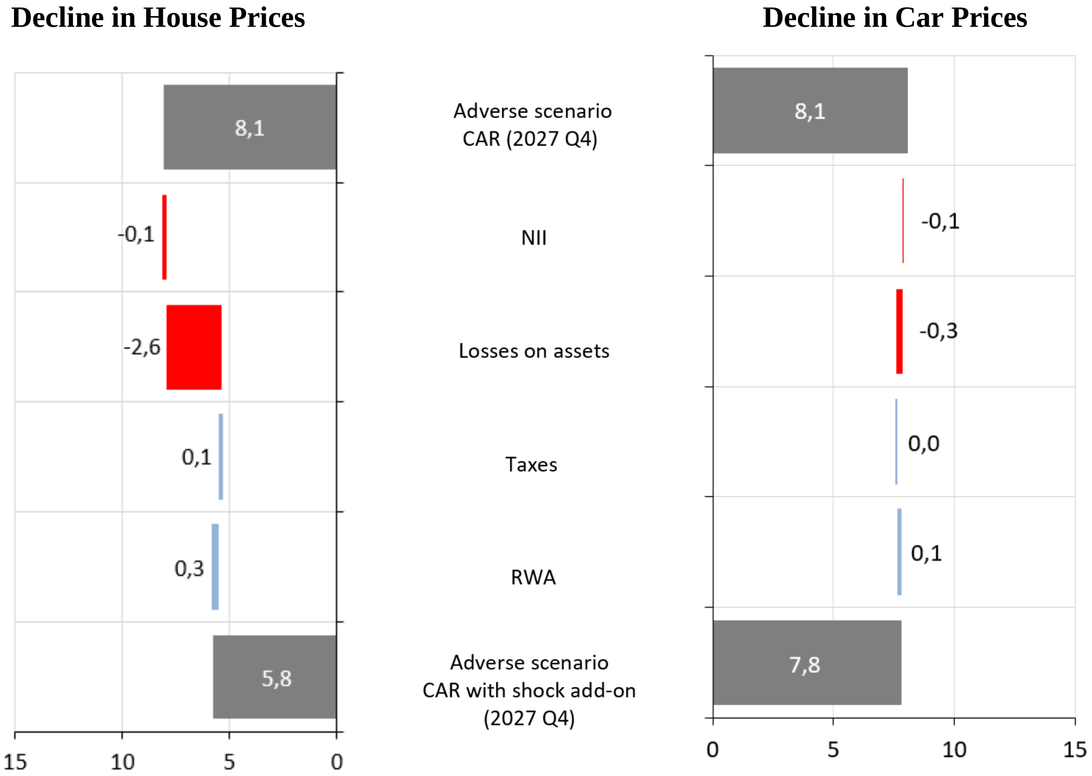


Source: CBU staff calculations.

A 30% decline in asset prices would slightly reduce the banking system's capital. By the end of 2027, 30% reduction in housing and car prices under the adverse scenario could decrease the CET1 ratio to 3.7% and 5.4%, respectively.

[119] It is assumed that borrowers with LTV ratio exceeding 120% due to the decline in asset prices would not service their loans.

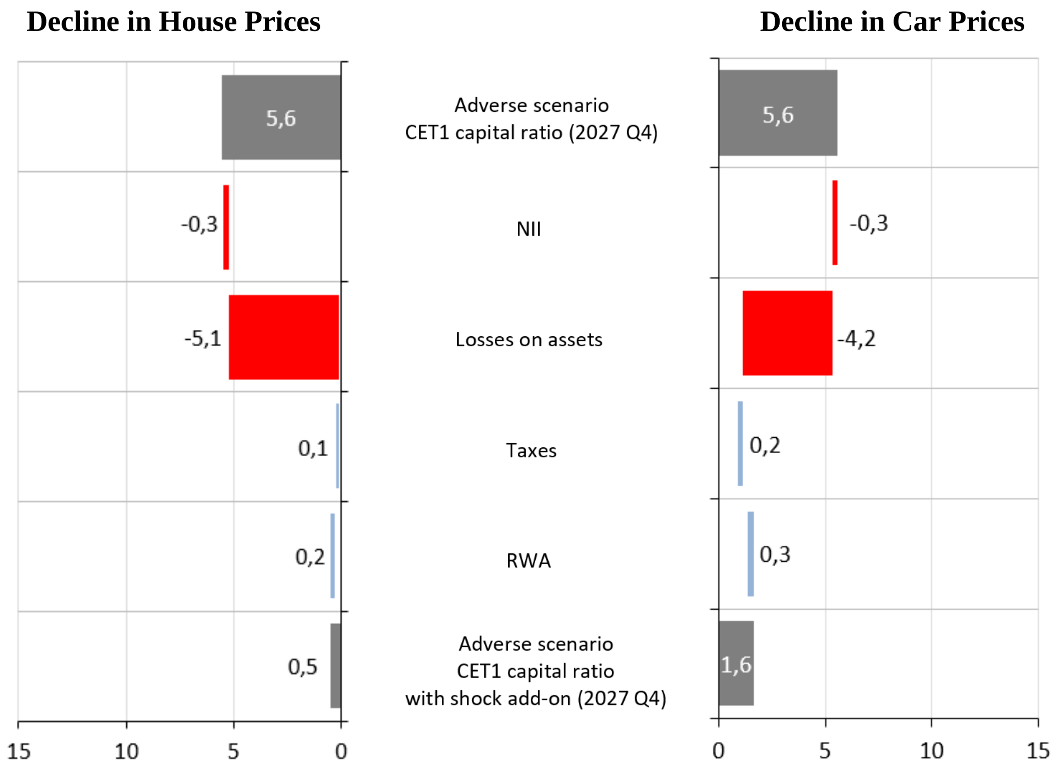
Figure 156. Macro Stress Test Results with 30% Decline in Asset Market Prices for CAR, %



Source: CBU staff calculations.

The impact of probable risks on the banking system is projected to be higher in the real estate market than in the car market. In particular, a 30% decline in house prices could negatively impact the CAR by 2.6 p.p. by the end of 2027, while a decline in car prices could exert a negative impact of 0.3 p.p. to the CAR.

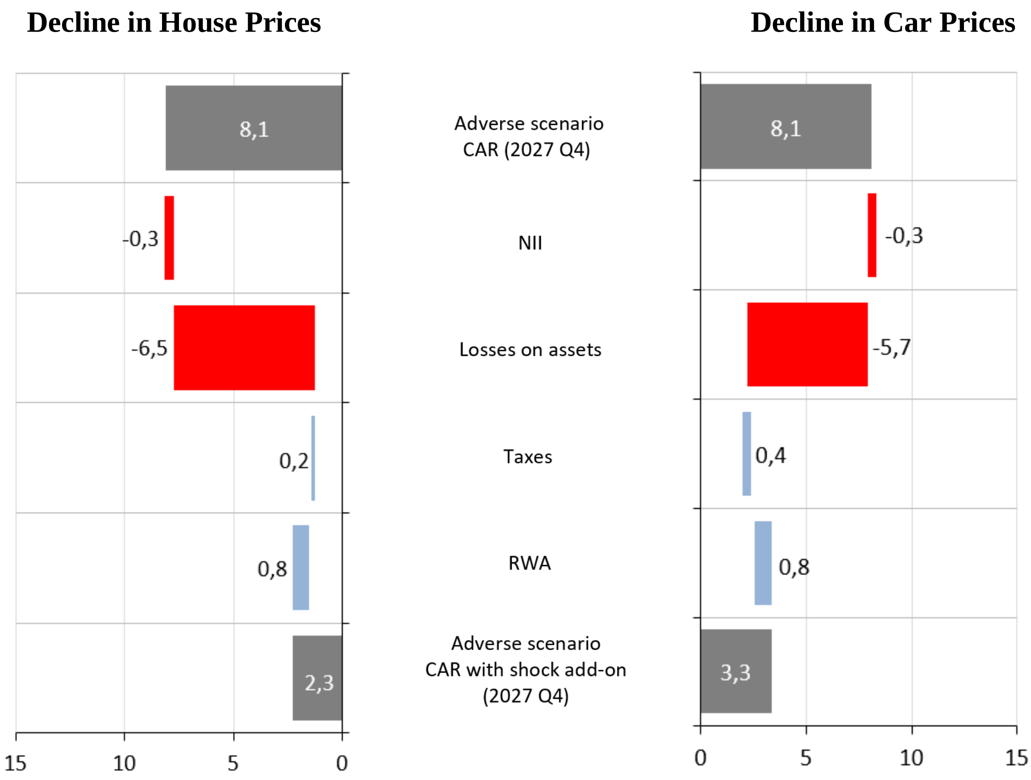
Figure 157. Macro Stress Test Results with 50% decline in Asset Market Prices for CET1 Capital Ratio, %



Source: CBU staff calculations.

A 50% decline in asset prices could result in significant loan losses. The steep drop in housing and car prices may cause borrowers to default on their mortgage and car loans, increasing the share of NPLs within bank assets. In this scenario, large asset losses would occur, resulting in a reduction of NII for banks. By the end of 2027, under the adverse scenario, a 50% fall in housing and car prices would lower the CET1 ratio by 0.5 p.p. and 1.6 p.p., respectively.

Figure 158. Macro Stress Test Results with 50% Decline in Asset Market Prices for CAR, %



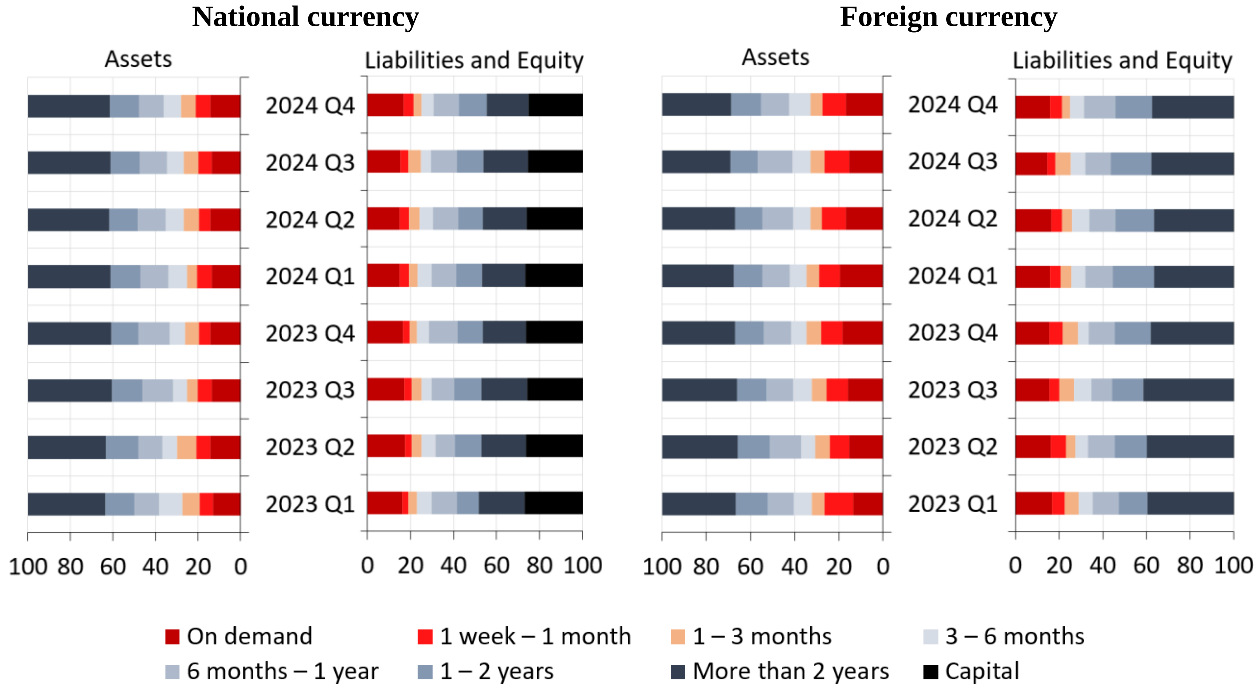
Source: CBU staff calculations.

The banking system's solvency is expected to deteriorate due to a 50% drop in asset market prices. By the end of 2027, under the adverse scenario, despite lower tax payments and contraction in RWA resulting from loan losses triggered by a 50% decline in housing and car prices, decrease in NII and materialization of losses on assets could reduce the CAR by 5.8 p.p. and 4.8 p.p., respectively.

5.3. Liquidity Macro Stress Test

The liquidity of the banking system was assessed through a macro stress test based on the baseline and adverse scenarios. Under the baseline scenario, the factors of the expected cash inflows and outflows were evaluated based on the recommendations of the Basel Committee. Under the adverse scenario the higher expected cash outflows and lower cash inflows resulting from elevated external and internal economic uncertainties were incorporated, along with depreciation of the national currency. In particular, the adverse scenario accounted for the risks arising from reduced confidence in banks due to uncertainties, the resulting withdrawal of deposits from banks and delays in meeting loan obligations (Appendix 6).

Figure 159. Breakdown of Banking System Balance Sheet by Term, %

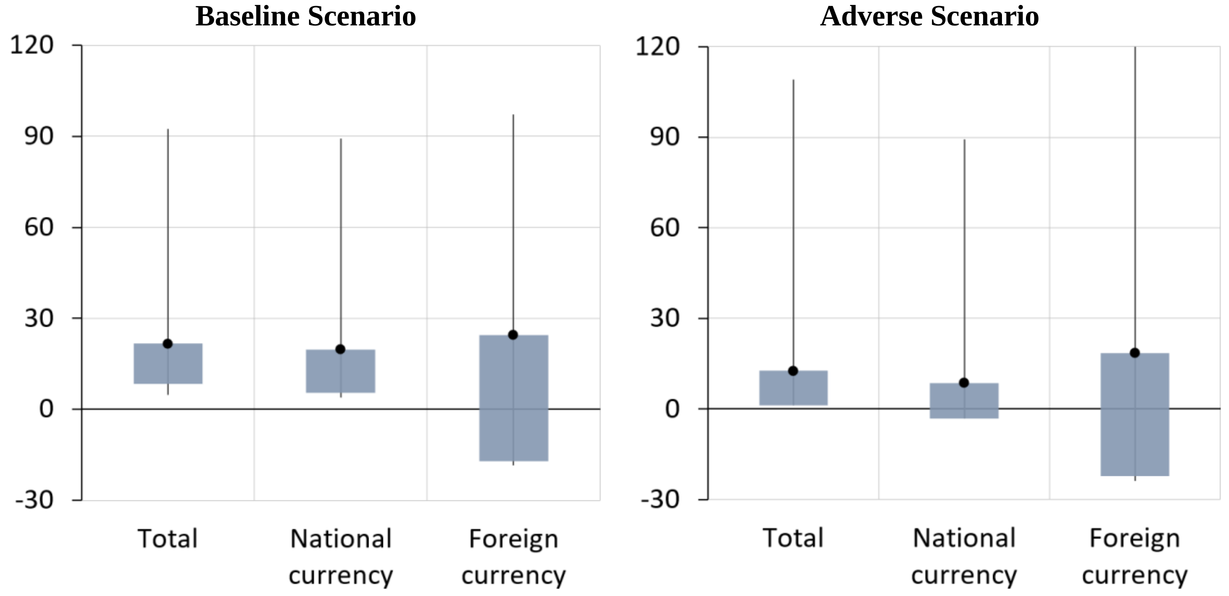


Source: CBU staff calculations.

A decline is observed in the maturity mismatch between banking system assets and liabilities denominated in the national currency. As of January 1, 2025, short-term assets with maturities of up to 1 year in UZS accounted for 48% of bank assets. The share of short-term liabilities in the total liabilities and equity of the banking system constituted 42%. The presence of sufficient short-term assets to meet short-term liabilities in UZS within the cash flows reduces the probability of liquidity risks materializing in the banking system.

