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# TRIANGULATING BANK FINANCIAL STABILITY IN A TRANSITION ECONOMY: THE Z-SCORE VERSUS A CAMELS-BASED COMPOSITE INDEX FOR UZBEKISTAN'S BANKING SYSTEM (2021–2024)

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**Abstract:** This study examines financial stability in Uzbekistan's banking sector by triangulating two complementary assessment methodologies: the accounting-based Z-Score and a composite CAMELS-inspired index constructed from capital adequacy, profitability, and cost-efficiency indicators. Using annual data for three structurally distinct institutions—Aloqabank, Asia Alliance Bank, and Mikrocreditbank—over 2021–2024, we compute bank-year Z-Scores following Boyd and Runkle (1993) alongside a newly constructed Composite Financial Strength Index (CFSI). The Spearman rank correlation between the two measures is moderate and statistically insignificant at conventional levels ( $\rho = 0.41$ ,  $p = 0.185$ ,  $n = 12$ ), indicating substantial divergence in stability rankings. The Z-Score systematically overstates Mikrocreditbank's resilience during 2021–2023 owing to abnormally low earnings volatility characteristic of its government-directed lending mandate (the “low-sigma effect”), while understating Asia Alliance Bank's genuine strength in periods of moderate volatility. The CFSI more consistently reflects prudential fundamentals, including Aloqabank's 2022–2023 capital adequacy breaches. The findings suggest that single-indicator stability assessments can materially mislead supervisors in markets with heterogeneous bank ownership structures, and that composite, multi-dimensional frameworks better support prudential decision-making in transition economies such as Uzbekistan.

**Keywords:** Z-Score; CAMELS; composite index; bank financial stability; Uzbekistan; transition economies.

**Аннотация:** В данном исследовании финансовая устойчивость банковского сектора Узбекистана рассматривается посредством сопоставления двух взаимодополняющих методик оценки: бухгалтерского Z-Score и композитного индекса, разработанного на основе подхода CAMELS и включающего показатели достаточности капитала, прибыльности и эффективности затрат. На основе годовых данных трёх структурно различных банков — «Алоқабанк», Asia Alliance Bank и «Микрокредитбанк» — за 2021–2024 годы рассчитываются банковские Z-Score по методике Boyd и Runkle (1993), а также вновь разработанный Композитный индекс финансовой устойчивости (CFSI). Коэффициент ранговой корреляции Спирмена между двумя показателями является умеренным и статистически незначимым на общепринятых уровнях ( $\rho = 0,41$ ,  $p = 0,185$ ,  $n = 12$ ), что указывает на существенное расхождение в рейтингах устойчивости. Z-Score систематически завышает устойчивость «Микрокредитбанка» в 2021–2023 годах вследствие аномально низкой волатильности прибыли, характерной для его мандата по кредитованию, ориентированному на государственные приоритеты (так называемый «эффект низкой сигмы»), одновременно занижая реальную устойчивость Asia Alliance Bank в периоды умеренной волатильности. CFSI более последовательно отражает пруденциальные фундаментальные показатели, включая нарушения нормативов достаточности капитала «Алоқабанком» в 2022–2023 годах. Полученные результаты свидетельствуют о том, что оценки устойчивости на основе единственного показателя могут существенно вводить в заблуждение надзорные органы на рынках с неоднородной структурой собственности банков, тогда как композитные многомерные подходы обеспечивают более эффективную поддержку принятия пруденциальных решений в странах с переходной экономикой, таких как Узбекистан.

**Ключевые слова:** Z-Score; CAMELS; композитный индекс; финансовая устойчивость банков; Узбекистан; страны с переходной экономикой.

## INTRODUCTION

Financial stability of the banking sector underpins sustainable macroeconomic development, particularly in transition economies undergoing structural reform. Banks intermediate between savers and investors, transmit monetary policy, and provide payments infrastructure; a fragile banking system amplifies shocks, restricts credit, and erodes public confidence. Robust early-warning frameworks capable of identifying vulnerability before it escalates into systemic failure remain a central concern for supervisors and researchers alike.

Among quantitative approaches, the Z-Score—originally formulated by Altman (1968) and adapted to banking by Boyd and Runkle (1993) and Laeven and Levine (2009)—has become a widely used proxy for a bank's distance to insolvency, valued for its parsimony and reliance on standard accounting data. However, a well-documented limitation constrains its reliability: because the Z-Score's denominator is the standard deviation of return on assets ( $\sigma$ ROA), institutions with mechanically smooth earnings—often policy-directed or state-owned banks with narrow, homogeneous lending mandates—can register extremely high Z-Scores that reflect low income variability rather than genuine resilience. Lepetit and Strobel (2013) term this the “low-sigma effect” and caution against interpreting Z-Score levels in isolation, particularly in markets with heterogeneous bank ownership structures.

