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Factors Affecting Non-Performing Loans: Empirical Evidence from Commercial Banks in Uzbekistan

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Abstract

This paper applies a dynamic panel data approach to examine the main factors affecting non-performing loans (NPL) of commercial banks in Uzbekistan. The paper utilizes both bank-specific factors such as loan-to-deposit ratio, size, leverage, and type of ownership as well as macroeconomic factors, such as GDP growth rate and exchange rate to determine their significance in credit risk of commercial banks. The results indicate that current loan-to-deposit ratio (LDR) and leverage have positive impact on NPL ratio while higher GDP growth rate is associated with lower rate of NPL. However, lagged LDR and leverage ratios have shown negative relationship with NPL. Size, bank ownership type and exchange rate have not exhibited any significant impact on NPL.

Keywords: *Banking; Credit Risk Management; Central Asia, Uzbekistan, Non-Performing Loans; Dynamic Panel Data.*

JEL Classification: *C23, G21.*

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1. Introduction

The health of banking system has important role in the country as its failure can disrupt its economic development. One of the main sources of income for the banking institutions in the economy is generated through interest income from granting loans or credit. As a result, the financial system is always exposed to credit risk. The collapse of a single bank or market can be directly transmitted to other markets or institutions because of the spillover effect and result in a financial crisis in a country or a region. According to Demirguc-Kunt and Detragiache (1998) there have been 30 major banking crises that are encountered from early 1980s and onwards. These authors point out adverse economic conditions to be one of the main reasons of such crises. Castro (2013) emphasized the liquidity and/or insolvency problems due to the increase in non-performing loans (NPL) as another reason for banking crises.

To avoid such crises, pragmatic and effective credit risk management is very critical for the banking system since it helps banks to reduce troubled loans that might result in default of the payments. This paper intends to investigate the relationship between NPL and two types of factors in the banking system of Uzbekistan: bank-specific such as size, leverage, liquidity and ownership, and macroeconomic ones such as GDP growth rate and currency exchange rate.

At the moment, the banking system of Uzbekistan is facing the following challenges in the coming years:

- *The rapid growth of credit amount in the banking system.* The economic liberalization in Uzbekistan resulted in rapid credit growth driven by increasing retail and private sector demand and larger state funding. After the 110 percent nominal growth in 2017 (partly due to local currency depreciation), credit portfolio in commercial banks has grown at about 50 percent in 2018, before slowing to 31, 18 and 20 percent in 2020, 2021 and 2022 respectively. Both state and private banks experienced the credit boom, with credit to the private sector doubling to 44 percent of GDP in 2017-2021.
- *Non-performing loans (NPL) are rising.* Following the low and stable NPL during 2018-2020 (about 1-3 percent), problem loans hiked in the period 2021-2022 to about 5-6 percent.
- *A large presence of state-owned commercial banks in the economy.* The current banking system in Uzbekistan consists of 35 commercial banks, of which 10 of them are state-owned. According to the data from the Central Bank of Uzbekistan, as of December 1st, 2023, approximately 71% of the credit portfolio in the banking system of Uzbekistan belongs to state-

owned banks. Roughly 4.15% of credit portfolio in state-owned banks is classified as NPL whereas this indicator is only 2.90% for commercial banks with no state ownership.

Based on these challenges, studying the NPL ratio and its main determinants is crucial for the Uzbek banking system to ensure financial stability, assess credit risk, maintain credit availability, formulate effective policies, and enhance investor confidence in this emerging economy.

The structure of this article is organized as follows. The literature review and research hypotheses are provided in Section 2. Section 3 provides the data, methodology, descriptive and empirical analysis of the determinants of NPL. Section 4 concludes by highlighting the key findings and policy implications of this study.

2. Literature Review

Over the past few years, there has been a growing interest in non-performing loans and the factors influencing them, which can be partially attributed to the increased availability of published data at the levels of banks, countries, and the overall banking system. Several studies have been undertaken to explore issues related to non-performing loans (NPL) and comparable default rates. Many scholars view non-performing loans as a form of "financial pollution," causing detrimental impacts on both economic progress and societal well-being (Brenda Gonzales-Hermosillo 1999; Levon Barseghyan 2010; Shihong Zeng 2011).

Past researchers have studied both macroeconomic and bank-specific factors affecting bank credit risk. Several authors, such as Ali and Daly (2010), Berge and Boye (2007), Castro (2013), and Shularick and Taylor (2012) have studied the impact of macroeconomic factors on NPL. On the other hand, Salas and Saurina (2002) have combined both macroeconomic and microeconomic variables to study the determinants of NPL in commercial banks of Spain for the period 1985-1997. Similarly, Zribi and Boujelbène (2011) have conducted similar research for Tunisia, Louzis et al. (2011) for Greek banks, Chaibi and Ftiti (2015) for Germany and France, Malenković (2023) for the Republic of Serbia and Kryazanowski et. al (2023) for Chinese banks.

