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THE ECONOMETRIC ANALYSIS OF FINANCIAL INDICATORS OF COMMERCIAL BANKS ACTIVITIES

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Abstract

As the result of the econometric analysis of the financial instruments of a concrete joint-stock commercial bank, it was carried out the efficiency of transformation of bank activities in Uzbekistan.

Keywords: *bank, transformation, efficiency, financial indicators, net commission income, bank transaction costs, net profit*

Introduction

Nowadays in Uzbekistan the process of Transformation of the economy on the basis of digitalization is considered as one of the most urgent issues that need to be implemented in Uzbekistan. In this field, commercial banks have achieved great technical and especially financial successes.

Therefore, in order to determine the level of efficiency of the activities of a concrete joint-stock commercial bank (the name of the bank has not been given in order to protect the trade secret) that successfully works in the field of digitization and transformation in our country we will conduct an econometric study of its financial indicators.

Econometric analysis

In the econometric analysis of this bank, net interest income is Y as a result factor (billion soums), and the influencing factors are – net commission income – X 1 (billion soums), operational expenses of the bank – X 2 (billion soums) and net profit X 3 (billion soums) has been received.

We will conduct descriptive statistics based on the performance indicators of the bank for the quarters of 2018–2022 (Table 1).

Table 1. *Descriptive statistics*

	Y	X_1	X_2	X_3
Mean	111.5050	54.55500	74.98000	33.31000

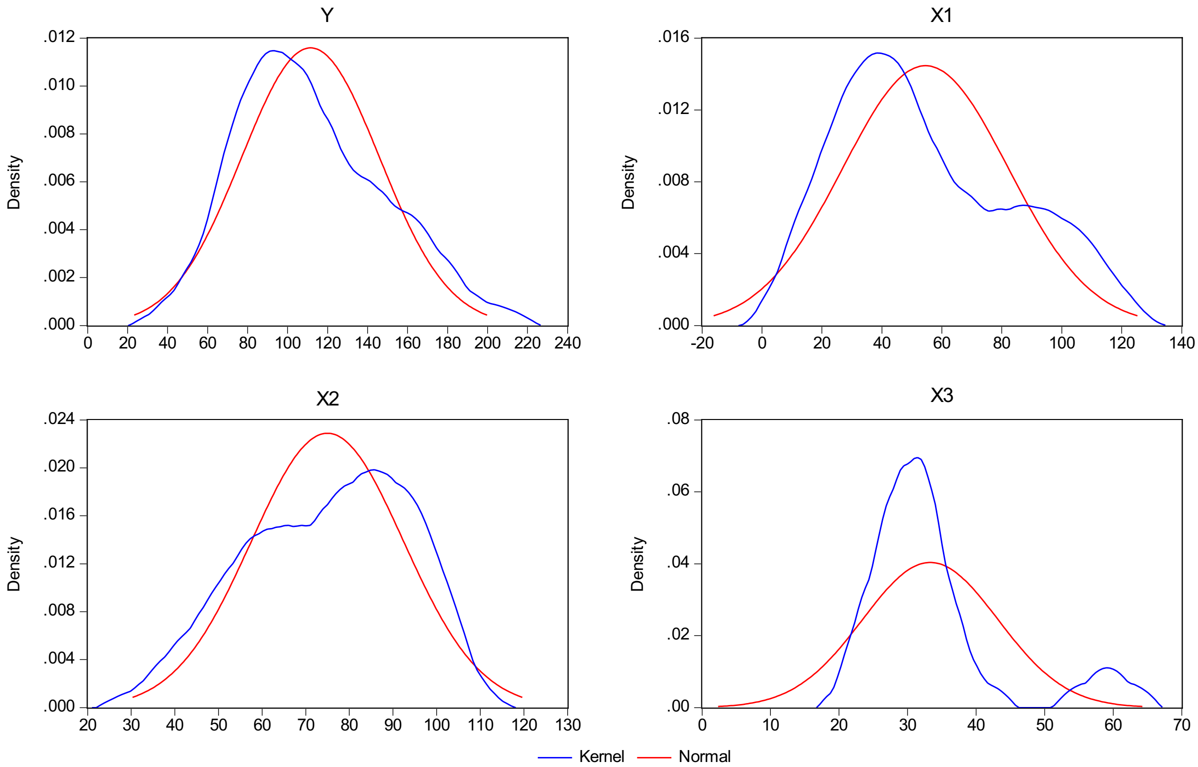
	Y	X_1	X_2	X_3
Median	99.70000	46.35000	76.70000	30.75000
Maximum	189.5000	104.8000	99.10000	61.60000
Minimum	57.80000	22.40000	40.60000	22.30000
Std. Dev.	34.42180	27.58429	17.43377	9.887946
Skewness	0.606590	0.633415	-0.379521	1.799375
Kurtosis	2.583561	1.997886	1.954918	5.649504
Jarque-Bera	1.371024	2.174241	1.390284	16.64240
Probability	0.503832	0.337186	0.499004	0.000243
Sum	2230.100	1091.100	1499.600	666.2000
Sum Sq. Dev.	22512.35	14456.97	5774.792	1857.658
Observations	20	20	20	20

