



Financial Stability Report

2023|1

October 2023

The Financial Stability Report is released biannually by the Central Bank of Uzbekistan. Its purpose is to evaluate macro-financial vulnerabilities and risks, analyze the stability of the domestic financial system, and propose policies and measures to promote financial stability.

This report is based on data as of July 1, 2023.

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

This report was prepared by the Financial Stability Department of the Central Bank of Uzbekistan. If you have any comments, please send them to rmakhammadiev@cbu.uz.

Acronyms

AEs	Advanced economies
AUROC	Area under the receiver operating characteristic curve
CAB	Current account balance
CAR	Capital adequacy ratio
CBU	Central Bank of Uzbekistan
CCoB	Capital conservation buffer
CCyB	Countercyclical capital buffer
CoVaR	Conditional value at risk
DSR	Debt service ratio
ELA	Emergency liquidity assistance
EMs	Emerging markets
EWI	Early warning indicator
FDIC	US Federal Deposit Insurance Corporation
FED	US Federal Reserve System
FGDCB	Fund for guaranteeing deposits of citizens in banks
FSI	Financial stress index
GARCH	Generalized autoregressive conditional heteroskedasticity
GDP	Gross domestic product
GSADF	Generalized supremum augmented Dickey-Fuller
HHI	Herfindahl-Hirschman index
HLA	Highly liquid assets
HP	Hodrick-Prescott
IMF	International Monetary Fund
JSC	Joint-stock company
LCR	Liquidity coverage ratio
LTV	Loan-to-value
MSCI	Morgan Stanley Capital International
NGFS	Network of Central Banks and Supervisors for Greening the Financial System
NSFR	Net stable funding rate ratio
OLS	Ordinary least squares
PTI	Payment-to-income
ROA	Return on assets
ROC	Receiver operating characteristic curve
ROE	Return on equity
RWA	Risk-weighted assets
SIB	Systemically important banks
SSM	State-space model
SyRB	Systemic risk buffer
UCI	Uzbekistan Composite Index
USD	United States dollar
UZS	Uzbek soum
VaR	Value at risk

Financial Stability Report for H1 2023

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Executive Summary

In H1 2023, the banking system in Uzbekistan maintained financial stability despite slightly tighter financial conditions. The period witnessed a stagnant money market and significant volatility in the foreign exchange market, contributing to heightened uncertainty in the banking sector. Although there was a decline in capital adequacy and liquidity metrics, these indicators stayed well above regulatory minimums. The banking sector saw an improvement in profitability despite a reduction in the share of highly liquid assets in total assets. The ratio of non-performing loans (NPLs) to total loans was low, and there was an increase in provisions to offset potential loan losses.

The population's debt burden significantly increased. Uzbekistan's retail lending sector saw a notable surge in H1 2023, leading to a rise in the population's debt burden on gross and mortgage loans. This surge has led to a higher credit-to-GDP ratio over recent years. The accelerated growth in the balance of loans issued to the population could escalate credit risk. Individuals with lower incomes may particularly struggle to fulfill their loan obligations. Despite a relatively low debt service ratio (DSR) for total loans, indicating manageable debt levels among the population, there is an evident trend of high growth. An increase in indebtedness levels among the population could render borrowers more vulnerable and lenders more exposed to shocks, potentially destabilizing the financial system.

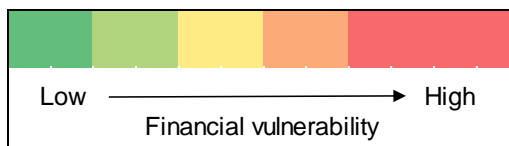
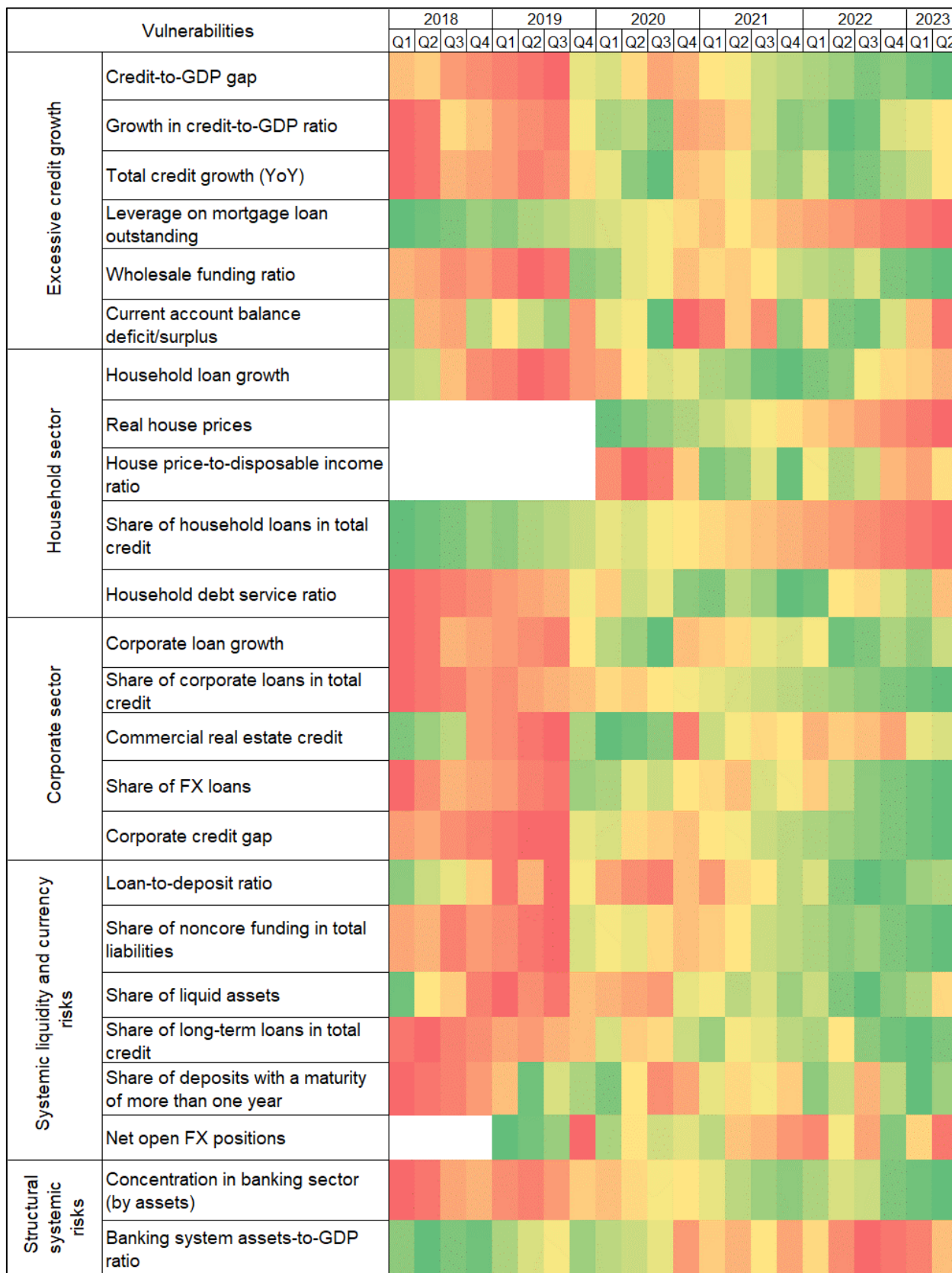
The housing market in Uzbekistan is currently experiencing overvaluation, with market prices significantly outpacing fundamental values. As of H1 2023, housing prices were, on average, 36 percent higher than their fundamental prices. Although housing price indices have climbed since 2022, a continuous upward trajectory might precipitate a market correction during economic downturns. The persistent demand for housing, outstripping supply, is expected to exacerbate the supply-demand imbalance in the real estate market. A sudden decline in the prices of houses used as loan collateral could amplify loan losses for banks.

In recent years, car loan growth has notably outpaced other loan categories, including mortgages and microloans. This has led to a higher concentration of car loans, increasing banks' vulnerability to economic shocks. Poor repayment discipline and significant loan losses are potential outcomes during economic downturns or car value depreciation. The surge in car loans is attributed to more lenient lending standards by banks, which, in turn, has stimulated demand in the automotive market. The combination of limited local supply and high import duties on cars has driven up prices, making vehicles one of the primary investment assets. Consequently, speculative activities in the car market are on the rise, bolstered by the growing investment appeal of automobiles.

According to macro stress testing, Uzbekistan's banking system has demonstrated resilience against shocks under both baseline and adverse scenarios. The total capital adequacy ratio (CAR) surpasses the Central Bank's minimum requirements in both scenarios. In the adverse scenario, even in the face of

significant loan, equity, and housing losses, alongside an increase in risk-weighted assets (RWA), robust net interest and non-interest income are expected to maintain the CAR above the minimum requirement at 13.6 percent, by the end of 2025.

Financial Vulnerabilities Heatmap for Uzbekistan's Banking System



The financial vulnerabilities heatmap in H1 2023 depicts a similar picture to previous periods. However, there has been a notable shift in credit activity from the corporate sector to the household retail sector. As a result, there has been an increase in household debt burden on gross and mortgage loans. This increase in the population's indebtedness can make borrowers and lending institutions more vulnerable to possible shocks, which can negatively impact the financial system's stability.

There is growing concern about the level of debt that people are taking on. This is due to increased activity in the retail loan market, leading to a rise in the DSR for individuals. This trend suggests that a larger portion of people's income is going towards repaying debts, which makes them more vulnerable to unexpected changes in income or other financial challenges.

The real prices of houses are on the rise. This could potentially result in a market price increase further beyond the fundamental value of these houses. If this trend continues, economic slowdown may lead to price corrections.

There has been a noticeable decrease in banks' liquidity. National currency deposits maintained growth rates, while foreign currency deposits decreased. This decline can be attributed to two factors: first, the outflow of funds previously set aside for import payments, and second, non-residents who moved to Uzbekistan due to the geopolitical tensions withdrawing their funds. Because of this, there was a significant decrease in the share of highly liquid assets in the banking system. Banks may face losses if they cannot meet their obligations and maintain their liquidity. This also poses a risk to the banking system as a whole.

There is still a relatively high level of current account deficit. This means that the negative foreign trade balance is significantly large, but it has been partially covered by the positive balance of primary and secondary incomes. A decline in cross-border remittances due to current uncertainty in external economic conditions may further increase the current account deficit (see Appendix 1).

I. Macrofinancial Conditions in Global and Uzbekistan's Economy

In H1 2023, global macroeconomic dynamics were influenced by multiple factors. These encompassed persistent geopolitical tensions, a pronounced global inflationary trend, and heightened volatility in financial markets, primarily driven by uncertainties in the financial sectors of the US and Europe. Several banks in the US and Europe incurred significant financial losses. Conversely, the technology sector experienced a rebound, with rising equity prices helping to mitigate the effects of tighter monetary policies. This contributed positively to the global financial conditions, which experienced a slight softening by the end of H1 2023. According to the International Monetary Fund's (IMF) global financial conditions index, there was a slight easing in financial conditions across both advanced economies (AEs) and emerging markets (EMs)¹.

Figure 1. Global Financial Conditions Index (standard deviation from the average)

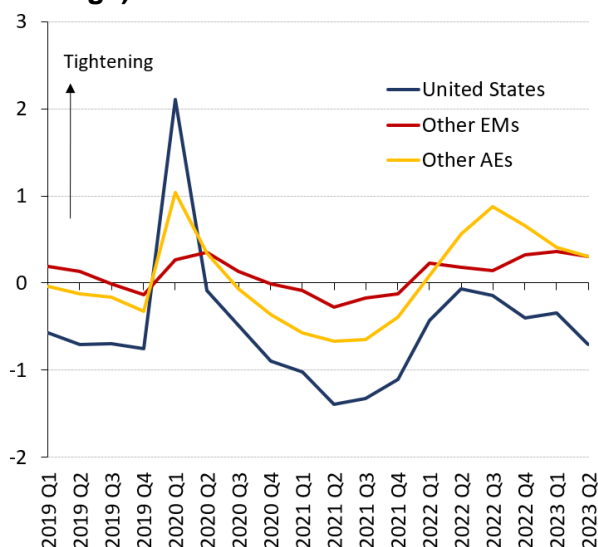
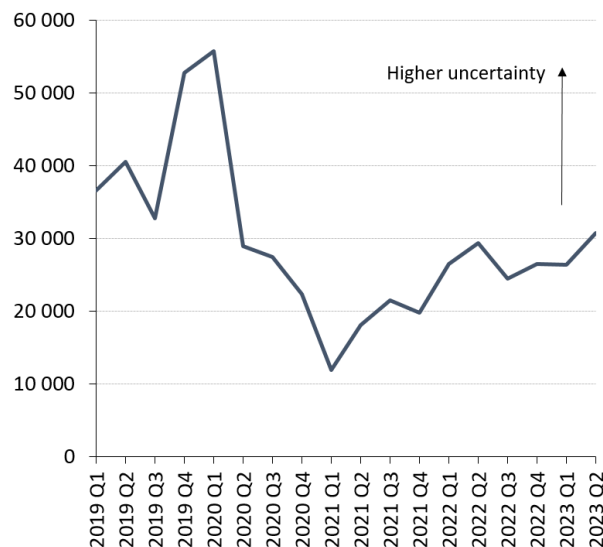


Figure 2. World Uncertainty Index (WUI)



Source: IMF.

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

During H1 2023, growing concerns about the banking sector were primarily driven by the high interest rates in AEs. The high interest rates led to tighter credit conditions, resulting in a slowdown in the growth of bank loans. In addition, the increased loan servicing costs due to these higher interest rates have negatively impacted credit

¹ International Monetary Fund. (2023, July). World Economic Outlook.

quality. Moreover, the high interest rates in AEs have also reduced the volume of bank loans by slowing down the allocation of corporate loans².

The World Uncertainty Index (WUI)³ has increased in recent years, reflecting growing concern among economists about global uncertainty and increased risks.

In H1 2023, Uzbekistan's economy grew by 5.6 percent, a 0.2 percent increase from the same period in 2022. The service, industry, and agriculture sectors significantly influenced this growth. Specifically, the service sector contributed 2.6 percentage points to the country's economic growth.

Agriculture, with its seasonality, contributed 0.7 percentage points to GDP growth and made up 19 percent of the GDP. However, the risks associated with climate change could result in significant financial losses among the banks with large exposures to the agricultural sector.

Meanwhile, the construction industry had a relatively low impact on GDP growth but did directly impact the supply of real estate. The small share of this sector in the GDP may be the reason for the inadequate supply of real estate compared to the growing demand.

Figure 3. Annual GDP Growth Decomposition, percentage point

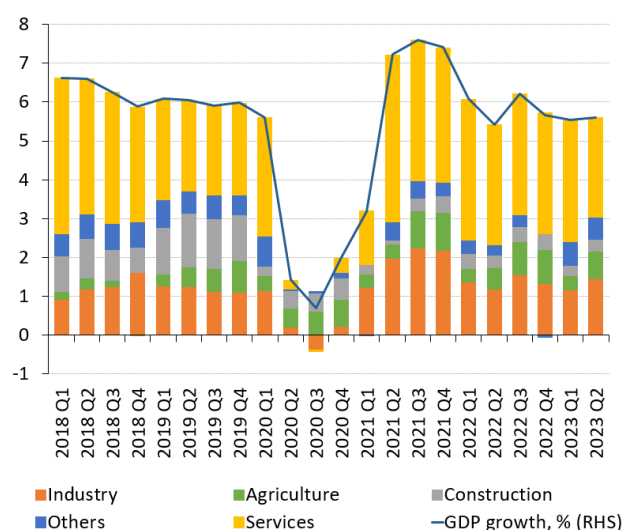
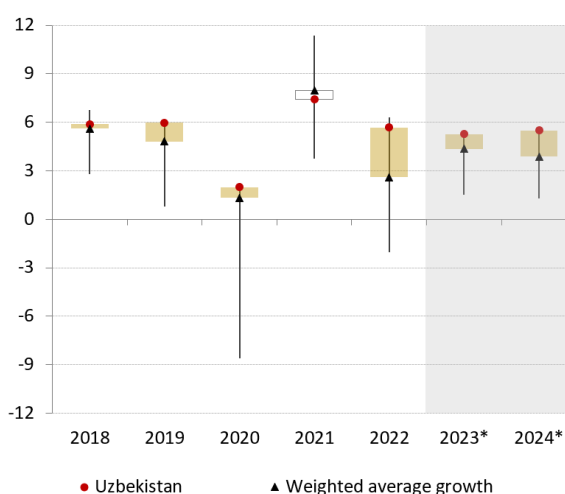


Figure 4. Growth Distribution of Uzbekistan's Main Trading Partners, %⁴



Sources: Statistics Agency, IMF, and CBU staff calculations.

Note: *Forecast.

² International Monetary Fund. (2023, July). World Economic Outlook.

³ Ahir, H., Bloom, N., & Furceri, D. (2022). The World Uncertainty Index. National Bureau of Economic Research.

⁴ The rectangle displayed in the chart represents the variation between Uzbekistan's GDP growth rate and the weighted average of GDP growth rates for selected countries (China, Kazakhstan, Kyrgyzstan, Russia, South Korea, Turkey, and Uzbekistan). The length of the rectangle indicates the difference between the growth rates. If Uzbekistan's GDP growth rate exceeds the weighted average, the rectangle is shaded, and if it is the opposite, the rectangle remains blank. The vertical black line on the chart represents the maximum and minimum growth rates among the seven countries for a given year.

Uzbekistan's economy is expected to grow at a higher rate compared to its main trading partners. The IMF estimates that the country's GDP will grow by 5.5 percent in 2023 and 2024⁵. Meanwhile, the World Bank anticipates the country's GDP will grow by 5.5 percent in 2023 and 5.6 percent in 2024⁶. The main trading partner countries, on the other hand, are projected to experience a lower growth rate. Based on IMF data, their GDP growth rates for 2023–2024 are estimated to be 4.4 and 3.9 percent, respectively.

Uzbekistan's current account balance (CAB) remained negative in H1 2023. The current account deficit amounted to 2.6 billion USD⁷, which increased by almost 2 billion USD⁸ compared to the same period in 2022. An unusual increase in outgoing remittances in 2022 can explain this change.

In H1 2023, the trade balance of the current account amounted to a negative 7.6 billion USD, while the balance of primary and secondary incomes was a positive 4.9 billion USD. The positive balance of primary and secondary incomes partially offset the negative trade balance. A persistent, widening current account deficit puts additional pressure on the UZS depreciation. The level of risk associated with the current account deficit, which arises from the negative trade balance, is closely connected to the nature of imported goods.

Figure 5. Quarterly Distribution of Current Account Balance, billion USD

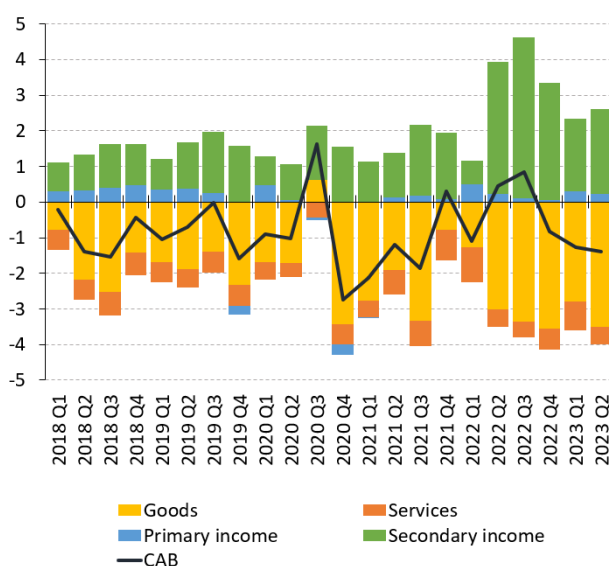
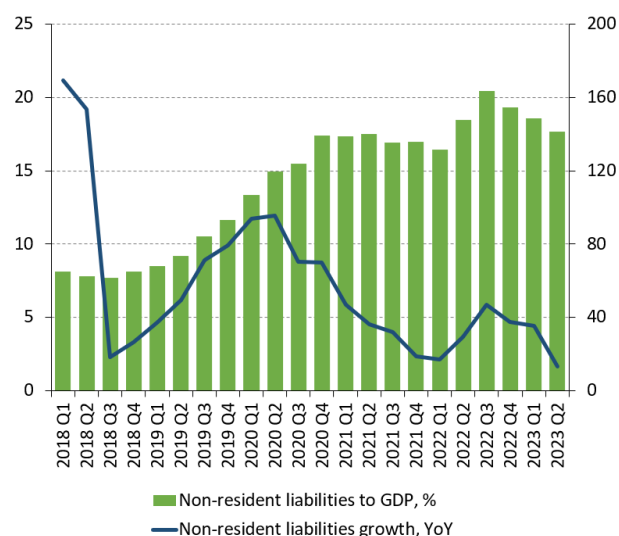


Figure 6. Bank Liabilities to Non-residents-to-GDP Ratio and YoY Growth of These Liabilities, %



Source: CBU.

Commercial banks are finding it more expensive to attract external funding due to the tightening conditions in the global financial markets. As a result, the pace of attracting external finance is slowing down, and banks' liabilities to non-residents are decreasing.

⁵ International Monetary Fund. (2023, October). World Economic Outlook.

⁶ World Bank. (2023, Fall). Sluggish Growth, Rising Risks.

⁷ O'zbekiston Respublikasi Markaziy banki. (2023). 2023 yilning I yarmi uchun to'lov balansi joriy operatsiyalar hisobining dastlabki ko'rsatkichlari.

⁸ O'zbekiston Respublikasi Markaziy banki. (2023). O'zbekiston Respublikasining to'lov balansi (tahliliy ko'rinishi).

Furthermore, the decrease in banks' liabilities to non-residents was caused by the reduction of non-resident funds placed last year by 1.2 billion USD. As a result, the annual growth rate of banks' gross foreign liabilities decreased by 16 percentage points compared to the corresponding period of 2022 as of July 1, 2021.

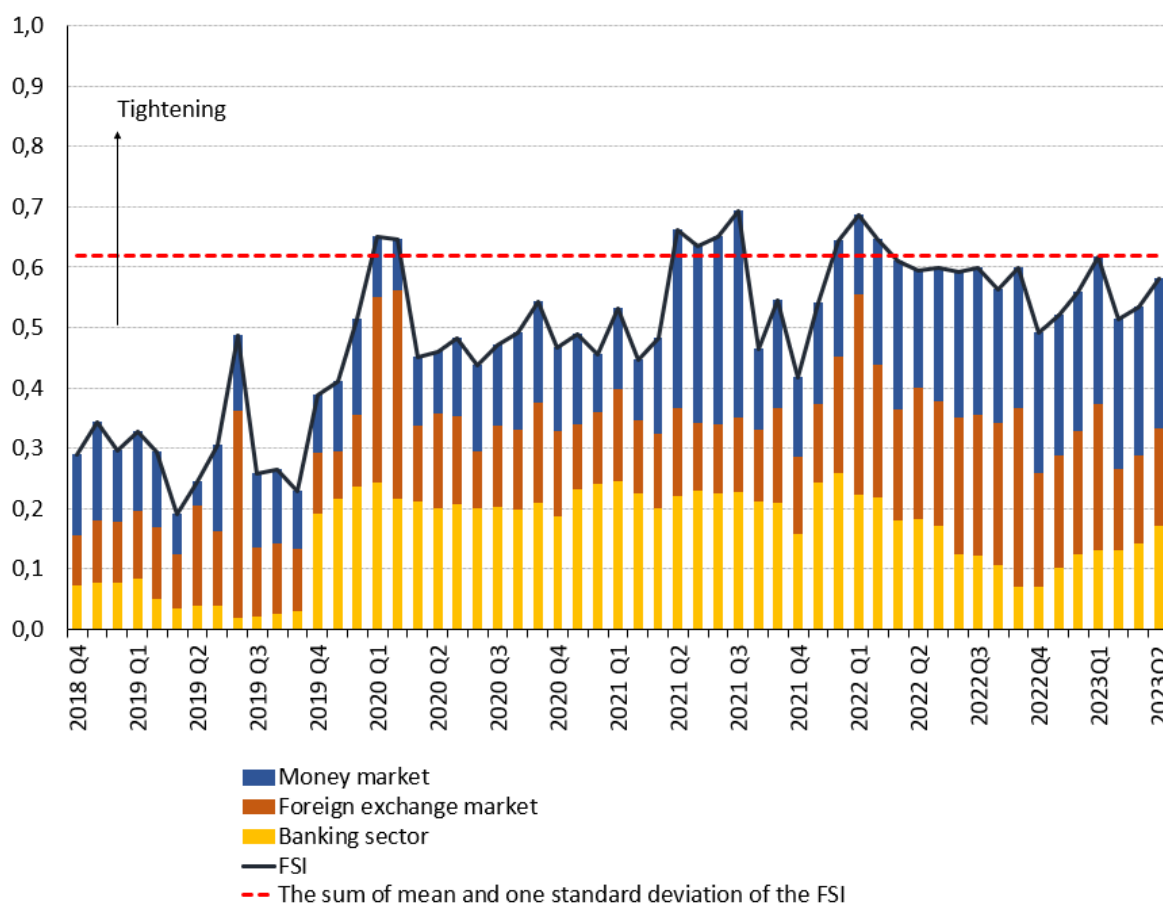
As of July 1, 2023, the ratio of commercial banks' gross external liabilities to GDP was 18 percent, which is approximately 1 percentage point lower compared to the corresponding period of 2022.

II. Financial Sector

2.1. Banking Sector

During H1 2023, Uzbekistan's Financial Stress Index (FSI)⁹ was lower than its average plus one standard deviation, despite significant volatility (see Appendix 2). The money market remained stagnant during this period, but high volatility in the foreign exchange market and slightly increased uncertainty in the banking sector led to a slight tightening of financial conditions.

Figure 7. Uzbekistan's Financial Stress Index



Source: CBU staff calculations.

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

The ongoing external geopolitical tensions caused an external trade deficit to increase (in H1 2023, it amounted to –4.9 billion USD, which is 4.4 percent higher than in H1 2022¹⁰), resulting in a high domestic demand for foreign currency. This and other

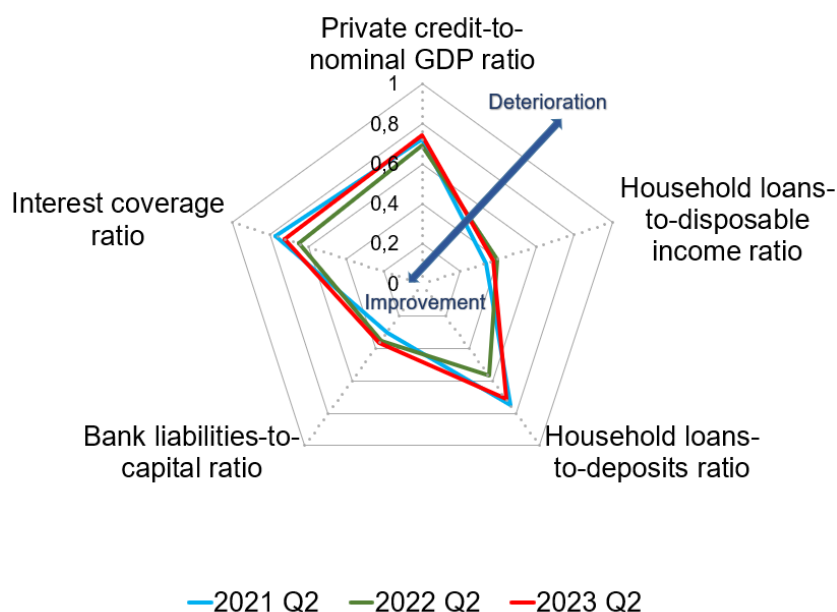
⁹ The FSI methodology is presented in the Financial Stability Report for 2022.

¹⁰ O'zbekiston Respublikasi Prezidenti huzuridagi Statistika agentligi. (2023). O'zbekiston Respublikasi tashqi savdo aylanmasi (2023 yil yanvar–iyun).

factors caused volatility in the domestic foreign exchange market in H1 2023. As of July 1, 2023, total deposits decreased by 6.4 percent¹¹ from the beginning of the year due to the reduction of foreign currency deposits.

According to the credit market risk map¹², the household loans-to-deposits and interest coverage ratios deteriorated. As of July 1, 2023, the household loans-to-deposits ratio increased by 20 percent compared to the same period in 2022.

Figure 8. Credit Market Conditions



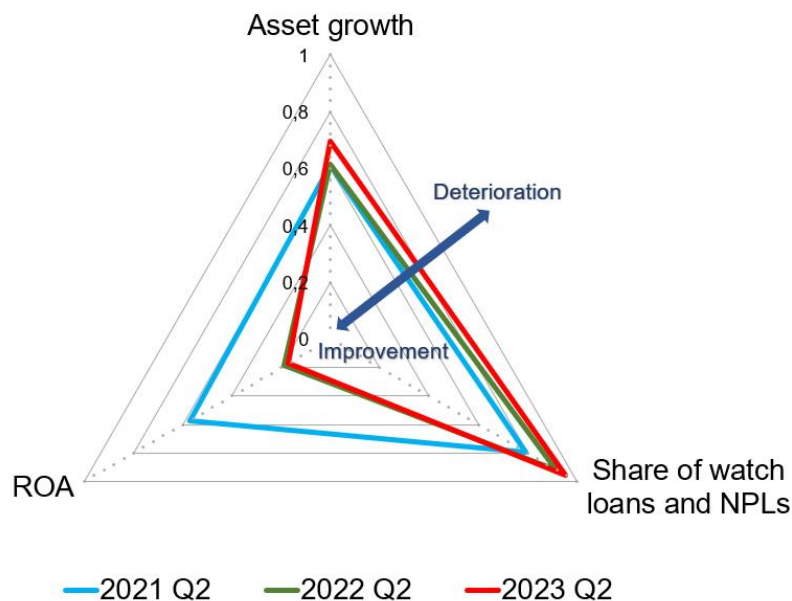
Sources: Statistics Agency and CBU staff calculations.

The interest coverage ratio also decreased by 4 percentage points compared to the corresponding period of 2022, indicating that banks' ability to cover interest payments on loans from bank profit decreased. However, there was a positive change in the household loans-to-disposable income ratio at the end of H1 2023 compared to the same period in 2022.

¹¹ O'zbekiston Respublikasi Markaziy banki. (2023). 2023 yil I yarim yillik Statistik byulleten.

¹² The risk map methodology is presented in the Financial Stability Report for H1 2022.

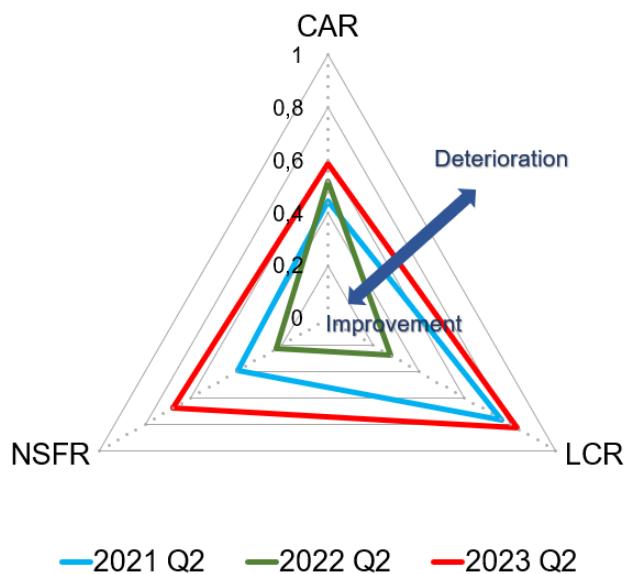
Figure 9. Financial Soundness Conditions



Source: CBU staff calculations.

According to the map of financial soundness conditions in the banking system, there has been a slight increase in risks associated with the slowdown in asset growth and the increase in the volume of assets with overdue payments for more than 31 days. Specifically, in H1 2023, the growth rate of bank assets dropped by 8 percentage points compared to the same period in 2022. Additionally, the share of substandard and NPLs increased by 2 percentage points by the end of H1 2023 compared to the same period in 2022. However, bank profitability in terms of return on assets (ROA) has remained positive at a steady 2.7 percent for the past two years.

Figure 10. Banking System Resilience



Source: CBU staff calculations.

A decline in capital adequacy and liquidity indicators negatively affected the banking sector's resilience, making it more vulnerable to potential shocks. As of July 1, 2023, the capital adequacy ratio (CAR) fell by 0.6 percentage points compared to the same period in 2022. The liquidity coverage ratio (LCR) and net stable funding ratio (NSFR)—indicators of banks' liquidity position—also decreased.

In H1 2023, the banking system's capital adequacy remained above the minimum requirements. This provides a cushion against potential losses even under unfavorable macroeconomic and external conditions. As of July 1, 2023, the total regulatory capital of banks increased by 14 percent compared to the same period in 2022, reaching 88.7 trillion UZS. Approximately 85 percent of this capital is considered high-quality Tier 1 capital.

Figure 11. CAR in Banking Sector, %

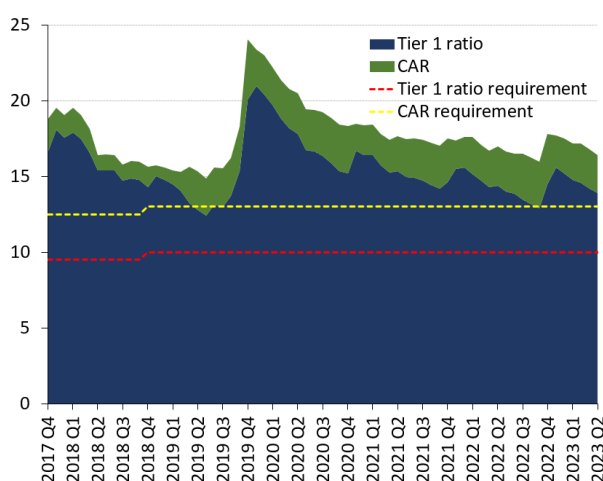
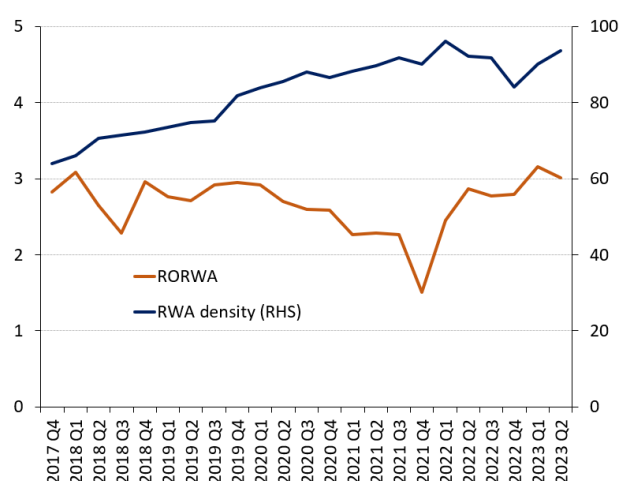


Figure 12. RWA Density¹³ and Return on RWA (RORWA), %



Source: CBU staff calculations.

As of July 1, 2023, the total CAR¹⁴ and Tier 1 capital ratio¹⁵ were 16.4 and 13.9 percent, respectively. Compared to the same period in 2022, the ratios decreased by 0.6 and 0.5 percentage points, respectively. The CAR for systemically important banks (SIBs) was 16.6 percent, which is 0.4 percentage points higher than that of other banks.