Aly and Daly (2010) have examined the macroeconomic factors that are significant for the US and Australia. They have also investigated how adverse macroeconomic shocks affect both countries' default rates. They discover that

despite the US economy being far more sensitive to negative macroeconomic shocks, the same set of macroeconomic variables exhibit differing default rates. Berge and Boye (2007) have reported that the declining NPL rate is primarily attributable to real interest rates and unemployment. Castro (2013) has analyzed the relationship between credit risk and macroeconomic factors for five European economies – Greece, Ireland, Portugal, Spain, and Italy. This author reported a negative relationship between GDP growth and NPL ratio, but a positive relationship with interest rate, unemployment rate, credit growth, and exchange rate. Shularick and Taylor (2012) have studied the behavior of money, credit, and macroeconomic indicators for 14 countries over the years 1870-2008. They have reported credit growth to be a powerful predictor of financial crises.

This paper can contribute to the existing literature in several ways:

- By focusing specifically on commercial banks in Uzbekistan, this study can add to the existing literature by providing insights and empirical evidence that are specific to the region of Central Asia which is rapidly growing in both economic and demographic terms.
- Given the absence of empirical study on this topic for commercial banks in Uzbekistan, it is expected that this research paper will fill the gap and provide an understanding of the determinants of NPL of commercial banks in Uzbekistan.
- This paper contributes to addressing a notable research gap by delving into the relationship between the lack of diversification in banking operations, an overreliance on interest income within net income, and the incidence of higher non-performing loans (NPL). Existing literature often explores factors contributing to NPL in the banking sector, but the specific link between the absence of operational diversification and the prominence of interest income in net earnings has been underexplored.

Consequently, the following research hypotheses were put forward:

H_1: Lack of diversification of operations and higher share of interest income in net income is associated with higher NPL ratio.

H_2: State-owned banks have a significantly higher rate of NPL compared to private banks.

H_3: There is a significant positive relationship between the loan-to-deposit (LDR) and NPL ratios.

H_4: An increase in average loan interest rates is expected to have a negative impact on the quality of loans, leading to a higher incidence of non-performing loans (NPL).

3. Data and Methodology

This study examines the impact of bank-specific factors, such as leverage, size, loan-to-deposit ratio (LDR), interest-to-income ratio (INI), cash-to-deposit ratio (CDR), and state ownership, as well as macroeconomic factors, such as GDP growth rate and exchange rate and average interest rate on loans on non-performing loans of commercial banks (see Table 1). Using unbalanced panel data of 35 commercial banks of Uzbekistan on quarterly basis over the period of quarter 1, 2020 to quarter 4, 2022, I estimate the impact of the aforementioned variables on NPL.

Table 1. Description of Variables

Variable	Definition	Expected Sign
Dependent variable		
Non-performing loans (NPL)	Troubled Loans / Total Loans	
Bank-specific		
Loan-Deposit Ratio (LDR)	Total Loans / Total Deposits	Positive
Interest-Income Ratio (INI)	Net Interest / Net Income	Positive
Cash-Deposit Ratio (CDR)	Total Cash / Total Deposits	Negative
Size	Natural Log of Total Assets	Negative/Positive
Leverage	Total Liabilities / Total Assets	Negative/Positive
State-ownership	Dummy (1 state ownership, 0 otherwise)	Positive
Macroeconomic		
Exchange rate	Natural Log of (UZS/USD)	Positive
Interest rate	Weighted Average of Interest Rate of Outstanding Loans	Positive
GDP growth	Annual Growth Rate of Real Gross Domestic Product (in percentage)	Negative

The dependent variable NPL is a loan that is on the brink of default since the borrower has not made the scheduled payments for a specified period. European Central Bank classifies the loan as non-performing if 90 days or more pass without the borrower paying the agreed instalments or interest. The formula to calculate NPL can be expressed as follows:

$$NPL = \frac{Total\ Non{-}Performing\ Loans}{Total\ Loans} * 100\%$$

Regarding bank-specific variables, the Loan-to-Deposit Ratio (LDR) is a key indicator of a bank's liquidity and lending capacity. It measures the proportion of loans funded by deposits and is an important factor in determining a bank's ability to meet its obligations and manage risk. If the ratio is too high, it means that the bank may not have enough liquidity to cover any unforeseen fund requirements. Conversely, if the ratio is too low, the bank may not be earning as much as it could be.

The relationship between LDR and NPL has been the subject of much debate in the literature, with some studies finding a positive relationship and others finding a negative relationship. For example, a study by Demirgüç-Kunt and Huizinga (1999) found that higher LDRs were associated with higher levels of NPL in a sample of 80 countries. On the other hand, Berger and DeYoung (1997) found that higher LDRs were associated with lower levels of NPL in a sample of US banks.