The volume of short-term foreign currency assets is higher than short-term FX liabilities. At the end of 2024, the share of short-term assets up to 1 year in total foreign currency assets was 55%. Meanwhile, 46% of the banking system's total liabilities and equity consisted of obligations maturing within 1 year.

Figure 160. Net Cash Inflow to Total Assets, % (as of January 1, 2026)



Source: CBU staff calculations.

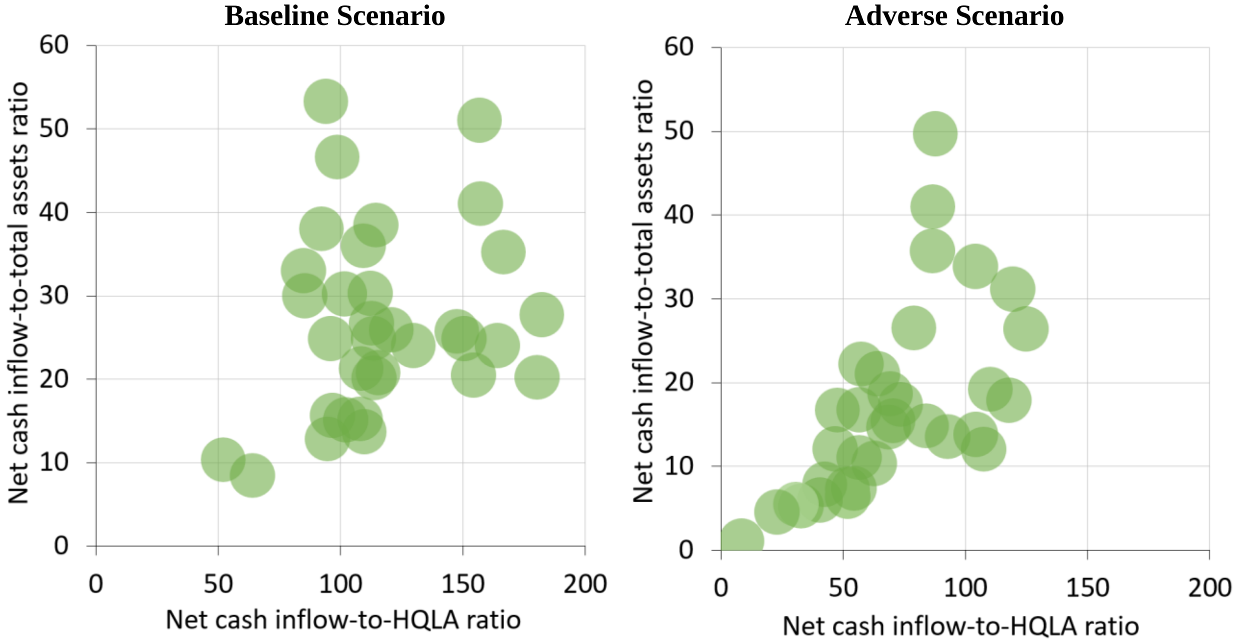
Note: In the graph, the rectangular shape represents the results of macro stress test, illustrating the difference between the banking system's net cash inflow to total assets ratio and the corresponding ratio of the bank with minimum value as of the end of 2025. The longer the rectangle, the greater 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 during 2025, 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 at the end of 2025.

Under the baseline scenario, a positive net cash inflow[120] is projected in banks across all currencies. By the end of 2025, the net cash inflow to total assets ratio for the banking system is projected to stand at 20% in national currency, 25% in foreign currency, and 22% in total currency. Furthermore, at the bank level, the lowest value of net cash income to total assets ratio is expected to constitute 9% in total currency, 6% in national currency, and a negative 17% in foreign currency.

Certain banks may experience negative net cash inflows even in national currency under the adverse scenario. As of January 1, 2026, under the adverse scenario, net cash inflows to the banking system's assets ratio is projected at 9% and 19% in national and foreign currencies, respectively. Meanwhile, the ratio of total net cash inflows to banking system assets in total currency is expected to reach 13%. Furthermore, for the bank with the highest liquidity risk in foreign currency, the net cash inflows to total assets ratio could drop to negative 22%.

[120] Net cash inflow is the difference between cash inflows and cash outflows.

Figure 161. Bank-by-Bank Liquidity Stress Test Results in Total Currency, %
(as of January 1, 2026)

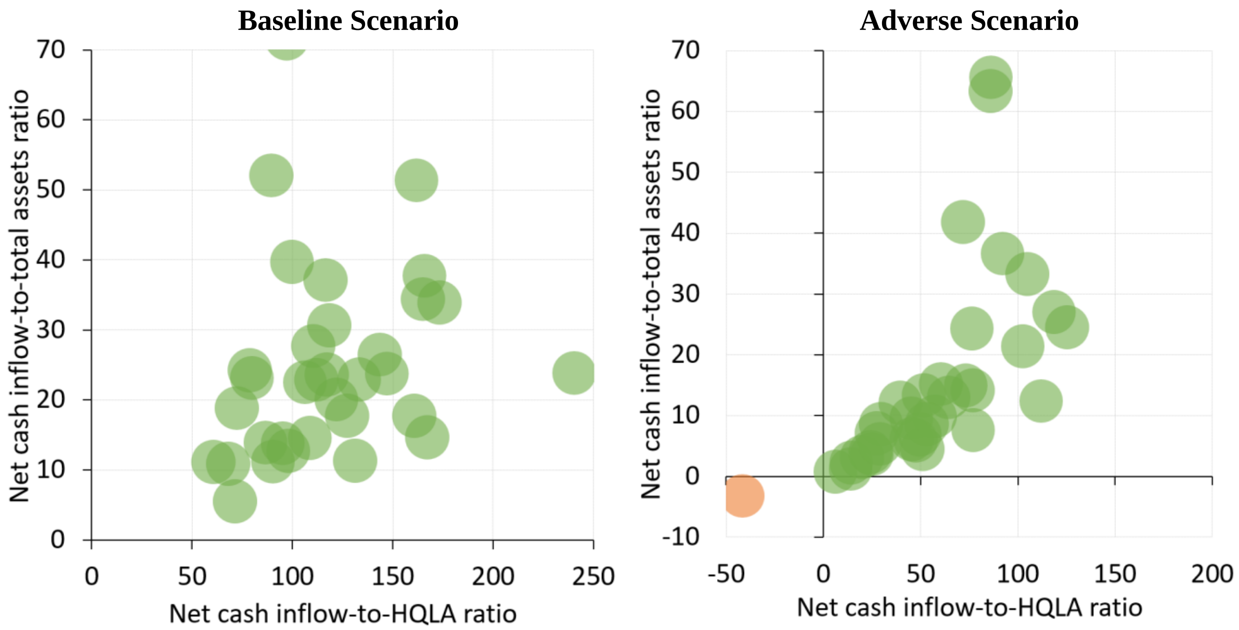


Source: CBU staff calculations.

Note: Banks with net cash inflows of up to 60% of total assets and net cash inflows to HQLA of up to 200% were included under both the baseline and adverse scenarios. The color green represents banks with positive net cash inflows in national currency.

According to the stress test results, no liquidity shortfalls were observed in total currency. The baseline and adverse scenarios for the end of 2025 indicate positive shares of net cash inflows in total and HQLA across all banks in total currency.

Figure 162. Bank-by-Bank Liquidity Stress Test Results in National Currency, %
(as of January 1, 2026)

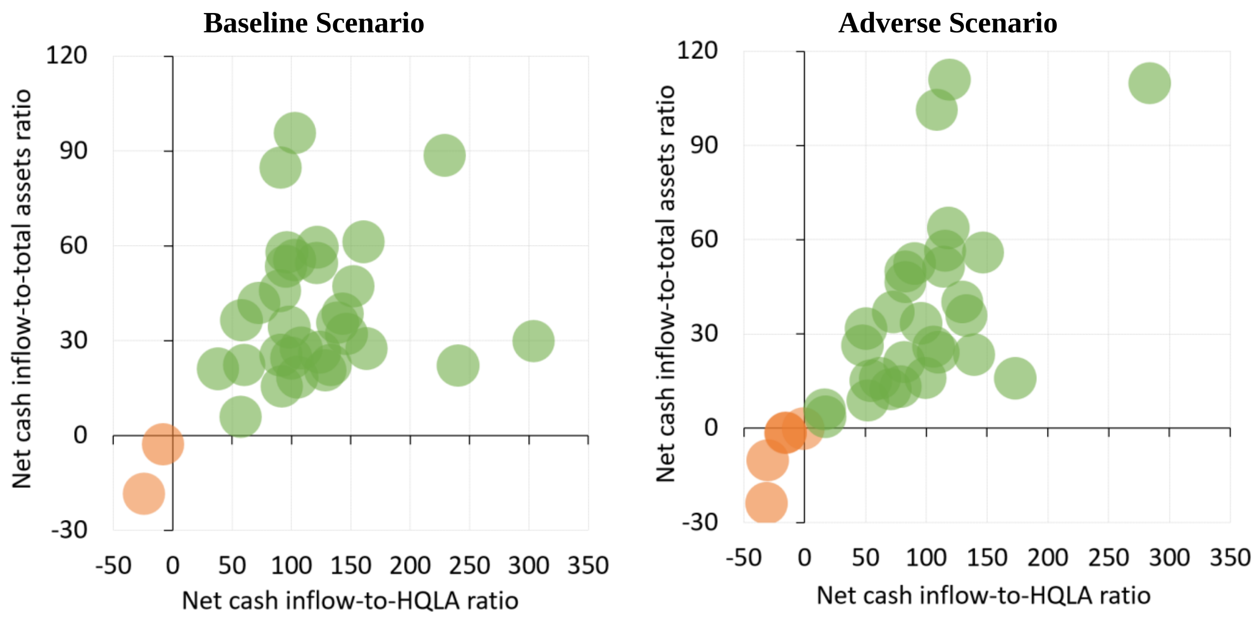


Source: CBU staff calculations.

Note: Banks with net cash inflows in national currency of up to 70% of total assets and net cash inflows to HQLA of up to 250% were included under both the baseline and adverse scenarios. The color green represents banks with positive net cash inflows in national currency, while the light red color denotes banks with negative net cash inflows.

The liquidity in the national currency demonstrates positive results. At the end of 2025, under the baseline scenario, no liquidity concerns were observed in any of the banks. The probability of systemic liquidity risk materializing is considered very low under the adverse scenario, despite one bank possibly experiencing a liquidity problem, as the bank is not systemically important.

Figure 163. Bank-by-Bank Liquidity Stress Test Results in FX, % (as of January 1, 2026)



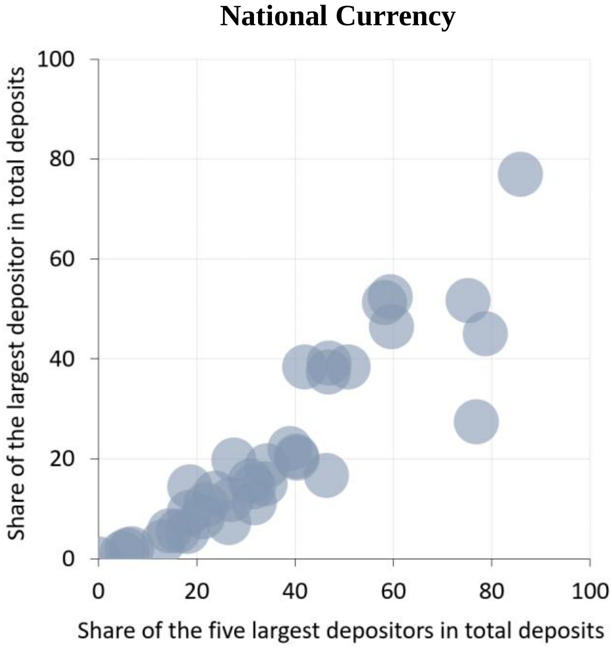
Source: CBU staff calculations.

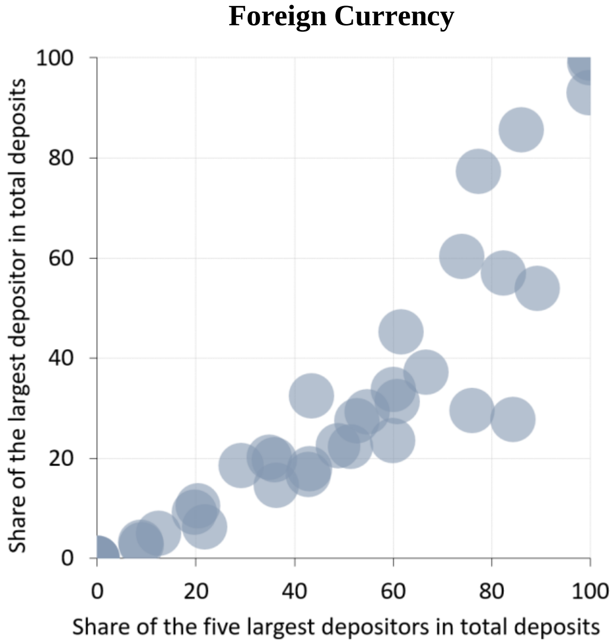
Note: Banks with net cash inflows in foreign currency of up to 120% of total assets and net cash inflows to HQLA of up to 350% were included under both the baseline and adverse scenarios. The color green represents banks with positive net cash inflows in foreign currency, while light red color denotes banks with negative net cash inflows.

Under both the baseline and adverse scenarios, several banks may experience liquidity problems in foreign currency. The foreign currency stress test results indicate that, by the end of 2025, two banks under the baseline scenario and five banks under the adverse scenario are projected to encounter liquidity problems. The availability of sufficient HQLA in these banks to cover the negative net cash inflows limits the contagion of liquidity risk across the banking system. Under the adverse scenario, liquidity shortfalls in FX may arise in only one D-SIB.

The liquidity of banks was assessed by applying an additional shock to the adverse scenario. A hypothetical additional shock was introduced to assess the risks stemming from the withdrawal of funds by the largest depositors in commercial banks' deposit portfolios. Under the adverse scenario, it was assumed that each bank's largest depositor would withdraw its funds.

Figure 164. Bank-by-Bank Shares of Single and Five Largest Depositors in Total Deposits, % (as of January 1, 2025)





Source: CBU staff calculations.

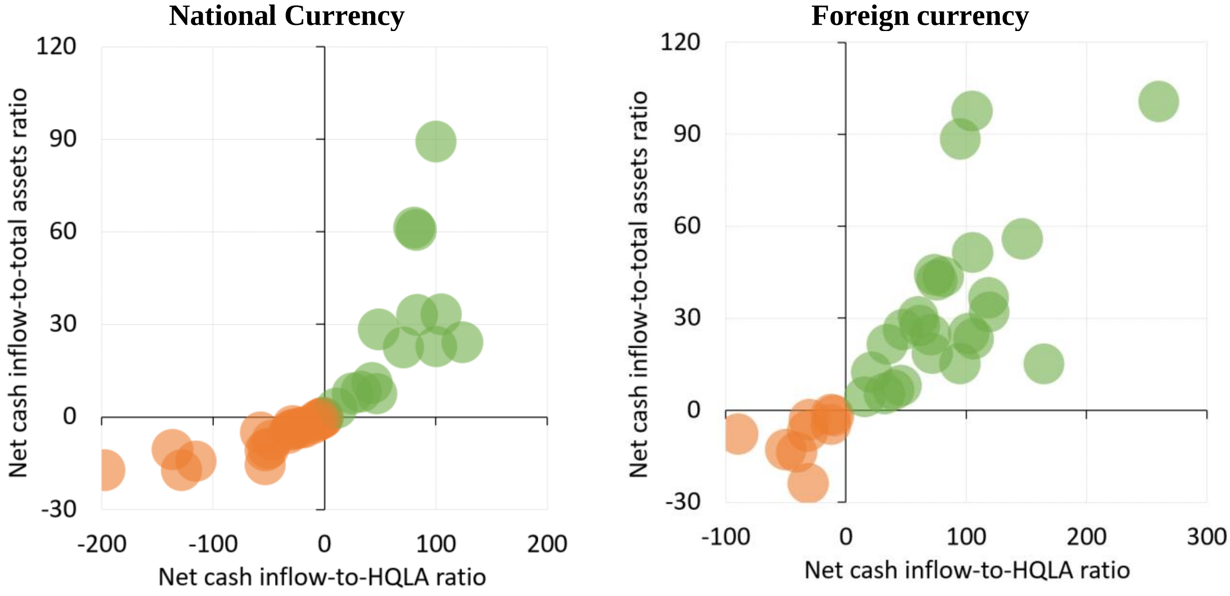
Note: Depositors include both legal entities and individuals.

