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Article

Dynamics of the Loan-to-Deposit Ratio and Efficiency Analysis of Commercial Banks in Uzbekistan

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Abstract: We use loan-deposit ratios (LDR), which is one of the most commonly used metrics for measuring liquidity and efficiency in banking, and essentially indicates the extent to which a bank is able to convert deposits into loans. Recent changes in the banking system of Uzbekistan, caused by changes in state banks and the entry of foreign banks have changed LDR (especially during pandemic years (2020–2023)). Though LDR is significant in the demand of liquidity and financial stability, however, there is a lack of empirical researches about trends of LDR, differences of LDR by ownership and systemic implications of bank LDR in the banking sector of Uzbekistan. This study investigates the determinants of LDR of commercial banks of Uzbekistan, explores ownership-specific differences, and applies statistical and clustering techniques to reveal commonalities beyond institutional types. The mean LDR was 174% suggesting that the banks depended on state and non-domestics resources instead of deposits, state-controlled banks have a greater LDR (higher than 258%) as opposed to with private banks (at about 130%), according to the descriptive statistic. ANOVA confirms statistically significant differences in LDR by ownership forms, except between private banks and foreign banks. Cluster analyses revealed three clusters: foreign banks grouped together and achieved mostly very high ratios; state banks were grouped together with medium spans; and private banks were grouped together with low spans. The originality of this study is to be the first basis systematic, multi-method study of LDR in Uzbekistan, describing, inferring and clustering LDR, revealing ownership based and structural differences. The results show how much state banks rely on outside resources, that private banks are stable, and that foreign ones are subject to fluctuations, providing policymakers with data-driven evidence that they can turn to when drafting rules for liquidity regulation, and banking reforms.

Keywords: loan-to-deposit ratio, liquidity, commercial banks, cluster analysis, financial stability

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1. Introduction

The loan-to-deposit ratio is one of the important indicators of liquidity assessment in banking. This indicator is calculated by dividing the bank's total loans by its total deposits. If the indicator is high, this means that the bank relies more on other financial resources in addition to deposits. On the contrary, a low indicator indicates that the bank is not using deposits effectively. Therefore, the loan-to-deposit ratio is widely used in assessing the financial stability and liquidity policy of banks [1].

It is emphasized in world practice that the recommended loan-to-deposit ratio should usually be around 80%. If this indicator is higher than this indicator, it indicates increased bank risks, while if it is too low, it means that the bank is not receiving sufficient

benefit from its resources. In particular, in conditions of financial crisis, a low loan-to-deposit ratio creates additional opportunities for banks to fulfill their obligations [2].

In the banking system of Uzbekistan, the loan-to-deposit ratio is of particular importance for regulators and investors as an important indicator. For investors, this indicator indicates how much the bank finances its credit operations from deposits, how much the bank relies on debt resources. This allows us to draw conclusions about the bank's margin and stability. [3]

In recent years, the acceleration of reforms in the country's banking system, the entry of foreign banks, and transformation processes in state-owned banks have directly affected the loan-to-deposit ratio. In particular, this indicator has undergone significant fluctuations during the pandemic period in 2020–2023 and beyond. This makes it relevant to analyze the volatility of the loan-to-deposit ratio.

The purpose of this study is to analyze the loan-to-deposit ratio of commercial banks in Uzbekistan in 2020–2023, identify differences by form of ownership, assess dynamics over time, and group banks using cluster analysis. This approach helps to better understand the level of liquidity in the banking system and develop effective financial policies [4].

Literature review

The loan-to-deposit ratio is widely used in international banking practice to assess liquidity and risk. As Saunders and Cornett point out, this indicator shows how banks use resources and how much risk they are exposed to. A significant excess of loans over deposits can have negative consequences for financial stability [5].

Demirgüç-Kunt and Huizinga study found that the loan-to-deposit ratio is directly related to bank profitability. A high ratio can bring short-term benefits, but in the long run it negatively affects liquidity. Therefore, many regulators consider it important to control and set limits on the loan-to-deposit ratio [6].

Borio and Lowe note that the loan-to-deposit ratio is one of the early signs of systemic risks in the banking system. Their research shows that this ratio tends to increase sharply before financial crises, which is a warning signal for regulators.

Studies in developing countries show that high credit-deposit ratios are often explained by reliance on state resources [7]. This may limit the ability of banks to conduct independent financial policies.

Although there is little scientific work on Uzbekistan, practical observations show that state-owned banks have high credit-deposit ratios and that this is often associated with resources allocated by the state. Therefore, this article is important in terms of in-depth analysis of the credit-deposit ratio in the national banking system and comparison with international practice [8].