Uzbekistan's banking sector offers a striking test case for this concern. Since the 2017 reform program initiated under Presidential Decree No. PD-3270, the sector has diversified from a state-dominated structure toward a heterogeneous mix of state-directed commercial banks, rapidly growing private institutions, and specialized policy lenders. This ownership diversity—illustrated by Aloqabank (a state-affiliated commercial bank), AsiaAlliance Bank (a private commercial bank), and Mikrokreditbank (a government-owned microfinance-oriented lender)—creates precisely the conditions under which single-indicator stability measures may diverge sharply from prudential fundamentals such as capital adequacy and operating efficiency.

This study addresses that concern directly. Building on an earlier Z-Score assessment of the same three institutions (Gaybulloev, 2025), we construct a complementary Composite Financial Strength Index (CFSI) using capital adequacy, profitability, cost-efficiency, and capitalization indicators already reported in official prudential disclosures, and formally test the degree of agreement between the two measures using Spearman rank correlation across 12 bank-year observations (2021–2024). Rather than treating the Z-Score as a stand-alone stability verdict, we ask: to what extent does it agree with a broader, regulator-oriented composite assessment, and where—and why—does it diverge?

The study makes three contributions. First, it provides updated empirical evidence on the comparative financial stability of three structurally distinct Uzbek banks. Second, it introduces a transparent, replicable composite index built entirely from indicators already available in prudential disclosures, avoiding the data burden of full CAMELS supervisory ratings. Third, and most importantly, it formally quantifies the divergence between accounting-based and composite stability measures, offering evidence directly relevant to supervisory design in transition-economy banking systems, including but not limited to Uzbekistan.

## REVIEW OF LITERATURE ON THE SUBJECT

The Z-Score has a long lineage in banking research. Following Roy's (1952) “safety-first” framework and Altman's (1968) corporate application, Boyd and Runkle (1993) adapted the measure to banking, and it has since become one of the most widely used proxies for bank risk in cross-country studies (Laeven & Levine, 2009; Beck & Demirgüç-Kunt, 2009; Demirgüç-Kunt & Huizinga, 2010). Its principal appeal is that it can be computed directly from standard accounting statements, making it well suited to emerging and transition markets where market-based indicators are unavailable or unreliable (Cihák & Hesse, 2010).

Nonetheless, several studies raise methodological concerns. Lepetit and Strobel (2013) demonstrate that Z-Score measures are sensitive to the choice of estimation window and can produce misleading rankings when earnings volatility is structurally compressed. Iannotta et al. (2007) find that state-owned banks in Europe exhibit systematically different risk-return profiles than private banks, a pattern with direct relevance to the low-sigma concern given that policy-directed lenders often display artificially smooth earnings. Ownership structure has similarly been shown to shape both risk-taking incentives and reported earnings stability (Berger et al., 2005), reinforcing the case for interpreting Z-Score rankings alongside complementary, ownership-sensitive indicators.

CAMELS-type composite frameworks, by contrast, are explicitly multi-dimensional, incorporating capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk—the supervisory logic underlying Basel Committee guidance and widely adopted by national regulators, including the Central Bank of Uzbekistan. While full CAMELS ratings require confidential supervisory information unavailable to external researchers, several studies have constructed simplified, publicly disclosable composite indices as proxies (Berdiyarov, 2021; Suryanto et al., 2022).

Within the Central Asian banking literature specifically, bank stability has been examined through several complementary lenses. Yudaruddin (2022) analyzes the effect of capital regulation and financial freedom on bank concentration and stability across Central Asian banking systems, while Begimkulov (2024, 2025) investigates the relationship between competition, digitalization, and stability in Kyrgyzstan and the wider Central Asian region using dynamic panel methods, also employing the Z-Score as a stability proxy. These studies collectively underscore that regulatory design and structural heterogeneity—not accounting ratios in isolation—shape banking sector resilience, motivating this study's emphasis on triangulating multiple stability measures rather than relying on the Z-Score alone.