The concentration risk associated with depositors is a high in commercial banks. By the end of 2024, the outstanding deposits in the national currency amounted to 231.2 trillion UZS, which was 3 times higher than the outstanding deposits attracted in FX[121]. The share of the largest depositors in the total deposits remains high in many commercial banks. In particular, at the end of 2024, the share of the largest single depositor in the total national currency deposits averaged 22% for the banking system[122], while the share of the five largest depositors amounted to 36%. In FX, these indicators reached 35% and 55%, respectively, for single and five largest depositors.

[121] The Central Bank of the Republic of Uzbekistan. (2025). Statistical Bulletin for December 2024.

[122] The average share of the largest depositors in total deposits for the banking system was determined by calculating the arithmetic mean of the shares of the largest depositors across individual banks.

Figure 165. Bank-by-Bank Stress Test Results with Withdrawal of Single Largest Depositor, % (as of January 1, 2026)



Source: CBU staff calculations.

Note: Banks with net cash flows in national and foreign currencies of up to 120% of total assets, and net cash flow to HQLA of up to 300% were included. The color green represents banks with positive net cash inflows, while light red color denotes banks with negative net cash inflows.

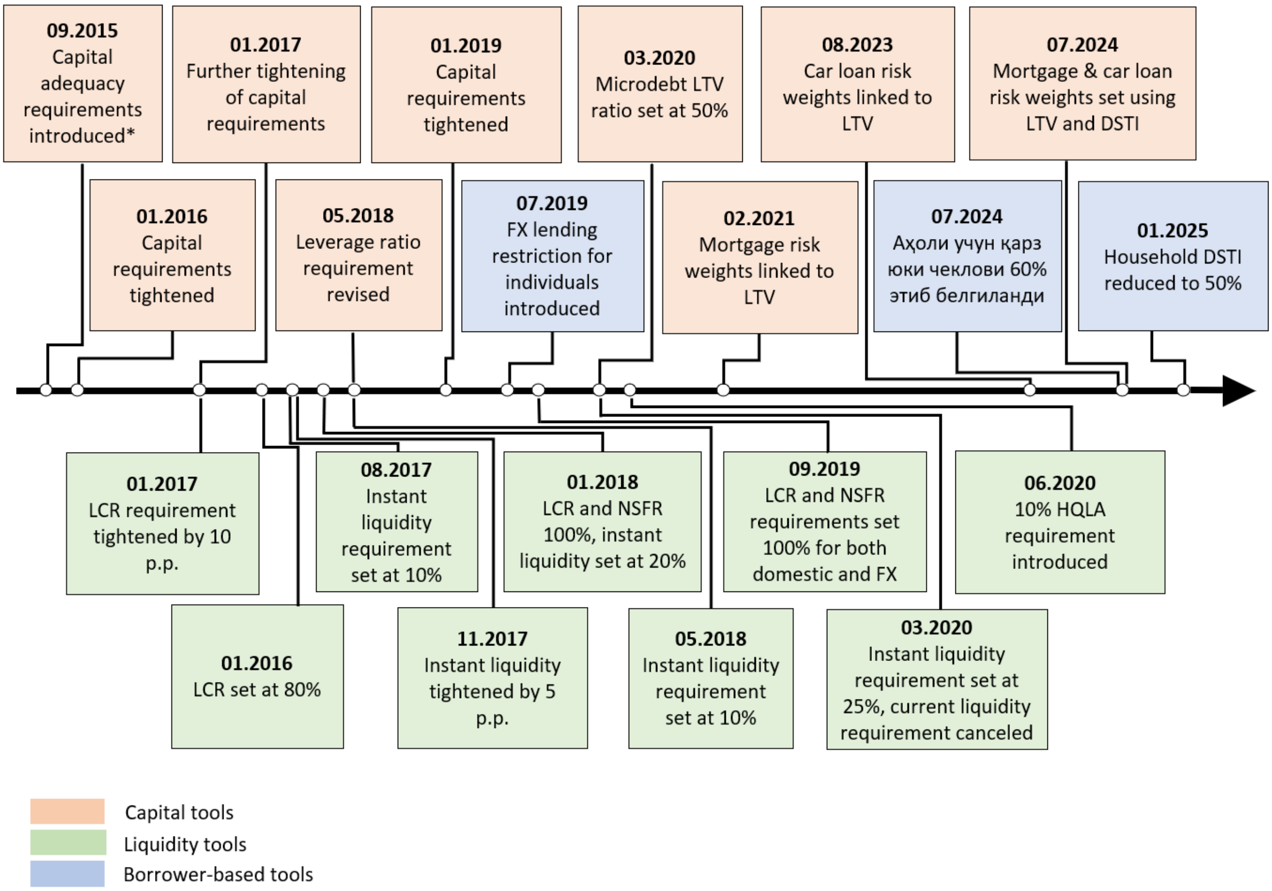
The results of stress test, based on the assumption that the largest depositors withdraw their funds, raise liquidity concerns in the banking system. By the end of 2025, the withdrawal of funds by the single largest depositor in each bank could lead to liquidity problems in both national and foreign currencies across many banks. This reflects the high concentration risk concerning depositors in the banking system.

VI. Macroprudential Policy

6.1. Effectiveness of Macroprudential Policy Tools

The CBU applies MPP tools based on prevailing macroeconomic conditions to maintain the stability of the banking system. In this context, capital, liquidity and borrower-based MPP tools are widely applied. The CBU's choice of MPP tools aligns with the nature of systemic risks and the objectives of their mitigation[123] (Appendix 7).

Figure 166. Key Changes in MPP Tools in Uzbekistan (as of January 1, 2025)



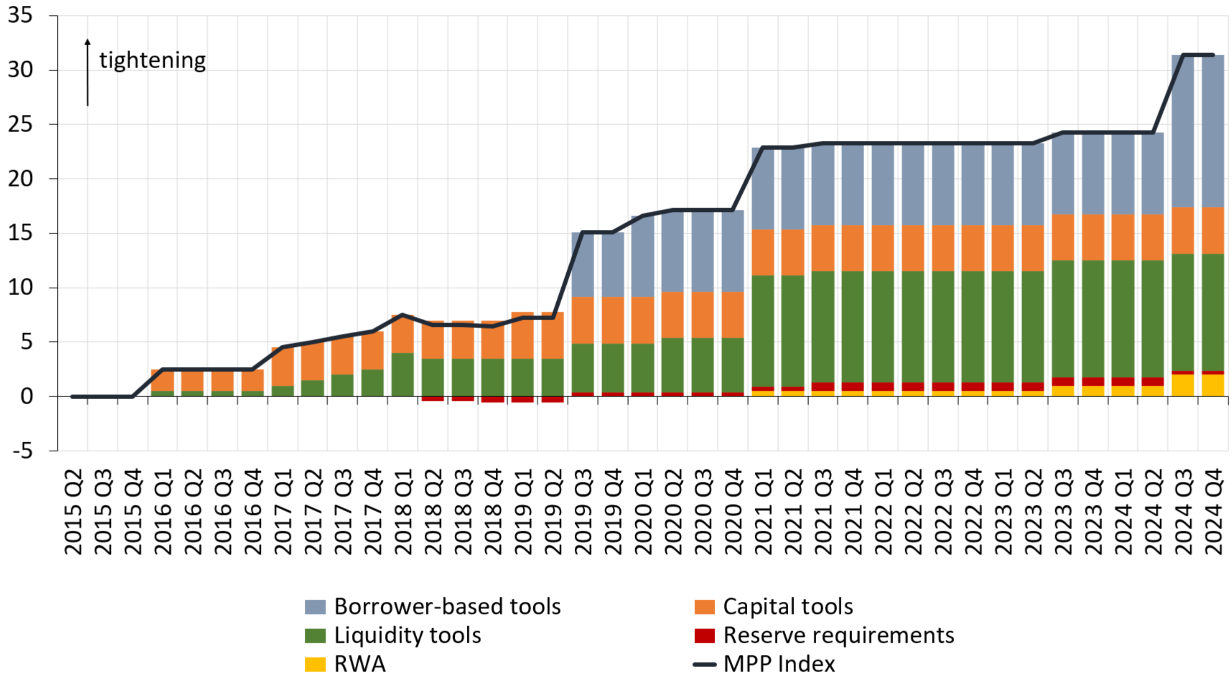
Source: CBU.

Note: *As of September 1, 2015, the minimum capital adequacy requirements were initially set at 10% for CAR, 7.5% for Tier 1 ratio, and 6% for CET1 ratio.

[123] More detailed information is provided in the CBU MPP Framework.

MPP tools are being improved. In order to ensure financial stability in Uzbekistan and strengthen the resilience of banks to unexpected shocks, the mechanisms for practical application of MPP tools is being enhanced (Appendix 8). In particular, the minimum requirements for banks' liquidity and equity adequacy were gradually increased, and borrower-based tools were introduced. Reserve requirements were modified, aiming to reduce the level of financial dollarization and improve banks' liquidity. At the same time, establishing capital buffers that strengthen the banking system's resilience to economic shocks and support the continuity of lending during periods of economic slowdown remains highly relevant (Appendix 9).

Figure 167. Uzbekistan's MPP Index



Source: CBU staff calculations.

Note: An increase in the MPP index reflects a tightening of the MPP in the country.

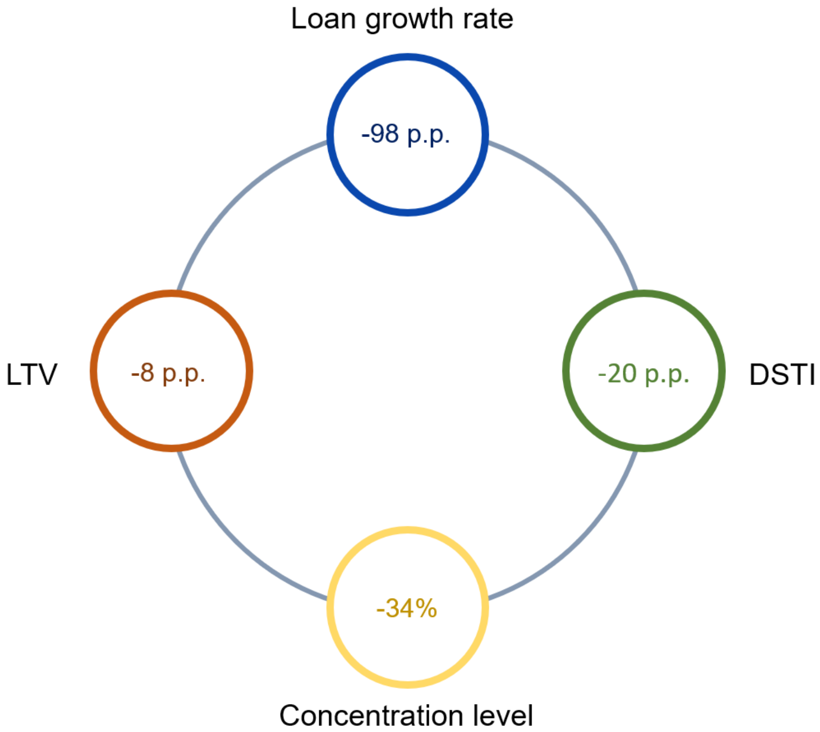
MPP Index has been developed to assess MPP standards. Uzbekistan's MPP Index incorporates capital and liquidity requirements, borrower-based measures, reserve requirements, as well as changes in RWA. In this context, an increase in the MPP Index indicates a tightening of MPP. The CBU also employs this index to conduct a comprehensive assessment of the effectiveness of the MPP tools implemented (Appendix 10).

In 2024, the tightening of borrower-based tools was reflected in the increase of the MPP Index. Starting from July 1, 2024, the DSTI cap of 60% was introduced for all types of loans issued to individuals. Previously, the 50% DSTI cap applied only to microdebts. In addition, the procedures for determining the risk weights for mortgage and car loans issued by banks were revised to incorporate both LTV and DSTI ratios[124].

[124] O'zbekiston Respublikasi Markaziy banki boshqaruvining 2015-yil 13-iyundagi "Tijorat banklari kapitalining monandligiga qo'yiladigan talablar to'g'risidagi nizomni tasdiqlash haqida"gi 14/3–sonli qarori.

MPP measures reduced banks' credit risk in the car loan segment. As a result of the tightening of MPP, both the collateralization of car loans and the debt burden of car loan borrowers improved, while the rapid growth rates of car loans slowed down. In particular, the weighted average LTV for auto loans issued in 2024 decreased by 8 p.p. compared to 2023, reaching 73%. Furthermore, the growth rate of car loans in 2024 decelerated by 98 p.p. relative to the growth rate in 2023. The HHI for car loans in the banking system fell by 34%. In addition, the average DSTI ratio for individuals who obtained car loans in H2 2024 decreased by 20 p.p. compared to H1 2024.

Figure 168. Impact of MPP Measures on Car Loans

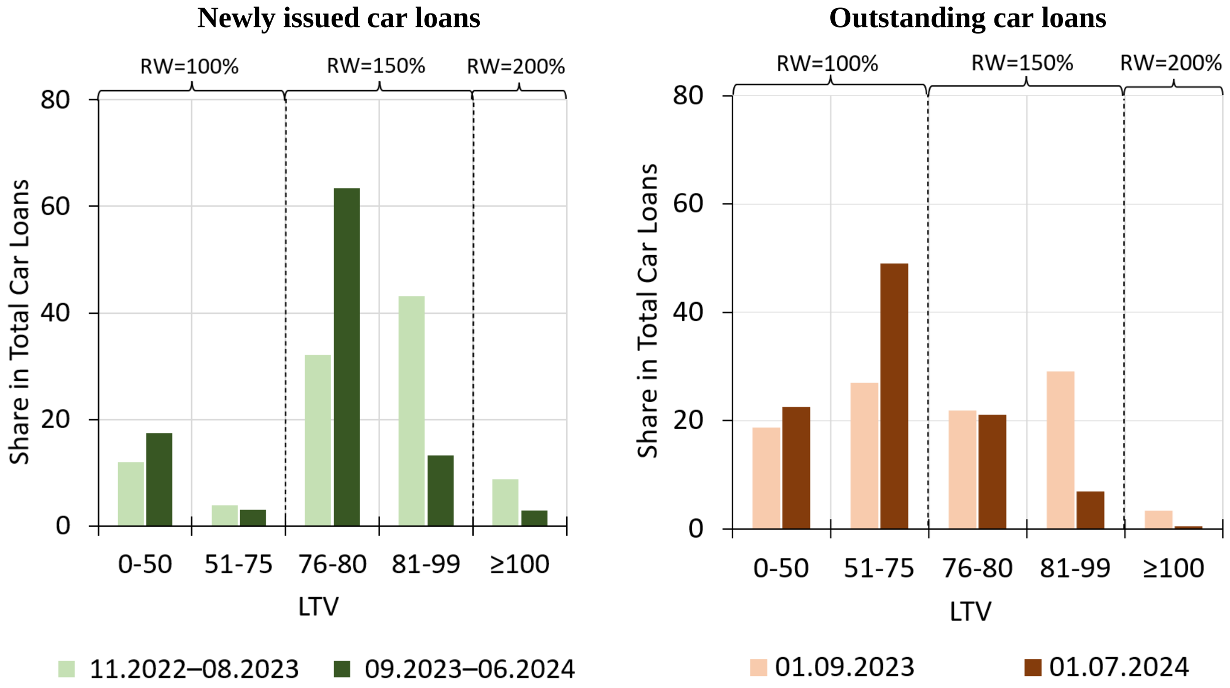


Note: The indicators reflect changes observed between the beginning and end of 2024. For the DSTI ratio, the difference between the average values in theH2 and H1 of 2024 is presented. The concentration level is measured using the HHI.