On the other hand, the Net Interest to Net Income ratio (INI) is a financial metric that measures the proportion of a company's net interest income (the difference between interest earned on assets and interest paid on liabilities) relative to its net income. It is calculated as follows:

$$INI = \frac{Net\ Interest\ Income}{Net\ Income}$$

The relationship is expected to be positive because a higher net interest to net income ratio may indicate that a significant portion of the company's income is coming from interest-related activities. If the source of this income is from risky loans or investments, it could potentially lead to higher non-performing loans.

The Cash-Deposit Ratio (CDR) measures the proportion of a bank's total deposits held in the form of cash or cash equivalents:

$$CDR = \frac{Total\ Cash}{Total\ Deposits} * 100\%$$

A higher cash deposit ratio generally indicates that the bank has a larger proportion of its deposits in liquid assets. This can be a positive sign for liquidity, as the bank is better positioned to meet short-term obligations. Strong liquidity management can contribute to effective risk management, potentially reducing the likelihood of non-performing loans. Mdaghri (2022) has reported that liquidity creation has diminished the non performing loans for Middle East and North Africa (MENA) region. Boussada et. al (2020) also reported negative relationship between liquidity and NPLs for MENA banks over 2004 – 2017.

Another important bank-spesific indicator is leverage. It is an investment strategy of using borrowed money to increase the potential return of an investment. There are various measurements in the literature and this paper uses the debt-to-asset ratio as a variable for leverage:

$$Leverage = \frac{Total\ Debt}{Total\ Assets}$$

Leverage (debt to asset ratio) can have a significant impact on the level of non-performing loans (NPL) in commercial banks. When a bank has a high leverage ratio, it means that it has a high level of debt relative to its assets. This can lead to financial instability and make the bank more vulnerable to economic downturns and changes in interest rates. In turn, this can increase the likelihood of borrowers defaulting on their loans, which can result in a higher level of NPL for the bank. Chaibi & Ftiti (2015) have studied 133 German banks for the period 2005 - 2011 and found a significant positive relationship between NPL and leverage.

Likewise, the size of banks also might have critical impacts on non-performing loans due to extant literature (Salas and Saurina, 2002; Keeton and Morris, 1987; Berger and DeYoung, 1997; Stern and Feldman, 2004; Louzis et al. 2012). While Salas and Saurina (2002) urge the “size effect” hypothesis which implies that bank size (proxied, e.g. by the total value of assets) is negatively related to non-performing loans, some authors such as Keeton and Morris (1987), Berger and DeYoung (1997), Stern and Feldman (2004), Louzis et al. (2012) suggested “too big to fail” or “moral hazard” hypothesis. The latter authors argue that larger banks tend to take excessive risks because they expect the governments to bail out or protect when banks fail to meet their obligations. As a proxy measurement for the size of the bank, this paper uses the natural logarithm of the total assets from the balance sheet statement:

$$Size = \ln(Assets)$$

Lastly, we consider state-ownership status of banks in our study as empirical evidence suggests that state-owned banks tend to have higher levels of NPL than privately-owned banks, although this is not always the case. The reasons for this vary but can include political interference, poorly-designed lending policies, and a lack of market discipline. In addition, state-owned banks may suffer from inefficient management and governance structures. Bureaucratic decision-making processes and lack of accountability can result in poor risk management practices, leading to higher NPL compared to private banks.

In terms of macroeconomic variables, the Exchange Rate of the national currency with other foreign currencies might have a different impact on NPL based on how the bank is exposed to foreign-currency-denominated loans. Espinoza and Prasad (2010) have found an inverse relationship between the exchange rate and NPL. According to these authors countries featuring a relatively high portion of private sector borrowing in foreign currency, a significant depreciation of the local currency may lead to a considerable increase in NPLs through the balance sheet channel. On the other hand, Klein (2013) has found a positive relationship between these two variables. This author explains this tendency by competitiveness channel which refers to improved export competitiveness because of the depreciation of national currency.

Considering that commercial banks in Uzbekistan are exposed to some dollar-denominated loans, I expect a negative association between the exchange rate and NPL. Depreciation of Uzbek soum makes it harder for borrowers in foreign currencies to pay back the loans and interest payments and hence increases the share of non-performing loans in the total loan portfolio.

On the other hand, we include Interest Rates into our study as another macroeconomic control variable. Generally, higher interest rates can lead to increased financial burden on borrowers, potentially resulting in a higher likelihood of loan defaults. However, the relationship is multifaceted, and the impact of interest rates on NPLs may vary depending on the economic environment, borrower characteristics, and other contextual factors.

Lastly, we include the annual GDP growth rate based on quarterly data as a control variable for macroeconomic business cycles. When the economy is expanding, borrowers do not face much difficulty to service their debt. But they might struggle to pay off their obligations during economic downturns.