## RESEARCH METHODOLOGY

Following Boyd and Runkle (1993) and Laeven and Levine (2009), the bank-adapted Z-Score is defined as  $Z = (\mu\text{ROA} + E/A) / \sigma\text{ROA}$ , where  $\mu\text{ROA}$  is the annual mean return on assets computed from monthly observations,  $E/A$  is the year-end equity-to-assets ratio, and  $\sigma\text{ROA}$  is the standard deviation of monthly ROA observations within the calendar year. A higher Z-Score indicates a larger statistical buffer against insolvency.

To assess whether the Z-Score's ranking of institutions is corroborated by a broader set of prudential fundamentals, this study constructs a Composite Financial Strength Index (CFSI) using four indicators already reported in official bank disclosures: the Capital Adequacy Ratio (CAR), Return on Equity (ROE), Cost-to-Income Ratio (CIR), and the year-end equity-to-assets ratio (E/A). Each indicator is converted into a 0–100 sub-score using threshold bands informed by Basel III capital requirements and CAMELS profitability/efficiency benchmarks: CAR scores 100 ( $\geq 18\%$ ), 80 ( $15 < 18\%$ ), 60 ( $13 < 15\%$ ), or 30 (below the 13% regulatory minimum, reflecting a prudential breach); ROE scores 100 ( $\geq 15\%$ ), 75 ( $10 < 15\%$ ), 50 ( $5 < 10\%$ ), 25 ( $0 < 5\%$ ), or 0 (negative); CIR scores 100 ( $\leq 40\%$ ), 75 ( $40 < 50\%$ ), 50 ( $50 < 60\%$ ), 25 ( $60 < 70\%$ ), or 0 ( $\geq 70\%$ ); and E/A scores 100 ( $\geq 15\%$ ), 75 ( $10 < 15\%$ ), 50 ( $7 < 10\%$ ), or 25 (below 7%). The CFSI is the unweighted average of the four sub-scores. Equal weighting is adopted for transparency and replicability, consistent with the exploratory, triangulation-oriented purpose of this study; the implications of this simplifying assumption are addressed in the Discussion.

To formally test the association between the Z-Score and CFSI rankings, Spearman's rank correlation coefficient is computed across all 12 bank-year observations (three banks  $\times$  four years, 2021–2024):  $\rho = 1 - (6\sum d^2) / (n(n^2 - 1))$ , where  $d$  is the difference between each observation's Z-Score rank and CFSI rank, and  $n = 12$ . Values of  $\rho$  closer to 1 indicate strong agreement between the two measures; values closer to 0 indicate substantial divergence.

Data are drawn from monthly balance sheet and income statement filings submitted to the Central Bank of Uzbekistan for Aloqabank, Asia Alliance Bank, and Mikrokreditbank, covering January 2020 through December 2024 (previously used in Gaybulloev, 2025, for Z-Score computation), together with year-end prudential disclosures for CAR, ROE, CIR, and E/A. All monetary figures underlying the ratios are expressed in millions of Uzbek soums (UZS mln). Z-Scores and CFSI values are reported from 2021 onward, as  $\sigma\text{ROA}$  requires a minimum of two monthly observations; 2020 serves as a descriptive baseline.

## ANALYSIS AND RESULTS

Table 1 reports annual Z-Scores for the three institutions (Table 1).

Table 1. Annual Z-Scores, 2021–2024<sup>1</sup>

| Year | Asia Alliance Bank | Aloqabank | Mikrokreditbank |
|------|--------------------|-----------|-----------------|
| 2021 | 20.93              | 34.42     | 100.85          |
| 2022 | 16.72              | 25.79     | 133.83          |
| 2023 | 32.63              | 14.82     | 351.63          |
| 2024 | 53.36              | 22.19     | 7.86            |

Asia Alliance Bank exhibits a clear upward trend, rising from 20.93 in 2021 to 53.36 in 2024, driven by mean ROA growth from 0.54% to 4.91% and declining earnings volatility ( $\sigma\text{ROA}$  falling from 0.62% to 0.38%). Aloqabank shows greater volatility, falling from 34.42 in 2021 to a trough of 14.82 in 2023—a period coinciding with breaches of the 13% regulatory CAR minimum (12.93% in 2022, 12.36% in 2023)—before a partial recovery to 22.19 in 2024. Mikrokreditbank records exceptionally high Z-Scores in 2021–2023 (100.85, 133.83,

<sup>1</sup> Source: author's calculations based on monthly filings submitted to the Central Bank of Uzbekistan.