The initial indirect LTV implemented for car loans is taking effect with a certain lag. The risk assessment for car loans is based on the ratio of the outstanding amount of car loans to the collateral value[125]. In this context, banks attempt to maintain their presence in the car loan market by issuing loans with higher LTV ratios, which entails a higher risk level. Consequently, the LTV ratio for car loans tends to settle close to the threshold between high-risk and low-risk levels. Over time, as outstanding loan amounts decrease, the LTV ratio declines, thereby reducing the associated risk.

[125] 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.

Figure 169. Effectiveness of Indirect LTV on Car Loans, %



Source: CBU staff calculations.

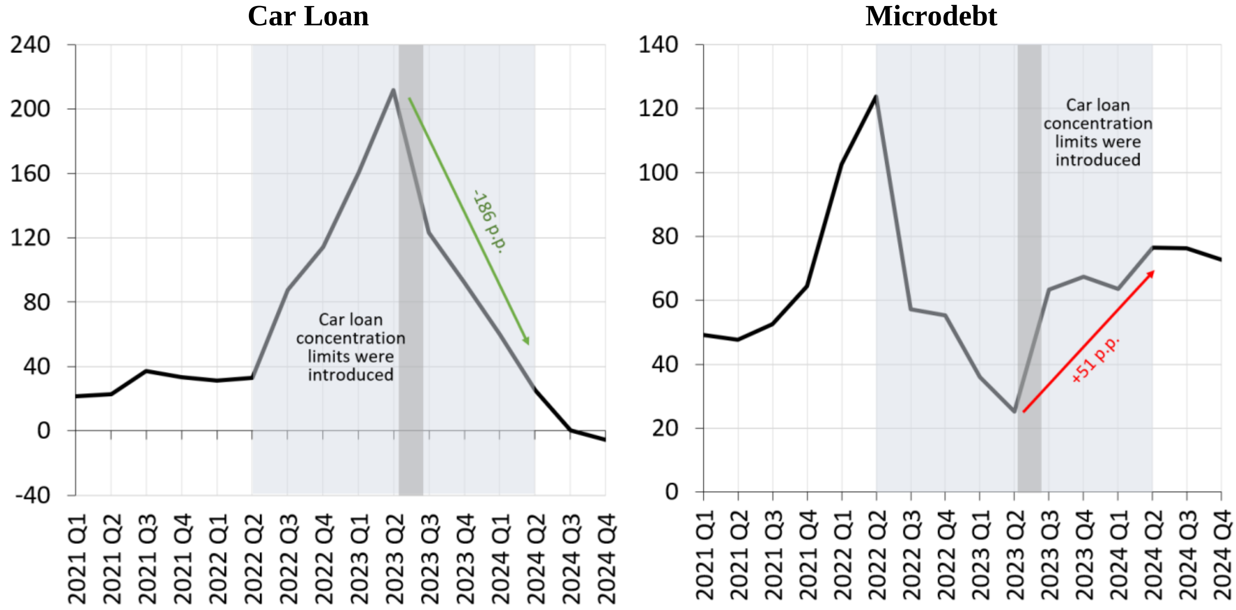
Note: From August 20, 2023, risk weights for car loans were determined based on the LTV ratio, and initial indirect LTV cap for car loans was implemented.

For newly issued car loans, the period prior to the application of the indirect LTV cap covers car loans issued between November 2022 and August 2023. The period following the introduction of the limit includes car loans issued between September 2023 and June 2024. To assess the effectiveness of the LTV caps for car loans, the pre-limit period was defined as the interval from the initial introduction of LTV to their subsequent revision.

For outstanding car loans, the pre-limit period is defined as outstanding amount of car loans as of September 1, 2023, while the post-limit period is defined as the outstanding amount of car loans as of July 1, 2024.

A positive development was observed in the LTV distribution of car loans. The main segment of the LTV ratios for newly issued car loans shifted from the 81–99% range to the 76–80% range, reflecting the effect of the initially introduced indirect LTV caps. In particular, during the 10 months following the implementation of indirect LTV caps, car loans with LTV ratios in the 76–80% range accounted for 63% of newly issued car loans, representing an increase of 31 p.p. compared with the 10 months prior to the introduction of indirect LTV caps. Additionally, as of July 1, 2024, in the outstanding car loan portfolio, the share of car loans with LTV ratios up to 75% reached 72%, increasing by 26 p.p. compared with September 1, 2023.

Figure 170. Impact of Car Loan Concentration Limit on Loan Growth, %



Source: CBU staff calculations.

The concentration limit had no noticeable effect on car market prices, highlighting the emergence of risks associated with regulatory arbitrage[126] in the banking system. In 2023, to mitigate credit concentration risk, a requirement was introduced stipulating that car loans must not exceed 25% of commercial banks loan portfolio. Although the growth rate of car loans fell sharply under the influence of these MPP tools, demand for cars in the asset market remained stable. In this context, the reduced demand in the car market resulting from the decrease in the car loans may have been covered by microdebts. In particular, as of July 1, 2024, the annual growth rate of outstanding car loans to individuals drop by 186 p.p. compared to the same period in 2023, while microdebts accelerated by 51 p.p.. In terms of loan volume, car loans declined by 14.3 trillion UZS, while microdebts increased by 10.7 trillion UZS.

MPP tools implemented in recent years reduced vulnerabilities in the real estate market. In 2024, the effectiveness of borrower-based and capital tools applied to mortgage loans was reflected in reduction of overvaluation in housing market price by 3 p.p. compared to the average fundamental value. In this context, the borrower-based and capital tools influenced the real estate market through the channels of resilience, credit demand, credit risk mitigation, and expectations.

The tightening of lending conditions slightly reduced the demand for mortgage loans. The impact of macroprudential tools on the real estate market through the credit demand channel was reflected in a 26 p.p. reduction of the housing affordability index[127] in 2024, driven by tighter mortgage lending conditions. In addition, the impact of LTV caps on the real estate market through the credit risk mitigation channel can be assessed as low.

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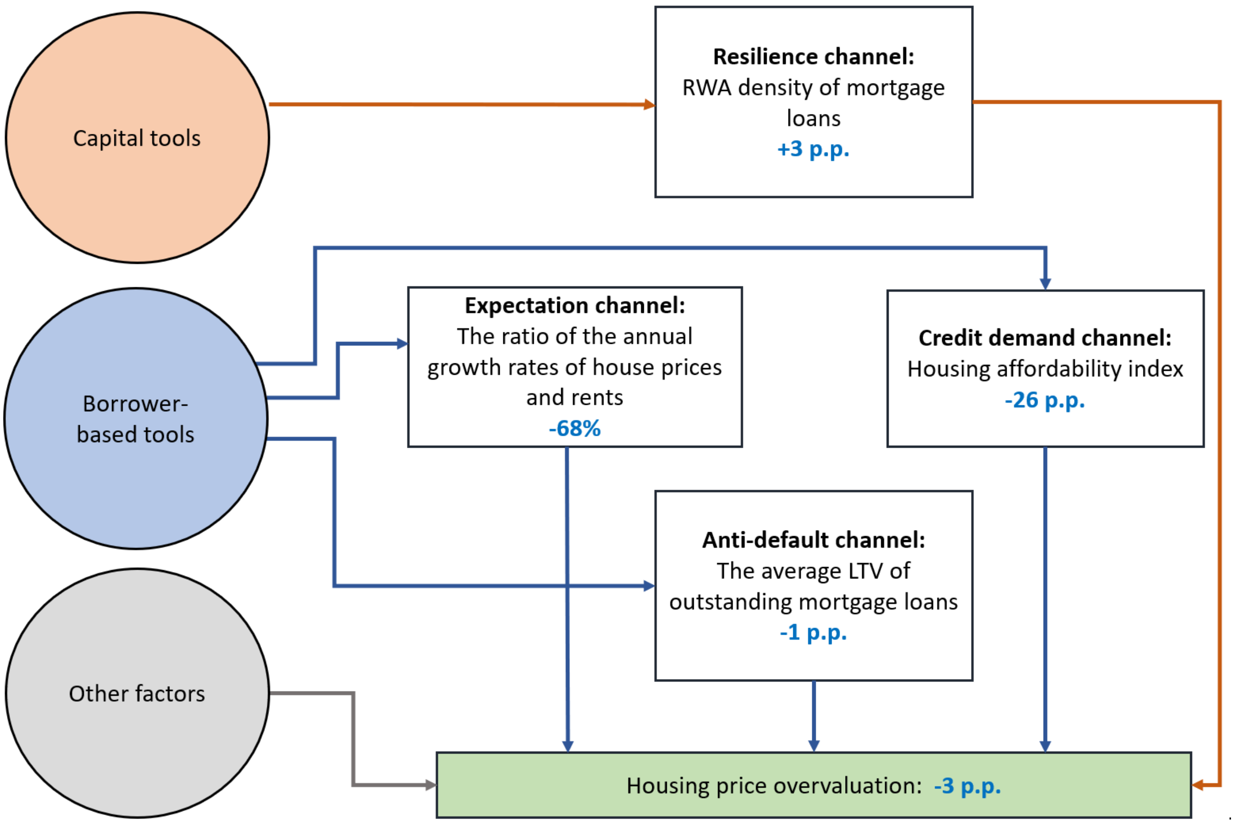
[126] Regulatory arbitrage is when financial market participants gain comparative advantages by moving and (or) starting their activities in relatively less regulated segments of the market to circumvent restrictions.

[127] The housing affordability index methodology is presented in the Financial Stability Report for H1 2024.

Figure 171. Impact of MPP Tools on Real Estate Market via Transmission Channels



Source: CBU.

Note: The indicators reflect changes between the beginning and end of 2024. Changes in transmission channels were captured using RWA density of mortgage loans for resilience channel, Housing Affordability Index for credit demand channel, average LTV ratio of mortgages for credit risk mitigation channel, ratio of annual growth ratios of housing and rent prices for expectations channel. Additionally, the overvaluation of housing prices was measured as the difference between the market price of housing and the average fundamental value estimated using models.

Borrower-based tools had a positive impact on the real estate market through the expectations channel. As a result of macroprudential measures, the reduction in opportunity of households to obtain multiple mortgage loans beyond their actual needs curbed the speculation in housing market. The decline in the ratio of annual growth rates of house prices to rents reflects a reduction in speculative incentives among borrowers. In particular, the ratio of annual growth rates of house prices to rents decreased by 68% in 2024.

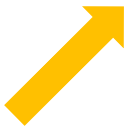
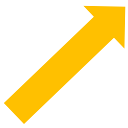
Changes in capital tools for mortgage loans strengthened banks' resilience to possible risks in the real estate market. The increase in the risk weight of mortgage loans requires banks to raise additional capital to meet the minimum capital adequacy requirements. By the end of 2024, due to changes in the risk weights, the RWA density of mortgage loans[128] reached 86%, increasing by 3 p.p. compared to the corresponding period of 2023. The rise in RWA density enhances banks' resilience to risks associated with mortgage loans.

[128] The RWA density of mortgage loans is determined by dividing the risk-weighted mortgage loans to the outstanding amount of mortgage loans. The risk-weighted mortgage loans is calculated as the sum of the product of each mortgage loan amount and its corresponding risk weight.

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**
Tightening of access to external financing sources. In the conditions of elevated interest rates in the global financial markets, rising yields on securities make it difficult for the country to attract financial resources from external sources and lead to higher 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. In addition, operational risks in global financial markets are increasing due to the rapid integration of artificial intelligence (AI) and advanced technologies. Although AI improves efficiency, it also introduces problems such as the possibility of market manipulation, increased volatility, and systemic vulnerabilities. AI-based trading systems may amplify market fluctuations, and dependence on a small number of large providers may result in similar actions that further undermine financial stability. These factors may limit foreign investment and make the attraction of external financial resources difficult. **Risk mitigation measures:** - increasing opportunities of attracting foreign direct investments by improving investment climate; - ensuring strict compliance to the upper limit of the consolidated budget deficit; - enhancing measures for promoting export in order to reduce the pressure of the reduction in external financing on the national currency depreciation; - increasing the scope of internal financing instead of external financing in the conditions of high volatility in global financial markets.		

Key risks for financial stability of Uzbekistan and mitigation measures	Risk level and its change	
	In the short term	**In the medium term**
Rising concerns about climate change. 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 monitoring 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; - increasing the expenditures of state budget that have a positive impact on climate change.	→	↗
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 US 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 investment, 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.	→	↘
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. **Risk mitigation measures:** - tightening the LTV cap for mortgage loans relative to RWA; - introducing a sectoral CCyB for mortgage loans.	→	→

Key risks for financial stability of Uzbekistan and mitigation measures	Risk level and its change	
	In the short term	In the medium term
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, commercial 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.		
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. In addition, the increase in operational risks, such as cyberattacks, data breaches, and data theft, heightens the financial losses of financial system participants resulting from external events. **Risk mitigation measures:** - strengthening control over transactions and establishing restrictions on suspicious transactions; - developing and continuously improving resilient information security systems by the financial system participants amid the evolving information environment; - 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 5. Climate Change

Table 2. 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	212,9	211,2	2023	↓
	Total carbon dioxide emissions	million metric tons	135,5	134,5	2023	↓
	Total greenhouse gas emissions per capita	metric tons of carbon dioxide (CO_2) equivalent	6,0	5,9	2023	↓
	Total greenhouse gas emissions per unit of GDP	metric kilogram of carbon dioxide (CO_2) equivalent per 1 million UZS	213,9	175,3	2023	↓
	Total greenhouse gas emissions from agriculture	million metric tons of carbon dioxide (CO_2) equivalent	50,3	50,3	2023	→
	Total greenhouse gas emissions from industrial processes and product use	million metric tons of carbon dioxide (CO_2) equivalent	10,3	10,3	2023	→
	Total greenhouse gas emissions from energy sectors	million metric tons of carbon dioxide (CO_2) equivalent	147,3	145,3	2023	↓
	Total greenhouse gas emissions from waste	million metric tons of carbon dioxide (CO_2) equivalent	8,1	8,8	2023	↑
	Effects of land-use and forestry on greenhouse gas emissions	million metric tons of carbon dioxide (CO_2) equivalent	-3,4	-3,4	2023	→
	Other greenhouse gas emissions	million metric tons of carbon dioxide (CO_2) equivalent	0,3	0,3	2023	→
	Total methane emissions	million metric tons of carbon dioxide (CO_2) equivalent	63,4	62,7	2023	↓
	Total methane emissions from agriculture	million metric tons of carbon dioxide (CO_2) equivalent	36,1	36,3	2023	↑
	Total methane emissions from industrial processes and construction sectors	thousand metric tons of carbon dioxide (CO_2) equivalent	0.9	0.9	2023	→
	Total methane emissions from energy sectors	million metric tons of carbon dioxide (CO_2) equivalent	19,7	18,7	2023	↓
	Total methane emissions from waste	million metric tons of carbon dioxide (CO_2) equivalent	7,6	7,7	2023	↑
	Total energy efficiency**	percent	5,0	4,5	2023	↓
	The share of renewable energy sources in the total volume of electricity production	percent	8,8	9,7	2023	↑
	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	↓

Indicator		Unit	The value of before the reference period	The value of the reference period	Reference period	Change
Mobilization indicators	Volume of "green" sovereign international bonds	million USD	0,0	348,4	2023	↑
	Environmental protection expenditures as % of GDP	percent	0,66	0,73	2023	↑
	State budget expenditures with a positive impact on climate change*** as % of GDP	percent	3,3	3,8	2023	↑
	Exports of low carbon technology products as % of GDP	percent	0,1	0,1	2023	→
	Imports of low carbon technology products as % of GDP	percent	1,8	3,2	2023	↑
	Total trade in low carbon technology products as % of GDP	percent	1,9	3,3	2023	↑
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	2,4	2,1	2024	↓

Sources: IMF, University of Notre Dame, National Statistics Committee, Ministry of Economy 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 measure 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 a decline in the transition[129] and physical risks[130] related to climate change. In particular, reductions in total greenhouse gas and methane emissions in the country may lower the possible financial losses arising from measures related to the transition to a low-carbon economy. Furthermore, the decline of greenhouse gas emissions in the energy sector, which accounts for the largest share of total greenhouse gas emissions, along with the increase in the share of renewable energy sources in total electricity generation, slightly alleviates concerns about climate transition risks.