3.1. Descriptive Analysis

Historically, Uzbekistan has had a relatively low level of NPL compared to some other countries. This can be attributed to the conservative and bureaucratic lending practices, and strict regulations implemented by the central bank of Uzbekistan. However, the banking system in Uzbekistan has undergone significant changes since the power change in 2016. Here are some key transformations:

- *Liberalization of Foreign Exchange Market.* The government implemented a shift from a heavily regulated exchange rate system to a more flexible and market-oriented approach. This move aimed to attract foreign investors, enhance competitiveness, and reduce the shadow economy.

- *Market-driven Interest Rates.* Uzbekistan transitioned from a system of state-determined interest rates on loans and deposits to a more market-driven mechanism. This change has allowed banks to set interest rates based on market conditions, stimulating competition and improving efficiency.

- *Strengthening Supervision and Regulation.* The Central Bank of Uzbekistan has enhanced its regulatory framework and increased its supervisory role over banks. Measures were taken to improve transparency, risk management, and compliance with international standards. This has promoted stability and trust in the banking system.

- *Introduction of Islamic Banking Windows.* Uzbekistan introduced Islamic banking principles to diversify its financial sector. This initiative has attracted new players (e.g. Iman Invest) and expanded banking services.

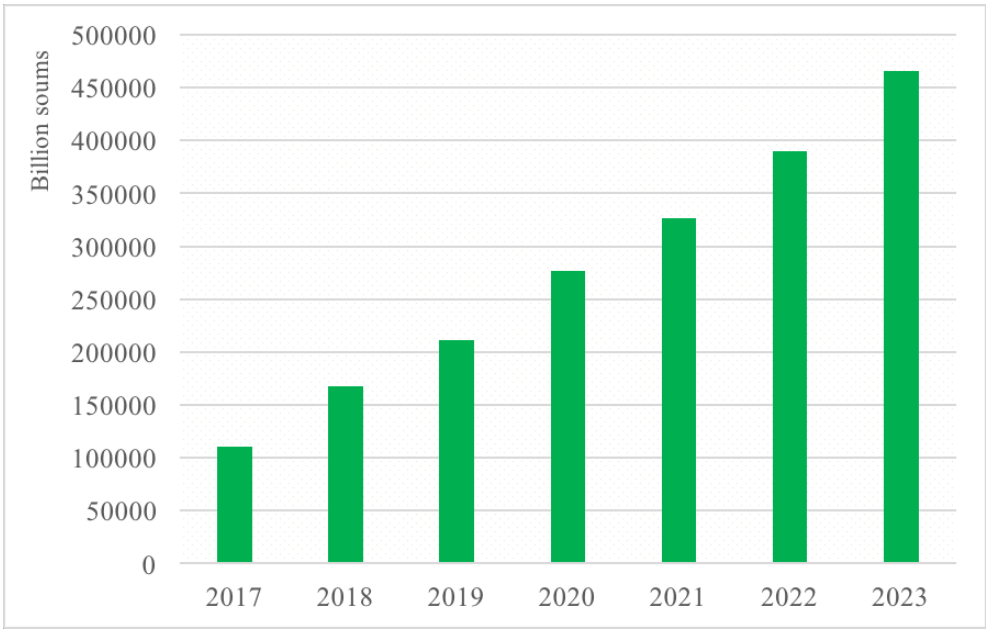
- *Digitalization and Fintech Development.* There has been a focus on digital transformation, financial technology (fintech) development, and the introduction of e-banking services such as Payme, Click Uz, Paynet, and Uzum Pay. This has improved access to financial services, simplified transactions, and reduced costs for both individuals and businesses.

- *Privatization and Foreign Investment.* The government has been actively promoting the privatization of state-owned banks and attracting foreign investment into the banking sector. On March 18th, 2022, the President of Uzbekistan has signed a decree to reduce the state ownership in the banking sector and privatize several state-owned banks.

Because of those reforms, the lending policy of commercial banks has loosened and the total loan portfolio has increased from 110,6 bln soums at the end of 2017 to 465,5 bln soums as of December 1st, 2023 (See Figure 1).

While commercial loans comprised the biggest share in the loan portfolio of commercial banks in Uzbekistan, their share has been gradually decreasing over the last few years. As evidence, 81% of all outstanding loans were commercial loans on June 1st 2020, but this share has dropped to 71% in June 2023.

