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Article

Econometric Modeling of Financial Stability Indicators of Banks

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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. Using the VAR model, the forecast indicators are determined, as well as the corresponding conclusions are given.

Keywords: The bank's core capital, net profit, interest-free income, gross domestic product, VAR model, forecast indicators.

Introduction

In an era 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.

Below, a correlation analysis of bank indicators was carried out, which determine the financial stability of banks in the country and affect it, which is associated with changes in GDP at current prices.

Materials and Methods

In implementing a short-term forecast of a country's economic growth, many central banks use the relationship equation. The main essence of such relationship equations is to reflect the target indicator in a model in which several changing factors are associated with the indicators. Many studies confirm that such models provide more accurate predictive data than a simple model.

In the practice of foreign countries, predictive models such as ARIMA, DFM, VAR are used in determining forecast indicators of macroeconomic indicators within the framework of monetary policy implementation.

Each of the above models has its advantages and disadvantages, and these approaches complement each other. In practice, it is difficult to find an ideal model that will allow for a complete and most accurate forecast of economic trends, so several models are used

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simultaneously, and a high-precision model is selected to implement one or another forecast indicator.

Baffigi, Golinelli, and Parigi tried in their study to determine the most suitable model for forecasting GDP growth in the EU from 1980 to 2002, and as a result of the study, it was concluded that the relationship equations provide more accurate predictive indicators than other models [1]. In another group of studies, the correlation equation is used as an indicator of supply and demand to predict GDP. For example, N. Pinkwart in his study estimates the components of GDP in terms of production and consumption using compatibility equations [2]. According to the results of the study, this approach will help to more accurately express short-term forecast indicators, forecasting GDP from the point of view of supply and demand will increase the level of accuracy.

B.Bernanke, J.Boivin, P.Eliasz in their research proposed using the factor-vector autoregression model (FAVAR) in analyzing the effectiveness of monetary policy[3]. The method proposed in this research paper will help to qualitatively analyze the impact of monetary policy on macroeconomic indicators. The authors concluded that adding factors to the model increases the accuracy of forecasting macroeconomic indicators.

A study by K.Astveit, K.R. Gerdrup, A.Jore and L.Thorsrud states that the Central Bank of Norway uses models such as VAR, AR, and vector error correction model (VECM) for short-term inflation forecasting[4]. In this case, the main indicator for the short-term inflation forecast is the high level of data compatibility with real data.

In his research, A. Andreev analyzed the effectiveness of using a joint method to implement a short-term inflation forecast in the Russian banking system. Various forecasting models were used, such as VAR, VAR2, RW, STAR, UC, each of which provides a generalized inflation forecast [5].

A. Bayesian studies the use of the VAR model for effective inflation forecasting in Turkish banking practice [6]. The results show that this method provides the most accurate prediction when logarithmic measures of variables are applied.

In 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

The following are indicators of the financial stability of the country's banking system, the forecast of gross domestic product under the influence of bank’s core capital, net profit and interest-free income. In the study, predictive indicators were performed using a vector autoregression model (VAR).

The VAR model is considered a statistical model and is used to determine the relationship between several variables over a certain period. VAR is a generalized autoregression model with a single dependent variable (AR) covering several time series. For each variable, as in the autoregression model, an equation will be compiled that models its formulation in a time series. This equation will consist of the previous values of the observed variable (lags), lags and errors of other variables.

The study used quarterly indicators of gross domestic product (GDP), bank’s core capital, net profit and interest-free income.

Using data from the Central Bank of the Republic of Uzbekistan and the State Committee of the Republic of Uzbekistan on Statistics to empirically verify the relationship between the indicators of financial stability of the country's banking system and economic growth, a database was created that presents periodic series of indicators of gross domestic product, the bank's core capital , net profit and interest-free income for 2017-2023 (Figure 1).

