ECONOMETRIC ANALYSIS OF FACTORS AFFECTING THE PROFITABILITY OF COMMERCIAL BANKS

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TIJORAT BANKLARINING FOYDASIGA TA'SIR ETUVCHI OMILLARNING EKONOMETRIK TAHLILI

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Abstract: The article analyzes the correlation-regression effect of inflation, risky assets, capital, loan interest rates on profits in 2021-2001 in 32 commercial banks with 836 branches in Uzbekistan. The effect of these factors on the bank's profit was studied theoretically and practically, and a model of the relationship between their effect on the outcome factor (profit) was developed.

In modern conditions, the main goal of commercial banks is to increase the level of profitability, and to increase it and ensure its stability will always be one of the most pressing issues. This is because a number of factors have a strong impact on the size and stability of the profits of commercial banks. In particular, the volume and quality of banks and risky assets, the capital of commercial banks and its sources, the average annual interest rates on deposits and loans, as well as the inflation rate. In addition, issues such as the level of implementation of the procedure for managing the national economy and credit institutions in the country, transparency, efficiency are also important factors.

It should be noted that the efficiency of assets (ROA) and capital (ROE) of commercial banks in Uzbekistan is high in private banks, and in commercial banks with a high share of the state in the authorized capital, these figures are significantly lower. Of course, there are a number of reasons for this.

The article identifies a number of factors affecting the profits of commercial banks of Uzbekistan on the basis of econometric analysis of correlation and regression of factors affecting the profits of commercial banks and develops recommendations to increase their profits.

Annotatsiya: Maqolada 2021-2001 yillarda O'zbekistonda 836 ta filialga ega 32 ta tijorat banklarida inflyatsiya, xatarli (riskli) aktivlar, kapital, kredit foiz stavkalarining foydaga korrelyatsion-regression ta'siri tahlil qilingan. Bu omillarning bank foydasiga ta'siri nazariy va amaliy jihatdan o'rganilib, ularning natijaviy omilga (foydaga) ta'siri o'rtasidagi bog'liqlik modeli ishlab chiqildi.

Zamonaviy sharoitda tijorat banklarining asosiy maqsadi rentabellik darajasini oshirish bo'lib, uni oshirish va barqarorligini ta'minlash hamisha eng dolzarb masalalardan biri bo'lib qoladi. Chunki tijorat banklari foydasining hajmi va barqarorligiga bir qancha omillar kuchli ta'sir ko'rsatadi. Xususan, banklarning tavakkal (riskli) aktivlari hajmi va sifati, tijorat banklari kapitali va uning manbalari, omonat va kreditlar bo'yicha o'rtacha yillik foiz stavkalari, shuningdek, inflyatsiya darajasi shular jumlasidandir. Bundan tashqari, mamlakatimizda xalq xo'jaligi va kredit tashkilotlarini boshqarish tartibining amalga oshirilish darajasi, shaffoflik, samaradorlik kabi masalalar ham muhim omil bo'lmoqda.

Ta'kidlash joizki, O'zbekistonda tijorat banklarining aktivlari (ROA) va kapitali (ROE) samaradorligi xususiy banklarda yuqori, ustav kapitalida davlat ulushi yuqori bo'lgan tijorat banklarida esa bu ko'rsatkichlar ancha past. Albatta, buning bir qancha sabablari bor. qiziqish yuqori.

Maqolada tijorat banklari foydasiga ta'sir etuvchi omillarning o'zaro bog'liqligi va regressiyasini ekonometrik tahlil qilish asosida O'zbekiston tijorat banklari foydasiga ta'sir etuvchi bir qator omillar aniqlangan va ularning foydasini oshirish bo'yicha tavsiyalar ishlab chiqilgan.

Key words: Bank, profit, inflation, risk, capital, interest on the loan.

Tayanch so'zlar: Bank, foyda, inflyatsiya, risk, kapital, kredit foizi.