Figure 1. Total Outstanding Loans of Commercial Banks in Uzbekistan

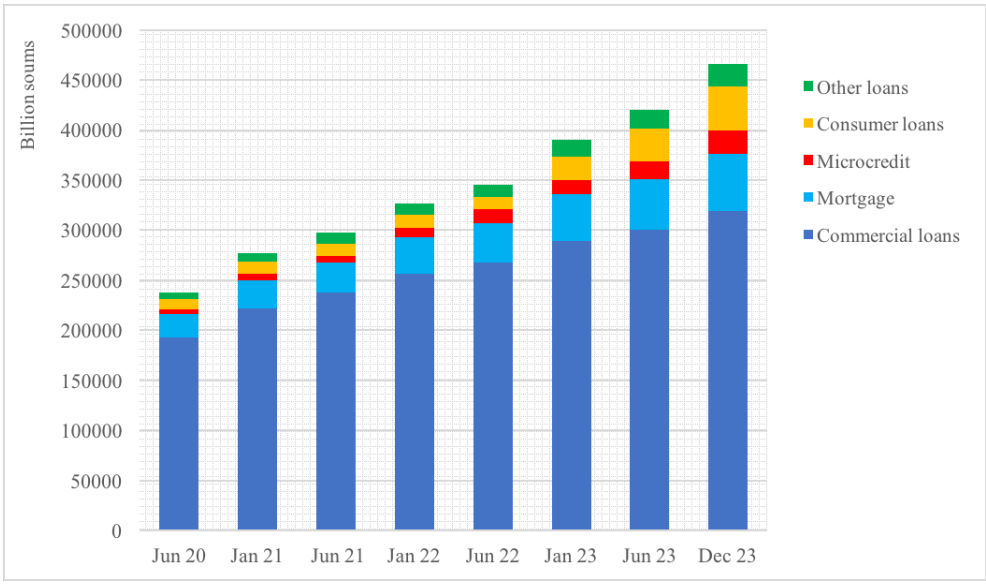


Source: Central Bank of Uzbekistan

Meanwhile, the share of the mortgage, microcredit, and consumer loans have increased from 10%, 2% and 5% to 12%, 4% and 8%, respectively during the same period. Consumer loans, mortgages, and microcredits have undergone significant changes in Uzbekistan over the past few years. The government has implemented various reforms to promote financial inclusion and develop the banking sector, leading to increased access to credit for individuals and businesses. Banks and financial institutions have expanded their lending portfolios, offering a range of loan products for various purposes such as purchasing household appliances, vehicles, or funding personal expenses. This increased availability of consumer loans has contributed to the growth of the retail sector and improved living standards for many people. Moreover, the mortgage market has also experienced significant growth in Uzbekistan. The

government has introduced measures to stimulate affordable housing, making mortgages more accessible to the population. As a result, the number of mortgage loans has increased, contributing to the development of the real estate market. Microcredit programs have been expanded to support small businesses and entrepreneurship in Uzbekistan. Microfinance institutions and commercial banks have been encouraged to provide microcredits to individuals and small enterprises, particularly in rural areas. These microcredits aim to facilitate economic growth, employment generation, and poverty reduction by enabling individuals to start or expand their businesses. The government has also introduced favorable conditions such as simplified procedures and reduced interest rates for microcredit borrowers.

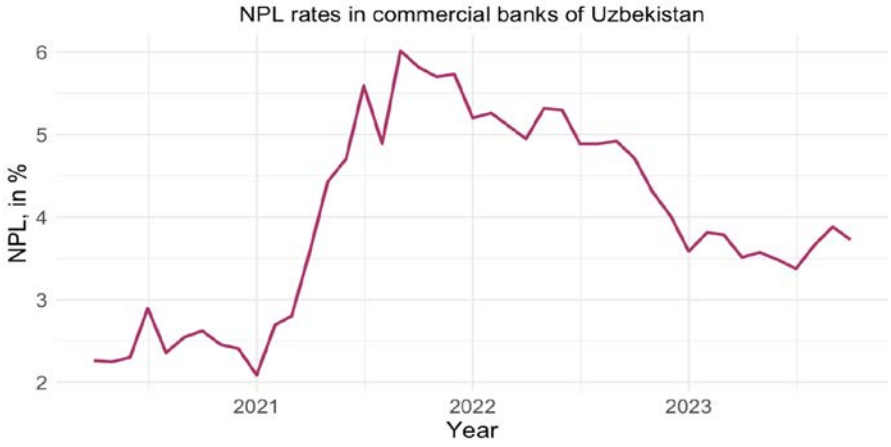
Figure 2. Composition of Outstanding Loans of Commercial Banks in Uzbekistan



Source: Central Bank of Uzbekistan

Significant expansion of loans to a greater population and improvements in financial inclusion are associated with higher NPL ratios in credit portfolios. While the NPL ratio was fluctuating between 2% and 3% until the end of 2020, it started increasing during the pandemic period reaching as high as 6% during mid-2021 (See Figure 3). This can be partially explained by the fact that many households faced financial troubles during pandemic lockdowns and they had to postpone their loan payment obligations.

