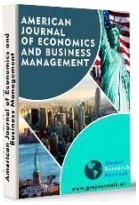

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Article

Correlation Analysis of the Relationship Between Indicators of Stability of the Banking Sector and Macroeconomic Indicators

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Abstract: The article analyzes the changes in the macroeconomic indicators of the country, their relationship with the use of econometric methods based on the influence of indicators of financial stability of banks. The forecast indicators are determined and the corresponding conclusions are made.

Keywords: The problem loan ratio, net stable funding ratio, the quick liquidity ratio, gross domestic product, model, forecast indicators.

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Introduction

One of the main directions of the strategy for reforming the banking system of the Republic of Uzbekistan is to address issues of increasing the financial stability of banks, improving corporate governance in banks using international standards and best practices in this area; ensuring moderate credit growth and improving the quality of the loan portfolio; developing a system of banking control and risk management in banks.

Based on these goals, the study of the interaction of indicators of the stability of the country's banking system with macroeconomic indicators, as well as on this basis, the definition of forecast indicators will become the basis for the development of priorities that must be fulfilled in this area in the future

Methodology

When carrying out research work, data collection, generalization, comparison, econometrics, research by domestic and foreign scientists on the econometric analysis of the impact of banking indicators on macroeconomic indicators were applied, conclusions and proposals were developed.

Results and analysis

In a time when volatility is very strong in the modern global economy, the study of the financial stability of banks is considered relevant. Ensuring the financial stability of banks provides for constant monitoring of the analysis of various risks of the financial system according to macroeconomic indicators and, accordingly, the implementation of response measures against them. With the help of indicators that determine the financial stability of banks, a correlation analysis can be carried out based on a large-scale data set for forecasting the gross domestic product (GDP) of Uzbekistan.

Macroeconomic forecasting based on monetary and financial information, large-scale data analysis helps to obtain reliable forecast data in real time. Below, we will conduct a corrective analysis of bank indicators that

determine the financial stability of banks in the country and affect it, which are associated with changes in GDP at current prices.

Studies by economists of the International Monetary Fund (Matias Costa Navajas and Aaron Thegeya), Russia (Grigorieva Kristina Vladimirovna), Ukraine (Svitlana Khalatur, Liudmyla Velychko, Olena Pavlenko, Oleksandr Karamushka, Mariia Huba) and Uzbekistan (Sattarov Odiljon Berdimuratovich) confirmed the existence of indicators that determine the financial stability of banks, as well as a strong correlation of the main indicators the banking system with macroeconomic indicators. This helps to forecast the gross domestic product.

While Matias Costa Navajas and Aaron Thegeya in their scientific research conducted an analysis according to which indicators such as the ratio of assets at risk to regulatory capital (CAR) and return on bank capital (ROE) have a strong correlation with banking crises [1]. In her scientific research, Kristina Grigorieva, based on an analysis of the practice of the Russian banking system, formed a model based on the correlation of indicators such as the equity adequacy ratio, the share of problem loans in the loan portfolio, return on capital, the ratio of liquid assets to short-term liabilities, with bank defaults [2]. In his research, Sattarov Odiljon Berdimuratovich, on the ground of a simple linear regression analysis, concluded that the real domestic product has a positive impact on the stability index of the banking system of Uzbekistan [3].

Below we will conduct an econometric analysis on the ratio of the main indicators and macroeconomic indicators that determine the financial stability of the banking system of Uzbekistan. The data of this study were formed using 7-year data on the dynamics of the main indicators that determine the financial stability of banks and GDP at current prices in 2016-2023, published by the Central Bank of the Republic of Uzbekistan and the Statistics Committee.

It is considered important to study the impact of financial stability indicators of banks on the national economy. Such an analysis is important in shaping the tasks that should be performed in the future precisely from the point of view of financial stability indicators.

In the course of the study, based on the data, an analysis was carried out using econometric methods of the problem loan ratio (NPL) issued to the national economy, net stable funding ratio, as well as the impact of the quick liquidity ratio.

In this analysis, using official data provided by the Central Bank of the Republic of Uzbekistan, the impact of such indicators as the problem loan ratio (NPL), net stable funding ratio, the quick liquidity ratio on changes in the country's gross domestic product was studied. Appropriate forecasts were provided from these analyses.

In this case, the following indicators are obtained:

Y	GDP, billion soums
X1	The problem loan ratio (NPL), percent
X2	Net stable funding ratio, percent
X3	The quick liquidity ratio, percent

Table 1

Dynamics of GDP and financial stability indicators[1]

Years	Y	X1	X2	X3
2016	255 421,9	0,74	102,6	40,1
2017	317 476,4	1,2	110,6	40,1
2018	426 641,0	2	107,9	30,9
2019	532 712,5	2,3	112,8	47,8
2020	605 514,9	2,1	109,9	67,4
2021	738 425,2	5,2	115,4	99,3
2022	888 341,7	3,6	115,6	110,1

[1] Compiled by the author based on information from the sites stat.uz and cbu.uz.