Introduction. The reforms in the banking sector started in 1991, when a two-tier banking sector was established on base former Gosbank USSR. Despite the liberalization of monetary policy in recent years, reforms to transform banks to market principles, the state's share in the capital of commercial banks in the country remains high (87.2%). At the same time, the assets of commercial banks account for 63.1% of GDP, credit flows - 47.7%, deposits - 19.1%, capital - 10.1%. The assets of the banking system of Uzbekistan make up 86.3% of risky assets, the ratio of net income to assets (ROA) is 2.2, and the capital ratio (ROE) is 10.3 (CBU, 2020). From the above data, it is clear that the inflow of loans does not play an important role in the formation of the profit of commercial banks in Uzbekistan, and their economic efficiency is low, despite the high proportion of risky assets in the composition of their assets. However, it is natural for commercial banks to pay special attention to the steady growth of profits, since the level of profits plays an important role in increasing dividends and wages paid to shareholders, increasing the bank's capital and

strengthening financial stability. Of course, there is an influence of local and foreign policy in favor of commercial banks, but the inflation rate, risky assets of the bank, bank capital and average annual interest rates on loans are factors that directly affect their profitability.

The Decree of the President of the Republic of Uzbekistan dated on February 7, 2017 "On the Strategy for the Further Development of the Republic of Uzbekistan" PD-4947 emphasizes the issues of deepening and ensuring the reform of the banking system, increasing the level of capitalization and the deposit base of banks, strengthening their financial stability and reliability (Decree,2017). In recent years, regulators have increased their focus on the capital adequacy of banking institutions to enhance the stability of the financial system (Rime, 2001). The main reason for this, in our opinion, stems from the global financial and economic crises, especially the COVID-19 pandemic in 2020, as well as the demands placed on commercial banks by the mega-regulator.

Materials and Methods. During the preparation of the article, the authors used a database based on information from the State Statistics Committee of Uzbekistan, the periodic statistical bulletin of the Central Bank. According to used data, the profit of commercial banks in Uzbekistan (Y), inflation rate (X1), risky assets of the banking system (X2), regulatory capital of commercial banks (X3), average annual interest rates on bank loans (X4) data were analyzed for correlation and regression, as of condition January 1, 2000-2020. In the correlation and regression analysis, we used simple factor analysis, methods of statistical correlation of the inflation rate affecting the profit margins of commercial banks, risk-weighted bank assets, regression analysis of weighted average annual

interest rates of bank capital and loans. In particular, the methods of balance and index were widely used to test functional relationships, and methods of parallel series, analytical grouping, analysis of variance, as well as methods of regression and correlation analysis were widely used to study correlation relationships.

Results. The advantages of commercial banks are the subject of research by many economists and experts as a topical issue. This is due to the fact that a number of factors directly or indirectly affect the benefits of banks. One of the main ones is inflation, which negatively affects not only the profitability of commercial banks, but also their stability. Without inflation, a company's profitability is overestimated if the cost of depreciation and inventory consumed during the year is based on historical cost rather than replacement cost (Slawson, 2015). Thus, when determining the level of profitability of a bank in conditions of inflation, the separation of inflationary income from its income structure allows us to determine the real situation in terms of its profitability.

Commercial banks' profitability is effected by the market power measured by the ratio outstanding loans to the country's credit, the size of the bank in terms of capital structure, the nature of business as it is exposed to risks and the set limit for capital adequacy (Koba, 2018). In fact, the volume of risky assets of commercial banks, in particular a large volume of loans, leads to an increase in their level of profitability, but also requires an increase in the amount of bank capital. Kwakwala puts forward important ideas about the capital adequacy of commercial banks. According to him, like any commercial organization, banks need capital to operate and survive. However, the banking sector, capital plays a much more specific role compared to

others industries because banks are high-level institutions. Regulatory bodies therefore, banks are required to maintain a minimum amount of capital to ensure this in any case (2015). The Central Bank of Uzbekistan seeks to further increase the volume of bank capital by raising the standards for risking the assets of commercial banks, the main goal of which is not to increase the lending rate of commercial banks.

The Central Bank of Uzbekistan is pursuing a tight monetary policy to ensure the stability of the consumer price index (CPI) in the national economy. Of course, the Central Bank focuses on fulfilling the inflation targeting forecast in exchange for a reduction in the money supply in the economy. As a result, interest rates on bank loans in the country tend to grow steadily, since the high demand for money in the real sector, the lack of sufficient financial resources of commercial banks to meet this demand directly leads to an increase in their lending rates.

The level of bank efficiency may affect future bank risk. In addition, a decrease in efficiency leads to an increase in the bank's risk. There should be a negative correlation between risk and efficacy when these exogenous events occur. Such events increase problem loans, increase risks, and in response, banks have to pay additional costs and have to resort to management actions. Accordingly, an increase in banking risk leads to a decrease in cost-effectiveness (Moscow & Bozdo, 2016). Indeed, the current increase in risky assets in Uzbek commercial banks has a positive effect on their profits, but high inflation has led to a decline in the bulk of profits as inflationary earnings and an increase in bank capital to ensure capital adequacy.