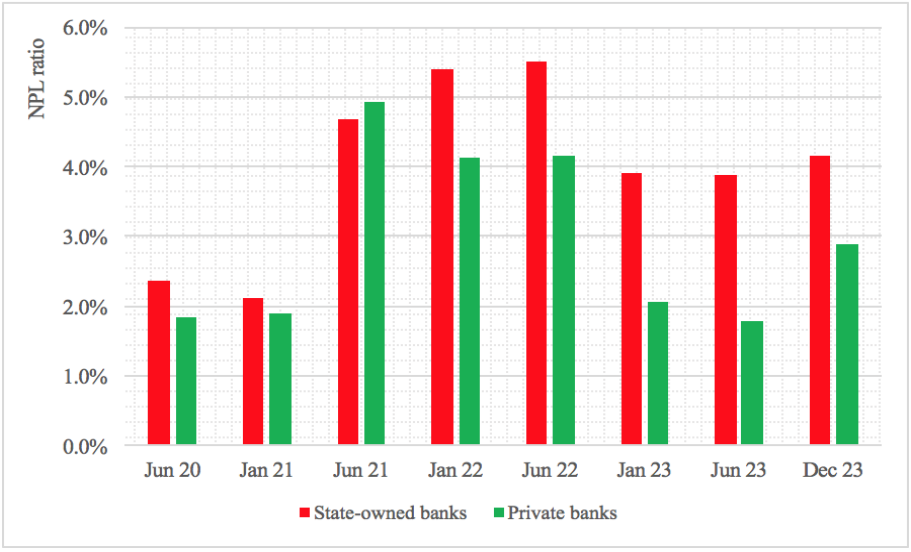
Figure 3. Share of NPL in Total Loans of Commercial Banks in Uzbekistan



Source: Central Bank of Uzbekistan

It is also worth mentioning that the difference in NPL ratios between state-owned banks and private banks was not significant from 2020 till the end of 2021. But that difference became much wider starting at the beginning of 2022, where the NPL ratio was more than 1 percentage point higher in state-owned commercial banks compared to other banks (see Figure 4).

Figure 4. Composition of NPL for State-Owned and Private Banks in Uzbekistan



Source: Central Bank of Uzbekistan

There might be a few reasons for such a higher NPL ratio in state-owned banks compared to private banks. First, state-owned banks might have been subject to political interference, meaning they may lend to certain projects or sectors in line with government objectives rather than based on commercial viability. This can lead to a higher proportion of loans to risky and non-profitable projects, increasing the likelihood of default and contributing to higher NPL ratios. Second, state-owned banks may have limited autonomy in decision-making, as their lending decisions can be influenced by government policies or directives. This lack of independence can lead to forced lending to politically connected or risky borrowers, again increasing the chances of non-performing loans.

Third, state-owned banks may have weaker risk management practices compared to private banks. This can be due to factors such as a lack of professional management, limited accountability, or inadequate risk assessment frameworks. These deficiencies can result in poor credit quality and higher NPL ratios. Fourth, state-owned banks often have a social and developmental mandate to support sectors or segments of the population that may have limited access to credit. While this can have positive social and economic impacts, it can also increase the likelihood of loans to borrowers with weaker credit profiles or inadequate repayment capacity, leading to higher NPL ratios. Finally, state-owned banks may face less competition compared to private banks, as they often enjoy certain advantages such as access to lower-cost funding or preferential treatment. This reduced competition can lead to complacency and a lack of incentive to manage credit risk effectively, resulting in higher NPL ratios. Even though NPL ratios for private banks have dropped to pre-pandemic levels, they remain high for state-owned banks.

By consolidating the quarterly data of bank-specific factors and macroeconomic indicators of Uzbekistan, the following descriptive statistics (see Table 2) were obtained for dependent and independent variables. The highest NPL ratios correspond to High-Tech, Turkiston, and Uzagroexport banks. Since October 2022, High-Tech and Turkiston banks have ceased their operations. According to the same statistics, approximately 34% of commercial banks are state-owned and about 25% of them are operating with foreign ownership.

The following conclusions can be drawn from this descriptive analysis:

- First, the amount of loans issued by commercial banks are increasing at a significant rate: the total loans have more than tripled from 2017 to 2023. The share of mortgage loans and consumer loans in the total credit portfolio is growing while the share of commercial loans has decreased from 81% in 2020 to 71% in 2023.

- Second, even though the number of state-owned banks (11) is less than the private ones (23) as of mid-2023, their share comprises approximately 77% of all assets and 81% of all outstanding loans of commercial banks in Uzbekistan.

Table 2. Descriptive Statistics

Statistic	Obs	Mean	St. Dev.	Min	Max	Source
NPL_share	417	0.087	0.199	0	0.96	Central Bank of Uzbekistan
LDR	417	2.097	3.015	0	33.338	Central Bank of Uzbekistan
Size	417	3.551	0.851	0	5.105	Central Bank of Uzbekistan
Leverage	417	0.729	0.238	0	1	Central Bank of Uzbekistan
Exchange_rate	417	-0.014	0.018	-0.059	0.024	Central Bank of Uzbekistan
GDP_growth	417	0.047	0.023	0.005	0.074	Trading Economics/World Bank
State_owned	417	0.343	0.475	0	1	Central Bank of Uzbekistan
Foreign_owned	417	0.247	0.432	0	1	Central Bank of Uzbekistan

Third, the percentage of non-performing loans in the total credit portfolio has risen during the pandemic period for all commercial banks. However, this rate has been decreasing for private banks and banks with foreign ownership since the beginning of 2023. The NPL ratio remains high for state-owned banks and banks with no foreign ownership.

