EMPIRICAL ANALYSIS OF FACTORS AFFECTING THE CREDIT PORTFOLIO OF COMMERCIAL BANKS

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Abstract. *This article examines the impact of external factors on the loan portfolios of commercial banks. Enhancing the efficiency of commercial banks' loan portfolios is a crucial factor in ensuring economic stability and competitiveness. Improving loan portfolio efficiency not only creates opportunities for commercial banks to generate profits but also ensures optimal distribution of financial resources. To achieve this, banks need to systematically review all stages of lending. According to the model results, it was determined that all selected indicators have an impact on the interest rates of loans from JSC Uzpromstroybank. This indicates that we have correctly identified the external factors influencing the interest rates on loans from JSC Uzpromstroybank. While the influence of these factors on JSC Uzpromstroybank's loan interest rates is evident, there are differences only in the time lags of their effects.*
Keywords: : *banking system, bank credit, loan portfolios, inflation, interest rates*

Introduction

Interest rate policy plays a central role in commercial banks' management of credit and deposit operations, enhancement of financial intermediation effectiveness, and maintenance of competitiveness in client relations. Interest rates directly influence the formation and allocation of bank resources, determining the bank's income-generating potential. Therefore, it is necessary to conduct a thorough empirical analysis of factors influencing interest rate policy formation - inflation rate, Central Bank key rate, interbank credit market conditions, liquidity levels, external economic environment, and credit risks. In developing countries like Uzbekistan, interest rate policy is not only an element of a bank's internal policy but also a crucial instrument affecting overall macroeconomic stability. Thus, analyzing the factors determining interest rate policy using precise and indepth statistical methods is extremely relevant from both scientific and practical perspectives.

Through empirical analysis, it is possible to precisely determine which factors have a real impact on commercial banks' interest rate policy, the degree of correlation between these factors, and how their changes affect interest rates. For instance, rising inflation leads banks to increase loan interest rates, which can dampen economic activity. Simultaneously, the Central Bank's monetary policy decisions play a decisive role in shaping commercial bank rates. Empirical analyses allow for identifying these factors and assessing their strength, aiding commercial banks in forecasting and strategic planning. Specifically, using methods such as regression analysis, VAR models, and panel data analysis can create a solid statistical foundation for understanding interest rate changes.

1. Materials and Methods

Enhancing the efficiency of commercial banks' loan portfolios is a crucial factor in ensuring economic stability and competitiveness. Improving loan portfolio efficiency not only creates opportunities for commercial banks to generate profits but also ensures optimal distribution of financial resources. To achieve this, banks need to systematically review all stages of lending. Enhancing the quality of lending, conducting in-depth analysis of clients' financial conditions, as well as minimizing credit risks increase efficiency. Banks should also consider diversifying their loan portfolios and allocating loans to new, highly profitable sectors.

A study conducted by N. Mirza et al. (2023) empirically and theoretically examined the impact of green lending on the efficiency of commercial banks' loan portfolios in BRIC countries. The research analyzed the effect of green loans, particularly those allocated to small and medium-sized enterprises (SMEs), on banks' overall financial performance. The researchers highlighted that green lending increases banks' profitability, reduces credit risks, and ensures long-term stability. The study results demonstrate that an increase in green loans generates positive financial outcomes for banks, as these loans have high repayment rates and stimulate business models based on environmental sustainability. The article also emphasizes that green credit policies enhance banks' reliability and make them more attractive for long-term investments. According to the empirical analysis results, it was found that the expansion of green lending in BRIC countries increases the return on banks' total assets and positively affects financial stability and loan portfolio quality. These findings justify the need for broader implementation of green lending strategies.

In the study conducted by K. Miyamoto (2022), the potential applications of quantum algorithms for calculating risk contributions in loan portfolios were examined both theoretically and empirically. The author compares traditional financial analysis methods with quantum computing approaches to analyze the possibilities of enhancing the efficiency of quantum computers in identifying and assessing credit risks. The research emphasizes that quantum algorithms demonstrate superiority in rapidly and accurately analyzing large, complex loan portfolios, as conventional computing methods require significant time and resources when dealing with big data. Empirical results indicate that quantum algorithms considerably accelerate the process of calculating credit risk distribution, enabling banks to organize their portfolio management strategies more effectively. Furthermore, the use of quantum computing allows for more precise forecasting in credit risk diversification and optimization. This study highlights the significance of quantum technologies as a novel financial analysis tool for commercial banks and substantiates the necessity for widespread implementation of quantum computing technologies in the banking sector in the future.