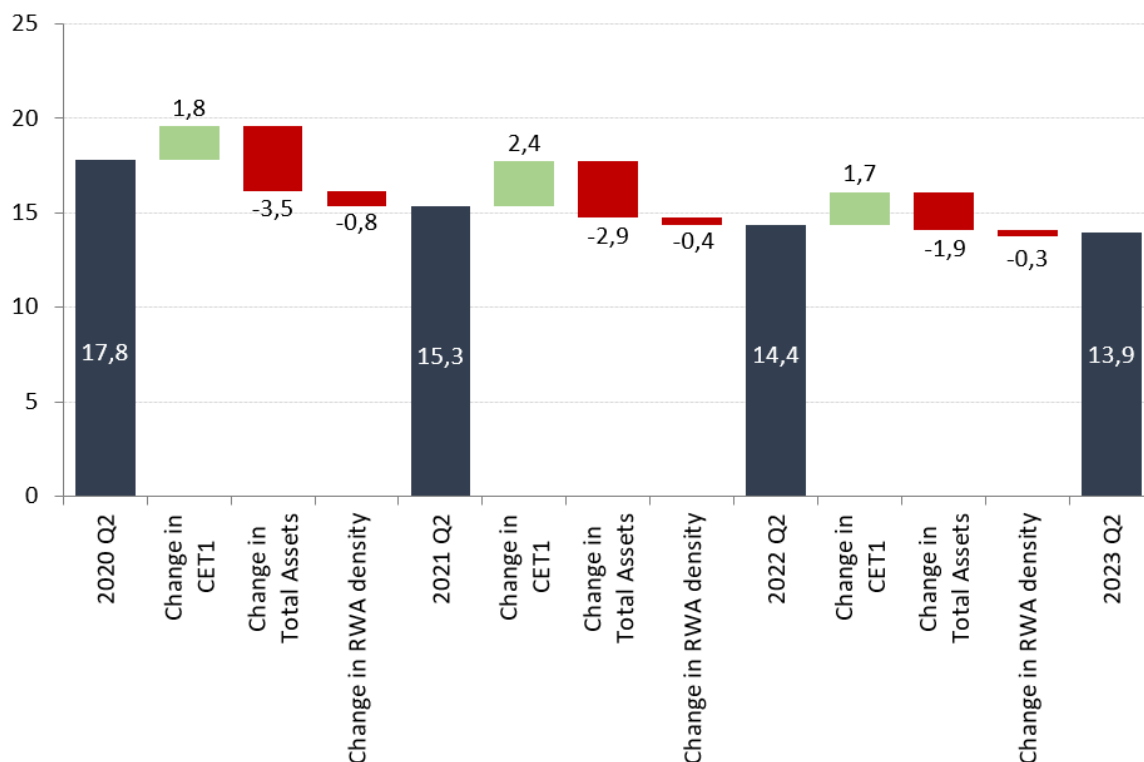
In H1 2023, the return on RWA (RORWA) was approximately 3 percent. The RWA density for the banking system saw an increase and was at 94 percent as of July 1, 2023. This rise in the RWA density indicates that banks' risk appetite is increasing. It also suggests that bank returns on increasingly riskier assets are not increasing commensurately.

¹³ To calculate the RWA density, the amount of RWA is divided by total assets. The RWA density provides a measure of riskiness of assets. An increase in the RWA density indicates a deterioration in overall risk profile of bank assets, while a decrease in the RWA density indicates an improvement in risk quality of assets.

¹⁴ The ratio of total regulatory capital to RWA.

¹⁵ The ratio of Tier 1 capital to RWA.

Figure 13. Changes in CET1 Capital Ratio, %



Source: CBU.

As of July 1, 2023, the CET1 capital decreased by 0.5 percentage points compared to the same period in 2022. However, it remains significantly higher than the required minimum for this capital. Changes in banks' total assets and the RWA density were the primary reasons for the annual decrease in CET1.

The banking system's profitability remained stable, with the return on equity (ROE) increasing by 1.6 percentage points as of July 1, 2023, compared to the same period in 2022. However, the ROA remained nearly unchanged. Furthermore, banks' net profit increased by 28 percent in H1 2023 compared to the same period in 2022. The high profitability of banks helped in their capital growth, which acts as an essential buffer against potential shocks and ensures their resilience.

Figure 14. Profitability in Banking Sector

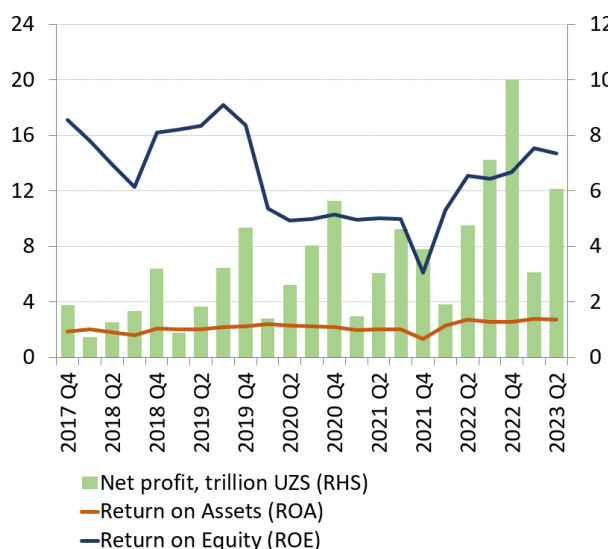
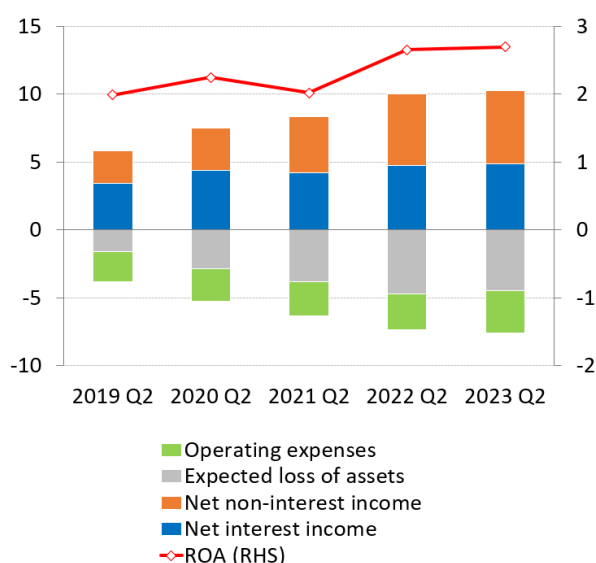


Figure 15. ROA Decomposition for Banking Sector, %



Source: CBU.

The share of net interest income in banks' ROA has consistently been high. As of July 1, 2023, it accounted for 4.8 percent. Additionally, the net non-interest income of banks increased the ROA by 5.4 percentage points. The increase in both net interest and non-interest income, along with the decrease in provisions created for expected losses on assets, helped cover the high operating expenses of banks. As a result, the ROA remained almost unchanged.

There has been a decline in the NSFR, which indicates banks' ability to finance long-term assets from stable sources. As of July 1, 2023, the NSFR decreased by 6 percentage points compared to the corresponding period of 2022, amounting to 110 percent. This shows that the banking system's funding profile weakened slightly. When the NSFR of all banks is plotted using the interquartile range¹⁶, the NSFR for the banking system and SIBs are close to the 25th percentile. Although the NSFR for the banking system had a downward trend, it was still higher than the minimum requirement set by the Central Bank of Uzbekistan (CBU), indicating that long-term assets were financed through stable sources.

¹⁶ This type of visual analysis displays the position of the studied indicator within an interval and how far it deviates from the median line. The boundaries are set by disregarding the lowest and highest 25 percent of all indicators.

Figure 16. LCR in Banking System, %

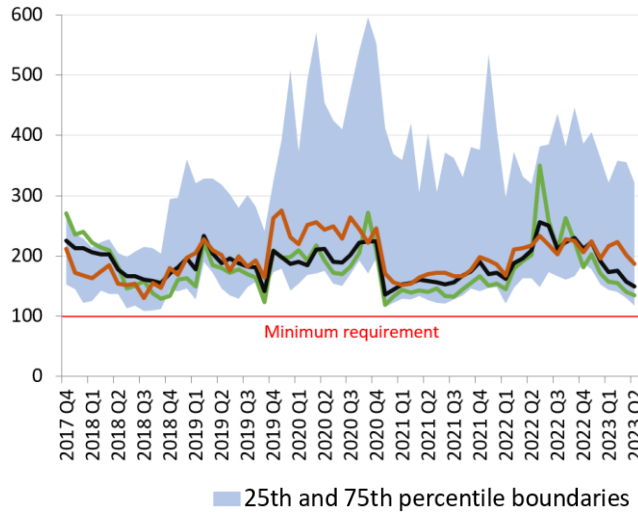
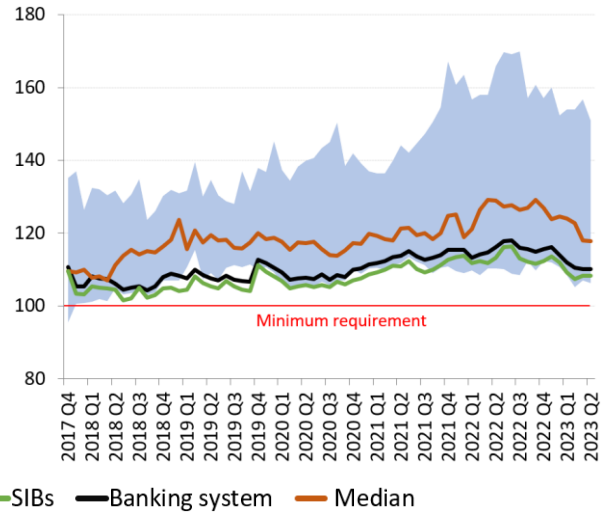


Figure 17. NSFR in Banking System, %



Source: CBU.

During H1 2023, the LCR for the banking system had a downward trend, but it was still higher than the CBU requirement. As of July 1, 2023, the LCR was 149 percent, which is 60 percentage points lower when compared to the corresponding period of 2022. This decrease is due to the decline in banks' highly liquid assets (HLA) volume. It is important to note that banks are more likely to struggle to fulfill their obligations without losses during liquidity distress episodes. Most banks had a relatively low LCR, as the banking system's LCR was close to the 25th percentile.

Figure 18. HLA-to-Total Assets Ratio, %

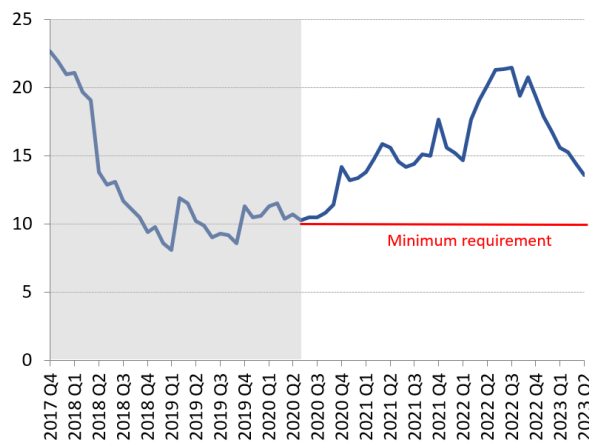
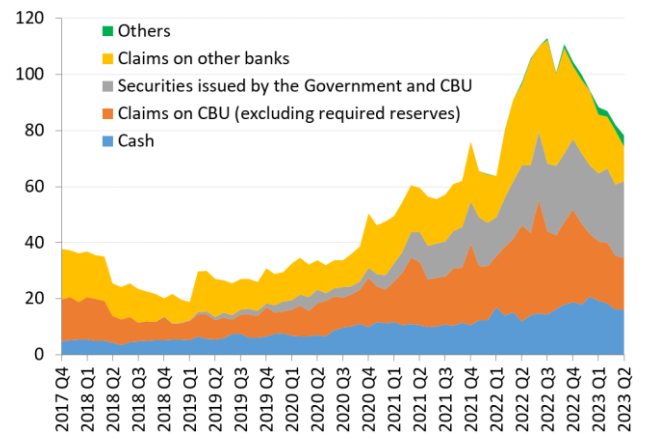


Figure 19. HLA Composition, trillion UZS



Source: CBU.

Note: A minimum requirement for HLA has been established as of June 1, 2020.

In the banking system, the share of HLA in total assets¹⁷ has decreased since H2 2022. As of July 1, 2023, this indicator was 13.6 percent, 6.6 percentage points lower than a year before. This decrease can be attributed to banks' high demand in the domestic foreign exchange market. Meanwhile, bank funds at the CBU without required reserves decreased by 16 trillion UZS. The decrease in foreign currency HLA was due to customers making import payments.

As a result of high credit activity in Uzbekistan, the total loans-to-GDP ratio has been significantly higher than the median for Central Asian and the Caucasian countries. As of July 1, 2023, this indicator for Uzbekistan was 44 percent, nearing the 75th percentile for countries in the region. Uzbekistan's ratio remained unchanged as the high credit growth was offset by commensurate GDP growth.

Figure 20. Total Loans-to-GDP Ratio in Central Asian and Caucasian Countries*, %

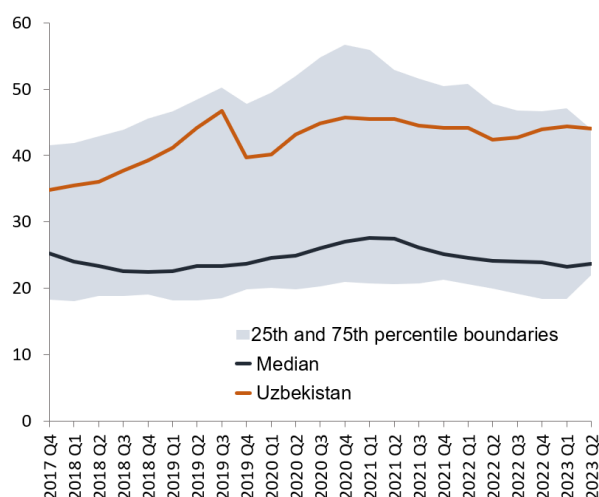
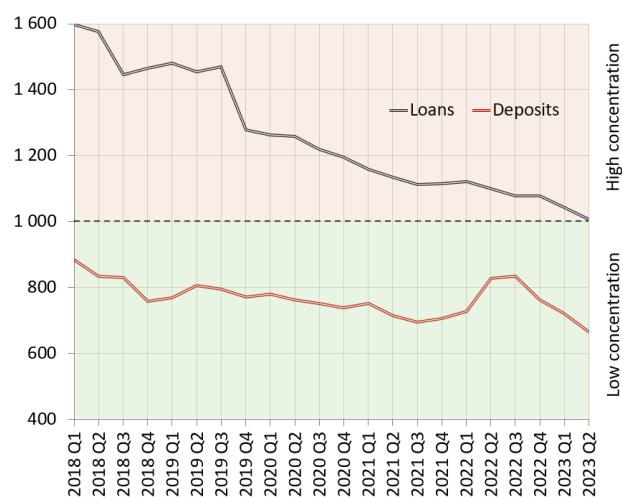


Figure 21. Concentration of Outstanding Loans and Deposits, HHI**



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

Notes: *Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Tajikistan, and Uzbekistan are included. Turkmenistan, Georgia and Tajikistan in Q2 2023 are excluded due to insufficient data.

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

The level of competition in the banking system increased, as indicated by the trend of the Herfindahl-Hirschman Index (HHI), which expresses the concentration of bank loans and deposits in the system. The HHI for loans issued by banks decreased and approached a low concentration at 1006 as of July 1, 2023. This positive change was

¹⁷ As of June 1, 2020, the CBU has set a minimum requirement of 10 percent for the ratio of HLA of banks to total assets.

attributed to the growing competitive environment in the retail credit market, while the share of large banks in loans issued to legal entities remained relatively high.

In addition, private banks offering attractive deposit types and digital banking services contributed to the highly competitive environment in the deposit market. As of July 1, 2023, the HHI for deposits attracted by banks was 665, indicating the low concentration. Private banks accounted for 48 percent of the total attracted deposits, 13 percentage points higher than a year before.

Figure 22. Loan-to-Deposit Ratio and Difference between Loans and Deposits, %

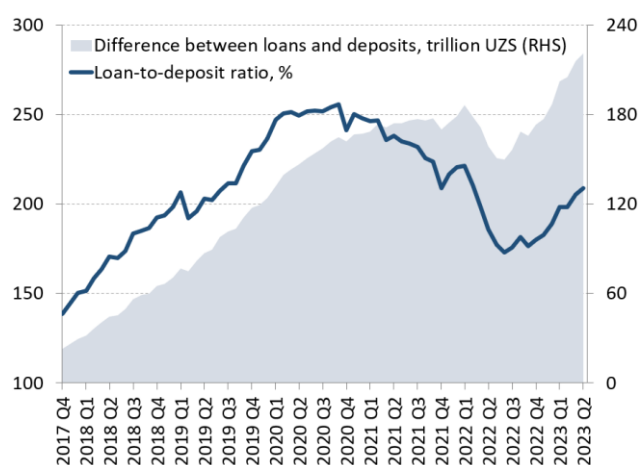
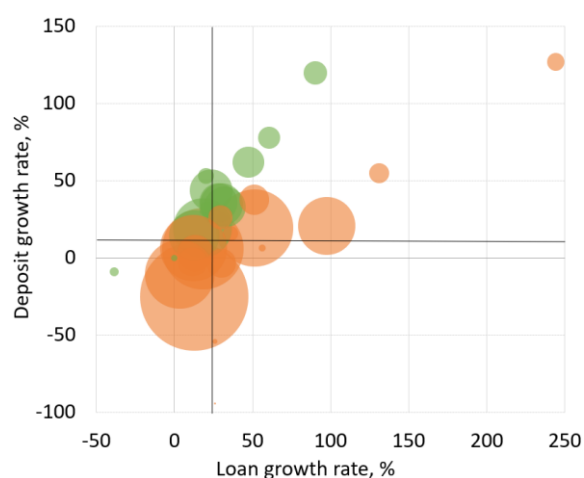


Figure 23. Bank-by-Bank Annual Growth Rates of Loans and Deposits (As of July 1, 2023)



Source: CBU.

Note: The color green on the chart 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 a bank's assets in all banks' assets. The continuous straight lines represent the average values of indicators for the banking system as of July 1, 2023.

As of July 1, 2023, the stock of bank loans was more than twice the stock of deposits and increased by 23 percentage points compared to the same period in 2022. This increase can be attributed to banks using other sources of financing rather than relying solely on deposits. The gap between the volume of bank loans and deposits widened. As of July 1, 2023, this gap reached 221 trillion UZS, a 39 percent increase compared to the same period in 2022. Large banks saw a higher growth rate in loans than in deposits, while small banks, especially private banks, actively sought to attract deposits and issue loans.

Figure 24. Bank-by-Bank Share of Deposits in Total Liabilities and Share of Demand Deposits in Total Deposits (as of July 1, 2023)



Source: CBU.

Note: The color green on the chart indicates the banks where the share of demand deposits in total deposits increased compared to the same period in 2022. Light red, on the contrary, represents banks where the share of demand deposits in total deposits decreased compared to the same period in 2022. The bubble size represents the share of a bank's assets in all banks' assets. The continuous straight lines on the graph represent the average values of these indicators for the entire banking system as of July 1, 2023.

A high share of demand deposits in a bank's total deposits can lead to liquidity issues. Banks cannot predict when these deposits will be withdrawn, making financial planning difficult. As of July 1, 2023, on average, 41 percent of banks' total liabilities comprised deposit balances. Private banks had an average of 64 percent, while state-owned banks had an average of 31 percent. This suggests that private banks with a small share in total assets mainly rely on deposits to finance their activities. Moreover, as of July 1, 2023, the average share of demand deposits in the banking system's total deposits was 40 percent. Many large banks saw a decrease in this proportion compared to the same period in 2022.

Figure 25. Share of NPLs in Total Loans; Annual Growth in NPL Ratio and Outstanding Loans

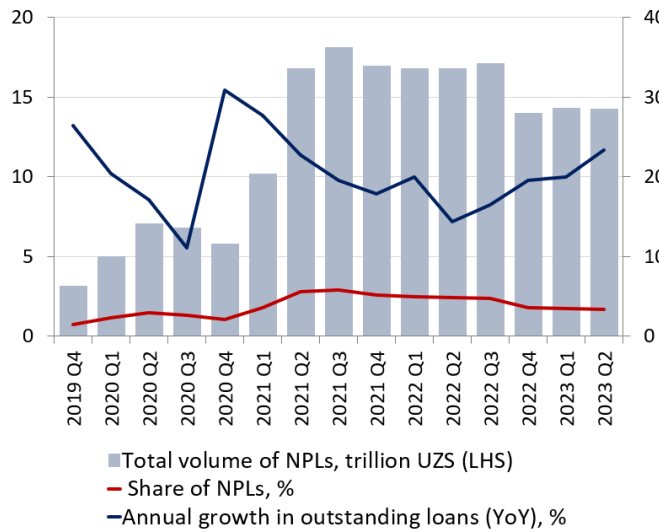
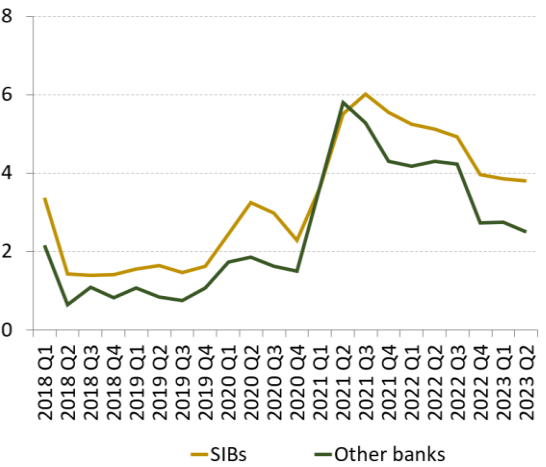


Figure 26. Share of NPLs in Total Loans of SIBs and Other Banks, %



Source: CBU.

During H1 2023, the credit stock's annual growth rate was 23 percent. Despite this, the share of NPLs in the banking system's total loans remained at 3.4 percent as of July 1, 2023. The decline in the share of NPLs in SIBs over the past two years continued and reached 3.8 percent as of July 1, 2023. The higher number of NPLs in SIBs compared to other banks was mainly due to the allocation of directive loans.

In H1 2023, the trend of the NPL coverage ratio continued to increase, meaning that more provisions were created to cover possible losses on NPLs. As of July 1, 2023, the NPL coverage ratio reached 48 percent, which is close to the level before the COVID-19 pandemic, which saw a sharp increase in the share of NPLs. A high NPL coverage ratio means banks are resilient to loan losses and other unexpected losses.

Figure 27. NPLs and Provisions, %

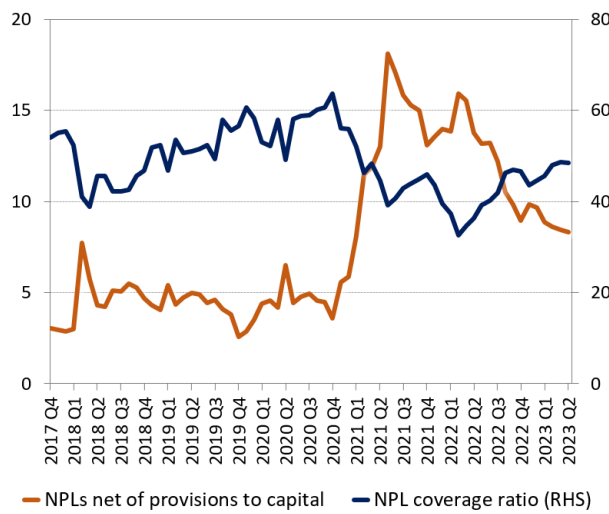
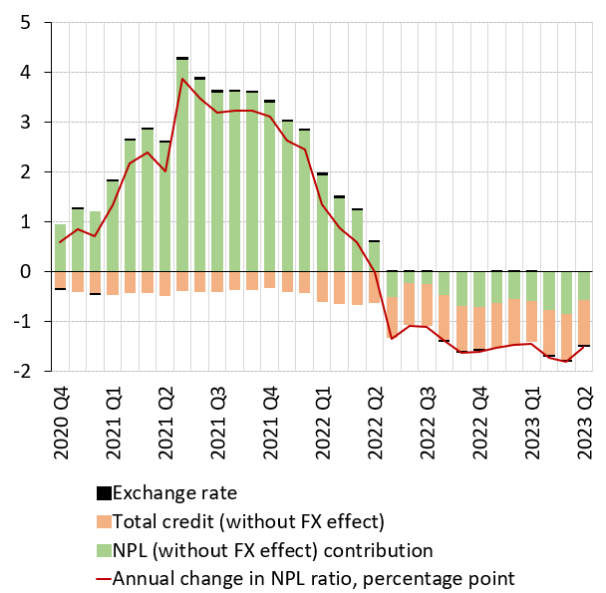


Figure 28. Decomposition of Annual Change in NPL Ratio, %



Source: CBU.

In H1 2023, NPLs net of provisions to capital for the banking system continued to decrease. As of July 1, 2023, the ratio decreased by almost 5 percentage points compared to the same period in 2022 and stood at 8 percent.

NPLs decreased due to a reduction in the volume of NPLs and an increase in the total loans. The exchange rate has remained stable in recent years and has had an insignificant impact on the share of NPLs in total loans.

Figure 29. NPL Ratio in Central Asian and Caucasian Countries*, %

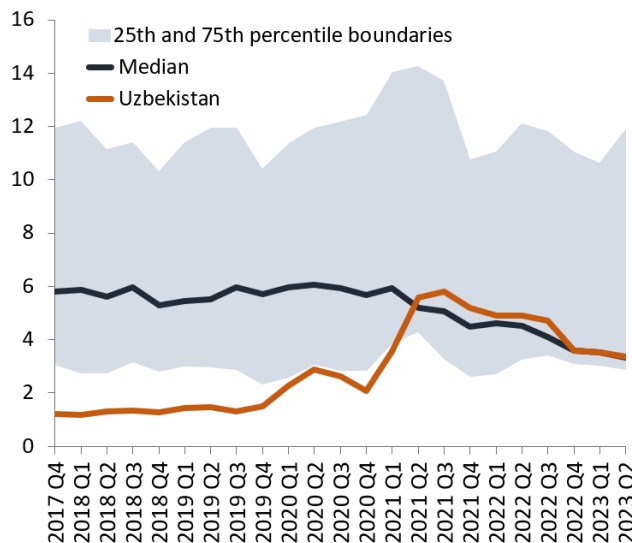
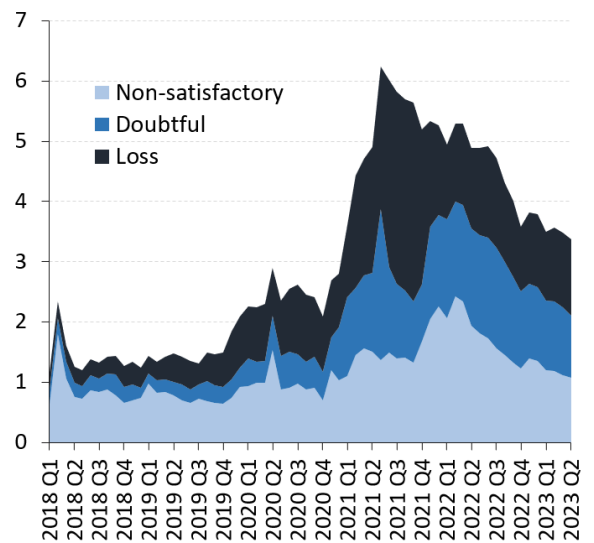


Figure 30. NPL Composition, %



Sources: National authorities, IMF, and CBU.

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

In Uzbekistan, the share of NPLs in total loans has decreased and is approaching the 25th percentile boundary for Central Asian and the Caucasian countries. As of July 1, 2023, the share of NPLs in Uzbekistan was 3.4 percent, the median indicator for this region. Furthermore, by the end of 2022, nominal wage growth was higher than the inflation rate in Central Asian and the Caucasian countries, including Armenia, Georgia, Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan¹⁸. A recovery in economic activity and rising real wages in the region made it easier for borrowers to repay their debts. As a result, there was an improvement in the loan portfolio quality of banks in Central Asian and the Caucasian countries in H1 2023.

The distribution of loans in the NPL composition shows that the shares of loans classified as "non-satisfactory" and "doubtful" are almost equal. Specifically, as of the end of H1 2023, the share of "non-satisfactory" and "doubtful" loans was around 31-32 percent, while "loss" loans accounted for 37 percent of NPLs.

The analysis of the banking system for H1 2023 has shown that Uzbekistan's banking system is financially stable and resilient to external and internal risks.

¹⁸ International Monetary Fund. (2023, May). Regional Economic Outlook: Middle East and Central Asia.

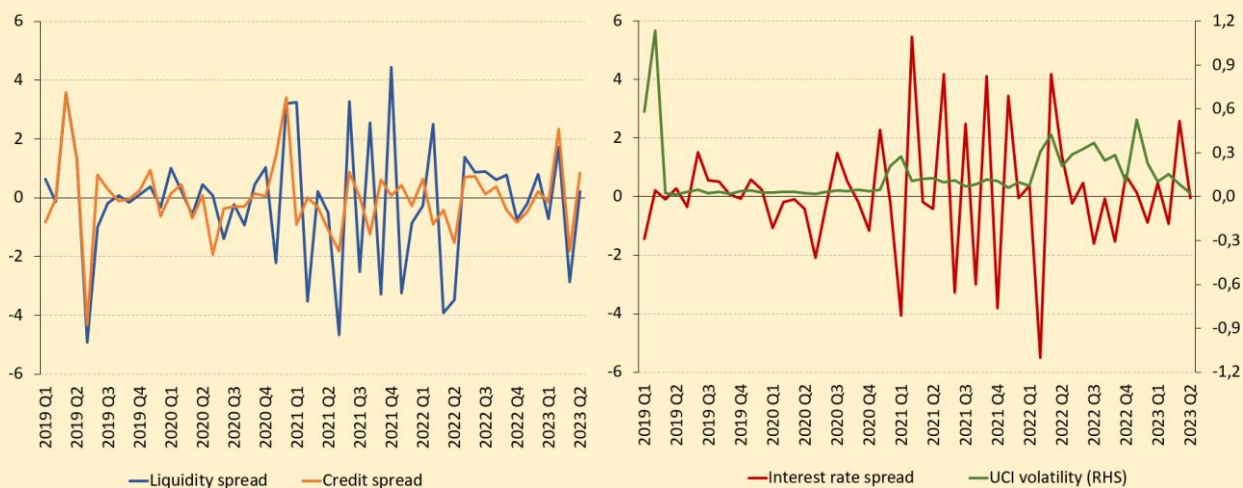
Box 1. Dynamic Δ CoVaR Model for Evaluating Systemic Risks in Banking Sector

During times of financial stress, contagion risk may materialize directly through financial relationships or financial institutions' exposure to the same or similar, interconnected assets. The dynamic Δ CoVaR (conditional value at risk)¹⁹ model can be used to estimate this risk.

CoVaR represents the estimate of the value of one variable corresponding to a specific quantile (5%, 1% quantile levels) in the distribution function, depending on the extreme value of another variable. The dynamic CoVaR model assesses contagion risk by measuring how much the financial system's overall stress level changes when banks experience financial stress. Δ CoVaR, a systemic risk measure, is the difference between the dynamic CoVaR value under normal conditions and during a period of stress (Appendix 3). Dynamic VaR (value at risk) and CoVaR indicators are determined by evaluating the influence of independent variables representing time-varying unexpected risk characteristics in banks using a quantile regression model (Appendix 4).

The difference between the current and lagged values of the banks' net profit before tax was used to determine bank profitability. The profitability of each bank was multiplied by its share of capital in the banking system, and the products were summed to determine the banking system's overall profitability.

Figure 31. Difference between Current and Lagged Values of Indicators, percentage point



Source: CBU staff calculations.

¹⁹ Adrian, T., & Brunnermeier, M. (2014). CoVaR. Federal Reserve Bank of New York.

Figure 32. Bank-by-Bank Δ CoVaR

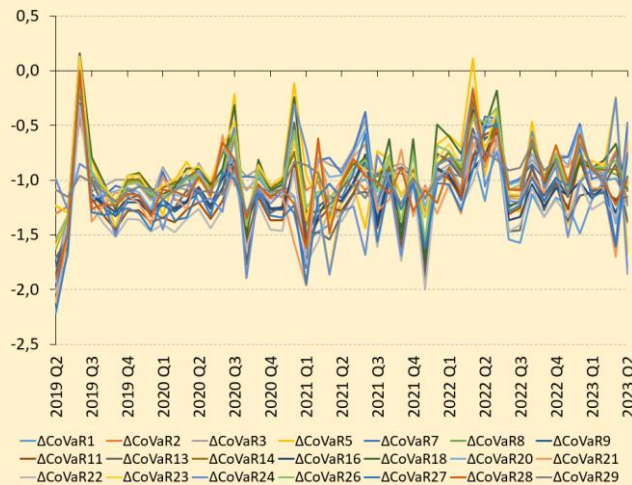
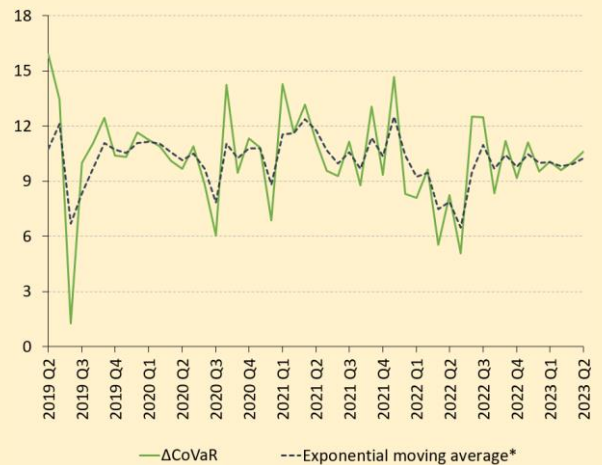


Figure 33. Δ CoVaR for Banking System



Source: CBU staff calculations.

Notes: The increase in Δ CoVaR means that systemic risk in the banking system is building up, while the decrease in Δ CoVaR 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.

Liquidity, interest rate, credit spreads, and stock market index (Uzbekistan Composite Index, UCI)²⁰ volatility indicators were used as variables representing the state of dynamics²¹.

Liquidity spread, the difference between the weighted average short-term interest rate and the one-year treasury bond interest rate, represents the bank's credit policy and the financing ability of market participants. The interest rate spread was estimated by calculating the difference between the weighted average long-term and short-term deposit interest rates.

The credit spread is defined as the difference between the yield on treasury bonds and the interest rates of deposits of commercial banks with maturities of one year. Interest rate spreads and credit spreads reflect interest rate risk and credit risk in the market and significantly affect banks' asset quality and leverage.

In Q1 2022, negative changes in variables representing systemic risk characteristics affected, with a time lag, the banking system's overall risk level. The dynamic CoVaR model's results

²⁰ The volatility of the stock market index is determined by the following formula:

$$rvol_t = \sqrt{\sum_{i=1}^n R_i^2}$$

Where,

$rvol_t$ is the realized variability;

R is the difference between the natural logarithm value of a daily UCI and its lagged value;

i is days;

t is months.

²¹ Bank of Korea. (2022). Financial stability in Uzbekistan. BOK Knowledge Partnership Program.

showed a high ΔCoVaR value. The systemic risk build-up was due to geopolitical tensions, the exchange rates volatility, global inflation, and macroeconomic uncertainties.

From Q2 2022 onwards, ΔCoVaR for the banking system showed a decline despite the continuing high volatility in the capital market. This decline resulted from reduced external risks and improved bank profitability, liquidity, capital adequacy, and asset quality indicators. In H1 2023, ΔCoVaR was around its historical average trend.

2.2. Non-bank Financial Sector

Although the non-bank financial sector²² has grown in recent years, it still makes up a small portion of the overall financial sector. Therefore, its impact on the stability of the financial system is limited. As of April 1, 2023, the assets of the non-banking sector only accounted for 1.6 percent of GDP²³, while the banking sector's assets comprised 61 percent of GDP. As of July 1, 2023, there were 83 microcredit organizations, 84 pawnshops, and 41 insurance companies in Uzbekistan. Non-bank credit organizations²⁴ had assets worth 5.5 trillion UZS, liabilities of 3.8 trillion UZS, and capital of 1.7 trillion UZS.

