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BANKOMETER MODEL: CAN FINANCIAL RATIOS PREDICT BANK INSOLVENCY?

Abstract

This study investigates the effectiveness of the Bankometer Model, an S-score approach using key financial ratios (based on IMF guidance), in predicting the risk of bank failure in Azerbaijan between 2018 and 2023. We assess the model's practical relevance by comparing its main indicators—such as capital levels and loan quality—with the documented reasons, particularly capital shortfalls, that caused actual bank insolvencies in Azerbaijan during this period. While recognizing that relying only on financial ratios has limitations, our findings indicate the Bankometer model is a valuable tool for monitoring risks across the banking system.

Keywords: *bankometer, insolvency, financial ratios, Azerbaijan banking sector, risk prediction.*

INTRODUCTION

A stable and well-functioning banking system serves as a fundament of a healthy economy. Banks play a crucial role in facilitating economic activity by channeling savings into productive investments and providing essential financial services to individuals and businesses. Consequently, the failure of a bank can have far-reaching negative consequences, impacting depositors, investors, and the overall financial stability of a country. The interconnected nature of the financial system means that the distress of one institution can potentially trigger a cascade of failures, leading to broader economic instability and a loss of public confidence. This connection within the system underscores the importance of identifying and mitigating risks within the banking sector to prevent systemic crises.

Recognizing the potential for widespread economic disruption, the prediction of bank insolvency has become a vital tool for both risk management within financial institutions and regulatory oversight by central authorities. Various models and analytical techniques have been developed over the years to assess the financial health of banks and forecast the likelihood of failure. These early warning systems enable proactive measures to be taken, potentially preventing bank failures or minimizing their impact on the financial system and the wider economy.

Among the array of predictive tools, the Bankometer Model, also known as the S-score model, stands out as a financial soundness measurement tool specifically designed for the banking industry. Developed based on recommendations from the International Monetary Fund (IMF), this model utilizes a set of bank-specific financial ratios to generate a solvency score, offering an indication of a bank's financial health and its vulnerability to bankruptcy. [1] This research will delve into the mechanics of the Bankometer Model, explore its significance in the context of predicting bank insolvency, and analyze its potential applicability to the banking sector of Azerbaijan, a developing economy that has experienced its own share of financial sector challenges.

Deconstructing the Bankometer Model: An S-Score Approach.

The Bankometer Model, or S-score model, is a methodology devised to evaluate the financial soundness of banks, drawing upon the expertise and recommendations of the International Monetary Fund (IMF). This model operates on the principle that a bank's financial health can be assessed by analyzing specific financial ratios that reflect its capital adequacy, asset quality, and profitability. [3]

By aggregating these ratios into a single solvency score, the Bankometer Model aims to provide a clear and concise indicator of a bank's bankruptcy risk. Its development aligns with international efforts to establish standardized tools for evaluating and predicting financial distress within the global banking system. [2]

At the heart of the Bankometer Model lies the S-Score formula, which combines six key financial ratios with specific weights to arrive at a comprehensive assessment of a bank's solvency. [1]

$$S = (1.5 * X1) + (1.2 * X2) + (3.5 * X3) - (0.6 * X4) - (0.3 * X5) - (0.4 * X6)$$

Where X1 through X6 represent the six financial ratios that form the basis of the model. The weights assigned to each ratio reflect their relative importance in determining a bank's financial health, as informed by the IMF's recommendations and insights from stress testing frameworks like the Credit Leona's Securities Asia (CLSA) stress test. [9]