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significant time and resources when dealing with big data. Empirical results indicate that quantum algorithms considerably accelerate the process of calculating credit risk distribution, enabling banks to organize their portfolio management strategies more effectively. Furthermore, the use of quantum computing allows for more precise forecasting in credit risk diversification and optimization. This study highlights the significance of quantum technologies as a novel financial analysis tool for commercial banks and substantiates the necessity for widespread implementation of quantum computing technologies in the banking sector in the future. modern approaches to ensure financial system stability and more precise management of credit risks. A study conducted by J. Castillo and A. Mora-Valencia (2023) analyzed the impact of moral hazard on the SME (small and medium-sized business) loan portfolio guaranteed by Colombia's National Guarantee Fund (NGF). The authors focused on how borrower behavior changes in loans issued through the NGF system, and how these guarantees affect the decision-making process of banks and credit institutions. Drawing on traditional economic theories, the authors emphasize that in cases of increased moral hazard, borrowers may use loan funds irresponsibly or violate payment discipline. This situation is particularly observed with state-guaranteed loans, as borrowers underestimate the risk of default due to the state guarantee, and the likelihood of financial indiscipline increases.

The results of the empirical analysis show that the default rate on NGF-guaranteed loans is significantly higher than on non-guaranteed loans, confirming the presence of moral hazard. The study authors assessed the repayment probability of loans under NGF guarantees using various statistical models and regression analyses, and the results showed that as the amount of guarantees increases, so does the probability of borrower default. These findings indicate the need to implement better monitoring and risk management systems to improve the effectiveness of government guarantee programs. According to the research recommendations, to reduce moral hazard, it is necessary to improve credit policies, better assess the financial stability of borrowers, and strengthen credit monitoring systems. This not only ensures the effective use of loans but also serves to reduce credit risks.

In the study conducted by L. Mbeukam (2024), the assessment of transition risks in the credit portfolio and hedging strategies were examined. Transition risks are interpreted as financial risks arising from the deterioration of borrowers' financial conditions over time or an increase in credit risk levels due to macroeconomic changes in the market. The study employed modern quantitative models to assess these risks, particularly models based on stochastic processes, uncertainty theory, and dynamic changes in credit ratings. Mbeukam emphasizes the importance of accurately assessing these variable risks in credit portfolio management and highlights the significance of developing optimal hedging strategies for financial stability. According to the empirical analysis results, inaccurate assessment of transition risks negatively impacts the stability of banks' credit portfolios. Consequently, the use of derivative instruments and portfolio diversification is recommended to minimize losses. The research findings suggest that commercial banks and investors should utilize advanced statistical models and risk hedging strategies in managing credit risks, as this plays a crucial role in ensuring the long-term stability of credit markets.

This study, conducted by Bykova and Pindyuk (2019), analyzes the issue of nonperforming loans (NPLs) in Central and Southeast European countries. As a theoretical foundation, the authors draw on financial stability theories to assess the impact of NPLs on the banking system and macroeconomic environment. The research examines factors influencing the formation of NPLs, including economic growth rates, unemployment levels, and interest rate volatility. The methodology employs panel regression and dynamic analysis techniques to examine NPL trends across various countries. The findings indicate that during periods of economic crisis and uncertainty, NPL levels rise, negatively affecting the stability of the banking system. The study also emphasizes the importance of institutional reforms, strengthening credit policies, and improving banking supervision to reduce NPLs.

Dimitras, Dokas, Mamou, and Spyromitros (2024) employ non-parametric methods in their research to evaluate the efficiency of European banks, particularly analyzing the significance of performing loans' efficiency. This work, grounded in financial efficiency theories, elucidates the interconnection between banking system stability and loan portfolio quality. The authors examine the quality of loans and their impact on bank profitability based on specific economic theories, including information asymmetry and agency theories, when assessing economic efficiency and banking performance. The study also highlights the superiority of non-parametric techniques, which allow for the creation of a model without constraints by relying on data, in contrast to traditional parametric approaches in evaluating the efficiency of financial institutions.