2. Materials and Methods

LDR of commercial banks in Uzbekistan from 2020 to 2023 were assessed systematically, thus the methodology of this study is based on the quantitative method. We use the loan-to-deposit ratio (LDR), defined as total loans divided by total deposits, as our primary measure of bank liquidity and efficiency. Data was collected on monthly bank-level data across four types of ownership structure (state-owned, private, joint-stock, and foreign) to ensure heterogeneity in performance. Then, some applied descriptive statistical techniques (mean, standard deviation, quartile analysis, and ranges of distribution) to the levels of LDR to identify the tendencies and dispersions in the LDR from group banks. Trends for time-series were analyzed to show wave by wave variations in ownership groups during the pandemic period and afterwards; Ownership specific dynamics were analyzed to ascertain whether institutional characteristics were effective in explaining this pattern. The analysis of variance (ANOVA) was used to examine whether

or not differences in mean LDR values across ownership types were statistically significant. Because of this we also performed post-hoc comparisons to examine which groups differed significantly. Third, we used Elbow method to determine the optimal k and we performed a cluster analysis to put banks with the same LDR profile together regardless of ownership. This ensured that patterns that could not be explained by ownership type were able to be identified. While the combination of descriptive, inferential, and clustering methods provides a holistic picture of LDR dynamics, it adds to robustness and the reliability of the findings. Such methodological design thus allows the study to provide the best of both worlds by aptly delivering highly descriptive statistical evidence while also richly contextualising these within the relevant banking policy and financial stability issues in Uzbekistan [9].

3. Analysis and discussion

The loan-to-deposit ratio reflects the liquidity of a bank by dividing total loans by total deposits over a given period. A high ratio indicates that the bank does not have enough liquidity to cover its potential liabilities. Conversely, a low ratio indicates that the bank is not making enough profit. That is, the bank is not using deposits effectively. However, a low loan-to-deposit ratio is useful during financial crises because banks have enough liquidity to meet their liabilities. The recommended ratio is usually around 80%, and a ratio below 80% indicates that the bank's risk is manageable. A ratio above 80% indicates that the bank's risk is increasing and that the bank's preparedness for crises and deposit calls is decreasing [10].

This ratio is important for investors, as it shows how much the bank is attracting deposits for lending operations and how effectively it is managing them. If the volume of bank deposits is decreasing while its loans are increasing, this means that the bank is attracting borrowed funds to finance lending operations. This, in turn, means that the bank's margin is decreasing. After all, the interest rate on borrowed funds is much higher than the interest rate on deposits [11].

While the ratio can provide valuable information about the health of the bank by analyzing the loans and deposits on the bank's balance sheet, its main drawback is that the ratio does not reflect the quality of the loans allocated to it. Therefore, the ratio cannot provide information on how many loans are allocated and how many of them are in default [12].

This indicator assesses how effectively the bank is using deposits to lend.

Credit-Deposit Ratio = ((General Loans)/(General Deposits))× 100

The table below provides illustrative statistics on the loan-to-deposit ratio based on monthly data from banks in Uzbekistan for the period from December 2020 to July 2023.

Table 1. Descriptive statistics of the loan-to-deposit ratio

Statistical	Total	Foreign banks	Private banks	Joint-stock commercial banks	State commercial banks
Number	974	158	365	355	96
Average	174.14	149.49	130.55	207.25	258.01
Std.dev	155.57	289.91	98.69	108.45	91.13
Min	0.67	1.40	0.67	26.69	118.86
25%	77.52	28.72	76.98	116.56	170.27
50%	127.80	74.54	100.57	226.14	261.72
75%	242.49	105.89	168.96	311.47	340.27
Max	1827.09	1827.09	1131.02	495.46	447.84

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As can be seen from the table, this indicator in the banking system of our country is on average 174%. This means that commercial banks rely more on borrowed funds and own funds than on deposits when issuing loans. These borrowed funds are mainly funds