Figure 34. Annual Growth Rates of Stock of Loans of Non-bank Credit Organizations, %

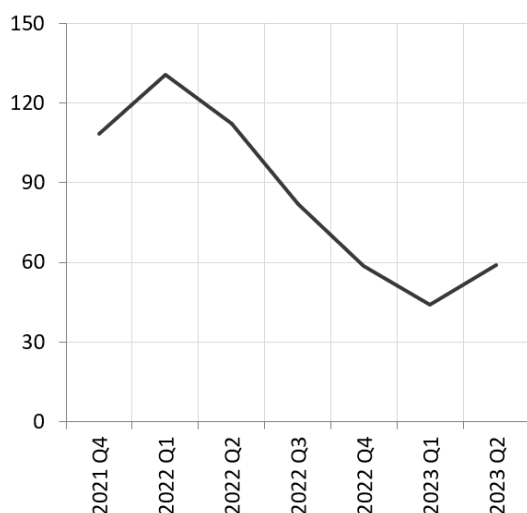
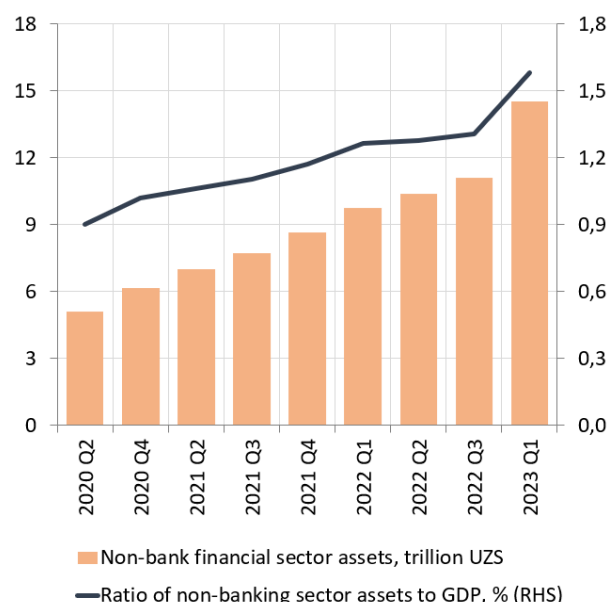


Figure 35. Non-bank Financial Sector Assets, trillion UZS



Sources: CBU, Statistics Agency, Insurance Market Development Agency, and insurance companies.

Non-bank credit organizations rely heavily on bank loans, which make up a large share of their liabilities, as they cannot accept deposits. As of July 1, 2023, the stock of loans issued by non-bank credit organizations increased by 59 percent compared to the same period in 2022.

²² In analyzing the non-banking sector, non-bank credit organizations and insurance companies were considered.

²³ As data on insurance sector assets for H1 2023 is not available, the data for Q1 2023 is used.

²⁴ Non-bank credit organizations include microcredit organizations, pawnshops, and mortgage refinancing organizations.

Figure 36. Investments of Insurance Companies, trillion UZS

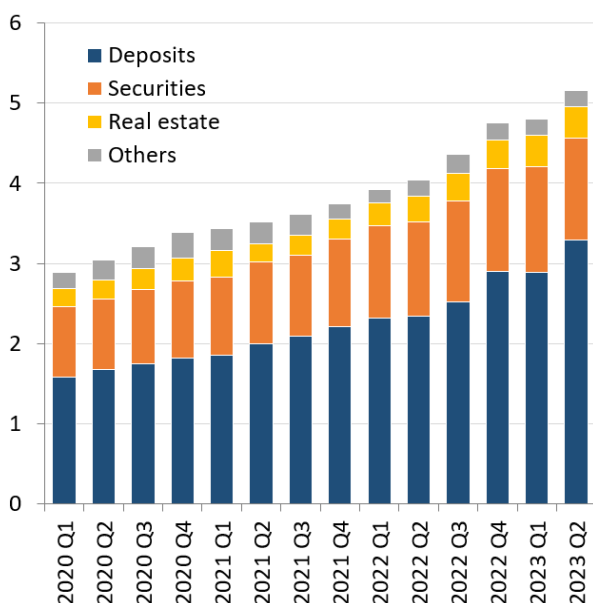
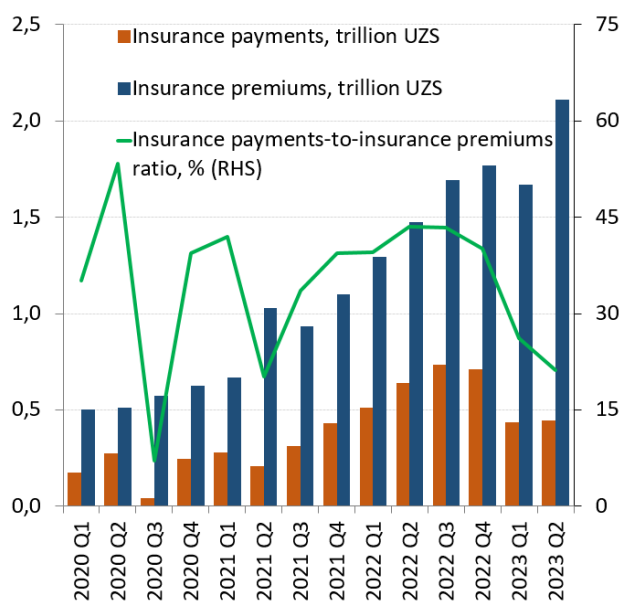


Figure 37. Quarterly Insurance Payments and Premiums



Source: Insurance Market Development Agency.

By the end of H1 2023, insurance organizations had collected a total of 3.8 trillion UZS in insurance premiums²⁵, which is 1 trillion UZS more than a year before. Out of this amount, 1.2 trillion UZS came from reinsurance payments²⁶. On the other hand, insurance payments²⁷ decreased by 270 billion UZS compared to the end of H1 2022, reaching 883 billion UZS. The largest insurance payments corresponded to loan insurance (319 billion UZS) and compulsory insurance of civil liability of vehicle owners (71 billion UZS).

Long-term liabilities and high liquidity of assets make the insurance sector of Uzbekistan an important player in the market of long-term resources. Insurance companies mainly invest by placing deposits, accounting for 63 percent of total investments as of July 1, 2023, while 24 percent of the investment portfolio comprises securities. The high level of deposits in the asset composition suggests that insurance companies direct their resources toward relatively safe and profitable investments.

However, a sudden fluctuation in interest rates could negatively impact the investment activities of insurance companies. Insurance companies with lower profitability, the significant asset-liability mismatch, relatively low capitalization levels, and higher vulnerability to various shocks are forced to take more risks when interest rates fall. This, in turn, worsens the solvency of companies based on the domino effect in the

²⁵ An insurance premium is the amount a policyholder pays an insurer according to the terms specified in the insurance contract and can be paid in national or foreign currency.

²⁶ Reinsurance is insurance by a reinsurer of all or part of the risk of insurance compensation under the insurance contract of another insurer.

²⁷ 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.

insurance market²⁸. An insurance company's size and degree of interconnectedness with other institutions in the financial infrastructure determine the extent of systemic risks related to liquidity and leverage indicators. Moreover, due to the similarity in asset composition of most insurance companies, they are susceptible to common shocks²⁹ known as the tsunami effect.

The high volume of insurance premiums in Uzbekistan compared to insurance payments indicates that the profitability of insurance companies remains high.

Figure 38. Insurance Penetration and Density in Uzbekistan

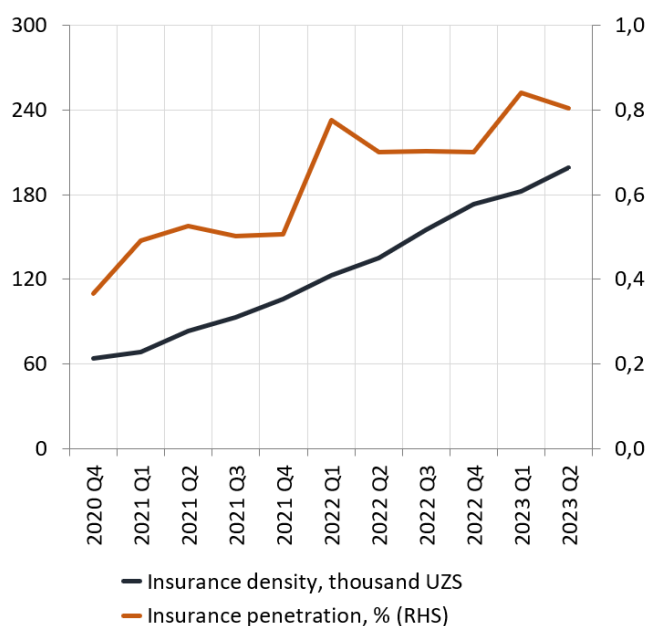
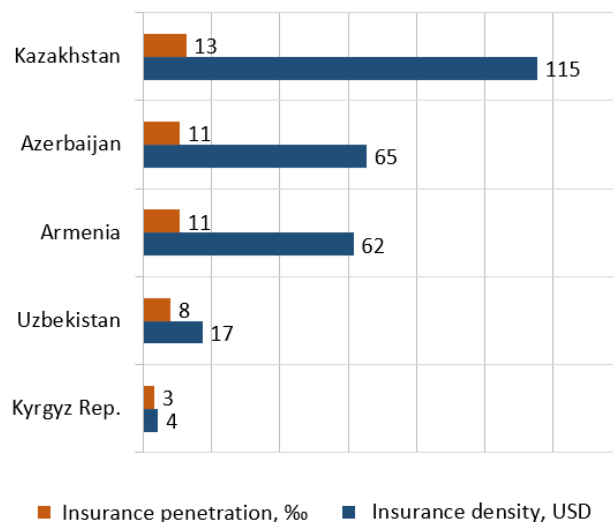


Figure 39. Insurance Penetration and Density in Selected Countries (As of July 1, 2023)



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

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

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

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

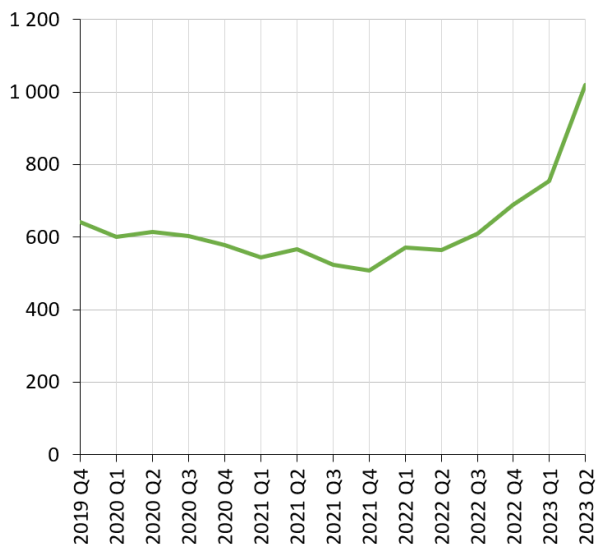
Insurance density in Uzbekistan has risen in recent years. As of July 1, 2023, it had reached 17 USD. However, insurance penetration in Uzbekistan was less than 1 percent as of the same date. This suggests that insurance services are not very popular in Uzbekistan, although the significance of the insurance sector in the country's economic development is gradually increasing. Globally, this indicator was at 6.6

²⁸ The domino effect occurs when a stressful situation in a large insurance company spills over to others in succession.

²⁹ International Monetary Fund. (2016, April). Global Financial Stability Report.

percent by the end of 2022³⁰. As of July 1, 2023, insurance density and penetration in Uzbekistan were relatively low compared to some countries in Central Asia and the Caucasus.

Figure 40. Insurance Premiums Concentration, HHI³¹



Sources: Insurance Market Development Agency, Statistics Agency, and CBU staff calculations.

Concentration of general insurance premiums is increasing steadily. By the end of H1 2023, the HHI reached 1020, indicating a shift from low to medium concentration. This suggests that insurance services are becoming more closely associated with a few companies. In the event of negative shocks, high concentration of insurance premiums among a few insurance companies may pose a risk to the financial system if they cannot cover the relevant payments. However, Uzbekistan's low insurance density and penetration reduce the likelihood of this risk spilling over to the rest of the financial system.

In general, the low share held by the non-banking sector in the financial sector, implies that it is unlikely to be a source of systemic risk.

³⁰ Allianz Research. (2023, May). Allianz Global Insurance Report: 2023. Anchor in turbulent times.

³¹ The HHI categorizes industries into low concentration (HHI below 1000), medium concentration (HHI between 1000 and 1800), and high concentration (HHI above 1800).

2.3. Capital Market

During H1 2023, the Morgan Stanley Capital International (MSCI) indices, which represent changes in the global stock market, showed an upward trend. Global bond yields fell, equity markets recovered, and international stock prices rose as market expectations for interest rates changed³². Lower risk expectations by investors and the rebound of the technology sector also helped stabilize the stock market. As a result, while the MSCI index for EMs was stable, the indices for AEs and the world increased.

The stock market in Uzbekistan is underdeveloped, which means that the stock prices are less sensitive to external and internal fundamental factors. This also suggests that changes in the UCI of the Republican Stock Exchange may not fully reflect the situation in the capital market. However, in recent years, the correlation between changes in the global stock market and the UCI has increased.

Figure 41. MSCI Indices*, USD

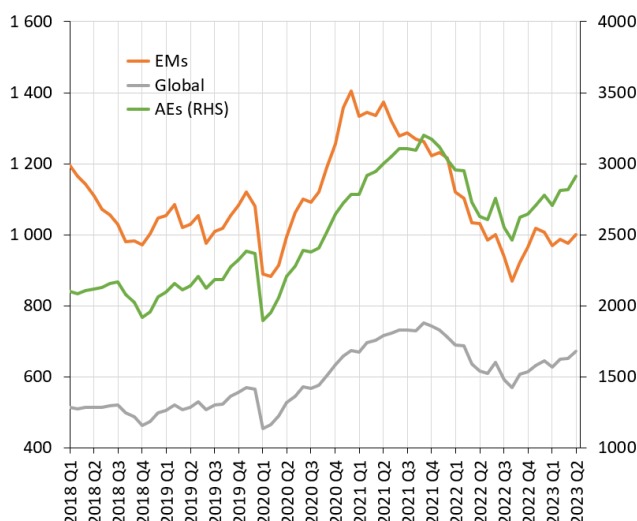
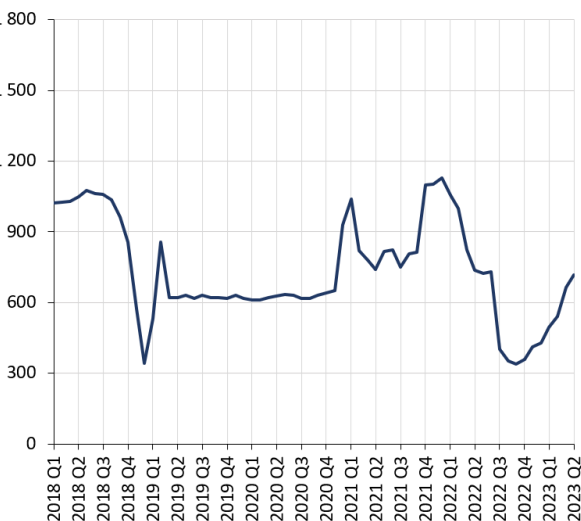


Figure 42. Uzbekistan Composite Index**



Sources: Bloomberg and Republican Stock Exchange.

Notes: *MSCI indices 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.

**The UCI³³ is a stock market index that represents the overall performance of listed stock issuers on the Republican Stock Exchange. As of July 1, 2023, there were 108 listed stock issuers on the exchange, out of which 17 were banks.

³² International Monetary Fund. (2023, April). Global Financial Stability Report.

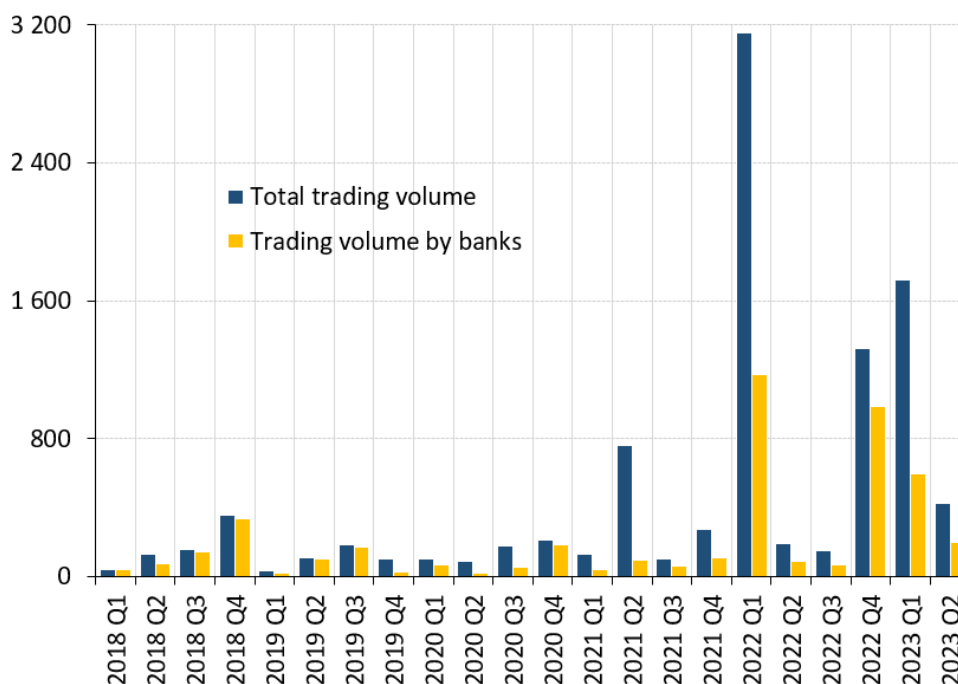
³³ The UCI is determined by the following formula:

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

During 2022, there were sudden changes in the stock prices of certain companies that directly affected the overall capitalization³⁴ of the stock market. Furthermore, the delisting of certain issuers' securities, as a result of failing to comply with the stock exchange's listing criteria, contributed to a downturn in the UCI over the same timeframe. The decline in the security prices of many highly liquid companies significantly impacted the index value.

During H1 2023, the total market capitalization increased significantly as a result of a rise in stock prices and the number of issuers. In particular, the prices of the most traded securities, particularly of banks and insurance companies, saw a significant increase. This led to a total market capitalization of 149.3 trillion UZS as of July 1, 2023, which is an 80 percent increase compared to the same period in 2022³⁵. Consequently, there was a positive change in the UCI during H1 2023. A listing of state-owned enterprises on the stock exchange increases the total market capitalization and may lead to a further strengthening of the UCI.

Figure 43. Trading Volume of Republican Stock Exchange, billion UZS



Source: Republican Stock Exchange.

Where,

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

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

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

³⁴ The total capitalization of the Republican Stock Exchange is determined by multiplying the number of securities and their closing prices on the trading day. If the index value decreases, it means there has been a decrease in the stock prices of the issuers included in the quotation list, resulting in a decrease in the overall market capitalization.

³⁵ Respublika fond birjasi. (2023). Statistik ma'lumotlar.

Over the past few years, the stock exchange has been more active, which has led to an increase in the total trading volume. During H1 2023, deals worth almost 2.1 trillion UZS were signed in stock market trading, of which 38 percent were of banks³⁶. To comply with the CBU's requirement of increasing the minimum bank capital from 100 to 500 billion UZS³⁷ between September 1, 2023, and January 1, 2025, banks have started issuing additional stocks to raise capital. This move may further increase the share of banks in stock market trading.

Figure 44. Yield on Treasury Bonds and CBU Policy Rate, %

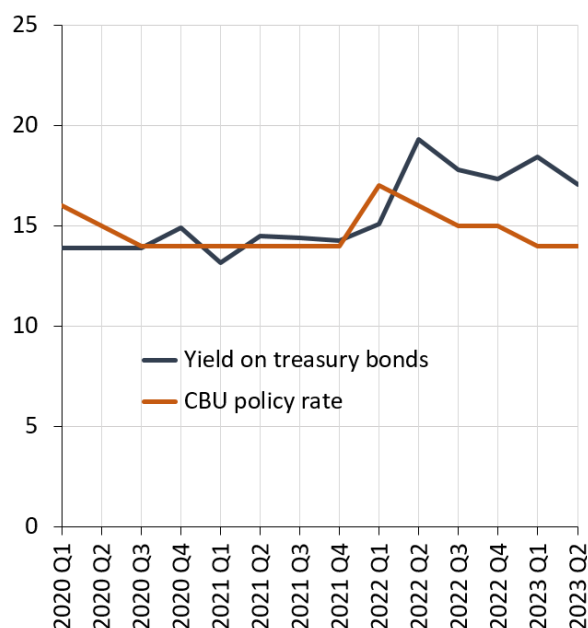
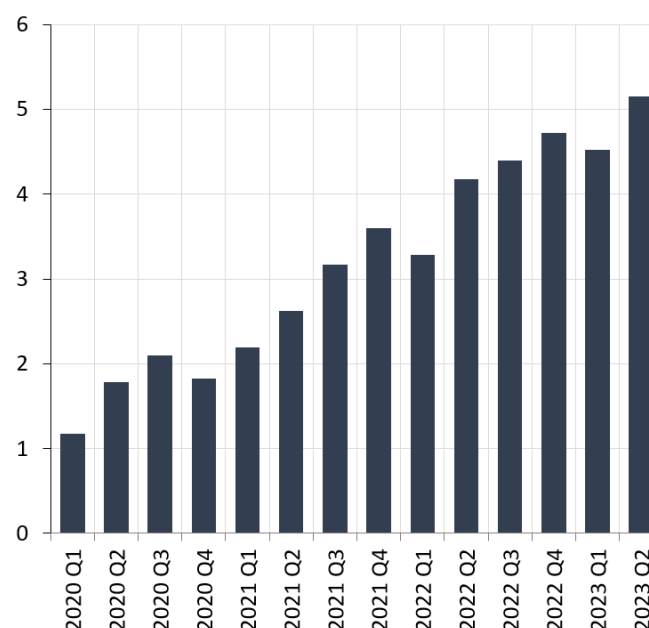


Figure 45. Share of Securities in Bank Assets, %



Sources: Uzbek Republican Currency Exchange and CBU staff calculations.

The CBU policy rate and the yield on treasury bonds are positively correlated. A sudden increase in the policy rate may adversely affect banks with a high share of fixed-rate bonds in their assets³⁸. As of July 1, 2023, the share of securities portfolio in the assets of banks was just about 5 percent. This implies the negligible impact of price fluctuations in the stock market on the banks' financial stability.

³⁶ Respublika fond birjasi. Savdo statistikasi.

³⁷ O'zbekiston Respublikasi "Banklar va bank faoliyati to'g'risida"gi O'zbekiston Respublikasi qonuniga o'zgartirishlar kiritish haqida"gi O'RQ-831-sonli qonuni, 2023 yil 19 aprel.

³⁸ When banks offer more attractive deposits after the policy rate hike, it causes a decrease in demand for bonds. Bonds usually have fixed interest rates and are long-term investments. As a result, changes in supply and demand in the capital market lead to a drop in bond prices.

Figure 46. Yield on Uzbekistan Foreign Currency Sovereign Eurobonds, %

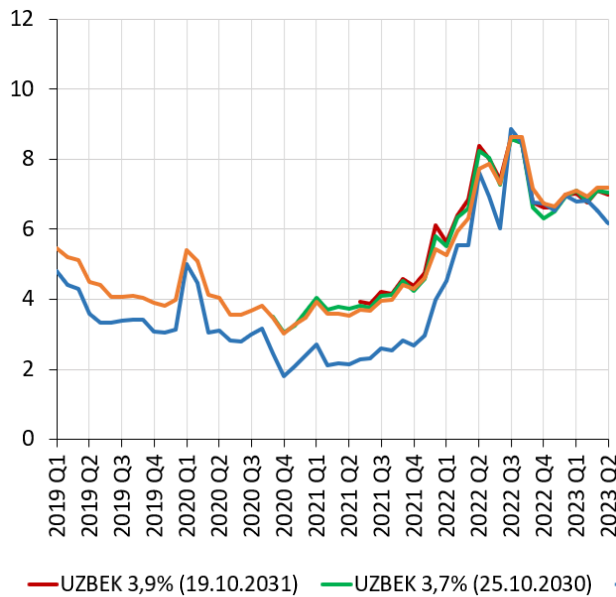
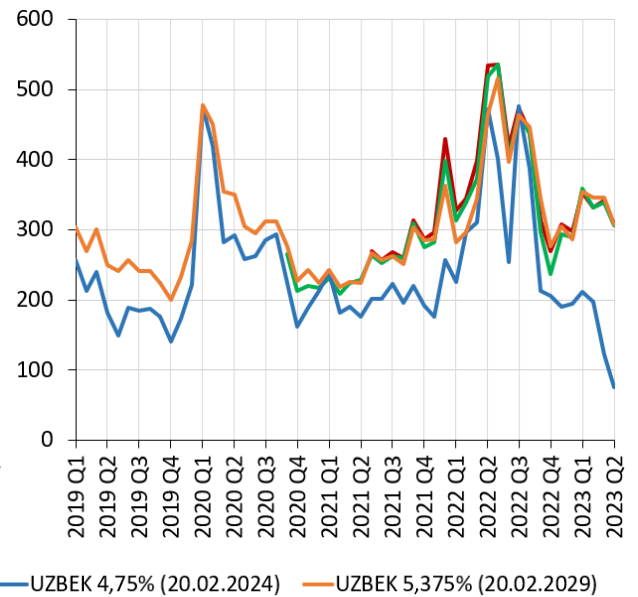


Figure 47. G-spread* of Uzbekistan Foreign Currency Sovereign Eurobonds, basis points



Source: Bloomberg.

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

Amid the increased risk expectations of investors, Uzbekistan's foreign currency sovereign eurobond prices have significantly declined since 2021. As a result, the yield on these bonds has increased. Despite the significant drop from their historic peak in 2022, eurobond yields were still above 6 percent as of July 1, 2023. The yields on sovereign eurobonds maturing in 2029, 2030, and 2031 were around 7 percent on the same date, maintaining an average spread of over 300 basis points over benchmark sovereign eurobonds. Furthermore, the yield on the 500 million USD eurobond maturing in 2024 was 6.2 percent. This has narrowed the spread to 75.4 basis points for the first time. International investors assess the long-term risk level of Uzbekistan's sovereign eurobonds higher than the short-term risk level. This suggests that investors may overestimate long-term risks.

III. Non-financial Sector

3.1. Corporate Sector

A deterioration in companies' financial and macroeconomic conditions can severely affect the banking system. Specifically, an increase in firm default cases, a rise in NPLs, and vulnerabilities in foreign currency loans may become sources of systemic risk.

Figure 48. Total Liabilities-to-Capital Ratio of Selected 60 Large Companies

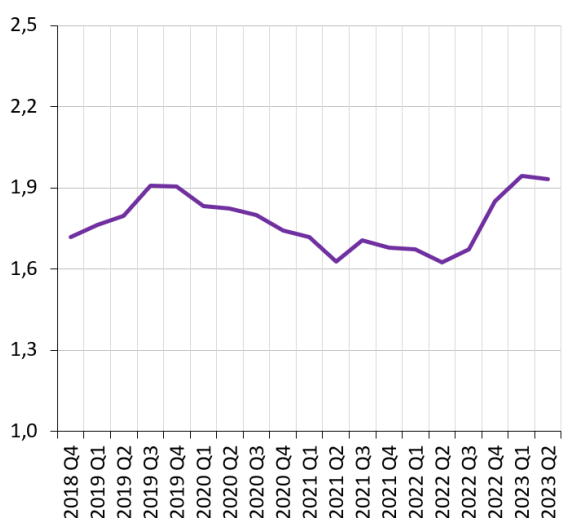


Figure 49. Discontinued and Non-operating Companies in Uzbekistan*, thousand



Sources: Statistics Agency, 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 60 large joint-stock companies (see Appendix 5).

*Discontinued companies are businesses whose operations have been terminated either by the founders' voluntary decision or by a commercial court ruling, as well as entities removed from the state register due to inactivity for three years. Non-operating companies are commercial entities that have not received funds from their financial and economic activities in their bank accounts or have not submitted tax reports for 9 months.

During H1 2023, the liabilities-to-capital ratio for selected large companies increased, indicating an increase in leverage in the corporate sector. This means that adverse shocks may make it difficult for companies to fulfill their all liabilities, including loan repayment.

The number of non-operating companies has increased since 2018, reaching 35,000 as of January 1, 2023.

In Uzbekistan, banks play a significant role in financing business activities due to the shallow and relatively underdeveloped capital market. In recent years, the share of corporate loans in total bank loans has decreased, but it remains high. As of July 1,

2023, corporate loans accounted for 71 percent of the total bank loans. By the end of H1 2023, the stock of corporate loans approached 300 trillion UZS, with about two-thirds of the loans provided in foreign currency. During H1 2023, the stock of corporate loans increased by 14 percent compared to H1 2022. However, the high demand for foreign currency loans by companies and the high dollarization of current loans amplifies the exchange rate risk for borrowers.

Figure 50. Corporate Loan Stocks by Currency Types and Annual Growth Rate

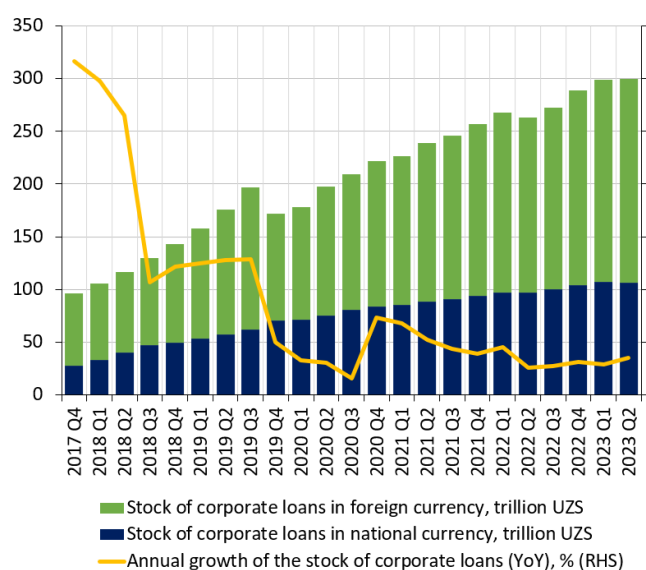
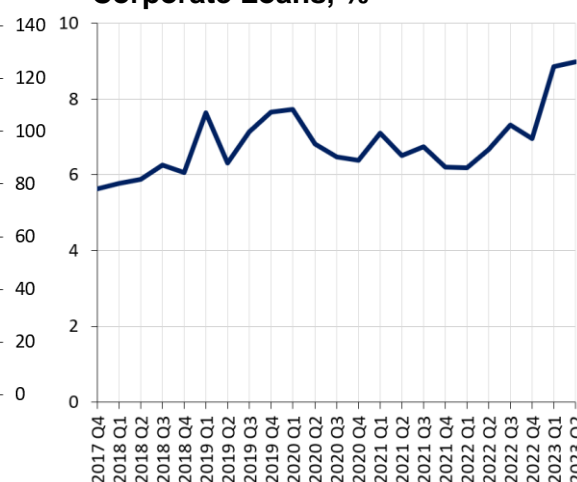


Figure 51. Weighted Average Interest Rate on Foreign Currency Corporate Loans, %



Source: CBU.

From the beginning of 2023, there was a significant rise in the interest rates on foreign currency loans issued to legal entities. In H1 2023, the average annual interest rates on foreign currency loans increased by 2.5 percentage points compared to H1 2022, up to 8.9 percent. As a result, this increase may lead to higher debt servicing costs for companies. The interest rates rose due to the tightening of global financial conditions, which led to higher external funding costs for banks.

Figure 52. Corporate Loan Stocks-to-Annual GDP by Sector, %

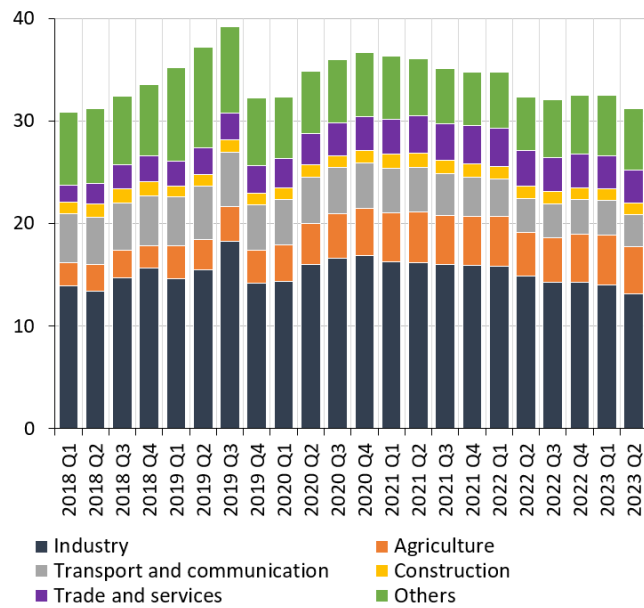
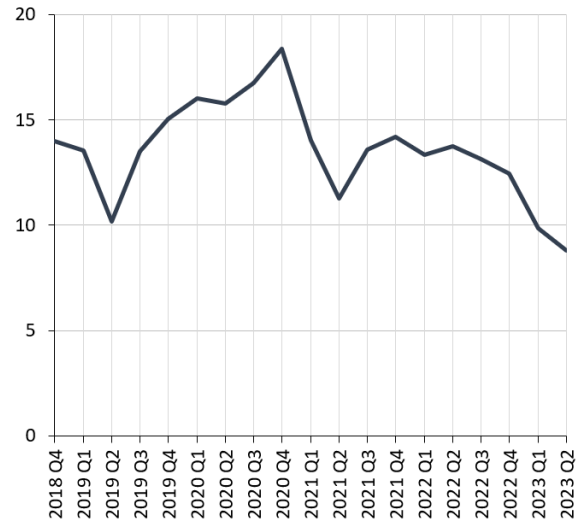


Figure 53. Interest Coverage Ratio for Selected 50 Large Companies



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

Note: The interest coverage ratio is calculated using an exponential moving average³⁹ based on the data from the 50 largest joint-stock companies (see Appendix 6). This ratio measures the number of times a company's net profit before tax can cover its debt interest costs. If the ratio is less than 1, 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.

As of the end of H1 2023, the industrial sector held the biggest share (13 percent of GDP) in the banks' corporate loans portfolio, indicating that most corporate loans were concentrated in this sector. The second biggest share (5 percent of GDP) was held by corporate loans to agriculture.

Since the start of 2023, there was a decline in the interest coverage ratio, which suggests that businesses' capability to repay debts slightly decreased. By the end of H1 2023, the interest coverage ratio dropped to around 8 percent.

³⁹ The exponential moving average is a technique used to smooth out the value of an indicator by reducing random and short-term fluctuations.

Figure 54. Absolute⁴⁰ and Current Liquidity⁴¹ Ratios for Selected Large Companies

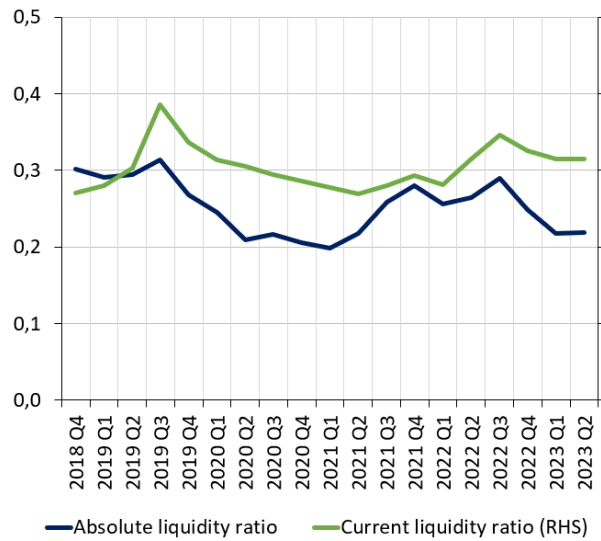
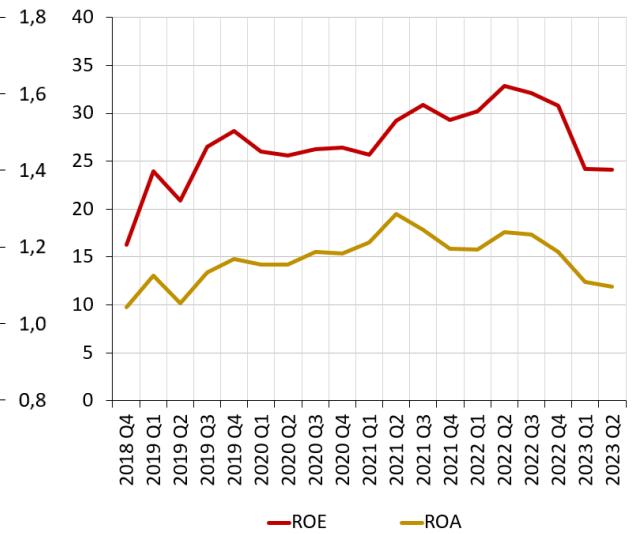


Figure 55. ROE and ROA for Selected 60 Large Companies, %



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

Note: ROE and ROA are determined based on the data from 60 large joint-stock companies (see Appendix 5).