In his research, Ozili (2019) examines the relationship between non-performing loans (NPLs) and financial development, analyzing the impact of this issue on the banking system and the economy. As a theoretical foundation, the author draws upon theories of financial development, credit market efficiency, and the concept of financial deepening. The study discusses the effect of NPLs on banking system stability and how they influence economic growth and the development of financial institutions. The author also employs agency theory and information asymmetry approaches to explain the impact of financial institution stability, regulatory policies, and lending conditions on NPL levels. Additionally, the research specifically examines the effects of economic crises, declining asset quality, and credit risk management strategies on NPLs.
In our analysis, using the structural vector autoregression model, we will study the impact of changes in the inflation rate in the economy, changes in the money supply in circulation, and changes in the interest rate in the money market (which is the main indicator of market interest rates in the economy) on the interest rates of Uzpromstroybank loans. Although these indicators are considered external factors, it is logically sound for Uzpromstroybank to determine its interest rate risk based on external factors, given that it is one of the largest banks. The selected indicators are quarterly and cover the period from the first quarter of 2005 to the second quarter of 2024. Additionally, to clarify the influence of these indicators, the selected statistical data have been natural log-transformed

2. Results

Empirical analysis of interest rate policy in commercial banks holds great practical significance, especially in Uzbekistan during the banking sector's transition to market

principles. In recent years, the Central Bank of the Republic of Uzbekistan's liberalization of monetary policy and adjustment of the key rate based on market conditions necessitate banks to adopt more flexible interest rate policies. Therefore, empirical research should determine which internal and external factors influence commercial banks' interest rate formation, their impact on client decisions, and overall credit activity. Based on such research findings, banks can expand their capacity to manage interest rate policy at a strategic level, maintain competitiveness, and secure stable income. Additionally, these analyses serve as a foundation for macroeconomic policy institutions to make crucial decisions.

To assess the data's compliance with normal distribution, the Jarque-Bera test was applied. The analysis results revealed that all the selected external factors follow a normal distribution. This is because the calculated Jarque-Bera statistic for all indicators showed reliable results, with their probability values being less than 0.05. In the preliminary stage of the analysis, we conducted descriptive statistics of the selected indicators.

Table 1. Descriptive statistics of selected factors

	Inflationt	***M2t***	***MMRt***	***SQBLRt***
Mean	0.966667	0.017382	0.276973	0.323747
Median	1.000000	0.016776	0.249194	0.297910
Maximum	4.100000	0.168219	1.753864	1.804052
Minimum	-0.500000	-0.064792	-2.860906	-2.824898
Std. Dev.	0.769507	0.031101	0.769325	0.772040
Observations	96	96	96	96

In the next stage of our analysis, we will determine the correlation matrix of the indicators. Through this, we will analyze the correlation coefficients between the interest rate on loans from Uzpromstroybank, changes in the inflation rate in the economy, changes in the money supply in circulation, and changes in the interest rate in the money market, which is considered the main indicator of market interest rates in the economy. This interrelationship helps to understand the degree of sensitivity among economic indicators.

Table 2. Correlation matrix of indicators

	Inflationt	***M2t***	***MMRt***	***SQBLRt***
Inflationt	1			
M2t	0.15	1		
MMRt	-0.79	-0.41	1	

SQBLRt	-0.36	-0.53	0.68	1

The inflation rate affects credit interest rates not directly, but rather through indirect channels. For example, the correlation between inflation and bank credit rates is -0.36, indicating a weak inverse relationship. This suggests that changes in inflation are not fully reflected in banks' interest rate policies; rather, banks rely more heavily on other factors when setting their interest rates - particularly on money market rates and the state of money supply. These analyses provide an important statistical foundation for optimizing credit policy, forecasting credit interest rate volatility, and effective management of bank resources. Going forward, there is a need to conduct in-depth studies of the dynamics of these relationships through regression or panel analyses.

In our analysis, we employ a structural vector autoregression model. This model evaluates the dynamic relationships among multiple variables that interact over time. When using the structural vector autoregression model, it is crucial to conduct an Augmented Dickey-Fuller Test on the indicators. Through this Augmented Dickey-Fuller Test, the indicators are examined for unit roots, and it is determined whether the selected indicators are stationary or non-stationary.

Table 3. Augmented Dickey-Fuller Test

	Ko‘rsatkichlar	**t-Statistic**	**Probability**	**Xулоса**
	Inflationt	-8.040331	0.0000	I(0)
	M2t	-7.607672	0.0000	I(0)
	MMRt	-7.995607	0.0000	I(0)
	SQBLRt	-7.975297	0.0000	I(0)

As evident from the above data, all selected indicators are in a stationary state, which serves as the basis for utilizing a structural vector autoregression model based on these indicators.

In the next stage of our analysis, we will develop a structural vector autoregression model of the selected indicators. When constructing this model, it is necessary to determine the optimal lag.