Despite the reduction in the scale of climate-related risks in the country, the impact of transition risks on the agricultural sector is increasing. In particular, although the total methane gas emissions in the country decreased in 2023, methane emissions from agriculture rose, constituting 58% of total methane gas emissions. This makes agriculture sector particularly vulnerable to probable transition risks under the global initiative[131] to reduce methane emissions.

State budget expenditures on mitigating climate-related impacts and adapting to climate change, along with the share of low-carbon technology trade in GDP, have increased. This development reflects an improvement in the country's preparedness for climate-related risks.

In 2024, the change in average air temperature in Uzbekistan relative to the 1951–1980 baseline averaged 2.1ºC, lowering by 0.3ºC compared to 2023. The decline in the average air temperature growth in Uzbekistan reduces the physical risks associated with climate change. However, this level in temperature change remains above the target set for global temperature under the Paris Agreement[132].

[129] 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.

[130] 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.

[131] O'zbekiston Respublikasi Prezidentining 2022 yil 2 dekabrdagi "2030 yilgacha O'zbekiston Respublikasining "yashil" iqtisodiyotga o'tishiga qaratilgan islohotlar samaradorligini oshirish bo'yicha chora-tadbirlar to'g'risida"gi PQ-436–sonli qarori.

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

Appendices

Appendix 1

Table 3. Findings on the Key Variables Driving Loan Interest Rates and The Interest Rate Spread

Indicator	Loan interest rate	Interest rate spread
Operating expenses to total assets ratio	6,0456***	2,4923*
CBU policy rate	0,9509****	0,6258***
Annual inflation rate	0,7347***	0,2551
Credit to the private sector-to-GDP ratio	0,5232***	0,1489
Share of non-interest income in total income	-0,2531***	-0,2034***
Intercept	-0,025	-0,3932

Source: CBU staff calculations.

Note: The symbols accompanying coefficient values indicate the statistical significance of the coefficients at different confidence levels (****p<0.1%; ***p<1%; **p<5%; *p<10%), respectively.

Exponential moving average

To determine the moving average of stationary time series[133], simple and exponential moving average methods are widely used[134] in practice. Each observed time series is considered stationary when its mean is constant and its error term can be represented by random fluctuations. In particular, a stationary time series is expressed as follows:

$$D_t = \mu + \epsilon_t.$$

Where,
D_t – stationary time series;
μ – the mean value of a stationary time series;
ϵ_t – random error drawn from a normal distribution with mean zero and variance (σ^2).

Simple moving average

The simple moving average of order N is calculated as the arithmetic mean of the most recent N observations of the stationary time series and, for period t is obtained as follows:

$$F_t = \frac{1}{N} \sum_{i=t-N+1}^{t} D_i = \frac{1}{N} (D_t + D_{t-1} + \cdots + D_{t-N+1}).$$

Where,
F_t – simple moving average;
D_t – stationary time series;
N – order of the moving average.

In calculating the moving average, each time a new observation of the stationary time series is added, the arithmetic mean of the last N observations must be recalculated. To avoid this recalculation, F_{t-1} can be written in the following form:

$$F_{t-1} = \frac{1}{N} \sum_{i=t-N}^{t-1} D_i = \frac{1}{N} [D_{t-1} + D_{t-2} + \cdots + D_{t-N+1} + D_{t-N}]$$

$$\frac{1}{N} [D_{t-1} + D_{t-2} + \cdots + D_{t-N+1} + D_{t-N} + D_t - D_t] = F_t + \frac{1}{N} [D_{t-N} - D_t]$$

$$F_t = F_{t-1} + \frac{1}{N} [D_t - D_{t-N}].$$

Since all indicators in a stationary time series are assigned the equal weights of $\frac{1}{N}$, the moving average will lag significantly behind the actual observed values. To address this issue, the exponential moving average is used.

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[133] Camps, E. C. (2022). Introduction to Time Series and Forecasting.
Stationary time series are time series whose mean and standard deviation remain constant across different time intervals.

[134] Steven, N., & Tava, L. (2015). Production and operation analysis.

Exponential moving average

The exponential moving average (F_t) assigns greater weight to the recent values of the stationary time series and is expressed as follows:

$$F_t = \alpha D_t + (1 - \alpha) F_{t-1}.$$

Where,
F_t – the value of the exponential moving average at period t;
F_{t-1} – the value of the exponential moving average at period $t - 1$;
D_t – stationary time series;
α – a weight between zero and one ($0 < \alpha \leq 1$) placed to the current observation as a smoothing constant.

Using the above formula, F_{t-1} is determined as follows:

$$F_{t-1} = \alpha D_{t-1} + (1 - \alpha) F_{t-2}.$$

Where,
F_{t-1} – the value of the exponential moving average at period $t - 1$;
F_{t-2} – the value of the exponential moving average at period $t - 2$;
D_{t-1} – stationary time series in period $t - 1$;
α – a weight between zero and one ($0 < \alpha \leq 1$) assigned to the current observation as a smoothing constant.

By substitution, the following equation is obtained:

$$F_t = \alpha D_t + \alpha(1 - \alpha) D_{t-1} + (1 - \alpha)^2 F_{t-2}.$$

In this way, the infinite expansion for F_t is obtained as follows:

$$F_t = \sum_{i=0}^{\infty} \alpha (1 - \alpha)^i D_{t-i} = \sum_{i=0}^{\infty} a_i D_{t-i}.$$

a_i is the weight given to each observation, and their sum is equal to one:

$$a_0 > a_1 > a_2 > \cdots > a_i = \alpha(1 - \alpha)^i$$

$$\sum_{i=0}^{\infty} a_i = \sum_{i=0}^{\infty} \alpha(1 - \alpha)^i = \alpha(1 - \alpha)^0 + \alpha(1 - \alpha)^1 + \alpha(1 - \alpha)^2 + \cdots$$

$$= \alpha(1 + (1 - \alpha)^1 + (1 - \alpha)^2 + (1 - \alpha)^3 + \cdots)$$

$$= \alpha * \frac{1}{1-(1-\alpha)} = 1.$$

The exponential moving average at each step requires the value of the previous period's exponential moving average. Therefore, in the initial calculations, the arithmetic mean of the initial period is used.

In the exponential moving average, a set of declining weights is applied to all past indicators of the stationary time series.

If the value of α is large, more weight is assigned to the current observation and less weight to past observations. If α is small, greater weight is given to past data, causing the influence of older observations to persist longer and reducing the responsiveness to recent changes. For this reason, determining the optimal value of α is considered important.

The optimal value of the smoothing constant α is determined using two methods. In the first method, the average age (A) of the moving averages is equalized. In the second method, the mathematical expectation and standard deviation of the difference $(F_t - D_t)$ between the moving averages and the stationary time series are equalized, respectively.

Equalization of average age (A)

The average age (A) of a stationary time series is determined as the sum of the products of each observation's position and its weight. In the simple moving average, equal weights of $\frac{1}{N}$ are assigned to the last N observations, and the average age (A) is calculated as follows:

$$\mathrm{A} = \frac{1}{N}(1 + 2 + 3 + \ldots \mathrm{N}) = \left(\frac{1}{N}\right)\frac{N*(N+1)}{2} = \frac{N+1}{2}.$$

Where,
A – average age of stationary time series;
N – the number of observations.

In the exponential moving average, the weight applied to the data at period i is equal to $\alpha(1-\alpha)^{i-1}$. For a time series with infinite historical observations, the average age of the exponential moving average is determined as follows:

$$\mathrm{A} = \sum_{i=1}^{\infty} i\alpha\,(1-\alpha)^{i-1} = 1\alpha(1-\alpha)^0 + 2\alpha(1-\alpha)^1 + 3\alpha(1-\alpha)^2 \ldots$$

$$\mathrm{A}(1-\alpha) = \sum_{i=1}^{\infty} i\alpha\,(1-\alpha)^{i} = 1\alpha(1-\alpha)^1 + 2\alpha(1-\alpha)^2 + 3\alpha(1-\alpha)^3 \ldots$$

$$\mathrm{A} - A(1-\alpha) = \alpha(1-\alpha)^0 + \alpha(1-\alpha)^1 + \alpha(1-\alpha)^2 \ldots$$

$$= \alpha \frac{1}{1-(1-\alpha)} = 1$$

$$\mathrm{A} = \frac{1}{\alpha}$$

Where,
A – average age of stationary time series;
α – a weight between zero and one ($0 < \alpha \leq 1$) placed on the current observation as a smoothing constant.

By equating the average age of the moving averages, the following result is obtained:

$$\frac{N+1}{2} = \frac{1}{\alpha}$$

$$\alpha = \frac{2}{\mathrm{N}+1}.$$

Where,
N – order of the moving average;
α – a weight between zero and one ($0 < \alpha \leq 1$) placed on the current observation as a smoothing constant.

Equalization of mathematical expectations and variances

In this process, the mathematical expectation and standard deviation of the difference between the moving averages and the stationary time series $(F_t - D_t)$ are respectively equalized.
A simple moving average is calculated as follows:

$$F_t = \frac{1}{N} \sum_{i=t-N+1}^{t} D_i.$$

Where,
F_t – simple moving average;
D_i – stationary time series;
N – order of the moving average.

The mathematical expectation of the difference $(F_t - D_t)$ between the simple moving average and the stationary time series is determined as follows:

$$E(F_t - D_t) = E(F_t) - E(D_t) = \frac{1}{N} \sum_{i=t-N+1}^{t} E(D_i) - E(D_t)$$

$$= \frac{1}{N}(N\mu) - \mu = 0.$$

The variance of the difference $(F_t - D_t)$ between the simple moving average and the stationary time series is calculated as follows:

$$\mathrm{Var}(F_t - D_t) = Var(F_t) + Var(D_t) = Var\left(\frac{1}{N}\sum\nolimits_{i=t-N+1}^{t} D_i\right) + Var(D_t)$$
$$= \frac{1}{N^2}\,(N\sigma^2) + \sigma^2 = \sigma^2\left(\frac{1}{N} + 1\right) = \sigma^2\left(\frac{N+1}{N}\right).$$

Using the defined variance, the standard deviation is calculated as follows:

$$\sigma_e = \sigma\sqrt{\frac{N+1}{N}}.$$

In this manner, the mathematical expectation and the standard deviation of the difference between the exponential moving average and the stationary time series are calculated as follows:

$$F_t = \alpha D_t + \alpha(1-\alpha)^1 D_{t-1} + \alpha(1-\alpha)^2 D_{t-2} + \cdots$$
$$E(F_t) = E(\alpha D_t + \alpha(1-\alpha)^1 D_{t-1} + \alpha(1-\alpha)^2 D_{t-2} + \cdots)$$
$$= \alpha E(D_t) + \alpha(1-\alpha)^1 E(D_{t-1}) + \alpha(1-\alpha)^2 E(D_{t-2}) + \cdots$$
$$= \alpha\mu + \alpha(1-\alpha)^1\mu + \alpha(1-\alpha)^2\mu + \cdots$$
$$= \alpha\mu\frac{1}{1-(1-\alpha)} = \mu$$
$$E(F_t - D_t) = E(F_t) - E(D_t) = \mu - \mu = 0$$

$$Var(F_t) = Var(\alpha D_t + \alpha(1-\alpha)^1 D_{t-1} + \alpha(1-\alpha)^2 D_{t-2} + \cdots)$$
$$= \alpha^2\sigma^2 + (1-\alpha)^2\alpha^2\sigma^2 + (1-\alpha)^4\alpha^2\sigma^2 + \cdots$$
$$= \alpha^2\sigma^2(1 + (1-\alpha)^2 + (1-\alpha)^4 + \cdots)$$
$$= \alpha^2\sigma^2\frac{1}{1-(1-\alpha)^2} = \frac{\sigma^2\alpha}{2-\alpha}$$
$$\mathrm{Var}(F_t - D_t) = Var(F_t) + Var(D_t) = \frac{\sigma^2\alpha}{2-\alpha} + \sigma^2 = \sigma^2\frac{2}{2-\alpha}$$
$$\sigma_e = \sigma\sqrt{\frac{2}{2-\alpha}}.$$

For both the moving average and the stationary time series, the mathematical expectation of their differences is equal to zero. By equating the standard deviations, the optimal value of α is determined as follows:

$$\sigma\sqrt{\frac{N+1}{N}} = \sigma\sqrt{\frac{2}{2-\alpha}}$$
$$\frac{N+1}{N} = \frac{2}{2-\alpha}$$
$$\alpha = \frac{2}{\mathrm{N}+1}$$

Where,
N – order of the moving average;
α – a weight between zero and one ($0 < \alpha \leq 1$) placed on the current observation as a smoothing constant.

The results were the same for both methods of determining the optimal value of the smoothing constant. This indicates that the average age of both moving averages, as well as the mathematical expectation and the standard deviation of the differences between the moving averages and the stationary time series, are the same. Moreover, although these methods are intended for stationary time series, because of the fact that time series are not always stationary, the standard deviations of both moving averages will be higher than the standard deviation of the observed time series.

Quantile regression model

The purpose of regression analysis is to demonstrate the relationship between dependent and independent variables. The classic linear regression model estimates the conditional mean[135]. The process of modeling the conditional mean involves applying the method of OLS, which simplifies the computation. When conducting regression analysis using the method of OLS, non-normality of residuals and the presence of periods with sharp variations during the observation period may lead to a decrease in the accuracy of the results, resulting in higher residuals. Therefore, applying the quantile regression model rather than OLS model in regression analysis increases the accuracy of the results[136].

The parameters of the quantile regression model are estimated by minimizing the weighted sum of the absolute values of residuals when estimating the unknown parameters of the conditional quantile function. The quantile regression model evaluates variations at conditional quantiles. Conditional median regression is a special case of quantile regression, in which the conditional median corresponds to the 50th quantile function. In general, it is possible to use any other quantiles to characterize non-central positions of the distribution and conduct analysis of the relationship between dependent and independent variables at different quantiles.

The equation of the quantile regression model does not differ from the simple linear regression equation. The regression equation of the quantile regression model takes the following form:

$$y_i = x_i \beta_q + \varepsilon_i.$$

Where,
y_i – $nx1$ vector of dependent variables;
x_i – nxk matrix of independent variables;
β_i – $kx1$ vector of unknown parameters;
ε_i – $nx1$ vector of residuals;
q – quantile.