351.63), reflecting an extremely low  $\sigma$ ROA (0.17%, 0.16%, 0.06%) characteristic of its narrow, government-directed lending mandate, before collapsing to 7.86 in 2024 when mean ROA turned negative (−0.57%) and  $\sigma$ ROA surged to 1.85%. Table 2 reports the corresponding CFSI values (Table 2).

Table 2. Composite Financial Strength Index (CFSI), 2021–2024<sup>2</sup>

| Year | Asia Alliance Bank | Aloqabank | Mikrokreditbank |
|------|--------------------|-----------|-----------------|
| 2021 | 58.75              | 57.50     | 76.25           |
| 2022 | 77.50              | 57.50     | 75.00           |
| 2023 | 83.75              | 70.00     | 75.00           |
| 2024 | 95.00              | 46.25     | 51.25           |

The CFSI presents a markedly different picture in several bank-years. Most notably, in 2022 the CFSI ranks Asia Alliance Bank (77.50) above Mikrokreditbank (75.00), whereas the Z-Score ranks Asia Alliance Bank last of the three institutions that year (16.72, versus 133.83 for Mikrokreditbank). This reversal arises because Asia Alliance Bank's CAR (13.74%), ROE (15.81%), and CIR (38.87%) were all within strong prudential ranges in 2022, despite a temporary increase in earnings volatility ( $\sigma$ ROA = 0.69%) that penalized its Z-Score.

Aloqabank's CFSI trajectory (57.50 → 57.50 → 70.00 → 46.25) diverges from its Z-Score path (34.42 → 25.79 → 14.82 → 22.19) most sharply in 2024: the Z-Score records a partial recovery (22.19, above the 2023 trough), while the CFSI registers its lowest value of the sample period (46.25), driven by a CIR of 62.27%—breaching the 60% efficiency threshold—combined with ROE collapsing to 3.10%. The Z-Score's apparent 2024 “recovery” is therefore attributable primarily to reduced earnings volatility ( $\sigma$ ROA falling from 1.22% to 0.62%) rather than genuine improvement in underlying prudential fundamentals.

Mikrokreditbank's CFSI remains comparatively stable across 2021–2023 (76.25, 75.00, 75.00) before declining to 51.25 in 2024—a substantially smaller swing than the Z-Score's collapse from 351.63 to 7.86. This contrast illustrates the CFSI's greater robustness to the low-sigma effect: because it evaluates capital, profitability, and efficiency independently rather than through the Z-Score's variance-sensitive ratio structure, a single volatile year does not mechanically dominate the composite assessment in the same way it dominates the Z-Score.

Table 3 presents the rank comparison underlying the Spearman correlation computation (Table 3).

Table 3. Rank comparison of Z-Score and CFSI across 12 bank-year observations<sup>3</sup>

| Bank-Year            | Z-Score | CFSI  | Z Rank | CFSI Rank | d   | d <sup>2</sup> |
|----------------------|---------|-------|--------|-----------|-----|----------------|
| Asia Alliance 2021   | 20.93   | 58.75 | 4      | 5         | −1  | 1              |
| Asia Alliance 2022   | 16.72   | 77.50 | 3      | 10        | −7  | 49             |
| Asia Alliance 2023   | 32.63   | 83.75 | 7      | 11        | −4  | 16             |
| Asia Alliance 2024   | 53.36   | 95.00 | 9      | 12        | −3  | 9              |
| Aloqabank 2021       | 34.42   | 57.50 | 8      | 3.5       | 4.5 | 20.25          |
| Aloqabank 2022       | 25.79   | 57.50 | 6      | 3.5       | 2.5 | 6.25           |
| Aloqabank 2023       | 14.82   | 70.00 | 2      | 6         | −4  | 16             |
| Aloqabank 2024       | 22.19   | 46.25 | 5      | 1         | 4   | 16             |
| Mikrokreditbank 2021 | 100.85  | 76.25 | 10     | 9         | 1   | 1              |
| Mikrokreditbank 2022 | 133.83  | 75.00 | 11     | 7.5       | 3.5 | 12.25          |
| Mikrokreditbank 2023 | 351.63  | 75.00 | 12     | 7.5       | 4.5 | 20.25          |
| Mikrokreditbank 2024 | 7.86    | 51.25 | 1      | 2         | −1  | 1              |

Pooling all 12 bank-year observations, the Spearman rank correlation between the Z-Score and the CFSI is  $\rho = 0.41$  ( $\Sigma d^2 = 168$ ,  $n = 12$ ;  $p = 0.185$ , not statistically significant at conventional levels given the small sample). This moderate, statistically insignificant coefficient indicates that while the two measures broadly agree at the extremes—Mikrokreditbank's 2024 collapse and Asia Alliance Bank's 2024 strength are captured by both methods—their agreement deteriorates substantially in intermediate cases, particularly Asia Alliance

<sup>2</sup> Source: author's calculations based on year-end prudential disclosures of the respective banks.