In accordance with the banking legislation and market principles in force in the country, the Central Bank does not have the right to give direct instructions to commercial banks on setting loans and interest rates. The Central Bank has established the order of risk at the level of 150, 200 and 300 percent: risking the amount of the loan, the interest rates on the loan exceed the limits that it satisfies. In this case, an increase in the volume of risky assets of commercial banks imposes an obligation to increase their capital. However, according to Jean, Ying, Salwa (2014), in accordance with market principles, banks find it risky to lend to those who agree to take out a loan at a high interest rate, because even if the borrower agrees to take out a loan at a high interest rate, this increases the risk of repayment. In fact, this idea finds its practical confirmation in the real sector, since the process of repaying loans issued by banks is very laborious and leads to additional costs. The increase by the central bank of the rate on risky assets of commercial banks also affects the level of profitability of their capital. This is noted by Lotto (2018), who recognizes that the size of assets at risk has a direct impact on the determination of a bank's capital adequacy, while the efficiency of their capital decreases. In fact, increasing the volume of risky assets of commercial banks requires a constant increase in the size of their capital. Currently, the capital adequacy ratio of commercial banks in Uzbekistan is 13%, fixed assets - 9.5%, which is significantly higher than the requirements of international Basel III (Benjamin, Michela, 2014). Altunbas, Carbo, Gardener and Molineux argue that there is an inextricable link between the capital, risky assets and financial stability of commercial banks, while increasing the volume of their risky assets will have a positive impact on profits (2007). In our opinion, in fact, an excessive increase in the volume of risky assets of the bank can lead to a difficult situation for them in fulfilling their obligations.

Among the factors influencing the profitability of commercial banks, the interest rate on a bank loan plays an important role. It is known that the interest rate on a loan should be adjusted based on supply and demand in the market. However, it is impractical to conclude that a high interest rate on a bank loan guarantees its profitability, since a number of factors affect its formation. For instance, in Uzbekistan, interest rates are directly affected by inflation and low money supply. Evidence is an indication that bank profitability depends on several factors in which inflation is one of them. Inflation as a virus that has come to stay in virtually all the economies of nations of the world both emerging and industrialized economies has reduced competitiveness in the world markets and can have a general debilitating effect on almost all type of economic activities, especially banking (Oleka, Eyisi, 2014). There is no doubt that the bulk of interest on loans from commercial banks will not be real income in the form of inflationary income. In addition, banks will not be very interested in attracting time deposits as a result of interest payments from legal entities and individuals. The share of term deposits in the deposits of commercial banks in Uzbekistan is low, and banks form risky assets at the expense of demand deposits, that is, demand deposits. This, in turn, leads to inconsistencies in their liquidity indicators. Al-Nimer, Dr-Munther, Lina, Rania (2013) found that a decrease in the liquidity of banks not only causes problems in fulfilling their obligations, but also leads to an increase in the risk level of assets of commercial banks. If the bank does not apply effective management policies in this process, it will have a negative impact on their profitability and financial stability (2013). According to Uremadu, while the capital and liquidity of commercial banks serve to ensure their financial stability, the fact that banks have excess capital and liquidity affects their profitability. Therefore, the liquidity and capital of the bank should be ensured to such an extent that it does not lead to the formation of excess capital and liquid funds in them (2012).

Correlation coefficients are used to determine the factors affecting the profitability of commercial banks using the following formula:

$$r_{x_1 x_2} = \frac{N \sum x_1 x_2 - \sum x_1 \sum x_2}{\sqrt{N \sum x_1^2 - \left(\sum x_1\right)^2} \sqrt{N \sum x_2^2 - \left(\sum x_2\right)^2}}$$

Using the correlation package in an Excel spreadsheet, find the following correlation coefficients[1]

	Y	*X1*	*X2*	*X3*	*X4*	*X5*
Y	1					
X1	0,10572115	1				
X2	0,99241435	0,098039	1			
X3	0,99560399	0,099902	0,994166	1		
X4	0,98963959	0,119929	0,977252	0,986213	1	
X5	0,06104374	0,983354	0,036521	0,049846	0,076851	1

[1] Made by authors based on calculations

Multiple factors were not found among the factos. Now the linear relationship between the factors y, x_1, x_2 is determined.