Table 2

The correlation between indicators of financial stability and GDP[2]

Correlation dependency				
Probability	GDP	The problem loan ratio (NPL)	Net stable funding ratio	The quick liquidity rat io
ЯИМ	1.0000			
The problem loan ratio (NPL) (X1)	0,8460	1.0000		
Net stable funding ratio (X2)	0,8415	0,8165	1.0000	
The quick liquidity ratio (X3)	0,9231	0,8356	0,7530	1.0000

Table 3

Regression statistical analysis of GDP and factors affecting it (Model 1)

Dependent Variable: GDP				
Method: Least Squares				
Sample (adjusted): 2016–2023 years				
Included observations: 7				
Variables	Ratio	The standard error	t-statistics	Probability
C	−1,50968e+06	913602	−1,652	0,1970
The problem loan ratio (NPL) (X1)	7718,02	51892,8	0,1487	0,8912
Net stable funding ratio (X2)	15707,2	8891,31	1,767	1,767
The quick liquidity ratio (X3)	4659,29	1419,10	3,283	0,0463
R-square	0,902252	The standard deviation of the dependent variable		226707,4
The sum of the squares of the residuals	3,01e+10	The standard error of the model		100238,5
F(4, 6)	41,81575	Adapted R-square		0,804504
Proximity to logarithmic reality	−87,57418	Prob(F-statistic)		0,006017
The Schwartz criterion	182,9320	The Akaike Criterion		183,1484
Parameter rho	−0,248914	The Hannah-Quinn Criterion		180,4742
Probability (F-index) The average value of the dependent variable	537790,5	Durbin-Watson statistics		2,361792

$$\mathbf{y = -1,50968e + 06 + 7\,718,02 * x_1 + 1\,5707,2 * x_2 + 4\,659,29 * x_3 + \varepsilon}$$

From the factors of this regression, it can be concluded that the problem loan ratio (NPL) (0.8912>0.05), as well as net stable funding ratio (1.767>0.05) do not have a 5% significance level. An increase in the quick liquidity ratio by 1% increased GDP by $4,65929 billion soums.

In this table, we determine the repeated correlation and form a model by subtracting the problem loan ratio (NPL) (X1) from the model due to insufficient statistical significance.

Table 4

Regression statistical analysis of GDP and factors influencing it (Model 2)

Dependent Variable: GDP				
Method: Least Squares				
Sample (adjusted): 2016–2023 years				
Included observations: 7				
Variables	Ratio	The standard error	t-statistics	Probability
C	−1,62528e+06	494345	−3,288	0,0303
Net stable funding ratio (X2)	16815,3	4836,53	3,477	0,0254
The quick liquidity ratio (X3)	4849,63	878,051	5,523	0,0052
R-square	0,901667	The standard deviation of the dependent variable		226707,4

[2] The calculations were carried out by the author in the Gretl program.

The sum of the squares of the residuals	4,47e+09	The standard error of the model	87068,46
F(4, 6)	64,24449	Adapted R-square	0,852501
Proximity to logarithmic reality	−87,59506	Prob(F-statistic)	0,000912
The Schwartz criterion	181,0279	The Akaike Criterion	181,1901
Parameter rho	−0,225764	The Hannah-Quinn Criterion	179,1845
Probability (F-index) The average value of the dependent variable	537790,5	Durbin-Watson statistics	2,339875

$$\mathbf{y = -1,62528e + 06 + 16\,815,3 * x_2 + 4\,849,63 * x_3 + \varepsilon}$$

From the factors of this regression, it can be concluded that an increase in the rate of net stable funding ratio by 1% will lead to an increase in GDP by 16,815.3 billion soums, and an increase in the quick liquidity ratio by 1% will lead to an increase in GDP by 4,849.63 billion soums.

Table 5

The results of regression equations calculated by the least squares method, the dependent variable is GDP

Independent variables	1	2
The problem loan ratio (NPL) (X1)	7718,02	
The net stable funding ratio (X2)	15707,2	**16815,3
The quick liquidity ratio (X3)	**4659,29	***4849,63
Coefficient of determination (R2)	0,902252	0,901667
F-statistical value, p-value	0,006017	0,000912
p-value of the Breusch-Godfrey Test	0,748	0,712

Note: The p-values of the regression coefficients are given as: * * * - p<0.01, * * - p<0.05, * - p<0.10

It can be seen from the data in Table 5 that the main factors affecting GDP are the net stable funding ratio and the quick liquidity ratio. In the second model, the influence of these two factors is statistically significant. In addition, one of the problems that arise in econometric modeling of dynamic series is autocorrelation. In these equations, autocorrelation was tested using the Breusch-Godfrey test. According to the results of this test, both models do not have an autocorrelation problem, since the Breusch-Godfrey test has a p-value exceeding 0.05. The results of the survey were obtained using the gretl program.

Since all regression factors in the third model are statistically significant at a 5% significance level and there is no first- and second-order autocorrelation, we select this model and check it for multicollinearity.

```
estat vif
    Variable |      VIF      1/VIF
-------------+----------------------
          X1 |     2,30   0,433087
          X2 |     2,30    0,433087
-------------+----------------------
    Mean VIF |     2.30
```

As can be seen from this test, we can conclude that the average value of VIF is 2.30, that is, since this value is less than 10, the model does not have multicollinearity.