The normal distribution function is determined by the following formula:

$$p(x) = \frac{1}{\sqrt{2\pi\sigma}} \cdot e^{\frac{-(x-a)^2}{2\sigma^2}}, \quad -\infty < x < \infty, \qquad (1)$$

As can be seen from Figure 1, all factors obey the law of normal distribution.

Figure 1. *Checking factors for normal distribution*



As can be seen from Figure 1, all factors obey to the law of normal distribution.

One factor has a negative skewness coefficient (lnX2), so the “tail” of this variable is skewed to the left, and also three factors have positive skewness coefficients (lnY, lnX1 and lnX3), the “tails” of these factors are skewed to the right.

In all factors, the value of the kurtosis coefficients is less than 3, except for the factor lnX3, and therefore the top of the graph of the functions of these factors is lower than the theoretical graph, i.e. flat.

Table 2. *The Correlation matrix*

Probability	Y	X1	X2	X3
Y	1.000000			
X1	0.954628	1.000000		
	13.60017	–––		
	0.0000	–––		
X2	–0.626636	–0.625296	1.000000	
	–3.411458	–3.399473	–––	
	0.0031	0.0032	–––	
X3	0.847719	0.278655	–0.152048	1.000000
	10.20268	0.870362	–0.652675	–––
	0.0000	0.4211	0.5222	–––

As can be seen from Figure – 2 that, visually there is a close direct relationship between the dependent variable and the factors influencing it.

We will calculate this relationship through the coefficients of private and paired correlation (Table 2).

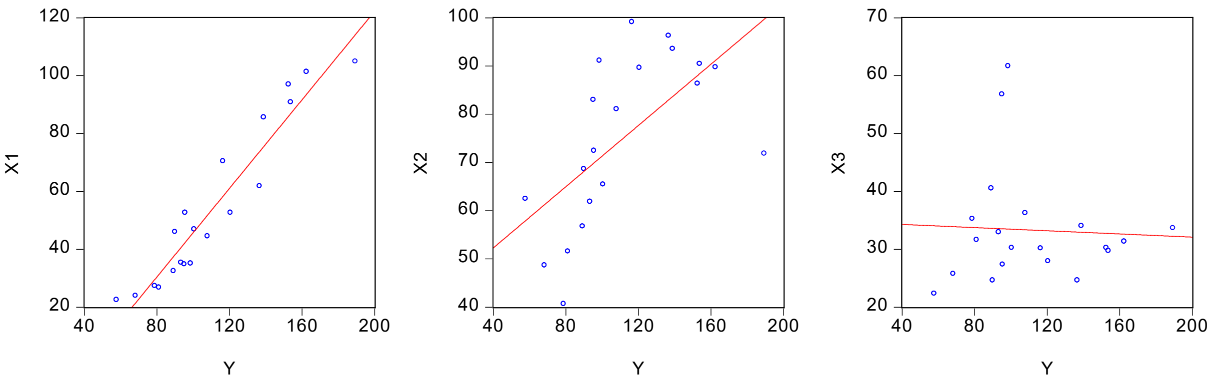
Two types of correlation coefficients are calculated here: partial and pairwise correlation coefficients.