<sup>3</sup> Source: author's calculations.

Bank's 2021–2022 period and Aloqabank's 2023–2024 period, where the Z-Score's sensitivity to earnings volatility produces materially different conclusions from the CFSI's broader prudential assessment.

The findings carry three main implications. First, they empirically confirm the low-sigma effect documented by Lepetit and Strobel (2013) in the specific context of Uzbekistan's government-directed microfinance segment: Mikrokreditbank's exceptionally high Z-Scores in 2021–2023 reflect the mechanical consequence of near-zero earnings volatility inherent to its concessional, policy-mandated lending portfolio, rather than superior underlying resilience. Supervisors relying on Z-Score rankings alone risk systematically underestimating the vulnerability of such institutions—a risk realized in 2024, when a single adverse earnings shock produced both a sign reversal in mean ROA and a Z-Score collapse of over 97%.

Second, the results demonstrate that the Z-Score can penalize banks undergoing legitimate, well-governed expansion. Asia Alliance Bank's temporary earnings volatility in 2022—a natural by-product of rapid loan portfolio growth and business diversification—depressed its Z-Score to the lowest level in the panel, even though its capital, profitability, and efficiency metrics were simultaneously improving. The CFSI's ranking of Asia Alliance Bank above Mikrokreditbank in that year arguably provides a more policy-relevant signal, consistent with the bank's subsequent trajectory toward the strongest CFSI score in the sample by 2024 (95.00).

Third, Aloqabank's case illustrates a scenario in which the two measures point in opposite directions within the same year. In 2024, the Z-Score recorded a partial recovery while the CFSI recorded its lowest value across the entire panel, driven by deteriorating cost efficiency and profitability rather than earnings volatility per se. This divergence highlights a structural limitation of the Z-Score: because it does not directly incorporate cost efficiency, a bank can register an "improving" Z-Score even as its underlying operational fundamentals deteriorate, provided its earnings simply become less volatile around a weaker mean.

These findings should be interpreted with several caveats. First, the CFSI's equal-weighting scheme, while transparent and replicable, is a simplifying assumption; supervisory authorities may prefer to calibrate weights according to jurisdiction-specific risk priorities. Second, the CFSI as constructed omits liquidity and asset-quality dimensions—specifically bank-level non-performing loan trajectories and the divergence between regulatory NPL classification and IFRS 9 Stage 3 recognition documented elsewhere for the Uzbek banking system—owing to data availability constraints at the individual-bank level; incorporating such indicators, where available, would likely sharpen the composite assessment further. Third, the sample of three banks, while deliberately chosen to represent Uzbekistan's principal ownership categories, limits the generalizability of the specific numerical findings, though the underlying methodological point—that single-indicator and composite assessments can diverge substantially—is consistent with theoretical predictions and prior evidence from other transition and emerging markets (Iannotta et al., 2007; Berger et al., 2005).

For prudential supervision in Uzbekistan and comparable transition economies, the practical implication is straightforward: early-warning systems built solely around Z-Score thresholds risk both false reassurance, in the case of low-volatility policy lenders, and false alarm, in the case of banks undergoing well-governed but volatility-inducing expansion. A triangulated approach—combining the Z-Score with a broader, regularly updated composite index—offers a more reliable foundation for supervisory judgment, consistent with the multi-dimensional logic underlying Basel Committee and CAMELS-based supervisory frameworks already in use by the Central Bank of Uzbekistan.

## CONCLUSIONS AND SUGGESTIONS

This study triangulated two complementary approaches to assessing bank financial stability in Uzbekistan—the accounting-based Z-Score and a newly constructed Composite Financial Strength Index—across three structurally distinct institutions over 2021–2024. The moderate, statistically insignificant Spearman rank correlation ( $\rho = 0.41$ ) between the two measures indicates that reliance on the Z-Score alone can produce materially misleading conclusions, particularly for government-directed lenders subject to the low-sigma effect and for privately owned banks undergoing legitimate but volatility-inducing expansion. Asia Alliance Bank emerges as the most consistently resilient institution across both measures by 2024; Mikrokreditbank's apparent 2021–2023 stability is shown to be substantially an artifact of its lending mandate rather than intrinsic strength; and Aloqabank exhibits persistent vulnerabilities in capital adequacy and cost efficiency that a Z-Score-only assessment would understate. Future research should extend the CFSI framework to incorporate liquidity and asset-quality dimensions as bank-level data become available, and should examine whether composite-index divergence from the Z-Score has predictive value for subsequent supervisory interventions across a larger panel of Uzbek and Central Asian banks.