4. Model Specification & Empirical Analysis

In the study of NPL, we use a dynamic panel data model as shown below:

$$NPL_{i,t} = \beta_0 NPL_{i,t-1} + \beta_i' X_{i,t} + \varepsilon_{i,t}$$

Where $\varepsilon_{i,t} = \eta_i + \nu_{i,t}$. The subscript *i* denotes the cross-sectional (banks) and t denotes the time (quarters) dimension of the panel sample. $NPL_{i,t}$ is the non-performing loan ratio, $NPL_{i,t-1}$ is its lagged value, β'_i is a *1xk* vector of parameters, $X_{i,t}$ is a vector of independent variables including their lagged values, and $\varepsilon_{i,t}$ is the error term. The $\varepsilon_{i,t}$ has two orthogonal components: η_i are the unobserved individual effects, and $\nu_{i,t}$ are the observed specific errors.

When using a dynamic specification, some econometric bias can arise from using traditional panel estimators such as pooled OLS, fixed effect, and random effects. Because lagged variable NPL_{t-1} might be correlated with the individual effect η_i proposed in the model. While this type of estimation is also presented in this paper, we extended this research by eliminating these biases by using a

generalized method of moments (GMM). While doing so, we included the first-order difference as proposed by Arellano and Bond (1991) to avoid the correlation between unobserved individual effects (η_i) and lagged variable of *NPL* (NPL_{t-1}). Therefore, GMM estimations took the following equation, where Δ is the first difference operator.

$$\Delta NPL_{i,t} = \beta_0 \Delta NPL_{i,t-1} + \beta_i' \Delta X_{i,t} + \mu_{i,t}$$

The next step of analysis is to investigate whether the model proposed above suffers from a multicollinearity issue. To address this question, the correlation matrix is presented in Table 3. According to this table, there is no strong correlation ($\rho > 0.8$) between independent variables. Therefore, no variables were excluded from the model.

Table 3. Correlation Matrix

	NPL_share	*LDR*	*Size*	*Leverage*	*Exchange_rate*	*GDP_growth*
NPL_share	1.000					
LDR	0.303	1.000				
Size	-0.337	-0.058	1.000			
Leverage	-0.202	-0.264	0.727	1.000		
Exchange_rate	0.092	0.014	0.021	-0.005	1.000	
GDP_growth	0.179	0.002	0.039	0.022	-0.010	1.000

Before deciding between fixed effects (FE) and random effects (RE) panel data analysis, we ran the Hausman specification test to identify the desired model. Hausman test produced Chi-Square test statistics of 7.99 (p-value = 0.786) and this indicated that RE estimations are desired for my empirical analysis (see Table 4). The second column of the dataset was provided for GMM estimations. Both models indicate that there is a serial autocorrelation since first-order lagged dependent variable is significant in both models.

However, this autocorrelation is not evident on the second-order lag. The results also show that the loan-to-deposit ratio (LDR) is positively associated with NPL. This means that a higher rate of lending is related to a higher rate of non-performing loans. But lagged LDR variable is significantly negatively associated with NPL. In both models, the Size variable showed no significance. It means the size of the bank in the banking system of Uzbekistan has no impact on the loan performance. This finding contradicts both the “size effect” and “moral hazard” hypotheses which proposed negative and positive impacts on NPL, respectively. This can be explained by the fact that the banking system in Uzbekistan is heavily regulated by Central Bank of Uzbekistan (CBU). The Central Bank conducts regular audits and inspections of banks to assess their compliance with regulations and to

monitor their financial health. It also has the authority to intervene in the operations of banks if they are found to be in violation of regulations or if their financial stability is at risk. The commercial banks are required to report to CBU about their NPL indicators on a monthly basis and CBU has full authority to take action if NPL of any commercial bank is rising.

Table 4. Estimation Results using RE and GMM

	RE estimations		GMM estimations	
Variables	*Coefficient*	*Std. Error*	*Coefficient*	*Std. Error*
NPL_{t-1}	0.777***	0.052	0.723***	0.050
NPL_{t-2}	0.013	0.049	-0.016	0.035
LDR	0.006***	0.002	0.007***	0.002
LDR_{t-1}	-0.004*	0.002	-0.004*	0.002
Size	-0.107	0.066	-0.188	0.153
$Sizet_{t-1}$	0.104	0.067	0.184	0.192
Leverage	0.248***	0.081	0.301*	0.183
$Leverage_{t-1}$	-0.255***	0.083	-0.521**	0.257
Exchange Rate	-0.250	0.330	0.025	0.169
$Exchange\ Rate_{t-1}$	-0.448	0.356	-0.242	0.250
GDP growth	0.272	0.284	0.624*	0.352
$GDP\ growth_{t-1}$	0.477	0.324	0.682	0.506
State owned	0.003	0.013	-	-
Foreign owned	-0.003	0.011	-	-
Obs	347		314	

Note: The *, **, and *** indicates significance levels at 10%, 5%, and 1% respectively.