allocated by the state within the framework of certain programs or attracted from international institutions. The banks with the lowest share of deposits in relation to allocated loans are banks with a state share, and banks directly owned by the state have an average of more than 258% for the period under analysis. That is, banks with this form of ownership allocate 258 soums of loans, attracting funds for a deposit of 100 soums. Since the standard deviation of state-owned commercial banks during the analysis period was the lowest, this indicator was more stable than for other forms of ownership [13]. The same conclusion is reached when comparing its minimum and maximum, since the range of fluctuations is much shorter than that of banks with other forms of ownership. Another final result is that the ratios of banks with indirect and direct state ownership are very similar, and their equality will be tested later. The lowest ratio belongs to private banks, which, on average, allocated 130 soums of loans for 100 soums of deposits during the analysis period. Foreign banks allocated about 150 soums of loans for 100 soums of deposits. However, this ratio has the largest standard deviation in them. This may be due to the entry of new banks. That is, the number of banks in this group has changed significantly during the analysis period. According to the quartile and median analysis, it can be seen that the median of this ratio is higher than the average in banks with a state share. It follows that in more than 50% of the observations of these banks, the ratio was greater than the average. That is, the large average ratio here is not due to extreme observations. In commercial banks directly owned by the state, according to the 3rd quartile, 75% of the observations show that 340 soums of loans were allocated, attracting a deposit of 100 soums. In private and foreign banks, the difference between the median and the average is high, which means that the higher average is due to extreme observations. According to the median, private banks allocated up to 100 soums of loans in 50% of the observations, attracting a deposit of 100 soums, while foreign banks allocated up to 74 soums of loans in 100 soums [14].

The descriptive statistic below does not tell us how the ratio changed over the period of analysis, given the average and quartiles for the overall period. To answer this question, the average value of the ratio over the period of analysis is given below (Figure 1).

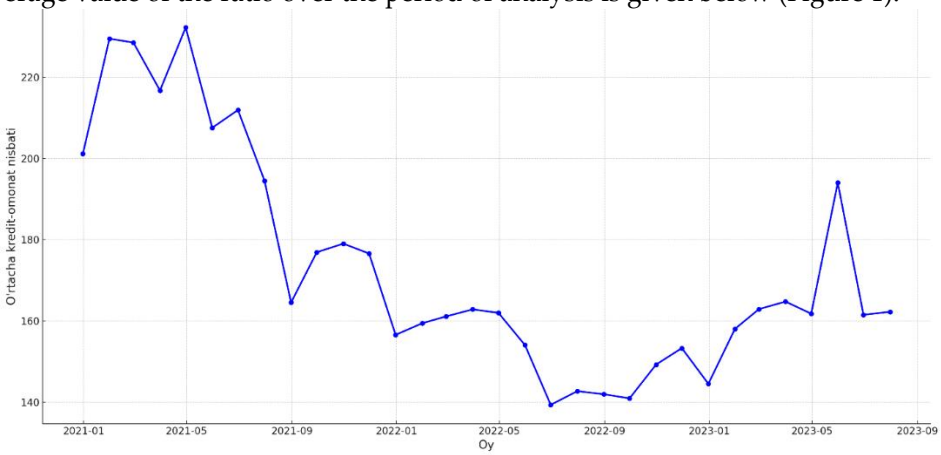

Figure 1. Change in the average loan-to-deposit ratio, 12/2020-07/2023

As can be seen from the figure above, the ratio was high in 2021 and had a downward trend starting in 2022. However, even in 2022, which was relatively stable, this ratio fluctuated between 140-160 and a sharp decline was observed after May 2022. Unfortunately, it is difficult to answer the question of whether such a sharp decline and high ratio were typical for all banks or whether some were due to extreme observations in banks using this figure 2.

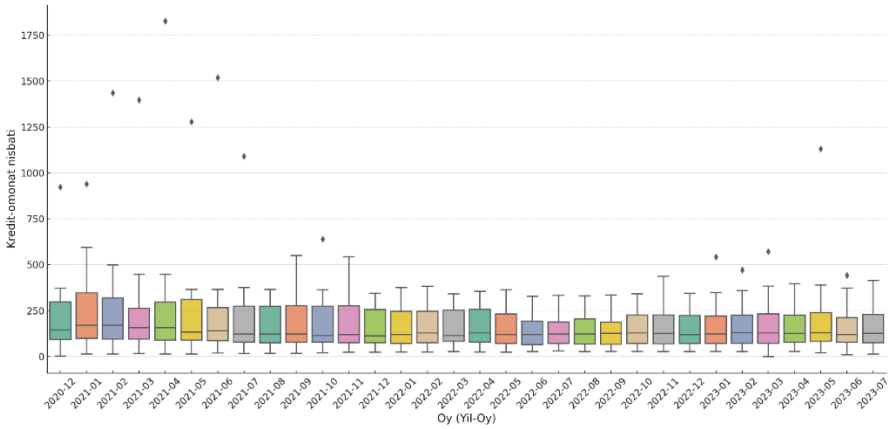

Figure 2. Box plot of the loan-to-deposit ratio, 12/2020-07/2023

The figure 3 shows that the loan-to-deposit ratio in banks has not actually changed significantly. The fact that the lines between the boxes have not changed significantly over the years indicates that there have been significant changes in the median. It is understood that the fluctuations are mainly due to extreme observations. Extreme observations were observed more in 2021 and 2023. Now, to see which ownership form of banks these outliers were observed more often, we present the ratio by ownership form of banks and by month. [15]