Private correlation coefficients show the relationship of the dependent variable with each influencing factors. For example, the relationship between net interest income of the bank (lnY) and net fee income – (lnX1) the private correlation coefficient is 0.9546. This shows that there is a close relationship between these indicators. The correlation coefficient between the bank's net interest income (lnY) and the bank's operating expenses (lnX2) took a negative value and is equal to –0.6266. This shows that an increase in the bank's operating expenses leads to a decrease in the bank's net interest income. The correlation coefficient between bank's net interest income (lnY) and bank's net profit (lnX3) is 0.8477. There is a direct strong correlation between these indicators. (Table 2)

We check the multicollinearity in the connections between the influencing factors (Xi, Xj). Multicollinearity refers to the case where the pairwise correlation coefficient value is greater than 0.7 between two influencing factors. It can be seen from the indicators of Table 2 on the bank data that the connection densities between the influencing factors are not greater than 0.7. This indicates that there is no multicollinearity between the influencing factors and it is the basis for including all factors in the multifactor econometric model.

In order to verify the above, let's look at their dot graphs to determine the relationship of each factor with the resulting indicator (Figure 2).

Figure 2. *Relationship between the dependent variable and influencing factors*



To investigate autocorrelation in the series of residuals of the dependent variable, we calculate VIF (Variance Inflation Factors) coefficients (Table 3).

Table 3. *Results of calculation of VIF (Variance Inflation Factors) coefficients*

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
X1	0.013361	9.613669	1.878628
X2	0.033147	38.11069	1.861707
X3	0.064822	15.16167	1.171169
C	146.0899	28.41732	NA

According to the rule, the value of VIF coefficient of each factor should be less than 10. From the coefficients of the table we can see that the VIF coefficients of the factors are less than 10. This indicates the absence of autocorrelation in a number of residuals of the dependent variable.

Table 4 below presents the estimation of autocorrelation between factors and specific autocorrelation.

Table 4. *Determination of autocorrelation and private autocorrelation between factors*

Date: 01/28/23 Time: 15:05
Sample: 2018Q1 2022Q4
Included observations: 20

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.735	0.735	12.507	0.000
		2	0.578	0.083	20.682	0.000
		3	0.477	0.058	26.571	0.000
		4	0.309	-0.171	29.197	0.000
		5	0.189	-0.044	30.243	0.000
		6	0.165	0.114	31.095	0.000
		7	0.031	-0.196	31.129	0.000
		8	-0.054	-0.047	31.235	0.000
		9	-0.136	-0.135	31.972	0.000
		10	-0.201	-0.005	33.753	0.000
		11	-0.245	-0.036	36.683	0.000
		12	-0.273	-0.083	40.793	0.000

The autocorrelation and private autocorrelation test between the factors also corresponded to the high obtained results.

It results that there is no autocorrelation in the studied time series, and it can be seen that all the residuals have probability values less than 0.05.

At the next stage, we will create a multi-factor econometric model of the bank's net interest income (Table 5).

Table 5. *Estimated parameters of the multifactor econometric model*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1	1.225424	0.115589	10.601562	0.0000***
X2	–0.013803	0.182063	–2.2765957	0.0015***
X3	0.448323	0.254601	1.7608846	0.0974**
C	30.75328	12.08676	2.5443774	0.0216***
R-squared	0.926925	Mean dependent var		111.5050
Adjusted R-squared	0.913224	S.D. dependent var		34.42180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
S.E. of regression	10.13990	Akaike info criterion		7.647689
Sum squared resid	1645.080	Schwarz criterion		7.846835
Log likelihood	–72.47689	Hannan-Quinn criter.		7.686564
F-statistic	67.65149	Durbin-Watson stat		1.777335
Prob (F-statistic)	0.000000			