- X1: Capital to Asset Ratio (CA): This ratio serves as a measure of a bank's capital adequacy and liquidity, indicating the proportion of its assets that are financed by its capital. It is calculated by dividing a bank's total capital by its total assets (Capital / Total Assets). A higher CA ratio generally signifies a greater ability for the bank to absorb potential losses and reflects a stronger overall financial position. The IMF suggests a minimum threshold of 4% for this ratio.
- X2: Equity to Asset Ratio (EA): Similar to the Capital to Asset Ratio, the Equity to Asset Ratio provides another perspective on a bank's capital adequacy, specifically focusing on the portion of assets funded by equity. The formula for this ratio is Equity divided by Total Assets (Equity / Total Assets). A higher EA ratio indicates that the bank relies more on its own funds rather than debt to finance its assets, suggesting greater financial independence from creditors and enhanced resilience to financial shocks. The IMF recommends maintaining this ratio above 2%.
- X3: Capital Adequacy Ratio (CAR): The Capital Adequacy Ratio is a key regulatory metric that assesses a bank's capital in relation to its risk-weighted assets. It is calculated as the sum of Tier 1 capital and Tier 2 capital divided by the bank's risk-weighted assets ((Tier 1 capital + Tier 2 capital) / Risk-weighted assets). This ratio is a critical indicator of a bank's capacity to cover potential losses arising from its risk exposures and is closely monitored by regulatory authorities. A minimum CAR of 8% is generally required for banks to operate soundly. [10]
- X4: Non-Performing Loan Ratio (NPL): This ratio serves as a crucial measure of a bank's asset quality, indicating the percentage of its total loans that are not being repaid by borrowers. It is calculated by dividing the total amount of non-performing loans by the total loan portfolio (Non-Performing Loans / Total Loans). A higher NPL ratio suggests potential issues with the bank's lending practices and signifies increased credit risk within its asset portfolio. The IMF recommends keeping this ratio below 15%, while an NPL ratio below 5% is often considered acceptable in international banking.
- X5: Cost to Income Ratio (CIR): The Cost to Income Ratio reflects a bank's management efficiency by comparing its operating expenses to its operating income. It is calculated by dividing the total operating expenses by the total operating income (Operating Expenses / Operating Income). A lower CIR indicates that the bank is more efficient in managing its costs relative to the income it generates, implying higher profitability. The IMF suggests that this ratio should not exceed 40%.
- X6: Loans to Asset Ratio (LA): This ratio provides insights into a bank's liquidity and its ability to meet the demand for credit using its total assets. It is calculated by dividing the total loans by the

total assets (Loans / Total Assets). While a higher LA ratio can indicate greater profitability through lending activities, it may also suggest lower liquidity if a significant portion of assets is tied up in loans. The IMF recommends keeping this ratio below 65%.

The S-Score generated by the Bankometer Model is interpreted based on established thresholds to classify banks into different risk categories, providing a framework for assessing their likelihood of insolvency. [9]

- An S-Score below 50 indicates a high risk of insolvency, classifying the bank as insolvent or bankrupt.
- An S-Score between 50 and 70 (inclusive of 50 but exclusive of 70) falls within the "Gray Area," suggesting a moderate risk of insolvency.
- An S-Score of 70 or above signifies a low risk of insolvency, indicating that the bank is solvent and considered to be in a financially sound condition.

The tiered risk assessment provided by these thresholds allows for a more comprehensive understanding of a bank's financial standing. Banks falling in the "Gray Area" warrant particular attention, as their S-Score suggests potential vulnerabilities that necessitate a closer examination of their individual financial ratios to pinpoint specific areas of concern or strength.

Key Characteristics of the Azerbaijani Banking Sector.

The banking sector in Azerbaijan forms the dominant segment of the country's financial system, holding approximately 90-95% of the total assets. This indicates a relatively underdeveloped non-banking financial sector. [5] As of November 2023, there were 25 banks operating in the country.

Compared to the overall economy, the banking sector's size is relatively modest, with total assets amounting to 47% of GDP in 2020, suggesting a low level of financial penetration. [11] The sector exhibits a high degree of concentration, with the four largest banks controlling over 60% of the total banking sector assets. Both domestic and foreign-owned banks are present in the Azerbaijani banking landscape; as of early 2022, 12 out of 26 registered banks had foreign capital.

Recent years have witnessed significant growth in the Azerbaijani banking sector. In 2022, lending increased by 31.5%, and deposits grew by 28.0%, driven by a rise in private consumption. This growth was accompanied by an improvement in the sector's profitability, with net bank profits rising by 70.1% in 2022, supported by healthy interest margins. [5] Furthermore, the quality of loan portfolios has improved, as evidenced by a decline in impaired loans to 0.3% in 2022, down from 4.2% in 2021.

There has also been a notable trend of decreasing dollarization in both deposits and loans. Deposit dollarization fell to 48.4%, and loan dollarization decreased to 19.7% in 2022. [11] While these recent developments point towards a resilient and growing banking sector, the high concentration of assets within a few large banks could still pose systemic risks. The sector is also in a recovery phase following past financial challenges, as indicated by the reduction in overdue loans from a peak of 16% in 2017 to 6% by the end of 2020.

Between 2018 and 2023, the Azerbaijani banking sector experienced several instances of bank insolvency, reflecting underlying financial vulnerabilities within the system.