When estimating the parameters of the quantile regression model, different weights are assigned to positive and negative errors. The parameters of the quantile regression are obtained by minimizing the weighted sum of the absolute values of residuals $\left(Q(\beta_q)\right)$, and take the following form:

$$Q(\beta_q) = \sum_{i: y_i \geq x_i \beta_q} q |y_i - x_i \beta_q| + \sum_{i: y_i < x_i \beta_q} (1 - q) |y_i - x_i \beta_q|.$$

Determining the unknown parameters in the equation requires using the linear programming type of an optimization model in mathematical programming.

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[135] Hastie, T., Tibshirani, R., & Friedman, J. (2017). The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Springer Series in Statistics.

[136] Cameron, A., & Trivedi, P. (2005). Microeconometrics: Methods and Applications. Cambridge University Press.

Solving linear programming problems requires first defining the objective function and the boundary conditions of the model. In the conditional quantile function of quantile regression, positive and negative errors are assigned asymmetric weights[137]:

$$Q(\beta_q) = \sum_{i:y_i \geq x_i\beta_q} q|y_i - x_i\beta_q| + \sum_{i:y_i < x_i\beta_q} (1-q)|y_i - x_i\beta_q|.$$

The optimal values of the unknown parameters are determined by minimizing this sum. The objective function of linear programming $\left(Q(\beta_q)\right)$ is obtained as follows[138]:

$$Q(\beta_q) = \sum_{i:y_i \geq x_i\beta_q} q s_i^+ + \sum_{i:y_i < x_i\beta_q} (1-q) s_i^-.$$

In the equation, s_i^+ and s_i^- are the positive and negative errors, respectively, and are obtained by the following formulas:

$$s_i^+ = y_i - x_i\hat{\beta}_q$$
$$s_i^- = -(y_i - x_i\hat{\beta}_q)$$
$$s_i^+ \geq 0, s_i^- \geq 0.$$

Where, $\hat{\beta}_q$ is the parameter estimated by the model.

Based on the boundary conditions of the linear programming model, the following equation is obtained:

$$y_i = x_i\beta_q + s_i^+ - s_i^-.$$

Under this boundary condition, the positive and negative errors cannot be non-zero at the same time. In this case, one or both parameters may take a value of zero.

The boundary conditions remain constant across all quantiles and only the objective function changes. Minimizing the function $Q(\beta_q)$ is considered equivalent to the problem of minimizing the objective function in linear programming. Therefore, it is sufficient to find the optimal value of the parameters β_q in the linear programming problem.

The simplex method for determining the optimal values of unknown parameters uses iteratively replacing processes. The expansion of the data series increases the accuracy of the regression parameters. In this case, sum $\left(Q(\beta_q)\right)$ in the objective function of the linear programming problem is minimized the under the boundary condition $\mathrm{Ax} = \mathrm{B}$.

[137] Asymmetric weight – different types of weights that are not equal to each other.

[138] Abdullahi, I. (2015). Analysis of quantile regression as alternative to ordinary least squares regression. Department of Mathematics Ahmadu Bello University.

Simplex method

The simplex method is one of the main methods for solving linear programming problems. By moving step-by-step toward optimality, it finds the optimal value of the variables $x_1, x_2, \dots, x_n$, which result in the objective function reaching its maximum or minimum value[139].

A linear programming problem that yields a maximum value is expressed as follows:

$$\sum_{j=1}^{n} a_{ij}\, x_j \le y_i,\ (i = 1, 2, \dots, m)$$
$$x_j \ge 0,\ (j = 1, 2, \dots, n)$$
$$Z = \sum_{j=1}^{n} c_j\, x_j \to max.$$

A simplex tableau is constructed for solving the problem. In constructing the simplex tableau, the given problem is first converted into canonical form. In this case, all the boundary conditions are transformed into equalities in order to obtain the canonical form. Inequalities are converted into equalities by adding slack variables to the inequalities. As a result of adding slack variables, the values of $n - m$ variables become zero, and the remaining m variables' unique values are found by determining the optimal values of the equations. After adding the slack variables, the inequalities are converted into the following equalities:

$$\begin{cases} a_{11}x_1 + a_{12}x_2 + \dots + a_{1s}x_s + \dots + a_{1n}x_n + x_{n+1} = y_1 \\ a_{21}x_1 + a_{22}x_2 + \dots + a_{2s}x_s + \dots + a_{2n}x_n + x_{n+2} = y_2 \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ a_{m1}x_1 + a_{m2}x_2 + \dots + a_{ms}x_s + \dots + a_{mn}x_n + x_{n+m} = y_m \end{cases}$$

$$x_j \ge 0\ (i = 1, 2, \dots, m)\ (j = 1, 2, \dots, n)$$
$$Z = c_1x_1 + c_2x_2 + \dots + c_nx_n \to max.$$

Where,
x_{n+i} – slack variables.

In order to distinguish the slack variables from the other variables, they are denoted as $e_1, e_2, \dots, e_m$, respectively. The expression on the right side of the objective function equation is transferred to the left side of the equation:

$$Z - c_1x_1 - c_2x_2 - \dots - c_nx_n = 0.$$

[139] Winston, W. (2004). Operations Research: Applications and Algorithms. Indiana University.

After the changes, the simplex tableau can be constructed in the following form:

	x_1	x_2	…	x_s	…	x_n	b_i
e_1	a_{11}	a_{12}	…	a_{1s}	…	a_{1n}	b_1
e_2	a_{21}	a_{22}	…	a_{2s}	…	a_{2n}	b_2
…	…	…	…	…	…	…	…
e_r	a_{r1}	a_{r2}	…	a_{rs}	…	a_{rn}	b_r
…	…	…	…	…	…	…	…
e_m	a_{m1}	a_{m2}	…	a_{ms}	…	a_{mn}	b_m
Z	$-c_1$	$-c_2$	…	$-c_s$	…	$-c_n$	0

All b_i constants are required to be positive. If a constant is not positive, both sides of the equation are multiplied by -1 to convert it into a positive form.

As the given problem has a maximization problem, the optimization process continues until all parameters in the Z row take non-negative values.

Initially, a basic feasible solution is determined. In this case, the first column of slack variables is considered the basic solution column, and all variables not located in this column are assigned a value of zero. In the simplex tableau, the basic feasible solutions e_i are determined:

$$e_i = b_i \text{ and } x_j = 0$$

This basic feasible solution is considered optimal if all the coefficients in the Z row are non-negative. If any of these coefficients is negative, the next simplex tableau is constructed. Initially, the pivot element is identified at the intersection of the pivot row and pivot column. The pivot column is determined by choosing the negative parameter in the objective function row that has the greatest absolute value.

For instance, if the element with the largest absolute value among the negative elements is c_s, this column s is considered as the pivot column. Once the pivot column is identified, the pivot row is determined. To find the pivot row, elements of the constants column is divided by corresponding pivot column elements, and the smallest positive value is selected.

$$\min\left\{\frac{b_1}{a_{1s}};\frac{b_2}{a_{2s}};\ldots;\frac{b_r}{a_{rs}};\ldots;\frac{b_m}{a_{ms}}\right\}.$$

If the smallest positive of these ratios is $\frac{b_r}{a_{rs}}$, then the row containing the element a_{rs} is called the pivot row, and the element a_{rs} itself is the pivot element. After determining the pivot element, the new simplex tableau is filled gradually.

The construction of the second simplex tableau is carried out in several steps. Initially, the positions of the pivot row and pivot column variables (x_s and e_r) are interchanged. Then, the elements of the pivot column are divided by the pivot element and written to the new tableau with negative values as follows:

$$a'_{is} = -\frac{a_{is}}{a_{rs}} \; (i \neq r)$$

The elements of the pivot row are also divided by the pivot element and written to the new tableau:

$$a'_{rs} = \frac{a_{rj}}{a_{rs}} \; (j \neq s)$$

The pivot element is replaced by its reciprocal.

$$a'_{is} = \frac{1}{a_{rs}}$$

The remaining elements of the new simplex tableau are calculated using the following formula:

$$a'_{ij} = \frac{a_{ij}a_{rs} - a_{is}a_{rj}}{a_{rs}} = a_{ij} - \frac{a_{is}a_{rj}}{a_{rs}}$$
$$(j \neq s), (i \neq r).$$

Where,
a_{ij} – the corresponding element of a'_{ij} in the previous tableau;
a_{is} – the element at the intersection of the column of the pivot element a_{rs} and the row containing a_{ij};
a_{rj} – the element at the intersection of the row of the pivot element a_{rs} and the column containing a_{ij};
a_{rs} – pivot element.

If all elements of the basic solution in the Z row of simplex tableau, except for the constant, are nonnegative, then this basic solution is unique and optimal. If at least one element in the Z row is negative, the optimization process is continued according to the procedure described above until the optimal value is derived.

$$Z = \sum_{j=1}^{n} c_j \, x_j \; \rightarrow max.$$

Additionally, a maximization problem can be converted into a minimization problem by multiplying it by -1:

$$-Z = \sum_{j=1}^{n} - c_j \, x_j \; \rightarrow min.$$

The optimal parameters obtained using the simplex method of linear programming are considered the optimal estimates of the unknown parameters of quantile regression. Using these parameters, the estimated values of the quantile regression are determined.

The 50th quantile of the following quantile regression equation was used to determine the fundamental price per square meter of houses:

$$y_t = \beta_{1,q} y_{t-1} + \beta_{2,q} x_{1,t} + \beta_{3,q} x_{2,t} + \varepsilon_t \, .$$

Where,
y_t – market price of houses in period t;
y_{t-1} – market price of houses in period $t-1$;
$x_{1,t}$ – annual growth rate of household loans;
$x_{2,t}$ – average disposable income of households;
$\beta_{1,q}$, $\beta_{2,q}$, $\beta_{1,q}$ – unknown coefficients;
q – quantile;
ε_t – residual.

Growth at Risk model

The Growth at Risk (GaR)[140] model links current macrofinancial conditions with future real GDP growth. The main advantage of this analysis is that it estimates the entire distribution of future real GDP growth. Using the GaR model, the likelihood of adverse scenarios can be quantified.

The evolution of changes in the financial system's condition may allow the identification of periods of change for future economic activity. In particular, the GaR model assesses the probability of a sharp economic downturn. In this context, the distribution of future real GDP growth is estimated based on data on macrofinancial variables.

The GaR model is implemented in two stages. In the first stage, the FCI[141] and current real GDP growth are taken as macrofinancial variables. These variables are utilized to estimate future real GDP growth at different quantiles using the quantile regression model. In the second stage, after being estimated by the quantile regression model, a skew-t[142] distribution function is fitted to the estimated discrete values of the conditional quantile regressions in order to estimate the conditional continuous distribution of future real GDP growth.

Quantile regression estimation

The first stage of the GaR model involves estimating the quantile regression model. In particular, the relationship between the current FCI and current real GDP growth with future real GDP growth is estimated using the quantile regression model. The quantile regression is estimated at different quantiles $q \in (10, 25, 50, 75, 90)$ and takes the following form:

$$y_{t+h}^{q} = \alpha^{q} + \beta_{\mathrm{C}}^{q} X_{\mathrm{C},t} + \beta_{G}^{q} X_{G,t} + \varepsilon_{t+h}^{q}$$

Where,
q – quantile;
t – time series;
y_{t+h}^{q} – real GDP growth h quarters ahead for quantile q;
$X_{\mathrm{C},t}$ – financial cycle index;
$X_{G,t}$ – current real GDP growth;
α^{q} – constant term;
ε_{t+h}^{q} – residual;
$\beta_{\mathrm{C}}^{q}, \beta_{G}^{q}$ – unknown coefficients.

140 Prasad, A., Elekdag, S., Jeasakul, P., Lafarguette, R., Alter, A., Xiaochen Feng, A., & Wang, Ch. (2019). Growth at Risk: Concept and Application in IMF Country Surveillance. IMF Working Paper.

141 The FCI methodology is presented in the Financial Stability Report for 2023.

142 Basalamah, D. (2017). Statistical Inference for a New Class of Skew T Distribution and Its Related Properties. Bowling Green State University.

Estimated discrete values of quantile regression for the next period are determined using quantile regression parameters estimated at different quantiles. The conditional continuous distribution function is obtained by fitting the t-skew distribution to these discrete values.

Deriving the conditional continuous distribution of future growth

After calculating various quantiles of the future period's real GDP growth, the entire conditional distribution can also be computed. The second stage of the GaR model involves creating a continuous distribution of the conditional growth of future real GDP. The conditional distribution of future real GDP growth is derived by fitting the Azzalini and Capitanio skew-t distribution to the predicted values of the conditional quantile regressions [143].

Azzalini and Capitanio's skew-t distribution is characterized by parameters for mean, standard deviation, skewness and degree of freedom. The skew-t distribution is derived using the Student-t distribution[144]. In this case, the standard skew-t distribution with zero mean and one standard deviation has an asymmetric form, and the probability density function has the following form:

$$f_{v,\beta}(x) = 2t_v(x)T_{v+1}\left(\beta x\sqrt{\frac{v+1}{x^2+v}}\right)$$

Where,
β – shape parameter;
v – degrees of freedom;
$t_v(x)$ – (v) the probability density function of the Student-t distribution with degrees of freedom;
T_{v+1} – distribution function of the Student-t distribution with $(v+1)$ degrees of freedom.

The probability density function of a random variable with a general z skew-t distribution with mean ξ and standard deviation ω is expressed as follows:

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[143] Drenkovska, M., & Volcjak, R. (2022). Growth-at-Risk and Financial Stability: Concept and Application for Slovenia. Bank of Slovenia.

[144] The probability density function of the Student t-distribution has the following form:

$$t_v(x) = \frac{\Gamma\left(\frac{v+1}{2}\right)}{\sqrt{\pi v}\,\Gamma\left(\frac{v}{2}\right)}\left(1+\frac{x^2}{v}\right)^{-\frac{v+1}{2}}$$

$$v = t - 1$$

$$\Gamma(p) = \int_0^\infty x^{p-1}e^{-x}dx.$$

Where,
$t_v(x)$ – probability density function;
v – degrees of freedom;
t – sample size;
$\Gamma(p)$ – Gamma function.

$$f_{v,\beta}\left(\frac{x-\xi}{\omega}\right) = 2t_v\left(\frac{x-\xi}{\omega}\right)T_{v+1}\left(\beta\frac{x-\xi}{\omega}\sqrt{\frac{v+1}{\left(\frac{x-\xi}{\omega}\right)^2+v}}\right)$$

$$z = \frac{x-\xi}{\omega}$$

The probability density function of the skew-t distribution is obtained by multiplying the probability density function of the Student-t distribution with the distribution function of the Student-t distribution. To demonstrate that the function $f_{v,\beta}(x)$ is a probability density function[145], the function is first considered in its general form.

If X is a random variable, the probability density function f(x) is symmetric with respect to the ordinate, and G(x) is an arbitrary distribution function, then for any α, $f(x;\alpha) = 2f(x)G(\alpha x)$ is a probability density function as follows[146]:

$$\int_{-\infty}^{\infty} f(x;\alpha)dx = \int_{-\infty}^{\infty} 2f(x)G(\alpha x)dx$$

$$= \int_{-\infty}^{\infty} f(x)G(\alpha x)dx + \int_{-\infty}^{\infty} f(x)G(\alpha x)dx$$

$$= \int_{-\infty}^{\infty} f(x)G(\alpha x)dx + \int_{-\infty}^{\infty} f(x)(1-G(-\alpha x))dx$$

$$= \int_{-\infty}^{\infty} f(x)G(\alpha x)dx + \int_{-\infty}^{\infty} f(x)dx - \int_{-\infty}^{\infty} f(x)G(-\alpha x)dx$$

$$= \int_{-\infty}^{\infty} f(x)G(\alpha x)dx + \int_{-\infty}^{\infty} f(x)dx - \int_{-\infty}^{\infty} f(-x)G(\alpha x)dx$$

$$= \int_{-\infty}^{\infty} f(x)G(\alpha x)dx + \int_{-\infty}^{\infty} f(x)dx - \int_{-\infty}^{\infty} f(x)G(\alpha x)dx$$

$$= \int_{-\infty}^{\infty} f(x)dx = 1.$$

In the process of proving this, the symmetry property of the Student-t distribution's probability density function, $f(x) = f(-x)$, and the property of distribution function, $F(-\alpha x) = 1 - F(\alpha x)$, are used. Since this proof is established for functions in general forn, it is also applicable to the skew-t distribution. In particular, the standard skew-t distribution is composed of the product of the probability density function of the symmetric Student-t distribution $t_v(x)$ and the

[145] The condition for being the probability density function is: $\int_{-\infty}^{\infty} f(x)dx = 1$.