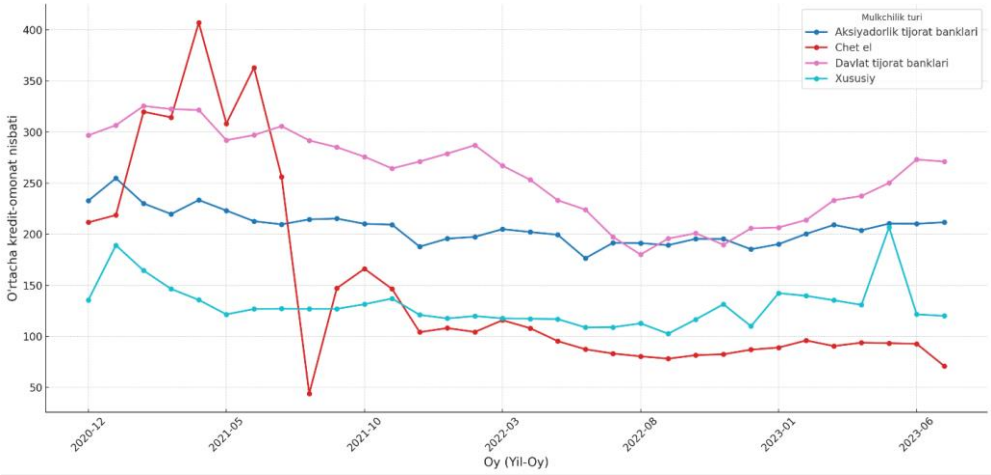

Figure 3. Loan-to-deposit ratio by ownership type and year

According to the figure, in 2021, foreign banks had a high volatility in the loan-deposit ratio. However, since 2022, it has stabilized and decreased below 100, that is, less than 100 soums were allocated for a deposit of 100 soums. Banks directly owned by the state had a downward trend, albeit with a slight decrease, from the beginning of the analysis period, but have had a steady growth trend since August 2022. Commercial banks indirectly owned by the state fluctuated between 200-250 without significant changes. Private banks also fluctuated between 100-150 without significant changes.

To answer the question of whether the form of ownership had a statistically significant effect on the loan-deposit ratio of banks, an ANOVA test was performed to determine whether there was a statistically significant difference between the means of banks by form of ownership. According to the test results, the F-statistic is 21.5 and the p-value is 0.000. The fact that the p-value is very small indicates that there is a statistically significant difference in the means of the ownership of the banks. To check which ownership this difference is due to, 6 pairs of 4 ownership forms were created and for each pair, it was tested whether the difference between the bank groups in the pairs was zero. The test results are presented in the table below (Table 2).

Table 2. Difference test between pairs of bank groups

Group 1	Group 2	Difference	p-value	Lower	High
Joint-stock commercial banks	Foreign banks	-41.91	0.03	-81.49	-2.33
Joint-stock commercial banks	State commercial banks	51.44	0.02	6.66	96.23
Joint-stock commercial banks	Private banks	-72.10	0.00	-102.78	-41.42
Foreign banks	State commercial banks	93.35	0.00	41.23	145.47
Foreign banks	Private banks	-30.19	0.22	-70.84	10.46
State commercial banks	Private banks	-123.54	0.00	-169.27	-77.81

According to the test results, the difference between the averages of credit-deposit ratios of foreign and private banks is not statistically significant, therefore, we could not reject the hypothesis of equality of both averages. The hypothesis that the difference between the averages of pairs of other bank groups is zero was rejected with high statistical significance in all cases.

Cluster analysis was performed to analyze the banks by dividing them into clusters with similar values of the credit-deposit ratio, without dividing them by ownership form. First, the optimal number of clusters was determined using the "Elbow" method. The result of the "Elbow" is presented in a graphical form below (Figure 4).