Table 4. VAR Lag Order Selection Criteria

Sampl: 2016M122024M12

Included observations: 91

Lag	LogL**	LR	FPE	AIC	SC	HQ
0	2293.596	NA	1.64e-27	-50.32080	-50.21043*	-50.27627*
1	2314.448	39.41255	1.48e-27	-50.42743	-49.87560	-50.20480
2	2335.959	38.76706	1.31e-27	-50.54855	-49.55525	-50.14782
3	2363.043	46.42955*	1.03e-27*	-50.79216*	-49.35738	-50.21331
4	2376.267	21.50662	1.11e-27	-50.73114	-48.85489	-49.97419

As we can observe from the table data, the sequential modified LR test statistic, Final prediction error, and Akaike information criterion indicate that the optimal number of lags is 3. However, according to the Schwarz information criterion and the Hannan-Quinn information criterion, the optimal number of lags is shown to be 0. Therefore, in our empirical analysis, we can consider the optimal number of lags to be 3. Based on the analysis above, we express the structural vector autoregression model of factors influencing the interest rate of Uzsanoatqurilishbank loans in the following form:

$$\Delta SQBLR_t = \alpha_1 + p_1 e_1 + \sum_{i=1}^{3} \beta_i \Delta SQBLR_{t-i} + \sum_{i=1}^{3} \delta_i Inflation_{t-i} + \sum_{i=1}^{3} \gamma_i \Delta M2_{t-i} + \sum_{i=1}^{3} \omega_i MMR_{t-i}$$

Table 5. Vector Autoregression Estimates (with restrictions)
Vector Autoregression Estimates (with restrictions)

	$Inflation_t$	$M2_t$	MMR_t	$SQBLR_t$
$Inflation_{t-1}$	0.000000 --- 	0.000000 --- 	0.000000 --- 	-0.114682 (0.05124) [-2.23814]
$Inflation_{t-2}$	0.000000 --- 	0.000000 --- 	0.000000 --- 	-0.071915 (0.05151) [-1.39607]
$Inflation_{t-3}$	0.000000 --- 	0.000000 --- 	0.000000 --- 	-0.080478 (0.04979) [-1.61643]
$M2_{t-1}$	0.000000 --- 	0.000000 --- 	0.000000 --- 	-0.021908 (0.01774) [-1.23513]
$M2_{t-2}$	0.000000 --- 	0.000000 --- 	0.000000 --- 	-0.017652 (0.02100) [-0.84044]
$M2_{t-3}$	0.000000 --- 	0.000000 --- 	0.000000 --- 	-0.364614 (0.01878) [-3.43999]
MMR_{t-1}	0.000000 --- 	0.000000 --- 	0.000000 --- 	0.651017 (0.18518) [2.59893]
MMR_{t-2}	0.000000 --- 	0.000000 --- 	0.000000 --- 	0.151368 (0.08351) [1.81255]
MMR_{t-3}	0.000000 --- 	0.000000 --- 	0.000000 --- 	0.118648 (0.08252) [1.43790]
C	-3.12E-15 (0.00083) [-3.7e-12]	2.62E-06 (4.8E-05) [0.05452]	4.76E-06 (0.00084) [0.00564]	7.40E-06 (0.00084) [0.00876]

3. **Discussion**

According to the model results, it was determined that all selected indicators have an impact on the interest rates of loans from JSC Uzpromstroybank. This suggests that we have correctly identified the external factors influencing the interest rates on loans from JSC Uzpromstroybank.

4. **Conclusion**

According to the model results, it was determined that all selected indicators have an impact on the interest rates of loans from JSC Uzpromstroybank. This indicates that we

have correctly identified the external factors influencing the interest rates on loans from JSC Uzpromstroybank. While the influence of these factors on JSC Uzpromstroybank's loan interest rates is evident, there are differences only in the time lags of their effects. Specifically, a one percent monthly increase in the inflation rate in the economy reduces JSC Uzpromstroybank's loan interest rates by 0.11 percent with a one-month delay. Additionally, a one percent increase in the money market interest rate raises JSC Uzpromstroybank's loan interest rates by 0.65 percent with a one-month lag. An increase in the money supply in circulation causes a decrease in commercial banks' interest rates by increasing their loan capital. This is a practical rule that operates in most economies. Although an increase in the money supply in circulation affects the money market faster than the commodity market, this does not occur in the short term. We can observe this situation in our economy as well. In particular, a one percent increase in the monthly money supply in circulation reduces JSC Uzpromstroybank's loan interest rates by 0.36 percent with a three-month delay

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