[146] Berlik, S. (2006). Directed Evolutionary Algorithms. Dortmund University.

distribution function of the Student-t distribution $T_{v+1}\left(\beta x\sqrt{\frac{v+1}{x^2+v}}\right)$. The process, which is valid for the standard skew-t distribution, is also applicable to the general skew-t distribution.

The optimal estimate of the unknown parameters is obtained by minimizing the squared distance between the estimated quantile regression values and the inverse distribution function of the skew-t distribution:

$$\{\hat{\xi},\widehat{\omega},\widehat{\alpha},\hat{v}\} = argmin\sum_{q}\left(\hat{Q}_{y_{t+h|x_t}}(q|x_t) - F^{-1}(\xi,\omega,\alpha,v)\right)^2$$

Where,
$\hat{Q}_{y_{t+h|x_t}}(q|x_t)$ – values estimated using quantile regression;

$F^{-1}(\xi,\omega,\alpha,v)$ – the inverse distribution function of the skew-t distribution.

The skew-t distribution can be fitted by finding four parameters that minimize the squared distance. In this case, it is necessary to have the inverse distribution function of the skew-t distribution expressed as a function of the parameters in order to solve the minimization problem. The inverse distribution function of the skew-t distribution can be determined using the Cornish-Fisher expansion[147]. In particular, the moment-based estimation of the Cornish-Fisher expansion has the following form:

$$\begin{gathered}
F^{-1}(x) \approx z_\alpha + \frac{1}{6}(z_\alpha^2-1)E(x^3) + \frac{1}{24}(z_\alpha^3-3z_\alpha)E(x^4) \\
-\frac{1}{36}(2z_\alpha^3-5z_\alpha)E(x^3)^2 + \frac{1}{120}(z_\alpha^4-6z_\alpha^2+3)E(x^5) \\
-\frac{1}{24}(z_\alpha^4-5z_\alpha^2+2)E(x^3)E(x^4) + \frac{1}{324}(12z_\alpha^4-53z_\alpha^2+17)E(x^3)^3 \\
+\frac{1}{720}(z_\alpha^5-10z_\alpha^3+15z_\alpha)E(x^6) - \frac{1}{180}(2z_\alpha^5-17z_\alpha^3+21z_\alpha)E(x^3)E(x^5) \\
-\frac{1}{384}(3z_\alpha^5-24z_\alpha^3+29z_\alpha)E(x^4)^2 \\
+\frac{1}{288}(14z_\alpha^5-103z_\alpha^3+107z_\alpha)E(x^3)^2E(x^4) \\
-\frac{1}{7776}(252z_\alpha^5-1688z_\alpha^3+1511z_\alpha)E(x^3)^4 + \cdots
\end{gathered}$$

Where,
z_α – the inverse distribution function of the standard normal distribution;
$E(x^n)$ – moments of order n.

[147] Amedee-Manesme, C., & Barthelemy, F. (2012). Cornish-Fisher Expansion for Real Estate Value at Risk. Cergy-Pontoise University

When the first four moments of the distribution are used, the following approximate equation is obtained:

$$F^{-1}(x) \approx z_\alpha + \frac{1}{6}(z_\alpha^2 - 1)E(x^3) + \frac{1}{24}(z_\alpha^3 - 3z_\alpha)E(x^4)$$
$$-\frac{1}{36}(2z_\alpha^3 - 5z_\alpha)E(x^3)^2.$$

The relationship between the general skew-t distribution and the standard skew-t distribution takes the following form[148]:

$$Y_{\xi,\omega,\alpha,v} = \xi + \omega Y_{0,1,\alpha,v}$$

Where,
$Y_{0,1,\alpha,v}$ – standard skew-t distribution;
$Y_{\xi,\omega,\alpha,v}$ – general skew-t distribution.

In determining the variance of the standard skew-t distribution, the following notations are introduced:

$$b_v = \sqrt{\frac{v}{\pi}}\frac{\Gamma\left(\frac{v-1}{2}\right)}{\Gamma\left(\frac{v}{2}\right)}$$
$$\delta_\alpha = \frac{\alpha}{\sqrt{1+\alpha^2}}.$$

Following these notations, the skewness parameter α which varies over $(-\infty; +\infty)$, becomes one that varies over $(-1; +1)$. After that, the variance of the standard skew-t distribution takes the following form:

$$\sigma_z^2 = var(z) = \frac{v}{v-2} - (b_v\delta_\alpha)^2$$

The parameter vector of the skew-t distribution (ξ, ω, α, v) is transformed into the vector of the usual mean, standard deviation, skewness, and kurtosis $(\mu, \sigma, \gamma, \kappa)$ based on the following equations:

$$\mu = \xi + \omega b_v \delta_\alpha$$

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[148] Uthaisaad, C., & Martin, D. (2018). The Azzalini Skew-t Information Matrix Evaluation and Use for Standard Error Calculations. SSRN.

$$\sigma^2 = \omega^2 \sigma_z^2, v > 2$$

$$\gamma = \frac{b_v \delta_\alpha}{\sigma^3}\left[\frac{v(3-\delta_\alpha^2)}{v-3} - \frac{3v}{v-2} + 2(b_v\delta_\alpha)^2\right], v > 3$$

$$\kappa = \frac{1}{\sigma_z^4}\left[\frac{3v^2}{(v-2)(v-4)} - \frac{4(b_v\delta_\alpha)^2 v(3-\delta_\alpha^2)}{v-3} + \frac{6v(b_v\delta_\alpha)^2}{v-2} - 3(b_v\delta_\alpha)^4\right] - 3,$$

$$v > 4.$$

Using notations, the Cornish-Fisher expansion is obtained and the approximate inverse distribution function of skew-t distribution is derived. The unknown parameters of the skew-t distribution are determined by applying the approximate inverse skew-t distribution in a minimization problem. The one-percent probability value of the fitted skew-t distribution is determined and assigned as the value of the GaR model.

Appendix 5

Table 4. Top-down Solvency Macro Stress Test Overview

Basic parameters	A total of 36 commercial banks, 9 of which are state-owned, were taken into account. As of January 1, 2025, the assets of commercial banks included in the macro stress test constituted 100% of the banking system assets. All commercial banks must comply with the capital adequacy requirements set by the CBU.
Stress test horizon	3 years (from the end of 2024 to the end of 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 enterprises, claims on other banks, and the CBU, increases based on the annual outstanding loan growth under the scenarios; – Asset composition changes during the stress test period; – Banks accumulate their capital from the 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 commercial banks in Uzbekistan. Under 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 real GDP growth rate is estimated using the GaR model. In this context, the FCI and the lagged value of real GDP are used as factors affecting economic growth. To fully reflect the risks, an additional shock of three standard deviations is applied to the FCI when assessing the real GDP growth rate under the adverse scenario. The 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. Loan and deposit interest rates are estimated through the model, incorporating the effect of the CBU policy 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 CAR, CET1, and Tier 1, and the minimum requirement is established for the leverage ratio. Banks use a standardized approach[149] to calculate RWA for credit risk. Assets are classified into five different categories according to their quality, and the following provisions are created for them as determined by the CBU[150]: – 1% for “standard” assets; – 20% for “watch” assets; – 25% for “non-satisfactory” assets; – 50% for “doubtful” assets; – Provisions for “loss” assets must be constructed using 100% of the bank’s expenses. Loans classified as “non-satisfactory”, “doubtful” and “loss” with repayment overdue by more than 90 days are considered NPLs.
Methodology	Based on macroeconomic scenarios, the components of the profit and loss module are evaluated. **Credit risk.** In credit risk, the NPL ratio (%) 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 impact of a sharp depreciation of the exchange rate on foreign currency NPLs was calculated based on the practice of 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 (after deducting NPLs) follows a similar pattern to the change in the NPL share. This change is determined based on the combined movement of watch loans and NPLs in Uzbekistan and similar countries. Through this process, the 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

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

[150] 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.

	creation of additional reserves for securities of private enterprises is considered under the adverse scenario. Furthermore, the macro stress test incorporates the profit or loss arising from the revaluation of foreign currency assets and liabilities based on the banks' disclosed FX positions and reflects the impact of fluctuations in the exchange rate. **NII.** The ratio of NII to interest-bearing assets is estimated for future periods using a satellite model based on its lagged value and the scenario-based values of loan growth rate, the exchange rate, and the net interest margin (the difference between loan and deposit interest rates). The amount of NII is determined by multiplying the total interest-bearing assets by the NII to interest-bearing assets ratio, which is estimated using a satellite model. **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 is positive. The dividend payout ratio from net profit after tax 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[151]: • CET1 ratio is 8% of RWA • Tier 1 ratio is 10% of RWA (including 3% CCoB) • CAR is 13% of RWA If the amount of Tier 2 capital exceeds 100% of the amount of Tier 1 capital, the excess amount is not included in the regulatory capital. In addition, provisions for loans classified as "standard", which is included in Tier 2 capital, must not exceed 1.25% of RWA. The minimum requirement for the leverage ratio is 6%[152].

[151] 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.

[152] 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.

Concentration risk	As an additional shock to the adverse scenario, the impact of the default by 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.
Asset price volatility risk	The impact of a sharp decline in asset prices on the quality of the banks' loan portfolios and total capital is assessed under 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. In this context, 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. In addition, 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	Under the adverse scenario, contagion risk is evaluated using the losses-tied-to-capital and unrecoverable-losses approaches: – In the losses-tied-to-capital approach, the extent of banks' losses from contagion risk is influenced by the defaulting bank's capital adequacy ratio. The lower the failing bank's capital adequacy ratio, 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. – In unrecoverable-losses approach, 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 capital adequacy ratio below the required minimum.
Result	The capital adequacy ratios (CET1, Tier 1, and CAR) and the leverage ratio, calculated for the banking system and individual banks after the macro stress test, represent final results.

Appendix 6

Table 5. Cash Flow Factors in Liquidity Stress Test under 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 (up to 181 days)	100%	100%
4. Amounts due from other banks and financial organizations (over 181 days)	50%	50%
5. Securities issued by the Government of the Republic of Uzbekistan and the CBU	100%	90%
6. Securities of low-risk countries	85%	85%
7. Securities issued by IMF, WBG, ADB, AIIB, EBRD, EIB, EIF, IsDB and the CEB.	100%	100%
8. Securities of leading companies of low-risk countries	50%	50%
9. Securities of mortgage refinancing organizations	75%	65%
10. Other securities	100%	100%
11. Customers' liabilities on drafts secured by letters of credit and trust documents, net	100%	100%
12. Customers' liabilities on unpaid acceptances to the bank, net	100%	100%
13. Loans and leases to the CBU, net (up to 181 days)	100%	100%
14. Loans and leases to the CBU, net (over 181 days)	50%	50%
15. Loans and leases to other banks, net (up to 181 days)	100%	100%
16. Loans and leases to other banks, net (over 181 days)	50%	50%
17. Loans and leases to customers, net	50%	25%
18. Securities purchased under REPO agreements	100%	100%
19. Unrealized profit as a result of the revaluation of derivative instruments (non-maturity)	0%	0%
20. Unrealized profit as a result of the revaluation of derivative instruments (term)	100%	100%
21. FX trading and currency positions	100%	100%
22. Other assets (non-maturity)	0%	0%
23. Other assets (term)	100%	100%
24. HQLA pledged as collateral	100%	100%

Cash inflows and outflows	Baseline scenario	Adverse scenario
Cash outflows		
1. Household demand deposits	5%	20%
2. Household deposits pledged as loan collateral (up to 181 days)	100%	100%
3. Household deposits pledged as loan collateral (over 181 days)	50%	50%
4. Other deposits pledged as loan collateral (up to 181 days)	100%	100%
5. Other deposits pledged as loan collateral (over 181 days)	50%	50%
6. Demand deposits	40%	50%
7. Term deposits	40%	40%
8. Household deposits	5%	20%
9. Individuals' balances on bank cards	5%	20%
10. Other customers' balances on bank cards	40%	50%
11. Customers' deposits under letters of credit	-5%	-20%
12. Other deposits	40%	50%
13. Amounts due to the CBU	40%	40%
14. Other amounts due to the CBU (instant payments and clearing systems)	25%	25%
15. Amounts due to other banks' correspondent accounts (up to 181 days)	100%	100%
16. Amounts due to other banks' correspondent accounts (over 181 days)	50%	50%
17. Accounts of other banks - Deposits (up to 181 days)	100%	100%
18. Accounts of other banks - Deposits (over 181 days)	50%	50%
19. Amounts due to banks for payments made from bank cards (up to 181 days)	100%	100%
20. Amounts due to banks for payments made from bank cards (over 181 days)	50%	50%
21. Other items (up to 181 days)	100%	100%
22. Other items (over 181 days)	50%	50%
23. Unpaid acceptances of the bank (up to 181 days)	100%	100%
24. Unpaid acceptances of the bank (over 181 days)	50%	50%
25. Liabilities for loans and leases (up to 181 days)	5%	5%
26. Liabilities for loans and leases (over 181 days)	2,5%	2,5%
27. Securities issued by the bank (up to 181 days)	100%	100%
28. Securities issued by the bank (over 181 days)	50%	50%
29. Subordinated debt (up to 181 days)	100%	100%
30. Subordinated debt (over 181 days)	50%	50%
31. High-quality liquid securities sold under REPO agreements	100%	100%
32. Other securities sold under REPO agreements (up to 181 days)	100%	100%
33. Other securities sold under REPO agreements (over 181 days)	50%	50%
34. Unrealized losses and other deferred income as a result of revaluation of derivative instruments (up to 181 days)	100%	100%
35. Unrealized losses and other deferred income as a result of revaluation of derivative instruments (over 181 days)	50%	50%
36. Clearing transactions (up to 181 days)	100%	100%
37. Clearing transactions (over 181 days)	50%	50%
38. Other liabilities (non-maturity)	0%	0%
39. Other liabilities (from 1 day to 181 days)	100%	100%
40. Other liabilities (over 181 days)	50%	50%
41. Off-balance sheet items	5%	20%

Table 6. Minimum Capital Requirements and Buffers as of January 1, 2025, % of RWA

Country	Minimum capital requirements			Capital buffer requirements			
	CET1[153]	Tier1[154]	CAR	CCoB	CCyB	SyRB	D-SIB buffer
Albania	6,75	9	12	2,5	0	0	0,5–1,5
Austria	4,5	6	8	2,5	0	0,5–1	0,45–1,75
Belgium	4,5	6	8	2,5	1	6	0,75–1,5
Bulgaria	4,5	6	8	2,5	2	3	0,5–1
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
Czech	4,5	6	8	2,5	1,25	0,5	0,5–2,5
Denmark	4,5	6	8	2,5	2,5	7	1–3
Estonia	4,5	6	8	2,5	1,5	0	0,5-2
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	0,5	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	0,5	0	1–3,5
Hungary	4,5	6	8	2,5	0,5	0	0,5–2
Ireland	4,5	6	8	2,5	1,5	0	0,5–1,5
Italy	4,5	6	8	2,5	0	0,5	0,25–1,5
Latvia	4,5	6	8	2,5	0,5	0	0,25–2
Liechtenstein	4,5	6	8	2,5	0	1	2
Lithuania	4,5	6	8	2,5	1	2	1–2
Malaysia	4,5	6	8	2,5	0	0	0,5–1
Malta	4,5	6	8	2,5	0	1,5	0,438–2
Moldova	5,5	7,5	10	2,5	0	1	1–1,5
Montenegro	4,5	6	8	2,5	0	1,5	1,25–2
New Zealand	4,5	7	9	2,5	0	0	2
North Macedonia	4,5	6	8	2,5	1,5	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
Portugal	4,5	6	8	2,5	0	4	0,25-1
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
Slovakia	4,5	6	8	2,5	1,5	0	0,25–1,75
Slovenia	4,5	6	8	2,5	1	0,5	0,25–1,25
Spain	4,5	6	8	2,5	0	0	0,25–1,25
Sweden	4,5	6	8	2,5	2	3	1
United Kingdom	4,5	6	8	2,5	2	0	1–2

Sources: National authorities and European Systemic Risk Board.