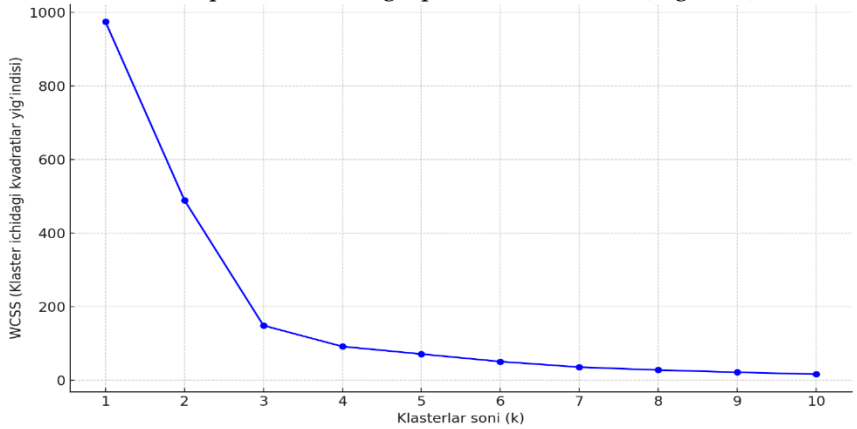

Figure 4. Determining the optimal number of clusters (Elbow method)

According to the figure, we choose 3 as the optimal number of clusters, which divides the turning point at a significant level. Therefore, the number of clusters will be 3. Below are the descriptive statistics of these clusters (Table 3).

Table 3. Descriptive statistics of clusters

Cluster	Number	Average	Std.dev	Min	25%	50%	75%	Max
0	299	306.23	68.70	203.63	249.75	309.39	340.38	639.51
1	666	99.86	47.51	0.67	65.90	89.88	130.12	202.55
2	9	1282.29	295.05	923.02	1089.90	1278.10	1435.71	1827.09

According to the clusters, cluster 0 contains observations with a loan-to-deposit ratio ranging from 203.6 to 639.5, while cluster 1 has the lowest loan-to-deposit ratio, ranging from 0.7 to 202.6. The last cluster contains 9 observations with loan-to-deposit ratios ranging from 923 to 1827.1. Each cluster contains banks with different ownership structures. The figure below shows the location of observations in the clusters and their ownership structures in different colors and shapes (Figure 5).

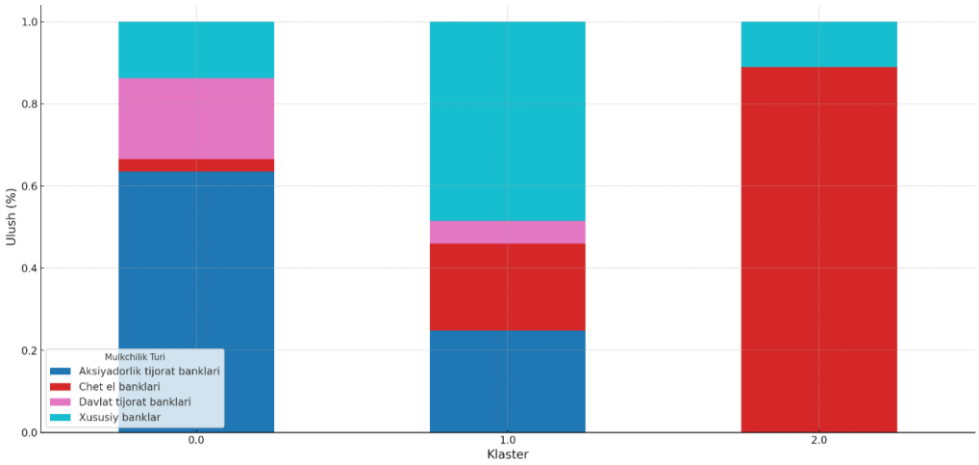

Figure 5. Clusters of loan-to-deposit ratios by bank ownership

The figure above shows that almost all of the observations in cluster 2 were foreign banks. Only one of them was a private bank. It can be seen that banks with state ownership are not present in cluster 2.

4. Conclusion

The results of the analysis showed that in 2020–2023, the loan-to-deposit ratio of Uzbek commercial banks was at a high level, with significant differences depending on the form of ownership. State-owned banks had the highest indicators, which, in addition to deposits, operated on state and international resources.

Private banks had relatively low indicators, which mainly provided loans based on deposits. Foreign banks, on the other hand, showed variable results, having a low ratio in some periods and a high ratio in others. This is explained by the entry of new foreign players and the processes of adaptation to the market.

When studied by month, while the loan-to-deposit ratio was high in 2021, a downward trend was observed starting in 2022. This may be due to economic reforms and the impact of the pandemic.

According to the results of the ANOVA test, there were statistically significant differences in the loan-to-deposit ratio depending on the form of ownership. Although the difference between foreign and private banks was not significant, state-owned banks differed sharply from other groups.

According to the results of the cluster analysis, banks were divided into three groups, including high, medium and low loan-to-deposit ratios. These results serve as an important basis for assessing the efficiency of banks and developing optimal financial policies.

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