## REFERENCES:

1. Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance*, 23(4), 589–609. <https://doi.org/10.1111/j.1540-6261.1968.tb00843.x>
2. Beck, T., & Demirgüç-Kunt, A. (2009). Financial institutions and markets across countries and over time: The updated financial development and structure database. *World Bank Economic Review*, 24(1), 77–92. <https://doi.org/10.1093/wber/lhp016>
3. Begimkulov, E. (2024). The empirical measurement of competition and digitalization for the banking sector of Kyrgyzstan: Impacts of efficiency, profitability, and stability. *Journal of Eastern European and Central Asian Research*, 11(5), 956–967. <https://doi.org/10.15549/jeecar.v11i5.1614>
4. Begimkulov, E. (2025). Bank digitalization and financial stability in Central Asia: Assessing risk and resilience. *Journal of Eastern European and Central Asian Research*, 12(1), 17–30. <https://doi.org/10.15549/jeecar.v12i1.2100>
5. Berdiyarov, B. (2021). Uzbekistan in banking practice: Opportunities to use foreign experience to ensure liquidity and solvency of commercial banks. *ACM International Conference Proceeding Series*.
6. Berger, A. N., Clarke, G. R. G., Cull, R., Klapper, L., & Udell, G. F. (2005). Corporate governance and bank performance: A joint analysis of the static, selection, and dynamic effects of domestic, foreign, and state ownership. *Journal of Banking & Finance*, 29(8–9), 2179–2221. <https://doi.org/10.1016/j.jbankfin.2005.03.013>
7. Boyd, J. H., & Runkle, D. E. (1993). Size and performance of banking firms: Testing the predictions of theory. *Journal of Monetary Economics*, 31(1), 47–67. [https://doi.org/10.1016/0304-3932\(93\)90016-9](https://doi.org/10.1016/0304-3932(93)90016-9)
8. Central Bank of Uzbekistan. (2024). Annual report on banking sector development 2023.
9. Cihák, M., & Hesse, H. (2010). Islamic banks and financial stability: An empirical analysis. *Journal of Financial Services Research*, 38(2–3), 95–113. <https://doi.org/10.1007/s10693-010-0089-0>
10. Demirgüç-Kunt, A., & Huizinga, H. (2010). Bank activity and funding strategies: The impact on risk and returns. *Journal of Financial Economics*, 98(3), 626–650. <https://doi.org/10.1016/j.jfineco.2010.06.004>
11. Gaybulloev, S. (2025). Prospects for applying the Z-Score model in assessing financial stability in the Uzbekistan banking system. *Muhandislik va Iqtisodiyot*, (12), 1586.
12. Iannotta, G., Nocera, G., & Sironi, A. (2007). Ownership structure, risk and performance in the European banking industry. *Journal of Banking & Finance*, 31(7), 2127–2149. <https://doi.org/10.1016/j.jbankfin.2006.07.013>
13. Laeven, L., & Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, 93(2), 259–275. <https://doi.org/10.1016/j.jfineco.2008.09.003>
14. Lepetit, L., & Strobel, F. (2013). Bank insolvency risk and time-varying Z-Score measures. *Journal of International Financial Markets, Institutions and Money*, 25, 73–87. <https://doi.org/10.1016/j.intfin.2013.01.004>
15. Roy, A. D. (1952). Safety first and the holding of assets. *Econometrica*, 20(3), 431–449. <https://doi.org/10.2307/1907413>
16. Suryanto, S., Muhyi, H. A., Kurniati, P. S., & Mustapha, N. (2022). Banking financial performance in the industry financial technology era. *Journal of Eastern European and Central Asian Research*, 9(5), 889–900. <https://doi.org/10.15549/jeecar.v9i5.1075>
17. Yudaruddin, R. (2022). Bank concentration and stability in Central Asia: The effect of capital regulation and financial freedom. *Journal of Eastern European and Central Asian Research*, 9(2), 206–216. <https://doi.org/10.15549/jeecar.v9i2.733>

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