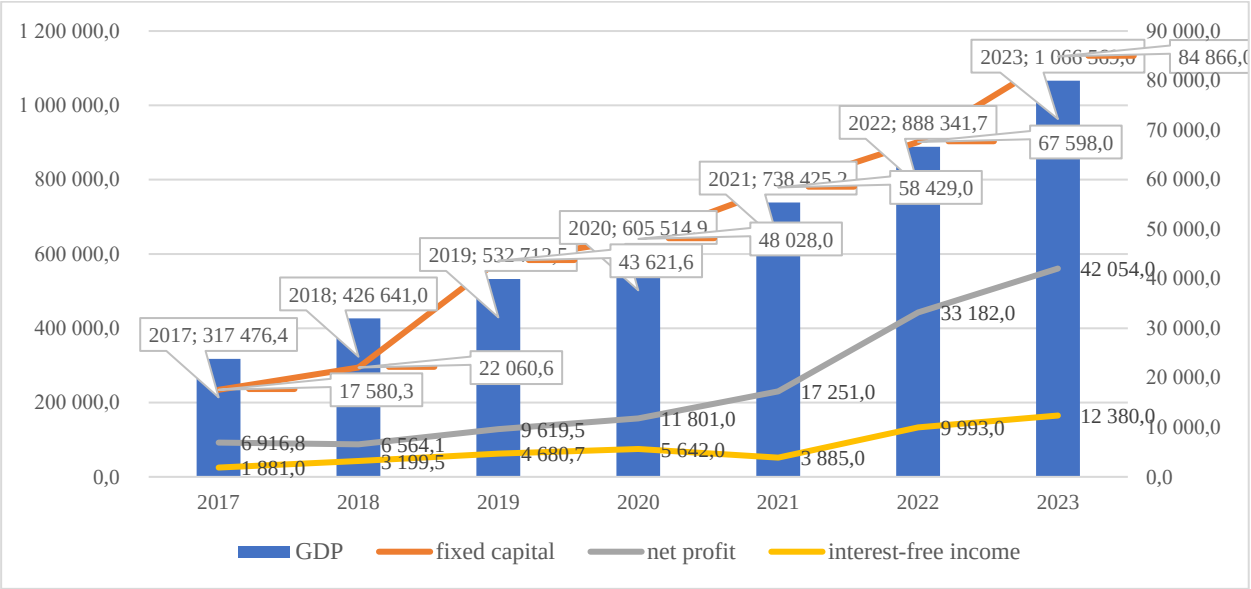

Figure 1. Dynamics of macroeconomic indicators and indicators of financial stability of banks, billion sum [7][1]

A test check is carried out for the differentiation of factorial and indirect signs, the choice of the degree of superiority, the freedom of indicators of models compiled using the VAR method in relation to each other.

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Vector autoregression

Sample:  2018q2 - 2023q4                        Number of obs     =         23
Log likelihood =  -914.0152                     AIC               =   82.61002
FPE            =   1.06e+31                     HQIC              =     83.057
Det(Sigma_ml)  =   3.87e+29                     SBIC              =   84.38731