We use the Breusch-Pagan test to check for the presence of heteroscedasticity in the Stochastic error of the selected regression model.

As a null hypothesis, the Breusch-Pagan test assumes that there is no heteroscedasticity in this model. If the probability is greater than R>0.05, then there is no heteroscedasticity, the stochastic error of the selected regression residuals is homoscedastic.

Table 6

The results of the Breusch-Pagan regression model test, in which GDP and its influencing factors were selected

The Breusch-Pagan test for 2nd order heteroscedasticity Method: Least Squares Sample (adjusted): 2016–2023y Dependent Variable: Large-scale uhat				
Variables	Ratio	The standard error	t-statistics	Probability
Const	−9,81354	14,0255	−0,6997	0,5227
The net stable funding ratio (X2)	−0,112592	0,134782	0,8354	0,4505
The quick liquidity ratio (X3)	−0,0264889	0,0196514	−1,348	0,2490

The average sum of squares = 1,85394

Testing statistics: LM = 0,926972,

Prob.= P (XI- square (2)) > 0,926972) = 0,629087

Since the result of the Breusch-Pagan test was P>0.62, this model does not have heteroscedasticity, it became possible to see that the random error of the selected regression residuals is homoscedastic. So, considering that the model we have chosen has passed regression evaluation tests positively, this means the reliability of the forecast indicators performed on the basis of this model.

Now, using the above calculations and the accepted model 2, we will present the projected GDP figures for the next 3 years and the factors affecting it.

The selected model 2 received the following look:

$$\mathbf{y = -1,62528e + 06 + 16\,815,3 * x_2 + 4\,849,63 * x_3 + \varepsilon}$$

Conclusion and discussions

We calculate the forecast indicators for the net stable funding ratio (X2), as well as the quick liquidity ratio (X3) and determine the forecast GDP (Y) for the next three years in accordance with the above formula.

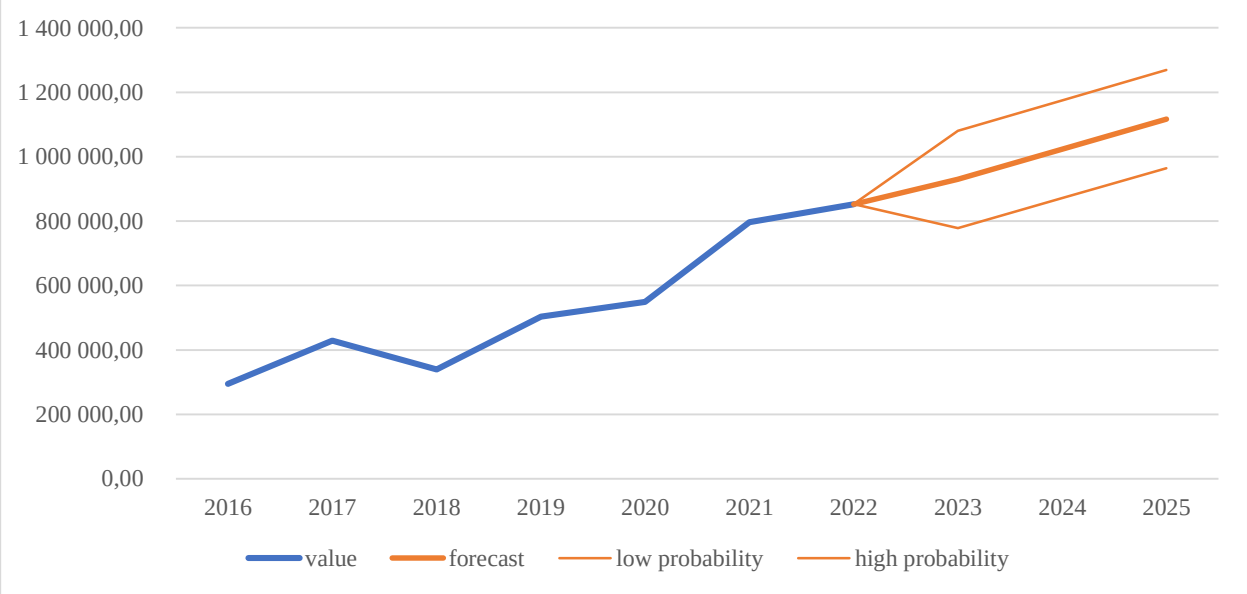

Figure 1. Projected GDP growth dynamics taking into account the impact of financial stability indicators[3].

This forecast will serve as the basis for the conclusion that, based on Model 2, GDP growth rates (Y) in 2023, 2024 and 2025 will be as follows, based on the impact of the net stable funding ratio (X2) and the quick liquidity ratio (X3) (Figure 1). From this, we can conclude that macroeconomic indicators are directly influenced by financial stability indicators, and we can use their correlation dependence to make short-term GDP forecasts.

[3] Compiled by the author based on information from the sites stat.uz and cbu.uz.

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