In H1 2023, both ROE and ROA decreased due to losses incurred by companies in the energy and chemical sectors. Over this period, the absolute liquidity ratio ranged from 0.2 to 0.3, indicating that the funds available to companies could partially cover their current liabilities. Moreover, the current liquidity ratio consistently remained above 1, meaning companies could meet their obligations.

⁴⁰ The absolute liquidity ratio indicates the amount of cash and short-term investments covering current liabilities. This ratio is calculated by dividing the company's most liquid funds by current liabilities.

⁴¹ The current liquidity ratio is determined by dividing current assets by current liabilities. A ratio of more than 1 indicates a stable financial condition of a company.

3.2. Household Sector

The household sector is pivotal in sustaining financial stability, with the population's debt burden and associated metrics being key determinants. In H1 2023, there was a marked uptick in retail lending in Uzbekistan, signaling an escalation in the population's debt obligations. Should there be a downturn in personal income or a depreciation in asset values, such as real estate or vehicles, individuals may encounter challenges in fulfilling their loan obligations. This situation could precipitate an increase in NPLs, ultimately leading to losses in bank loans.

The DSR⁴² indicates that the overall debt burden for bank loans of individuals is relatively low but has been increasing lately. In H1 2023, the average DSR for the population's all loans was 9 percent, which is a 2 percentage point rise compared to H1 2022. Different from the DSRs for mortgages and car loans, the aggregate DSR for all loans of individuals is relatively low, as it includes many smaller loans. Mortgage and car loan borrowers spend 50–70 percent of their disposable income to pay off their debt obligations.

Figure 56. DSR for All Loans of Individuals, %

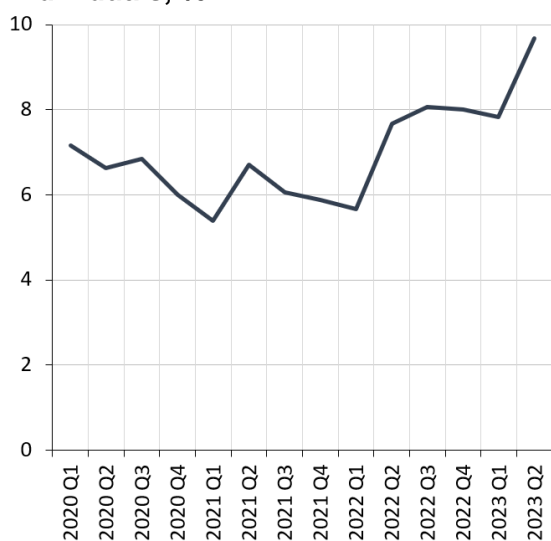
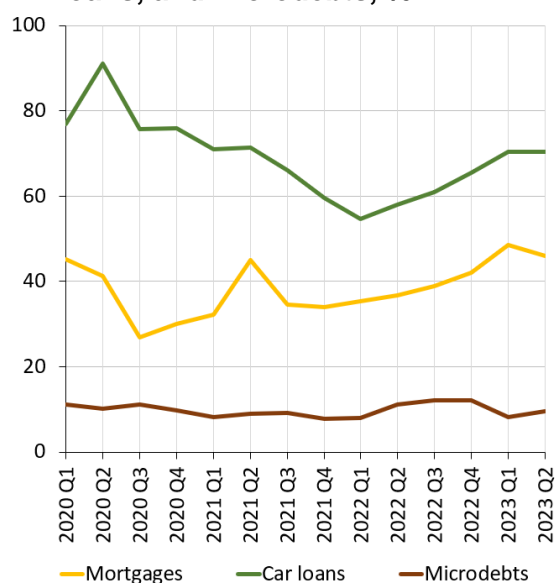


Figure 57. DSR for Mortgages, Car Loans, and Microdebts, %



Source: CBU staff calculations.

By the end of H1 2023, the DSR for microdebts of individuals decreased by almost 2 percentage points compared to H1 2022 and amounted to 10 percent. The marginal change in the DSR for microdebts was driven by a higher increase in the average quarterly income per microdebt borrower (22 percent) compared to an increase in the average microdebt volume per borrower (14 percent).

In H1 2023, the DSR for mortgage loans of individuals was 46 percent, an increase of 9.3 percentage points compared to H1 2022. This increase was due to two factors: an

⁴² The DSR methodology is given in the CBU's Debt Service Ratio Analysis for Individuals.

increase in the average loan volume per borrower by 47 percent and an increase in the average weighted annual interest rates by 1 percentage point. By the end of H1 2023, the DSR for car loans increased by 13 percentage points compared to the corresponding period of 2022 due to the increase in the average loan volume per borrower by 69 percent. The observed trend in the DSR for mortgages and car loans indicates that debtors' income is increasingly allocated to repay principal and interest payments.

In H1 2023, mortgage loans with a loan-to-value (LTV) ratio ranging from 51 to 75 percent accounted for the majority of the mortgage loan portfolio. Around half of these loans had relatively low LTV ratios in the 0–75 percent range. The weighted average LTV of mortgages issued during this period remained almost the same at roughly 75 percent compared to H1 2022.

Figure 58. LTV Distribution of Mortgage Loans

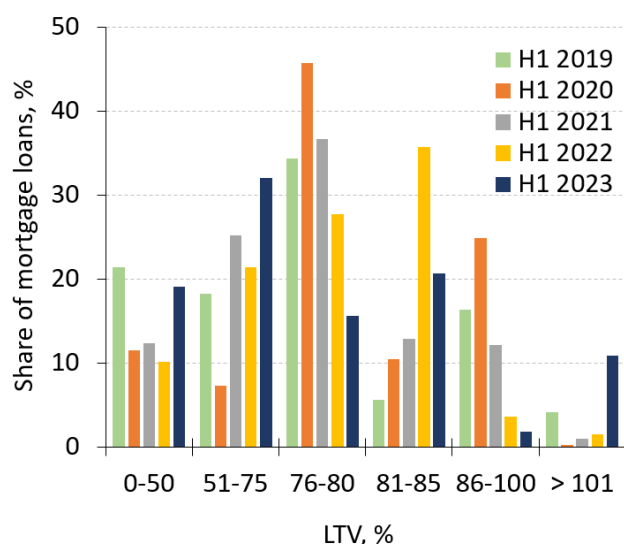
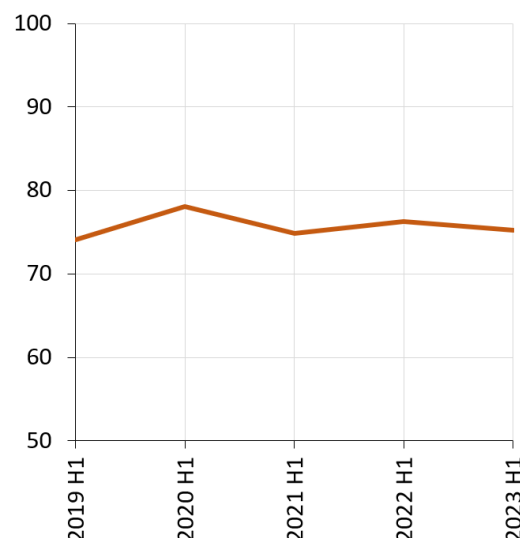


Figure 59. Weighted Average LTV of Mortgage Loans, %



Source: CBU staff calculations.

In an effort to safeguard the banking system against the adverse effects of a potential steep drop in housing prices, the maximum mortgage loan limit for borrowers in 2022 was established at 416.5 million UZS for Tashkent city and 327.3 million UZS for other regions⁴³. Maintaining these limits through the end of 2023⁴⁴ may lead to a reduction in the LTV ratio.

⁴³ O'zbekiston Respublikasi Prezidentining 2021 yil 9 dekabrda "Bozor tamoyillariga asoslangan ipoteka kreditlari orqali aholini uy-joy bilan ta'minlashga oid qo'shimcha chora-tadbirlar to'g'risida"gi PF-33–sonli Farmoni.

⁴⁴ O'zbekiston Respublikasi Prezidentining 2023 yil 14 aprelda "2023 yilda bozor tamoyillariga asoslangan ipoteka kreditlari orqali aholini uy-joy bilan ta'minlash dasturini amalga oshirish chora-tadbirlari to'g'risida"gi PF-51–sonli Farmoni.

Figure 60. LTV Distribution of Car Loans

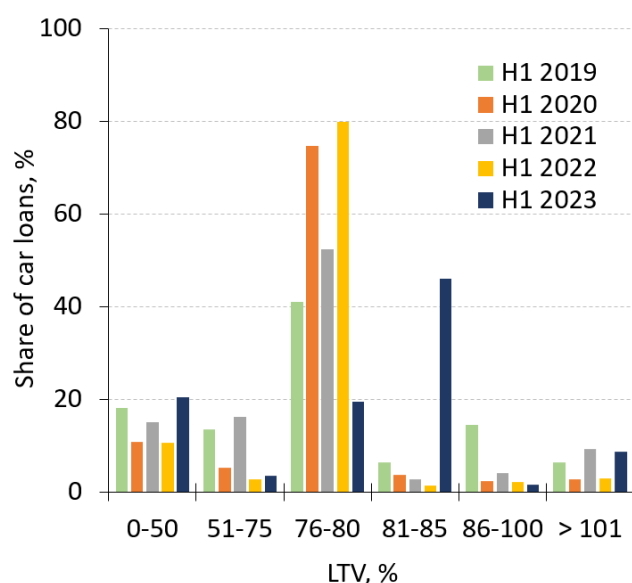
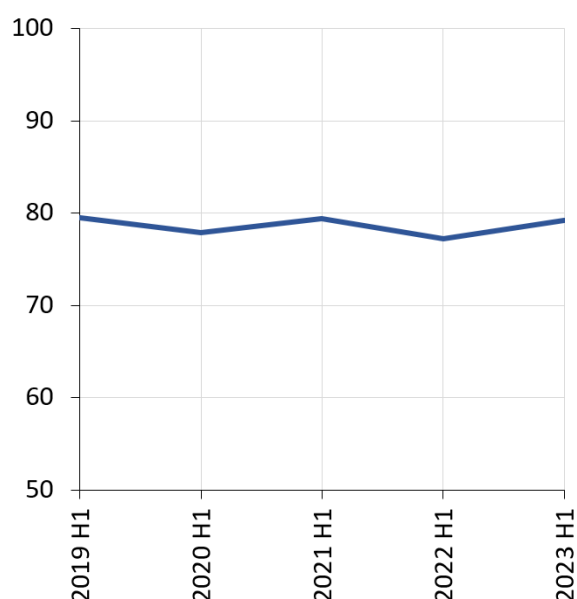


Figure 61. Weighted Average LTV of Car Loans, %



Source: CBU staff calculations.

In H1 2023, there was a notable surge in the share of car loans with a LTV ratio in the 81–85 percent range. This trend suggests an escalation in the credit risk associated with car loans for banks. Specifically, car loans with an LTV ratio exceeding 81 percent constituted 57 percent of the total car loans during this period, marking a substantial 50 percentage point increase from H1 2022. Such a shift indicates potential vulnerabilities, as decreases in car values or unexpected reductions in borrowers' incomes could lead to a deterioration in loan repayment behaviors and significant losses in bank portfolios. Additionally, the average LTV ratio of car loans issued in H1 2023 was 79 percent, reflecting a 2 percentage point rise from H1 2022.

The loans of individuals-to-GDP gap can help identify the build-up of vulnerabilities in the retail lending sector⁴⁵. A positive widening of this gap compared to its long-term trend⁴⁶ indicates an increase in potential risks. In H1 2023, the loans of individuals-to-GDP gap showed a positive expansion. The loans issued to individuals reached almost 30 percent of the total stock of loans. During this period, the stock of loans given to individuals grew by 54 percent annually, whereas the nominal GDP grew by 19 percent. These trends suggest that while an unsatisfied demand for loans is normal, the population's debt burden is significantly increasing. This can make them more vulnerable to income and other adverse shocks.

⁴⁵ Aldasoro, I., Borio, C., & Drehmann, M. (2018, March). Early warning indicators of banking crises: expanding the family. BIS Quarterly Review.

⁴⁶ 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.

Figure 62. Loans of Individuals-to-GDP Gap, percentage point

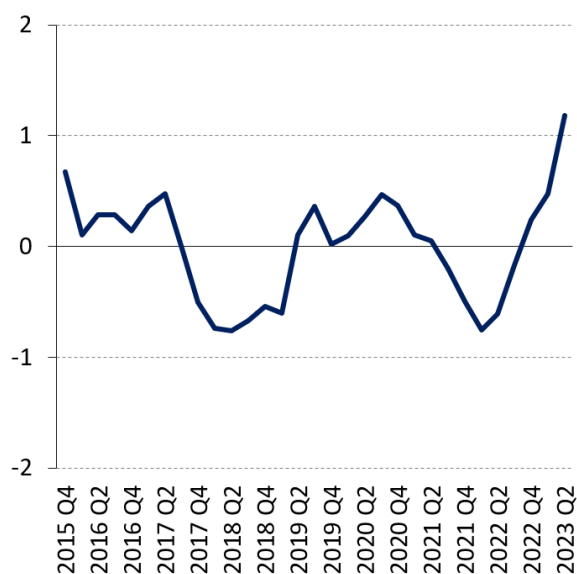
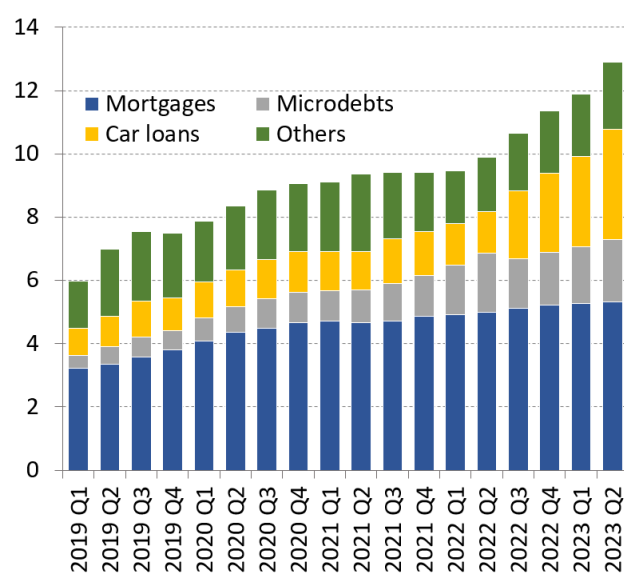


Figure 63. Loans of Individuals by Types, % of GDP



Source: CBU staff calculations.

The stock of mortgage loans of individuals-to-GDP was 5.3 percent in H1 2023.

In the past few years, the volume of car loans has increased significantly. In H1 2023, car loans totaling 18.5 trillion UZS were issued⁴⁷. As of July 1, 2023, the ratio of the outstanding car loans to GDP was 3.5 percent. The surge in car loans could be attributed to the population’s high demand for cars and the favorable loan terms offered by banks. Banks might have also increased their focus on issuing car loans ahead of the CBU’s regulation with stricter risk weights for car loans⁴⁸.

⁴⁷ O‘zbekiston Respublikasi Markaziy banki. (2023). 2023 yil I yarim yillik Statistik byulleten.

⁴⁸ 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 64. Annual Growth (YoY) of Outstanding Loans of Individuals, %

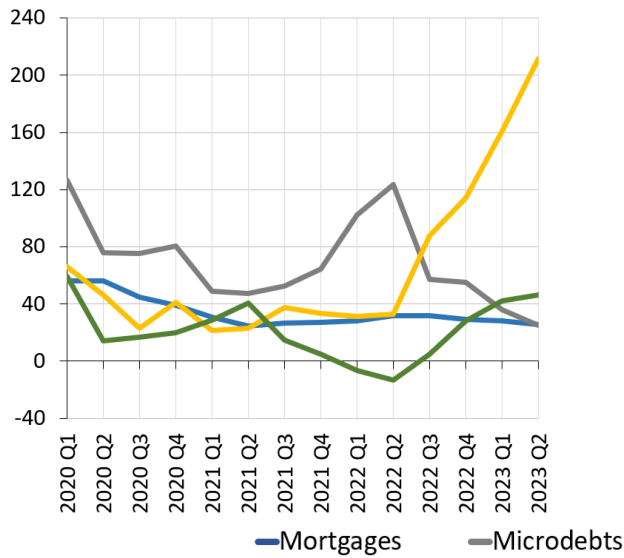
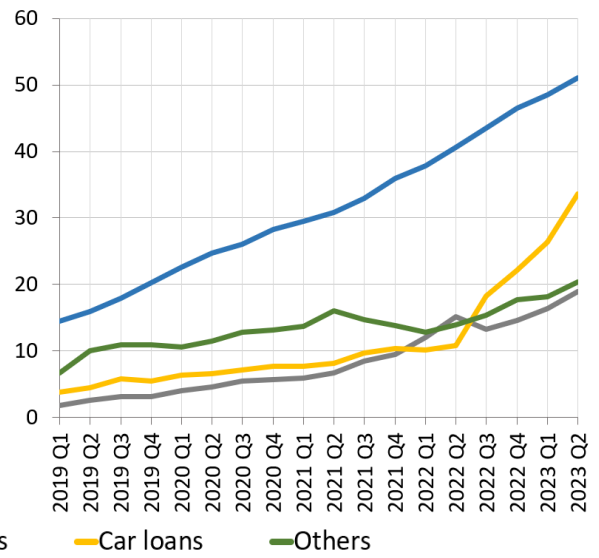


Figure 65. Outstanding Loans of Individuals, trillion UZS



Source: CBU staff calculations.

As of July 1, 2023, the annual growth rate of the outstanding car loans of individuals was higher than that of mortgages, microloans, and other loans. Specifically, as of July 1, 2023, the outstanding car loans increased by 212 percent annually compared to the same period of 2022. This may intensify concentration risk in the bank loan portfolio, increasing credit risk.

Since the beginning of 2021, the unemployment rate has decreased on the back of the recovery of economic activity. Nominal wages have increased, and by July 1, 2023, their growth surpassed 22 percent.

Figure 66. Bank Borrowers and Borrowers per 1,000 Individuals*

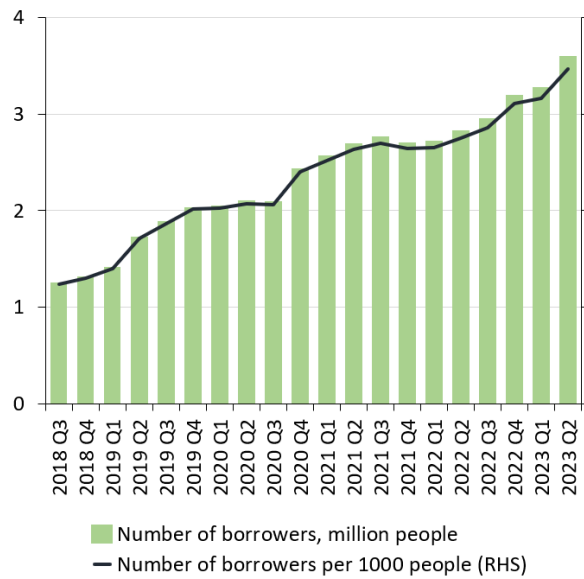
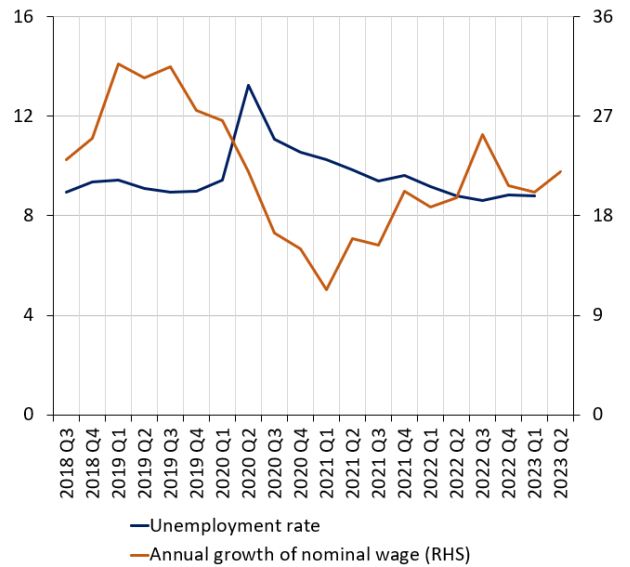


Figure 67. Unemployment Rate and Annual Growth of Nominal Wages (YoY), %



Sources: Statistics Agency and CBU staff calculations.

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

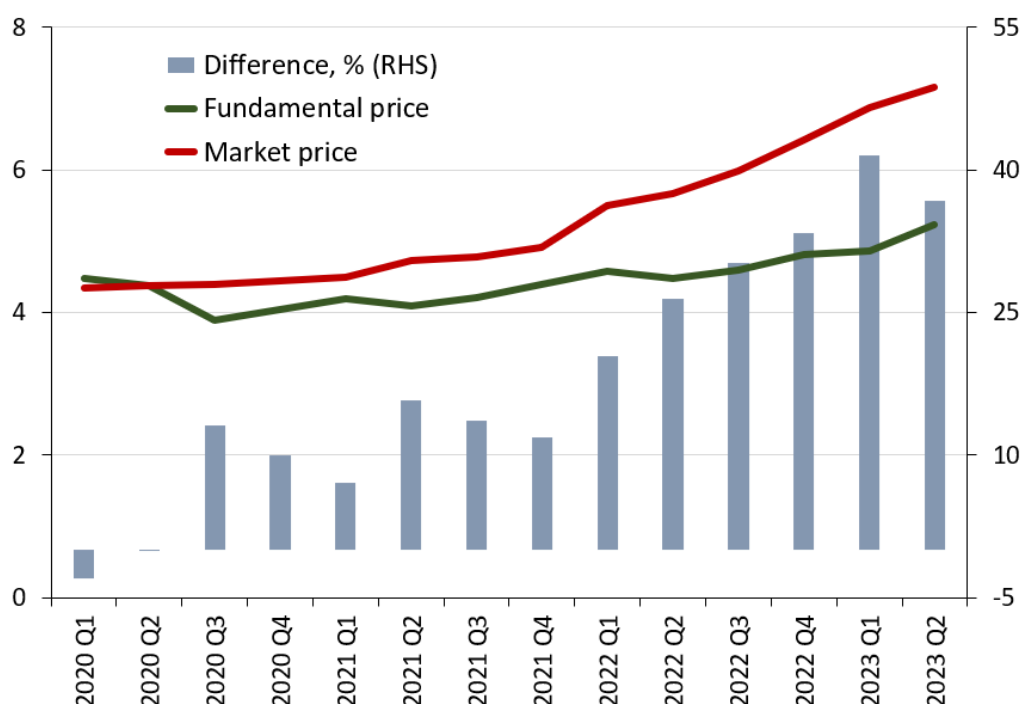
In H1 2023, there was an increase in the number of borrowers. As of July 1, 2023, the total number of borrowers reached 3.6 million people, which is 28 percent higher than a year before, an increase of 800,000. This period also witnessed a noticeable uptick in the number of borrowers per 1,000 working-age residents, reaching 173 borrowers. Such an increase underscores a growing inclination among people to take on credit. Nonetheless, this trend carries the potential for repercussions, particularly in the wake of economic disturbances. Borrowers encountering difficulties in fulfilling their repayment obligations could cause a decline in the quality of bank assets.

IV. Asset Markets

4.1. Real Estate Market

Due to an imbalance between the demand and supply of housing in the real estate market, the housing market price was overvalued by an average of 36 percent from the fundamental price⁴⁹ in H1 2023. In recent years, demand for housing has surged, stimulated by preferential mortgage loans⁵⁰ and additional government subsidies⁵¹.

Figure 68. Market and Fundamental Prices of Houses in Uzbekistan, million UZS per square meter



Source: 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 housing prices in UZS and USD have increased since 2022. Until 2022, the housing market prices increased mainly due to changes in the exchange rate. As of July 1, 2023, the UZS and USD housing price indices rose, in annual terms, by 21 and 13

⁴⁹ The fundamental value of housing prices was calculated based on the ability to obtain a mortgage loan using the price and income model.

⁵⁰ O'zbekiston Respublikasi Prezidentining 2022 yil 22 sentyabrdagi "Ipoteka kreditidan foydalanishda aholiga qo'shimcha qulayliklar yaratish chora-tadbirlari to'g'risida"gi PQ-377-sonli qarori.

⁵¹ Starting from January 1, 2023, individuals who received subsidies to cover a down payment and part of the interest on mortgage loans do not have to pay income tax on the salary and other income used to pay the principal amount and interest of mortgages.

units, respectively. The quickly ascending housing price index in both UZS and USD may reflect a speculative demand for real estate.

Figure 69. Housing Market Price Indices (2020 Q1=100)

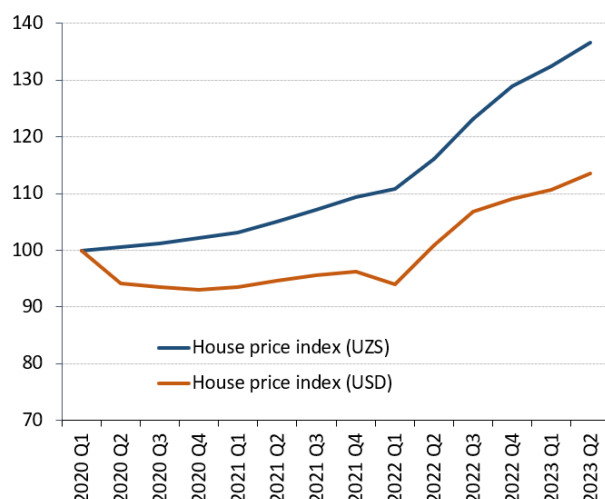
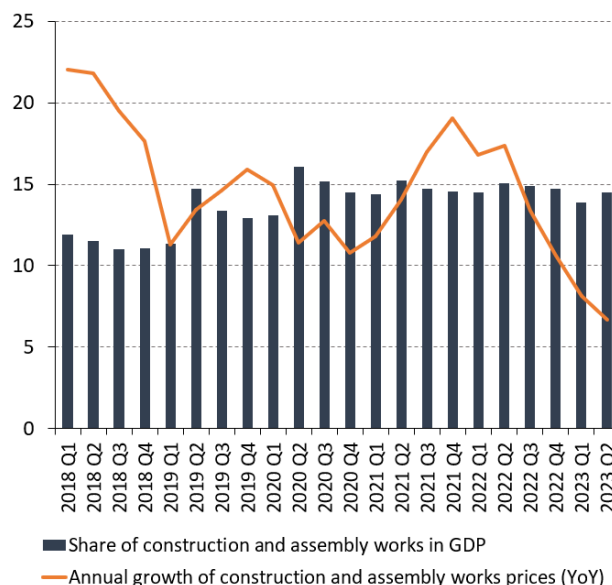


Figure 70. Construction and Assembly Works Prices (YoY change), %



Sources: Statistics Agency and CBU staff calculations.

In H1 2023, there was a decreasing trend in the annual growth rate of prices for construction and assembly works. The decrease in construction and assembly works prices, which are the main supply-side factors in housing prices, suggests that the current housing prices are not driven by fundamental factors.

As of July 1, 2023, the ratio of construction and assembly works to nominal GDP was 15 percent, almost the same as a year before. The growth rate of construction works (14 percent) is lower than the nominal GDP growth (18 percent), indicating that the increasing demand in the real estate market may not be met by sufficient supply.

The supply of real estate has increased thanks to a zero rate of customs duty on the import of construction materials and raw materials, provision of guarantees and compensation for up to 24 months for UZS loans issued by banks to private contractors on special terms of the State Fund for the Support of Entrepreneurial Activities⁵². Additionally, banks provided loans of 500 billion UZS for up to 18 months at the expense of budget funds to replenish the working capital of construction and installation companies. Banks have also implemented a practice of gradually pledging the completed part of the multi-apartment buildings under construction as a loan guarantee.

⁵² O‘zbekiston Respublikasi Prezidentining 2023 yil 13 apreldagi “2023 yilda bozor tamoyillariga asoslangan ipoteka kreditlari orqali aholini uy-joy bilan ta‘minlash dasturini amalga oshirish chora-tadbirlari to‘g‘risida”gi PF-51–sonli Farmoni.

Figure 71. Housing Contracts and Mortgage Borrowers per 1,000 Individuals*

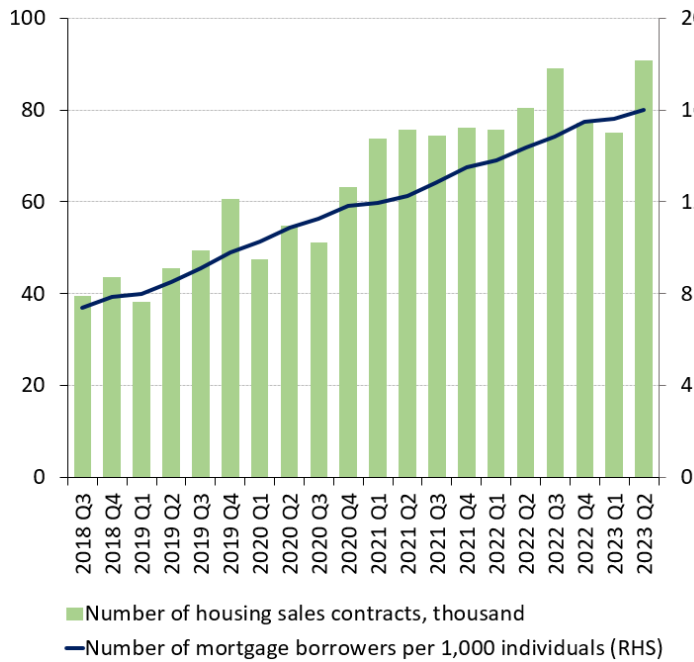
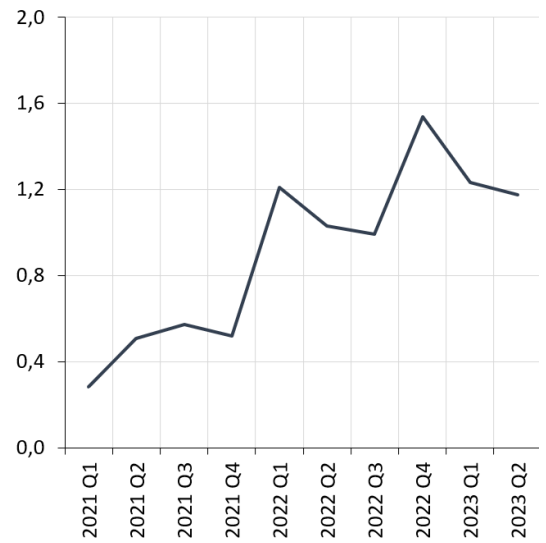


Figure 72. Ratio of Annual Growth Rate of Housing Prices to Annual Growth Rate of Average Monthly Salary, %



Sources: Statistics Agency, Ministry of Justice, and CBU staff calculations.

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

Since 2022, the sharp growth in housing prices relative to average salaries highlights the impact of factors beyond official income on real estate values. Despite this, the housing market continues to experience robust demand. Individuals lacking official income can still qualify for mortgage loans based on their credit scores, further stimulating demand.

The real estate sector is witnessing heightened activity, as evidenced by the rise in housing sales contracts. In H1 2023, there was a 6.3 percent increase in real estate sales contracts compared to H1 2022. This surge is partly attributed to government initiatives aimed at increasing accessibility of mortgage loans, thereby boosting housing demand. In H1 2023, there were 16 mortgage borrowers per thousand working-age individuals. This uptick signifies a growing trend of people opting for mortgage loans. The relatively low figure of this metric suggests room for further growth in house demand. The combination of unmet housing demand and the expansion of government-backed mortgage programs is likely to exert upward pressure on house prices.

Figure 73. Weighted Average Term and Interest Rate of Mortgage Loans

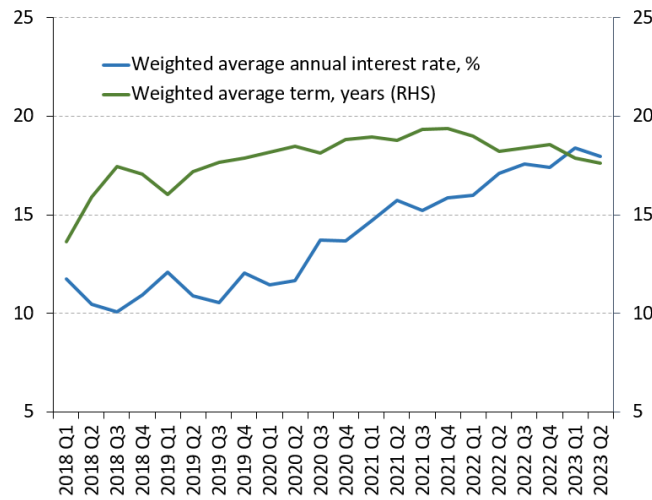
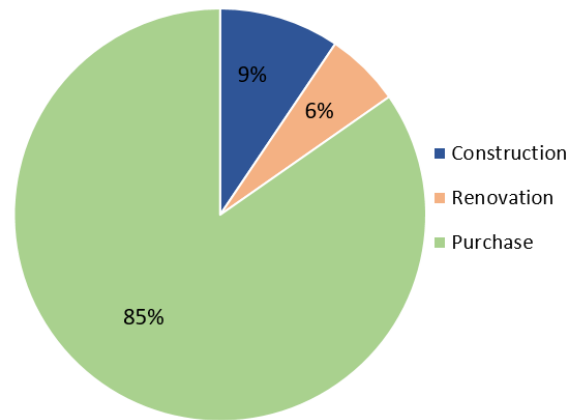


Figure 74. Mortgage Loans Issued in H1 2023 by Purpose

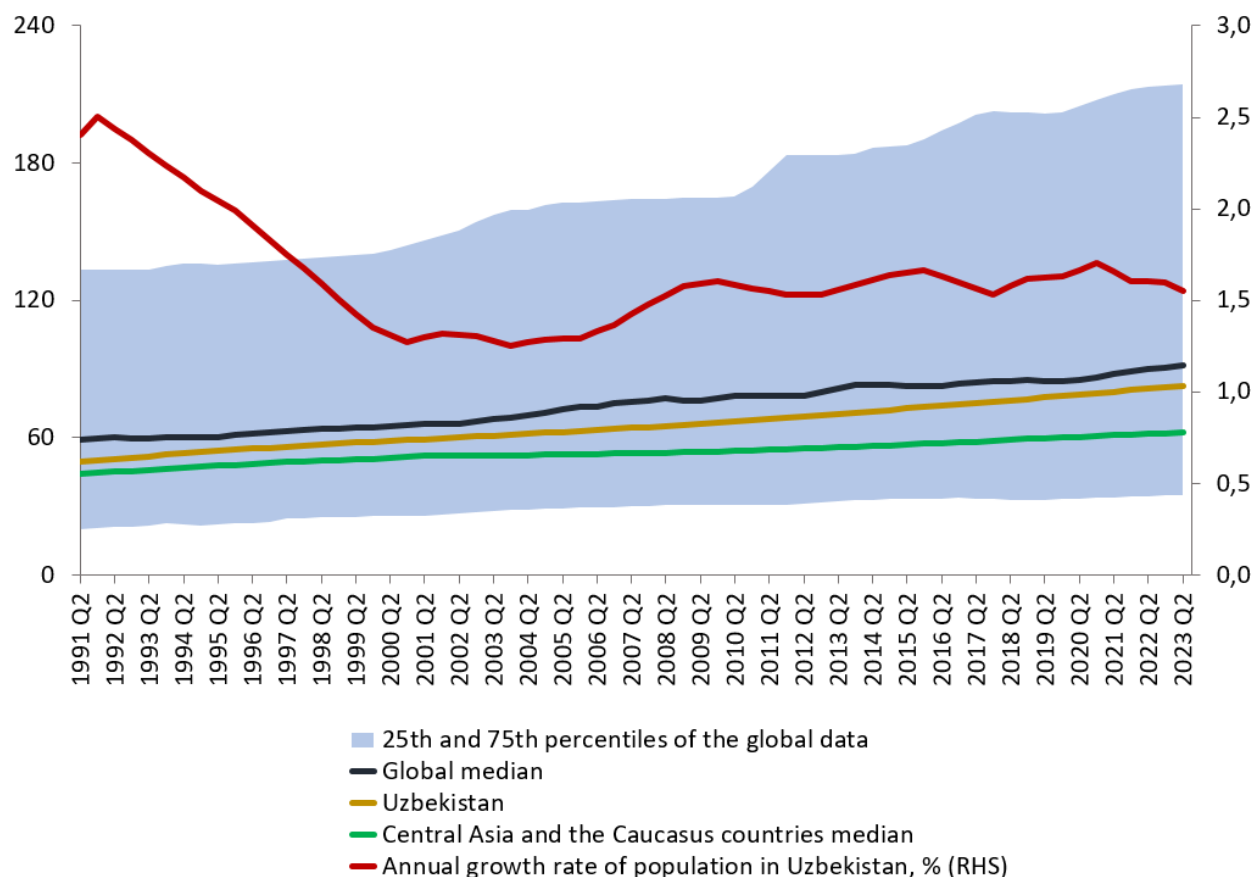


Source: CBU staff calculations.