The linear relationship between the type of connection and the factors y, x_1, x_2 is searched for in the following representation:

$$\tilde{y} = a_0 + a_1 x_1 + a_2 x_2 + a_3 x_3 + a x_4$$

Using computer calculations, we compose the following regression equation:

$$\tilde{y} = -649{,}32 - 86{,}3 x_1 + 0{,}11 x_2 + 0{,}027 x_3 + 79{,}5 x_4$$

Based on the regression coefficients, we calculate the standardized coefficients using the following formulas:

$$\beta_1 = a_i \cdot \frac{\sigma_{x_i}}{\sigma_y}$$

$$\sigma_{x_1} = 1{,}5 \qquad\qquad \sigma_{x_2} = 98923{,}04$$

$$\sigma_{x_3} = 3518{,}04 \qquad \sigma_{x4} = 7{,}6$$

$$\sigma_y = 5927{,}9$$

$$\beta_1 = 0{,}00002 \qquad\qquad \beta_2 = 0{,}00019$$

$$\beta_3 = 0{,}00002 \qquad \beta_4 = 0{,}00012.$$

We get the equation in the standard form:

$$t_y = 0{,}000002 \cdot t_{x_1} + 0{,}00019 \cdot t_{x_2} + 0{,}000002 \cdot t_{x_3} + 0{,}000012 \cdot t_{x_4}$$

Since the standardized regression coefficients are comparable, the greatest impact on profitability is x_2 - the assets of the banking system, total (billion soums) and x_3 - risky assets of the banking system, total (billion soums), since their absolute value of the coefficients is about the same and much more. We calculate the elasticity coefficients using the following formula:

$$E = a_i \frac{\bar{x}}{\bar{y}}.$$

Calculate the coefficients of elasticity:

$E_1 = -0{,}92826$
$E_2 = 7{,}569123$
$E_3 = 1{,}058989$
$E_4 = 0{,}019251$

It is obvious that with an increase in the total assets of the banking system by 1% (billion soums), the bank's profit will increase by 7.5%. The model is evaluated using Fisher's criterion to assess relevance and adequacy.

Analysis of variance for multivariate regression[2]

Variation y	Rate of availability	Sum of squares	Average square	F
Factor	$v_{factor} = p$	$SS_{factor} = \sum(\tilde{y} - \bar{y})^2$	$MS_{factor} = \dfrac{SS_{factor}}{v_{factor}}$	
Residue (Balance)	$v_{residue} = n - p - 1$	$SS_{residue} = \sum(y - \tilde{y})^2$	$MS_{residue} = \dfrac{SS_{residue}}{v_{residue}}$	$F = \dfrac{MS_{factor}}{MS_{residue}}$
Total	$v_{total} = n - 1$	$SS_{total} = \sum(y - \bar{y})^2$		

Main features of analysis of variance:

$$SS_{total} = SS_{factor} + SS_{residue}.$$

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[2] Made by authors based on calculations

Standard error S or residual variance S^2 is used to assess the adequacy of the selected models.

Discussion. A number of modules and equations are used in regression and correlation analysis of factors affecting the profitability of commercial banks. It should be noted that when the factors affecting the benefits of commercial banks in the country change, it is important to apply market principles and transparency. Because in this case, the accuracy of the generated data is ensured, which makes it possible to form effective conclusions based on correlation and regression analysis (Berkinov, 2015). With this in mind, Fisher's test is used to assess the density and adequacy of the model.

The following statistical hypothesis was made:

$$H_0 : a_1 = a_2 = a_3 = ... = a_n = 0$$

In other words, the factors x_1, x_2 ,..., x_n *have almost no effect on the result y.*
The actual F– score is calculated using the following formula:

$$F = \frac{MS_{factor}}{MS_{residue}} = \frac{R^2}{1-R^2} \cdot \frac{n-p-1}{p}, (5)$$

where n – is the number of observations; p – is the number of factors involved in the model; R^2 – is the coefficient of determination.

Now should be found the value F_{fact} (α, $k1$, $k2$) from the Fisher quantum distribution table. In this case, $k_1 = p = 4$ and $k_2 = n - p - 1 = 16$.
The actual state according to the $F_{хис}$ Fisher criterion is determined by the following formula for analysis of variance:

$$F_{comp.} = \frac{MS_{factor}}{MS_{residue}},$$

$$F_{comp.} = \frac{12602496,09}{9325,03} = 1351,5.$$

If after the calculation it turns out that $F_{comp.} > F_{tab.}$, it will be possible to predict the future values of the factor $\widetilde{y}$ using the regression equation.