On the other hand, leverage (Total liabilities/Total assets) is found to have a positive impact on NPL, while its lagged value has negative relationship. The positive relationship between current leverage and the NPL ratio can be explained by the following reasons:

- *Risk-taking behavior.* Banks that take on higher levels of debt relative to their assets may also be more inclined to engage in riskier lending practices. This increased risk can lead to a higher likelihood of borrowers defaulting on their loans, resulting in a higher NPL ratio.
- *Asset quality*. A bank's debt-to-assets ratio can be influenced by the quality of its assets. If a bank has a higher proportion of non-performing or low-quality assets, it may need to take on more debt to finance its

operations. Consequently, this can lead to a positive relationship between the leverage and the NPL ratio.

- *Capital structure.* Banks with a higher debt-to-assets ratio may have a lower equity buffer, making them more susceptible to absorbing losses from non-performing loans. This can result in a higher NPL ratio as the bank may struggle to write off or recover these bad loans effectively. This finding is in line with the findings of Chaibi and Ftiti (2015) and Louzis et. al (2012) who have also reported positive relationship between leverage and NPL ratio.

On the other hand, the negative relationship between lagged leverage and the NPL ratio can be explained by several factors:

- *Financial Discipline.* Companies with higher levels of debt are more likely to face financial constraints and are motivated to maintain strong financial discipline. This can lead to more prudent lending practices and stricter credit risk assessments, which in turn can reduce the likelihood of borrowers defaulting on their loans.
- *Better Risk Management.* Companies with higher levels of debt in the past may have a greater focus on risk management. They may employ more rigorous loan monitoring and assessment processes, leading to a lower NPL ratio.
- *Less Aggressive Lending.* Companies with higher levels of debt in the past may be more cautious and less likely to engage in aggressive lending practices. They may be more selective in lending to borrowers with stronger credit profiles, reducing the likelihood of loans turning into non-performing ones.

The positive relationship between the GDP growth rate and the NPL ratio is contrary to my expected relationship and a majority of early studies. Chaibi and Ftiti (2015) have found a negative relationship for commercial banks in Germany and France, and Louzis et. al (2012) have found similar relationship for Greek banks. However, Radivojević et al (2019) have a found positive relationship between GDP growth and NPL rate for emerging economies in Latin America.

Other factors such as exchange rate, state-ownership, or foreign ownership in commercial banks did not demonstrate any significant impact on NPL.

5. Conclusion

In conclusion, this research paper aimed to identify the key determinants of non-performing loans in commercial banks of Uzbekistan. Through an empirical analysis, I concluded that several determinants significantly impact the level of NPL in the banking sector of Uzbekistan.

Firstly, bank-specific characteristics such as loan-to-deposit ratio (LDR) and debt-to-assets ratios (leverage) were found to be significantly associated with NPL ratio. While the current level of LDR and leverage increases the NPL ratio, lagged LDR and leverage ratios were found to have a negative impact on NPL.

Secondly, I found a positive relationship between NPL and GDP growth rate. Even though this finding was contrary to my prior expectations, the followings are some possible explanations:

- During periods of economic growth, businesses and individuals tend to take on more debt to finance their activities. This increased borrowing can lead to a higher NPL ratio as some borrowers may struggle to repay their loans.

- In times of economic expansion, financial institutions may relax their lending standards and extend credit to riskier borrowers who may have a higher likelihood of defaulting on their loans. This can contribute to an increase in the NPL ratio.

- Rapid GDP growth can sometimes be driven by asset bubbles or excessive investments in certain sectors, such as real estate or stock markets. When these bubbles burst or investments fail to generate expected returns, borrowers may struggle to repay their loans, resulting in a higher NPL ratio.

- The impact of economic downturns on the NPL ratio may not be immediately apparent. A lag effect can occur where the NPL ratio continues to rise even as GDP growth slows or declines, reflecting the delayed consequences of economic contractions on loan repayment capacity. The growth in NPL ratio might be due to the burden of pandemic lockdowns and this effect might have been delayed and reflected during higher economic growth.

The findings of this paper have some policy implications for bankers and economists in Uzbekistan and in general. They can strengthen the regulatory framework to prevent excessive lending without conducting proper due diligence and implementation of a robust credit risk management system. This includes the need to enhance the role of regulatory authorities in ensuring that banks adhere to prudent lending practices, risk management, and loan classification guidelines.

Future studies could expand on the study. To generalize the empirical findings, it would be helpful to look at other Central Asian nations to investigate the similarities in credit risk management policies. Additionally, the group of regressors could be extended by including profitability indicators and proxy measures for best practices of corporate governance of the banking system in Uzbekistan.

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