In H1 2023, the weighted average interest rate on mortgage loans increased by about 1.6 percentage points compared to H1 2022, reaching 18.2 percent. Mortgage loans funded by banks using their own funds increased by 47 percent in H1 2023 compared to H1 2022. 85 percent of mortgage loans were given to finance the purchase of a home.

As of July 1, 2023, Uzbekistan's population density was 81 people per square kilometer. This is lower than the global median of 91 people but higher than the median of the countries in Central Asia and the Caucasus, which is 62 people. This indicates the potential for more real estate development in the country. Additionally, the population density of Uzbekistan increased by 2.2 percent, and the number of residents grew by 1.6 percent compared to the same period in 2022. This suggests that high demand for housing may persist, which could drive real estate prices further up.

Figure 75. Population Density, people per square kilometer



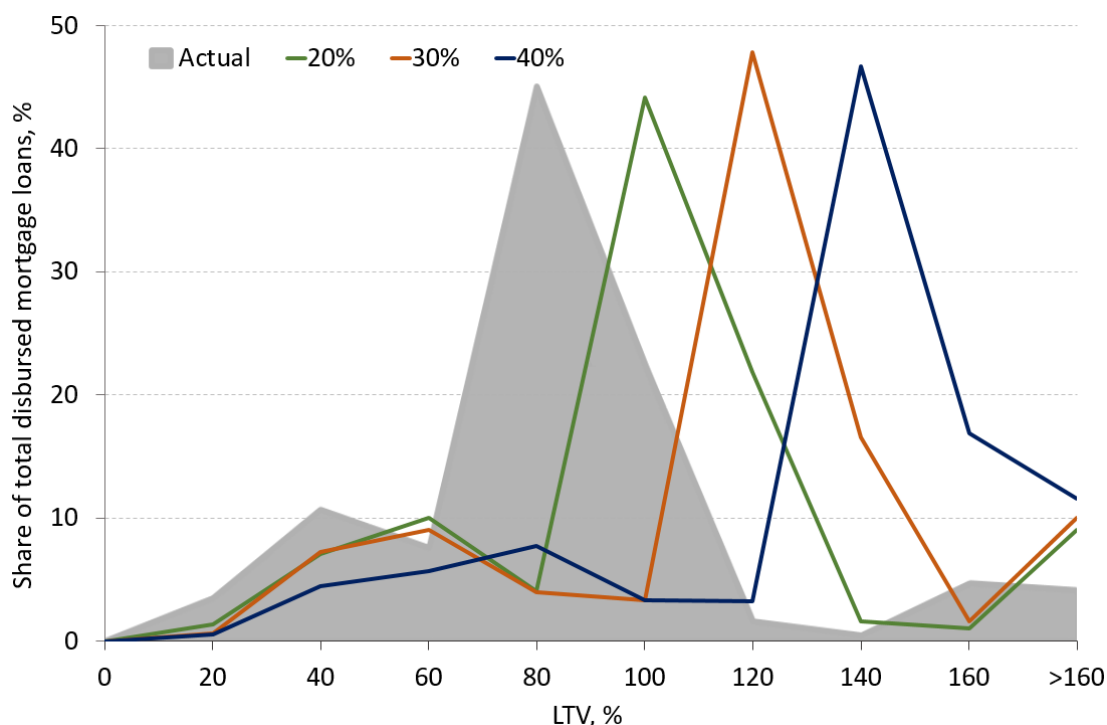
Sources: United Nations and CBU staff calculations.

Note: 193 United Nations member states are taken into account.

The real estate market is currently experiencing a significant imbalance between supply and demand, driven by a high demand for housing and a constrained supply. This disparity has the potential to inflate a potential price bubble. Presently, there is a substantial gap between market housing prices and their fundamental values, heightening systemic risk. If these trends continue, they could precipitate a steep decline in housing prices. Factors such as sluggish economic growth, a decrease in the population's overall real income, rising real interest rates, and more stringent mortgage lending criteria could dampen market demand.

The potential impact of house price shocks on the banking system was evaluated using data from H1 2023. This assessment considered three distinct scenarios—declines of 20, 30, and 40 percent in house prices. It also accounted for the rise in LTV ratios, attributable to the reduced market value of properties used as collateral for bank mortgage loans. It is assumed that a significant drop in housing prices would likely increase the risk of loan defaults, particularly for borrowers with LTV ratios exceeding 120 percent.

Figure 76. LTV Distribution of Mortgages after House Price Shocks, H1 2023



Source: CBU staff calculations.

Note: The numbers displayed on the horizontal axis, along with the preceding number, indicate the upper and lower boundaries of the LTV distribution range.

Should housing prices in Uzbekistan fall by 20 percent, it is projected that one-third of the mortgages issued in H1 2023 could end up with an LTV ratio exceeding 100 percent. Additionally, approximately 12 percent of these mortgages are expected to have an LTV ratio above 120 percent, increasing the likelihood that borrowers might choose foreclosure over repayment.

If housing prices decrease by 30 and 40 percent, the proportion of mortgages with an LTV ratio exceeding 100 percent in H1 2023 is anticipated to be 76 percent and 78 percent, respectively. This suggests that in these scenarios, a substantial portion of the mortgage loans may lack adequate collateral. With a 30 percent drop in housing prices, the share of mortgages with an LTV ratio above 120 percent is estimated to be 28 percent, while a 40 percent reduction could raise this figure to 75 percent. This indicates a higher propensity for borrowers to opt for foreclosure rather than loan repayment, primarily because the loan amount significantly exceeds the house value due to the steep decline in house prices. Consequently, this situation is expected to lead to an increase in NPLs and loan losses.

An analysis of the impact of a drastic reduction in house prices on bank asset quality reveals that a 20 percent price drop is not anticipated to significantly affect the current ratio of NPLs to total loans. However, a 30 and 40 percent decrease in house prices by the end of H1 2023 could result in NPLs constituting 3.8 and 4.6 percent of the total loan portfolio and 4.7 and 7.4 percent of loans of individuals. This may lead to a marked rise in mortgage loan losses for commercial banks.

As of January 1, 2023, mortgages accounted for a significant portion (41 percent) of the total loans given to individuals. This high proportion underscores that real estate market risks can significantly negatively impact the banking system. Additionally, the introduction of mortgage securities, as a step toward the further advancement of the capital market, would strengthen the linkage between the real estate and capital markets⁵³. Consequently, this development may enhance the speed at which risks are transmitted from the real estate market to the capital market⁵⁴.

4.2. Car Market

In recent years, there has been a marked increase in the share of car loans in the loan portfolio of commercial banks. This trend poses a potential risk of significant loan losses for banks, if car prices were to plummet. During an economic downturn, car prices often fall sharply as a result of reduced consumer income, leading to diminished demand for vehicles. Under such circumstances, banks might find themselves unable to recoup loan losses through the sale of cars that were held as collateral.

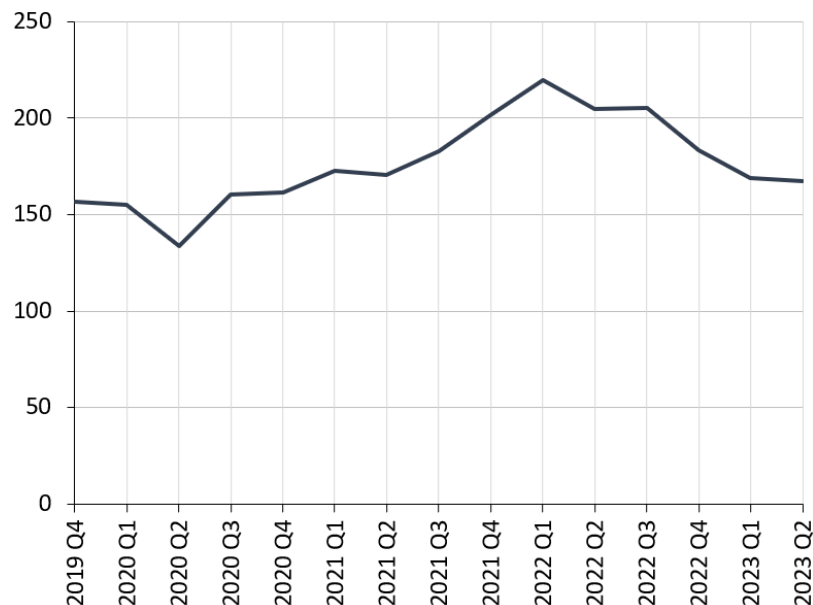
The Car Affordability Index, developed to gauge the feasibility of purchasing a car with a car loan, has shown a declining trend since 2022. Despite a 22 percent⁵⁵ annual increase in the average nominal monthly salary in H1 2023, the index continued to fall, signaling a reduced capacity for average income households to afford a car.

⁵³ O'zbekiston Respublikasi Prezidentining 2021 yil 13 apreldagi "Kapital bozorini yanada rivojlantirish chora-tadbirlari to'g'risida"gi PF-6207–sonli Farmoni.

⁵⁴ Mortgage-backed bonds are a type of bond that enables the trading of one or more mortgage loans. These loans, originally issued by a commercial bank, are packaged and sold as bonds to participants in the capital market.

⁵⁵ O'zbekiston Respublikasi Prezidenti huzuridagi Statistika agentligi. (2023). Mehnat bozori.

Figure 77. Car Affordability Index⁵⁶



Source: CBU staff calculations.

Note: 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.

Additionally, the surge in car loan growth rates, spurred by banks' relaxed lending standards, has fueled demand in the car market. This demand, coupled with limited domestic supply and high import duties on cars, has driven up car prices, making them a major asset for accumulation. Concurrently, cars are becoming more attractive as investment options, leading to increased speculative activities.

⁵⁶ National Association of Realtors. Methodology: Housing Affordability Index.

The Car Affordability Index reflects the feasibility of purchasing a vehicle through a car loan, relative to the average household income. A decline in the index indicates a diminished capacity to afford a car using a car loan, which can be attributed to car prices increasing at a rate outpacing household incomes. The index is calculated as follows:

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

Where,

AI is the Car Affordability Index;

MI is the average disposable income of the population;

QI is the income required for the average monthly car loan payment.

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

The income required for the average monthly car loan payment is determined as follows:

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

Where,

QI is the income required for the average monthly car loan payment;

L is the average car loan amount;

i is the weighted average monthly interest rate on allocated car loans;

n is the weighted average monthly term of allocated car loans.

Figure 78. Passenger Cars Manufactured in Uzbekistan (Excluding Special Vehicles) in Primary Car Market, thousand

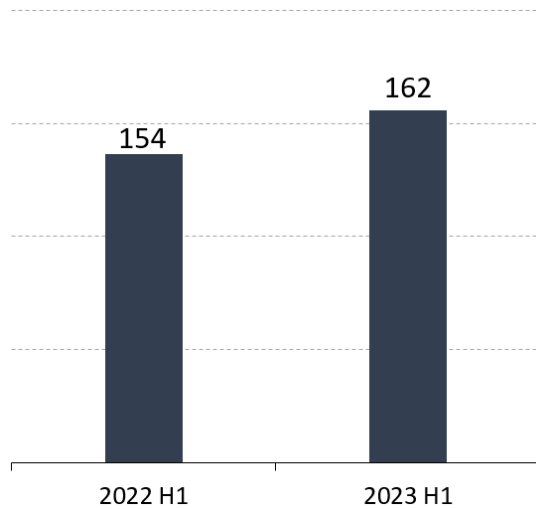
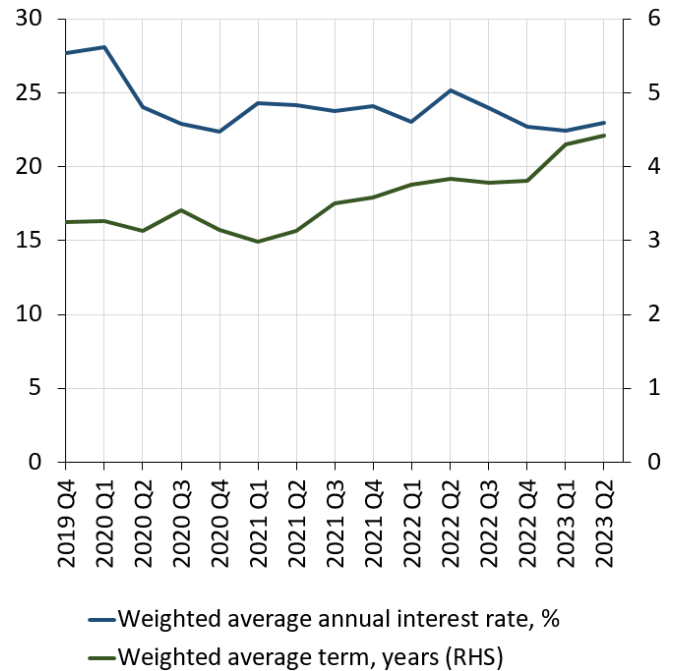


Figure 79. Weighted Average Term and Interest Rate of Car Loans



Sources: Statistics Agency, UzAuto Motors, and CBU staff calculations.

The attractiveness of car loans, bolstered by banks' appealing offers, including extended terms for principal repayment, has led to longer average loan terms. In H1 2023, the average car loan term extended to 4.4 years, an increase of 0.6 years from H1 2022. While interest rates on car loans remained high, averaging 24 percent in H1 2023, the longer loan terms positively impacted the population's car purchasing capacity.

During H1 2023, Uzbekistan's production of passenger cars (excluding special vehicles) reached approximately 162,000, marking a 5 percent increase from the same period in 2022⁵⁷. Amid rising demand, inadequate supply volumes in the primary car market, accompanied by a rise in average car prices, are exerting upward pressure on secondary car market prices.

⁵⁷ O'zbekiston Respublikasi Prezidenti huzuridagi Stastika agentligi. (2023). O'zbekiston Respublikasining sanoat ishlab chiqarishi 2023 yil yanvar-iyun.

Figure 80. Passenger Cars per 1,000 Individuals (as of January 1, 2023)

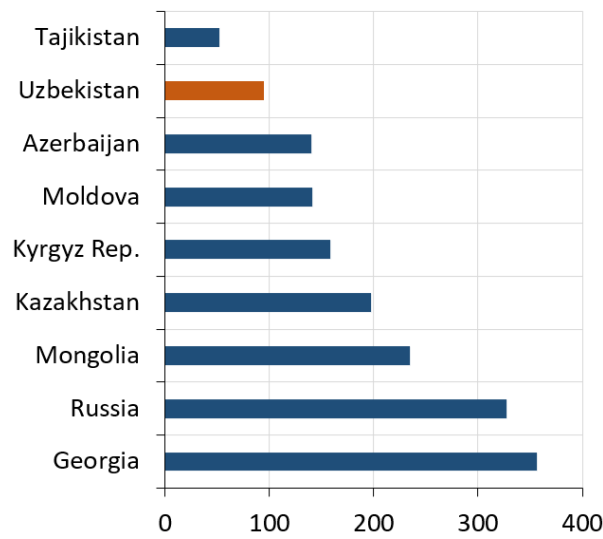
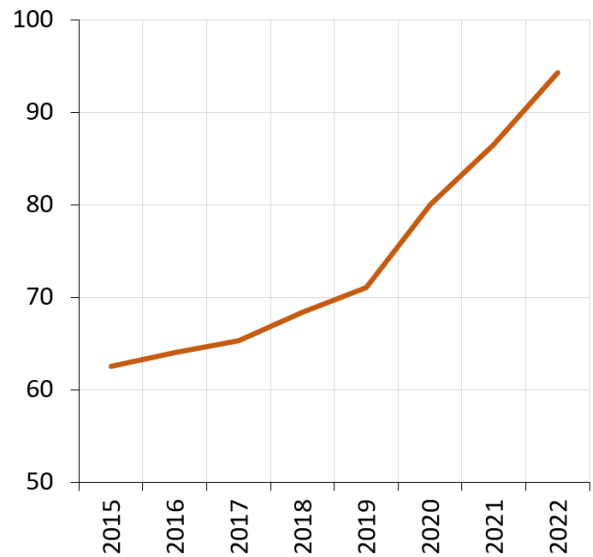


Figure 81. Passenger Cars per 1,000 Individuals in Uzbekistan



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

As of the beginning of 2023, Uzbekistan’s passenger car fleet saw an 11 percent year-over-year increase. By January 1, 2023, there were 94 passenger cars for every 1,000 permanent residents in Uzbekistan, an increment of nearly 8 cars compared to the same period in 2022. Despite this growth in car ownership, the figure remains relatively low compared to other countries in Central Asia, the Caucasus, and beyond. This suggests a significant level of unmet demand in the Uzbek car market.

Since the end of H2 2022, there has been a notable rise in the car loan market concentration. Specifically, during H1 2023, the HHI reached approximately 2,500, representing an increase of 3.1 times compared to H1 2022. This heightened level of concentration is particularly evident as the HHI for car loans now falls into the highly concentrated category (HHI>1800), signifying that a limited number of banks hold a substantial share of the total car loans.

Figure 82. Concentration in Bank Car Loan Portfolio, HHI

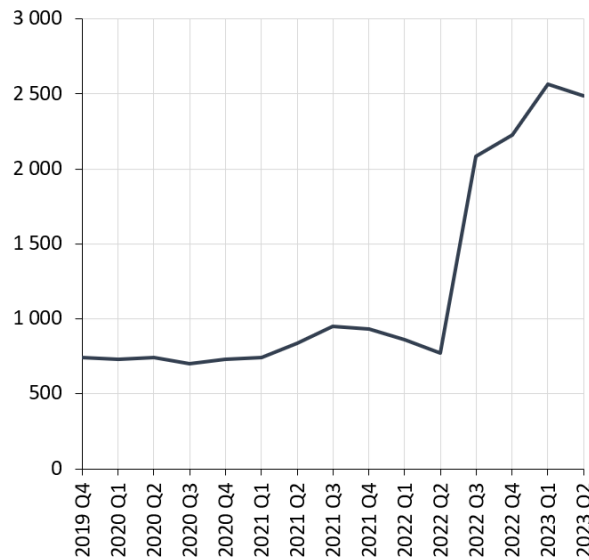
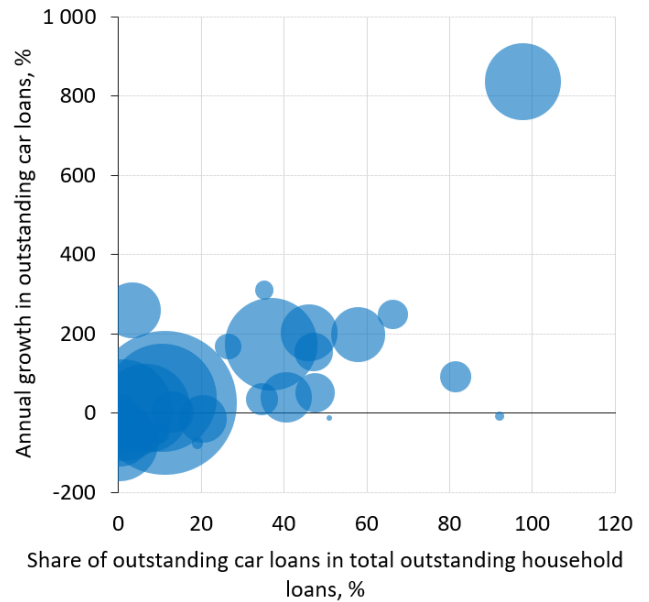


Figure 83. Bank-by-Bank Car Loans Issued to Individuals (As of July 1, 2023)



Source: CBU staff calculations.

Note: The bubble size corresponds to the share of bank assets in the total assets for each respective bank. Banks with an annual growth rate in outstanding car loans exceeding 1,000 percent are excluded.

The surge in car loans can heighten concentration risk in banks' loan portfolios, which could amplify the negative impact of economic shocks on the banking system.

Uzbekistan's prospective accession to the World Trade Organization, coupled with lower import tariffs and the establishment of new car manufacturing facilities in Uzbekistan, is likely to boost the supply in the car market. Consequently, this increase in supply could lead to reduced car prices domestically.

With a drop in car prices, the market value of vehicles used as collateral for car loans decreases. Under these circumstances, car loans may become inadequately collateralized. This insufficiency increases the likelihood of loan defaults by borrowers, elevating NPLs and loan losses in commercial banks. Banks with a significant share of car loans in their loan portfolio are particularly vulnerable to large losses in the event of a drastic decline in car market prices. Financial difficulties of these banks could spill over to the entire banking system, triggering systemic risk.

V. Macro Stress Test for Banking System

5.1. Macroeconomic Scenarios

The resilience of the banking system was examined through a macro stress test, utilizing the CBU's macroeconomic forecasts for H2 2023 through the end of 2025 (see Appendix 7). Two scenarios were developed—baseline and adverse—both of which factored in key economic indicators such as GDP growth, interest rates, and the exchange rate.

The baseline scenario is predicated on the continuation of current economic trends. Conversely, the adverse scenario is modeled after the economic downturns experienced by similar countries, considering both internal and external shocks with low probability but severe impact on the banking sector. The adverse scenario accounts for potential sustained geopolitical tensions, heightened global recession risks, diminished domestic and external demand, and increased volatility in the international financial system. Specifically, in the adverse scenario, Uzbekistan's decelerated GDP growth is envisaged, with correspondingly lower loan interest rates than those projected in the baseline scenario. Furthermore, it anticipates a considerable UZS depreciation, driven by the depreciation of major trading partners' currencies and a reduction in external demand.

The share of NPLs in total loans, the ratio of net interest income to total interest-bearing assets, and the ratio of net non-interest income⁵⁸ to total assets were also projected under both scenarios. These projections were based on macroeconomic indicators specific to the respective baseline and adverse scenarios.

The credit risk model⁵⁹ suggests that in the adverse scenario, characterized by an economic slowdown, there will likely be a decline in the incomes of both individuals and businesses. This decline is expected to adversely affect their ability to repay debts, leading to an increase in NPLs.

Furthermore, the model examining the ratio of net interest income to total interest-bearing assets⁶⁰ of banks indicates that, in both baseline and adverse scenarios, a reduction in loan interest rates will result in decreased net interest income for banks. Regarding the ratio of net non-interest income to total assets⁶¹, the model suggests that in the adverse scenario, a downturn in GDP growth can lead to a reduced volume of financial transactions in the economy. This reduction is anticipated to cause a decrease in banks' net non-interest income. Also, the adverse scenario includes the potential UZS depreciation, which reduces banks' net interest income due to an increase in foreign currency NPLs.

⁵⁸ Difference between non-interest income and non-interest expense.

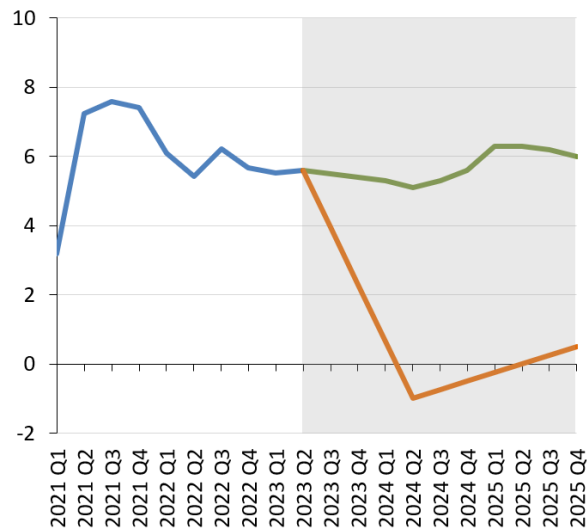
⁵⁹ The credit risk model projects the share of NPLs by using the NPL value lagged once, GDP growth, and the loan interest rate values based on different scenarios.

⁶⁰ The model estimating the ratio of net interest income to total bank interest-bearing assets uses the scenario-specific values of loan interest rates and the exchange rate.

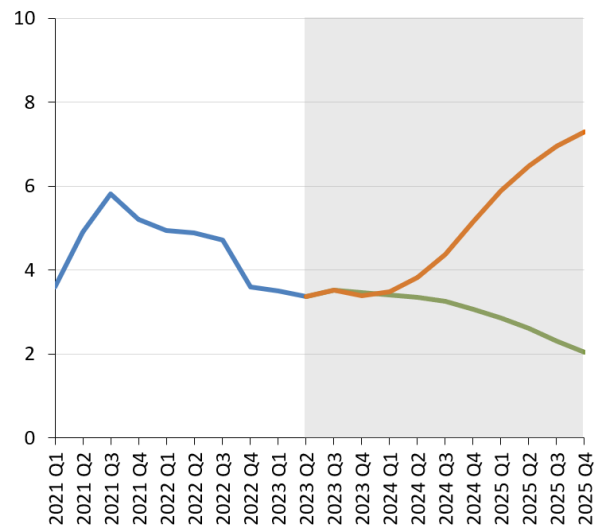
⁶¹ The ratio of net non-interest income to total assets was estimated using the scenario-specific values of GDP growth and the exchange rate.

Figure 84. Macroeconomic Scenarios⁶²

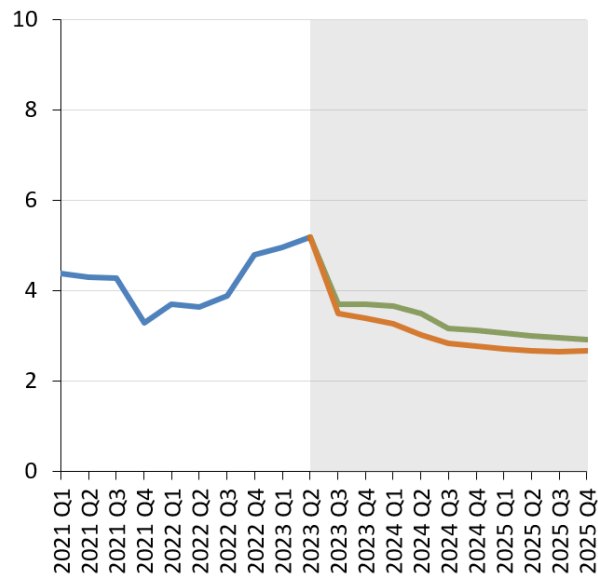
Annual Real GDP Growth, %



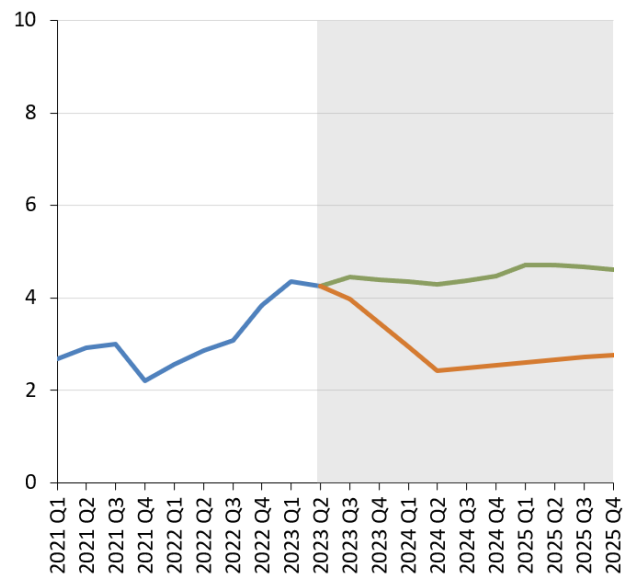
Share of NPLs in Total Loans, %



Net Interest Income to Interest-Bearing Assets, %



Net Non-Interest Income to Total Assets, %



— History — Baseline — Adverse

Source: CBU staff calculations.

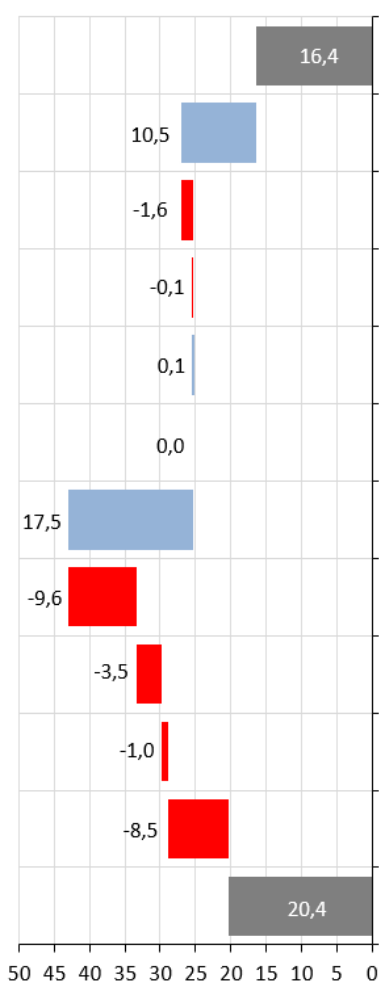
⁶² Macroeconomic scenarios address high-level risks, known as tail risks, which have a very low probability of occurrence. The scenarios do not constitute forecasts of indicators.

5.2. Macro Stress Test Results

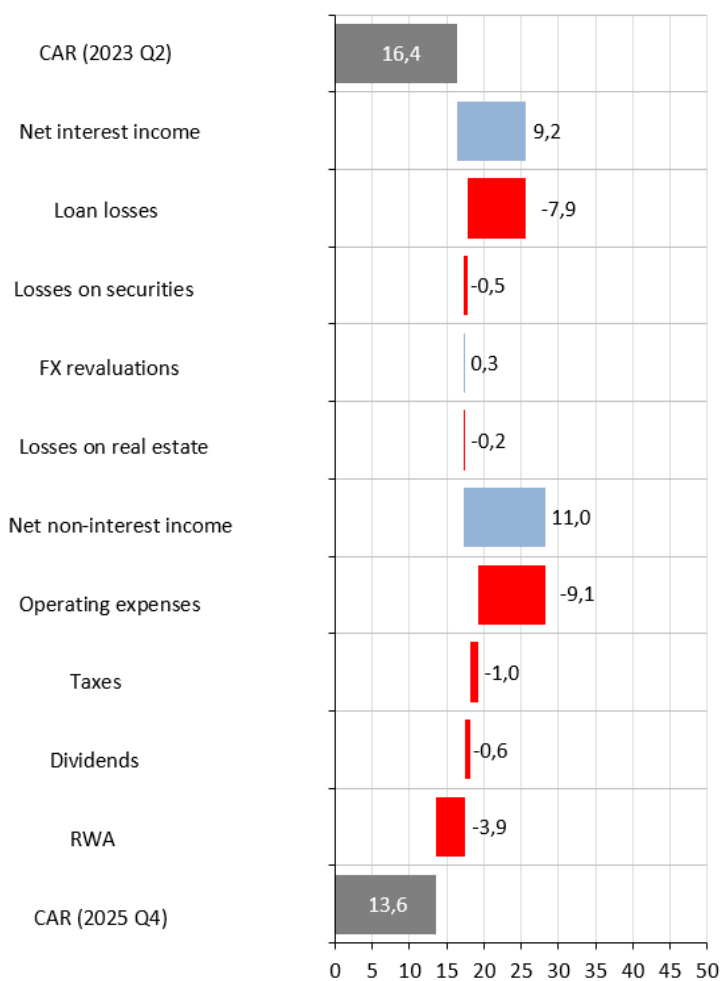
The top-down solvency macro stress test indicates that Uzbekistan's banking system is resilient against various shocks under both baseline and adverse scenarios. The CAR of the banking system surpasses the CBU's minimum regulatory capital requirement in both scenarios. Under the baseline scenario, it's projected that the CAR could reach 20.4 percent by the end of 2025. This scenario anticipates low losses in securities, an absence of concentration risk in the banking system, and no losses in the real estate market. Furthermore, in light of higher economic growth, an increase in banks' operating expenses is expected, which will be accompanied by a rise in net interest and non-interest income. However, higher earnings will lead to an increase in the payment of taxes and dividends, which are forecasted to reduce the CAR by 3.5 and 1 percentage points, respectively. Additionally, loan losses are projected to be considerably lower in the baseline scenario.

Figure 85. Macro Stress Test Results

Baseline Scenario



Adverse Scenario



Source: CBU staff calculations.

The UZS depreciation does not lead to immediate losses, given the near-equilibrium of foreign currency assets and liabilities in commercial banks. However, in the adverse scenario characterized by a sharp UZS depreciation, there can be an increase in debt servicing costs for borrowers of foreign currency loans. This situation may consequently lead to a rise in NPLs and potential loan losses.

Figure 86. CAR of Banking Sector in Baseline and Adverse Scenarios, %

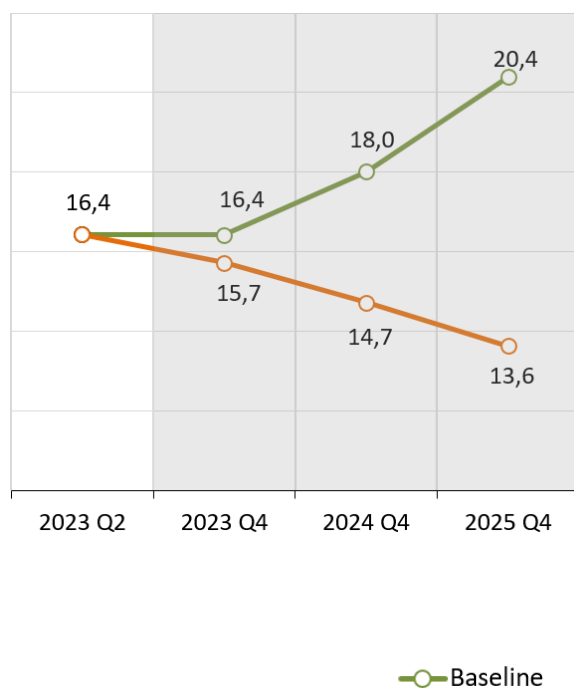
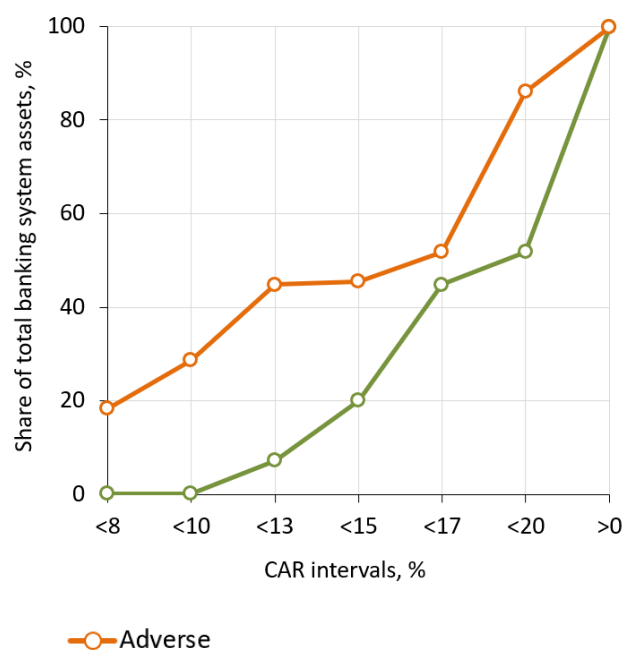


Figure 87. Distribution of Banking Sector's CAR Intervals and Shares in Total Assets*, %



Source: CBU staff calculations.