*Note: *** – 0.05 accuracy, ** – 0.1 accuracy*

Using the data of Table 5 above, the multifactor econometric model of banking activity shows:

$$\ln \widehat{y} = 30{,}7533 + 1{,}2254x_1 - \\ -0{,}0138x_2 + 0{,}4483x_3 . \quad (4)$$

The calculated multifactor econometric model (4) shows that the bank 's net commission income averages 1 bln. If it increases to com (X_1), the net interest income of the bank (*Y)* average 1.2254 billion. as it may increase to soums. Bank 's operating costs (X_2) average 1.0 bln. increase in soum, net interest income of the bank (*Y)* an average of 0.0138 billion. and the net profit (X_3) is on average 1.0 bln. An increase in soums will increase the interest income of the bank (*Y)* average 0.4483 billion. it is observed that it will increase to soum.

To check the quality of the multifactor econometric model (4), we examine the coefficient of determination. The coefficient of determination shows how many percent of the resulting factor is made up of the factors included in the model. The calculated coefficient of determination (R^2 – R-squared) is equal to 0.9269. This shows that 92.69 percent (4) of the bank's net interest income (*Y)* is made up of the factors included in the multi-factor econometric model. The remaining 7.31 percent (1.0–0.9269) is the influence of unaccounted factors.

In order to be able to compare models with different number of factors and this number of factors does not affect the R^2 statistic, a smoothed coefficient of determination is usually used, i.e.:

$$R^2_{\text{adj.}} = 1 - \frac{s^2}{s_y^2} \quad (5)$$

Adjusted coefficient of determination (Adjusted R-squared) is equal to 0.9132 and its closeness to R^2 means that the model can accept values around the change in the number of influencing factors.

We check the statistical significance of the multifactor econometric model (4) using Fisher's F-criterion. Fisher's calculated F-criterion value is compared with its value in the table. If $F_{count} > F_{table,}$ then the multivariate econometric model (4) is said to be statistically significant.

Given the level of significance $\alpha = 0{,}05$ and the degrees of freedom $k_1 = 3$ and, $k_2 = 20 - 3 - 1 = 16$ the table value of the F-criterion F_{count} = 3.24 is equal to. The calculated value of the F-criterion is F_{count} = 67.6515 and the table value is equal to F_{table} = =3.24 and the multifactor econometric model (4) is called statistically significant because the condition of F_{count} >F table is fulfilled.

We check the reliability of calculated parameters of the multifactor econometric model (4) using Student's t-creation. The table value of t-criterion is equal to confidence probability and degree of freedom.

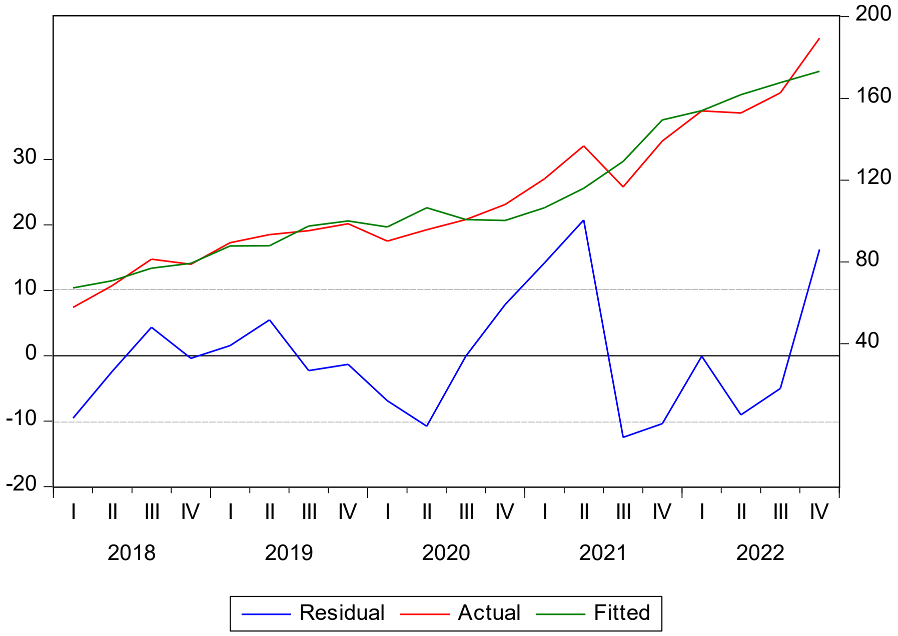
From the regression calculations, it can be seen that the calculated values of the t-criterion for all factors are greater than the table value in accuracy (Table 5). This allows these factors to participate in the multifactor econometric model. The resulting factor according to the multivariate econometric model (4). We use the Darbin-Watson (DW) criterion to check autocorrelation in the residuals.