In 2020, four banks – Atabank OJSC, AGBank OJSC, NBCBank OJSC, and Amrah Bank OJSC – were declared insolvent and subsequently closed. The primary reason behind their insolvency was the unresolved capital issues stemming from the sharp currency devaluation that occurred in 2015. The total capital of these four banks had fallen below the regulatory minimum of AZN 50 million, and in fact, had entered negative territory. [8] It was estimated that a significant amount of capital, at least AZN 677 million, was needed for these banks to meet the legal requirements for operation. The ineffective intervention of the Financial Market Supervisory Authority, which held regulatory powers between 2016 and 2019, also contributed to the persistence of these capital deficiencies.

In 2023, the Central Bank of Azerbaijan revoked the licenses of two more banks, Gunay Bank OJSC and Mugan Bank OJSC. The reasons cited for these actions were similar to those of the 2020

closures: the total capital of both banks had fallen below the minimum requirement of 50 million manats, and their capital adequacy ratios were below 3%. [12] Additionally, the CBA stated that these banks were not conducting their current activities in a reliable and prudent manner, and they exhibited inadequacies in their internal management and control procedures.

Table 1

List of insolvent Azerbaijani banks (2018-2023) and reasons for insolvency

Bank Name	Year of Insolvency	Key Reasons for Insolvency
Atabank OJSC	2020	Unresolved capital issues from 2015 devaluation, total capital below minimum regulatory requirement, negative capital.
AGBank OJSC	2020	Unresolved capital issues from 2015 devaluation, total capital below minimum regulatory requirement, negative capital.
NBCBank OJSC	2020	Unresolved capital issues from 2015 devaluation, total capital below minimum regulatory requirement, negative capital.
Amrah Bank OJSC	2020	Unresolved capital issues from 2015 devaluation, total capital below minimum regulatory requirement, negative capital.
Gunay Bank OJSC	2023	Total capital below minimum requirement (50 million manats), capital adequacy ratio below 3%, unreliable and imprudent activities, inadequate management.
Mugan Bank OJSC	2023	Total capital below minimum requirement (50 million manats), capital adequacy ratio below 3%, unreliable and imprudent activities, inadequate management.

The recent bank insolvencies in Azerbaijan highlight the critical role of adequate capital reserves and sound management practices in maintaining the stability of financial institutions. The primary reasons for failure – capital inadequacy and weaknesses in management and regulatory oversight – are directly related to several of the financial ratios that form the core of the Bankometer Model.

For the purposes of this research, the financial data for the 23 Azerbaijani banks analyzed between 2018 and 2023 was sourced directly from the prudential reports submitted by these institutions to the Central Bank of Azerbaijan. This reliance on regulatory filings offers several key advantages for the study.

Firstly, the standardized nature of prudential reporting ensures a consistent framework for financial data across all banks and throughout the study period, facilitating more reliable comparative analysis and trend identification. Secondly, the data contained within these reports is specifically geared towards assessing the financial health, stability, and risk profiles of banks from a regulatory perspective, aligning directly with the research objective of predicting bank insolvency. Furthermore, the legal obligation for banks to submit accurate prudential reports enhances the reliability of the data, as it is subject to regulatory oversight and potential verification mechanisms by the Central Bank.

This direct access to primary regulatory data also allows for a focused analysis on key financial indicators and ratios that are deemed critical by the Central Bank for monitoring financial stability within the banking sector. The analysis within this paper will leverage this standardized and reliable data source to investigate the predictive power of the Bankometer model and specific financial ratios in anticipating bank insolvency within the Azerbaijani context, particularly in relation to the observed defaults of Gunay Bank and Mugan Bank during the study period.

The research involved examining the reported financial ratios and any derived Bankometer scores of these defaulting banks in the years leading up to their insolvency, comparing their trajectories with those of solvent banks and assessing for any significant deviations or breaches of regulatory requirements that could have served as early warning signals of their impending failure. This approach aims to provide valuable insights into the effectiveness of using regulatory data for predicting bank insolvency in the Azerbaijani banking sector.