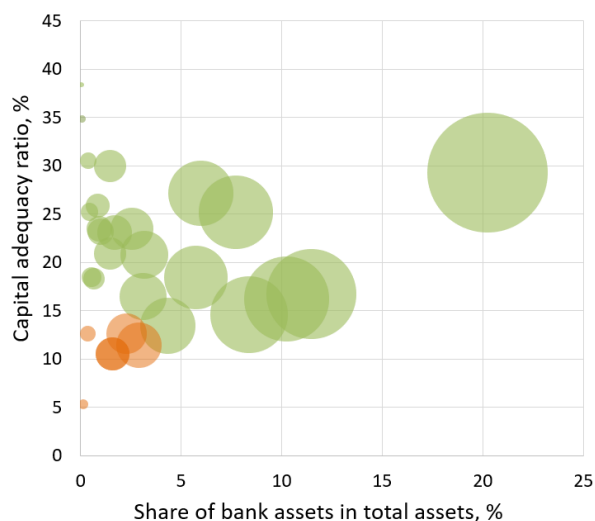
Note: The cumulative order is used to set the shares of total assets of banks located within specific CAR intervals.

In the adverse scenario, the CAR of the banking sector is projected to reach 13.6 percent by the end of 2025. This is due to substantial loan losses, some losses in securities and real estate, and an increase in RWA. Nevertheless, the CAR is expected to remain well above the CBU's minimum requirement, bolstered by growth in net interest income and net non-interest income.

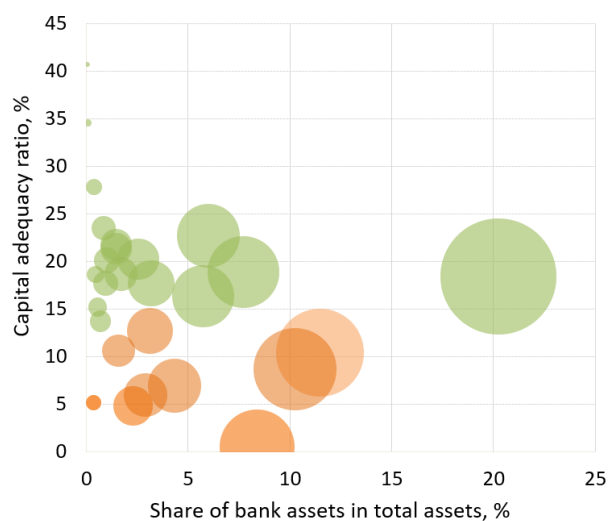
The macro stress test results, which consider the concentration level in banks' loan portfolios and the potential for a single bank's instability spilling over to the broader banking system, provide insight into the extent of risk and help evaluate the likelihood of these issues escalating into systemic risk. In the baseline scenario, some banks are expected to fall below adequate capital levels by the end of 2025. However, in the adverse scenario, banks representing nearly 45 percent of the banking system's assets might struggle to meet the minimum capital requirements.

Figure 88. Bank-by-Bank Macro Stress Test Results

Baseline Scenario



Adverse Scenario



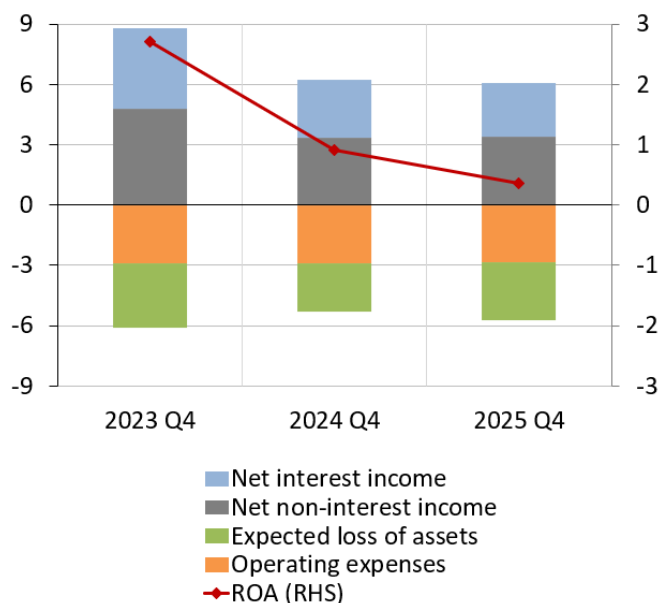
Source: CBU staff calculations.

Note: The graph presents data on banks, each depicted by a bubble, showing their CAR within the 0–45 percent range. The bubble size for each bank is proportional to its asset share in the total assets of the banking system. Banks are color-coded: a green bubble denotes a bank that satisfies the minimum capital adequacy requirement of 13 percent, whereas a light red bubble represents a bank that falls short of this threshold.

In the baseline scenario, the share of banks with a CAR below the minimum requirement is relatively low in the overall assets of the banking system, which diminishes the likelihood of systemic risk. On the other hand, in the adverse scenario, it is assumed that if a bank's CAR falls below 0, it indicates a potential for losses exceeding the banks' regulatory capital. This scenario increases the possibility of structural systemic risk, especially as several large banks could incur losses due to a variety of economic shocks.

In the adverse scenario, the banking system's ROA is expected to decline. This decrease stems from reduced interest and non-interest income, which are consequences of slower economic growth and a drop in loan interest rates. Additionally, operating expenses are projected to grow at a similar rate as total assets through the end of the period.

Figure 89. Banking Sector ROA in Adverse Scenario, %



Source: CBU staff calculations.

By the end of 2023, asset losses are anticipated to reach a peak. Subsequently, in 2024, there will be a decline in the ratio of these losses relative to total assets. However, by the end of 2025, the pace of growth in total assets is expected to decelerate, accompanied by a resurgence in loan losses. In the adverse scenario, the ROA might hover around 0.4 percent by the end of 2025.

5.3. Contagion Risk

Contagion risk may materialize if the default of one or more banks, triggered by various shocks, negatively affects other banks due to the interconnected financial relationships within the banking system. Under the adverse scenario, banks with the CAR below the minimum requirement are more likely to default. Hence, they may pose systemic risk to the banking system stemming from these banks' inability to fulfill their obligations to other banks.

In the adverse scenario, contagion risk is assessed using two distinct approaches. The first approach considers the losses from bank defaults as being linked to banks' capital⁶³. The second approach assumes these losses are not recoverable at all⁶⁴.

⁶³ In the approach, where losses from bank defaults are tied to capital, the extent of banks' losses from contagion risk is influenced by the defaulting bank's CAR. The lower the failing bank's CAR, the greater the proportional losses incurred by banks that have financial connections with it, such as those that have provided loans to or placed deposits with the defaulting bank.

⁶⁴ In the approach, where losses from bank defaults are not recoverable, banks face the loss of all their loans to or deposits placed with a bank with a high probability of default, i.e., a bank with the CAR below the required minimum.

Figure 90. Contagion Risk: Bank Default Losses Tied to Capital (Approach 1)

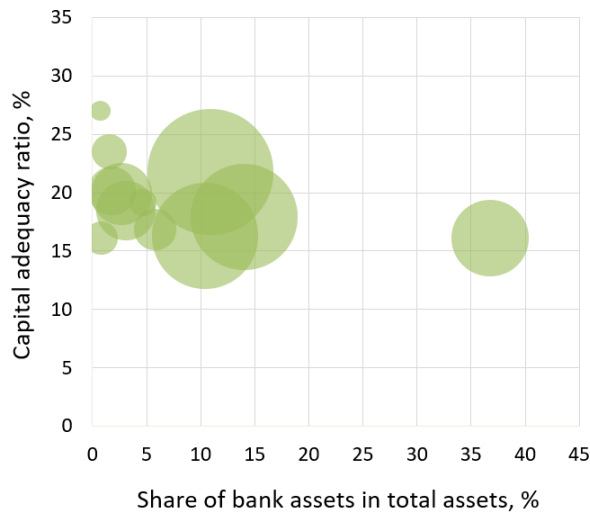
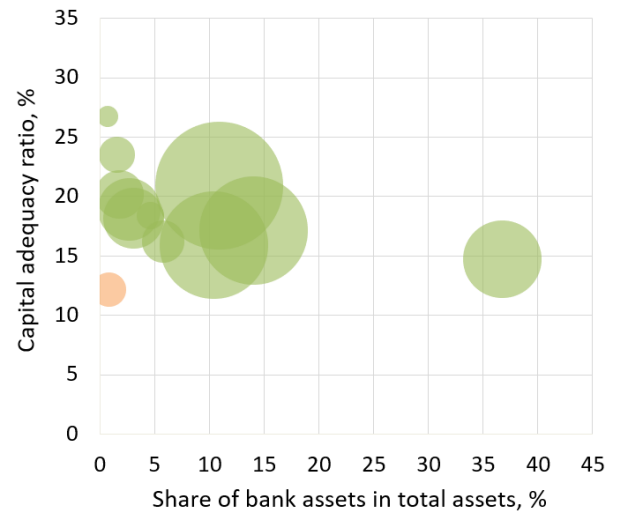


Figure 91. Contagion Risk: Unrecoverable Bank Default Losses (Approach 2)



Source: CBU staff calculations.

Note: The graph presents an analysis of various banks, categorized based on three criteria: those with a CAR below 35 percent, those with liabilities to other banks, and those that meet the minimum capital adequacy requirement of 13 percent under the adverse scenario. Each bank is represented by a bubble, the size of which indicates its proportion of interbank liabilities relative to the total interbank liabilities. 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 losses-tied-to-capital approach reveals that the default of banks with a CAR below 13 percent has a minimal negative effect on the overall banking system. Furthermore, the default of such banks does not hinder other banks from meeting their minimum capital requirements. Under the unrecoverable-losses approach, the default of banks with a CAR below 13 percent could lead to two additional banks failing to meet their minimum capital requirements, primarily due to non-repayment of debts by the undercapitalized banks that failed first. However, since these affected banks have negligible or no liabilities to other banks, their inability to meet the CAR does not pose a significant risk to the broader banking system. Additionally, the relatively small share of interbank liabilities in the total assets suggests a low level of interconnectedness among banks.

5.4. Additional Shocks under Adverse Scenario

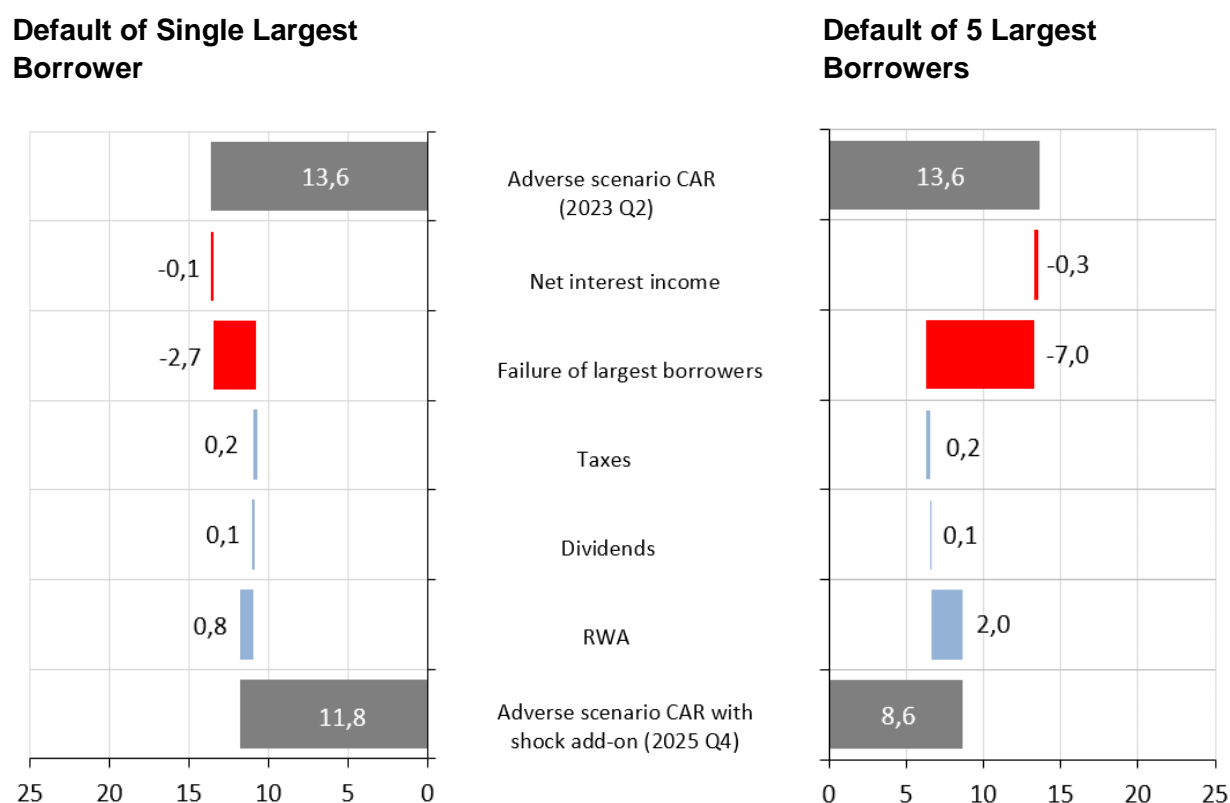
The banking system's resilience against additional systemic risks under the adverse scenario was evaluated. This adverse scenario included risks such as high concentration risk, a substantial decrease in housing and car prices, and a reduction in population income.

Concentration Risk

Concentration risk arises when a significant portion of a bank's loan portfolio is concentrated among a small number of borrowers. In times of economic stress, the default of these borrowers can result in substantial credit losses in the banking system. The default of either the single largest or the top five borrowers at each bank under the adverse scenario conditions was analyzed to evaluate the impact of such a scenario. It was assumed that the loss-given default (LGD) would be 50 percent, implying that half of the outstanding loans would be unrecoverable due to these borrowers' default.

The CAR of the banking system could decrease to 11.8 and 8.6 percent, depending on whether the default involves the single largest or the top five borrowers at each bank, respectively. During an economic downturn, coupled with a high concentration risk, the financial troubles of these large borrowers can lead to substantial credit losses for banks. This, in turn, could result in the banking system's CAR falling below the minimum regulatory requirement.

Figure 92. Macro Stress Test Results with Concentration Risk, %



Source: CBU staff calculations.

Sharp Decline in House Prices

The steady rise in housing prices enhances the market value of collateral for mortgage loans. This increase enables banks to mitigate credit losses by selling the collateral if borrowers default. However, the increasing disparity between market and fundamental housing prices indicates the build-up of systemic risk in the real estate market. Such a situation can precipitate significant loan losses in the banking sector following a sudden downturn in housing prices.

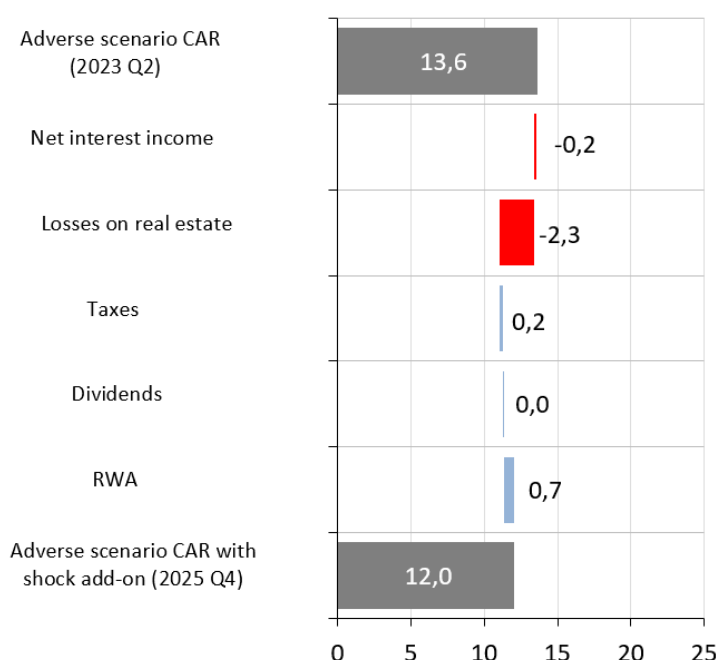
To assess the potential impact of a drastic fall in housing prices on the banking system's stability, an additional shock was introduced in the adverse scenario. In this sub-scenario, it was assumed that if the LTV ratio exceeds 120 percent due to a steep decline in house prices, borrowers will forfeit their collateral and default on their mortgage loans. The stress test shows that a 20 percent reduction in house prices would not substantially affect the rise in NPLs or the overall stability of the banking system. This indicates that the mortgage loans issued by banks are generally backed by adequate collateral.

Figure 93. Macro Stress Test Results with Decline in House Prices, %

30% Decline in House Prices



40% Decline in House Prices



Source: CBU staff calculations.

As a result of the 30 and 40 percent reductions in housing prices, it is projected that by the end of 2025, the share of NPLs of individuals in the total individual loan portfolio will rise to 11.6 and 18.3 percent, respectively. Concurrently, the CAR of the banking system is expected to decline to 13 and 12 percent, respectively. Furthermore, commercial banks' actions to sell collateral houses in an effort to recover losses from

mortgage loans during a period of declining prices could increase the supply in the real estate market and dampen further housing prices.

Sharp Decline in Car Prices

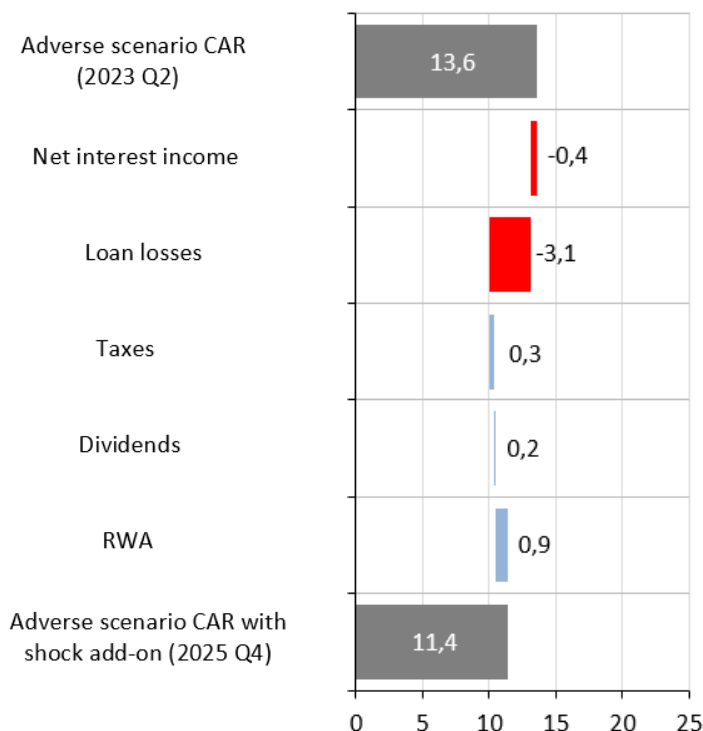
A sharp drop in car prices might result in a rise in foreclosures among borrowers with elevated LTV ratios. Therefore, an additional shock was applied to the adverse scenario to evaluate the potential impact on the banking system's stability from a reduction in car prices of up to 20, 30, and 40 percent. It was assumed that a substantial drop in car prices would lead borrowers with LTV ratios exceeding 120 percent to forfeit their collateral and default on their car loans.

Figure 94. Macro Stress Test Results with Decline in Car Prices, %

30% Decline in Car Prices



40% Decline in Car Prices



Source: CBU staff calculations.

The stress test results indicate that despite car prices decreasing by 20 and 30 percent, there was no significant decline in the CAR due to the banking system's sufficient collateral. However, a 40 percent reduction in car prices could result in NPLs of individuals reaching 24 percent by the end of 2025, potentially causing the CAR to fall below the minimum requirement.

5.5. Prospects for Primary Data Collection for Climate Stress Testing

In recent times, there has been an increasing focus on evaluating how climate change impacts the stability of the financial system. This scrutiny arises from the understanding that climate-induced risks could give rise to substantial losses for both businesses and individuals, thereby posing a serious threat to financial stability.

Climate change risks are categorized into two main types: physical and transition risks. Physical risks encompass both rare natural catastrophes, such as floods and droughts, and ongoing challenges, like the gradual increase in average air temperatures. The escalation in physical risks can lead to market risk by diminishing asset values and credit risk for banks due to the financial distress of borrowers affecting their ability to repay loans. For instance, floods can wreak economic havoc by damaging residential properties and manufacturing facilities, while heat stress can reduce agricultural yields, increase energy costs, and diminish worker productivity⁶⁵.

On the other hand, transition risks are tied to the legislative, policy, technological, and market shifts that occur as the world moves toward a greener economy. These risks include government policies aimed at reducing greenhouse gas emissions, the integration of climate change considerations by investors during investment decision-making, technological advancements, and changing consumer attitudes toward the environmental impact of producers⁶⁶. A sudden or poorly managed transition to a low-carbon economy could sharply increase operational costs for businesses, leading to financial strain and, consequently, higher loan default rates in banks.

The interplay between delayed action on climate change and the slow shift to a low-carbon economy amplifies the probability of physical risks. This suggests that the two types of risks are inextricably linked to each other.

The Notre Dame Global Adaptation Initiative (ND-GAIN) index⁶⁷ indicates that Uzbekistan has a low vulnerability to climate change and a high resilience to potential impacts⁶⁸. However, Uzbekistan's index score is lower than the median for Central Asian and the Caucasian countries, signaling greater susceptibility to climate change risks compared to its regional counterparts.

Looking ahead, Uzbekistan faces potential physical risks from climate change, including increased temperatures, more frequent droughts, water scarcity, and the salinization

⁶⁵ Acharya, V., Berner, R., Engle, R., Jung, H., Stroebel, J., Zeng X., & Zhao, Y. (2023). Climate Stress Testing. Federal Reserve Bank of New York.

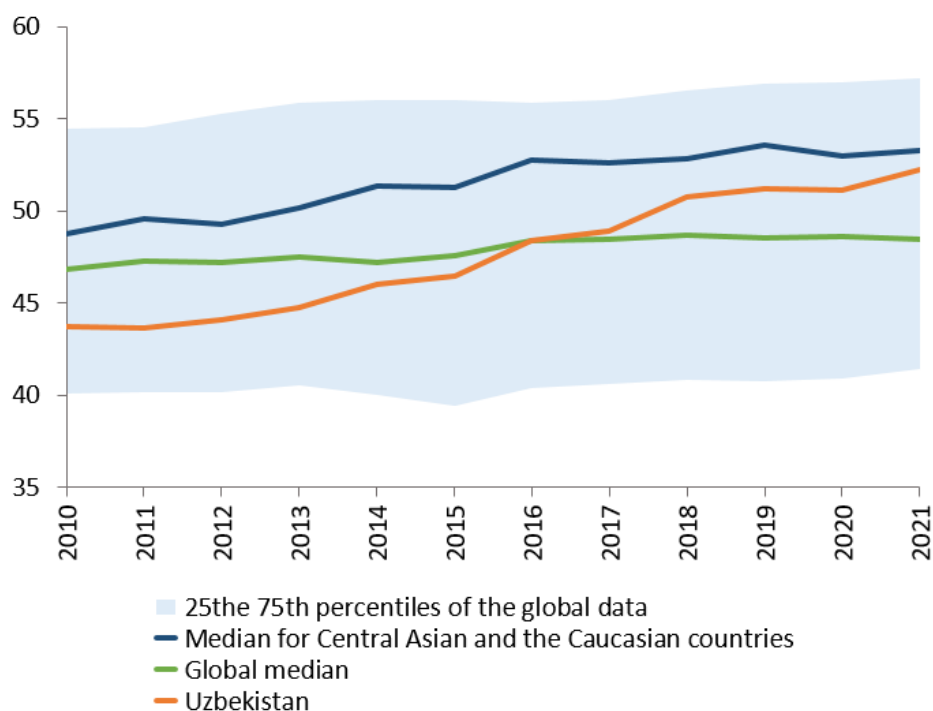
⁶⁶ Carlin, D., Arshad, M., Fraser, E., & Noinville, V. UNEP Finance Initiative's Comprehensive Good Practice Guide to Climate Stress Testing.

⁶⁷ The index measures a country's susceptibility to climate change and other global challenges, as well as its capacity to mitigate these challenges' effects. This calculation assesses the vulnerability of a nation across six crucial sectors: food, water, health, ecosystem services, human habitats, and infrastructure. It evaluates the extent to which the country is exposed to climate change, the sector's sensitivity to climate change, and the society's adaptive capacity to address climate change-induced issues. A country's preparedness for climate change is gauged by its effectiveness in directing investments towards climate change adaptation. The ND-GAIN index evaluates a country's readiness for climate change through three key components: economic, governance, and social.

⁶⁸ ND-GAIN Country Index. Notre Dame Global Adaptation Initiative. University of Notre Dame.

and desertification of agricultural lands⁶⁹. Specifically, projections for Uzbekistan's air temperature, under the high greenhouse gas concentration scenario (SSP5-8.5)⁷⁰, indicate a rise in the median air temperature from 13.66°C in 2014 to 15.67°C by 2050. Moreover, the occurrence of days with temperatures exceeding 35°C⁷¹ is expected to increase, with the median number of such days potentially escalating from 66 to 88 days compared to the baseline period⁷².

Figure 95. ND-GAIN Index



Sources: University of Notre Dame and CBU staff calculations.

Note: The ND-GAIN Index assesses the susceptibility of 192 countries to climate change and various global challenges, alongside their readiness to enhance resilience against these challenges. A lower index score indicates a country's vulnerability to climate change and related issues, whereas a higher score denotes relative resilience. Essentially, the index inversely reflects a country's vulnerability to

⁶⁹ Ministry of Economic Development and Poverty Reduction of the Republic of Uzbekistan, The World Bank, The Regional Environmental Center for Central Asia. (2022). Green Growth and Climate Change in Uzbekistan Policy Dialogue Series: A Compendium of Proceedings.

⁷⁰ Shared Socioeconomic Pathways (SSPs) are comprised of five distinct scenarios, each reflecting varying changes in socio-economic factors such as population, economic growth, education, urbanization, and technological development through the end of the 21st century. These scenarios include: SSP1 (Sustainability), which envisions a world embracing sustainability and green initiatives; SSP2 (Middle of the Road), where social, economic, and technological trends continue along a trajectory similar to current patterns; SSP3 (Regional Rivalry), where nationalism drives policy and focus is placed on regional and local issues rather than global issues; SSP4 (Inequality) is characterized by reduced investment in human capital and increasing economic disparities between nations, leading to heightened economic inequality; and SSP5 (Fossil-fueled Development), which leans towards development fueled by non-renewable energy sources. These scenarios serve as a foundation for developing climate change projections using Integrated Assessment Models (IAMs).

⁷¹ This pertains to days when the daily air temperature exceeds 35°C.

⁷² World Bank Climate Change Knowledge Portal | Uzbekistan.

climate change and similar threats, and directly correlates with its preparedness to bolster its defenses against these challenges.

According to the International Labor Organization, air temperatures exceeding 24–26°C result in diminished labor productivity across all economic sectors, with pronounced impacts in physically demanding industries such as agriculture, construction, and transportation⁷³. Consequently, this can significantly reduce the average income and productivity of workers in these sectors, potentially affecting businesses' ability to honor their financial commitments to banks and heightening the risk of loan defaults.

Figure 96. Air Temperature Scenarios

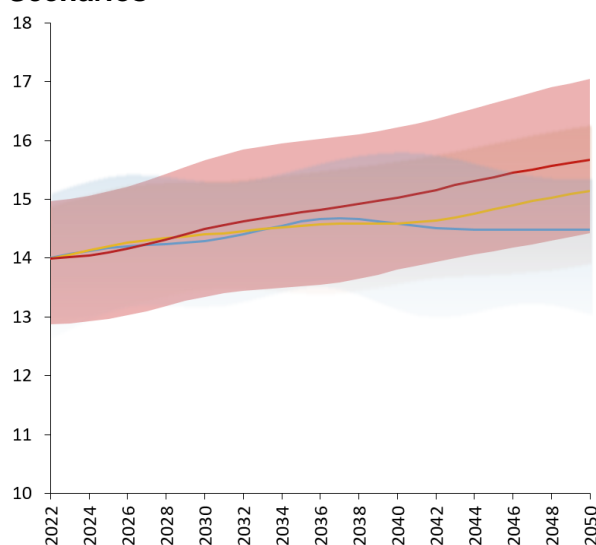
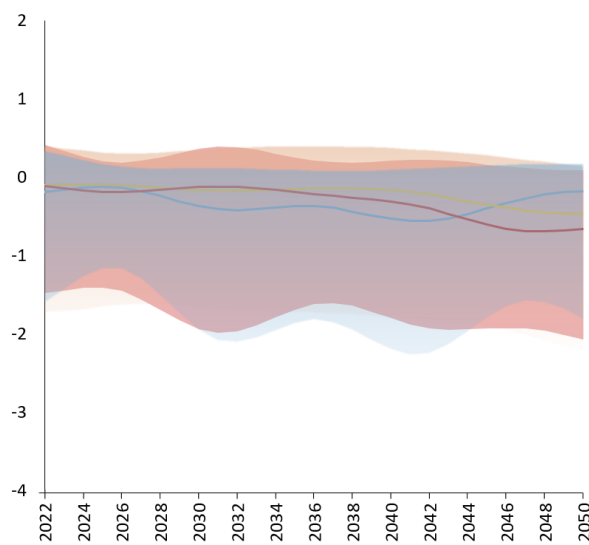


Figure 97. Drought Index Scenarios



- 10th and 90th percentile boundaries (SSP1-1.9)
- 10th and 90th percentile boundaries (SSP2-4.5)
- 10th and 90th percentile boundaries (SSP5-8.5)
- SSP1-1.9
- SSP2-4.5
- SSP5-8.5

Source: World Bank.

Note: Elevated average air temperatures negatively impact the economy. A drought index ranging from -1 to 1 denotes normal conditions. Indices between -1.5 and -1 indicate a moderate drought, while values below -1.5 represent a very severe drought.

Furthermore, projections from the Standardized Precipitation-Evapotranspiration Index (SPEI)⁷⁴, under the high greenhouse gas concentration scenario (SSP5-8.5), indicate a shift in the median index to -0.66 by 2050 from its baseline of 0 in 2014⁷⁵. This shift may

⁷³ International Labor Organization. (2019). Working on a warmer planet: The impact of heat stress on labour productivity and decent work.

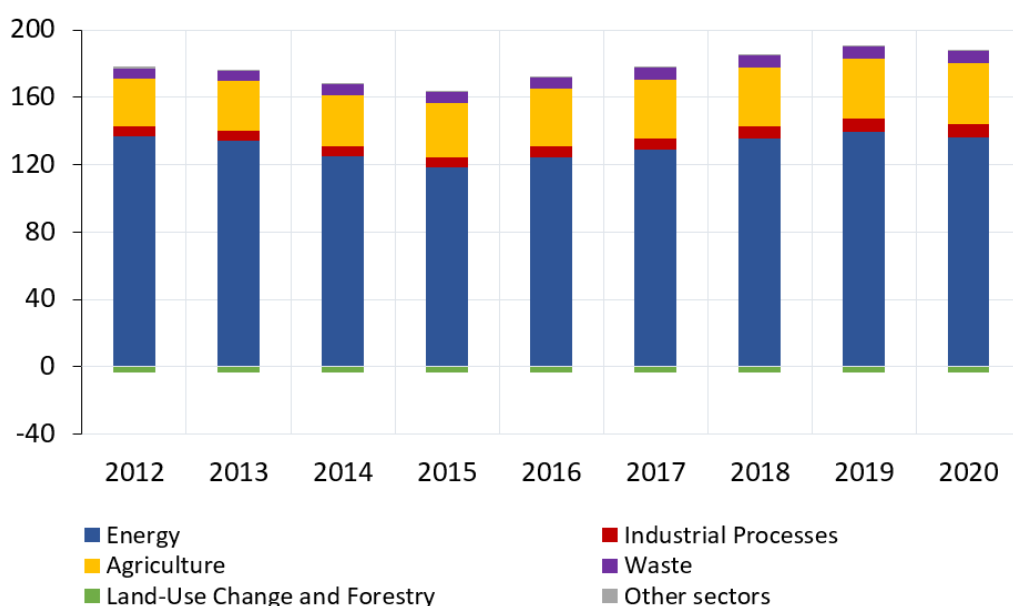
⁷⁴ The Standardized Precipitation-Evapotranspiration Index (SPEI) is a metric specifically developed to quantify drought conditions by assessing precipitation levels and potential evapotranspiration rates. This index is calculated on a 12-month basis, enabling it to evaluate the potential effects of drought on ecosystems, crops and water resources.

⁷⁵ World Bank Climate Change Knowledge Portal | Uzbekistan.

substantially increase drought occurrences by mid-century, potentially leading to severe financial losses in various economic sectors, particularly agriculture. Such conditions are likely to exacerbate credit losses in banks significantly.

The energy sector is notably vulnerable to transition risks due to its substantial contribution to greenhouse gas emissions. As of 2020, the sectoral distribution of greenhouse gas emissions in Uzbekistan was as follows: the energy sector accounted for 73.9 percent, agriculture for 19.6 percent, industrial processes for 4.4 percent, waste management for 4.0 percent, with land-use change and forestry contributing negatively at -1.8 percent, and other sources at 0.2 percent⁷⁶. Additionally, data from 2017 highlights key processes in greenhouse gas emission: natural gas extraction, processing, and transportation (22.6 percent), fuel combustion in power generation (15.2 percent), fuel combustion in the processing industry, and construction (10.1 percent), residential fuel combustion (9.4 percent), and internal fermentation in agriculture (9.3 percent)⁷⁷.

Figure 98. Greenhouse Gas Emissions Across Economic Sectors in Uzbekistan (in million tons of CO₂ equivalent)⁷⁸



Source: World Resources Institute.

Note: The most recent data available is from 2020, as data publication occurs on a 2-3-year cycle.

Businesses engaged in high-emission activities face transition risks that could indirectly or directly lead to banking sector credit losses. The potential introduction of a carbon tax in Uzbekistan, coupled with increasing consumer demand for "green" products and a decline in investments for businesses deemed vulnerable to transition risks, may

⁷⁶ World Resources Institute. (2023). Climate Watch Historical GHG Emissions 1990–2020.

⁷⁷ Republic of Uzbekistan | Updated Nationally Determined Contribution. (2021). United Nations | Nationally Determined Contributions Registry.

⁷⁸ World Resources Institute. (2023). Climate Watch Historical GHG Emissions 1990–2020.

financially strain these enterprises⁷⁹. Consequently, their struggle to fulfill debt obligations could lead to increased loan losses for banks.

Essential Data for Climate Stress Testing in Uzbekistan

To conduct an effective climate stress test, it is crucial to gather a blend of traditional macroeconomic data and climate-specific information. The latter encompasses indicators like air temperature, precipitation, and potential paths of natural disasters, including floods and forest fires. These elements are vital for assessing physical risks under various scenarios, despite the complexities involved in modeling the macroeconomic and financial market impacts of such natural calamities. Evaluating the direct economic losses incurred by these disasters is beneficial for financial institutions, as it aids in understanding the tangible repercussions on the economy.

An integral part of assessing physical risks includes collecting data on the location of production facilities and residential areas for businesses and individuals with loans. This information is key to estimating damages to properties in the event of natural disasters, thus enabling the operationalization of a climate stress test. Transition risks, on the other hand, are examined through indicators such as carbon pricing, greenhouse gas emissions, energy consumption volumes, and the prices of energy resources. These assessments are complemented by analyzing macroeconomic effects through indicators like GDP, sector-specific GDP, unemployment rates, interest rates, inflation rates, housing prices, exchange rates, and stock market indices. Moreover, understanding shifts in businesses' financial situations due to impending transition risks necessitates data on atmospheric carbon emissions and corporate financial reports.

However, the scarcity of climate-related data currently presents a significant challenge to the feasibility of conducting climate stress tests.

⁷⁹ Carlin, D., Arshad, M., Fraser, E., & Noinville, V. UNEP Finance Initiative's Comprehensive Good Practice Guide to Climate Stress Testing.

VI. Enhancing Macroprudential Policy Framework

6.1. Selection of Early Warning Indicators of Crises

Early warning indicators (EWIs) are crucial for the successful implementation of macroprudential policy. These indicators enable the activation and adjustment of the countercyclical capital buffer (CCyB) to mitigate the severe losses associated with banking crises, economic downturns, and other adverse shocks. For EWIs to offer reliable forecasts, their signals must come early enough, allowing for effective macroprudential interventions. Furthermore, these indicators should display consistent trends, underpinning the premise that financial vulnerabilities accumulate gradually over time. It is also vital for EWIs to be straightforward and interpretable to ensure their warnings are heeded. Therefore, they must be simple, transparent, and logically aligned with the financial cycle's dynamics.