[153] The minimum requirement for Tier 1 capital, which is 6%, includes the minimum requirement for CET1 capital, 4.5%.

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

Appendix 8

Table 7. Financial Stability Measures in Uzbekistan as of January 1, 2025

Target	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 ratio	10%
	CET 1 ratio	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 foreign currency loans to individuals	Loans in FX are not granted
	Differentiated reserve requirements	4% for national currency 14% for FX
	LCR in FX	100%
	NSFR in FX	100%
Debt burden mitigation	DSTI	50%
	Daily limit on interest payments on a loan or microdebt in relation to the principal outstanding	0,3%
	Differentiated RWA	In line with the 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 a group of related borrowers	5% of the 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.

Table 8. Current and Announced Positive CCyB Rates, % of RWA

Country	Buffer rate as of January 1, 2025	Scheduled buffer rate in the upcoming period
Albania	→ 0	30.06.2025: ↑ 0,25
Armenia	→ 1,5	
Australia	→ 1	
Austria	→ 0	
Belgium	↑ 1	
Bulgaria	→ 2	
Chile	→ 0,5	
Croatia	↑ 1,5	
Cyprus	→ 1	14.01.2026: ↑ 1,5
Czech	→ 1,25	
Denmark	→ 2,5	
Estonia	→ 1,5	
France	→ 1	
Georgia	→ 0,5	15.03.2025: ↑ 0,75 15.03.2026: ↑ 1
Germany	→ 0,75	
Greece	→ 0	01.10.2025: ↑ 0,25
Hungary	→ 0,5	01.07.2025: ↑ 1
Iceland	→ 2,5	
Ireland	→ 1,5	
Italy	→ 0	
Latvia	→ 0,5	18.06.2025: ↑ 1
Lithuania	→ 1	
Luxembourg	→ 0,5	
Moldova	→ 0	
Montenegro	→ 0	01.04.2025: ↑ 0,5 01.01.2026: ↑ 1
Netherlands	→ 2	
North Macedonia	↑ 1,5	01.07.2025: ↑ 1,75
Norway	→ 2,5	
Poland	→ 0	25.09.2025: ↑ 1
Portugal	→ 0	01.01.2026: ↑ 0,75
Romania	→ 1	
Serbia	→ 0	
Singapore	→ 0	
Slovakia	→ 1,5	
Slovenia	↑ 1	
South Korea	↑ 1	
Spain	→ 0	01.10.2025: ↑ 0,5 01.10.2026: ↑ 1
Sweden	→ 2	
Switzerland	→ 0	
United Kingdom	→ 2	

Sources: National authorities.

Appendix 10

Methodology of MPP Index for Uzbekistan

The MPP Index is used to aggregate all MPP measures implemented by the CBU into the single index and to assess whether the macroprudential condition has tightened or eased. It is also employed to analyze the impact of MPP measures on loan growth and house prices[155].

The MPP Index was developed to comprehensively assess changes in MPP tools and to identify the tightening and easing phases of MPP. The index includes borrower-based and liquidity tools, minimum capital requirements, reserve requirements, and risk weights of assets. In particular, although minimum capital requirements are mainly set within the scope of banking supervision, changes in these requirements affect the level of systemic risk. Also, taking into account that the CCoB is part of Tier 1 capital requirements, minimum capital requirements have been included in Uzbekistan's MPP Index.

In calculating the MPP Index, historical changes in the regulatory requirements for banks were taken into account, using the dates of these requirements' entry into force and repeal. In addition, changes in the indicators were considered in the calculation of the index.

As borrower-based tools, the index includes DSTI cap for loans to individuals, as well as changes in requirements for issuing loans to individuals in FX.

Changes in minimum requirements for Tier 1 and CAR are included in the MPP Index as capital requirements.

Liquidity tools included in the index cover changes in the requirements for LCR, NSFR, instant and current liquidity ratios, the share of HQLA in total assets, concentration limit on car loans, and the maximum exposure limit for borrowers.

As reserve requirements within the index, changes in the reserve requirements on deposits attracted from legal entities and individuals in national and foreign currencies, are taken into account.

Changes in the risk weights of mortgage and car loans are incorporated in the MPP Index as assets risk measures.

In calculating the MPP Index, regulatory requirements for MPP tools are first defined, and changes in these requirements are calculated based on quarterly data.

[155] Eller, M., Martin, R., Schuberth, H., & Vashold, L. (2020). Focus on European Economic Integration Q2/20. Macroprudential policies in CESEE – an intensity-adjusted approach. Oesterreichische Nationalbank.

Table 9. Impact of Changes in MPP Tools on Index

Subindex	MPP tool	Impact on MPPI
Borrower-based tools	DSTI cap for loans to individuals	A 1 p.p. tightening (or easing) of the requirement increases (or decreases) the index value by 0.2 units
	Restriction on issuing FX loans to individuals	The imposition (or removal) of the restriction elevates (or demotes) the index value by 6 units
Capital tools	Tier 1	A 1 p.p. increase (or decrease) in the minimum requirement raises (or lowers) the index value by 0.5 units
	CAR	A 1 p.p. rise (or fall) in the minimum requirement expands (or decreases) the index value by 1 unit
Liquidity tools	LCR	Tightening (or easing) of the ratio increases (or decreases) the index value by 0.5 units
	NSFR	Tightening (or easing) of the ratio increases (or decreases) the index value by 0.5 units
	LCR in national and foreign currencies	Tightening (or easing) of the ratio in national and foreign currencies raises (or lowers) the index value by 0.5 units
	NSFR in national and foreign currencies	Tightening (or easing) of the ratio in national and foreign currencies increases (or decreases) the index value by 0.5 units
	Instant liquidity ratio	Tightening (or easing) of the ratio rises (or shortens) the index value by 0.5 units
	Current liquidity ratio	Tightening (or easing) of the ratio grows (or reduces) the index value by 0.5 units
	Share of HQLA in total assets	Tightening (or easing) of the limit increases (or decreases) the index value by 0.5 units
	Concentration limit on car loans	The imposition (or removal) of the concentration limit accelerates (or decelerates) the index value by 0.5 units
	The requirement established for identifying large exposures	A 1 p.p. decline (or growth) in the limit increases (or decreases) the index value by 0.1 units
	Bank's maximum exposure limit for one borrower or a group of interconnected borrowers	A 1 p.p. contraction (or expansion) in the limit raises (or lowers) the index value by 0.1 units
	The maximum amount of unsecured credit risk of a bank attributable to a single borrower or a group of related borrowers	Tightening (or easing) in the quantity limit increases (or decreases) the index value by 0.25 units
	A limit on the total amount of all major risks of the bank	A 40 p.p. drop (or surge) in the limit expands (or shrinks) the index value by 0.1 units
	A limit on the maximum amount of risk per affiliated person	A 1 p.p. reduction (or growth) in the limit increases (or decreases) the index value by 0.1 units
	Maximum exposure limit for all affiliated persons	Tightening (or easing) in the quantity limit raises (or reduces) the index value by 0.25 units

Reserve requirements	Changes in reserve requirements for deposits of legal entities and individuals in national currency	A 1 p.p. increase (or decrease) in the requirement raises (or contracts) the index value by 0.1 units
	Changes in reserve requirements for deposits of legal entities and individuals in FX	A 1 p.p. rise (or decline) in the requirement increases (or decreases) the index value by 0.1 units
RWA	Risk weight requirements for mortgage loans.	Tightening (or easing) in requirements expands (or lowers) the index value by 0.5 units
	Risk weight requirements for car loans.	Tightening (or easing) in requirements increases (or decreases) the index value by 0.5 units

Source: CBU.

The impact of changes on the final index is determined based on the relative significance of the tools. In this context, increase or decrease in the implemented requirements are directly reflected in the index through changes in the nominal values of the measures, indicating the tightening or easing of MPP. In addition, the index also incorporates changes arising from the difference between the established requirements and the upper limits. Moreover, tools without quantitative indicators, such as the imposition of limits on issuing FX loans to individuals, are directly reflected in the tightening of the index value.

The value of each tool within the subindices is calculated cumulatively based on its changes and level of significance. The value of the subindices is determined as the sum of the values of their constituent tools. The MPP Index consists of subindices for borrower-based tools, capital requirements, liquidity tools, reserve requirements, and RWA, and the final index value is calculated as the sum of all identified subindices[156].

An increase in the MPP Index indicates a tightening of MPP conditions in the country, while a decrease reflects an easing of these conditions.

[156] The MPP Index is determined by the following formula:

$$MPP\ Index = BB + CB + LB + RR + RW$$

Where,

$MPP\ Index$ – macroprudential policy index;
BB – borrower-based tools subindex;
CB – capital requirements subindex;
LB – liquidity tools subindex;
RR – mandatory reserve requirements subindex;
RW – risk weights of assets subindex.

Glossary

Capital buffer for D-SIBs refers to additional capital requirements introduced to enhance the resilience of D-SIBs to potential shocks or losses that may arise during their operations. The high solvency of D-SIBs strengthens not only the stability of the financial system but also the overall stability and security of the economy.

Capital buffers are requirements formed as part of the CET1 capital and introduced in addition to the regulatory capital standards to increase banks' resilience to various shocks.

CCyB is a capital requirement designed to counter procyclicality in the financial system. When the cyclical systemic risk is judged to be increasing, institutions should accumulate capital to create buffers that strengthen the resilience of the banking sector during periods of stress when losses materialize. This will help maintain the supply of credit to the economy and dampen the downswing of the financial cycle. The CCyB can also help dampen excessive credit growth during the upswing of the financial cycle.

Deleveraging is the process undertaken by banks to reduce their debt. When deleveraging is voluntary, it is mainly aimed at mitigating risks; however, it is sometimes used to avoid bankruptcy that may arise as a result of a deterioration in financial condition.

Financial cycle can be considered economic fluctuations amplified by—or stem directly from—the financial system. It typically manifests as a co-movement between credit aggregates and asset prices with a possible impact on real economic developments.

Financial stability is the capability of the financial system, i.e., financial institutions and market infrastructures, to withstand possible shocks and reduce the possibility of disruptions in the performance of financial intermediation functions. Achieving financial stability means ensuring the stability of the entire financial system, not individual financial institutions.

Fire sales occur when an owner of an asset is forced to sell it at a discounted price to meet creditor demands.

Guided discretion is an approach that considers not only automatic rules, but also relies on quantitative indicators and relevant qualitative information. Given that macroprudential tools can generate multiple effects on the financial system, the MPP decisions on the activation/deactivation and calibration of macroprudential tools should not be based entirely on strict rules, allowing the macroprudential authorities a high degree of flexibility and the possibility of entering qualitative factors in the decision-making process.

Leverage ratio is a capital adequacy tool that measures a bank's Tier 1 capital divided by its total exposures; it is used to monitor a bank's overall risk. Its principal objective is to constrain the maximum degree to which a bank can leverage its equity. It differs from capital adequacy requirements by not taking into account RWA, and it is a simple and effective tool against the disproportionate excess of assets relative to capital.

LCR promotes the short-term resilience of a bank's liquidity risk profile. It does this by ensuring that a bank has an adequate stock of unencumbered HQLA that can be converted into cash easily and immediately in private markets to meet its liquidity needs for a 30-calendar day liquidity stress scenario. It will improve the banking sector's ability to absorb shocks from financial and economic stress, whatever the source, thus reducing the risk of spillover from the financial sector to the real economy.

LGD is a bank's financial loss when the borrower cannot repay its debt; the share of a loan or security's nominal value that would not be recovered following default.

Macro stress test is a set of tools used to measure the resilience of the entire financial system to systemic risk factors, including severe but possible macroeconomic indicators in adverse scenarios, and to ensure that it has sufficient capital and liquid assets to maintain stability in the event of a stress situation.

MPP is defined as limiting systemic risks and mitigating their negative consequences, increasing the stability of the financial system by introducing buffers that ensure the stable functioning of the economy. MPP is characterized by reference to three defining elements: (i) Its objective: to limit systemic risk–the risk of widespread disruptions to the provision of financial services that have serious negative consequences for the economy. (ii) Its scope: the focus is on the financial system as a whole (including the interactions between the financial and real sectors) as opposed to individual components (that take the rest of the system as given). (iii) Its instruments and associated governance: it uses primarily prudential tools calibrated to target the sources of systemic risk.

MPP tools are tools and limits designed to achieve MPP's ultimate and intermediate objectives.

NSFR is complementary to the LCR in that it aims to ensure funding resilience over a longer time horizon, requiring banks to fund long-term assets with long-term liabilities and thus limit the degree of maturity mismatch.

Regulatory arbitrage is when financial market participants gain comparative advantages by moving and (or) starting their activities in relatively less regulated segments of the market to circumvent restrictions.

Risk profile represents the investor's attitude to risk and is important for effective asset allocation in the investment portfolio. Individual investors, financial institutions, or companies have unique risk profiles as their risk appetites may differ according to psychological factors, loss-absorbing capacity, investors' age, and other investment objectives. Usually, investors can be divided into conservative, rational, and aggressive types based on the risk profile.

Structural (cross-sectional) dimension of systemic risk is a risk arising due to the distribution of risks throughout the financial system and interconnectedness between financial institutions and common exposures.

Systemic risk is the risk of widespread disruption to the provision of financial services caused by an impairment of all or parts of the financial system, which can cause serious negative consequences for the real economy. By mitigating systemic risks, macroprudential measures ultimately aim to reduce the frequency and severity of financial crises. Systemic risk is generally recognized as having two dimensions: structural (cross-sectional) and time dimension.

SyRB can be used if other macroprudential tools, like the CCyB or the D-SIB buffer, do not address systemic risks. The buffer can address general systemic risks or risks related to a subset of bank exposures.

Systemically important bank are banks on which the banking system's stability depends; they are banks whose disorderly failure, because of their size, complexity, and systemic interconnectedness, would cause significant disruption to the broader financial system and economic activity.

Time dimension of systemic risk refers to procyclicality, which is based on a collective tendency by financial and non-financial economic agents to increase risk exposures during the boom phase of a financial cycle and become overly risk-averse during the bust phase. Procyclicality manifests itself in credit and liquidity cycles induced by excessive leverage in corporations and households and excessive maturity mismatches in the financial sector.

"Too big to fail" institution is so systemically important that it cannot be allowed to fail, as its failure would cause instability across the financial system and disrupt the economy at large.

Transmission channels of MPP are channels through which MPP decisions can impact the resilience of the financial sector and the credit cycle. The tightening of MPP tools is transmitted to the financial system and the real economy through price, quantity, resilience, and expectations channels.

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