The calculated Darbin-Watson value is compared with the DWL and DWU in the table. If DWcount < DWL, the residuals are said to have autocorrelation.

If DWcount > greater than DWU, the residuals are said to have no autocorrelation. The lower limit value of the Darbin-Watson criterion is DWL = 1.00 and the upper limit value is DWU = 1.68. DW = 1.7773. Therefore, since DWAccount>DWU, there is no autocorrelation in the net interest income (Y) balances of the resulting factor bank.

The absence of autocorrelation in the residuals of the resulting factor also shows that the multi-factor econometric model given above (4) can be used in forecasting (Figure. 3).

Figure 3. *Graph of the actual (Actual), calculated (Fitted) values of the bank's net interest income and the differences between them (Residual)*

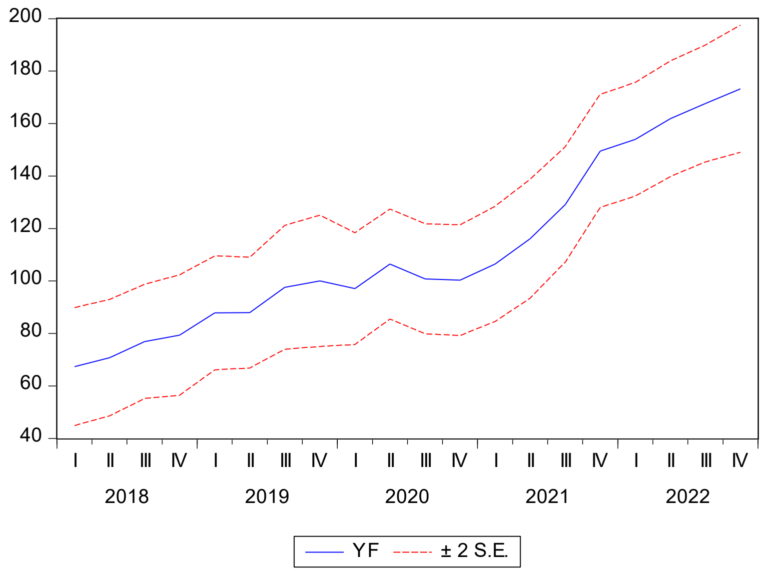


It can be seen from Figure 3 that (4) the graph of the calculated values of the bank's net interest income according to the multi-factor econometric model is very close to the graph of its actual values, and the differences between them are not so great. This is another proof that the multifactor econometric model (4) can be used in forecasting the bank's net interest income for near future.

From the multifactor econometric model calculated (4), we calculate the value of the MARE coefficient in forecasting the output indicator for future periods.

If the calculated MARE coefficient value is less than 15.0 percent, the model can be used to predict the resulting factor, otherwise it cannot be used. The value of the MARE coefficient on the bank's net interest income is 8.3294 percent (Figure 4).

Figure 4. *Indicators of using the estimated multifactor econometric model in forecasting*



Forecast: YF	
Actual: Y	
Forecast sample: 2018Q1 2022Q4	
Included observations: 20	
Root Mean Squared Error	9.069398
Mean Absolute Error	7.046402
Mean Abs. Percent Error	6.299383
Theil Inequality Coefficient	0.039003
Bias Proportion	0.000000
Variance Proportion	0.018968
Covariance Proportion	0.981032

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