The effectiveness of EWIs was assessed using the area under the receiver operating characteristic curve (AUROC) model (see Appendix 8). This model identifies errors such as the indicators' failure to signal an impending crisis (Type I error) or false alarms during stable periods (Type II error). Indicators with higher AUROC values more accurately identify crisis periods, whereas a value of 0.5 indicates random crisis predictions⁸⁰.

Research by the Bank for International Settlements identified the credit-to-GDP ratio gap and the DSR as the most reliable EWIs⁸¹. Specifically, the credit-to-GDP gap provides long-term crisis warning, while the DSR can offer more accurate crisis signals two years in advance. An increase in non-core liabilities relative to a rapid credit expansion is another indicator signaling potential financial vulnerabilities. IMF research highlights differences in financial cycles between EMs and AEs, with stock prices and output gaps being significant EWIs for banking crises in AEs⁸². In EMs, stock and housing prices, along with the credit-to-GDP gap, are reliable crisis indicators. Utilizing these EWIs collectively can facilitate early detection of financial and banking crises, providing sufficient lead time to implement macroprudential measures to mitigate crisis impacts.

In Uzbekistan, EWIs are instrumental in enabling prompt crisis mitigation actions, enhancing the financial system's resilience and preventing severe economic downturns. Drawing from international experience and considering Uzbekistan's financial system nuances, the following indicators have been identified as EWIs:

⁸⁰ The AUROC value ranges from 0 to 1. In this context, an AUROC value of 0.5 indicates that the EWI's warnings of a crisis are no better than random chance, whereas an AUROC value of 1 signifies that the EWI is perfect in predicting crises.

⁸¹ Drehmann, M., & Juselius, M. (2013, August). Evaluating early warning indicators of banking crises: Satisfying policy requirements. Bank for International Settlements.

⁸² Chen, S., & Svirydzenka, K. (2021, April). Financial Cycles – Early Warning Indicators of Banking Crises? International Monetary Fund.

1. Credit-to-GDP gap
2. DSR for individuals
3. Real housing price gap
4. Loans of individuals-to-GDP gap
5. Share of non-core liabilities in total liabilities
6. Foreign currency liabilities-to-total liabilities ratio

Assessing these indicators' effectiveness requires defining a crisis period. Given the absence of a recorded banking crisis in Uzbekistan, the significant economic downturn during 2020–2021 (the period when GDP fell behind its potential trend) due to the COVID-19 pandemic was considered. Evaluation using the AUROC model (see Appendix 9) on whether the selected indicators for Uzbekistan signal crises revealed that the credit-to-GDP gap and the loans of individuals-to-GDP gap have AUROC values of 0.6 and 0.5, respectively, indicating a low crisis prediction capability.

Table 1. AUROC Model Results on EWIs' Crisis Signaling

Indicator	AUROC value	Warning capability
Credit-to-GDP gap	0.57	Medium
DSR for individuals	0.12	Low
Real housing price gap	0.36	Low
Loans of individuals-to-GDP gap	0.53	Medium
Share of non-core liabilities in total liabilities	0.44	Low
Foreign currency liabilities-to-total liabilities ratio	0.46	Low

Source: CBU staff calculations.

Additionally, the efficacy of EWIs for 4 pre-crisis quarters (lags) was analyzed (see Appendix 10), with the real housing price gap (AUROC=0.7) being the most effective crisis indicator 4 quarters ahead. All other indicators fell below the random signal threshold (AUROC=0.5), indicating their limited predictive value.

Table 2. AUROC Model Results on EWIs' 4-Quarter Crisis Warning

Indicator	AUROC value	Warning capability
Credit-to-GDP gap	0.25	Low
DSR for individuals	0.5	Low
Real housing price gap	0.72	High
Loans of individuals-to-GDP gap	0.24	Low
Share of non-core liabilities in total liabilities	0.28	Low
Foreign currency liabilities-to-total liabilities ratio	0.17	Low

Source: CBU staff calculations.

The development of EWIs, crucial for identifying and assessing systemic risks, enhances the efficacy of macroprudential policy implementation.

Box 2. Evaluation of Core and Additional Indicators for CCyB Calibration

The credit to the private sector-to-GDP gap is negative, signaling that the CCyB's benchmark rate should be 0 percent. Conversely, additional indicators highlight emerging vulnerabilities in the financial system. These include a rise in the DSR for individuals, persistent overvaluation in housing market prices, growth in the credit-to-GDP ratio, an increase in the total outstanding loans, and the current account-to-GDP ratio. Furthermore, a declining trend in the banking sector's capitalization level is evident, particularly seen through the diminishing dynamics of the Tier 1 capital.

Table 3: Core and Additional Indicators for CCyB Activation

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

Source: CBU staff calculations.

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

Implementing the positive CCyB is advisable to enhance the banking system's capacity to withstand emerging vulnerabilities and to build additional capital for loss absorption should these risks materialize. The CCyB's flexibility allows regulators to adjust capital requirements in response to changes in economic cycles, thereby providing a buffer during downturns and promoting financial stability. Following the COVID-19 pandemic crisis, there has been an increase in the number of countries employing the CCyB (see Appendix 11). This trend underscores the global recognition of the CCyB as a vital tool for ensuring banking sector resilience and safeguarding the broader economy against future shocks.

6.2. Opportunities for Implementing Systemic Risk Buffer

The systemic risk buffer (SyRB) is a tool designed to prevent and mitigate structural systemic risks that are not adequately covered by standard regulatory capital requirements and other additional capital buffers. Its purpose is to enhance the resilience of the banking sector against systemic risks that could arise from a wide array of sources, thereby ensuring financial stability. Unlike other buffers that might target cyclical or institution-specific risks, the SyRB is specifically designed to address systemic risks with structural origins. These can include vulnerabilities stemming from the macroeconomic environment, the structure of the banking sector itself, or specific market segments such as the real estate sector, which has historically been a source of systemic risk. Like other capital buffers, the SyRB must be formed of the highest quality capital, specifically CET1 capital (see Appendix 12).

The flexibility of the SyRB is one of its key features; authorities can apply it across the board to all banks within a jurisdiction or tailor it to a specific subset of banks that are particularly exposed to the identified structural systemic risks. This targeted approach allows for a more effective mitigation strategy without imposing unnecessary burdens on the entire banking sector.

Figure 99. General SyRB Rates Across Selected Countries, % (as of July 1, 2023)

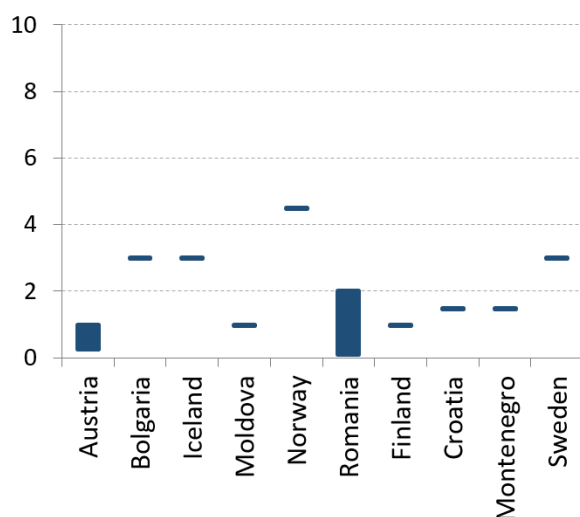
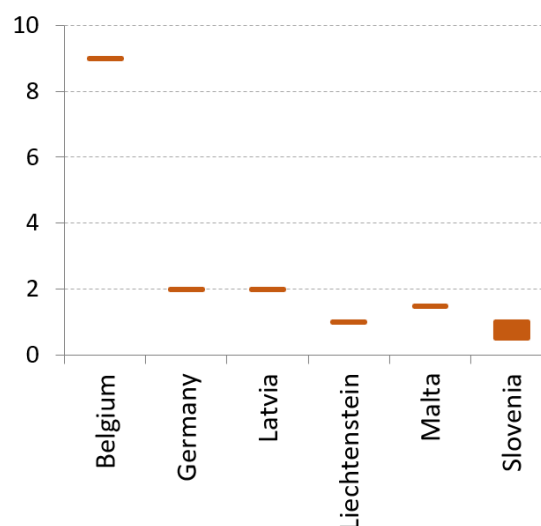


Figure 100. Sectoral SyRB Rates Across Selected Countries, % (as of July 1, 2023)



Sources: European Systemic Risk Board and national authorities.

The SyRB is adopted predominantly by European countries. The revision of the Capital Requirements Directive IV⁸³ in 2013 aimed to enhance the capital and liquidity standards for commercial banks and investment firms, incorporating Basel III standards into European legislation. This revision introduced the SyRB as a flexible instrument

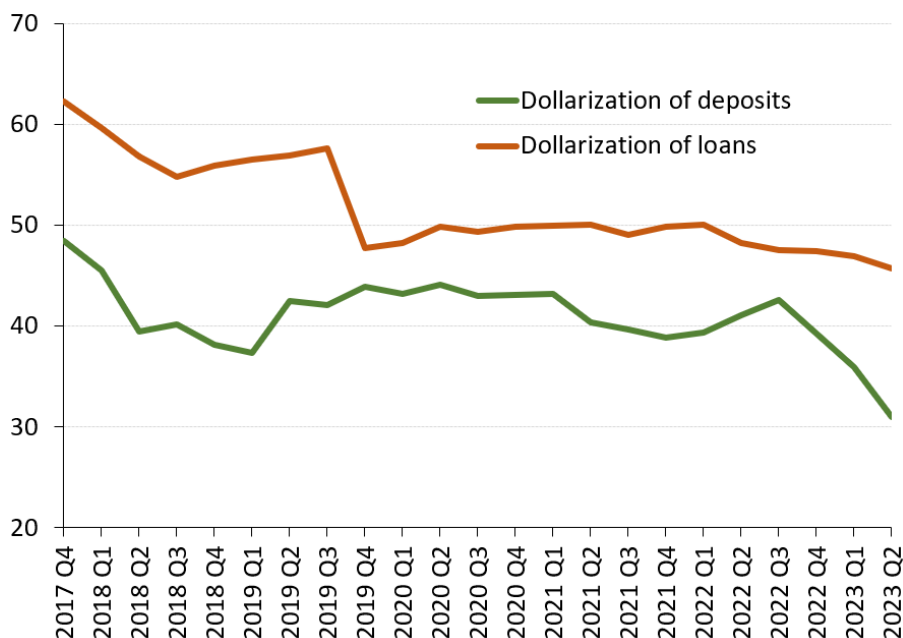
⁸³ European Parliament and Council of the European Union. (2013). Directive 2013/36/EU (CRD IV). Official Journal of the European Union.

alongside the established buffer requirements recommended by the Basel Committee, including the capital conservation buffer (CCoB), the CCyB, and the capital buffer for SIBs.

There is no upper limit set for the SyRB, though rates above certain thresholds may require authorization from the European Commission. Belgium and Norway have implemented the highest buffer rates at 9 and 4.5 percent, respectively. Belgium’s sectoral SyRB requirements applicable only to Internal Ratings Based (IRB) banks’ residential mortgages in Belgium, illustrating the targeted application of the SyRB to address specific systemic risks. Norway’s SyRB rate is justified by structural vulnerabilities in the Norwegian financial system, such as high household indebtedness and significant bank exposure to commercial real estate. On the other hand, Austria and Slovenia have the lowest SyRB rates, ranging from 0.25 to 1 percent (see Appendix 13). Decisions regarding the SyRB must be revisited at least every two years to ensure they are aligned with the prevailing systemic risk landscape⁸⁴.

Like other countries, Uzbekistan is vulnerable to external shocks. A high degree of financial dollarization has the potential to destabilize not only the banking system but also the broader economy. Despite recent efforts in Uzbekistan to mitigate financial dollarization through macroprudential measures, foreign exchange risk remains a concern. In this context, the SyRB emerges as a viable tool to curtail dollarization levels (see Appendix 14).

Figure 101. Dollarization of Deposits and Loans in Uzbekistan, %



Source: CBU.

⁸⁴ European Parliament and Council of European Union. (2019). Amendments to Directive 2013/36/EU (CRD V). Official Journal of the European Union.

By the end of H1 2023, the share of deposits in foreign currency decreased to approximately 30 percent. Nonetheless, the dollarization of loans remains persistently high. To reduce the levels of dollarization, macroprudential policy could be effectively utilized in conjunction with a monetary policy aimed at controlling inflation. In this context, implementing the SyRB for banks with a high degree of loan dollarization could directly target foreign exchange risk. Furthermore, the CBU could employ the SyRB as a tool to address other structural systemic vulnerabilities in the financial system.

Box 3. SyRB Application Across Various Jurisdictions

The SyRB is designed to address structural vulnerabilities outside the scope of other capital buffers. Its flexibility and adaptability have led to its varied application by different countries in addressing specific systemic risks.

In Belgium, Germany, and Lithuania, the SyRB has been deployed to mitigate risks associated with the real estate sector. Czechia utilized this tool until October 2021 to bolster the resilience of SIBs against shocks⁸⁵. In 2021, the Central Bank of Estonia chose to deactivate the SyRB concerning risks tied to general macroeconomic conditions, opting instead for a positive CCyB. Furthermore, it suggested the potential future use of the SyRB to address other structural vulnerabilities⁸⁶. Romania employs the SyRB to enhance the banking sector's management of credit risks from a macroprudential perspective, aiming to fortify the sector's resilience to potential credit losses. The adjustment of the buffer in Romania considers the share of NPLs and their coverage ratio, following this guideline⁸⁷:

Table 4. SyRB Adjustment in Romania

Share of NPLs	NPL coverage ratio	Buffer level (in % of RWA)
<5%	>55%	0
>5%	>55%	1
<5%	<55%	1
>5%	<55%	2

Source: Central Bank of Romania.





In March 2023, the Financial Supervisory Authority of Finland established a 1 percent SyRB for all credit institutions' exposures. The decision was motivated by systemic concerns, including the high value of credit organizations' balance sheets to nominal GDP, cross-border interconnectedness, a concentration of significant risks in the real estate market, and the population's overall high indebtedness⁸⁸.



⁸⁵ European Systemic Risk Board. Annual Report 2021.

⁸⁶ Eesti Pank. Financial Stability Review 2/2021.

⁸⁷ National Bank of Romania. The systemic risk buffer.

⁸⁸ Financial Supervisory Authority of Finland. (2023). Decision of the Board of the Financial Supervisory Authority on the application of macroprudential instruments.

Key financial stability risks and mitigation measures	Risk level and its change	
	In the short term	In the medium term
External risks		
<p>Increase in interest rates in the international markets.</p> <p>The rise in interest rates in the international markets leads to an increase in the risk premium for Uzbekistan, a decrease in the capacity to attract debt, and an increase in the cost of servicing external debt. Also, higher interest rates in the international markets lead to tighter financial conditions.</p> <p>Risk mitigation measures:</p> <ul style="list-style-type: none"> - ensuring strict adherence to the established upper limit on the consolidated budget deficit; - seeking external financing sources with fixed interest rates; - implementing export promotion measures to alleviate the devaluation pressure on the UZS. 		
Internal risks		
<p>A significant increase in the debt burden of the population.</p> <p>The population's debt burden has seen a significant rise, accompanied by a rapid expansion in lending to individuals. This trend heightens credit risk, especially for lower-income borrowers. Consequently, the share of NPLs in the banking sector may increase amid systemic shocks, potentially hampering the banks' ability to extend credit to the real economy.</p> <p>Risk mitigation measures:</p> <ul style="list-style-type: none"> - introducing a payment-to-income (PTI) limit across all loan types for individuals to ensure borrowing does not exceed a manageable portion of their income; - implementing the CCyB, aimed at bolstering the banking system's shock resilience and curbing the rise of unsustainable lending. 		

Key financial stability risks and mitigation measures	Risk level and its change	
	In the short term	In the medium term
<p>Housing price overvaluation.</p> <p>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.</p> <p>Risk mitigation measures:</p> <ul style="list-style-type: none"> - tightening the LTV limit for mortgage loans relative to RWA; - implementing a PTI limit for mortgage loans; - introducing a sectoral CCyB for mortgage loans. 		



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

Table 4. Indicators Used in Financial Vulnerabilities Heatmap⁸⁹

Component	Indicator	Rationale	Description	Risk direction	Data transformation	Source
High credit growth	Credit-to-GDP gap	The credit-to-GDP gap is considered one of the early warning indicators of a financial crisis, and its increase indicates the accumulation of cyclical systemic risks.	The deviation of the credit-to-GDP ratio from its long-run trend, as determined by the HP filter.	+	Percentage point	CBU and Statistics Agency of Uzbekistan
	Growth in the credit-to-GDP ratio	A high growth rate of the credit-to-GDP ratio could result in a decrease in loan quality, an increase in systemic risk, and a deterioration of banking system stability.	Annual growth rate of the credit-to-GDP ratio	+	Percent	CBU and Statistics Agency of Uzbekistan
	Total credit growth (YoY)	The rapid expansion of loan portfolios can lead to capacity constraints—such as those needed to manage risks, gather information, or assess the quality of applications—beginning to bind. This situation may result in new loans originating without adequate screening and risk management.	Annual total credit growth rate	+	Percent	CBU
	Leverage on mortgage loans outstanding	A higher growth rate of residential mortgage loans in relation to GDP results in increased exposure of the financial system to a single shock,	The ratio of mortgage loans to GDP	+	Percent	CBU and Statistics Agency of Uzbekistan

⁸⁹ Nier, E. et al. (2014). The Staff Guidance Note on Macroprudential Policy—Detailed Guidance on Instruments. IMF.

Arbatli, E. C., & Johansen, R.M. (2017). A heatmap for monitoring systemic risk in Norway. Norges Bank staff memo 10.

Igan, D., & Pinheiro, M. (2011). Credit growth and bank soundness: Fast and furious?. IMF.

Component	Indicator	Rationale	Description	Risk direction	Data transformation	Source
		namely, a fall in house prices.				
	Wholesale funding ratio	A higher share of wholesale funding exposes the banking system to potential funding risks, as wholesale funding can be more volatile and dry up more quickly during periods of stress. Since the providers of wholesale funding constantly monitor the financial condition of banks, large amounts of these funds are withdrawn during times of uncertainty in the banking system.	Wholesale funding (total liabilities less household deposits) as a share of total assets	+	Percent	CBU
	Current account balance deficit or surplus	An increase in the current account deficit represents an increase in the difference between a nation's spending and earnings abroad, which could lead to a rise in foreign liabilities and depreciation of the national currency.	The current account consists of the trade balance, net primary income, and net secondary income for a given period.	-	Level	CBU
Household sector	Household loan growth	The high growth rate in these loans can cause a decline in consumer spending and aggregate demand in the economy due to the increased debt servicing costs for borrowers. Also, it increases the likelihood of credit losses in case borrowers' financial conditions deteriorate.	Annual growth rate of household loans	+	Percent	CBU

Component	Indicator	Rationale	Description	Risk direction	Data transformation	Source
	Real house prices	A higher growth rate of house prices compared to the inflation rate for a long time could lead to an increased likelihood of credit losses in case of sharp house price declines in the future.	The ratio of the average nominal house prices to inflation in Uzbekistan	+	Level	Center for Economic Research of Uzbekistan, CBU
	House price-to-disposable income ratio	Elevated house price valuations can lead to higher losses for lenders and can reinforce unsustainable lending growth by increasing collateral valuations. An abrupt fall in house prices can lead to an increase in bank losses, either directly through losses on housing loans or indirectly through its effect on aggregate demand.	The ratio of average house prices to average disposable income per capita in Uzbekistan	+	Level	Center for Economic Research of Uzbekistan, CBU, and Statistics Agency of Uzbekistan
	Share of household loans in total credit	An increase in this indicator can lead to a higher probability of credit losses in banks as a result of the deterioration of the financial condition of debtors.	The ratio of individuals' outstanding loans to the total loans	+	Percent	CBU
	Household debt service ratio	High values of this ratio can signal unsustainable levels of indebtedness and a higher vulnerability of households to shocks.	The ratio of principal and interest payments on individuals' loans to their disposable income	+	Percent	CBU, Statistics Agency of Uzbekistan
Corporate sector	Corporate loan growth	The rapid growth of outstanding corporate loans increases the probability of large credit losses in banks due to solvency issues in legal entities, which may arise from shocks in the real economy.	Annual growth rate of outstanding loans to legal entities	+	Percent	CBU

Component	Indicator	Rationale	Description	Risk direction	Data transformation	Source
	Share of corporate loans in total credit	The high levels of this indicator show an increased risk of corporate concentration within the bank's loan portfolio, which increases the likelihood of bank loan losses stemming from the deterioration of the financial condition of legal entities.	The ratio of outstanding corporate loans to total loans	+	Percent	CBU
	Commercial real estate credit	The high growth of outstanding commercial real estate loans elevates the credit risk for banks, as borrowers are more likely to default in the event of a sharp decline in real estate prices.	Outstanding loans issued to legal entities for construction and reconstruction	+	Level	CBU
	Share of FX loans	Large national currency depreciation could lead to a lower repayment ability for unhedged borrowers due to increased debt servicing costs and high loan losses in the banking system.	The ratio of corporate loans in foreign currency to total loans	+	Percent	CBU
	Corporate credit-to-GDP gap	This indicator captures increases in leverage relative to a long-run trend and signals periods of sustained and large increases in leverage. Periods of heightened levels of leverage can signal higher credit risk and potential debt overhang effects (the situation when companies incur too much debt, and creditors are reluctant to provide more funding).	The deviation in the ratio of corporate credit to GDP from its long-run trend, as determined by the HP filter.	+	Percentage point	CBU, Statistics Agency of Uzbekistan

Component	Indicator	Rationale	Description	Risk direction	Data transformation	Source
Systemic liquidity and currency risks	Loan-to-deposit ratio	A higher loan-to-deposit ratio implies greater maturity transformation and potential vulnerabilities to liquidity risks in the banking system, due to banks' reliance on unstable sources of funding for lending purposes.	The ratio of total loans to total deposits	+	Percent	CBU
	Share of non-core funding in total liabilities	Due to the high sensitivity of wholesale funding to changes in the financial system, large withdrawals of these funds are typically observed during periods of uncertainty. Therefore, an increase in the share of wholesale funding sources in the total liabilities of banks can lead to liquidity problems.	Wholesale funding (total liabilities less household deposits) as a share of total liabilities	+	Percent	CBU
	Share of liquid assets	The reduction of highly liquid assets in total assets represents an increase in liquidity risk in the banking system.	The ratio of highly liquid assets to total assets	-	Percent	CBU
	Share of long-term loans in total credit	An increase in this ratio may create the asset-liability mismatch. Therefore, if the share of long-term loans is high, banks could face liquidity problems when there is uncertainty in the banking system.	The ratio of long-term loans to total loans	+	Percent	CBU
	Share of deposits with a maturity of more than one year	The decline of this indicator signifies a reduction in the share of stable funding sources in	The share of deposits with a maturity exceeding one year in total deposits	-	Percent	CBU

Component	Indicator	Rationale	Description	Risk direction	Data transformation	Source
		the composition of bank liabilities.				
	Net open FX positions	An increase in a net open FX position represents an increase in the potential losses that banks may incur as a result of sudden movements in exchange rates.	The mismatch between the foreign currency asset and liability positions of banks.	+	Level	CBU
Structural systemic risks	Concentration in banking sector (by assets)	The HHI serves as a measure of the degree of concentration and competitiveness in the banking sector. A higher index represents a more concentrated, or less competitive, lending market.	The HHI for banking system assets is the sum of the squares of the share of each bank's assets in the total banking system assets.	+	Level	CBU
	Banking system assets-to-GDP ratio	A large increase in the size of the banking system can signal higher risk-taking, credit risks, and increasing complexity. A rise in this indicator implies an increase in the degree of interdependence between the real economy and the banking system, which could lead to higher spillover effects on the economy in case of banking system instability.	The ratio of total assets of the banking system to GDP	+	Percent	CBU

Note: A positive (+) sign indicates that an increase in the indicator is associated with a rise in financial vulnerabilities. Conversely, a negative (-) sign suggests that an increase in the indicator results in a reduction of financial vulnerabilities. With the exception of the net open FX position for Q1 2019, all indicators have been mapped since Q1 2018.

Table 5. Uzbekistan's Financial Stress Index

The essence of the FSI	The primary objective of the FSI is to consolidate the overall condition of the financial system into a singular, comprehensive indicator. In computing the FSI, fluctuations within the banking sector, money market, and foreign exchange market are considered, reflecting the unique attributes of the Uzbekistan's financial system. The FSI's initial measurement period commenced in January 2019, using monthly data.
Indicators	<p>Banking sector:</p> <ul style="list-style-type: none"> – The deviation of total credit outstanding from its trend, as identified by the Hodrick-Prescott (HP) filter. – The deviation of total deposit outstanding from its trend, also determined by the HP filter. – The ratio of net interest income to total bank assets earning interest. <p>Money market:</p> <ul style="list-style-type: none"> – The difference between the average interest rate in the interbank money market and the average yield of Uzbek treasury bonds. – The volatility of the average interest rate in the interbank money market, determined by the generalized autoregressive conditional heteroskedasticity (GARCH) model. <p>Foreign exchange market:</p> <ul style="list-style-type: none"> – The realized volatility of the UZS-USD exchange rate. – The realized volatility of the UZS-EUR exchange rate.
Standardization of indicators	Z-score method.
Aggregation of indicators into a sub-index	Principal Component Analysis (PCA), which involves transforming the values of sub-indices to fall within a range of 0 to 1 using a logarithmic function.
Determining the weight of sub-indices	The composition of the final FSI is shaped by assessing the influence of each sub-index on GDP growth and determining their respective weights accordingly.

Consolidation of sub-indices into the final index	The final result of the FSI is calculated by summing the products of the sub-index values and their corresponding weights.
FSI results	An FSI value approaching 1 signifies elevated stress, whereas a value nearing 0 suggests minimal stress. When the FSI exceeds the threshold of its mean plus one standard deviation, it denotes periods of significant increase in the index's value.

Methodology for Calculating Dynamic CoVaR

VaR^i (value at risk) represents the maximum loss of bank i at the confidence level α . However, VaR^i falls short of capturing single bank's contribution to overall systemic risk. To address this, $CoVaR^i$ (conditional value at risk) is introduced, evaluating the contribution of an individual bank's risk to the overall risk level of the banking sector. $\Delta CoVaR_q^i$ serves as a tool to evaluate risk levels. It is defined by calculating the difference between the median value of bank indicators within a specific quantile and the stable conditions.

The quantile functions for different quantiles between the profitability of banks and the values of lagged state variables⁹⁰, as well as the profitability of the banking system and the profitability of each bank and the state variables are expressed in the following form⁹¹:

$$X_t^i = \alpha_q^i + \gamma_q^i M_{t-1} + \epsilon_{q,t}^i$$

$$X_t^{system|i} = \alpha_q^{system|i} + \gamma_q^{system|i} M_{t-1} + \beta_q^{system|i} X_t^i + \epsilon_{q,t}^{system|i}$$

Here, X_t^i and $X_t^{system|i}$ represent the profitability of bank i and the banking system, M_{t-1} is the vector of values of lagged state variables, α_q^i , γ_q^i , $\alpha_q^{system|i}$, $\beta_q^{system|i}$ and $\gamma_q^{system|i}$ are estimated coefficients, and $\epsilon_{q,t}^i$ and $\epsilon_{q,t}^{system|i}$ are the error terms. The estimated coefficients of the quantile functions are determined by the quantile regression model for different quantiles. The profitability of banks, influenced by state variables, is estimated using the quantile regression model of the quantile function, which yields $VaR_{q,t}^i$ for each bank.

$$VaR_{q,t}^i = \hat{X}_t^i$$

$$VaR_{q,t}^i = \hat{\alpha}_q^i + \hat{\gamma}_q^i M_{t-1}$$

Here, $\hat{\alpha}_q^i$ and $\hat{\gamma}_q^i$ are coefficients determined by the quantile regression model, and M_{t-1} is the vector of values of lagged state variables. The value of $CoVaR_{q,t}^i$ for each bank is determined by the coefficients of the quantile function determined by quantile regression and the influence of $VaR_{q,t}^i$ and the values of lagged state variable as follows:

⁹⁰ State variables are variables that capture important information about the future state of the banking system.

⁹¹ Adrian, T., & Brunnermeier, M. (2014). CoVaR. Federal Reserve Bank of New York.

$$CoVaR_{q,t}^i = \hat{\alpha}_q^{system|i} + \hat{\gamma}_q^{system|i} M_{t-1} + \hat{\beta}_q^{system|i} VaR_{q,t}^i$$

Here, M_{t-1} is the vector of values of lagged state variables; $VaR_{q,t}^i$ is the value of VaR for bank i in q quantile; $\hat{\alpha}_q^{system|i}$, $\hat{\gamma}_q^{system|i}$ and $\hat{\beta}_q^{system|i}$ are coefficients determined by the quantile regression model. The most important indicator is the value of $\Delta CoVaR_{q,t}^i$, which is computed by determining the difference between the values of $CoVaR_{q,t}^i$ in the q quantile and the 50 percent quantile as follows⁹²:

$$\Delta CoVaR_{q,t}^i = CoVaR_{q,t}^i - CoVaR_{50,t}^i$$

The higher the value of $CoVaR_{q,t}^i$ in the q quantile from this median indicator, the greater the risk level becomes. $\Delta CoVaR_{q,t}^{system}$ for the banking system is derived from two components: the sum of $\Delta CoVaR_{q,t}^i$ calculated for each bank, and the product of the shares of each bank's capital in the overall banking system's capital.

⁹² The 50 percent quantile is the median value of CoVaR and represents the lowest level of risk.

Quantile Regression Model

A quantile regression model is used to estimate the unknown parameters of a linear quantile function. In the quantile regression model, the unknown coefficients of the linear function are determined by estimating the smallest value of the sum of the absolute values of the relative errors⁹³.

According to the quantile regression model, the minimum value of the following expression is estimated⁹⁴:

$$Q_N(\beta_q) = \sum_{i:y_i \geq x'_i \beta} q |y_i - x'_i \beta_q| + \sum_{i:y_i < x'_i \beta} (1 - q) |y_i - x'_i \beta_q|$$

Here, x'_i is the dependent variable, y_i is the independent variable, q is the quantile, β_q is the estimated coefficient. For example, when estimating unknown coefficients of a linear function at the 70th quantile, $q = 0,7$ is set. The estimated coefficients of the smallest value of $(Q_N(\beta_q))$ are determined.

In contrast to the method of least squares, the quantile regression model uses the method of linear programming⁹⁵ to determine the smallest value of the sum of absolute values of relative errors $(Q_N(\beta_q))$.

In the quantile regression model, the estimated coefficients of the quantile function are determined according to the linear programming method. The estimated coefficients satisfy the following condition:

$$\begin{aligned} \epsilon_{q,t}^i &= X_t^i - \alpha_q^i - \gamma_q^i M_{t-1} \\ \min_{\alpha_q^i, \gamma_q^i} \sum_t &\begin{cases} q |\epsilon_{q,t}^i|, & \text{if } \epsilon_{q,t}^i \geq 0 \\ (1 - q) |\epsilon_{q,t}^i|, & \text{if } \epsilon_{q,t}^i < 0 \end{cases} \\ \epsilon_{q,t}^{system|i} &= X_t^{system} - \alpha_q^{system|i} - \beta_q^{system|i} X_t^i - \gamma_q^{system|i} M_{t-1} \\ \min_{\alpha_q^{system|i}, \beta_q^{system|i}, \gamma_q^{system|i}} \sum_t &\begin{cases} q |\epsilon_{q,t}^{system|i}|, & \text{if } \epsilon_{q,t}^{system|i} \geq 0 \\ (1 - q) |\epsilon_{q,t}^{system|i}|, & \text{if } \epsilon_{q,t}^{system|i} < 0 \end{cases} \end{aligned}$$

⁹³ Fabozzi, F., Focardi, S., Rachev, S., & Arshanapalli, B. (2014). *The Basics of Financial Econometrics*. John Wiley & Sons.

⁹⁴ Cameron, A., & Trivedi, P. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press.

⁹⁵ The linear programming method is a method of programmatically replacing the unknown coefficients in finding the optimal values of the minimum or maximum points being determined.

Here, X_t^i and X_t^{system} represent the profitability (returns) of bank i and the banking system, M_{t-1} is the vector of values of the lagged independent variables, $\alpha_q^i, \gamma_q^i, \alpha_q^{system|i}, \beta_q^{system|i}$ and $\gamma_q^{system|i}$ are the estimated coefficients, $\epsilon_{q,t}^i$ and $\epsilon_{q,t}^{system|i}$ are the error terms.

Table 6. Selected 60 Large Enterprises

No.	Joint stock company
1	UzAuto Motors
2	Uzbek Commodity Exchange
3	Uzkabel JV
4	Toshkentdonmahsulotlari
5	Chilonzor buyum savdo kompleksi
6	Qizilqumsement
7	Quvasoycement
8	Maxsusenergogaz
9	Andijon biokimyo zavodi
10	Andijonkabel JV
11	Asaka don mahsulotlari
12	Do'stlik don mahsulotlari
13	Jizzax akkumulyator zavodi
14	Koson yog'-ekstraksiya
15	Uchqo'rg'on don mahsulotlari
16	Kattaqo'rg'on yog'-moy
17	Oq oltin don mahsulotlari
18	Toshkent qishloq xo'jaligi texnikasi zavodi
19	Toshkentvino kombinati
20	Dori-Darmon
21	O'zbekgeofizika
22	Namangandonmahsulotlari
23	O'ZDONMAHSULOT
24	O'zbekko'mir
25	Navoiyazot
26	Ohangaronsement
27	Jizzaxdonmahsulotlari
28	Angren Issiqlik Elektr Stansiyasi
29	O'zbekiston rangli metall parchalari, chiqindilarini tayyorlash va qayta ishlash zavodi
30	O'zenergota'minlash
31	Surxondaryodonmahsulotlari
32	O'ZELEKTROAPPARAT-ELECTROSHIELD
33	Maxsuselektrtarmoqqurilish
34	Toshkent yo'lovchi vagonlarini qurish va ta'mirlash zavodi
35	Ohangaron don
36	Maxam - Chirchiq
37	QO'QON BOKIMYO
38	Kvarts
39	Olmalik kon-metallurgiya kombinati
40	O'zbekiston metallurgiya kombinati
41	Buxoro hududiy elektr tarmoqlari korxonasi
42	Shohrud

43	Buxorodonmahsulotlari
44	O'z-Tong Hong Kompani Uzbekistan-Korea JV
45	Oqtosh-don
46	NO'KIS VINOZAVODI
47	Chirchiq transformator zavodi
48	Qo'qon don mahsulotlari
49	Farg'ona hududiy elektr tarmoqlari korxonasi
50	Farg'onaazot
51	Urganch yog'-moy
52	Farg'onadonmahsulotlari
53	Ammofos-Maxam
54	Buxoroneftgazparmalash
55	Inter-Rohat JV
56	Konvin
57	BEKTEMIR-SPIRT EKSPERIMENTAL ZAVODI
58	G'alla-Alteg
59	O'zbekgidroenergoqurilish
60	Uzbek Leasing International

Table 7. Selected 50 Largest Enterprises

No.	Joint stock company
1	Uzbek Commodity Exchange
2	Uzkabel JV
3	Toshkentdonmahsulotlari
4	Chilonzor buyum savdo kompleksi
5	Qizilqumsement
6	Maxsusenergogaz
7	Andijon biokimyo zavodi
8	Andijonkabel JV
9	Asaka don mahsulotlari
10	O'zneftgazquduqta'mirlash
11	Dostlik don mahsulotlari
12	Uchqo'rg'on don mahsulotlari
13	Kattaqo'rg'on yog'-moy
14	Oq oltin don mahsulotlari
15	Toshkentvino kombinati
16	Dori-Darmon
17	O'zbekgeofizika
18	O'ZDONMAHSULOT
19	Navoiyazot
20	Ohangaronsement
21	Jizzaxdonmahsulotlari
22	Angren Issiqlik Elektr Stansiyasi
23	O'zbekiston rangli metall parchalari, chiqindilarini tayyorlash va qayta ishlash zavodi
24	O'zenergota'minlash
25	O'ztemiryo'lyo'lovchi
26	Surxondaryodonmahsulotlari
27	O'ZELEKTROAPPARAT-ELECTROSHIELD
28	Maxsuselektrtarmoqqurilish
29	Toshkent yo'lovchi vagonlarini qurish va ta'mirlash zavodi
30	Ohangaron don
31	QO'QON BOKIMYO
32	Kvarts
33	Olmaliq kon-metallurgiya kombinati
34	O'zbekiston metallurgiya kombinati
35	Buxoro hududiy elektr tarmoqlari korxonasi
36	Buxorodonmahsulotlari
37	O'z-Tong Hong Kompani Uzbekistan-Korea JV
38	Oqtosh-don
39	NO'KIS VINOZAVODI
40	Chirchiq transformator zavodi
41	Qo'qon don mahsulotlari

42	Farg'ona hududiy elektr tarmoqlari korxonasi
43	Farg'onaaazot
44	Urganch yog'-moy
45	Farg'onadonmahsulotlari
46	Inter-Rohat JV
47	BEKTEMIR-SPIRT EKSPERIMENTAL ZAVODI
48	G'alla-Alteg
49	O'zbekgidroenergoqurilish
50	Uzbek Leasing International

Table 8. Solvency Top-down Macro Stress Test Tool

Basic parameters	A total of 35 commercial banks, 10 of which are state-owned, were taken into account. As of January 1, 2023, the assets of the commercial banks included in the macro stress test constituted 100 percent of the assets of the banking system. All commercial banks must comply with the capital adequacy requirements set by the CBU. The starting period for the macro stress test is H1 2023.
Stress test horizon	3 years (from H1 2023 to H1 2025)
Assumptions in the stress test	Dynamic balance: <ul style="list-style-type: none"> – The amount of total loans and other bank assets, including securities issued by the Ministry of Finance or CBU, securities of private organizations, claims on other banks, and the CBU, increases based on the forecast of the annual loan outstanding growth. – Asset composition changes during the stress test period. – Banks form their own capital from retained earnings.
Macroeconomic scenarios	In the baseline scenario, the future state of the economy is projected based on the continuation of existing economic trends. The adverse scenario, however, considers the impact of both internal and external severe shocks on the economy. Specifically, this scenario is shaped by considering factors such as the heightened negative impact of geopolitical tensions on economic growth, reduced aggregate demand, and increased instability in the global financial system.
Regulatory standards	Capital adequacy requirements are set for total regulatory capital, CET1, and Tier 1. Banks use a standardized approach ⁹⁶ in the RWA calculation. Assets are classified into five different categories according to their quality, and the following provisions are created for them as determined by the CBU ⁹⁷ : <ul style="list-style-type: none"> – 1 percent for "standard" assets; – 20 percent for "watch" assets; – 25 percent for "unsatisfactory" assets; – 50 percent for "doubtful" assets; – Reserves for "loss" assets must be formed using 100 percent of the bank's expenses.