Where $F_{comp.} = 1351,5 > F_{tab.} = 3,01$.

The multivariate correlation coefficient determines the density of the relationship between the factors x_1, x_2 ,..., x_p and the resulting index **y**. The multivariate correlation coefficient using analysis of variance is determined by the following formula:

$$R = \sqrt{\frac{SS_{total}}{SS_{factor}}} = \sqrt{1 - \frac{SS_{residue}}{SS_{factor}}} = 0,998523$$

the importance of the regression equation is appeared.

For individual regressor, the t– Student's test is used. This makes it possible to create the optimal filling of the model
. $t_{a_j} = \frac{a_j}{S_j}, (10)$, where $S_j^2 = \frac{\sum(y-\widetilde{y})^2}{n-p-1}$ - is the squared residual error.

If the inequality $\left|t_{a_j}\right| \le t_{tab}(\alpha, n-p-1)$ is true, then the hypothesis is confirmed, i.e., the coefficients of the regression a_j *are equal to 0 and the hypothesis H_0 is confirmed. That is, it determines the significance of the parameter a_j* and we hypothesize that the factors x_j do not depend on the result:

$$H_0 : a_1 = a_2 = a_3 = ... = a_n = 0$$

In this case, there is no connection between the regressors x_j and y. Otherwise, hypothesis H_0 is not confirmed. In this case, there is a relationship between the regressors x_j and y. It was found that there is a relationship between the regressors x_j and y from

$$t_r = |-4,21695| = 4,21695,$$

$$t_{a_1} = |-4,293| = 4,293, \qquad t_{a_2} = 9,696,$$

$$t_{a_3} = 3,9434, t_{a_4} = 4,3192 \text{ and } t_{table} = 2,09.$$

the strength of the relationship between the resulting and influencing factors was confirmed, since a correlation coefficient is

$$R = \sqrt{\frac{SS_{total}}{SS_{factor}}} = 0,998523$$

The importance of the regression equalization

$$\tilde{y} = -649,32 - 86,3x_1 + 0,11x_2 + 0,027x_3 + 79,5x_4$$

according to Fisher's criterion $F_{com.} = \dfrac{MS_{factor}}{MS_{residue}}$

, $\quad F_{com.} = \dfrac{12602496,09}{9325,03} = 1351,5 \quad$ the value found in the table of values is greater than $F_{table} = 3$.

Hence, there is appeared the importance of the regression equalization

$$\tilde{y} = -649,32 - 86,3x_1 + 0,11x_2 + 0,027x_3 + 79,5x_4$$

As a result of research using the t–Student's test it was found that there is a relationship between the regressors x_j and y from

$$t_r = |-4,21695| = 4,21695,$$

$$t_{a_1} = |-4,293| = 4,293, \qquad t_{a_2} = 9,696,$$

$$t_{a_3} = 3,9434, t_{a_4} = 4,3192 \text{ and } t_{table} = 2,09.$$

In short, it can be predicted using a regression equation,

$$\tilde{y} = -649,32 - 86,3x_1 + 0,11x_2 + 0,027x_3 + 79,5x_4$$

that Elastic Coefficients are:

E₁=-0,92826
E₂=7,569123
E₃=1,058989

Where E₄=0,019251, the change in each of the above factors can be determined.

Conclusion. We were able to formulate a number of conclusions based on the correlation-regression analysis of factors affecting the profitability of commercial banks.

1. It was found that the factors affecting the y – bank's profit (billion soums) in commercial banks are associated with x_1 – inflation (in percent), x_2 – risky assets of the banking system as a whole (billion soums, x_3 – the bank's regulatory capital (billion soums), x_4 – average interest rates of the bank (in percent).

2. The high level of inflation in the economy negatively affects the profitability of the bank, which leads to an increase in inflationary income. In the course of the analysis, high inflation negatively affects the time deposits of depositors in banks, which indirectly and negatively affects their profits, naturally, due to a decrease in the amount of risky assets of banks.

3. An increase in the volume of risky assets of commercial banks has a direct positive impact on the bank's profit. According to the results of the correlation-regression analysis, the growth of risky assets of banks increased by 7.5%, while bank's profits increased by 10.5%.

4. A 1% increase in the bank's regulatory capital will increase the bank's profits by 1.05%, while the increase in interest rates on bank loans should be based on supply and demand in the economy, and in an environment of high inflation, interest rates rose.

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