Table 2

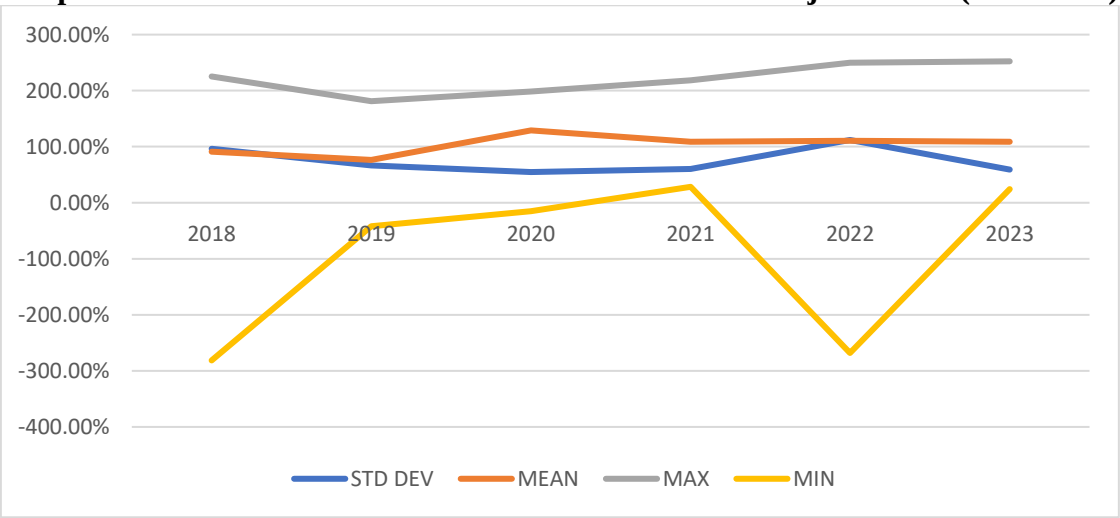
Results of analysis for the Azerbaijani banks using bankometer model (2018 – 2023)

Year	STD DEV	MEAN	MAX	MIN
2018	96,42%	91,28%	225,12%	-281,35%
2019	66,29%	76,43%	181,20%	-42,19%
2020	54,77%	129,08%	198,32%	-15,24%
2021	60,15%	108,56%	218,23%	28,39%
2022	112,01%	110,46%	249,87%	-268,00%
2023	59,17%	108,72%	252,31%	24,20%

Based on the analysis of the prudential reports of Azerbaijani banks from 2018 to 2023 using the Bankometer model, we can observe the following overall trends:

- X1 (Equity/Total Assets) and X2 (Shareholder Equity/Total Assets): The mean values for both these capital-related ratios remained relatively stable across the period, generally fluctuating within a similar range each year.
- X3 (Regulatory Capital/Risk-Weighted Assets): The mean for this ratio showed some variability but generally remained at a healthy level across the years.
- X4 (Non-performing Loans (>90 Days)/Loan Portfolio): The mean value for this ratio showed a notable decrease over the period, particularly from 2018 to 2023, suggesting an improvement in the overall quality of loan portfolios in the Azerbaijani banking sector.
- X5 (Operating Expenses/Operating Income): The mean for this efficiency ratio showed significant fluctuations, with a very high peak in 2018 and 2022. This indicates potential periods of lower efficiency in the banking sector during those years.
- X6 (Loan Portfolio/Total Assets): The mean for this liquidity-related ratio showed some variation but generally remained within a moderate range across the analyzed years.

Graph 1. Overall Rresults of S-score model for the Azerbaijani banks (2018-2023)



The mean S-Score remained consistently above the threshold of 70 across all the years (2018-2023), indicating that, on average, the Azerbaijani banking sector appeared financially sound according to the Bankometer model during this period.

However, the minimum S-Score showed more significant volatility, dropping below the "Gray Area" threshold (70) in 2019 and even entering the "Insolvent" range (below 50) in 2018 and 2022. This suggests that while the average performance was healthy, some individual banks may have experienced periods of financial distress during these years.

Our research period (2018-2023) aligns with a period where several banks in Azerbaijan did indeed become insolvent. Specifically, in 2020, Atabank OJSC, AGBank OJSC, NBCBank OJSC, and Amrah Bank OJSC had their licenses revoked due to capital inadequacy issues stemming from the 2015 devaluation. Later, in 2023, Gunay Bank OJSC and Mugan Bank OJSC also faced license revocation for similar reasons, including capital falling below the regulatory minimum and low capital adequacy ratios.

The fact that the minimum S-Score dropped into the insolvent range in 2018 and 2022 could potentially reflect the financial distress experienced by some of these banks in the years leading up to their eventual failure.

Our analysis suggests that while the Azerbaijani banking sector as a whole demonstrated average financial soundness according to the Bankometer model between 2018 and 2023, there were instances of individual banks facing significant financial distress, as indicated by the low minimum S-Scores. This aligns with the actual bank insolvencies that occurred during this period.

This highlights the potential utility of the Bankometer model as a tool for identifying banks that may be at higher risk of insolvency in Azerbaijan. However, it is crucial to remember that financial ratio-based models like the Bankometer have limitations. They provide a quantitative assessment based on past financial data and may not always capture all the factors that can contribute to bank failure, such as sudden economic shocks, changes in regulations, or issues with management and governance.