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
Y                      9    193882   0.6451   41.79894   0.0000
X1                     9    8484.9   0.8942    194.429   0.0000
X2                     9   6061.98   0.8017   93.01203   0.0000
X3                     9    2148.8   0.6782   48.47475   0.0000
------------------------------------------------------------------
```

Figure 2. Engel-Granger test[2].

With the help of the Stata program, the level of accuracy of the hypotheses put forward as a result of the relevant tests was determined. According to the Engel-Grainger engagement test above, since the prob>chi2 column for GDP regression has a value of less than 0.05, the hypothesis that bank's core capital, net profit and interest-free income directly affect GDP is considered confirmed (Figure 2).

In addition, it is also possible to determine the model with the least error in the analysis using the VAR method.

The results of the Dikkey Fuller test show that the probability of GDP is less than 0.05 (0.0474) and that it is stationary. On the other hand, the probabilistic values of the indicators X1, X2, X3 (p-value) are less than 0.05 (0.9351, 0.8808, 0.5523, respectively), and the time series were initially non-stationary, so they were differentiated. When the value of the above factors is differentiated, respectively, at stage I of the integration process, both time series become stationary representations. It follows that a regression relationship between time series can be established using the VAR model.

[1] It was formed by the author on the basis of data from the State Committee of the Republic of Uzbekistan on Statistics and the Central Bank of the Republic of Uzbekistan.

[2] Calculated by the author using the Stata program.

When implementing the VAR model, the relationship between the indicators is initially determined and the number of these relationships is checked using the Johansen test.

Johansen tests for cointegration

Trend: constant — Number of obs = 23
Sample: 3 - 25 — Lags = 2

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	20	-940.08028	.	52.1302	47.21
1	27	-923.01801	0.77320	18.0056*	29.68
2	32	-918.04455	0.35110	8.0587	15.41
3	35	-914.26479	0.28012	0.4992	3.76
4	36	-914.01519	0.02147		

Figure 3. Johansen test[3]

The Johansen test shows how many connection numbers exist between the indicators. According to the results of this test, it was found that there is one cointegration equation between the analyzed indicators. For observation, 23 periods are taken as a basis, the number of lags is 2.

In the test, the logarithmic probability is -940.08, and the observation statistics in the ratio 52.13 do not contain a correlation of indicators. According to the test results, we conclude that the logarithmic probability is -923.01, as well as the correlation of 1 between the indicators in a row with the observation statistics of 18.00.

The study assumes that:

Hypothesis H0: an increase in the bank's bank's core capital, net profit and interest-free income has a positive impact on the country's gross domestic product.

The coefficients of the cointegration equation obtained based on the test results are shown in Figure 4. The data obtained confirmed that the normalized signal of the cointegration coefficient, as well as the results of the T–test, correspond to the hypothesis under study and that basic capital and net profit have a positive impact on GDP. The presence of a cointegration relationship between the variables suggests that in the long run they tend to each other.

We use the VAR model to see the short-term relationship between variables. To evaluate the VAR model, it is necessary to select an appropriate lag value using the Akaike AIC and Schwarz SC criteria. In the case under consideration, the optimal lag value is two.

It should also be noted that the above-mentioned bilateral communication, that is, the banking system, supported the idea that financial stability indicators affect economic growth, and economic growth affects the financial stability indicators of the banking system, in Uzbekistan it was found that the growth of financial stability indicators of the banking system of Uzbekistan directly affects the level of financial stability of the banking system on fluctuations in GDP. That is, according to calculations, an increase in the volume of bank's core capital by 1 billion will lead to an increase in GDP by 7.33 billion sum[4].

Below, as a result of the analysis conducted on the basis of the VAR model, forecast values of indicators are formed, for which further analysis is carried out as a result of interaction in a year and two years.

[3] Calculated by the author using the Stata program.

[4] N. Sharipova "Econometric modeling of financial stability indicators of banks" / / Economic Development and Analysis, 2023, No. 4, pp. 239-245.

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. varbasic Y X1 X2 X3, lags(1/2) step(8)

Vector autoregression

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Log likelihood =  -914.0152             AIC               =   82.61002
FPE            =   1.06e+31             HQIC              =    83.057
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------------------------------------------------------------------
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Y						
Y						
L1.	.232386	.4938781	0.47	0.638	-.7355974	1.200369
L2.	-.920662	.4164428	-2.21	0.027	-1.736875	-.1044492
X1						
L1.	-11.66244	6.785204	-1.72	0.086	-24.9612	1.636317
L2.	17.96863	7.209194	2.49	0.013	3.838869	32.09839
X2						
L1.	-2.620854	21.28079	-0.12	0.902	-44.33044	39.08873
L2.	14.26997	17.92774	0.80	0.426	-20.86775	49.40769
X3						
L1.	17.19784	55.92777	0.31	0.758	-92.41857	126.8143
L2.	-6.374928	52.18165	-0.12	0.903	-108.6491	95.89923
_cons	311307.8	137585.5	2.26	0.024	41645.2	580970.4

Figure 4. VAR Modelling results[5].

Conclusions and suggestions

According to the results of the VAR model, after 2 lag periods we will get the following model:

$$Y = 17{,}96\,X1 + 14{,}26X2 - 6{,}37X3 \quad (2)$$

The above equation reflects the values of changes in the country's gross domestic product under the influence of bank's core capital, net profit and interest-free income of banks after two years. That is, according to the model, in two years an increase in bank's core capital by 1 billion soums will lead to an increase in GDP by 17.96 billion soums, and an increase in net profit by 1 billion soums will lead to an increase in GDP by 14.26 billion soums. While the increase in interest-free income in the first year had a positive effect on GDP, in the second year it had the opposite effect. From this it can be concluded that the main focus should be on stimulating interest income.

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