⁹⁶ Bank for International Settlements. Calculation of RWA for credit risk, standardized approach.

⁹⁷ O'zbekiston Respublikasi Markaziy banki boshqaruvining "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, 2021.

	"Unsatisfactory," "doubtful," and "loss" loans that are more than 90 days past due are considered NPLs.
Methodology and types of risks taken into account	<p>Based on macroeconomic scenarios, the components of the profit and loss module are evaluated.</p> <p>Credit risk</p> <p>The NPL share is forecasted for both baseline and adverse scenarios using a satellite model. The effect of a sharp UZS depreciation on the NPL in foreign currency was calculated based on practices observed in countries similar to Uzbekistan. IFRS 9's expected credit loss (ECL) approach classifies loans into three categories⁹⁸: standard, watch, and NPL.</p> <p>During times of economic instability, an increase in standard and watch loans is projected, in line with the increase in the share of NPLs. In this context, based on the initial value of performing loans and the share of watch loans in performing loans (total loans less NPLs), the forecast of this ratio changes with the same coefficient as the NPL forecast during the stress test period. This coefficient is set according to the combined movement of watch loans and NPLs in Uzbekistan and similar countries.</p> <p>Through this process, the amount of standard and watch loans 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.</p> <p>Market and currency risk</p> <p>According to current regulations in Uzbekistan, banks are not required to revalue securities in their possession at market prices. Therefore, the book value of securities is reflected at base prices, and changes in market interest rates do not affect the value of securities. However, the current regulation mandates the creation of reserves for securities that do not generate income for a certain period. Thus, the creation of additional reserves for securities of private organizations in the adverse scenario is considered. Furthermore, the macro stress test incorporates the profit or loss arising from the revaluation of assets and liabilities denominated in foreign currencies. This assessment is based on the banks' disclosed currency positions and reflects the impact of fluctuations in the exchange rates.</p> <p>Net interest income, non-interest income, and expenses</p>

⁹⁸ Bank for International Settlements. IFRS 9 and expected loss provisioning – Executive Summary, 2017.

	<p>The amount of net interest income is calculated by multiplying interest-earning assets by the net interest margin percentage. The net interest margin is calculated as the average of 2022 and H1 2023 (annualized), for each bank under both the baseline scenario, which remains consistent with the current period, and the adverse scenario, which sees a decrease of 0.2 percentage points in each future period relative to the current one. Future projections for non-interest income and expenses incorporate the assumed growth rates, building on the average of 2022 and H1 2023 (annualized) for each institution.</p> <p>In the baseline scenario, it is projected that non-interest income will see an increase of 5 percent in the first year, followed by 10 and 15 percent in the subsequent years, relative to the current period. Conversely, in the adverse scenario, non-interest income is expected to decrease by 15 percent annually from the current period. As for non-interest expenses, under both scenarios, they are anticipated to rise by 5 percent in the first year, with subsequent increases of 10 and 15 percent in the following years compared to the current period.</p> <p>Dividends</p> <p>In the macro stress test, dividends are allowed if the net profit after tax is positive. The dividend payout ratio is determined for each bank based on the dividend payouts of previous periods.</p>
Capital requirements	<p>Capital adequacy requirements set by the CBU for commercial banks⁹⁹:</p> <ul style="list-style-type: none"> – CET1 ratio is 8 percent of RWA – Tier 1 ratio is 10 percent of RWA (the CCoB is 3 percent of RWA) – CAR is 13 percent of RWA – If the amount of Tier 2 capital exceeds one-third of the amount of Tier 1 capital, the excess amount is not included in the regulatory capital. In addition, provisions for loans of the "standard" classification, included in Tier 2 capital, should not exceed 1.25 percent of RWA.
Concentration risk	<p>As an additional shock to the adverse scenario, the impact of the default of the largest borrowers on the banking system's total capital is considered.</p>
The final results	<p>Capital adequacy ratios (CET1, Tier 1, and CAR) are the final results of the macro stress testing conducted for the entire banking system as well as for individual banks.</p>

⁹⁹ "Tijorat banklari kapitalining monandligiga qo'yiladigan talablar to'g'risidagi nizomni tasdiqlash haqida" O'zbekiston Respublikasi Markaziy banki Boshqaruvining 2015 yil 13 iyundagi 14/3–son qarori, 2015.

Area Under Receiver Operating Characteristic Curve (AUROC)

EWIs serve to detect in advance the signals of possible systemic risks that could lead to a crisis¹⁰⁰. When an indicator variable exceeds a specified threshold, a signal is generated. This means that if the indicator remains under the threshold, no signal is emitted; however, if it surpasses the threshold, a signal is issued. The outcomes can be organized in the following manner: (A) When an indicator exceeds a threshold and a crisis unfolds, the observation is considered a good signal, indicating accurate crisis prediction; (B) When an indicator exceeds a threshold without a subsequent crisis, it constitutes a false alarm (Type II error); (C) When an indicator falls below a threshold and a crisis occurs, the observation is identified as a missed signal (Type I error); (D) When an indicator is below a threshold and no crisis happens, it is categorized as a good silence, demonstrating accurate prediction of the tranquil period.

For every threshold value, the effectiveness of a signal is evaluated through metrics like the ratio of missed crises (Type I errors)¹⁰¹ or the occurrence of false alarms (Type II errors)¹⁰².

Table 8. Risk Warning Outcomes

Indicator's position	Crisis	No crisis
Above threshold	A	B
Below threshold	C	D

Source: Bank of England.

The risk threshold for indicators is determined by assessing the cost linked to the two types of errors. The low threshold leads to receiving warnings about almost all crisis periods, but also to a large number of false alarms (Type II errors). On the other hand, when the threshold is set high, many crisis warnings will be missed. The Type I and Type II error rates, signal ratio, and noise ratio are defined as follows:

$$\text{Signal ratio} = \frac{A}{A + C}$$

$$\text{Noise ratio} = \frac{B}{B + D}$$

¹⁰⁰ Chatterjee, S., Chiu, C-W. J., Duprey, T., & Hoke, S. H. (2017, December). A financial stress index for the United Kingdom. Bank of England.

¹⁰¹ In a Type I error, a crisis is not expected to occur, but it does.

¹⁰² In a Type II error, a crisis is expected to occur, but it does not.

$$\text{Type I error rate} = \left(\frac{\text{"false positive"}}{\text{"false positive"} + \text{"true positive"}} \right)$$

$$\text{Type II error rate} = \left(\frac{\text{"false negative"}}{\text{"false negative"} + \text{"true negative"}} \right)$$

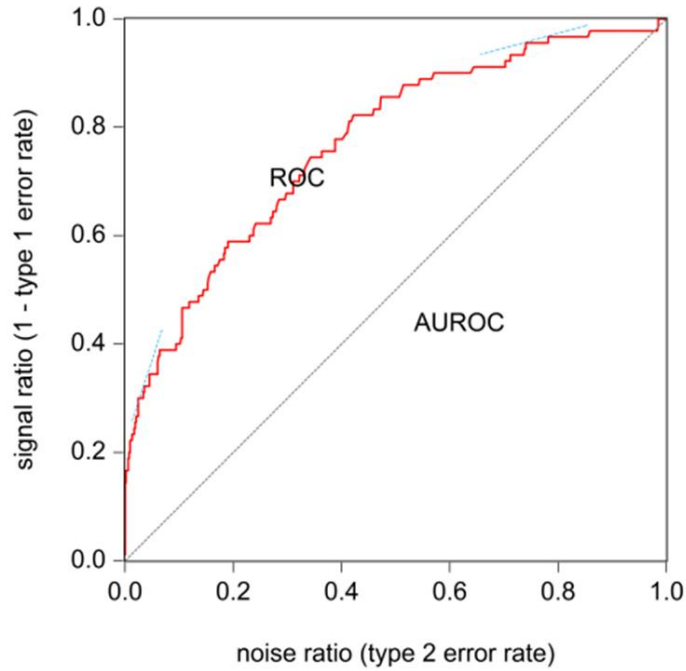
A true positive rate is when the indicator correctly predicts a crisis. A false positive rate is when the indicator incorrectly predicts no crisis. A true negative rate is when the indicator correctly predicts no crisis. A false negative rate is when the indicator incorrectly predicts a crisis. An effective indicator should maintain a noise-to-signal ratio below 1. Achieving a ratio of 1 implies that the signals generated by the indicator are entirely random.

A receiver operating characteristic curve (ROC) summarizes the relationship between Type I and Type II errors and plots the noise ratio against the signal ratio for every possible threshold value above which a signal is defined.

An AUROC is a portion of the area of the unit square, and its value is between 0 and 1. A random signal forms a diagonal line between coordinates (0;0) and (1;1), and the area under the diagonal line is equal to 0.5. An indicator with an AUROC value of 0.5 gives only a random warning of a crisis. In this case, the AUROC value of a good signal indicator should be higher than 0.5. For example, an AUROC value of 0.7 means that the indicator correctly distinguishes between crisis and non-crisis situations with 70 percent accuracy. Different signal-to-noise ratios are determined by gradually lowering the risk threshold set for the indicator. A ROC curve is generated as a result of the determined ratio values. The AUROC value of the indicator is equal to the area bounded by the ROC curve.

$$AUROC(x_i) = \int_0^1 ROC_i(t) dt$$

Figure 102. ROC and AUROC¹⁰³



Using geometry to find the definite integral¹⁰⁴, the AUROC value is determined by the sum of the surfaces of small trapezoids divided into segments:

$$AUROC(x_i) = \frac{1}{2} * \sum_{j=1}^n ((b_j + b_{j+1}) * (a_{j+1} - a_j))$$

Here, a_j and a_{j+1} are the noise ratios of the j and $j + 1$ order risk thresholds of the x_i indicator, b_j and b_{j+1} are the j and $j + 1$ of the x_i indicator signal ratios at the risk threshold of order $j + 1$.

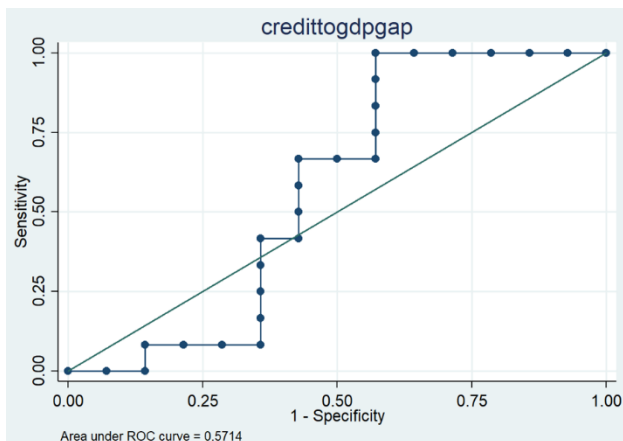
The effectiveness of the indicator, using the AUROC model, is primarily determined through econometric programs.

¹⁰³ Goldstein-Greenwood, J. (2022). ROC Curves and AUC for Models Used for Binary Classification. University of Virginia.

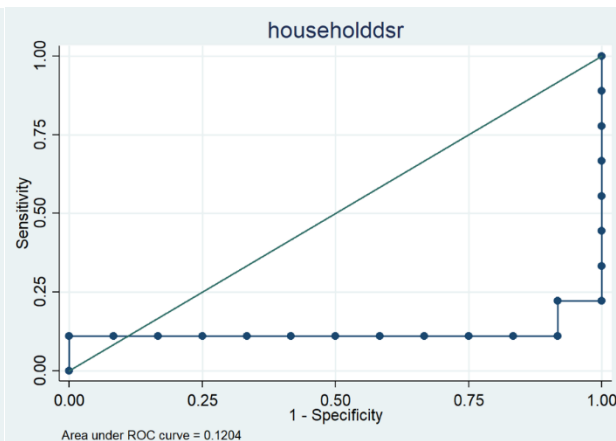
¹⁰⁴ Anton, H., Bivens, I., & Davis, S. (2012). Calculus. John Wiley & Sons.

Figure 103. AUROC Model: Efficacy of Selected Indicators in Predicting Crises

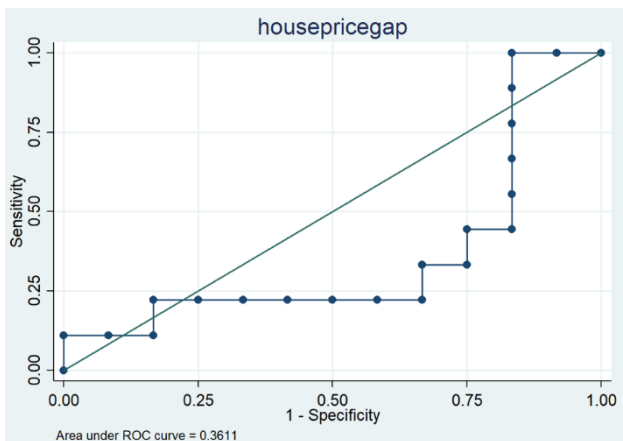
Credit-to-GDP gap



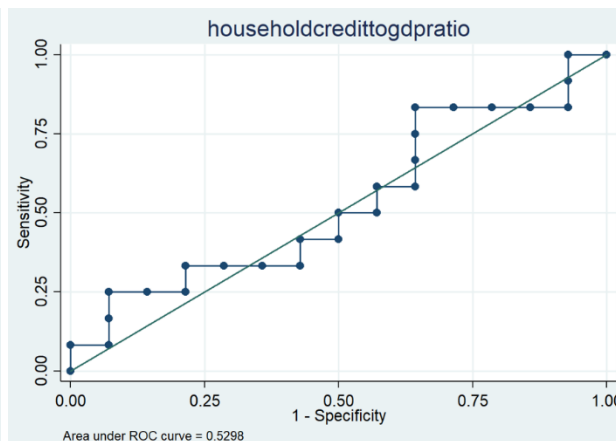
DSR for households



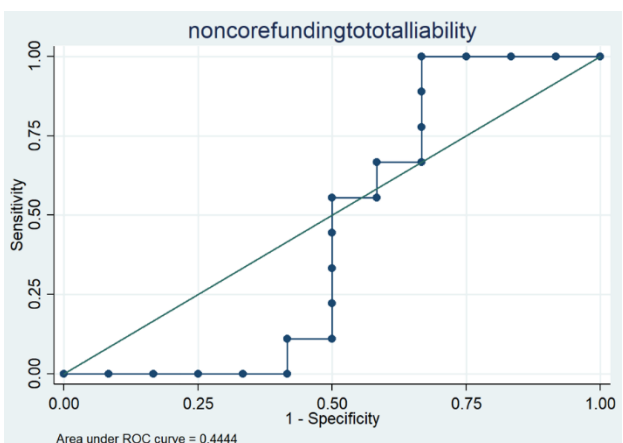
Real housing price gap



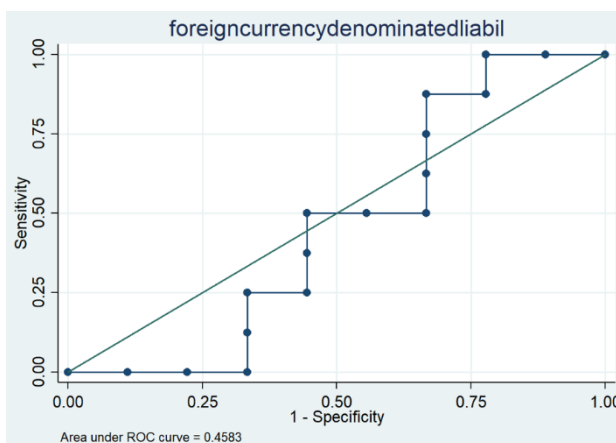
Loans to households-to-GDP ratio



Share of non-core liabilities in total liabilities



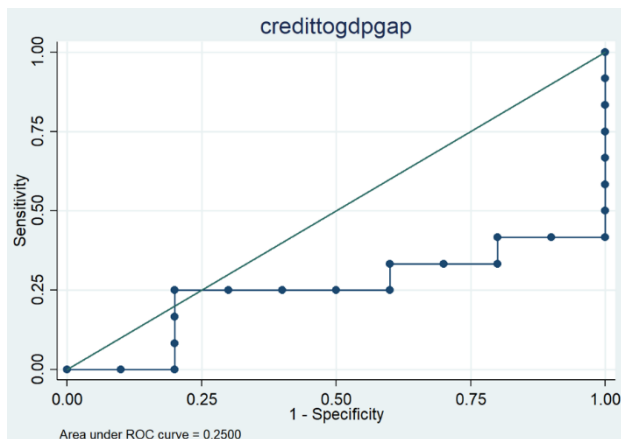
Foreign currency liabilities-to-total liabilities ratio



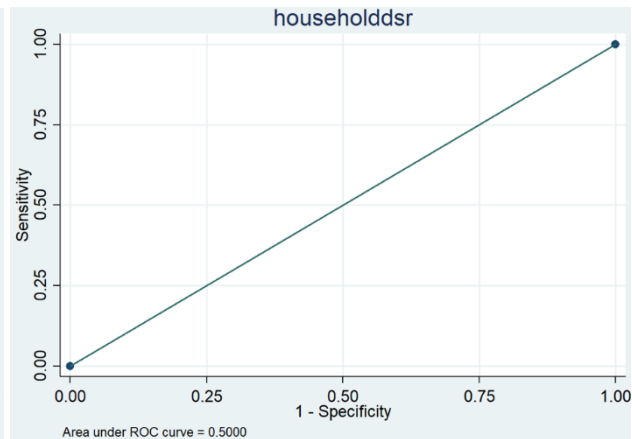
Source: CBU staff calculations.

Figure 104. AUROC Model: Efficacy of Selected Indicators in Providing 4-Quarter Advance Crisis Warning

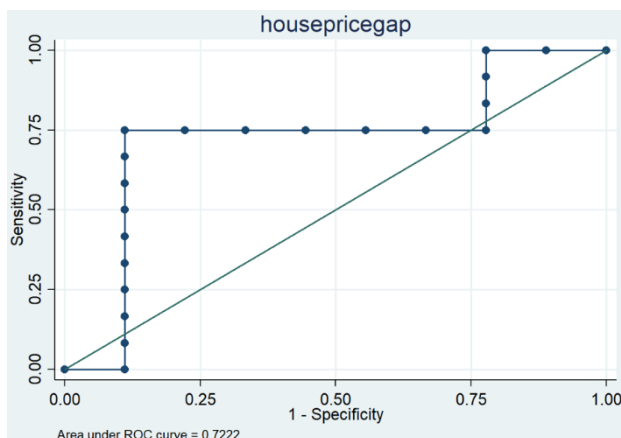
Credit-to-GDP gap



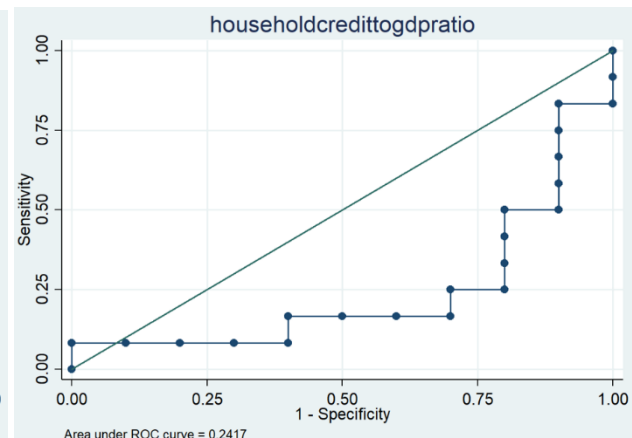
DSR for households



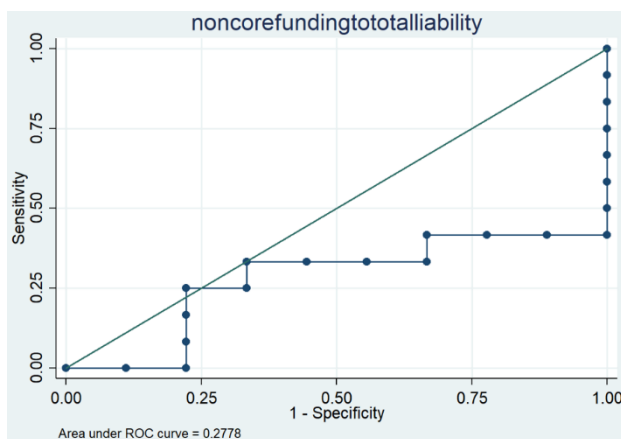
Real housing price gap



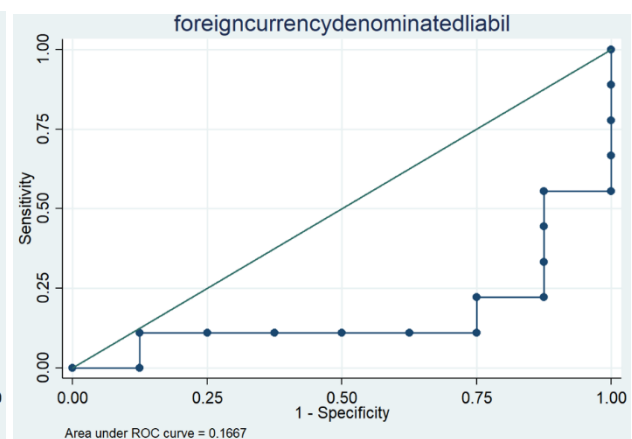
Loans to households-to-GDP ratio



Share of non-core liabilities in total liabilities



Foreign currency liabilities-to-total liabilities ratio



Source: CBU staff calculations.

Table 10. Current and Announced Positive CCyB Rates, % of RWA

Country	Buffer rate as of July 1, 2023	Scheduled buffer rate in the upcoming period
Armenia	↑ 1	01.08.2023: ↑ 1,5
Australia	↑ 1	
Belgium	→ 0	01.04.2024: ↑ 0,5
Bulgaria	↑ 1,5	01.10.2023: ↑ 2
Chile	→ 0	23.05.2024: ↑ 0,5
Croatia	↑ 0,5	31.12.2023: ↑ 1
Cyprus	→ 0	30.11.2023: ↑ 0,5
Czechia	↑ 2,25	
Denmark	↑ 2,5	
Estonia	↑ 1	01.12.2023: ↑ 1,5
France	↑ 0,5	02.01.2024: ↑ 1
Georgia	→ 0	15.03.2024: ↑ 1
Germany	↑ 0,75	
Hong Kong	→ 1	
Hungary	→ 0	01.07.2024: ↑ 0,5
Iceland	↑ 2	15.03.2024: ↑ 2,5
Ireland	↑ 0,5	24.11.2023: ↑ 1
Lithuania	→ 0	01.10.2023: ↑ 1
Luxembourg	→ 0,5	
Netherlands	↑ 1	31.05.2024: ↑ 2
Norway	↑ 2,5	
Romania	↑ 0,5	23.10.2023: ↑ 1
Slovakia	→ 1	01.08.2023: ↑ 1,5
Slovenia	→ 0	31.12.2023: ↑ 0,5
Sweden	↑ 2	
Switzerland	↑ 2,5	
United Kingdom	↑ 1	05.07.2023: ↑ 2

Sources: National authorities and European Systemic Risk Board.

Table 11. Capital Adequacy Requirements and Buffers Across Countries
(% of RWA as of July 1, 2023)

Country	Minimum capital requirements			Buffer requirements			
	CET1 ¹⁰⁵	Tier 1 ¹⁰⁶	CAR	CCoB	CCyB	SyRB	SIB buffer
Belgium	4,5	6	8	2,5	0	9	0,75–1,5
Croatia	4,5	6	8	2,5	0	0	0,25–1
Cyprus	4,5	6	8	2,5	0,75	2	0,25–2
Czechia	4,5	6	8	2,5	1	0	1–3,5
Estonia	4,5	6	8	2,5	0	0	1
Finland	4,5	6	8	0	0	0	1,0–2,5
France	4,5	6	8	2,5	0	0–2	0,5–2,5
Georgia	4,5	6	8	2,5	0,5	0	0,5–1,5
Germany	4,5	6	8	2,5	0	0	0,25–1
Greece	4,5	6	8	2,5	0	0	0,25–1,5
Hong Kong	4,5	6	8	2,5	0	0	0,25–2
Hungary	4,5	6	8	2,5	0	1	2
Ireland	4,5	6	8	2,5	0	0	0,5–1
Italy	4,5	6	8	2,5	0	0	0,25–2
Kazakhstan	4,5	6	8	2,5	2,5	4,5	1–2
Latvia	4,5	6	8	2,5	0	0	0,25–2
Liechtenstein	4,5	6	8	2,5	0,5	0–2	0,5–2
Malaysia	4,5	6	8	2,5	0	0	0,5–2,5
Malta	4,5	6	8	2,5	0	0,5–1	0,25–1,25
New Zealand	4,5	6	8	2,5	0	0	0,5–2,5
North Macedonia	4,5	6	8	2,5	0,5	0	0,25–1,5
Norway	4,5	6	8	2,5	0,5	1,5	0,5–2
Poland	5,5	6,5	8	2-3	0	0	1
Romania	4,5	6	8	2,5	2,25	0	0,5–2,5
Saudi Arabia	4,5	6	8	2,5	0	0	1–3,5
Slovenia	4,5	6	8	2,5	1	0	2
South Africa	4,5	6	8	2,5	0	0	2

Sources: National authorities and European Systemic Risk Board.

¹⁰⁵ The minimum requirement for Tier 1 capital, which is 6 percent, includes the minimum requirement for CET1 capital, 4.5 percent.

¹⁰⁶ The minimum requirement for regulatory capital, 8 percent, includes the minimum requirement for Tier 1 capital, 6 percent.

Table 12. Systemic Risk Buffer Application by Country¹⁰⁷ (% of RWA as of July 1, 2023)

Country	Buffer level	Type	Coverage
Austria	0.25–1	General	All risks
Belgium	9	Sectoral	Retail exposures backed by residential real estate
Bulgaria	3	General	Domestic risks
Germany	2	Sectoral	All risks secured by residential real estate
Iceland	3	General	Domestic risks
Lithuania	2	Sectoral	Retail exposures backed by residential real estate
Liechtenstein	1	Sectoral	All exposures to individuals secured by residential real estate, retail and legal entities secured by commercial real estate
Malta ¹⁰⁸	1.5	Sectoral	Retail exposures to individuals secured by residential real estate
Moldova ¹⁰⁹	1	General	Domestic risks
Norway	4.5	General	Domestic risks
Romania	0–2	General	All risks
Slovenia	1	Sectoral	Retail exposures backed by residential real estate
	0.5	Sectoral	Other risks to individuals
Finland	1	General	All risks
Croatia	1.5	General	All risks
Montenegro ¹¹⁰	1.5	General	All risks
Sweden	3	General	All risks

Sources: National authorities and European Systemic Risk Board.

¹⁰⁷ European Systemic Risk Board. Systemic risk buffer.

¹⁰⁸ Central Bank of Malta. (2023). Sectoral Systemic Risk Buffer.

¹⁰⁹ National Bank of Moldova. (2023). Press release on maintaining the systemic risk buffer rate of 1 percent for banks.

¹¹⁰ Central Bank of Montenegro. (2021). Information on setting the structural systemic risk buffer.

Table 13. Financial Stability Measures in Uzbekistan as of July 1, 2023

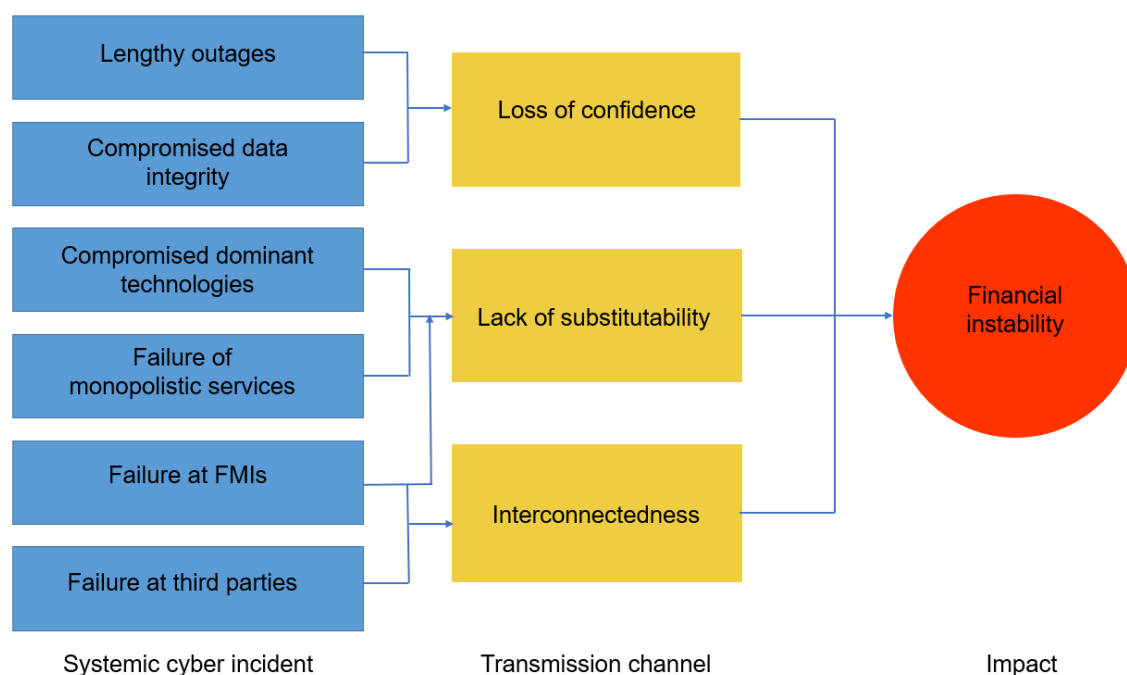
Measure	Tool	Applicable norm
Ensuring liquidity in the banking system	Share of highly liquid assets in total assets	10%
	Current liquidity ratio	25%
	LCR	100%
	NSFR	100%
Maintaining capital adequacy in the banking system	Regulatory capital ratio	13%
	Tier 1	10%
	CET1	8%
	CCoB	3% (as part of regulatory 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 foreign currency are not granted
	Differentiated mandatory reserve requirements	4% for the national currency 18% for foreign currencies
	LCR in foreign currencies	100%
	NSFR in foreign currencies	100%
Regulating the debt burden	PTI	50% (only for microloans)
	Daily limit on interest payments on a loan or microloan in relation to the principal outstanding	0.3%
	Differentiated RWA	In line with the LTV ratio on mortgages and car loans
Mitigating key risks	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

Impact of Cyber Risks on Financial Stability

The global financial system, increasingly digital and interconnected, depends on the reliability of its information and communication technology infrastructures, as well as the security, integrity, and confidentiality of its data and systems. Cyber attacks targeting the data systems of financial institutions and financial market infrastructure can disrupt the financial system.

A cyber event is any occurrence within an information system or network, potentially leading to a cyber incident when it exploits firm-level vulnerabilities and causes significant damage, such as data loss, operational disruptions, or financial costs¹¹¹. Cyber incidents become a concern for financial stability when they impact system-level vulnerabilities, such as the financial system's interconnectedness or dependency on critical services, potentially leading to widespread service disruptions, confidence crises, or payment system breakdowns. While many cyber events are effectively managed with robust cybersecurity measures, those that evolve into incidents can significantly disrupt financial stability by directly affecting services or amplifying existing system vulnerabilities.

Figure 105. Interconnections between Cyber Security and Financial Stability



Source: IMF.

The impact of cyber attacks on financial stability is manifested through three different transmission channels: loss of confidence, lack of substitutability, and

¹¹¹ Brando, D., Kotidis, A., Kovner, A., Lee, M., & Schreft, S. L. (2022, May). Implications of Cyber Risk for Financial Stability.

interconnectedness. A decline in confidence in the financial system is a critical factor that can precipitate a crisis following a cyber incident¹¹². For such an event to pose systemic risk, the financial damage must be substantial enough to impair the financial system's capacity to absorb losses. For instance, prolonged suspension of crucial operations due to a cyber attack, theft of funds, or leakage of confidential information can erode trust among customers and market participants, reducing liquidity and credit availability.

The financial system's reliance on technology vulnerable to cyber attacks, combined with the high costs of adopting and implementing alternative technologies, presents a risk of substitutability.

Moreover, the extensive interconnectedness of the financial system and its technologies amplifies the adverse effects of cyber incidents. While not all such incidents lead to financial instability, they can compromise the system's ability to withstand losses, affect liquidity, and incur additional costs.

In Uzbekistan, the Law on Cyber Security has been passed¹¹³, to regulate cyber security-related activities. Additionally, various laws and regulations have been adopted to secure the data of public agencies and financial institutions, laying the foundational legal groundwork for protecting critical information infrastructure¹¹⁴.

To mitigate the impact of cyber risks on financial stability and enhance the system's resilience to shocks, the following strategies are recommended:

- Developing a set of indicators for identifying and addressing systemic cyber risks¹¹⁵;
- Conducting cyber stress tests;
- Crafting laws and regulations at both micro- and macroprudential levels;
- Ensuring macroprudential policy encompasses not just financial institutions but technology providers as well;
- Establishing coordination mechanisms for information sharing and communication among financial organizations, delineating responsibilities, and maintaining media and public relations stability in the event of a systemic cyber incident¹¹⁶.

¹¹² European Systemic Risk Board. (2020, February). Systemic cyber risk.

¹¹³ O'zbekiston Respublikasi "Kiberxavfsizlik to'g'risida"gi 764-sonli Qonuni, 2022 yil 15 aprel.

¹¹⁴ O'zbekiston Respublikasi "Axborotlashtirish to'g'risida"gi, "Telekommunikasiyalar to'g'risida"gi, "Avtomatlashtirilgan bank tizimida axborotni muhofaza qilish to'g'risida"gi qonunlari va boshqalar'.

¹¹⁵ Financial Stability Board. (2021, September). FSB Financial Stability Surveillance Framework.

¹¹⁶ European Systemic Risk Board. (2022, January). Mitigating Systemic Cyber Risk.

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