Therefore, while the Bankometer model can be a valuable component of a broader monitoring and risk assessment framework for the banking sector in Azerbaijan, it should ideally be used in conjunction with other qualitative and quantitative analyses, as well as ongoing regulatory oversight by the Central Bank of Azerbaijan.

CONCLUSION

While financial ratios like those used in the Bankometer Model provide valuable insights into a bank's financial health, relying solely on them to predict insolvency has inherent limitations.

Macroeconomic conditions play a significant role in a bank's financial stability, and these external factors are not always fully reflected in financial ratios. Economic downturns, fluctuations in key economic indicators like oil prices (particularly relevant for Azerbaijan), and changes in interest rates can rapidly impact a bank's asset quality and profitability, potentially leading to distress even if pre-crisis ratios appeared healthy.

Furthermore, financial ratios primarily offer a quantitative perspective and may not fully capture crucial qualitative factors such as the quality of a bank's management, the effectiveness of its corporate governance practices, and the soundness of its strategic decision-making. [4] These qualitative aspects can significantly impact a bank's resilience to financial distress.

Regulatory changes within the banking sector can also influence the predictive power of financial ratios. New regulations regarding capital requirements, lending practices, or reporting standards can alter the interpretation of previously established ratio thresholds and may necessitate adjustments to prediction models. [7]

Unforeseen events, often referred to as "black swan" events, such as global pandemics or geopolitical crises, can trigger sudden and severe financial distress that is difficult to anticipate through

historical financial data alone. [6] These events can lead to rapid shifts in market sentiment, bank runs, and significant losses that may not be foreshadowed by pre-crisis financial ratios.

The use of any model, including the Bankometer Model, carries model risk. This risk arises from the possibility of flawed assumptions, errors in model design or implementation, or the misuse of model outputs, all of which can lead to inaccurate predictions and flawed decision-making.

The dynamic nature of the banking industry, with its continuous evolution of new financial products, services, and business models, poses another challenge for static ratio-based prediction models. Traditional ratios might not adequately capture the risks associated with new and complex financial activities.

Predicting bank insolvency is of paramount importance for a wide array of stakeholders, including depositors seeking to protect their savings, investors evaluating risk, creditors assessing creditworthiness, and regulatory bodies striving to maintain financial stability. For the overall financial health of a nation, the ability to anticipate and potentially prevent bank failures is crucial in avoiding economic disruptions and fostering public confidence in the financial system.

However, it is essential to recognize that relying solely on financial ratios, including those within the Bankometer Model, has inherent limitations. External macroeconomic conditions, regulatory changes, unforeseen events, the quality of financial data, qualitative factors such as management expertise, the evolving nature of the banking industry, and the potential need for context-specific adjustments to model thresholds all play a significant role in determining a bank's true insolvency risk.

Therefore, a comprehensive and prudent approach to bank insolvency prediction necessitates a balanced perspective. While quantitative models like the Bankometer Model provide valuable insights based on financial data, they should be complemented by qualitative assessments, expert judgment, and continuous monitoring of the broader economic and regulatory landscape. This integrated strategy will offer a more holistic and accurate understanding of a bank's financial health and its vulnerability to failure, ultimately contributing to a more stable and resilient banking system in Azerbaijan and beyond.

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Bankometer modeli: maliyyə əmsalları bankların müflisləşməsini proqnozlaşdıra bilərmi?

Xülasə

Tədqiqat Beynəlxalq Valyuta Fondunun (BVF) təlimatlarına əsaslanan əsas maliyyə əmsallarından istifadə edərək S-ballı yanaşması olan Bankometer Modelinin 2018-2023-cü illər arasında Azərbaycanda bankların müflisləşmə riskini proqnozlaşdırmaqdakı effektivliyini araşdırır. Biz modelin əsas göstəricilərini – kapital səviyyələri və kreditlərin keyfiyyəti kimi – bu dövrdə Azərbaycanda faktiki bank müflisləşmələrinə səbəb olan sənədləşdirilmiş səbəblərlə, xüsusən kapital çatışmazlıqları ilə müqayisə edərək onun praktik əhəmiyyətini qiymətləndiririk. Yalnız maliyyə əmsallarına güvənməyin məhdudiyyətlərini qəbul etməklə yanaşı, bizim tapıntılarımız göstərir ki, Bankometer modeli bank sistemi üzrə risklərin monitorinqi üçün dəyərli bir alətdir.

Açar sözlər: *bankometer, müflisləşmə, maliyyə əmsalları, Azərbaycan bank sektoru, risk proqnozlaşdırılması.*